Business Broadband Assessment & Feasibility Study

City of New Braunfels

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1. Executive Summary

"Broadband access is the great equalizer, leveling the playing field so that every willing and able person, no matter their station in life, has access to the information and tools necessary to achieve the American Dream". [1] This quote from Michael K. Powell, former chairman of the FCC, stresses that broadband is a vital element of everyday life and is essential to the City of New Braunfels' current and future economic vitality. Fast, reliable, and affordable broadband access affects nearly every business, and community anchor institution (e.g. hospitals, fire stations, etc.) within the community. Broadband provides the digital infrastructure necessary to connect communities virtually to the rest of the digital world. As more of New Braunfels' businesses, community anchor institutions, and community organizations utilize the internet for critical services and enhanced lifestyle opportunities, the more reliant they become on fast, high quality, affordable broadband services. This, along with the explosion of more sophisticated online business applications (e.g. Telemedicine, Video Advertising), is driving the need for consistently higher bandwidths.

Broadband is high-speed connectivity to the internet that takes a variety of forms, including DSL over copper, cable, and fixed and mobile wireless platforms. In New Braunfels, most businesses subscribe to either DSL (AT&T) or cable services (Time-Warner). Though these services continue to try and evolve to provide greater speeds and reliability to New Braunfels' consumers, the demand for bandwidth is quickly outpacing the supply because of inherent limitations in these traditional broadband technologies.

While DSL and cable services are currently acceptable for some of New Braunfels' business users, it is unlikely that these technologies will meet the long-term broadband demands of the New Braunfels business community. 97% of those surveyed said internet availability was important to their business and that 69% were unsatisfied with the current internet options.

To resolve the increasing demand for more bandwidth, next-generation Fiber-to-the-Premise (FTTP) broadband technologies are being deployed in cities across the country to provide much greater speeds, reliability, and performance. Communities with next-generation broadband are well positioned to thrive and take full advantage of every opportunity the internet and electronic world has to offer.

With the move of communities to next-generation FTTP technologies, the question being asked is what will incumbent providers such as AT&T and Time-Warner do to remain competitive? Time-Warner has publicly stated that they believe that their current cable platform technology can continue to evolve to allow greater speeds, but even with the latest technology upgrade, they cannot match the speeds nor bandwidths of the next-generation FTTP platforms. AT&T has announced that it will replace DSL with FTTP over time, but it is focusing initially on the top 100 cities over the next five to ten years. For other communities, AT&T is looking to install Fiber-to-the-Node (FTTN) technology which installs fiber to centralized distribution points, but still employs DSL and its inherent limitations from the distribution point to the premise.

[1] Michael K. Powell, former Chairman of the Federal Communications Commission (FCC)

Outside of current technology limitations, the affordability of broadband services is another key issue in New Braunfels, particularly for local businesses who need more than a basic broadband service. For most businesses, fiber-optic broadband connections are just too expensive. For example, AT&T will offer a direct connect fiber platform for individual business, but the platform is very expensive to install and maintain. Only large-scale businesses can afford this type of platform, leaving the majority of businesses with only the DSL option. Without affordable, next-generation broadband, New Braunfels' economic development potential will be negatively impacted in several ways. New Braunfels will not be able to effectively attract new businesses, nor retain some of the existing businesses, as these businesses will locate or migrate to more tech savvy communities.

Although broadband providers have made high-speed fiber-optic services available to New Braunfels' business community, only larger businesses are able to afford them. This leaves New Braunfels' small and medium businesses, which represent about 58% of total GDP with limited options for their internet connectivity.

As the pace of the online revolution increases, cities equipped with high-speed, high-quality broadband networks will flourish in the digital world while others struggle to keep up. Realizing the importance to their communities, cities have become actively engaged in how their local communities are served and actively participate in the broadband development process. Vinton Cerf, American internet pioneer and recognized as one of "the fathers of the internet" shares his view on the government's role in high-speed broadband by stating, "Governments should look at investment in broadband as a national priority on the grounds that having broadband access for virtually everyone creates opportunities for the development of the economy that wouldn't otherwise be available."

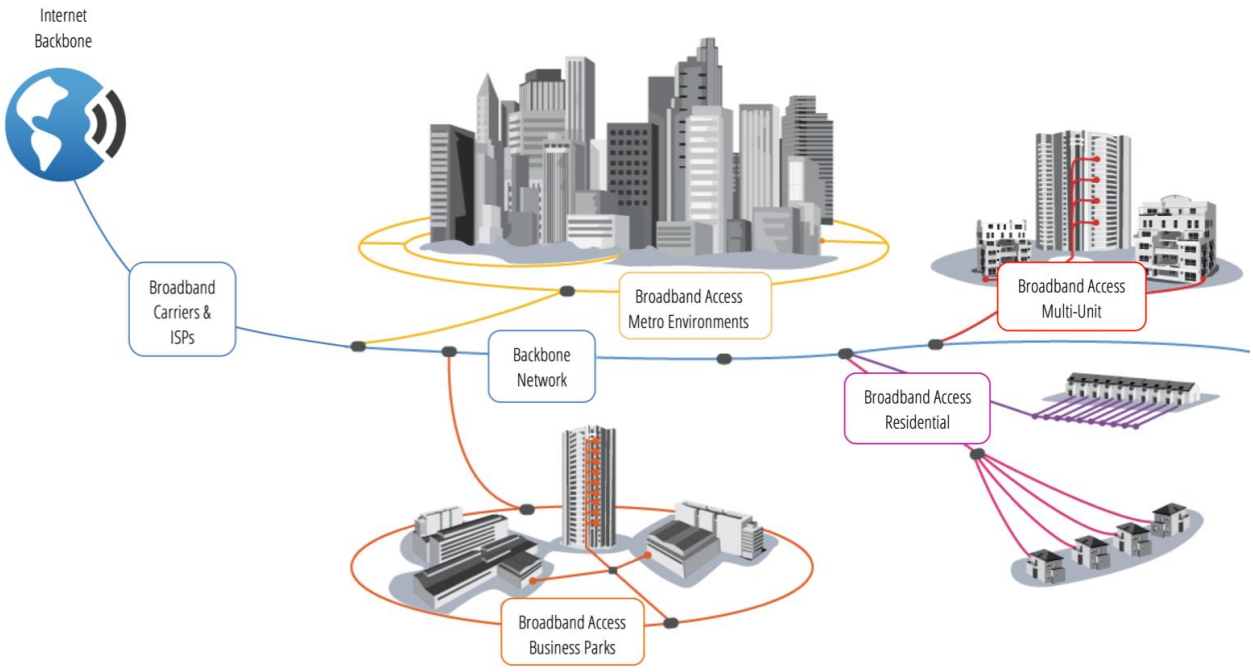
The goal of this Business Broadband Assessment and Feasibility Study is to give the City of New Braunfels the information it needs to understand the various broadband technologies, the current state of broadband in New Braunfels, what is driving broadband demand in New Braunfels, discussion of viable options, and what we recommend as the best solution based on:

1. Leveraging the city's core capabilities as a public organization,
2. Current fiber-optic infrastructure,
3. City's ability to create policy to positively impact broadband development,
4. Economic and financial sustainable
5. Ability to cultivate key public and private partnerships to increase the effectiveness how the community is served, and
6. Perceived risk tolerance of the various options.

2. Overview of Broadband Technologies

Broadband is deployed throughout communities as wired and wireless infrastructure that carries digital signal between end users and the content they want to access. The content comes in many forms and from many locations across the world in the networks that connect the local community to the internet backbone. Websites, television, streaming video, videoconferencing, cloud services, and even telephone service are just a few types of content that are delivered across local broadband networks. Access to this content is made available through the type of infrastructure and kinds of connections available in the local network. Robust local infrastructure results in faster, more reliable access to content. Conversely, local infrastructure that is aging and built on older technologies results in slower, less reliable access to content.

Figure 2-1: How Broadband Connects Our Communities



A. Dial-Up Access

Though not defined as a broadband technology due to speed and bandwidth limitations, dial-up access still exists in many areas of the world. Dial-up internet access is a form of internet access that uses the facilities of the public switched telephone network (PSTN) to establish a connection to an internet service provider (ISP) by dialing a telephone number on a conventional telephone line.

B. Digital Subscriber Line (DSL)

DSL is a wireline transmission technology that transmits data faster over traditional copper telephone lines installed in homes and businesses. DSL-based broadband provides transmission speeds ranging from

several hundred Kbps to millions of bits per second (Mbps). The availability and speed of DSL service may depend on the distance from your home or business to the closest telephone company facility.

The following are types of DSL transmission technologies:

- Asymmetrical Digital Subscriber Line (ADSL/ADSL2/ADSL2+/VDSL) – Used primarily by customers who receive a lot of data but do not send much. ADSL typically provides faster speed in the downstream direction than the upstream direction. ADSL allows faster downstream data transmission over the same line used to provide voice service, without disrupting regular telephone calls on that line.
- Symmetrical Digital Subscriber Line (SDSL) – Used typically by businesses for services such as video conferencing, which need significant bandwidth both upstream and downstream.

C. Cable Modem

Cable modem service enables cable operators to provide broadband using the same coaxial cables that deliver pictures and sound to your TV set. Most cable modems are external devices that have two connections: one to the cable wall outlet, the other to a computer. They provide transmission speeds of 1.5 Mbps or more. Subscribers can access their cable modem service by simply turning on their computers, without dialing-up an ISP. You can still watch cable TV while using it. Transmission speeds vary depending on the type of cable modem, cable network, and traffic load. Speeds are comparable to DSL.

D. Fiber Optics

Fiber optic technology converts electrical signals carrying data to light and sends the light through transparent glass fibers about the diameter of a human hair. Fiber transmits data at speeds far exceeding current DSL or cable modem speeds, typically by tens or even hundreds of Mbps.

The actual speed you experience will vary depending on a variety of factors, such as how close to your computer the service provider brings the fiber and how the service provider configures the service, including the amount of bandwidth used. The same fiber providing your broadband can also simultaneously deliver voice (VoIP) and video services, including video-on-demand.

Variations of the technology run the fiber all the way to the customer's home or business, to the curb outside, or to a location (node) somewhere between the provider's facilities and the customer.

- Fiber to the Node (FTTN) - Fiber to the Node technologies bring high-capacity fiber-optic cables to local services areas to connect to existing DSL equipment. Rather than bringing fiber-optic cables to every home or business, the fiber is connected to the existing DSL network to increase its capacity. It allows these networks to carry more traffic; however, often times the copper-based "last mile" DSL network, connecting homes and businesses to the local nodes is still a bottleneck and results in subscribers not able to access the true speeds of fiber-optic connections.

- Fiber to the Premise (FTTP) - Fiber-To-The-Premise is a technology for providing internet access by running fiber optic cable directly from an Internet Service Provider (ISP) to a user's home or business. It facilitates much faster speeds than dial-up and most coaxial cable internet connections, and generally needs to be serviced less. It's also considered one of the most "future proof" types of internet technology, since there are no foreseeable devices that could use more bandwidth than can be sent via fiber optic cables.

Figure 2-2 compares traditional broadband technologies such as DSL, cable, and wireless to fiber-based next-generation broadband. Whereas traditional broadband technologies have an upper limit of 300Mbps, next-generation broadband that utilizes fiber-optic connections surpasses these limitations and can provide 1Gbps and greater [2]

Figure 2-2: Capacity Comparisons

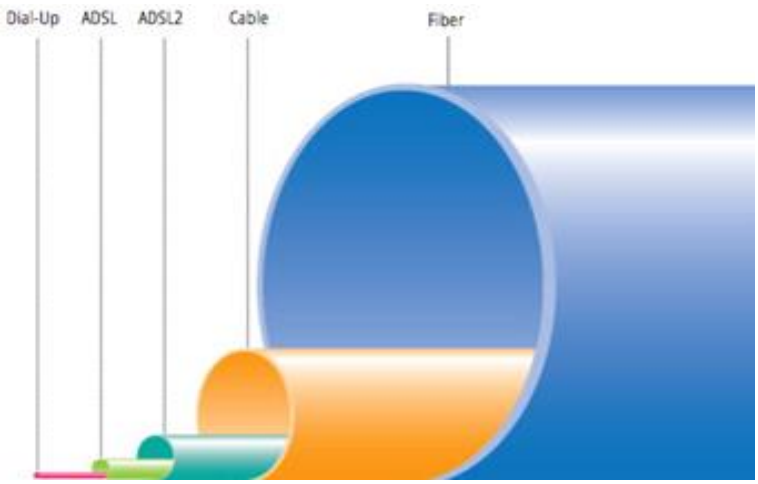
Dial-Up – 56Kbps
- Legacy Technology
- Shared Technology

ADSL – 10Mbps
- First Generation of DSL
- Shared Technology

ADSL2 – 24Mbps
- Second Generation DSL
- Shared Technology

Cable – 150Mbps
- DOCSIS 3.0
- Shared Technology

Next-Generation Fiber-Optic – 1Gbps
- PON, Active Ethernet
- Shared and Dedicated Technology



E. Wireless

Wireless broadband connects a home or business to the internet using a radio link between the customer's location and the service provider's facility. Wireless broadband can be mobile or fixed. Wireless technologies using longer-range directional equipment provide broadband service in remote or sparsely populated areas where DSL or cable modem service would be costly to provide. Speeds are generally comparable to DSL and cable modem. An external antenna is usually required. Wireless broadband internet access services offered over fixed networks allow consumers to access the internet from a fixed point while stationary, and often require a direct line-of-sight between the wireless transmitter and receiver. These services have been offered using both licensed spectrum and unlicensed devices. For example,

[2] Actual speed and quality of service will depend on the specific service contracted by the end user, whether using a traditional broadband service or a next-generation broadband service.

thousands of small Wireless Internet Services Providers (WISPs) provide such wireless broadband at speeds of around one Mbps using unlicensed devices, often in rural areas not served by cable or wireline broadband networks. Mobile wireless broadband services are also becoming available from mobile telephone service providers and others. These services are generally appropriate for highly mobile customers and require a special PC card with a built in antenna that plugs into a user's laptop computer. Generally, they provide lower speeds, in the range of several hundred Kbps.

3. The Current State of Business Broadband in New Braunfels

Through outreach meetings with the City of New Braunfels leadership, The Greater New Braunfels Chamber of Commerce, Comal Independent School District, New Braunfels Independent School District, New Braunfels Utilities, and approximately 30 other organizations, various information was gathered detailing the current state of business broadband in New Braunfels.

In addition to the outreach meetings, an online survey of New Braunfels' businesses was conducted to understand further the community's broadband uses and needs. 132 businesses responded to the online survey, with the details being provided under a separate document referenced in Appendix B.

Based on information garnered, an overwhelming majority of respondents are serviced by one of two incumbent carriers, either Time Warner Cable (59%) using coaxial cable platform or AT&T DSL (19%) using copper twisted pair platform. The main reasons the Internet is used in these businesses include email, e-commerce, e-support, web advertising, online research, online banking, and social media. The industries represented in the survey included: Accommodation and Food Services; Agricultural & Farming; Arts, Entertainment, and Recreation; Construction; Educational Services; Finance and Insurance; Healthcare and Social Assistance; Hospitality; Manufacturing; Professional, Scientific, and Technical Services; Real estate, Rental and Leasing; Retail Trade; Transportation and Warehousing; and Miscellaneous Others.

With the majority of New Braunfels' businesses still utilizing copper-based broadband infrastructure to transmit information from a user to the internet, DSL and cable networks have provided sufficient bandwidth to only 69% of responding business users. As bandwidth needs have grown, businesses demand more and more bandwidth out of these systems to support more applications and devices. In reaction to the growing bandwidth needs, DSL and cable networks are trying to evolve technologies to provide more bandwidth to businesses. Broadband providers have continued to upgrade equipment and networks (e.g. Fiber-to-the-Node) to make these lines faster and more reliable, however; according to the survey results, 81% of the businesses stated that limited speed and unreliability are still two of the more urgent issues they encounter on a day-to-day basis. There also exists several fundamental issues with copper infrastructure that pose long-term challenges to the growing bandwidth demand:

- Broadband signals degrade significantly as distances increase in copper-based networks.
- Broadband signals are susceptible to electrical interference and signal degradation in copper-based networks, particularly as they increase in age.
- Copper-based networks delivering broadband services generally utilize shared bandwidth among pools of users that results in an uneven distribution of speed to these users.

A small percentage of the businesses, who have found copper technology limitations untenable, have deployed fiber-optic technology through a direct-connect infrastructure, however the costs for deployment of this platform is cost-prohibitive for most businesses. Only 15 of the approximate 5600 business in New Braunfels currently utilize a FTTP platform (< 1%).

Business owners in New Braunfels are struggling with quality broadband availability and have observed much greater broadband investment from incumbent providers and Google in San Antonio and Austin, leaving New Braunfels to cope with their current infrastructure provided primarily by Time Warner Cable and AT&T. One business interviewed stated that cost of TWC service for speeds offered is too high and they have had issues with reliability of internet. They switched to AT&T for about a week but switched back because they couldn't get the internet working from them. They are very frustrated with customer service between both companies. When internet goes down it basically shuts down their business. Issues seem to occur monthly. When they occur it seems to last for a couple of days.

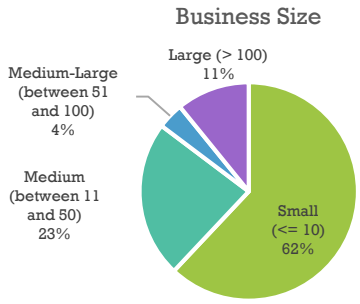
The two largest providers of internet access in New Braunfels, Time-Warner Cable and AT&T have publicly acknowledged that their current solutions do not meet the upcoming broadband demands, but are taking different approaches to provide solutions. Time-Warner has publicly stated that they believe that their current cable platform technology can continue to evolve to allow greater speeds, but even with the latest technology upgrade, they cannot match the speeds nor bandwidths of the next-generation FTTP platforms. AT&T has announced that it will replace DSL with FTTP over time, but it is focusing initially on the top 100 cities over the next five to ten years. For other communities, AT&T is looking to install Fiber-to-the-Node ("FTTN") technology which installs fiber to centralized distribution points, but still employs DSL and its inherent limitations from the distribution point to the premise.

Along with technology issues, businesses scored customer service from the incumbent providers as average at best and there is an overall feeling that providers are comfortable in the market, and therefore there is no real competition to drive better service. According to the latest American Customer Satisfaction Index (ACSI), Time Warner Cable ranks the lowest of all internet providers with a score of 54 out of 100. This was a -14.3% change from the previous year. AT&T had a score of 65 out of 100 with no improvement from previous year.[3]

Summary of some key survey areas:

85%

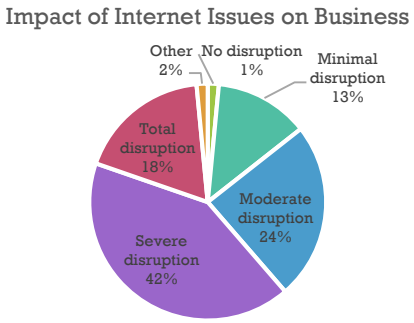
Respondents that are businesses with 50 or fewer employees.



[3] 2015 American Customer Satisfaction Index, ACSI and its logo are Registered Marks of the University of Michigan

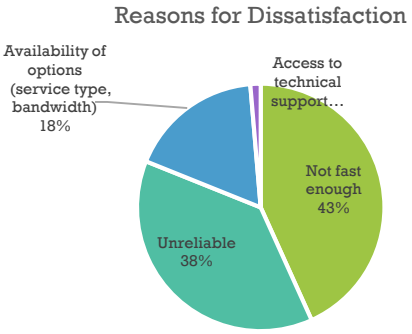
84%

Businesses that have experienced moderate, severe, or total disruption of their business from internet problems with reliability and speed.

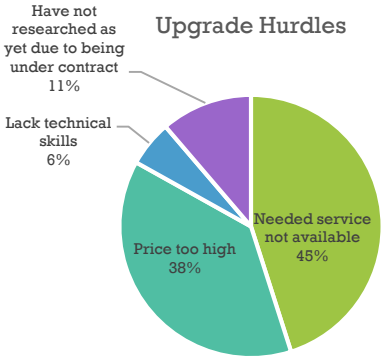


69%

Businesses confirm or feel that current internet services are insufficient for their business needs.

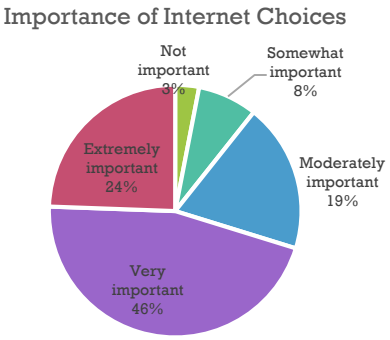


Of the businesses with insufficient internet, there are four main hurdles why businesses are reluctant or unable to upgrade services to mitigate the above insufficiencies.



97%

Businesses that indicated that having choice and access to multiple internet and broadband providers is important to their business.



Further adding to business owner frustration, GVTC Communications (a local telephone cooperative) is rapidly building and expanding fiber optic and broadband offerings in the region immediately surrounding New Braunfels which businesses cannot participate.

Central Texas Technology Center (CTTC) is a member of the Regional Center of the Alamo Colleges. Content for classes come from a number of the University of Texas and Texas Tech campuses. CTTC currently has two T-1 lines from AT&T, but feel they need more. Between just the online learning system and the Polycom phone system much of their existing bandwidth is consumed. CTTC feels that they need at least four T-1 lines right now to adequately deliver service to their campus but cannot get them from AT&T because there is no more capacity at that location to install additional lines. Due to their location in the New Braunfels Airport property, they cannot get cable service from TWC at all. Due to bandwidth limitations, they cannot partner with NETnet to bring additional programs, services and opportunities to their students. NETnet is a Consortium of 14 higher education institutions to bring a wide range of instruction to Texas counties containing 46% of the rural Texas population. Besides capacity issues, they average about 7 hours of downtime a month.

In summary, there is a large pent up demand for a majority of businesses in New Braunfels for better, more reliable, and affordable service. Although broadband service is available throughout the New Braunfels business corridor, it is service that is architected on older legacy copper technologies and it does not present the level of service that the businesses desire or need. Without expansion of broadband service in New Braunfels, the community is at risk of losing existing businesses and opportunities to relocate business into New Braunfels due to the lack of advanced broadband services and fiber optic delivery options. Although fiber optic service is available to businesses in New Braunfels, businesses perceive the service to be very expensive, to the point where it is prohibitive, and not available at speeds greater than 10/10 Mbps without becoming extremely overpriced.

In terms of attracting new business, a key focus of the New Braunfels' economic development organizations is to target businesses in the technology, software development and other professional service sectors, all which are dependent on highly automated technology. Broadband is a fundamental utility asset that these types of businesses will require, as they will rely on broadband to maintain

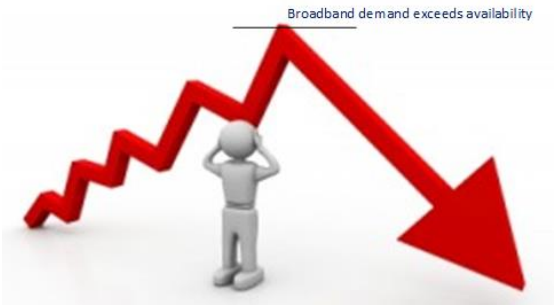
connectedness to the electronic world. The majority of these types of businesses rely on online services to maintain their daily operations, therefore; it is critical that New Braunfels is able to promote the availability and affordability of broadband services in its recruitment efforts. This can be a true differentiator for New Braunfels; through promotion of the community's leading-edge broadband services, prospective businesses and site selectors can be assured that they can locate in the region and have robust access to the rest of the electronic world. Available and affordable high-speed broadband has also gone beyond being a differentiator to being a key part of the "minimum ante" for attracting and retaining desirable businesses and facilities. Additionally, the Chamber of Commerce has been advocating for a "Digital New Braunfels" economic development message designed to attract gaming and movie production industries into the New Braunfels region. The Chamber believes broadband infrastructure is key to moving this concept forward.

Over 58% of New Braunfels' GDP is produced by businesses with less than 100 employees. Small and medium businesses need high-quality broadband to grow and compete.

4. Future of Business Broadband Demand in New Braunfels?

A. Overview

Accessible, affordable, and reliable broadband services is a key economic development tool to attract and retain businesses in New Braunfels. In many cases, bandwidth consumption outpaces the broadband speeds local businesses are able to purchase and upgrading is often times not an option due to the prices businesses are able to afford as well as other IT related factors. When these broadband services cannot "keep up" with business needs, businesses lose productivity and efficiency; affecting their bottom line and making them less competitive with regions having more widely deployed and affordable broadband services. This will eventually result in a less competitive business market from an economic perspective. It also leads to retention issues as businesses that are not able to gain efficiencies with their existing broadband services will, in many cases, move operations to communities that have more availability of these services.



New Braunfels' business market is predominately made up of small to medium sized businesses. These are the same businesses that need high-speed fiber based broadband infrastructure yet, are hampered by the current legacy copper offerings. In many cases, these businesses reported taking services from two different providers, i.e., DSL from AT&T and cable service from Time Warner. Businesses reported doing so because they could not rely on a single connection to maintain their connectivity needs. This doubles the costs for the business

In terms of attracting new business, a key focus of the New Braunfels' economic development organizations is to target businesses in the Aviation-Related, Healthcare & Related Medical Technologies, Data Centers, Logistics/Distribution, Telecom/Information, Specialty Foods, Automotive Suppliers, and Music Industry sectors[4], all which are dependent on highly automated technology. Broadband is a fundamental utility asset that these types of businesses will require, as they will rely on broadband to maintain connected to the electronic world. The majority of these types of businesses rely on online services to maintain their daily operations, therefore; it is critical that New Braunfels is able to promote the availability and affordability of broadband services in its recruitment efforts. This can be a true differentiator for New Braunfels; through promotion of the community's leading-edge broadband services, prospective businesses and site selectors can be assured that they can locate in New Braunfels and have robust access to the rest of the electronic world. Available and affordable high-speed broadband has also gone beyond being a differentiator to being a key part of the "table stakes" for attracting and retaining desirable businesses and organizations.

[4] Economic Development Strategic Plan New Braunfels, Texas Final Report, September 2012

B. Applications

Today, business broadband subscribers across every class are utilizing more and more online services and particularly those that consume larger amounts of high-quality bandwidth. Figure 4-1 and Figure 4-2 illustrate demands for applications today and the increases in broadband that are necessary to accommodate this demand. Currently, broadband subscribers make heavy use of the core internet functions, consisting of internet browsing, web hosting, e-commerce, virtual private network connectivity, and voice services. However, subscribers are beginning to consume more real time video and streaming applications, which require significant bandwidth, reliability, and performance out of their broadband connections. We are still early in the lifecycle of internet video applications and these are expected to grow significantly over the next 10 years, replacing much of the text-based internet.

Figure 4-1: Broadband Application Speed Requirements

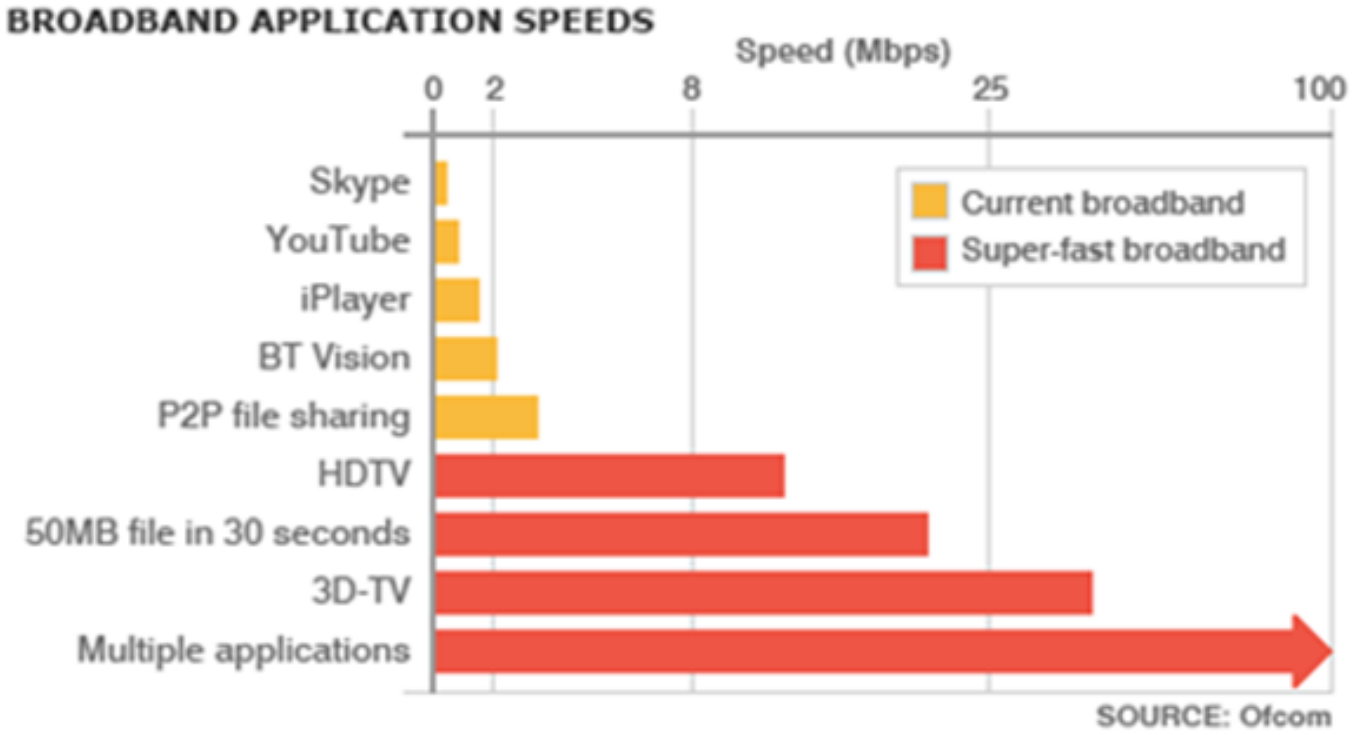
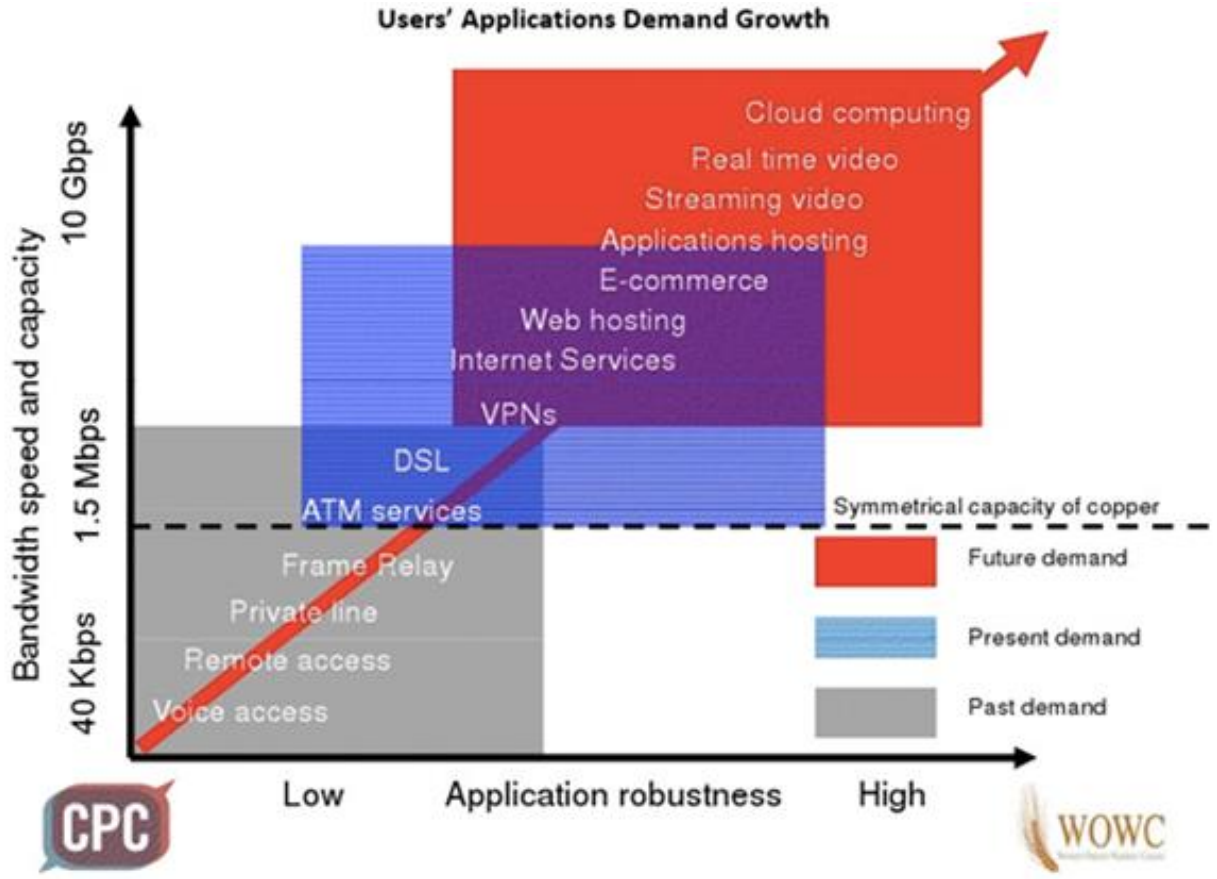


Figure 4-2: Application Bandwidth Demand Growth



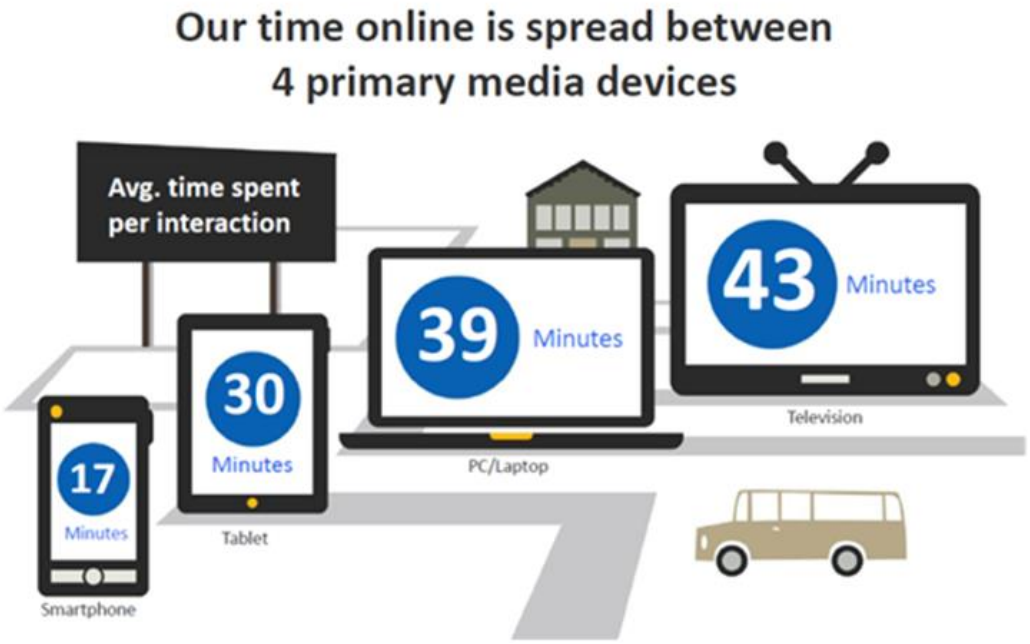
In addition, the myriad of cloud services is driving the need for more symmetrical[5] broadband as real time and cloud applications require additional bandwidth, both in download speed and upload speed. As more of these applications are deployed and replace traditional PC-based software, broadband connections will need to accommodate the increased bandwidth load. Many times these applications synchronize in real time, meaning that they are always consuming bandwidth at a constant rate rather than only when the user is actively engaging the application.

The proliferation of mobility needs and devices is also driving the need for more bandwidth as more devices in the business and public areas need access to broadband connections. A report published by Google in 2012 demonstrates the amount of time the average user spends with their devices across each type of device, and how users interact with multiple devices simultaneously. Although the study's primary

[5] Symmetrical broadband connections provide equal download and upload speeds, such as 10 Mbps down, 10 Mbps up, instead of traditional asymmetrical broadband services that provide unequal speeds, such as 10 Mbps down and 2 Mbps up.

goals were to "gain a deep understanding of consumer media behavior over a 24-hour period…,"[6] an important implied finding is that users are spending significantly more time with their devices, devices that all require broadband connections. As these devices all vie for bandwidth on a users' broadband connections, the demand for more bandwidth to support more applications grow.

Figure 4-3: Proliferation of Broadband Devices

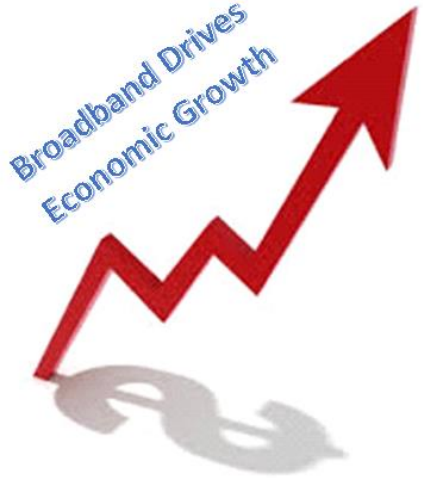


These demands also effect many devices inside the business that are now being connected to the internet using broadband connections. Many video/audio systems, thermostats, irrigation and security systems are now connected to the internet, consuming more broadband bandwidth.

[6] The New Multi-Screen World. Understanding Cross-Platform Consumer Behavior" Google 2012. http://think.withgoogle.com/databoard/media/pdfs/the-new-multi-screen-world-study_research-studies.pdf. Accessed, January 2015.

C. Economic Development

Accessible, affordable, and reliable broadband services is a key economic development tool to attract and retain businesses in New Braunfels. In many cases, bandwidth consumption outpaces the broadband speeds local businesses are able to purchase and upgrading is often times not an option due to the prices businesses are able to afford as well as other IT related factors. When these broadband services cannot "keep up" with business needs, businesses lose productivity and efficiency; affecting their bottom line and making them less competitive with regions having more widely deployed and affordable broadband services. This will eventually result in a less competitive business market from an economic perspective. It also leads to retention issues as businesses that are not able to gain efficiencies with their existing broadband services will, in many cases, move operations to communities that have these services.



It is evident that the internet has changed the way people live and do business. There is proof of this in almost everything we do. Our lives have been changed forever with the past decades advances in technology. This effect is even more evident in the way small businesses operate daily. A new study just out by the "Internet Association" confirms our observations about the internet and its driving force on part time small business in the U.S. The study, titled "Internet Enabled Part-Time Small Businesses Bolster the U.S. Economy", explores how Americans, in an attempt to find more revenue during an economic downturn, have turned to the internet to start small businesses and earn extra income.

According to the study, "the internet contributed $141 billion dollars to the US economy in 2011, with the internet helping to drive nearly all part-time businesses, with 90% of all those surveyed using the internet to conduct at least some of their business, and over half saying that they couldn't conduct business at all without the internet. These businesses employ 6.6 million people, producing wages of $797 million. According to the survey, most small businesses owners that rely on the internet say that if the internet didn't exist, at least half of their income would go away."[7]

Beginning in 2011, the NTIA has published statistics on the availability of gigabit broadband. This data has allowed one of the first empirical studies of the benefits of next generation internet connectivity on economic activity. Looking at 14 communities in nine states, we conclude that next generation broadband is likely to have a substantial impact on economic output and, consequently, consumer welfare. These gains are likely due to numerous factors, including the direct effect of infrastructure investment and increased expenditures, as well as early shifts in economic activity (e.g., job creation and occupational changes) and productivity gains. For example, recent reporting on gigabit broadband service in

[7] http://www.theamericanconsumer.org/2013/10/internet-driving-the-economy-and-helping-small-businesses-grow/

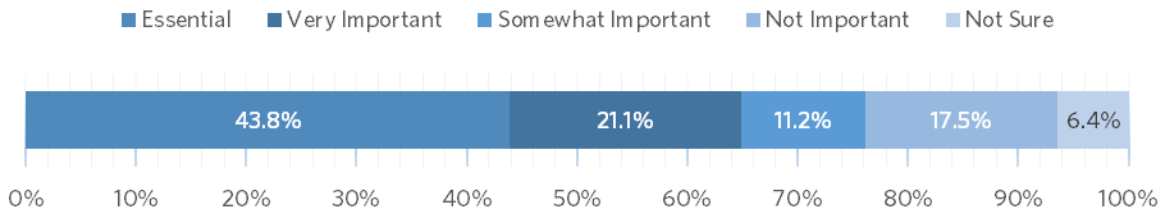
Chattanooga, Tennessee has attributed 1,000 new jobs, increased investment, and "a new population of computer programmers, entrepreneurs and investors" to gigabit broadband.[8]

While it is difficult to estimate the exact economic impacts that broadband can have on any community due the complexity of variables that range from adoption and utilization rates to upload speeds, there are some trends that appear to apply generally across all broadband communities.

First, it is important to realize that broadband is an enabler of economic development opportunity. Simply deploying fiber throughout the community is not going to do much in the way of economic development on its own. However, when used as cornerstone of a larger economic development strategy, broadband can be the key differentiator for site development and site location analyses. Moreover, broadband not only supports business and industrial recruitment efforts, but perhaps more important to realize, the availability of broadband has an even larger impact on the ability to retain existing business and industry that is already important to the economy community.

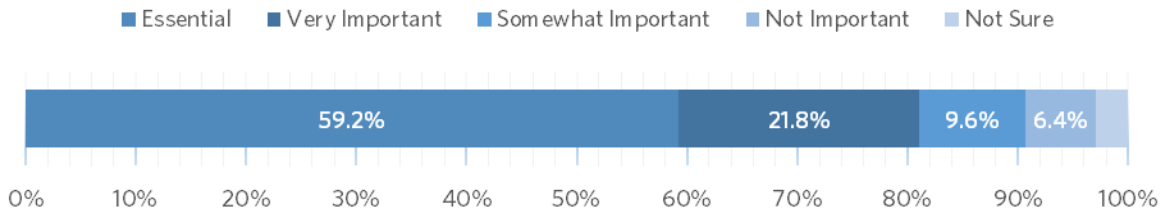
Recent data collected by broadband economist firm Strategic Networks Group (SNG) in 2014-2015, surveyed fiber-connected business leaders in 11 states and asked them to rate the importance that fiber access had on the decision to either relocate their business or remain in the community. Figure 0-1 represents survey results of 3,074 business and industry leaders that rated the importance of availability of fiber during the site selection process. As seen below, nearly 65% of businesses say fiber connectivity was "essential" or "very important" to their decision to select their community. Figure 4-4 represents survey results of 3,684 businesses that had decided to remain or expand in their existing community. As seen, over 80% of businesses said fiber connectivity was "essential" or "very important" in their decision to remain or expand in their current community.

Figure 4-4: Importance that the presence of fiber connectivity had on decision to select a new location.



[8] From the study "Early Evidence Suggests Gigabit Broadband Drives GDP" by Analysis Group

Figure 4-5: Importance that the presence of fiber connectivity had on decision to remain in the community.



Therefore, in order to estimate the economic impact that fiber-based broadband can have on New Braunfels, it is important to recognize the importance of retaining the existing business and industry that is supporting the jobs and economy of the community already. These findings stress the importance of local economic development leaders understanding and responding to the needs of existing businesses and industry by offering the advanced networking and communications capabilities that fiber-optic connectivity can offer.

A leading indicator of economic performance in a community is employment, and through the recruitment, retention, and expansion of employers with access to fiber-based broadband, New Braunfels could expect to see an increase in employment due to increased utilization of broadband. Again, drawing from SNG data 2014-2015, 1,103 employers in 11 states with fiber-optic connectivity reported an aggregate employment of 70,171. Of that aggregate total, 3,436 were considered new full-time jobs, and of those new jobs, 1,650 were new jobs attributed to the existence of fiber-based broadband. So in those 11 states, employers with fiber-optic broadband saw an overall increase in employment of 4.9%, with a 2.4% increase in jobs due directly to the existence of broadband.

Another aspect of broadband utilization that often does not get the attention it deserves is the cost savings that broadband can offer a business. While economic developers do tend to look at revenue and growth for economic impacts, equally important are the earnings that attributed to the reduction of operating costs through increased internal efficiencies that broadband can offer. Drawing again 2014-2015 SNG data from 11 states, 259 business establishments reported an aggregate of $458.1M in annual operating costs. Cost savings, in aggregate from those business total $20.6M, for cost savings of 4.3%.

Interesting to note that while the cost savings was 4.3% across all businesses surveyed, the actual cost savings vary by the employment size of the business. While it likely goes without saying that the larger employers realized a greater bottom line operating cost savings, the smaller the employment size of the business, the greater the percentage of cost savings. For example, businesses with 1-4 employees with average operating cost of $298k saw an average cost savings of $40.2k, a savings of 11.9%, while businesses with 20-49 employees with average operating cost of $2.5M saw an average cost savings of $155.2k, a savings of 5.8%. These findings of course, speak to the importance that affordable fiber-based broadband has on small- and medium-sized business.

While simply having access to broadband can lead to business recruitment and business expansion and increased employment, it is essential that meaningful utilization occur so that businesses can realize

significant costs savings, which can then be re-invested in the company and in the community, perhaps through salary increases to employees or to business expansion.

These are all just a few of the variables that go into the potential economic impacts that fiber-optic broadband can have on a community.

In terms of attracting new business, a key focus of the New Braunfels' economic development organizations is to target businesses in the technology, software development and other professional service sectors, all which are dependent on highly automated technology. Broadband is a fundamental utility asset that these types of businesses will require, as they will rely on broadband to maintain connectedness to the electronic world. The majority of these types of businesses rely on online services to maintain their daily operations, therefore; it is critical that New Braunfels is able to promote the availability and affordability of broadband services in its recruitment efforts. This can be a true differentiator for New Braunfels; through promotion of the community's leading-edge broadband services, prospective businesses and site selectors can be assured that they can locate in the region and have robust access to the rest of the electronic world. Available and affordable high-speed broadband has also gone beyond being a differentiator to being a key part of the "minimum ante" for attracting and retaining desirable businesses and facilities.

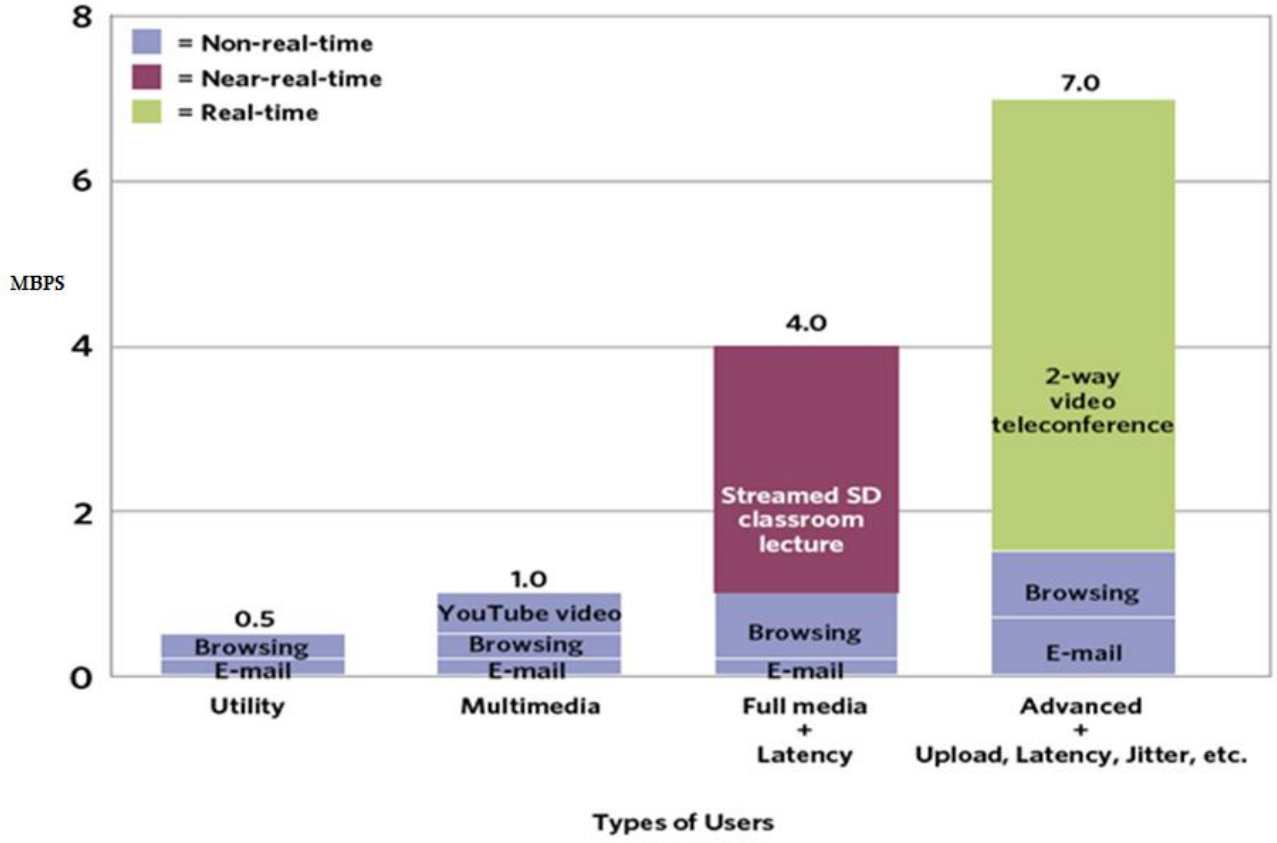
See Appendix B – Economic Development Case Study for a more in-depth review of the impact of fiber to Bristol, Virginia

D. Education

Educational organizations are a major user of broadband in New Braunfels and their needs continue to grow. These include K-12 schools and the Central Texas Technology Center. Online applications used by these organizations require not only high-bandwidth broadband, but also services that meet strict quality and performance requirements to support real-time video and voice applications such as distance learning and teleconferencing. Online textbooks are in use today, and that utilization is only expanding. Texts and teaching resources incorporate multimedia – sound, graphics, video, and data. Many states have also instituted requirements for online testing or are in the process of doing so, creating an even greater need for high-quality broadband services. Additionally, educational institutions are utilizing more online content to support their curricula, from sources such as YouTube, TeacherTube, Vimeo, and Facebook.

Figure 4-6 illustrates the bandwidth requirements per student for common educational applications and the quality and performance requirements of these applications. Basic educational tools, such as web browsing and YouTube consume up to about 1 Mbps per student. However, moving up to more advanced educational technologies such as streamed classroom lectures and 2-way video teleconferences use significantly more bandwidth per student, 4 Mbps and 7 Mbps, when combined with the basic educational tools. In addition, these advanced tools require not only more bandwidth but also strict broadband quality metrics that allow them to function properly, such as low latency and higher upload speeds.

Figure 4-6: Bandwidth Demands for Educational Technologies Per Student



The New Braunfels Public School District is comprised of eight elementary, two middle, and one senior high school and nearly 8,400 students. The district participates in the federal E-Rate program with an average subsidy rate of 59%; meaning that 59% of its broadband connectivity and internet costs are paid for by the federal government through the E-Rate program. E-Rate is the commonly used name for the Schools and Libraries Program of the Universal Service Fund, which is administered by the Universal Service Administrative Company (USAC) under the direction of the Federal Communications Commission (FCC). The program provides discounts to assist schools and libraries in the United States to obtain affordable telecommunications and internet access. It is one of four support programs funded through a Universal Service fee charged to companies that provide interstate and/or international telecommunications services, and this fee is passed on to consumers on their telecommunications bills. Since all households that consume video and/or telephone service are required to pay into the Universal Service Fund, it is important that communities maximize their participation in the E-Rate program to help recoup the investment made by their residents that pay into the fund.

New Braunfels Public Schools obtains its broadband connectivity and Wide Area Network (WAN) internet services through a purchase of its own fiber transport with an agreement with New Braunfels Utilities for operations and maintenance. The district has several technology initiatives including the use of Google Apps, online subscription based book services, and online testing. 1:1 initiatives are in the early stages, however robust high-speed wireless networks will be required on campus and in school facilities to support a wide deployment to the students. They are also pursuing iPads for grades 5-12 and Bring Your

Own Devices (BYOD) in grades 5-12. BYOD will allow students to bring their own devices to use at school. If a student does not have a device, the schools have the ability to loan the student one using a "check out" process.

The Comal Independent School District (CISD) is a 563 square mile district comprised of 18 elementary, five middle, and four senior high school and nearly 17,000 students. CISD currently has fiber connections only in its New Braunfels location. Time Warner Cable is the internet provider with 1Gpbs fiber into the main data center. The network is provided via leased lines at a very high cost. Outside of high costs, bandwidth issues have caused limitations in services such as the BYOD option for students. The ability to launch any new technology initiatives will be hampered in the future.

Central Texas Technology Center (CTTC) is a member of the Regional Center of the Alamo Colleges. Content for classes come from a number of the University of Texas and Texas Tech campuses. They are already experiencing bandwidth issues impacting their ability to bring state-of-the-art curriculum and services to its students and faculty. Information Security, Business Administration, and Nursing programs are primary areas of studies at this campus. Enrollment is approximately 1000 degree seeking and 2400 from the workforce. The campus is expanding with a new building that will more than double degrees seeing enrollment in the near term. If fiber were available, they would like at least 100 Mbps minimum through 2019. After 2019 they feel they would need at least 150 Mbps.

The CTTC is funded by the State of Texas and would switch to a fiber based service immediately if it were to become available and feels that educational opportunities would expand for the community of better service were available.

E. Healthcare

Broadband is crucial for New Braunfels' healthcare providers that are interested in meaningfully leveraging electronic health records, as many of the capabilities of health IT such as telehealth and electronic exchange of health care information, require high performance broadband capability. New Braunfels' major hospitals currently maintain access to high-speed broadband services but beyond these organizations, few healthcare providers maintain this type of access. Doctor's offices, clinics, and imaging centers all have growing broadband needs to ensure they stay connected as their organizations transition to the digital healthcare environment. For these smaller organizations, high-speed broadband becomes a critical need to fulfill their mission and long-term success.

Some of the largest healthcare providers have noted a push from many independent providers to a Healthplex style of patient care, which will require more bandwidth and connectivity, as many physicians come together at one location to deliver more efficient care. Each Healthplex will need to communicate back to their affiliated hospitals and imaging center facilities. Redundancy is critical for these facilities, as a loss of connectivity can become a life-endangering event for patients. Christus reported, due to provider limitations, costs, etc., only acute care hospitals have diverse and redundant circuits.

Future needs of healthcare providers in New Braunfels will continue to grow. As a guide, the FCC has released minimum recommended broadband speeds for healthcare organizations, as part of its Healthcare Connect program. These speeds should be considered minimum requirements and New Braunfels' healthcare organizations should have access to more bandwidth if needed.

Single Physician Practice – 4 megabits per second (Mbps)

- Supports practice management functions, email, and web browsing
- Allows simultaneous use of electronic health record (EHR) and high-quality video consultations
- Enables non real-time image downloads
- Enables remote monitoring

Small Physician Practice (2-4 physicians) – 10 Mbps

- Supports practice management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables non real-time image downloads
- Enables remote monitoring
- Makes possible use of HD video consultations

Nursing home – 10 Mbps

- Supports facility management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables non real-time image downloads
- Enables remote monitoring
- Makes possible use of HD video consultations

Rural Health Clinic (approximately 5 physicians) – 10 Mbps

- Supports clinic management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables non real-time image downloads
- Enables remote monitoring
- Makes possible use of HD video consultations

Clinic/Large Physician Practice (5-25 physicians) – 25 Mbps

- Supports clinic management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables real-time image transfer
- Enables remote monitoring
- Makes possible use of HD video consultations

Hospital – 100 Mbps

- Supports hospital management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables real-time image transfer
- Enables continuous remote monitoring
- Makes possible use of HD video consultations

Academic/Large Medical Center – 1,000 Mbps

- Supports hospital management functions, email, and web browsing
- Allows simultaneous use of EHR and high-quality video consultations
- Enables real-time image transfer
- Enables continuous remote monitoring
- Makes possible use of HD video consultations

F. Public Safety

We live in a changing world where public safety agencies must address new threats and challenges both natural and man-made. It is no longer enough for first responders to rely on a push-to-talk (PTT) network for situational awareness. Police, fire, and emergency medical services (EMS) play the central roles in emergency response. Mobile technology capable of sending and receiving bandwidth-intensive information can help first responders do their jobs much more effectively and safely. These emergency response organizations need broadband networks that let them share streaming real-time video, detailed maps and blueprints, high resolution photographs, and other files that today's public safety and commercial wireless networks cannot handle, especially during major events or catastrophes.

Broadband technology and infrastructure is critical to the success of our first responders because it provides them with enhanced situational awareness in emergencies. By leveraging broadband networks, public safety organizations can gain access to site information, video surveillance data, medical information or patient records, and other information that would be useful in an emergency. These networks also support and improve 9-1-1 Public Safety Answering Points (PSAPs) response time and efficiency by establishing a foundation for transmission of voice, data, or video to the responding entity.

New broadband technologies give first responders new tools to save lives. These tools include:

- Next-Generation Radio Systems;
- Advanced Security Camera Systems;
- Gunshot Detection Systems;
- Chemical, Biological, Radiological, Nuclear, and Explosives Sensor Systems;
- Body-Worn Cameras; and
- Next-Generation Wireless Data Systems.

G. Community Support

In order for a community to thrive and grow, community support organizations must be in place. Organizations such as local chambers of commerce, human services organizations, churches, and other organizations that help connect people to the services they need in the community. These organizations traditionally access the needs and resources available in the community and collect the data necessary to help fill the gaps in services and investigate opportunities to solve community problems and issues.

Broadband plays a vital role in helping these types of organizations fulfill their missions. Whether it is as simple as a community church streaming their weekly service or the local chamber of commerce advertising their latest event through their web presence and email, broadband equips these organizations with one of the most critical communication tools necessary to ensure they are successful in their support roles.

Broadband availability inspires these organizations to be innovative in their use of technology and brings a higher level of welfare to the communities they serve. Take for example All Saints Church in rural Norfolk County, UK. The church is utilizing its spire (the tallest structure in the area) to deliver wireless internet service to the surrounding community. Now, in a community that was lucky to see speeds up to 1 Mbps, now speeds of over 8 Mbps are not uncommon. This community support organization has brought broadband service into an area that was previously underserved and is helping to bridge the digital divide that plagues many communities around the globe.

H. Smart City Innovation

Broadband networks become key drivers of efficiency and innovation as more and more municipal applications are enabled online. As cities expand online services, broadband will become an even more critical component of the daily operations to serve communities. Applications migrated to a community network enjoy greater availability and increased bandwidths over what has traditionally been available; creating a more effective and efficient municipal organization. High-speed, reliable broadband enables these organizations to: i

- Improve operational efficiencies;
- Reduce direct and indirect costs;
- Enable new interactions with citizens and businesses;
- Respond more quickly to the local community;
- Ensure better preparedness in times of emergency;
- Provide enhancements to public safety;
- Provide more information to citizens and businesses; and
- Better serve the local community.

Municipal fiber is capable of much more than just providing broadband services. It can provide a publicly owned communications infrastructure that can be used for additional public benefits, including enhanced municipal utilities, new e-government applications, technology collaboration, and infrastructure sharing programs. In addition, a municipally owned network can provide a platform for long-term innovation of Smart City technologies and applications, ranging from smart homes to energy conservation and management to green building programs. While the initial goal of this infrastructure is to enhance local broadband services, it will become a long-term asset to support Smart City programs that increase efficiency, lower cost, reduce environmental impact, and enhance quality of life.

As a future Smart City, the City of New Braunfels will take advantage of new and emerging digital technologies to enhance the wellbeing and efficiency of its community, reducing cost, and resource consumption while more effectively engaging its citizens. Smart Cities are more efficient at responding to local, national, and global challenges and position themselves to be more successful than other communities that do not leverage these new technologies.

Through the implementation of a wireless sensor network that utilizes the city's fiber network infrastructure as a platform, the City of New Braunfels can take advantage of the rising popularity of "Internet of Things" technologies. This will allow the city to monitor many components of the city's infrastructure in real time such as traffic networks, power networks, water and sewage control systems, and street lighting. By actively monitoring these and other systems in real time, the city can more proactively adjust services to better meet the needs of the community while reducing costs by gathering data to conduct efficiency studies on how the services are delivered. The data collected could potentially be used to reduce energy consumption, increase operational efficiencies, and

deliver an overall higher quality of service to the community. A few of technologies that are being examined for New Braunfels include:

I. Smart Trash Containers

Smart Trash Containers are emerging technology that has been successfully implemented in several communities around the globe. These systems rely on embedding refuse containers with wireless sensor technology to monitor and remotely alert when the containers are at capacity and need to be emptied. By alerting only when a container is full, this saves the personnel collecting the refuse time by not having to check or empty containers that are empty or only partially full. Additionally, data can be collected with regard to the rate the containers are reaching capacity and thus allow the waste management service providers to adjust their service in real time to better meet the needs of the community. This technology can also help to determine the best placement of containers geographically in the region and predict with additional capacity may be needed in a service area.

J. Street Temperature & Air Quality Sensors

By establishing an air quality monitoring system, the City of New Braunfels can enhance their understanding of the quality of life within the community. Relationships between air pollutants and human health can be discovered by combining the data of air quality and health outcomes. By establishing early warning thresholds, health risks to the community can be reduced. Many studies on air quality monitoring employ expensive instrumentation to measure variations of air pollution on a large scale and covering vast geographic regions. The newer trend is to establish street-level monitoring systems that can report on areas that are more specific and generate more granular and accurate data.

Establishing a street-level monitoring system of air quality can assist in exploring fine-scale relationships between air pollutants and people. The sensors of a street-level monitoring system can capture fine-scale spatial-temporal variations of air quality and the information gathered can help local leaders gain a more realistic view of the quality of life in New Braunfels. With the rapid growth of the manufacturing process in semi-conductor technology resulting in smaller chip sizes and new sensing materials, lower-power consumption and better measurement accuracy can be achieved simultaneously. It is now possible to deploy an effective wireless sensor network in urban settings for studies on environmental monitoring.

K. Smart Street Lighting Systems

The businesses and residents of New Braunfels can benefit from the implementation of a Smart Street Lighting system. These types of systems employ high efficiency Light Emitting Diode (LED) technology to replace traditional incandescent bulb. In power savings alone, LEDs have demonstrated to be approximately 90% more energy efficient than traditional bulb solutions; however, simply replacing the existing bulbs with LEDs does not create an intelligent lighting system.

The "Smart" components refer to the system being able to adapt in real time to the movements of pedestrians, cyclists, and automobiles. These systems will dim when no activity is detected and brighten when people or vehicles are present. Additionally, Smart Street Lighting Systems may be used to both deliver and receive data in the future creating useful "LiFi" networks that can provide greater and more efficient coverage than current "WiFi" networks.

- Benefits that result from this type of technology include:
- Large energy savings from LED technologies and ability to dim lights during low activity levels;
- Reduced maintenance costs because of the long life cycle of LED lights;
- Reduced CO_2 emissions due to reduced energy consumption; and
- Higher Quality of Life due to reduction of light pollution due to dimming.

L. Smart City Innovations through Municipal Fiber Networks

Broadband Services

- Common backbone for all anchors
  - County & City
  - Schools
  - Libraries
  - Hospitals
  - Clinics
  - Public Safety
  - Community Support
- Interconnection with service providers
- WiFi in public centers

IT Collaboration

- E-Government applications
- Bulk internet purchasing
- Application sharing
- Disaster recovery
- EOC communications

Public Safety Applications

- Video monitoring
- First responder support
- Collaboration with State & Federal agencies
- FirstNET preparedness

Future Energy & Utility Management

- Smart Grid & Demand Response
- Automated Meter Reading
- Advanced Metering Infrastructure
- SCADA communications and control

5. Opportunity Assessment - What Impact Can The City Have on Local Broadband?

The primary objectives of employing the city's fiber optic network, broadband-friendly public policies, and strategic investments are to improve access and availability of broadband services in New Braunfels. These tools are utilized to increase the supply of broadband infrastructure that is available to serve New Braunfels' businesses, residents, and community anchors. A number of benefits can be realized by expanding access and availability of broadband in New Braunfels, including:

A. Improving Affordability

By leveraging broadband assets that are already available within the city, the amount of new broadband construction is limited, reducing the investments necessary to provide services to subscribers. The cost of new broadband construction within the city may range from $50,000 - $100,000 per mile of fiber-optic infrastructure, depending on the location. In places where the city already has available conduit and fiber-optic infrastructure, "overbuilding" may not be necessary by broadband service providers, which will help them reduce their total costs to provide services to end users. In some cases, costs for broadband construction are directly passed on to end users in the fees collected by broadband service providers. In other cases, these costs become part of a broadband service provider's total cost of services from which standard rates for residential and business broadband services are derived. In both cases, the costs for broadband construction increase broadband service providers' "bottom line." Reducing these costs where feasible can positively impact costs for these providers and in turn, can lower the rates paid by subscribers

B. Increasing Adoption

Broadband adoption is influenced by two key factors, relevancy, and affordability. The city has the opportunity to improve affordability by leveraging its fiber-optic network and making measured investments in additional infrastructure. Affordability and adoption of broadband services are positively correlated. As affordability increases, so does adoption. The city can positively influence adoption by negotiating agreements with broadband service providers to provide "lifeline" internet services at low costs for disadvantaged residents, small businesses and other targeted populations in exchange for discounted use of its broadband assets. These incentive programs can help broadband service providers deploy more quickly and at lower costs in exchange for their participation in such lifeline programs.

C. Improving Public Efficiency and Effectiveness

Leveraging the city's broadband assets to connect more public institutions throughout the community creates the opportunity to establish collaborative technology programs across multiple organizations. Establishing institutional access to the city's conduit and dark fiber networks would create a high-speed, inter-governmental backbone through which these organizations could collaborate with one another on Information Technology and communications projects. Connecting schools, libraries, local government, public safety, and community organizations to one another could facilitate the sharing of technology resources among the organizations connected. Some of the potential benefits may include cost reductions through joint volume purchasing agreements, application sharing, and improvements to emergency operations and communications.

D. Reducing Taxpayer Spend

Improving public efficiency and effectiveness should reduce the costs of government to the local taxpayer. If employed effectively, New Braunfels' broadband initiatives can become a tool that facilitates cost reductions, not only for the city itself but also for other public organizations across the city, including schools, libraries and other community organizations. An inter-governmental network connecting these public organizations should consolidate the purchasing power of all agencies for common information technology and communications services, resulting in lower overall costs. The network can also "futureproof" the connectivity needs of these public agencies and protect them from cost increases, as they require additional bandwidth.

E. Reducing Lead Times for Installation

The time to install and activate end users' broadband services is significantly determined by the availability of infrastructure in the area. Businesses are negatively impacted by fiber construction lead-times that may result in delays to activate their services. 30 days is the typical industry standard lead-time for activation of fiber-optic broadband services, without a provision for special construction. In many cases, the lead-time may double or triple depending on how much additional fiber construction is necessary to reach the end user's location. The city's conduit and dark fiber infrastructure can be used to supplement existing broadband service provider infrastructure to reduce these lead times.

F. Supporting Reliability and Performance

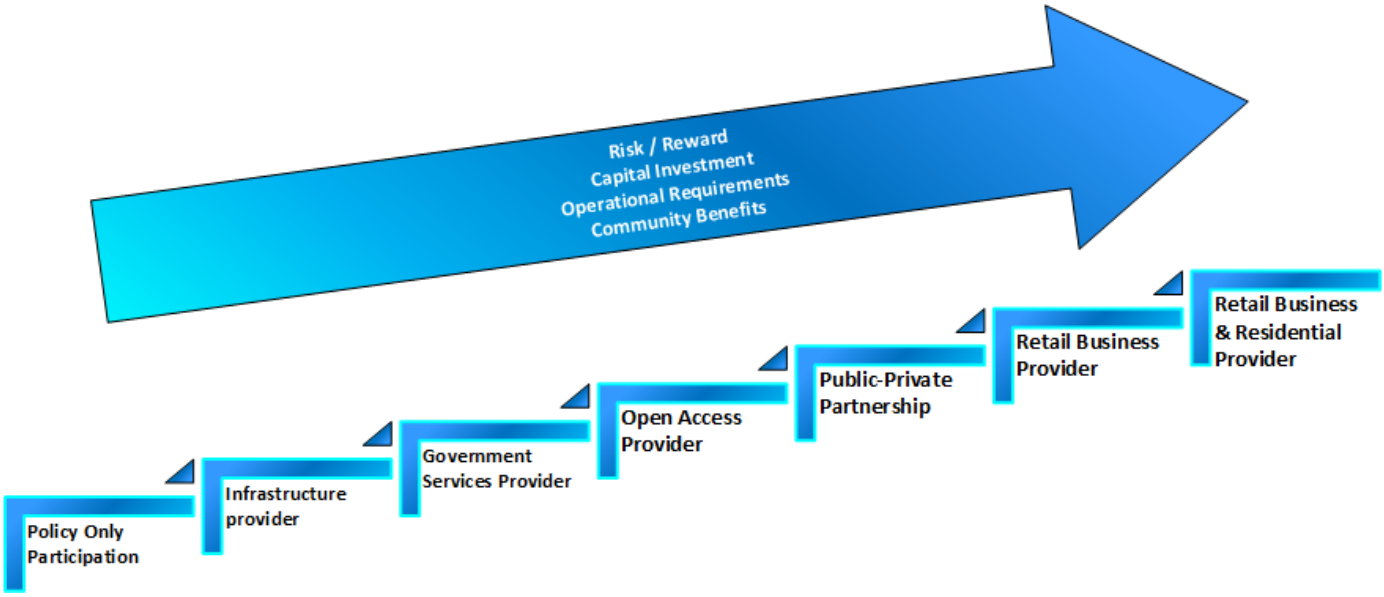
New Braunfels' broadband assets can be used to support the reliability and performance of broadband services across the city. These assets can be employed to provide new physical route diversity to the networks of existing broadband service providers and increase capacity in existing routes. They can be used to increase backhaul capacity in areas of the city that are near or at their limit and equip more commercial towers with dark fiber connectivity, increasing the bandwidth

available to mobile carriers serving New Braunfels' wireless needs. Community anchors can utilize these assets to achieve significant upgrades in speed and connectivity between their facilities as well as diversity for their primary connectivity.

6. Broadband Business Models Overview

Selecting the right business model for New Braunfels' broadband strategy depends greatly on the specific environment, market, needs, appetite for risk, funding availability, payback, and return requirements. The commonly implemented business models fall on a continuum that begins with low risk, low impact options and ends with high risk, high impact options. Figure 6-1 illustrates this continuum. As New Braunfels evaluates the various business model options from left to right, it will encounter greater degrees of risk and reward; risk, in terms of financial, operational, and regulatory risk; reward, in terms of community benefits, revenue generation, and overall profitability. New Braunfels must determine the most appropriate risk/reward balance to achieve its goals. To do so, Magellan has evaluated each business model to hone in on those that are most feasible for New Braunfels to consider. This evaluation accounted for local market, competition, funding requirements, organizational capabilities, and the regulatory environment.

