UNINCORPORATED ALAMEDA COUNTY

Broadband Needs Assessment

Magellan ADVISORS

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INTRODUCTION

From smartphones to social media, digital currency to smart infrastructure, broadband-enabled devices and information have become critical components to economies and ways of life around the world. According to Cisco, by 2023 there will be 5.3 billion internet users and the number of connected devices worldwide will be more than three times the global population[1]. Local and global markets have followed the trend of enhanced connectivity; inventory tracking for major retailers, digital platforms for major publications, and automated transportation technologies for the delivery of manufactured goods are just a few examples of how the twenty-first century economy has been digitized.

In light of the central role that connectivity now plays, local governments have been tasked with understanding broadband internet service[2] as a new utility and ensuring its availability for residents and businesses. Recognizing this, Alameda County selected Magellan Advisors to conduct this Broadband Needs Assessment, which examines the current and future state of broadband internet connectivity in the urban unincorporated areas of the County, including the areas of Ashland, Castro Valley, Cherryland, Fairview, and San Lorenzo.

To better understand the current market, the study includes market and asset assessments that detail the current internet service offerings and broadband-related infrastructure available in these areas of the County. These assessments indicate a clear lack of investment by private broadband providers. In most regions of the study area, only one or two providers are advertising service, and the higher bandwidth fiber-optic assets are extremely limited, mostly following major thoroughfares that do not connect smaller communities, as seen in the figures below.

Figure ES-1 shows a number of metro service providers that have limited investments in fiber within the study areas that could directly serve customers. Figure ES-2 depicts long haul fiber investments by providers that could deliver high bandwidth fiber services, but many only pass through or around the region.

[1] Cisco's Annual Internet Report, 2018-2023 https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.html

[2] The Federal Communications Commission ("FCC") defines broadband as connections with speeds that meet or exceed 25 mbps download and 3 mbps upload.

Figure ES-1. Current Private Metro Fiber Assets in the Study Area

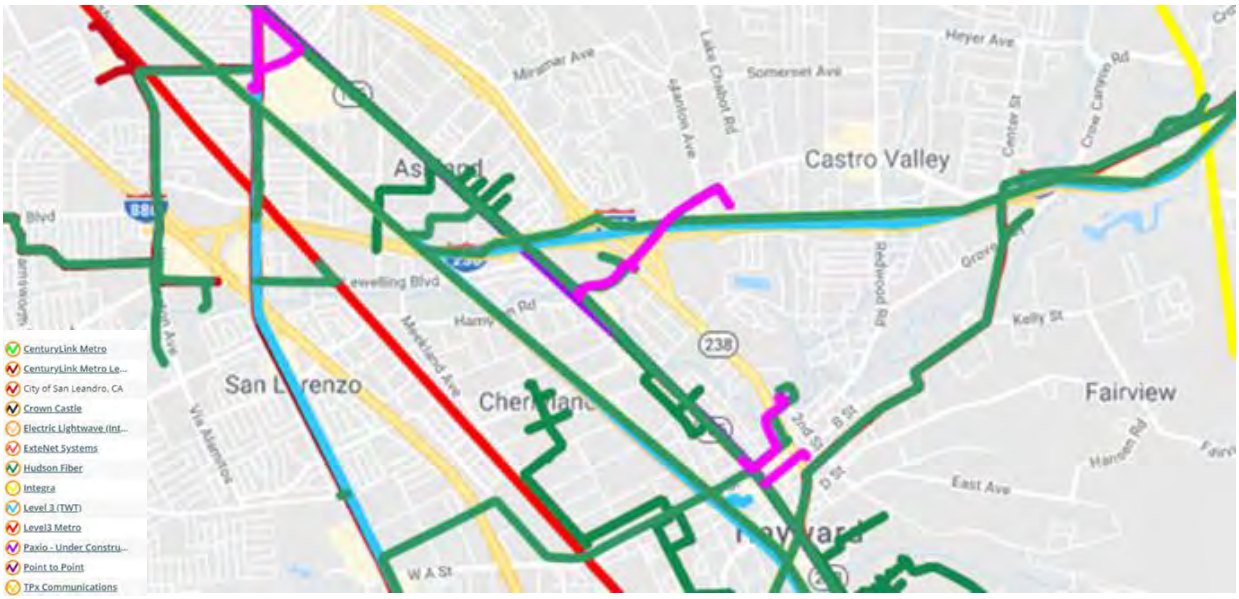
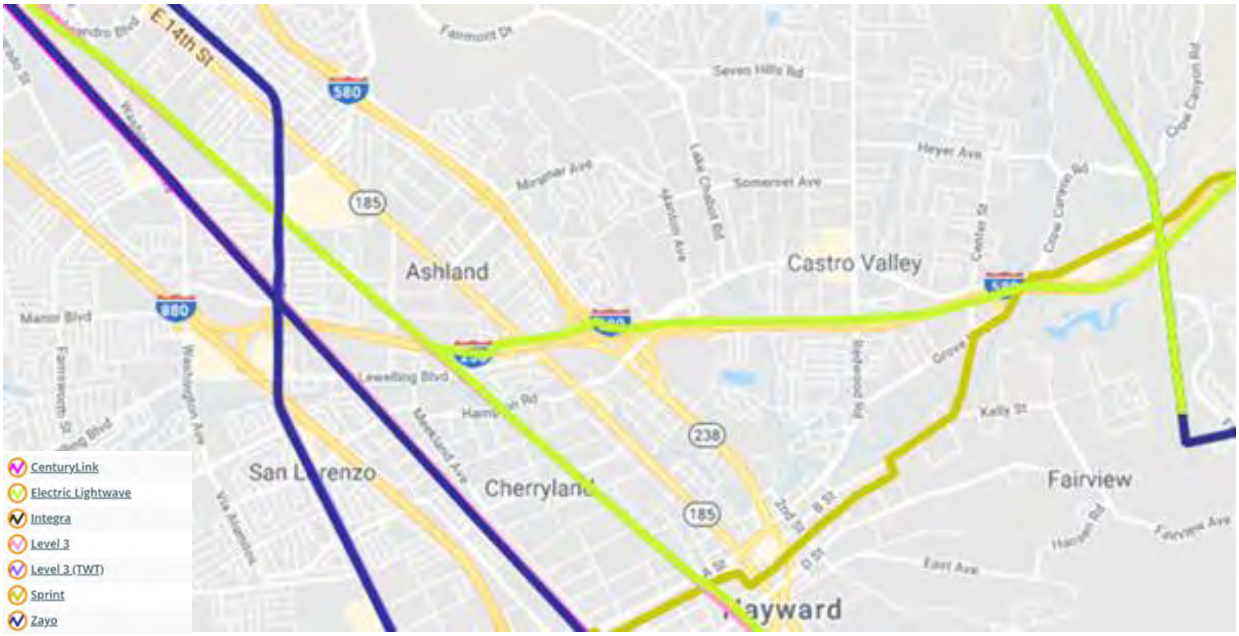


Figure ES-2. Current Private Longhaul Fiber Assets in the Study Area



An online survey tool and interview sessions provided additional information about the current and future needs for businesses and anchor institutions within the region. Although the response numbers were not high enough to achieve statistical reliability, the sentiment gathered through these outreach efforts serves as anecdotal evidence that many members of the community are frustrated by an uncompetitive broadband market in which a lack of choice drives up pricing and

limits service options. Furthermore, while some of their needs may be met today, bandwidth demand is likely to increase even as sparsely placed, outdated infrastructure remains status quo, creating a widening "digital divide" between businesses and residents in the study areas and the more connected communities that surround them.

Due to the low response rate, it is unclear how widespread the demand for better internet service is in these areas. However, based on the investments being made in surrounding communities, the urban unincorporated regions of Alameda County are falling well behind neighboring areas in terms of broadband investment. Although these areas of the County consist mostly of small parcels that are unlikely to house large business parks, the needs of smaller local businesses and residents should still be considered. If economies in these areas are to grow and thrive and if residents are to benefit from improvements such as Smart City services and the Internet of Things (IoT) that come with connectivity, more investment in broadband assets is imperative.

> Based upon the findings of this Needs Assessment, the current lack of broadband investment puts urban unincorporated areas of Alameda County at a serious risk of falling further behind surrounding communities.

As cities such as San Leandro and Hayward have realized, a competitive broadband market that encourages and compels investment by private companies is essential for meeting the demands of the market. Companies and their employees are often unwilling to locate in regions that do not offer robust broadband internet options and, in a region as competitive as Silicon Valley-adjacent Alameda County, this could be problematic for communities that don't have affordable, reliable connections.

Fortunately, the County has options for improving the state of broadband in these communities. Many local governments have taken steps to enhance broadband availability, ranging from simply implementing more broadband-friendly policies to becoming competitors themselves by directly offering services to businesses and residents. Both San Leandro and Hayward have taken steps to invest in broadband assets that will allow them to provide or encourage more options for their businesses and anchor institutions.

This Assessment recommends that the County take a more conservative, measured approach. Rather than building new broadband infrastructure, Alameda County can use its current assets including existing and planned conduit in such locations as

Grant Avenue, East 14th Street, and Hesperian Blvd, and above-ground assets such as rooftops and hilltops to encourage investment by private providers. Public-private partnership arrangements for the use of such assets as well as potential in-kind negotiations for lowered wireless permitting fees and related fiber joint build opportunities could significantly lower the cost of entry for new broadband providers in the region. By simply leveraging existing assets and those of other potential public partners such as schools, the County could stimulate a more competitive broadband environment, to the benefit of both businesses and residents of urban unincorporated Alameda County.

In the course of conducting this study, Magellan has identified at least two interested parties, both of whom already have a presence in surrounding areas and have a track record of partnering with local governments. Zayo, a national internet service provider with some existing assets in the area, is interested in the use of conduit assets and traffic signal interconnect to expand its market to the urban unincorporated Alameda County. Common Networks, a San Francisco-based wireless provider that offers residential broadband to unserved and underserved markets, is already serving San Leandro and small sections of Ashland and San Lorenzo in the western part of the urban unincorporated County. Common Networks has expressed interest in partnering with Zayo as its backhaul[3] provider to extend that footprint. Where financially feasible, Zayo would provide fiber to businesses; in areas where fiber proves too expensive, Common would provide wireless solutions.

Other interested parties may include incumbent telecommunications providers such as AT&T, CenturyLink, Comcast, and Level 3. These entities may be interested in leveraging their local assets under similar arrangements that would be beneficial to businesses and residents. To fully understand the array of partnership opportunities, the County should consider releasing an RFP to collect details about the assets and business models that these companies would be willing to consider. Asset use, ownership, revenue sharing, and non-exclusivity should be discussed in detail with each of the interested parties before entering into any agreements.

Simultaneously, the County itself should capitalize on all opportunities to expand its own broadband infrastructure, including deploying additional conduit that could be leased to providers and potentially County-owned fiber. Any capital projects or other work by third parties being done in the public right-of-way (PROW) should be considered for joint builds that reduce the cost of deploying infrastructure for all involved parties. The extent of new conduit and/or fiber deployed will depend on budget considerations, but at a minimum, the County should consider deploying 2”

[3] A backhaul is the connection from a wireless cell tower to the internet *(source: https://www.highspeedinternet.com/resources/what-is-a-backhaul)*.

conduit in all cases. Ownership of the assets will depend on the County's approach to capital contributions and should be discussed as a part of partnership agreements with the other parties. All infrastructure that is publicly funded should be owned by the County.

This study strongly recommends that, in addition to implementing broadband-friendly policies, the County engage in discussions with interested parties to attract their investment in the areas in question. In summary, next steps for the County should include:

1. Create a diverse Urban Unincorporated Alameda County Broadband Task Force to direct efforts to address broadband issues in urban unincorporated Alameda County.
2. Formalize broadband-friendly policies including a Dig Once policy, allowing coordination for joint build opportunities to realize cost savings of building new infrastructure.
3. Add 2" conduit when performing any capital projects or other work in the PROW for future deployment of fiber.
4. Create a Broadband Infrastructure Program to inventory and track broadband assets throughout the County. If appropriate, conduct an assessment to determine usability of existing assets.
5. Develop a rate structure and consider in-kind opportunities for the use of assets such as conduit, hilltops, rooftops, and other vertical structures.
6. Collaborate with surrounding municipalities such as San Leandro and Hayward to leverage regional partnerships that could enhance the broadband environment.
7. Engage with potential public partners such as the school district regarding the use of their assets to attract investment.
8. Continue participating in the regional public sector broadband forum, comprised of officials from the County, cities and utilities to further the expansion of broadband assets and investments.
9. Continue discussions with Common Networks, Zayo and other interested parties to further explore public-private partnership opportunities. Consider releasing an RFP to collect information from interested parties about partnership models.

CHAPTER 1

1. Background

OVERVIEW OF BROADBAND INFRASTRUCTURE

The term "broadband" refers to high-speed internet services that provide users access to online content including websites, television shows, videoconferencing, cloud services, or voice conversations. These applications can be accessed and shared through a variety of technologies including personal computers, smartphones, tablets, and other connected devices. Although demands for this high-speed data are rapidly increasing, the Federal Communications Commission (FCC) defines broadband speeds as at least 25 Mbps downstream and 3 Mbps upstream. Cable, DSL, fiber, and wireless are the prime broadband delivery systems used to meet these demands by connecting users to the internet.

Broadband is deployed throughout communities as wired cables or wireless technologies that carry digital signals to and from users. The content comes into the local community from around the world via global, national and regional networks. The local infrastructure is built, connected and operated by internet and telecommunications companies that own the physical wires to each household. This started with telephone companies, which deployed twisted-pair copper telephone lines. The second wire came from television companies in the form of coaxial cable. Later satellite and wireless phone companies provided video and voice, with more flexibility to mobile and remote devices using radio waves. Beginning in the mid-1990s these companies repurposed their infrastructures to connect to the internet and carry digital content.

Infrastructure built on these older technologies is aging and results in slower, less reliable access to content. Capacity limits of the infrastructure limit service providers' ability to reliably provide high speeds, and in turn, the amount of data consumers can use is also limited.

Satellite internet services are not typically considered for broadband planning because of the slow speeds they deliver. These services come with data caps and have latency issues: Connections start fast but then slow to a crawl as data is buffered for transmission to/from the satellite. Subscribers who exceed their monthly data cap will experience reduced data speeds. Therefore, satellite connectivity is excluded from this analysis.

WHY FIBER?

Fiber-optic cables (or "fiber") is used to transmit large amounts of data securely over long distance with high reliability, and is considered the gold standard for municipal communications, broadband services, and internet access. It supports a

wide range of applications and is scalable to support nearly unlimited data capacity. Local governments that own fiber consider it a capital infrastructure asset similar to water, road, and electric infrastructure and it has a lifespan of up to 50 years.

Figure 1-1. Physical Bandwidth Capacity Comparisons

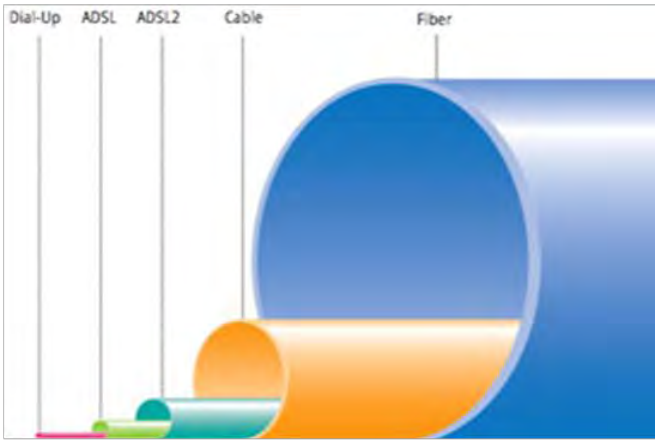
Dial-Up – 56Kbps
- *Legacy Technology*
- *Shared Technology*

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

ADSL2 – 24Mbps
- *Second Generation DSL*
- *Shared Technology*

Cable – 150Mbps
- *Data Over Cable (DOCSIS 3.0)*
- *Shared Technology*

Next Generation Fiber – 1Gbps
- *Passive Optical, Active Ethernet*
- *Shared and Dedicated Technology*



The benefits of such infrastructure are extensive. These networks are becoming increasingly important to cope with the rapid growth in connected devices, from smart building functions such as remotely controlled HVAC to the use of vehicle and pedestrian counters to manage public safety. These broadband-enabled devices demand high bandwidth, but the benefits include allowing governments and businesses to be more efficient, reducing costs and increasing the value they deliver to their constituents.

5G and Fiber Dependency

Fourth Generation or "4G" mobile wireless technology has been widely available for many years. Now "5G", the latest generation, is emerging, with forecasted commercial availability in 2021 and an increased maturity of the network in 2035. These new networks are designed to provide increased efficiencies while decreasing latency and are anticipated to improve the performance of connected devices, including the IoT and network architectures with an emphasis on massive multiple input multiple output technologies (MIMO) and device-to-device (D2D) communications such as autonomous vehicles, healthcare technologies (such as blood glucose monitoring), and ultra-high-definition video.

5G networks operate multiple frequencies in three bands using millimeter wavelengths—the highest of which is anticipated to offer download/upload speeds of 1 Gbps. 5G networks are distinguished from the present 4G technology by use of low power transmitters with a coverage radius of approximately 400 feet; 5G thus

requires the use of wireless technology for maximum usability, meaning close spacing and increased numbers of antennas. These 5G antennas must be connected to and backhauled via fiber due to the vast amounts of data being transmitted and the high speed required to provide low latency and reliability. Therefore, we consider 5G wireless and fiber optics to be complementary, rather than competing technologies.

A recent study and report by Deloitte noted that "Deep deployment of fiber optics into our nation's network infrastructure might not be as glamorous as the eagerly anticipated launch of fifth-generation mobile networks (5G); however, it is just as important—if not more so. In fact, 5G relies heavily on fiber and will likely fall far short of its potential unless the United States significantly increases its deep fiber investments."[4] The study estimates that the US will need to invest $130 - $150 billion in the next 5-7 years in fiber infrastructure in order to support the roll out of next generation wireless.

BENEFITS OF BROADBAND

High-speed internet has a net positive economic and social impact to communities by enhancing key functions such as economic competitiveness, workforce development, training, educational capabilities, municipal operations, and digital equity. Therefore, as the County considers how to approach the broadband question, it should understand what benefits broadband could bring to Alameda County's urban unincorporated areas. Many communities consider the indirect social benefits (some examples of which are explored in more detail below) equally important to the financial aspects, although most local governments believe that broadband projects should in general be able to pay for themselves over time.

Economic Development

Local governments leverage their investments in broadband to support fiber-ready business corridors that attract new business and retain existing ones. Although it would be misleading to imply that the availability (or lack thereof) of broadband is the *only* factor by which businesses decide their locations, many companies do consider a lack of affordable, reliable broadband a major barrier to entry. In locations such as Santa Monica, California, major employers have been dissuaded from relocating because the local government was able to offer an alternative cost-efficient broadband service.[5]

[4] https://www2.deloitte.com/us/en/pages/consulting/articles/communications-infrastructure-upgrade-deep-fiber-imperative.html

[5] As noted by Jory Wolf, former CIO of the City of Santa Monica, who built CityNet, Santa Monica's municipal broadband network. Jory currently serves as Magellan's VP of Digital Innovation and is the Project Executive for this Assessment.

More choices, coupled with higher speeds and lower prices, help to reduce the cost of doing business in cities or counties that have invested in broadband. This has a positive effect on local business retention. Also, fiber is a "must have" for medium and large businesses considering new locations. Ensuring key business parks are equipped with fiber allows site selectors to "check the box" for advanced telecommunications versus eliminating a location for further consideration.

Smart City: Improving Government Services to Enhance Community Benefits

Broadband infrastructure such as fiber can accommodate smart and connected technologies as more municipal and community functions are carried out online. Smart City technologies and the Internet of Things ("IoT") are two growing ecosystems of devices that will change the way that local governments carry out their missions. More devices, sensors, and people will be connected than ever before. By encouraging a more robust fiber environment in the urban unincorporated communities, Alameda County will be prepared to accommodate these emerging trends. The existence of fiber infrastructure puts communities at the leading edge of innovation and supports a range of municipal, community, and broadband applications. Without it, the County cannot consider the vast majority of Smart City technologies and IoT.

Smart cities, counties, towns and municipalities capitalize on smart IoT devices to make their organizations more efficient and effective, while gathering data from devices to make better informed decisions regarding operations. The opportunities range from connected Supervisory Control and Data Acquisition (SCADA) networks, electric grids, traffic cameras and signalization systems, smart light pole grids for monitoring and control, smart trash cans, smart park benches, smart parking and wayfinding, smart irrigation systems, and IoT systems within government buildings.

While many of these functions may not directly fall under the purview of Alameda County, these applications may greatly benefit other partners such as regional utilities, municipalities, and transportation agencies. To assess applicability, a regional broadband working group that is specific to the urban unincorporated areas of Alameda County could be formed, and should include these parties as well as any County departments that take part delivering these services to the community.

Supervisory Control and Data Acquisition (SCADA): Supervisory Control and Data Acquisition systems are connected to the internet, many times wirelessly, for the objective of gathering real-time data for decision making across a variety of utilities including water, wastewater, electric, and gas. Modern day SCADA systems can take data, analyze it, and send commands back to the system to provide insight about utility usage and control valves, pumps, motors, relays, switches and meters for more efficient delivery of services. Additionally, the systems can forecast or

make predictions based on historical data, assisting municipalities with planning activities. These networks can achieve utility cost savings, better maintenance, and improved service for citizens. Municipalities, however, should consider and plan for possible errors in communications, the additional cost to implement, and mitigating cybersecurity threats.

Electric Smart Grids: Connected smart grids for electric utilities can save municipalities time, expense, energy, and carbon footprint. These grids connect to the internet allowing for real-time communication of meter reading, issues, and outages. This decreases the need for vehicle drives to read meters and aids technicians in being prepared for service calls.

Smart Light Pole Grids: By establishing a grid for smart light poles, municipalities can automate and control their lighting effectively and efficiently. These streetlights have LED lighting saving in recurring costs, although by allowing for dimming and brightening when vehicles and pedestrians come near saves additional cost.

Traffic Cameras and Signalization: Connecting traffic cameras and allowing for signalization control can assist municipalities in managing traffic congestion and public safety issues. Traffic signal controlling and automation aids in managing traffic congestion and getting public safety officials where they need to be quickly and safely. Public safety and mass transit vehicles would have controls on board to allow for light changes in a safe and easy manner.

Smart Irrigation Systems: Smart irrigation systems utilize sensors that monitor rainfall to determine when the landscape needs watering. Most systems allow for scheduling of irrigation, however, if scheduled and raining or wet the systems will delay or cancel deployment. This alleviates over-watering of landscapes and saves water, which in many drought ridden areas is a precious resource.

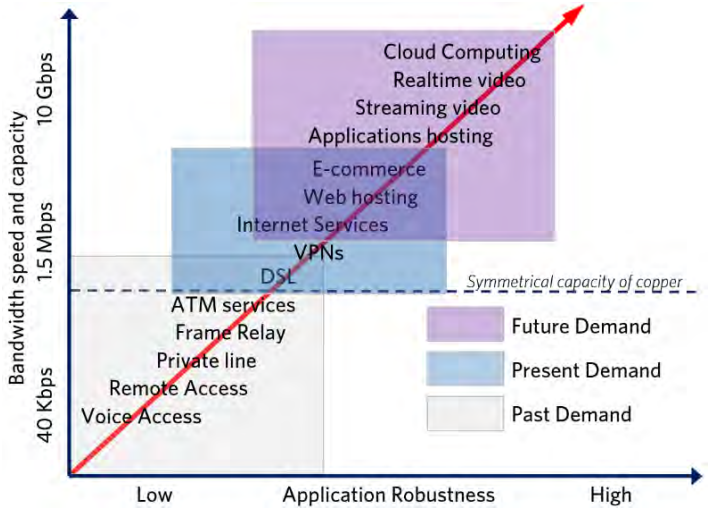
IoT Systems Within "Smart Buildings": In an effort to save energy costs, public agencies and businesses are installing connected thermostats, lighting controls and automation, and smart building strategies such as installing intelligent windows and facades and smarter HVAC systems that save energy by reacting to environmental conditions in real time with features such as automated tinting, shading and controlling indoor air conditions. Smart buildings reduce water and energy consumption, increase positive occupant experience, and create sustainable structures.

Connectivity for Residents

In addition to private and public organizations, residents also have a need for broadband. Much like businesses and governments, many of the daily functions that citizens perform rely on internet connections. When deciding to purchase a

home or relocate, most people would not consider moving to a community that does not offer internet connectivity, a fact that Magellan has confirmed many times through our extensive survey work conducting broadband studies around the country. Although the amount of data for residential use may not reach the levels needed for commercial or municipal use, broadband enables entertainment, healthcare, smart home applications, and telecommuting in homes around the US and throughout urban unincorporated Alameda County.

Figure 1-2. Growth in Application Bandwidth Demand[6]



Although we are still early in the evolution of internet video applications, needs are expected to grow significantly over the next ten years as more users opt for video-based information over traditional text-based content. Cloud computing has also driven the need for more symmetrical[7] broadband as real-time, and cloud applications require additional bandwidth, both in download speed and upload speed. As these applications continue to proliferate, reliable high-speed internet connections will become an even bigger necessity in daily life.

A 2012 study[8] demonstrated the amount of time the average user spends on each of their devices and how these users interact with multiple devices simultaneously. This study was designed to understand consumer media behavior over a 24-hour period, and findings revealed that users are spending significant amounts of time with broadband-enabled devices. More recently, a 2017 study revealed that

6 West Ontario Wardens' Caucus Broadband Background https://wowc.ca/broadband-background

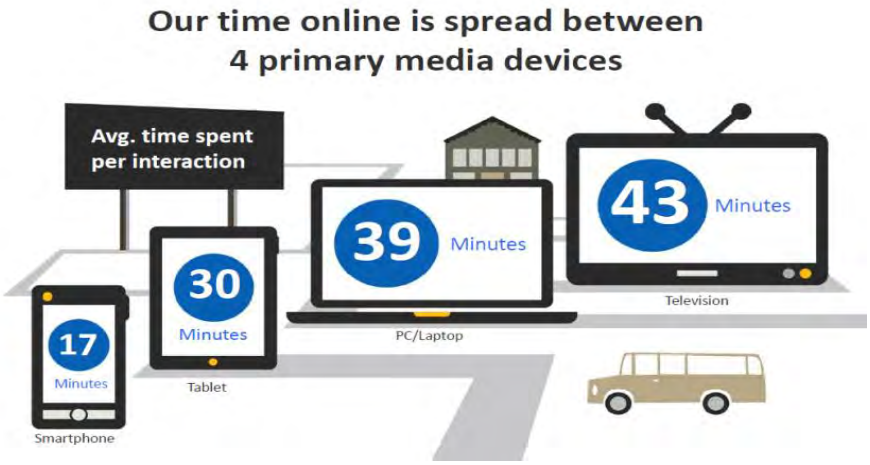
7 Symmetrical broadband connections provide equal download and upload speeds, such as 10 Mbps down, 10 Mbps up, instead of traditional asymmetrical broadband services that provide unequal speeds, such as 10 Mbps down and 2 Mbps up.

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

individuals are spending an average of five hours a day across all devices for personal use, a 20% increase from the fourth quarter in 2015.[9]

Outside of personal use, many more devices are now connected to the internet to automate a variety of daily functions. Multimedia entertainment systems, thermostats, irrigation systems, food storage and preparation areas, and home security and monitoring systems are just some of the "smart home" innovations that have entered the scene. Each of these requires high speed connectivity to function, further increasing demand for broadband inside the home.

Figure 1-3. The Proliferation of Broadband-Connected Devices[10]

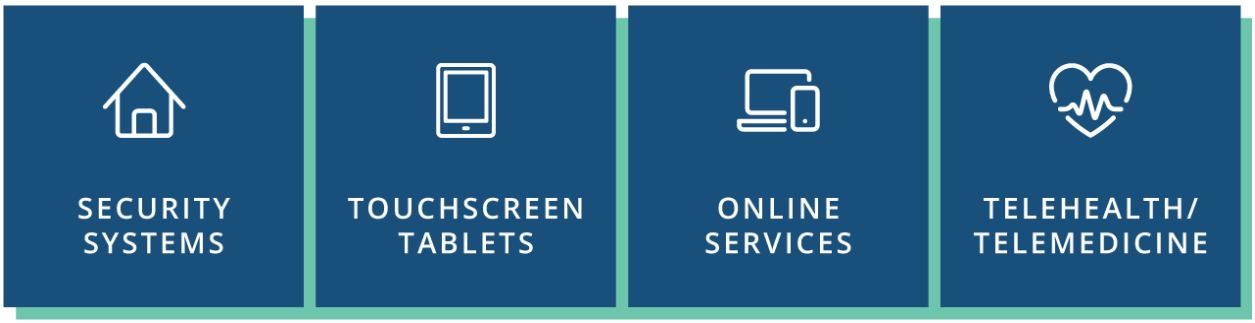


Aging in Place

As the US population ages, many residents desire to age in place, in their home, instead of moving into nursing/assistance facilities or burdening family or loved ones by moving in with them. Studies have demonstrated that in some cases, a person using aging in place applications and services may spend less per month than what they would spend on assisted living facilities per month, all while being safe and comfortable in their home. There are organizations that provide the service of retrofitting the home for aging in place, using technology that is aiding in this movement through the following types of systems or applications:

[9] Flurry Analytics, 2017: https://www.flurry.com/post/157921590345/us-consumers-time-spent-on-mobile-crosses-5

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



Telemedicine

Telemedicine is a growing field as health care providers look to empower healthcare through technology. Health care providers are implementing more telemedicine routines for not only treatment, but for continued health and well-being ongoing care as well. Elderly patients can be significant telemedicine beneficiaries, given they do not always have transportation available to get to a clinic.

Many clinics use online teleconferencing platforms for discussions between doctors for consults, including specialists not actually employed by the clinics. Smaller clinics often cannot afford to have every specialist on staff, so they rely on a network of specialists, sometimes out of the state, to join them, and their patients, in joint video conference calls. Home health monitoring devices are also becoming more and more common place (such as glucose monitors, blood pressure monitors, etc.), but they too need broadband to function.

Other examples of the need for broadband to support medical care include:

- Electronic medical records and billing data is often off-site, which is a big driver for bandwidth needs. Health care providers and practitioners require reliable connectivity to the cloud to perform their jobs. Clinics and providers enter the data, then it goes to a remote clearing house, from which the bills are sent, mostly electronically.
- Trauma centers share records including MRI, CT scan, X-Ray, etc., via electronic means. Medical practitioners especially need to do this at the more remote clinics, requiring bandwidth to do it in real-time.
- Doctors and employees use laptops to record patient information and access EMR. Tablets are also used.
- Paramedics and EMT's use tablets to record first responder information in the field. Without broadband or cellular connectivity, the transmitting of information is delayed until returning to an area where WiFi or cell service is available.

- Voice-to-text applications for recording patient information
- Scribing services
- Medical imaging is shared and used via broadband between sites and for access to specialists in other parts of the state.
- Video chats made accessible via specialized portable carts that have screen, WiFi connections, cameras, software etc. The video chats provide access to specialists such as Infection Specialists, Psychology, and Stroke Specialists.
- Continuing Education facilitated via web training and web conferences. This is extremely valuable, especially for busy doctors.
- Healthcare home visit services, where the practitioners visit patients using laptops equipped with WiFi cards to access patient information.

DIGITAL INCLUSION

Among the most important considerations in the digital, global economy is ensuring equal access to the opportunities brought about by these technologies. Because high-speed internet is necessary for employment opportunities, education, and identifying social resources, areas in which broadband is unaffordable or unreliable are at a distinct disadvantage. Many skilled jobs now require a level of digital literacy and availability, and increasingly, schools are incorporating online learning into their curriculums. Unserved or underserved populations are at risk of falling into a "digital divide," defined by a lack of equity in access to online resources.

Governments are increasingly taking note of these inequities and their economic and social consequences. To mitigate these pitfalls, many are using policy, expansion of existing networks, and the use of municipal infrastructure to fill existing gaps, especially in areas where private parties have not invested in the infrastructure required to support a competitive broadband market.

Broadband adoption is influenced by two key factors: relevancy and affordability. Local governments may invest in broadband to improve both affordability and relevancy by leveraging their positions as policy makers and owners of assets, and often by making measured investments in infrastructure and services. Affordability, adoption and utilization of broadband services are positively correlated; as affordability increases, so does adoption; when adoption increases so does utilization; following utilization comes the anticipated socioeconomic benefits.

CHAPTER 2

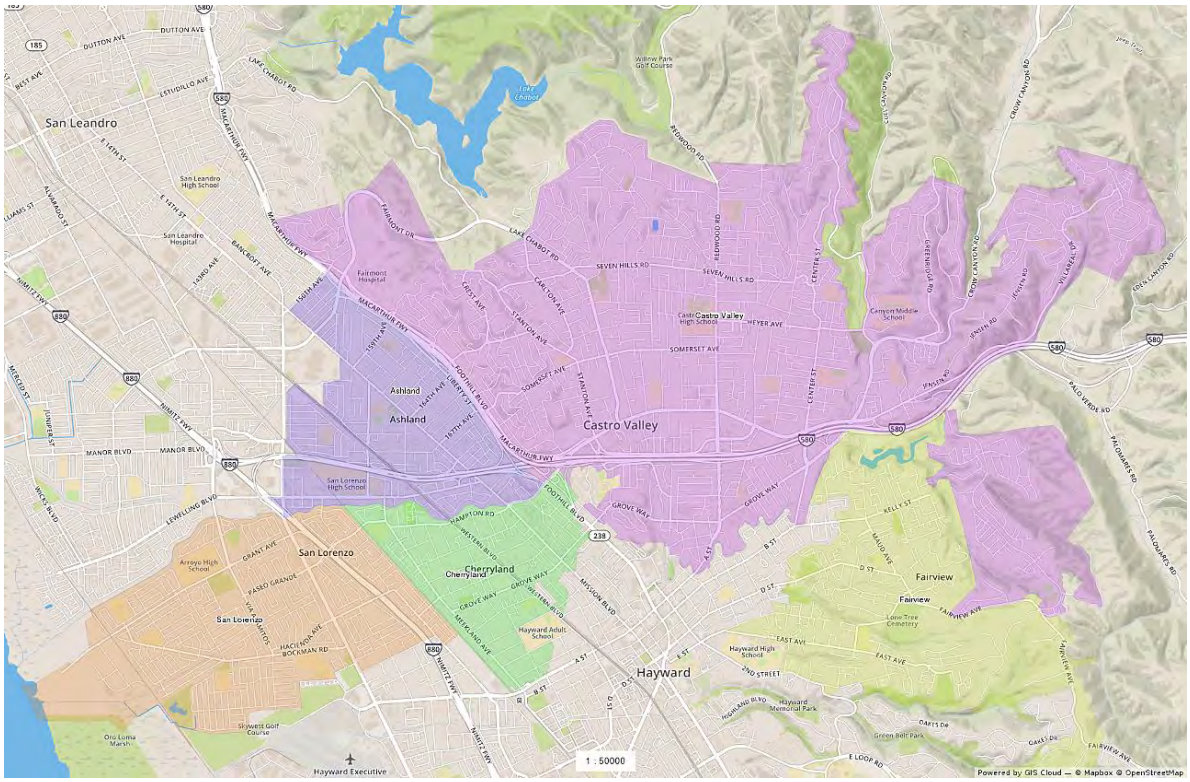
2. Analysis of the Current Broadband Market

To better understand the availability of broadband in Alameda County's urban unincorporated areas, a competitive market analysis was completed assessing the options available to small and large (enterprise) businesses in the County's urban unincorporated areas. The analysis focused on internet speeds and pricing from commercial service providers. This section summarizes the findings of this research and makes observations regarding the services currently offered in the study area. The assessment then addresses the state of competition and effects on costs, speeds and quality of services.

STUDY AREA

This study was conducted across all urban unincorporated areas of Alameda County, including the communities of Ashland, Castro Valley, Cherryland, Fairview, and San Lorenzo, as shown in the map below.

Figure 2-1. Map of the Urban Unincorporated Alameda County



The area spans across six (6) zip codes and includes a population of approximately 131,496 people, as shown below.

Figure 3-2. Urban Unincorporated Areas in Alameda County[11]

Community	Zip Code	Residential Population*	Residential Housing Units *
Ashland	94541	21,925	7,758
Castro Valley	94546, 94552	61,388	23,392
Cherryland	94541	14,728	4,975
Fairview	94541, 94542	10,003	3,642
San Lorenzo	94580	23,452	7,674
Total		131,496	47,441

Most of the commercial parcels in these areas are on the smaller side, with small to medium sized businesses rather than large industrial sites or business parks. A lot of new development is occurring in the area, most of which consists of mixed use along commercial corridors including national restaurant and retail chains. There is a plan for a new 166-unit mid-sized commercial development at Mission & Hampton in Cherryland, but there are no plans for any large business parks to be developed in these areas at this time.

There are three main commercial corridors within the study area: Castro Valley Boulevard, East 14th Street/Mission Boulevard, and Hesperian Boulevard. Castro Valley Boulevard, in Castro Valley, consists mainly of local businesses including restaurants, real estate offices, and area-serving retail plus chain businesses such as banks, drug stores and fast-food establishments. Hesperian Boulevard, in San Lorenzo, has a similar make-up to Castro Valley Boulevard with the addition of a number of large empty retail buildings. East 14th Street/Mission Boulevard is comprised of small businesses, many that are auto-related, as well as small restaurants, fast-food and area-serving retail. There is a small industrial zone in San Lorenzo at the west end of Grant Street; none of the current occupants are particularly tech-focused businesses.

ASSUMPTIONS AND DEFINITIONS

For purposes of this analysis, "broadband" is defined as minimum speeds currently specified by the Federal Communications Commission (FCC). As of January 2015, the FCC defines "broadband" as a minimum of 25 megabits per second (Mbps) download speed, and 3 Mbps upload speed. In January 2018, the FCC reaffirmed

11 2010 US Census

that definition. (As an example, speeds will be quoted as 25 down / 3 up (Mbps), or 25 / 3.) Gigabit speeds represent 1000 megabits; e.g. 1 Gbps = 1000 Mbps.

Identical download and upload speeds are termed "symmetric". But in most cases, Magellan finds that download speeds far exceed upload speeds (i.e., "asymmetric"), and typically, only download speeds are advertised. As businesses and consumers publish increasing amounts of data-rich web content such as videos, photographs, other social media, today's "slower" upload speeds will have a greater adverse effect on overall user experience; thus, demand for faster upload speeds and symmetric services will accelerate.

Where cited, costs will be classified as non-recurring costs ("NRC", or "one-time costs"), typically required up front for service installation. Monthly fees for service, or monthly recurring costs ("MRC") represent recurring payments, which may or may not be part of a subscription tied to committed service term. Quoted costs are exclusive of federal and local taxes, subscriber fees, Universal Service fees, and equipment rental costs.

Notably, much of the data represented here is self-reported by the existing internet service providers (ISPs) that serve the Alameda County area. These statistics measure availabilities based on the vendor's ability to service that proportion of Alameda County's businesses or residents as a percent of the total businesses or residences in Alameda County, respectively.

To supplement this self-reported information provided by the incumbent ISPs, Magellan conducted a business broadband survey that measured actual speeds and asked area businesses to report on actual costs and availability of high-speed internet. This information will be used as a part of this market assessment to gain a more objective view of the broadband market in Alameda County.

Additional questions were also asked of respondents to generate a clear picture of their sentiment about broadband in Alameda County. These additional findings are detailed in the Needs Assessment section of this document.

INCUMBENT TELECOMMUNICATION SERVICE PROVIDERS

The two major, "incumbent" providers in urban unincorporated Alameda County are Comcast and AT&T. Comcast is the major cable provider, with infrastructure consisting of primarily DOCSIS (legacy cable TV technology) infrastructure. AT&T provides DSL to most areas of the County and has fiber connectivity available in a few select areas.

Comcast

XFINITY Comcast is the largest cable provider in the US reaching over 100 million customers and operating in 41 states within the US, Comcast Business currently

operates in 39 states. Comcast offers cable-based services with a reported 17% to 100% coverage depending on the urban unincorporated area. Comcast's fastest speed is 987 Mbps with plans starting at $69.95 per month for speeds at 100 Mbps.

Availability for Comcast's services varies throughout the study area. According to stakeholders, Comcast only recently (within the last two years) extended its offerings to serve some businesses on Castro Valley Boulevard, a key commercial corridor for the urban unincorporated Alameda County. Additionally, according to some local business owners, the cost for construction to connect as quoted by Comcast, (ranging from $11,000 to $30,000) is passed on to the businesses who wish to subscribe to their service. Given the economic makeup of the area, such costs are unreasonable for most small to medium sized businesses.

AT&T

AT&T offers DSL connectivity covering 100% of the urban unincorporated areas it serves, with the fastest speed advertised up to 100 Mbps. Speeds from 50 Mbps start at $50 per month. AT&T also offers fiber connectivity (1 Gig), but coverage varies by serving area (9% to 43%).

AT&T has some fiber infrastructure in the area, although it is unclear exactly where. One stakeholder involved with reselling AT&T fiber indicated that the company is willing to construct new fiber in some places if it is no more than a mile or two from where current infrastructure is located, presumably for enterprise customers. This interviewee indicated that a dedicated 10 Mbps symmetrical fiber connection costs $500-700 per month and that a dedicated 100 Mbps symmetrical connection is approximately $1000-1400 per month, although these price points are not advertised, and quotes are given on an individual basis.

Internet Service Offerings to Small Businesses

There are 5 providers that offer internet service to small business entities in the urban unincorporated areas of Alameda County, and broadband coverage appears to be available in some areas. However, competition is limited, with just 2 providers (AT&T and Comcast) offering service to most areas. The other 3 providers (Cruzio, Etheric Networks and Sonic) have minimal coverage. In addition, speeds are relatively low, especially compared to the cost of service. Cruzio Internet and Etheric Networks offer Fixed Wireless connectivity, with 100% coverage, but speeds are low at 30 Mbps and 35 Mbps respectively. Sonic offers DSL with 3% to 27% coverage depending on the serving area.

Table 2-1. Small Business Internet Service Offerings in the Urban Unincorporated Areas of Alameda County[17]

Provider	Type	Coverage	Fastest Speed	Starting Monthly Price
AT&T	DSL	100%	100 Mbps	$50.00
AT&T Fiber	Fiber	9% to 43%	1 Gig	$50.00
Cruzio Internet	Fixed Wireless	100%	30 Mbps	$99.95
Comcast (Xfinity)	Cable	17% to 100%	987 Mbps	$69.95
Etheric Networks	Fixed Wireless	100%	35 Mbps	$199.00
Sonic	DSL	3% to 27%	100 Mbps	$90.00

Internet Service Offerings to Enterprise / Large Businesses

For enterprise and large business entities in the urban unincorporated Alameda County several options exist for internet providers and service is offered in all areas. However, providers do not offer enterprise business solutions in all urban unincorporated areas. In addition, the service is expensive, the speed is limited, coverage offerings are dependent on technology offered by providers within the vicinity of the business, and true broadband even as defined by the FCC is not always available.

Fixed Wireless - The broadest coverage available to large businesses and enterprise entities within Alameda County's urban unincorporated areas are offered by Etheric Networks and Cruzio Internet, both of which offers fixed wireless (requiring line-of-sight to the business) covering 100% of the areas. The fastest offering (download speeds) are 35 Mbps and 30 Mbps respectively. It should be noted that this is an advertised "best effort," meaning that customers will not necessarily experience these speeds.

Fiber Services – AT&T is the only provider offering Fiber, but has limited fiber connectivity in just three urban unincorporated areas (Castro Valley, Cherryland, and Fairview). AT&T offers fiber connectivity in Castro Valley (42% coverage), Cherryland (43%), and Fairview (9%). All have speeds up to 1 Gig.

Copper Services – There are three providers that offer copper connectivity, but all have limited coverage in just a few of the urban unincorporated areas. In addition, most of the download speeds are low. TPX offers copper connectivity in some areas including Ashland (11.6% coverage / 4.0 Mbps), Cherryland (7.3% coverage /

50 Mbps), and San Lorenzo (11.8% coverage, 100 Mbps). Other providers include Century Link (in Ashland and San Lorenzo), and GTT (Ashland).

DSL Services – There are just three providers offer DSL connectivity in the urban unincorporated areas of Alameda County. AT&T offers speeds ranging from 18 Mbps to 100 Mbps, with coverage of 90-99% depending on the area. GTT covers 7% to 18% where it offers DSL and only at 6 Mbps. Sonic also offers DSL with coverage in the areas it serves ranging from 7% to 31% and speeds ranging from 12 to 100 Mbps.

Table 2-2. Enterprise Internet Service Offerings in the Urban Unincorporated areas of Alameda County[16]

Provider	Type	Market / Coverage	Fastest Speed
AT&T Fiber	Fiber	Castro Valley: 41.7% Cherryland: 43.3% Fairview: 9%	1 Gig
Century Link	Copper	Ashland: 8.2% San Lorenzo: 8.2%	45 Mbps
Comcast (Xfinity)	Cable Internet	Ashland: 91% Castro Valley: 95.8% Cherryland: 99.4% Fairview: 100% San Lorenzo: 91%	987 Mbps
GTT	Copper & DSL	Ashland: 7.0% Castro Valley: 5.7% Cherryland: 6.3% Fairview: 10% San Lorenzo: 7%	6 Mbps 6 Mbps 8 Mbps 8 Mbps 6 Mbps
Sonic	DSL	Ashland: 16.7% Castro Valley: 3.0% Cherryland: 18.9% Fairview: 6.9% San Lorenzo: 16.7%	12 Mbps
Tekifyfiber & Wireless	Fixed Wireless	Cherryland: 47.4% Fairview: 70%	100 Mbps
TPX Communications	Copper	Ashland: 11.6% Cherryland: 7.3% San Lorenzo: 11.6%	4.0 Mbps 50 Mbps 4 Mbps

BROADBAND AVAILABILITY AT SELECTED LOCATIONS

To validate coverage claims, a number of commercial locations were selected across the area, and availability information was gathered from broadband providers. Only three companies nominally provide wired broadband services to any of these locations: AT&T, Comcast, and Sonic. As shown in 2-3, the number and quality of market offerings can vary greatly, even over relatively short distances.

One location (280 Grant Avenue) had no commercial mass market broadband services available to it. The monthly cost per megabit per second (Mbps) of capacity at this site was at least $129.12. Note that if Comcast serves a location, all of its offerings are nominally available there, up to an asymmetrical 1 Gbps service (the nominal upload speed for Comcast's 1 Gig service is 35 Mbps). AT&T's offerings, in contrast, vary greatly. For example, 15951 Hesperian Blvd. has all AT&T services available to it, including a symmetrical 500 Mbps service. A difference of three tenths of a mile between 16395 E 14th St, San Leandro, CA 94578 and 16160 E 14th St, San Leandro, CA 94578 translates into fewer options and around $0.50 per month per Mbps higher costs.

3161 and 3169 Castro Valley Boulevard are essentially right next door to each other but have profoundly different costs to connect ironically *because* one has competition. AT&T DSL service offering is $60/month for 1.5 Mbps. Not only is this not true broadband, it equates to $40 a month for a Mbps. Clearly, this is not an economical option where Comcast 1 Gig service provides a Mbps of download capacity for $0.50 a month. AT&T's 1 Gbps service, which was only available to one of the twelve selected locations, provides the same bandwidth for $0.31/month. Sonic does not serve any of these locations currently because they are too far from the central office used for DSL and the company has no fiber in the area. Fiber-based service could be provided for about $1,000/month but requires a substantial lead time and upfront costs.

Cable broadband tends to be the first choice because it is much faster than traditional telco internet access. On the other hand, DSL is generally available in more places than cable. Most consumers choose DSL only where there is no alternative because it is so much more expensive for the bandwidth provided. It brings down the average cost of internet access where available, but does not drive cable costs lower. The urban unincorporated areas of Alameda County demonstrate this fact because, unfortunately, several of the selected locations have cable broadband available to them but *not* DSL. Areas with true alternatives to cable broadband see substantially lower market rates for bandwidth.

[12] All prices were the minimum advertised/public prices. All speeds are for maximum download only. Thus, this analysis should be considered a best-case scenario.

Table 2-3. Broadband Offerings at Selected Locations Analyzed

Address	AT&T	Comcast	Average MRC	Average Speed	Average $/M/m
15951 Hesperian Blvd, San Lorenzo, CA 94580	7	6	$200.14	307.7	$1.52
16160 E 14th St, San Leandro, CA 94578	0	6	$200.98	294.3	$1.86
16395 E 14th St, San Leandro, CA 94578	3	6	$177.43	244.4	$1.30
17331 Hesperian Blvd, San Lorenzo, CA 94580	3	6	$180.76	244.4	$1.38
19845 Lake Chabot Rd, Castro Valley, CA 94546	2	6	$187.73	265.6	$1.34
20800 Mission Blvd, Hayward, CA 94541	3	0	$96.67	50.0	$2.12
22427 Meekland Ave, Hayward, CA 94541	0	6	$200.98	293.7	$2.53
2480 Grant Ave, San Lorenzo, CA 94580	0	0	$283.33	19.2	$129.11
2720 Castro Valley Blvd, Castro Valley, CA 94546	3	0	$96.67	50.0	$2.12
3161 Castro Valley Blvd, Castro Valley, CA 94546	3	6	$180.76	244.4	$1.38
3169 Castro Valley Blvd, Castro Valley, CA 94546	0	6	$199.55	293.1	$6.58
325 W A St, Hayward, CA 94541	3	0	$169.80	31.5	$69.81

FIBER OPTIC INFRASTRUCTURE AVAILABILITY

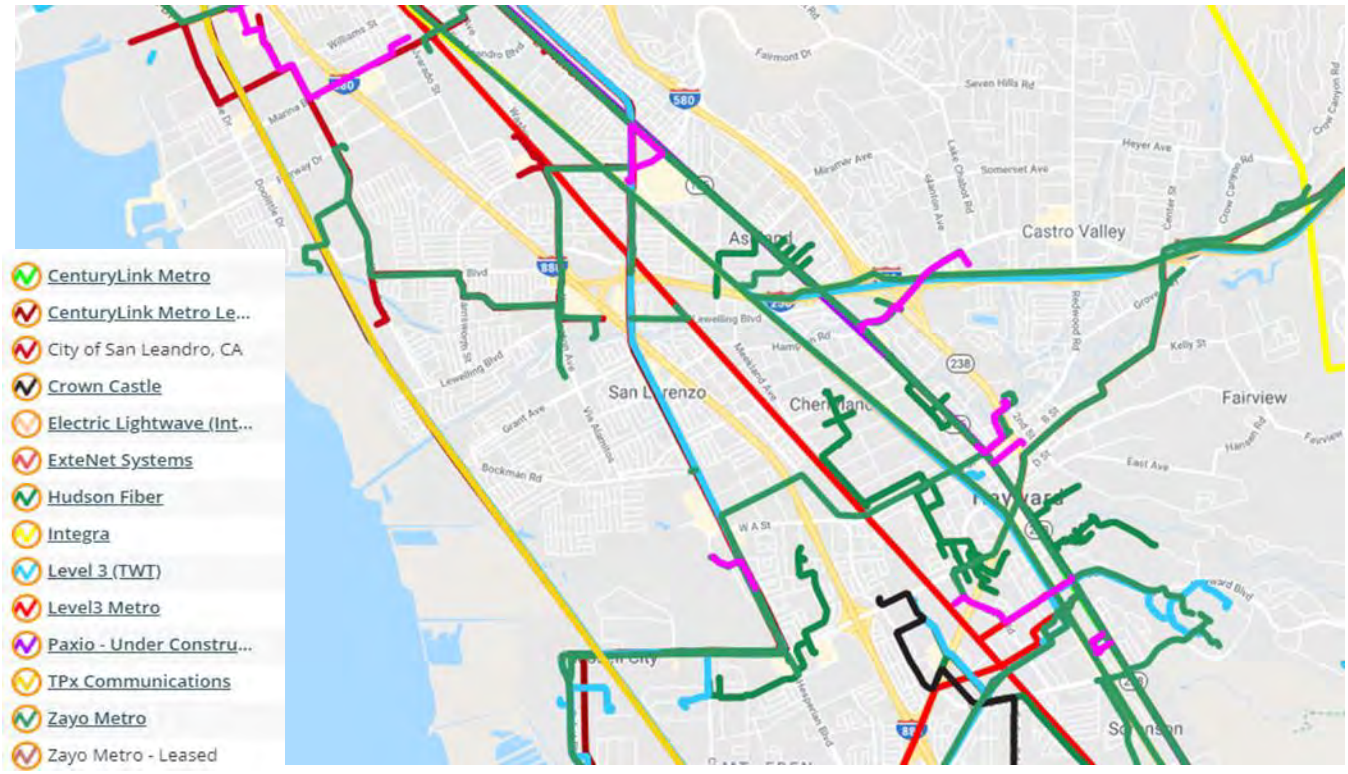
In addition to the analysis of service offerings in the study area, this study also analyzed the availability of fiber-optic infrastructure in the urban unincorporated Alameda County. Because fiber is the gold standard for providing high-speed (see Chapter 1 for more details), reliable broadband, its presence is key to the current and future state of internet in the region. As the need for bandwidth continues to grow, fiber infrastructure will be able to support the needs of communities into the future. In contrast with aging copper and coax technologies, fiber is capable of supporting high bandwidth Smart City applications as well as the growing needs of both businesses and residents for gigabit and multi-gigabit services. As

dependence on cloud services for commercial businesses and at home businesses increases and as more people work from home and run home based businesses, demand for high bandwidth services will continue to increase and become the expected norm.

Metro Networks

Based on the latest available information, some metro fiber networks are present in the study areas, mainly along major arterials shown in the map below.

Figure 2-2. Metro Fiber Networks



Hudson Fiber and Zayo appear to have the most metro fiber infrastructure in the area (their networks are shown separately in the two figures below), while Paxio is constructing new fiber to a few commercial areas including along the southwest portion of Castro Valley Boulevard.

Figure 2-3 Zayo Metro Network

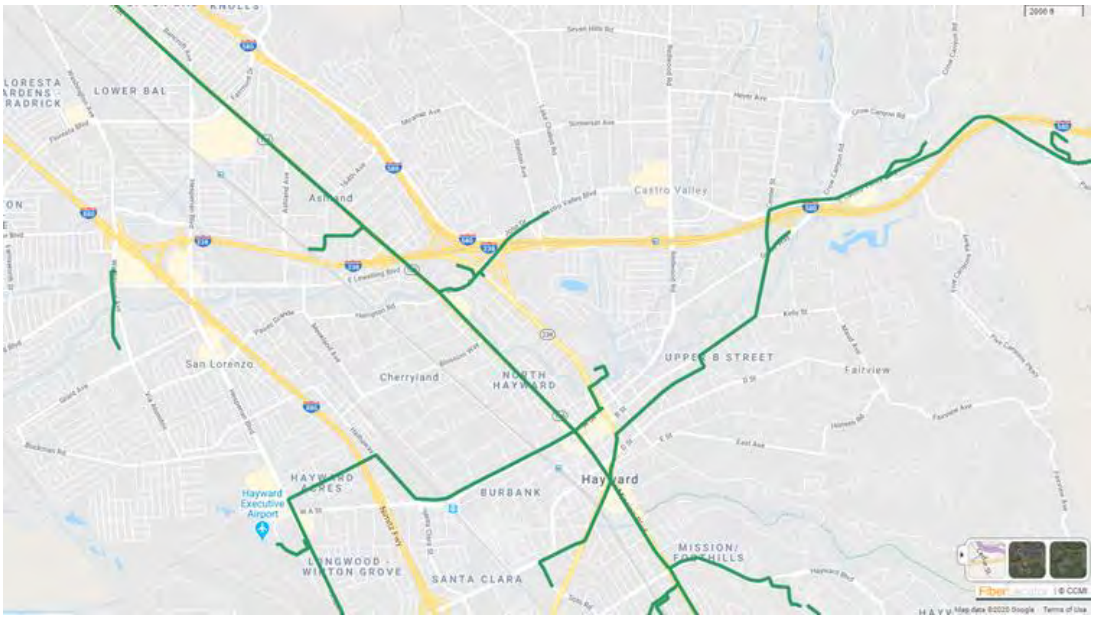
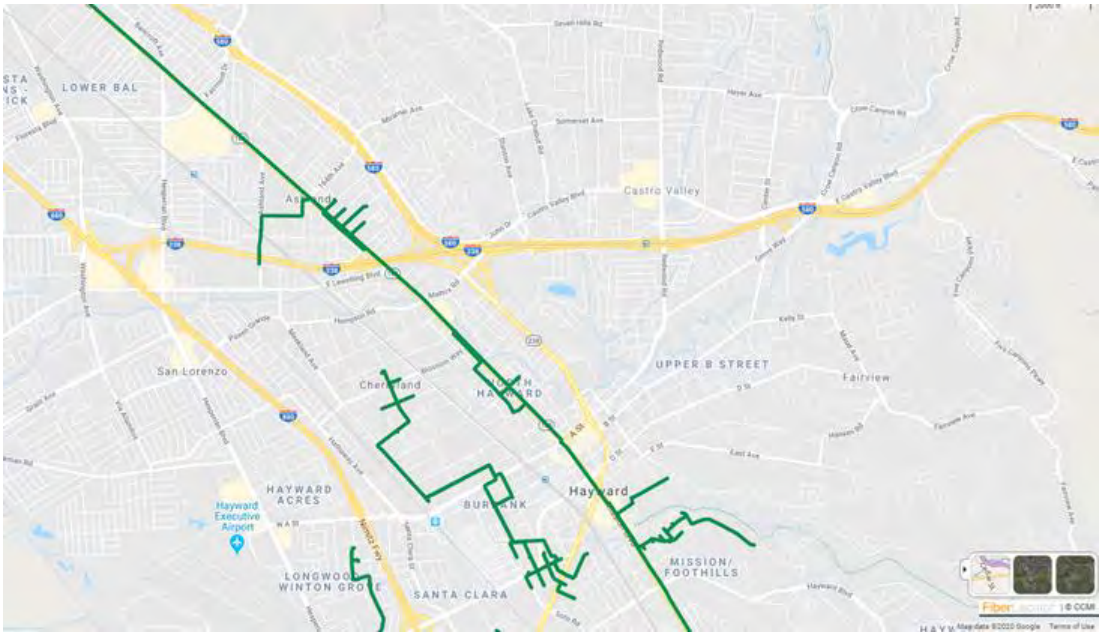


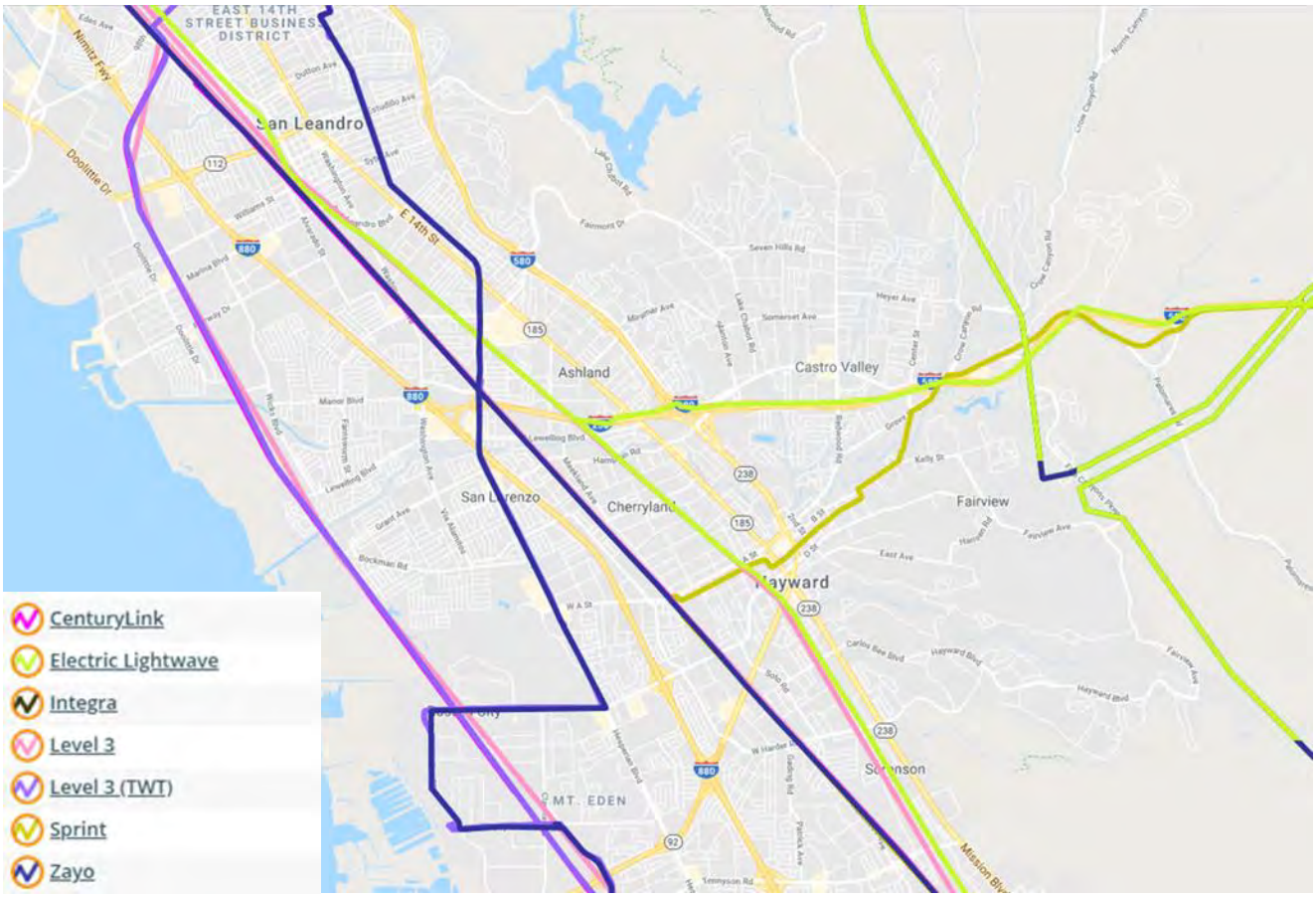
Figure 2-4 Hudson Fiber Metro Network



Longhaul Networks

In addition to the localized metro networks, a few longhaul fiber networks run through the study area. As displayed in the figure below, Zayo, CenturyLink, Level 3, and Electric Lightwave all have assets that run more or less parallel to the Interstate 880 alignment on a north-south trajectory. Electric Lightwave also appears to have some fiber assets that bisect the study area east-west along the Interstate 238 alignment.

Figure 2-4. Longhaul Fiber Networks



Overall, compared to surrounding communities such as San Leandro and Hayward, the fiber assets within the urban unincorporated areas of Alameda County are less diverse and robust. Based on these maps, all three key commercial corridors (Castro Valley Boulevard, E. 14th St/Mission Blvd, and Hesperian Boulevard) are left without an option for fiber connectivity, as are the majority of neighborhoods in all five of the urban unincorporated regions.

These major gaps in fiber-optic infrastructure, combined with the lack of competition amongst providers of other service solutions in the area, indicate a lack of investment by private telecommunications companies. Without further investment, present issues with broadband availability, affordability, and reliability among businesses and residents (explored further in Chapter 3 of this Assessment) will likely be further exacerbated in the future as bandwidth demands continue to grow.

CHAPTER 3

3. Needs Assessment

BROADBAND SURVEY

Over the course of several months, Magellan Advisors' team worked with Alameda County to evaluate the specific broadband needs and capabilities of urban unincorporated areas including Ashland, Castro Valley, Cherryland, Fairview, and San Lorenzo.

To do this, stakeholder outreach was performed to better understand the needs of municipal operations and businesses in Alameda County and the role of broadband in economic development, emerging business opportunities, and the operations of public facilities and services. Magellan worked with staff at the Alameda County Community Development Agency's Economic & Civic Development Department to create an online Broadband Survey to collect an understanding of sentiment about broadband services in the region and perceived needs and shortfalls.

The survey gathered feedback about the current state of broadband and technology, future plans that would necessitate high-speed internet access, and the perceived impacts of enhanced availability of adequate broadband speeds at more affordable prices, with greater choice of providers, and high levels of reliability and customer service.

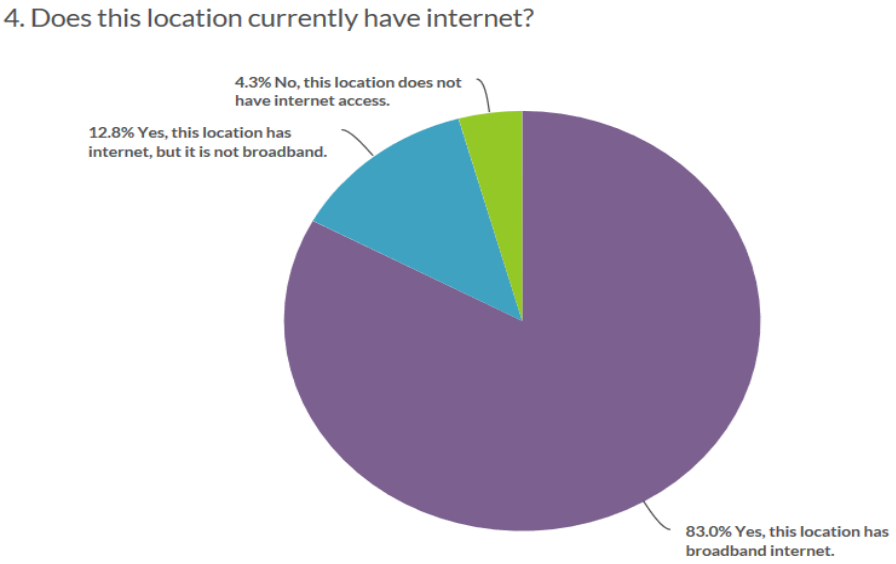
The Urban Unincorporated Alameda County Business Broadband Survey was open to businesses and organizations located in the County's urban unincorporated communities, as defined by the County's website[13], for approximately two months (May-June 2019). Throughout its duration, the survey was promoted through email, Facebook, and U.S. mail campaigns to achieve maximum response rates.

As of its closing date of July 1, 2019, the survey received a total of 48 responses, 30 of which contained answers to all required questions (hereafter referred to as "complete") and 18 of which contained answers to some but not all required questions (hereafter referred to as "partial"). Although partial responses did not necessarily contain data for all required questions, the responses given are nonetheless deemed to be valuable and are thus included as a part of this analysis. Findings of this outreach are presented and discussed below.

[13] http://www.acgov.org/uninc/

BROADBAND ADOPTION AND AVAILABILITY

Figure 3-1. Does the Location for Which You Are Completing This Survey Have Broadband?



Value	Percent	Responses
Yes, this location has broadband internet.	83.0%	39
Yes, this location has internet, but it is not broadband.	12.8%	6
No, this location does not have internet access.	4.3%	2

Most respondents (83.0%) reported that their location had a broadband internet connection[14]. Of those that did not have broadband, only one respondent completed the question asking them to rank reasons for not having broadband. This response ranked the reasons as shown below:

1. Smartphone meets internet access needs
2. Access internet elsewhere (work, school, library, public/free Wi-Fi, etc.)
3. Available services are too expensive
4. Available services are too slow or unreliable
5. Do not need internet services
6. Broadband is not available at this location

As shown in Table 3-1, below, zip code 94546 was the location of both responses indicating that the location did not have internet access, as well as the most

[14] For the purposes of the survey, "broadband" internet was defined as 25 Mbps or greater download speeds and 3 Mbps or greater upload speeds, as defined by the Federal Communications Commission (FCC). The survey noted that cell phone, dial-up via modem, and satellite connections are not considered broadband.

responses (3) indicated that the location had internet, but that it was not broadband. However, because this zip code also had the highest response rates overall, we cannot determine that these data indicate lower broadband adoption proportionally when compared to other zip codes.

Table 3-1. Broadband Adoption By Zip Code

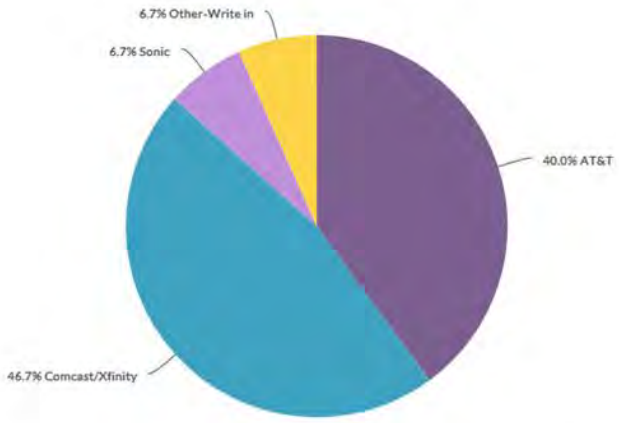
Zip	Total Responses	Yes, this location has broadband	This location has internet, but not broadband	This location does not have internet access
94541	7	7	0	0
94578	8	8	0	0
94580	9	7	2	0
94546	22	17	3	2
94552	1	0	1	0

To gain an understanding of the available service in the urban unincorporated areas of Alameda County, the survey also asked respondents to identify which company provided internet service to their location. As shown in Figures 3-2 and 3-3, below, the vast majority of respondents indicated either Comcast/Xfinity (46.7%) or AT&T (40.0%) provided internet service to their location.

A smaller number of respondents (6.7%) reported that Sonic provided service. Two respondents (6.7%) stated that a company not listed provided internet service; one of these identified their provider as United Telecom, while the other, located at the address of Castro Valley Unified School District, identified Alameda County Office of Education (ACOE) as their provider.

Figure 3-2. What Company Provides Internet Service to Your Location?

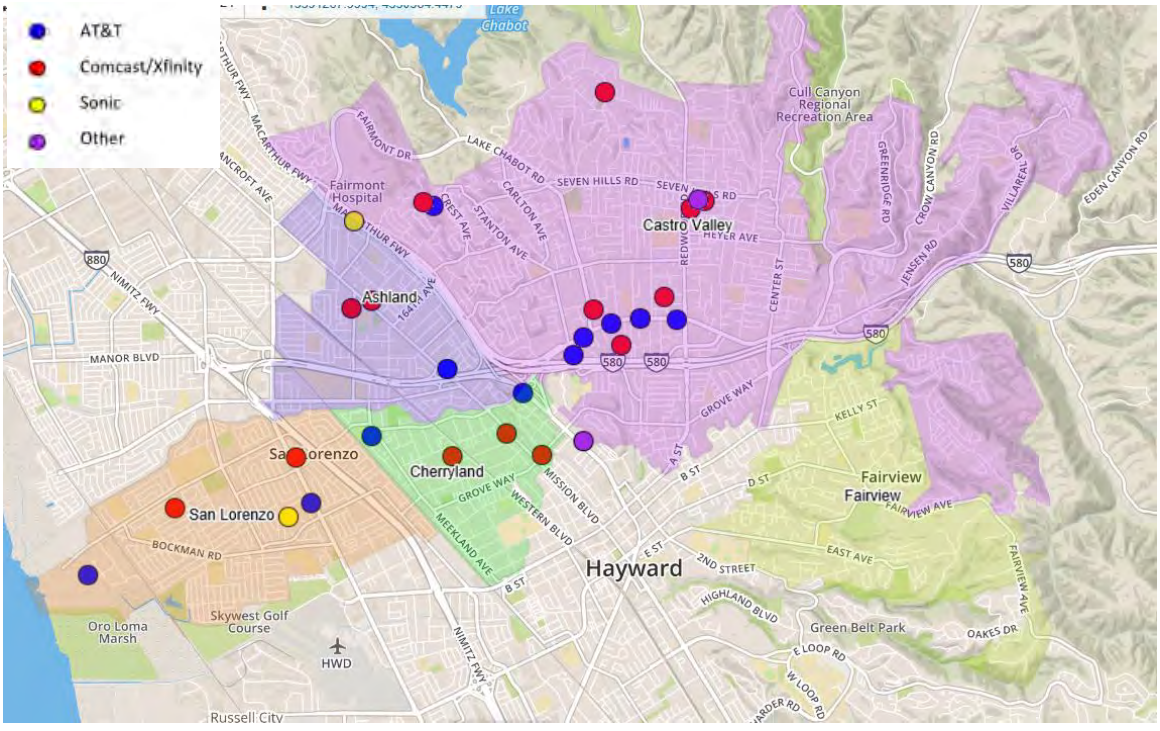
6. What company provides your internet service? If the location has more than one source of internet access, select the primary provider.



Value	Percent	Responses
AT&T	40.0%	12
Comcast/Xfinity	46.7%	14
Sonic	6.7%	2
Other-Write in (click to view)	6.7%	2

Totals: 30

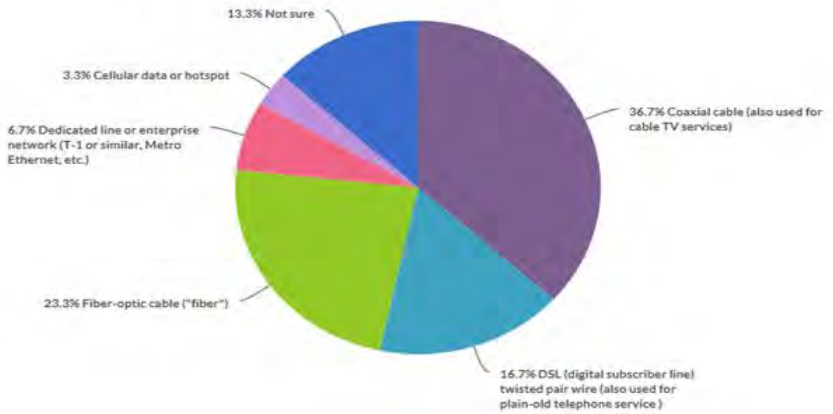
Figure 3-3. Mapped Survey Results: Provider



The survey asked respondents to identify how the location was connected to the internet. Most (36.7%) selected coaxial cable as their connection type, followed by fiber-optic cable (23.3%) and digital subscriber line or "DSL" (16.7%). Based on the speed tests and what we know about service offerings in the area, some respondents who reported fiber connections may in fact have coaxial cable or DSL connections. Several respondents (13.3%) were unsure of their connection type.

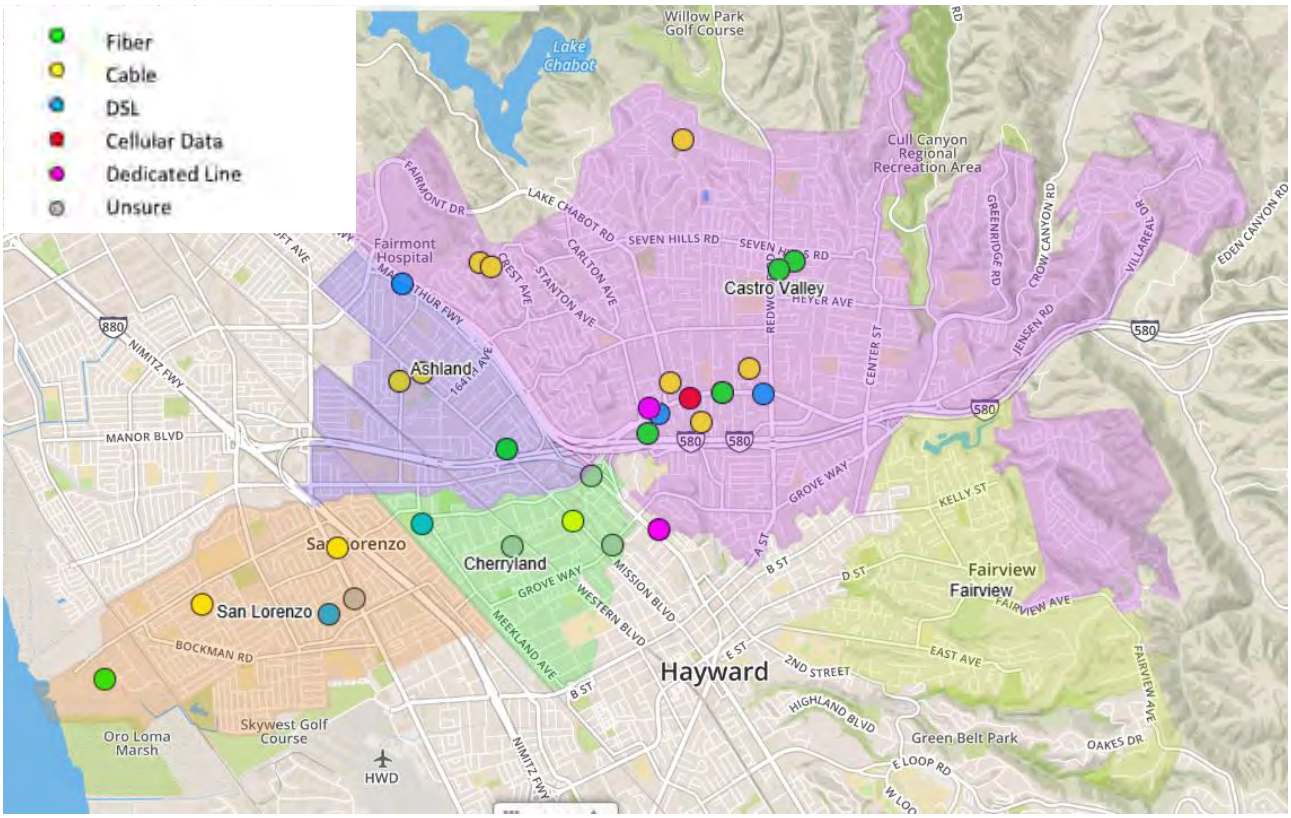
Figure 3-4. How is This Location Connected to the Internet?

5. What type of internet access do you have? If your location has more than one source of internet access, select the primary connection type.



Value	Percent	Responses
Coaxial cable (also used for cable TV services)	36.7%	11
DSL (digital subscriber line) twisted pair wire (also used for plain-old telephone service)	16.7%	5
Fiber-optic cable ("fiber")	23.3%	7
Dedicated line or enterprise network (T-1 or similar, Metro Ethernet, etc.)	6.7%	2
Cellular data or hotspot	3.3%	1
Not sure	13.3%	4
		Totals: 30

Figure 3-5. Mapped Survey Results: Connection Type



PERFORMANCE OF CURRENT INTERNET SERVICES

As indicated in Table 2, below, a notable discrepancy was observed between the contracted and actual speeds of the survey's respondents. While the average contracted speed was 176.63 Mbps download and 123.64 Mbps upload, the survey's speed test results indicate that users are actually seeing speeds of less than half of that, with an average actual speed of 65.01 Mbps download and 37.82 Mbps upload. This indicates that advertised speeds are "best effort," and that actual bandwidths are much lower due to shared bandwidth and throttling from non-commercial or enterprise service offerings.

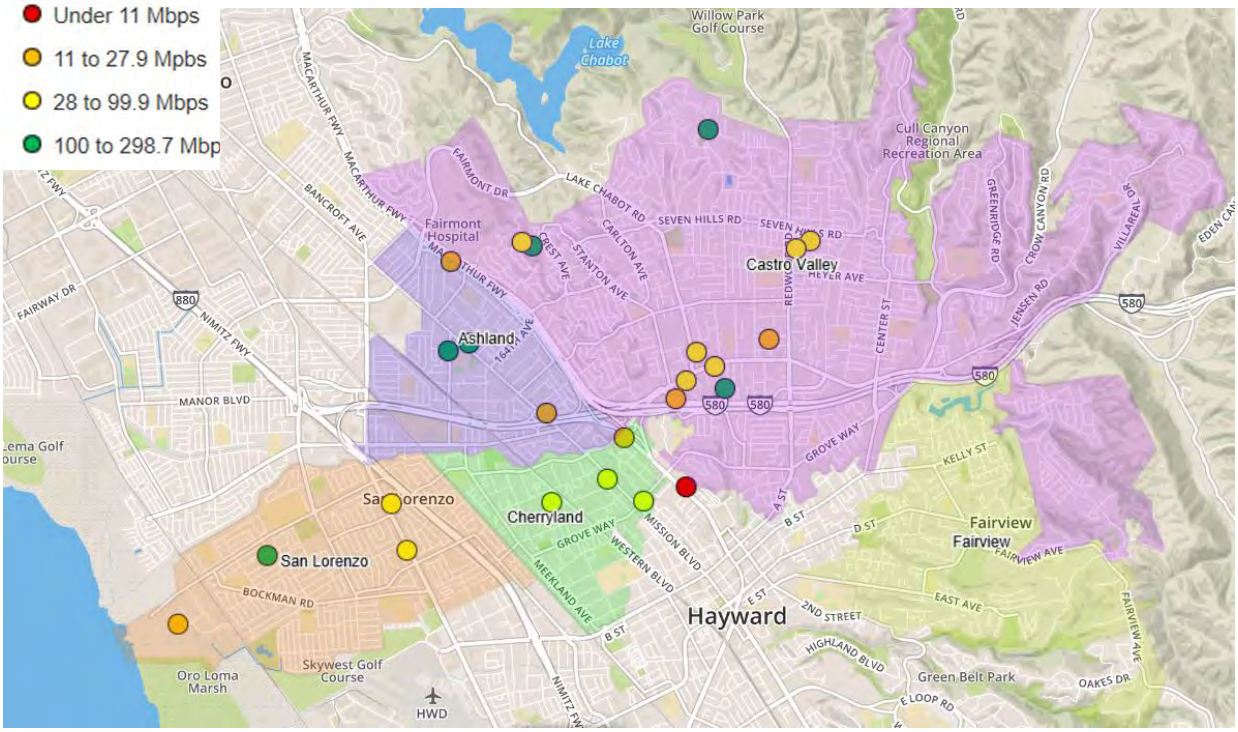
Table 3-2. Contracted versus Actual Speeds

Contracted Speed	Count	Average	Max	Median	Min
Download	26	176.63	1000	100	3.00
Upload	25	123.64	1000	25	0.50

One survey respondent indicated that they had a contracted speed on 1000/1000 through Comcast. However, speed test results indicate that their connection was actually performing at speeds of 83.22 Mbps download/17.53 Mbps upload.

Instances of these discrepancies were found across all respondents, all carriers, all contracted speeds, and all types of connections, indicating that most of the respondents are not getting the speeds for which they are paying.

Figure 3-6. Mapped Survey Results – Speed



At about $268 per month and average speeds of 88.13 Mbps download/23.69 Mbps upload, Comcast was reported as the most expensive option, but also appears to be the second fastest option (the fastest was the ACOE fiber connection at the address for the Castro Valley Unified School District). The slowest speeds and highest cost per megabit per second came from a respondent who indicated they had a Sonic DSL connection. Detailed results are shown in Table 3-3, below.

Table 3-3. Average Monthly Recurring Costs (MRC) and Actual Speeds by Provider

PROVIDER	# of Speed Tests	MRC	Mbps Download	Mbps Upload
COMCAST/XFINITY	13	$268	88.13	23.69
AT&T	9	$163	43.74	30.23
SONIC	1	$100	22.01	1.89
ACOE	1	N/A	99.99	398.62
UNITED TELECOM	1	$50	10.21	16.89

The survey also asked participants to indicate how often their internet service slows down or goes out altogether. Results are displayed in the figure below. While

outages of more than a day or more do not appear to be common, 20% (6 respondents) reported that service slows down on a daily basis and more than half of respondents report experiencing intermittent outages of between a few minutes and several hours at least once a year.

Figure 3-7. Frequency and Duration of Outages and Slow Speeds

13. How often is your internet service out or slow?

	Never	Once a year or less	Every few months	Every few weeks	Every few days	Everyday	Responses
Service slows down							
Count	6	5	5	3	5	6	30
Row %	20.0%	16.7%	16.7%	10.0%	16.7%	20.0%	
Service is out briefly							
Count	4	14	6	2	1	2	29
Row %	13.8%	48.3%	20.7%	6.9%	3.4%	6.9%	
Service is out for less than an hour							
Count	7	11	7	3	0	1	29
Row %	24.1%	37.9%	24.1%	10.3%	0.0%	3.4%	
Service is out for an hour or two							
Count	11	12	5	0	1	0	29
Row %	37.9%	41.4%	17.2%	0.0%	3.4%	0.0%	
Service is out for several hours							
Count	14	10	4	0	1	0	29
Row %	48.3%	34.5%	13.8%	0.0%	3.4%	0.0%	
Service is out for a day or more							
Count	19	7	2	0	0	0	28
Row %	67.9%	25.0%	7.1%	0.0%	0.0%	0.0%	
Totals							
Total Responses							30

Despite the periodic slowness and outages, when asked about satisfaction with current service, most respondents (51.7%) indicated that they were very satisfied or somewhat satisfied with their current service. Conversely, around 30% of respondents indicated that they were very dissatisfied or somewhat dissatisfied overall. Price was the factor with which most respondents were somewhat or very dissatisfied, followed by performance/speed. Figure 3-8, below, shows these responses in detail.

Figure 3-8. Levels of Satisfaction with Current Broadband

14. How well does your current broadband service meet the needs for bandwidth and connectivity at this location?

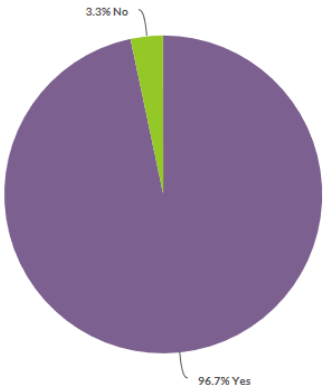
	Very Satisfied	Somewhat Satified	Neither/Neutral	Somewhat Dissatisfied	Very Dissatisfied	Responses
Overall						
Count	6	9	5	7	2	29
Row %	20.7%	31.0%	17.2%	24.1%	6.9%	
Performance/speed						
Count	3	11	4	8	3	29
Row %	10.3%	37.9%	13.8%	27.6%	10.3%	
Price						
Count	4	6	6	8	5	29
Row %	13.8%	20.7%	20.7%	27.6%	17.2%	
Customer/technical support						
Count	5	9	5	5	5	29
Row %	17.2%	31.0%	17.2%	17.2%	17.2%	
Reliability						
Count	6	12	5	4	2	29
Row %	20.7%	41.4%	17.2%	13.8%	6.9%	
Service options						
Count	5	6	11	4	3	29
Row %	17.2%	20.7%	37.9%	13.8%	10.3%	
Totals						
Total Responses						29

CRITICALITY OF INTERNET

Finally, the survey sought to gain an understanding of the criticality of internet access for conducting business in Alameda County. The vast majority of respondents (96.7%) stated that they considered internet access to be an essential service or utility.

Figure 3-9. Internet as a Utility

16. Do you consider internet access to be an essential service or utility?



Value	Percent	Responses
Yes	96.7%	29
No	3.3%	1

Totals: 30

Most respondents indicated that internet connections were critical to their organizations for a variety of uses, including administration and management, production of goods and providing services to their customers, buying materials and recruiting new employees, and outbound logistics. Figure 3-10, below, displays the criticality of internet for a variety of functions, as indicated by survey respondents.

Figure 3-10. Criticality of Internet for Organizational Functions

17. How important is the internet to each of these functions within your organization?

	Not important	Helpful, but not very important	No opinion/Don't care	Somewhat important	Very important	Critical	Response
Administration and management Count Row %	0 0.0%	0 0.0%	0 0.0%	2 6.9%	6 20.7%	21 72.4%	29
Buying materials, etc., and finding and hiring employees Count Row %	2 7.1%	0 0.0%	1 3.6%	1 3.6%	10 35.7%	14 50.0%	28
Inbound logistics: bringing materials in for use in production Count Row %	4 14.8%	0 0.0%	3 11.1%	3 11.1%	4 14.8%	13 48.1%	27
Production of goods for and providing services to customers Count Row %	3 10.7%	0 0.0%	1 3.6%	0 0.0%	9 32.1%	15 53.6%	28
Outbound logistics: getting goods and services to customers Count Row %	3 10.7%	0 0.0%	2 7.1%	2 7.1%	7 25.0%	14 50.0%	28
Sales and marketing Count Row %	0 0.0%	0 0.0%	4 14.8%	3 11.1%	7 25.9%	13 48.1%	27
Support and maintenance Count Row %	1 3.6%	2 7.1%	1 3.6%	4 14.3%	6 21.4%	14 50.0%	28
Point of Sale Count Row %	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 100.0%	1
Totals							

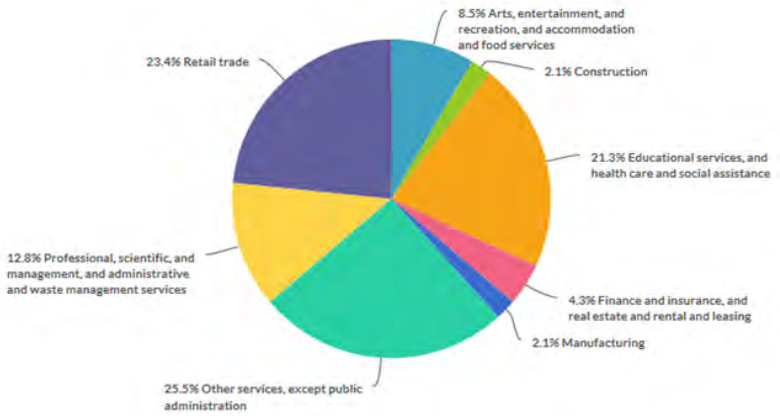
INDUSTRY / SECTOR

For context, the survey asked that respondents identify their organizational sector using corresponding North American Industry Classification System (NAICS) codes.

Industry. As shown in Figure 3-11, below, top industries were Other services, except public administration (25.5%), Retail trade (23.4%), and Educational services, and health care and social assistance (21.3%).

Figure 3-11. Respondent Industry Sectors

3. What is your business industry or sector?



Value	Percent	Responses
Arts, entertainment, and recreation, and accommodation and food services	8.5%	4
Construction	2.1%	1
Educational services, and health care and social assistance	21.3%	10
Finance and insurance, and real estate and rental and leasing	4.3%	2
Manufacturing	2.1%	1
Other services, except public administration	25.5%	12
Professional, scientific, and management, and administrative and waste management services	12.8%	6
Retail trade	23.4%	11

Totals: 47

SURVEY COMMENTS

Finally, the survey allowed respondents to provide open text comments about what better broadband would mean to them, their family, their organization, and the area. Notable comments include:

"In SLZ village, internet speeds are especially slow. Public wifi outside of the village is more reliable and quicker. All the ISP's are the same. Each ISP vendor has blamed slow speed on infrastructure, utility boxes are too far away, not enough cable, etc. Please help in this regard." – Respondent # 31

"There are not too many provider options in our area, if other options exist then the prices may be more competitive." – Respondent #50

"The Legislative definition of Broadband in California is 6 down 1 up. 25/3 is a recommended FCC threshold. Your survey is misleading. It would help to provide the participant more relevant information such as what speeds are needed for most services. The bandwidth is surprising low. Also, look at other FCC studies that show that even when 100/100 or 1000/1000 speeds are available, most users still go with something in the 50/60 down range. Building more expensive cars doesn't mean people want them. If this is in any way leading to proposals for public funds to build broadband networks - I vote no." – Respondent #55

"Any improvement in the system would be great. BUT DO NOT INSTALL 5G.....THAT IS NOT WHAT WE NEED." – Respondent #57

STAKEHOLDER INTERVIEWS

In addition to the survey for businesses, the Assessment included discussions or written communications with a number of stakeholders to better understand the state of broadband in the study area. These discussions included a number of business owner/operators, particularly from the Castro Valley Boulevard area, as well as the Castro Valley / Eden Area Chamber of Commerce, and staff from various County departments.

Overall, these interviews and other written correspondence pointed to two primary concerns regarding broadband in urban unincorporated Alameda County: inconsistent or unavailable broadband service offerings and lack of competition.

Inconsistent or Unavailable Broadband Service Offerings

As shown in the Market Assessment, the service offerings within the study area are inconsistent from address to address. Several interviewees stated that they have access to high-speed broadband with bandwidth as high as 1GB/1GB at home, while their neighbors or their places of work have no available service options or options that only deliver dramatically lower speeds; in some cases, the inverse is true.

Lack of Competition

Associated with the inconsistent or unavailable options is the concern that even when broadband is available, there is a lack of competition among providers. This is not uncommon; many communities lack choice due to telecommunications providers' business strategies that call for carving out service territories or when there is little incentive for them to invest in building new assets or improving services to some areas. The absence of a competitive market negatively impacts

subscribers, often lowering the bar for customer service and raising prices for services among comfortable incumbent providers.

Areas of Concern

Interviewees mentioned several specific areas of concern, including Hesperian Boulevard and Castro Valley Boulevard.

Anecdotally, businesses along Hesperian Boulevard in San Lorenzo suffer from some of the worst internet issues in the area. Stakeholders report that there are frequent outages and that several areas have few or no options for broadband speeds. When community events occur, connectivity is especially overwhelmed, and, despite organizers' best efforts to put on events, some may not be feasible due to the lack of broadband. The Castro Valley / Eden Area Chamber of Commerce, for instance, would like to promote the ability to conduct retail sales during the "Showtime in San Lorenzo" event where businesses can set up popups; however, without the connections often needed for point of sale applications, those capabilities will be limited.

Business owners along Castro Valley Boulevard also expressed their frustration with a lack of choice for service options in the area. One business owner indicated that although she subscribes to the most expensive, highest bandwidth offering available, she is unable to use a point of sale application and stream music at the same time and has to work from home to get adequate bandwidth to fill out paperwork. Options for internet service in this area are limited and, although Comcast has recently built out more infrastructure to serve those businesses, it was reported that the cost for them to connect was between $11,000 and $30,000, the full amount of which would be passed on to the business that wants the connection.

Notably, some of the businesses in this area are satisfied with their service. Although they report slow-downs in service every 3-4 months, the price and bandwidth are meeting current needs. Most of these, however, are not large consumers of bandwidth. Even among those small businesses that offer free wi-fi to incentivize customers to visit, there is concern that connectivity is strained during community events that draw large crowds to the Castro Valley Boulevard area. For businesses that have any automated broadband-enabled components requiring high bandwidth, this is problematic. Reportedly, one business, a pharmaceutical company, that was using an automated robot had to get a special moratorium lifted to build out Comcast infrastructure to reach their building. As one participant pointed out, residents may expect such issues in some of the more rural parts of the County, but not at Castro Valley Boulevard and Redwood Road, "the biggest intersection in town."

Other areas mentioned as being underserved include residences in the Canyonlands and near the Church of Jesus Christ of Latter-day Saints on the corner of Almond Road and Seven Hills Road in Castro Valley, as reported by an interviewee with a family member who lived near the church.

CONCLUSIONS

While the low number of survey responses does not provide adequate insight into the broadband environment throughout the urban unincorporated area of Alameda County, some key trends can be noted.

First, internet is overwhelmingly indicated as a critical service for the surveyed businesses. Organizations across a range of industries see broadband as critical to their daily operations and consider it to be an essential utility.

Second, there is a level of dissatisfaction among the respondents, mainly related to price and a lack of choice and service options in the area. As is common among surveyed communities, most customers are experiencing lower than contracted speeds. Outages occur intermittently and slower speeds are experienced regularly by many users.

Survey respondents are fairly evenly split on whether needs are being met with the current service. Although some feel their current service is adequate, more choices would be welcomed in the area to control prices and to offer higher speeds to those organizations that desire them.

The stakeholder interviews indicate that two main issues dominate the broadband landscape in urban unincorporated Alameda County: inconsistent service offerings and a lack of choice in providers. Although the region is not dominated by broadband-intensive industries and consists mainly of small and medium sized businesses, the service, at least in some cases, is not meeting even the low bandwidth needs for uses such as point of sale applications and wi-fi for customers. Therefore, while some respondents may be satisfied with the current services in the area, the current state of broadband is not playing a role in attracting any new commercial activity. Instead, it is disabling many of the businesses in the areas.

CHAPTER 4

4. Key Findings and Opportunities

KEY FINDINGS

Based on the data collected, several points should be noted regarding the broadband needs of urban unincorporated Alameda County. Key findings of this Needs Assessment include:

1. **Mixed Response from the Community**
   Because of the low number of survey responses, statistically valid results regarding the need for broadband could not be obtained. However, the responses that were received, as well as interviews and written correspondence with stakeholders, provide anecdotal information about whether current needs are being met.

   Satisfaction with current broadband offerings is somewhat mixed: about half of survey respondents expressed satisfaction while the other half indicated significant issues. Generally, those who expressed satisfaction were small to medium sized who are not heavy users of high bandwidth. Other respondents, many of which are also small-to medium-sized businesses, stressed a need for higher bandwidth and more competitive options to drive down prices. This indicates that both the quality of broadband and the options for providers are highly inconsistent from address to address.

2. **Digital Divides Need Attention**

   Current inconsistencies in the availability of broadband from neighborhood to neighborhood will widen digital divides if unaddressed. As the economy, education, healthcare, and government services become increasingly digitized, businesses and residents in locations without access to affordable, reliable broadband service are at risk of suffering serious and lasting inequities. Without investment in these communities, this region of Alameda County is likely to struggle in supporting future needs.

3. **Lack of Investment in Fiber Infrastructure**

   This Assessment's analysis of available broadband infrastructure in the study area shows a lack of investment in fiber infrastructure by broadband providers. Compared with surrounding communities such as Hayward and San Leandro, urban unincorporated Alameda County has limited assets that,

for the most part, only run along major transportation routes that bypass commercial corridors and residential areas. While some other communications infrastructure such as copper and coax are available, such methods of delivering internet service are not adequate for building a robust broadband environment that will support the needs of the community many years into the future.

4. **Current Broadband Environment Will Not Attract or Support Growth**

   Overall, if urban unincorporated Alameda County seeks to attract and retain businesses as the economy continues to shift more towards automation and internet-enabled industries, the broadband investments in these areas will suppress economic development and quality of life. While some small businesses are satisfied with what is available, there is little room for growth and businesses or workers considering locating in these areas may think twice due to the lack of available broadband.

   The urban unincorporated areas of Alameda County are at risk of falling behind surrounding communities such as San Leandro and Hayward if additional investments are not made to support a more robust broadband environment. These communities could be attractive to small start-up businesses that could boost the local economy, but they require broadband to operate and thrive. While broadband is certainly not the only factor determining where businesses locate, lack of adequate communications infrastructure can be a major barrier to entry and thus, to economic growth.

   The current state of broadband is also not adequate for supporting Smart Cities services that can streamline the delivery of government services and improve quality of life. Innovations such as public wi-fi, environmental sensors, telemedicine, virtual learning and automated transportation bring quality-of-life benefits but require high bandwidth to function. Commercial corridors such as Castro Valley Boulevard have the potential to become community spaces that host events and bring residents together, and better broadband could bolster those efforts.

5. **Key Commercial Corridors are Priorities**

   The downtown business areas of both San Lorenzo and Castro Valley are suffering from a lack of choice. While the incumbent providers have made some efforts to extend their infrastructure to these areas, both still lack competition and prices for construction to connect small businesses are untenable.

   Because these areas are major commercial corridors, they should be the priority for investment. Castro Valley Boulevard, where many business

owners expressed frustration and where there is currently very little fiber infrastructure, should be a key focus. Another opportunity is the installation of conduit and/or fiber during the streetscaping project along East 14th Street/Mission Boulevard. Hesperian Boulevard is also a priority.

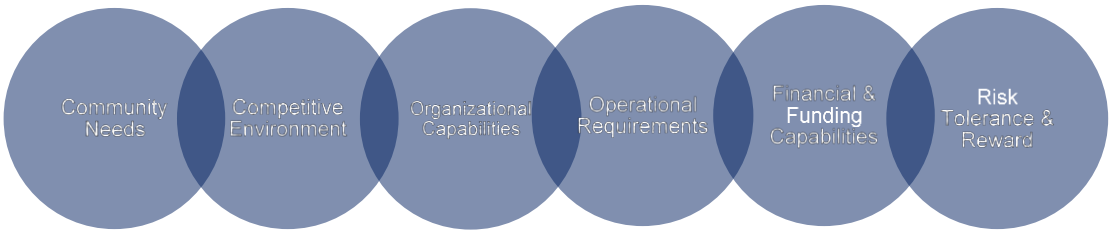
6. **Attractive Infrastructure**

   Although the County does not own very much fiber infrastructure in these areas, other assets are still attractive to providers. The County has existing conduit along Grant Avenue (Via Seco to UPRR) and plans to install additional conduit along East 14th Street between 162nd and I-238 and along Hesperian Boulevard from I-880 to A Street. Conduit that contains traffic signal interconnect may have innerduct that would allow for fiber to be run, and streetlight poles, rooftops, hilltops, and even park sites can be attractive locations for wireless providers to place equipment. At least two providers have expressed interest in the use of these assets.

OPTIONS FOR COMMON APPROACHES

When considering options for addressing broadband issues, local governments may pursue a variety of options, ranging from simply implementing broadband-friendly policies all the way to using public assets to directly offer services to businesses and/or residents. Selecting the right broadband approach for local government is highly dependent on several factors that indicate the most appropriate option for the organization. Understanding the community needs, knowing the competitive market factors that define what infrastructure options fit well within the community, and determining organizational and operational capabilities of the local government all play into the selection process. As important is an understanding of the financial commitments and risk and reward that participating organizations are willing to support to fund and sustain a successful broadband initiative.

Figure 4-1. Inputs to Selecting the Right Broadband Approach



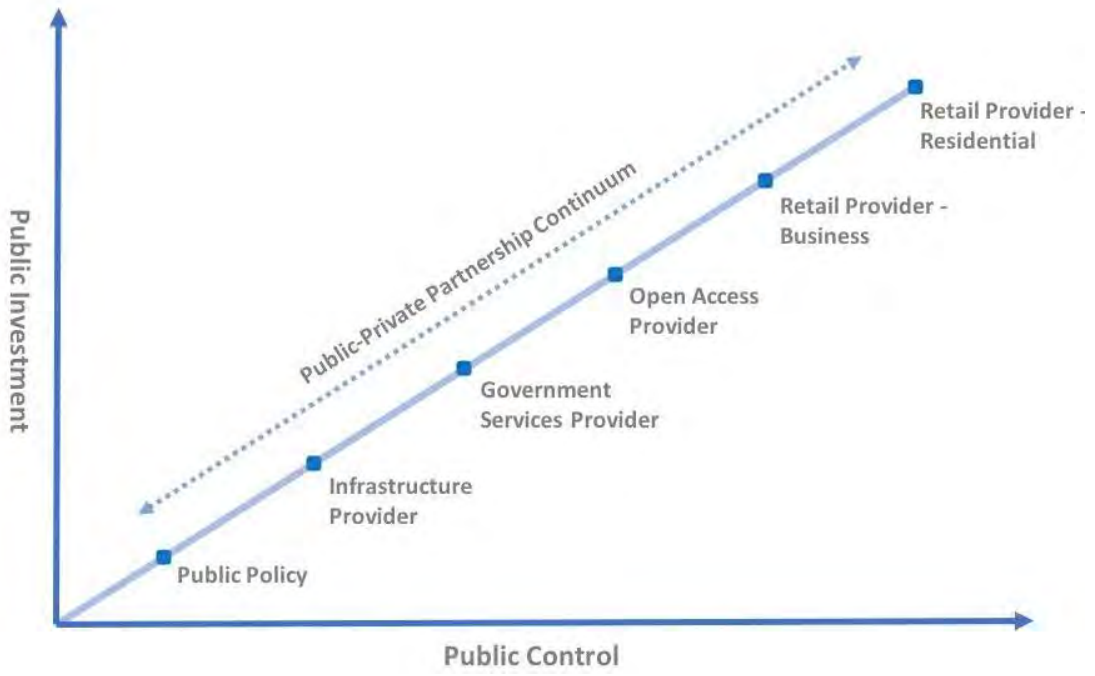
The commonly pursued approaches fall on a continuum that ranges from low risk, low investment options to higher risk, high investment options. Figure 4-2 (below) illustrates this continuum. Moving along the continuum of approach options involves

increasing degrees of risk and reward: risks in terms of financial, operational, and regulatory risk; rewards in terms of community benefits, revenue generation, and over potential for profit. Moving "up" the continuum generally requires increasing levels of investment and implies greater local government participation in the delivery of broadband services.

Public policy and infrastructure only options are considered "passive" business models, where the government does not operate a broadband network as compared to "active" models such as Government Services Providers, Open Access Providers, and Retail Provider Options, where the government operates a broadband network. Public-private partnerships are not classified as a specific business model but instead fall along the continuum because these partnerships take many forms. Local governments must determine which business models meet their organization's risk/reward tolerance to achieve the community's broadband goals.

The table below displays this continuum, ranging from a government acting only in a public policy capacity all the way up to acting as a retail service provider for residents and businesses, which requires more public investment and increases public control.

Figure 4-2. Continuum of Municipal Broadband Approaches



In many cases, multiple options may be selected by an organization; however, in some cases, a local government will not utilize multiple models, as they may conflict with one another. For example, local governments generally implement broadband-friendly public policy with any of the business models, as these policies will complement all other business model options. Conversely, a local government would

not likely implement a retail model and public-private partnerships together, as these would lead to competition between the local government and one or more private partners.

The figure below illustrates the differences among the commonly used approaches that could be enacted by the County to address the issues indicated in this Assessment. While there are variations of each model, they generally fall into the categories described. Specific examples are provided in Appendix B of this Assessment.

Figure 4-3. Comparison of Municipal Broadband Business Models

COMPARISON OF BROADBAND BUSINESS MODELS							
	Government Passive Models			Government Active Models			
	Public Policy Only	Infrastructure Only	Public-Private Partnerships (P3)	Public Services Provider	Open Access Wholesale	Retail Provider Business-Only	Retail Provider Residential & Business
Services Provided	None	Dark Fiber Only	None	Dark Fiber, Transport, Internet, Phone	Transport	Internet & Phone	Internet, TV, Phone & Value-Added Services
Customers	None	Broadband Providers	None	Public Organizations Only	Broadband Providers	Businesses	Businesses & Residents
Funding Required	Low	Moderate	Low to High	Moderate	Moderate	High	High
Competing with Broadband Providers	No	No	No	No	No	Yes	Yes
Operational Requirements	Low	Low	Low	Low	Moderate	High	Very High
Regulatory Requirements	Low	Low	Low	Low	Moderate	High	Very High
Revenue Generation	Low	Low	Low to High	Low	Moderate	High	Very High
Operational Costs	Low	Low	Low	Low	Moderate	High	Very High

Financial Risk	Low	Low	Low	Low	Moderate	High	Very High
Execution Risk	Low	Low	Moderate	Low	Moderate	High	Very High

Based on the dearth of available County-owned broadband infrastructure and the uncertainty of demand, Alameda County should consider a low-risk, passive model that includes implementing broadband-friendly policy, coordinating with providers for use of existing assets, and incrementally expanding assets through joint build opportunities. The opportunities recommended by this Assessment do not require significant investment, but still take advantage of opportunistic public-private partnership options to enhance the state of broadband throughout the urban unincorporated areas.

CRITERIA FOR PARTNERSHIP EVALUATION

The County should engage with parties such as Common and Zayo that have expressed interest in partnering to expand broadband in the study area. To capture all of the available options, an RFP may be developed in which respondents are asked to submit information about their assets, business models, construction plans, and other details about proposed agreements.

There are several guidelines that the County should consider when evaluating opportunities for partnerships with telecommunications providers. These include:

Benefit to the Community: Ultimately, partnerships with the private sector are strongest when they provide as many benefits as possible to the community. Providers may be willing to provide no- or low-cost services to areas in need, small businesses, or public spaces such as libraries that benefit students with no broadband at home. Support for Smart City applications may also be offered. Community benefits such as these should be weighed heavily during the evaluation process.

Non-Exclusivity: The County should not enter into any exclusive agreements. Non-exclusivity allows for a more competitive environment in which the County can partner with multiple entities to get the most benefit from use of assets.

Cost Savings for County Operations: Proposals that include connecting County facilities to reduce telecommunications expenditures could be highly advantageous. Many partners in similar agreements have been willing to connect County facilities at no cost, sometimes even handing over ownership of assets such as fiber strands. Such arrangements should be strongly considered.

New investment and infrastructure: Where possible, the County should give preference to providers who are deploying new infrastructure to reach unserved locations. The two simple reasons are that (a) this represents new investment rather than using legacy infrastructure to avoid additional costs and (b) new infrastructure will be better aligned with public interests, higher-capacity, and more reliable. The County should also consider whether providers will bring jobs and training to the local economy.

Construction Methods and Timelines: Some partners may propose quick, minimally invasive construction methods to speed deployment and lower costs. Magellan strongly recommends that Public Works take part in discussions about the specifics of these construction methods and that timeframes for deployment are specifically stipulated in contracts to ensure that County roadways are properly restored and that the community is not inconvenienced by drawn out construction.

Revenue Sharing or Compensation for Use of Assets: Partners may offer revenue sharing for the use of County assets such as conduit. The percentage will vary depending on the terms of the agreement and the specific assets in question. In any case, as with all proposals, revenue sharing estimates should be heavily vetted including assumptions for take rates and ramp periods and should be evaluated against fair market rates for the use of County assets.

OPPORTUNITIES FOR ENHANCING BROADBAND IN URBAN UNINCORPORATED ALAMEDA COUNTY

It is recommended that Alameda County take action to ameliorate the state of broadband in its urban unincorporated areas. There are several strategies that should be pursued to address these issues. These options are "low-hanging fruit" that capitalize on existing assets and relationships and do not necessitate large investments of public funds. They include developing a Broadband Task Force, implementing broadband-friendly policies, entering public-private partnerships with broadband providers for the use of County assets, creating a Broadband Infrastructure Program, and leveraging regional partnerships to reach shared goals.

County Broadband Task Force

The County should consider developing a diverse group of representatives from a variety of departments and agencies to create an Urban Unincorporated Area Broadband Task Force that will oversee initiatives to address broadband concerns in these specific areas. The Broadband Task Force may be a subset of the County's existing broadband group and its members should consist of staff from the County's Community Development Agency, IT, Public Works, General Services Agency, utilities, transportation agencies, and public safety organizations, with an

emphasis on the urban incorporated areas outside of the larger cities like Hayward and San Leandro. The Urban Unincorporated Area Broadband Task Force should meet regularly to review and direct broadband initiatives, as well as gathering input from the community about their diverse and changing needs.

Digital inclusion strategies should also be considered. Some examples include:

- Connecting schools for youth development programming
- Providing students with Chromebooks and iPads for homework programs
- Internet workstations in libraries and public facilities
- My Wi-Fi check out programs in public libraries
- Maker spaces in public libraries
- Meeting and conference rooms in libraries for small business development and video conferencing
- Public internet, video editing, music editing and homework programs in computer labs at parks, schools and libraries
- Virtual doctor visits in low income housing unit community rooms
- After school youth development programs sponsored (fiber and Wi-Fi connection) by local government and conducted by the Girls & Boys Clubs of America and/or other after school programs in the area
- Discounted broadband for low income housing families that qualify for life-line or universal access programs under state utility regulations by the CPUC
- State and Federal mandated subsidy programs for rural broadband connections, end user equipment loans, opportunity zones and marginalized populations
- Community Block Grant Funding (CDBG) programs for economic development
- Youth and Adult Technology Training Programs such as Girls that Code and Code for America

Implementing Broadband Friendly Policies

Dig Once

"Dig Once" can be defined as policies and/or practices that foster cooperation among entities (especially utilities) that occupy public rights-of-way, to minimize the number and scale of excavations when installing infrastructure (especially telecommunications[15]) in public rights-of-way. Dig Once has numerous substantial benefits, including promoting and supporting the placement of broadband infrastructure (e.g., fiber-optic cable and conduit), reducing the consequences and

[15] Many utilities are "monopolistic" providers (such as gas, water/sewer and electric) but there are a number of telecommunications providers that seek permission to encroach on public rights-of-way, including cable TV companies, competitive telecommunications companies, and wireless communications companies.

disruptions of repeated excavations (traffic disruption, road deterioration, service outages, and wasted resources), and enhancing service reliability and aesthetics.

Dig Once accomplishes the goal of minimizing costs of constructing separate trenches and facilities – via shared costs of construction. The cost savings are significant. The Federal Highway Administration estimates it is ten times more expensive to dig up and then repair an existing road to lay fiber, than to dig support structure for fiber (e.g., conduit) when the road is being fixed or built. According to a study by the Government Accountability Office, "dig once" policies can save from 25-33% in construction costs in urban areas and approximately 16% in rural areas.[16] In addition, development of Dig Once standards and guidelines for deployment of conduit and fiber will facilitate economic development and growth, as it enables cost-effective staged or gradual deployment of broadband infrastructure by local authorities.

Dig Once implementation requires revision to the planning and coordination process for construction projects in the public rights-of-way. When subsurface utility work occurs, it presents telecommunications providers, other utilities, and the County itself to install new fiber in the right-of-way at reduced costs via coordination of work This enables both private and public organizations to expand their ownership of fiber anytime subsurface utility work occurs, at preferential costs to new construction.

The concept can also extend to required placement of conduit whenever the ground is opened, as expressed in recent Congressional legislation. This concept was embodied in the Broadband Conduit Deployment Act of 2018, which required the inclusion of broadband conduit during construction of any road receiving federal funding.[17]

The cost of deploying broadband infrastructure such as conduit and fiber throughout sections of urban unincorporated Alameda County could be significantly lower if the County considers installing conduit and fiber during planned Capital Improvement Projects (CIPs) such as the streetscaping project on East 14th Street and Hesperian. As one of the three major commercial corridors in Unincorporated Alameda County, this location would be a prime target for taking advantage of ongoing construction if the ground is already being excavated for other reasons.

16 https://eshoo.house.gov/issues/economy/eshoo-walden-introduce-dig-once-broadband-deployment-bill
17 The Broadband Conduit Deployment Act of 2018, H.R. 4800, January 16, 2018.

The County could also consider making placement of conduit a requirement for development agreements to ensure that new buildings have the makings of communications infrastructure before they are completed.

Specifically, Magellan recommends placement of two 2-inch conduits anytime work is being conducted in the public right-of-way at a depth of at least 24 inches.

The County should also evaluate its permitting processes for telecommunications providers seeking to work in the public right-of-way. Consideration of lowered permitting fees, in-kind asset exchanges, and other considerations could be made to lower barriers to entry and to become a partner, rather than simply a regulator, with private organizations that are attempting to improve the broadband environment.

Use of County Assets

Rather than building new broadband infrastructure, Alameda County can use its current assets including conduit and above-ground assets such as rooftops and hilltops to encourage investment by private providers. Public-private partnership arrangements for the use of such assets as well as potential in-kind negotiations for lowered permitting fees and joint build opportunities could significantly lower the cost of entry for new broadband providers in the region. By simply leveraging existing assets and those of other potential public partners such as schools, the County could stimulate a more competitive broadband environment, to the benefit of both businesses and residents of urban unincorporated Alameda County.

In the course of conducting this study, Magellan has identified at least two interested parties, both of whom already have a presence in surrounding areas and have a track record of partnering with local governments. Zayo, a national internet service provider with some existing assets in the area, is interested in the use of conduit assets and traffic signal interconnect to expand its market to urban unincorporated Alameda County. Common Networks, a wireless provider that offers residential broadband to unserved and underserved markets, is already serving small sections in the western part of the urban unincorporated County in parts of Ashland and San Lorenzo and has expressed interest in partnering with Zayo as its backhaul provider to extend that footprint.

This study strongly recommends that, in addition to implementing broadband-friendly policies, the County engage in discussions with Zayo and Common Networks to attract their investment in the areas in question. In summary, next steps for the County should include:

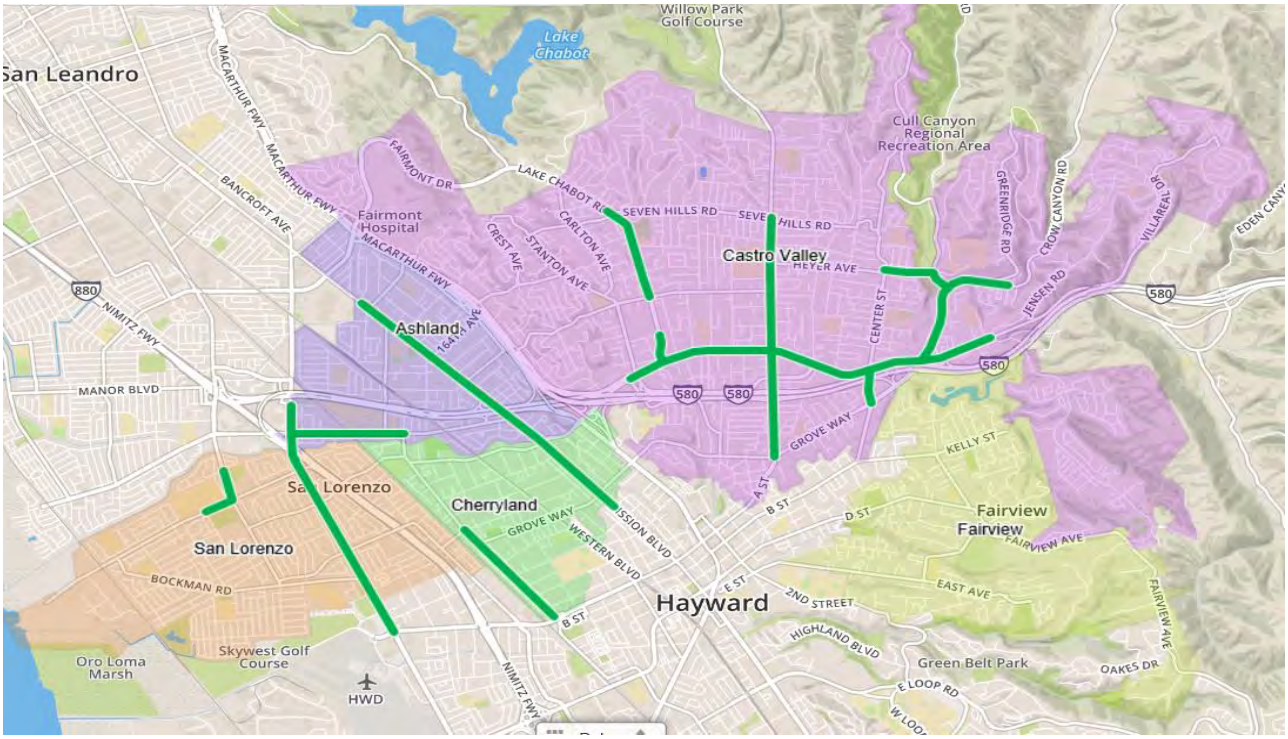
Conduit

As seen in the figure below, the County has traffic signal interconnect in several locations within the study area, including along Castro Valley Boulevard and

Hesperian Boulevard. Although the traffic signal interconnect is copper rather than fiber, the conduit that contains the copper is still valuable. The County's General Services Agency also indicates that there is existing County-owned conduit on Grant Avenue (Via Seco to UPRR) and plans existing to install additional conduit along East 14th Street (162nd to I-238) and Hesperian Boulevard (I-880 to A Street).If conduit is available in these locations, it could be leased to telecommunications providers at reasonable market rates to encourage their investment.

Zayo, a nationwide internet service provider that frequently deploys fiber for commercial and residential backhaul, has expressed the desire to speak further with the County about the use of its conduit assets, particularly to access potential subscribers at the corner of Redwood Road and Castro Valley Boulevard. Such an expansion of Zayo's infrastructure has the potential to provide the many businesses on Castro Valley Boulevard additional options for internet service, improving the state of broadband in a key commercial corridor.

Figure 4-1. County Traffic Signal Interconnect



Vertical Assets: Rooftops, Hilltops, and Poles

In addition to its valuable conduit assets, the County may also leverage vertical assets such as rooftops, hilltops, and even field lighting in parks. Such locations are ideal for deploying wireless connectivity, especially in residential areas, which can then be backhauled to fiber. The price for deploying this type of infrastructure is generally much lower than deploying fiber and such technologies are likely to be

sufficient for residential and small to medium-sized business subscribers in these areas.

Generally, companies that would be interested in bringing this technology to locations like urban unincorporated Alameda County look for vertical assets that provide line of sight to their end users. They can deploy from anything from a rooftop to a pole fixture, although to build a robust network, rooftops of buildings that are four or more stories are ideal.

Common Networks, a local wireless internet service provider, has expressed interest in expanding such infrastructure into the study area. Indeed, Common already serves portions of Ashland and San Lorenzo, as well as partnering with neighboring San Leandro. They are particularly interested in using rooftops of County facilities and schools in residential neighborhoods; at this point, Common's business model consists of mostly residential customers, but they do serve some small businesses and are exploring the possibility of serving more commercial entities.

Common Networks and Zayo have a history of working both with each other and with other local governments in California to deploy infrastructure that improves broadband services in communities. Both companies have expressed interest in engaging Alameda County in discussions about a network design that would alleviate many of the issues identified in this Assessment. Magellan encourages the County to engage in those discussions to further investigate arrangements that could be mutually beneficial for all parties, including businesses and residents.

Broadband Infrastructure Program

The County should begin to formalize a Broadband Infrastructure Program ("BIP"), focused on the broadband issues identified in this Assessment and solutions such as monetizing any assets that are available. Local governments across the United States, and in California specifically, are developing these types of infrastructure programs to drive new revenues and to support broadband investment within their communities. These revenues may be generated from leasing conduit and vertical assets such as rooftops, streetlights, and towers.

To formalize this program, the County should take the following steps:

- Document and maintain an inventory of available assets and their condition
- Develop and standardize agreements for conduit leasing
- Develop pricing policies for conduit leasing
- Publish rates and terms
- Create an enterprise fund to maintain proper budgets, cost accounting, and to track revenues of the program

These actions will indicate that the County is committed to improving broadband in its urban unincorporated areas and will allow the County to take measured steps to address the issues without needing to make additional investments.

In the future the BIP may be used to explore and implement more active approaches to resolving broadband issues in the County. For instance, the County's BIP could consider reinvesting funds received for the use of County assets into building out additional County-owned conduit or fiber, particularly when joint build opportunities exist that will significantly reduce the cost of construction.

Regional Partnerships

In addition to providers like Common and Zayo, the County has municipal partners in the region that could provide opportunities to improve broadband in urban unincorporated Alameda County. Both the cities of San Leandro and Hayward have fiber assets and are undertaking their own broadband programs.

The City of San Leandro has expressed a willingness to partner with the County to address broadband issues in the region. The City may serve as the connector and provide access to an internet point of presence ("POP") in Oakland for the urban unincorporated areas of Alameda County. This would relieve providers from having to build a connection all the way to Oakland; they could go through San Leandro instead. This could help companies such as Common use San Leandro's assets that they already use for San Leandro to build wireless connections in the urban unincorporated areas of Alameda County.

We encourage the County to continue discussions with San Leandro, as well as engaging Hayward about possible partnership opportunities. If not currently doing so, the County should ensure that the interests of these areas are represented at regional consortiums of local governments to further improve broadband.

RECOMMENDATIONS AND NEXT STEPS

1. Create a diverse Urban Unincorporated Alameda County Broadband Task Force to direct efforts to address broadband issues in urban unincorporated Alameda County.
2. Formalize broadband-friendly policies including a Dig Once policy, allowing coordination for joint build opportunities to realize cost savings of building new infrastructure.
3. Add 2" conduit when performing any capital projects or other work in the PROW for future deployment of fiber.

4. Create a Broadband Infrastructure Program to inventory and track broadband assets throughout the County. If appropriate, conduct an assessment to determine usability of existing assets.
5. Develop a rate structure and consider in-kind opportunities for the use of assets such as conduit, hilltops, rooftops, and other vertical structures.
6. Collaborate with surrounding municipalities such as San Leandro and Hayward to leverage regional partnerships that could enhance the broadband environment.
7. Engage with potential public partners such as the school district regarding the use of their assets to attract investment.
8. Continue participating in the regional public sector broadband forum, comprised of officials from the County, cities and utilities to further the expansion of broadband assets and investments.
9. Continue discussions with Common Networks, Zayo and other interested parties to further explore public-private partnership opportunities. Consider releasing an RFP to collect information from interested parties about partnership models.

Appendix A: Glossary of Terms

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.
5G – Fifth Generation	The coming fifth generation of mobile broadband technology, used by smart phones, tables, and other mobile devices to access the web. Distinguished from previous generations by network densification through the use of "small cell" wireless devices that carry large amounts of data over short distances.
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.
Dark Fiber	Refers to fiber infrastructure that has not yet been "lit" by equipment installed at its terminus. Dark fiber can be provided to entities that have their own equipment; lit fiber is usually actively managed by the owner or a third party.
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.
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.
Transport	Physical connections to infrastructure to interconnect the local network back to the larger internet
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.

Appendix B. Business Model Examples

Policy Participation Only

Public policy tools influence how broadband services are likely to develop in the community. This includes permitting, right-of-way access, construction, fees, and franchises that regulate the cost of constructing and maintaining broadband infrastructure within a 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: Fairfield, CA

The City of Fairfield is in the process of developing a series of broadband policies including a Dig Once ordinance, Telecommunications Ordinance, Master License Agreement for placement of wireless infrastructure, and Design Standards & Guidelines for small cell wireless facilities. These policies will drive conversations with providers who are interested in expanding their infrastructure and others doing work in the public right-of-way to allow the City opportunities to advocate for investment in key areas. Much like Alameda County, the City will take advantage of joint build opportunities to incrementally develop its own broadband infrastructure, which may allow Fairfield to enter into a more active broadband model in later years.

Infrastructure Provider

Local governments can lease and/or sell 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 utility 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 that time, the City has been licensing use of that fiber, which is currently bringing in additional revenues of more than $2 million per

year. Palo Alto has earmarked the revenues from these assets for additional fiber investments, which will allow it to realize even greater revenues and to increase broadband competition in the City into the future. "

Government Services Provider

A government service provider uses its fiber-optic network to interconnect multiple public organizations 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 connectivity and often, the municipal network provides higher capacity at lower costs than these organizations are able to obtain commercially. Municipal and utility 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, government service providers may be cities, counties, or consortia that build and maintain the network. The providers 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 department 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.

Open-Access Provider

Local governments that adopt open-access generally own 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" to service providers interconnecting with the 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 providers to utilize in order to connect their customers. It allows municipalities to provide an aggregation of local customers on a single network that they are able to compete for and 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 retains neutrality and non-discriminatory practices with the providers who operate on the network. The municipality establishes a standard rate structure and terms of service for use by all participating service providers. The City of Vallejo is a local example of an open access model.

Example: City of Palm Coast, FL

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 $2 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, while generating over $500,000 annually in new outside revenue generated from use of the network.

Retail Service Provider – Business Only

Municipalities that provide end users services to business customers are considered retail service providers. 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 providing 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. The City

of San Leandro is a local example of a retail service provider offering services to businesses.

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 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.

Full Retail Service Provider – Business & Residential

Local governments that provide end user 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, 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. 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.

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.

Public-Private Partnership (P3)

A broadband public-private partnership is a negotiated contract between a public and private entity to fulfill certain obligations to expand broadband services in a given area. In recent years, P3s have been increasingly implemented as more municipalities employ public broadband and utility infrastructure in conjunction with private broadband providers. P3s 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 forgo the "getting into the business" of providing retail services and instead, make targeted investments in their broadband infrastructure, and make it available to private broadband providers with the goal of enhancing their communities. In this type of model, the local government would be considered an Infrastructure Provider who maintains permanent ownership interest in the broadband infrastructure (e.g., conduit and perhaps dark fiber) that is funded by the local government for a "piece of the action", generally a negotiated revenue share paid by the provider.

Example: The Covenant of Rancho Santa Fe, CA

The Covenant of Rancho Santa Fe (RSF) was established in 1928 as a country residential community located in San Diego County, CA. Today it is one of the most exclusive, beautiful, and desired rural communities in the country. The community includes a world class golf course and over 1,800 homes with an average home price of approximately $3 million. Several years ago, RSF requested an upgrade to its telecommunications facilities, specifically asking for a FTTH build. Its incumbent providers agreed, however requested that RSF pay the capital required to build out the network which was estimated at $20 million at the time. The RSF Board declined their offer, and instead undertook a FTTH Feasibility Study that outlined the options available to bring fiber-based service offerings to its community. Since the study was completed, RSF has decided to self-fund the buildout, maintaining long-term ownership of this very important community asset, and has embarked on the process to develop a Public Private Partnership. RSF has identified numerous potential partners that would operate the network while providing its residents, businesses, and anchors with state-of-the-art fiber-based telecommunications services.

COMMENTS FROM PUBLIC WORKS / BILL LEPERE:

1. What are the next steps in this process. It would appear to me that there should be a plan for roadway location, conduit size, and conduit type to be either installed or planned. If not we would run into the same issue we have with curb & gutter and sidewalk locations at different locations along the roadways.

Next steps are included on pages 55-56 of the report. We have added details about conduit size and placement (two 2" conduits on any project in the PROW at least 24 inches deep).

2. The dig once policy sounds good but is there an actual policy in policy in place?

Magellan was informed by the County that there may be a Dig Once policy in place. However, if that policy has not been formalized and is not actually in practice, the County should formalize and implement as soon as possible. This is detailed in the Recommendations.

3. The plan recommends a "low Risk Passive" model but I'm having trouble seeing in the report how that is defined. The report should clearly define what is being recommended.

The low risk, passive model being recommended includes policy, working with providers by allowing them to use assets, and gradually expanding County-owned assets when joint build opportunities arise. This has been clarified in the report.

4. It makes sense to partner with an existing fiber optic firm. How that firm is selected should be briefly described in the report.

This will depend on County procurement practices, but we have added a section on considerations for choosing a partner. The County may choose to enter into agreements with interested parties such as Zayo and Common after discussions about partnership opportunities, or it may choose to collect additional information during an RFP process. In either case, the County should consider partners offering maximum benefits to the community.

5. The report recommends use of county infrastructure such as rooftops, street lights, SCADA repeater stations to send information. My assumption is the next step would be to perform an assessment of county infrastructure and how it can be utilized.

The County may see fit to perform such an assessment if the condition and/or exact location of these assets is unknown. This has been added as part of the recommendation for keeping an inventory of assets.