CITY OF FAIRFIELD, CA

Broadband Development Plan

August 2020

CITY OF FAIRFIELD CALIFORNIA

Magellan ADVISORS

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Contents

Executive Summary

The City of Fairfield is fiscally and geographically well-positioned for sustainable growth. But there is an essential piece missing from the City's plans, which prominently feature traditional infrastructures: network infrastructure.

Fiber-optic and radio networks are critical to the City's operations and—with the pandemic situation driving demand for connectivity on top of demand due to growth—they will only become more important. For similar reasons, networks are essential to economic development and directly impact various forms of land use. Substantial investment in network infrastructure will be necessary for Fairfield to grow as planned.

This report provides a vision for network infrastructure and services to drive investment, enable the City to fully capitalize on that investment, and meet Fairfield's operational needs. The vision addresses major elements of Fairfield's plans and policies and builds on its municipal assets and operations. The plan is comprehensive and integrated. Most importantly, it focuses on getting more investment in Fairfield's network infrastructure by more companies.

METHODOLOGY

Magellan Advisors did extensive data-gathering with City departments, particularly Information Technology and Public Works. Much of this data relates to municipal assets, which we analyzed in terms of Fairfield's connectivity requirements. Requirements were identified via numerous interviews with internal stakeholders. We thoroughly reviewed the City's Community and Economic Development plans, as well as policies related to network infrastructure. We also gathered information about network service providers' interests in and plans within the City.

In parallel, Magellan's policy team worked with the City's IT, Public Works, Community and Economic Development, and City Attorney to develop and implement policies that will streamline the deployment of wireless and wired infrastructure within the City. A Master License Agreement (MLA) was created to facilitate new 4G and 5G wireless facilities, along with Design Standards and Guidelines for these facilities, allowing the City to oversee new installations and ensuring that they meet aesthetic and other requirements.

The MLA will also allow the City to negotiate with carriers for new revenue streams, as well as in-kind considerations. A new Telecommunications Ordinance was also created to regulate both new and existing communications infrastructure in the City. In addition, a Dig Once ordinance was developed to protect the City's investment in the public right-of-way and encourage coordinated efforts to deploy additional broadband infrastructure by sharing construction costs.

SUMMARY OF FINDINGS

Effectively all of Fairfield's plans require network infrastructure, both ultra-high-capacity fiber-optic and fast, flexible wireless. These requirements are internal, for City operations, but also external, particularly for new commercial, industrial, and residential development. Network service providers such as cellular telephone carriers also have infrastructure requirements. Ultimately, Fairfield will need to ensure its businesses, institutions, and residents have great connectivity, if the City is to develop as planned.

Generally, the City of Fairfield needs to interconnect its facilities for all departments to access their business applications. Wireless connectivity for the public is required at civic facilities, including Fairfield's numerous parks. Transportation assets, including traffic signals, transit facilities, and even streetlights must be connected. Water assets, too, must be connected all the way to the meters for monitoring, meter reading and control. Stormwater and waste management have to be monitored and managed as well, which requires connectivity. Connectivity is literally a matter of life and death for Fairfield's emergency services and law enforcement.

The City's microwave based wide-area network (WAN) is outdated and is being replaced by high-cost AT&T connections with limited resilience. The City's traffic management and public safety camera network is separate from the WAN, as is the Water Division's SCADA[1] network. Both have been consistently growing. Additional functions, such as water demand management, will make it necessary to connect even more assets to the network, especially as growth continues.

Most network service providers, including broadband, cellular, and enterprise network companies, do not plan to expand in Fairfield in the near future. While this is somewhat disappointing, it gives the City some breathing room and an opportunity to be proactive about network development. A fundamental question for City leadership is whether it's acceptable to have limited options for network services or whether Fairfield wants more options, more rapid investment, and more competition amongst service providers.

A related issue is the City's general approach to network investment. Fairfield's leadership should decide whether it prefers a hands-off, passive approach, or seeks to actively facilitate or even invite investment; this Plan recommends the latter approach. The City has numerous options for getting investments in network infrastructure, including private capital and public funding. We expect these options to increase. Fairfield can also economically expand the City's network

[1] SCADA is a common term among utilities that stands for "supervisory control and data acquisition."

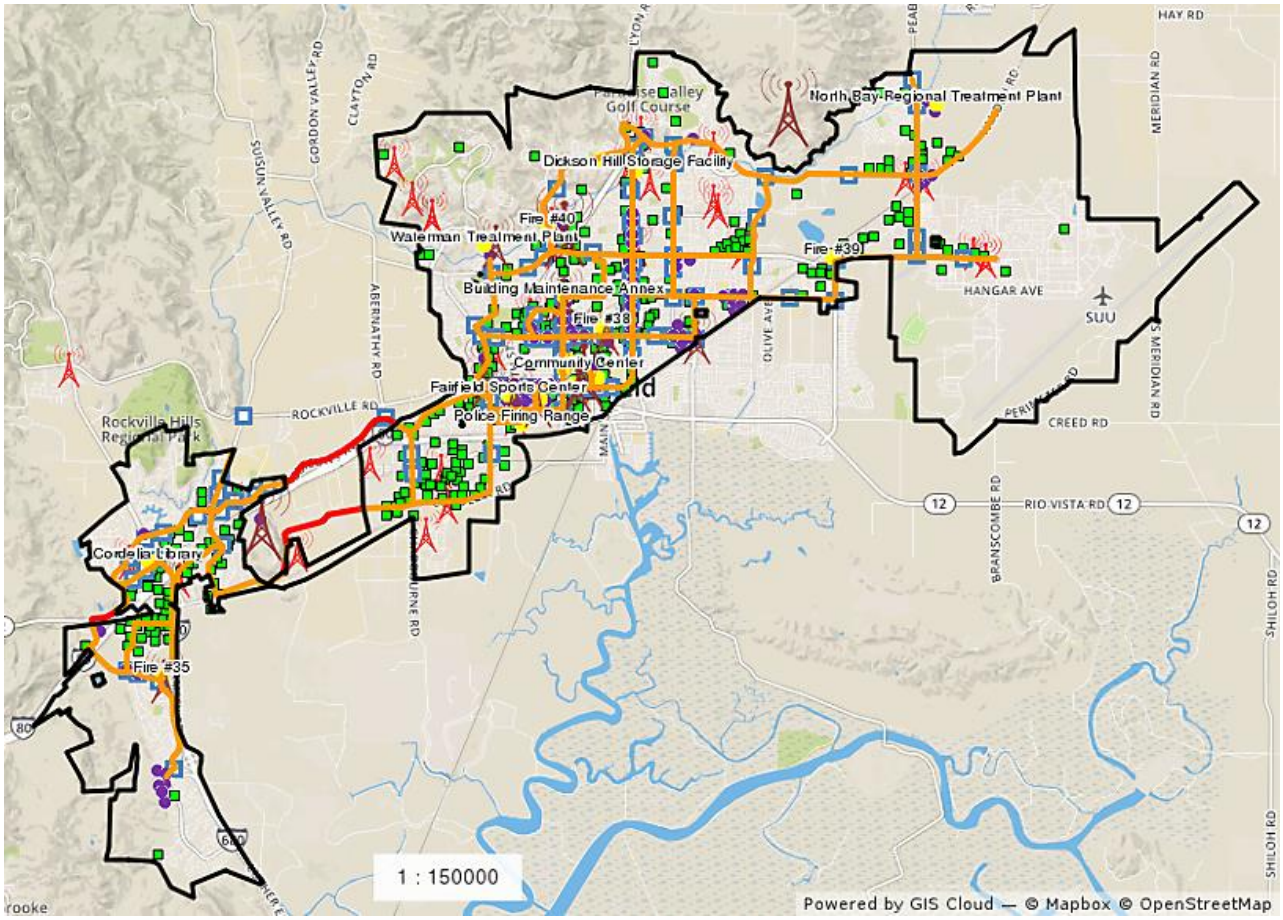
assets with an incremental, opportunistic approach, incorporating network assets with other infrastructure projects. Existing assets, particularly utility poles and the public right-of-way, can be leveraged for investment, services, and even new revenue for the City.

The City should also take steps to formalize the policies and processes developed throughout this project including the Dig Once practices to reduce the cost of deploying new broadband infrastructure, negotiating for in-kind considerations when entering into Master License Agreements, and generally guiding telecommunications providers' priorities for connecting key areas of the City.

RECOMMENDATIONS

Magellan Advisors recommends the City of Fairfield adopt a general program of network infrastructure development in alignment with encroachment activities by third parties in the public right-of-way and private sector partners. Get ahead of the development curve to capitalize on and direct telecom investment. Establish a comprehensive, integrated approach to network infrastructure development to get more robust, manageable, and economical connectivity for the City. For this purpose, Magellan Advisors provides a network vision in this plan to guide development efforts.

Illustrated below, the network infrastructure is envisioned based on proximity to key economic and municipal assets. It would involve nearly 60 miles of high-capacity fiber optic cable and total investment of almost $7M. Under the recommended approach most of this would be built, funded, and owned by private partners.



Magellan Advisors' Proposed Network Vision for the City of Fairfield

Approach providers as prospective investors based on the business case laid out in this plan. We found multiple providers with some level of interest in partnering with the City. Common and Zayo appear to be the best fit based on their market plans and presence. Discussions with Common and Zayo indicate that both parties are interested in partnering with the City to deliver gigabit service via wireless and fiber infrastructure throughout the City. CenturyLink and Sonic could be good partners if the City can aggregate demand and jointly procure network services with other local institutions. Small, regional providers may make good partners, as well. Incumbent cellular and wireline telephone and television companies could be partners but may be less interested in partnering due to their market position vis-à-vis competitors and other geographic areas.

Continue recent actions led by Public Works to include network assets in capital improvements, with a process for identifying those that align with the above connections. Engage local businesses, institutions, and neighboring jurisdictions in network planning to attract investment, build community capacity, and translate these improvements into sustainable economic growth. Magellan Advisors recommends the City of Fairfield take the following actions to develop its network infrastructure:

1. ***Complete, adopt, and implement improved policies for network asset development.***
    - Finalize documents with review from City Attorney and leadership
    - Submit for industry review and collect feedback
    - Take documents to Planning Commission and to Council for 1st/2nd reading
    - Determine licensing and application fees based on cost of permitting and maintaining assets
    - Determine approach to encroachment including cost sharing structure for joint builds
    - Negotiate Licensing Agreements with carriers
2. ***Designate a department and position to coordinate and lead network infrastructure development.***
    - Designate a department to lead execution of this Plan
    - Maintain an inventory of existing assets such as conduit and streetlight poles that could be offered for use by broadband providers
    - Retain GIS files (provided by Magellan) of the Network Vision to be referenced during permitting and development processes
3. ***Develop and release an RFP for assistance developing, evaluating, and finalizing partnerships with providers.***
    - Develop an RFP to solicit responses from interested parties
    - Attract investment by aggregating demand among large anchor institutions and other businesses
    - Engage in conversations with interested parties including Common Networks, Sifi, and Zayo about their needs and business models
4. ***Enter non-exclusive agreements with partners to expand broadband in the City.***
    - Evaluate partnership opportunities using considerations provided in this report
    - Enter non-exclusive agreements with partners to expand broadband in the City

5. ***Evaluate and pursue investment opportunities that align with City priorities and the network vision described in this report. Prioritize connections to:***
    - City Facilities
    - Safety Cameras and Traffic Signals
    - Commercial Corridors
    - New Developments
    - Water Facilities
6. ***Create workflows to review capital projects, permits, and development agreements to economically build network infrastructure.***
    - Establish technology and broadband infrastructure as an integral component of plans for City projects
    - Implement quarterly meetings with utilities and other entities working in the public right-of-way
    - Establish processes for IT and Public Works to review permits, development agreements, and capital projects for broadband expansion opportunities
    - Map all capital projects, commercial developments, moratoriums, and permits in the public right-of-way
7. ***Set aside funds for deploying additional conduit and fiber as opportunities arise.***
    - Consider reinvesting funds generated through 5G license agreements for the use of vertical assets
    - Maintain and use the fund according to cost sharing policy for joint build approach
    - Track federal and state grant opportunities for expansion of broadband infrastructure including EDA, FCC, and CASF funds.
8. ***Involve the County, other local institutions, and regional stakeholders in network development efforts.***
    - Create a regional broadband working group that includes representatives from public agencies, community anchors such as schools and hospitals, public safety, transportation partners, and representatives from the business community
    - Leverage the demand and assets of these parties to attract additional investment from interested broadband providers
    - Develop a regional vision that targets areas for investment and strategies for expanding infrastructure using the guiding principles of this Plan.

CHAPTER 1

Introduction

The purpose of this Plan is to ensure the City of Fairfield, California, has abundant connectivity for municipal operations, fully capitalizes on City assets for private companies to provide network services, and minimizes costs and disruptions for the community. The City needs to interconnect its various sites—City Hall, community centers, fire stations, etc.—and requires connectivity to monitor and control security, traffic, and water systems. It is now practical to make municipal assets such as water meters, vehicles, streetlights, and garbage cans "intelligent" through the addition of sensors and servomechanisms. These "Smart City" technologies can result in substantial cost savings, faster and more flexible response times, and improve quality of life; however, all of them require connectivity to high-bandwidth, low latency broadband. To meet these needs, this Plan will provide a strategy to ensure the City of Fairfield can economically deploy these technologies when and where they have clear value for employers, residents, and visitors.

OVERVIEW OF BROADBAND INFRASTRUCTURE

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

Fiber-optic cables (or just "fiber") are strands of glass the diameter of a human hair that carry waves of light. Unlike other connections that carry electrons across copper wire, fiber supports fast, reliable connections by using photons across glass, giving it the capacity to carry nearly unlimited amounts of data across long distances at spectacularly fast speeds. Because of this speed and reliability, fiber is considered the gold standard for supporting broadband across the full spectrum of devices and applications. Fiber's usability and resiliency have brought fiber to the forefront of broadband, making it a highly desired asset for all entities, public and private, that own or control it. The availability of a reliable, cost-effective fiber connection creates opportunities for the communities it serves.

Generally, broadband is one of many services offered by telecommunications companies on multiple tiers of performance and cost. These services are divided into business and consumer users and are then offered at a subscription fee. The

variety of services and technologies are increasing—exemplified by the explosion in smartphone apps —but the networks themselves are converging, so that any device operated by any user can potentially connect with vast amounts of information either inside or outside of the same network.

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

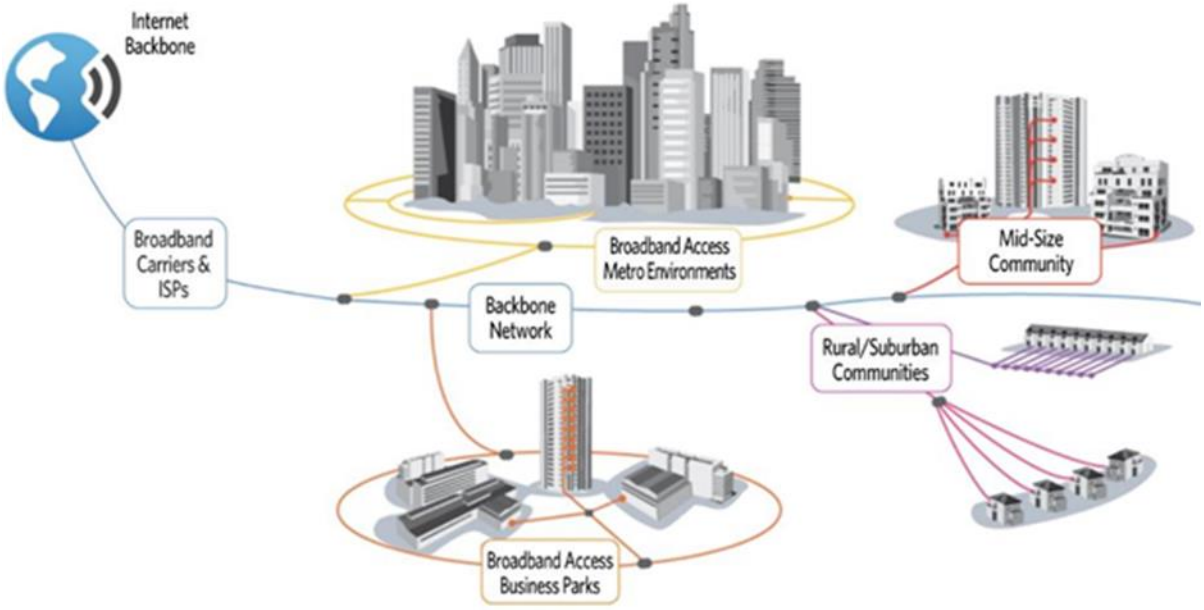


Figure 1-1. How Fiber Connects Communities

Infrastructure built on the older technologies described above is aging and results in slower, less reliable access to content. Capacity limits of this infrastructure limit service providers' ability to reliably provide high speeds, and in turn, the amount of data consumers can use is also limited. Fiber provides the robust infrastructure that connect telephone, cable and internet infrastructure between communities and around the world. It was originally used by telecommunications for their core infrastructure, to connect their major switching centers, and was only available to their biggest corporate and institutional customers. Today, fiber-optic networks

serve homes and businesses throughout the world providing telephone and television as well as internet access services.

With fiber-optic broadband networks, speeds in the billions of bits per second range are possible. The fiber-optic network today operates at nearly 300 Terabits per second, which is so fast that a single fiber could carry all the traffic on the internet. More commonly, fiber-optic networks provide between 100 Mbps and 10 Gbps to users. Fiber-optic networks can be designed to be highly reliable as well as fast. Fiber-optics are used extensively by major corporations and institutions and are beginning to be at the core of every telecom company's network.

Figure 1-2 illustrates the relative difference between common internet connection methods, comparing access technologies from basic dial-up service through DSL, cable, and fiber. Whereas traditional broadband 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.

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

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

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

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

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

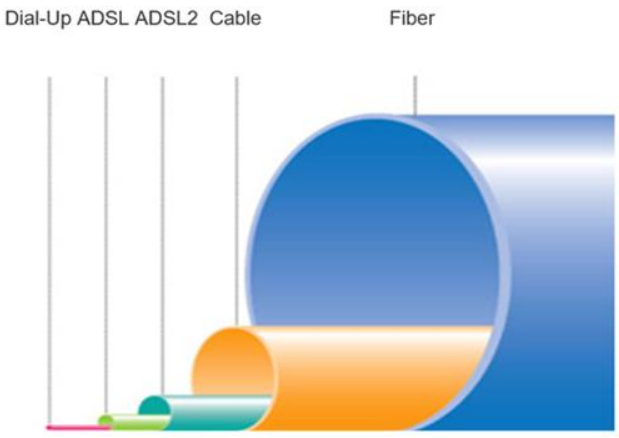


Figure 1-2. Physical Bandwidth Capacity Comparisons

5G and Fiber Dependency

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

5G networks operate multiple frequencies in three bands using millimeter wavelengths—the highest of which is anticipated to offer download/upload speeds

of 1 Gbps. The speed and range the consumer gets depends on a variety of factors, including what spectrum is being used by the service provider:

- Low-band frequencies work well across long distances and in rural areas; speeds are greater than 4G but slower than other 5G frequencies.
- Mid-band frequencies are currently sought after since they permit greater speeds while covering relatively large areas.
- High-band frequencies provide the fastest speeds but in more limited circumstances such as close to the antenna and in areas without physical obstructions (i.e., windows, buildings, walls). Thus high-band will work well in dense areas where antennas can be placed every few hundred feet. This spectrum delivers the high speeds that are commonly associated with 5G when the subject comes up.
- It is therefore likely that 5G networking will be a combination of low, mid, and high-band frequencies.
- Also, obtaining 5G service requires using a 5G-ready device, of which at present there are only a handful (though the number is growing).

5G networks are distinguished from the present 4G technology by use of low power transmitters with a coverage radius of approximately 400 feet; 5G thus requires the use of wireless technology for maximum usability, meaning close spacing and increased numbers of antennas. These 5G antennas must be connected to and backhauled via fiber due to the vast amounts of data being transmitted and the high speed required to provide low latency and reliability. Therefore, we consider 5G wireless and fiber optics to be complementary, rather than competing technologies.

A recent study and report by Deloitte noted that "Deep deployment of fiber optics into our nation's network infrastructure might not be as glamorous as the eagerly anticipated launch of fifth-generation mobile networks (5G); however, it is just as important—if not more so. In fact, 5G relies heavily on fiber and will likely fall far short of its potential unless the United States significantly increases its deep fiber investments."[2] The study estimates that the US will need to invest $130 - $150 billion in the next 5-7 years in fiber infrastructure in order to support the roll out of next generation wireless.

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

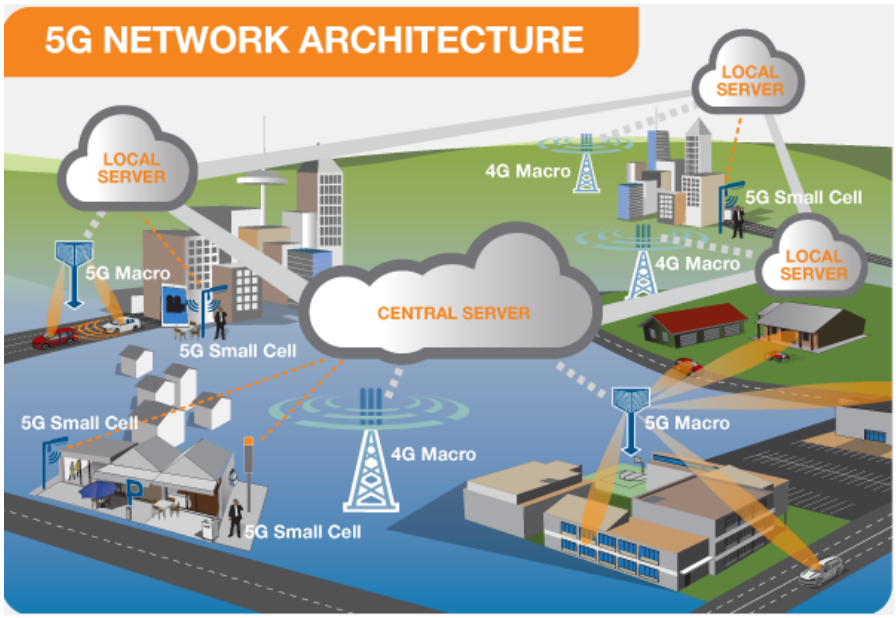


Figure 1-3. Diagram of 5G Infrastructure[3]

BROADBAND & ECONOMIC DEVELOPMENT

Across the board, industries increasingly rely upon transmitting and receiving large amounts of data and the internet to operate and thrive. Consequently, the availability and affordability of broadband has become a driver for decisions about where companies locate their headquarters, manufacturing facilities, distribution centers and satellite locations.

To attract and retain these industries, infrastructure that supports a competitive environment for affordable, reliable, redundant broadband services must be readily available in areas where office, technology, and industrial parks and other major commercial developments exist today or are being planned and built. In some cases, local governments have taken it upon themselves to ensure that this infrastructure exists so they can continue to drive economic investment in their regions. This includes working with residential developers for the delivery of fiber-to-the-home for support of home-based businesses, telemedicine, aging in place, public safety, and emergency response. Other benefits include managing the energy grid and increasing housing and property values for the high-tech jobs needed to support economic growth supported by the internet.

Although it would be misleading to imply that the availability (or lack thereof) of broadband is the only factor by which businesses decide their locations, many companies do consider a lack of affordable, reliable broadband a major barrier to entry. In locations such as Santa Monica, California, major employers have been

[3] http://www.emfexplained.info/?ID=25916

dissuaded from relocating because the local government was able to offer an alternative cost-efficient broadband service. Following in this effort, cities and counties across the country are implementing fiber and wireless networks for economic development and quality of life. These include Fort Collins, CO, Centennial, CO, Inglewood, CA, Culver City, CA, Santa Clarita, CA, Oxnard, CA, Ventura, CA, Paso Robles, CA, San Luis Obispo, CA, San Leandro, CA, Carlsbad, CA, Chattanooga, TN and hundreds more throughout the country.

ENHANCING PUBLIC SERVICES

The private sector is not the only major consumer of broadband. As technology becomes more integrated into daily life, government operations have also become increasingly reliant on transmitting and receiving large amounts of data via broadband internet connections. These networks are becoming increasingly important to cope with the rapid growth in connected devices, from utility assets, to streetlights, to traffic signals, to surveillance cameras, combining "Smart City" technologies to create Smart Regions of interconnected infrastructure that allow governments to be more efficient, reducing costs and increasing the value they deliver to their constituents. Figure 1-4 displays some elements of Smart City technologies.

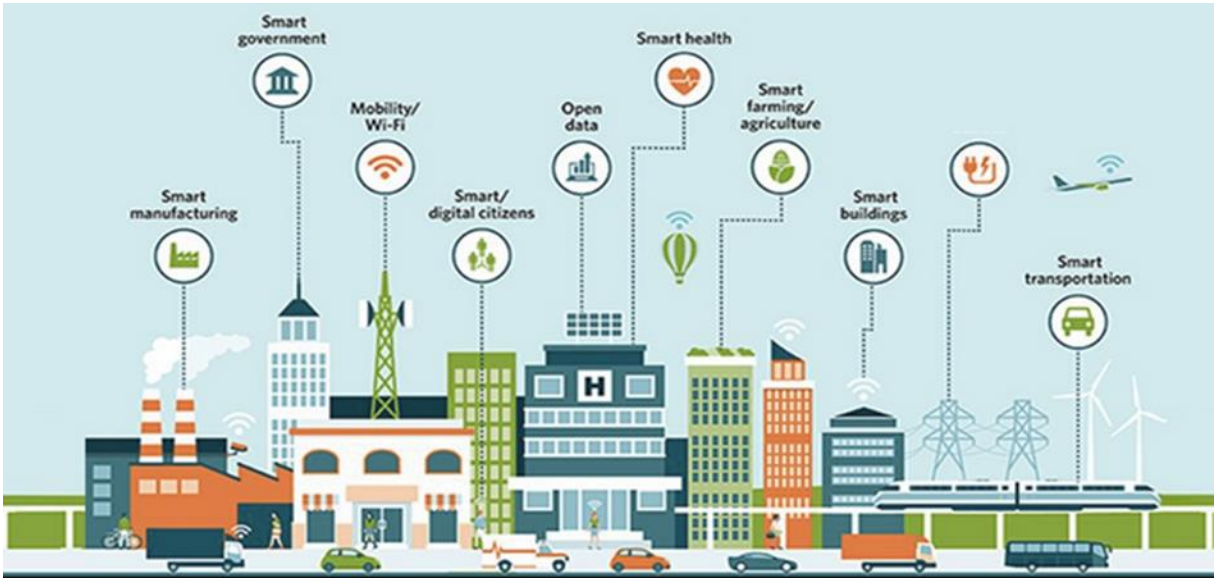


Figure 1-4. The Smart City

In addition to using internet connections for communications for field staff, the burgeoning Internet of Things (IoT) enables municipal applications that can promote citizen engagement and government innovation. These improvements can foster efficiency and innovation across a variety of community services including public safety, sustainability and energy efficiency, recreation, intelligent transportation, traffic and parking, and environmental monitoring.

Smart cities, towns, and municipalities capitalize on internet enabled smart IoT devices to make their organizations more efficient and effective while gathering data from devices to make better informed decisions regarding operations. The opportunities range from connected Supervisory Control and Data Acquisition (SCADA) networks, electric grids, traffic cameras and signalization systems, smart light pole grids for monitoring and control, people sensors, vehicle sensors, smart trash cans, smart park benches, smart parking and wayfinding, smart irrigation systems, IoT systems within buildings for energy management, and access control systems, can all enable more responsive crowd management along with dynamic planning for public safety responses.

REDUCING MUNICIPAL TELECOMMUNICATIONS SPENDING

Many cities invest in advanced communications (broadband) infrastructure not only to enhance local internet services, but also to support their own operational needs and other public agencies, utilities, and transportation districts in their area. Investment in fiber backbone infrastructure is generally utilized to provide a foundation for broadband. This allows cities to allocate some of the costs of broadband to their own purposes, which has a positive impact on the overall cost structure for deploying broadband since local governments can realize a return on investment by offsetting the monthly recurring fees they currently pay for connectivity.

The telecommunications budget required for many of the applications used in Smart City applications that are enabled by broadband purchased through a third-party internet service provider will continue to grow as the need for bandwidth and the number of sensors and internet enabled devices increases. For fiscal year 2020, the City of Fairfield will spend $383,000 in capital and $90,000 in recurring fees. Internet service alone required $60,000 in capital and $40,000 per year in recurring fees. Owning the infrastructure within a Smart Region allows support for high-bandwidth connectivity without the need for increasing telecommunications costs from commercial providers.

ADDRESSING COMMUNITY NEEDS

In addition to private and public organizations, broadband supports community needs including telemedicine, aging in place, distance learning, and telecommuting. The COVID-19 pandemic has accelerated the long-term trend of digitalization of business processes, the economy overall, and everyday life.

The coronavirus pandemic is accelerating shifts and trends toward internet technologies and business trials. Perhaps the obvious example is the boom in Zoom meetings but there are many other trends developing or accelerating as well.

> The proportion of companies ramping up globally on automation technologies will at least double

over the next two years, according to a Bain survey of nearly 800 executives.[4]

"The coronavirus pandemic is deepening a national digital divide, amplifying gains for businesses that cater to customers online, while businesses reliant on more traditional models fight for survival. The process is accelerating shifts already under way in parts of the US economy in ways that could last long after the health crisis has passed…"[5]

From a community perspective, interconnection of billions of devices allows evolution of smart cities, smart homes, smart schools, safer and autonomous vehicles, and a safer, healthier, smarter place to live. From a business perspective, interconnection of devices provides data like never before to inform operations and decision-making and automate/innovate in the production process.

[4] "Pandemic Speeds Up Corporate Investment in Automation"; The Wall Street Journal, April 9, 2020.
[5] "Crisis Speeds Up Economy's Shift"; The Wall Street Journal, April 2, 2020.

CHAPTER 2

Policy & Governance

Implementing policies related to broadband is a vital role that local governments play in expanding access and creating a competitive market. Much of the current legislation at the federal, state, and local levels relates to the coming of 5G, which will be accompanied by additional encroachment activities as more fiber is deployed to support additional wireless telecommunications facilities. To be proactive about these coming changes, the City of Fairfield worked with Magellan over the last several months to implement four key policy and process documents designed to align Fairfield with the current federal and state regulatory environment, and to conform to best practices that maximize local control and capitalize on opportunities to expand broadband in the City. Details about current legislation and each of these four documents – Telecommunications Ordinance, Small Cell Design Standards, Master License Agreement, and Dig Once ordinance – are provided in the following section, along with recommendations about a governance structure that will allow Fairfield to make the most of these new policies.

5G SMALL CELLS

As previously stated, 5G relies upon closely spaced, small antennas, commonly referred to as "small cells". Wireless carriers such as AT&T, Verizon, the newly merged T-Mobile/Sprint and their contracted outsourced infrastructure providers (e.g., Crown Castle, Mobilitie, etc.) are increasing demand for access to City-owned and utility-owned structures and public rights-of-way to accommodate "4G/4G+" and "5G" "small cell" deployments. Current "4G/4G+" deployments are aimed at densification and increasing capacity in high-use areas while 5G small cell facilities are also being deployed in larger numbers to greatly increase speed and data capacity on a "fill-in" basis. As stated by the FCC,

> The wireless industry is currently deploying and planning for additional construction of large numbers of small cells – 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 a 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.[6]

In the years following this FCC pronouncement all wireless providers did indeed begin deployment of 5G (during 2019), and the deployment continues in the US with three wireless carriers (given the recent merger of T-Mobile and Sprint) but perhaps at a reduced pace given financial and business impacts of the COVID-19 pandemic. Both AT&T and T-Mobile are on target to offer "nationwide" 5G using low-band spectrum by mid-year.[7]

Just as in other cities, in the City of Fairfield, requests to encroach on public rights-of-way and attach small cell antennas to City-owned streetlights, for example, will be accompanied by requests to place fiber optic cable for backhaul and network connection, whether via boring, trenching, or other placement technique. The City needs to have appropriate administrative practices and policies in place to address these requests for encroachment permits and placement of antennas on City-owned structures when they come. In addition, the City may consider policy steps such that the City benefits from future fiber deployments in the public rights-of-way.

FEDERAL POLICY

The placement of wireless facilities is governed by an interrelated legal framework characterized by shared jurisdiction between state (e.g., the California Public Utilities Commission) and federal authorities (the FCC).[8] But in the past two decades the FCC (and Congress) has preempted the authority of state and local

[6] 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 Record 13360, December 22, 2016, at page 3-4 (citations omitted). ("Improving Wireless Facilities Siting Policies Public Notice").

[7] AT&T "plans to reach nationwide coverage this summer" (2020). https://about.att.com/newsroom/2020/5g_announcements.html (viewed on May 27, 2020). "T-Mobile has launched nationwide 5G: Here is what that means." https://www.cnn.com/2019/12/03/tech/tmobile-5g/index.html (viewed on May 27, 2020). See also, "What is 5G? The definitive guide to the 5G network rollout"; https://www.tomsguide.com/us/5g-release-date,review-5063.html (viewed on May 27, 2020).

[8] The following discussion does not constitute a legal opinion and should not be construed as such. Questions about interpretation or applicability of these or other provisions of federal or California law should be referred to legal counsel.

jurisdictions, most recently in its "Small Cell Order".[9] The Small Cell Order (currently under appeal in the Ninth Circuit) limits local authority in many areas including fees (most notably the annual fee limit of $270 per pole), requirements and criteria that may be used, time frames, and provisions of state laws where the FCC claims the ability to preempt local authority. The 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.[10]

The 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.[11] 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 being assessed in an non-discriminatory manner.[12]

Beyond fees, the Small Cell Order also addressed state and local requirements in the areas of aesthetic requirements, undergrounding requirements, and minimum spacing requirements using the "materially inhibits" standard created by the FCC in its Small Cell Order. According to the Order, these requirements are not federally preempted if they are 1) reasonable, 2) no more burdensome than those applied to other types of infrastructure deployments, and 3) objective and published in advance. This leaves open the specter of federal preemption of local authority in these and other areas.

The Small Cell Order is under broadscale legal challenge in the Ninth Circuit Court of Appeals at present. Among the challenges is that the FCC had no basis for the $270 per pole limit which would make it arbitrary and capricious, and that the FCC wrongly infringed on local authority over placement of wireless facilities. But, pending those appeals, the Order is enforceable. Many cities have chosen in the meantime not to take new actions that are in significant contradiction of the FCC Order. Other cities have chosen to recognize that the FCC's Small Cell Order is under appeal and not in effect, and either set fees/terms and conditions as they would have otherwise, and/or incorporated provisions in ordinances and

[9] 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" or "Order".)

[10] Small Cell Order, at paragraph 50.

[11] *Id*., at paragraphs 78-79.

[12] *Id*., at paragraph 80.

agreements that have "change of law provisions" with the current appeal in mind. Such "change of law provisions" allow changes to fees (i.e., the FCC annual fee "limit" of $270 per pole), agreements and other regulations in the event the FCC Order is substantially upheld.

Prior to the Small Cell Order, the "Spectrum Act" enacted by Congress in 2012[13] added new requirements and directives to the FCC for processing and approval of wireless deployments. Following the Spectrum Act, the FCC issued new regulations to interpret and implement the Section 6409(a) requirements and directives of the Act related to local authorities processing of applications for wireless communications facilities. The Act tightens the application of "shot clock" timelines, and requires local jurisdictions to approve certain collocations and modifications to existing wireless communications facilities under shortened explicit deadlines, if it is an "eligible facilities request" – any request for modification of an existing tower or base station that does not substantially change the physical dimensions of such tower or base station, involving (1) collocation of new transmission equipment; (2) removal of transmission equipment; or (3) replacement of transmission equipment. The new FCC regulations established defined standards for what for "substantial change" and implemented the statutory changes to "shot clock" regulations.

The basis for federal preemption is that federal law allows cities and counties to regulate the "placement, construction, and modification" of wireless communications facilities but subject to certain limitations.[14] Those limitations include:

- City regulations may not "prohibit or have the effect of prohibiting the provision of personal wireless services"[15];
- City regulations may not "unreasonably discriminate among providers of functionally equivalent services"[16];
- Any denial of an application to place, construct, or modify a personal wireless facility must be based on "substantial evidence contained in a written record"[17]; and,
- City regulations may not "regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such

[13] *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).

[14] 47 U.S.C. § 332(c)(7)(A).

[15] 47 U.S.C. § 332(c)(7)(B)(i)(I).

[16] 47 U.S.C. § 332(c)(7)(B)(i)(II).

[17] 47 U.S.C. § 332(c)(7)(B)(iii).

facilities comply with the Commission's regulations concerning such emissions."[18]

Also, the FCC has regulatory jurisdiction over transmission of radio frequencies (RF), since the 1996 Telecommunications Act preempted local regulation of RF safety standards in favor of a uniform national RF safety standard under FCC jurisdiction.[19] "The FCC's limits for maximum permissible exposure (MPE) to RF emissions depend on the frequency or frequencies that a person is exposed to. Different frequencies may have different MPE levels."[20] Local authorities can require compliance with FCC RF standards be demonstrated in evaluating 5G siting applications. Applicants often make this demonstration part of the application package. Local authorities may not however deny wireless communications facilities siting applications based on RF emissions – Congress has preempted local authority on this subject.

STATE AND LOCAL POLICY

The urgency of state and local policy considerations for small wireless facilities stems from the fact that many carriers consider streetlights and utility poles to be "ideal" supporting structures for placement of small cell antennas and equipment, which drives the cities' need for standards and guidelines on placement of antennas and other facilities on or near these structures. Cities and counties often prefer installation of small cell wireless facilities on streetlights owned by the local authority based on the positive visual qualities of these facilities when built in conformance with design standards, efficient use of assets and the public rights-of-way, as well as in support of Smart City initiatives as described throughout this Plan.

Wireless providers are advocating for their preferred form of legislation in state legislatures as well as at the federal level (especially the FCC), designed to preempt and limit local authority over matters pertaining to small cell deployment. Specifically, in California, SB 649 was presented to the State Legislature and passed the State Senate and Assembly in September 2017. However, it was ultimately vetoed by Governor Brown. The bill would have significantly reduced local authority over small cell pole attachments in the public right-of-way, including aesthetics, safety and revenue. Legislation on this subject has evidently paused while the FCC's Small Cell Order is being considered on appeal.

[18] 47 U.S.C. § 332(c)(7)(B)(iv).

[19] 47 U.S.C. § 332(c)(7).

[20] A Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules, Procedures, and Practical Guidance; Local and State Government Advisory Committee, Federal Communications Commission, June 2, 2000, at page 3.

To achieve a City-specific balance between local authority and federal preemption, Magellan Advisors assisted the City in the development of several new policies designed to maximize local control over deployment, including an updated Telecommunications Ordinance, Small Cell Deployment Standards, a Master License Agreement, and a Dig Once ordinance.

Telecommunications Ordinance

As permitted by state and federal law, policies enumerated in the City's new Telecommunications Ordinance are intended to establish reasonable, uniform and comprehensive standards and procedures for small wireless facilities deployment, construction, installation, collocation, modification, operation, relocation and removal within the City's territorial boundaries while reflecting and promoting the community interest by (1) ensuring that the balance between public and private interests is maintained; (2) protecting the City's visual character from potential adverse impacts and/or visual blight created or exacerbated by small wireless facilities and related communications infrastructure; (3) protecting and preserving the City's environmental resources; (4) protecting and preserving the City's public rights-of-way and municipal infrastructure located within the City's public rights-of-way; and (5) promoting access to high-quality, advanced wireless services for the City' s residents, businesses and visitors.

The standards and procedures contained in this Ordinance are intended to, and should be applied to, protect and promote public health, safety and welfare, and balance the benefits from advanced wireless services with local values, which include without limitation the aesthetic character of the City.

The Telecommunications Ordinance addresses all the requirements and conditions for deployment of small cell wireless facilities on a detailed basis consistent with "best practices" emerging in California as cities adopt wireless ordinances and small cell deployment standards and guidelines. In particular, the Citywide Policy addresses:

1. The requirement for a Small Wireless Facilities Permit, and the Application requirements for same
2. Permit application submittal and completeness review process
3. Required findings for approval
4. Standard conditions including permit term and renewal, build out period, site maintenance and landscaping, cost reimbursement, undergrounding and electric meter upgrades
5. Location requirements and preferences as an ordered hierarchy; and,
6. Design standards addressing concealment, antenna volume, noise, landscape features, site security, signage, pole requirements, utility connections and services, and setbacks.

A draft of the City's Telecommunications Ordinance was a team effort undertaken by Fairfield's IT, Public Works, Planning, Community Development, and City Attorney's divisions in coordination with Magellan Advisors and is near completion. It will be submitted to City Council for adoption in the coming months.

Small Cell Deployment Standards and Guidelines

An emerging best practice for management of small cell deployments by cities and counties is the use of small cell design standards and guidelines. These Standards and Guidelines are administered by the relevant City department (e.g., Public Works) under authority included in the wireless ordinance. This best practice avoids embedding specific terms, guidelines and procedures in ordinances and allows the City to be more flexible over time in how it administers wireless facilities placement requirements and adapts to rapid change in technology.

Small cell deployment standards are intended to achieve a balance among protecting and promoting public health, safety and welfare, and the benefits that flow from robust, advanced wireless services with the City's local values, which include without limitation the aesthetic character of the City, its neighborhoods and community. Small Cell Deployment Standards and Guidelines encompass details regarding certain general requirements including equipment placement and location, specifications regarding poles and other support structures, wiring and cabling requirements, radio frequency requirements, notification requirements, standard conditions and maintenance requirements, and submittal requirements.

Magellan Advisors provided sample Small Cell Deployment Standards and Guidelines which have been recently adopted by other cities in California to illustrate the approach to managing small cell deployments through such practices. In coordination with Fairfield's IT, Public Works, and Planning divisions, the document was updated to fit the needs of Fairfield and to address most, if not all, of the subjects addressed in these Small Cell Deployment Standards and Guidelines. It is intended as an administrative document and will be overseen by the City's Public Works Director.

Master License Agreement

Use of Master License Agreements ("MLA") has emerged as a key practice for cities and counties to deal with the large number of pole attachments that are associated with 5G deployment. An MLA establishes the procedures, terms and conditions under which licensees may request individual pole licenses. The MLA is a comprehensive document that contains uniform terms and conditions applicable to all wireless facilities installed on City-owned poles. Individual pole licenses identify the licensed pole and contain detailed exhibits for the site plans, permits, fee schedules, insurance documentation, and other materials that are unique to each

site. When the City grants a pole license, that pole license (together with all the plans, equipment specifications and fee schedules) become integrated with the MLA.

Use of an MLA framework provides for a level playing field since the MLA format remains essentially the same regardless of licensees. Each wireless service provider executes a separate MLA with the City that entitles them to obtain pole licenses on a first come, first- served basis for a specific time period. Thus, one set of rules is used for all wireless service providers which in turn reduces the administrative burden on the City and promotes a level playing field among competitive licensees.

The wireless service providers benefit from use of an MLA to license existing City–owned infrastructure to install small cell facilities rather than bearing the time and cost of negotiating individual pole licenses. This more streamlined process accelerates the deployment of advanced wireless facilities. The City benefits from use of an MLA as well by establishing more robust wireless broadband networks available to the City's residents and businesses, maintaining greater control over aesthetics and potential liability from wireless facilities on City-owned poles, and earning license revenues which help defray the costs of managing and administering access to the public rights-of-way and recognize the value of attaching to City assets.

The City recognizes the importance of the MLA concept, and has been working with Magellan on finalizing a draft of the document, as well as setting annual licensing fees for placement of small cells on City-owned poles. While the current FCC rulemaking calls out $270 per pole per year as a safe-harbor rate, cities may charge more as long as the fees are both reasonable and justified, reflecting direct and indirect costs of maintaining these assets.

Many cities have also pursued strategies for asset swapping and in-kind agreements with providers during the process of negotiating for the use of public assets. In some cases, mobile providers (Verizon, AT&T, T-Mobile/Sprint, etc.) or third party fiber infrastructure owners (Crown Castle, etc.) are open to providing the City with broadband assets such as conduit or fiber in exchange for access to poles. Fairfield should consider leveraging its vertical assets for similar agreements that might provide better connectivity options, especially for City facilities.

Final rates and any in-kind considerations will be negotiated with each provider individually, at which time the MLA will be sent to Fairfield's City Council for approval.

Dig Once Ordinance

"Dig Once" can be defined as policies and/or practices that foster cooperation among entities (especially utilities) that occupy public rights-of-way, to minimize the number and scale of excavations when installing infrastructure (especially telecommunications[21]) in public rights-of-way. Dig Once has numerous substantial benefits, including promoting and supporting the placement of broadband infrastructure (e.g., fiber-optic cable and conduit), reducing the consequences and disruptions of repeated excavations (traffic disruption, road deterioration, service outages, and wasted resources), and enhancing service reliability and aesthetics.

Dig Once accomplishes the goal of minimizing costs of constructing separate trenches and facilities – via shared costs of construction. The cost savings are significant. The Federal Highway Administration estimates it is ten times more expensive to dig up and then repair an existing road to lay fiber, than to dig support structure for fiber (e.g., conduit) when the road is being fixed or built. According to a study by the Government Accountability Office, "dig once" policies can save from 25-33% in construction costs in urban areas and approximately 16% in rural areas.[22] In addition, development of Dig Once standards and guidelines for deployment of conduit and fiber will facilitate economic development and growth, as it enables cost-effective staged or gradual deployment of broadband infrastructure by local authorities.

Dig Once implementation requires revision to the planning and coordination process for construction projects in the public rights-of-way. When subsurface utility work occurs, it presents opportunities for the City to install new fiber in the right-of-way at reduced costs via coordination of work. Dig once and joint trench policies allow the City to take advantage of other subsurface utility projects for the installation of fiber. This enables the City to expand its ownership of fiber anytime subsurface utility work occurs, at preferential costs to new construction.

The concept can also extend to required placement of conduit for fiber-optic conduits whenever the ground is opened, as expressed in recent Congressional legislation. This concept was embodied in the Broadband Conduit Deployment Act of 2018, which required the inclusion of broadband conduit during construction of any road receiving federal funding.[23]

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

[22] https://eshoo.house.gov/issues/economy/eshoo-walden-introduce-dig-once-broadband-deployment-bill

[23] The Broadband Conduit Deployment Act of 2018, H.R. 4800, January 16, 2018.

Magellan Advisors provided the City with best practice Dig Once ordinance language recently considered and adopted in other California cities and counties. This draft document was reviewed and further updated by City IT, Public Works, Planning, and the City Attorney's office in coordination with Magellan to produce a final draft "Dig Once" ordinance document.

GOVERNANCE

Governance ensures that maximum public benefit is realized from any public investment in network infrastructure, whether by fostering competition, meeting public sector requirements, or minimizing negative impacts of development. Governance aligns investment with public goals and priorities. Policy guides development, laying out what can be built and how. Political will is the starting point for the governance and policies simply because without it there is nothing to govern and no possibility for policy. The City of Fairfield has demonstrated political will by undertaking this planning effort.

Political Will

It is important for the City to assess and build political will, which means providing a strong rationale for this Plan to influential people, including appointed and elected officials, executives with major employers and prospective investors, and those citizens who are well-connected to others. Rationale for broadband can be based on risk of loss—such as poor economic competitiveness—but the strongest rationale is built on this Plan. Broadband can be used to improve operations, increase impacts, reduce costs, and transform economies.

The process of building political will is as important as the individuals involved and the rationale for action. Indeed, all three work together: the process must be tailored to the individuals and rationale. For broadband, the rationale revolves around uses and impacts as well as availability, costs, and performance. Support from business executives and technologists reinforces this rationale. These stakeholders are most likely to respond to peers, particularly personal outreach from top public officials. Generally, the process involves:

1. Clearly articulate project goals and objectives in public documents
2. Identify, educate, and mobilize internal champions to garner support from stakeholders
3. Reach out to and inform councils, commissions, and community stakeholders
4. Organize a task force of diverse advocates

Governance and Ownership

Owners incur the cost of building or buying, maintaining, and operating an asset. They also control how it is used and—depending on business arrangements and

economic circumstances—get the bulk of benefits or profits from those uses. These truisms apply to fiber-optic cables in much the same way as to real estate. An optical fiber is simply a real asset that can be used for moving information between two or more locations. To-date, most fiber network assets have been privately owned for private interests.

If Fairfield is to use publicly-owned network assets, built with tax-payer funds, governance must ensure the network meets the interests of its owners—the public. The only way to accomplish this is by directly involving members of the public. We recommend beginning early by creating an advisory council or task force to provide input to this Plan and to engage and inform other members of the public. As the network is deployed, the advisory council should be transformed into a governance board.

Internal and External Policy Development

Appoint a range of local leaders, reflecting the community's diversity, to the advisory council. Ensure that task force meets regularly. The advisory council should establish policies and procedures for the governance board, including for situations in which those policies and procedures are not followed. This Plan identifies a variety of internal and external policies, including a Dig Once. The advisory council should have a role in reviewing these policies, and the governance board should ensure the policies are consistently applied.

Internal Cooperation, Communication, and Alignment

A key function of governance is to reduce internal "silos." Currently, the City departments operate separately. Rather, top level representatives from all departments should be aware of this Plan and coordinate efforts to break down silos and ensures that every dollar spent on technology benefits as many municipal functions as possible.

The City should include IT and Public Works in reviewing capital project and development/permit review processes for opportunities to expand broadband assets. Network infrastructure should be integrated into approval practices for right-of-way projects—public and private—and development agreements. Internal best practices and workflow for these purposes include:

- Document and share information about municipal, utility, and private sector assets.
- Review development agreements and capital projects for opportunities to expand broadband infrastructure.
- Invite private sector participation in Public Works projects.
- Hold quarterly Dig Once meetings with parties working in the PROW to encourage coordination.

- Trade and lease public and private assets for network expansion.
- Utilize GIS asset tracking for management and expansion.
- Streamline excavation and pole permitting processes.
- Streamline wireless permitting processes.
- Combine Public Works schedules for lowering construction costs.
- Build on demand and for savings.
- Bid multi-year infrastructure design and construction contracts.

Internal Budget Considerations

There are several budgetary implications of good governance. The first is combining telecommunications budgets for efficiencies. Rather than putting telecom spending in separate departmental budgets, have a single budget for all departments, including the Libraries and Schools as practical. This basically gives taxpayers more "bang for their bucks." We recommend cities create master funds for telecom and reinvest savings to enhance and expand the network. It is also important to budget resources and materials for Dig Once and joint trench opportunities.

Ownership and Public Private Partnerships

The master fund and network assets can be used as incentives for private sector participation. Specifically, the City can drive private investment to provide competitive access by leveraging its network assets or covering a portion of development cost with the master fund in return for additional assets. These, along with governance measures described above, are strategies to maintain public control over network futures. It is important to understand legal barriers to public ownership and public-private partnerships, including federal, state and local legislation.

CHAPTER 3

Asset Assessment

The purpose of the City of Fairfield Network Planning and Policy project is to (a) facilitate investment in the City by telecommunications companies, particularly broadband and cellular service providers, and (b) enable the city to economically meet its internal connectivity requirements via concessions, in-kind exchanges, swap, and other arrangements with providers. To achieve the second purpose, Magellan Advisors is undertaking an assessment of Fairfield's current assets, requirements, needs, and opportunities. The utility of a network is determined by the number of devices, sites, or users it connects. Therefore, this assessment considers the full range of civic assets in Fairfield as well as network assets, including emerging or outstanding needs for connectivity.

All of the information in this memo came from City documents or personnel and secondary sources of information about Fairfield. Magellan's staff was onsite in November 2019 to interview and discuss the broadband and connectivity needs of the City of Fairfield's internal departments. Our team met with ten (10) internal departments over two days to learn about the City's current connectivity, gaps and future projected needs. The City of Fairfield provided extensive geographic information (GIS) on its assets and other documentation. We have analyzed this data, researched the area, and reviewed published plans for the City. We also met with several telecommunication company representatives and have since had follow-up discussions this those and other companies' representatives.

The City of Fairfield has extensive and evolving connectivity requirements. Digital connectivity is essential to the City's plans, yet is largely missing from them. Numerous objectives in the "Heart of Fairfield" plan, for example, require network infrastructure and services, yet the topic is not addressed anywhere in the plan. Numerous regional, state, and federal entities have assets in the area, all of which are likely to have similar requirements. Aligning City investment with key local stakeholders can be a highly effective means to drive and guide private investment, including in communications infrastructure.

MUNICIPAL ASSETS

The City of Fairfield has over 700 employees in 29 facilities—including City Hall, community centers, five fire stations, Housing Authority, Solano County Library, four police sites, a transit center, and multiple utility facilities—at 23 street addresses. Fairfield has a Civic Center campus where City Hall and Police Department, departmental office building, a fire station, a County library, and recreation center are located adjacent to the Chamber of Commerce, schools, and other community anchors. The Public Works Department controls the public rights-

of-way (ROW) in the City of Fairfield, while Community Development is responsible for permitting infrastructure that is outside of the ROW (under zoning). Community Development handles economic development, and planning and zoning, in support of the City's Planning Commission, for commercial, industrial, and residential development and public facilities.

Fairfield's 26 parks cover nearly 1,600 acres distributed across the City. The Public Works department has the most assets around the City, including 18,250 poles with more than 9,000 streetlights, 426 traffic cameras (with requests for 26 more), 100 traffic signal control cabinets, and 70 water control valves. The water system consists of 2 treatment plants, 12 reservoirs, and about 400 miles of distribution lines. The City also has about 280 miles of sewer lines. Fairfield operates a sizeable fleet of vehicles for Fire, Police, Public Works, and other departments, including a fleet of buses that run eight local routes for Fairfield and Suisun Transit (FAST).

Financially stable with minimal debt, 75% of Fairfield's budget is general funds. About 40% of the general funds come from sales and transaction taxes. Property tax is about 15% of general funds but that source is decreasing as property tax allocation from redevelopment agencies is winding down. The City's Water utility has an enterprise fund. Other funding sources include hotel tax, vehicle fees, franchise fees for utilities, utility user fees, and business license tax based on business revenues.

The City's technology fund is housed in its internal service funds—CCTV, Computer, Public Internet, Radio, and Telephone—which are imputed to all departments. The City has a history of bond projects, including quite a few at the Water utility. The two golf courses, which are structured as their own enterprise funds, were bonded and now almost paid off. The City has established Community Facilities Districts (CFD)[24] and issued tax exempt bonds to finance infrastructure development.

Other Community Assets

Fairfield is the county seat of Solano County. County administrative offices, courthouse and court offices, emergency operations center, jail, and Sheriff's office are located in Downtown Fairfield. The Fairfield-Suisun Sewer District, which manages area stormwater and provides wastewater services to the area, is in Fairfield. Twenty-four of the Fairfield-Suisun Unified School District schools are in Fairfield, including both high schools, one of which is in Downtown across the street from Solano County offices. The School Superintendent's office is located in

[24] Established in California by the Mello-Roos Community Facilities Act of 1982, any City, County, Joint Powers Authority, School District or Special District can use CFDs to finance cultural facilities and emergency services as well as streets, sewer systems, and other basic infrastructure.

the Cordelia portion of Fairfield. Five Travis Unified School District schools and five private schools are also located in the City. Three Solano County Libraries are in Fairfield, one the Cordelia area, another at the County Hall of Justice, and one at the Fairfield Civic Center.

Solano Community College is located just outside Fairfield city limits and just off the freeway between Cordelia and the central area of the City. Two non/not-for-profit healthcare providers—NorthBay and Sutter—have multiple facilities in Fairfield. Numerous other area non-profits are in Fairfield, including Solano Family and Children Services, which is headquartered there. The State of California has Fish and Wildlife Department, Tax Administration, and two California Highway Patrol offices in Fairfield. Travis Air Force Base, which hosts large transport aircraft, reconnaissance, and medical operations, is located entirely within the City. Interstates 80 and 680 and U.S. Highway 12 converge in Fairfield. All three of the Solano Express bus routes run through the City to Bay Area Rapid Transit (BART) stations and to Sacramento. There are Capital Corridor train stations in Suisun and Fairfield, both of which are also served by Amtrak, immediately adjacent to northeast and south of Fairfield.[25]

Fairfield has a diverse, dynamic economy, anchored by Travis Air Force Base, with over 14,000 employees. Along with the institutional and public entities discussed above, which employ over 10,000 persons, Fairfield is home to Co-Part, GeoVera, and Westamerica Bancorporation headquarters, Amcor PET, Anheuser Busch, Ball, and Jelly Belly manufacturing, and numerous major retailers.[26] These companies alone account for about 4,500 jobs. As of 2012, according the U.S. Census Bureau, Fairfield had over 27,000 employees averaging about $40,000 per year in wages, working at over 1,600 establishments, generating about $5.7 billion in revenue.[27] The City estimated there were over 42,000 jobs in Fairfield by 2018, the median household income was $81,475, and there were about 230,000 persons in the regional workforce.[28] As of February 2020, the City had over 2 million square feet of industrial/office space and nearly 600,000 square feet of commercial/retail space in development.

NETWORK ASSETS

The City of Fairfield has a microwave wide-area network (WAN) first built in 2000 that consists of 42 antenna connecting 19 tower sites and most of the City's 29

[25] The Capitol Corridor "Suisun-Fairfield" station is physically located in the City of Suisun, a few blocks south of Downtown Fairfield, while the station located in Fairfield at the corner of Peabody and Vanden roads is the "Fairfield-Vacaville Hannigan" station.
[26] Source: https://www.fairfield.ca.gov/gov/depts/cd/ed/facts/employers.asp
[27] Source: U.S. Census Bureau, Economy-wide Key Statistics, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml
[28] Source: https://www.fairfield.ca.gov/about/demographics.asp

facilities, illustrated in Figure 3-1. The hub sites are City Hall, where the data center is located, and Martin Hill, which supports the most connections. Along with Martin Hill, Cement Hill and Nelson Hill, both of which are outside City boundaries, are tower locations for the microwave WAN and land mobile radio (LMR). Four sites connect to the WAN via wireless (Wi-Fi) bridges, and a fifth connects via a Comcast dedicated line.

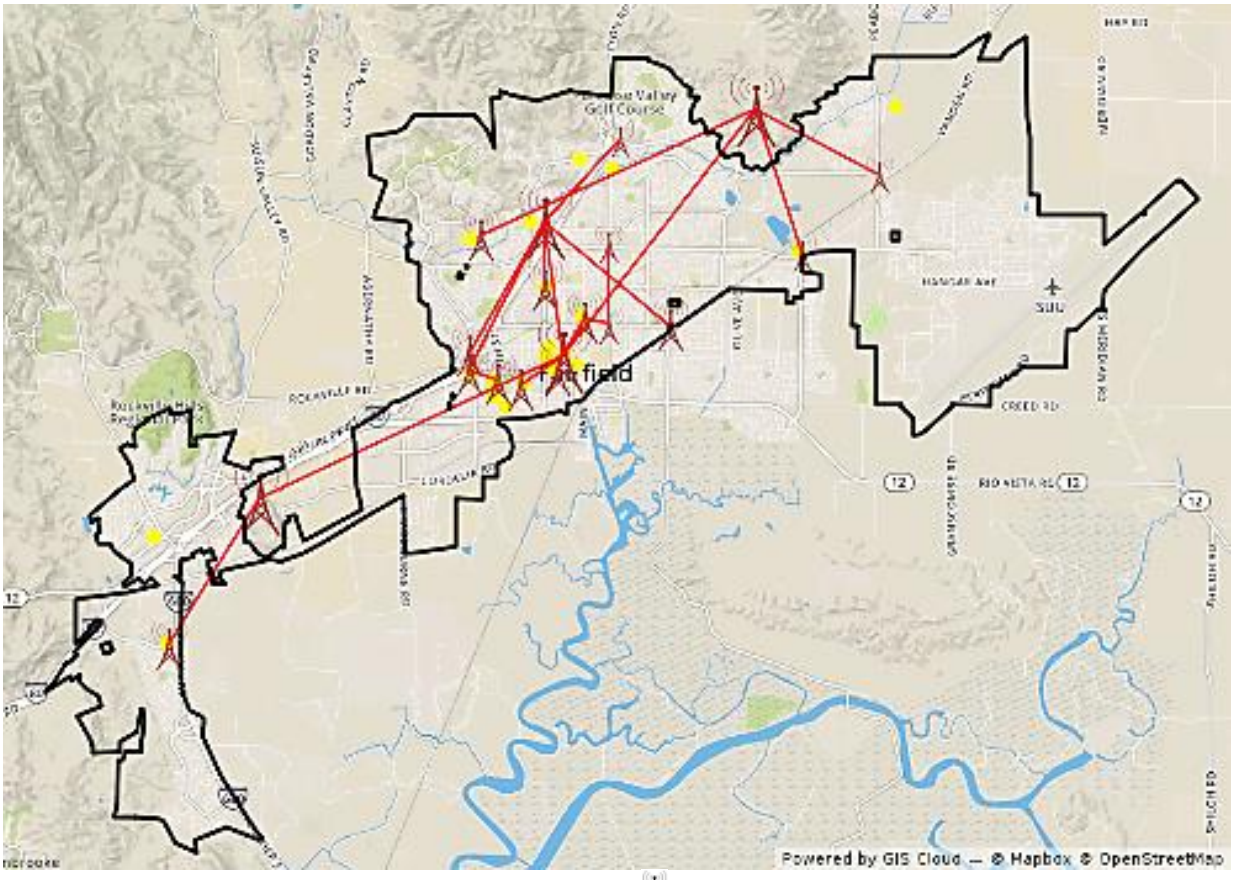


Figure 3-1. City of Fairfield Microwave Links and Towers

The City also owns buried conduit, most of which has fiber installed, for its traffic management system and is planning to install more. Most of the installed fiber is 12-strand, although some is 24. Table 3-1 summarizes how much conduit and fiber Fairfield has built and is planning to build. In addition to fiber assets for traffic management, the City has fiber throughout its central Civic Center campus. These assets are structured in a star with campus facilities "home-runned" to the data center in City Hall. At the time of the analysis, the City was replacing the old multi-mode campus-area fiber with single mode and upgrading the connection speeds. Several City Facilities, particularly Laurel Creek Park, are cellular sites, and most public facilities have public Wi-Fi.

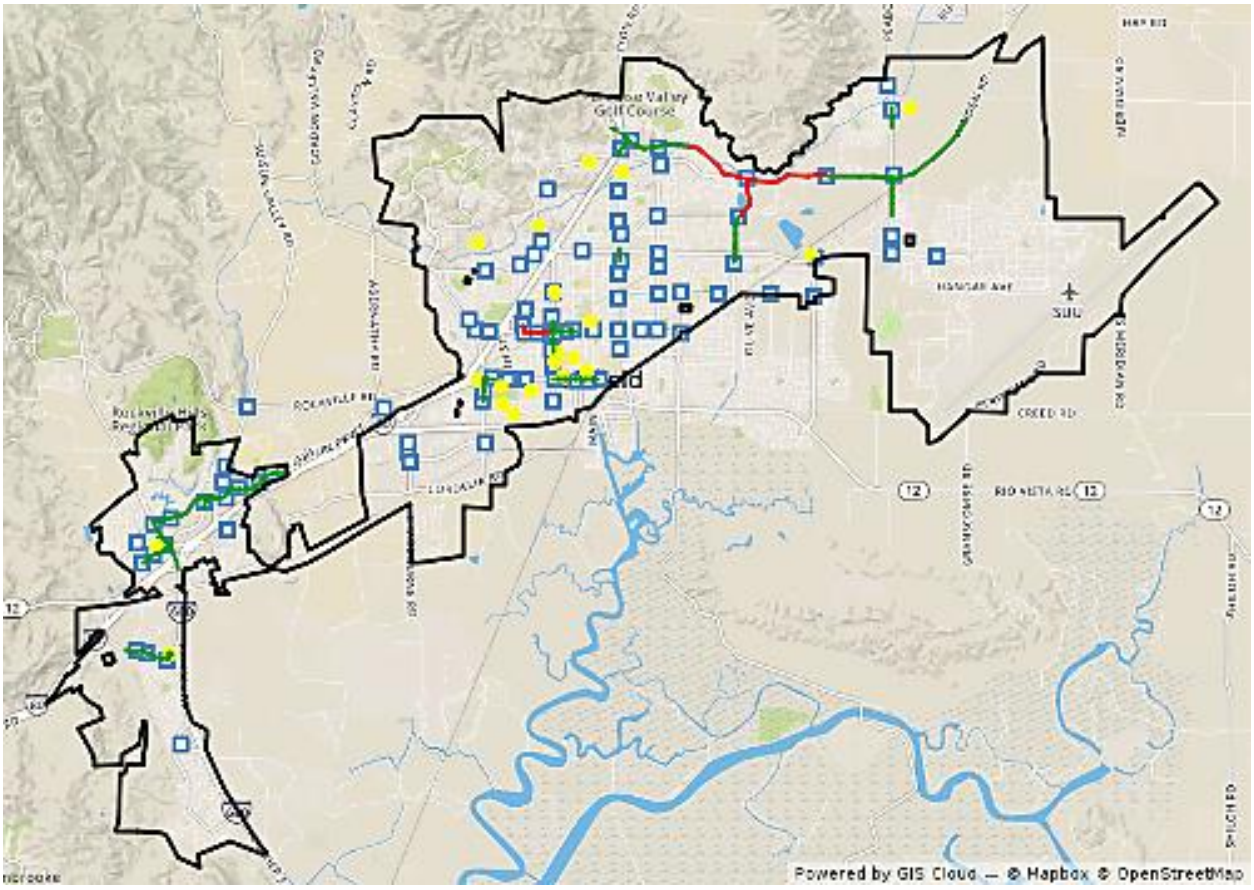


Figure 3-2. City of Fairfield Conduit and Fiber

Table 3-1. Miles of Existing and Planned Conduit and Fiber

Asset	Existing	Planned	Overall
Conduit	12.21	-	40%
Fiber	10.97	7.25	60%
Totals	**23.18**	**7.25**	**30.43**

The microwave infrastructure supports the City's land mobile radio (LMR) network, wide-area network (WAN), supervisory control and data acquisition (SCADA) for water and wastewater, and traffic management. The City uses the 900 MHz ISM band for SCADA and traffic management, including 110 traffic signals and traffic cameras. It operates a LMR simulcast system with Vacaville in the 850 MHz band

using Motorola Type II SmartNet trunking equipment, which is being replaced with an upgraded P25[29] system that also includes Solano County and Suisun.

Internet access is provided by both AT&T and Comcast, and the City has standardized on HP network gear. The City also has mobile network assets, including automatic vehicle locators, cellular-connected mobile data terminals in vehicles, and smartphones and tablets. Data storage, staff capacity, and other downstream dependencies are recognized as issues to be addressed in conjunction with expanding network utilization.

The City of Fairfield owns over 18,000 poles, most of which are jointly used. About three-quarters of poles are metal, about 9% are made of wood, 5% are concrete, and the remainder are decorative, traffic signal, and similar poles.

Table 3-2. City-owned Poles by Use

Pole Type	Count	Joint Use
Streetlight	8,706	15.5%
Traffic Signal	631	36.6%
Sign	8,773	30.5%
Traffic Signal Pedestrian	134	0.0%
Total	18,244	

CURRENT PROVIDERS

Multiple companies have network assets in or near Fairfield. Most of these are long-haul fiber, as shown in Figure 3-3, which interconnects providers' points of presence (POPs) with effectively no physical access in between. Four companies have "metro" fiber, which has access at key locations on the routes, illustrated in Figure 3-4. Much of both the long-haul and metro fiber networks follow a route to the south of Fairfield between San Francisco and Stockton.

[29] P25 (short for Project 25) is a set of digital mobile radio standards for defense, emergency, and public safety data and voice communications. For more information see http://www.project25.org/.

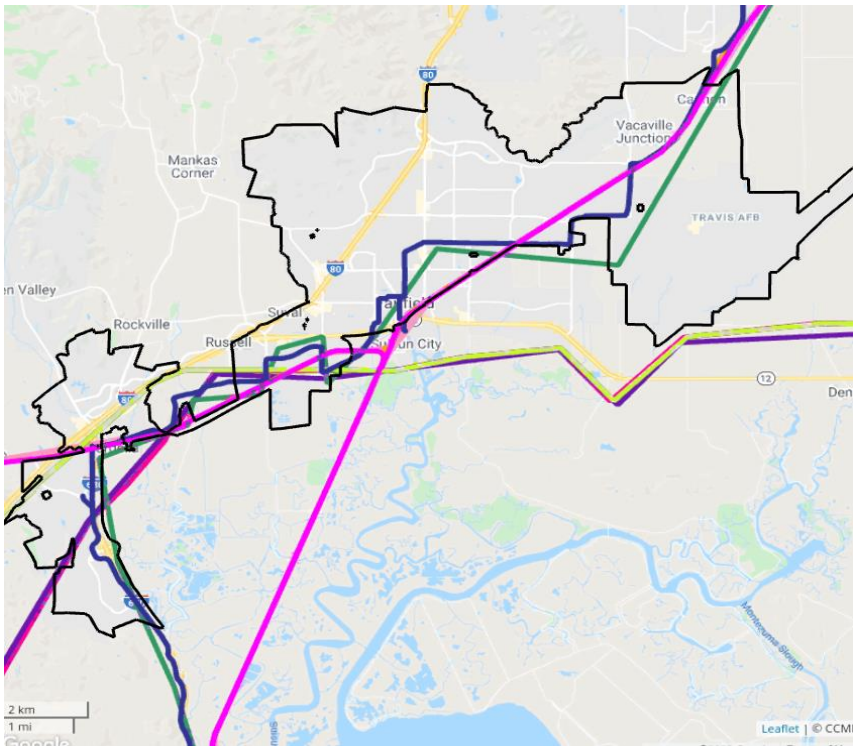


Figure 3-3. