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Final

A scenic landscape photograph of Sonoma County, California, showing rolling hills, a winding river, and vineyards in the foreground. The image is overlaid with a semi-transparent blue and white geometric design in the top right corner.

# SONOMA COUNTY BROADBAND STRATEGIC PLAN



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## 1 BACKGROUND

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The Sonoma County Board of Supervisors recognizes that broadband is critical for the economic growth of Sonoma County; as, the lack of broadband connectivity in many communities throughout Sonoma County directly impacts economic development in various industries, including: public safety, healthcare, agriculture, education, private businesses, public agencies, and more. Broadband access can attract new businesses, improve existing businesses, connect public safety agencies and officials to communicate and respond to natural disasters and create employment in rural communities. The Broadband Strategic Plan describes opportunities and recommends high level actions for Sonoma County to enhance public and private investment in broadband infrastructure and strengthen its economic competitiveness.

The Broadband Strategic Plan recommends the County consider the action items contained in “Conclusions and Next Steps” to address broadband issues. These action items include the following:

- Appoint a Sonoma County lead county-wide advisory board consisting of county, city and industry officials to lead and coordinate implementation of the Broadband Strategic Plan.
- Create a database of publicly-owned assets (towers, buildings, parks) that could be used to locate broadband facilities.
- Develop a broadband infrastructure program leveraging municipally-owned assets to meet needs and demands of agencies and benefit the greater community.
- Formalize broadband friendly policies, procedures and regulations, and incorporate best practices into county projects including roads, water, sanitation and parks.
- Work proactively with telecom providers to construct high quality and resilient wireless communication systems to facilitate emergency communications throughout the County.
- Work collaboratively with telecom providers to expand and deploy broadband infrastructure to service rural and underserved areas.
- Consider options to fund broadband expansion to rural areas including grants, public private partnerships and special tax districts.



- Consider constructing a publicly-owned broadband infrastructure system connecting County and other municipal facilities as part of Recovery and Resiliency Programs.
- Hire a full-time county employee dedicated to the coordination of all activities between federal, state, county, city, unincorporated areas as well as industry officials necessary for the BSP implementation process.

## OUTCOMES:

Some of the anticipated outcomes by implementing the recommended action items include creating and enhancing:

- Resilient high-quality public safety and communications systems
- Telemedicine and healthcare development
- Precision Agriculture and AgTech Innovation
- Distance learning and increased education rates
- Business expansion and operating efficiency
- Smart City applications
- Smart Homes and sustainable living
- Innovation Districts and technical workforce attraction
- Programs to further close the Digital Divide and connect unserved communities

The Broadband Strategic Plan was funded in part by a grant from the California Public Utilities Commission, the Sonoma County Water Agency, Sonoma Clean Power and the County Economic Development Board. Magellan Advisors, a municipal broadband consultant, prepared the Broadband Strategic Plan. Work on the Strategic Plan included conducting the following outreach:

- Focus group meetings with major economic clusters and all five county districts;
- Interviews with public and private organizations and officials;
- Advisory committee meetings;
- County wide business surveys.



Magellan has expertise from broadband projects they have worked on across the nation and is aware of the many best practices municipalities can pursue to develop broadband services effectively. Content in the Strategic Plan derived from data collected in the consultant’s outreach, which lead to the recommendations contained in the section “Conclusions and Next Steps.”

The Broadband Strategic Plan is a collaborative effort and includes input and data from dozens of locally and nationally established public/private organizations. The Broadband Strategic Plan has incorporated input from the various stakeholders listed below:

- Santa Rosa Junior College
- Sonoma State University
- Sonoma County Library
- West County Health Services
- Sonic
- Comcast
- AT&T
- Verizon
- Frontier
- Race Communications
- CENIC
- California Public Utilities Commission
- Federal Communications Commission
- California Emerging Technology Fund
- United States Department of Agriculture
- North Bay North Coast Broadband Consortium
- Sonoma County Farm Bureau
- Sonoma County Office of Education
- Sonoma County Sherriff’s Department
- Sonoma County Information Services Department
- Santa Rosa Fire Department
- Sonoma County Permit and Resources Management Department
- Sonoma Water
- Sonoma County Transportation Public Works Department
- Sonoma County Office of Recovery and Resiliency
- County of Mendocino
- NUCCE
- Farm Trails
- Access Sonoma Broadband
- North Bay Business Association
- Town of Windsor
- City of Santa Rosa
- City of Petaluma
- City of Sonoma
- City of Healdsburg
- City of Cloverdale
- City of Cotati
- City of Rohnert Park
- City of Sebastopol



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## 2 EXECUTIVE SUMMARY

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### 2.1 Introduction

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Progressive communities and rural regions across the United States are increasing their reliance on local government investments, and federal/state funding to expand high-speed internet services in their areas. Urban municipalities are investing in broadband infrastructure assets to connect government facilities, to increase digital adoption, and to support the roll-out of Smart City/Internet of Things (IoT) technologies; while rural areas are simply trying to achieve 2018 broadband speeds for the basic benefit of its citizenry.

As constituents continue to adopt new digital platforms, more emphasis is being placed on meeting the growing demands for bandwidth, protective network redundancy and more competitive pricing. Yet rural areas lack basic connectivity. Communities and regions that have invested in fiber infrastructure are reaping the economic benefits of these assets and are leveraging them to bring next-generation broadband to their residents, businesses, and governmental/community support organizations – looking for ways to provide near ubiquitous/uniform access.

Through its Access Sonoma Broadband Program, the Sonoma County Economic Development Department has been “working on broadband” for many years. And while great progress has been made, a new planning direction, and approach to local broadband investment is recommended. Sonoma County Economic Development Board published a Connectivity Report in 2001-2002, and in 2016, a North Bay North Coast Broadband Consortium<sup>1</sup> “NBNCBC” Regional Middle Mile Backbone Fiber Project Feasibility Analysis was conducted which identified a long-haul middle mile network connecting the communities along the 101 corridor. This analysis was conducted by the NBNCBC, with an intent to “provide an order of magnitude investment level with sufficient detail regarding specific routes to develop a realistic and workable plan for providing high-speed digital connectivity” between these communities. The Sonoma County Economic Development Board published the *Strategic Sonoma* Action Plan which recommended a project advocating for the County to work to increase mobility by closing the digital divide. “Broadband may not initially appear to serve mobility, but technology continues to change how we access services.

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<sup>1</sup> The NBNCBC is a planning and advocacy organization consisting of Marin, Sonoma, Mendocino and Napa Counties. It is governed by an Oversight Committee consisting of supervisors from member counties and funded by a planning grant from the California Public Utilities Commission.



Increasingly, many individuals are able to telecommute, have groceries delivered, and even receive medical care and monitoring remotely. To ensure all residents can participate in the digital economy and use technology to age in place, expanding broadband infrastructure across the county must be a priority.<sup>2</sup> This Broadband Strategic Plan will assist the County in furthering these efforts.

Other counties in California are taking innovative approaches. As shown in the table below, local governments are directly investing in broadband infrastructure, while others are looking to public-private partnership “P3” agreements. Riverside County, CA is recognized as the 10<sup>th</sup> largest county in the United States and is home to 2.2 million people. In 2017, RIVCO Connect, a Riverside County Initiative, supported by the Riverside County Board of Supervisors, and led by Riverside County Information Technology “RCIT,” developed a Broadband Strategic Plan, and a follow-on RFI, which sought to form strategic partners with industry to bring next-generation broadband to every premise in the County. They received six innovative proposals, however, plans have stalled due to the inability to reach any agreement. RIVCO recognizes they “went big,” but the process sparked a renewed interest, and a greater discussion about connectivity – which Riverside believes is important.

There is no single right answer, and every community can take a different approach. Ownership and control of the assets can provide communities, and local governments, with the necessary tools to affect the improvements sought. Sonoma’s cities, like Healdsburg, Petaluma, and Santa Rosa are actively engaged in planning and deploying fiber-optic and wireless networks and have stated goals in leveraging these assets.

The Broadband Strategic Plan recommends the County initiate development of a framework by which it can make incremental investments into existing public assets and engage more efficiently with the telecommunications industry. Sonoma County and its governmental/community agencies currently contract for leased lines by incumbent providers. These contracts account for millions of dollars that are paid to national providers each year, which could otherwise be invested locally through key partnerships and under the right business case. Many community anchor institutions currently contract for high-speed broadband delivered by fiber; however, they report the need for more bandwidth and increased resiliency, unfortunately in many cases, the costs can be prohibitive under current commercial arrangements.

This Broadband Strategic Plan is meant to provide Sonoma County with strategic direction, and specific Action Items and Initiatives which will support the greater deployment of broadband infrastructure throughout Sonoma County, while identifying a supportive governance structure. To achieve those goals, the County and its partners (i.e. cities, community anchor institutions, public agencies) should focus on

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<sup>2</sup> Avalanche. (2018) *Strategic Sonoma* Sonoma County Comprehensive Economic Development Strategy. p. 54. Retrieved from <https://www.strategicsonoma.com/>



governance and the internal organization of how it can operate and expand a broadband program, and more importantly maintain ownership of these vital assets. The Plan recommends the development of a publicly owned middle-mile network, built primarily from the interconnection of County facilities, and strategic sites. Finally, while County investment is a necessity, strategic partnerships with industry are absolutely required, and further documented in this Plan’s framework.

## 2.2 BACKGROUND OF MUNICIPAL BROADBAND<sup>3</sup>

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Sonoma County and its communities are capable of internally organizing and planning to make strategic investments in broadband infrastructure. A resulting opportunity from those investments are County-owned assets that could pay dividends for decades to come. While municipally owned fiber networks can be a big leap for counties and cities, this infrastructure will support and enhance new middle-mile infrastructure<sup>4</sup> connecting community anchors and providing new capacity and assets to the individual communities throughout Sonoma County. In addition, these investments will form a community owned backbone capable of meeting the communications and technology needs of government, while supporting greater innovation throughout the Sonoma County community.

Broadband investments will become a key resource that Sonoma County, in partnership with the private sector, will leverage to drive value across a range of governmental and community functions from healthcare, to economic development, as well as bridging the digital divide and providing an overall better quality of life to Sonoma County residents. Municipal-based investment in telecommunications assets will allow the County and its communities to make decisions on how their communities are best served, including decisions around network speeds, content partners, and last-mile infrastructure buildout plans.

Sonoma County should look to an appropriate business case to support the funding required to begin connecting its facilities, using the savings from disconnecting leased line services to fund any required debt service. The County would then make its excess network capacity (conduit, fiber, and other vertical assets) available, to generate additional revenue streams, and possibly to forge new P3 relationships.

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<sup>3</sup> Municipal or community broadband refers to broadband policies, initiatives or infrastructure taken on by any municipal organization. These range from dig once policies, coalitions, infrastructure for municipal uses, P3 agreements, to municipals providing services to businesses and/or residents. Community and Municipal Broadband can be considered as synonymous terms.

<sup>4</sup> Middle Mile Infrastructure - The list of interconnection points between the service provider and the Internet backbone. These connections are capable of very high bandwidth, speeds, and capacities and may be service assured.



These network assets are foundational to a “connected” Sonoma County community and will place local leaders into the driver’s seat when it comes to driving future investments in telecommunications assets and determining optimal services and service levels. Today, nearly all investment decisions are made by incumbent providers at the national level, even while most rural deployments and upgrades are funded through subsidized taxpayer dollars, such as the FCC’s Connect America Fund Phase II (CAF II) and Mobility Fund Phase II, the California Advanced Services Fund (CASF), and others.

Fiber is the gold standard for community/government communications, broadband services, and Internet access. Fiber is used to transmit large amounts of data securely over long distances with high reliability. It is flexible enough to support a wide range of applications and scalable enough to support nearly unlimited capacity and speed. It is considered a capital infrastructure asset like water, road, and electricity and has a lifespan of up to 50 years or more with the proper installation and maintenance.

Thousands of cities, counties and communities in the US own some form of municipal fiber network and have used it for decades to support their operations. These networks are becoming increasingly important to cope with the rapid growth in connected devices. These devices run the gamut from utility assets and street lights, to traffic signals and surveillance cameras. Cities that maintain these networks are able to accommodate these “smart city” technologies which allow them to be more efficient, reducing costs, while increasing the overall value they deliver to their constituents.

Within the past 15 years, many cities and counties have expanded the use of these networks to enhance local broadband services in their communities. As broadband has become a key asset to support economic development, education, healthcare, and other community functions, communities have leveraged their networks to foster fiber-based broadband services, either directly, or more often through partnerships with their local broadband providers.

The US Chamber of Commerce made the support of public-private broadband partnerships a “2016 Public Policy Priority.” Organizations such as Smart Cities, The Intelligent Community Forum, and Next Century Cities have organized to share the successes of public-private initiatives and to promote public engagement and oversight.

Table 1 showcases various municipal broadband models being implemented in California to provide awareness of these various models. Broadband models are not one size fits all, each community is unique, requiring broadband to be implemented according to the assets and limitations of the community or organization. Table 2 highlights a number of models that could be considered as avenues Sonoma County may desire to pursue.



Table 1: California Municipal Broadband Models

Municipal Broadband Provider	Business Model	Details
<b>Hayward</b>	Economic Development	The federal government awarded a \$2.74 million grant, from the Department of Commerce’s Economic Development Administration, for Hayward to fund the design and installation of a fiber network in the industrial district. Approximately half the cost of the network.
<b>Loma Linda</b>	Municipal FTTH	In 2004, the city began requiring all new developments to have fiber connectivity built to them. 600 homes now have 5 Mbps connectivity for \$30/month up to \$100 for 15 Mbps, symmetrical. Half of the residents choose to buy their internet from the city.
<b>Brentwood</b>	Public-Private Partnership	Owns 150 miles of conduit and the network reaches 8,000 customers with services being provided by Sonic.
<b>Lompoc/Lompocnet</b>	City-wide WiFi	Municipal WiFi to residents, businesses, and organizations.
<b>San Luis Obispo</b>	Public-Private Partnership	23 miles of fiber are in place connecting 75 buildings with fiber-optic internet service. Plan to continue to expand to additional businesses and residences.
<b>Rancho Cucamonga</b>	Public-Private Partnership	Owns and operates 25-mile backbone connecting city facilities. In the process of partnering with a private organization for FTTP service to the city residents and businesses.
<b>Manhattan Beach</b>	In development	City is currently working on a Fiber Master Plan to determine network build and reach.



Table 2: California Municipal Business Models for Consideration

Municipal Broadband Provider	Business Model	Details
<b>Modesto/LinkMODESTO</b>	Municipal Network	Aerial and underground fiber providing internet for city facilities for administration, public safety and utilities. Currently exploring options of expansion for additional uses including providing to businesses.
<b>Burbank Water &amp; Power/ONE Burbank</b>	Dark Fiber	Provides dark fiber and business internet services over its owned network.
<b>Dry Creek Community – Sonoma County</b>	Public-private partnership	Sonoma County is submitting for grant funding to provide the backbone conduit and searching for a P3 partnership for fiber and services. The provider will provide the last mile to business customers.

## 2.3 BROADBAND STRATEGIC PLAN

This Sonoma County Broadband Strategic Plan recommends an incremental fiber buildout strategy which the County can execute on over the next 10-year period, while reducing its long-term telecommunications expenditures, and its overall reliance on the region’s providers. The Broadband Strategic Plan is a first step in organizing the County's telecommunications governance, from which it makes the County aware of the potential opportunities it can pursue in the future. The Strategic Plan not only provides incremental fiber buildout strategies, but is also an educational tool for Sonoma County to learn of the various opportunities associated with telecommunications and technology expansion. It is meant to provide a framework by which Sonoma County and its local government partners can organize and develop governance and policy to further the advancement of broadband deployments throughout the County. Similarly, Magellan Advisors has seen this in other regional rural FTTH projects, the residents who want this next-generation service are willing to step up and fund these projects. From The Sea Ranch, to Occidental, Dry Creek, and Nicasio to the South, residents have organized, and have decided that these infrastructure improvements are worth the time and expense. These decisions, and the resulting tax assessments or increased HOA fees in The Sea Ranch and possibly Dry Creek, represent major investments for these people, yet, they’ve decided that high-speed Internet access is a requirement, and worth it. These people realize that Internet access is the Fourth Utility, and they are willing to pay for the necessary infrastructure improvements to gain their required level of service.



For many, the County’s ability to provide oversight and some level of management in the form of creating special taxing districts, or funding infrastructure improvements can accelerate this Plan’s goal greatly. The County’s current telecommunications spend of \$1.5 million (to connect 100 sites or more), will total \$60.5 million over the course of 30 years, including a modest 2% annual increase. This is a tremendous amount of money to spend on telecommunications services, and for Sonoma County – there may be a better way.

By investing in a publicly owned fiber-optic network, the County would not only enhance its telecommunications capabilities, but it would introduce new broadband infrastructure into the local Sonoma County markets, where providers could utilize these assets to enhance and expand current infrastructure.

## 2.4 FINANCIAL SUMMARY

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Management and execution of this Broadband Strategic Plan may require an additional demand for internal County resources, communities time, and outside expertise. All Action items defined in this plan can be completed through the dedication and oversight of existing resources, or local advisory committee volunteers.

No immediate capital costs are associated with this Plan. We recommend more detailed analysis of the County’s operating expense payments for internet connections compared to a high-level engineering analysis of the network cost to serve present county locations. Recognizing that such a network project would not be started and completed in one year, cost estimates for the work and related investment should be divided into phases (e.g., four). While the work is significant, investing in such a network asset likely would generate increasing financial benefit to the County even under a relatively static analysis (i.e. only the existing county locations are served, no cost increases for paying existing vendors for faster or different services is assumed, and no cost sharing or revenues from other community anchor institutions included). These estimated costs should then be spread over time assuming an appropriate municipal borrowing rate for comparison to the annual spend for the particular locations – escalated over time using an appropriate inflation factor – to assess cost/benefit. With the proper planning, final route selection, and the application of smart public policy the County could construct an initial middle-mile build and gain significant cost-benefit both financially and considering “off balance sheet” benefits. Any further expansion should be based on dig-once/joint-trench opportunities that are discovered through the implementation of effective policy, or through the development of partnerships or receipt of grant funding.



## 2.5 CONCLUSIONS AND NEXT STEPS

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Sonoma County suffers a broadband gap, primarily related to funding issues. Like other rural areas throughout the United States, it is dependent on competitive service providers willing to buildout rural fiber routes and communities based upon grant and subsidized loan programs. In short, the funding to wire rural Sonoma County is coming from taxpayers and other related state and/or federal programs.

An exception to this has occurred in The Sea Ranch and Occidental, as well as in neighboring Marin County's Nicasio, where property owners are stepping up to fund the necessary capital to build next-generation fiber to the home networks. The Sea Ranch network is owned by the homeowners' association and Gigafy Occidental is owned and operated by Race Communications. Race funded the network and ratepayers will be contributing to a portion of the payback via subscribing to the network. The funding by property owners is nothing new, in fact, many incumbent providers rely on aid to construction charges to build infrastructure where their private-sector business plan cannot support it. Aid to construction is essentially a capital pass through to the end user, which they can opt to pay in a single upfront payment, or many times, in an extended monthly recurring charge which can mirror the terms of their telecom services contract – it's essentially tacked onto the monthly bill. Unfortunately, when this occurs, and is managed through a service provider, the aid to construction fees expand the provider's infrastructure – public ownership of the assets is not granted.

Sonoma County should focus on building public infrastructure, ensuring long-term ownership is maintained by those paying for the infrastructure – the public. Long-term ownership, decision making authority over the infrastructure, how it's used, and the benefit derived from it should be controlled by those funding the efforts. This is a central theme to this Sonoma County Broadband Strategic Plan, and the action items and recommendations support this vision.

Sonoma County can accomplish the goals and initiatives documented in this Plan by organizing itself and building consensus amongst the community and potential partners to move broadband forward throughout the region, the overwhelming results leave much of the County still underserved.

This Broadband Strategic Plan is meant to provide a framework for Sonoma County and its partners to organize under, while both recommending direct public investment into broadband infrastructure, while at the same time empowering the private-sector to serve potential customers. This Plan represents an incremental fiber buildout strategy which the County can execute on over the next 10-year period, while reducing its long-term telecommunications spend, and its overall reliance on the region's providers.



Sonoma County’s Broadband Strategic Plan’s Roadmap and Action Plan include the following Action Items and Initiatives:

**Action Item 1: Redefine Advisory Board to Focus on Driving the Sonoma County Broadband Strategic Plan**

**Action Item 2: Identify Governance Structure/Lead Organization-County**

**Action Item 3: Formalize Broadband Friendly Policies and Standards**

**Action Item 4: Continue to Work Collaboratively with and to Encourage Providers to Expand Infrastructure to Serve Rural and Underserved Sonoma County**

**Action Item 5: Provide Structure and Funding for the Formation of Special Districts to Enable Broadband Expansion (taxing districts, etc.)**

**Action Item 6: Proof and Validate all Community Assets for Use in the Broadband Infrastructure Program (BIP)**

**Action Item 7: Formalize a BIP to Make Use of Broadband Related Assets**

**Action Item 8: Develop RFI, and Seek Partnerships in Meeting Stated Goals**

**Key Initiative 1: Develop County Fiber-Optic Backbone and Middle-Mile Network**

**Key Initiative 2: Expand Connections to Regional Data Centers and Colocation Facilities**

**Key Initiative 3: Equip Economic Development Areas with Fiber Connectivity**

**Key Initiative 4: Develop Last-Mile Investment Framework and Facilitate Deployment of Next Generation Broadband Service**

**Key Initiative 5: Identify Community Partners and Funding Sources to Expand the Network Opportunistically**

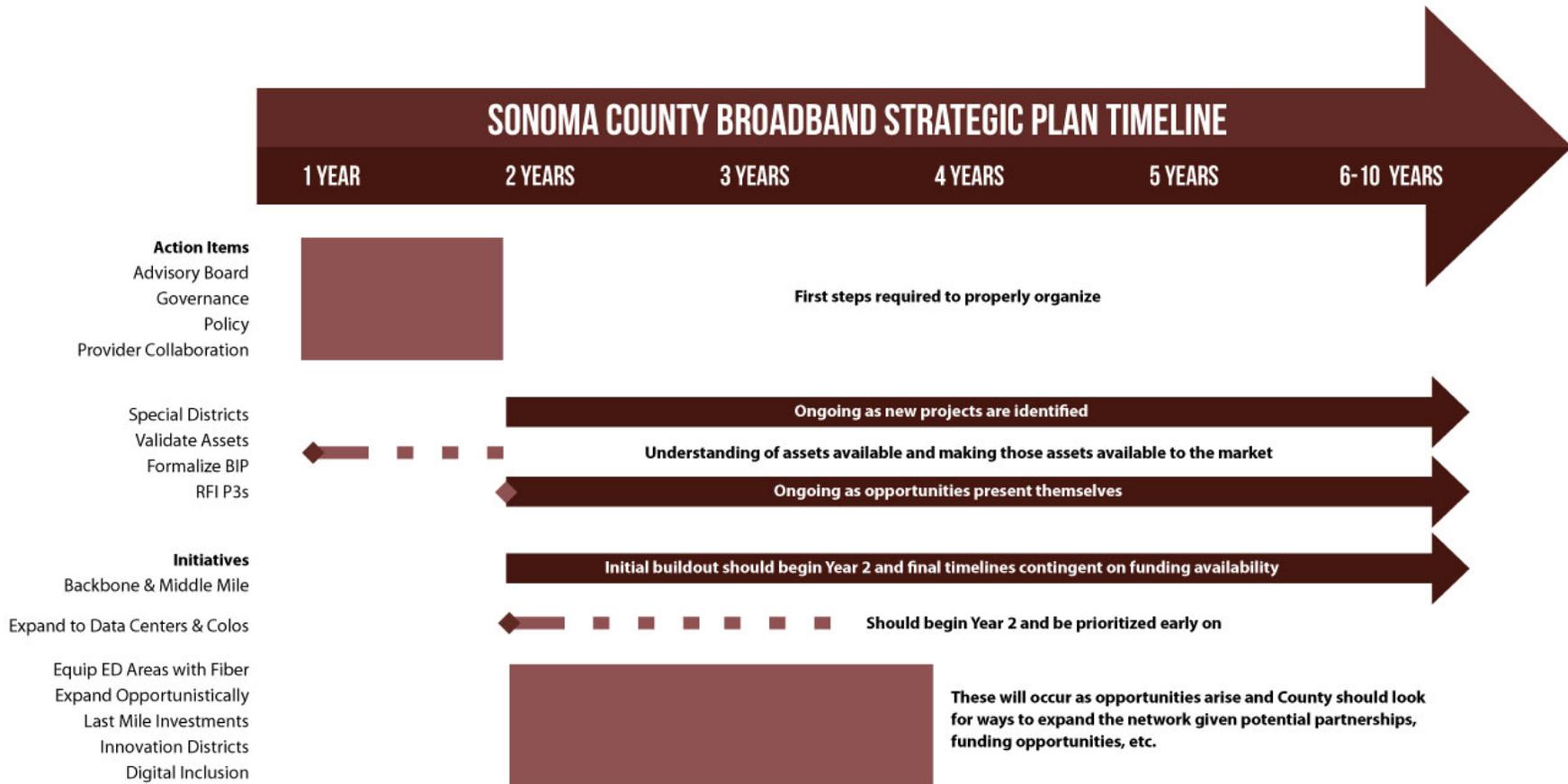
**Key Initiative 6: Evaluate and Implement Smart Community Technologies when appropriate**

**Key Initiative 7: Develop Innovation Districts**

**Key Initiative 8: Digital Divide Digital Inclusion**



Figure 1: Sonoma County Broadband Strategic Plan Timeline





### 3 SONOMA COUNTY OVERVIEW

Sonoma County, located in northern California north of the San Francisco Bay area, is well known for its burgeoning vineyards and wineries. Tourists travel from far and wide to come visit Sonoma County and visit the beautiful vineyards, dine in restaurants, experience events, and engage in outdoor activities in the numerous state, national, and local parks. Sonoma County is 1,575 square miles and much of the county is rural in nature.

The County is divided into five Supervisorial Districts, each led by a County Supervisor. These Districts will be profiled in the following section, noting broadband needs and accessibility. In addition, major cities and the unincorporated areas of the County are profiled within the Appendix to this report. The general 2016<sup>5</sup> demographics and statistics for the county and the districts are provided in the following table.

Table 3: Sonoma County Demographics Overview

	District 1	District 2	District 3	District 4	District 5	County Totals
Population	99,531	98,402	98,082	99,123	98,575	503,070
Hispanic	19.0%	21.0%	19.0%	31.0%	31.0%	26.6%
Median Age	48.6	40.9	34.4	39.7	40.9	40.9
Per Cap Income	\$40,041	\$36,513	\$27,379	\$32,952	\$28,420	\$33,061
Education						
Less HSD	9.0%	10.0%	15.0%	14.0%	16.2%	12.8%
HSD	16.0%	20.0%	22.0%	21.5%	21.0%	20.1%
Some College	32.0%	35.0%	36.0%	35.6%	33.6%	34.4%
Bachelors	27.0%	24.0%	18.0%	18.5%	17.6%	21%
Professional	16.0%	11.0%	9.0%	10.5%	11.6%	11.6%
Households						
HH Income	\$63,527	\$73,506	\$52,640	\$68,505	\$57,402	\$64,240
More \$150	16.0%	16.8%	7.7%	15.5%	9.8%	13.6%
\$100k-\$150k	15.2%	18.6%	11.9%	17.7%	14.9%	15.1%
\$75k-\$100k	12.6%	13.9%	13.9%	13.6%	13.2%	13.4%
\$50k-\$75k	16.8%	16.9%	19.5%	16.2%	19.8%	17.8%

<sup>5</sup> [www.census.gov](http://www.census.gov) July 1, 2016.



	District 1	District 2	District 3	District 4	District 5	County Totals
\$25k-\$50k	23.1%	19.2%	22.2%	20.3%	23.2%	21.6%
Less \$25k	16.2%	14.6%	24.9%	16.7%	19.2%	18.3%
<b>Jobs</b>						
Total Jobs	31,888	49,243	56,168	49,290	37,412	223,992
Employed	46,809	52,457	48,236	49,478	48,395	245,375
Education and HealthCare	22.4%	12.2%	22.8%	15.4%	14.4%	17.4%
Hospitality	15.5%	11.2%	10.6%	10.8%	11.0%	11.8%
Retail	12.8%	15.9%	17.0%	11.9%	15.6%	14.6%
Professional	9.9%	8.4%	9.5%	11.4%	8.9%	9.6%
Manufacturing	7.5%	8.6%	3.5%	15.0%	10.0%	8.9%
Construction	6.2%	8.5%	4.9%	7.2%	9.4%	7.3%
Real Estate	3.3%	n/a	4.4%	n/a	n/a	3.85%
Government	3.2%	6.0%	n/a	9.3%	3.7%	5.5%
Financial	3.0%	4.7%	4.3%	n/a	n/a	4.0%
Wholesale	n/a	7.9%	n/a	4.0%	n/a	5.9%
<b>2020 Projections</b>						
Population	102,177	101,136	101,298	101,566	100,282	506,459
Per Cap Income	\$45,575	\$41,676	\$30,706	\$37,829	\$32,555	\$37,688

Population density is an important indicator as to the availability of robust, affordable broadband. Most carriers that provide service today look at population densities as an initial indicator of whether or not a network build would be profitable. The denser an area is, the more likely it is that the carrier can produce a profit from building out in that area.

The cost for middle mile infrastructure is shared by all users that the network passes. The more homes/businesses it passes, the more potential end users will share the cost, thus making it more profitable. This is called “economies of scale” and is typical in making the business case for a broadband build or expansion. The carriers’ business plans look at the total number of potential subscribers along a given broadband route and estimate how many of those potential users will sign up for service. The more users along a given route will increase the number of actual subscribers and thus provide a better return on investment (ROI) for the carrier. Carriers measure this in subscribers per mile, or in many cases use a household population density to determine where to target network assets.



Sonoma County has many areas of dense populations which are typical of suburban norms. These areas are generally in the 1,000's of homes per square mile. In these areas, robust broadband is often available to both residential and business users. As with other more rural areas, which make up a large part of Sonoma County, the population densities make it difficult for a for-profit company to earn an ROI, as the shared cost of the broadband network is split between too few households. As a result, we have many of the less densely populated areas without adequate broadband services.

Each district does have pockets of “higher” density population centers. However, with the exception of District 3, all these districts have large amounts of rural areas that are especially lacking in adequate broadband.

- District 1 has the highest average age, the highest per capita income and the highest percentage of college graduates.
- District 2 has the highest per household income and the highest percentage of households that earn more than \$100,000 per year.
- District 3, the most densely populated area, has the most households earning \$50,000 per year or less.

While District 3 does have broadband access in most areas due to its population density, many within the district are unable to afford that broadband. This concern was expressed by several people from Santa Rosa Junior College. Students and families from lower income households tend to have an issue with broadband affordability, which results in issues with completing assignments. This affordability gap is not only at the college level but affects all elementary and secondary (K-12) grade levels as well.

Those living in the other districts and who are outside the more densely populated centers generally have the means to afford broadband, however they lack access since the infrastructure is simply not available.



Table 4: Sonoma County Population Densities

Sonoma County

Square Miles	1575
Homes Per Sq. Mile	123
Population Per Sq. Mile	319

Key Densities – Homes Per Square Mile

Santa Rosa	1634	Healdsburg	1075
Sonoma	2021	Geyserville	71
Kenwood	108	Cloverdale	1294
Glen Ellen	200	Sebastopol	1981
Petaluma	1580	Bodega	45
Cotati	1671	Bodega Bay	127
Rohnert Park	2395	Cazadero	47
Fulton	106	Forestville	305
Larkfield – Wikiup	677	Sea Ranch	112
Windsor	1313		

Lack of broadband in rural Sonoma County is not an issue specific to Sonoma County, but one that plagues all of rural America. Because traditional carriers lack a sufficiently profitable business plan to cover rural markets, Congress, the FCC and other state and local agencies have been working for years to address the issue. As with many things, it all comes back to funding and the political will to provide adequate funding for areas where for-profit companies will not venture. The U.S. has spent billions of dollars for the last few decades subsidizing the cost of broadband construction in rural areas. These funds, administered by the FCC through various agencies, and provided to both large and small broadband companies, has made an impact in some rural communities, but not all. Some communities are rural, and some are very rural, and the current cost-per-subscriber is still too high for many to invest.



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## 4 REGIONAL BROADBAND-RELATED ECONOMIC DEVELOPMENT OPPORTUNITIES

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This section identifies economic development opportunities for Sonoma County from broadband and related technologies. Digital technologies like broadband have unique economic characteristics that yield opportunities different from traditional economic development. Technology helps with costs of doing business—labor, land, market access, and raw materials—but also opens up new markets and is the basis for totally new, high-value products and services. Therefore, this section starts by summarizing the economic implications of digital technologies like broadband.

Development opportunities for digital technologies also depend on local economic structure and dynamics. Therefore, this section really focuses on the local economic base, support industries and institutions, and their results for the inhabitants of Sonoma County. There is an analysis of areas of growth and strength in the economy, and an examination of household demographics and economic characteristics.

Finally, the two areas—local circumstances and technology-based opportunities—are brought together to identify potential opportunities. This analysis does not consider local political or social dynamics, and is not presented as a strategy, per se. It simply considers what is possible based on general local market analysis.

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### 4.1 The Economic Impacts and Implications of Broadband

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Broadband impacts how we work, play, and learn via applications. It is not an application per se, but it has many applications—specific business, operational, or practical uses—because it provides fast, stable connections. Broadband is just one of an array of digital technologies that impact all aspects of the economy and society. The impacts depend on complementary investments in hardware, skills, and, of course, software. Together digital technologies allow us to find, decide, and coordinate better, cheaper, and easier. Basically, broadband is a better, faster, more economic and flexible way to get and use information.

Digital technology can be used to automate, differentiate, and innovate. Each of these is like a step. Automation generates data even as it replaces other resources. The data can then be used for differentiation: enhancing current products and processes to create more value to existing customer and/or get new customers. Differentiation builds customer relationships. Insights from these relationships reveal opportunities to totally new products and services—innovations—which create new, high-margin sources of income. These steps of digital development provide both benchmarks and tactics for getting the most technology benefits for the least cost.



All digital technologies enable distributed activities, make it easier to find things, and greatly reduce the need for centralized command and control (i.e., overhead costs). Organizations' capital requirements drop as digital technology replaces equipment, facilities, labor, and material. Software returns to scale increase along with economies of scope. Digital technologies enable us to make more, better, faster with less. Consequently, firms are increasingly valued for their intangible, "soft" assets rather than traditional "hard" forms of capital. The minimum efficient scale of production gets smaller (3D printing, for example) while production cycles and time to market get shorter. These economic impacts of digital technologies have several important practical implications.

The first implication is that, as digital technologies become more pervasive, people and relationships matter more than ever. Their inherent value is multiplied by the instrumental value of their capabilities: People who are good with digital technology and other people can make more money with less work than skilled workers of the past. Indeed, skilled technologists today commonly make top dollar, especially those with strong inter-personal skills. Digital capabilities are easier to gain and monetize than traditional analog skills, and digital workers' capabilities and value increase as they connect with others who have complementary capabilities and interests. Digital skills make human skills more valuable, and vice versa. Investments in digital capabilities have huge returns—to employers, people, and society in general. If you want to boost economic outcomes, then the community leaders need to help people connect, learn, and work together via, around, and about technology.

The second implication, which follows directly from the first, is that activities can be a better investment than assets. Buildings, places, and technologies matter because of what people do in and with them. Investing in activities leads to investments in real, physical assets, but it does not necessarily work the other way around. Just because you build it doesn't mean they'll come. The challenge is to tap latent demand to do things. Inclusive, open, technology-focused activities are essential for really capitalizing on broadband. Digital technologies make this much easier than in the past. They provide both the means for technology-focused development activities as well as the focus. Of course, all of this is predicated on assets to some extent: There should be some facilities and systems in place to organize, host, and build on activities. The effect is that relatively higher-value assets require higher-value activities. Places and spaces are valuable when they enable people, which is what broadband and other digital technologies are all about. You can really help a lot of people with modest facilities if you have good events and programs. If you've got great facilities and are going for big impacts, you need really amazing activities featuring top notch technologists. Next, software, including data and code, which make up applications and networks, is now a critical asset. Even more than that: Software is infrastructure, and it should be treated as such. Reliability and security are now essential for digital technologies, which has not been the case in the past. The key feature of broadband, which distinguishes it from prior technologies, is that it has software integrated into it



that makes it fast, flexible, and resilient. Software equates to activities for people. Think about cables and hardware as streets and buildings: Software is what happens in those places. Broadband is the vehicle that provides connections, code and data flow over those connections, and people use them to do things and create things. It is necessary to have physical network components—and be constantly upgrading them. Applications, code, and data are now essential to economic growth.

The really good news is that growth based on digital technology is practically limitless, inherently resilient, and fundamentally sustainable, presuming the technology is well-designed, deployed correctly, and adequately maintained (which means continuously upgraded). We see this in broadband, in particular, as well as with the code and data that comprise applications. This is a whole new economic territory that has no boundaries except the ones we create. The last practical implication is that digital development, including broadband development, is a critical component of economic development overall; and, as technology continues to rapidly evolve, it requires ongoing governance to ensure an economy is operating efficiently with modernized infrastructure. And, everyone has an interest in making sure it is.

## 4.2 Sonoma County Demographic and Economic Statistics<sup>6</sup>

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Sonoma County naturally has a complex and vibrant economy simply due to its location near the Pacific Coast, on the southern end of the Northern Coast Range, north of San Francisco and west of Sacramento. Those metroplex areas are nominally dominated by tech and state government, respectively, which inevitably has spillover effects for the County’s economic base and population.

### 4.2.1 Business and Industry

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Over 50% of Sonoma County employment was in services industries<sup>7</sup> in 2017. Some 20% was in educational services, and health care and social assistance sectors, and about 11% each were in professional, scientific, and management, and administrative and waste management services and arts, entertainment, and recreation, and accommodation and food services. Retail trades had about 11% of the employment, too, but its percentage shrank from 13.1% in 2010, losing 2,000 jobs, while services grew 1.4% annually between 2010 and 2017, based on analysis of ESRI data and America Community Survey data.

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<sup>6</sup> Source: Sonoma County Economic Development Board unless noted otherwise. These data are from a variety of sources. 2017 data come from ESRI, Inc., and Emsi, Inc.; noted where appropriate.

<sup>7</sup> Source for services sectors, 2010 and 2016 only: US Census Bureau, *American Community Survey 5-year Estimates*, [https://factfinder.census.gov/faces/nav/jsf/pages/community\\_facts.xhtml](https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml). Data from EDB for 2017, so sector statistics are approximate.



The County’s other major sectors were manufacturing and construction with 9.2% and 7.9% of total employment, according to ESRI. In 2016, ACS had manufacturing at 10% of total employment, and 7.7% for construction, and 9.9% and 8.7% respectively in 2010. Emsi data gives government a larger share of jobs, nearly 13% in 2017, making it comparable to retail with 11% of jobs and health care, which this data separates out, with 14%. It is possible to estimate growth rates from Emsi data by comparing it to County Business Patterns (CBP).<sup>8</sup> This analysis shows the fastest employment growth in Other Services (10.3% annually), Construction (9.4%), and Professional, Scientific, and Technical Services (7.9%) between 2010 and 2017. Other sectors grew in the mid-single digits except for Wholesale Trade, which contract over 1.2% annually, Finance and Insurance (down 0.4% per year), and Information, which was flat.

Although agriculture and related industry only accounted for only 3.2% of employment, that sector’s percentage of total employment has grown by 1.9% annually since 2010. Sonoma County has a 1.68 LQ in agriculture, forestry, fishing and hunting, and mining, and 1.33 LQ for this sector relative to the state. Location quotient (LQ) is a ratio of the percent of total local employment in an industry to total local employment nationally (or at the state level). Anything above 1.00 represents a strength, anything below 1.00 is a weakness, and the farther from 1.00 the larger the difference. The area is also relatively strong in construction.

For services overall, the County’s LQ is 1.0, but there are interesting details behind these statistics. As shown in Table 11, arts and culture-related industries have seen the greatest gain in percentage of total employment. In 2010, this sector was comparable to manufacturing and construction in terms of percentage of total employment. Employment in this sector increased 3.6% annually—equivalent to over 5,000 jobs—between 2010 and 2016. The LQ is respectable, especially compared to the nation.

Table 5: Employment details for service sectors in Sonoma County, California

Sector	Employees	Percent total		Annual Rate	LQ to	
	2016	2016	2010		CA	US
Professional, scientific, and management, and administrative and waste management services	28,247	11.6%	11.0%	1.55%	0.89	1.04
Educational services, and health care and social assistance	51,185	21.0%	19.8%	1.74%	1.00	0.91
Arts, entertainment, and recreation, and accommodation and food services	26,721	11.0%	9.3%	3.63%	1.07	1.13

<sup>8</sup> US Census Bureau, *County Business Patterns* for 2010, [https://factfinder.census.gov/faces/nav/jsf/pages/community\\_facts.xhtml](https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml).



Sector	Employees	Percent total		Annual	LQ to	
	2016	2016	2010	Rate	CA	US
Other services, except public administration	13,391	5.5%	5.6%	0.52%	1.04	1.12

A comparison of Emsi 2017 estimated to 2010 County Business Patterns shows a somewhat different story.<sup>9</sup> This analysis shows accommodations and food services accounting for over 9% of jobs, while arts, entertainment, and recreation only had 2%. Similarly, this data has healthcare and social services with 14% of total employment in 2017, while educational services employs a relatively small 1.4% of all workers. These sectors grew in the range of 4% to 7% (once other sectors are filtered out), with education adding jobs the fastest, followed by healthcare and social services.

The number of healthcare and social service establishments, according to these data, grew an astounding 22% per year, from about 1,500 to 6,000, or an average of 639 new establishments per year. This while the number of all establishments grew 5% per year. The total number of jobs grew about 5% per year, too, as did health care and social services employment. The average size of establishments, in terms of employment, has stayed about the same overall, but has dropped 13% per year in healthcare and social services. According to this data the number of agricultural establishments has also increased at an astounding rate.<sup>10</sup> These rates could be chalked up to differences in the data sets—how they counted what—but they suggest rapid growth in the number of small companies in these sectors, particularly in healthcare and social services.

The Emsi estimates and County Business Patterns provide wage information. Average wages grew substantially in healthcare and social services, about 8% per year, but other sectors' wages grew stronger. Management of companies and retail grew 10% per year. It was 12% in administrative businesses and arts, entertainment, etc., and 13% in finance and insurance. Per employee earnings grew by an astounding 23% per year in real estate. Other sectors' wages grew at a healthy rate, around 8% per year, construction being the exception: Per employee wages only grew 6% per year. While that is weak in comparison to other sectors in the local economy, overall wages for the nation only grew about 3% between 2010 and 2017.

In relation to total wages per establishment in 2017, manufacturing led the pack generating \$2.3 million per location. Other sectors generated between \$500,000 and \$1.5 million, with arts, entertainment, and recreation generating the least payroll per

<sup>9</sup> The 2017 estimate are from Emsi, Inc., based on US Census Bureau's Quarterly Census of Employment and Wages and County Business Patterns, as well as other sources. While data sets are comparable, they are from different sources, therefore all results should be considered approximate.

<sup>10</sup> These data sets do not contain employment numbers for agriculture, so average establishment size cannot be calculated. They also do have wage data for that sector.



location. Utilities and information generated the most return on payroll—both generated over \$5 in revenue for each \$1 spent on wages—followed by manufacturing and real estate. Agriculture also had relatively high returns on wages. Healthcare generated only \$2 of revenue per dollar of payroll. Education, management, and professional/technical service sectors had the lowest returns on salaries.

Manufacturing stands out in the Sonoma County economy for the revenue it generates: 21.6% of total local revenue in 2017. The information and management sectors generated around \$9 million each. Other sectors generated \$1 million to \$4 million per location, except healthcare and social services, which only generated \$788,283 per location in 2017. Of course, this should be considered with this sector’s rapid growth in the number of locations and much smaller size: The average manufacturing location had 26 employees. The average health establishment had 21 employees.

### 4.3 Households and Population

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Sonoma County’s population has grown at roughly the same rate as the state and nation, around 1% annually, between 2010 and 2017. Annual growth is expected to decline to 0.7% through 2022. The areas of strongest historic growth will see the greatest reduction but will still grow stronger than the state and nation: Cloverdale, which grew at 1.56% annually and 11.4% overall, is projected to grow 0.8% per year, and the City of Sonoma will drop to 0.88% annual growth from 1.48%.

The median age of the county’s population will move up from 41 years, which 5 years more than the State of California’s population and 3.7 years older than the nation overall, to 41.7 years. The statistics and forecasts suggest this difference in age comes from solid growth in older population (age 65+)—3.5% annually from 2010 and 3.3% through 2022—and declining middle aged and youth populations. The percentages of persons 0 through 24 and 35 through 54 have gone down about 1% per year and are expected to decline more, although slower, over the next five years. The percentage of persons under age 65 in the population is projected to shrink 0.7% per year through 2022. Ethnicity is a similar but reverse trend: The percentage of whites in the population are forecast to decrease while the percentages of other ethnic groups, particularly Asian, increase.

Educational achievement among the population of Sonoma County is higher than the state and nation.<sup>11</sup> Over 42% of Sonoma County residents had a college degree—associate, bachelor, or higher—in 2016, compared to 39.8% for the state and 38.5% for the United States. Across the board the percentage of persons with college degrees grew between 2010 and 2016. In Sonoma County the percentage of college

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<sup>11</sup> Source: US Census Bureau, *American Community Survey 5-year Estimates*, [https://factfinder.census.gov/faces/nav/jsf/pages/community\\_facts.xhtml](https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml)



graduates increased 1.23% while the percentage of persons with high school or less education fell 1.35%. These rates were more than the state but less than the nation as a whole.

The unemployment rate is both absolutely and relatively low in Sonoma County. At 3.4% for 2017, the County was generally at full employment. Only the cities of Sebastopol, Sonoma and Cotati along with a number of unincorporated areas, had an employment rate over 4%.

- Cotati City: 4.6%
- Monte Rio CDP: 10.9%
- Fetters Hot Springs Agua Caliente CDP: 5.7%
- Forestville CDP: 5.1%
- Sonoma City: 5.0%
- Sebastopol City: 4.9%
- Graton CDP: 4.6%
- Guerneville CDP: 4.5%

Local unemployment was lower than the state and nation in both 2016 and 2017, and it dropped faster. There were approximately 252,300 employees in Sonoma County in 2017, an increase of 8,700 over a decade.

About three quarters of these employees were private wage and salary workers, and over a third of them were management, business, science, and arts occupations.<sup>12</sup> The number of workers in these occupations grew 1.8% annually between 2010 and 2016, second only to service occupations. Sales and office occupations declined 1.2%. Sonoma County has relatively more construction and natural resource workers, but the number of those jobs has also been dropping. Unpaid family workers declined the fastest—8.6% annually—but that class of worker makes up a small part of the workforce. Sonoma County’s clear strength is in self-employed workers, who make up about 12% of the workforce: The area has a 1.9 LQ for this class of worker compared to the nation overall.

Sonoma County also has relatively more upper income households than the rest of the nation, as shown in Table 12. The percentage of upper income households grew strongly between 2010 and 2016 while the percentage of lower income households fell. Slower, but still relatively strong, growth in the percentages of higher income households are predicted through 2022. The loss of middle-income households is expected too, matching the rate at which the percentage of high-income households grow. The statistics show local household incomes growing at least as fast as the state and nation, and faster than population growth. These data suggest that middle income households are moving into higher earnings brackets, a conclusion bolstered by the

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<sup>12</sup> *Ibid.*



fact that Sonoma County has relatively more high-income households than the nation, and that relative strength has increased since 2010.

Table 6: 2016 Sonoma County percentage of households in income ranges

Household Income	2016 LQ	Average Annual Growth Rate	
		2010-2016	2017-2022
<\$15,000	0.69	-0.78%	0.39%
\$15,000-\$24,999	0.83	-1.94%	-0.59%
\$25,000-\$34,999	0.85	-1.36%	-1.29%
\$35,000-\$49,999	0.91	-0.80%	-2.34%
\$50,000-\$74,999	0.99	-0.18%	-2.35%
\$75,000-\$99,999	1.14	-0.73%	0.00%
\$100,000-\$149,999	1.32	0.20%	1.76%
\$150,000-\$199,999	1.39	3.96%	2.79%
\$200,000+	1.36	4.45%	2.84%

Median home values are nearly double the nation’s at \$670,000. In 2016, according to American Community Survey, median homeowner costs were \$2,173 per month, which is a bit more than state median costs but is 45% more than across the United States. About a third of homeowners paid 35% or more of their income on housing. Contrast this to renters in Sonoma County who paid a median rent of \$1,380—also 45% more than the nation overall: 46% of renters paid 35% or more of their income on housing. Total taxable sales in Sonoma County for 2016 were \$9 billion, an increase of 3.4% over 2015. According to ESRI data, almost a third of household spending was on housing. Transportation, at 11.5%, food (a total of 11.9%), and health care (8%) were other major expenses for Sonoma County households.

Table 7: Housing unit vacancy rates

	Owned Homes	Rental Units
United States	1.8%	6.2%
California	1.3%	3.8%
Sonoma County, California	1.1%	3.3%

Not surprisingly, housing markets are quite tight in the area, as shown in Table 7. The availability of housing in Sonoma County appears similar to the rest of the nation and somewhat better than California. For example, the ratio of total housing units to total population is about 42% for the county and nation but 36% for the state. Retail and industrial vacancy rates were lower than rental housing at 4% and 5%, respectively, but office vacancy rates were 14% during 2017. Compared to national vacancy rates,



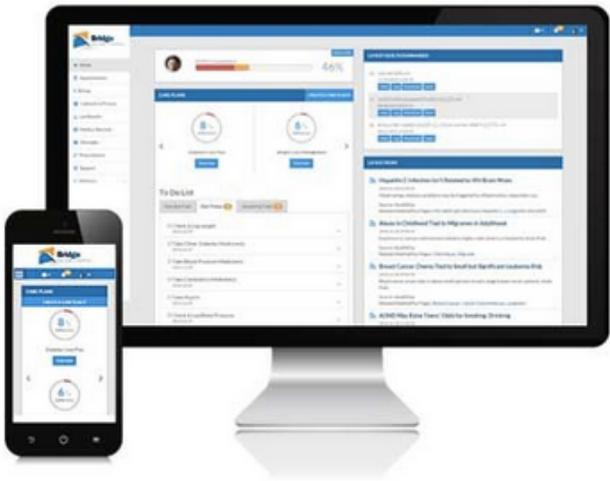
Sonoma County has limited supply of retail and, to a lesser extent, industrial properties, but a surplus of office space.

Table 8: Commercial real estate vacancy rates

	Industrial	Office	Retail
Sonoma County	5.0%	13.9%	3.7%
United States <sup>13</sup>	10.4%	12.9%	9.6%

### 4.4 Broadband Applications and Opportunities

The data suggest that workforce is a major issue in Sonoma County. Unemployment is very low, there is strong employment growth in key sectors, and wages are rising. An aging population exacerbates this issue as people leave the workforce and demand additional services. The general opportunity, therefore, is to increase worker productivity. Agriculture is an important sector simply due to Sonoma County’s strength relative to the nation. Service industries are overall important in terms of employment. Knowledge and relationship-intensive service sectors are growing strongest: educational, health, professional, scientific, social, and technical. Additionally, these sectors are seeing strong wage growth. Health and social services are also on the entrepreneurial and enterprise vanguard of more, smaller establishments. Manufacturing remains a core part of the county’s economy due to its employment and productivity, especially because most of this is exported, which brings capital into the area.