Figure 6-1: Broadband Business Models



A. Policy Participation Only

Under this option, New Braunfels utilizes its public policy tools to influence how broadband services are likely to develop in the region. This includes permitting, right of way access, construction, fees, and franchises that regulate the cost of constructing and maintaining broadband infrastructure within its jurisdiction. This option is not considered a true business model, but does significantly affect the local broadband environment and is therefore included as one option. Municipalities that do not wish to take a more active role in broadband development often utilize policy participation to positively impact the local broadband environment.

Example: Santa Cruz County, CA

The Santa Cruz County board of supervisors in November 2013 approved an eight-month timeline to overhaul its broadband infrastructure plans and regulations. Specific areas of focus include permitting fee reductions and a proposed "dig once" ordinance that would make it easier to install new fiber-optic cables during other work on area roads or utilities lanes. "The county will continue a focus on broadband infrastructure throughout the county to enable businesses to function in the digital era, and students and households to have high quality access to information and communication. The county will work with industry providers to develop a Broadband Master Plan in order to identify focus areas within the county that will be most suitable for gigabyte services, particularly as the Sunesys backbone line is constructed during 2014 and 2015. The county will work with service (last mile) providers to ensure that these focus areas are deemed a priority, in order to support streaming requirements, product development, job creation and online selling capability."

B. Infrastructure Provider

New Braunfels leases and/or sells physical infrastructure, such as conduit, dark fiber, poles, tower space, and property to broadband service providers that need access within the community. These providers are often challenged with the capital costs required to construct this infrastructure, particularly in high cost urbanized environments. The municipal infrastructure provides a cost effective alternative to providers constructing the infrastructure themselves. In these cases, municipalities generally use a utility model or enterprise fund model to develop programs to manage these infrastructure systems, and offer them to broadband service providers using standardized rate structures.

Example: City of Palo Alto, CA

In 1996, Palo Alto built a 33-mile optical fiber ring routed within the city to enable better internet connections. Since then, we have been licensing use of this fiber to businesses. For the past decade, this activity has shown substantial positive cash flow and is currently making in excess of $2 million a year for the city. We now have that money in the bank earmarked for more fiber investments."

C. Government Services Provider

If New Braunfels becomes a government service provider, it will utilize its fiber-optic network to interconnect multiple public organizations (community anchor institutions) with fiber-optic or wireless connectivity. These organizations are generally limited to the community anchors that fall within their jurisdiction, including local governments, school districts, higher educational organizations, public safety organizations, utilities, and occasionally healthcare providers. The

majority of these anchors require higher capacity connectivity and often, the municipal network provides higher capacity at lower costs than these organizations are able to obtain commercially. Local government networks across the country have been built to interconnect cities, counties, school districts, and utilities to one another at lower costs and with long-term growth capabilities that support these organizations' future needs and protect them from rising costs. In these cases, entities extending networking to CAIs may be cities, counties, or consortia that build and maintain the network. The entities utilize inter-local agreements between public agencies to establish connectivity, rates and the terms and conditions of service.

Example: Seminole County, FL

Seminole County owns and operated a 450-mile fiber-optic network that was installed over the past 20 years by the county's Public Works departments primarily to serve the needs of transportation. Since that time, the network has grown to connect the majority of the county's facilities, five cities within Seminole County, Seminole Community College, Seminole County Schools, and other public network to a common fiber-optic backbone. The network has saved millions of dollars in taxpayer dollars across the county and has become a long-term asset that enables the county and the other connected organizations to meet their growing connectivity needs.

D. Open-access Provider

Municipalities that adopt open-access generally own and operate a substantial fiber-optic network in their communities. Open-access allows these municipalities to "light" the fiber and equip the network with the electronics necessary to establish a "transport service" or "circuit" for service providers interconnecting to incorporate additional capacity and connectivity into their local network. Service providers are connected from a common interconnection point with the open-access network and have access to all customers connected to that network. Open-access refers to a network that is available for any qualified service provider[9] to utilize in order to connect their customers. It allows municipalities to provide an aggregation of local customers on a single network that service providers are able to compete for efficiently and cost effectively to provide services. The concept of open-access is designed to enable competition among service providers across an open network that is owned by the municipality. The municipality remains neutral and ensures non-discriminatory practices and access for all providers who operate on the network. The municipality establishes a standard rate structure and terms of service for use by all participating service providers.

Example: City of Palm Coast, FL

[9] "Qualified" can mean an entity that has been certificated and authorized by the state's public utilities commission.

In 2006, the Palm Coast City Council approved a 5-Year fiber-optic deployment project funded at $500,000 annually for a total investment of $2.5 million. The network was developed to support growing municipal technology needs across all public organizations in the area, including city, county, public safety, and education. It was also planned to support key initiatives such as emergency operations, traffic signalization, collaboration, and video monitoring. The city utilized a phased approach to build its network using cost-reducing opportunities to invest in new fiber-optic infrastructure. As each phase was constructed, the city connected its own facilities and coordinated with other public organizations to connect them; incrementally reducing costs for all organizations connected to the broadband network. Showing a reasonable payback from each stage of investment allowed the city to continue to fund future expansion of the network. Through deployment of this network, the city has realized a savings of nearly $1 million since 2007 and projects further annual operating savings of $350,000 annually. In addition to these savings, the city's network provides valuable new capabilities that enhance its mission of serving the residents and businesses of the community.

E. Retail Service Provider – Business Only

Municipalities that provide end users services to businesses customers are considered retail service providers.[10] Most commonly, municipalities provide voice and internet services to local businesses. In many cases, a municipality may have built a fiber network for the purposes of connecting the city's primary sites that has been expanded to connect local businesses, in effort to support local economic development needs for recruitment and retention of businesses in the city. Municipalities that provide these services are responsible for managing customers at a retail level. They manage all operational functions necessary to connect customers to the network and provide internet and voice services. Municipalities compete directly with service providers in the local business market, which requires the municipality to manage an effective sales and marketing function in order to gain sufficient market share to operate at a break-even or better. This may or may not require certification and authority from the state's public utilities commission.

Example: Fort Pierce Utilities Authority

Primary FPUAnet services are Dedicated Internet Access, fiber Bandwidth Connections, E-Rate IP Links, and Dark Fiber Links. FPUAnet services also include Wireless Broadband Internet and Wireless Bandwidth Connections, which extend FPUA's fiber through wireless communications. The FPUAnet Communications mission statement is "To help promote economic development and meet the

[10] This does not preclude provision of open access network services for use by service providers in serving residential customers also.

needs of our community with enhanced, reasonably priced communications alternatives. It all began around 1994, when FPUA began to build a fiber-optic network to replace leased data links between its buildings in Fort Pierce. The new optical fiber system proved more reliable and cost effective, and was built with sufficient capacity for external customers. In 2000, FPUA allocated separate fibers through which it began to offer Dark Fiber Links to other institutions. This soon expanded to include businesses and more service types.

F. Retail Service Provider – Business & Residential

Municipalities that provide end users services to businesses and residential customers are considered retail service providers. Most commonly, municipalities provide voice, television, and internet services to their businesses and residents through a municipally owned public utility or enterprise fund of the city. As a retail service provider that serves businesses and residents, the municipality is responsible for a significant number of operational functions, including management of its retail voice, television and internet offerings, network operations, billing, provisioning, network construction, installation and general operations and maintenance. The municipality competes with service providers in the business and residential markets and must be effective in its sales and marketing program to gain sufficient market share to support the operation. Many municipalities that have implemented these services are electric utilities that serve small to midsize markets, which already operate and maintain a fiber optic network for internal uses. Many of these markets are rural or underserved in areas that have not received significant investments by broadband service providers. Retail service providers must comply with state and federal statutes for any regulated telecommunications services. These organizations must also comply with state statutes concerning municipal and public utility broadband providers; a set of rules has been developed in most states that govern the financing, provision, and deployment of these enterprises. This may or may not require certification and authority from the state's public utilities commission.

Example: Bristol Virginia Utilities (BVU OptiNet)

BVU OptiNet is a nonprofit division of BVU, launched in 2001, that provides telecommunication services to approximately 11,500 customers in areas around Southwest Virginia. OptiNet is known for its pioneering work in the area of municipal broadband throughout the area. BVU is acknowledged as the first municipal utility in the United States to deploy an all-fiber network offering the triple play of video, voice and data services. Offering digital cable, telephone service, and high-speed internet from a remote-area utility provider makes BVU exceptional, even on a global level.

Figure 6-2: Comparison of Business Models

	Infrastructure Provider	Government Services Provider	Open Access Provider	Public-Private Provider	Retail Business Provider	Retail Business & Residential Provider
Services Offered	• Conduit • Right of way • Dark fiber • Tower space • Property	• Connectivity service to public organizations • Conduit • Right of way • Dark fiber • Tower space • Property	• Wholesale transport service to service providers • Connectivity service to public organizations • Conduit • Right of way • Dark fiber • Tower space • Property	• Wholesale transport service to service providers • Connectivity service to public organizations • Conduit • Right of way • Dark fiber • Tower space • Property	• Internet, voice, and other business-focused retail services • Connectivity service to public organizations • Conduit • Right of way • Dark fiber • Tower space • Property	• Internet, voice, video and other business and residential retail services • Connectivity service to public organizations • Conduit • Right of way • Dark fiber • Tower space • Property
Customers	• Service providers • Community anchors	• Service providers • Community anchors	• Service providers • Community anchors	• Residential • Business	• Business • Service providers	• Residential • Business
Opportunity	• Accelerate broadband deployments • Improvements to general broadband access and availability • Reduce costs to provide new services	• Enhanced capacity and capabilities to community anchors • Increased efficiencies and collaboration among public organizations • Reduced cost for public organization	• Specialized fiber service to serve business and economic development • Establish a more competitive market with more providers • Accelerated delivery to market	• Triple-play services to homes and businesses • Control over how and where services are available to maximize community impact • Accelerated delivery to market • Possible revenue share	• Improved services to business community • Establish a more competitive market with more providers	• Triple-play services to homes and businesses • Control over how and where services are available to maximize community impact
Risks	• • Slow uptake • Inefficient utilization of assets	• Execution and collaboration with other public organizations	• Operating expertise • Meeting service provider performance requirements • Service provider adoption of a municipal broadband network	• Operating expertise • Meeting service provider performance requirements • Service provider adoption of a municipal broadband network	• Operating expertise • Significant funding required • Competition with service providers	• Operating expertise • Significant funding required • Competition with service providers • Politically challenging • Market response • Questionable financial sustainability

7. Retail Business Models

New Braunfels has many business model options available to affect its citizens' access to broadband services. However, through analysis of information received from the City of New Braunfels and New Braunfels Utilities as it pertains to an acceptable risk/reward spectrum, certain business models are not complementary and appear through this Study's analysis to be impractical for New Braunfels. With this in mind, Magellan does not recommend that New Braunfels consider providing subscriber-based retail services (e.g. internet, voice, video, wireless, etc.) as part of its broadband initiative.

The reasons to exclude retail models are as follows:

1. Lack of political support in becoming retail provider - While participating in outreach and stakeholder meetings, it became evident that many of the key stakeholders would not support the city becoming a retail provider directly competing with the other providers in market. It was felt that this was not a good role for New Braunfels and that it should focus more on investing in infrastructure and investigating public-private partnerships.

2. State laws regulating municipality broadband – Texas Utilities Code, § 54.201 defines the roles that a Texas municipality may utilize as it relates to the deployment of telecommunication facilities and services. The statute does not allow New Braunfels to provide retail broadband services. The law does, however, allow New Braunfels to make investments in broadband infrastructure for its own internal use and for the provision of wholesale telecommunications services within its jurisdiction. Recent FCC rulings in North Carolina and Tennessee may eventually overturn the current Texas statute. New Braunfels also has the ability to petition the FCC to allow it to provide retail services if it desires to do so right away.

3. Financial sustainability of such an endeavor appears questionable - Competition in New Braunfels may be significant enough that it would challenge New Braunfels' ability to gain enough market share to produce the revenues necessary to support capital, operational and debt service expenses of a telecommunications utility. Broadband providers could be expected to lower existing prices and lock in customers to long-term contracts to maintain their existing market share, and impede entry by New Braunfels. In addition, the region has multiple providers delivering business and residential services today; not only by incumbent cable and telephone providers, but New Braunfels has several other regional competitors. It is not clear the market would support another provider.

4. Funding such an endeavor could be fiscally challenging - Initial funding of a telecommunications utility would require a significant upfront investment in fiber-optic network, equipment, and professional services to implement the utility. In addition, significant ongoing funding for operations and management would be required to support the utility for many years until revenues were great enough to cover all of the utility's operating expenses, debt service, and reserves. Telecommunications utilities generally utilize revenue bonds to fund these projects. It is unlikely that the municipal bond market would provide favorable rates and covenants based on the financial projections for a retail provider.

5. New Braunfels does not maintain the core competencies to become a retail provider - New Braunfels does not currently have the capabilities to manage a telecommunications utility, which would require significant operations and management resources. These services stray from New Braunfels' core competencies to the degree that starting a telecommunications utility could potentially result in significant challenges to providing quality retail services commensurate with those currently available from broadband providers.
6. A retail model could severely limit New Braunfels' other options, opportunities and partnerships - As a retail provider, New Braunfels would be forced to compete with broadband providers to gain enough market share to maintain financial sustainability. This would create a hostile environment between New Braunfels and broadband providers that would eliminate meaningful public-private partnerships.

8. Business Model Recommendations

Magellan believes that New Braunfels' best strategy to quickly bring next-generation broadband to its public and private sectors will be to utilize a combination of business models along with the city's infrastructure strengths. New Braunfels should use strategies from the policy tools, open-access, government services, and public-private partnerships models.

In support of these strategies, New Braunfels should immediately look to implement broadband-friendly public policy tools. These policy tools influence how broadband services are likely to develop in its community. This includes permitting, right of way access, construction, fees, and franchises that regulate the cost of constructing and maintaining broadband infrastructure within its jurisdiction.

A. Broadband-Friendly Public Policy Tools

i) What are Broadband-Friendly Public Policy Tools?

Broadband-friendly public policies are tools that New Braunfels can utilize to encourage broadband implementation and reduce the cost of broadband infrastructure construction. Strategic policies also enable more opportunities for the installation of broadband infrastructure in conjunction with other public and private projects occurring within the city's jurisdiction. Public policy tools are constructed and implemented according to each city's existing ordinances and processes; there is no one single approach to creating effective policies.

ii) Comprehensive Broadband Standards / Joint Trenching Policies

Incorporating broadband infrastructure requirements into the city's land development statutes will allow and encourage broadband construction in conjunction with other capital projects. For example, installation of conduit during projects involving roads, sidewalks, trails, lighting, etc. would be less costly than installing conduit through standalone projects. Since the majority of costs to build broadband infrastructure in New Braunfels are incurred through trenching, boring, and restoration, this strategy can alleviate significant costs by opening the ground once instead of multiple times. New Braunfels, through the use of its Capital Improvement Plan, can determine which projects will best utilize this strategy.

This policy should also be coordinated with New Braunfels Utility and other broadband providers to minimize the need to overbuild and to ensure that providers have an opportunity to place their infrastructure in capital projects as well. Joint trenching policies can facilitate more opportunities to install conduit, fiber, and other infrastructure due to lower costs. Standardization of these agreements across all potential owners of underground infrastructure can be established to ensure all parties are aware of the joint trenching opportunities as they become available.

iii) Creation of an Infrastructure Fund

The city would establish an infrastructure fund set-aside, allocating monies to build broadband infrastructure when opportunities arise, aligned with the capital project schedule. The city would

establish funding based on the capital project schedule and areas where the city could favorably build infrastructure. This would typically be a rolling fund with a reserve or set-aside for unanticipated projects.

iv) GIS and Infrastructure Record Keeping

As part of implementing broadband-friendly public policy measures, the city should require that Geographical Information System (GIS) documentation of all broadband infrastructure installations, upgrades, et al. be maintained and updated as incurred. If the city does not currently have a GIS, Magellan strongly suggests that the city should invest in a GIS based fiber management system to capture and track documentation of its broadband infrastructure. This will allow the city to maintain a clear understanding of locations of the broadband infrastructure such as conduit, vaults, pull boxes, transitions, fiber-optic cable, and other outside plant resources.

v) How Would The City Implement Broadband-Friendly Public Policy Tools?

Developing broadband friendly-pubic policies requires the City of New Brianfels to evaluate current land use, permitting, construction, and right-of-way policies to determine how these can be tailored to incent development of broadband infrastructure in the city. Below is a list of ways that New Braunfels can encourage broadband development through the adoption of broadband-friendly polices:

- The city should adopt policies that incorporate broadband as a public utility and create a policy framework to promote its deployment in public and private projects as appropriate
- Draft policies to the city's specific needs and adopt them into local policy, codes, and standards (including policies, dig-once, joint trenching, engineering standards, etc.).
- Incorporate broadband concepts into the city's Capital Improvement Plans (CIP), as appropriate, and make a commitment to fund broadband infrastructure.
- Identify opportunities to install broadband infrastructure in conjunction with public and private construction projects.
- Develop a process so that local Planning and Public Works Departments coordinate with the city to identify projects that could install infrastructure at reduced costs.
- Maintain broadband infrastructure specifications in a city owned GIS based fiber management system, requiring GIS-based drawings and implementation of other means for accurate documentation.
- Develop methods to streamline the broadband permitting processes within public rights-of-way to ensure broadband providers do not face unnecessary obstacles to building infrastructure.
- Evaluate fees levied on broadband providers for constructing broadband infrastructure to ensure they do not discourage broadband investment.

vi) Municipalities That Have Implemented Broadband-Friendly Public Policies?

Example: City of Palm Coast, FL

In 2005, the city created specifications for broadband standards that were adopted by the City Council and became part of the city's engineering standards for all projects. Since 2005, the city has built 30+ miles of underground conduit infrastructure at a

fraction of the cost by incorporating it into the design of water and sewer, road widening, and street lighting projects. The city has also worked with local developers to incorporate these standards into their commercial and residential projects to ensure that any new or retrofit development is outfitted with basic broadband infrastructure.

Example: Santa Cruz County, CA (County Organization)

Santa Cruz County has implemented a number of broadband-friendly public policies that act to streamline, expedite, and reduce the cost of building broadband infrastructure. The County has implemented the following:

1. *A master lease agreement allowing the placement of broadband infrastructure on county assets.*
2. *A new ordinance that more easily allows the installation or upgrades of broadband infrastructure in the county rights-of-way.*
3. *Conduit specifications for placement of conduit during construction projects (dig once).*
4. *A broadband master plan to target sections of the county (such as economic vitality areas) for additional broadband infrastructure.*

vii) Are There Any Risks?

There is little financial risk in implementing policy tools because they require little upfront funding if managed correctly. In some cases, municipalities have struggled with incorporating broadband into their existing land use policies because they are unfamiliar with how to manage a new "utility" type of asset. This requires the collaboration of multiple departments and the ability of these departments to work together to a common goal. The city should expect that some new business and operational processes would be required as well as changes to existing processes in order for the policies to be effective.

B. Public-Private Strategies

Before embarking on pursuing public-private partnerships (PPP), a municipality should investigate interest from regional providers to see if there is any interest in this type of arrangement. This is an important first step for the city to take in that it will help the city understand what benefits can be achieved working in partnership with existing broadband providers. This step was accomplished during the information gathering stage for the feasibility study by Magellan through discussions with an area provider, GVTC. They expressed interest in further discussions and await specifics from New Braunfels for evaluation. As every public-private partnership is different, the city should consider some key questions before pursuing. The following sections provide guidance on broadband public-private partnerships (PPPs).

i) What is a Broadband Public-Private Partnership?

A broadband public-private partnership ("PPP") is a negotiated contract between a public and private entity to fulfill certain obligations to expand broadband services in a given area. PPP's have gained popularity over recent years as more municipalities employ public broadband and utility infrastructure in conjunction with private broadband providers. PPPs leverage public broadband assets, such as fiber, conduit, poles, facilities with private broadband provider assets and expertise to increase the availability and access to broadband services. Municipalities make targeted investments in their broadband infrastructure and make it available to broadband providers with the goal of enticing providers to service their communities. In this type of model, New Braunfels would be considered an Infrastructure Provider who maintains permanent ownership interest in the broadband infrastructure funded by the city.

ii) Implementing a Broadband PPP?

One method to develop a broadband PPP is to hold competitive negotiations with one or more broadband providers interested in providing service to New Braunfels. Depending on the needs of the city and the provider(s), the partnership may take many forms. In the city's case, it would bring public broadband assets to the negotiating table with private broadband providers to achieve mutually desirable benefits to both the city and the partner(s).

The city could also consider issuing a "Request For Proposal" (RFP) as a vehicle to recruit, evaluate and procure a provider. The RFP approach is used for several reasons. First, in cases where organizations do not want to engage in managing broadband resources, they have used RFP's to negotiate the wholesale use of their assets while retaining the underlying public ownership. Second, they often want to utilize established procurement vehicles through which they can negotiate "partnerships" with broadband providers. RFP's are a commonly used as form of procurement; enabling municipalities to follow procurement and negotiation guidelines that are familiar to them. Third, the organizations often want to ensure their procurements are open and non-discriminatory to qualified broadband providers.

The RFP would invite broadband providers to submit information detailing how they would utilize the city's broadband infrastructure to achieve the objectives laid out in the RFP. RFP's are generally not solely evaluated on price as the revenues and costs within the project negotiated between the parties are a constantly changing due to multiple factors and many times are not determined until well into the negotiation. Rather, they are executed on the total value derived from the project, in terms of revenue, economic development, new jobs, increases in the tax base, pricing for services, quality of services, and other "non-financial" or "off balance sheet" benefits.

iii) Important Criteria for Broadband PPPs?

As the city begins its discussions with potential broadband providers, it is important to consider the following questions to ensure it is making informed decisions about moving forward:

Q1: Should the city negotiate with one or multiple broadband providers?

The decision to form a Broadband PPP with a single or multiple providers will determine how much power the city maintains at the negotiating table with potential partners and how much of the city's

goals are agreed to by the partner. In a single provider PPP, the provider will generally be incented by the opportunity to capture a large market through use of the city's broadband assets and do so with no competition from other providers for those assets. In a multi-provider PPP, multiple providers will have access to those assets, reducing the incentives a single provider would enjoy. However, a multi-provider PPP would protect the city from a lack of performance or a default of a single provider, which may render the PPP ineffective.

Q2: What is the range of potential partners available to the city?

The city should make the RFP open and non-discriminatory, allowing all qualified providers the opportunity to submit their proposal. This will be somewhat determined by the city's legal ability to negotiate with one provider without a public procurement. In many public-private partnerships, a public procurement has been used to ensure the municipality enforces non-discrimination requirements as a public organization. The RFP may be inclusive of New Braunfels' current broadband providers, including incumbents, cable companies, and other competitive providers. The city may also consider the geographic scope of potential partners. Limiting the scope of qualified applicants to only those serving New Braunfels today could limit the city's range of proposals. The city should consider expanding this scope to cover the greater US telecom/broadband market to include potential partners that may deliver other new and innovative broadband solutions to the region.

Q3: What incentives can the city offer potential partners?

The city can make its broadband assets available to one or more partners on a cost basis (with minimal markup over cost) to incent providers to accelerate broadband deployments in New Braunfels. These incentives may also help providers reduce costs to citizens, businesses, and community anchors. The city should clearly identify the assets that it will employ in the partnership, the value of these assets and the consideration given to partners for incentivized use of the assets. Doing so will ensure the city and partner(s) clearly document the exchange of value between the partners. Many municipalities have used economic development agreements to memorialize these exchanges.

Q4: What conditions could the city ask of broadband providers?

The city should clearly define its expectations in the partnership(s). These expectations may include offering specific types of services in target areas, guaranteeing performance and quality of services and offering low-cost "lifeline" packages for economically disadvantaged residents and businesses. The city should identify which components are required and non-negotiable in the partnership versus those components that may be negotiated. For New Braunfels, some of the critical "ask" terms for the city should include:

- Providing free or low-cost internet service to public organizations
- Establishing a non-compete agreement for connectivity services to public organizations, the city desires to expand its services to schools, healthcare and other public organizations directly;

- Meeting price targets for specific tiers of service to residential and commercial customers;
- Providing Gigabit internet services to businesses and potentially residents;
- Co-Marketing programs that the region's economic development organizations can utilize to recruit new business and promote New Braunfels as a connected region;
- Enabling low-cost "lifeline" broadband services for economically disadvantaged residents;
- Equipping business parks, community redevelopment areas, and other designated places with broadband services;
- Guaranteeing performance, availability, and reliability of services provided under the PPP; and
- Inclusion of an equity/penalty clause should the provider fail to meet the agreed upon terms.

Q5: How could the partnership be managed?

The city should anticipate the need for ongoing management of a Broadband PPP. This will require the city to establish resources such as administrative, management, and operational personnel or arrange for these tasks to be outsourced to a third party. The primary management functions include measuring the progress and performance of the partner(s), overseeing the broadband assets employed in the partnership, and managing ongoing operational functions such as new broadband build outs.

iv) How to Achieve the Most Favorable Outcome

Outcomes are highly dependent on the city's goals in the project, value of the broadband assets, and desire to maintain control over how the broadband provider utilizes the assets. To achieve the most favorable outcomes, the city should strive to accomplish several key items in negotiating a PPP with the potential partner (or others):

1. Treat broadband providers as stakeholders in the community
    a. Consider their capital requirements
    b. Remember that providers are for-profit, and their decision-making will be based on achieving internally required returns
    c. Understand that their payback requirements are shorter than in the municipal world

2. Identify the target areas for broadband expansion in the PPP
    a. Identify the boundaries
    b. Pinpoint the city's broadband assets for use in these target areas
    c. Define the services that are expected to be provided by the broadband provider

   d. Enable the provider to deploy services as quickly as possible by minimizing the following obstacles:
      i. Permitting timeframes
      ii. Requiring single versus bulk/blanket permits for their projects
      iii. Strict construction requirements for placement of conduit, fiber and facilities

3. Minimize one-time ongoing fees to keep prices for broadband services low in the local market
   a. Normalize, reduce or waive permitting fees for construction projects
   b. Minimize leasing fees for the city's broadband assets such as fiber and conduit
   c. Allow for lower cost construction methods where possible (in conjunction with item 1c)

4. Clearly define the consideration given and received in the project with the broadband provider
   a. Determine the value given by the city to the provider in the PPP
   b. Determine the value generated by the provider to the community as a result of the PPP
   c. Define the timeframe for the community to receive the benefits of the PPP

5. Define how the PPP will be managed and governed
   a. How will the parties conduct business with one another and maintain alignment
   b. How do the parties deal with shortfalls if either party isn't able to meet the requirements in the timeframe desired
   c. How is performance of the PPP and the partners measured?

Example: Google Fiber in Kansas City, Provo, and Austin

These projects utilize a form of public-private partnership whereby each municipality developed agreements for the use of municipal broadband infrastructure and/or policy incentives to attract the provider to the city.

Example: Axcess Ontario, NY

Axcess Ontario builds the fiber infrastructure to supply/lease telecom technology, which enables carriers to provide service to their customers. Axcess Ontario collaborates with broadband providers such as Verizon Wireless and Time Warner Telecom to leverage its fiber-optic network to bring more broadband services to the community.

v) What are the Risks?

Broadband PPPs are relatively new to local governments but their popularity is growing because they align public organizations and private providers, leveraging each other's core strengths. In most cases, PPPs alleviate municipalities from the requirements to provide retail or wholesale broadband services and allow them to employ their broadband infrastructure and policies with providers who take on these responsibilities.

Fundamental alignment between the public and private partner(s) is important for successful PPPs. Municipal goals must be balanced with private sector goals and strategies. These goals and strategies must fulfill each party's critical needs and must be forged early in the process. The identification and selection of the right partner(s) is paramount to success in the project. Execution risks can be high for municipalities that do not have a clear understanding of the true needs of their communities or those of broadband providers.

C. Broadband Infrastructure

i) What Infrastructure Would The City Build?

The city would make key strategic investments in underground conduit and fiber optics throughout the key business corridors and areas of New Braunfels. The city in turn would offer these assets to providers to use to deliver high-speed broadband services to the businesses, community anchors and potentially residents throughout the service area. These directed investments would allow retail providers to use the infrastructure to reach more customers without the need for a business case to obtain capital to build the costly fiber infrastructure. The city would maintain responsibility for this function.

ii) Why Would The City Build This Network?

Many municipalities find the investment in infrastructure to be a compelling option for them as it allows local input and oversight into the deployment of broadband services as well as the ownership of these key community assets. The city's involvement can also be used to keep prices low for potential users, while at the same time providing for the advanced capabilities enabled by fiber optic cable. It also allows them to continue the buildout of their fiber-optic networks for municipal and community purposes by owning the underlying physical fiber network. These investments in infrastructure are long-lived assets, and will continue to bring value to the region for decades to come.

By making key investments in fiber infrastructure throughout New Braunfels, the city can consider these areas as "fiber ready." This can be a significant game changer for economic development, as potential businesses would have the ability to know it can locate its business within a "fiber zone", and that scalable fiber services are readily available. Through investment in a network infrastructure, the city could potentially provide a new source of next-generation broadband access to service providers while maintaining neutrality and non-discrimination while "staying out of the business" of providing retail services. The city's only customers are the service providers that utilize the municipal network to reach businesses, anchors and potentially residents in New Braunfels.

iii) C. How Would The City Build This Network?

Becoming an infrastructure provider would require the city to create an appropriate organizational and operational structure to manage the broadband infrastructure assets. Some considerations for the city to evaluate in implementing this network include the additional operations and management responsibilities required to maintain the network, recruitment, negotiation and financing requirements to build the network.

iv) Broadband Infrastructure Investment Concept

The city's investment in broadband infrastructure could be utilized as an additional asset that can be brought to the table in a Public-Private-Partnership. This infrastructure, which would be owned by the city would be utilized by the partnering provider as the distribution/access network used to connect commercial buildings and users within the fiber zones identified in this Study. Availability of these assets removes the barrier of entry for providers that would like to enter the market or expand, yet have constraints of capital or difficulty making the business case. In addition, the entire region can make use of the city's network providing local ownership and decision-making as it relates to telecommunications, and in the support of deploying Smart Community technologies that can drive innovation and efficiency.

In many cases, providers operating in and out of New Braunfels have to justify the cost to build fiber infrastructure to connect potential subscribers. This process involves the development of a business case and a reasonable payback, which for many telecom entities is 18 to 36 months, a generally short timeframe. In areas such as downtown New Braunfels, these paybacks can be difficult to obtain especially when underground placement is required if aerial deployment is not an option, and the cost per foot for construction/restoration can be very high. The City of New Braunfels can strategically build a fiber network to serve these fiber deployment zones and can utilize local funding, long-term financing options and can include the off-balance sheet benefits such as job growth, business retention, and increased quality of life to develop its business case and return on investment.

A city owned network could also be utilized to expand fiber service to key anchor institutions in the region for intergovernmental collaboration purposes, increased local access for Smart Community initiatives or to access telecommunications providers who may be interconnected to the network. Not only would this fulfill additional connectivity needs, but would likely do so at a reduced cost than can otherwise be obtained in the local market.

The city's ownership in this long-term asset provides the local region with ownership of the broadband infrastructure that will drive community and economic development for decades to come. The city and its local government partners will have the ability to make key decisions on how and where this asset is expanded, providing local control and decision making that is otherwise absent from the environment today. This network would allow the city to aggregate local demand for telecommunications services across a common network, paid for and owned by the communities it serves.

The existing fiber map [Figure 8-1] shows that New Braunfels is well positioned to address the fiber deployment zones mapped below. These include the major business areas of the city and encompass the Downtown Core [Figure 8-2], North [Figure 8-3] and South [Figure 8-4] Business Zones, the Airport Park [Figure 8-5], and the future Business Park area [Figure 8-6]. Connectivity between these zones would provide additional fiber connectivity options for those businesses located in these key corridors. From an Economic Development perspective, these identified zones could be classified as "Fiber Ready" areas where direct fiber services are readily available. The implementation of this concept takes the guess work out of trying to figure out whether or not fiber service is available in a specific area of the region, as well as the aid to construction costs which are normally passed along to the business

requesting service. Businesses looking to locate in the New Braunfels region can be directed to these fiber zones with assurance of high-speed scalable broadband connectivity being readily available.

Figure 8-1: City of New Braunfels, New Braunfels Utility, and New Braunfels ISD Existing Fiber Routes

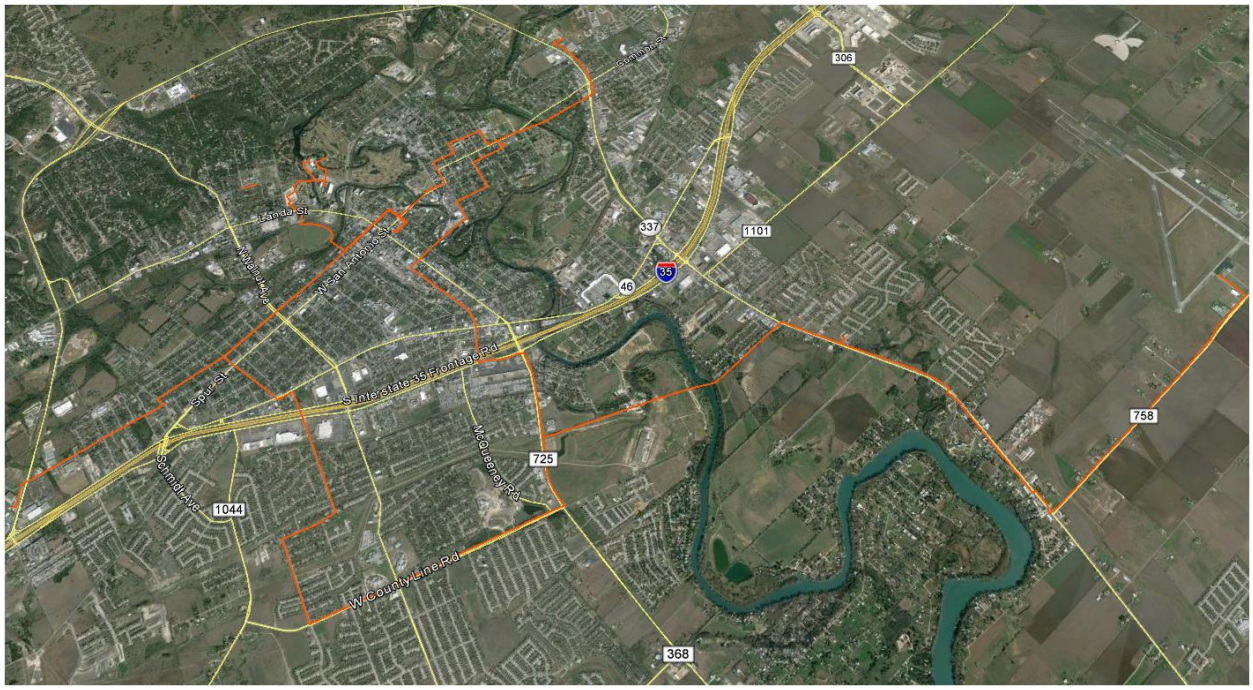


Figure 8-2: Downtown Core, Zone 1

Figure 8-3: Map of North Business Area, Zone 2

Figure 8-4: Map of South Business Area, Zone 3

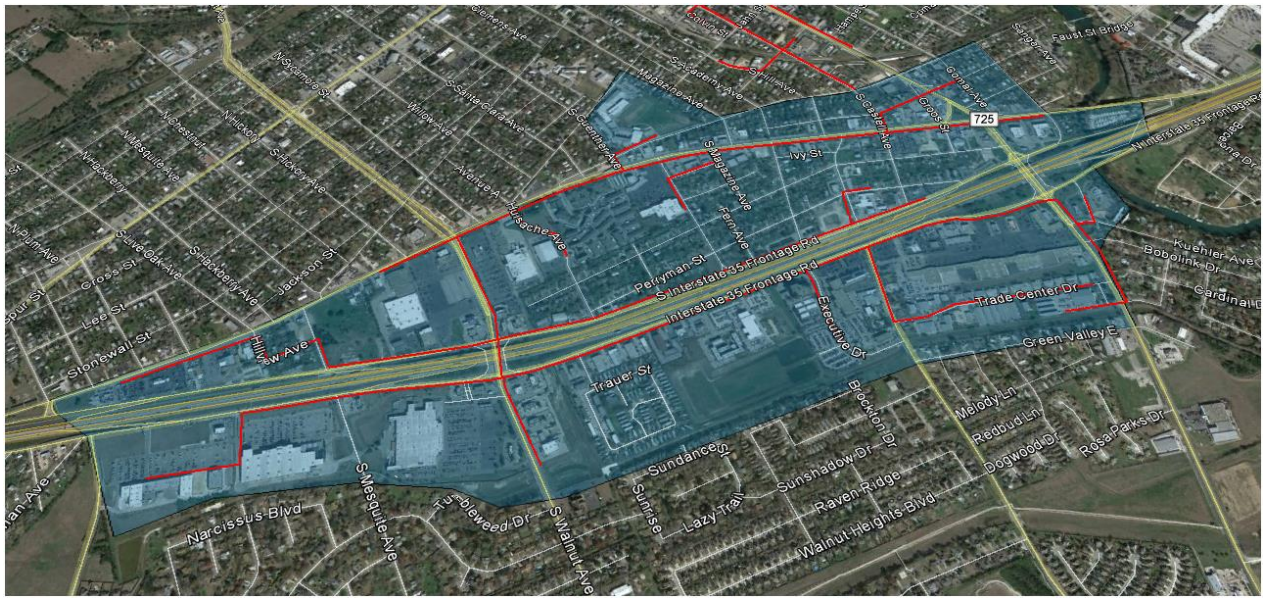
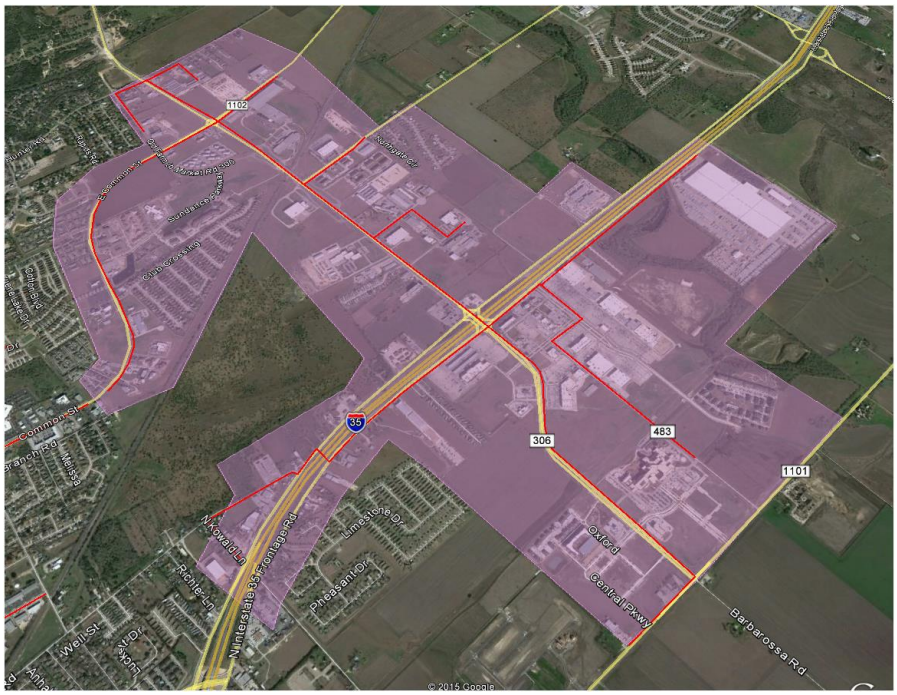


Figure 8-5: Map of Airport Park, Zone 4

Figure 8-6: Map of Future Business Park, Zone 6



The following maps show the overall deployment areas [Figure 8-7] and the overall deployment areas overlaid against the existing fiber network [Figure 8-8].

Figure 8-7: Map of Overall Deployment

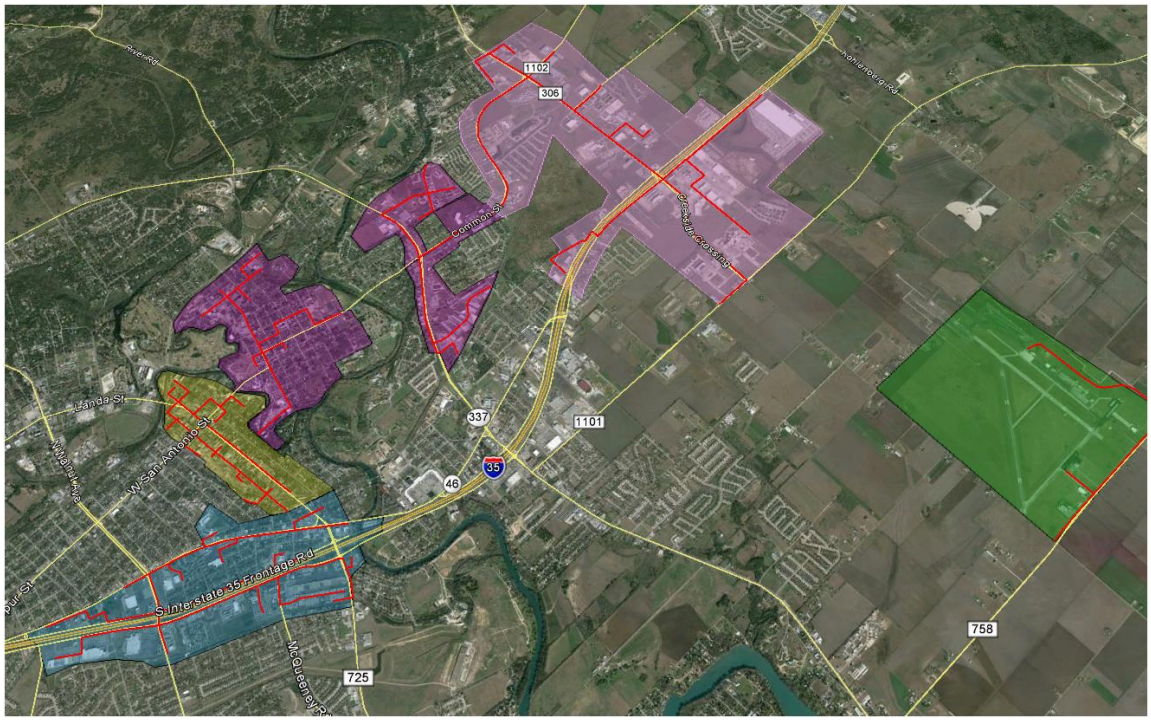
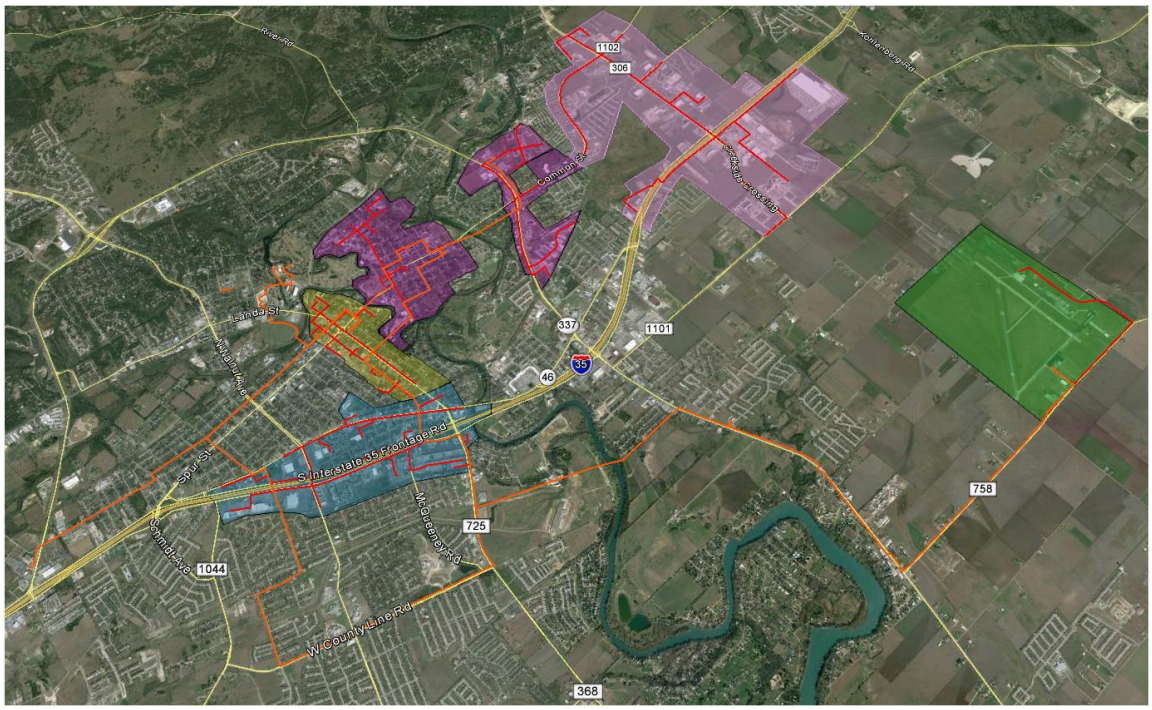


Figure 8-8: Overlay of Existing Fiber Routes to Deployment Areas



Final costs will depend on the area to be served. To determine the geographic scope of the network, the city would identify key business corridors and areas that are "prime" for broadband deployment as indicated above. Most municipal networks are built into commercial areas first because this is where the need for fiber based broadband services is highest and tend to have the greatest impact. These networks also generate positive economic development benefits in a short amount of time by enabling local businesses to access next-generation broadband at affordable rates. Magellan would suggest using a phased approach that first brings fiber-optic broadband to New Braunfels' business corridors.

Figure 8-9: New Braunfels Network Deployment Phasing Plan

The preliminary designs of the business fiber zones identified include 100% new construction in all areas with varied combination of aerial and underground placement. The outlined costs are conservative worst-case scenario and do not include the use of any existing fiber routes or conduit. The city should be able to reduce these overall costs by aligning conduit and fiber deployment with planned underground capital projects or using existing fiber routes and pole lines. In addition, current city and New Braunfels Utility fiber assets have not been included in the overall design, but could provide additional cost-savings if incorporated.

Figure 8-10: New Braunfels Business Corridor Build-Out Costs

Zone	1	2	3	4	5	Total
Area	Downtown Core	North Business Area	South Business Area	Airport Park	Future Business Park	Overall Deployment
Commercial Properties	129	150	125	6	96	506
Fiber-Optic Network Costs	$523,054	$893,251	$950,016	$222,977	$825,282	$3,414,580

While the costs above provide the necessary basis to build a distribution/access network throughout these identified areas, these costs do not include the fiber drops to each building. A fiber drop is the last-mile connection that connects the premise to be served to the greater fiber network and is essential to completing the fiber path to the subscriber. Typical drop costs range from $1,500 to $5,000 per premise or building and are highly attributed to underground versus aerial placement and the overall distance of the drop. The city should plan to include funding to build and own the drop as this gives long-term stability to the network and underlying ownership of the assets. Drop costs are one-time capital cost, however are not realized until a subscriber or property owner is ready to take service.

v) Existing Government Owned Networks

If the city decides on making key investments in broadband infrastructure and takes on the management and operational responsibility for this network, it would make sense to aggregate any locally government owned networks in the region under the City of New Braunfels' oversight. This would allow the city to make use of existing fiber, conduit and other assets without having to overbuild exiting infrastructure. In addition, it could allow the city to manage and market these assets. Economies of scale could be leveraged for the operations and maintenance of the assets, while continuing to provide the New Braunfels Utility and New Braunfels ISD with access just as is available today.

Currently the City of New Braunfels maintains its own fiber network shared with New Braunfels Utility and the New Braunfels ISD which is used to support the various organizations internal operations. In each of these cases, the city could manage and operate these networks while allocating the necessary fiber strands to support the various partners currently making use of these networks. In addition, the city would include these routes into a Fiber Management System for asset tracking and mapping purposes.

The city would be responsible for determining the Operational and Management (O&M) costs for management of all fiber throughout the region, and allocating back a pro rata share to New Braunfels Utility and the New Braunfels ISD for O&M charges, which primarily would be paid to third-party firms. O&M is operations and maintenance, and includes repairs, restoration, documentation and preventative maintenance of the infrastructure. The city could possibly include a provision during the PPP negotiations, passing this requirement onto the partner.

vi) How Will New Braunfels Receive a Return on Its Investment?

The city would have many opportunities to realize a return on its investment in funding and constructing a fiber network throughout the New Braunfels region. These opportunities include a potential revenue share through the successful negotiation of a public-private-partnership, lease of dark fiber and the off balance sheet returns such as business growth and retention, business recruitment and an increase in the quality of life for its constituents. While several of these stated opportunities offer direct financial contributions to the city's return on investment, it is difficult to quantify the off balance sheet returns. In addition, it's important to remember that this investment is being made into a long-term asset, which will continue to drive efficiency and innovation throughout the region for many years to come. These assets will remain on the city's books, as ownership will be retained by the City of New Braunfels.

A successful negotiation of a public-private-partnership would include a revenue share to the city of the gross revenue generated from the city's broadband assets. A revenue share of 5% - 10% of gross revenue could be expected and would generate a consistent annual revenue stream to the city. This revenue share would be paid by the private partner through subscriber fees collected for the provision of broadband services. Negotiation of the revenue share is a balancing act as this is typically a pass-through of fees collected from local subscribers. Therefor the higher the revenue share, the higher the fees passed onto the subscribers through service fees. The lower the revenue share, the lower the fees. It will be important for the city to understand the level and timeframe of payback it's willing to consider and should adjust the revenue share accordingly.

The city could also utilize the broadband infrastructure to lease dark fiber to community anchors or other providers that may require capacity in the region. The city would establish dark fiber lease rates and would make these available to users that would require this type of service. In addition, the city could develop IRU rates that provide discounted lease rates for long-term prepaid lease agreements.

Finally, investments in broadband infrastructure will allow the city to make strategic decisions in how the area is served and offers yet another tool in the city's toolbox for growing the business environment. While it is often difficult to quantify the financial impact to economic development activities, there is a clear correlation between bringing new companies and jobs to the region and the overall financial viability of the area.

Estimates place the build out of a feeder/distribution fiber network in all areas identified at approximately $3.5 million. This network could be built in whole or in a phased approach depending on funding availability. This network would provide fiber access to any premise or subscriber requesting service within the service areas defined. The city would incur additional construction costs above the initial $3.5 million to connect the various buildings to the network. To determine the city's return on its investment, it's necessary to outline the parameters that are included in developing the business case. The parameters that directly impact ROI include the capital investment amount, average revenue per user (ARPU), revenue share, rate of return, payback term (10, 15, 20 and 30 year), and the cost of administration and overhead. The sensitivity of the return is directly impacted by the revenue share, rate of return and payback term.

Through analysis of the full deployment throughout the identified zones, we're able to understand the number of subscribers that would have to take service from the network to provide a return. These numbers will have to be vetted through the negotiation process and the potential partner will need to understand the assumptions the city has made. As one begins to break down the various areas that have been identified as broadband deployment zones and run individual financial analysis of each zone, its becomes clear that some zones could be more likely to perform as capital costs may be lower than others, and may have greater business density.

Figure 8-11: Financial Analysis of Deployment (10% Revenue Share, 3% Rate of Return)

Assumptions	Timeframe	10 Year	15 Year	20 Year	30 Year
ARPU: $150 per month	Annual Revenue to City	$505,000	$388,333	$330,000	$271,667
Revenue Share: 10%	Average Revenue per Sub	$180	$180	$180	$180
Capital Investment: $3.5M	Average Annual Customers	2,806	2,157	1,833	1,509
Rate of Return: 3%					
Annual OPEX: $50,000	**Total Return**	**$5.05M**	**$5.83M**	**$6.6M**	**$8.15M**

Figure 8-12: Financial Analysis of Deployment (10% Revenue Share, 0% Rate of Return)

Assumptions	Timeframe	10 Year	15 Year	20 Year	30 Year
ARPU: $150 per month	Annual Revenue to City	$400,000	$283,333	$225,000	$166,667
Revenue Share: 10%	Average Revenue per Sub	$180	$180	$180	$180
Capital Investment: $3.5M	Average Annual Customers	2,222	1,574	1,250	926
Rate of Return: 0%					
Annual OPEX: $50,000	**Total Return**	**$4M**	**$4.25M**	**$4.5M**	**$5M**

The analyses provided in

Figure 8-11 and Figure 8-12 show a Rate of Return of 3% and 0% respectively. The overall annual customer requirements and total return numbers greatly differ between both projections. The city should use these guidelines as a basis for negotiating a final agreement with a private partner, but should also realize that there are a number of additional ways to monetize the network through the leasing of dark fiber, IRUs and through other off-balance sheet returns dealing with economic growth, which are both difficult to quantify at this point.

* Total returns listed above are non-inflation adjusted and should be used as general guidelines in this Broadband Feasibility Study.

vii) What are the Risks?

The risks of investing in the proposed fiber optic network by the city are minimal and tempered because the city will retain long-term ownership of the asset. While it is recommended that the city continue to make key strategic investments in underground infrastructure when possible, it does not recommend full build out as the plan indicates until a successful public-private-partnership agreement has been reached. In many ways, this is not a "build it and they will come" approach, but leans heavily on the private partner to know and understand the local market and their ability to execute their side of the

partnership. With this being said, the city should ensure it conducts the proper amount of due diligence on all responding providers to ensure it adequately vets its potential partners.

It is always possible for the local incumbents to drop their current prices and to make an attempt at locking their current customers into long-term contracts. The fact is that their current service offerings will still be delivered over legacy copper infrastructure and service levels will not compete with the new fiber based offerings. It is very unlikely that current incumbents will overbuild their current infrastructure and therefor will be unable to compete over the long-term.

9. Regulatory Analysis

Magellan Advisors has reviewed the regulatory and policy environment in Texas pertaining to municipal broadband. Information was gained from communication with the Texas Municipal League staff and Public Utility Commission of Texas staff (Texas PUC), review of the Texas Statutes and Texas PUC filing and certification requirements, as well as through Magellan's own research and knowledge. Broadband facilities and services have been very lightly regulated at the federal (Federal Communications Commission) or state (Texas PUC) levels. The FCC in its application of federal law had generally treated broadband internet access services as unregulated services and subjected them to fewer regulations than cable TV or telecommunications services.[11] However, the FCC recently changed its approach to broadband services. Specifically, prior to this year the FCC had employed light-handed regulatory practices for internet access under its "Title I", Information Services authority. By its "Net Neutrality" order in February 2015, the FCC changed from viewing internet access (and other services) as Title I "Information Services", and reclassified those services to be regulated as "Title II" services.[12] At the federal level, this reclassification permits the FCC to use its full array of public utility-style regulatory practices, but very significantly, the FCC has indicated it will "*forbear*" from applying these practices, and in fact, the FCC has very carefully avoided calling internet access a "telecommunications service". FCC regulation of internet services is intended by the FCC to remain light-handed through this "forbearance", with regulatory scrutiny focused mainly to ensure greater transparency, reasonable network management practices, authority to review interconnection practices, and to ban three practices: blocking access to legal content; throttling on the basis of content; or paid prioritization. Therefore the decision to reclassify internet services as "Title II" does not present concerns from that perspective, but this FCC decision could have consequences for municipal provision of broadband services, due to existing Texas state statutes.

The Texas Legislature enacted the "Public Utility Regulatory Act of 1995" ("PURA 95"), which included Section 54.202 "Prohibited Municipal Services", as follows:

1. A municipality or municipal electric system may not offer for sale to the public:
    a. a service for which a certificate of convenience and necessity, a certificate of operating authority, or a service provider certificate of operating authority is required; or
    b. a non-switched telecommunications service used to connect a customer's premises with:
        i. another customer's premises within the exchange; or
        ii. a long distance provider that serves the exchange.

[11] This discussion and analysis does not constitute a legal opinion and should not be construed as such.

[12] Report and Order on Remand, Declaratory Ruling, and Order; *In the Matter of Protecting and Promoting the Open Internet*; GN Docket No. 14-28; FCC 15-24; Adopted February 26, 2015 and Released March 12, 2015. [The "Net Neutrality Order"]

2. Subsection (a) applies to a service offered either directly or indirectly through a telecommunications provider.

Opponents of this legislation asked the FCC to use its authority to preempt its effectiveness. Preemption was sought under 47 U.S.C. Section 253 (a) which relates to "telecommunications services", not "information services". The FCC declined to preempt the effectiveness of the statute, and this decision was upheld on appeal.[13] The statute did not and does not address "information services", so while the FCC maintained its classification of internet services as "Title I" information services, municipal provision of internet access services was not impaired by PURA 95.[14]

In 1999 the Texas Legislature enacted Section 54.2025, "Lease of Fiber Optic Cable Facilities", as follows:

> Nothing in this subchapter [Subchapter E, Municipalities] shall prevent a municipality, or a municipal electric system that is a member of a municipal power agency formed under Chapter 163 by adoption of a concurrent resolution by the participating municipalities on or before August 1, 1975, from leasing any of the excess capacity of its fiber optic cable facilities (dark fiber), so long as the rental of that fiber facilities is done on a nondiscriminatory, non-preferential basis.

Therefore, it appears that the City of New Braunfels would be able to provide broadband infrastructure such as dark fiber, but the FCC's recent "Net Neutrality" decision may add an element of risk to the ability of the city to provide internet access facilities, even though the Texas PUC does not regulate provision of broadband services by municipalities.[15] The FCC has very carefully not called internet access a "telecommunications service" even though it has classified it as a Title II service. The current PUC staff interpretation is that since internet access has not been definitively labeled a "telecommunications service" by the FCC, this would not trigger the application of the "Prohibited Municipal Services" of Section 54.202.

Furthermore, the FCC has taken recent action to eliminate state barriers to the municipal provision of broadband services, and this action was taken at the same open meeting in which the FCC made its

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[13] *Public Utility Commission of Texas, et al. Petitions for Declaratory Ruling and/or Preemption of Certain Provisions of the Texas Public Utility Regulatory Act of 1995*; CC Dockets 96-13, 96-14, 96-16, 96-19; Memorandum Opinion and Order; 13 FCC Rcd 3460; upheld on appeal, *City of Abilene, Texas, et al. v. FCC*, 164 F. 3rd 49 (D.C. Circuit 1999).

[14] The preemption filings before the FCC and subsequent court action pertaining to Section 54.202, and the distinctions between Title I "Information Services" and Title II "Telecommunications Services" are analyzed in detail in the *Reply Comments of the Texas Cities Coalition to the Comments of the Advanced Communications Law and Policy Institute at New York Law School*, filed before the FCC In the Matter of Petitions Pursuant to Section 706 of the Telecommunications Act of 1996 for Removal of State Barriers to Broadband Investment and Competition; WCB Docket No. 14-115 (Wilson, North Carolina); and, WCB Docket No. 14-116 (Electric Power Board of Chattanooga, Tennessee); September 29, 2014. New Braunfels is a member of the "Texas Cities Coalition" that filed the comments.

[15] Under the current structure, a municipality need not even apply for PUC certification to provide broadband internet services, however, provision of voice telephone service is prohibited.

"Net Neutrality" decision. In its decision on the petitions of the City of Wilson, North Carolina and the Electric Power Board of Chattanooga, Tennessee, the FCC preempted the effect of state laws that restrict municipal provision of broadband services.[16] This decision is fact-specific to only the two cities, but it is clear that the FCC would make similar rulings for other cities on similar circumstances. The City of New Braunfels on its own, or concert with other cities in Texas has the opportunity to similarly petition the FCC for preemption of state laws that constitute barriers to municipal provision of broadband services in the best interests of the city's own citizens and residents.

[16] Memorandum Opinion and Order; *In the Matter of Petitions Pursuant to Section 706 of the Telecommunications Act of 1996 for Removal of State Barriers to Broadband Investment and Competition*; WCB Docket No. 14-115 (Wilson, North Carolina); and, WCB Docket No. 14-116 (Electric Power Board of Chattanooga, Tennessee); FCC 15-25; Adopted February 26, 2015 and Released March 12, 2015.

10. Recommendations and Next Steps

The City of New Braunfels and regional business leaders recognize broadband infrastructure as an important part of the region's economic development strategy in retaining existing businesses and attracting new companies to the area. The market is currently served by legacy copper networks with the exception of minimal fiber Gigabit-capable Passive Optical Networks (GPON) and dedicated fiber connections in some cases. Current dedicated fiber connections are available but very expensive, many times due to the aid to construction charges. This alone does not allow the City or other economic development organizations in the region to respond to prospective businesses or site locators with absolute fiber offerings or costs, which can lead to the area being disqualified early in the site investigation process.

The city has an opportunity to be a leader in the New Braunfels region by immediately developing broadband-friendly policies and making key investments in broadband infrastructure that can be utilized by other public agencies and by private providers to serve the market. This Study had identified the main business areas and corridors in the region and has identified over 500 commercial properties that could be served by fiber optics through the city's initiative. These areas and the commercial properties could be considered on net, allowing direct, immediate access to fiber based telecommunications services, which is otherwise absent in the region today.

In conjunction with policies and infrastructure investments, the City of New Braunfels should take the following steps to create a public-private partnership:

1. Investigate/finalize potential sources to fund the necessary infrastructure.
2. Develop an RFP outlining the city and region's vision and goals for bringing high-speed broadband infrastructure to the New Braunfels region and defining the terms and conditions of the partnership.
3. Release RFP for a 30-60 day period in a public procurement process.
4. Evaluate, short-list, interview and select a partner to begin negotiations.
5. Begin to negotiate and work toward development of a Memorandum of Understanding (MOU) and a final definitive agreement to formalize the partnership.
6. Develop a business plan for the City of New Braunfels to become an infrastructure provider of fiber-optic infrastructure in the New Braunfels region.

11. Appendix A – Glossary

3G – Third Generation	The third generation of mobile broadband technology, used by smart phones, tablets, and other mobile devices to access the web.
4G – Fourth Generation	The fourth generation of mobile broadband technology, used by smart phones, tablets, and other mobile devices to access the web.
ADSL – Asymmetric Digital Subscriber Line	DSL service with a larger portion of the capacity devoted to downstream communications, less to upstream. Typically thought of as a residential service.
ADSS – All-Dieletric Self-Supporting	A type of optical fiber cable that contains no conductive metal elements.
AMR/AMI – Automatic Meter Reading/Advanced Metering Infrastructure	Electrical meters that measure more than simple consumption and an associated communication network to report the measurements.
ATM – Asynchronous Transfer Mode	A data service offering that can be used for interconnection of customer's LAN. ATM provides service from 1 Mbps to 145 Mbps utilizing Cell Relay Packets.
Bandwidth	The amount of data transmitted in a given amount of time; usually measured in bits per second, kilobits per second (kbps), and Megabits per second (Mbps).
Bit	A single unit of data, either a one or a zero. In the world of broadband, bits are used to refer to the amount of transmitted data. A kilobit (Kb) is approximately 1,000 bits. A Megabit (Mb) is approximately 1,000,000 bits. There are 8 bits in a byte (which is the unit used to measure storage space), therefore a 1 Mbps connection takes about 8 seconds to transfer 1 megabyte of data (about the size of a typical digital camera photo).
BPL – Broadband over Powerline	A technology that provides broadband service over existing electrical power lines.
BPON – Broadband Passive Optical Network	BPON is a point-to-multipoint fiber-lean architecture network system which uses passive splitters to deliver signals to multiple users. Instead of running a separate strand of fiber from the CO to every customer, BPON uses a single strand of fiber to serve up to 32 subscribers.

Broadband	A descriptive term for evolving digital technologies that provide consumers with integrated access to voice, high-speed data service, video-demand services, and interactive delivery services (e.g. DSL, Cable internet).
CAD – Computer Aided Design	The use of computer systems to assist in the creation, modification, analysis, or optimization of a design.
CAI – Community Anchor Institutions	The National Telecommunications and Information Administration defined CAIs in its SBDD program as "Schools, libraries, medical and healthcare providers, public safety entities, community colleges and other institutions of higher education, and other community support organizations and entities". Universities, colleges, community colleges, K-12 schools, libraries, health care facilities, social service providers, public safety entities, government and municipal offices are all community anchor institutions.
CAP – Competitive Access Provider	(or "Bypass Carrier") A Company that provides network links between the customer and the Inter-Exchange Carrier or even directly to the internet Service Provider. CAPs operate private networks independent of Local Exchange Carriers.
Cellular	A mobile communications system that uses a combination of radio transmission and conventional telephone switching to permit telephone communications to and from mobile users within a specified area.
CLEC – Competitive Local Exchange Carrier	Wireline service provider that is authorized under state and Federal rules to compete with ILECs to provide local telephone service. CLECs provide telephone services in one of three ways or a combination thereof: 1) by building or rebuilding telecommunications facilities of their own, 2) by leasing capacity from another local telephone company (typically an ILEC) and reselling it, and 3) by leasing discrete parts of the ILEC network referred to as UNEs.
CO – Central Office	A circuit switch where the phone lines in a geographical area come together, usually housed in a small building.
Coaxial Cable	A type of cable that can carry large amounts of bandwidth over long distances. Cable TV and cable modem service both utilize this technology.

CPE – Customer Premise Equipment	Any terminal and associated equipment located at a subscriber's premises and connected with a carrier's telecommunication channel at the demarcation point ("demarc").
CWDM – Coarse Wavelength Division Multiplexing	A technology similar to DWDM only utilizing less wavelengths in a more customer-facing application whereby less bandwidth is required per fiber.
Demarcation Point (“demarc”)	The point at which the public switched telephone network ends and connects with the customer's on-premises wiring.
Dial-Up	A technology that provides customers with access to the Internet over an existing telephone line.
DLEC – Data Local Exchange Carrier	DLECs deliver high-speed access to the internet, not voice. Examples of DLECs include Covad, Northpoint and Rhythms.
Downstream	Data flowing from the internet to a computer (Surfing the net, getting E-mail, downloading a file).
DSL – Digital Subscriber Line	The use of a copper telephone line to deliver “always on” broadband internet service.
DSLAM – Digital Subscriber Line Access Multiplier	A piece of technology installed at a telephone company’s Central Office (CO) and connects the carrier to the subscriber loop (and ultimately the customer’s PC).
DWDM – Dense Wavelength Division Multiplexing	An optical technology used to increase bandwidth over existing fiber-optic networks. DWDM works by combining and transmitting multiple signals simultaneously at different wavelengths on the same fiber. In effect, one fiber is transformed into multiple virtual fibers.
E-Rate	A Federal program that provides subsidy for voice and data circuits as well as internal network connections to qualified schools and libraries. The subsidy is based on a percentage designated by the FCC.
EON – Ethernet Optical Network	The use of Ethernet LAN packets running over a fiber network.

EvDO – Evolution Data Only	EvDO is a wireless technology that provides data connections that are 10 times as fast as a traditional modem. This has been overtaken by 4G LTE.
FCC – Federal Communications Commission	A Federal regulatory agency that is responsible for regulating interstate and international communications by radio, television, wire, satellite and cable in all 50 states, the District of Rock Falls, and U.S. territories.
FDH – Fiber Distribution Hub	A connection and distribution point for optical fiber cables.
FTTN – Fiber to the Neighborhood	A hybrid network architecture involving optical fiber from the carrier network, terminating in a neighborhood cabinet with converts the signal from optical to electrical.
FTTP – Fiber to the premise (or FTTB – Fiber to the building)	A fiber-optic system that connects directly from the carrier network to the user premises.
GIS – Geographic Information Systems	A system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data.
GPON- Gigabit-Capable Passive Optical Network	Similar to BPON, GPON allows for greater bandwidth through the use of a faster approach (up to 2.5 Gbps in current products) than BPON.
GPS – Global Positioning System	a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.
GSM – Global System for Mobile Communications	This is the current radio/telephone standard developed in Europe and implemented globally except in Japan and South Korea.
HD – High Definition (Video)	Video of substantially higher resolution than standard definition.
HFC – Hybrid Fiber Coaxial	An outside plant distribution cabling concept employing both fiber-optic and coaxial cable.
ICT – Information and Communications Technology	Often used as an extended synonym for information technology (IT), but it is more specific term that stresses the role of unified communications and the integration of telecommunications, computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information.

IEEE – Institute of Electrical Engineers	A professional association headquartered in New York City that is dedicated to advancing technological innovation and excellence.
ILEC – Incumbent Local Exchange Carrier	The traditional wireline telephone service providers within defined geographic areas. Prior to 1996, ILECs operated as monopolies having exclusive right and responsibility for providing local and local toll telephone service within LATAs.
IP-VPN – Internet Protocol-Virtual Private Network	A software-defined network offering the appearance, functionality, and usefulness of a dedicated private network.
IRU - Indefeasible Right Use	A contractual agreement between the operators of a fiber optic network and a client for "exclusive, unrestricted, and indefeasible right to use one, a pair, or more strands of fiber of a fiber cable for any legal purpose." The contract, typically 10-20 years, defines detailed technical and performance specifications for the fibers. More specifically, it includes acceptance and testing procedures, the description of the physical route, operating specifications for the infrastructure, performance specifications, maintenance and restoration terms. These terms must be valid for the full duration of the contract. Moreover, it includes specific actions and procedures in cases of changes on the grantor's fiber network, degradation of fiber performance etc.
ISDN – Integrated Services Digital Network	An alternative method to simultaneously carry voice, data, and other traffic, using the switched telephone network.
ISP – Internet Service Provider	A company providing internet access to consumers and businesses, acting as a bridge between customer (end-user) and infrastructure owners for dial-up, cable modem and DSL services.
ITS – Intelligent Traffic System	Advanced applications which, without embodying intelligence as such, aim to provide innovative services relating to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks.
Kbps – Kilobits per second	1,000 bits per second. A measure of how fast data can be transmitted.

LAN – Local Area Network	A geographically localized network consisting of both hardware and software. The network can link workstations within a building or multiple computers with a single wireless internet connection.
LATA – Local Access and Transport Areas	A geographic area within a divested Regional Bell Operating Company is permitted to offer exchange telecommunications and exchange access service. Calls between LATAs are often thought of as long distance service. Calls within a LATA (IntraLATA) typically include local and local toll services.
Local Loop	A generic term for the connection between the customer's premises (home, office, etc.) and the provider's serving central office. Historically, this has been a copper wire connection; but in many areas it has transitioned to fiber optic. Also, wireless options are increasingly available for local loop capacity.
MAN – Metropolitan Area Network	A high-speed intra-city network that links multiple locations with a campus, city or LATA. A MAN typically extends as far as 30 miles.
Mbps – Megabits per second	1,000,000 bits per second. A measure of how fast data can be transmitted.
MPLS – Multiprotocol Label Switching	A mechanism in high-performance telecommunications networks that directs data from one network node to the next based on short path labels rather than long network addresses, avoiding complex lookups in a routing table.
ONT – Optical Network Terminal	Used to terminate the fiber-optic line, demultiplex the signal into its component parts (voice telephone, television, and internet), and provide power to customer telephones.
Overbuilding	The practice of building excess capacity. In this context, it involves investment in additional infrastructure projects to provide competition.
OVS – Open Video Systems	OVS is a new option for those looking to offer cable television service outside the current framework of traditional regulation. It would allow more flexibility in providing service by reducing the build out requirements of new carriers.
PON – Passive Optical Network	A Passive Optical Network consists of an optical line terminator located at the Central Office and a set of associated optical network terminals located at the customer's premise. Between them lies the optical distribution network comprised of fibers and passive splitters or couplers. In a PON network, a single piece of fiber can be run from

	the serving exchange out to a subdivision or office park, and then individual fiber strands to each building or serving equipment can be split from the main fiber using passive splitters / couplers. This allows for an expensive piece of fiber cable from the exchange to the customer to be shared amongst many customers, thereby dramatically lowering the overall costs of deployment for fiber to the business (FTTB) or fiber to the home (FTTH) applications.
PPP – Public-Private Partnership	A Public–Private Partnership (PPP) is a government service or private business venture that is funded and operated through a collaborative partnership between a government and one or more private sector organizations. In addition to being referred to as a PPP, they are sometimes called a P3, or P^3.
QOS – Quality of Service	QoS (Quality of Service) refers to a broad collection of networking technologies and techniques. The goal of QoS is to provide guarantees on the ability of a network to deliver predictable results, which are reflected in Service Level Agreements or SLAs. Elements of network performance within the scope of QoS often include availability (uptime), bandwidth (throughput), latency (delay), and error rate. QoS involves prioritization of network traffic.
RF – Radio Frequency	a rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals.
Right-of-Way	A legal right of passage over land owned by another. Carriers and service providers must obtain right-of-way to dig trenches or plant poles for cable systems, and to place wireless antennae.
RMS – Resource Management System	A system used to track telecommunications assets.
RPR – Resilient Packet Ring	Also known as IEEE 802.17, is a protocol standard designed for the optimized transport of data traffic over optical fiber ring networks.
RUS – Rural Utility Service	A division of the United States Department of Agriculture, it promotes universal service in unserved and underserved areas of the country with grants, loans, and financing. Formerly known as "REA" or the Rural Electrification Administration.
SCADA – Supervisory Control and Data Acquisition	A type of industrial control system (ICS). Industrial control systems are computer controlled systems that monitor and control industrial processes that exist in the physical world.

SNMP – Simple Network Management Protocol	An internet-standard protocol for managing devices on IP networks.
SONET – Synchronous Optical Network	A family of fiber-optic transmission rates.
Steaming	Streamed data is any information/data that is delivered from a server to a host where the data represents information that must be delivered in real time. This could be video, audio, graphics, slide shows, web tours, combinations of these, or any other real time application.
Subscribership	Subscribership is how many customers have subscribed for a particular telecommunications service.
Switched Network	A domestic telecommunications network usually accessed by telephone, key telephone systems, private branch exchange trunks, and data arrangements.
T-1 – Trunk Level 1	A digital transmission link with a total signaling speed of 1.544 Mbps. It is a standard for digital transmission in North America.
T-3 – Trunk Level 3	28 T1 lines or 44.736 Mbps.
UNE – Unbundled Network Element	Leased portions of a carrier's (typically an ILEC's) network used by another carrier to provide service to customers. Over time, the obligation to provide UNEs has been greatly narrowed, such that the most common UNE now is the UNE-Loop.
Universal Service	The idea of providing every home in the United States with basic telephone service.
Upstream	Data flowing from your computer to the internet (sending E-mail, uploading a file).
UPS – Uninterruptable Power Supply	An electrical apparatus that provides emergency power to a load when the input power source, typically main power, fails.
USAC – Universal Service Administrative Company	An independent American nonprofit corporation designated as the administrator of the Federal Universal Service Fund (USF) by the Federal Communications Commission.
VDSL – Very High Data Rate Digital Subscriber Line	A developing digital subscriber line (DSL) technology providing data transmission faster than ADSL over a single flat untwisted or twisted pair of copper wires (up to 52 Mbit/s downstream and 16 Mbit/s

	upstream), and on coaxial cable (up to 85 Mbit/s down and upstream); using the frequency band from 25 kHz to 12 MHz.
Video on Demand	A service that allows users to remotely choose a movie from a digital library whenever they like and be able to pause, fast-forward, and rewind their selection.
VLAN – Virtual Local Area Network	In computer networking, a single layer-2 network may be partitioned to create multiple distinct broadcast domains, which are mutually isolated so that packets can only pass between them via one or more routers; such a domain is referred to as a Virtual Local Area Network, Virtual LAN or VLAN.
VoIP – Voice over Internet Protocol	An application that employs a data network (using a broadband connection) to transmit voice conversations using Internet Protocol.
VPN – Virtual Private Network	A virtual private network (VPN) extends a private network across a public network, such as the internet. It enables a computer to send and receive data across shared or public networks as if it were directly connected to the private network, while benefitting from the functionality, security and management policies of the private network. This is done by establishing a virtual point-to-point connection through the use of dedicated connections, encryption, or a combination of the two.
WAN – Wide Area Network	A network that covers a broad area (i.e., any telecommunications network that links across metropolitan, regional, or national boundaries) using private or public network transports.
WiFi	WiFi is a popular technology that allows an electronic device to exchange data or connect to the internet wirelessly using radio waves. The Wi-Fi Alliance defines Wi-Fi as any "wireless local area network (WLAN) products that are based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards".
WiMax	WiMax is a wireless technology that provides high-throughput broadband connections over long distances. WiMax can be used for a number of applications, including “last mile” broadband connections, hotspot and cellular backhaul, and high speed enterprise connectivity for businesses.
Wireless	Telephone service transmitted via cellular, PCS, satellite, or other technologies that do not require the telephone to be connected to a land-based line.

Wireless Internet	1) Internet applications and access using mobile devices such as cell phones and palm devices. 2) Broadband Internet service provided via wireless connection, such as satellite or tower transmitters.
Wireline	Service based on infrastructure on or near the ground, such as copper telephone wires or coaxial cable underground or on telephone poles.

12. Appendix B – Economic Development Case Study

Who:

Bristol, Virginia, located in southwest Virginia

Background:

In 2001, Bristol Virginia Utilities (BVU) launched BVU Optinet to provide fiber-based telecommunication services to approximately 12,500 customers in the Southwest Virginia region. To accomplish this goal, BVU installed approximately 150 miles of fiber around and throughout the city of Bristol. BVU is acknowledged as the first municipal utility in the United States to deploy an all-fiber network offering the triple play of video, voice and data services.

In September 2005, based on the success of its city fiber deployment, BVU was asked to construct an additional 160 miles of fiber backbone to connect two planning district commissions (PDCs) in the region. BVU Optinet, in conjunction with the planning districts, created CPC Optinet to bring data and telephone services to the regions.

As a recipient of an NTIA/BTOP grant in 2010, BVU Optinet expanded its fiber footprint to nine counties in Southwest Virginia by installing an additional 388 miles of fiber. This gave economically challenged areas access to high-speed services critical to their survival.

Based on BVU Optinet's continued successes and positive impact to the community, Bristol, Virginia became nationally recognized and received the 2008 GOLD AWARD for Municipal Excellence from the National League of Cities. In 2009, Bristol was acknowledged as a Top 7 Intelligent Community from the Intelligent Community Forum. It was the only U.S. City to make the list.

Economic and Community Impact:

In 2011, Bristol commissioned a study to try and quantify the impact that fiber has had on its economy and citizen's. Below are some of the findings from that study.

- Access to high-speed fiber-based was one of the key points in attracting several large businesses to Bristol and the surrounding areas served by BVU Optinet.
  - » Northrop Grumman – Company manages a large number of activities and processes for the Commonwealth of Virginia, and has added over 700 new jobs in rural Southwest Virginia
  - » CGI - A $3.6 Billion IT and systems integration company with 26,000 employees, opened a Technology Center in Lebanon, VA in December 2007. At the opening ceremony, CGI CEO, Michael Roach, praised the Lebanon center as CGI's first in "rural America" and a key part of CGI's strategy to keep its major business centers "onshore" in the US instead of sending them to low wage countries. Already, CGI has added over 400 jobs to rural Southwest Virginia.
  - » Universal Fibers – Provides high tech processes for recycling and colorization of poly fibers. Recently recognized by the Governor of Virginia for excellence in sustainability processes. Added

over 330 jobs to the area. Expected to expand capital spending by up to twenty million dollars in next five years. Per company, "Reliable and very High Speed Broadband is critical for Universals continued expansion".

- DirecTV – A satellite company is creating 100 jobs in a virtual call center. Gary Qualls, Vice-President Customer Care, commented that "The remote agents hired by DIRECTV are able to work from home due to the high-speed Internet access available in many communities throughout our region".
- CPC OptiNet – A partner of BVU Optinet in rural Southwest Virginia offering data and telephone services to businesses and anchor institutions has over 600 data business customers.

- 169 organizations reported on fiber impact to sales
  - 18% reported a total increase to sales of $2,711,250 in the previous 12 months
  - Average increase in sales of $21,017 per organization
  - 71% reported cost savings due to fiber use
  - Total cost saving equaled $354,105 in previous 12 months
  - Average cost savings per organization of $2,951
  - Net increase in employment of 286 jobs in the previous 12 months
  - Net increase in employment of 10.1% due to fiber

- Fiber use has direct and measurable benefits to businesses and organizations on local economy
  - Extrapolating survey results to all fiber users indicates significant potential impact to the community
    - Direct increase in sales revenues of $19.4M per year
    - Net cost savings of $2.7M per year
    - Increased sales and cost savings contribute to business growth and additional employment
    - Indirect effects flow through to non-fiber businesses that provide goods and services in the community
  - Allowed more telecommuting
    - Days worked from home increased
    - Nearly 17% work more from home directly because of FTTH
    - Average of 12 days more
    - New DirecTV call center all from work at home (100 plus jobs as of 2011)
  - Estimated cost savings to internet users from 2007 to 2011 due to fiber equaled $1,622,382

- Additional feedback from fiber business and residential users
  - Speed and bandwidth were widely cited as key benefits for quality-of-life
  - Many recognized the increased reliability of fiber compared to prior forms of access
  - Service pricing, customer service and support were also cited as benefits of moving to fiber
  - The most common perceived benefits from businesses were that fiber makes operations easier, increasing efficiency and saving time
    - 60% cite cost saving as important

  - 69% have adopted new processes
  - 68% see marketing benefits
  - 60% say fiber is important for sales
- Organizations are increasingly incorporating high-speed capabilities into their daily operations
  - Large document transfer
  - Real-time communications with customers and suppliers
  - Online-transactions, and research

In addition to economic impact to the area, fiber-based high speed access has allowed or enhanced services to businesses and residents. Many of these services would not have been available or affordable without the fiber infrastructure deployed in Bristol and surrounding areas. A few of these services include:

- Online video sharing
- Internet video
- Telemedicine
- 24-hour home monitoring
- On-line education
- Video conferencing
- Energy management (Smart Grid)
- Business security (alarms, cameras, etc.)

Comments from Local Businesses on Impact of Fiber:

- "There are two major reasons. One, if we didn't have it we would have to move the business out of the community. Second, we are anticipating doubling our staff and profit and if it weren't for the broadband we wouldn't be able to accomplish that." - Publishing (10 employees)
- "The main change is in file transfer. We deal a lot with electronic artwork in the printing industry, and it has enabled us to more fluidly conduct business on the artwork side." - Printing (6 employees)
- "Research has been the biggest area which it has helped as well as access to online training materials. It reduces the time for the office staff to access external documents and serve customers." - Engineering firm (73 employees)
- "Over fiber I'm able to transfer home and commercial building plans, engineering, and design modifications. Over dial up it would take hours to do download this information." - Building materials retail (5 employees)
- "Time saved is $$. We have to communicate with our manufacturers and there would be no way to do this over dial-up due to the size of files that are transmitted and received. More and more departments have to communicate via PC's. Dial-up couldn't handle." - Auto dealer (40 employees)

13. Appendix C – Business Broadband Survey Results

Under Separate Cover

Business Broadband Assessment & Feasibility Study
City of New Braunfels
Survey Results (Appendix C)

14. Appendix D – Public Policy – Samples

Under Separate Cover

Business Broadband Assessment & Feasibility Study
City of New Braunfels
Policy Samples (Appendix D)

Business Broadband Assessment & Feasibility Study

City of New Braunfels

Survey Results

(Appendix C)

Prepared by: Magellan Advisors
Released: June 22, 2015
Version: 1.0

Magellan ADVISORS

Table of Contents

1. Business Addresses / Number of Employees

Summary:

Number of Responding Businesses: 132

Please note that not all businesses entered data for all categories, therefore total responses may not equal the total number of responding businesses

Answered: 128 Skipped: 4

Breakdown by City	# Businesses	%
Blanco	1	0.8%
Canyon Lake	1	0.8%
Natural Bridge Caverns	1	0.8%
New Braunfels	124	96.9%
Sattler	1	0.8%

Answered: 129 Skipped: 3

# of Employees By Size Category (New Braunfels Only)	Small (<= 10)	Medium (between 11 and 50)	Medium-Large (between 51 and 100)	Large (> 100)
	80 (62.02%)	30 (23.26%)	5 (3.88%)	14 (10.85%)

Detail:

Business Name	Address			# of Employees (New Braunfels Only)
Tejas Direct Inc	585 Anns Way	Blanco	78606	Two in New B and two in Blanco.
Yogi Bear Jellystone Resort	12915 Fm 306	Canyon Lake	78133	26
Natural Bridge Caverns, Inc.	26495 Natural Bridge Caverns Road	Natural Bridge Caverns	78266	120
Acorn: Educational Consulting	415 Blue Spruce	New Braunfels	78130	1
Antoinette'S Cottage	1258 Gruene Rd	New Braunfels	78130	
Bob Wolf Creations L.C.	2444 Dimmitt Dr.	New Braunfels	78130	2
Brazzel Ins Agency	142 W Jahn St	New Braunfels	78130	7
C. Herb Skoog	631 Lakeview Blvd. #A-105	New Braunfels	78130	1
Candela Property Advisors	119 Swan Dr	New Braunfels	78130	1
Carlos Campos Md Pa	189 E. Austin Street #102	New Braunfels	78130	8
Century 21 Randall Morris & Associates	190 S. Seguin Ave	New Braunfels	78130	20
Century 21 Randall Morris & Associates	190 S. Seguin	New Braunfels	78130	

Century 21 Randall Morris & Associates	190 S. Seguin Ave.	New Braunfels	78130	18
City Of New Braunfels	424 S Castell Avenue	New Braunfels	78130	500
Coldwell Banker D'Ann Harper	1235 Terrace Court	New Braunfels	78130	2
Comal County Court At Law #2	150 N. Seguin, Suite 301	New Braunfels	78130	4
Comaltex Insurance	457 Landa Street	New Braunfels	78130	10
Comaltex Insurance Agency Inc	457-F Landa Street	New Braunfels	78130	11
Communities In Schools	161 S. Castell Avenue	New Braunfels	78130	25
Communities In Schools	161 S. Castell Ave.	New Braunfels	78130	13
Connections	1414 W. San Antonio Street	New Braunfels	78130	40
Connections Individual And Family Services	1414 W. San Antonio St.	New Braunfels	78130	45
Cozart Photography	1911 Palace	New Braunfels	78130	2
Curley Chiropractic, LLC	1312 Ste 407	New Braunfels	78130	4
Detex Corporation	302 Detex Drive	New Braunfels	78130	90
Donna Lemley	176 Landa Street #310	New Braunfels	78130	0
Farmers Insurance Jp Kesselring Agency	1551 N Walnut	New Braunfels	78130	5
Fua Window Coerings	899 S Castell Ave	New Braunfels	78130	3
Garland Transmissions	2141 Ih 35 North	New Braunfels	78130	7
Gastroenterology Of New Braunfels	200 N Union	New Braunfels	78130	15
Gisi	2828 Granite Cove	New Braunfels	78130	3
Gnbcc	390 S. Seguin Ave.	New Braunfels	78130	17
Gnbcc	390 S Seguin Ave	New Braunfels	78130	17
Great American Products	1661 S. Seguin Avenue	New Braunfels	78130	120
Greater New Braunfels Chamber Of Commerce	390 South Seguin Avenue	New Braunfels	78130	16
Greater New Braunfels Chamber Of Commerce, Inc.	390 S. Seguin Ave.	New Braunfels	78130	17
Gruene House Design	2135 Gruene Road	New Braunfels	78130	
Guadalupe River Houses	178 Comal	New Braunfels	78130	5
Hd Supply	1511 East Common Street	New Braunfels	78130	500
Hill Country Payroll	1293 Common St	New Braunfels	78130	8
Hmt	410 N Seguin Ave.	New Braunfels	78130	35
Hmt Engineering & Surveying	410 N Seguin Avenue	New Braunfels	78130	36
Hmt Engineering & Surveying	410 N Seguin Ave	New Braunfels	78130	33
Hope Hospice	611 N Walnut Ave	New Braunfels	78130	85
Ibex Global	1672 Independence Drive	New Braunfels	78130	560
Iniosante Inc	462 S Walnut Ave	New Braunfels	78130	Six people work in our office.
Invictus Healthcare Solutions	66 Gruene Park Dr	New Braunfels	78130	10
It Guys	1386 Industrial Dr. Suite 110	New Braunfels	78130	6
J&R Gymnastics	1437 S Walnut Ave	New Braunfels	78130	10 part time
Kgnb/Knbt	1540 Loop 337 North	New Braunfels	78130	15
Law Office Of Caroline Moore	200 N. Seguin Ave.	New Braunfels	78130	1
Law Office Of Roy Neal Linnartz, Pllc	297 W. San Antonio Street	New Braunfels	78130	1
Legacy Commercial Real Estate	396 North Seguin Avenue	New Braunfels	78130	3

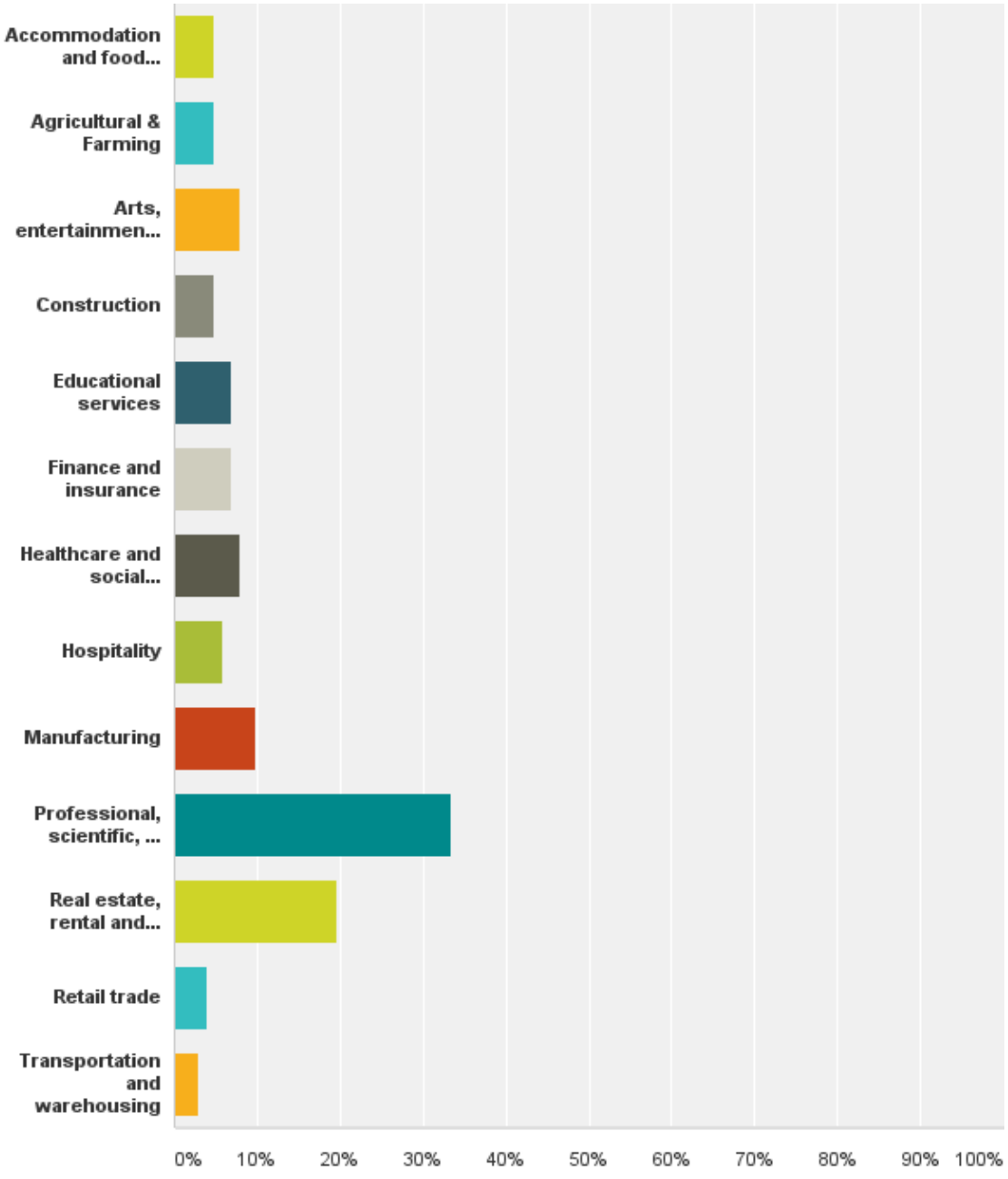
Legacy Commercial Real Estate	396 Seguin Ave	New Braunfels	78130	3
M&S Engineering	376 Landa Street	New Braunfels	78130	20
Marriott International (Remote Location)	650 Northhill Circle	New Braunfels	78130	1
Moeller & Associates	1040 N. Walnut, Ste B	New Braunfels	78130	7
Monsterweb	1259 Loop 337	New Braunfels	78130	9
Ncs Solutions	625 Creekside Way, Stephanie 1747	New Braunfels	78130	1
New Braunfels Area Community Foundation	801 W. San Antonio	New Braunfels	78130	2
New Braunfels Herald-Zeitung	549 Landa Street	New Braunfels	78130	50
New Braunfels Isd	430 W. Mill St.	New Braunfels	78130	970
New Braunfels Leasing & Resorts	471-B Main Plaza	New Braunfels	78130	4
New Braunfels Properties	389 S Seguin Avenue	New Braunfels	78130	2
New Braunfels Smokehouse	441 N Guenther	New Braunfels	78130	120
New Braunfels Smokehouse	441 N Guenther	New Braunfels	78130	120
New Braunfels Smokehouse	441 North Guenther Ave	New Braunfels	78130	150
New Braunfels Utilities	263 E. Main Plaza	New Braunfels	78130	220
New Braunfels Ymca	710 Landa Drive	New Braunfels	78130	85
Older Achievers	2071 Kuehler Ave	New Braunfels	78130	1
Oroian, Guest & Little Pc	524 S. Seguin	New Braunfels	78130	
Parks And Recreation	110 Golf Course Road	New Braunfels	78130	50
Property Professionals	421 S. Seguin Ave	New Braunfels	78130	20
Property Tax Alliance	553 Landa Street	New Braunfels	78130	10
Protex Fire	1450 Hillview	New Braunfels	78130	3
Raba Kistner Consultants	211 Trade Center Suite 300	New Braunfels	78130	2
Riverstone Advisors LLC	480 W Mill St	New Braunfels	78130	1
Rougeux & Associates Pllc	595 S. Castell	New Braunfels	78130	4
Schlitterbahn Waterparks	381 East Austin St.	New Braunfels	78130	500
Scott J Realtor Group Of Keller Williams Realty	453 W San Antonio St	New Braunfels	78130	1
Scottjrealtor Group Of Keller Williams Realty	453 W. San Antonio St	New Braunfels	78130	1
Sh Utility, LLC	1972 Round Table	New Braunfels	78130	3
Sperry Van Ness / Norris Commercial Group	373 S. Seguin Ave	New Braunfels	78130	9
Sperry Van Ness / Norris Commercial Group	373 S Seguin Ave	New Braunfels	78130	3 + 6 independent contractors
Sperry Van Ness | Norris Commercial Group	373 S. Seguin Avenue	New Braunfels	78130	11
Star Manufacturing Ltd	1132 Pride Drive	New Braunfels	78130	11
Stewart Title	111 W. San Antonio Street, Suite 110	New Braunfels	78130	5 in NB office
Stewart Title Company	111 W San Antonio Street Suite 110	New Braunfels	78130	5
Supplize, Inc.	4102 Loop 337	New Braunfels	78130	17
Taylor Designer Floors	1937 Interstate 35 N, Suite 100	New Braunfels	78130	7
The Ammo Group	251 West San Antonio Street	New Braunfels	78130	9

The Ammo Group	251 West San Antonio Street	New Braunfels	78130	10
The Herald-Zeitung	549 Landa St.	New Braunfels	78130	Approx. 25
The It Guys	1386 Industrial Dr, Suite 110	New Braunfels	78130	5
United Way Of Comal County	468 S. Seguin Ave, Ste 403	New Braunfels	78130	2.25
Utsa	800 W. San Antonio	New Braunfels	78130	2
Valmark Chevrolet	725 South Ih 35	New Braunfels	78130	60
White Tucker Co.	1555 North Business 35	New Braunfels	78130	4
Wingate By Wyndham	245 Fm 306	New Braunfels	78130	16
Woods Cycle Country	1933 N Interstate 35	New Braunfels	78130	35
Yourdocumentary.Com (A Sole Proprietorship From A Home Office)	763 W. Mill St.	New Braunfels	78130	Sole proprietor, though collaborate with and punt to various freelancers and contractors.
<No name given>	245 S Seguin Ave	New Braunfels	78130	2
<No name given>	186 E Lincoln St (Residence)	New Braunfels	78130	2
Nbu	263 Main Plaza	New Braunfels	78131	213
Amcs-Usa	901 Oak Bluff Trl	New Braunfels	78132	2
Ballistic Marketing Group	220 Arendes Drive	New Braunfels	78132	1
Bob'Z Enterprises, LLC	1505 Edwards Blvd.	New Braunfels	78132	5
Christian Brothers Automotive	1760 Hwy. 46 West	New Braunfels	78132	9
Dry Comal Creek Vineyards	1741 Herbelin Rd	New Braunfels	78132	5
Ergos Technology	1375 Wald Road	New Braunfels	78132	3
Genesis Construction	1319 Fm 1863	New Braunfels	78132	4
Gvtc Communications	36101 Lfm 3159	New Braunfels	78132	210
Huaco Springs Ranch	3735 River Rd.	New Braunfels	78132	2
Huaco Springs Ranch /Judge R.T. Pfeuffer Office	3735 River Rd.	New Braunfels	78132	12
Ibex Global	1672 Independence Drive	New Braunfels	78132	900
Judge Robert T. Pfeuffer	3735 River Road	New Braunfels	78132	2
New Braunfels Christian Academy	220 Fm 1863	New Braunfels	78132	50-100
Outlier Engineeering	240 Oak Court	New Braunfels	78132	4
R&R Assoc.	521 Hunters Creek Dr	New Braunfels	78132	2
River Road Nurseries / Tieffenbach Consulting	3485 River Rd	New Braunfels	78132	2
Ron Reaves & Associates, LLC	521 Hunters Creek Dr	New Braunfels	78132	2
Spass Walking Tours Of New Braunfels	2232 Granada Hills	New Braunfels	78132	1
The Harvest	363 Texas Country Dr.	New Braunfels	78132	1
The Harvest	363 Texas Country Dr.	New Braunfels	78132	1
<No name given>	825 San Fernando	New Braunfels	78132	2
Coldwell Banker D'Ann Harper, Realtors	532 S. Segin	New Braunfels	781330	52
Standard Casualty Co	100 Northwoods Dr	New Braunfels		40
<No name or address given>		Sattler	78133	1
<No name or address given>				3
<No name or address given>				12

<No name or address given>				2
<No name or address given>				2

2. Business Industry Classifications

Answered: 102 Skipped: 30



Answer Choices	Responses	
Accommodation and food services	**4.90%**	5
Agricultural & Farming	**4.90%**	5
Arts, entertainment, and recreation	**7.84%**	8
Construction	**4.90%**	5
Educational services	**6.86%**	7
Finance and insurance	**6.86%**	7
Healthcare and social assistance	**7.84%**	8
Hospitality	**5.88%**	6
Manufacturing	**9.80%**	10
Professional, scientific, and technical services	**33.33%**	34
Real estate, rental and leasing	**19.61%**	20
Retail trade	**3.92%**	4
Transportation and warehousing	**2.94%**	3
Total Respondents: 102		

3. Current Internet Providers and Speed Information

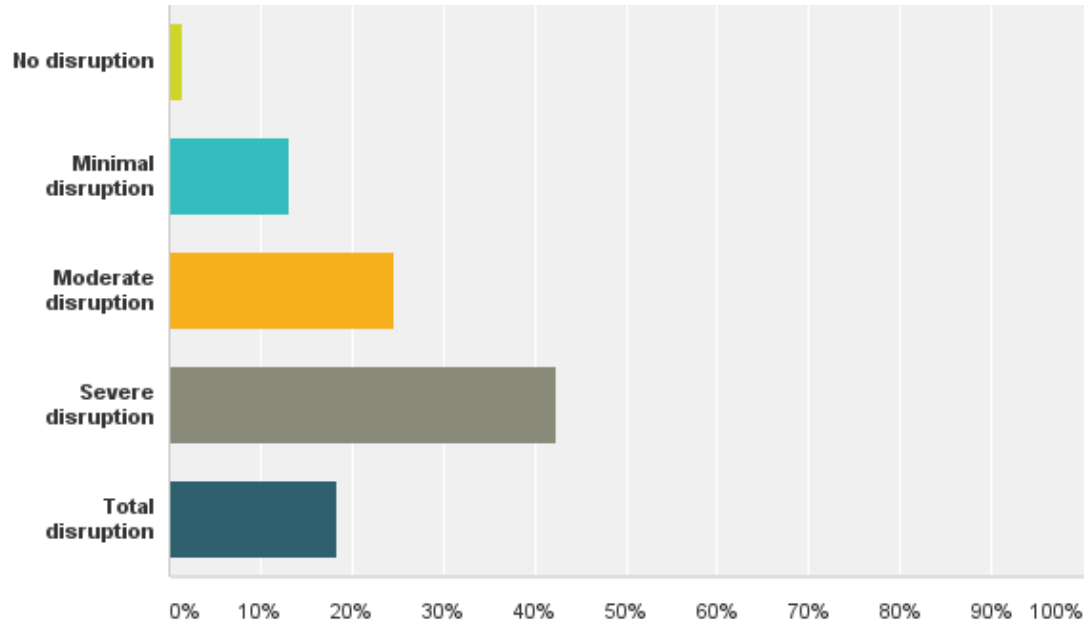
Answered: 120 Skipped: 12

Internet Provider	Businesses	%	Avergage Download (Mbps)	Avergage Upload (Mbps)
AT&T	23	19.2%	15.23	4.67
Birch Telephone	1	0.8%	5.18	0.66
Clear Wireless	1	0.8%	5.34	1
Cox Communications	2	1.7%	27.09	19.78
Don'T Know - Comal County	1	0.8%	1.13	0.26
Education Service Center Region 13	1	0.8%	93.7	91.06
GVTC	5	4.2%	30.97	7.12
IT Guys of New Braunfels	3	2.5%	30.45	28.25
Not Sure	1	0.8%	20.86	4.42
Reallinx - Fiber Provider	2	1.7%	45.79	46.33
Sprint	2	1.7%	0.5	0.48
Texas Wireless	1	0.8%	1.52	No upload data provided
The People'S Republic Of Time Warner Cable	1	0.8%	15.92	1.11
Time Warner	71	59.2%	18.43	4.38
Verizon	4	3.3%	7.67	4.12
Windstream	1	0.8%	8.81	9.24

Overall Speed Statistics	Minimum (Mbps)	Provider	Maximum (Mbps)	Provider	Average (Mbps)
Download	0.2	AT&T	95.76	GVTC	18.48
Upload	0.09	Time Warner	91.06	Education Service Center Region 13	6.4

4. Impact of Internet Problems Including Reliability & Speed On Business?

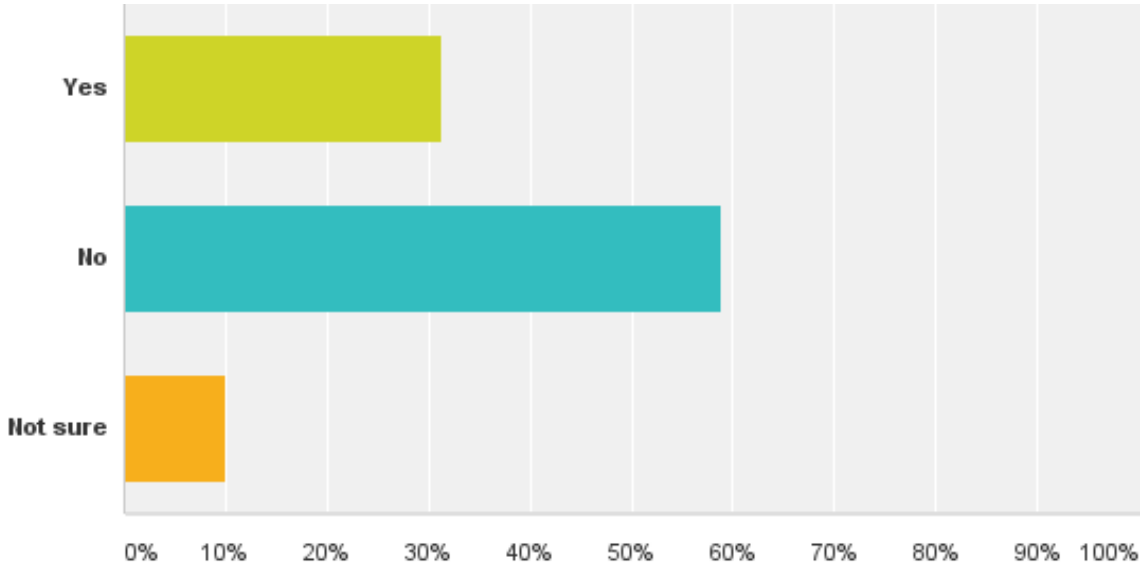
Answered: 130 Skipped: 2



Answer Choices	Responses	
No disruption	**1.54%**	2
Minimal disruption	**13.08%**	17
Moderate disruption	**24.62%**	32
Severe disruption	**42.31%**	55
Total disruption	**18.46%**	24
Total		**130**

5. Are Current Internet Services Fulfilling Business Needs?

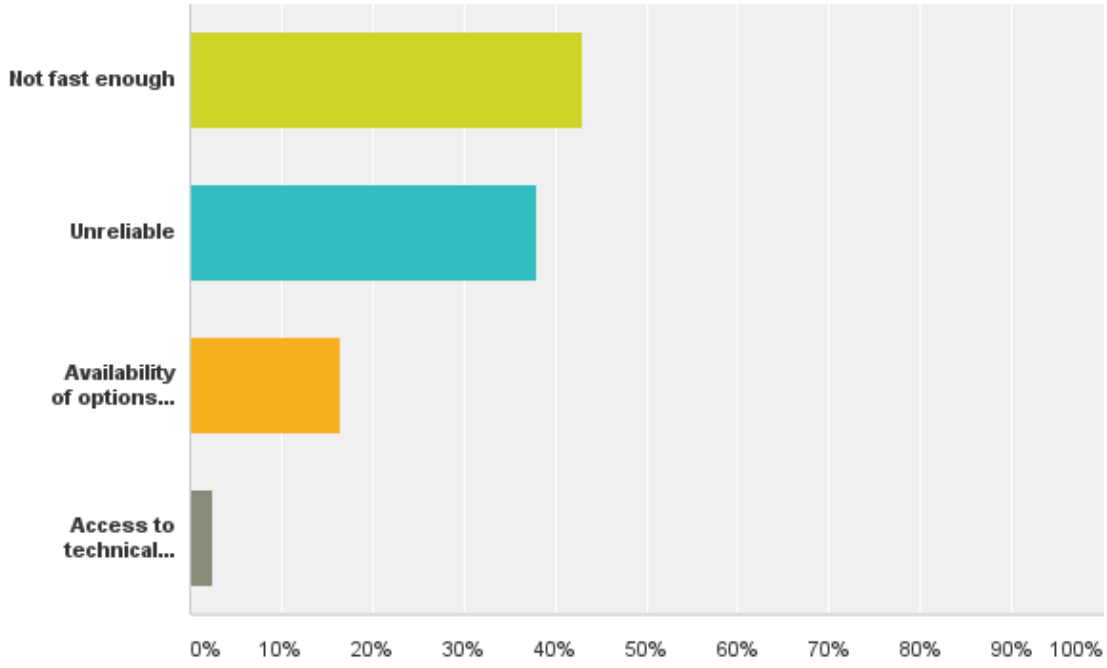
Answered: 131 Skipped: 1



Answer Choices	Responses	
Yes	**31.30%**	41
No	**58.78%**	77
Not sure	**9.92%**	13
Total		**131**

6. If "No" For #4, in What Way Is Your Internet Insufficient?

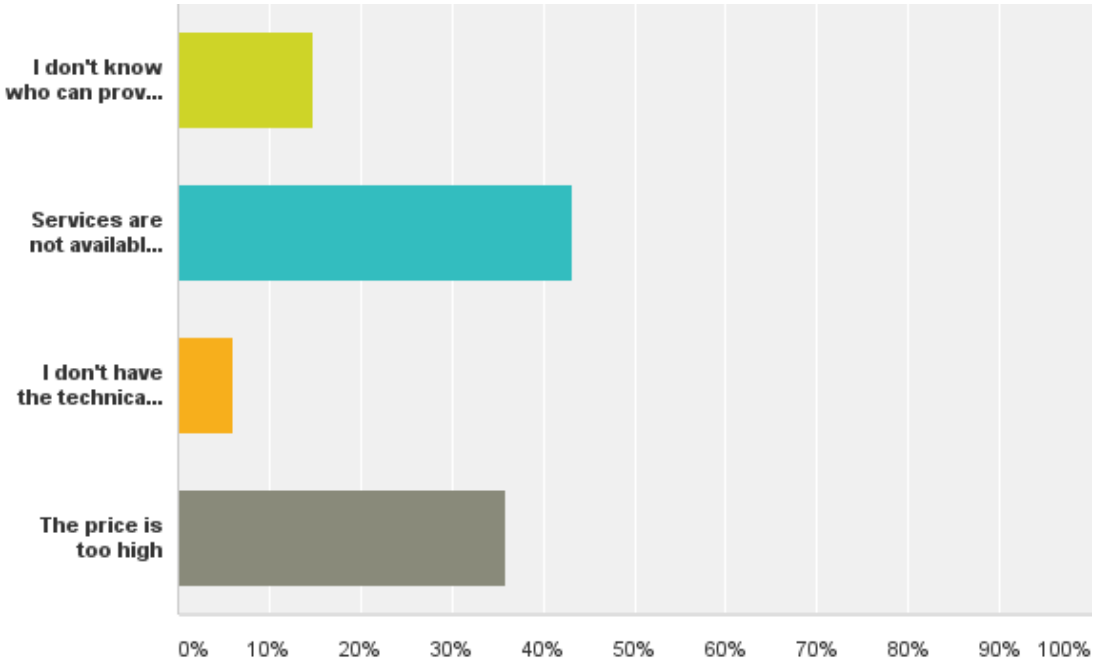
Answered: 79 Skipped: 53



Answer Choices	Responses	
Not fast enough	**43.04%**	34
Unreliable	**37.97%**	30
Availability of options (service type, bandwidth)	**16.46%**	13
Access to technical support	**2.53%**	2
Total		**79**

7. If "No" For #4, Why Haven't Internet Services Been Upgraded?

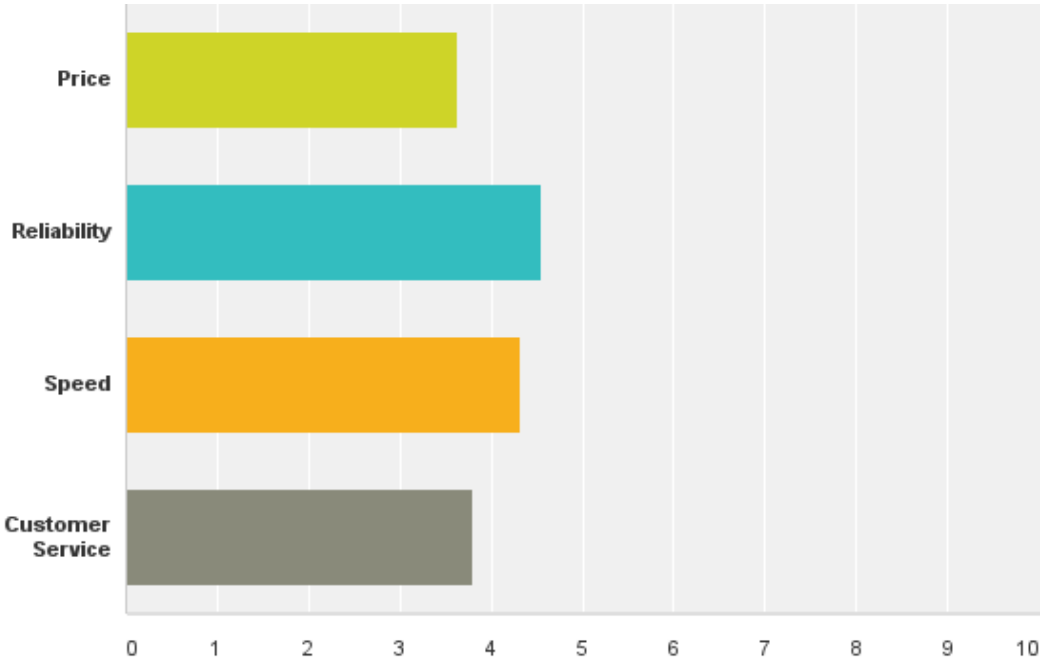
Answered: 67 Skipped: 65



Answer Choices	Responses	
I don't know who can provide services in my area	**14.93%**	10
Services are not available in my area	**43.28%**	29
I don't have the technical skills necessary	**5.97%**	4
The price is too high	**35.82%**	24
Total		**67**

8. Current Internet Services Ratings

Answered: 129 Skipped: 3

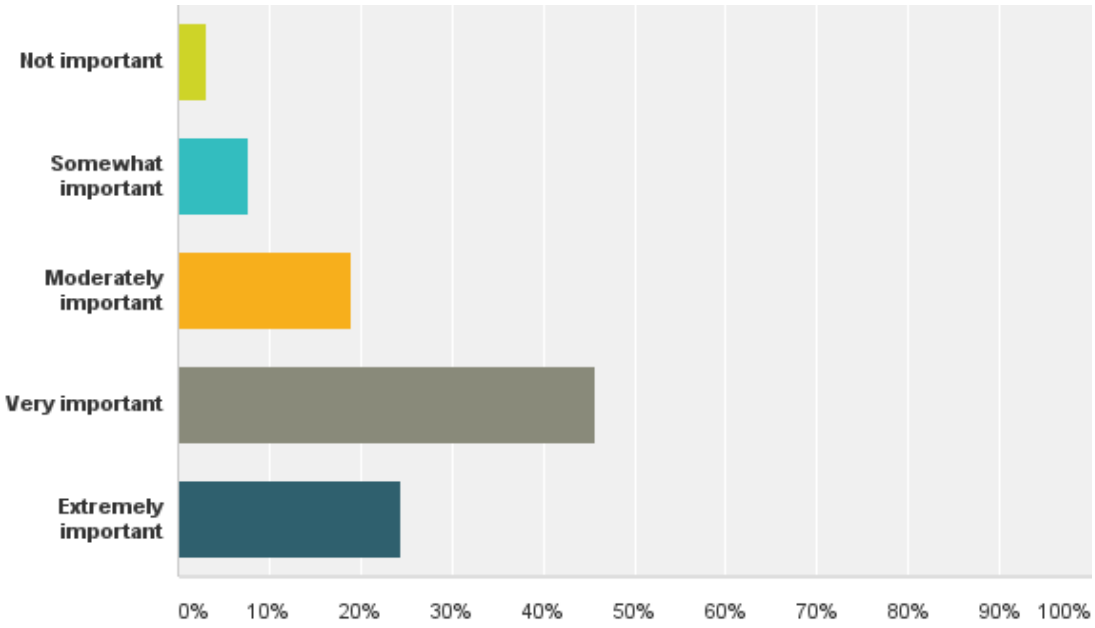


(5 = most important, 1 = least important)

	1	2	3	4	5	Total	Weighted Average
Price	**3.10%** 4	**7.75%** 10	**29.46%** 38	**42.64%** 55	**17.05%** 22	129	3.63
Reliability	**3.10%** 4	**0.78%** 1	**10.08%** 13	**10.08%** 13	**75.97%** 98	129	4.55
Speed	**2.34%** 3	**4.69%** 6	**8.59%** 11	**27.34%** 35	**57.03%** 73	128	4.32
Customer Service	**0.78%** 1	**12.50%** 16	**23.44%** 30	**33.59%** 43	**29.69%** 38	128	3.79

9. Importance of Having Multiple Choices of Internet And Broadband Providers

Answered: 131 Skipped: 1



Answer Choices	Responses	
Not important	**3.05%**	4
Somewhat important	**7.63%**	10
Moderately important	**19.08%**	25
Very important	**45.80%**	60
Extremely important	**24.43%**	32
Total		**131**

Business Broadband Assessment & Feasibility Study

City of New Braunfels

Policy Samples

(Appendix D)

Prepared by: Magellan Advisors
Released: June 22, 2015
Version: 1.0

Magellan ADVISORS

Table of Contents

1. Overview

The following samples and templates are taken, with permission, from other municipalities in other states. These samples and templates should be used as guidelines for creating your own policies and standards and will need to be altered to adhere to your local rules and regulations.

2. Sample General Plan Communication Policy

I. ISSUES / OPPORTUNITIES / CONSTRAINTS

Communications

1. Telecommunications infrastructure and services are critical components for long-term growth and sustainability for the County, as they provide the basic resources necessary for businesses to operate and add to the quality of life for residents. Increasingly, business success is tied to online accessibility, including e-commerce solutions, discoverability, and the overall necessity of high-quality broadband capable of high speeds with symmetric up and down transfer rates. Of equal importance is broadband to residents for access to online education, research, employment, health care, and government resources.

2. Historically, Mono County has suffered from a lack of quality broadband due to our rural nature and low population with dispersed community areas. With the installation of Digital 395 (see III.C. Definitions for more information) in 2013, however, capacity issues will be resolved and new opportunities will arise.

3. With the rapid advances in mobile device technology, both providers and subscribers are increasingly looking to mobile solutions to help fill communication gaps and provide alternatives to typical fixed deployments. While the mobile alternatives are extremely valuable at fulfilling their role, they are not a panacea for solving broadband issues throughout the county.

4. The primary issues with the mobile broadband solution are the data caps that are placed on customers, the overall cost of the service, and the typical requirement of a long-term contract in order to receive the service. While these are hurdles typically overcome by those looking to utilize this technology as a secondary method for accessing the Internet, for those who are looking at it as their primary, they may be insurmountable.

5. For the most part, some form of cellular coverage exists in almost every community; however, it is carrier dependent. AT&T and Verizon are the two main carriers, whose coverage models overlap, but do not provide the same coverage in all of the same areas. In addition to some communities not having cellular service, there are significant sections of our primary highway corridors without coverage, which poses safety concerns and convenience issues for travelers.

6. With Digital 395, cellular coverage throughout the county may improve as new sites are developed and existing sites improved with upgraded technology that adopts a fiber-fed backhaul. This development pattern is important, and should be considered strategically and implemented thoughtfully in order to meet goals and objectives while adhering to policies and parameters.

7. Within the context of non-mobile broadband technology, Mono County continues to struggle with the basic aspects of accessibility, reliability, and adoption. These three aspects are closely related to each other, as the region as a whole has been starved of quality Internet until very recently. Where service is accessible (mainly in the major community areas), the reliability and usability of that service has not always been great enough to motivate everyone to adopt. Coupled with the demographics of the region (a mix of income levels, education, age, and ethnicities), a portion of the population still does not use the Internet.

8. Outside of the Town of Mammoth Lakes and the community of June Lake, most communities do not have more than one Internet Service Provider. For the most part, smaller communities are serviced by a single fixed wireless provider (Schat.net), leaving only one other small, wireline provider (Escape Broadband) to compete with the bigger companies offering wireline service – Suddenlink and Verizon.

9. Due to limited competition, the market in each community has been dominated by a single (non-mobile) carrier, which limits consumer choice, stifles competition, and does not afford redundancy. In addition, business use of Internet is limited to residential grade service plans, with only a small number of T1 type connections, or similar higher speed service offerings. In general, this has not only resulted in those businesses being confined to Mammoth or June Lake, but also made it difficult or financially impractical for businesses to get higher speeds or symmetric service offerings.

10. A high priority is placed on broadband market development, and the engagement of Mono County in the regional deployment of this critical infrastructure. Participation in local, regional, statewide, and federal efforts that are aimed at the improved diffusion of broadband and communications technology is an important part of achieving the goals and objectives.

II. DEFINITIONS

Communications

1. Digital 395: A 583-mile long Middle Mile fiber optic project between Carson City, NV and Barstow, CA. This project was jointly funded by the U.S. Department of Commerce under the American Recovery and Reinvestment Act of 2009 (ARRA), and a ratepayer fund dedicated to broadband development known as the California Advanced Services Fund which is administered by the California Public Utilities Commission.

2. California Broadband Cooperative: A not-for-profit telephone cooperative that will serve as the long-term owner and operator of the Digital 395 network.

3. Praxis Associates, Inc.: A recognized California-based fiber optic development firm responsible for securing the funding and serving as the lead on the design, management, and construction of the Digital 395 project.

4. Middle Mile: In utilities and telecommunication networks, this is the core portion of the infrastructure that provides the high-capacity, long-haul routes from points of origin for service to local service providers and smaller distribution networks.

5. Last Mile: In utilities and telecommunication networks, this is the local network that delivers service to consumers, as developed and carried out by Internet Service Providers (ISPs).

6. Anchor: As it relates to Digital 395, these are government, education and medical facilities, and service provider points of interconnect where services are provided by Digital 395.

7. Node: As it relates to Digital 395, these are locations along the fiber route where hardware is located that amplifies signal in the fiber, routes traffic on the network, and provides points of interconnect.

8. Fiber Access Point (FAP): Typically located in underground vaults, these are points of access to fibers broken out from the Digital 395 backbone for the purpose of providing a point of interconnect for future middle or last mile services.

9. Network Interface Device (NID): A piece of technology installed at anchors where the Digital 395 network is terminated and can be interfaced with a local network.

10. Mobile Wireless: A general term used to describe broadband service that is offered typically by cellular carriers via 3G, 4G, LTE or similar types of networks to smartphones, tablets, and other mobile technology.

11. Fixed Wireless: A term used to describe broadband service that is offered by an Internet Service Provider via wireless infrastructure that is installed on premise and aimed at a repeater site.

12. Wireline: A general term that is used to describe a connection to the Internet which is provided via hardwire, as in the case of DSL, Cable, or Fiber based technologies.

II. POLICIES

Communications

Broadband Distribution and Quality of Service

Goal 1. Facilitate the distribution of the best broadband service possible, to as many users within community areas and key transportation corridors as possible, in a timely and cost effective manner that minimizes impacts to visual and natural resources.

Objective 1.A. Work with providers to deliver the best service possible to Mono County residents, businesses, and visitors.

Policy 1.A.1. Providers shall develop new infrastructure projects using the best available technology that meets or exceeds current industry standards and is consistent with Goal 2.

Action 1.A.1.a. Providers shall meet or exceed standards set by the California Advanced Services Fund (CASF) for 'Served' communities.[1]

Action 1.A.1.b. Encourage new infrastructure projects to use high-capacity wireline solutions (such as Fiber-to-the-Premise). Providers should demonstrate a justification for alternative technologies requirements when wireline is impractical.

[1] California Advanced Services Fund is a division of the California Public Utilities Commission (CPUC) and is responsible for increasing broadband adoption in hard to reach areas of California. More information at http://www.cpuc.ca.gov/PUC/Telco/Information+for+providing+service/CASF/index.htm.

Policy 1.A.2. Providers shall develop and deliver services that improve accessibility to high quality broadband while protecting consumers and ensuring fair and equal access to those utilizing services within the County.

Action 1.A.2.a. Ensure Internet Service Providers (ISPs) possess a current Business License, and be current on all applicable Franchise Licenses, taxes, and fee payments.

Action 1.A.2.b. ISPs shall furnish and uphold Customer Service Standards that provide privacy protection, clear service and billing procedures, reliability, or a similar service level agreement, and means by which to contest service not meeting said standards.

Action 1.A.2.c. The County should work with providers to establish and maintain consumer awareness information and materials. Periodically review and publish information on local providers based on service standards, including but not limited to coverage area, speeds, etc.

Objective 1.B. Deploy broadband to as many community areas and key transportation corridors as possible, and pursue additional providers to increase competition, and improve quality of service.

Policy 1.B.1. Work with providers and other entities to develop projects that deliver broadband service to all communities.

Action 1.B.1.a. Establish and maintain a list of high priority communities that can be referred to when providers are looking to build new projects.

Action 1.B.1.b. Actively seek out providers and other reasonable alternatives to establish broadband service in unserved communities throughout the County.

Action 1.B.1.c. Coordinate and work with Eastern Sierra Connect Regional Broadband Consortium (ESCRBC) and other entities to locate funding opportunities for providers interested in building projects in 'unserved' and 'underserved' communities.

Action 1.B.1.d. Pursue additional providers or other reasonable alternatives to improve the quality of service, competition, and reliability in communities throughout the County.

Action 1.B.1.e. Look for opportunities to establish access to broadband in other rural or outlying areas for the purpose of enhancing Health & Safety or Economic Development purposes where traditional approaches or solutions are impractical.

Policy 1.B.2. Establish free WiFi in public spaces including County buildings, parks, community centers, and in commercial corridors in community areas.

Action 1.B.2.a. Provide free WiFi for public use in County offices and facilities.

Action 1.B.2.b. Work with service providers to establish free WiFi in commercial corridors and other public areas to support and promote local businesses.

Action 1.B.2.c. Limit speeds on public WiFi networks so as not to compete with residential or business connections offered by local service providers.

Design and Placement of Communications Infrastructure

Goal 2. Ensure deployment and implementation minimizes impacts to visual and natural resources. Provide development standards for communication infrastructure located throughout the County.

Objective 2.A. Minimize the impact on the environment and scenic resources of communications projects and infrastructure.

Policy 2.A.1. Providers shall utilize distribution practices that cause the least amount of long-term/significant environmental and visual impacts, including the use of design and screening tactics (also see Mono County Design Guidelines).

Action 2.A.1.a. Projects shall comply with requirements in Chapter 11, Section 11.010, of the Land Use Element.

Action 2.A.1.b. To support utilization of existing infrastructure and co-location, the County should maintain a database of existing communications infrastructure that can be referenced when evaluating projects and prior to permitting, and that is available to providers.

Action 2.A.1.c. Encourage placement of towers outside of community areas.

Policy 2.A.2. Underground existing overhead infrastructure when possible.

Action 2.A.2.a. Seek and utilize Rule 20, grant funds, public-private partnerships, or other creative funding opportunities, such as loans or mortgages, to underground infrastructure.

Action 2.A.2.b. Utilize a community-based public planning process to help identify and prioritize future undergrounding projects; review area plans for existing community direction.

Action 2.A.2.c. Establish an inventory and set of priorities for each community for future undergrounding projects based on areas of high preference or priority, as driven by public safety, reliability, community benefit (commercial cores, downtowns, etc.), or visual blight issues.

Action 2.A.2.d. Maintain an inventory of all underground districts and past funded projects in the County.

Policy 2.A.3. Utilize existing permit review procedures, such as the Land Development Technical Advisory Committee, to ensure project compliance and engage interested County departments, including Information Technology (IT), and other stakeholders.

Objective 2.B. Develop and manage underground infrastructure as 'basic infrastructure' that adheres to standards, is available for public use, and is managed as an asset in line with other public property.

Policy 2.B.1. Underground infrastructure shall be installed in accordance with standards specified in Chapter 11, 11.010, regarding placement, material, and method, and should adhere to other best practices.

Action 2.B.1.a. Conduit in public streets should be placed a minimum depth of three feet.

Action 2.B.1.b. Conduit installed for the purposes of Middle-Mile or long-haul routes, or that is installed in major streets or arterials should be the equivalent minimum of 4" in diameter.

Action 2.B.1.c. Conduit installed for the purposes of Last-Mile or distribution routes should be a minimum of 1½" in diameter.

Action 2.B.1.d. Conduit should be installed at the intersection of streets that is the equivalent of at least 4" in diameter and made accessible via vaults or similar appropriate means.

Action 2.B.1.e. Encourage the use of microduct or similar technology in conduit installations so as to segregate providers.

Action 2.B.1.f. A reasonable amount of space shall be retained by the owner of the underground infrastructure for the purpose of their potential future use.

Action 3.B.1.g. Allow developers who install conduit to recover their costs through renting or leasing space in conduit at a fair and competitive price until the point that the cost of installation is paid off.

Strategic Planning For Communications Infrastructure

Goal 3. Plan for the improvement and expansion of the communications infrastructure network by seeking cost-effective and efficient solutions.

Objective 3.A. Utilize County property and rights-of-way, or other public spaces and resources, for communication sites or infrastructure.

Policy 3.A.1. The County shall provide sites or space for communication facilities, including cabinet structures, pedestals, antennas, etc. where appropriate and feasible.

Action 3.A.1.a. Develop and maintain an inventory of viable sites, permissible uses, associated costs, power and backhaul access, and other relevant information on County property and rights-of-way.

Action 3.A.1.b. Consolidate and co-locate facilities on County property or rights-of-way without interfering with County infrastructure, and design new facilities and projects taking into consideration future communication infrastructure.

Action 3.A.1.c. Review locations of Digital 395 Fiber Access Points (FAPs) within County Rights of Way and determine how providers may utilize or access FAP and install necessary infrastructure in Right of Way.

Policy 3.A.2. Projects conducted on County property, including rights-of-way, shall follow a 'Dig Once' objective.

Action 3.A.2.a Install conduit in public streets during construction/re-construction for future communications infrastructure use.

Action 3.A.2.b. Accommodate construction of conduit laterals leading to private property for potential future use.

Policy 3.A.3. Interested parties shall be notified of any opportunity for installing additional conduit or infrastructure in open trenches in County right-of-way.

Action 3.A.3.a. Look for opportunities to place new conduit through joint utility trenches.

Action 3.A.3.b. Require formal notification of utilities and interested parties of a joint trench opportunity prior to issuance of permit for construction work.

Action 3.A.3.c. Require installation of secondary or tertiary conduit whenever new conduit is being installed in public Rights of Way to accommodate future use/growth.

Policy 3.A.4. Underground infrastructure in County rights-of-way shall be accessible and remain available for use by qualified providers.

Action 3.A.4.a. Accept offers of dedication for underground infrastructure from private developers and maintain conduit in the public's interest.

Action 3.A.4.b. Work with special districts, quasi-public entities, or third-party companies and vendors for long-term ownership or management of underground conduit, so long as the infrastructure remains available to the public at a fair price and in an open and competitive manner.

Policy 3.A.5. Leverage existing broadband infrastructure, including Digital 395, before constructing new infrastructure.

Action 3.A.5.a. Lease existing bandwidth, dark fiber, or conduit space from California Broadband Cooperative when network routes parallel Digital 395 infrastructure.

Policy 3.A.6. Collaborate with public land managers and other agencies to provide infrastructure locations consistent with Mono County's policies and regulations.

Action 3.A.6.a. Encourage use of public land for site location and pursue opportunities with federal agencies, special districts, or local agencies.

Action 3.A.6.b. Work with land management agencies to ensure knowledge and understanding of future development plans, County General Plan policies and guidelines, and find opportunities to synchronize policies and objectives between entities.

Objective 3.B. Design communication infrastructure for future use into County projects.

Policy 3.B.1. Communication projects shall be added to the County Comprehensive Capital Facilities Plan for consideration through the established process for prioritization and funding.

Policy 3.B.2. The County shall consider communications conduit as a standard aspect of a street and shall take advantage of opportunities to install infrastructure when appropriate.

Action 3.B.2.a. Conduit shall be incorporated in the design and cost estimate phases of new street, sidewalk, or other related transportation projects.

Action 3.B.2.b. Establish dedicated revenue account(s) to be funded through leases or rents of County property for communications infrastructure, and to be made available for future conduit development and maintenance projects.

Action 3.B.2.c. When funding is not available for conduit, look for alternative sources including grants, special districts, public-private partnerships, private funding, or improvement district(s) in advance of actual construction effort.

Objective 3.C. Evaluate opportunities and establish a plan for future communications infrastructure needs and development opportunities.

Policy 3.C.1. Utilize existing committees, such as the Collaborative Planning Team, to coordinate and review communication development projects in neighboring jurisdictions or with a regional perspective.

Action 3.C.1.a. Work to develop a common set of standards and protocols for permitting, design, etc. that ensure consistency for providers and ensure the best delivery of service to our constituents.

Action 3.C.1.b. Evaluate Capital Improvement Plans (CIPs) for potential integration of broadband/communication projects.

Policy 3.C.i2. Work with the private sector to identify future projects.

Action 3.C.2.a. Work with cellular providers and third party tower developers to gain an understanding of future development intentions.

Objective 3.D. Develop and maintain a comprehensive inventory of communications, and related infrastructure for planning purposes.

Policy 3.D.1. The County shall establish and maintain a GIS database containing information and data on existing infrastructure. (Basic infrastructure information is also located in the Master Environmental Assessment [MEA]).

Action 3.D.1.a. Develop and maintain an inventory of communication infrastructure, capacity, and relevant characteristics for underground conduit, cell tower sites, and other facilities, with a focus on County properties and rights-of-way.

Action 3.D.1.b. Develop and maintain a list of priority "unserved" and "underserved" areas throughout Mono County in need of broadband and engage Last-Mile Providers with the intent of developing projects in those areas.

Action 3.D.1.c. Develop and maintain an inventory of cell phone coverage gaps, shadow areas, and potential locations (when/if identified).

Action 3.D.1.d. Catalog potential projects and future development plans in a GIS database for internal reference purposes and planning efforts.

Action 3.D.1.e. Acquire maps, data, and other relevant information from special districts and service districts throughout the County who provide service to local residents.

Action 3.D.1.f. Inventory and develop a publicly accessible dataset that contains the best known locations for infrastructure that may be used by future providers, as well as public sites anticipated to be problematic.

Objective 3.E. Improve and expand the communications network to meet critical public needs, improve government services, and support vibrant communities and local economies.

Policy 3.E.1. Leverage Digital 395 and other broadband and communications resources to improve public safety.

Action 3.E.1.a. Implement an Emergency Services Network using Digital 395 that connects the satellite facilities of emergency services personnel within Mono County, as well as surrounding jurisdictions with the intent of improving the exchange of information between all parties.

Action 3.E.1.b. Utilize the Emergency Services Network to improve Enhanced 911 services by coordinating information shared between dispatch and responders.

Policy 3.E.2. Improve cellular coverage area and establish redundant communications in communities.

Action 3.E.2.a. Direct future providers to key transportation corridors and community areas without cellular service due to coverage gaps or shadow areas. (See Action 3.D.1.c.)

Policy 3.E.3. Utilize Digital 395 and technology as a whole to improve government accountability and accessibility, improve efficiency, and reduce environmental and fiscal impacts.

Action 3.E.3.a. Develop and/or promote use of video conferencing, virtual meetings, a ride-share program, and other methods to reduce trips between County offices and to non-County locations.

Action 3.E.3.b. Budget for, install, and make available video conferencing equipment at County locations, such as community centers, libraries, and satellite offices.

Action 3.E.3.c. Utilize mobile data terminals or other similar computing devices to provide service to customers in the field.

Action 3.E.3.d. Explore and utilize paperless approaches for meetings, public information, and publication of reports, etc.

Action 3.E.3.e. Develop policies and guidelines for County staff to work remotely or telecommute when appropriate.

Action 3.E.3.f. Utilize the Internet, including websites, emails, and other similar communication vehicles to disseminate information to constituents and the general public.

Action 3.E.3.g. Provide access to public meetings via the Internet, "Public, Education, and Government (PEG) Access Channels", or other similar communication vehicles.

Policy 3.E.4. Develop a broadband economic development strategy for Mono County.

Action 3.E.4.a. Develop information and products including marketing collateral, white papers, case studies, and other relevant materials that can assist with the promotion of technology-focused business in Mono County.

Action 3.E.4.b. Develop a strategic outreach and marketing plan utilizing the developed materials and targeting technology focused businesses.

Action 3.E.4.c. Promote telecommuting as a viable method allowing visitors to stay in the region longer and work remotely, and attract new permanent residents to relocate to the area and work from Mono County.

Action 3.E.4.d. Promote workforce development and educational opportunities to train local residents and stakeholders about benefits and uses of technology, focused on the expansion of existing business and development of new business ventures.

Action 3.E.4.e. Utilize the broadband network to attract new businesses and promote business development.

Policy 3.E.5. Perform a business opportunity analysis study.

Action 3.E.5.a. Evaluate locations in the County that would be viable for various types and sizes of new technology businesses.

Action 3.E.5.b. Evaluate issues, opportunities, and constraints pertaining to business development in various locations of the County.

Action 3.E.5.c. Consider changes to policies that may hinder or otherwise complicate development of technology or green business development, including waiving of permit or licensing fees.

Action 3.E.5.d. Evaluate broadband adoption and digital literacy programs and initiatives to support business retention and expansion.

Objective 3.F. Build support and funding for improving and expanding the communication infrastructure system through collaboration.

Policy 3.F.1. Support programs and initiatives that improve broadband adoption and digital literacy.

Action 3.F.1.a. Work with regional broadband consortia, state and national initiatives, and local service providers to offer broadband to low-income, at-risk, and under-/un- served populations.

Policy 3.F.2. Leverage and support the California Broadband Cooperative, Eastern Sierra Connect Regional Broadband Consortium, and other similar not-for-profit broadband organizations to help achieve County goals and objectives.

Action 3.F.2.a. Maintain a County seat on the Eastern Sierra Connect Regional Broadband Consortium and maintain the County's interest in regional broadband development and adoption programs.

Action 3.F.2.b. Appoint a non-elected representative to the Board of Directors for the California Broadband Cooperative.

Policy 3.F.3. Seek grants and other funding opportunities for communication infrastructure projects consistent with these General Plan Policies.

3. Sample Development Standards

DEVELOPMENT STANDARDS

Q1: Chapter 11 – Utilities

Sections:

11.010 Placement of Utility Infrastructure.

A. Exemption for Regulated Public Utilities.
The provisions of this section shall not apply to distribution and transmission lines owned and operated as part of the statewide electrical network regulated by the California Public Utilities Commission (PUC). The authority for this exemption is set forth in the California Constitution, Article XII, Section 8, which vests exclusive regulatory authority over the distribution and transmission lines of these utilities in the California Public Utilities Commission. However, the County shall work with the PUC and applicant to cooperatively meet the standards set forth in Section F.

B. Uses Permitted.
Underground facilities for the distribution of gas, water, sewer, telephone, television, communications and electricity shall be allowed in all designations.

C. Definitions.
For the purposes of this section, the following definitions shall apply:

"Individual development" means an individual development project, such as a single-family residence and/or Accessory Dwelling Unit, a garage, a single commercial use, one apartment building, or similar uses. It does not mean a subdivision, land division, condominium development, or development of more than one detached unit at the same time.

"Overhead utility lines" means utility distribution lines and service laterals that are installed above ground, either overhead, in an above ground conduit, or in some other manner.

"Subdivision" means the division of any unit or units of improved or unimproved land as further defined in Section 02.1520 and the Mono County Subdivision Ordinance.

"Utility" means gas, water, sewer, telephone, television, communications and electricity.

"Wireline" is a general term that is used to describe a connection to the Internet which is provided via hardwire, as in the case of DSL, Cable, or Fiber based technologies.

D. Utility Distribution Lines to Individual Development.
Utility distribution lines to an individual development shall be installed underground, unless the applicant has obtained a Director Review Permit with Notice for overhead installation, in the manner specified in Chapter 31, Director Review Processing. For projects that require a use permit, the application for overhead utility lines shall be processed as part of the use permit application.

Prior to considering issuance of a permit, planning staff shall work with the applicant to site and design the project in a manner that avoids or minimizes the use of overhead lines, and that avoids or minimizes the impacts of overhead lines. Consideration should be given to combining lines and co-locating with other applicable facilities whenever possible.

In granting a permit for overhead utility lines, the Community Development Director (Director) or the Planning Commission (Commission) shall make one of the following findings, in addition to the required Director Review or Use Permit findings:

1. The overhead line placement will not significantly disrupt the visual character of the area. In making this determination, the Director or the Commission shall consider the following:

    a. In areas without a number of existing overhead lines in the immediate vicinity, would overhead lines create the potential for a significant cumulative visual impact; i.e., would allowing an overhead line be likely to result in future requests for additional overhead lines in the area? If so, it may be determined that an overhead line will have a significant impact on the visual character of the area.

b. Does the topography or vegetation in the area effectively screen the proposed lines? If so, then an additional line may not significantly disrupt the visual character of the area.

c. Are there other potential alignments that would have less visual impact?

d. Does the project reduce the overall number of overhead lines and poles in the area; are the lines co-located with existing facilities; and/or do design features such as height of lines, size, color, reflectivity, tension in line, or other features reduce visual impacts? If so, it may be determined that an overhead line will not have a significant impact on the visual character of the area.

The Director or the Commission may consider additional information pertaining to the visual character of the area which is deemed relevant to the application.

2. The placement of utility lines above ground is environmentally preferable to underground placement. In making this determination, the Director or the Commission shall consider the following:

a. Will underground placement disturb an environmentally sensitive area, including but not limited to the following: cultural resource sites, significant wildlife habitat or use areas, riparian or wetland areas, or shallow groundwater? If so, above-ground placement may be preferable.

b. Will overhead placement cause impacts to sensitive species, such as the Bi-State Distinct Population Segment of Greater Sage-Grouse, or other environmental impacts? If so, above-ground placement may not be preferable, or perch deterrents and other mitigations may be required (see sage-grouse policies in C/OS).

c. Will underground placement require disturbance of a waterway, including perennial, intermittent and seasonal streams? If so, above-ground placement may be preferable.

d. Will underground placement increase the utility line's exposure to environmental hazards, such as flood hazards, fault hazards or liquefaction? If so, above-ground placement may be preferable.

e. Are there other potential alignments that would avoid potential environmental impacts?

The Director or the Commission may consider additional information pertaining to the environmental sensitivity of the area which is deemed relevant to the application.

3. The installation of underground utilities would create an unreasonable financial hardship on the applicant due to the unique physical characteristics of the property. In making this determination, the Director or the Commission shall consider the following:

   a. Is the cost of the line to be installed excessive?

   b. Will the installation of underground utilities require trenching under a stream bed?

   c. Will the installation of underground utilities require unreasonable trenching or blasting through rock?

   d. Are there alternate alignments that would eliminate or significantly lessen the financial hardship?

   The Director or the Commission may consider other site specific financial hardships deemed relevant to the application.

4. The exclusive purpose of the overhead line is to serve an agricultural operation.

   For the purposes of this section, agricultural operations are defined as use of the land for the production of food and fiber, including the growing of crops and grazing of livestock. Above-ground utility lines may be permitted for agricultural uses such as pumps and similar uses.

E. Utility Distribution Lines for Subdivisions.
Utility distribution lines for all subdivisions and land divisions shall be installed underground, unless a specific hardship can be demonstrated (see # 3 above). If a specific hardship can be demonstrated, overhead installation may be allowed subject to approval of a variance (see Ch. 33, Variance Processing).

Subdivisions may be required to underground the feeder distribution line to the subdivision. An assessment district, or a similar mechanism, may be established for this purpose as a condition of the tract map approval.

F. Utility Distribution Lines for All Other Communication Infrastructure

All other types of utility distribution lines shall be installed underground, unless the applicant has obtained a Director Review Permit with Notice for overhead installation, in the manner specified in Chapter 31, Director Review Processing. For projects that require a use permit, the application for overhead utility lines shall be processed as part of the use permit application. Projects located in the County right-of-way shall also require an encroachment permit from the Public Works Department.

Prior to considering issuance of a permit, planning staff shall work with the applicant to site and design the project in a manner that avoids or minimizes the use of overhead lines, and that avoids or minimizes the impacts of overhead lines. Consideration should be given to combining lines and co-locating with other applicable facilities whenever possible. If overhead installation is necessary, all of the findings in Section 11.010D 1-4 shall be evaluated to provide justification. In addition, the following requirements shall be applied:

1. Within Scenic Highway corridors, a variance (see Ch. 33, Variance Processing) and/or deviation authorization from the California PUC is required prior to approval of overhead construction.

2. In County rights-of-way other than Scenic Highway corridors, a use permit must be obtained prior to allowing overhead construction.

G. Use Permit.

Other utility (municipal, private, and if applicable, public utilities not regulated by the PUC) distribution lines, transmission lines and corridors, towers, electrical substations, repeater stations, pumping stations, and uses accessory thereto, including microwave facilities, may be allowed in all districts subject to first securing a use permit, in the manner specified in Chapter 32, Use Permit Processing.

H. Exceptions.

In the event that any regulations of the Public Utilities Commission or any other agency of the state with jurisdiction over utilities conflicts with the provisions of land use designations and the land development regulations, the regulations of the state shall apply, to the extent that the same are conflicting.

I. Locational Requirements.
Whether or not a utility is subject to any permitting requirements as delineated in subsections A to G, above, all new utility distribution lines, transmission lines, corridors, rights of way, towers, electrical substations, repeater stations, pumping stations, cell/communication towers and uses accessory thereto, including microwave facilities, shall comply with the policies of this General Plan and applicable area or specific plans.

J. Cellular and Wireless Towers

Towers erected for the purposes of providing communications through wireless or cellular technologies are permitted in all land use designations subject to a use permit. These towers shall exhibit substantial compliance with the following, unless such substantial compliance would result in an effective prohibition of the provision of wireless communication facilities, or in unreasonable discrimination against a provider of wireless communication facilities, as defined in the Telecommunications Act of 1996:

1. Visual mitigations strategies included in the Mono County Design Guidelines.

2. Cellular and wireless towers shall bond for the reclamation of the site in the event that the infrastructure has not been utilized for a period of three years. Infrastructure shall be removed within one year of abandonment.

3. Towers shall be sited only when there is an identified service provider who has proved a need for the facility.

4. Facilities shall be co-located to minimize the number of towers, and new sites shall include capacity for additional providers to utilize the facility.

5. New sites shall reference the County's inventory of shadow areas and coverage gaps, when available, and provide coverage maps/data demonstrating a reduction in areas without coverage.

6. Height shall be mitigated by locating towers on high ground but below ridgelines or hill tops. Heights greater than 60' may be allowed in Public Facilities (PF) Land Use Designations subject to the following use permit finding, but in no case shall the height exceed 80':
   a. The additional height shall not result in substantial detrimental effects on the enjoyment and use of surrounding properties.

In addition, at least one of the two following findings must be made in the use permit, and in no case shall additional height be granted above the minimum necessary to provide for the finding:

b. The increased tower height is necessary to provide line-of-sight and service coverage that significantly reduces shadow areas and coverage gaps as demonstrated by coverage maps/data, and/or
c. The increased tower height is necessary to support multiple carriers on one tower with adequate line-of-sight and service coverage as demonstrated by coverage maps/data.

7. Perch deterrents and other sensitive species mitigations shall be required consistent with C/OS policies.

8. Cell tower operators shall be required to verify compliance with the FCC's RF Emission Standards.

K. Installation of Conduit and Wireline Infrastructure

Conduit and wireline for the purposes of providing communications infrastructure are permitted in all land use designations, and shall be installed underground and co-located with existing facilities or utilize existing wireline unless a Director Review Permit or Use Permit has been obtained. Projects located in the County right-of-way shall also require an encroachment permit from the Public Works Department. New conduit and wireline infrastructure shall be subject to the following requirements in addition to the applicable permit:

1. Evidence of need for new conduit or wireline infrastructure shall be demonstrated. Applicants should reference the County's communication infrastructure database, when available.

2. New conduit in the County right-of-way shall contain tracer wire, or be mapped with GPS, or have accurate georeferenced as-built digital drawings, or be otherwise locatable using standard devices or means. Data must be submitted to the County at completion of construction.

3. New wireline infrastructure shall be placed in existing underground conduit before installing new conduit or overhead lines. Overhead lines shall be subject to Section F.

4. All new, large-scale, commercial underground infrastructure shall be filed with the Underground Service Alert (USA).

5. Sites shall be reclaimed and all infrastructure removed within 180 days of abandonment or cessation of use.

L. Commercial Communication Infrastructure on Private Property
A Director Review Permit (Ch. 31, Director Review Processing) must be secured prior to locating commercial communication infrastructure on private property for reasons other than personal consumption by the property residents.

4. Sample Infrastructure Improvement Ordinance

ORDINANCE NO. _____ 05B9

ORDINANCE ADDING CHAPTER 12.25 TO SANTA CRUZ COUNTY CODE RELATING TO TELECOMMUNICATIONS INFRASTRUCTURE IMPROVEMENTS

The Board of Supervisors of the County of Santa Cruz ordains as follows:

SECTION I

Chapter 12.25 of the Santa Cruz County Code is enacted to read as follows:

TELECOMMUNICATIONS INFRASTRUCTURE IMPROVEMENT ORDINANCE

Sections:

12.25.010 Findings and intent.

A. It is the intent of the County of Santa Cruz, in enacting Chapter 12.25, to streamline and simplify the process of installing and upgrading telecommunications equipment throughout the County, and to encourage improvement and modernization of telecommunications infrastructure.

B. Access to modern telecommunications infrastructure is vital for communication, education and economic development.

C. It is the desire of the County to foster a fair and level playing field for all market competitors that does not disadvantage or advantage one service provider or technology over another.

D. The County seeks to promote widespread access to the most technologically advanced telecommunications services for all County residents and businesses in a nondiscriminatory manner regardless of socioeconomic status.

E. It is the responsibility of the County to protect and control access to public rights-of-way.

F. The County has a duty to ensure that all service providers utilizing County property, facilities or rights-of-way comply with all applicable state and local health, safety and other laws.

G. It is consistent with the County's goals and values to encourage investment in telecommunications infrastructure to help close the digital divide. 0590

H. It is necessary to update County policies and practices to recognize the authority of the California Public Utilities Commission as established in state and federal statutes.

I. It is the desire of the County to assess fees sufficient to recover the actual costs of providing services but not to discourage improvement of necessary infrastructure.

12.25.015 Definitions.
A. For the purposes of this Chapter, the following definitions apply:
1. "Telecommunications" refers to data, voice, video or other information provided by wire, fiber optic cable or other technology.

2. "Facilities" and "Infrastructure" refers to wires, cables, conduit, switches, transmission equipment or other equipment for use in transmitting or processing telecommunications services or for providing support or connection to such equipment.

3. "Rights-of-way" refers to the area upon or adjacent to any County-owned road, highway or rail line or along or across any of the waters or lands owned or controlled by the County.

4. "Service providers" refers to any person, company, corporation or other entity providing data, voice, cable, video or other information services by wire, fiber optic cable or other technology.

5. "Excavation" refers to any process which removes material from the ground through digging, drilling, boring or other activity for the purpose of installing utilities, infrastructure or other structures or equipment.

6. "Conduit" refers to a tube, duct or other device or structure designed for enclosing telecommunication wires or cables.

7. "Reconstruction" refers to any project which repairs or replaces fifty percent or more of an existing road, highway or rail line.

12.25.020 Telecommunications Infrastructure Improvement
In recognition of the need to provide local residents and businesses within the community with the infrastructure required to meet their telecommunications needs, all construction, reconstruction or repaving of a County right-of-way will include provisions for the installation of telecommunications cable, conduit and other related equipment wherever practical and feasible. Where appropriate, telecommunications infrastructure shall be installed in or adjacent to County rights-of-way in conformance with current County standards. County staff will work with contractors to identify most cost-effective approach consistent with County requirements. If a project includes excavation in or adjacent to a County right-of-way, installation of or upgrades to telecommunications cable, conduit or other infrastructure will be included as needed. All installations shall conform to the size, shape, location and other specifications as determined by the Director of Public Works.

12.25.025 Implementation.
No less than 60 days before this ordinance takes effect, the County of Santa Cruz shall e-05(mail, fax, mail or deliver a copy of it to all telecommunications service providers and other affected entities doing business within the unincorporated County of Santa Cruz.

12.25.030 Exemptions.
A. The Director of Public Works, or the director's designee, may exempt projects from the requirements of this chapter where compliance is found to be not practical or feasible. Requests for an exemption shall be in writing, and the Director's or the director's designee's decision shall be final.
B. An exemption application shall include all information necessary for the Director of Public Works or the director's designee to make a decision, including but not limited to documentation showing factual support for the requested exemption.
C. The Director of Public Works or director's designee may approve the exemption application in whole or in part, with or without conditions.

12.25.035 Enforcement.
Enforcement of this ordinance shall be as follows:
A. The Director of Public Works, or designee, shall have primary responsibility for enforcement of this ordinance and shall have authority to issue citations for violation of this chapter. The Director, or designee, is authorized to establish regulations or administrative procedures to ensure compliance with this chapter.

B. A person or entity violating or failing to comply with any of the requirements of this chapter shall be guilty of an infraction.

C. The County of Santa Cruz may seek legal, injunctive, or any other relief to enforce the provisions of this chapter and any regulation or administrative procedure authorized by it.

D. The remedies and penalties provided in this chapter are cumulative and not exclusive of one another.

E. The Director of Public Works or designee may inspect the premises of any construction, reconstruction, repaving or excavation project to verify compliance with this ordinance.

12.25.040 Violations.
Violations of this ordinance shall be enforced as follows:
Violation of this chapter is hereby declared to be a public nuisance. Any violation described in the preceding paragraph shall be subject to abatement by the County of Santa Cruz, as well as any other remedies that may be permitted by law for public nuisances, and may be enforced by injunction, upon a showing of violation.

12.25.045 Severability.
If any word, phrase, sentence, part, section, subsection, or other portion of this chapter, or any application thereof to any person or circumstance is declared void, unconstitutional, or invalid for any reason, then such word, phrase, sentence, part, section, subsection, or other portion, or the proscribed application thereof, shall be severable, and the remaining provisions of this chapter, and all applications thereof, not having been declared void, unconstitutional or invalid, shall remain in full force and effect. The County of Santa

Cruz hereby declares that it would have passed this title, and each section, subsection, sentence, clause, and phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses, or phrases had been declared invalid or unconstitutional. 0592

12.25.050 Effective Date.
This ordinance shall become effective three (3) months after the date of final passage by the County of Santa Cruz Board of Supervisors.

12.25.055 No Conflict with Federal or State Law.
Nothing in this ordinance shall be interpreted or applied so as to create any requirement, power, or duty in conflict with any Federal or State law.

12.25.060 Preemption.
The provisions of this chapter shall be null and void if State or Federal legislation, or administrative regulation, takes effect with the same or substantially similar provisions as contained in this chapter. The Board of Supervisors shall determine whether or not identical or substantially similar statewide legislation has been enacted or regulations issued.

SECTION II

This ordinance shall take effect and be in force six months from the date of adoption.

PASSED AND ADOPTED this _____ of _____ _____ 20___, by the Board of Supervisors of the County of Santa Cruz by the following vote:

AYES: SUPERVISORS
NOES: SUPERVISORS
ABSENT: SUPERVISORS
ABSTAIN: SUPERVISORS

_____
Chairperson of the Board of Supervisors

Attest: _____
Clerk of the Board

APPROVED AS TO FORM:

_____
Office of County Counsel

Telecommunications Ordinance.doc

5. Sample Joint Trenching Agreement

EXHIBIT D

JOINT TRENCH AGREEMENT

THIS JOINT BUILD AGREEMENT ("Agreement"), effective the ___ day of _____, 200__, is made by and between _____, a _____ corporation with an office at _____ ("Lead Company"), and _____ _____, a _____ corporation with an office at _____ _____ ("Participant").

WHEREAS, each party intends to install, construct, own and operate underground conduit facilities ("Facilities") in connection with each party's respective operations; and

WHEREAS, to minimize the costs of constructing separate trenches and Facilities, the parties are willing to jointly construct such trenches and Facilities and to share the costs of such construction in accordance with the terms and conditions set forth herein;

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions and obligations contained herein, and intending to be legally bound hereby, the parties hereby agree as follows:

1. **Certain Definitions**. For purposes of this Agreement, the following terms are defined as follows. This is not intended as an exhaustive list of all defined terms used in this Agreement.

(i) "Acceptance Testing" shall have the meaning attributed to it in Section 4(F).

(ii) "Access Point" shall mean an opening, individually owned by a particular party, in the Joint Build by which the party may enter for the purpose of installing and maintaining Facilities (i.e. manhole or handhole).

(iii) "Affiliate" shall mean any Person controlling, controlled by, or under common control with another Person.

(iv) "Authorizations" shall have the meaning attributed to it in Section 3.

(v) "Completion Notice" shall have the meaning attributed to it in Section 4(F).

(vi) "Conduit" shall mean a structure containing one or more Innerducts.

(vii) "Innerduct" shall mean a single enclosed raceway acceptable for communications cables.

(viii) "Drawings" shall have the meaning attributed to it in Section 4(A).

(ix) "Facilities" shall mean Innerducts, Conduits, Access Points and associated equipment, devices and hardware that are supplied by, or installed or designed for, a particular party.

(x) "Governmental Authority" shall mean any federal, state or local government, or any agency or instrumentality thereof, having competent jurisdiction over the Facilities, the Joint Build or the parties hereto.

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(xi) "Joint Build" shall mean a trench and any combination of poles, Ducts, Conduits, Access Points, manholes, vaults and other Facilities to be constructed hereunder pursuant to the Scope of Work.

(xii) "Lead Company" shall mean the party who is responsible for managing the Work for the Joint Build.

(xiii) "Participant" shall mean a party other than Lead Company who is responsible for paying its portion of the Project Costs in consideration for its participation in the Joint Build and ownership rights in a certain defined portion of said Joint Build.

(xiv) "Person" shall mean an individual, association, partnership, corporation, or other legally recognized entity.

(xv) "Project Costs" shall mean all labor, transportation, supervision, materials and other direct costs associated with the Work relating to the Joint Build, other than the costs which will be borne entirely by one party pursuant to this Agreement or the Scope of Work.

(xvi) "Scope of Work" means the written description of the Work and the respective responsibilities of Lead Company and Participant. The Scope of Work as specified on Exhibit A is incorporated herein and becomes, upon execution by the parties hereto, a part of this Agreement.

(xvii) "Specifications" shall have the meaning attributed to it in Section 4(F).

(xviii) "Work" shall mean all necessary installation, management, engineering, placement, make-ready and preparatory work required for the construction of the Joint Build.

2. Order of Precedence of Contract Documents. In the event of a conflict or inconsistency between this Agreement and the terms set forth in the Scope of Work, the terms of the Scope of Work shall prevail.

3. Governmental Authorities. Each party agrees to comply with all applicable laws, rules, and regulations relating to the installation, maintenance and use of its Facilities. Each party will file the necessary applications and take all further action required in order to obtain, prior to the commencement of construction under the Scope of Work, all rights, easements, licenses, permits, approvals, agreements and other authorizations required by any Governmental Authority and any other third party agreements necessary to complete the Work contemplated by this Agreement and to occupy and use the right-of-way occupied by the Facilities constructed hereunder (collectively "Authorizations"). Each party shall provide written evidence of such Authorizations to the other party upon request.

4. Prosecution of Work.

(A) Approval of Drawings and Costs; Execution of Scope of Work. Prior to the commencement of Work on the Joint Build, Lead Company shall provide Participant with a copy of the engineering drawings it intends to use when it commences the Work ("Drawings") and the cost breakdown of Participant's share of the Project Costs. Participant shall have twenty (20) business days after receipt of the Drawings and the cost breakdown to either accept or reject the Drawings or the cost breakdown by delivery of a written notice (reasonably detailed, in the case of a rejection) to Lead Company. In the event Participant rejects the Drawings or the cost breakdown, Lead Company shall

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promptly resolve any objection or deficiency to the reasonable satisfaction of Participant. If the parties cannot reach an agreement on the Drawings or the cost breakdown, Participant may terminate this Agreement as provided in Section 14, whereupon Participant shall reimburse Lead Company for the reasonable costs it incurred that arose out of Participant's agreement to participate in the Joint Build. If Participant fails to reject the Drawings or the cost breakdown within such twenty (20) day period, the Drawings and the cost breakdown shall be deemed acceptable by Participant and Lead Company shall proceed with the Work. Within thirty (30) days after Participant's acceptance of the Drawings and the cost breakdown, Lead Company shall prepare the Scope of Work, which Lead Company and Participant shall execute within ten (10) days thereafter.

(B) Management of the Work. Upon acceptance of the Drawings, Lead Company shall be responsible for all Work thereunder, including the hiring and management of any contractor and subcontractors and the acquisition of all required construction permits. Lead Company shall provide Participant with a copy of all construction permits it obtains. Lead Company shall perform such Work in a good and workmanlike manner and in accordance with the specifications of this Agreement, the Scope of Work, the Occupational Safety and Health Act, the National Electrical Safety Code, the National Electrical Code, applicable industry standards, and laws and regulations of applicable Governmental Authorities. Lead Company and Participant shall timely pay each invoice it receives from Lead Company's contractor, subcontractors and material suppliers who supplied the labor and/or materials for the Work. Furthermore, Participant shall reimburse Lead Company for all costs of removing any liens placed on the Joint Build (including reasonable attorneys' fees and costs) which arise from non-payment or late payment to subcontractors or suppliers due to failure of Participant to make timely payments hereunder. Lead Company shall be solely responsible for removing any liens which arise from its failure to make timely payments in any other instance. Upon the commencement of the Work, Lead Company shall designate an authorized representative in connection with the Work, and shall prepare and provide to Participant a construction schedule and progress report from time-to-time, but not less than once every thirty (30) days. Participant shall have the right, but not the obligation, to inspect the Work from time-to-time prior to its completion, subject to the restrictions and consent of any Governmental Authority or other third party which owns or controls the real property rights-of-way upon which the relevant portion of the Joint Build is constructed.

(C) Project Costs. The Project Costs will be shared by the parties in the manner set forth in the Scope of Work.

(D) Management Fee. Participant shall pay to Lead Company a fee in the amount of __% of Participant's share of Project Costs to cover Lead Company's costs for managing and supervising the Work for the Joint Build in accordance with the terms of the Scope of Work.

(E) Materials. Except as otherwise set forth in the Scope of Work (Exhibit A), each party shall arrange for the purchase and delivery of its materials required for the construction of the Joint Build as set forth in the Scope of Work. All materials supplied shall comply with the agreed upon specifications.

(F) Acceptance Testing. The Joint Build shall meet the technical specifications ("Specifications") set forth in Exhibit A, the Scope of Work. Upon completion of the Joint Build, Lead Company shall perform testing on the Joint Build to determine whether it complies with these Specifications ("Acceptance Testing"). Lead Company shall provide Participant with five (5) days prior written notice of the date and time of the Acceptance Testing and Participant shall have the right, but not the obligation, to be present for observation of the Acceptance Testing. When Lead Company reasonably determines that the Joint Build is installed and operating substantially in conformity with the

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Specifications set forth in the Scope of Work, Lead Company shall provide written notice of the same to Participant ("Completion Notice"). Upon receipt of a Completion Notice, Participant may inspect the Work performed by Lead Company and shall have thirty (30) days to either accept or reject the Completion Notice by delivery of written notice to Lead Company, specifying, if rejected, its grounds for such rejection. In the event Participant rejects the Completion Notice, Lead Company shall correct any such deficiencies on the Joint Trench Build as soon as practicable and a retest shall be performed. Upon completion of such retest, Lead Company shall provide another Completion Notice to Participant. The foregoing procedure shall apply again and successively thereafter until Lead Company has remedied all deficiencies in the Work. If Participant fails to reject a Completion Notice within the thirty (30) day period, the Work shall be deemed accepted by Participant, and Lead Company shall have no further liability related to Acceptance Testing of such Joint Build.

(G) Location of Joint Build. The specific location of the Joint Build shall be as designated in the Scope of Work (Exhibit A). Lead Company shall provide Participant with "as-builts" in a mutually acceptable electronic format that depict the construction and location of the Joint Build, within ninety (90) days after acceptance of the Completion Notice.

(H) Changes. In the event that a party seeks changes in, additions to, or deletions from the Work and/or the Scope of Work, the party seeking changes, additions or deletions shall promptly notify the other party in writing of (i) the proposed changes, additions or deletions; (ii) the estimated cost of the proposed changes, additions or deletions; (iii) the effect of the proposed changes, additions or deletions upon the scheduled completion of the Work; (iv) whether additional Authorizations are required as a result of the proposed changes, additions or deletions; and (v) the effect of the proposed changes, additions or deletions upon the other party's share of Project Costs. If both parties agree to the proposed changes, additions or deletions, the Lead Company shall promptly proceed with the performance of the Work as so modified. The Project Costs and time for performance of the Work shall be equitably adjusted as necessary to reflect the impact of the agreed upon changes, additions or deletions on the Work and/or the Scope of Work.

5. Ownership. All Facilities installed and designated for Participant as set forth in the Scope of Work shall be and remain the property of the Lead Company; provided that upon the payment by Participant of its share of the Project Costs, said Facilities shall become the property of Participant. After acceptance of the Completion Notice, each party shall take all necessary precautions to protect the other party's Facilities from any physical damage and to keep such Facilities in the same manner as such party protects its own Facilities.

6. Maintenance and Restoration.

(A) General. After completion and acceptance of the Joint Build, each party shall be responsible for performing (at its own cost) all maintenance and repairs of its Facilities. Such maintenance and repairs shall be performed in a good and workmanlike manner, in accordance with the specifications of this Agreement, the Scope of Work, the National Electrical Safety Code, the National Electrical Code, applicable industry standards, and regulations of applicable Governmental Authorities.

(B) Access. Subject to any limitations contained in the Scope of Work, each party shall have access to its Facilities on a 24-hours per day, 7-days per week basis as necessary for the proper maintenance and/or restoration thereof; provided, however, such access shall be coordinated with the other party. Before beginning any non-emergency, inspections or scheduled maintenance, each party shall give the other at least twenty-four (24) hours advance notice. Notwithstanding the foregoing, following acceptance, each party shall have unlimited access to its individually owned Access Points as

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designated in the Scope of Work, without the requirement of prior notice to the other party. If both parties require simultaneous access to the Joint Build, then the parties shall reasonably and equitably coordinate such access.

(C) Emergency Maintenance. Subject to any limitations contained in the Scope of Work, in the event of an emergency, each party shall have the right to perform maintenance and/or restoration of its Facilities and such party shall use its best efforts to notify the other party as soon as practicable of such efforts. If both parties require simultaneous access to the Joint Build, then the parties shall reasonably and equitably coordinate such access in a manner that will accommodate the needs of both parties.

(D) Damages. Each party shall indemnify and hold harmless the other party for any losses, costs or damages to such other party's property (including, without limitation, its Facilities) arising from the indemnifying party's negligence or intentional misconduct in its maintenance or restoration efforts.

7. Relocation. In the event that a Governmental Authority requires the transfer, rearrangement or relocation of any portion of the Joint Build, the parties shall each pay their pro rata share (proportionate to their percentage of ownership of the Joint Build or portion thereof to be relocated) for all reasonable costs of the transfer, rearrangement or relocation. The parties shall use their best efforts to identify an alternate location for the Joint Build. In the event the parties are unable to agree on a suitable alternate location for the Joint Build, then either party may terminate this Agreement with respect to such Joint Build (or portion thereof) and shall promptly remove its Facilities located therein.

8. Representations and Warranties. Each party represents and warrants that it has full right and authority, including any requisite corporate authority, to perform its respective obligations under this Agreement; the execution of this Agreement is not violative of its charter, by-laws or any law, regulation or agreement by which it is bound or to which it is subject; no litigation or governmental proceeding (other than the Authorizations required by any Governmental Authority to occupy and use the locations and rights-of-way for the Facilities constructed herein) is pending or threatened in writing which might have a material adverse effect on this Agreement, the transaction contemplated by this Agreement or the rights of the parties hereunder. Each party further warrants that it shall carry out its obligations hereunder in a professional and workmanlike manner. Except for the foregoing and except as otherwise provided in the Agreement, neither party makes any warranty to the other, and each party expressly disclaims all further warranties, including without limitation, the implied warranties or merchantability or fitness for purpose.

9. Taxes. Each party shall pay its pro rata share of any present or future taxes, fees, charges or assessments which Lead Company is required or obligated to pay by reason of the construction or ownership of the Joint Build or the installation, operation or maintenance of the Facilities. After acceptance, each party shall be responsible for any taxes imposed by a Governmental Authority relating to such party's respective Facilities.

10. Term. This Agreement shall become effective as of the date written above and, if not earlier terminated in accordance with the provisions hereof, shall remain in effect until acceptance of the Completion Notice by Participant.

11. Billing and Payment. All undisputed amounts due Lead Company or its contractor under this Agreement shall be paid by Participant within forty-five (45) days following receipt of invoices

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along with a detailed accounting of such amounts. If any undisputed amount is not paid to within such period, Participant shall be required to pay a late charge of one and one-half percent (1½%) per month times the amount unpaid or, if that late charge is unlawful, the maximum rate permitted by law. Participant must identify and explain in detail its dispute with any invoice item within forty-five (45) days of the receipt of such invoice. The parties shall proceed in an amicable manner to resolve such dispute for at least thirty (30) days, after which either party shall have the right to seek redress of such dispute by other legally available means. In no event shall either party be entitled to bill the other party more frequently than once each month for any amounts due under this Agreement. The foregoing payment provisions apply to any amounts Lead Company owes Participant pursuant to applicable provisions of this Agreement. With the final payment of its share of the Project Costs, Participant shall receive final lien waivers from all contractors and suppliers performing work and/or providing materials to the Joint Build. If the lien law applicable to the Joint Build or portion thereof provides for delivery of lien releases following payment, then Lead Company shall deliver same to Participant within two (2) business days after the time period for delivery required by such law.

(A) Payment Default. Undisputed amounts owed to Lead Company or Lead Company's contractor not paid within forty-five (45) days of receipt of an invoice may be deemed in default ("Payment Default") by Lead Company at its sole discretion, upon written notice to Participant. Any such Payment Default may, at Lead Company's sole discretion, be grounds for termination of this Agreement by Lead Company. In case of such termination, Lead Company shall automatically assume ownership of all Joint Build property and materials, including, without limitation, any Facilities supplied by Participant, and Participant shall have no right of reimbursement, refund or compensation for such assumption whatsoever. Such right of assumption is in addition to, and in no way limits, Lead Company's other available rights at law or in equity, arising from or related to the Payment Default by Participant.

(B) Costs. In the event of a Payment Default, and in addition to its rights set forth above, Lead Company and Lead Company's contractor shall be entitled to recover from Participant its reasonable costs of collection, including reasonable attorneys' fees and court costs.

12. Indemnification. Except to the extent such claims are caused by the negligence of a party indemnified hereunder, each party ("Indemnitor") shall defend, indemnify and hold harmless the other party ("Indemnitee") from and against and shall pay all losses, damages, liabilities, penalties, fines, assessments, claims and actions, and all related expenses (including reasonable attorneys' fees and expenses and the costs of litigation) by reason of injury or death to any person, damage to any property or any other occurrence arising out of, resulting from or in any manner caused by or related to: (i) the negligence or intentional misconduct of the Indemnitor in the installation, maintenance, operation, presence, use or removal of any Facilities; (ii) infringement of copyright, libel, slander, or unauthorized use of information arising out of, resulting from or in any manner caused by the operation or use of Indemnitor's Facilities; (iii) Indemnitor's failure to secure necessary Authorizations from any applicable Governmental Authority and any necessary rights-of-way from owners of property; or (iv) infringement of patents with respect to the manufacture, use and operation of Indemnitor's Facilities. Any party seeking indemnification hereunder ("Indemnitee") shall promptly notify the other party ("Indemnitor") of the nature and amount of such claim and the Indemnitee shall consult with the Indemnitor respecting the defense and satisfaction of such claim, including the selection of and direction to legal counsel, and the Indemnitee shall not pay or settle any such claim without the prior written consent of the Indemnitor, which consent shall not be unreasonably withheld. To the extent such limitation is legally enforceable, in no event shall either party be liable for any punitive, consequential, incidental, special damages or lost profits incurred or alleged to have been incurred by anyone.

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13. Insurance. During the term of this Agreement, each party shall obtain and maintain, and shall require any of its permitted subcontractors to obtain and maintain, the following insurance, naming the other party as an additional insured: (i) Commercial General Liability insurance with minimum limits of: $2,000,000 general aggregate limit; $1,000,000 each occurrence sub-limit for all bodily injury or property damage incurred in any one occurrence; $1,000,000 each occurrence sub-limit for personal injury and advertising; $2,000,000 products/completed operations aggregate limit, with a $1,000,000 each occurrence sub-limit for products/completed operations; (ii) worker's compensation insurance in amounts required by applicable law and employer's liability insurance with minimum limits of $100,000 for bodily injury-each accident, $500,000 for bodily injury by disease-policy limits and $100,000 for bodily injury by disease-each employee; (iii) and automobile liability insurance covering death or injury to any person or persons, or damage to property arising from the operation of vehicles or equipment, with limits of not less than $1,000,000 combined single limits per occurrence, which coverage shall extend to all owned, hired and non-owned vehicles.

(A) Self-insurance. Both parties expressly acknowledge that a party shall be deemed to be in compliance with the provisions of this Section if it maintains an approved self-insurance program providing for a retention of up to $ [insert dollar amount].

(B) Certificates. Unless otherwise agreed, all insurance policies shall be obtained and maintained with companies rated B+-VII or better by Best's Key Rating Guide and each party shall, upon request, provide the other party with an insurance certificate confirming compliance with the requirements of this Section 13. Such certificates shall provide for thirty (30) days' advance written notice to the other party for any cancellation, material change, reduction of coverage or non-renewal.

(C) Liability. The obtaining and maintaining of insurance coverage in accordance with this Section 13 shall not be construed as in any way limiting or eliminating a negligent (or intentionally wrongful) party's liability to indemnify the other party in accordance with the applicable provisions of this Agreement for losses suffered by such other party.

14. Termination. In the event a party fails to observe or perform any of the material terms and provisions of this Agreement and such failure continues for a period of thirty (30) days after written notice from the other party (or such longer period as may be necessary if such failure cannot reasonably be cured within such 30 day period, provided that such party promptly and diligently undertakes efforts to bring about such cure and thereafter proceeds, in good faith, to cure such failure; which in no event shall exceed sixty (60) days) ("Default"), the non-defaulting party may, in addition to any and all other remedies allowed by law, terminate this Agreement in its entirety. Upon termination of this Agreement for Default, Lead Company shall continue to complete the Work to a reasonable stopping point, and each party shall pay for its pro rata share of the Project Costs and management fees through the completion of such Work. The right of termination described in this provision is in addition to, and does not in any way limit or eliminate, the right of termination for a Payment Default as provided in Section 11 above.

15. Condemnation. Upon receipt of a formal notice of condemnation or other taking by eminent domain, each party shall notify the other party immediately of any such proceeding that is threatened or filed against any portion of the Joint Build. In the event and to the extent of any condemnation or other taking by eminent domain of all or any part of the Joint Build, or any property or rights relating thereto, then the proceeds thereof shall be apportioned on a pro rata basis as set forth in the Scope of Work.

EXHIBIT D

16. Waiver of Compliance. Failure of either party to enforce or insist upon compliance with any of the terms or conditions of this Agreement shall not constitute a waiver or relinquishment of any such terms or conditions. To the contrary, the same shall remain at all times in full force and effect.

17. Limitations. Except as set forth in this Agreement, nothing shall in any way restrict, modify, or alter either party's absolute right to lease, sell, dispose of or utilize, in its sole discretion, its Facilities which are subject to this Agreement. The party leasing, selling or disposing of its Facilities shall either (i) include the maintenance and restoration language in paragraph 6 of this Agreement in any agreement to lease, sell or dispose of the Facilities or (ii) make such lease, sale or disposal specifically subject to such provisions.

18. Assignment. Neither Party may assign or otherwise transfer this Agreement or its duties and obligations contained in this Agreement without the prior written consent of the other, which consent shall not be unreasonably withheld or delayed; provided, however, neither party shall be required to obtain the consent of the other for any corporate reorganization, assignment or transfer of this Agreement or the rights herein granted to any Affiliate, any purchaser of all or substantially all of the assets of such party, or any person with which or into which such party may merge or consolidate. This Agreement shall be binding upon and inure to the benefit of the parties hereto and their respective permitted successors and assigns.

19. Sublease. Nothing shall in any way restrict, modify, or alter either party's right to lease, sublease, license, sell, dispose of or utilize, in its sole discretion, its Facilities which are subject to this Agreement. All sublessees and licensees shall use the Facilities in a manner consistent with this Agreement and the agreement between such party and the proposed subtenant or licensee (which agreement is hereinafter referred to as the "Lease", the said subtenant or licensee being hereinafter referred to as "Lessee") shall in all respects be subject to the terms and conditions of this Agreement. For purposes of this Agreement, all acts and omissions of the Lessee shall be deemed acts and omissions of the party who owns or controls such Facilities. Notwithstanding the foregoing, the rights of the parties to grant Leases shall be subject to the restrictions, contractual or otherwise, imposed by any Governmental Authority or other third party which owns or controls the real property rights of way upon which the relevant portion of the Joint Build is constructed.

20. Notices. All notices shall be in writing and shall be delivered by certified mail return receipt requested or any other generally accepted delivery system that is capable of providing proof of delivery. Any such notice shall be deemed effective on the date of receipt. All notices shall be addressed to the parties as specified below:

If to _____: Address & Contact

If to _____: Address & Contact

A party may change the above addresses to which notices are sent by giving written notice of such change to the other party in accordance with the provisions of this Section 20.

21. Severability. In the event that any term or provision of this Agreement is declared to be illegal, invalid or unconstitutional, then that provision shall be deemed to be deleted from this Agreement and have no force or effect and this Agreement shall thereafter continue in full force and effect, as modified.

EXHIBIT D

22. Confidentiality. Both parties hereby agree that if either party provides confidential or proprietary information to the other party ("Proprietary Information"), such Proprietary Information shall be held in confidence, and the receiving party shall afford such Proprietary Information the same care and protection as it affords generally to its own confidential and proprietary information (which in any case shall be not less than reasonable care) in order to avoid disclosure to or unauthorized use by any third party. The parties acknowledge and agree that all information disclosed by either party to the other in writing in connection with or pursuant to this Agreement shall be deemed to be Proprietary Information.

(A) All Proprietary Information, unless otherwise specified in writing, shall remain the property of the disclosing party, shall be used by the receiving party only for the intended purpose, and such written Proprietary Information, including all copies thereof, shall be returned to the disclosing party or destroyed after the receiving party's need for it has expired or upon the request of the disclosing party. Proprietary Information shall not be reproduced except to the extent necessary to accomplish the purpose and intent of this Agreement, or as otherwise permitted in writing by the disclosing party.

(B) This provision shall not apply to any Proprietary Information which (i) becomes publicly available other than through the disclosing party; (ii) is required to be disclosed by a governmental or judicial law, order, rule or regulation; (iii) is independently developed by the receiving party; or (iv) becomes available to the receiving party without restriction from a third party.

(C) Either party may disclose Proprietary Information to its employees, agents, lenders, funding partners and legal and financial advisors and providers to the extent necessary or appropriate in connection with the negotiation or performance of this Agreement or in obtaining financing, provided that each such party is notified of the confidential and proprietary nature of such Proprietary Information and is subject to or agrees to be bound by similar restrictions on its use and disclosure.

(D) Neither party shall issue any public announcement or press release relating to the execution of this Agreement without the prior approval of the other party.

(E) In the event either party shall be required to disclose all or any part of this Agreement in, or attach all or any part of this Agreement to, any regulatory filing or statement, each party agrees to discuss and work cooperatively, in good faith, with the other party, to protect, to the extent possible, those items or matters that the other party deems confidential and that may, in accordance with applicable laws, be deleted therefrom. The confidentiality provisions of this Article shall survive expiration or termination of this Agreement.

23. Joint Work Product. This Agreement is the joint work product of the parties hereto; accordingly, in the event of ambiguity no presumption shall be imposed against any party by reason of document preparation.

24. Force Majeure. Neither party shall be liable to the other for any failure of performance under this Agreement due to causes beyond its control (except for the fulfillment of payment obligations as set forth herein), including, but not limited to: acts of God; fire, flood or other catastrophes; adverse weather conditions; material or facility shortages or unavailability not resulting from such party's failure to timely place orders therefor; lack of transportation; the imposition of any governmental codes, ordinances, laws, rules, regulations or restrictions; national emergencies; insurrections; riots, wars; or strikes, lock-outs, work stoppages or other labor difficulties; provided however, that the party unable to perform its obligations shall promptly notify the other party in writing of such delay and said time period shall be extended for only the actual amount of time said party is so delayed. An act or omission shall

EXHIBIT D

not be deemed to be "beyond its control" if committed, omitted or caused by such party, or its employees, officers, agents or affiliates, or by any corporation or other business entity that holds a controlling interest in said party, whether held directly or indirectly.

25. Public Relations. This Agreement shall not be construed as granting to either party the right to use any trademarks, service marks or trade names of the other party, or otherwise refer to the other party in any marketing, promotional or advertising materials or activities. Without limiting the generality of the foregoing, neither party shall disclose (i) the terms of this Agreement, (ii) the existence of a particular Joint Build or any contractual relationship between the parties, or (iii) issue any publication or press release relating directly or indirectly to (i) or (ii) above without the other party's prior written consent.

26. Dispute Resolution.

(A) Any controversy or claim, whether based on contract, tort or other legal theory (including, but not limited to, any claim of fraud or misrepresentation) ("Claims"), arising out of or related to this Agreement, or any Scope of Work, or its breach shall be resolved in accordance with the dispute resolution procedure contained in this Section 26 and the then current rules of the American Arbitration Association, unless the parties agree in writing otherwise.

(B) The disputing party shall give written notice to the other party of any and all Claims as soon as possible after the event giving rise to such Claim. Pending the final resolution of any Claim, Lead Company shall continue to proceed with the performance of the contract in accordance with its terms pending resolution of the dispute. In such event, Participant shall continue to pay Lead Company in accordance with this Agreement for undisputed amounts.

(C) Either party may submit the matter to mediation with a professional mediation service selected by mutual agreement of the parties. Good faith mediation is a condition precedent to arbitration. Persons with authority to resolve the dispute shall be present at the mediation. Unless the parties agree otherwise, the mediation shall take place in the city in which the Facilities involved in the Claim are located. Such mediation shall be conducted in accordance with the Voluntary Construction Mediation Rules of the American Arbitration Association, unless the parties agree in writing otherwise.

(D) If the parties do not resolve the dispute through mediation or if 90 days have passed since the parties submitted the dispute to mediation and the parties are not in active negotiations, either party may submit the dispute to arbitration. If the parties cannot agree on an arbitration service, such service shall be provided pursuant to the American Arbitration Association Construction Industry Arbitration Rules. The award may be confirmed and enforced in any court of competent jurisdiction. Unless the parties agree otherwise, the arbitration shall occur in _____, California.

(E) The parties shall each bear the expenses of their share of the dispute resolution process. The costs of mediation and arbitration, including the fees and expenses of the mediator and arbitrator, shall be paid equally by the parties. Each party shall bear the cost of preparing and presenting its case, including its own attorney fees, expert witness fees, and travel-related expenses.

(F) The parties agree that neither an arbitrator nor a judge shall have the power or authority to make any award that provides for punitive, exemplary or other types of damages that are waived or prohibited by this Agreement. The parties expressly waive all punitive damages and other damages waived in this Agreement.

EXHIBIT D

27. Governing Law. This Agreement shall be governed by and construed in accordance with the laws of the State of California, exclusive of its choice of law provisions.

28. Survival. Any and all provisions of this Agreement which, by their nature, would reasonably be expected to be complied with or performed after the expiration or termination of this Agreement, including, without limitation, the maintenance obligations set forth in Section 6 hereof, shall survive and be enforceable after the expiration or termination of this Agreement.

29. Entire Agreement. This Agreement and the Scope of Work contains the entire agreement between the parties and supersedes all prior oral or written agreements with respect to the subject matter hereof. This Agreement may not be amended or modified except by a written instrument executed by the parties hereto.

30. No Partnership. The parties acknowledge and agree that this Agreement does not create a partnership between, or a joint venture of, the parties.

31. Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original and all of which together shall constitute one agreement.

IN WITNESS WHEREOF, the parties hereto have caused their duly authorized officers to execute this Agreement as of the date set forth above.

Company Name:

By:_____
_____
(Print Name)
Title: _____
Date Signed: _____

Company Name:

By:_____
_____
(Print Name)
Title: _____
Date Signed: _____

EXHIBIT D

SCOPE OF WORK

_____(Project Name)_____

This Scope of Work is entered into this _____ day of _____, 20__, by and between _____, a _____ corporation ("_____") and _____, a _____corporation ("_____") as an addendum to the Joint Build Agreement dated _____, 20__. Upon execution by the parties hereto, this Scope of Work shall be attached to and become a part of the Joint Build Agreement. In the event of a conflict or inconsistency between this Scope of Work and the terms set forth in the Joint Build Agreement, the terms of this Scope of Work shall in all cases prevail. All capitalized terms not otherwise defined in this Scope of Work shall have the meaning set forth in the Joint Build Agreement.

1. Project Description:

1.1 _____shall be Lead Company and _____ shall be Participant (hereinafter collectively "the Parties").

1.2 The "Project" consists of engineering and construction of a Joint Build of approximately _____ linear feet, in the proposed route and (if applicable) consisting of the various components thereof (such components being referred to herein as "Segments"), all as described in Exhibit A hereto ("Route Description & Route Map"). Unless otherwise agreed between the Parties, all underground Segments of the Project shall be constructed in accordance with the trench detail set forth in the engineering/construction drawings that (a) already have been completed and referenced in Exhibit A hereto and copies of which have been provided to each Party and each Party acknowledges receipt thereof, or (b) when completed and agreed to by the Parties, shall be provided to each Party. Lead Company's and Participant's manholes/handholes will be placed along all underground Segments of the Project in locations to be agreed upon between the Parties, which locations shall be noted in the agreed upon engineering/construction drawings. Manholes/handholes will be placed for each party as needed. Placement of fiber optic cable is not included in this Scope of Work and each party is individually responsible for the placement of fiber optic cables. Prior to installation, Lead Company and Participant will agree to material specifications.

1.3 In the event that any investigation, site monitoring, containment, cleanup, removal, restoration or other remedial work of any kind or nature is reasonably necessary or desirable under any applicable local, State or governmental or non-governmental entity or person because of, or in connection with the discovery of historical artifacts within the Project; or the current or future presence, suspected presence, release or suspected release of a hazardous substance in or into the air, soil, groundwater, surface water, soil, at, on, about, under or within the Project (or any portion thereof), the Lead Company shall immediately stop the Work and promptly inform Participant of the findings. Work will not continue until a remedial plan has been agreed to in writing by Lead Company and Participant.

1.4 Each Party acknowledges and agrees that the proposed route as set forth in Exhibit A hereto is subject to a change due to Force Majeure as provided in the Agreement. When any party discovers that such a change is required, such party will immediately notify the

EXHIBIT D

other party. Notwithstanding anything to the contrary contained in the Agreement, to the extent any such change is required to a particular Segment, immediately after becoming aware thereof, the Parties shall negotiate in good faith to reach agreement as to a mutually acceptable change to the affected Segment(s). If no agreement can be reached within thirty (30) days after the commencement of such negotiations, then at any time thereafter, unless and until the parties reach agreement on such change, either Party may terminate its participation in the affected Segment at a reasonable and mutually agreed upon physical point adjacent to such Segment or within such Segment and shall pay to the other non-terminating Party the terminating party's share of all Project Costs incurred as of the date of such termination with respect to the terminated Segment, plus the terminating Party's share of demobilization and restoration costs incurred as a result of such termination.

1.5 Lead Company will provide field engineers to inspect the entire Project while under construction. Participant will be entitled to conduct field inspections where applicable. If Participant chooses to conduct field surveys, Participant must follow all safety regulations set by any Governmental Authority and all safety regulations set by the sub-contracting company on site.

2. Construction Schedule:

2.1 Lead Company will complete construction of the Project with all work required to be performed under this Scope of Work by the dates set forth in Exhibit B ("Construction Schedule"). However, the Construction Schedule shall be suspended and extended to the extent necessary by reason of Force Majeure as provided in the Agreement, or by Paragraph 1.3 as set forth above in this Scope of Work. For purposes of this Paragraph, a "working" day shall be defined as Monday through Friday with the exception of recognized holidays.

2.2 At the start of the Project, Lead Company will notify Participant within 7 days of the project kick-off meeting so that Participant can arrange for an inspector to attend.

2.3 Lead Company shall provide Participant with an overall project schedule identifying critical path items (i.e. engineering, permitting and construction) every two weeks.

2.4 If by reason of Force Majeure as provided in the Agreement or Paragraph 1.3 in this Scope of Work, the date of completion set forth in the Construction Schedule will be delayed, or is reasonably likely to be delayed for more than thirty (30) days after such completion date, the Parties shall immediately after becoming aware thereof negotiate in good faith to reach agreement as to a mutually acceptable course of action to mitigate the impact of such delay on the Project. If no agreement can be reached within thirty (30) days after the commencement of such negotiations, then at any time thereafter, unless and until the parties reach agreement on such course of action, either Party may terminate this Scope of Work at a reasonable and mutually agreed upon point in time and location within the affected Segment(s) and pay to the non-terminating Party the terminating Party's share of all Project Costs incurred as of the date of such termination, plus the terminating Party's share of demobilization and restoration costs incurred as a result of such termination.

3. Project Costs:

EXHIBIT D

3.1 Project costs shall be allocated and paid as set forth in Exhibit D ("Cost Sharing Basis").

3.2 Estimated Project costs for each Party (including material costs) are as set forth in Exhibit E ("Estimated Costs").

3.3 In the event that Participant fails to timely pay any amounts owed to Lead Company or Lead Company's contractor under this Scope of Work, Lead Company shall retain ownership of Participant's Conduit pursuant to Paragraph 5 of the Joint Build Agreement. Once Participant pays the amounts due under to this Scope of Work (plus the amounts due under a settlement agreed to by both parties in writing of disputed amounts, if applicable), Participant shall receive title to Participant's Conduit.

3.4 In the event that Lead Company and Participant agree to allow additional party(ies) to participate in any Segment of the Project, the costs will be allocated among Participant, Lead Company and such other party(ies) in such manner as set forth in Exhibit D.

3.5 If at any time during the construction, circumstances arise that are beyond the control of either of the Parties that result in a cost increase of more than ten percent (10%) of the estimated Project Costs, the Parties shall confer and attempt in good faith to determine by mutual agreement whether to terminate construction or modify the construction plans. If no agreement can be reached, either party may terminate this Scope of Work at a reasonable and mutually agreed upon point. The terminating Party shall pay to the other Party the terminating Party's share of all Project Costs incurred as of the date of such termination, plus the terminating Party's share of demobilization and restoration costs incurred as a result of such termination.

4. Specifications:

4.1 Lead Company's current (as of the date of this Scope of Work) Outside Plant Specifications, a copy of which has previously been provided to Participant, are incorporated herein by this reference and the Work performed hereunder shall be in compliance therewith, except to the extent such Specifications are modified by this Scope of Work as depicted in Exhibit C ("Supplemental Specifications").

5. Points of Contact/Escalation Procedures:

	Lead Company	Participant
First Level	_____	_____
Second Level	_____	_____

IN WITNESS WHEREOF, the parties hereto have executed this Scope of Work on the day and year written above.

_____

EXHIBIT D

By: _____

Title: _____

Date: _____

_____

By: _____

Title: _____

Date: _____

EXHIBIT D

EXHIBIT A

To Scope of Work
_____(Name of Project)_____

ROUTE DESCRIPTION & ROUTE MAP

Route description to include Participant's # and size of ducts, length of route, estimated # of manholes, manhole arrangement in the header.

Describe route with linear feet on each street, which is tied to Construction schedule.

Attach map

EXHIBIT D

EXHIBIT B
Scope of Work
(Name of Project)

CONSTRUCTION SCHEDULE

Segment	Length (Miles)	Begin Construction	End Construction

EXHIBIT D

EXHIBIT C
To Scope of Work
(Name of Project)

SUPPLEMENTAL SPECIFICATIONS

1. Lead Company shall ensure that Contractor will obtain all necessary permits before proceeding with construction.

2. Lead Company shall ensure that all manholes/handholes will be free of debris, adequately sealed, and covers shall be secured as required by their manufacturer.

3. Participant has arranged for delivery of its materials as follows:

_____

_____

_____

4. Lead Company shall provide one (1) floppy disk or CD-ROM of as-builts in the current format utilized by the Lead Company for as-builts.

5. Manhole Specifications/Requirements

6. [IF APPLICABLE:] Lead Company shall ensure that Contractor warrants that all Work to be furnished under this Agreement shall conform in all respects to the requirements of the Agreement or this Scope of Work; are free from any defects in workmanship; and are free of defects causing caving or sinking of the trench or the paving for a period of two (2) years following acceptance of the Work.

_____

EXHIBIT D
To Scope of Work
(Name of Project)

COST SHARING BASIS

This Exhibit sets forth the Cost Sharing Basis between the parties.

TERM	DEFINITION	COMPENSATION
Materials	This line item includes all direct materials required for underground construction. Example materials include conduit, quad duct, duct plugs, manholes, handholes, innerduct, HDPE, and steel pipe (bridge attachments). Bridge attachment material will be prorated since a single hanger may be used for multiple conduits.	Each participant to pay 100% of the cost of all Materials used for its respective conduit system(s).
Indirect Costs	This line item includes all costs incurred by the Lead Company's general contractor that are not Underground Labor and Common Materials as defined below. Examples of Indirect Costs include, but are not limited to, engineering, permitting, generation of as-builts, and inspection services.	Each participant to share equally in these costs based on the number of total participants for the total footage of participation.
Underground Labor & Common Materials	This line item includes all direct labor to install Materials. Examples of labor that are part of this include trenching, boring, bridge attachments, placing conduit, restoration, manholes/handhole placement. Common materials include bore casings, bridge attachment hardware, trench tape, etc.	Each participant to pay percentage based on the Equity Cost Sharing Formula set forth in this Exhibit.
General Contractor's Fee	This line item covers costs for Lead Company's general contractor's General and Administrative expenses and mark-up. This includes, but is not limited to the allocation of the general contractor's corporate overhead and is apportioned to the build as a percentage cost.	Each participant to pay percentage based on the Equity Cost Sharing Formula set forth in this Exhibit.
Lead Company Management Fee	This line item is the Lead Company's management fee. This management fee covers cost of capital, oversight, bonds and insurance required for the Lead Company by jurisdictional authorities, staff to write and administer contracts and management costs. The management fee applies to all costs	The percentage of this fee to be indicated in each Joint Build Agreement and to be paid by each participant company as noted.

EXHIBIT D

	set forth in this Exhibit except for materials provided by the Participant.	

Equity Cost Sharing Formula:
Each participant pays its pro rata share of the cost of Underground Labor and Common Materials based on the number of conduit for that participant and the size of the conduit.

EXHIBIT D

EXHIBIT E
To Scope of Work
(Name of Project)

PROJECT COST ESTIMATE

(TO BE ATTACHED AS EXCEL SPREADSHEET)

EXHIBIT D

JOINT TRENCH AGREEMENT

THIS JOINT BUILD AGREEMENT ("Agreement"), effective the ___ day of _____, 200__, is made by and between _____, a _____ corporation with an office at _____ ("Lead Company"), and _____ _____, a _____ corporation with an office at _____ _____ ("Participant").

WHEREAS, each party intends to install, construct, own and operate underground conduit facilities ("Facilities") in connection with each party's respective operations; and

WHEREAS, to minimize the costs of constructing separate trenches and Facilities, the parties are willing to jointly construct such trenches and Facilities and to share the costs of such construction in accordance with the terms and conditions set forth herein;

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions and obligations contained herein, and intending to be legally bound hereby, the parties hereby agree as follows:

1. **Certain Definitions**. For purposes of this Agreement, the following terms are defined as follows. This is not intended as an exhaustive list of all defined terms used in this Agreement.

(i) "Acceptance Testing" shall have the meaning attributed to it in Section 4(F).

(ii) "Access Point" shall mean an opening, individually owned by a particular party, in the Joint Build by which the party may enter for the purpose of installing and maintaining Facilities (i.e. manhole or handhole).

(iii) "Affiliate" shall mean any Person controlling, controlled by, or under common control with another Person.

(iv) "Authorizations" shall have the meaning attributed to it in Section 3.

(v) "Completion Notice" shall have the meaning attributed to it in Section 4(F).

(vi) "Conduit" shall mean a structure containing one or more Innerducts.

(vii) "Innerduct" shall mean a single enclosed raceway acceptable for communications cables.

(viii) "Drawings" shall have the meaning attributed to it in Section 4(A).

(ix) "Facilities" shall mean Innerducts, Conduits, Access Points and associated equipment, devices and hardware that are supplied by, or installed or designed for, a particular party.

(x) "Governmental Authority" shall mean any federal, state or local government, or any agency or instrumentality thereof, having competent jurisdiction over the Facilities, the Joint Build or the parties hereto.

6. Sample Engineering Outside Plant (OSP) Standards

<INSERT CLIENT NAME> OSP Standards

Communication Conduit for Fiber Optics

A. Scope of Standard

These guidelines identify and define the <INSERT CLIENT NAME> requirements and policies for designing and installing telecommunications infrastructure and substructure at all <INSERT CLIENT NAME> facilities and within the <INSERT CLIENT NAME> limits and rights-of-ways. Use of, and compliance with these guidelines is mandatory for architects, engineers, and installation contractors working on <INSERT CLIENT NAME> projects.

B. Design Guidelines

A. The <INSERT CLIENT NAME> Infrastructure Standard is based upon the code requirements and telecommunications industry standards contained in the following guidelines. These guidelines will not duplicate the information contained in those references, except where necessary to provide guidance, clarification or direction.

B. In instances where several technical alternatives may be available to provide a design solution, these guidelines will identify the preferred solution to meet <INSERT CLIENT NAME> needs. However, each facility and project is unique. Design for new construction will differ from design for retrofit of existing facilities. These guidelines will differentiate certain design approaches and solutions to be applied to new construction versus existing facilities, and different types of <INSERT CLIENT NAME> facilities. However, designers and installers shall always use sound engineering judgment in order to comply with the requirements of the codes and standards identified in this section.

C. Designs will include, but not be limited to, all man-hole, hand-holds, conduits, roads, bridges, railway crossings, railways, buildings, utility poles, traffic light structures, traffic control boxes, other utilities structures, both existing and planned (new) that are pertinent to the construction of the fiber path.

D. As-builts will be provided in paper 8.5" x 14" format with all construction notes and geo-spatially correct measurements (verified by GPS), as well as digitally in AutoCAD 2008 or earlier and projected in the coordinate system <ENTER SPECIFIC COORDINATE SYSTEM INFORMATION>. Scale should be 1ft. x 1 ft. As-builts will include cadastral boundaries to include right of ways and planimetric boundaries that includes edge of pavement. <INSERT

CLIENT NAME> base map can be provided upon request. As-builts shall be provided to designated City representative, incorporating any changes made during or after construction. Final As-builts shall be completed only once all Fiber-Optic cables in said project have been fully installed and tested and tests have been accepted by designated City representative prior to project closeout.

C. Reference Standards

A. Adherence to, and compliance with, the codes and standards referenced, and the <INSERT CLIENT NAME>'s unique requirements and design solutions identified in the manual, is mandatory. Requests to deviate from the industry standards and design solutions prescribed in these guidelines may be submitted, on a case-by-case basis, to the <INSERT CLIENT NAME> Engineer for review and approval. No deviation from the requirements of the National Electrical Code will be allowed.

B. Architects, Consultants, and Contractors shall always reference the most recent standards available. Most references listed below can be purchased directly from the individual standards organization, or from:

Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112-5776
Telephone: (800) 854-7179 (303) 397-7956
Fax: (303) 397-2740
http://www.global.ihs.com

D. Codes, Standards, References, and Applicability

Design, Build Firm to follow all standards, references and technical special provisions referenced below.

A. NATIONAL ELECTRICAL CODE, NFPA 70

The National Fire Protection Association has acted as the sponsor of the National Electrical Code (NEC) since 1911. The original Code was developed in 1897 as a result of the united efforts of various insurance, electrical, architectural, and allied interests. The purpose of the NEC is the practical safeguarding of persons and property from hazards arising from the use of electricity. The NEC provides the minimum code requirements for electrical safety. In telecommunications distribution design, the NEC must be used in concert with the ANSI/EIA/TIA standards identified below, which are intended to insure the performance of the telecommunications infrastructure.

B. ANSI/TIA/EIA STANDARDS

The Telecommunications Industry Association/Electronics Industry Association (TIA/EIA) engineering standards and publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers. The standards facilitate interchangeability and improvement of products and assist the purchaser in selecting and obtaining the proper product for his or her particular need.

The TIA/EIA Standards are updated every five years. Due to the rapid changes in the telecommunications and electronics industries, TIA/EIA publishes periodic Telecommunications Systems Bulletins (TSB), which provides additional guidance on certain technical issues that must be addressed prior to the next scheduled revision of the standards. The information contained in TSBs is usually incorporated into the applicable standard during the next standards revision. Standards and publications are adopted by TIA/EIA in accordance with American National Standards Institute (ANSI) patent policy. The TIA web site is: http://www.tiaonline.org/

C. FIBER OPTIC TEST STANDARDS, TIA/EIA-526 (SERIES)

The TIA/EIA-455 series, together with its addenda, provides uniform test procedures for testing the fiber optic components intended for, or forming a part of, optical communications and data transmission systems. This series contains standard test procedures for optical fibers, cables, transducers, and connecting and terminating devices.

D. CABLING STANDARD, ANSI/TIA/EIA-568 (SERIES)

The ANSI/TIA/EIA-568-A series, together with its addenda is the Commercial Building Telecommunications Cabling Standard. This standard defines a generic telecommunications wiring system for commercial buildings that will support a multiproduct, multivendor environment. It also provides direction for the design of telecommunications products for commercial enterprise.

The purpose of the standard is to enable planning and installation of building wiring with little knowledge of the telecommunications products that subsequently will be installed. Installation of wiring systems during building construction or renovation is significantly less expensive and less disruptive than after the building is occupied. TIA/EIA-568-A series establishes performance and technical criteria for various wiring system configurations for interfacing and connecting their respective elements.

E. GROUNDING AND BONDING, ANSI/TIA/EIA-607 (SERIES)

The ANSI/TIA/EIA-606 (series) is the Commercial Building, Grounding and Bonding Requirements for Telecommunications. The National Electrical Code (NEC) provides grounding, bonding, and electrical protection requirements to ensure life safety. Modern telecommunications systems require an effective grounding infrastructure to insure optimum performance of the wide variety of electronic information transport systems that may be used throughout the life of a building. The grounding and bonding requirements of this standard are additional technical requirements for

telecommunications that are beyond the scope of the NEC. These standards are intended to work in concert with the cabling topology specified in ANSI/TIA/EIA-568-A series, and installed in the pathways and spaces designed in accordance with ANSI/TIA/EIA-569-A.

F. CUSTOMER OWNED OUTSIDE PLANT (OSP), ANSI/TIA/EIA-758

The ANSI/TIA/EIA-758 provides industry standards for the design and construction of customer owned OSP infrastructure. Unless specified otherwise in the <INSERT CLIENT NAME>, standard OSP designed and constructed at all <INSERT CLIENT NAME> facilities will be in compliance with ANSI/TIA/EIA-758.

G. TRANSMISSION PERFORMANCE SPECIFICATIONS, TIA/EIA BULLETIN TSB67

TSB67 is the Transmission Performance Specification for Field Testing of Unshielded Twisted- Pair (UTP) Cabling Systems. This bulletin specifies the electrical characteristics and performance requirements of field test instruments, test methods, and the minimum transmission requirements for UTP cabling. All testing of horizontal distribution cabling at <INSERT CLIENT NAME> facilities will be performed with a TSB67 Level II test instrument.

H. ADDITIONAL HORIZONTAL CABLING PRACTICES FOR OPEN OFFICES, TIA/EIA BULLETIN TSB75

This document specifies optional practices for open office environments, for any horizontal telecommunications cabling recognized in TIA/EIA-568. It specifies optional cabling schemes and topologies for horizontal cabling routed through modular office furniture or movable partitions, which are frequently reconfigured

I. LOCAL AREA NETWORK ETHERNET STANDARD, IEEE 802.3 (SERIES)

<INSERT CLIENT NAME> utilizes the Ethernet LAN protocol at all facilities. All <INSERT CLIENT NAME> infrastructures must be designed to support the Institute of Electrical and Electronic Engineers (IEEE) Ethernet 802.3 standards, which define protocols and signaling technologies. All newly installed cabling must support 1000BaseX Gigabit Ethernet protocol based on the IEEE 802.3z standard.

J. THE BICSI TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL

The Building Industry Consulting Service International, Inc. (BICSI) is a Telecommunications Association whose mission is to provide state-of-the-art telecommunications knowledge to the industry, resulting in good service to the end user. BICSI develops and publishes the Telecommunications Distribution Methods Manual (TDMM). The TDMM is not a code or standard. The TDMM is an extensive volume of information on the various aspects of telecommunications systems and telecommunications distribution. The TDMM provides discussions and examples of various engineering methods and design solutions that can be selected and employed in order to meet the requirements of the NEC and ANSI/TIA/EIA standards. Designers and installers are encouraged to use the TDMM as an engineering

tool, within the constraints of the unique requirements of the <INSERT CLIENT NAME> Infrastructure Standards.

K. CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS) Refer to the current standard for CALTRANS Intelligent Transportation Systems, Technical Special Provisions for Fiber Optic Cable and Interconnect;

L. INTERNATIONAL TELECOMMUNICATIONS UNION – (ITU-T 652 Categories A, B, C, D) Refer to the international standard on Fiber Optic Cable covering "reduced-water-peak", "low-water-peak" and "full spectrum fiber". Material deployed in the project shall be ITU-T 652.D full spectrum compliant such as Corning SMF-28e for full compatibility and interoperability with legacy fiber, while providing low Polarization Mode Dispersion (PMD).

E. Definitions

Fiber Optic Cable: A cable that contains individual glass fibers, designed for the transmission of digital information, using light pulses.

All Dielectric Self Support (ADSS) Cable: A cable designed and constructed with non-metallic components, that is designed for aerial applications and does not require a separate cable messenger.

Loose Tube Cable: A cable designed and constructed with non-metallic components, which is designed for underground applications. These are "dry" cables using water swellable powders to protect against water penetration.

OTDR: Optical Time Domain Reflectometer. A device used for characterizing a fiber, wherein an optical pulse is transmitted through the fiber and the resulting backscatter and reflections are measured as a function of time.

Single-mode Fiber: An optical fiber with a small core diameter, in which only a single mode of light is capable of propagation. All Single-mode glass employed on project shall meet or exceed .35/.25dB/km optical attenuation and Polarization Mode Dispersion: ≤0.5 ps / km

Multi-mode Fiber: An optical fiber whose core diameter is large compared with the optical wavelength and which, consequently, a large number of light modes are capable of propagation.

Splicing: A permanent junction between optical fiber splices. May be thermally fused or mechanically applied.

Minimum Bend Radius: The minimum radius a fiber may be bent before optical losses are induced.

F. Guidelines for Designing Underground Fiber Optic Cable Routes

Governing California Department of Transportation (CALTRANS) Indexes and regulations should be used as well as all applicable codes in force.

Conduit Placement

The conduit shall be placed at an offset from the roadway that meets the governing MDT regulations and indexes while still staying within the ROW. If this cannot be accomplished please raise issue to the <INSERT CLIENT NAME> Project Engineer or liaison.

Depth (Minimum / Maximum)

The conduit used as the primary carrier of the fiber optic cable should be buried no greater than 42." and no less than 36." beneath grade except where code requires otherwise or directed in writing by the Project Engineer on behalf of the <INSERT CLIENT NAME>.

Grade away from Buildings/Structures

The conduit shall be placed in such a way to as to maintain a gradual grade down away from buildings and other major structures.

Conduit type/ Inner Duct type

Standard placement shall be of quantity (2), 2" ID HDPE conduit direct buried/trenched/bored as appropriate to the construction needs (Color Orange and Blue). If specified an outer conduit shall be of the HDPE type, of suitable strength per the governing MDT indexes for the location of work. Conduit shall be 6" I.D. in size with quantity (2), 2" ID HDPE conduits (Color Orange and Blue)

All conduits and inner ducts should be cleared and cleaned prior to capping.

Conduit Turns & Transitions

All conduit turns shall be made with 45-degree bends or sweeps. At no time shall 90-degree bends be utilized in the outside plant arena, unless it is an already existing conduit, and approved by the <INSERT CLIENT NAME>.

Exceptions may be made to this rule for work inside of buildings.

Trace Wire

A minimum #12 AWG trace wire should be placed along with all conduits put in place. This trace wire should maintain continuity from end station to end station. Where possible it is okay to use vaults/hand holes for joining the trace wire, while keeping these joints visible and out of the way of the fiber cable. Where not possible please use the small hand hole for joining the trace wire.

Marker Poles

Easily visible, marked, 6' fiber optic marker poles should be placed above the conduit at all major transitions to said conduit (turns greater than 25 degrees, etc.), where applicable. Please get marking poles approved by the <INSERT CLIENT NAME> prior to installation/purchase.

Conduit Entering Hand Holes/Man Holes

All conduits should be stubbed up underneath the bottom of each manhole/hand hole leaving at least 8" but no more than 12" of visible conduit exposed. Conduit and inner ducts should be capped until use, after use they should be plugged appropriately to maintain the integrity of the conduit/inner duct from dirt and water.

Locate Information

As an as-built information gathering job, all splice points, vaults/hand hole/manhole/conduit turns of 45 degrees or greater should receive a GPS coordinate that is marked and labeled back onto the as-built drawings.

Building Entrances

All building entrances should be checked and approved with the <INSERT CLIENT NAME> Project Engineer or liaison. Preference is given in the following order (but dictated by the facility itself) utilizing existing conduit to enter the building, core drilling and bringing conduit up through the floor, bringing conduit up the outside of a facility, attaching a pull box to the exterior of said building and entering through the wall of the building.

Box Sizing

Please confirm with the <INSERT CLIENT NAME> your selection of boxes and box sizes PRIOR to utilization of said boxes in quote or design. All boxes utilized MUST meet the MDT applicable indexes and be on the MDT approved equipment list. The following sizes are to be used wherever possible:

16x22x18." (straight wall)
16x22x30." (flared wall)
17x30x18." (flared wall)
24x36x30." (flared wall)
30x60x36." (flared wall)

Please get all boxes approved during the design phase and prior to purchasing/installation of said boxes. All box lids shall have a Logo embedded on them. This logo is to be provided by the <INSERT CLIENT NAME>.

G. Guidelines for Installing Conduit

Depth (Minimum / Maximum)

The conduit used as the primary carrier of the fiber optic cable should be buried no greater than 42" and no less than 36" beneath grade except where code requires otherwise or directed in writing by the Project Engineer on behalf of the <INSERT CLIENT NAME>.

Reel Placement
Have the reel set adjacent to the manhole and use a fiber optic manhole pulling block assembly.

Conduit type/ Inner Duct type
Standard placement shall be of quantity (2), 2" ID HDPE conduits (Color Orange and Blue), direct buried/trenched/bored as appropriate to the construction needs.

If specified an outer conduit shall be of the HDPE type, of suitable strength per the governing MDT indexes for the location of work. Conduit shall be 6" I.D. in size with quantity (2), 2" ID HDPE conduits (Color Orange and Blue).

All conduits and inner ducts should be cleared and cleaned prior to capping.

H. Guidelines for Installing/Pulling Underground Fiber Optic Cable

Bend Radius
The main risk of damage to the fiber optic cable is by overlooking the minimum-bending radius. It is important to know that the damage occurs more easily when the cable is bent under tension, so when the installation is in process be sure to allow for at least the minimum bending radius. The number of 90-degree turns on a pull shall not exceed four (4).

Reel Placement
Have the reel set adjacent to the manhole and use a fiber optic manhole pulling block assembly from Sherman & Reilly (or similar).

Cable Slack
Please coil 150 feet of cable at transition points, termination points, and every 1500 feet.

Splices
All splice locations will be designated by the <INSERT CLIENT NAME>.

Strength
The fibers in the cable will shatter under considerable impact, pressure or if pulling tensions exceed 600 LB, although from the outside of the cable this will not be apparent. With fiber optic cable the jacket of the cable and the Kevlar layer directly beneath give the cable its strength so please be sure to note and repair all nicks and cuts.

Installation

When installing use a swivel eye for pulling the fiber optic cable and conduit system.

Precautions
Please review the manufacturer's installation instructions prior to commencing with the installation. If any questions arise during installation please refer to the manufacturer's installation instructions, or notify the Project Engineer.

Testing
Perform OTDR test on each fiber in the installed cable, to verify the parameters of each fiber meet the system design criteria. Power meter tests should also be performed. All test results should be provided to the <INSERT CLIENT NAME> Project Engineer in PDF format.

I. Safety

Contractor to provide proper work zone safety through an approved site-specific MOT (Maintenance of Traffic) plan.

Contractor to ensure that all personnel working in the field adhere to all PPE (Personnel Protection Equipment) requirements needed for the particular job location at all times.

Contractor to conduct pre-work safety briefings with workers prior to starting work each day/shift in the field. This briefing should be conducted by supervisor/manager in the field. All safety briefings should be logged in paper and this log easily accessible by <INSERT CLIENT NAME> personnel in the field.

J. Locating Fiber Optic Cables

<INSERT CALIFORNIA SPECIFIC STATE LOCATE REQUIREMENTS>

The DigAlert office will contact the <INSERT CLIENT NAME> locating contractor requiring locates of our facilities.

Aiding the locators, please install a #12 gauge wire. Pull #12 gauge wire in with the fiber cable for the underground conduit systems.

Terminate the ends of the #12 gauge wire in a handhold box. This box can be used by the locating contractor.