Demand for services is being met by more, smaller firms. This is especially evident in healthcare and social services in Sonoma County. A range of applications—from customer relationship management and patient portals through interactive monitoring to assistive robots—are possible in this sector depending on population needs. Additional research is necessary, but there appears to be burgeoning competition, so small health service companies may be seeking any edge

<sup>13</sup> Source: Statista, 2018, <https://www.statista.com/statistics/245054/us-vacancy-rate-forecast-for-commercial-property-by-type/>



technology might provide. Of course, both patients and providers require fast, flexible connections. And, the applications are only as good as the software and services behind them. Smaller companies can be challenged to find and fully use technology solutions, and this can be especially true in service sectors.

The number of agriculture establishments has also grown strongly, and the area has relatively large amount of employment in this sector. The nature of applications in agriculture depends a great deal on the type of agriculture. Generally, systems for monitoring inputs and growth, for harvesting and sorting, and for processing and packaging are common in agriculture. In the past, technologies have been expensive and inaccessible for small farmers and producers. Digital technology is changing that, enabling smaller scale production and higher margins. The key is connection to markets: Many high-value agricultural products must be moved quickly to niche consumers and require careful processing. Broadband and related technologies are essential to this.

Manufacturing remains an economic force in Sonoma County in part due to technology. While local specifics can only come from additional study, automation and differentiation via digital technologies are pervasive in manufacturing. Few manufacturers can be viable today without CAD/CAM, CNC, PLCs, process control systems, robotics, and sophisticated customer relations, project, and sales management systems. Technology is a major reason why manufacturing jobs pay relatively well. Although manufacturing firms seem relatively large, technology has enabled them to get much smaller in recent decades. Consider that Sonoma County’s average manufacturer is not much larger than its average arts, entertainment, and recreation establishment. The biggest technology opportunities with manufacturing may be enabling them to continue with these trends, investing more in technology and people, and sharing their insights with other sectors.

Housing demand and changing demographics present interesting opportunities for technology applications. On one hand there are numerous applications related to home operations and lifestyle support that enable people to stay in their homes longer. Similar technologies allow them to remain productive, socially connected, and in the workforce if they choose. Remote interaction and work can flow both into and out of the home. Many services can be delivered electronically, others can be coordinated better, and many complement each other. Consider telemedicine: Both the patient and provider can work from home, automated monitoring can identify health issues before they arise, and smart transportation can get provider and patient to medical facilities flexibly and quickly.

On the other hand, new technologies are enabling new ways of building and living. The scale of domestic space has decreased with technology, and “third spaces” – neither home nor work, shared with others – are increasingly important. Interconnections between rural and urban spaces can be transformed via digital



technologies, as can suburban neighborhoods. The overall challenge is keeping people and things while moving them in an efficient and timely manner. Densification and human scale development go hand-in-hand, and both can be done better via technology. Digital technologies have impact across the scale from regional planning to design and construction of buildings to how people access and use spaces. Innovations in space utilization are most likely in relatively wealthy areas with high density and housing demand.

Agriculture and service sectors, particularly health services, may be prime candidates for automation, especially smaller scale and growing enterprises. For agriculture, this will likely take the form of the Internet of Things “IoT” numerous sensors and servomechanisms connected into a control and monitoring system. Automation in health services is more likely to be interpersonal, replacing trips to the offices and even offices themselves, although smart devices with sensors will likely play a significant role in health and wellness. Culture and hospitality-related industries have similar opportunities, except embedded in particular facilities and places. These sectors will need connectivity literally out in the field, so pervasive broadband is important. Wireless seems like an ideal medium due to the mobile and remote nature of applications. Data analysis and management is likely to be an issue for agriculture, where health services are likely more concerned with social media functionality. Automation in agriculture and health services will spill-over to affect housing issues, too: access and environmental controls, safety and security monitoring, smart appliances, etc.



Differentiation is especially important and practical for small but growing enterprises, of which there appear to be many in Sonoma County. A simple example application is content creation, focused on current products and services. Product-oriented content provides value to audience members (customers) while promoting a brand, and it generates useful data from readers/viewers. Such tactics require minimal resources: Tweaking service information to “test” new markets, targeting based on interests and preferences, or simply reaching expanded geographic markets via social media advertising. These tactics all require good data to guide marketing and messaging. Agriculture might focus on high-end restaurants,

“localvores,” or niche food product manufacturing. Services can focus in on specific clients and build on those relationships to generate additional business. Accommodation, arts, entertainment, food, and recreation are prime examples of sectors that are ripe for these applications. Manufacturers, who almost have to be in one or more supply chain, can differentiate in terms of quality and responsiveness via technology, while methodically seeking new ways to use their capabilities—all electronically.



Manufacturing is possibly the most well-positioned sector for innovation, with multiple opportunities. There are inevitably additional internal innovation opportunities to improve processes and outputs with technology. Key product innovations can be enabled by digital design and production technologies. Prototyping is a general area of innovation opportunity for manufacturers, along with one-off or small batch production—essentially “artisanal manufacturing”—enabled by 3D printing hardware and modelling software. Another area of innovation opportunity are value-added services: Manufacturers can provide design, maintenance, and technical support services electronically. Accommodation, arts, entertainment, food, and recreation have similar opportunities, especially in conjunction with local government: Technology can be a powerful enabler for having meaningful experiences and wayfinding. The challenge is to add digital content to places and products.

There are numerous innovation opportunities for manufacturers to build technology into their products, to make them “smart,” which also leads to opportunities for new information and relationship-based services. This is true for other sectors, too, generally cultural, health, and place-based services that need to be location-aware. These opportunities have high potential impact because they drive demand for specialized technology products and services, creating opportunities for new technologies to be manufactured—or built, so as to include software and facilities—in Sonoma County. The automation opportunities in agriculture, health services, and other sectors feed directly into opportunities to build innovative new products. Smart systems will

likely use a combination of highly customized and simple, standardized components, and they will require careful design and regular upgrades. This creates opportunities for information sector companies, especially software developers and content services, which is relatively weak in Sonoma County, as well as small hardware producers.



The key to all of these opportunities is “smart infrastructure,” which necessarily include broadband—fiber and wireless—but also devices, data, and code. The County and local municipalities should determine where smart technology could benefit their community and design infrastructure accordingly that supports smart technology for today and the future. The County and cities should consider their roles as data producers. Local government has undoubtedly had numerous automation opportunities: smart city



applications for environment, lighting, parking, safety, transit, waste, etc. Sonoma County also has opportunities to differentiate from other locales with technology. Deploying sensors, other monitoring technology, and controls in alignment with key sectors—agriculture, health services, recreation—to support local government functions multiplies the impact of technology investment. Engaging manufacturing and technology industries would further contribute to both impact and practicality of “smart” initiatives.

There are innovation opportunities for planning in Sonoma County. Much of the economic activity in Sonoma County appears to be in private homes or other small facilities. There may be need and opportunity for more connections among and between these spaces, which will impact many facets of the community. Sonoma County should consider infrastructure and land use in terms of smaller companies with less dedicated space. Technology can enable that process. Social media can be used to reach home-based businesses, entrepreneurs, independent professionals, and telecommuters. They and other interested parties can use online tools to provide feedback and input. Similar methods are useful for older and younger persons to participate in planning activities. As with other applications and opportunities identified here, this requires extensive digital connectivity across the County and somewhat specialized software tools.

By deploying advanced technologies such as artificial intelligence and the Internet of Things in conjunction with key local industry, the County and cities can boost the local knowledge base while minimizing risk. The opportunity here is to initiate a conversation. Various sectors, including local government, are facing similar technology-driven issues and have similar technology-enabled solutions. For all, it isn't enough to get a solution, they have to apply it effectively. The opportunity is, of course, much larger than just dialog: Technology capabilities can be shared across organizations and sectors, creating new business opportunities in the process.

Ultimately, the intelligence behind the infrastructure, and which uses it to solve problems, is human. Broadband connects people. Economic statistics tell us general things about people, where they put their time, how they make a living, what they value. Those are but the starting point for data: It can get so much more detailed. But, like any infrastructure, data is only as good as its uses. The fundamental opportunity for Sonoma County may be to facilitate a profound new form of workforce development that equates directly into economic development. By fostering gains in knowledge and improvements in skills, the local public sector could promote new business opportunities while increasing capacity to meet residents' critical needs. The challenge is to find common interests and complementary needs at a household and even individual level—and at the start-up or micro-enterprise level—and translate those into larger-scale opportunities.



Entrepreneurs and small businesses can have a huge impact in today's economy; and, Sonoma County can benefit from these groups in all industries. When entrepreneurs and small businesses have sufficient connectivity, they have the ability to support their work skills, along with new innovation and technologies. Entrepreneurs and small businesses can benefit from smart city applications and technologies that result in public data collection. Public data can be used by entrepreneurs and small businesses for research and development on new and existing technologies which could allow the County and local municipalities to expand, attract, and sustain a technology driven workforce.

### 4.5 Conclusion

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Sonoma County's demographic and economic dynamics appear well-suited to—and demand—smart infrastructure. Hybrid fiber-wireless infrastructure is clearly a critical component that directly enables opportunities related to key trends. Rapid growth in the number along with smaller size of health service companies, for example, or continued strength of manufacturing in revenue generation, and relative strength of local agriculture. Broadband provides the foundation for solutions tailored to each sector and firm's needs. Even basic workforce demand such as is evident in education and retail can be met via technology—to some extent.

Changing demographics and economies means changing needs for capabilities, products, and skills; and it means changes in the way business is done. Local governments are no less affected by these changes. How they address them can make all of the difference. While some sectors, such as manufacturing, have climbed up the technology learning curve, others are still climbing. Sectors facing regulatory requirements and smaller enterprises face additional challenges. Every enterprise needs more socially and technically capable people. There appears to be an opportunity for local government to lead learning to apply and use technology, as well as build digital infrastructure.



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## 5 STATE OF BROADBAND IN SONOMA COUNTY

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### 5.1 Market supply

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An assessment of private-sector telecommunications infrastructure and services in the greater Sonoma County area provides context for the more targeted assessment of Sonoma County and its cities. It also informs the cities' and County's strategies, since these companies are prospective partners and potential competitors. Companies that nominally sell network services in the Sonoma County area are listed in Table 15. Within each city and unincorporated area profile, a market analysis is included based on data gathered via BroadbandNow.com. This information details the service providers, type of service, availability, and fastest speeds offered in each area.

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#### 5.1.1 Incumbent telecommunications service providers

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The two major, "incumbent" providers are AT&T and Comcast. AT&T is the inheritor of the local public switched telephone exchange. Like many of the former incumbent telephone companies, AT&T allows competitors to lease and resell its lines. Comcast Business is the major cable provider in the Sonoma County area, having 39 – 100% availability throughout the major areas of the county. Comcast was founded in 1963 through the purchase of a 1,200 subscriber cable system in Tupelo, MS. Over the next 50 years, the organization acquired others or purchased networks before merging with GE to form NBCUniversal, LLC in 2011.



Table 9: Network service providers within the Sonoma County area

<b>Company - web address</b>	<b>Incumbent</b>	<b>Facilities-based</b>	<b>Scope</b>
AT&T <sup>14</sup>	Yes	Yes	National
Blackmountain Communications <sup>15</sup>	No	No	Local
Comcast Business <sup>16</sup>	Yes	Yes	National
Digital Path <sup>17</sup>	No	No	Local
Frontier <sup>18</sup>	Yes	Yes	National
Global Capacity <sup>19</sup>	No	Yes	Regional
GTT <sup>20</sup>	No		Global
Integra <sup>21</sup>	No	No	Regional
Internet Free Planet <sup>22</sup>	No	No	Regional
Level 3 (owned by CenturyLink) <sup>23</sup>	No	Yes	Global
Lighttower (owned by Crown Castle) <sup>24</sup>	No	Yes	Regional
Mega Path <sup>25</sup>	No	No	National
North Coast Networks <sup>26</sup>	No	No	Regional
Sonic <sup>27</sup>	No	Yes	Regional
TPX Communications <sup>28</sup>	No	No	National
Valley Internet <sup>29</sup>	No	No	Regional
Vista Broadband Networks <sup>30</sup>	Elsewhere	Wireless	National

<sup>14</sup> <https://www.att.com/local/internet/california/sonoma/>

<sup>15</sup> [www.blackmountaincom.com](http://www.blackmountaincom.com)

<sup>16</sup> <https://www.comcastbusinessoffers.com>

<sup>17</sup> <http://digitalpath.net/>

<sup>18</sup> <https://business.frontier.com/>

<sup>19</sup> <https://globalcapacity.com/>

<sup>20</sup> <https://www.gtt.net/>

<sup>21</sup> <http://www.getintegra.com/>

<sup>22</sup> <http://www.myifp.com/>

<sup>23</sup> <http://www.level3.com/en/>

<sup>24</sup> <http://www.lighttower.com/>

<sup>25</sup> <https://www.megapath.com/>

<sup>26</sup> <https://www.northcoastnet.com/>

<sup>27</sup> <https://www.sonic.com/>

<sup>28</sup> <https://www.tpx.com/>

<sup>29</sup> <https://valleyinternet.com/>

<sup>30</sup> <http://www.vistabroadband.com/>



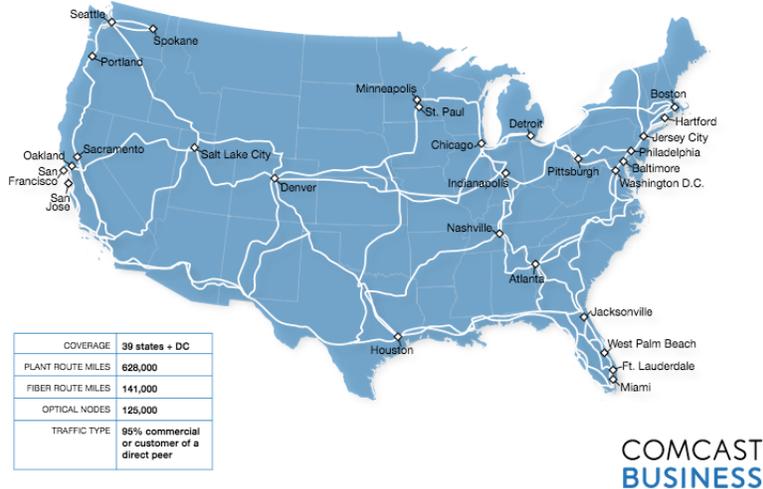
**Comcast Business:** XFINITY Comcast is the largest cable provider in the US reaching over 100 million customers and operating in 41 states within the US, Comcast Business operates in 39 states currently. Advertised offerings and packages include:

Package	Price	Speed/Inclusions
Starter Internet 25 Business Internet 75	\$84.90 per month	Speeds up to 25 Mbps download, ideal for supporting multiple devices for a growing business
Business Internet 150	\$109.95 per month	Speeds up to 75 Mbps download, great for large email attachments, file sharing, and high-volume transactions. Plus 2 voice lines.
Business Internet 300	\$154.90 per month	Speeds up to 150 Mbps download, ideal for heavy usage for 10 + users/devices. Plus 1 voice line.
Business Internet 1 Gig	\$214.90 per month	Speeds up to 300 Mbps download, ideal for heavy usage. Plus 1 voice line.
	\$514.90 per month	Speeds up to 1000 Mbps download, ideal for heavy usage. Plus 1 voice line.

\*\*First 24 months price guarantee and 2 year contract.

According to BroadbandNow, Comcast covers significant areas of Sonoma County, however, service and availability was reported in interviews to be poor. A map of the fiber-optic network map for Comcast Business is below.

Figure 2: Comcast Fiber-optic Map (<https://cdn.wcdc.business.comcast.com/>)





**AT&T:** AT&T is the incumbent local exchange carrier (ILEC) serving most of the exchanges throughout the Sonoma County area. AT&T is one of the world's largest providers of IP-based communications services for businesses, including Virtual Private Network (VPN) and Voice over IP (VoIP), and is very well known for its wireless network.<sup>31</sup> AT&T has recently acquired DirecTV, and the FCC conditioned its approval of the transaction on AT&T extending fiber connections to additional locations as well as offering gigabit connections to E-rate eligible schools and libraries.<sup>32</sup> AT&T network maps were requested, but not provided.

AT&T offers business packages in the Sonoma County area as follows (bundles with television are also available):

Cloverdale

<b>PACKAGE</b>	<b>PRICE</b>	<b>SPEED/INCLUSIONS</b>
<i>Internet 18</i>	\$60 per month	3-18 Mbps download

Cotati, Healdsburg, Petaluma, Rohnert Park, Santa Rosa, Sebastopol

<b>PACKAGE</b>	<b>PRICE</b>	<b>SPEED/INCLUSIONS</b>
<i>Internet 25</i>	\$70 per month	Up to 25 Mbps download plus AT&T phone
<i>Internet 50</i>	\$115 per month	Up to 50 Mbps download plus unlimited calling, and 24/7 remote tech support
<i>Internet 100</i>	\$135 per month	Up to 100 Mbps download and unlimited calling

\*\*2 year guarantee, no term commitment or data caps

\*\*\*Petaluma (limited fiber available)

Sonoma

<b>PACKAGE</b>	<b>PRICE</b>	<b>SPEED/INCLUSIONS</b>
<i>AT&amp;T Wireless Internet</i>	\$60 per month	50 Gb data, caps include fees and data speed reductions
<i>AT&amp;T Wireless Internet + phone</i>	\$100 per month	100 Gb data, caps include fees and data speed reductions

<sup>31</sup> <http://www.att.com/gen/investor-relations?pid=5711>

<sup>32</sup> In the Matter of Applications of AT&T Inc. and DIRECTV For Consent to Assign or Transfer Control of Licenses and Authorizations; MB Docket No. 14-90; Memorandum Opinion and Order; FCC 15-94, Released July 28, 2015, at page 148.



Windsor

<b>PACKAGE</b>	<b>PRICE</b>	<b>SPEED/INCLUSIONS</b>
<i>Direct Express</i>	\$50 per month	Up to 1.5 Mbps download

**Frontier:** Frontier Communications is the other incumbent local exchange company serving Sonoma County. Frontier Communications provides wireline retail and wholesale services in 28 states, including former Verizon operations in many states.<sup>33</sup> Frontier Communications has a business model that emphasizes expansion of broadband availability, using FCC Connect America Funds. Frontier’s network maps were requested, but not provided.

Frontier markets the following residential packages, all requiring a two-year agreement, and all under the FCC recommended speed to be considered broadband:

<b>PACKAGE</b>	<b>PRICE</b>	<b>SPEED/INCLUSION</b>
<i>Simply Broadband Max</i>	\$19.99 per month	Up to 6 Mbps download
<i>Simply Broadband Ultra</i>	\$25.00 per month	Up to 12 Mbps download
<i>Simply Broadband Ultimate</i>	\$35.00 per month	Up to 24 Mbps download

Frontier’s business packages start at \$49.99 for speeds up to 40 Mbps.

\*\* This is pricing from 2017. Upon reanalysis in November 2018, Magellan Advisors could not find advertised broadband pricing in Sonoma County. Further, BroadbandNow.com no longer lists Frontier as a competitive provider.

**Sonic:** Sonic is a fiber internet service provider in California with availability in San Francisco, Brentwood, and Sebastopol serving residents and businesses with gigabit fiber services. In order to bring fiber internet to various areas of California, Sonic asks residents and businesses to “spread the word” by signing up on their website and checking availability for connections in the area. Sonic’s home and business packages start at \$40 per month, 500 Mbps for \$499 per month, and gigabit fiber on a case-by-case basis.

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<sup>33</sup> <http://investor.frontier.com>



**Level 3:** On November 1<sup>st</sup>, 2017 CenturyLink acquired Level 3 and all of the organizations’ assets and networks. Level 3 Communications is a global communications provider, supplying communications services to enterprise, government, and carrier customers. Anchored by extensive fiber networks on three continents connected by undersea facilities, Level 3’s global services platform features deep metro assets reaching more than 500 markets in over 60 countries. Level 3 maintains extensive fiber routes through California including metro fiber in larger cities. Level 3 offers a portfolio of connectivity services including Internet, voice, transport, dark fiber, and other complementary service offerings. Level 3 provides this depiction<sup>34</sup> of its network in California on their website.

Figure 3: Level 3 Fiber-optic Map (<http://www.level3.com/~media/files/maps/en-network-services-level-3-network-map.pdf>)



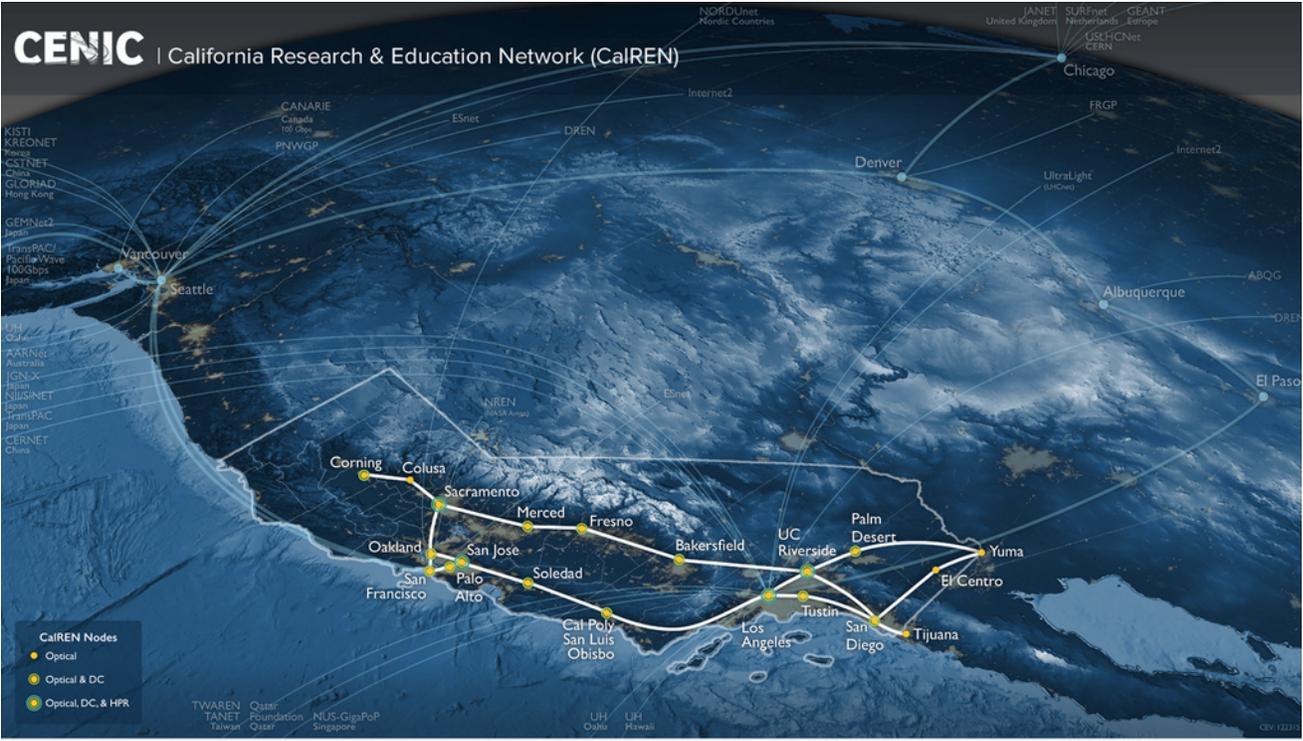
**CENIC:** CENIC connects California to the world—advancing education and research statewide by providing the world-class network essential for innovation, collaboration, and economic growth. This nonprofit organization operates the California Research and Education Network (CalREN), a high-capacity network designed to meet the unique requirements of over 20 million users, including the vast majority of K-12 and higher education students together with educators, researchers and individuals at other vital public-serving institutions. CENIC’s Charter Associates are part of the

<sup>34</sup> <http://www.level3.com/~media/files/maps/en-network-services-level-3-network-map.pdf>



world’s largest education system; they include the California K-12 system, California Community Colleges, the California State University system, California’s public libraries, the University of California system, Stanford, Caltech, the Naval Postgraduate School, and USC. CENIC also provides connectivity to leading-edge institutions and industry research organizations around the world, serving the public as a catalyst for a vibrant California.

Table 10: CENIC CalREN Map



## 5.2 Facilities-based network service providers

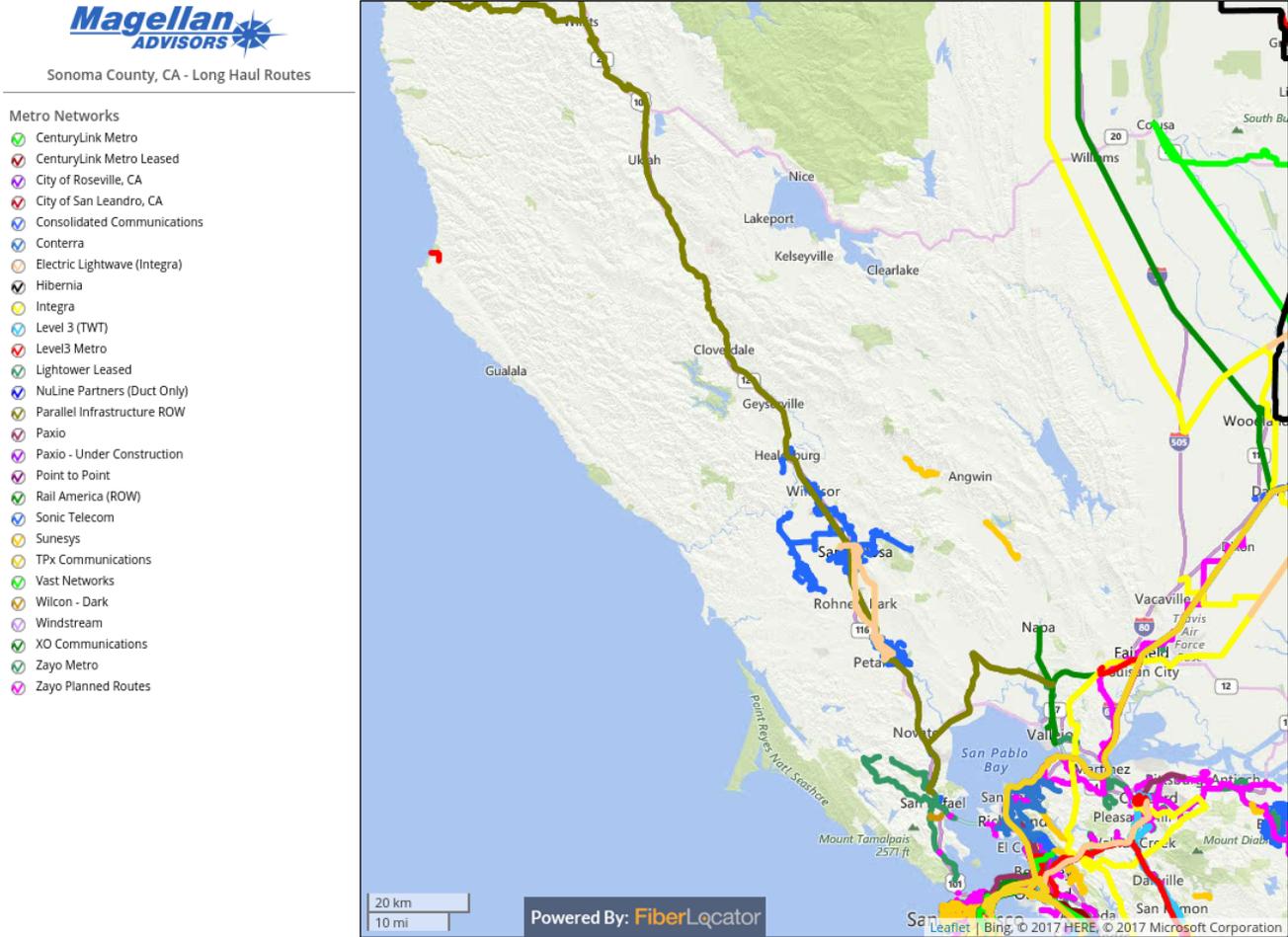
Many network service providers do not have roots in cable TV or telephony. Some started “from scratch” as fiber-optic networks. Others started as IT service companies. Many sell services over others’ infrastructure. “Managed services” companies might operate an enterprises’ network under contract or provide network design services but not own network assets.

There are several providers who operate in the market, but do not own network assets. There are also several providers listed who do not publish their network maps. Verizon exited the California wireline business in 2016, and its assets are now owned and operated by Frontier Communications. If we only count those providers whose public information lists physical fiber-optic network assets in area, there are five. Several of





Figure 5: Long Haul Fiber Routes



### 5.3 Data centers

Data centers are buildings that house servers and equipment that connect providers and their customers to backbone and long-haul networks, creating a synergy between ISPs, wireless carriers and data centers creating benefits for the customers on the networks.

There are not any commercial data centers located within Sonoma County. The closest data centers to Sonoma County are located in Sacramento and San Francisco.



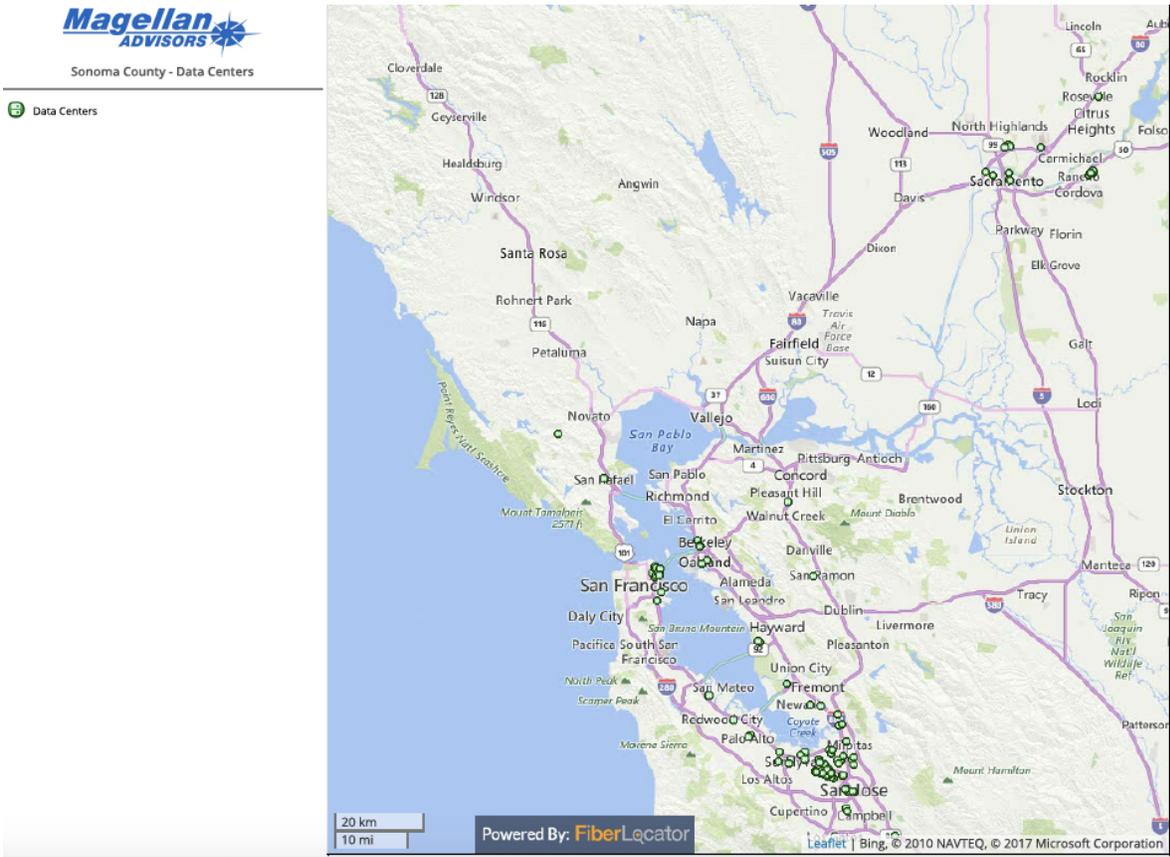


Digital Realty operates SFR2, an Internet Exchange data center at 365 Main Street in San Francisco. This collocated facility is carrier neutral and services early, middle and Fortune 1000 companies in the region.

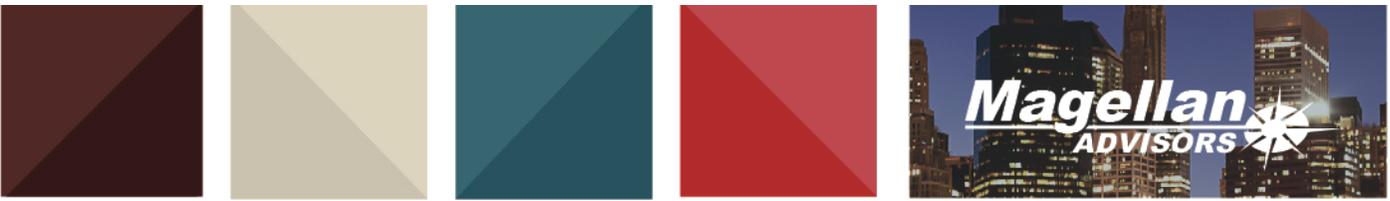
Level 3 Communications (owned by CenturyLink) operates four data centers in the region—at 23965 Connecticut St, Hayward, CA 94545., 1005 N B St, Sacramento, CA 95811., 1313 53rd St, Emeryville, CA 94608, 13424 N Highway 1, Mendocino, CA 95460, and 19700 S Highway 1, Manchester, CA 95459. Level 3 does not include these on its list of North American data centers, so they may have limited services available.<sup>35</sup>

A map of the other regional data centers is provided below.

Figure 6: Map of Data Centers



<sup>35</sup> See <http://www.level3.com/en/products/data-centers/north-america-data-centers/> for a nominally complete list of Level 3's data centers.



## 5.4 Broadband Penetration in Sonoma County

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### 5.4.1 Broadband Penetration in Sonoma County Per FCC Data

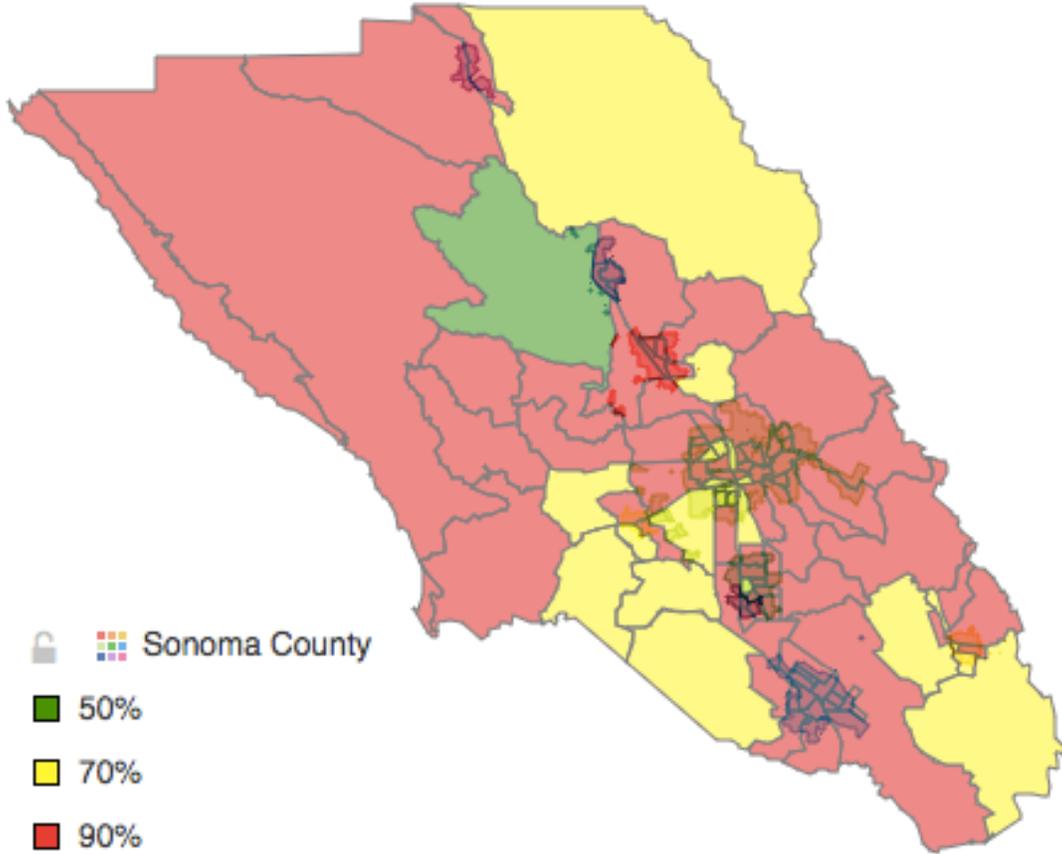
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Figure 19 illustrates the most recent residential broadband penetration data, as reported in FCC Form 477 by providers that serve the County of Sonoma. Data is reported per census tract for every census tract in the county. Census tracts are shaded below to illustrate the average broadband penetration. Penetration means the percentage of residential households that have subscribed to a wireline broadband service such as cable or DSL internet service. While these penetration rates track residential households, its usually a good representation of general broadband availability within a given census tract, inclusive of business subscribers. Tracts shaded in green exhibit 50% average penetration, census tracts in yellow exhibit 70% average penetration and census tracts in red exhibit 90% average penetration. Cities exhibit significantly higher broadband penetration whereas rural areas exhibit lower rates. The predominant reason why broadband penetration is lower in rural census tracts is due to a lack of broadband availability in these areas. The FCC data reports actual broadband lines connected, not availability of broadband services.

It is important to note here that broadband penetration statistics are based on FCC notations of penetration consisting of speeds 10 Mbps download and 1 Mbps upload, rather than standards upgraded in 2015 to 25 Mbps download and 5 Mbps upload. Additionally, these speeds are based on residential census tract data, not businesses. However, when researching marketed speeds within the city and unincorporated profiles it becomes apparent that providers such as Comcast offer speeds up to 250 Mbps over cable which create disparities in this data. Although the speeds are offered, the pricing may be perceived as too expensive and/or the provider may not offer services to each and every location within the census tract.



Figure 7: FCC Broadband Penetration Map



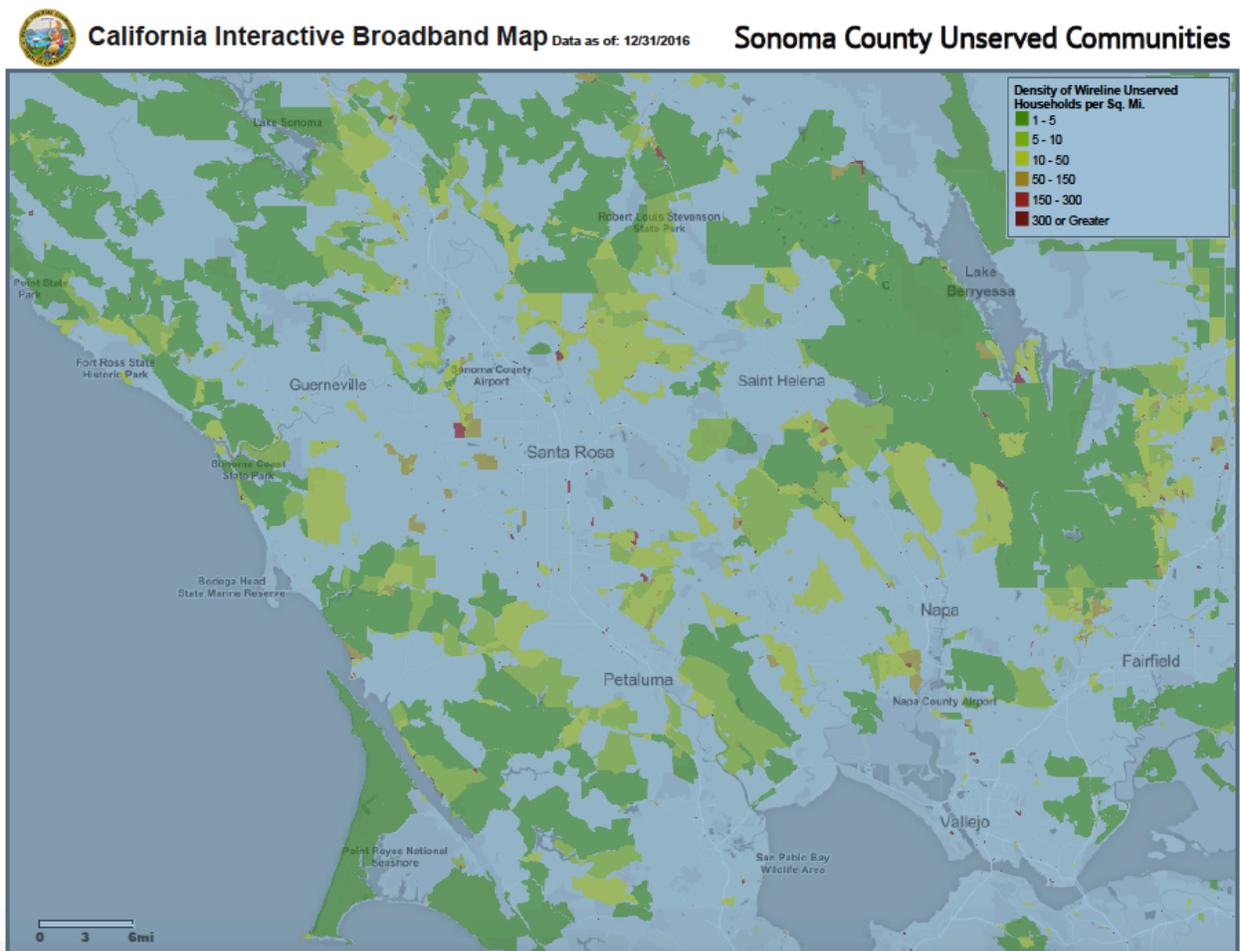


## 5.4.2 Broadband Penetration in Sonoma County Per CPUC Data

The CPUC recently updated the data on CA Broadband Availability, while this map does not directly indicate broadband speeds, it broadly indicates coverage by providers. While the FCC map shows 90% penetration in west Sonoma County, the CPUC Broadband Map shows severe underserved areas and coverage by any provider in many areas to the west. The CPUC has indicated that they are continuing to update how information is gathered, provided, and reported on broadband availability and speed in California.

Magellan Advisors recommends that Sonoma County continue to engage and work with the CPUC to ensure that these maps are accurate and representative of the state of broadband in Sonoma County.

Figure 8: CPUC Broadband Availability Map





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### 5.4.3 Technology Concerns

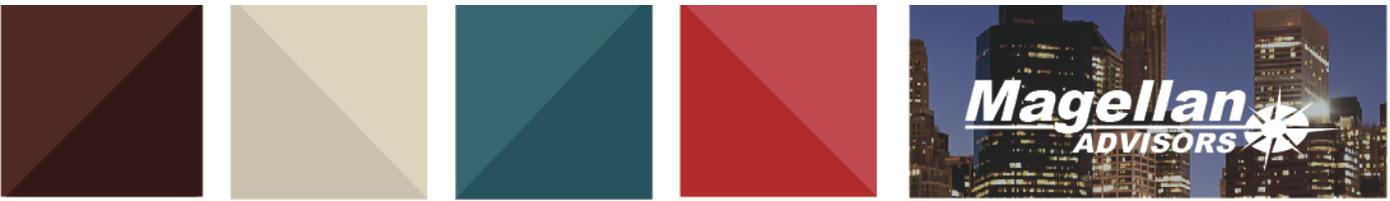
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When you have limited funds available to meet an ever-increasing demand, not everyone will get everything they want, which is the case with federal and state broadband subsidies. There is roughly six billion in federal dollars per year set aside for rural broadband support. Much of this is earmarked for new construction, but a lot is also set aside for ongoing maintenance and operations for existing customers. This money tends to go directly to service providers, as opposed to new entities that might build and operate networks. The big debate has always been how to get broadband available to the largest number of subscribers for the money available.

All broadband networks are made up of “last mile” and “middle mile” segments. Last mile refers to the physical network elements that run from a telephone company’s central office and out to the consumers’ home or business. The middle mile portion of the network is what connects all these last mile networks to the internet. The physical last mile medium can be either copper twisted pair wires, fiber-optic cables, coaxial cable, wireless or even satellite. Middle mile can also be any of these, but in most cases today is based on fiber-optics.

Technology plays an important role in determining this cost versus the service availability solution. Most homes, as a result of a century of building telephone services to each and every home (just like electricity to every home), do have physical cables available that could carry broadband, depending on the current definition of broadband. This copper-based technology is called DSL, which runs on the same twisted pair wires that your traditional voice service uses. DSL shares the same physical medium as voice service. In the early days of DSL, all carriers used it to provide broadband, and it was more than adequate to provide the speeds required at the time. However, DSL, as a technology, suffers in comparison to other mediums like fiber in that the signal weakens the further you get from the “central office.” This weakened signal has a significant effect on broadband speeds. For instance, with today’s DSL, if you are less than 3,000 feet from the central office, you could potentially get 40 Mbps broadband service. However, if you are 12,000 feet or greater, you may not get any broadband. Hence, the rural broadband problem. Rural homes are generally far apart and a long way from a telephone central office, so even though you have voice service, you may not be able to get broadband as the home is too far away. DSL technology has improved over time, but it is not keeping up with current broadband expectations.

The FCC has designated 10Mbps/1Mbps as the required broadband speeds for some areas, while other areas it has designated 25Mbps/3Mbps as the level of service for funding. This brings up several issues. First, DSL is a dying technology that is not keeping up with broadband trends required for many of the devices and applications



consumers and businesses want to use. Many suburban areas can get 1 Gbps (1,000 Mbps) broadband via their fiber or coax cables. This availability is creating the digital divide between urban, suburban and rural areas. The FCC has decided on these numbers because DSL can often support those speeds. If the FCC were to increase their requirements, then DSL would not be able to support it. New, more expensive infrastructure would have to be deployed and the cost of that is not something funds are currently available to support. As such, those in rural communities, even with DSL service, will forever struggle to get adequate broadband enjoyed by urban/suburban communities.

Other technologies have also tried to provide last mile broadband in rural areas. Fixed wireless solutions and satellite-based technologies are available in many rural markets. Satellite solutions have many inherent problems when compared to fixed based solutions. For instance, current satellite solutions, while available everywhere and provide 15-25 Mbps of broadband, suffer from latency issues and make them unusable for most video or real-time applications. In addition, satellite companies, in order to manage their limited bandwidth, often put caps on the amount of data end users are allowed each month, creating frustration amongst users who are constantly worried about being penalized for going over that allotment. Many view satellite services as a service of last resort only viable when nothing else is.

Fixed wireless is also an alternative offered in many rural markets. Wireless providers, usually local companies, erect towers on top of vertical assets or on hilltops and then provide a line-of-site based broadband service to end users with a receiving antenna mounted on their home or business. These services can offer anywhere between 1 Mbps to 1 Gbps depending on the provider and their individual network capabilities. There are many fixed wireless providers located in Sonoma County that have established themselves to help fill the broadband access void created by the larger carriers not seeing a business model in these rural communities. These wireless ISPs face a lot of challenges with their business model, including RF interference due to terrain, lack of appropriate spectrum, access to tower sites, equipment upgrades/cost and their ability to respond to changes in user expectations over time. All fixed wireless traffic will eventually have to be carried to the internet via fiber based middle mile networks. Many tower sites or potential tower sites in Sonoma County do not have fiber-based infrastructure available, as many are in remote sites that are too expensive to construct fiber to.

There are a few anchor institutions in Sonoma County that rely on fixed wireless for their broadband and internet access. For instance, Sonoma Valley Hospital has some of their remote offices and sites using fixed wireless to backhaul broadband traffic. It can be done, but the preference is going to be fiber when available.

Fixed wireless will have a place in the most rural communities given it can be the only fairly cost-effective solution available. But as with everything wireless, it depends.



There are new technologies (5G) coming available soon that should help with at least part of the challenges of fixed wireless. Verizon and AT&T have announced plans to use 5G as a fixed wireless technology in rural markets to help deliver broadband. Even with this new technology however, fixed wireless providers will still be challenged with RF interference, terrain, lack of tower sites and lack of backhaul from those sites. 5G will not be a fix-all for rural broadband, but could help a few select communities, even within Sonoma County.

Importantly, technology selection is only part of the equation for enhancing broadband in rural markets. Finding technology that is applicable in Sonoma County's rural markets is important; however, it is only a part of the equation. There are several other components listed below that should be considered in order to enhance rural broadband access.

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#### 5.4.4 Political Will

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Political will should not be underestimated in the power it has to drive rural broadband. Political will is the ability of the government organizations, local vocal community organizations and other prominent entities like first responders, politicians, hospitals and large businesses to be vocal about their lack of services and its adverse effects on the life and economy of those that live and work in these rural areas. Part of political will means being vocal and public about the lack of adequate broadband and its effect on the community.

Political will also includes those same government agencies doing whatever they can to help create an environment for these carriers to be able to provide broadband services.

This includes:

- Having fair permitting policies and procedures;
- Making county/city sites available for co-location of assets by the carriers;
- Proper broadband planning considerations included in all construction projects by the city, county, state or federal agencies (such as dig once or joint trench);
- Organizing/facilitating/overseeing grass root efforts of selected interested communities looking for broadband; and,
- Investing in broadband assets directly when a clear business case is presented.



Assisting on funding by applying for available grants when opportunities are identified – see Appendix C: Broadband Infrastructure Funding Sources.

Sonoma County should continue to have staff assigned to programs, specifically to rural and municipal broadband coordination efforts. The staff would be responsible for identifying potential communities that need broadband and then coordinating internal and external efforts to help drive everything required to get broadband for that community. These staff members should know how to navigate the political and commercial environment on behalf of the community in getting the appropriate broadband for their needs. In many instances, a Broadband Program Manager has been identified within the organization to manage aspects of this plan, executing key initiatives. For example, in Riverside County, CA, this role sits within the County’s Information Technology Department, and is responsible for driving the RivCo Connect Broadband Program.

Access Sonoma Broadband (ASB) has been in operation within the County operations with oversight by the Economic Development Board since 2011. The members of the ASB team have continually worked with coalitions and alliances over the past five years, engaging the CPUC and others in grassroots efforts to address the broadband challenges in Sonoma County. The County should continue to support and further develop the ASB efforts and streamline their efforts.

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### 5.4.5 Expensive, Very Expensive and Extremely Expensive

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Rural communities are not all alike aside for the fact that they are rural. Some areas are more rural than others in terms of population densities (number of households per square mile) and distance from urban population centers and major highways. How rural a community is, is often subjective. Many in Washington, DC view rural as anything just outside the beltway, whereas someone in Montana or Alaska will have a completely different perspective on what rural means. Sonoma County can be considered somewhere in the middle for much of its area.

It should be noted, that with the technologies available today, some rural homes may not, for the foreseeable future, get 1 Gbps broadband that they can afford. The real cost to deliver those services is just too great for any one person, company or organization to provide. There may be some within Sonoma County that do not get affordable broadband that is comparable with those in urban communities in the near future. Instead, they will rely on satellite services or other slower forms of broadband.

All too often, people just assume that because a community has a designation of rural, that all hope is lost forever regarding getting broadband and all efforts are futile. This should not be the attitude of Sonoma County. There are many rural communities that can feasibly secure broadband, but it will require some dedicated planning, realistic expectations and a sustained effort. The Sea Ranch is an example of a community that



bonded together and drove toward developing a broadband solution. Their efforts should be modeled by other communities throughout Sonoma County.

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### 5.4.6 It Will Take Time

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A grassroots movement to secure broadband is not an overnight or one-time effort. It does require a coordinated, consistent and motivated plan. It will take time. Windows are often open when broadband efforts can make progress, including advances in new technologies, new grant funds become available, new construction projects happening, natural catastrophes highlight the negative impacts of lack of broadband, or the political environment changes. Smart planners are looking for these windows and are ready when these opportunities present themselves.

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### 5.4.7 Recommendation

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The County should assign staff to be responsible for driving rural broadband efforts. This person would be responsible for:

- Identifying and coordinating all rural broadband efforts and opportunities;
- Understanding and driving grant funding opportunities – applying for them;
- Educating local representatives on issues of rural broadband to develop political will;
- Ensuring public policies are in place to encourage broadband providers and ensure they have what they need to deliver broadband;
- Being a champion at all levels within the community for rural broadband and its benefits;
- Being the expert on technology solutions available for use in broadband;
- Being a liaison between the broadband providers and the community to help identify and drive solutions;
- Keeping rural broadband efforts in the public mindset; and,
- Working with government agencies to identify and map gaps in critical communications services and working to fill those gaps.



## 5.5 Wireless Broadband in Sonoma County

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### 5.5.1 Wireless Broadband

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Wireless technology can be used to deliver broadband especially in places that are traditionally hard to reach using wired infrastructure. Wireless networks have been built to deliver both broadband and communications services in both rural hard-to-reach locations, as well as in urban/suburban areas. Wireless networks can often be less expensive to deploy especially in hard to reach places where “traditional” wired solutions are cost prohibitive.

When many people discuss wireless broadband, they often associate cellular service with wireless service. There are some nuanced differences between the two with the expectations that each one might provide. Traditionally, cellular service was targeted for a mobile/nomadic environment where you build a cell tower and deliver voice and now data services to people using handsets and smartphones for communications purposes. As the user moves out of range of one cell site, the technology passes the user off to the next cell site, so the end user does not lose connection. This is what gives the user mobility.

Traditional wireless broadband has not been considered cellular in nature as it does not support mobility but is designed to be more akin to wireless DSL type service instead. A tower is constructed and those within range of the tower can receive broadband at their fixed locations.



Wireless broadband can carry both wireless last mile (DSL type service) and is also used for middle mile or backhaul service as well. This use in a backhaul environment is referred to as microwave backhaul and generally requires two antennas on two different tower sites being able to “see” each other, referred to as line-of-sight service. In fact, many cellular providers use wireless microwave services to carry their aggregated traffic from one tower location to another instead of relying on fiber or other fixed infrastructure, especially in tower locations that are remote and hard to reach.



In the past, cellular service has not been appropriate as a true broadband solution given the best effort nature of delivery, slower data speeds, monthly data allowances and the fact that it is a shared medium meaning that speeds and performance may vary depending on how many users are connected to the same tower at the same time. However, with new advances in cellular technologies, the line between cellular service and wireless broadband expectations are getting less obvious. Many cellular companies are now delivering “broadband” speeds over their cellular networks and using their same network infrastructure to deliver both wireless broadband and cellular service. Both AT&T and Verizon for instance, traditional cellular providers, have announced plans to use 5G (next generation cellular service) to provide fixed wireless broadband services to those in hard to reach areas and including rural communities where traditional fixed line services may be cost prohibitive. AT&T specifically has targeted/announced 5G fixed broadband solutions for portions of Sonoma County to help cost effectively fulfill their CAF II broadband obligations to the FCC. This new technology (5G) was designed to overcome some of the traditional limitations of using cellular service as a means of providing true broadband to end users. It increases speed, latency and overall performance when compared to traditional cellular service.

Why would a company use wireless instead of wired (copper, cable or fiber) for its last mile solution? Economics. Given a choice, carriers will always choose fiber over any wireless broadband solutions. However, the cost of deploying fixed wired solutions to hard-to-reach locations can be very expensive on a cost-per-home basis. Rural communities are a classic example of potentially expensive locations to build to given



the small number of homes per square mile. Carriers look at what it will cost on a per subscriber basis and if a lot of infrastructure must be installed or built and only a few

homes help to pay for that infrastructure, then carriers do not see a business case and will look or wait for alternatives. Hence the lack of adequate broadband in many rural parts of the US and world.

Wireless broadband, in some instances, can help address the cost equation for delivering broadband to many, especially in rural locations, where fiber or copper-based solutions are too expensive. At a high level, carriers can construct a tower and then anyone within “range” of that tower could get broadband services, bypassing the need to install fiber or copper-based solutions. However, wireless solutions are not without their challenges either.

Delivering broadband via wireless may seem very simple and on paper, it is. To deliver a wireless solution, providers need to consider a few things:

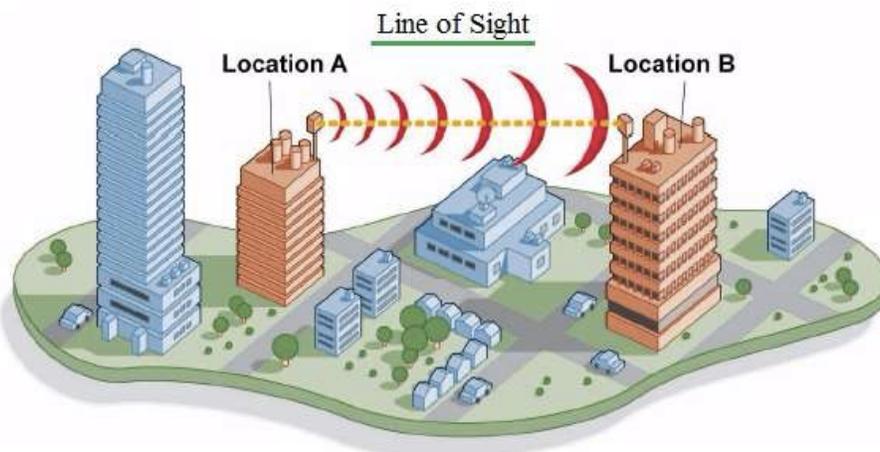
- Available and appropriate spectrum – not all spectrum is created equal
- Tower locations and siting
- Terrain
- Backhaul options
- Bandwidth requirements

Wireless (and cellular) signals travel through the air via wireless spectrum. This spectrum is not an infinite resource, there is only so much available. While technology continues to improve the amount of bandwidth it can deliver over a set amount of spectrum, spectrum is still a limited resource. Spectrum in the US is managed by the Federal Communications Commission (FCC). The FCC establishes rules for how spectrum is to be used, who has the rights to use it and then works to govern the use of that spectrum. There is spectrum set aside for radio (FM/AM), TV broadcast, military communications, airlines, satellites, emergency use, ship-to-shore communications, research, cellular communications and many others. Blocks of spectrum are basically lumped into two buckets, licensed and unlicensed spectrum (there are more, but outside the scope of this report). Unlicensed spectrum can be used by anyone who agrees to “play nice” within that spectrum. Wi-Fi is an example of unlicensed spectrum that the FCC has made available for anyone to use as long as you adhere to the rules of playing in that sandbox. Carriers will not traditionally deploy their services in unlicensed spectrum because they would have a difficult time providing any type of guaranteed quality of service to their end users. From time to time, the FCC makes spectrum available via an auction to the highest bidder which becomes licensed spectrum. The largest cellular providers have paid billions for the spectrum that they have exclusive rights to use. This exclusive use allows them to control the user experience which is a competitive differentiator between them and their competitors.



The reason the spectrum can be so expensive is that spectrum is limited and only rarely comes up for auction. Supply and demand increases the price.

Not all spectrum is created equal. When designing a wireless or cellular network, engineers start with the network requirements (what does the network need to deliver in terms of performance) and then work to design a network to meet those requirements. Choice of spectrum is one of their first considerations. Appropriate spectrum is not always available to them, which may change the network design and costs. Spectrum behaves differently depending on where it is in the spectrum range. Spectrum in the lower ranges say 400MHz-900MHz as an example is very good about penetrating through walls, foliage, buildings and such, but on a per hertz basis it does not carry much bandwidth when compared to something higher in the spectrum range. The higher the spectrum range, the more bandwidth it can carry. However, the higher spectrum ranges used in cellular and wireless networks, do not penetrate walls, buildings or foliage very well even though they can carry more bandwidth. Network engineers then have to balance their network marketing requirements with the spectrum they have available and at their disposal. Getting high bandwidth broadband and the ability to penetrate walls and terrain is a balancing act. Spectrum in the lower spectrum ranges offer better non-line-of-sight solutions, whereas the higher spectrum ranges need a more line-of-sight solution. Line-of-sight requires the transmitting antenna to be able to “see” the receiving antenna with limited trees and buildings in the way to be effective.



Terrain then plays an important role in the network design. Spectrum does not get over mountains or hills very well, nor does certain spectrum do very well in penetrating through trees, bushes, water or distance. The farther away the transmitter and the receiver are from each other, the less bandwidth you will get. Many wireless designs will struggle to be appropriate in Sonoma County given the terrain, foliage and



distances between potential sites. This generally means more sites, closer together, or higher on hilltops which can put them above the clutter. Sites are important too. An engineer designing a new wireless network also has to take into consideration where they can actually put tower sites. Sites are not always available in the best locations, so network engineers have to design around where sites are available. Sites also need a means of backhaul whether via fiber or microwave to another site where it then transitions to a wireline fiber network. Fiber can be costly to install to remote locations. Electrical power, security and access are also considerations when locating appropriate tower sites.

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### 5.5.2 Wireless Broadband in Sonoma County

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The explanation above was provided to help set the stage for what the County can do to help drive broadband adoption within Sonoma County. It explains some of the challenges with delivering broadband, especially in the rural communities. Wireless will/should play a part in the delivery of broadband to rural Sonoma County. In fact, moving forward with some of the recent developments in cellular technology, namely 5G, wireless could play an increasing role in the deployment of broadband in urban/suburban environments as well. For instance, Verizon has announced several suburban cities they are targeting in California for the deployment of 5G wireless. Verizon has indicated they plan to deliver gigabit services via wireless in these suburban communities.

What role could the County play in encouraging/facilitating the deployment of wireless broadband in rural Sonoma County? The County should consider making its tower sites available for commercial co-locations. The County has many current sites that it could make available to commercial providers to help augment their cost and complexity of deploying broadband in hard to reach locations. As these emergency service provider organizations are becoming increasingly reliant on commercial service, it would serve their interests to get better communications services available to them by sharing their sites with these providers.

Magellan Advisors met with County PRMD during the course of stakeholder engagement. It was learned that the permitting process can, at times, pose a challenge for providers to install infrastructure in a timely manner. The County should create a database of current and future tower sites and make it available to providers for use in designing future networks. This database should establish a list of facilities available at each site including security, backhaul options, tower heights available, and policies associated with using these facilities.



### 5.5.2.1 Current Wireless Broadband Providers

There are several current providers delivering broadband to mostly rural areas of Sonoma County in operation today. They are generally smaller providers that live and work within their community and saw a need for more solutions and took it upon themselves to help deliver those solutions. These local providers struggle with the same things the larger carriers struggle with in regard to delivering wireless fixed broadband; lack of appropriate spectrum, challenging terrain, and lack of tower sites. They too could benefit from the County making more of the County assets available for commercial use. The wireless internet providers in Sonoma County include:

#### **Vista Broadband**

<p><b>VISTA BROADBAND BASIC SERVICES INCLUDE:</b></p> <p>(CLICK TO LEARN MORE)</p> <ul style="list-style-type: none"> <li>- Speeds from 1 Mbps to 10 Gbps</li> <li>- Domain, Web and Email Hosting</li> <li>- Dynamic or Static IP's</li> <li>- Spam Filtering</li> <li>- VPN &amp; VoIP Ready</li> <li>- 24x7x365 Engineering Support</li> </ul>	<p><b>VISTA BROADBAND VALUE-ADDED SERVICES INCLUDE:</b></p> <p>(CLICK TO LEARN MORE)</p> <ul style="list-style-type: none"> <li>- Disaster Preparedness Solutions</li> <li>- Co-Location Solutions</li> <li>- Custom Transport Builds</li> <li>- Multi-Tenant Building Set-Ups</li> <li>- VistaHDe - Highly Diverse Redundancy Solutions</li> <li>- Remote Video Surveillance</li> <li>- Event Services</li> <li>- Remote Data Backup Services</li> <li>- Service Level Agreements (where available)</li> </ul>
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\* Download speeds and upload speeds match. EX: 10Mbps downloads with 10Mbps uploads.

**\*\*Pricing not advertised**

#### **AVISP**

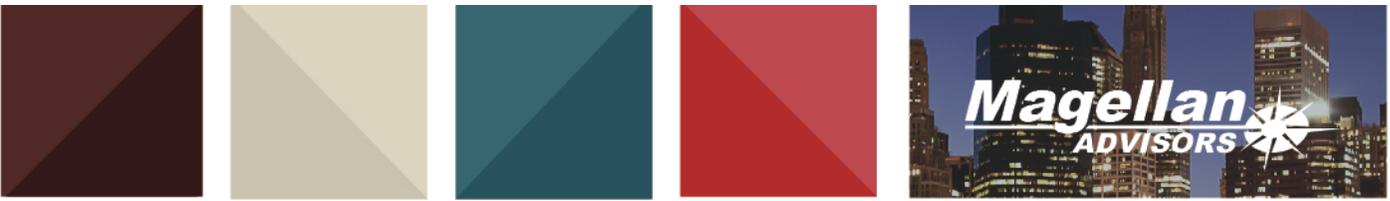
### Business & Commercial Services

High speed internet is vital to every business in today's economy. AVISP is dedicated to providing the highest quality services to local businesses. From the home-based business to local wineries, service companies and everything in between; AVISP has a service to keep you connected.



- Unlimited Data
- Multiple service plans for any size business
- Seamless service support solutions
- Network monitoring
- Email & spam filtering
- Local Technical Support Services - Knowledgeable and experienced

**\*\*Pricing not advertised**



The County can use its assets to help encourage and influence wireless broadband that will serve portions of rural Sonoma County. As 5G becomes more prevalent, siting will be important in urban and suburban locations as well. Having a defined vertical assets policy will be critical in the deployment of appropriate broadband to all of Sonoma County.

## 5.6 Broadband Gaps and Issues (SWOT)

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From a broadband perspective, Sonoma County has a number of strengths, which include strong and progressive leadership at the city and county level that recognizes the growing importance of broadband infrastructure. Both the cities and the County are making support for broadband infrastructure a key priority. Work has begun on developing “Dig Once” policies and practices which are crucial underpinnings for broadband infrastructure development. Sonoma County has proximity to San Francisco and Silicon Valley, and a tech savvy talent pool. The SMART Train transit route moves both people and data communications for the cities and the County using dedicated fiber for the latter – establishing a significant high-speed communications path through the heart of Sonoma County. The dedicated fiber has been placed for the Smart Train by a motivated local telecommunications firm – Sonic. The regional presence of CENIC adds to the broadband infrastructure in Sonoma County.

Sonoma County faces challenges from the topography and rural nature of much of the County. The natural beauty attracting so many to Sonoma County includes hills and valleys, rivers and redwoods, with a panoramic but rugged coastline. This type of terrain is challenging to serve from a telecommunications perspective, as the rugged terrain can make buried fiber for high speed broadband very costly and make cost effective fixed wireless deployments depending on line of sight also very complicated and costly, while creating “dead spots” for mobile wireless networking and signals. Scenic roads have narrow or non-existent shoulders and narrow rights-of-way, which are not conducive to placement of buried fiber – much of the telecommunications plant is aerial. Therefore, the further one is from the US 101 corridor that bisects Sonoma County, fiber-based broadband service and other competitive broadband options become less readily available. Costly upgrades and expansions are implied to meet growing needs for bandwidth, which in turn is a challenge for city and county government broadband planning. Finally providing for public safety communications particularly in the rural areas and West County is presently limited by significant connectivity issues.



Opportunities from broadband infrastructure are vast and derive significantly from connected devices and the Internet of Things. Sonoma County’s geographic location and talent pool can be the fuel for leveraging technology developments from precision agriculture and applications supported by 5G wireless deployment including sensor networks, Smart City applications, and autonomous and connected vehicles.

Broadband infrastructure will support Sonoma County’s human infrastructure, including connectivity for education and personal improvement and advancement, and health care to support “aging in place.” Rebuilding after the fire disaster provides the opportunity for broadband infrastructure improvement via implementation of Dig Once practices as those areas are redeveloped, and Brentwood-style site development standards that require placement of conduit and fiber-optic cable, including devotion of fiber strands to city or County use. However, for the latter opportunity, time is of the essence for passage of “Brentwood” site development requirements since rebuilding is occurring.

Threats to development of broadband infrastructure include lack of funding, and funding issues as well as federal or state legislative changes that limit city and County plans for broadband deployment. Also, broadband infrastructure development requires a consistent “champion” – lack of leadership from community champions will threaten development of broadband infrastructure. The champions will develop “buy-in” for the broadband action plan, the lack of which will threaten the success of the plan.

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## 6 SONOMA COUNTY NEEDS ASSESSMENT

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### 6.1 Capacity/State of Broadband

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There is a widespread view among stakeholders that broadband internet access has become so important to everyday life that it is a “utility.” Broadband is much more imperative now, very much a necessity, for instance, health insurance companies require individuals to sign up for coverage under the Affordable Care Act online. “Everything in life is moving in that direction, if it’s not there already”, “I have never understood why broadband is not a basic utility”, and “broadband is the fourth utility” are sentiments or statements that Magellan heard during focus groups in the Fall of 2017.

***The definition of broadband has already moved beyond a number – it has moved to the concept of fluidity of access where “things (applications) work.” There is a functional expectation for broadband, and in this respect younger people no longer “know a number” for broadband speed.***

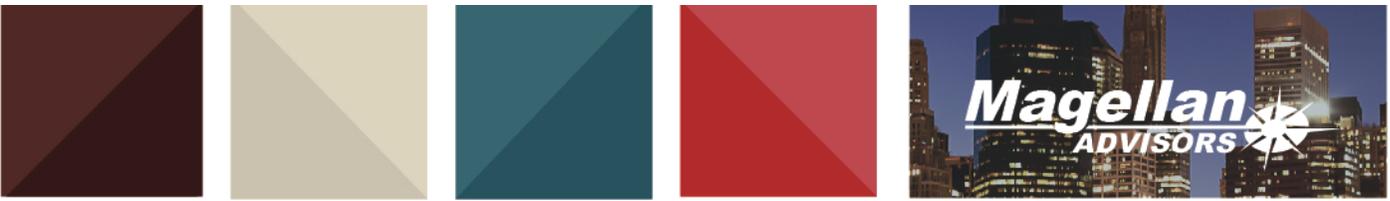


Sonoma County includes “very diverse communities,” and a significant rural population. As a general rule, the further the distance a residence or business is from the US 101 “spine” that runs through Sonoma County, the fewer broadband choices the business or residence will have, in many areas broadband essentially will be unavailable or unaffordable, and broadband speeds become slower and slower.

Some of those interviewed say there are areas with concentrated populations that carriers still haven’t served. Beyond those areas there is very limited broadband availability in the North and West County areas –whether wireline or wireless service, although not considered broadband. Stakeholders indicate that due to the topography/geography and tall redwoods, connectivity is “horrible” in North and West Counties. While this is obviously problematic from a consumer standpoint, it is a very significant public safety issue as well. In addition, property values are significantly impacted, which by extension limits property tax receipts for government entities. In particular there are many Home Owners’ Associations (HOA) which become active due to poor broadband service. HOA representatives advocate on behalf of residents who see limitations and reduced property values since there are more people that want to work at home – potential buyers are walking away from deals due to lack of adequate broadband capacity and speeds. Lack of adequate broadband in areas of Sonoma County is viewed as having serious economic impacts.

In many cases, consumers at best have a choice of two service providers, with inadequate service in the more rural areas. Away from the US 101 corridor, geography/terrain and demographics can severely limit choices to, for example, satellite service or service from Wireless Internet Service Providers (WISPs) rather than any landline or mobile phone options. As you move further west, it gets harder to get “good internet.” Mobile service coverage is spotty, and it can be problematic any time a consumer tries to access the wireless network for data. Every day examples are failure of “Open Table” reservations and use of GPS for directions. Additionally, the use of Facebook Live can be a real problem – the overall trend is strong growth in video consumption, and the ability to upload video has become more and more important.

While WISPs are commendable for their dedication to providing service in challenging topography, costs of available options can be high, and service quality/speeds problematic due to topography/geography and propagation characteristics of radio signals. As a result, applications that many take for granted are not available as distance from the US 101 increases – such as streaming video, web browsing, or telecommuting.



According to stakeholder interviews, these applications and others drive customer demand for faster access and fiber-based service. The residential market demands speeds of 25-100 Mbps, with some indicating demand for gigabit speeds. Businesses want fiber-optic based services. Stakeholder interviews also suggest that buildings that don't have fiber will have problems attracting tenants into the building. Thus, access to high-speed broadband via fiber-optic cable is important for economic development.

In addition to the incumbent telephone and cable companies (AT&T, Frontier, and Comcast, respectively), Sonic entered the market following the Telecommunications Act of 1996. Sonic began by using unbundled loops from AT&T for parts of California, and now serves 125 cities in California. Sonic has recently begun deploying Fiber to the Home in Sebastopol, in addition to San Francisco and Brentwood. Sonic uses its own fiber infrastructure to serve residences in small quantities today, and to serve enterprise customers in the US 101 corridor. Services range from 5 Mbps to 100 Mbps using bonded pairs for residential, and 1.5 Mbps and up to Symmetric 100 Mbps, Asymmetric 500 Mbps/100 Mbps for business – in addition to the gigabit services offered in FTTH areas.

Sonic has planned capital investments and network expansions, extending fiber to cell tower sites, school districts, and enterprise projects in business parks all over the county. In addition, Sonic has constructed fiber-optic networking to serve SMART Rail operational needs and separated off fibers for cities and the County along the route. State agencies are broadband providers.

Sonoma County is covered by California Department of Transportation's ("CalTrans") District 4 out of Oakland. CalTrans is working on a 10-year broadband plan for state highways. Traffic cameras more and more often utilize fiber-optic cable, and CalTrans has a localized approach to traffic cameras at on/off ramps. Furthermore, new legislation (AB 1549) requires CalTrans to promulgate "Dig Once" rules, and also requires the Department of Transportation to notify companies working on broadband deployment of Department-led highway construction projects and authorizes those companies to coordinate with the Department on conduit installation.<sup>36</sup> Bay Area Rapid Transit is also a transportation agency that places and uses fiber-optic network assets for its operations, and has a reputation for cooperation in making dark fiber assets available.

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<sup>36</sup> By January 1, 2018 the Department must develop guidelines to facilitate the installation of broadband conduit on state highway rights-of-way. CalTrans White Paper, "Dig Once: Policies and Best Practices"; Kelli Hughes, California Department of Transportation.



## 6.2 Medical/Health Care

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Health care practices have become much more data reliant, therefore much more dependent on high-speed broadband networking, both at health care facilities, and in the field. Examples include:

- Electronic medical records and billing data is all 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, the bills are sent, mostly electronically. Reliable broadband is essential.
- Trauma centers share all kinds of records including MRI, CT scan, X-Ray, etc., via electronic means. Medical practitioners especially need to do this at the more remote clinics, but do not have the 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 are now using 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 are used.
- 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 are 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.
- Video conferencing is seen as expanding in the future. There is a new paradigm called Project Echo that provides for a standing live conference call with remote specialists that the doctors can join and ask live questions/consultation of that specialist during these live sessions. This is extremely valuable to clinics, who want to use more of these in the future.
- Continuing Education is facilitated via web training and web conferences. This is extremely valuable, especially for busy rural doctors.
- Healthcare home visit services, where the practitioners visit patients using laptops equipped with WiFi cards to access patient information.

Health care providers desire to empower rural healthcare through technology. Telemedicine is being utilized, and health care providers would like to be able to pursue it more broadly – telemedicine is a growing field and application. In a rural area, where it can sometimes take an hour to get to a clinic, telemedicine is a huge



improvement in care. Elderly patients can be significant telemedicine beneficiaries, given they do not always have transportation available to get to a clinic. Health care providers would like to implement more telemedicine routines, for not only treatment, but for continued health and well-being ongoing care as well.

Those interviewed suggest that many connections today are adequate, but more bandwidth is going to be needed, particularly at satellite offices. The maximum capacity at some locations is only “T1” (1.544 Mbps), which is inadequate. Health care institutions incur significant cost for redundancy which is required given the urgent nature of health care, electronic healthcare records, collaboration between specialists at other facilities, billing, and lost business (care) due to outages. Healthcare organizations have learned lessons of outages over the years and believes it necessary to spend the money to better ensure they are up most of the time.

One clinic is using Skype video chats with some remote patients, rather than having them come to the clinic. It is much faster and saves a lot money. California AB 415 that has given these clinics the approval to do remote video appointments, but Medicare does not pay for those sessions yet, so it difficult to promote such options without reimbursement. The federal regulatory environment generally lags behind technology capabilities. There is a view that federal practices will catch up and allow these methods, but it is not clear when that will happen.

Clinics also use Skype video for discussions between doctors for consults, including specialists not actually employed by the clinics. These smaller clinics 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. This highlights the need for adequate broadband.

Home health monitoring devices are becoming more and more common place (such as glucose monitors, blood pressure monitors, etc.), but they too need broadband to make them work. Also, while technically these devices work, issues such as liability, integration of results into a database and expectations issues are still being worked out. Just because it is technologically available, doesn’t mean it is feasible in practice yet. As is a common theme, again clinics do not get paid this way. Clinics only get paid for office visits if through Medicare. Many communities are focusing on “Aging in Place” initiatives focused on delivering technology into the home over next-generation broadband services. Telemedicine and in-home health monitoring technologies will allow people to spend more of their lives in the comfort of their own homes, through enabling remote monitoring, through sensors, and alarming/alerting innovations.

Other barriers to expanded use of technology in health care include concerns about the tech savviness of the end user, lack of end user broadband, and ability of health care providers to be paid for services provided via telemedicine. All residents in rural areas do not have access to adequate broadband that makes the telehealth model



viable. Telehealth is the trend in healthcare to help improve quality and reduce the cost of expensive care for many patients, but without broadband, it is a non-starter.

### 6.3 Public Safety

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Public safety relies on wireless services, and stakeholders note that particularly during larger events there are too many devices being used in command post circumstances, which reduces data speeds to a crawl. A further reality in the state of broadband today is non-redundant backhaul from Frontier, as the successor company to Verizon, which has resulted in four outages in the past four years due to mistakes or fiber cuts. The NBNCBC Telecommunications Outage Report detailing the 2017 Northern California Wildfires is based on a survey that received over 3,700 responses from residents. The report details the findings of the survey, reflecting the public's demand for more resilient telecommunications infrastructure and communications to improve public safety during future disasters. Other reports, such as the Sonoma County's Civil Grand Jury 2017-2018 Report on Emergency Response, the KQED's Investigative Report on Emergency Response and Communications Loss, and Cal OES Report on Emergency Response and Communications Loss all reported similar findings and recommendations regarding more resilient and reliable telecommunications infrastructure and systems. The impact of telecommunications and power outages on communications systems correlates to the time residents have to evacuate their homes in this type of emergency. For those in rural areas, especially with animals, this meant leaving behind almost all possessions in order to save living beings. The lack of telecommunications and communication from public safety caused many of those surveyed to feel minimally informed or completely in the dark and most of those surveyed felt endangered by the lack of telecommunications in the County during this dangerous emergency situation. Public Safety and telecommunications are at the top of County and municipal leaders and residents' minds in the wake of the firestorm disaster. It is realized by those in Sonoma County that broadband could increase the level of public safety within their region.

### 6.4 Schools/Education

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#### 6.4.1 Public K-12 Education

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According to educators, it can be generalized that the education sites that are close to US 101 have broadband, but, the farther away the schools are, the harder it is to serve. Sonoma County has greater population density than neighboring counties, in terms of residents per square mile. There is an attractive density in Sonoma County that should bring more players into the mix.



The “BIIG” program ("Broadband Infrastructure Improvement Grant") is a state budget funding program designed to connect the least connected schools in State. Eligibility is determined by an aggregator for K-12 (outsourced from State Superintendent). Many schools in Sonoma County were identified as being eligible, but only three schools in Sonoma County have been connected under this program. Most of these schools received no bids, those that did were too expensive. Many sites that are connected are at a low bit rate. Fort Ross Elementary School District, Sonoma County Office of Education, Kashia Elementary have all received funding from the BIIG program. A discussion of E-rate status of school districts is presented within the profiles of cities and towns, located under a separate cover.

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## 6.4.2 Higher Education

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### 6.4.2.1 Santa Rosa Junior College

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The SRJC provides WiFi broadband on campus to all of its students. During interviews, the SRJC indicated they have experienced two major issues with providing education to their demographic. One issue is the availability of broadband to many students living in remote/rural locations. They do not have access to broadband and this lack of access impedes their ability to learn, as well as the instructors’ options/ability to teach. Students often work and go to school, so finding enough time to stay at school where broadband is available is very difficult for many of them. It delays their ability for job training and improvement when learning is made more difficult due to the lack of broadband. The other issue is with affordability. The SRJC caters to a demographic that is oftentimes below the poverty level in income. Even if broadband is available, many cannot afford the monthly fees required to have broadband at home. As a result, many will look for alternative places to work, which is not always the most convenient or efficient model. School officials agree, something needs to be done to help address both of these issues.

Lack of broadband availability and capacity is a huge frustration for students and faculty. For example, Santa Rosa Junior College just adopted CANVAS, which is an academic system accessed through browsers. Students and faculty have to be able to get online to access CANVAS, which is also used for advanced course work. Where there is no broadband access, there is no access to this crucial system.

There are a lot of service industry workers and other persons with educational aspirations in The Sea Ranch area (and other areas), that would like to be taking classes for personal advancement, but they can’t due to broadband limitations. Students at Santa Rosa Junior College are being trained for web development, but they can’t work on assignments, practice, or hone skills outside the US 101 corridor due to lack of broadband. Living in the US 101 corridor to have



access to broadband is much more expensive – this is a bad trade-off for students and depresses opportunities.

A new pedestrian and bicycle bridge is being planned to cross US 101, connecting residential and other areas/districts to the Santa Rosa Junior College and high school campuses. Inclusion of conduit in the bridge is planned, per Santa Rosa staff. Furthermore, the City is looking at how to connect it, including SMART Rail Transit fiber, as there is a landing spot owned by SMART Rail Transit a half mile south of the current station. This would be easy to “T” off of.

#### 6.4.2.2 Sonoma State University

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Sonoma State University (SSU) is located in Rohnert Park and this 269-acre campus is part of the California State University (CSU) system. This CSU campus offers six schools and 75 programs (whether degreed or credentialed) to the student population. Officials from SSU were not available for stakeholder interviews and did not provide information to Magellan Advisors regarding their network. However, it can be concluded that students living off campus attending Sonoma State University would have many of the same difficulties locating affordable, available high-speed broadband. In addition, it can be assumed that the students attending SSU would have related requirements regarding online learning platforms, akin to CANVAS at SRJC.

#### 6.4.2.3 CENIC

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The Corporation for Education Network Initiatives in California (CENIC) is a key statewide provider of high capacity bandwidth to educational and other non-profit or public institutions. More generally, CENIC provides direct fiber high capacity network connections to research universities, with 11,000 member-institutions connected. The CENIC backbone is 8,000 fiber miles, and the lease was just renewed for backbone facilities to 2040. Beyond that, CENIC’s next steps include an acquisition of fiber for lit service in community college districts. CENIC also has a strategic goal of developing a “northern loop,” generally I-5 to Eureka and up US 101. According to CENIC, Sonoma County by far has more CENIC projects, activity and progress than other adjacent counties, due to relatively higher population densities.

CENIC connects libraries, working through each main branch to terminate capacity in the community, some of which may only have one library. CENIC runs the state E-Rate consortium (which is the largest in country), using “Letters of Agency.” Santa Rosa uses CENIC for library connections, which is a huge benefit. The Santa Rosa Library recently turned up streaming video services, and demand is “blowing up.” CENIC provides lit services to most junior colleges, sometimes through the district, sometimes directly. Santa Rosa Junior College has 2 connections – a gigabit connection to San Francisco, and a back-up 45 Mbps to Emeryville.



In Sonoma County, CENIC serves public school districts, 171 out of 187 public schools. Schools are so reliant on digital resources, and this assumes that fiber is available in the first place. There is still a need for adequate digital resources for private and charter schools within the county. More and more county education offices are going to fiber solutions and there is interest in 100 Gbps speeds. CENIC noted that a problem in Sonoma County is average bandwidth is 45 - 50 Mbps, not 1 Gbps as is usually found in school districts served by fiber supported by CENIC. Sonoma County is disadvantaged significantly by this.

CENIC provides for a number of broadband needs in Sonoma County and the state of California, generally. The research community in California is huge and is significantly supported by CENIC. CENIC also provides service to local entities on a case by case basis, but so far not very broadly. Los Angeles was the first, instigated by the Mayor and Chief Innovation Officer, in pursuit of “big data” initiatives, which are of great mutual interest to both CENIC and cities. Smart Cities was the initial motivation for Los Angeles, with the initiative forming around several Smart City applications.

More generally, any city or county that wanted to work on answering big data questions could be supported, although demonstration of political will is necessary. CENIC has peered networks with cities of Los Angeles and San Francisco. CENIC then peered with the state network at Sacramento to make the state data center and state network available. CENIC’s work with libraries is substantial and significant since they are woven into the fabric of the communities they serve. One example of the unpredictable course of collaborations is illustrated through a researcher (archeologist) at UC San Diego, who has been working to preserve the history of Middle East in the face of potential physical destruction. Various types of tools are being used by the researcher so that many can experience some of these Middle East archeology sites in “3D” in an immersive environment. There is a great desire for this experience to be available in libraries, to provide better access to cultural treasures. This concept is replicable for other archeological treasures, such as Venice. A key finding from this project is that a “big data” approach brought peace between two crucial communities who were previously at loggerheads on preservation issues – art and architecture.

CENIC is looking at big data applications in all disciplines and is engaged with multiple companies such as Juniper Networks and Facebook. Facebook is engaging and continuing to meet to talk about technical infrastructure projects and non-proprietary ways to enhance Facebook. While 100 Gb networks may be adequate today, future big data needs will drive capacity requirements and massive networking well beyond the state of the art networks in place today – but it will not be different architecturally from current networking for anchor institutions. Last year CENIC transmitted 60-70 petabytes on its network – which is increasing 50% every six months, with no end in sight. Multinational, multi institutional collaborations to maximize use of engineering talents are driving capacity demand, as is machine learning, autonomous networks,



and software stack. Some demand is big data, some is just massive use by multiple institutions. For consumers, trends depend on the “Internet of Things,” but the security issues associated with IoT are mindboggling.

Other stakeholders in education make it clear that the biggest demand factor for broadband is the move to digital textbooks. Students may want paper, but also are required to use digital copies. This creates a large problem regarding educational access from home when students live in areas where broadband is unavailable, especially in the West County. For example, there are many dairies and working farms west of Petaluma, with working families with children, and not necessarily a lot of means. These young people have educational needs, and there is a growing risk that they cannot be served with the broadband network as it is today. From a Junior College perspective, this means many can't access coursework – 12% of classes are online now and this will double in a few years. A Junior College can expand this class format much easier than expanding classroom space in buildings, plus this is what many students want. Broadband access is now required for the Junior College to accomplish its primary charter and mission, education to citizens in the county – from high school students to retirees. The more effectively the Junior College can serve the community, the more benefits flow: enhanced employability, higher value work, etc. This is both a business view and an educational view.

Given growth projections, the Junior College expects that a capacity upgrade will be required from 10 Gb to 40 Gb within 5 years. The library is a big usage node, and students bring and use multiple devices, over two devices per student now (prior to the upgrade, the previous 1 Gb link was saturated multiple times daily). CENIC continues to work on the strategic goal of a northern loop including: I-5 to Eureka and infrastructure along US 101. The idea is to bring the backbone closer to communities we serve, add nodes, and make tail circuits shorter and cheaper. There are plenty of possibilities, but all rife with complexities typically associated with how the infrastructure is funded, who builds it, when and under what ownership.

## 6.5 Needs/Applications

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Stakeholders observed that there is a growing need for infrastructure to support computer and consumer applications moving to “the cloud.” Stakeholders also observe that broadband internet access has risen to a level of importance that it is “the fourth utility,” on par with level of importance to the public with gas, electric, and water service.



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## 6.5.1 Local Government/Public Safety

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The recent fire disaster demonstrated the need for dynamic communications during the emergency. Also, it put redundancy of communications on “everyone’s” mind. The fire disaster has also created an interest in mounting and supporting cameras/video transmission in the hills to watch for smoke and get an early break on fires and determine early-on that a public emergency may be imminent. From a public safety standpoint, lack of funding is perceived as the critical issue. Wireless service is viewed in the public safety community as having failed during the fire disaster at critical times, as many sites went down. EMS communication is affected by lack of broadband in rural areas. Public safety stakeholders have shared that half of Sonoma County is not covered by cellular and a few spots are still not covered by public safety 800Mhz systems. More tower sites are required to fill in coverage, and to help to provide redundancy. Additional sites are not in a “ring” configuration and are therefore at risk for outage with no backup. Furthermore, there is a need to move current T1 connections to Internet Protocol based solutions.

County Fair facilities are used in disaster relief efforts and must be considered in broadband planning. Fairground facilities are used for evacuation, staging and communications during disasters. The Fair also accepts animals in times of an emergency, unlike many other shelters.

At both the city and County level, stakeholders see a need for more community cameras, for monitoring of city and county locations and facilities. There is also a need for traffic cameras, which requires an upgrade to fiber-optic connections, from today’s use of twisted pair cables for traffic signals. Presence sensors are used for signaling today, which is not sufficient for “hold the green” signaling for runs by emergency service vehicles. County applications include open data initiatives which rely on broadband, connecting landfills to the Public Works office for monitoring, and connection of water meters for Supervisory Control and Data Acquisition (SCADA) applications. Sonoma County Water Agency has many needs and applications for broadband technology, including flood control, irrigation, and meter reading. In particular, monthly meter reads via radio are very costly as they miss early detection of leaks – thus the move to SCADA to go real time. Similarly, there are also important applications at Sonoma Clean Power.

Cities are also very interested in support of expanded WiFi for community use (public WiFi often comes up in Santa Rosa city council meetings), around the cities for public spaces, pools, parks, city facilities, etc. Furthermore, there is significant interest in “Smart City” applications, including smart parking, various analytics made possible, and noise pollution. These applications become feasible with community owned fiber-optic cable to connect all public locations.



One compelling Smart City example cited by CENIC in Chicago, where a collaboration has been structured among the Argonne National Laboratory, the University of Illinois-Chicago, and the University of Chicago to place and monitor an array of sensors across the City of Chicago, using light poles and other infrastructure. Similarly, New York City has repurposed all telephone booths for a Smart City initiative known as LinkNYC, without requiring any city or state funding.

## 6.6 Innovations through Municipal Fiber Networks

As communities invest in fiber infrastructure, they empower their residents and businesses to take on a multitude of technology-based initiatives. These initiatives can include expanded broadband services, collaboration opportunities, public safety applications, as well as energy and utility management functions and features.

### Broadband Services

- Public Wi-Fi
- Common Internet backbone for all anchors
- City and County
- Schools and libraries
- Hospitals and clinics
- Public Safety
- Community Support
- Interconnection with service providers
- Internet of Things

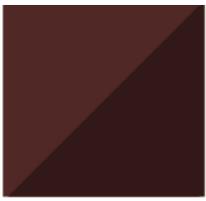
### IT Collaboration

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

### Public Safety Applications

- Video monitoring
- First responder support
- Collaboration with state and federal agencies
- FirstNET preparedness





## Future Energy and Utility Management

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

## 6.7 Business and Agriculture

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Stakeholder interviews provided perspectives on rural California and the unique broadband issues in those areas. There is a strong feeling that broadband is key to economic development, especially in rural areas, but the stakeholders also acknowledge the cost issues associated with the deployment of broadband. The biggest issues put forward revolve around service complaints about lack of service or no service in many rural areas. Lack of customer support from the incumbents is also an issue. Some stakeholders noted that official state and federal broadband maps are not accurate and would like to see a local program to update and correct those maps. Efforts need to be taken at the local level for anything meaningful to happen to the coverage maps accuracy. The census blocks structure of the broadband mapping is simply too imprecise to offer accuracy to the detail needed, when availability of broadband varies premise by premise and street by street.

Broadband in rural Sonoma County is important not just for agriculture but also for:

- Wineries
- Dairy
- Cattle
- Tourism/Recreation
- Coastal Tourism

Sonoma County’s proximity to San Francisco area greatly expands opportunities for tourism and agri-tourism. New technology being applied for agriculture and wineries is getting better all the time. It is recommended that this study produce some case studies on technology use in agriculture and its effect on the bottom line. Labor costs for agriculture are very high and going higher given new laws (minimum wage and overtime) recently passed. This is driving renewed and increasing interest in technology, which can help reduce the labor costs while at the same time offering operating efficiencies while resulting in better products – this is viewed as “win-win-win.”

The new farmer will need to be more tech savvy in the future. Application of technology will reduce costs, improve products, reduce environmental footprint, improve yields and provide more real-time information and access to customers. For example, new software planning tools for harvest/planning increased furrows by 7%.



Other examples of applications include:

- Health wearables for livestock
  - Provide for early treatment before diseases get passed between the herd
  - Decrease use of antibiotics, reducing cost, increasing quality
- Product quality reporting/yields
- Increased use of sensors, including ground sensors for moisture to trigger irrigation when needed and optimal.

Application of broadband technology to dairy farming is a strong trend in agriculture. Local wireless capacity and WiFi is key to automating the farm. Without this capacity (and decent backhaul), agricultural advances in technology cannot be applied effectively.

Data on broadband in agricultural use is limited. Current USDA reporting statistics only ask if the farmer uses a computer and does not ask any other detailed questions about broadband, advanced technology, or how the computer is used. Additionally, USDA data is out dated and needs serious upgrades to ask appropriate questions for today's farmer. Therefore, this study should develop a method to collect what is actually in the field as there is no real, accurate data today regarding broadband technology and utilization in agriculture. Some stakeholders would like to see case studies for tech usage in rural communities as they see it helping them and the USDA drive the point home with elected officials.

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### 6.7.1 Broadband Use in Winery Operations

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“In wine growing, wine making, and wine selling – broadband is a necessity,” stated a stakeholder during an interview. Whether it is sensor technologies to monitor water usage and soil nutrients or data driven sales processes, broadband is affecting all aspects of a winery's business. The stakeholder believes that broadband will change the business in many ways, with the following being the most important currently implemented or needed in the immediate future.

**Sensors:** Sensor technologies to monitor water usage, well water, and soil nutrients are incredibly important. Additionally, much of the data collected from these sensors will be required to upload and report to the State via online reporting portals. Use of the sensors, uploading of the data and reporting of the data will all use connectivity in some way.



**Reporting/Communications:** Whether it is reporting data garnered from sensors, simple label approvals, or communicating with suppliers or customers, reporting and communications occur online. Use of internet-based platforms is rapidly becoming vital to conduct business. Without broadband internet, customers are lost, and data analysis cannot occur, which impedes the business.

**Employment and Data Driven Sales:** Many times, people associate IoT and automation with a reduction in workforce. In the case of one winery in Sonoma County, this wasn't the case. When this winery used their connectivity to utilize a point-of-sale system called Wine Direct, they needed to hire someone to use it and follow-through with the data driven sales tactics. The customer management system assists wineries in follow up and creating sales based on historical data, increasing their direct to customer sales. After hiring the new employee, the sales generated paid for the employee the first month and one year later, the sales are up 22% over the same quarter last year. The winery attributes this to the added employee generating managing the customer base.

**Local Broadband for Employees:** Employees are an important part of any business, but when many of your employees are farm workers and low-income households, additional considerations come into play. This stakeholder discussed the importance of broadband to support telemedicine for these workers and their families. For example, if a child has a rash, the mother could schedule a telemedicine appointment and get medication without needing to miss work or make a long drive to a nearby town for treatment.

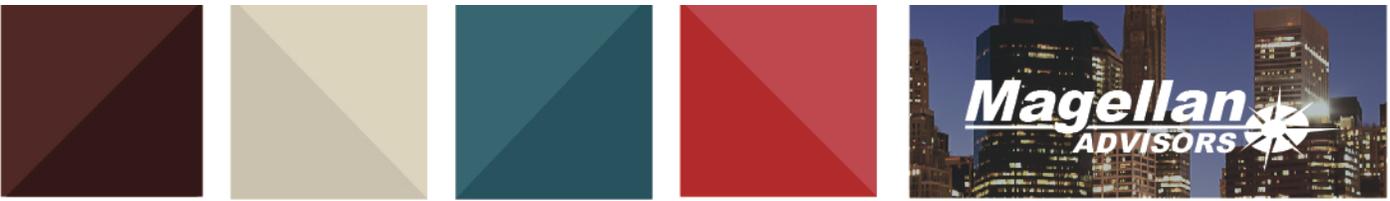
This particular winery is fortunate to have broadband access. Comcast provides wired cable to the winery based on a 3-year contract at a cost of \$1,500 per month with speed tests revealing approximately 100 Mbps download and 12 Mbps upload speeds. While the speeds are high for Sonoma County, the winery believes higher upload speeds will be necessary moving into the future for uploading of data for reporting to the cloud and in support of new sensor technologies.

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### 6.7.2 Broadband Use in Dairy Operations

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One stakeholder operates a large organic, family-run dairy farm in Sonoma County, with 750 head of cattle that get milked two to three times per day. Cows need to be milked every day, two to three times daily, 365 days a year. The farm is fortunate to have broadband access, while many colleagues do not. Currently, Comcast Business is used for their broadband and it seems to meet their needs. Previously, the farm had service from AT&T, but the plant was outdated and the service insufficient. Technology is improving all the time in agriculture, especially for the dairy farmer.



There is a clear need to plan for the future, which includes use of broadband, wireless/cellular and gadgets.

This farm uses a product called “Dairy Herd Improvement” developed in Utah to help manage the health of the herd. The process requires a tester to come out periodically, test the milk and send samples to Utah for analysis. DHI then sends back the results so appropriate adjustments can be made as necessary either to the feed or health of the cow. The goal is to have the appropriate mix of fat, milk and vitamins that milk buyers demand. DHI also can help determine the best time to breed the cows. Most breeding is done via artificial means, so timing is especially crucial and efficient. Genome work is being done to help identify the best stud cows, thus eliminating the trial/error/luck methods of the past.

Robotic milking is a trend occurring in the dairy industry. Milk cows will have an RFID collar installed and when the cow decides it wants to be milked, it will head to a gate for milking. If the computer, via the RFID determines the cow is ready to be milked, it will open the necessary gates, allowing the cow to pass. The robotic arms attach and milk the cow. Computerized records are kept of each cow and how and what the cow is producing and data analysis can help determine changes in milk quality and quantity.

Labor costs are very high in the dairy industry. They are going up even further with new state mandated minimum wages and overtime requirements, so anything the dairy farmer can do to cut down on costs (labor) and to be more efficient will be welcomed. Robotic farming has the promise to cut down on labor costs tremendously.

Technology is significantly aiding farm management. Technology applications include:

- Sensors implanted in cows that provide information regarding ovulation, sickness, etc. to help manage the health of the herd;
- Remote/automatic operation of gates;
- Cameras for monitoring herds;
- Special feed mixes to optimize output;
- Drones to help find/locate grazing cattle on large farms; and,
- Moisture and soil meters/sensors assisting with health management.

## 6.8 Barriers and Challenges

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Deployment of broadband infrastructure is challenging as the distance from the US 101 corridor increases. Availability and affordability of both wireline and wireless broadband services generally declines as distance from the US 101 corridor increases. Stakeholders noted there is always some level of criticism of anything with a price attached to it, but as a fourth utility, and a requirement for daily life, broadband should be accessible to all levels of economic status. If broadband is going to be a

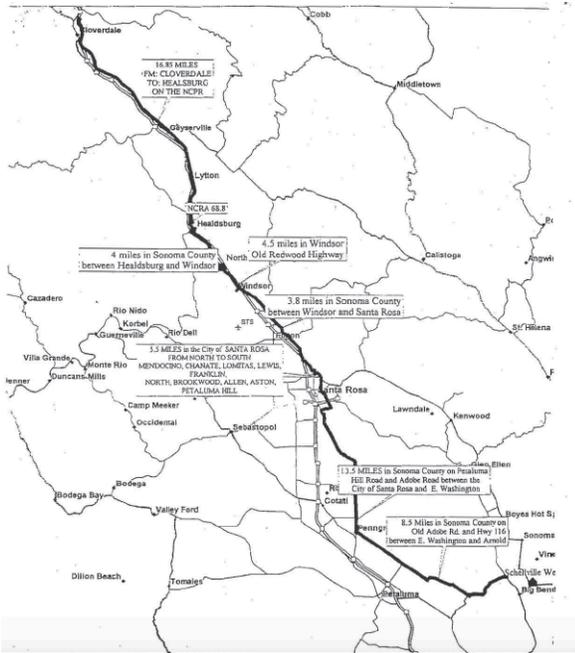


requirement of schools and society, signing up for health insurance coverage, etc. it should be accessible and affordable.

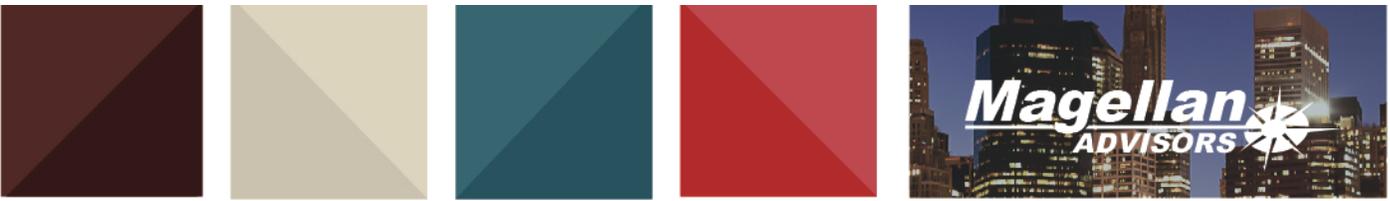
The recent fire disaster illustrated the backhaul dilemma for the first time for many – backhaul capacity is needed to make towers work, even temporary towers. It is a common misconception that “wireless service” is wireless between both ends of the call or data transmission, when in fact it is the wireless transmission only between the handset or device, and the antenna/tower. Backhaul facilities – predominantly fiber-optic cable – connect antennas and towers via the wireline network. Placement of a temporary tower is useless to restore wireless service, without backhaul network connection. Also, some observers noted a realization from the fire disaster that there are fewer and fewer landlines. This is ascribed to changing demographics, including the fact that even video-based entertainment is more and more common on handheld devices.

Geography/terrain and demographic factors affect placement of broadband infrastructure. Normal return on investment considerations prioritize infrastructure investment for San Francisco and other more urbanized areas over rural Sonoma County, for example. The traditional telecommunications and cable companies make investment decisions based on the potential return on its investment at any given time. The return on investment is entirely based upon financial return, whether immediate monetary, or long-term investment gain. Communities, or more specifically, cities and counties, are charged with providing the “health, education and welfare” of its constituents, and can reap financial gains, and the off-balance sheet returns typically attributed to economic development, higher levels of education and healthcare, and improvements in the overall quality of life.

Figure 9: WilTel conduit map



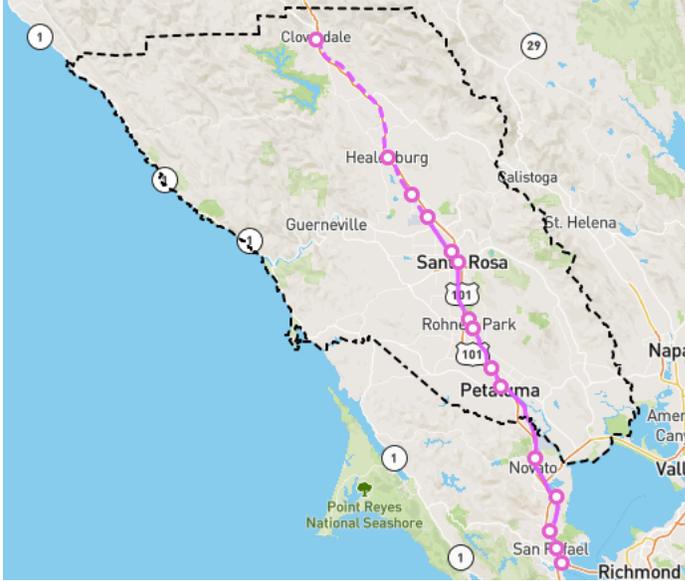
Some stakeholders have observed that a rock-solid inventory of conduit routes and availability would be very helpful, and broadband expansion and planning is challenged without this conduit inventory.



Challenges which are also opportunities include:

- How to effectively use available former WiTel conduit which the County now owns for broadband expansion. This conduit is located in unincorporated areas. The actual value and condition of the conduit is not yet fully known. The conduit evidently is non-contiguous, the segments of which are in unknown condition. Commercially acceptable valuation and usability of the conduit is therefore unknown but is being explored by the County. The WiTel conduit system requires additional assessment to understand its usability.
- How to effectively utilize fiber strands along the SMART Rail Transit route which the service provider (Sonic) has granted to the County and cities along its route.

Figure 10: SMART Rail Map



Some stakeholders state that the County permitting process is a substantial challenge. There is a view that the permitting process associated with deployment of wireline and wireless broadband infrastructure could be much more flexible and collaborative. Permitting and inspection processes in the County and cities are viewed by some stakeholders on a range or spectrum, from “good” to “bad.” As a result, it can be a big problem simply to cross a city street, and it is sometimes cheaper to use a microwave shot, due to cost and time required for approvals and permits. Major build projects have multiple jurisdictions that add significant complexity and challenges. Fees can also be an issue, as some jurisdictions have recently substantially increased pole attachment fees. In order for a County, region, or city to efficiently invest in broadband infrastructure, current public policy and internal processes should be aligned to support broadband development and cost optimization. Organizations should look to “streamline the process,” in order to incentivize broadband investment from the private sector.



City and County departments are challenged by a lack of depth of knowledge and experience to deal with wireless providers on tower siting and consolidation, for the emerging requirements associated with “small cell” and “5G” wireless deployments.

Healthcare challenges include that wireless service outside the US 101 corridor is often very slow or not available, which hampers patient care. It is believed that healthcare applications will grow and help improve patient care to help reduce the cost of care, eventually with video exams/consults using broadband. But today, health care providers cannot be reimbursed for broadband consultations or appointments, and also many rural clients do not have adequate broadband to facilitate remote monitoring and/or video conferencing. It is a problem. Usability is also a concern for a certain demographic, and concerns about the tech savviness of the end user, lack of end user broadband.

Educators state that while both affordability and availability are barriers, availability is the real challenge. Lack of availability is actually **limiting** higher education enrollment, since many students also work and have families. A fair number of students live in West County, and lack of broadband capacity is a real barrier to their ability to do their classwork and connect. There is a sizeable immigrant community (restaurant and hotel service employees/service economy participants) who require access to ESL classes but have no broadband access except through phones and often no WiFi available where they live.

One structural barrier is FCC’s Universal Service Fund (USF), which is composed of “walled” separate programs for education, health care, wireless deployment, and wireline deployment. If the separate programs could be pooled, those resources plus additional contributions could provide for capital expenditure. At present, the FCC USF program doesn’t fully support reaching communities that need it due to this “walled” or siloed structure. A similar issue exists with state funding of broadband in California, where funding is restricted between vertical segments such as education and health care. These funding restrictions work against funding broadband infrastructure with aggregated demand.

## 6.9 Opportunities

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Meetings and discussions with stakeholders have been very beneficial both to prompt initial and continuing discussions regarding collaborative opportunities and to identify specific opportunities. In particular the *fire disaster* has put broadband communications “top of mind” in several ways. Redundancy of communication is on “everyone’s” mind now, and it is appropriate to rethink facilities deployment in high hazard areas. Partnering with utilities, and opportunities to plan for undergrounding are more possible now.



The fire disaster caused evacuation of people from high population density areas to rural west and north unincorporated areas. This created broader public awareness of non-metro connectivity issues, but it also allowed people to see that if the broadband infrastructure was in place, rural areas could absorb people and contribute to continued functioning of families and institutions. Furthermore, if people could work from home, putting people on the road to go to work at the worst possible time would be avoidable. Longer term, the fire disaster evacuation illustrated the prospect that people can move into parts of the county that were not impacted and keep working.

As a result of the fire disaster, conversations about the importance of broadband occurred with the Governor’s office and agency heads. A big issue going forward is information dissemination, notifications and notification systems, and lack of redundancy and resiliency on privately-owned broadband communications systems. In testimony before the California Legislature, the Director of the Office of Emergency Services stated that the State does not have authority to make sure the networks operated by private telecommunications companies to serve the public have adequate redundancy and resiliency to withstand disasters.<sup>37</sup>

### 6.10 Survey Results

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Two surveys were released during the time Magellan Advisors and the Sonoma County Broadband Advisory Committee were working on the Broadband Strategic Plan. The Broadband Advisory Committee was appointed by the Economic Development Director and consisted of members representing government, business, and agriculture.

Initially, a Broadband Survey was released via the County website and social media. This survey was also distributed through email to various organizations in the County. During the time Magellan Advisors was working on research and outreach in Sonoma County, the 2017 fire storms devastated many areas of the County destroying telecommunications infrastructure. In order to learn about the affects the fires had on telecommunications outages, the North Bay/North Coast Broadband Consortium (NBNCBC) released a survey to citizens and visitors. “The purpose of this report was to provide an overview on the state of services/infrastructure in the 3-county region and the impact any outages had on residents. There was no publicly available documentation of any previous telecommunications outages resulting from wildfires;

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<sup>37</sup> Testimony of Mark Ghilarducci, Director, Governor’s Office of Emergency Services, before the Joint Legislative Committee on Communications and Conveyance, December 4, 2017. <https://www.usnews.com/news/best-states/california/articles/2017-12-04/california-official-emergency-alerts-hurt-by-private-system>



thus, the report is the first of its kind and intended to organize the survey data for future interpretation and analysis.”<sup>38</sup>

Of the 3,705 total survey respondents to the NBNCBC telecommunications survey, 1,102 responses were from Sonoma County (27% of the total). Seventy percent of respondents from Sonoma County reported internet outages. Approximately 89.8% of surveyed Comcast subscribers in Sonoma County suffered outages, followed by 50% of Sonic subscribers and 48.3% of AT&T subscribers.

There were over twenty recommendations within the report, and of those many related specifically to broadband access. These recommendations indicate correlation between the results of the telecommunications survey and the Broadband Strategic Plan. Recommendations included:

1. Continue to encourage investment in telecommunications infrastructure - both private and public, to address and close the “Digital Divide.”<sup>39</sup>
2. Develop a broadband strategic plan for each county with input from all stakeholders.
3. Inventory and map all telecommunications infrastructure in county, including fiber routes and secured/unsecured fiber.
4. Find effective and strategic ways to protect telecommunications infrastructure in areas where possible and necessary (e.g. undergrounding, joint-trenching, etc.).
5. Review internal processes for all telecommunications related procedures and identify more efficient solutions to effectively deploy broadband through the counties - everything to help remove barriers and deploy more networks (dig-once policies, streamlined permitting, etc).
6. Coordinate efforts between public officials and regulatory agencies (CPUC, FCC) to solve major issues. Counties should participate in relevant CPUC and FCC proceedings.
7. Subsidize IoT research directed towards public safety and wildfire prevention.

Magellan Advisors created and distributed a Broadband Survey to Sonoma County community anchors and businesses in July – November 2017 and 57 responses were received. Of those responses, 28% were from the Agricultural and Farming sector, 16% Retail or Wholesale Trade, 14% Hospitality and Food Service, 11% Professional, Scientific, and Technical Services and 7% Educational Services. Generally speaking, the respondents were from small and medium sized organizations, with only 10%

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<sup>38</sup> NBNCBC Telecommunications Outage Report – 2017 Firestorm. April 2018.  
<http://www.mendocinobroadband.org/wp-content/uploads/1.-NBNCBC-Telecommunications-Outage-Report-2017-Firestorm.pdf>

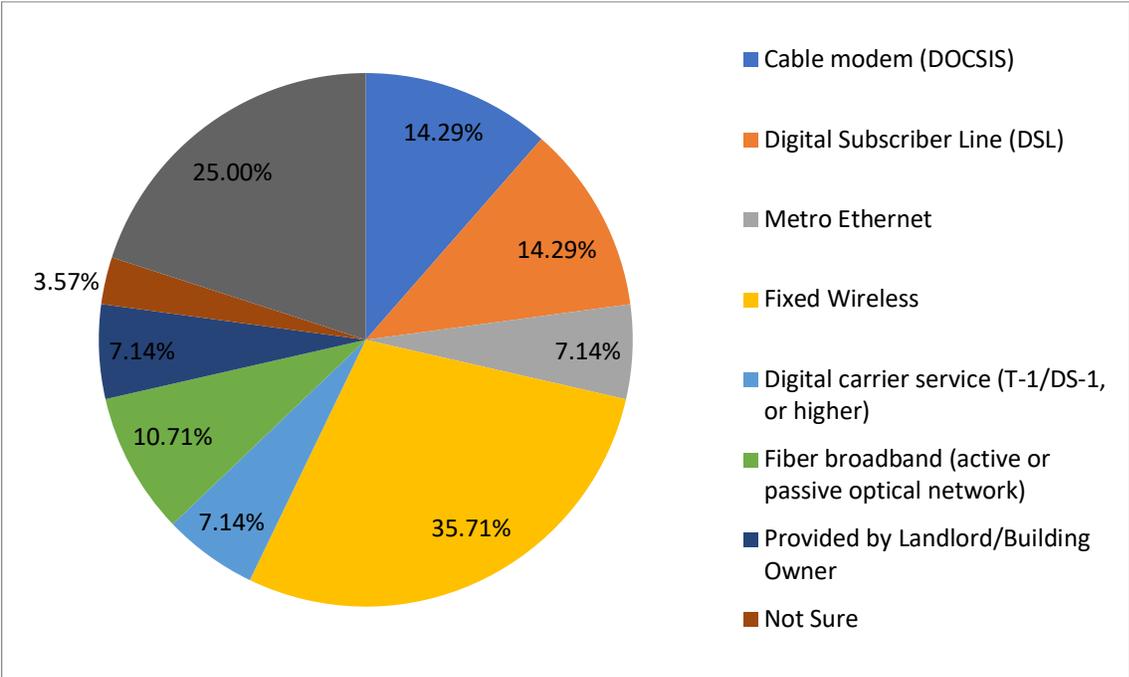
<sup>39</sup> Digital divide: the gulf between those who have ready access to computers and the Internet, and those who do not.



having over 100 employees. A selection of the questions asked of business organizations in Sonoma County are discussed below.

Of the 28 respondents to the question, “What type(s) of internet access does your organization have?”, a large number of businesses responded with fixed wireless (36%). As stated in other sections of this report, fixed wireless does not constitute true broadband and can tend to be unreliable due to line of sight issues. Metro ethernet (25%), DSL (14.29%), and digital carrier service (14.29%) trail behind fixed wireless.

Figure 11: What types(s) of internet access does your organization have?



When asked the question, “Please rate your current internet service provider(s) to the best of your knowledge.”, 76% of 25 responses reported poor availability of services in the Sonoma County area, demonstrating the lack of viable competition in the Sonoma County market. The trend lines to the right demonstrate the distribution of the answers for each of the categories. Normally, a bell-shaped curve would indicate the majority of responses should occur somewhere around the middle of the distribution. However, the trends lines within the following table the lines are higher to the left than the right, especially so with price, reliability, performance, and availability of services. These trend lines indicate lower levels of satisfaction with these categories.

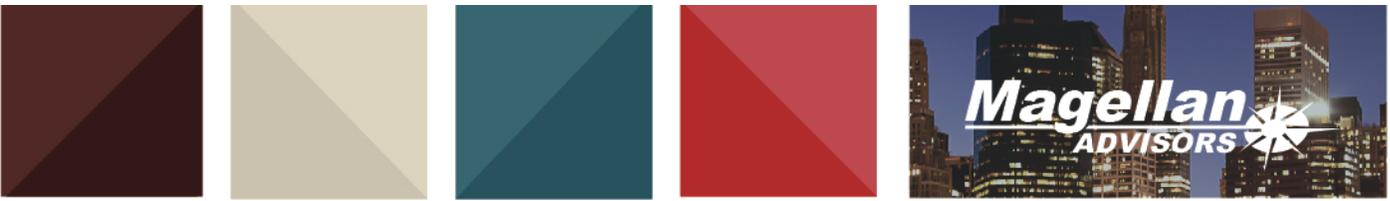


Figure 12: Please rate your current internet service provider(s) to the best of your knowledge.

	Poor	Fair	Good	Very Good	Excellent	Trend Line
Customer/Technical Support	16.00%	36.00%	12.00%	16.00%	20.00%	
Price of internet access	45.83%	25.00%	12.50%	0.00%	16.67%	
Reliability of internet access	32.00%	20.00%	12.00%	20.00%	16.00%	
Performance/speed of internet access	44.00%	24.00%	12.00%	4.00%	16.00%	
Other products or services	47.37%	21.05%	15.79%	0.00%	15.79%	
Availability of alternative services from other providers	76.19%	9.52%	0.00%	0.00%	14.29%	

When asked to provide an anecdotal answer regarding how broadband would help their business, survey respondents provided a variety of answers. Of all of the comments, only one indicates satisfaction with services in the Sonoma County area.

1. We need rural broadband. AT&T and Comcast are known poor providers but access in rural locations is more important than trying to compete with them in markets where they can drop cost to compete with anyone foolish enough to try.
2. Expanding infrastructure (fiber, PRI) or enhancing point-to point wireless service for data and digital voice.
3. With locations in Napa/Sonoma and Mendocino, it could potentially help with consolidated services and pricing.
4. Don't see the benefit. Current provider is excellent.
5. A level playing field for online goods and services that are currently not available on microwave broadband, which I hardly call broadband due to latency issues.
6. Save taxpayers \$ currently going to Comcast and AT&T.
7. Please connect us with fiber optics.
8. I would assume faster speeds, better reliability, better customer service, lower price.
9. This issue, of access is critical to me. My partner and I both work at home. Are dependent upon the Internet. Must use the Internet for video conferencing. Have been through multiple solutions. Things are fairly stable today, but as you can see...I still don't have the upload/download promised. It's a nightmare.
10. We run a rural farm and have no options for internet other than Satellite internet, which is very expensive, slow and service often goes down.
11. Internet service goes out several times a day. We have been told the only way to improve service outages is to cut speed to 3mbps download or less.
12. Increased access to standard services, increased ability to market, increased efficiency.
13. I am a lawyer who works primarily from my home office on Timber Hill Road. We have horrifyingly bad Internet access here. The only options are DirecTV satellite, Exceed satellite, and awful point to point wireless which was totally unreliable and costs too much. I have tried to get Sonic to run fiber here but



there are not enough homes to merit it. The nearest DSL connection box is too far away to make cabling worthwhile to the companies. I've been located here for three years and Internet access has been one of the worst parts of living here and working here. I'm also a musician and photographer and slow Internet access is in an enormous problem in those businesses.

14. Data revolution. Choice provider. It is mostly a monopoly so alternates are great. That and convincing web developers that small websites are good.
15. We are a retreat center who have many visitors from outside the county and state. Our single largest complaint is slow internet. We are sure improved service will provide more returning guests in the future. I suspect local business will also benefit a little simply from the additional exposure it could provide.
16. Faster, cheaper.

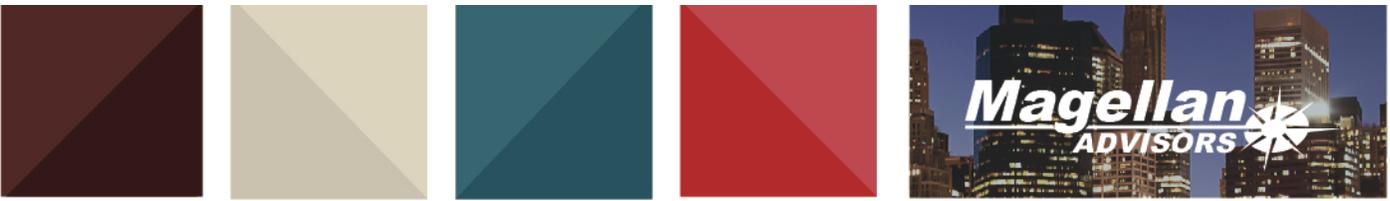
## 6.11 Former WilTel Conduit

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WilTel constructed and used conduit in Sonoma County, ownership of which has now reverted to the respective government units. Previously, there was a joint-powers agreement (JPA) for the ownership of the WilTel conduit – but that agreement is no longer standing. At this time, the cities of Santa Rosa, Healdsburg, Cloverdale, and Windsor own the conduit within their city limits, and the County owns the portions outside city limits. The conduit is approximately 30 miles in length but is not contiguous due to presence of easements which were not crossed, as well as through some wetlands. Also, it is not clear that the condition/usability of the conduit has been confirmed (i.e., sections are not plugged, collapsed, etc.).

The County has solicited interest in using the WilTel conduit by service providers, seeking dark fiber for County use in return. So far, this solicitation has not yet borne any fruit. The County had initiated a negotiation process regarding a trade for the conduit, but the negotiations have ceased, and it is unclear why the negotiations have not gone any further. It is possible the issue lies in the depths of the conduit, some believed to be up to 20 feet deep, and with other segment gaps existing within the known route that may be within environmentally sensitive areas.

Magellan believes there are opportunities to bring partners to the table under the right framework. Strategies are needed to leverage the WilTel conduit to create a continuous conduit facility. Furthermore, renewed attention needs to be paid to use of the conduit to provide for undergrounding infrastructure where aerial infrastructure was destroyed by fires. See Figure 21 for the WilTel conduit map.



## 9.11 SMART Rail Transit Fiber/US 101 Pedestrian/Bicycle Bridge Conduit

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The Sonoma-Marín Area Rail Transit (SMART) district route is being developed to provide passenger rail service along the Sonoma-Marín corridor.<sup>40</sup> The SMART route serves Petaluma, Cotati, Rohnert Park, Santa Rosa and Sonoma County airport currently, with route extension planned to Windsor, Healdsburg, and Cloverdale. Among the services provided by SMART to riders is WiFi, which is provisioned using fiber-optic cable placed along the SMART Rail Transit route by Sonic. There are four conduits in place, with only one in use with 432 strands of fiber. Sonic has set aside six fiber strands in this cable to be used by cities and Sonoma County for their own

public purposes. Each of the cities and Sonoma County should incorporate this fiber availability into its planning process. The three available conduits could potentially be an opportunity for lease from SMART and could be incorporated in the fiber planning process. In Santa Rosa, the SMART Rail fiber planning should include the conduit being placed in conjunction with the new pedestrian and bicycle bridge over US 101 adjacent to Santa Rosa Junior College, which is approximately half a mile south of the current SMART Rail station and would be relatively easy to interconnect. See Figure 19 for the SMART Rail fiber map. This fiber route along the SMART rail right-of-way provides a route outside of Sonoma County, capable of connecting the County to the Bay area, and the abundance of content and service providers. This network once extended would provide the necessary middle-mile connectivity to each community along the route – a necessary component to broadband investment and development.

## 6.12 Leverage City/County Infrastructure and Purchasing Power

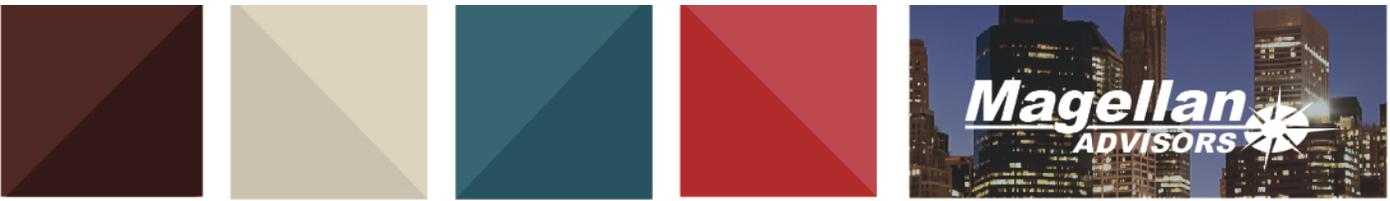
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There is a view that the County has flexibility in financing infrastructure if there is an associated revenue stream. Furthermore, it is acknowledged that there is always a role for the County in providing infrastructure, via cooperation and collaboration. This is particularly true for broadband infrastructure, which is considered to be the fourth utility, in addition to gas, electric, and water service.

Collectively, Sonoma County and the cities within it lease substantial broadband capacity at retail rates from various service providers including AT&T, Comcast and Sonic. The County and the cities also operate and maintain fiber-optic network

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<sup>40</sup> <http://sonomamarintrain.org/about-smart>



facilities of their own to interconnect city and County buildings and for other purposes including traffic management. For example, the buildings at the County’s Administration Center campus are connected with fiber-optic cable configured in a dual 40 Gb ring. Thus, the cities and the County have experience with fiber networking. More broadly the county owns or leases facilities for approximately one hundred sites. Some are lower speed for functions such as proximity card readers or alarms. Some circuits are T1 or DSL. Many sites are served via Ethernet.

The cities and County could use this experience with fiber-optic network operation to place their own fiber facilities and achieve significant lifetime savings, compared to paying continued annual/monthly lease payments for capacity. Investment in long term assets will reduce monthly costs and budgets. The effect of leveraging city/County purchasing power as an anchor tenant on a fiber network is that it would drive toward widespread deployment of dark fiber in the long term to catalyze economic development. Diverse paths and redundancy would be created over time as well. The additional benefit of leveraging city and County purchasing power in this fashion is that dark fiber or wave capacity would also be available for use by other parties in expanding broadband availability and affordability. The extent of these

benefits should be quantified by performing a high-level analysis of the network cost to serve each of the County’s presently connected locations, spreading those costs over time using an appropriate municipal borrowing rate and comparing those annual costs to the expected payments to service providers over time for those services.

Some suggest that the cities and County model a broadband expansion approach on Sonoma Clean Power (SCP). SCP was initiated by the County, based on the idea of buying power from renewable sources to supplement or replace power from PG&E. Under this model, SCP’s customers cover the added overhead to find competitively priced, renewable energy sources, from steam/geysers and solar, etc. thereby supporting the push toward more renewable energy sources. The Agency also supports expanded use of electric vehicles by subsidizing chargers and purchase of electric vehicles (EVs). Sonoma County could use a similar approach to support expanded broadband capacity and availability.

Infrastructure owned or managed by the city or County could potentially be utilized to support broadband. For example, the City of Santa Rosa has significant water main replacement coming up, which provides opportunity for conduit and fiber placement. Also, there may be an opportunity to place a wireless tower and antennas at the water treatment facility serving the Freestone Water District (near the Bodega Bay area). A similar opportunity may exist on water storage tanks, which are “owned” by Public Works. County owned towers could be used to expand broadband, and solar panels and antennas on rooftops of rural fire stations would serve hundreds. Fiber backhaul to county buildings and more rural areas is needed to support wireless deployment. While these are large potential opportunities they would need to be vetted with



stakeholders and for compliance with historic foundation requirements. Also, Public Works may have some infrastructure on bridges or public rights-of-way.

Related policy steps include implementation of “Dig Once” practices, along with placement of conduit that can be made available using the presence and purchasing power of the cities and County as anchor tenants to catalyze development.

Cooperation and coordination is crucial to support opportunities. For example, California Department of Parks and Recreation has a radio system that operates on the coast, which is not shared with public safety. State Parks also does not have its own public safety system, which suggests the opportunity for a mutually beneficial opportunity to connect State Parks and public safety radio systems. Also, while cities and the County have ideas on municipal networks, coordination is in its early days. Coordination among cities and the County is crucial for “Smart Cities” readiness, and this could start with the County and cities coordinating on Capital Improvement Plans to that end.

## 6.13 Leverage Federal Funding

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The Federal Communications Commission has large programs which are intended to fund broadband deployment. These include:

- Connect America Fund (“CAF II”) funding is provided by the FCC Universal Service Fund to service providers. In California, this funding has been accepted on a statewide basis by AT&T and Frontier. However, the actual timing and location of broadband deployment by these service providers is not known to the public, including any specific plans for Sonoma County.
- Universal Service Fund (USF) funding for schools and health care providers, through the E-rate program and Health Care Connect program.
- The USF also includes a “Mobility Fund” designed to expand wireless broadband capacity in unserved and underserved areas – a definition large areas of West County would likely meet.
- Leverage low income housing funding, which requires “broadband” be offered to tenants. Tax credits require a condition that low income housing offer “broadband.”



## 6.14 PG&E

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Collaboration to provide broadband internet access in Sonoma County with PG&E could also be an opportunity. PG&E obviously has an extensive utility transmission and distribution network to provide electric service to most if not all premises in Sonoma County. As is common to all electric utilities, PG&E has constructed fiber networking throughout its electric distribution network for operational support purposes. In April 2017, PG&E filed an application before the CPUC for a Certificate of Public Convenience and Necessity to operate as a telephone company and provide communications services using its fiber network, including in Sonoma County. PG&E stated it “intends to provide services to telecommunications carriers and businesses, government, and educational enterprises, and such services may include managed wavelength point-to-point connections, Ethernet services, private fiber networks, and wireless backhaul. Applicant intends to offer services that other telecommunications providers and large enterprise customers require as the overall demand for wireless and broadband services continues to grow. Applicant does not intend to provide residential local exchange services.” This case is currently working its way through the hearing process at the CPUC, with ongoing settlement conferences among the parties. The presence of PG&E fiber facilities in Sonoma County, and its interest in using them to provide broadband internet access is a significant opportunity to extend broadband service via collaboration. PG&E fiber networking could be used to expand broadband capacity in West County and other underserved areas outside the US 101 corridor, both on a wired and wireless basis. In particular, use of the fiber for wireless backhaul could expand 4G wireless coverage in West County and other underserved areas. While the same terrain, geography, and redwood challenges exist regardless of infrastructure provider, PG&E fiber facilities offer interesting opportunities that should be explored. However, current challenges being faced by PG&E relating to the fire disaster in Sonoma County need to be recognized and temper expectations.

## 6.15 Dig Once and Other Policy

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The fire disaster may open the door to new requirements supporting broadband, including requiring new construction sites to install conduit from “curb” to the housing units.

The County does not have a Dig Once policy. Guidance on “Dig Once” policy is desired by the County and cities, as well as standards and Guidelines for fiber builds they can adhere to including conduit size, bend angles, handholds placement, fiber counts, etc. During interviews and meetings with city staff, it was mentioned that dig once and joint trench policies are on the horizon, and guidance is desired around these policies, in general. See Section 2.5.3.6 for more information regarding dig once policies.



Table 11: Summary of Sonoma County Local Governments Telecommunications Policies

<b>Local government</b>	<b>Cable Television</b>	<b>Wireless Towers/Collocations</b>	<b>Wired Right-of-Way: Excavation &amp; trenches</b>	<b>Wireless Right-of-Way: Pole Attachments &amp; Small Cell</b>
<b><u>Cloverdale</u></b>	CH. 17.12.260 IMPROVEMENTS REQUIRED. (1989)	CH 15.37 TELECOMMUNICATION FACILITY AND ANTENNA CRITERIA (1995)	CH12.08 RULES AND REGULATIONS FOR THE ISSUANCE AND ENFORCEMENT OF ENCROACHMENT PERMITS WITHIN THE PUBLIC RIGHT-OF-WAY	NONE
<b><u>Cotati</u></b>	CH. 5.20 CABLE TELEVISION FRANCHISES (1994)	CH. 17.44 TELECOMMUNICATIONS FACILITIES (2004)	CH. 11.01 ENCROACHMENTS WITHIN PUBLIC RIGHTS-OF-WAY (2009)	NONE
<b><u>Healdsburg</u></b>	CH. 5.36 CABLE COMMUNICATION FRANCHISES (1998)	CH. 20.20.080 TELECOMMUNICATION FACILITIES (1998)	CH. 12.12 STREET ENCROACHMENTS (1998)	NONE
<b><u>Petaluma</u></b>	CH. 14.40 COMMUNITY ANTENNA TELEVISION SYSTEMS (1984)	CH. 14.44 TELECOMMUNICATIONS FACILITY AND ANTENNA CRITERIA (1996)	CH. 13.14 RESTRICTIONS ON EXCAVATION IN NEWLY CONSTRUCTED OR RESURFACED PUBLIC RIGHTS-OF-WAY (2007)	NONE
<b><u>Rohnert Park</u></b>	TITLE 5 - BUSINESS LICENSES AND REGULATIONS	TITLE 5 - BUSINESS LICENSES AND REGULATIONS & TITLE 17 ZONING	CH. 5.34 - PUBLIC RIGHTS-OF-WAY (2000)	NONE
<b><u>Sonoma City</u></b>	TITLE 5 BUSINESS LICENSES AND REGULATIONS (1996)	CH. 5.32 TELECOMMUNICATIONS FACILITY AND ANTENNA CRITERIA (1996)	CH. 12.20 ENCROACHMENTS (1973)	NONE
<b><u>Santa Rosa</u></b>	CH. 3-50 STATE VIDEO SERVICE FRANCHISES	CH. 20-44 TELECOMMUNICATIONS FACILITIES	CH. 13-04 STREET ENCROACHMENTS	NONE
<b><u>Sebastopol</u></b>	CH. 5.46 GRANTING OF FRANCHISE FOR COMMUNITY ANTENNA TELEVISION SYSTEM	CH. 17.100 GENERAL PROVISIONS RELATING TO TELECOMMUNICATIONS FACILITIES AND MINOR ANTENNAS	CH. 12.48 ENCROACHMENT PERMIT	CH. 5.30 GRANTING THE FRANCHISE TO USE ALL POLES, WIRES, CONDUITS AND APPURTENANCES FOR TRANSMITTING AND DISTRIBUTING ELECTRICITY*
<b><u>Sonoma County</u></b>	CH. 8 - CABLE TELEVISION (1998)	CH. 26-88-130. - TELECOMMUNICATION FACILITIES (1998)	CH. 11 - GRADING, DRAINAGE, AND VINEYARD AND ORCHARD SITE DEVELOPMENT (2009)	NONE
<b><u>Windsor</u></b>	CH. 5 - FRANCHISES AND COMMUNICATION SYSTEMS, ARTICLE 1 CABLE TELEVISION	ARTICLE XXX - WIRELESS TELECOMMUNICATIONS FACILITIES (2007)	SEC. 5-1-185. - JOINT TRENCHING/BORING. (2005)	SEC. 16-30-90. - WIRELESS COMMUNICATION FACILITIES IN PUBLIC RIGHTS-OF-WAY. (2007)



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## 7 CALIFORNIA BENCHMARKS<sup>41</sup>

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California is known to be a progressive state, many times ahead of the game in many industries, markets, and policies. This can be said for municipal broadband as well. There are many fiber networks being implemented in and around the state at the current time. The business models used for the networks in California run the gamut, depending on the organization, situation, and location. These benchmarks provide an overview of the developments that have occurred or are being planned throughout the State of California.

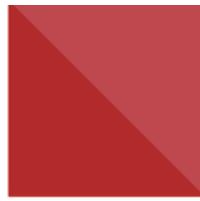
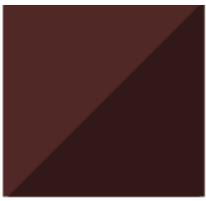
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<sup>41</sup> Complete listing can be found through City of Palo Alto. (2017) ConnectedCity Core Team. Municipal Broadband.



Table 12: California Benchmarks

Municipal Broadband Provider	Business Model	Details
<b>Burbank Water &amp; Power/ONE Burbank</b>	Dark Fiber	Provides dark fiber and business internet services over its owned network.
<b>Hayward</b>	Economic Development	The federal government awarded a \$2.74 million grant, from the Department of Commerce's Economic Development Administration, for Hayward to fund the design and installation of a fiber network in the industrial district. Approximately half the cost of the network.
<b>Loma Linda</b>	Municipal FTTH	In 2004, the city began requiring all new developments to have fiber connectivity built to them. 600 homes now have 5 Mbps connectivity for \$30/month up to \$100 for 15 Mbps, symmetrical. Half of the residents choose to buy their internet from the city.
<b>Brentwood</b>	Public-Private Partnership	Owns 150 miles of conduit and the network reaches 8,000 customers with services being provided by Sonic.
<b>Lompoc/Lompocnet</b>	City-wide WiFi	Municipal WiFi to residents, businesses, and organizations.
<b>Modesto/LinkMODESTO</b>	Municipal Network	Aerial and underground fiber providing internet for city facilities for administration, public safety and utilities. Currently exploring options of expansion for additional uses including providing to businesses.
<b>San Luis Obispo</b>	Public-Private Partnership	23 miles of fiber are in place connecting 75 buildings with fiber-optic internet service. Plan to continue to expand to additional businesses and residences.
<b>Rancho Cucamonga</b>	Public-Private Partnership	Owns and operates 25-mile backbone connecting city facilities. In the process of partnering with a private organization for FTTP service to the city residents and businesses.
<b>Manhattan Beach</b>	In Development	City is currently working on a Fiber Master Plan to determine network build and reach.




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## 8 SONOMA’S BROADBAND VISION AND PRINCIPLES

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### 8.1 Broadband and Technology are Investments in Sonoma County’s Future

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Communities such as Sonoma County invest in and manage “community support” infrastructure across many diverse sets of capital investments. While roads, fire protection, and basic utilities are a given in day to day community planning, today’s use of digital roads otherwise known as the Internet, has given rise to the belief that Internet access is in fact a utility. In Magellan’s survey engagements across the US, there is overwhelming support for considering Internet access to be an essential utility service – the “fourth utility.”

Essential services, no longer considered just a “nice to have,” have motivated governments and community leaders to step up to ensure equitable access to those services. Water, sewer, gas and electric services have regularly been assimilated

within the context for governments, when private sector providers have fallen short, or are simply unable to provide an acceptable level of service. As we approach the year 2020, this is the case for rural America, and specifically rural Sonoma County. This is the crux of why broadband has been an active topic in and around Sonoma County for the last decade. Changes and improvements are occurring in Sonoma County. For example, a recently completed project, known as Sea Ranch Connect<sup>®</sup>, provides some of the best broadband in the county, with 50 Mbps symmetrical speeds being reported. This project was a collaborative effort, funded by local residents, support of local and state grant funding, and through a P3 with a regional Internet Services provider. This is a prime example of how innovative partnerships can happen, when local residents organize, and have the appropriate structure required for what can be a sizeable capital investment. These are the types of initiatives that Sonoma County needs to encourage, and support through direct investment in infrastructure.

Through development of this Broadband Strategic Plan and identified as priorities within local governments across the US, it is now being recognized that development of broadband assets are in fact direct investments into the local community, and the local economy. For Sonoma County, broadband is an investment in Sonoma County’s future. The rural areas, like others, lag their urban counterparts. The internet, disruptive technology, devices, and the aggregation of video and documents, requires that users upgrade their network speeds more often, however, for rural areas, this is simply not possible. While The Sea Ranch community recently received upgrades to their



infrastructure, it was to a maximum speed of 50 Mbps, while urban areas such as Chattanooga receive speeds of 1 Gbps for \$69 per month, or 10 Gbps for \$299 per month. The next issue that Sea Ranch Connect® may need to address is the fiber backhaul options/costs that are available to it. If Sea Ranch Connect® had competitively priced high-speed fiber middle-mile options, it would be able to increase the overall throughput to each user of Sea Ranch Connect® significantly.

Sonoma County and its community partners (city, schools, medical facilities, other anchors), budget annually for operating expenses associated with Internet and telecommunications services. Very few organizations within Sonoma County actually own fiber-optic infrastructure. Sonoma County alone spends \$1.5 million per year on telecommunications and internet connectivity at speeds generally ranging from 10 to 100 Mbps. Sonoma County’s largest cities spend at least \$700,000 or more.

Table 13: Data Circuits and Internet Service Annual Expenditure

	<b>Data Circuits and Internet Service Annual Expenditure</b>						
	<b>Sonoma County</b>	<b>Santa Rosa</b>	<b>Petaluma</b>	<b>Windsor</b>	<b>Healdsburg</b>	<b>Rohnert Park</b>	<b>Total Annual</b>
<b>Annual Spend</b>	\$1,466,058	\$425,500	\$76,068	\$62,117	\$150,000	\$30,000	\$2,209,74
<b># of Connections</b>	100 (approx..)	20	11	6	8	8	3

Sonoma County and its cities could opt to invest these dollars being paid out every year as an operating expense into local capital projects, within City and County ROW, to build a fiber-optic network capable of providing faster speeds, at a lower overall cost of ownership. Cities and counties have the ability to take long-term approaches to capital investments, they plan for decades. Today’s investments in telecommunications assets would enable and support the local communities for the next 50 years, given the proper installation and maintenance. Not only will Sonoma County’s telecom spend stay local, but it will permanently reduce Sonoma County’s operating costs for decades to come, while expanding opportunities, and investing in locally owned, and controlled broadband assets. These assets can be used to support community-based innovation, to support local industries and network/content providers, while generating other positive community benefits, and potential new revenue streams. The County would have the ability to make excess capacity available to the market, to support the broader goals of this Broadband Strategic Plan. For instance, connecting Sea Ranch Connect® directly to an Internet PoP in the Bay Area, providing a new middle-mile fiber infrastructure in areas severely lacking.



The County's goals and efforts toward supporting Ag Tech include “create Sonoma County AgTech Innovation and Manufacturing Alliance Initiatives,” based on the *Strategic Sonoma Action Plan*. Many of the smart farming devices and innovations require connectivity, many for the purpose of uploading real-time data to cloud-based software and partners for analysis. Greater connectivity will be required to further the County's goals in this respect.

## 8.2 Broadband is Critical Infrastructure

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Broadband is not only essential, but is also critical infrastructure, as Sonoma County unfortunately knows all too well. Community and government organizations should be able to communicate during times of natural disasters. For decades, local governments have depended on local government owned, and operated tower-based radio communications systems for public safety. Today's IP enabled systems depend on high-speed connectivity, and “fiber to the tower” is the preferred transport mechanism. Broadband powers today's electrical systems and is the basis for tomorrow's smart grid applications.

While a provider's damaged networks can be detrimental during times of disaster, local government has the ability to deploy these networks underground, in a more protected fashion, as it utilizes smart broadband friendly public policy to expand its network. It doesn't have to deploy its fiber network in the cheapest, most expeditious manner, but again, can take the long-term planned approach, designing and building it right, suited to Sonoma County's needs.

Broadband is critical to the evolution of communities in the 21<sup>st</sup> century, and are the key to an immersive, innovative workforce environment, and economic success. Broadband affects every aspect of a smart, connected community. In rural areas such as Sonoma County, high-speed connectivity allows those citizens to experience the same level of service to the Internet, and its abundance of apps, data sets, and knowledge. For those residents, teleworking, telehealth, and other remote oriented services, can drastically improve the life of remote citizens.

Sonoma County knows too well the stories of natural disaster. Communications is the most important function during these times, the Telecommunications Outage Report detailing surveys of the 2017 Northern California Firestorms spoke to this issue. Residents feel unsafe, individuals are not evacuated quickly, and homes are lost. Higher quality, more redundant communications systems would improve public safety for the residents of Sonoma County.



### 8.3 Broadband Development is a Long-Term Program

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Just as the broadband assets are long-lived, broadband should be a long-term program within Sonoma County and its partner’s local government operations. The area, through development of this Broadband Strategic Plan, has opted to take a more holistic view of the area’s needs, and through execution of this Plan, can begin to build and manage this very important infrastructure.

While several entities such as Petaluma and Santa Rosa have clear goals in their municipal planning documents to expand their fiber infrastructure, the County and others seem to take a more ad hoc approach. To support long term development, it is advised to invest incrementally, in a planned, methodical manner. The County should develop a 5-year, or 10-year plan, and begin to incrementally invest in phases, focusing on the greatest impact first, and using broadband policies such as dig-once/joint trench to build out planned routes early, and at a much-reduced cost. Having a plan, for where the network is “going,” will allow the County and its partners to cease any opportunities that arise where the ROW along these planned routes may be disturbed. These types of practices can reduce the long-term capital projections of any planned network buildout. As an example, the City of Clermont, FL included 2”

conduit along all water main extensions for a period of 5 years, and then built out the remainder of its 20-mile network. The areas where existing, pre-planned conduit was placed, cost the City less than \$5 per foot with fiber once completed, while areas where conduit was not available, cost over \$15 per foot. There is significant savings to be had in any major local government telecommunications project, the key is a long-term planning approach.

Finally, all long-term capital programs require appropriate funding. Fiber assets have a 25-year financial life, while their useable life can exceed 50 years given the proper installation and maintenance. When funding these projects, local governments have the ability to accept a longer payback period than most incumbent, or even competitive providers can. While governments focus on the well-being, education, and welfare of its residents, private companies focus on creating shareholder value, and increasing profits – these strategic goals are in direct conflict unfortunately.

While the private sector will always have its role in providing the next-generation broadband experience, it’s questionable whether the buildout of strategic assets such as fiber middle-mile networks should be. There are key issues in Sonoma County due to access and availability of broadband assets and infrastructure, and it’s important to remember, that rural Sonoma County projects are only being built on the backs of investment by residents/taxpayers, and state/federal funding programs, like CAFII.



Sonoma County should look to replace its current telecommunications operating spend, by instead funding a long-term capital project to build a County owned fiber middle-mile network. The network over time will connect more County sites, at a lesser overall total cost of ownership, while at the same time providing much needed fiber capacity to areas and major corridors of the County. Over time, the County through its Broadband Program can incrementally expand as new opportunities or needs arise. Sonoma County’s \$1.5 million annual spend, equates to an \$85 million operating expense assuming a 4% escalation rate over the next 30 years, without any increase in the number of sites served. This Broadband Strategic Plan outlines a “new option” for the County to consider, which has the potential to cost less, while providing much greater benefits to the region over time.

## 8.4 EXPECTED RESULTS OF A MUNICIPAL BROADBAND NETWORK

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There are many benefits that Sonoma County could realize through the deployment of a publicly owned middle-mile network, and through adoption of this Broadband Strategic Plan. These include direct benefits to the County, its local government partners, businesses, and residents, along with additional benefits such as economic development, better education, healthcare, and the myriad of operational efficiencies that can be realized regionally.

### Leading Edge Broadband (Business and Residential)

Sonoma County’s Broadband Strategic Plan aims to drive new investment into underserved and unserved areas of the County. Given the proper framework, funding options, and partnerships with providers, the County can take a leadership role in ensuring leading edge broadband services are available to its residents and businesses.

### Economic Development

Economic development will become a key beneficiary of the Sonoma County Broadband Strategic Plan. Agriculture, cannabis, construction, craft beverages, specialty foods, tourism, and restaurants are among the major industries within Sonoma and the County seeks to continue to recruit and retain these businesses along with others in the region. While industries do not tend to move to areas simply due to broadband access, Magellan’s experience with communities across the US is that industries may choose not to locate in an area when broadband is not available. Marketing a community or a region as Gigabit capable can be a bargaining chip for economic development organizations and leaders.



### Education

Educational institutions around the country have become one of the greatest beneficiaries of community owned fiber networks. While all public K-12 schools are connected to fiber as of the development of this report, non-public institutions, and rural residents lack the same levels of connectivity. Education has become a community responsibility with organizations such as libraries, businesses, and non-profits providing support, internships, and alternatives. Connecting to these new programs and tools requires high-speed, reliable, and affordable connectivity. As virtual reality, augmented reality, instant language support and access to free, world-class educational resources escalate, so does a community's responsibility to provide for all of its learners – during and beyond the school day. Rural Sonoma County residents do not have the same opportunity as those in more urban areas, as connectivity continues to be an issue in these key areas of the County.

### Public Safety

Public Safety is a key user of broadband access. Broadband supports cellular connectivity and in many areas of rural Sonoma County, there are large gaps in service. These dead zones throughout the County, mainly in the west and south, cause major public safety issues. Where there is lack of cellular connectivity, there are increased response times for police and fire and a decrease in communications during disasters.

### Healthcare

While major hospitals and providers have access to high-speed broadband through corporate contracts, smaller practices in rural areas continue to lack the high-speed connectivity needed to function in 21<sup>st</sup> Century Healthcare. Broadband supports electronic medical records, uploading and transferring of patient information, and telemedicine functionalities. Telemedicine, or telehealth, includes a variety of applications for remote office visits, health monitoring, and outpatient care. The applications could be important in supporting aging in place for those of advanced ages in Sonoma County along with workers who could benefit tremendously from remote offices visits when caring for their families' health and wellbeing.

### Tech Innovations

Tech Innovations relate to all industries, supporting residents and organizations alike. The Internet of Things "IoT" is permeating all industries, from home surveillance and appliances to manufacturing facility sensors and robotics. In Sonoma County, Agricultural Technology, or AgTech, is becoming a buzz word in the agricultural sector. Farmers, especially in the dairy and wine industries, want to take advantage of it and implement the many innovations coming to market, but lack the broadband to support the majority of the applications.



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## 9 BROADBAND STRATEGIC PLAN, ROADMAP AND ACTION PLAN

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This Broadband Strategic Plan has been developed for Sonoma County, in partnership with Sonoma County Economic Development Board, and the Access Sonoma Advisory Committee. This Broadband Strategic Plan is meant to identify opportunities which the County can consider and execute upon to incentivize additional broadband investment throughout Sonoma County through direct public investment, and in developing key partnerships with industry.

The Roadmap and Action Plan provides the County with strategic direction and has been divided into two different sets of tasks, otherwise called Action Items, they include ORGANIZING and EXECUTING. In order for this Broadband Strategic Plan to be adopted, and carried out successfully, key decisions around lead organization(s), governance approach, and internal/stakeholder organization will be required. Short

Term Action Items have been identified to provide direction and guidance for the ORGANIZING stage and should be accomplished prior to investing or creating partnerships. For this reason, a series of Short-Term Action Items have been identified, and are intended to provide direction and guidance as it relates to ORGANIZING.

Fiber Expansion and Investment Initiatives are much more complex issues, and require various levels of approvals, and very tight coordination between the participating agencies, and partners. Further, these initiatives require real monetary investments, further complicating the Plan. For this reason, this portion of the Roadmap and Action Plan relates to EXECUTING the Broadband Strategic Plan as it relates to direct investment and expansion of broadband assets throughout the County.

While Sonoma County's Broadband Strategic Plan has been forecasted over a 5 to 10-year period, the ultimate timeline will be dictated by the lead organization chosen to oversee and execute this Plan, and more so by the budgets and resources dedicated to this Program.



## 9.1 Initial Action Items

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The Action Items listed below support the required organizational and governance capabilities for a lead organization to manage infrastructure. In addition, they are meant to provide frameworks for collaboration and partnerships.

While these Action Items are geared toward the greater Sonoma County Broadband Plan, each municipality has a role to play in ensuring their communities are served, and that they have a seat at the table when it comes to the greater broadband discussion. While several cities are already involved in activity planning for broadband infrastructure, others simply don't have the resources, or they simply haven't identified the need yet. This is exactly where greater collaboration, and more regional leadership can help to drive these improvements into every corner of the County.

These Action Items are short-term in nature and should be accomplished within the first 12-18 months of this Plan's adoption.



Table 11 below is meant to outline each Action Item documented within this Strategic Plan, and should provide guidance to each local government entity as to their role in this Plan. These Action Items, and Initiatives will be included within the Community Profile Sheets.

Table 14: Action Items by local government jurisdiction

Action Item	County	Cloverdale	Cotati	Healdsburg	Petaluma	Rohnert Park	Santa Rosa	Sebastopol	Sonoma	Windsor
<b>Advisory Board</b>	L	S	S	S	S	S	S	S	S	S
<b>Governance</b>	L	S	S	S	S	S	S	S	S	S
<b>Policy</b>	L	C	C	C	C	C	C	C	C	C
<b>Provider Collaboration</b>	L	C	C	C	C	C	C	C	C	C
<b>Special Districts</b>	L	S	S	S	S	S	S	S	S	S
<b>Validate Assets</b>	L			C	C		C			
<b>Formalize BIP</b>	L			C	C		C			
<b>RFI P3s</b>	L	C	C	C	C	C	C	C	C	C

In this context the Lead (L) organization leads the efforts and overall planning for this Plan. Support (S) organizations provide oversight and participate in the planning efforts, while Coordinated (C) organizations have a complementary role in executing specific actions. For instance, while we recommend Sonoma County consider taking a lead role in all of these activities, we recommend that each local government organization adopt and implement Broadband Friendly Public Policy in a coordinated fashion with the County. While we could recommend each organization lends its support to the County in taking the lead on the Advisory Board, and overall program/project governance, we'd recommend that Healdsburg, Petaluma, and Santa Rosa act in a coordinated fashion in Validating its Assets, and developing coordinating Broadband Infrastructure Programs to build, and make assets available to market.



### **Action Item 1: Appoint an Advisory Board to Focus on Driving Broadband Strategic Plan**

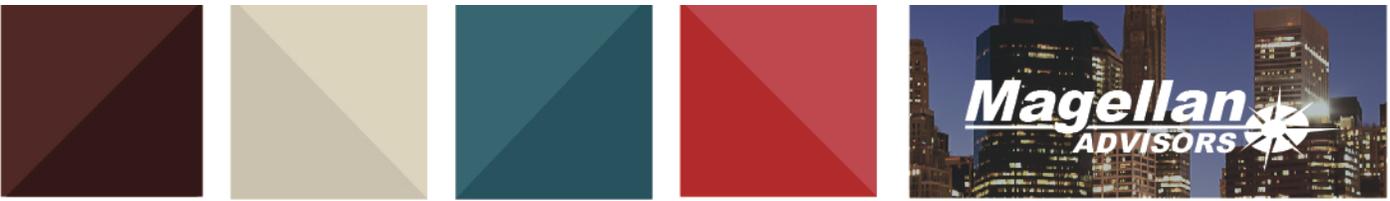
The Sonoma Broadband Advisory Committee and Access Sonoma Broadband has been meeting and working at a high-level to develop and influence broadband infrastructure development. With a new Broadband Strategic Plan in hand, it is recommended that the County task this advisory committee with providing oversight of the Plan, working hand in hand with Sonoma County, and Sonoma County IT in deploying the assets and managing the programs identified in this roadmap. It is recommended Advisory Committee consist of members from local government including cities, education, public safety, health care, business, labor and telecom companies. In addition, it is recommended the Advisory Committee develop a Memorandum of Understanding (MOU) defining its membership and responsibilities.

RIVCO Sample MOU Language to be included in Appendix D: Local Telecommunications Templates.

### **Action Item 2: Identify Lead Organization-County**

An organization or department should be selected that has the proper capabilities to adopt, manage, and execute the Broadband Strategic Plan. These capabilities will include, but are not limited to, raising capital through taxes, grants or other means, investing in and managing infrastructure, and working with organizations at all levels throughout the Strategic Plan's region of influence – the greater Sonoma County region in this case.

It is very difficult for grass roots groups, or for very specifically focused community organizations to take these types of projects on, especially given an area the size of Sonoma County. For Sonoma County, Magellan has not identified a lead organization with the capabilities to take this on, however, the County government organization is likely the lead who can most easily establish the required organizational and operational requirements to support this Plan, and the resulting roadmap. Additionally, Sonoma County has a direct need, and long-term interest in building and maintaining fiber and wireless infrastructure, as its needs for more connectivity, faster speeds, and better collaboration with its local governments will become more necessary.



In order to properly execute this Broadband Strategic Plan, the lead organization should be able to:

- Raise money through taxes or government allocations;
- Build, manage, and expand fiber-optic infrastructure, as required;
- Contract for, and manage contractors who can build, maintain, repair, and expand fiber-optic infrastructure;
- Use public policy tools to incentivize broader investment throughout the market, and to expand infrastructure when opportunities to align deployment with other capital projects are realized; and,
- Form P3 agreements with industry in an effort to meet the goals outlined in this Plan.

Further, Sonoma County should work toward developing a County Resolution, in the same fashion as Riverside County’s RIVCO CONNECT, in which each local government within Sonoma County provides support for Sonoma County’s Broadband Strategic Plan, enabling the County and its community partners to work together to positively affect broadband deployment throughout Sonoma County. Riverside County’s Resolution<sup>42</sup> identified, and addressed a number of related issues which affect broadband deployment, including:

- WHEREAS, all Riverside County residents, businesses and institutions need high quality gigabit broadband services where they live, work, learn and play; and
- WHEREAS, closing the digital divide is important and provides long-term community benefits that include that ability to fully engage in the digital economy, access existing and emerging services, and expands economic opportunities; and
- WHEREAS, high speed broadband enables improved healthcare access, treatment and information; and
- WHEREAS, high speed broadband enables new business models, creates business efficiencies, drives job creation, and connects goods and services to customers and partners worldwide; and

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<sup>42</sup> Riverside County RivCo Connect. A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF RIVERSIDE, CALIFORNIA, SETTING FORTH CITY OF RIVERSIDE’S SUPPORT FOR RIVERSIDE COUNTY’S BROADBAND FIBER TO THE PREMISE MASTER PLAN.  
<http://www.rivcoconnect.com/Portals/0/RivcoDocs/Riverside%20City%20Resolution.pdf>



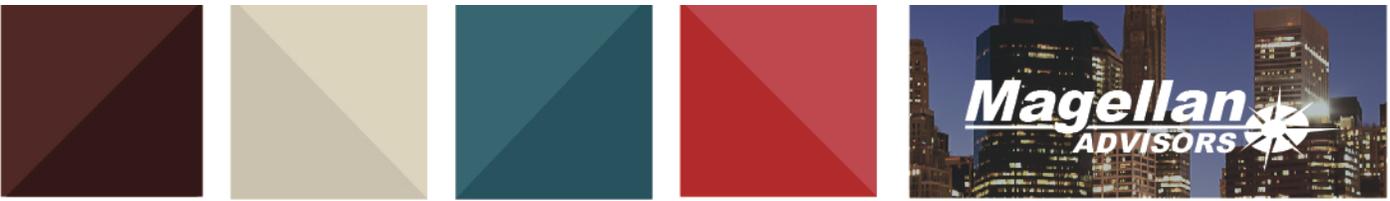
- WHEREAS, high speed broadband enables changes in how we access educational resources, collaborate, conduct research and continue to learn anytime, anyplace and at any pace; and
- WHEREAS, high speed broadband enables greater civic participation and brings communities together, helps improve public safety, and makes our transportation systems more resilient and efficient; and
- WHEREAS, the City Council of Riverside and other community partners can work together to affect the deployment decisions of broadband providers by lowering the cost of entry and operation of systems in our communities, reduce the risks of delays during the planning, permitting and construction phases, provide opportunities for increasing revenue, and creating new avenues for competitive entry; and
- WHEREAS, the City Council of Riverside supports the concept of consistent expedited broadband permitting processes throughout participating jurisdictions; and Riverside supports the concept of ‘Dig Once’ whereby
  - Conduit is installed for future or immediate use for fiber optic cable installation whenever
  - Underground construction occurs in a roadway; and
  - WHEREAS, the City Council of Riverside supports the concept of aggregation of
  - Demand by all participating communities as anchor tenants of selected provider(s) if acceptable
  - Services are available.

Seminole County developed its initial fiber-optic network to connect hundreds of city and county traffic signals in the mid-90s. As the network grew organically, the county began expanding the network to local schools, community colleges, city offices, sheriff’s stations, state agencies, and DOT facilities. Today, the network connects over 300 facilities and saves the county and its stakeholders millions of dollars per year.

**BENEFITS**

- Cost reductions across all agencies participating in the network
- Unlimited capacity for future growth
- Integrated communications amongst all stakeholders





**Action Item 3: Formalize Broadband Friendly Policies and Standards**

***What are Broadband-Friendly Public Policies?***

Broadband-friendly public policies are tools that Sonoma County is formalizing that will encourage broadband infrastructure growth. These include many items that are already informally performed by the County now, such as practices that reduce the duplication of effort and minimize the cost associated with installing utility and broadband infrastructure within its jurisdiction. Below is a list of ways that the County can encourage broadband development through the adoption or continuation of broadband-friendly polices:

Evaluate fees levied on broadband providers for constructing broadband infrastructure to ensure they do not discourage broadband investment.

Develop methods to streamline the broadband permitting processes within public rights of way and incentivize broadband providers to build more infrastructure as a result of lower permitting costs and shorter permit processing time frames.

Develop a process so that municipal Planning, Engineering, and Public Works Departments coordinate with each other to identify projects that could install infrastructure at reduced costs.

Identify opportunities to install broadband infrastructure in conjunction with public and private construction projects.

Maintain broadband infrastructure specifications in a county-owned GIS-based fiber management system, requiring updates as built, and implement processes for accurate documentation.

Adopt policies that incorporate broadband as a public utility and create a policy framework to promote its deployment in public and private projects as appropriate.

Draft policies to the County’s specific needs and adopt them into local policy, codes, and standards (including dig-once, joint trenching, engineering standards, etc.).

Incorporate broadband concepts into Sonoma County’s Capital Improvement Plans (CIP), as appropriate, and make a commitment to fund broadband infrastructure.

The County should adopt a dig once ordinance and effectively manage its new wireless communications ordinance for placement and method of 5G small-cell deployments.

The County should adopt in-kind negotiation strategies when licensing small cell pole attachment agreements. The City of Huntington Beach, CA reduced its newly adopted pole attachment rates to a large wireless carrier by approximately 25% in exchange for six strands of dark fiber on all existing and any future fiber routes built by the provider.



***What are Broadband-Friendly Public Policies? (con't)***

Comprehensive Broadband Standards and Joint Trenching Policies that incorporate broadband infrastructure requirements into Sonoma County’s land development statutes or General Plan will allow and encourage broadband construction in conjunction with other capital projects. For example, installation of fiber-optic conduit during all projects involving roads, sidewalks, trails, or lighting projects where the ground is to be opened for other purposes would be less costly than installing conduit through standalone broadband projects. Since the majority of costs to build broadband infrastructure is incurred through trenching, boring, and restoration, this strategy can alleviate significant costs by opening the ground once instead of multiple times. In many states and municipalities, this formalized policy is referred to as a “Dig Once” policy.

It is recommended that Sonoma County formalize to encourage next-generation broadband infrastructure growth is to formalize broadband-friendly public policies. While conducting stakeholder outreach, it was discovered that many progressive considerations are already in place, and informal policies were being formalized that are generally accepted as best practice. Furthermore, Sonoma County and its local government partners should ensure that it employs conditions for development that includes the addition of telecommunications assets as part of the necessary development infrastructure.

In support of this strategy, Sonoma County should continue to implement broadband-friendly public policy tools. These tools influence how broadband services develop throughout the region and show the community and prospective newcomers that Sonoma County is serious about promoting broadband growth and accessibility – and more importantly, that it is planning for future technologies, and a 21<sup>st</sup> century digital economy.

In addition, these policies can allow the County, and its local governments to expand its underground conduit and fiber systems with savings over more traditional fiber construction methods, allowing the region to take a master planning approach versus deploying in an ad-hoc, unplanned, uncoordinated fashion.

County and city government organizations should align broadband-friendly policies allowing for consistency across the County. Table 17 within Section 10.17 illustrates the current inconsistencies in policy implementation across municipalities within Sonoma County.



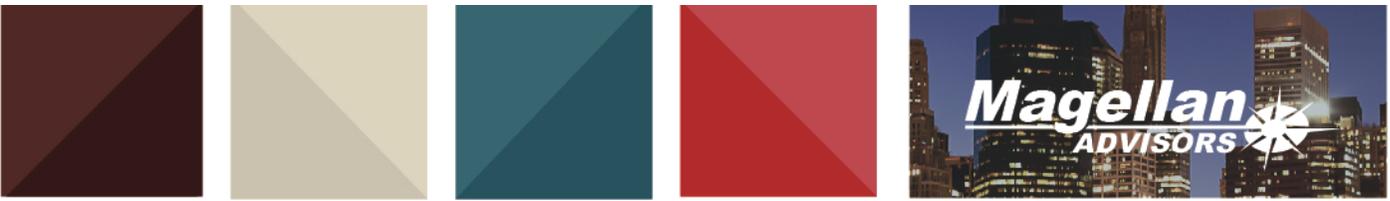
In addition, it is recommended Sonoma County:

- Develop policies, standards and procedures for Sonoma County, and its local government subdivisions and agencies;
- Host a Broadband Policy Workshop with County/City/Agency planners, Public Works, IT, and leadership;
- Coordinate development of policy changes;
- Improve telecommunications permitting process with current best practices (eg. streamlining) and opportunities that arise from the Fire Disaster (eg. dig once) and green field vs brown field. This should be recognized as an immediate opportunity for Sonoma County;
  - Consider redevelopment opportunities of fire impacted areas and into a smart communities or innovation areas;
  - Continue progressive political advocacy at State and Federal levels to promote broadband expansion and funding legislation;
  - Consider Land Development Standards, include placement of conduit and fiber as a development requirement. Brentwood, CA should be used as a best practice. Section 16.120.120, Undergrounding of advanced technology systems.  
[http://qcode.us/codes/brentwood/view.php?topic=16-16\\_120&showAll=1&frames=on](http://qcode.us/codes/brentwood/view.php?topic=16-16_120&showAll=1&frames=on)
- Prepare for both Public and Private Development projects, whereby the County or its cities are deploying in public construction projects, or with private developers who may be developing commercial, retail or mixed-use projects.

With the pending redevelopment of the affected fire disaster areas, Sonoma County, and its municipal partners have the opportunity to include new, underground fiber infrastructure as the redevelopment occurs. This is an urgent task that should be undertaken immediately as local utility providers, and developers/builders begin to mobilize. In recent news, within Santa Rosa, it was discovered that the existing water delivery system was damaged beyond repair, as the water pipes/conduits melted, even though they were underground. Replacement of the water system is a perfect complementary project which can allow for the placement of underground telecommunications conduit and fiber optics.

#### **Action Item 4: Continue to Work Collaboratively with and to Encourage Providers to Expand Infrastructure to Serve Rural and Underserved Sonoma County**

Sonoma County and its telecommunications partners have a vested interest in furthering the buildout and delivery of next-generation broadband services to the region's users. Unfortunately for areas like Sonoma County, the vast rural nature of the area makes this a challenge. And, as is evident with current rural projects, they require government funding and subsidies in order to happen.



This is precisely why governments at nearly all levels are funding rural broadband, through grant and loan programs. FCC’s Connect America Fund Phase II (CAF II) and Mobility Fund Phase II, the California Advanced Services Fund (CASF), are all allocations of funding being used to further services throughout the Sonoma County region. Sonoma County’s current providers have applied for and been granted these dollars and have expanded/continue to expand services – but for those greatest affected, this is not soon enough. To further this problem, communications between the providers, and the local communities is not great. Upgrade plans are not public and are therefore not discussed openly. Expectations cannot be met when they are not clearly defined and communicated. The lack of transparency around these upgrades greatly contributes to the problem.

Sonoma County should work to ensure that its local government peers, and industry partners/providers are at the table regularly to discuss the region’s roadmap for deploying broadband. The County should require regular quarterly updates on upgrade plans, and results for newly upgraded areas.

In addition, Sonoma County should push for fiber connectivity. Often providers that accept rural upgrade dollars will invest in upgrading the existing copper plant to a newer standard or upgraded specification, thereby providing minimal upgrades to the services offered. While these upgrades are welcomed, they still position the area to lag others. These incremental upgrades provided by the area providers will no doubt have to occur again, and again – until they adopt a future-proof wireline technology such as fiber.

**Action Item 5: Provide Structure and Funding for the Formation of Special Districts to Enable Broadband Expansion** <sup>43</sup>

In many cases, rural communities can organize to support investment for next-generation broadband services. Local raising of capital by the potential subscribers or homeowners is one way to entice broadband providers to serve their areas. Homeowners associations (HOAs) are well suited for this as they are able to levy assessments for development improvements – this is exactly what The Sea Ranch, has already done for their communities.

Unfortunately for much of rural Sonoma County residents, they do not live in “organized” neighborhoods, where an overarching HOA is available to manage these types of infrastructure projects, leaving most residents to fend for themselves. But special taxing districts have been used throughout the State of California, and specifically in Sonoma County to fund infrastructure related.

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<sup>43</sup> The following analysis should not be considered to be a legal opinion. The analysis is based on a plain reading of the cited statutes and other materials.



There are approximately 66 “special districts” in Sonoma County. Most common are fire protection, health care and water districts. Other types of special districts include sanitation, life support/EMS, transportation, libraries, and others. Community Service Districts are one type of Special District, which is considered to be “independent” in nature. In contrast, the County Service Area is “dependent” since it is governed and administered by the County.

Community Service Districts

More than 300 communities formed community service districts between 1955 and 2005, under the previous laws.<sup>44</sup> The underlying theory of these CSDs was to support consistent and adequate service levels across large and diverse geographical areas within counties.

The CSD statute was amended in 2005 to remedy its structure which had become convoluted over time and was not modern statutory construction. In 2008, Senate Bill 1191 added provisions to allow a community services district to construct, own, improve, maintain and operate broadband facilities and provide broadband services “if a private person or entity is unable or unwilling to deploy broadband services.”<sup>45</sup> The CSD is obliged to transfer ownership and operation (or lease the operation) of the broadband facilities to a private person or entity when that private person or entity is “ready, willing and able to take over the facility” or operation. The transfer or lease is to be at “fair market value.”<sup>46</sup>

A CSD must be approved by the Local Agency Formation Commission prior to undertaking the activity. Residents initiate the formation of a CSD through petition or resolution at the county level. A CSD can issue bonds or form an improvement district to support bond issuance. Property owners will pay taxes or special assessments for services including infrastructure development within the district. The CSD may be governed by an independent board of directors.

County Service Areas (CSAs)

A CSA is a form of special district that is governed by the county Board of Supervisors, administered by county staff and is designed to deliver more county services to a specific geographic area where constituents are willing to pay for them. Residents (by petition) or county supervisors (by resolution) initiate the formation of a CSA. Once proposed, the formation of the CSA is subject to public notice and hearing. If more than 50% protest, voter approval at a special election may be required.

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<sup>44</sup> Cal. Gov. Code § 61001(a)(4).

<sup>45</sup> Cal. Gov. Code § 61100.

<sup>46</sup> *Id.*



The basic premise of a CSA is to fund consistent and adequate levels of service across large and diverse geographical areas or in small communities in unincorporated areas that the County would not otherwise be able to fund through traditional sources (property tax, sales tax, fuel tax, etc.). This funding is created by a direct assessment that a property owner pays for a particular service. The most common type of service and associated assessment is for road and drainage maintenance in new subdivisions, but there are others ranging from lighting to fire protection. One benefit of CSAs is that they allow a county to segregate costs and benefits of providing additional services.

Community Facilities Districts

The Mello-Roos Community Facilities Act of 1982 allows establishment of Community Facilities Districts (CFD) to support financing of public improvements and services by a county, city, special district or joint powers authority<sup>47</sup> – the CFD must have a sponsoring local government agency. Formation of a CSD requires a two-thirds majority vote of residents living within the proposed boundaries. Upon formation, a special tax lien is placed on each property in the CFD, which is covered by a Special Tax paid each year. Also, municipal bonds can be sold to fund initial investments.

A CFD can be used to finance “maintenance and operation of any real property or other tangible property with an estimated useful life of five or more years that is owned by the local agency or by another local agency pursuant to an agreement entered into under Section 53316.2”.<sup>48</sup> Section 53316.2 addresses the requirement for a “joint community facilities agreement” in the case that more than one public agency is involved. It thus appears that, for example, a Community Facilities District could be used by Sonoma County or a joint powers authority to finance and support expansion of broadband facilities in specified unincorporated areas of the county.

Conclusions

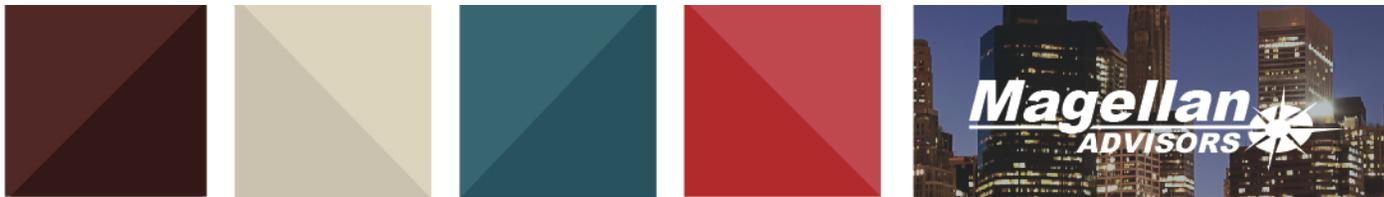
Formation of a Community Service District or County Service Area is subject to LAFCO requirements. There is a great deal of work that is required to go through the LAFCO process and form a CSD or CSA. However, broadband is important enough for areas within the County to consider formation of special districts to support broadband investment. Establishment of Community Facilities Districts are not subject to LAFCO, and may be more appropriate for the County to consider to reach its goal of expanded broadband availability throughout the County.

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<sup>47</sup> Joint Powers Authorities are legally created entities that allow two or more public agencies to jointly exercise common powers. Forming such entities may not only provide a creative approach to the provision of public services, but also permits public agencies with the means to provide services more efficiently and in a cost-effective manner.

<https://www.bbknowledge.com/general/the-ins-and-outs-of-joint-powers-authorities-in-california/>

<sup>48</sup> Cal. Gov. Code § 53313(g), emphasis added.



The requirement to transfer ownership of broadband facilities and operations funded under the CSD structure to a private entity, when that private entity decides at its discretion it is “ready, willing and able” to take over provision of service in the area is a negative provision of the CSD structure for broadband. The citizens of the CSD area undertook the work and effort to form and operate a broadband CSD because the service was inadequate or unavailable from a private service provider. This open-ended provision lends ambiguity to the CSD’s operation and business plan which is harmful to efforts to secure funding. Furthermore, the citizens have paid for the facilities through their tax assessments and are then required to give those facilities over to the private service provider with no limitations on the prices that can be charged back to the citizens. The public investment of the CSD is taken out of public hands and put under private control. CSDs are therefore an unpalatable alternative for Sonoma County to consider for broadband expansion to unserved and underserved areas.

However, consideration of a CSA for broadband may be worthwhile given the extent of the gap which exists outside the US 101 corridor. A Mello-Roos Community Facilities District could be employed to provide the financial capability to expand broadband availability in the designated areas throughout Sonoma County. Sonoma County should identify the most optimal structure which would allow the public to retain long-term ownership of any assets funded and constructed by the creation of a broadband focused district, while enabling a P3 with a private provider to provision and manage retail service offerings.

### **Examples of Potential Broadband Focused Districts**

As part of this analysis, Magellan modeled 3 rural underserved residential areas as examples as communities that could form a district to fund broadband infrastructure. Timber Cove (65 households), Chalk Hill Road (247 households), and The Foothills (98 households), have each been mapped, with fiber-to-the-home infrastructure laid out to provide fiber based broadband services to each household. While these districts would likely be setup to facilitate the capital expansion requirements of the network, subscriber fees would be paid directly to the P3 provider selected to operate the networks.

It is assumed that each district would utilize traditional bond funding methods, using a cost of money of 3.5%, and a time period of 30-years. This would place a new “infrastructure tax” on each homeowner’s tax bill, which would then be paid over the same duration. There is substantial variation shown here in cost and per household impact, which could be smoothed out and lessened through use of a broader Community Facilities District.<sup>49</sup>

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<sup>49</sup> There are specific statutory and other requirements associated with calculation of the Special Tax under Mello-Roos for a CFD, and the Table does not purport to show this calculation.



Table 15: Focused Districts Assumed CAPEX

Target Area	Households	Fiber Route Mileage	Total FTTH CAPEX (passing cost)	Avg. CAPEX per Household (passing cost)	Avg. Annual Capital Cost Coverage Requirement (30-year)
<b>Timber Cove</b>	65	15	\$3.6M	\$55,441	\$3,011
<b>Chalk Hill Road</b>	247	47	\$11.05M	\$44,732	\$2,432
<b>The Foothills</b>	98	8	\$2.11M	\$21,516	\$1,171

\*additional fiber drop to each subscriber is estimated at \$1,600 per household for an average 400 ft. drop. These costs are not included in the passing costs outlined above.

## Timber Cove

Figure 13: Timber Cove Conceptual Map

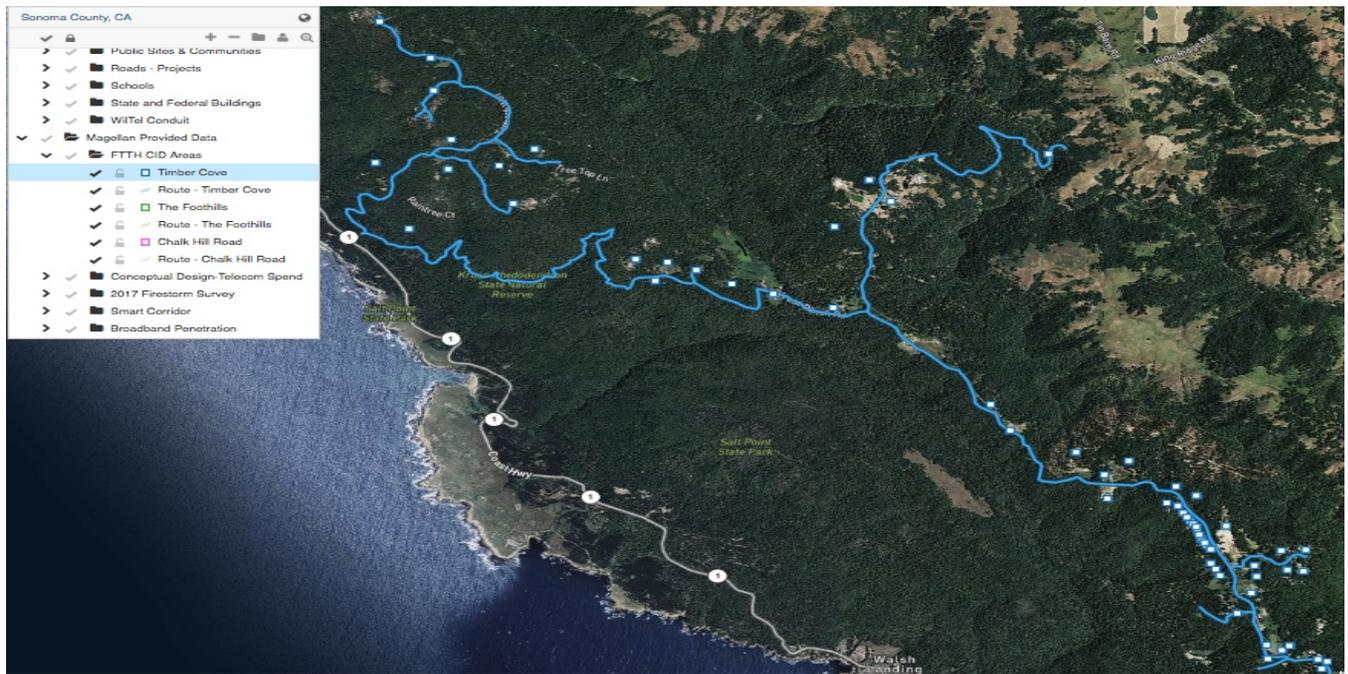




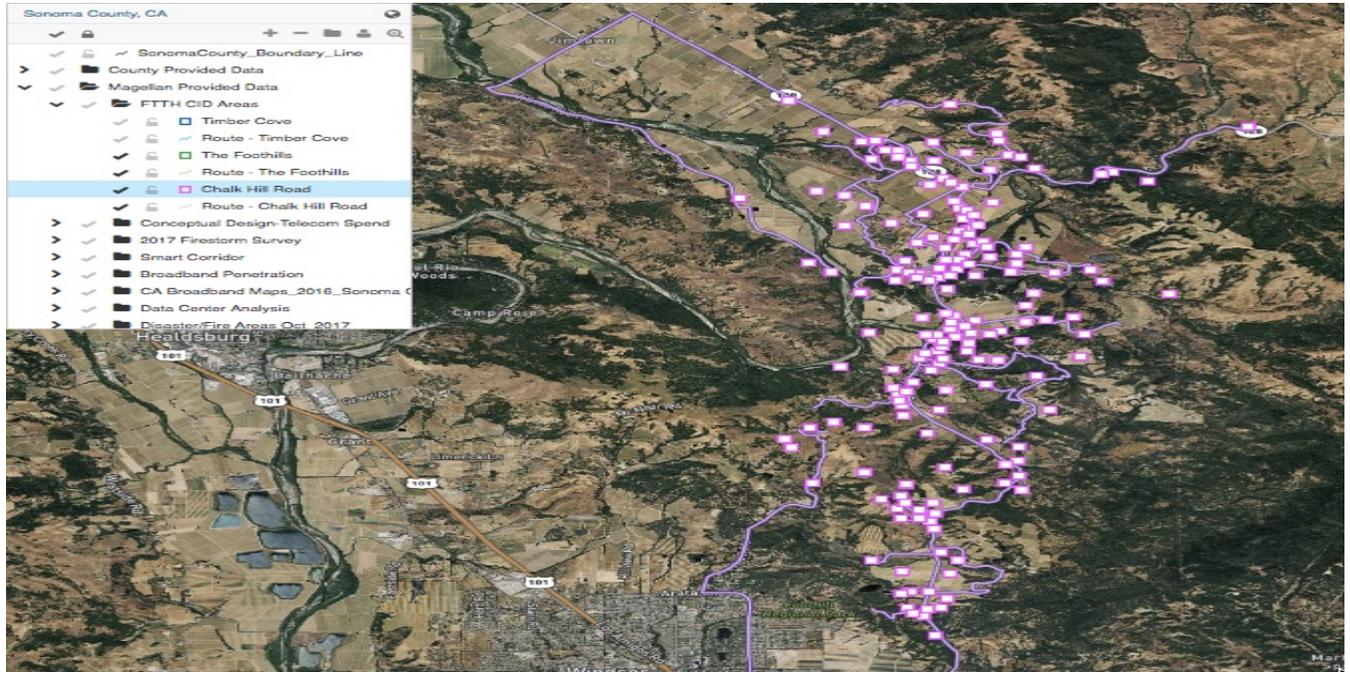
Table 16: Timber Cove Conceptual Costs

Timber Cove						
Assumptions:		All installation would be 100% underground. Does not include headend equipment, permit fees or drop cost. - Assumes 20% rock and no environmental issues.				
Item	Labor	Price	Unit	Quantity	Subtotal	Notes
1	Job Design	1.50	Foot	80082.36	\$120,123.54	
2	Install Muletape	0.25	Foot	80082.36	\$20,020.59	
3	Install #12 Tracer Wire	0.20	Foot	80082.36	\$16,016.47	
4	Install Fiber Cable in Duct- including all slack	0.85	Foot	85802.53	\$72,932.15	
5	Install (1) 2" Duct in normal soil conditions	32.00	Foot	64065.89	\$2,050,108.39	
6	Install (1) 2" Duct in rock	50.00	Foot	16016.47	\$800,823.59	
7	Install Handhole	300.00	Each	114.40	\$34,321.01	
8	Mid Sheath Fiber Entry	250.00	Each	66.74	\$16,683.82	
9	Prep Cable in Panel	250.00	Each	4.00	\$1,000.00	
10	Prep Cable in Splice Case/NAP	250.00	Each	66.74	\$16,683.82	
11	Splice Fibers	35.00	Each	842.94	\$29,502.94	
12	Install 4u Fiber Panel - loaded 144 port panel	250.00	Each	4.00	\$1,000.00	
13	Test Network	2500.00	All	1.00	\$2,500.00	
14	Install Marker Post	35.00	Each	85.80	\$3,003.09	
15	Install Marker Post with Test Station	50.00	Each	28.60	\$1,430.04	
16				<b>Labor Subtotal</b>	<b>\$3,186,149.45</b>	
Item	Material	Price	Unit	Quantity	Subtotal	Notes
17	Mule tape	0.05	Foot	80082.36	\$4,004.12	
18	96 fiber	1.25	Foot	85802.53	\$107,253.16	
19	Splice Trays	35.00	Each	35.12	\$1,229.29	
20	Splice Cases/NAP	706.00	Each	66.74	\$47,115.12	
21	Handholes	750.00	Each	114.40	\$85,802.53	
22	#12 Tracer Wire	0.35	Foot	80082.36	\$28,028.83	
23	Ground Rods	25.00	Each	66.74	\$1,668.38	
24	Marker Post	45.00	Each	85.80	\$3,861.11	
25	Marker Post with Test Station	65.00	Each	28.60	\$1,859.05	
26	(1) 2" Duct	1.00	Foot	80082.36	\$80,082.36	
27	4u Fiber Panel - Loaded 144 port panel	4668.00	Each	4.00	\$18,672.00	
28				<b>Material Subtotal</b>	<b>\$379,575.95</b>	
<b>Timber Cove Total</b>					<b>\$3,603,683.00</b>	
					\$45.00	per foot (avg.)



## Chalk Hill Road

Figure 14: Chalk Hill Conceptual Map



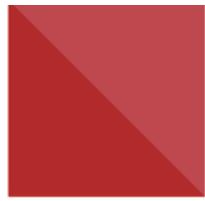
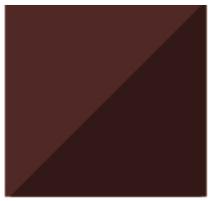


Table 17: Chalk Hill Conceptual Costs

Chalk Hill Road						
Assumptions:		All installation would be 100% underground. Does not include headend equipment, permit fees or drop cost. - Assumes 20% rock and no environmental issues.				
Item	Labor	Price	Unit	Quantity	Subtotal	Notes
1	Job Design	1.50	Foot	246335.60	\$369,503.39	
2	Install Muletape	0.25	Foot	246335.60	\$61,583.90	
3	Install #12 Tracer Wire	0.20	Foot	246335.60	\$49,267.12	
4	Install Fiber Cable in Duct- including all slack	0.85	Foot	263931.00	\$224,341.35	
5	Install (1) 2" Duct in normal soil conditions	32.00	Foot	197068.48	\$6,306,191.27	
6	Install (1) 2" Duct in rock	50.00	Foot	49267.12	\$2,463,355.97	
7	Install Handhole	300.00	Each	351.91	\$105,572.40	
8	Mid Sheath Fiber Entry	250.00	Each	246.34	\$61,583.90	
9	Prep Cable in Panel	250.00	Each	4.00	\$1,000.00	
10	Prep Cable in Splice Case/NAP	250.00	Each	246.34	\$61,583.90	
11	Splice Fibers	35.00	Each	1561.34	\$54,646.98	
12	Install 4u Fiber Panel - loaded 144 port panel	250.00	Each	4.00	\$1,000.00	
13	Test Network	2500.00	All	1.00	\$2,500.00	
14	Install Marker Post	35.00	Each	263.93	\$9,237.58	
15	Install Marker Post with Test Station	50.00	Each	87.98	\$4,398.85	
16		<b>Labor Subtotal</b>			<b>\$9,775,766.61</b>	
Item	Material	Price	Unit	Quantity	Subtotal	Notes
17	Mule tape	0.05	Foot	246335.60	\$12,316.78	
18	96 fiber	1.25	Foot	263931.00	\$329,913.75	
19	Splice Trays	35.00	Each	65.06	\$2,276.96	
20	Splice Cases/NAP	706.00	Each	246.34	\$173,912.93	
21	Handholes	750.00	Each	351.91	\$263,931.00	
22	#12 Tracer Wire	0.35	Foot	246335.60	\$86,217.46	
23	Ground Rods	25.00	Each	246.34	\$6,158.39	
24	Marker Post	45.00	Each	263.93	\$11,876.89	
25	Marker Post with Test Station	65.00	Each	87.98	\$5,718.50	
26	(1) 2" Duct	1.00	Foot	246335.60	\$246,335.60	
27	4u Fiber Panel - Loaded 144 port panel	4668.00	Each	4.00	\$18,672.00	
28		<b>Material Subtotal</b>			<b>\$1,157,330.26</b>	
<b>Chalk Hill Road Total</b>					<b>\$11,048,829.89</b>	
					\$44.85	per foot (avg.)



## The Foothills

Figure 15: The Foothills Conceptual Map





Table 18: The Foothills Conceptual Costs

The Foothills						
Assumptions:	All installation would be 100% underground. Does not include headend equipment, permit fees or drop cost. - Assumes 20% rock and no environmental issues.					
Item	Labor	Price	Unit	Quantity	Subtotal	Notes
1	Job Design	1.50	Foot	44032.19	\$66,048.28	
2	Install Muletape	0.25	Foot	44032.19	\$11,008.05	
3	Install #12 Tracer Wire	0.20	Foot	44032.19	\$8,806.44	
4	Install Fiber Cable in Duct- including all slack	0.85	Foot	47177.34	\$40,100.74	
5	Install (1) 2" Duct in normal soil conditions	32.00	Foot	35225.75	\$1,127,223.96	
6	Install (1) 2" Duct in rock	50.00	Foot	8806.44	\$440,321.86	
7	Install Handhole	300.00	Each	62.90	\$18,870.94	
8	Mid Sheath Fiber Entry	250.00	Each	110.08	\$27,520.12	
9	Prep Cable in Panel	250.00	Each	4.00	\$1,000.00	
10	Prep Cable in Splice Case/NAP	250.00	Each	110.08	\$27,520.12	
11	Splice Fibers	35.00	Each	1016.32	\$35,571.27	
12	Install 4u Fiber Panel - loaded 144 port panel	250.00	Each	4.00	\$1,000.00	
13	Test Network	2500.00	All	1.00	\$2,500.00	
14	Install Marker Post	35.00	Each	47.18	\$1,651.21	
15	Install Marker Post with Test Station	50.00	Each	15.73	\$786.29	
16		<b>Labor Subtotal</b>			<b>\$1,809,929.26</b>	
Item	Material	Price	Unit	Quantity	Subtotal	Notes
17	Mule tape	0.05	Foot	44032.19	\$2,201.61	
18	96 fiber	1.25	Foot	47177.34	\$58,971.68	
19	Splice Trays	35.00	Each	42.35	\$1,482.14	
20	Splice Cases/NAP	706.00	Each	110.08	\$77,716.81	
21	Handholes	750.00	Each	62.90	\$47,177.34	
22	#12 Tracer Wire	0.35	Foot	44032.19	\$15,411.27	
23	Ground Rods	25.00	Each	110.08	\$2,752.01	
24	Marker Post	45.00	Each	47.18	\$2,122.98	
25	Marker Post with Test Station	65.00	Each	15.73	\$1,022.18	
26	(1) 2" Duct	1.00	Foot	44032.19	\$44,032.19	
27	4u Fiber Panel - Loaded 144 port panel	4668.00	Each	4.00	\$18,672.00	
28		<b>Material Subtotal</b>			<b>\$271,562.19</b>	
<b>Foothills Total</b>					<b>\$2,108,647.67</b>	
					\$47.89	per foot (avg.)

### **Action Item 6: Proof and Validate all Community Assets for Use in a Broadband Infrastructure Program (BIP)**

The Strategic Plan recommends the County consider leveraging existing public assets to support expanded broadband deployment. Collectively, Sonoma County’s local and state government offices have extensive assets which can support the efficient delivery of broadband services. Conduit, fiber, towers (water, fire or public safety communications), street light poles, and strategically located buildings can all be used to support the deployment of broadband infrastructure. Once this inventory of assets can be utilized through a Sonoma County Broadband Infrastructure Program (or BIP, later explained further in Action Item 8), whereby community assets are leased to service providers for the provision of broadband or wireless services. These assets not only expedite deployment but can be utilized to generate revenue to cover maintenance and operations costs of the network assets, and to fund network expansion.



It is recommended the County should consider completing an asset inventory, of all sites and facilities that are approved for an alternate use of supporting provision of commercially available broadband services. The County would also determine which assets could be used for co-location of broadband facilities.

Further, various segments of conduit and fiber exist, and are being expanded regularly in local jurisdictions such as Santa Rosa<sup>50</sup>, and Petaluma<sup>51</sup>. The County, and its partners, should ensure that additional fiber and conduit capacity is included within these projects, that could be utilized, and that fiber allocations are dedicated to a greater Sonoma County project. These expansions should be supported by joint trench/dig-once practices.

**Action Item 7: Formalize a BIP to Make Use of Broadband Related Assets**

Sonoma County should begin to formalize a Broadband Infrastructure Program (BIP), focused on meeting telecommunications needs and demands of government agencies and community anchors, while bringing value to the greater community, and monetizing any County assets that are made available. Counties and cities across the United States, and in California specifically, are developing these types of infrastructure programs to drive new revenues to local government, and to support long-term sustainability in their communities – including in bridging the digital divide.

Revenues are being generated off conduit and dark fiber assets, lit network services, and through the lease of vertical assets such as street lights, and towers. In many cases, municipal broadband networks provide residential FTTH or business fiber-optic telecommunications services both in retail and wholesale offerings.

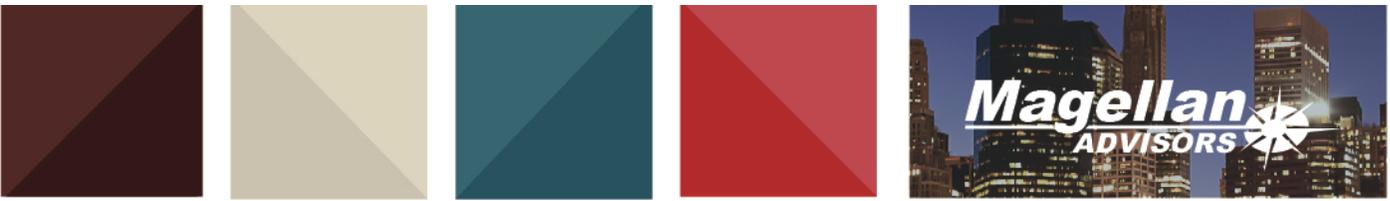
Furthermore, a BIP, when equipped with adequate assets, can negate the need for additional buildout in key areas, making community assets available to providers, instead of requiring them to build their own. For many local governments, this allows for greater control and management of ROW access, including during underground construction which can severely impact major transportation corridors, and can sometimes be impacted through underground construction moratoriums.

There are several tasks required in order for Sonoma County to formalize this program, they include:

- Document and maintain an inventory of available assets;
- Implement a Fiber Management System (FMS);
- Develop and standardize agreements for fiber, conduit, and pole/tower leasing;

<sup>50</sup> Based on information gathered during stakeholder meetings.

<sup>51</sup> City of Petaluma Technology Strategic Plan 2014-2019.



- Develop pricing policies for fiber, conduit, and pole/tower leasing;
- Publish non-discriminatory rates and terms;
- Create an enterprise fund to maintain proper budgets, cost accounting, and to track expenses and revenues of the program; and,
- Create a capital fund to cover costs of building infrastructure.

It is recommended the County should be prepared to incrementally grow its program as outlined in this Broadband Strategic Plan. This progression will allow Sonoma County to take measured steps to deploying broadband throughout the County, enabling it to incrementally expand its network as opportunities and community needs present themselves. This will also allow the County to support business and community anchor needs, as well as underserved/unserved residents, through the use of these community assets, and in partnership with local service providers who require access to the County’s infrastructure.

### **Action Item 8: Develop RFI and Seek Strategic Partnerships in Meeting Stated Goals**

Sonoma County is a large complex region, and that any broadband plan should be multi-faceted in its approach. The County should seek partners that can help in meeting this Plans stated goals, with an eye toward delivering next-generation broadband services throughout Sonoma County. Over the next 10 years, the cost to deliver broadband in the most rural areas will come down in cost, or will be delivered through more effective means, but in the meantime, speeds and services should continue to be upgraded and improved.

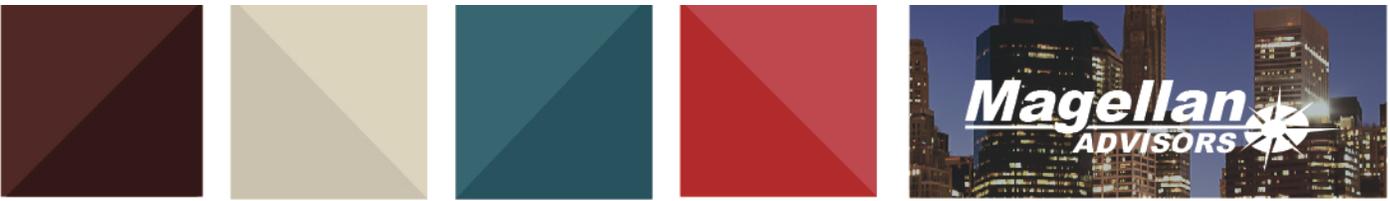
The County, and its local governments, should take an approach that works for their individual community. Public private partnerships should be considered to fund broadband projects. Broadband P3s are a great way to use public investment into critical infrastructure, with the industry perspectives of a private, or non-profit organization, who is focused on delivering a retail telecommunication service, or “utility” to a region’s constituents.

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#### **9.1.1 What is a Public-Private-Partnership?**

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A broadband public-private-partnership (P3), 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 local governments employ public broadband and utility infrastructure in conjunction with private broadband providers. P3s leverage public broadband assets, such as fiber, conduit, poles and towers, buildings and other facilities with private broadband



provider assets, and expertise to increase the availability and access to broadband services. Local governments forgo “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 Sonoma County would be considered an Infrastructure Provider, operating a BIP. The County would maintain permanent ownership interest in the broadband infrastructure (e.g., conduit, dark fiber, poles) that is funded by the County or its public partners for a fee, generally a negotiated revenue share paid by the provider, or fee per use.

A P3 would provide a competitive provider with access to the Sonoma County's telecommunications market, one that otherwise would be inaccessible for various reasons, such as the capital requirements to construct. Sonoma County's residents would benefit through access to a new fiber-based service offering, where local decision makers have the ability to influence how the community is served. Finally, the County would have the opportunity to negotiate a revenue share based on total revenues generated from the network or a simple fee for use model. This revenue would be used to maintain and expand the network as needed, and can be earmarked for other community improvements as identified by County leadership.

9.1.1.1 What is Sonoma County's Role in a PPP?

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A P3 allows Sonoma County to move forward with deployment of next-generation broadband services throughout areas of the County using a “shared risk” model. Dedicated funding for rural areas of the County may be available through the use of a special district or CFD or zone of benefit. A “shared risk” concept would allow Sonoma County to direct its investments into broadband infrastructure, while leaning heavily on its private partner to focus solely on the execution of delivering broadband services. A P3 allows the County to own this very important asset, which connects its facilities and community partners to the rest of the digital world, while significantly impacting the local telecommunications market.

Under a P3, the County could leverage a possible County owned and operated middle-mile network to bring fiber access to each of the residential neighborhoods and business areas throughout the County. While this is a major effort, using a coordinated approach and proper management framework, the County will be well poised to guide, and direct more targeted investment. It is recommended that the County consider the option to build and maintain ownership of all passive network infrastructure, including backbone conduit/fiber, and any distribution conduit/fiber that may be deployed to facilitate County connections – See Fiber Initiative #1.



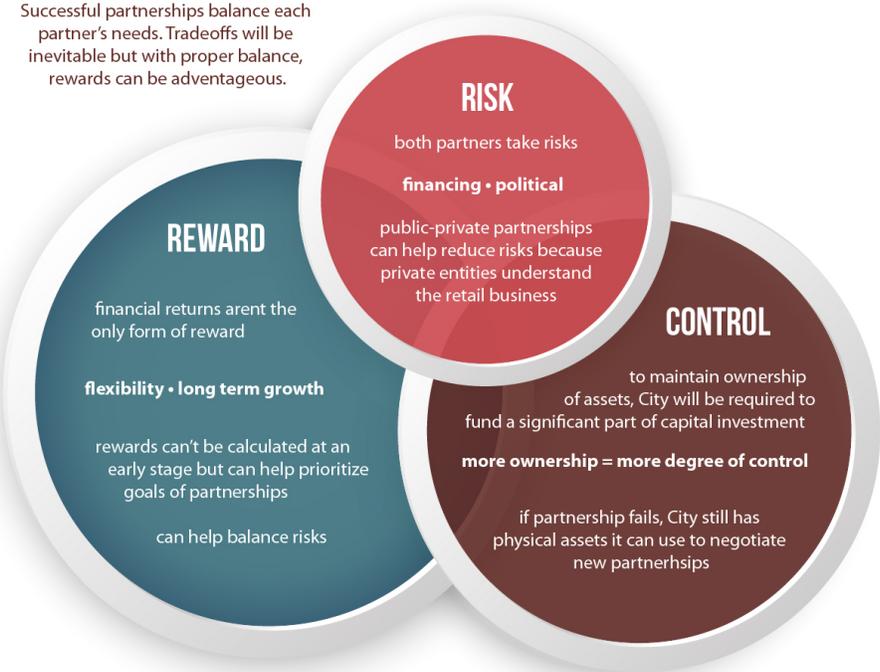
These partnerships, in a “shared risk” model, requires a careful balance between Reward, Risk, and Control. The County has the opportunity to decide what levels of each are appropriate for the potential investment, however, generally speaking the

more Reward or Control Sonoma County would like, the more Risk it will be expected to shoulder. As outlined in Figure 32, below, concepts of Reward, Risk and Control are more fully explained.

Figure 16: Broadband P3 Partnership

## BROADBAND PARTNERSHIP

Successful partnerships balance each partner’s needs. Tradeoffs will be inevitable but with proper balance, rewards can be advantageous.





## 9.2 Fiber Expansion and Investment Initiatives

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The Fiber Expansion and Investment Initiatives listed below are complex in nature, due to capital investment requirements and the construction and ownership of real assets. Therefore, these initiatives are projected over years 2 to 10 of the Plan. We anticipate an initial buildout of 4-5 years for the County network infrastructure, and incremental expansion as opportunities arise. These Fiber Expansion projects can begin after careful planning, final route selection, and once budgetary estimates are finalized.



Table 17 below is meant to outline each Fiber Expansion Initiative documented within this Strategic Plan and should provide guidance to each local government entity as to their role within these specific initiatives. These Initiatives will be further documented within the Community Profile Sheets.

Table 19: Fiber Expansion Initiatives by local government jurisdiction

<b>Initiatives</b>	<b>County</b>	<b>Cloverdale</b>	<b>Cotati</b>	<b>Healdsburg</b>	<b>Petaluma</b>	<b>Rohnert Park</b>	<b>Santa Rosa</b>	<b>Sebastopol</b>	<b>Sonoma</b>	<b>Windsor</b>
<b>Backbone &amp; Middle Mile</b>	L	C	C	C	C	C	C	C	C	C
<b>Expand to Data Centers &amp; Colos</b>	L	S	S	S	S	S	S	S	S	S
<b>Equip ED Areas with Fiber</b>	L	C	C	C	C	C	C	C	C	C
<b>Expand Opportunistically</b>	L	C	C	C	C	C	C	C	C	C
<b>Last Mile Framework</b>	L	C	C	C	C	C	C	C	C	C
<b>Innovation Districts</b>	L	C	C	C	C	C	C	C	C	C
<b>Digital Inclusion</b>	L	C	C	C	C	C	C	C	C	C

In this context the Lead (L) organization leads the efforts, and overall planning for these initiatives. Support (S) organizations provide oversight and participate in the planning efforts, while Coordinated (C) organizations have a complementary role in executing specific initiatives. For instance, while we recommend Sonoma County consider building a Sonoma County fiber backbone and middle-mile network, each city should participate, and coordinate where possible – especially where the fiber routes may pass through or near communities. Those communities should make sure their needs are identified as it relates to an interconnect with the County’s network infrastructure. While we recommend the County take the lead in ensuring Economic Development areas, such as industrial zone and business parks, are properly equipped with fiber, or in the development of Innovation Districts or Digital Inclusion programs, each local government should be prepared to participate and drive the message into their local communities, ensuring consistency and greater coordination is achieved.



**Key Initiative 1: Develop County Fiber-Optic Backbone and Middle-Mile Network**

Sonoma County government, as of budget year 2018, spends approximately \$1.5 million per year for telecommunications services from the region’s telecommunications providers. This expenditure includes internet connectivity for the County’s offices, at relatively low speeds ranging from 10 Mbps up to 100 Mbps, with the exception of a 500 Mbps connection for Human Services.



Table 20: Sonoma County Sites and Facilities – 50 Total Sites

Address	County Dept Served	Current Speed Mbps
<b>Transportation &amp; Utilities</b>		
1200 CENTURY CT SANTA ROSA	Health: Animal Services	100
	General Services: Fleet Heavy	
133 AVIATION BL SANTA ROSA	Agricultural Commissioner	100
	UC Extension	
404 AVIATION BL SANTA ROSA	Sonoma County Water Agency	20
1440 GUERNEVILLE RD SANTA ROSA	Community Development	100
	Health: WIC	
150 MATHESON HEALDSBURG	Transportation and Public Works: Air Quality	20
19722 8TH STREET EAST SONOMA	Transportation and Public Works: Road Yard	20
747 MENDOCINO AV SANTA ROSA	Open Space District	100
<b>Law Enforcement</b>		
9291 OLD REDWOOD HWY WINDSOR	Sheriff: Windsor Police	100
965 SONOMA AV SANTA ROSA CA	Connection to Santa Rosa Police	100
969 PETALUMA BOULEVARD NORTH PET	Connection to Petaluma Police	100
7400 STEVE OLSON LN FORESTVILLE	Probation Camp	20
7425 RANCHO LOS GUILICOS RD SANTA ROSA	Probation: Juvenile Justice Center	100
500 CITY CENTER DR RHNRT PK	Connection to Rohnert Park Police	100
16255 CHURCH GUERNEVILLE	Sheriff: River Substation	20
2254 ORDINANCE RD SANTA ROSA	Sheriff: North County Detention Facility	100
203 W SIERRA AV COTATI	Connection to Cotati Police	50
<b>Health and Human Services</b>		
3325 CHANATE RD SANTA ROSA	Health: Admin and others on Chanate campus	20
490 MENDOCINO AV SANTA ROSA	Health: Community Intervention Program	100
520 MENDOCINO AV SANTA ROSA	Human Services: Economic Assistance	100
112 CHILDREN'S CIR SANTA ROSA	Human Services: Valley of the Moon Children's	100
1300 CODDINGTOWN MALL SANTA ROSA	Health: DUI Program	100
1360 N MCDOWELL BL PETALUMA	Health: Community Mental Health - site closed	20
1355 INDUSTRIAL AVE PETALUMA	Health Services	20
1202 APOLLO WY SANTA ROSA	Human Services: Family Youth & Children	100
2225 CHALLENGER WAY SANTA ROSA	Health: Crisis Stabilization Unit	100
2227 CAPRICORN WY SANTA ROSA	Health: SonomaWorks	20
2227 CAPRICORN WY SANTA ROSA	Human Services: Employment and Training	100
3600 WESTWIND BL SANTA ROSA	Human Services NOC	500
3600 WESTWIND BL SANTA ROSA	Human Services NOC	20
3645 WESTWIND BLVD SANTA ROSA	Human Services: Adult and Aging	20
3725 WESTWIND BL SANTA ROSA	Human Services: In-Home Supportive Svcs	100
3725 WESTWIND BL SANTA ROSA	Department of Child Support Services	100
1430 NEOTOMAS AV,SANTA ROSA	Health Services	20
16390 MAIN,GUERNEVILLE	Health Services	10
195 CONCOURSE BL,SANTA ROSA	Health Services	20
2235 CHALLENGER WY,SANTA ROSA	Health Services	100
2245 CHALLENGER WY,SANTA ROSA	Health Services	20
2255 CHALLENGER WY,SANTA ROSA	Health Services	20
2550 PAULIN DR,SANTA ROSA	Human Services	100
2755 MENDOCINO AV,SANTA ROSA	Human Services	10
3313 CHANATE RD,SANTA ROSA	Health Services	100
5350 OLD REDWOOD HWY,PETALUMA	Human Services	50
5350 OLD REDWOOD HWY,PETALUMA	Health Services	20
625 5TH,SANTA ROSA	Health Services	100
7400 RANCHO LOS GUILICOS RD,SANTA ROSA	Health Services	20
8511 LIMAN WY,RHNRT PK	Health Services	100
<b>Administration</b>		
433 AVIATION BL SANTA ROSA	Retirement (SCERA)	100
	Auditor Controller (EFS) tenant	
11 ENGLISH PETALUMA	Clerk Recorder Assessor	20
1375 N DUTTON AV SANTA ROSA	ISD: Records	20
2260 APOLLO WY SANTA ROSA	ISD connection to Sonic.net used by SCPSC	100



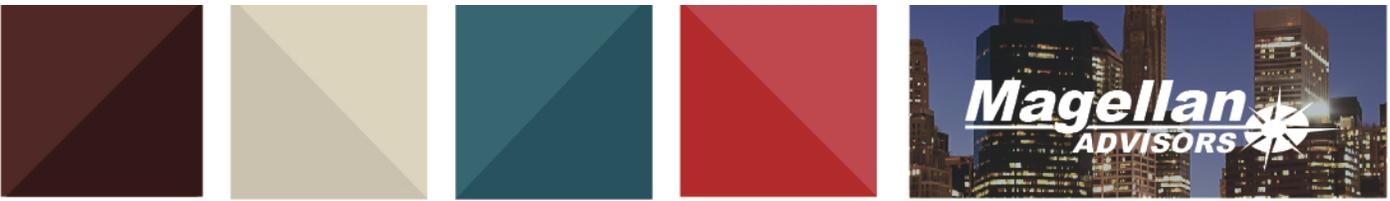
Payments for internet connectivity are treated as a County IT operating expense, which annual outflow does not fund development of County-owned assets – that would provide long-term value to the community. Sonoma County’s \$1.5 million annual spend, equates to a much larger total operating expense over time without considering any increase in the number of sites served or type/speed of service provided to existing sites. The question Sonoma County should consider as it relates to its telecom investment, is whether there is a better way to plan for and serve its long-term needs. Can the County convert this large operating expense expenditure into developing the County’s capital assets, investing locally, to build a community asset which will serve Sonoma County’s needs for the next 50 years? Such an investment will provide off balance sheet benefits to the County, beyond just pure cost avoidance of the annual expense.

Given Magellan’s initial review of County spending data for internet services and connectivity, it appears the County should perform a more detailed analysis, including a high-level engineering analysis of the network cost to serve each of the County’s present connected locations (or a core set of locations). Recognizing that such a network project is not started and completed in one year, cost estimates for the work and related investment should be divided into phases (e.g., four). While the work is significant, investing in such a network asset likely would generate increasing financial benefit to the County even under a relatively static analysis (i.e. only the existing County locations are served, no cost increases for paying existing vendors for faster or different services is assumed, and no cost sharing or revenues from other community anchor institutions is included). These estimated costs should then be spread over time assuming an appropriate municipal borrowing rate for comparison to the annual spend for the particular locations – escalated over time using an appropriate inflation factor – to assess cost/benefit.

**Fiber-Optic Standards**

Sonoma County should adopt broadband infrastructure and fiber-optic standards from which it will plan and construct its network. In addition, it should incorporate these standards into all planning and expansion projects, including joint trench/dig-once requirements.

The proposed fiber backbone provides high capacity fiber-optic cables throughout the major corridors of the County. New construction proposed will deliver a robust, redundant, and reliable County backbone fiber network, which would interconnect planned County facilities traversing several of Sonoma County’s cities. Access points would be strategically placed throughout the fiber routes to allow easy interconnection with facilities, County/city/community assets, business districts, and neighborhoods.



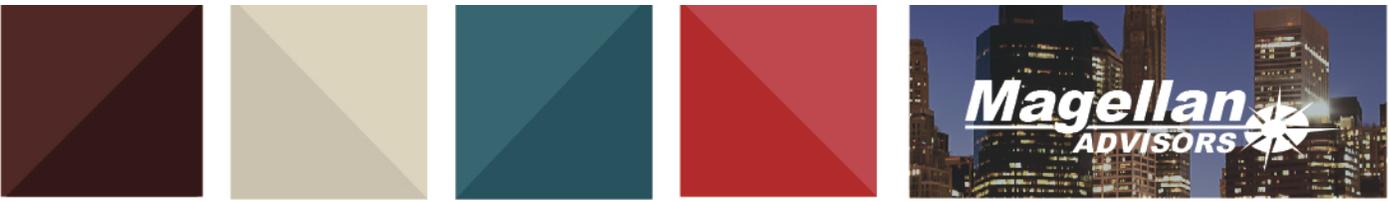
Fiber backbones will generally consist of a minimum 288-count fiber-optic cable on major routes. This cable size would enable the ability to allocate capacity among multiple applications, including:

- County government operations
- Future smart city/connected community applications
- Community anchor connections
- Broadband applications
- Spare capacity

Secondary or lateral fiber will consist of 12 to 24-strand cable connecting individual facilities and sites. For primary County facilities, such as primary data center facilities, cables will be more appropriately sized with larger fiber counts. The network will use an in-and-out splicing design that allows community anchors and points of interest to interconnect their locations in a “ring” topology that supports high redundancy for their communications. A range of specialized connections will be made to accommodate additional traffic signal, smart technology, and broadband applications that should be individually engineered based on the application. General specifications of the backbone are found below. Actual specifications may change based on actual engineering design; however, it is important that the County maintain compliance with these key specifications to achieve its long-term goals.

**Fiber Specifications**

- Backbone cable size – 288-count fiber (minimum)
  - Lateral cable size – 12-count to 24-count fiber generally, 1 to 2-count fiber for business or component connections
  - Singlemode, loose-tube non-armored cable
  - Jacketed central member
  - Outer polyethylene jacket
  - Sequential markings in meters
  - All dielectric
  - Gel-free/dry buffer tubes
  - 12 fibers per buffer tube
  - Color coded buffer tubes based on ANSI/TIA/EIA-598-B Standard Colors
- Conduit Specifications
- 36” minimum acceptable depth
  - (2) 1.5" outer conduit



**Handhole Specifications**

Each route (Backbone/Lateral) will require a unique design and exact box placement will depend on a variety of factors to be determined in the final engineering analysis. Boxes along the backbone are generally placed every 500’ or at major intersections to allow for pulling in the fiber and splicing to adjacent buildings and infrastructure. Conduit sweeps into handholes shall enter in flush with the cut-out mouse holes aligned parallel to the bottom of the box and come in perpendicular to the wall of the box. Conduits shall not enter at any angle other than near parallel. Sweeps from the mainline to the conduit shall be accomplished using radii recommended by the manufacturer. Handholes will be sized based on the size of cable(s) transiting the structures, the total number of cables, and the specific applications required by the County.

**Key Initiative 2: Expand Connections to Regional Data Centers and Colocation Facilities**

The County’s broadband infrastructure should ideally be connected to at least one collocation facility in the greater Bay Area. By connecting the network to a regional data center, collocation facility, or Internet Point of Presence (PoP), the County would be able to interconnect with a number of broadband providers residing in the facility. This enables any organization connected to the County’s fiber infrastructure to also be connected to the facility, reaching a world-class market of service and content providers. The County’s fiber could be used as the last-mile network to connect community anchors to providers that reside in these locations. This creates important benefits to the County and its economic development efforts including:

- It can provide a significant reduction in Internet service costs;
- It can facilitate direct cross-connect access to several regional and national carrier networks;
- It will enable private access to cloud-based service providers; and,
- It will improve resiliency of the County’s infrastructure.

As previously identified, there are several data center/collocation facilities located in the San Francisco Bay area to the South. With Sonoma County’s participation in the Smart Corridor/Railroad project, along with its local government partners, have secured conduit/fiber access into a Marin County transportation hub.



The City of Santa Monica connected its community fiber-optic network to the One Wilshire Data Center in Downtown Los Angeles. By doing so, businesses connected to the City's network were able to reach hundreds of broadband and cloud providers. It also allowed the City to benefit from direct data center access for its cloud, storage and disaster recovery needs.

### BENEFITS

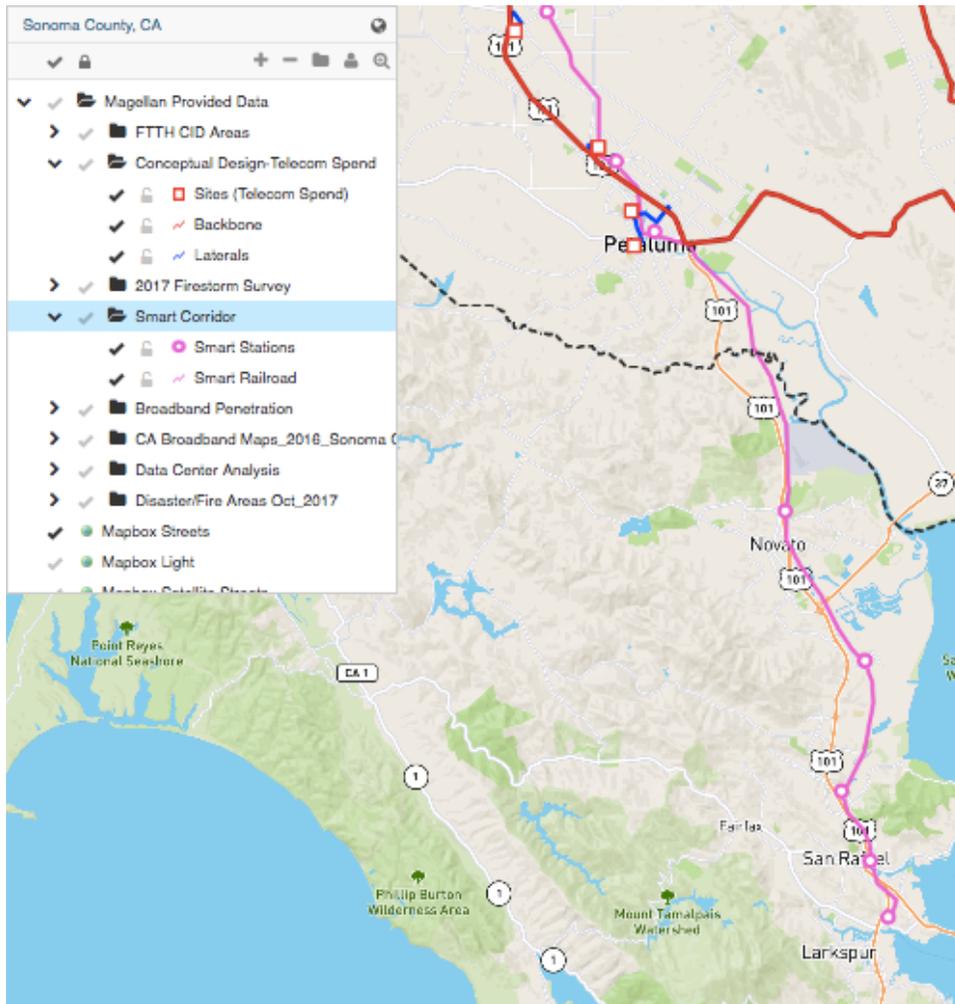
- More competition and choice of providers
- More affordable broadband services
- Brand the City as a connected community, "ready for business"
- Marketing the City's broadband to site sectors and developers
- Supported data storage and cloud computing opportunities



This creates an opportunity for greater regional collaboration with regional transportation partners such as CALTRANS to enter the Bay Area, and then with BART for access into the Bay Area data centers. BART has provided access to city/county partners for use of its conduit/fiber systems in the past, however the closest BART interconnect resides in Richmond, just north of Berkley. BART and Caltrans are focused on transportation, regional connectivity, and intergovernmental uses, however, assets are typically not supported under a commercial agreement. Sonoma County should work to establish a relationship with these transportation groups and should specifically focus on attaining routes and access into potentially interconnected data center facilities.



Figure 17: Smart Corridor/Railroad Conduit Path



Further, Sonoma County should look for opportunities to bring data center facilities to Sonoma County. With Sonoma Clean Power established and providing competitive rates, for clean, green energy, the region could be poised to locate data centers in Sonoma County. While data center projects do not normally create numerous long-term jobs, they do represent large capital investments into the community, with high paying short-term construction jobs, and constant energy consumption.



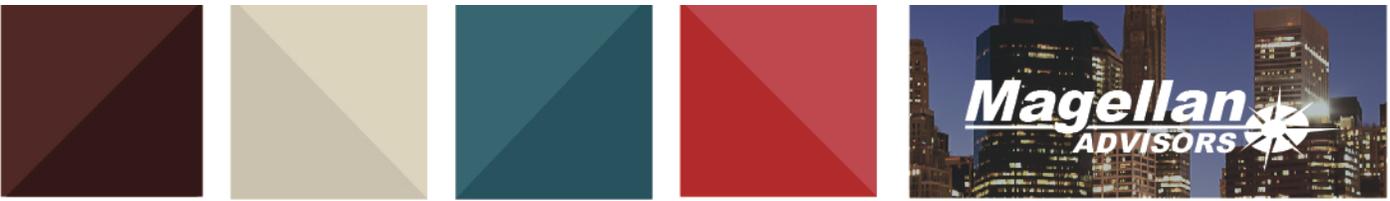
**Key Initiative 4: Equip Economic Development Areas with Fiber Connectivity**

Economic development areas, such as industrial zones or business parks, should include any areas within the County that have been identified, marketed, or developed as a key area of Sonoma County capable of driving additional economic value within the County and the greater region. Sonoma County should strive to ensure proper next-generation broadband infrastructure, and leading services are readily available when companies decide to move into that area.

Taking a proactive approach to planning for telecommunications and technology in each area will ensure the necessary services are readily available from day one. As previously stated, Sonoma County should adopt development standards for telecommunications infrastructure, and should enforce those standards, ensuring the project is designed, and constructed with this infrastructure. Sonoma County should not wait for the telecom providers to lay the necessary infrastructure, as they will not typically deploy until potential customers have been identified. For Sonoma County, and its economic development partners, this issue can create a “chicken and egg” scenario, whereby the infrastructure is not readily available when site selectors, and companies begin their search for the optimal location. It is usually too late at this point.

The County can take several steps to ensure its existing and planned areas are properly prepared, they include:

- Adopt appropriate development standards, conditioning next-generation fiber-based telecommunications infrastructure.  
Sonoma County and its cities, have the ability to condition development, whereby the approvals for development are contingent upon the necessary broadband infrastructure being installed as part of initial site development. Further, many California cities have required the infrastructure to be dedicated to the local government once rights-of-way, and other utility assets have been turned over.
- Ensure Sonoma County’s downtown areas have the necessary capacity.  
Small businesses and entrepreneurs are locating in more urban downtown areas where industry networking occurs more frequently, and where they can engage in a more collaborative setting. Maker spaces, co-working facilities and collaboration studios are becoming more of a norm, as communities begin to focus their attention on attracting talent. These facilities require high-speed connectivity and can usually take a focal point in establishing these types of professional ecosystems.



- Ensure connectivity to Economic Development areas.  
In addition to the last-mile connectivity within the areas, middle-mile connectivity, connecting the site to the Internet, and major data center facilities is a necessary piece of the overall solution. Sonoma County should design appropriate handhole/vault configuration to enable easy interconnect as the County middle-mile network is expanded.

### **Key Initiative 5: Identify Community Partners and Funding Sources to Expand the Network Opportunistically**

Local governments who have built fiber-optic networks have traditionally began this process by connecting its sites and facilities in an effort to permanently reduce the organizations telecom spend – very much as recommended in Key Initiative 1. These initial projects are funded by reducing the OPEX (operating spend) for leased services, instead taking an investment approach, many times rolling the savings into a capital budget. This allows for an initial network to be constructed to meet the long-term needs of the organization. At the same time, excess capacity in the existing infrastructure can be utilized to connect partnering organizations. In many cases, these partners have the ability to tap grants or other funding programs.

While the Sonoma County middle-mile network initially focuses on the County’s 50 connected sites, it will have a greater reach in connecting other Sonoma County community partners, and even regional initiatives.

Sonoma County’s infrastructure could be expanded to facilitate additional needs, including:

- Connect public safety facilities and communications tower infrastructure which can provide:
  - Redundancy and diversity, focus on remote areas of Sonoma County that have no cell service, and no capacity for high-bandwidth programs.
  - Need for fiber-based assets to serve with microwave for redundancy and/or diversity. Need more sites to increase coverage. Move from T1's to fiber-based solutions.
  - Fairgrounds/Veteran’s buildings - Disaster Relief Center. Need to make sure they have adequate cell and broadband services.
- Serve schools and other educational organizations, including faith-based and private schools
- Identify public housing facilities and funding
  - Burbank Housing stated during interviews that there are 2,800 units and building more; less expensive broadband - County level (HUD grants).
  - Redevelopment of Housing for Disabled (possible office park) – in need of a broadband solution.



- Identify Utility providers and districts
  - Sewer and Water - Use the facilities and planned upgrades for assistance in buildout of broadband. They are looking to upgrade solutions. Further, utility providers and districts should participate in County dig-once efforts.
- Traffic signaling and traffic improvements
  - Many cities are looking to upgrade their traffic signaling infrastructure from twisted pair to fiber. Some state funds are available.
- Explore benefits of cooperation with other regional partners:
  - PG&E;
  - Sonic; and,
  - Sonoma Clean Power.

A detailed funding analysis is provided in Appendix C: Broadband Infrastructure Funding Sources.

### **Key Initiative 6: Develop Last-Mile Investment Framework and Facilitate Deployment of Next Generation Broadband Service**

A Sonoma County middle-mile fiber network would provide new fiber infrastructure assets into areas of the County that are otherwise lacking. The County’s backbone and data center interconnections are necessary tools that communities require to take on last-mile development projects. As Sonoma County explores the concept of broadband special districts, which are focused on facilitating the funding/structure requirements of last-mile infrastructure investments, these networks would benefit greatly from the ability to connect into major data center facilities, and from the abundance of content and service providers who can be reached through these facilities.

While the County’s network infrastructure would not penetrate into residential neighborhoods, it can be used as an interconnect, or “jumping off” point, providing the necessary capacity to residential areas along the route. The County backbone has been spec’d to ensure high-count fiber cables which would support fiber-to-the-home distribution networks within reach of the network’s fiber routes. For example, this network could be used to support the Community Facility Districts analyzed above for The Foothills, Chalk Hills Road and Timber Cove.

Lack of competition in retail providers is influenced greatly by the availability of infrastructure or lack thereof, and by the enormous cost to build infrastructure. Many competitive regional or national providers will not take the risk of using their own capital to overbuild current incumbent networks, when the outcome may be to only capture a small portion of the market. Rather, providers will often times accept federal dollars in forms of grants or loans to buildout high-cost or underserved areas – relying



on tax payer subsidies. This fact further negates the argument for fair competition as it relates to tax payer funded or "government owned networks," when most providers will only build into "areas that don't make the business case" when they're using other sources of capital or "other people's money."

The business case or justification for buildout throughout Sonoma County, under the "Internet is a utility" model, should necessitate local investments into furthering the access of next-generation broadband for all. With that being said, last-mile investments cannot be solely placed upon Sonoma County, but should have buy-in from the local communities to be served.

With the proper tools, high-speed/affordable middle-mile capacity, On-Net data center facilities – and the ecosystem of interconnected carriers, each community or neighborhood in Sonoma County could make the local decision on if and how to fund last-mile broadband buildout – and, if it's a fiber, wireless, or hybrid approach. They would even have finite control as to who their retail provider or providers would be. Further, each municipality or community can make the decision on how to fund, operate, or partner to provide end user services.

Municipalities and local communities have many options when selecting a business model targeted at incentivizing further broadband investment. These business models range in options for ownership, governance, and operations, all of which can vary greatly depending on funding/investment options. When selecting a business model, an organization should understand its operating and technical capabilities, and its willingness to add personnel if the determined model is labor intensive. While this roadmap is not meant to select any last-mile deployment option for Sonoma communities, it is meant to provide each community with the required network assets and deployment frameworks which it can then use to make the best local decision on how to drive their last-mile investment.

Columbia County developed its initial fiber-optic and wireless network to connect hundreds of CAls. It developed a carrier neutral data center, numerous communications towers and lit the network using a carrier ethernet self healing ring architecture. Today the network sells transport, tower collocation, wholesale IP, and data center co location to regional, governments, education related organizations, business and retail telecommunications providers.

**BENEFITS**

- Consolidated regional government spend to community owned network
- Included wireless for more rural areas of the county
- Driving last-mile FTTH investments



COLUMBIA COUNTY  
GEORGIA



**Key Initiative 7: Implement Smart Community Technologies and Innovation Districts**

Communities across the globe are experiencing a digital revolution, whereby connectivity is being used to connect everyone, and in many cases, everything. Smart communities are the future, where sensors will be deployed to provide real-time analytics around vehicle/pedestrian counts, environmental (air quality, temperature, humidity), and public safety concerns. The data created from these activities will be used to adjust/modify local government work plans and performance, to notify the public, and to provide open data versions of the datasets which could spur additional, complementary business efforts. Santa Monica, CA was able to use its real-time parking systems and data to spur a startup focused on routing vehicles to open parking spaces – this technology is now integrated into BMW, Mercedes and Audi vehicles.

For Sonoma County, there is opportunity to support and incubate local technologies that impact agriculture, and other Sonoma County industries. Sometimes all that is needed to spur innovation is to connect home-based entrepreneurs, inventors, researchers and software development professionals, and coordinate them around a common problem. Innovation Districts can facilitate this kind of economic development activity, creating local solutions to industries which are currently in the midst of major positive transformations through automation.

**“The trend is to nurture living, breathing communities rather than sterile, remote compounds of research silos.”**

-Pete Engardio, “Research Parks for the Knowledge Economy.”  
Bloomberg Businessweek

The County and its partners should look for key areas that could be fruitful grounds for an innovation designation. According to the Brookings Institute “a new complementary urban model is now emerging, giving rise to what we and others are calling ‘innovation districts.’” These districts, by our definition, are geographic areas where leading-edge anchor institutions and companies cluster and connect with start-ups, business incubators, and accelerators. They are also physically compact, transit-

accessible, technically-wired and offer mixed-use housing, office, and retail.”

Further, “Innovation districts are the manifestation of mega-trends altering the location preference of people and firms and, in the process, reconceiving the very link between economy shaping, place and social networking. Our most creative institutions, firms and workers crave proximity so that ideas and knowledge can be transferred more quickly and seamlessly. Our “open innovation” economy rewards collaboration, transforming how buildings and entire districts are designed and spatially arrayed. Our



diverse population demands more and better choices of where to live, work and play, fueling demand for more walkable neighborhoods where housing, jobs and amenities intermix.”<sup>52</sup>

As this recommendation is focused on urban cities, the County would serve a supporting role, rather than lead.

Sonoma County should:

- Use its public network assets as a platform for innovation;
- Support and incubate technologies such as ag tech, precision farming, etc.; and,
- Define and identify prime urban locations, including supporting industries
  - Downtowns, specific parks and areas, redevelopment areas.
- Showcase technology, through strategic partnerships where possible.

**Key Initiative 8: Digital Divide/Digital Inclusion**

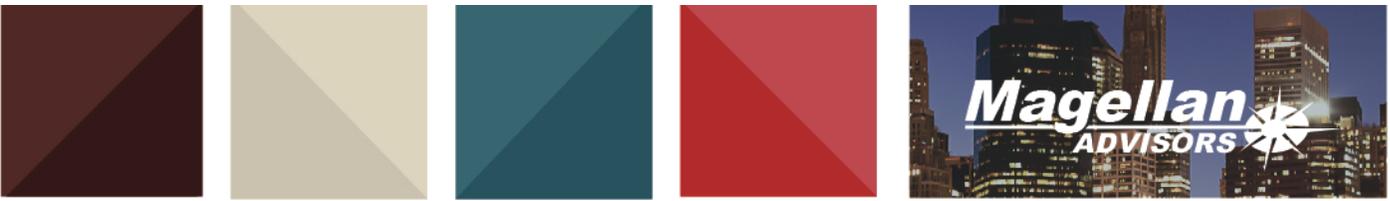
Disparities remain between the haves and the have nots of broadband internet access across the United States. These disparities result in certain classes of individuals, typically those in poverty or low-income households, to lack the tools they need to be successful in education, apply for health insurance, or have the digital literacy necessary in today’s economy. Policy makers and advocacy groups have termed this disparity the “digital divide, as a social issue referring to the differing amount of information between those who have access to the Internet (especially broadband access) and those who do not have access.”<sup>53</sup> While “digital inclusion refers to the activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of Information and Communication Technologies (ICTs). This includes 5 elements: 1) affordable, robust broadband internet service; 2) internet-enabled devices that meet the needs of the user; 3) access to digital literacy training; 4) quality technical support; and 5) applications and online content designed to enable and encourage self-sufficiency, participation and collaboration.”<sup>54</sup> Communities across the United States are trying to bridge the digital divide through using tools of digital inclusion to ensure all citizens and students have access to the tools that they need to function within the 21<sup>st</sup> Century workforce, environment, and society.

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<sup>52</sup> <https://www.brookings.edu/essay/rise-of-innovation-districts/>

<sup>53</sup> ICT Information Communications Technologies. (2018) The Digital Divide, ICT and Broadband Internet. <https://www.internetworldstats.com/links10.htm>

<sup>54</sup> NDIA. (2018) Definitions. <https://www.digitalinclusion.org/definitions/>



The following are best practices to bridging the digital divide, some of which Sonoma County and local organizations are already engaging in. These should continue to be encouraged, further developed, and publicized. Many times, getting the word out is half of the battle, as in today’s society word is spread through social media and the Internet, which may not be the most effective tool in reaching those that are living in “the divide.”

- Affordable Home-based Broadband: Sonoma County and local municipalities should work with local providers to ensure providers are offering Lifeline Internet programs to eligible families in their areas. While most providers have programs in place, they are not offered in all service areas. Eligible families will be those with children on free/reduced lunch plans, receiving SNAP, or social security. Certain exclusions do apply, however, families can get assistance from school administrators. Examples include:
  - Comcast Xfinity – Internet Essentials - <https://www.xfinity.com/support/articles/comcast-broadband-opportunity-program>
  - Frontier – Lifeline- <https://frontier.com/resources/discountprograms/lifeline-program>
  - AT&T – Access - <https://www.att.com/shop/internet/access/#/>
- Work with Consortia and Grant Funding to provide devices and training: Oakland The East Bay Consortium in Oakland, among many other consortia in California have used CASF funding to provide for low income families. The East Bay Consortium used the program to provide 4,000 free computers to low income families. The program also involved providing digital literacy training classes to the recipients.
- Youth Tech Programs (<http://www.santamonicyouthtech.com/>): Santa Monica created Summer Youth Tech Programs to teach students lean start up methods, coding, leadership, critical thinking, and collaboration skills. The students’ innovations or programs are then pitched to companies for development. Many of these students have become entrepreneurs in their own right, through participation in this program. Through development of programs such as these, you create an entrepreneurial spirit in youth and bring a tech knowledge, interest, and industry to local economies. Local municipalities and school districts should consider local industry or reach out to nearby Silicon Valley or support in development of similar programs.
- Coordination of Public and School-based WiFi: Many school districts across the country have seen success in assisting students with limited access to high-speed broadband through opening WiFi at schools and public sites, including government buildings, city-wide WiFi, K-12 schools, and libraries. This would require a coordinated business approach to WiFi, while coordinating free access after-hours for eligible members of the community. A number of districts in the United States have also installed WiFi devices or access points in school buses,



allowing students to continue to work while traveling to and from school. Some districts also take this a step further by parking these buses in areas lacking internet access, to allow students to continue working in the evenings and on weekends. While these devices parked in these areas are meant for students, parents can also access the students' devices or parents can be provided credentials to log in devices as well for use for job searches, insurance filing, or reading news media. School districts are required to set filters on these devices in accordance with the Federal Children's Internet Protection Act (CIPA) and Cal. Ed. Code § [18030.5](#).

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## 10 CONCLUSIONS AND NEXT STEPS

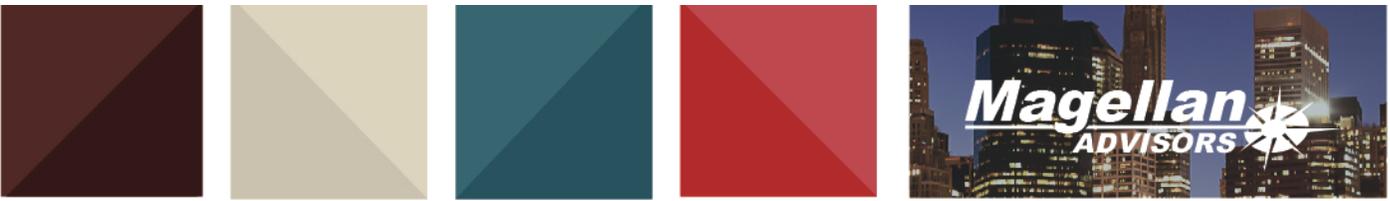
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Sonoma County, due to its rural nature, suffers a broadband gap primarily related to a funding gap. Like other rural areas throughout the United States, it is dependent on competitive service providers willing to buildout rural fiber routes and communities based upon grant and subsidized loan programs. In short, the funding to wire rural Sonoma County is coming from taxpayers and other related state and/or federal programs.

A caveat to this has occurred at The Sea Ranch and Occidental, as well as in neighboring Marin County's Nicasio, where property owners are stepping up to fund the necessary capital to build next-generation fiber to the home networks. The funding by property owners is nothing new, in fact, many incumbent and competitive providers rely on aid to construction charges to build infrastructure where their business plan cannot support it. Aid to construction is essentially a capital pass through to the end user, which they can opt to pay in a single upfront payment, or many times, in an extended monthly recurring charge which can mirror the terms of their telecom services contract – it's essentially tacked onto the monthly bill. Unfortunately, when this occurs, and is managed through a service provider, the aid to construction fees expand the provider's infrastructure – public ownership of the assets are not granted.

Sonoma County should focus on building public infrastructure, ensuring long-term ownership is maintained by those paying for the infrastructure. Long-term ownership, decision making authority over the infrastructure, how it's used, and the benefit derived from it should be controlled by those funding the efforts. This is a central theme to this Sonoma County Broadband Strategic Plan, and our action items, and recommendations support this vision.

Sonoma County should consider organizing itself in order to accomplish the goals and initiatives documented in this Plan. Additionally, Sonoma County should build consensus amongst the community and potential partners to move broadband forward throughout the region.



Sonoma County’s Broadband Strategic Plan’s Roadmap and Action Plan include:

**Action Item 1: Redefine Advisory Board to Focus on Driving BSP**

**Action Item 2: Identify Governance Structure/Lead Organization-County**

**Action Item 3: Formalize Broadband Friendly Policies and Standards**

**Action Item 4: Continue to Work Collaboratively with and to Encourage Providers to Expand Infrastructure to Serve Rural and Underserved Sonoma County**

**Action Item 5: Provide Structure and Funding for the Formation of Special Districts to Enable Broadband Expansion (taxing districts, etc.)**

**Action Item 6: Proof and Validate all Community Assets for Use in the Broadband Infrastructure Program (BIP)**

**Action Item 7: Formalize a BIP to Make Use of Broadband Related Assets**

**Action Item 8: Develop RFI, and Seek Partnerships in Meeting Stated Goals**

**Key Initiative 1: Develop County Fiber-Optic Backbone and Middle-Mile Network**

**Key Initiative 2: Rehab WiTel Conduit System or solicit P3 for activation, and interconnect key areas along the route. (keep in mind there are gaps in wetlands – impacts the value)**

**Key Initiative 3: Expand Connections to Regional Data Centers and Colocation Facilities**

**Key Initiative 4: Equip Economic Development Areas with Fiber Connectivity**

**Key Initiative 5: Develop Last-Mile Investment Framework and Facilitate Deployment of Next Generation Broadband Service**

**Key Initiative 6: Identify Community Partners and Funding Sources to Expand the Network Opportunistically**

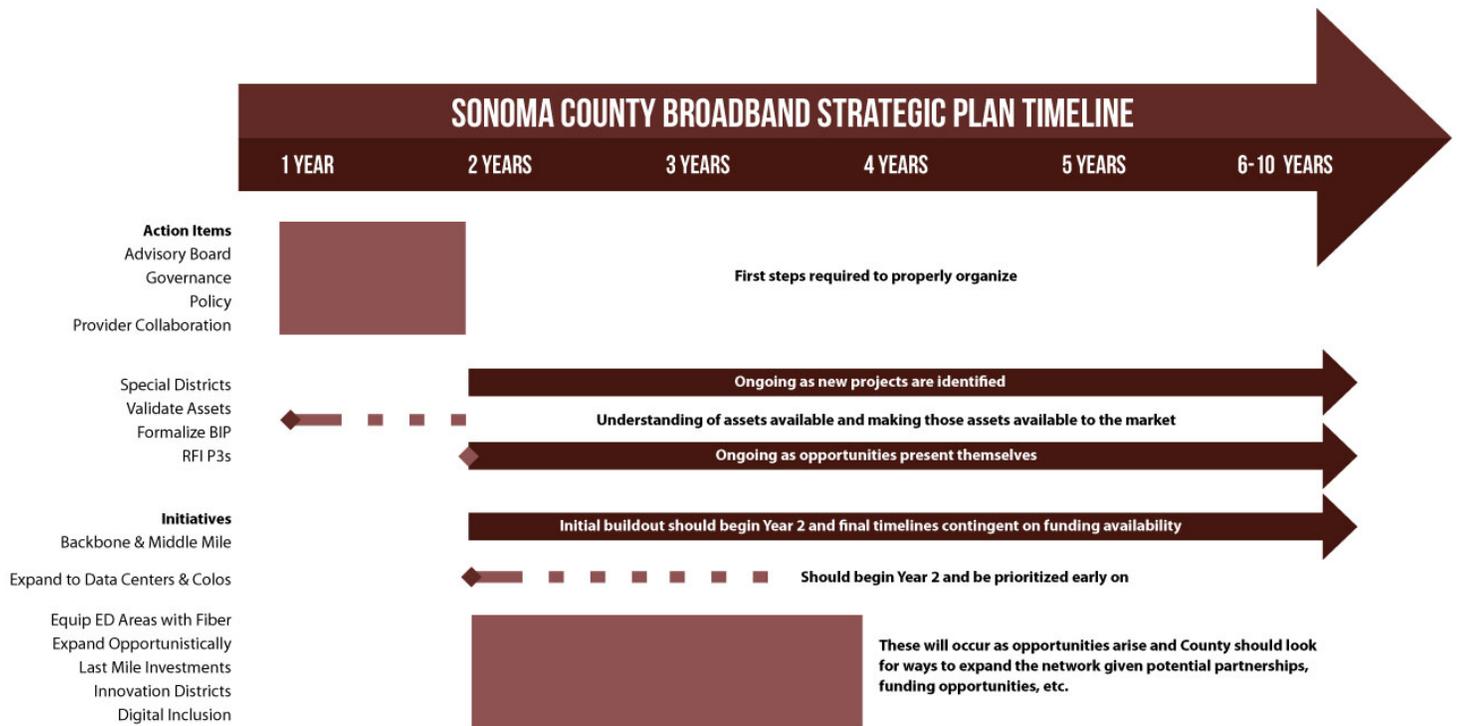
**Key Initiative 7: Evaluate and Implement Smart Community Technologies when appropriate**

**Key Initiative 8: Develop Innovation Districts**

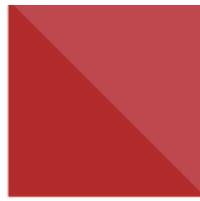
**Key Initiative 9: Digital Divide Digital Inclusion**



Figure 18: Sonoma County Broadband Strategic Plan Timeline



The next steps Magellan Advisors is recommending for Sonoma County to follow over the next 10 years are intended to be incremental. By setting a 10-year timeline, the incremental steps are feasible and realistic for Sonoma County to pursue, allowing adequate time to ease into the Broadband Strategic Plan's recommended model. Initializing the Broadband Strategic Plan model should be viewed similarly to the original creation of other county departments in the past, in terms that, public demand for better telecommunications is gradually increasing; and, Sonoma County should consider the opportunities in the Broadband Strategic Plan to effectively meet the public demand in the next 10-year horizon and onward. Sonoma County will continue to update the Broadband Strategic Plan over time as new data becomes available and projects are completed.



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## Appendix: Broadband Overview

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### 1 BROADBAND BASICS

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Access to fast, reliable, and affordable Internet is essential to every resident, business, community anchor, and municipality across the nation. Those without high-speed broadband suffer from lack of access to health insurance portals, continuing education, effective sales and marketing, and high-quality business systems. Broadband is vital to economic prosperity, in many instances businesses state that they would move their businesses to another location for high-speed Internet and other regions experience “brain drain” when students move from home towns after high school never to return, in part due to access. Broadband provides the digital infrastructure necessary to connect communities to the rest of the world. Sonoma County’s businesses, industries, and institutions will continue to realize the necessity of broadband to effectively manage their operations and residents will require Internet for crucial online services and quality of life opportunities. This, along with the explosion of more sophisticated online business applications, like telemedicine or interactive video advertising, is driving the need for consistently higher bandwidth.

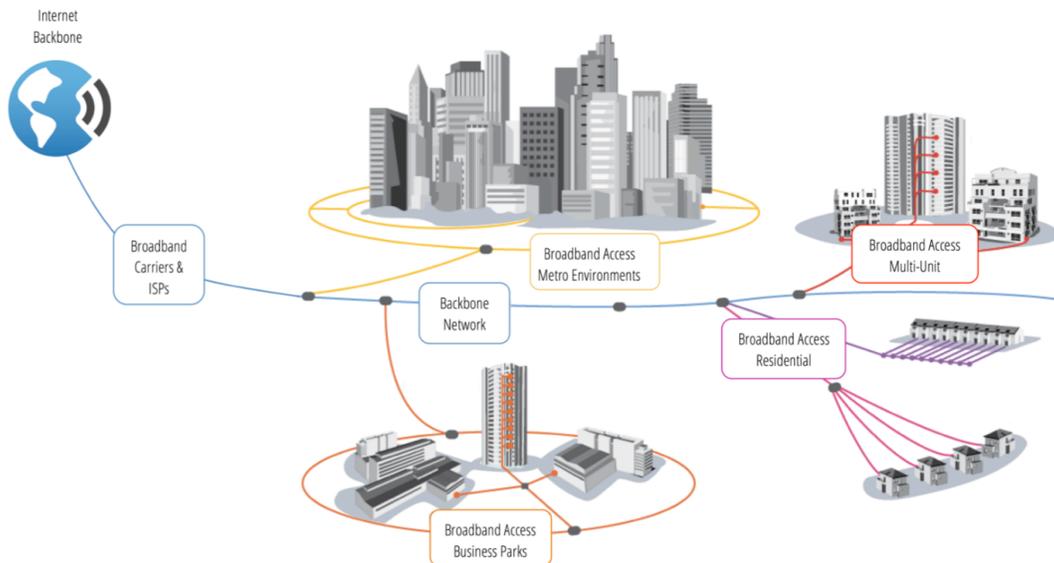
Broadband is deployed throughout communities as wired and wireless infrastructure that carries digital signals between end users and the content they want to access. The content comes in many forms and from many locations across the world in the networks that connect the local community to the Internet backbone. Websites, television, streaming video, videoconferencing, cloud services, and even telephone service are just a few types of content that are delivered across local broadband networks.

Access to this content is made available through the type of infrastructure and selection of connections available in the local network. Robust local infrastructure results in faster, more reliable access to content. Conversely, local infrastructure that is aging and built on older technologies results in slower, less reliable access to content.





Figure 19: How fiber-optics connect our communities



## 1.1 Dial-up access

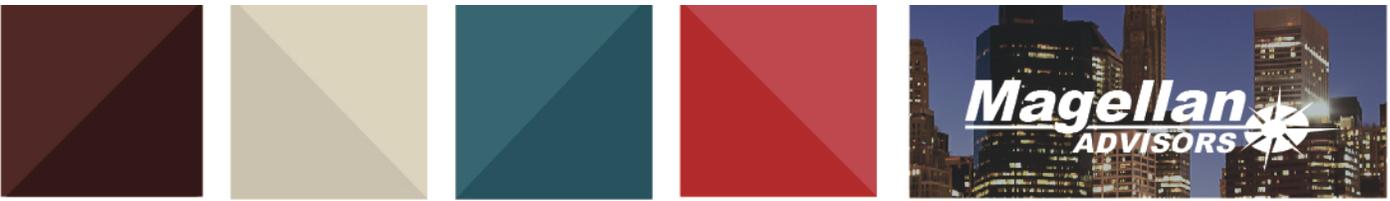
Though not defined as a broadband technology due to speed and bandwidth limitations, dial-up access still exists in many areas of the world. Dial-up Internet access is a form of Internet access that uses the facilities of the public switched telephone network (PSTN) to establish a connection to an Internet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

## 1.2 Digital subscriber line (DSL)

DSL is a wireline transmission technology that transmits data faster over traditional copper telephone lines installed in homes and businesses. DSL-based broadband provides transmission speeds ranging from several thousand bits per second (Kbps) to millions of bits per second (Mbps). The availability and speed of DSL service may depend on the distance from your home or business to the closest telephone company facility.

The following are types of DSL transmission technologies:

- Asymmetrical Digital Subscriber Line – Used primarily by customers who receive a lot of data but do not send much. ADSL typically provides faster speed in the downstream direction than the upstream direction. ADSL allows faster downstream data transmission over the same line used to provide voice service, without disrupting regular telephone calls on that line.



- Symmetrical Digital Subscriber Line – Used typically by businesses for services such as video conferencing, which need significant bandwidth both upstream and downstream.

## 1.3 Cable modem

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

## 1.4 Fiber-optics

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Fiber-optic network technology converts electrical signals carrying data to light and sends the light through transparent glass fibers about the diameter of a human hair. Fiber transmits data at speeds far exceeding current DSL or cable modem speeds, typically by tens or even hundreds of megabits per second. With fiber-optic broadband networks, speeds in the billions of bits per second range are possible.

The actual speed you experience will vary depending on a variety of factors, such as how close to your computer the service provider brings the fiber and how the service provider configures the service, including the amount of bandwidth used. The same fiber providing your broadband can also simultaneously deliver voice over IP circuits (VoIP) and video services, as well as a full suite of over-the-top (OTT) service offerings. Variations of the technology run the fiber all the way to the customer's home or business, to the curb outside, or to a location (node) somewhere between the provider's facilities and the customer.

- Fiber to the Node (FTTN) - Fiber to the Node technologies bring high-capacity fiber-optic cables to local service areas and then connect to existing DSL equipment. Rather than bringing fiber-optic cables to every home or business, the fiber is connected to the existing DSL network to increase its backhaul capacity. It allows these networks to carry more traffic; however, often times the copper-based "last mile" DSL network, connecting homes and businesses to the local nodes, is still a bottleneck and results in subscribers inability to access the true speeds of fiber-optic connections.
- Fiber to the Premise (FTTP) - Fiber to the Premise (FTTP), also referred to as Fiber to the Home (FTTH), is a technology for providing Internet access by running fiber-optic cable directly from an Internet Service Provider (ISP) to a



customer’s home or business. Fiber facilitates much faster speeds than dial-up and most coaxial cable Internet connections, and generally needs to be serviced less. This technology is considered one of the most "future proof" types of Internet technology, since there are no foreseeable devices that could use more bandwidth than can be sent via fiber-optic cables.

Figure 20: Comparison of internet connections

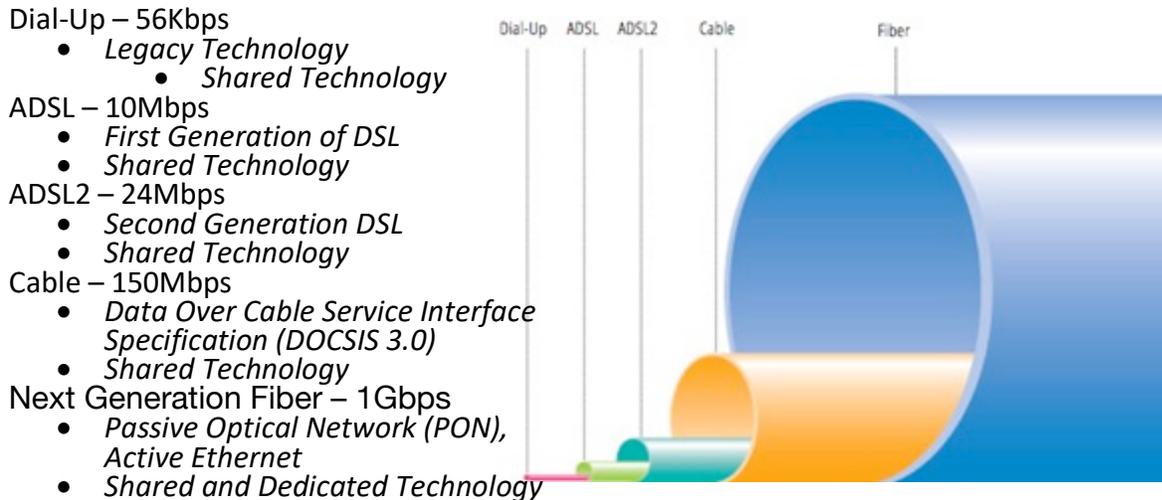


Figure 3 illustrates the relative difference between common Internet connection methods, legacy technologies have an upper limit of 300 Mbps, next-generation broadband that utilizes fiber-optic connections surpasses these limitations and can provide data throughputs of 1 Gbps and greater.<sup>55</sup>

## 1.5 Wireless

Wireless broadband connects a home or business to the Internet using a radio link between the customer’s location and the service provider’s facility. Wireless broadband can be mobile or fixed. Wireless technologies using longer-range directional equipment provide broadband service in remote or sparsely populated areas where DSL or cable modem service would be costly to provide. Speeds are generally comparable to DSL and cable modem. An external antenna is usually required.

<sup>55</sup> Actual speed and quality of service will depend on the specific service contracted by the end user, whether using a traditional broadband service or a next-generation broadband service.



Wireless broadband Internet access services offered over fixed networks allow consumers to access the Internet from a fixed point while stationary, and often require a direct line-of-sight between the wireless transmitter and receiver. These services have been offered using both licensed spectrum and unlicensed devices. For example, thousands of small Wireless Internet Services Providers (WISPs) provide such wireless broadband at speeds starting at 1 Mbps using unlicensed devices, often in rural areas not served by cable or wireline broadband networks.

Mobile wireless broadband services are also becoming available from mobile telephone service providers and others. These services are generally appropriate for highly mobile customers and require a special PC card with a built-in antenna that plugs into a user’s laptop computer. Generally, they provide relatively lower speeds, in the range of several hundred Kbps, to several Mbps (e.g. 4GLTE).

With 5G deployment in the early stages, we can assume this technology will begin to be utilized in last-mile deployments – if the planned throughput can be achieved. However, it’s questionable whether or not 5G will support residential deployments where multiple HD streams and dozens of devices could be connected to the Internet. In addition, while 5G is planned, and in early deployment stages the fiber providers are beginning to release 10Gb capable fiber to the home networks.

While future wireless technologies hold promise for much faster speeds, it’s likely they may continue to lag fiber-optics. Many community anchors (schools and hospitals) do not consider wireless to be an option to support their long-term needs, however future wireless will be required as an overlay to all fiber-optic backbone networks. Remote connectivity and the numerous smart-city devices that are coming to market will necessitate ubiquitous high-speed wireless coverage, with next-generation fiber-optic backhaul. As an example, in Santa Monica CA, the city negotiated a small-cell DAS deployment using city owned street lights and fiber connectivity at each DAS placement. Fiber-optic backhaul will continue to drive wireless deployment through 5G and beyond.

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## 2 BANDWIDTH TRENDS

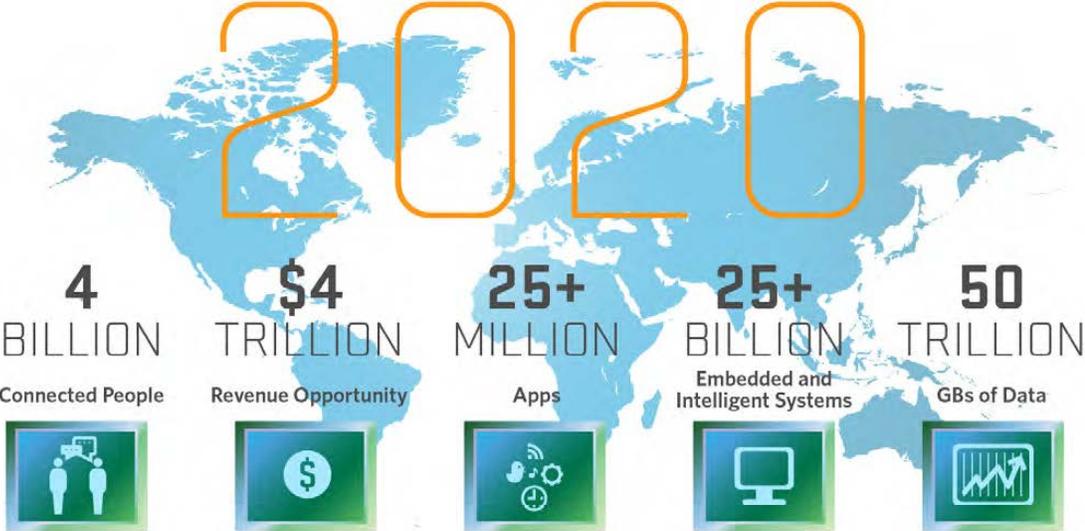
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Broadband technologies have evolved to carry more and more data because of the advancements in online applications and the growth in the number of online devices. According to a new report by Gartner, “As it becomes cheaper to fit sensors to consumer products, the number of smart devices in a typical home in developed countries could grow to over 500 by 2022, .... They expect that these smart devices, which make up the so-called Internet of Things (IoT), where wearables and sensors



constantly exchange information, to be updated automatically with new features.”<sup>56</sup> While many of these devices have not made it mainstream, “tech geeks” and wealthy individuals are more likely to invest in and try out these options, where the everyday consumer may not have the knowledge or means to do so.

Figure 21: IDC Predicts Huge Growth in the Number of Global Connections



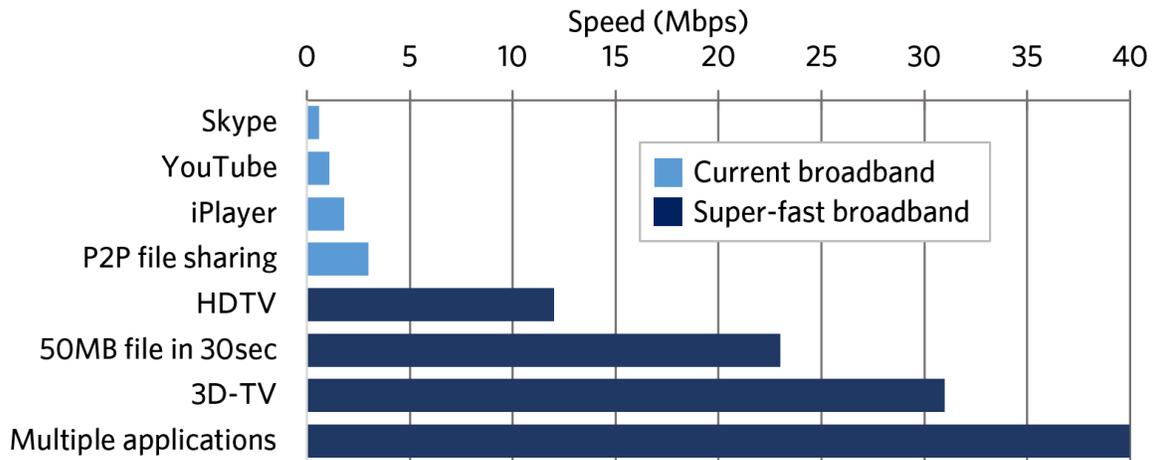
Source: Mario Morales, IDC

Every application requires a certain amount of bandwidth on a broadband connection to function properly. As time has progressed, we have witnessed significantly more devices, each with hundreds of possible applications, and significantly more bandwidth used by those applications. Figure 5 illustrates the bandwidth requirements of common applications and the impact of multiple applications running across a broadband connection.

<sup>56</sup> <http://www.techgoindu.com/2014/09/13/gartner-over-500-smart-devices-per-home-by-2022/>



Figure 22: Broadband Application Speed Requirements



Today, broadband subscribers across every user class are utilizing more online applications, and particularly those that consume larger amounts of high-quality bandwidth. As the adoption of the Internet of Things (IoT) increases, these demands will escalate dramatically.

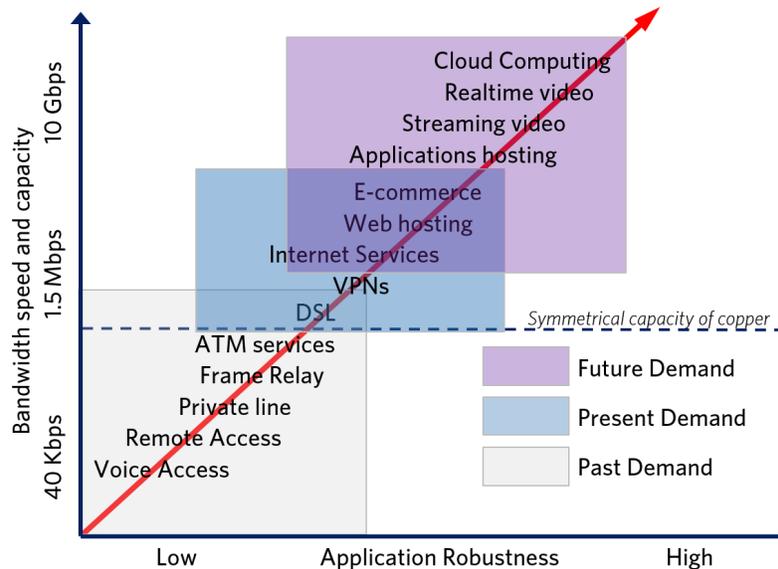
Figure 6 illustrates broadband demand for applications today and the increases in broadband that are necessary to accommodate this demand. Broadband subscribers make heavy use of the core Internet functions of Internet browsing, web hosting, e-commerce, virtual private network connectivity, and voice services.

However, subscribers are consuming more real time video and streaming applications, which require significant bandwidth, reliability, and performance from their broadband connections. We are still early in the evolution of Internet video applications and these are expected to grow significantly over the next 10 years, replacing much of the text-based Internet. In addition, the myriad of cloud services is driving the need for more symmetrical<sup>57</sup> broadband as real time and cloud applications require additional bandwidth, both in download speed and upload speed. As more of these applications are deployed, broadband connections will need to accommodate the increased bandwidth load. Many times, these applications synchronize in real time, meaning that they are always consuming bandwidth at a constant rate rather than only when the user is actively engaging the application.

<sup>57</sup> 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.



Figure 23: Growth in Application Bandwidth Demand



The proliferation of devices is also driving the need for more bandwidth as more devices in the home, businesses, and public places all access existing broadband connections. A report published in 2012 demonstrates the amount of time the average user spends with their devices across each type of device, and how users interact with multiple devices simultaneously. Although the study’s primary goals were to gain a deep understanding of consumer media behavior over a 24-hour period,<sup>58</sup> an important implied finding is that users are spending significantly more time with their devices, devices that all require broadband connections. As these devices all vie for bandwidth on a users’ broadband connections, the demand for more bandwidth to support more applications grow. A more recent study has shown that individuals spend an average five hours a day across all devices for personal use, up 20% from fourth quarter 2015.<sup>59</sup>

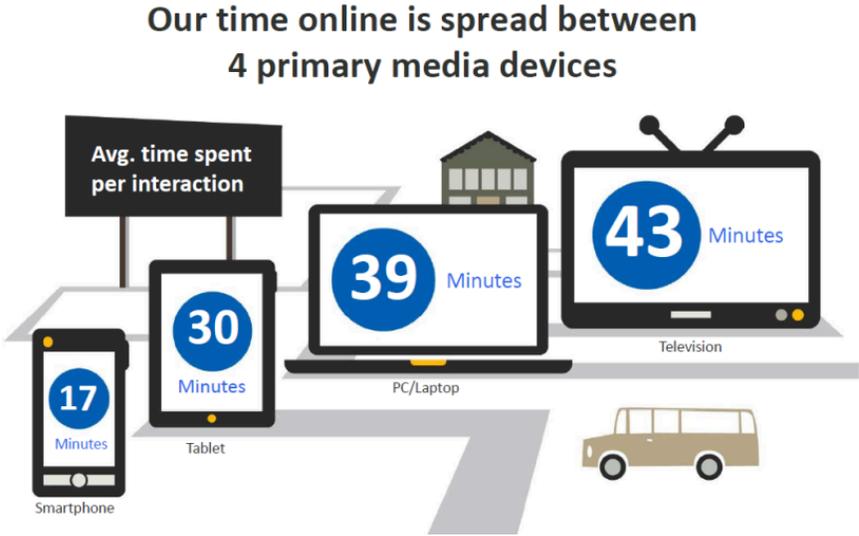
These demands also extend to many devices inside the home that are now being connected to the Internet and using our broadband connections. Many multimedia entertainment systems, thermostats, irrigation systems, food storage and preparation areas, and security and monitoring systems are now connected to the Internet, consuming even more home broadband bandwidth. The explosion of Internet-

<sup>58</sup> *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](http://think.withgoogle.com/databoard/media/pdfs/the-new-multi-screen-world-study_research-studies.pdf)

<sup>59</sup> Khalaf, S. (2017) *U.S. Consumers Time-Spent on Mobile Crosses 5 Hours a Day*. Flurry Analytics. <http://flurrymobile.tumblr.com/post/157921590345/us-consumers-time-spent-on-mobile-crosses-5>

connected home devices will lead to increased use of residential broadband connections, as “always-on” technologies are constantly connected to the Internet.

Figure 24: The Proliferation of Broadband-Connected Devices



## 2.1 Agri-tech Trends

### How Technology is Enabling the Next Evolution in Farming and Agriculture

Since early man, and for the millennia after, farming has been a very labor-intensive endeavor. Producing enough yield to support growing populations required vast amounts of land, labor, and resources and often came at the expense of destroyed environments through clear cutting forests and eventual over fertilization and exposure to harmful pesticides. Feeding today’s world population is still a struggle in balancing the need for food with the need to help protect the environment, keep farmers profitable, and provide it in the most efficient way possible.





By the turn of the century, farmers were starting to mechanize their operations with the advent of machinery, thus reducing the need for hard manual laborers while also helping to improve the yields out of each animal or acre of land. These machines continued to become more sophisticated over time, such as with the introduction of specialized harvesters, seeding machines and other mechanized solutions, further improving the economics behind farming and at the same time, supplying even better products to their customers.

During the mid 1980's and mid 1990's, technology started to be integrated with the farm equipment and around the same time science and technology was being used to improve the crops themselves through selective DNA modifications making crops resistant to adverse environments. John Deere was one of the early pioneers of integrating technology into their farm equipment by adding GPS based technology to help automate many of their functions. Harvesters could now "drive" themselves without human interaction based on a GIS based map and assisted by GPS location technology. These GPS guided systems mean the equipment could be more efficient, harvest/plan longer and yes, produce better yields. It was the start of the Precision Agriculture evolution.

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### 2.1.1 Precision Agriculture

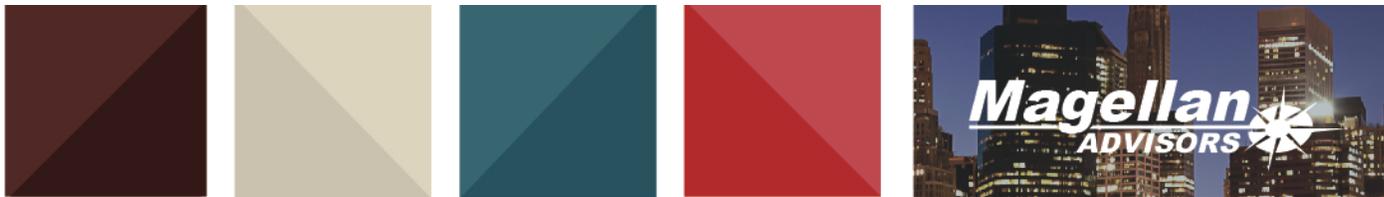
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Precision Ag, Smart Farm, and Farming 4.0, all refer to roughly the same thing – the ability of science and technology to assist farmers and producers with increased profitability, efficiency and sustainability, all while doing a better job at protecting the environment.

While precision agriculture principles have been around for more than 25 years, it's only been over the past decade that they have become mainstream due to technological advancements and the adoption of other, broader technologies.



Precision Ag, or Smart Farming, supports all disciplines of our food production including farming, ranching, dairy, aquaculture, row crops, field crops and orchards. Precision Farming is about managing variations in the field more accurately to grow more food using less resources and reducing the cost of production. Today, we are seeing a new farming evolution that is triggered by the adoption of new technology targeted specifically towards the agriculture industry including satellites, higher



precision GPS, smart sensors, drones, and a whole host of other Internet of Things (IoT) devices and applications.

While precision agriculture – the use of satellite navigation, remote sensing and other tools to farm each square meter as efficiently and sustainably as possible – has been an evolving reality for some time, it has now reached a point where it is not only possible to collect vast quantities of data, but also to use quite inexpensive, small processors to make use of this information to control different pieces of equipment or monitor individual animals.

Livestock farmers, using modern information technology, can now record numerous attributes of each animal, such as pedigree, age, reproduction, growth, health, feed conversion, and meat quality. The goal of precision livestock farming is to provide a mixture or ration that satisfies the animal's requirements at the lowest possible cost. For too many years, thousands of years in fact, farmers, ranchers and other producers have struggled to develop the “right” formulas for getting the best yields from their crops. Complex variables such as weather, soil moisture and nutrient levels, weeds, pests and diseases interact and create a mix of difficult to capture and even more difficult to address solutions. Smart farming allows the producer to collect the variables accurately and efficiently, and then using technology, it can help the producer process the matrix for appropriate solutions. Coho and Steelhead Smotes from the Dry Creek hatchery are PIT tagged with hatch date, location of release, species, and fish ID # which can be read by remote sensing devices. Fish can be tracked from Dry Creek, through the Russian River to the Pacific and the success rate can be measured by adult fish returning to Dry Creek several years later to spawn.

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### 2.1.2 Ag Technology

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Technology is changing the agricultural business in many ways. Modern technology allows farmers to produce better crops with better yields at a more affordable price. Many crop farmers are using autonomous combines, harvesters and other farm equipment to help save on the labor and associated costs of farming. Tractors with GPS navigation can be programmed for more accurate harvesting routes and can work at any time of the day or night, 24 hours a day. Sensors track fuel and oil levels, electrical issues, and other maintenance concerns with the equipment and remotely alert the owner or mechanics of potential issues, often before they become issues. Sensors are also used within grain bins to help determine grain levels in real-time that are then tied to current market prices allowing the farmer to have accurate awareness of the value of current supplies. Farmers are using fixed sensors, placed in the ground, to monitor and control soil samples including nutrient content for the desired crop, moisture content to adjust the watering schedule accordingly, mold or other issues, as well as soil erosion and water availability issues.



Intelligent farming equipment can be used to spread water, pesticides and fertilizer only where it is needed, rather than a wasteful blanket of product. This not only increases the efficiencies, and lowers the costs for the farmer, but also helps to protect our environment, by applying more precise, usually less amounts of chemicals, and other supporting materials.

Wineries, which are very prevalent in Sonoma County, are using sensors and technology to test their crops to determine the most appropriate time to harvest, recording the yields of each crop and the long-term history of each type of grape, and the resultant product with its desirability in the market. Efficient, automated machines/robots are now being employed in vine and orchard harvesting as well. Robots with sensors determine when crops are ready to be picked, harvest them and then load into bins to final processing in preparation for distribution to the retail, foodservice and remanufactures.

Ranchers are using drones to locate and track their livestock when feeding over large areas. Traditionally, ranchers would need to physically monitor their livestock periodically, which can be difficult and time consuming, especially in inclement weather, but now they are using GPS sensors located on the livestock that drones can then use to locate, video, and report back conditions. Many are experimenting with drones as a vehicle used in the actual herding of animals to their desired locations.



Drones are also being used to collect crop information with specialized sensors looking for soil conditions, erosion, moisture content, pests and disease. Once collected, this information is entered into software applications that assist in determining the best remedies to maximize field or orchard yields.

Technology is changing the face of agriculture. It is transforming the industry into a more efficient, profitable operation and with better products, to help feed the billions of people that are accustomed to cheap and plentiful products of the 21<sup>st</sup> century, not only in the US, but around the world. The US is the top producer of agricultural products and services in the world and the application of technology will help ensure we continue to provide the best products available anywhere. These trends are underway today in Sonoma County, and will become more mainstream as the technology improves. Silicon Valley, just a couple of hours away from Sonoma



County, is beginning to take AgTech more seriously and start-up companies are taking root there. Summits, Meetups, and conferences are being held in Silicon Valley which agricultural, economic development, and municipal leaders from Sonoma County could attend, participate in, and learn about new technologies coming to market. Sonoma County and this Broadband Strategic Plan should look to the future, position its assets, and influence to support the evolution of its agriculture industries. Access to high-speed connectivity will be a key driver to greater adoption.

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### 2.1.3 Broadband and Agriculture

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Broadband is becoming an absolute necessity for our US farmers to continue their lead on the world stage. Without it, our agriculture industry will struggle to maintain its competitiveness and can risk disruptions in our food supply as more areas are being converted from agriculture to suburban neighborhoods, and others dry and desolate. We need to ensure better yields from less available land if we are going to continue to supply the world with food, all while protecting our environment and natural resources. Technology can lead. Broadband and connectivity have become the glue that so many of these new advances rely on to be effective.

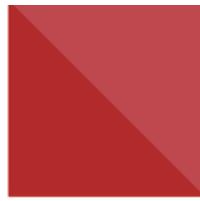
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### 2.1.4 Rural Farming/Winery Technologies

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Technology is beginning to play a bigger role in vineyards, wineries, and wine cellars' business models. While wine making is viewed as an ancient art form by many, this industry is being modernized with a variety of innovations related to efficiencies, increased revenues, and environmental impacts.

Tractors and field equipment are being equipped with technology applications and devices to increase efficiencies for the driver and data collector. Applications applied to the equipment are loaded on tablets to assist in geolocating where the driver is and needs to be in the vineyard. Additionally, applications are used to measure and assess vines, leaves, and grapes in order for the vineyard to manage the crop. In the past, vineyards have used cameras via airplanes and satellites to view and monitor their crops. Today, these vineyards use drones with cameras and other technologies to assess the status and possible issues across their vines.



Increasingly, vineyards are not just in the business of growing grapes. Oftentimes, the vineyard makes wine within a winery onsite, and sells the wine in tasting rooms onsite or nearby. Direct sales has become a large portion of the wineries business model, accounting for a large portion of revenues. In an effort to capitalize on direct sales, wineries are becoming more effective at customer management, retention, and repeat sales tactics. In order to be effective, software programs are used to monitor, manage, and communicate with customers. Many of these programs are internet or cloud-based, requiring high-speed Internet to be successful.



California endured massive drought conditions from 2010-2016. While conditions have improved in recent years, the state continues to be vigilant in monitoring weather and water conditions. Agriculture is among the hardest hit when droughts occur in a region, and wineries are no exception. To maximize the use of water in wineries, and other agriculture industries, sensor technology and management systems can be implemented to monitor water levels in the soil and in wells. Additionally, these sensors can be used for monitoring soil quality and health, leading to higher quality grapes and wines.

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### 2.1.5 Rural Farming/Dairy Technologies

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Dairy farming is a labor intensive, exhausting and an un-relenting business. There are no days off and no holidays. Cows always need to be milked. In such a labor-intensive industry, many would be inclined to assume that technology would have little effect on improving the industry. They would be wrong.

Labor costs are very high in the traditional dairy industry. Technology is working to help reduce the labor costs and human time needed to process dairy products and increase productivity of the cows themselves which at the same time provide a better yield in terms of product and financial considerations.

Dairymen are using sensors, located on or within the cow (wearables – think Cow FitBit™) to assist them in tracking the location of the cow, how often it has been milked, what the cow’s yield is, the quality of the milk produced by each specific cow, and what the general health is of the cow so that issues can be detected before they become serious and costly.



Technology also allows the cow to determine when it wants to be milked and then “guides” the cows to the proper locations via automated gates and into the milking facility. Once there, automated machines clean and prep the cow, then attach to start the milking process – no human labor required. Once milking is completed, the yields and history are recorded, and quality is assessed and reported. If quality is suspect, an action plan is developed for not only the specific cow, but for the herd in general and includes recommendations for different grain mixtures (which can then be automatically mixed from different bins), supplements or other options are also provided.

On the dairy farm, technology plays a role in herd management including the opening and closing of gates via sensors, temperature mitigation plans, herd location and corralling, fertilizer management, video surveillance and real-time market pricing based on product on hand. Herd pedigree information can also be tracked and recorded ensuring the most productive cows and bulls are used for reproductive purposes.

Sensors within the cows can be used to report when cows are most apt to conceive and when they are in fact pregnant.



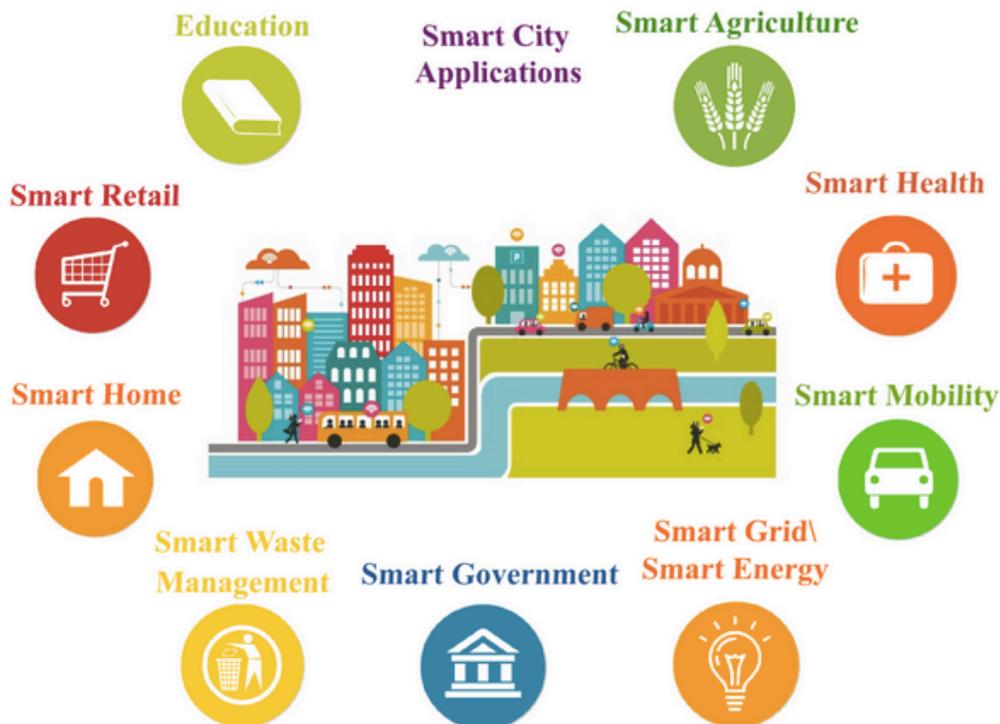
Automation is changing the face of the dairy business. Broadband is the technology that makes this new paradigm viable. Without broadband, modern small dairy farmers will be at a distinct disadvantage from those that could capitalize on the labor saving, better yielding, farm programs.

The current dairy farmers in Sonoma County mentioned many of these trends in technology,

however, most do not have the broadband capacity and speeds to be able to implement them at this time. One farmer discussed that he uses a product called Dairy Herd Improvement. This product requires the milk to be tested in a manual process and sent to DHI based in Utah for analysis. DHI then sends the results back so adjustments can be made as necessary regarding feed or health of the cow. They want to have the appropriate mix of fat, milk and vitamins that their buyers demand. DHI also can help determine best time to breed the cows. Most breeding is done via artificial means, so timing is especially crucial and efficient.

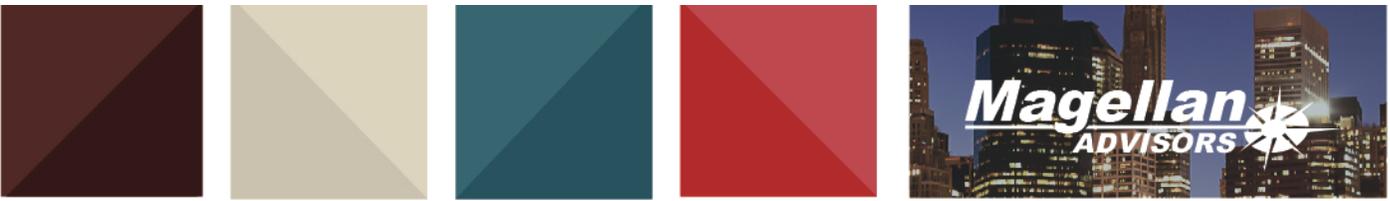
## 2.2 Smart Community Trends

As communities invest in fiber infrastructure, they are constructing foundational communications infrastructure required to support a multitude of technology-based initiatives that require connectivity. These initiatives can include broadband services, collaboration opportunities, public safety applications, and future energy and utility management functions and features as outlined below.



RVA recently conducted a study<sup>60</sup> through 176 interviews with cities across the nation to gain perspective on smart city deployments and decision making. Among their findings was that citizen quality of life (88%) was the major driver of smart city implementations followed by improving public information for citizens (71%) and

<sup>60</sup> RVA LLC. (March 2018) Status of US Small Cell Wireless/5G & Smart City Applications from the Community Perspective.



reducing municipal costs (58%). Additionally, respondents that had fiber assets serving the city, businesses, and/or residents were more likely to be deploying smart city applications. Among those smart city technologies was small cells, of which two-thirds of respondents noted that they are currently implementing small cells (44%) or considering small cell technologies (26%). The majority of the cities interviewed are collaborating with the providers and 41% have an official agreement in place. Based on respondents' discussions the general locations of small cell deployments are as follows:

- 37% telephone or electric poles
- 32% street lights
- 19% new poles
- 11% billboards, buildings or other structures

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### 2.2.1 Innovative Mobility/Connected and Autonomous Vehicles

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Autonomous vehicles or “driverless cars” technology is present on the streets in our cities and towns, but the full functionality is not yet activated. The science and technology are in place for connected and autonomous vehicles, and large companies (e.g., Intel, Uber, auto manufacturers) are “all in.” Connected vehicles exchange digital information between vehicle and the world, e.g., another vehicle (V2V) or infrastructure (V2I). Autonomous vehicles contain systems that influence the lateral or longitudinal operation – or both – of a vehicle. An SAE International Standard has been defined for automation levels. Using five levels, this “standard defines vehicle capabilities, how people can use them, and to what extent they can rely on the technologies.”<sup>61</sup> Many vehicles currently have partial autonomous capabilities such as autonomous cruise control, brake, and lane control.

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<sup>61</sup> Future Cities: Navigating the New Era of Mobility; Center for Automotive Research, 2017. [https://planetm.michiganbusiness.org/globalassets/pdf/future-cities\\_final-report\\_30-october-2017.pdf?rnd=1522511866020](https://planetm.michiganbusiness.org/globalassets/pdf/future-cities_final-report_30-october-2017.pdf?rnd=1522511866020)



Table 21: Autonomous Vehicles

Available	Level		
Today	0	No Driving Automation	
Today	1	Driver Assistance	Nissan ProPilot Assist
Today	2	Partial Driving Automation	Tesla Autopilot v. 9.0
Future	3	Conditional Driving Automation	2019 Audi A8
Future, 2020?	4	High Driving Automation	
Future	5	Full Driving Automation	

“Automated vehicle systems perform three functions: monitoring (cameras, radar, lidar), agency (information processing), and action (physical actuation systems).”<sup>62</sup> The following technologies are the core components to driverless cars:

1. Radar sensors – Two are located in the front and two in the back. These sensors assist the car in detecting obstacles in the road and communicate to the brain or main computer in the car.
2. Optics (High powered cameras) – These cameras are able to recognize various road markings and signals. They also operate similar to the human eye, able to overlap images and detect peripheral movement and depth of sight.
3. LIDAR (Laser Illuminating Detection and Radar) – As the name infers, LIDAR uses lasers to illuminate, detect, and provide raw information about the car’s surroundings to the main computer. The laser beam is circulated, bouncing off of objects and provides a map to the vehicle mapping system.
4. GPS (Global Positioning Software) – The GPS Software works similarly to Google maps, providing locations and directions to where the car needs to go.
5. Processors (computers) – Mini-computers are used within the vehicle controlling various instruments. All of the data generated by the cameras and sensors is processed in real-time, as well as modeled behavioral dynamics of other drivers, pedestrians, and objects around the vehicle. While some data is hard-coded into the car, such as stopping at red lights, other responses can be learned based on previous driving experiences through machine learning.

Autonomous vehicles clearly are on the horizon, and cities and municipalities need to be ready to support them, whether through policy and ordinances, technology to support their functionality, and electric charging stations to keep them running. The

<sup>62</sup> *Id.*



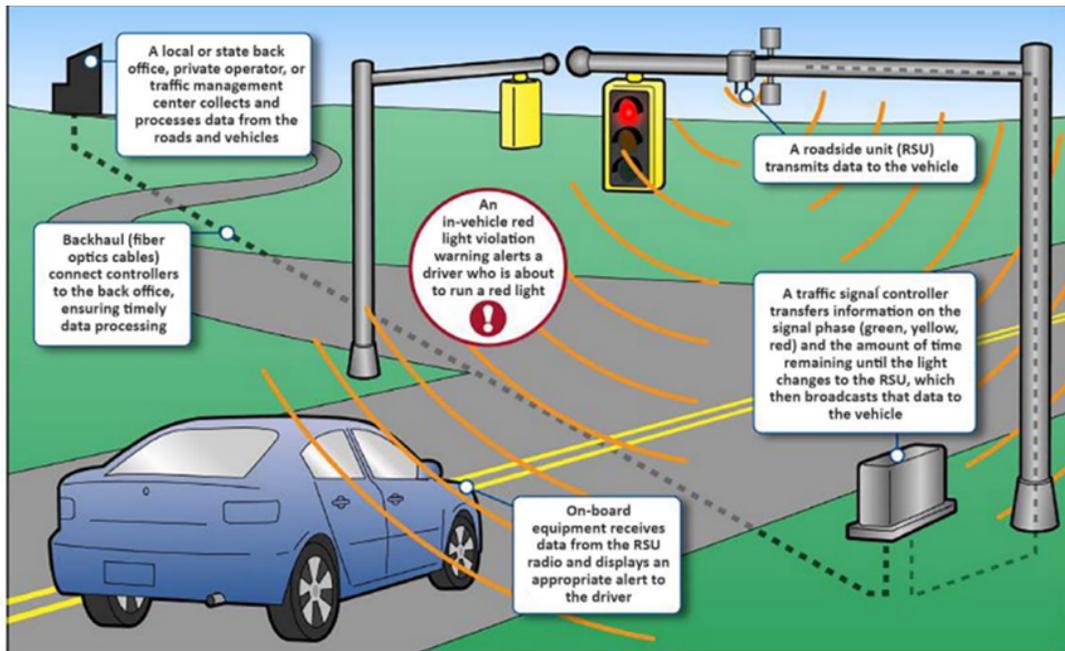
most likely connectivity options are 4G and 5G wireless networks and 5.9 GHz Dedicated Short-Range Communication (DSRC). DSRC is only in pilot environments, and 5G is still in development with ongoing standards activity. 4G of course has been deployed.

While the communications infrastructure is being deployed to support connected and autonomous vehicles, there are a number of other decisions and actions that need to be taken beyond communications infrastructure/broadband deployment, including:

- Include mobility in the planning process, by including connected and autonomous vehicle expertise in city departments, using public engagement on the topic and developing a vision for future mobility, analyzing the impact of innovative mobility, and using incentive zones to encourage/enable use of innovative mobility and shared automated vehicles
- Provide new or improved transportation services, including partnering with Innovative Mobility providers and hosting pilot tests
- Update Transportation policies, including development of policies for multimodal integration, and update parking to capitalize on benefits of innovative mobility and connected and autonomous vehicles
- Update and prepare the road infrastructure for innovative mobility, by allocating right-of-way for innovative mobility, building infrastructure to enable Innovative Mobility using Complete Streets design principles<sup>63</sup>, maintaining reflective lane markings and rumble strips, and supporting DSRC based V2I communication (roadside units, traffic signal controllers, traffic management centers, and user/vehicle-based equipment).

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<sup>63</sup> National Association of City Transportation Officials, <https://nacto.org/>.



Source: (U.S. Government Accountability Office, 2015)

The *Strategic Sonoma Action Plan*, highlights mobility projects including collaboration with the regional planning organizations to ensure Sonoma County is leveraging regional transportation networks and resources. These are all important subjects of separate studies which should be undertaken promptly by cities in Sonoma County.

## 2.2.2 Tesla Satellites

Tesla CEO, Elon Musk, is planning to cover the planet in high-speed, gigabit capable satellite service. While traditional satellites orbit the earth 22,000 miles up, SpaceX satellites will orbit closer, roughly 100 – 1,250 miles, in what is called a low Earth orbit. However, since these satellites will be so much closer to the Earth, the service area will have to be much smaller requiring many more satellites. Musk plans to orbit 4,000 satellites around the Earth to create this high-powered, truly ubiquitous internet network. In February of 2018, the FCC approved SpaceX’s request to launch the satellites, with the requirement that 50% be in place within 7 years. The entire network of satellites is not planned to be complete for another 10 years. This will be an expensive feat, so expensive that many fear that SpaceX will end up being unable to deploy enough satellites for the network to function as planned.



## 2.3 Education Broadband Trends

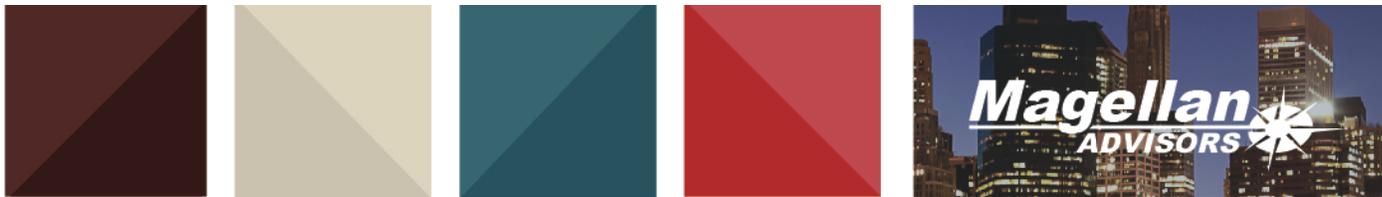
Online applications used by educational organizations require high-speed broadband, with services that meet strict quality and performance requirements to support real-time video and voice applications such as distance learning and teleconferencing. Today’s teaching resources incorporate multimedia—sound, graphics, video, and data, while the use of online textbooks is continuing to expand.

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

Table 22: Recommended bandwidth per user<sup>64</sup>

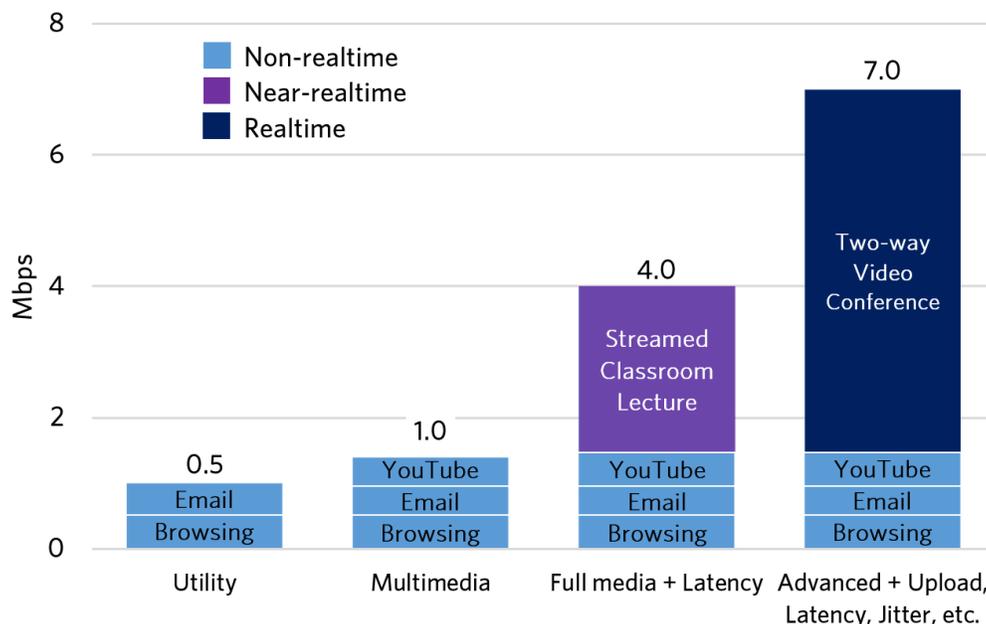
<b>Activity</b>	<b>Recommended Download speeds</b>
<i>Email and Web Browsing</i>	464 Kbps
<i>Download a 1 MB digital book in 5.3 seconds</i>	1.5 Mbps
<i>Online Learning</i>	250 Kbps
<i>HD-quality Video Streaming</i>	4 Mbps
<i>Skype Group-Video Session, 7+ people</i>	8 Mbps
<i>Download a 6,144 MB Movie in 8 minutes</i>	100 Mbps
<i>Current Generation Multiple Choice Assessments</i>	64 Kbps/student

<sup>64</sup> State Educational Technology Directors Association (SETDA), “[The Bandwidth Imperative](#),” page 21.



In response to increased demand, many states have instituted requirements for online testing, creating an even greater need for high-quality broadband services. Additionally, educational institutions are utilizing more online content to support their lesson plans, from streaming sources such as YouTube, TeacherTube, Vimeo, and Facebook. Figure 8 shows how these requirements multiply.

Figure 25: Bandwidth Demands for Educational Technologies per Student



Jessica Rosenworcel, FCC Commissioner, stated during a panel discussion on Aspen Ideas<sup>65</sup> that seven in ten teachers assign homework that require broadband access to complete, however, one in three students live in households without access to high-speed broadband Internet. Access to high-speed Internet is becoming an important component of education, inside the classroom and in the home. This integration of technology into learning is only going to increase over time, those students without access in the home may fall behind in their academic success further widening the social issue termed the “digital divide” or “homework gap.” There are many areas in rural Sonoma County that do not have the connectivity for students living there and students experience these social issues.

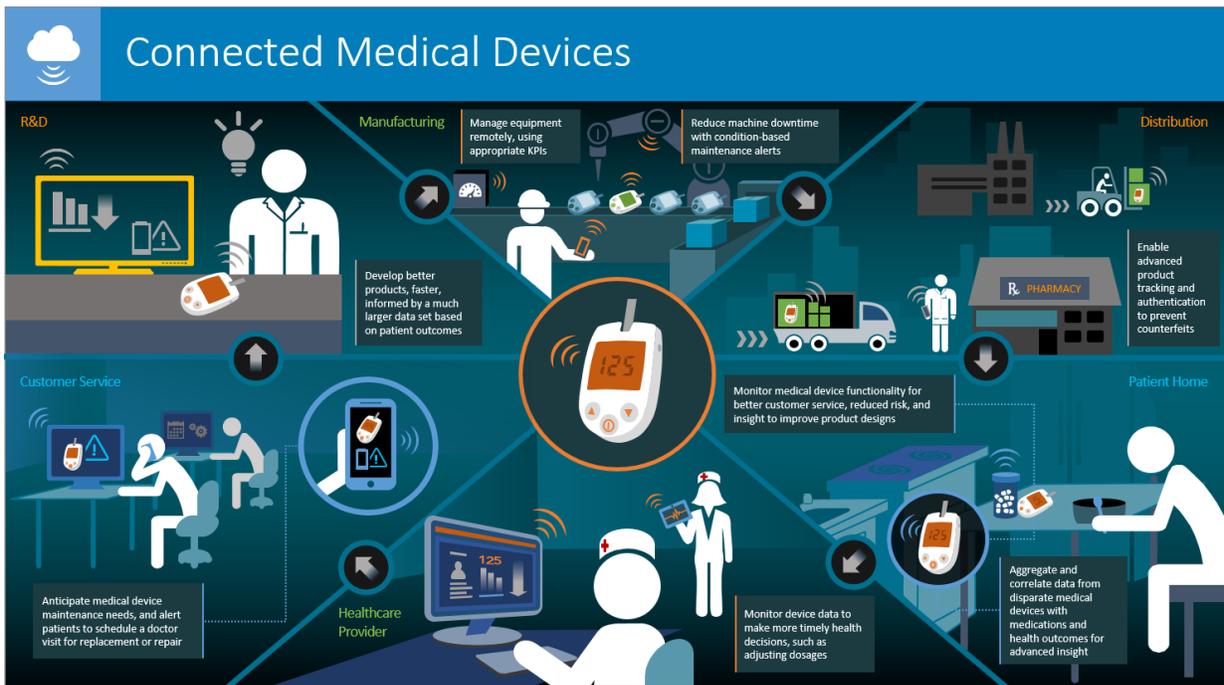
In addition to high-speed Internet needs of traditional brick and mortar schools, the residents of the Sonoma County area would see value in real-time online educational platforms. Executives or retirees may engage in courses through online universities as students or professors. Creation of and participation in streamed online lectures require reliable, high-speed Internet access and significant bandwidth.

<sup>65</sup> Aspen Ideas Festival. (2016) Panel discussion. <http://www.aspenideas.org/session/closing-digital-divide>

## 2.4 Healthcare Broadband Trends

Broadband is crucial for Sonoma County’s healthcare providers as they begin to leverage electronic medical records and other important capabilities of health IT, such as telehealth and electronic exchange of healthcare information. Sonoma County’s population trends older and will experience vast improvements in healthcare over the coming years – in large part to technology and connectivity platforms. Healthcare applications require high performance broadband capability. Healthcare facilities currently maintain access to high-speed broadband services but beyond these organizations, the healthcare providers that have access to this type of service is unknown. Doctor’s offices, clinics, and imaging centers all have growing broadband needs to ensure they stay connected as their organizations transition to the digital healthcare environment. For these smaller organizations, high-speed broadband becomes a critical need to fulfill their mission and provide for long-term success. As more advancements are made in health technology, high-speed symmetrical speeds will be required in the home to provide access to the many health devices that will be online. These advances will allow the healthcare community to provide real-time healthcare to those that require it and will allow our family and friends to age in place – in the comforts of their homes.

Figure 26. Connected Medical Devices are more and more common





## 2.5 National Broadband Policy

### 2.5.1 FCC Broadband Deployment Reports

The Federal Communications Commission (FCC) is tasked with the oversight responsibility relative to telecommunications standards and practices throughout the United States. The FCC is empowered to fulfill its obligations under the authority granted by the Telecommunications Act of 1996. Every year, as required by Section 706(b) of the Act, the FCC assesses the progress of the broadband industry and publishes its findings in its “Broadband Progress Report.” A key focus of the Report is to determine “whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion.”<sup>66</sup>

Table 23: FCC Bandwidth Benchmarks – Fixed Location

Year	Download Speeds	Net Increase	Upload Speeds	Net Increase
1996	<b>Telecommunications Act defined “advanced telecommunications capability” as fixed landline.</b>			
1999	200 Kbps <sup>67</sup>	-	200 Kbps	-
2010	4 Mbps	2,000%	1 Mbps	500%
2015	25 Mbps	600%	3 Mbps	300%
2020	TBD	TBD	TBD	TBD

Some of the most important outputs from the annual FCC study include recommendations for more precise measures of the industry’s progress. Such recommendations typically include new or revised performance benchmarks. Each benchmark is accompanied by a precise definition that explains the criteria by which the benchmarks will be measured and assessed. For example, the 2015 Report concluded that the existing benchmark standards for broadband transmission speeds were insufficient to keep pace with the current use and foreseeable demands by subscribers. “Subscribers” are individuals and businesses that contract for telecommunications services from federal and/or state-approved “service providers.”

<sup>66</sup>In the Matter of Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion; GN Docket No. 17-199; 2018 Broadband Deployment Report; FCC 18-10/ released February 2, 2018; (*Broadband Deployment Report*), at paragraph 7, citing 47 U.S.C. Section 1302 (b).

<sup>67</sup> Collected and compiled from FCC reports and orders.



As a result of the information collected during the course of the study, the FCC recommended that the benchmarks for bandwidth speed be increased, thereby redefining the national expectation of “advanced telecommunications capability.”<sup>68</sup> In addition, for the very first time the FCC sought comment on the adoption of a minimum speed benchmark for mobile broadband services and suggested industry benchmarks for mobile service offerings to be considered “broadband.” The intent for fixed broadband is to offer high-speed, high-capacity connections capable of supporting multiple, simultaneous users.

The recommendation to establish the wireless rate is important to note considering that a mobile broadband metric has not yet been formally adopted. In the absence of that standard and in consideration of the rapidly growing consumption of mobile data, the fixed broadband metric was suggested for both fixed and mobile communications.

On February 2, 2018 the FCC issued its 2018 Broadband Deployment Report<sup>69</sup> to review and update consumer broadband market assessments and related benchmarks and criteria. This assessment follows the previous 2016 Report<sup>70</sup>, which found:

- Approximately 34 million Americans still lack access to fixed broadband at the benchmark speeds of 25 Mbps download and 3 Mbps upload.
- A persistent urban-rural divide has left 39 percent of the rural population without access to fixed broadband at the minimum speed, while only 4 percent of the urban population lacks such access;
- However, this is an improvement over previous years (2012: 55%; 2013: 53%)
- Fixed and mobile broadband services offer distinct functions meeting both complementary and distinct needs;
- Fixed broadband offers high-speed, high-capacity connections capable of supporting bandwidth-intensive uses, such as streaming video by multiple users;
- Mobile devices provide broadband access on the go and especially useful for real-time two-way interactions, mapping applications, and social media. But consumers who rely solely on mobile broadband tend to perform a more limited range of tasks and are significantly more likely to incur additional usage fees or forgo use of the internet.

<sup>68</sup> Telecommunications Act of 1996, Pub. L. No. 104-104, § 706(a), 110 Stat. 56, 153; SEC. 706. Advanced Telecommunications Incentives; (c) (1) Definitions

<sup>69</sup> 2018 Broadband Deployment Report.

<sup>70</sup> *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 15-191, 2016 Broadband Progress Report, 31 FCC Rcd 699.



The 2018 Broadband Deployment Report finds that “advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion,” and thus reverses the negative finding in the previous FCC Report (2016).<sup>71</sup> This reversal results from a change of perspective in the evaluation: from evaluating how close the service providers are to connecting all Americans to 25/3 Mbps broadband, to comparing deployment in the present year (2016) to deployments in previous years. Other changes from the previous Report include removing price as a factor in the analysis, and including satellite service in the availability calculations (which pares 11 million from the estimate of unserved Americans).

Additional findings of the 2018 Broadband Deployment Report include:

- The current speed benchmark of 25 Mbps/3 Mbps remains an appropriate measure;
- 18% of the US population has access to speeds of 1 Gbps (although FCC Form 477 data indicates it is only 11%)<sup>72</sup>;
- No latency or other performance benchmarks are adopted at this time<sup>73</sup>;
- Similarly, pricing or data usage allowances are not examined<sup>74</sup>;
- Based on 2016 Form 477 data (which overstates penetration) 92.3% of the U.S. has fixed terrestrial internet service available which meets the 25/3 broadband standard<sup>75</sup>;
- Based on 2016 Form 477 data (which overstates penetration) 69.3% of the rural areas of the U.S. has fixed terrestrial internet service available which meets the 25/3 broadband standard<sup>76</sup>;
- Based on 2016 Form 477 data (which overstates penetration) 99.6% of the U.S. has mobile LTE internet service available with a minimum 5/1 speed<sup>77</sup>;
- Mobile services are not currently full substitutes for fixed broadband service; and,
- Analysis combines assessment of fixed and mobile wireless.

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<sup>71</sup> 2018 Broadband Deployment Report, at paragraph 94.

<sup>72</sup> Id., at paragraph 23.

<sup>73</sup> Id., at paragraph 35.

<sup>74</sup> Id., at paragraph 39.

<sup>75</sup> Id., at Table 1.

<sup>76</sup> Id.

<sup>77</sup> Id., at Table 2a.



Looking at the penetration data from the other perspective,

Today there are 24 million Americans without access to broadband. There are 19 million Americans in rural areas who lack the ability to access high-speed services at home. There are 12 million school-aged children who are falling into the Homework Gap because they do not have the broadband at home they need for nightly schoolwork.<sup>78</sup>

In a measure that critics could argue is made up to maximize apparent availability of “broadband” internet access, the FCC reports a new statistic showing population coverage of fixed terrestrial at 25/3 or mobile LTE at 5/1, as being 99.8% of the U.S. and 98.9% of the rural areas of the U.S.<sup>79</sup> At the overall level, this does not appear to square with reality in Sonoma County. The FCC reports that in 2016 83.1% of the US has fixed terrestrial service at 25/3 and mobile LTE at 5/1 available.<sup>80</sup>

Market observers, like Vox Media, know quite a bit about online usage. Through one of their web outlets in January 2015, they offered this observation following the release of the FCC Report.

*Changing the national broadband standards to 25 Mbps down and 3 Mbps up is a bold move for the FCC, which has faced opposition from cable providers which are staunchly against this measure, as it essentially removed DSL services from the broadband discussion.*

*While cable and fiber-optic services can easily meet the new standards, DSL — which is delivered over telephone lines — generally never reach the new download threshold.<sup>81</sup>*

Nonetheless, in reaction to growing consumer demand for bandwidth, network operators have continued to upgrade equipment and networks within capital budget limitations to make these lines faster and more reliable, however several fundamental issues exist that pose long-term challenges to meeting the growing bandwidth demand through copper infrastructure:

- Broadband signals degrade significantly as distances increase.
- Broadband signals are susceptible to electrical interference and signal degradation, particularly as they age.
- Service Providers generally share bandwidth among pools of users that result in an uneven distribution of speed to users, and speed degrades to all as these facilities become congested.

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<sup>78</sup> Id., Rosenworcel Dissent, at page 89.

<sup>79</sup> Id., at Table 3c.

<sup>80</sup> Id., at Table 6.

<sup>81</sup> <http://www.theverge.com/2015/1/29/7932653/fcc-changed-definition-broadband-25mbps>



- Service Providers understand that fiber-optic broadband delivers the only long-term solution to the ever-growing bandwidth needs of homes, businesses, and
- community anchors and that the actual speeds associated with fiber-optic connectivity are always dependent on the services provisioned by the provider who operates the system.

In sum, broadband is deployed throughout communities as wired and wireless infrastructure that carries digital signals between end users and the content they want to access. The content comes in many forms and from many locations across the world in the networks that connect the local community to the Internet backbone. Websites, television, streaming video, videoconferencing, cloud services, and even telephone service are just a few types of content that are delivered across local broadband networks.

Every minute of every day, subscribers are consuming real time video and streaming applications at work, at home – and in between. More than ever, planners, regulators and consumers alike need to understand the roles of Accessibility, Bandwidth, and Continuity.

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## 2.5.2 Wireline Regulation and Policy

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Broadband facilities and services essentially have been not regulated at the federal (Federal Communications Commission) or state (California PUC) levels. The FCC in its application of federal law had generally treated broadband Internet access services as unregulated services and subjected them to fewer regulations than cable TV or telecommunications services. The FCC briefly went back-and-forth on this issue with the imposition of its “Net Neutrality” order in February 2015, in which the FCC changed from classifying Internet access (and other services) as Title I “Information Services,” and reclassified those services to be regulated as “Title II” services.<sup>82</sup> The intent was to allow regulatory scrutiny focused mainly to ensure greater transparency, reasonable network management practices, authority to review interconnection practices, and to ban three practices: blocking access to legal content; throttling on the basis of content; or paid prioritization. However, this decision has been reversed by the current FCC, and re-imposition of “Net Neutrality” requirements is not likely in the foreseeable future.

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<sup>82</sup> Report and Order on Remand, Declaratory Ruling, and Order; *In the Matter of Protecting and Promoting the Open Internet*; GN Docket No. 14-28; FCC 15-24; Adopted February 26, 2015 and Released March 12, 2015. [The “Net Neutrality Order”]



The FCC has opened a proceeding to address barriers to investment in and deployment of wireline broadband infrastructure. The FCC has issued an Order<sup>83</sup> to address some issues in that docket, and sought comment on other issues (e.g., notice requirements for discontinuance or grandfathering of services) to “continue reducing barriers to broadband deployment.”

### 2.5.2.1 Support Funds

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#### 2.5.2.1.1 CONNECT AMERICA FUND PHASE II

The FCC is implementing a reverse auction process to award up to \$1.98 billion over 10 years to service providers that commit to offer voice and broadband services to fixed locations in unserved high-cost areas. These unserved areas are those which no provider committed to serve in prior rounds of CAF funding acceptance. Collectively, the price cap carriers accepted the majority of CAF funding offered, but up to nearly \$2 billion (up to \$200 million annually for 10 years) remains to be awarded for parts of 20 states via the CAF Phase II auction.

The Connect America Fund Phase II bidding and auction process is not fully specified at this time, but the Commission plans for the auction to take place in 2018. The FCC issued a *Public Notice* in August 2017, proposing procedures to implement the Phase II auction.<sup>84</sup> A short form application is required to participate in the bidding and a long form application must be provided by winning bidders. The short form application deadline was March 30, 2018, and bidding is set to begin on July 24, 2018. The maximum amount of support that any service provider will receive in the CAF Phase II auction, also known as the “reserve price,” is the amount of support that was previously rejected by the incumbent price cap carrier.

#### 2.5.2.1.2 MOBILITY FUND PHASE II

The FCC established a framework for the Mobility Fund Phase II auction, which will allocate up to \$4.53 billion over the next decade to advance the deployment of 4G LTE to unserved areas and to preserve service where it might not otherwise exist.<sup>85</sup> Auction timelines are not yet established. On February 27, 2018 the FCC released its map of areas presumptively eligible for Mobility Fund Phase II support, with the Sonoma County area show below:

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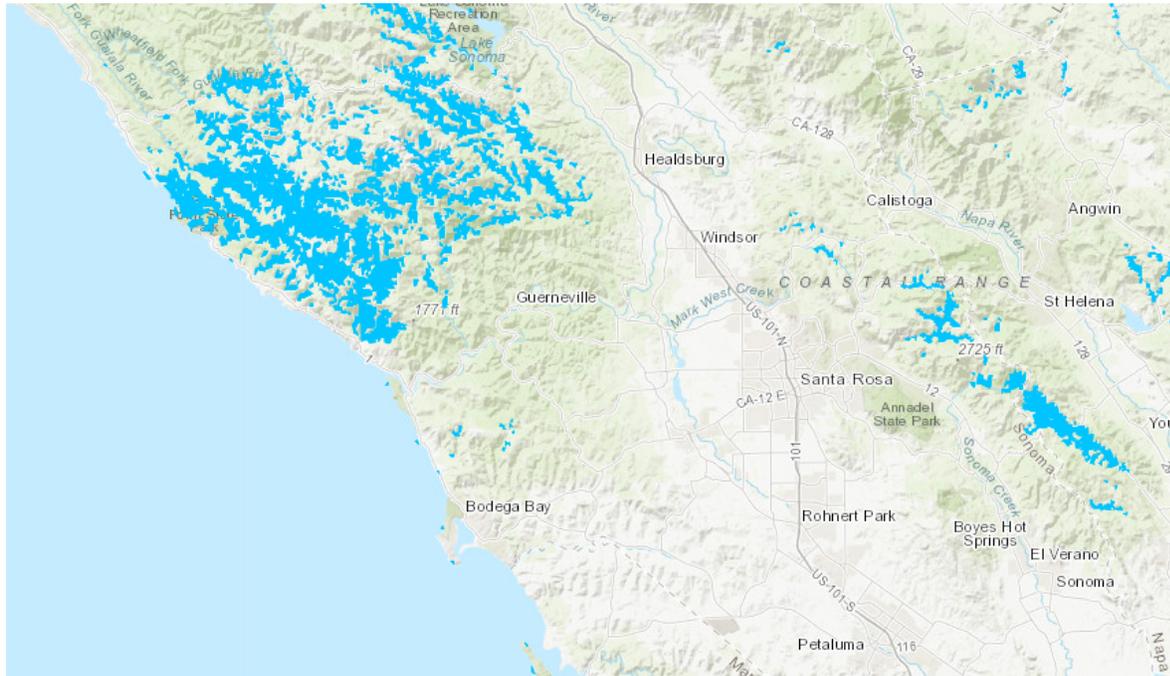
<sup>83</sup> *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Report and Order, Declaratory Ruling, and Further Notice of Proposed Rulemaking, FCC 17-154 (rel. Nov. 29, 2017)

<sup>84</sup> *Comment Sought on Competitive Bidding Procedures and Certain Program Requirements for the Connect America Fund Phase II Auction*, AU Docket No. 17-182, Public Notice, 32 FCC Rcd 6238 (2017).

<sup>85</sup> *Connect America Fund et al.*, WC Docket Nos. 10-90 et al., Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 2152 (2017).



Figure 27: Mobility Fund Phase II Map




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## 2.5.3 Wireless Regulation and Policy

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### 2.5.3.1 Introduction

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Wireless providers are looking forward to the deployment of “5G,” which is distinguished from the present “4G” based wireless service by use of low power transmitters with coverage radius of approximately 400 feet – 5G thus requires close spacing of antennas and more of them. This has obvious implications for city and county authorities with applications for location of antennas by service providers before city and county authorities. These providers – Verizon, AT&T, Sprint and T-Mobile – are making a concerted push for new rules and legislation before state, local and federal authorities with jurisdiction and responsibilities for siting of wireless facilities.



As stated by the FCC,

The wireless industry is currently deploying and planning for additional construction of a large number of small cells, and the number of these facilities is expected to grow rapidly over the next decade. S&P Global Market Intelligence estimates that between 100,000 and 150,000 small cells will be constructed by the end of 2018, and that small cell deployments are expected to reach 455,000 by 2020 and nearly 800,000 by 2026. AT&T has reported that the substantial majority of its infrastructure deployments over the next five years will be small cell sites. In addition, Verizon is deploying small cells in several urban areas, including New York, Chicago, Atlanta, and San Francisco. Sprint announced last year a goal of deploying 70,000 small cells within two years.<sup>86</sup>

The placement of wireless facilities is governed by an interrelated legal framework including shared jurisdiction of state and federal authorities. The Federal Communications Commission has preempted the authority of state and local jurisdictions in other cases and has taken preemptive steps again regarding siting of wireless facilities, in recent decisions in two proceedings. The FCC stated its view regarding jurisdiction as follows:

We recognize, as did Congress in enacting Sections 253 and 332 of the Communications Act, that localities play an important role in preserving local interests such as aesthetics and safety. At the same time, the Commission has a statutory mandate to facilitate the deployment of network facilities needed to deliver more robust wireless services to consumers throughout the United States. It is our responsibility to ensure that this deployment of network facilities does not become subject to delay caused by unnecessarily time-consuming and costly siting review processes that may be in conflict with the Communications Act.<sup>87</sup>

The emergence of 5G technology has caused significant ongoing rulemaking and legislative activity in both the federal and state jurisdictions. In California, SB 649 was passed in 2017 but ultimately vetoed by Governor Brown.

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<sup>86</sup> *Streamlining Deployment of Small Cell Infrastructure by Improving Wireless Facilities Siting Policies; Mobilitie, LLC Petition for Declaratory Ruling*, WT Docket No. 16-421, Public Notice, 31 FCC Rcd 13360, December 22, 2016, at page 3-4 (citations omitted). (“Improving Wireless Facilities Siting Policies Public Notice”).

<sup>87</sup> *Id.*, at page 2.



### 2.5.3.2 Federal Communications Commission (FCC)

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The FCC has implemented “Shot Clock” requirements that place a maximum time for local authorities to review applications to place wireless facilities. Current FCC shot clock requirements arise in two contexts. First the 60-day clock for “Wireless Facility Modifications”<sup>88</sup> arises from § 6409(a) of the Spectrum Act.<sup>89</sup> The Spectrum Act applies to applications which do not “substantially change” an existing tower or base station, and thus are eligible requests to modify existing towers or base stations which do not substantially change the physical dimensions. Eligible requests include collocation of new transmission equipment, removal of transmission equipment or replacement of transmission equipment. All terms are defined in the rule, including “substantial change.” The time-period for review is “within 60 days of the date on which an applicant submits a request seeking approval.” The 60-day clock may be tolled only by mutual agreement, or when the agency determines the application is incomplete. Clear and specific written notice is required within 30 days. Requests for approval gain “deemed granted” status if the request is not acted on within the 60-day timeframe, and the applicant notifies the local authority in writing.

The second context for “shot clock” requirements is under § 332(7) of the Communications Act<sup>90</sup>, regarding “Preservation of local zoning authority.” In its Declaratory Ruling<sup>91</sup> in 2009 the FCC set “presumptively reasonable period of time” deadlines of 90 days for collocation applications, and 150 days for all other applications, including new siting applications. An application is defined as a request for collocation “if it does not involve a ‘substantial increase in the size of the tower’ as defined in the Nationwide Programmatic Agreement for the Collocation of Wireless Antennas.”<sup>92</sup> Applications are not “deemed granted” if the local authority fails to act on a completed application within the shot clock time period for review, instead the provider must pursue any relief in court.

The statutory provisions of the Communications Act and the Spectrum Act overlap to a certain extent, but the FCC up to now has specifically preserved the distinct standards above under the two provisions.

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<sup>88</sup> 47 CFR § 1.40001.

<sup>89</sup> See Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, 126 Stat. 156, § 6409(a) (2012) (Spectrum Act), *codified at* 47 U.S.C. § 1455(a).

<sup>90</sup> 47 U.S.C. § 332(7).

<sup>91</sup> *Petition for Declaratory Ruling to Clarify Provisions of Section 332(c)(7) to Ensure Timely Siting Review*, Declaratory Ruling, Federal Communications Commission, 24 FCC Rcd 13994 (2009), at paragraph 45.

<sup>92</sup> *Id.*, at paragraph 46.



### 2.5.3.3 Wireless Infrastructure NPRM

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On April 21, 2017, the FCC opened an inquiry into “accelerating wireless broadband deployment by removing barriers to infrastructure investment.”<sup>93</sup> The FCC’s Notice of Proposed Rulemaking (NPRM) identified estimated benefits from deployment of “next-generation wireless broadband,” i.e., 5G, and sought to define an “updated regulatory framework that promotes and facilitates next generation network infrastructure facility deployment” to realize those potential benefits.<sup>94</sup> The NPRM stated “an urgent need to remove any necessary barriers” to deployment of “large numbers of wireless cell sites to meet the country’s wireless broadband needs and implement next generation technologies.”<sup>95</sup>

A large portion of the NPRM focused on the “process for reviewing and deciding on wireless facility deployment applications conducted by State and local regulatory agencies,” and examining new rules or clarifications intended “to expedite such review.”<sup>96</sup> The NPRM appeared to place the onus on State and local authorities, with only passing mention of the actions or inactions of wireless service providers – although comment is sought on that subject as well.

The FCC sought comments in the Wireless Infrastructure NPRM on the extent to which the above shot-clock framework should be modified, including whether the “deemed granted” remedy should now also apply for § 332 applications, changing the “rebuttable presumption” to “irrebuttable presumption” that the time frame for review is adequate. The NPRM also examined whether the shot clocks should be aligned and shortened, i.e., the collocation shot clock under § 332 reduced to 60 days from 90 days under the Spectrum Act, and whether there should be new categories for applications, with different shot clocks. Importantly for Sonoma County and its cities, the NPRM also sought comments “on the proper role of aesthetic considerations in the local approval process,”<sup>97</sup> opening the door that aesthetic considerations may be diminished as a factor by the FCC. Finally, the NPRM sought comment “on the extent to which localities may be seeking to restrict the deployment of utility or communications facilities above ground and attempt to relocate electric, wireline telephone, and other utility lines in that area to underground conduits.”<sup>98</sup>

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<sup>93</sup> Notice of Proposed Rulemaking and Notice of Inquiry; *In the Matter of Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*; WT Docket No. 17-79, FCC 17-38; released April 21, 2017. (“Wireless Infrastructure NPRM” or “NPRM”) The FCC has a parallel investigation into accelerating wireline broadband deployment.

<sup>94</sup> *Id.*, at paragraph 1.

<sup>95</sup> *Id.*

<sup>96</sup> *Id.*, at paragraph 4.

<sup>97</sup> *Id.*, at paragraph 92.

<sup>98</sup> *Id.*, at paragraph 98.



The FCC recently acted on the NPRM by issuing a Declaratory Ruling and Third Report and Order<sup>99</sup>. The Small Cell Order broadly interprets the “effective prohibition” provisions of the Telecommunications Act Sections 253(a) and 332(c)(7) to find that a state or local government need only “materially inhibit” placement of “small wireless facilities” to have an effect of prohibiting the provision of wireless service. The Small Cell Order defines “small wireless facilities” as facilities which meet certain conditions:

- 1) “The facilities
  - i. Are mounted on structures 50 feet or less in height including their antennas ..., or
  - ii. Are mounted on structures no more than 10 percent taller than other adjacent structures, or
  - iii. Do not extend existing structures on which they are located to a height of more than 50 feet or more than 10 percent, whichever is greater;
- 2) Each antenna associated with the deployment, excluding associated antenna equipment ... is no more than three cubic feet in volume;
- 3) All other wireless equipment associated with the structure, including the wireless equipment associated with the antenna and any pre-existing equipment on the structure, is no more than 28 cubic feet in volume;
- 4) The facilities do not require antenna structure registration ...;
- 5) The facilities are not located on Tribal lands, ...; and
- 6) The facilities do not result in human exposure to radiofrequency radiation in excess of the applicable safety standards .... ”<sup>100</sup>

These are the “small wireless facilities” to which the Small Cell Order applies. The Small Cell order permits fees only to the extent they are non-discriminatory (“no higher than the fees charged to similarly-situated competitors in similar situations”), and are a “reasonable approximation” the government entity’s “objectively reasonable costs” specifically related to the deployment.<sup>101</sup> The Small Cell Order sets out fee levels which are “presumptively reasonable” are \$270 per small wireless facility per year, \$500 application fee for up to five facilities, plus \$100 for each facility beyond five.<sup>102</sup> Higher fees can be charged if the state or local government entity can show the higher fees are a reasonable approximation of cost and the costs themselves are reasonable and

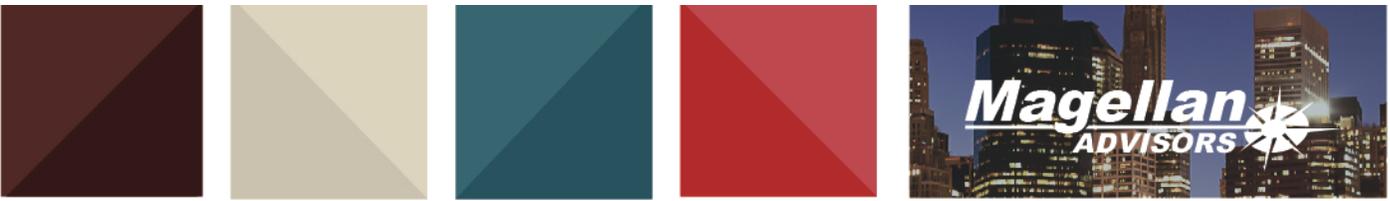
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<sup>99</sup> Declaratory Ruling and Third Report and Order; In the Matter of Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment; WT Docket No. 17-79; In the Matter of Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment; WC Docket No. 17-84; Released by the Federal Communications Commission, September 27, 2018. (“Small Cell Order”)

<sup>100</sup> Small Cell Order, at footnote 9.

<sup>101</sup> Small Cell Order, at paragraph 50.

<sup>102</sup> *Id.*, at paragraphs 78-79.



being assessed in a non-discriminatory manner.<sup>103</sup> The FCC appears in a footnote to preclude “in-kind” services or contributions stating such services or contributions “are not cost-based” and “they inherently have “the effect of prohibiting’ service”.<sup>104</sup> The Order permits fees paid to consultants and third-party contractors to be passed through as long as they are reasonable.<sup>105</sup>

Additional provisions of the Small Cell Order include:

- Aesthetic requirements must be reasonable, non-discriminatory and published in advance, or they are subject to possible preemption;<sup>106</sup>
- Undergrounding requirements are subject to similar criteria;<sup>107</sup>
- Shortened shot clocks pertaining to small wireless facilities:
  - 60 days for siting on preexisting structures (which is a new definition of collocation – a facility need not already have a wireless facility attached to it),
  - 90 days for siting requests the involve construction of a new qualifying structure;
  - Rejection of “deemed granted” remedy for failure to act within these time frames;
- Shot clocks are applied to all authorizations, e.g., zoning permits, building permits, electrical permit, road closure permits, and engineering permits;<sup>108</sup>
- Conflicting provisions of state small cell laws would evidently be preempted by the FCC;<sup>109</sup> and,
- Conflicting provisions of preexisting contracts could be preempted by the FCC, depending on facts and circumstances.<sup>110</sup>

The FCC’s Small Cell Order is not immediately effective – it becomes effective 90 days after publication in the Federal Register, which occurred on October 15, 2018. Furthermore, the FCC’s rulings are not self-effectuating – the service provider or other entity would have to prevail on the matter in court or before the Commission on a complaint. But the FCC’s actions in the Small Cell Order are subject to Petition for Reconsideration before the FCC (within 30 days of publication in the Federal Register), or direct appeals to federal court (within sixty days of publication). Numerous organizations have stated intention to appeal the Small Cell Order which appeals are often accompanied by a request for a “stay” of the Order while the appeal is being

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<sup>103</sup> *Id.*, at paragraph 80.  
<sup>104</sup> *Id.*, at footnote 252. The footnote cites no evidence beyond comments of service providers.  
<sup>105</sup> *Id.*, at paragraph 70.  
<sup>106</sup> *Id.*, at paragraphs 84-89.  
<sup>107</sup> *Id.*, at paragraph 90.  
<sup>108</sup> *Id.*, at paragraph 144.  
<sup>109</sup> *Id.*, at paragraph 6.  
<sup>110</sup> *Id.*, at paragraph 66.



considered. The likely appeals of the FCC’s decision would delay and defer effectiveness of the Order until final decision on the legal challenges. It is not possible to predict when this will happen.

2.5.3.4 The Mobilitie Petition

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The FCC has another proceeding open on wireless siting – the Public Notice on “Improving Wireless Facilities Siting Policies,” based on Mobilitie’s Petition for a Declaratory Ruling. The FCC has sought comments in this matter as well, noting that:

Many wireless providers are deploying small cells and distributed antenna systems (DAS) to meet localized needs for coverage and increased capacity in outdoor and indoor environments. Although the facilities used in these networks are smaller and less obtrusive than traditional cell towers and antennas, they must be deployed more densely – i.e., in many more locations – to function effectively.<sup>111</sup>

The FCC’ s Public Notice suggests it may use provisions of the Communications Act and the Spectrum Act to “remove barriers to deployment of wireless network facilities by hastening the review and approval of siting applications by local land-use authorities.”<sup>112</sup> The FCC has called for comments on the Mobilitie Petition to develop a “factual record” regarding whether and to what extent “the process of local land-use authorities’ review of siting applications is hindering, or is likely to hinder, the deployment of wireless infrastructure.”<sup>113</sup> The Public Notice requesting comments lists a number of complaints by wireless providers about fees, cost and time period for review of applications, and opines in other areas. It also notes instances where cities have modified processes, citing New York City, Boston, and Baltimore. The Public Notice seeks current information – systematic data, not anecdotal evidence – on a broad array of subjects including industry changes since FCC actions in 2009 and 2014 regarding the “shot clock”; local actions or inactions, if any, that have had the effect of hindering small cell deployment; the amount of time that elapses for small cell applications reasonableness of application fees; and other related matters.

This proceeding has been open from December 16, 2016 and numerous comments have been filed by a broad array of parties including the wireless tower companies, service providers, state regulators, cities and municipalities and other interested government organizations (e.g., NATOA). The FCC has not acted formally on the Petition which opened this proceeding but has used many of the comments filed in this matter in its Small Cell Order regarding “removing barriers to infrastructure investment” in the wireless and wireline telecommunications industry. The FCC’s Small Cell Order

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<sup>111</sup> Improving Wireless Facilities Siting Policies Public Notice, at page 1.

<sup>112</sup> Improving Wireless Facilities Siting Policies Public Notice, at page 2.

<sup>113</sup> *Id.*



covers most if not all topics raised by Mobilitie in its Petition so it is unlikely there will be any separate FCC action in this proceeding beyond what has been stated in the Small Cell Order.

### 2.5.3.5 State and Local Authorities

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Along with pushing for reexamination of FCC rules, the wireless providers – Verizon, AT&T, Sprint and T-Mobile – have embarked on a nationwide push for state legislation to limit what local authorities can do regarding placement of “small wireless facilities.” The state legislative push is strategic on the part of the wireless providers looking forward to the deployment of “5G,” given the vastly increased number of antennas that will be required. The state legislative framework advanced by the wireless providers generally truncates timelines, limits review, limits payments, and removes this subject from home rule authority. Such legislation has passed in some states (approximately 20)<sup>114</sup> and has been introduced but not passed in other states including California where SB 649 was vetoed by Governor Brown.

### 2.5.3.6 Dig Once Policy

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“Dig Once” can be defined as policies and/or practices that foster cooperation among entities that occupy public rights-of-way, to minimize the number and scale of excavations when installing telecommunications infrastructure in the rights-



of-way. Dig Once has a number of substantial benefits, including promoting and supporting the placement of broadband infrastructure (e.g., fiber-optic cable and conduit); reducing the consequences and disruptions of repeated excavations (traffic disruption, road deterioration, service outages, and wasted resources), and enhancing service reliability and aesthetics. Dig Once accomplished 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 a channel for it 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.<sup>115</sup> In addition,

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<sup>114</sup> <http://www.ncsl.org/research/telecommunications-and-information-technology/mobile-5g-and-small-cell-legislation.aspx>

<sup>115</sup> <https://eshoo.house.gov/issues/economy/eshoo-walden-introduce-dig-once-broadband-deployment-bill>



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. Sonoma County and several cities have therefore expressed interest in exploring and adopting Dig Once policies.

Dig Once policy discussions generally address the planning and coordination process for construction projects in the public rights-of-way. But the concept can also extend to required placement of conduit for fiber-optic conduits, as expressed in recent Congressional legislation. The Broadband Conduit Deployment Act of 2015 required the inclusion of broadband conduit during construction of any road receiving federal funding.<sup>116</sup>

Policy approaches also differ between detailing specific Dig Once processes in ordinances (e.g., San Francisco) or stating the policy direction to require coordination of projects in the roads and rights-of-way, leaving specific implementation and management to designated city officials (e.g., Director of Public Works). Magellan Advisors recommends that Sonoma County and the cities explore and implement this approach to coordination of projects in the rights-of-way to promote expansion of broadband infrastructure, reduce disruptive repeated excavations which cause traffic disruption, road deterioration, service disruptions and wasted resources.

## 2.6 Consumer Broadband Trends

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A recent Pew Research Center report, “Home Broadband 2015”<sup>117</sup> reaches similar conclusions to the FCC’s 2016 report and additional insights:

- Home broadband adoption seems to have plateaued, at 67% of Americans, down slightly from 70% in 2013. It is unclear whether this statistically significant difference represents a “blip” or not. The decline in rural adoption is larger, from 60% in 2013 to 55%.
- This downturn takes place at the same time there is an increase in “smart-phone only” adults. Smart phone adoption is at parity with home broadband adoption (68% v. 67%).
- 15% of American adults are “cord cutters” – those that have abandoned pay cable or satellite TV. Cord cutters cite the availability of televised content from the internet as one factor.
- Those who are smartphone-dependent face distinct challenges as being more likely to run up against data-cap limits, cancel or suspend service due to

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<sup>116</sup> *Id.*

<sup>117</sup> Pew Research Center, December 21, 2015, “Home Broadband 2015”; Available at: <http://www.pewinternet.org/2015/12/21/2015/Home-Broadband-2015/>



financial constraints, and be challenged in key tasks such as filling out job applications and writing cover letters.

- “The monthly cost of broadband service is now cited by a plurality of non-adopters as the most important reason for not having a home broadband subscription.”<sup>118</sup>
- “69% of Americans indicate that not having a home high-speed internet connection would be a major disadvantage to finding a job, getting health information, or accessing other key information – up from 56% who said this in 2010.”<sup>119</sup>
- “65% of non-adopters say that lacking home broadband service is a major disadvantage” when it comes to looking for job opportunities, accessing government information and services, following the news, learning new things, or getting health information. This is up from 48% who said so in 2010.<sup>120</sup>
- “Large numbers of non-broadband households have never had home high-speed service in the past, and few have interest in subscribing in the future.”
- “Among non-adopters, price sensitivity – where the monthly cost of service is the chief barrier to adoption – is the most prominent among those who have had service in the past, and/or are interested in getting it in the future.”<sup>121</sup>

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<sup>118</sup> *Id.* at page 4.

<sup>119</sup> *Id.* at page 4.

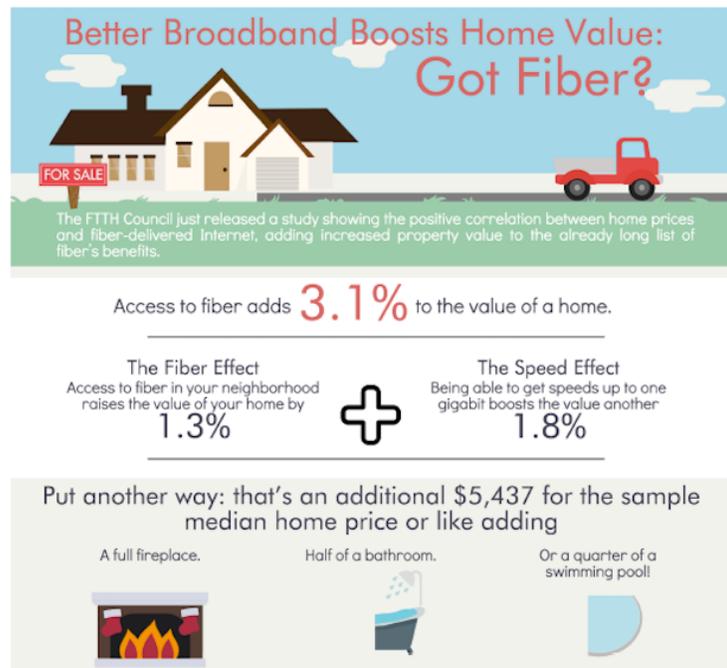
<sup>120</sup> *Id.* at page 5.

<sup>121</sup> *Id.* at page 5.

## 2.7 Broadband and Property Values

Recent research has shown the impact of high-speed broadband on property values. “In recent years, we’ve been hearing that high-speed broadband is good for home values – and conversely that a lack of broadband can depress home values and/or make homes harder to sell. But until now there has been little or no scientific research to back up those assertions.”<sup>122</sup> “A 2015 white paper by the Fiber to the Home Council Americas goes even further, citing data from the University of Colorado at Boulder. Apparently, not only does a fiber connection add an average of 3.1 percent to a property’s value, but valuations are increased by an additional 1.8 percent when comparing areas with connectivity speeds of 100 Mbps with those that support 1 Gbps or more.”<sup>123</sup> Importantly, Sonoma County has experienced increases in home sale pricing to \$590,000, a \$48,000 increase over prior year (2017). An additional 3.1% increase would further escalate home values to \$608,290.

Figure 28: Broadband Boosts Home Values



In the past, proximity to roads, buildings, and easy parking determined the value of property. In today’s business and real estate, proximity to viable and reliable Internet access, namely fiber, could increase property value in greater terms. “The evidence is mounting: investment in fiber improves the economic performance of a community as well as its quality of life,” said FTTH Council President and CEO Heather Burnett Gold. “Around the United States, leaders at the local level have started to think about how their community’s Internet infrastructure is a catalyst for economic, educational, and governmental innovation.”<sup>124</sup>

<sup>122</sup> <http://www.telecompetitor.com/broadband-and-home-values-ftth-council-study-looks-at-fiber-impact/>

<sup>123</sup> <https://www.atlantech.net/blog/why-fiber-has-more-impact-on-real-estate-value-than-physical-location>

<sup>124</sup> <http://www.ftthannual.org/blog/study-shows-home-values-up-3.1-with-access-to-fiber>



## 2.8 Business Broadband Trends

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While major industries in Sonoma County tends to center around retail and food services as well as social services such as education and healthcare, there have been increases in light manufacturing companies and small pockets of technology-based organizations. The Sonoma County Economic Development Board has been working diligently with organizations to recruit and retain industries to the area. Some key broadband trends and benchmarks around these industries can provide insight into the importance of broadband for the businesses.

### 2.8.1 Manufacturing

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**“We are at the beginning of a revolution that is fundamentally changing the way we live, work and relate to one another”** - Professor Klaus Schwab, Founder and Executive Chairman of the World Economic Forum and author of *The Fourth Industrial Revolution*.<sup>125</sup>

The first industrial revolution occurred in the late 1700s (factories), the second during the early 20th century (automobiles) and the third after World War II (computers). As a result of these revolutions, products are manufactured faster and with higher consistency, and the products we are able to develop are increasingly complex and have greater value to consumers. The manufacturing industry and technology in general is progressing at exponential rates. Some of the key trends that will be occurring in 2018 include:

1. Nascent technologies including collaborative robots, 3D printing, virtual reality and voice-activation assistants will be piloted next year with broad adoption by 2021.
2. Industry 4.0 and smart factories will win more converts in 2018 driven by the need to improve product quality and enable more efficient strategies for attaining compliance.
3. The Internet of Things (IoT) hype of having a sensor on literally everything on a shop floor will give away to unique use cases where millions of dollars of savings are attained, and higher accuracy levels achieved.<sup>126</sup>

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<sup>125</sup> World Economic Forum. (June 22, 2017) 5 trends for the future of manufacturing. <https://www.weforum.org/agenda/2017/06/what-s-going-on-with-manufacturing-b013f435-1746-4bce-ac75-05c642652d42/>

<sup>126</sup> Manufacturing Blog. (December 13, 2017) IQMS Manufacturing ERP. <https://erpblog.iqms.com/top-10-manufacturing-trends-2018/>



Nascent technologies, Industry 4.0, and the Internet of Things all will be supported by the fiber-based infrastructure providing connectivity to the sensors and devices. Without high-speed internet access, manufacturing facilities will be unable to progress, increase efficiencies, and compete globally.

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## 2.8.2 Information Industry

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**"We work with a lot of start-up companies, and some of them are high-tech and having those higher Internet speed capabilities is key."** - Director of Entrepreneurial Programming Katie Connelly

With Sonoma County organizations such as Keysight and Calix, along with other technological companies, high-speed broadband will be key in recruiting and retaining high-tech businesses in the area. In 2001, Tacoma, WA had over 100 high-tech companies set up shop in their off the grid city after their municipally owned power company installed a fiber-based subsidiary Click! Network. In addition to affordable high-speed Internet which was difficult to find in many large cities, Tacoma also touted comparatively low office and housing costs making Tacoma a prime choice for organizations such as Amazon and OnFree.<sup>127</sup> Recently, Lafayette, LA has been coined the Silicon Bayou. In 2014, after LUS Fiber began operation the city attracted three high-tech companies bringing 1,300 well paying positions to the area. One of those organizations was CGI, and Vice President Dave Henderson cited UL-Lafayette's top-ranked computer science program, Lafayette's growing workforce, and the city's fiber-optic network.<sup>128</sup>

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## 2.8.3 Arts and Entertainment

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**"A growing percentage of artists' incomes is shifting to online sales (visual art, music, etc.), individual artists who have limited access to solid internet connectivity are burdened by geography in doing the most basic elements of a sales transaction."**

- Kristen Madsen, Director Creative Sonoma

A significant number of individual artists, who are entrepreneurs and/or sole proprietors, live in West Sonoma County. In other parts of the country, artists are much more able to collaborate with partners all over the world via internet connectivity – sharing files, recording from multiple sites in real time, etc. This is not possible in locations that are not served with strong connectivity.

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<sup>127</sup> Starner, Ron. Wired Cities. Working Class Communities Build Next Frontier of High-Speed Connectivity. Site Selection. January 2001. Accessed May 11, 2016 from <http://siteselection.com/issues/2001/jan/p43/>.

<sup>128</sup> Gonzalez, Linda. Three New Companies Move to the Silicon Bayou. Community Broadband Networks. Sept. 22, 2014. Accessed May 11, 2016 from <http://muninetworks.org/content/three-new-companies-move-silicon-bayou>.



Additionally, the film industry has a significant presence in the county. Film companies need access to bandwidth to be able to operate effectively and efficiently. When transmitting the massive amounts of digital footage, an organization within the film industry would need significant amounts of bandwidth. Furthermore, there are many festivals, concerts, and events that occur in the county and when supporting these massive events, tremendous bandwidth is necessary. When coverage is lacking during events, not only do the participants become frustrated, but public safety also becomes an issue and concern.

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### 2.8.4 Tele-workers

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**“About one in five workers around the world telecommute frequently, and nearly 10% work from home every day. Plus, according to a new Census report, an additional 4.2 million professionals worked from home at least one day a week.”<sup>129</sup> - Reuters online**

More frequently people in the workforce are choosing to go into business for themselves or take employment that allows them the flexibility to work from home. With tools like groupware, virtual private conferencing, and video conferencing it is possible for companies to connect with their



employees over long distances. However, to use these applications to stay connected, high-speed Internet access is vital. It is common for a business person to include high-speed Internet and broadband in the equation when making the decision to purchase a home or vacation property. The availability of high-speed Internet and broadband could assist in the attraction of this type of individual to live in Sonoma County. This subject was made abundantly clear following the 2017 firestorm, when people moved from urban Santa Rosa to rural areas of the county, much of which was either underserved or unserved, they were prevented or limited from performing telecommuting tasks as they were able to complete in Santa Rosa.

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<sup>129</sup> <http://www.bandwidthplace.com/home-office-internet/>



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## 2.8.5 Job Growth and Retention

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**“Connecting rural Missouri to technology and adequate internet means there will be brighter, more vibrant communities for the next generation to call home. It means additional agricultural advancements, better education, more comprehensive healthcare services and an enhanced quality of life— all of which are necessary to incentivize retention and growth.”** - Chris Chinn, Missouri Director of Agriculture

Businesses and organizations, large and small, require Internet access to be viable and productive in today’s economy. If the organization providing the product or service can’t acquire Internet service of great capacity and at a fair cost, the organization may very well search for a different location to operate. When customers book hotel stays, dine at restaurants, or attend business meetings they demand Wi-Fi access. Internet service to businesses, and their customers alike, are of great importance to attracting and retaining organizations in a city or town.

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## 3 MUNICIPAL BROADBAND, BUSINESS MODELS AND CASE STUDIES

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Cities across the nation are realizing the importance of next-generation broadband services to support the future of their communities. Evidence suggests that broadband services have a net positive economic and social impact to communities by enhancing functions such as, economic competitiveness, workforce development, educational capabilities, municipal operations, and smart city deployment.

In order to determine which business model for municipal broadband is best, local governments should analyze the municipality and understand various factors, such as: community needs, competitive market factors that define infrastructure options, and organizational and operational capabilities of the local government. The ability to understand the community needs, know the competitive market factors that define infrastructure options, and determine organizational and operational capabilities of the local government all play into the selection process.

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### 3.1 Public Policy Only

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The municipality utilizes its public policy tools to influence how broadband services are likely to develop in its community. Public policies are shaped to streamline the processes of designing, constructing, and managing broadband infrastructure in a local government’s jurisdiction. Focus areas include right-of-way access, permitting processes and costs, construction practices and placement methods, and franchises



and utility fee assessments. Examples of policies and standards include: joint trenching and “dig once” policies, utility relocations, and funding mechanisms for design, labor, and materials. This option is not considered a true business model, but does impact the local broadband environment and is therefore included as one option.

### Santa Cruz County, California

In 2013, the Board of Supervisors approved an overhaul of its broadband infrastructure plans and regulations. Specific areas of focus include permitting fee reductions and a proposed “dig once” ordinance that would make it easier to install fiber-optic cables during other work on area roads or utilities lanes.

Zach Friend, Santa Cruz County Supervisor, said, “Many regions throughout the country face a situation similar to ours: deemed too rural for real capital investment by the Internet Service Providers but urban enough that this lack of investment really puts us at an economic and community disadvantage. To have these policies recognized at a national level shows their applicability and value throughout the country.”

The initiatives were crafted into a comprehensive set of policies:

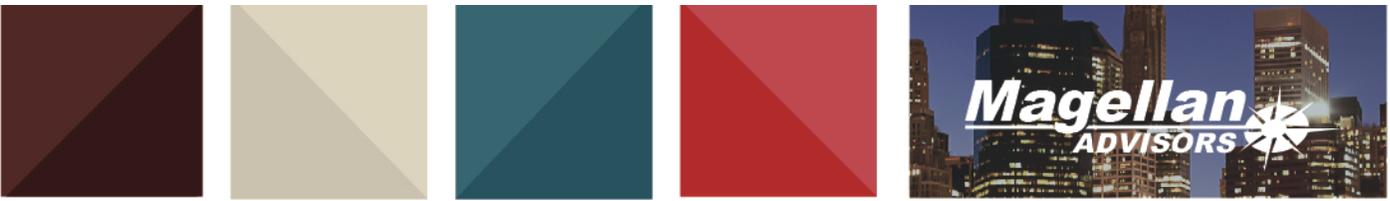
- A “dig once” process that requires notification and an opportunity for broadband companies to join in whenever a street is open.
- Development of master lease agreements to simplify access to county facilities.
- Including conduit as part of public works projects, new developments, and land divisions.

The key challenges to policy development and implementation relate to internal departments working together and communicating the shortcomings in current practices and policies. With a better understanding of interdependent responsibilities, policies can be improved. In addition, changes often come with an associated cost, so the municipality will need to establish a fund to financially assist the early adoption of certain policies.

## 3.2 Public Services Provider

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Public services providers utilize fiber and broadband resources to interconnect multiple public organizations with fiber or wireless connectivity. These organizations are generally limited to the community anchors within their jurisdiction, including local governments, school districts, higher educational organizations, public safety organizations, utilities, and healthcare providers. The majority of these anchors require substantial connectivity and often, the local government’s network can provide higher capacity at lower costs than these organizations are able to obtain in the commercial market.



## Seminole County, Florida

Seminole County owns and operates a 450-mile fiber-optic network that was installed over the past 20 years primarily to serve the needs of transportation. The county's Traffic Engineering Group initially developed the network by connecting traffic signals to fiber in the early 1990s to provide enhanced communications and better reliability. What was originally conceived to be a network used exclusively for transportation became a resource that connected public organizations across the county.

To date, the county's Traffic Engineering Department has connected 26 fire stations, 58 county buildings, 44 schools, 4 Seminole State College campuses, 41 city buildings, and 17 water treatment plants. In addition, the department maintains over 375 traffic signals, 148 school flashers at 73 locations, 46 beacons and flashers, and 29 variable message signs. The fiber network consists of different types of cables and strand counts: single mode, multi-mode, and hybrid. This results in approximately 1,246 active strand pair miles of fiber.

Seminole County's network has saved the public organizations millions of dollars and has enabled the county and its cities to:

- Share resources between the county, cities, schools and community colleges;
- Aggregate demand for public procurements to attain volume purchasing power;
- Provide inter-jurisdictional public safety communications between the county and cities;
- Reduce public organizations spend on communications services on a countywide basis; and,
- Future-proof the communications needs of all organizations connected to the network.

Significant challenges were identified in certain portions of the County's network, resulting from the commingling of fiber assets with the Florida Department of Transportation (FDOT). The restricted use of the FDOT's assets limited the County's opportunities to utilize this fiber in commercial transactions. However, the County was still able to utilize these assets for its own purposes as well as other public organizations connected to the network.

### 3.3 Open-Access Provider

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Local governments that adopt open-access generally own substantial fiber-optic networks in their communities. Open-access allows these local governments 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. The concept of open-access enables competition among service providers across a network that is owned by the local government. The municipality remains neutral and



non-discriminatory with providers who deliver services over the network. Service providers lease access to the network based on the amount of bandwidth required by the end customer and establishes a standard rate structure and terms of service. They generally charge wholesale rates to retail broadband providers to use their networks. They publish rates to competitive service providers, charging a monthly recurring fee based on bandwidth of the service utilized or a flat fixed fee per month. Services offered may include Internet, telephone, data connectivity (transport), and dark fiber.

### Palm Coast, Florida

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 including city, county, public safety, and education. 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. 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. The 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 from use of the network.

In a market where local fiber was scarce and unaffordable for all but the largest businesses, Palm Coast FiberNet now provides cost-effective fiber access for as little as \$50 per month for a 10Mbps connection. Service providers utilize the network to deliver Internet and business communications services for significantly lower costs than were previously available. FiberNet has reduced the costs of business Internet services across the city by 30%. The city has enabled new competition and introduced a competitively priced fiber product into the wholesale market within Palm Coast. Palm Coast struggles with decisions of whether to build out to customers in line with city's overall goals of supporting local economic development whether that be opting to not build the connections; proceeding with these connections; or declining to build where these connections are infeasible. Under most conditions, the city has been successful at building out these connections; however, this has been a recurring issue facing FiberNet and several other municipally owned networks.



### 3.4 Infrastructure Provider

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Cities that provide conduit and dark fiber services to local organizations are generally considered infrastructure providers. They lease these assets to community organizations, businesses, and broadband providers. These organizations use municipal fiber to connect to one another and to data centers to reach the Internet, cloud services, and other content networks. Many municipal providers who have deployed these services began by building their own fiber networks to serve purely municipal functions. As their networks grew, they realized that these networks could provide access to local organizations needing fiber connectivity.

Dark fiber is the core product of most infrastructure providers and is generally utilized by businesses, community anchor organizations, and in a few cases residents. Commonly, dark fiber strands are leased using a simple mileage-based price calculation to the end user. However, customers may require new construction to reach their facilities, resulting in construction costs to be incurred by the municipality and which will be charged back to customers to allow the municipality to recoup its investment.

#### Santa Monica, California

In 2002, Santa Monica renewed its franchise with the local cable provider, it also included a lease of fiber-optic network capacity to connect various schools and community college sites. The city paid construction costs of \$530,000 and shared the ongoing costs with the schools and community colleges saving a combined \$400,000 in annual telecommunications costs which grew to \$500,000 over several years. The savings were used as seed capital for the development of the city's own fiber-optic network.

Today, 126 businesses are connected to CityNet and approximately five are added monthly. The network covers approximately eight square miles and soon will be delivering up to 100Gbps of symmetrical broadband access. Prices for services are negotiated for each business customer individually.



Santa Monica’s CityNet fiber network was able to achieve the following goals for the community:

- Lower costs of Internet access for the city and schools
- Establish free Wi-Fi in 35 public hot zones as well as distribute 375 computers in kiosks and libraries in town for free access
- Nurture existing businesses, attract new businesses, support startups, VCs, and incubators
- Create an environment for other incumbents to invest in city infrastructure. The city has no plans to provide residential service

As demand for high-speed Internet services grew over the past five years, small and medium businesses desired an affordable Internet solution that was enabled by a single provider. The struggle Santa Monica faced was maintaining lean operations and a “hands off” approach while still serving a range of business customers. Retail was a new business model that Santa Monica had not encountered yet which required a “change in thinking” to have true impact in the SMB market. The decision was made to offer direct Internet services as part of its portfolio of services.

### 3.5 Municipal Retail Provider – Business Only

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A common goal for municipalities that deploy broadband networks is to support local economic development needs. Local governments equip their business and industrial districts with fiber infrastructure through which they can provide cost effective, high-speed Internet, and other services to local customers.

Municipal business providers offer competitively priced Internet and communication services that are generally very competitive in the small and medium business market against other provider offerings. They compete on both price and quality, generally focused on the following value proposition, all at a lower monthly cost:

- Higher bandwidth, scalable to Gigabit speeds
- Symmetrical service, the same upload and download
- Higher quality fiber connections with less downtime and a stronger service level agreement
- Responsive local customer service

#### Hudson, Ohio

Similar to other communities that have recently decided to invest in municipal networks, Hudson’s focus is only on Internet access and voice. The gigabit network will be deployed incrementally by Hudson Public Power focusing on downtown and areas of high demand. Through the reinvestment of service fees from customers, the city plans to grow the network as a self-sustaining venture.



Hudson’s municipal network is marketed under the name Velocity Broadband and is one of the first cities in the Midwest to offer gigabit connectivity and is signing on business customers while the network is being deployed. The city has no definite plans to serve residents but once business services are in place, they will consider a residential service offering.

### 3.6 Municipal Retail Provider – Residential

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Municipalities that provide end user services to residential and business customers are considered retail service providers. Most commonly, local governments offer triple-play services consisting of phone, television, and Internet services. As a retail provider, the organization is responsible for a significant number of operational functions, including management of retail services, network operations, billing, provisioning, network construction, and general management.

Perhaps the most important decision when evaluating a retail business case is whether the municipality should provide linear television services. Television is the “glue” that holds the triple-play service bundle together, and without television, many networks fail to achieve strong market share above 30%.

Costs vary between municipal retail providers. Therefore, it becomes difficult to set benchmarks consistently as each provider has a cost structure that differs from its peers. We do not advise that a city rely on the performance of other municipal providers to forecast its own expected performance.

#### Morristown, Tennessee

At the time of Morristown’s initial deployment in 2004, fiber-to-the-home was not a common practice. However, once they realized that fiber was a way to secure the network investment for the future, it was an easy decision. Nearly a decade later the upgrade to gigabit capability did not have to touch the fiber network – the electronics were simply changed on either end.

Morristown Utility System (MUS) FiberNet started signing up customers in 2006, and by 2008 had a take rate of 33%, with take rates in 2015 over 44% of homes passed, and a greater percentage of businesses. Out of the four service providers that Morristown has for broadband, 80% of residents have availability to choose from at least two of those providers<sup>130</sup> and 100% of Morristown households have access to broadband Internet.

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<sup>130</sup> <http://www.musfiber.net>



FiberNet's strong financial performance resulted in:

- Cash flow positive two years after launch
- Net income positive after five years
- Revenues of \$8.6 and \$8.9 million in 2013 and 2014, respectively
- Businesses and residents saving \$3.4 million annually
- \$840,000 in savings from a smart meter program
- \$20,000 in savings due MUS's dedicated network specialists.

MUS FiberNet's impact on economic development:

- Oddello Industries, a contract furniture manufacturer that relies on FiberNet for its communications, announced a \$4 million expansion resulting in 228 new jobs. Molecular Pathology Laboratory Network (MPLN), a global leader in personalized laboratory medicine located its primary backup facility in Morristown.

While many benefits that outweigh the challenges, MUS admits that broadband and telecommunications is tough for a small community, due primarily to the economies of scale. The challenge for Morristown leaders was to gain the political will to be successful, battle the telecom lobby and the Tennessee legislature, and make good business decisions with vendors. MUS leadership says it takes determination because it is not an easy business.

### 3.7 Public-Private Partnerships

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Public-private partnerships (P3s) are an emerging business model that provides an innovative solution to an ongoing municipal broadband issue: how does a local government invest in municipal broadband without operating a broadband network? Generally, P3s bring a local government and one or more private organizations into a partnership to plan, fund, build, and maintain a broadband network within the municipality's jurisdiction. In many cases, P3s are still in development as there are few cases of networks today permanently using this model.

To make a P3 successful, each organization should align on negotiable agreements, which can include:

- Who has rights to access the network and is the P3 exclusive or non-exclusive?
- What are the public and private partners' goals and how are they incentivized?
- What roles and responsibilities does the public and private partner have in the P3?
- What assets are financed through the public and private partner?
- What revenue model is used by the public and private partner to recoup their investment?
- What requirements must the private partner meet, in terms of service availability, speed, price, locations, and timeframes?
- How will the partners determine future buildouts and who pays for them?



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### 3.7.1 Ontario, Rancho Cucamonga, and Vallejo, CA

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The cities of Ontario, Rancho Cucamonga, and Vallejo, CA have all contracted with Inyo Networks in P3 agreements for Inyo to function as the network operator and retail provider of business and residential fiber services. The cities will receive a percentage of gross revenues generated from the network assets, and in turn will be responsible for all capital cost associated with fiber expansion, as well as operations and maintenance of all conduit and fiber assets.

Under this agreement, Inyo will own all end-user customers and will be responsible for providing an excellent customer experience, including customer services. Inyo provides a full suite of IP enabled services including cable TV, phone and high-speed Internet services. In Rancho Cucamonga, a 1 Gbps residential service starts at \$69 per month, and a 1 Gbps business service at \$250 per month.

In conclusion, determining the right business model is key to the success or failure of a municipal broadband project. Selecting appropriate business models should be based on a number of factors, including a local government’s stage of broadband development, local environment, funding capacity, organizational capabilities and desired benefits to the community. Exploring all available options will help municipalities understand which business model(s) fit best within their current environments using a context of risk and reward, in terms of financial and community benefits.

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## 3.8 Community Benchmarks and Lessons Learned

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### Riverside County, CA – RIVCOConnect

RIVCOConnect is a Riverside County, CA initiative, supported by the County Board of Supervisors and Executive Office and led by Riverside County Information Technology, that seeks to invite the private sector, either incumbent vendors or business entities new to the county, to work in a cooperative fashion and create partnerships to deliver broadband services countywide at speeds of 1 Gbps and above.

The main objective of RIVCOConnect is to encourage development and reduce restrictions on private entities to entice fiber network builds throughout the county. The strategies RIVCO is utilizing center around:

- Open Data Portals;
- Streamlining and reduction of costs regarding applications, permits, inspections, etc.;
- Seeking grants to minimize costs;
- Creating opportunities for providers to secure revenues after build-outs; and,
- Encouraging innovations that create demand.



### Monroe County, NY

Over the course of the previous two decades, Monroe County spent millions of dollars installing fiber and conduit as part of sewer maintenance projects and an emergency communications systems project. As a result, the County has over 350 miles of fiber throughout the area with approximately 18% of the fiber strands being utilized to date. The network was constructed to initially connect county facilities with no plans by the County to compete with private providers. Furthermore, Monroe County provides network access to the City of Rochester, and other municipalities throughout the County.

Monroe County is now exploring opportunities to connect its network into regional data centers, and NY State education and research networks.

### Columbia County, GA

The C<sup>3</sup>BU (Columbia County Broadband Utility) network currently offers 20 Gigabits bandwidth and is scalable to several hundred Gigabits. The Dense Wave Division Multiplex (DWDM) platform is Metro Ethernet Forum (MEF) 2.0 certified to provide true carrier-class performance to their customers. The C<sup>3</sup>BU Software Defined Network (SDN) also provides carrier-class packet optical transport services to other service providers.

C<sup>3</sup>BU directly serves Community Anchor Institutions (CAI) which consist of government, education, public safety, and non-profit facilities. C<sup>3</sup>BU currently partners with multiple providers for commercial and residential services. C<sup>3</sup>BU serves over 180 facilities through the network (excluding residential customers), and five service providers collocated in the point of presence facility.

C<sup>3</sup>BU seeks to use their technology investments to achieve the following goals:

- Stimulate demand for broadband, economic growth, and job creation by expanding the availability of affordable broadband Internet access for all people, businesses and community organizations.
- Promote the use of broadband to improve the quality and availability of health care, education and government services.
- Enable Intelligent Traffic System (ITS) to increase traffic management efficiency, thus reducing carbon emission impact.
- Support Supervisory Control and Data Acquisition (SCADA) migration from radio-based transport to Ethernet.
- Provide bandwidth to next generation applications such as Software As A Service (SAAS), public safety cameras, E-Health records, disaster recovery, automatic utility meter readings and distance learning.
- Provide public safety agency radio interoperability facilitated by new tower construction.



- Develop the C<sup>3</sup>BU into a hub access point for the region.<sup>131</sup>

### City of Newport and Newport Utilities, TN

Newport Utilities is located in rural Cocke County, TN and provides electric, water, and waste water services to the residents in Newport, TN. This rural area is underserved and unserved in many areas of NU's footprint.

In December of 2015, Newport Utilities (NU) conducted a feasibility study regarding creation of a broadband network – overwhelming the response was positive from residents and businesses. By September of 2016, NU embarked on developing a formal implementation plan. In December of 2016, the NU Board unanimously approved the Phase 1 Business Plan.

The fiber network will be completed in a phased approach, with Phase 1 connecting 7,000 residential customers and nearly 1,200 businesses. Phase 1 is expected to take 12 to 18 months, with Phase 2 beginning shortly after. Early in March 2018, NU connected its first pilot customer, who was very excited to have gigabit connectivity to the home in Cocke County.<sup>132</sup>

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<sup>131</sup> <http://www.columbiacountyga.gov/government/departments-a-c/broadband-utility/about-broadband>

<sup>132</sup> <http://www.newportutilities.com/fiber/index.shtml>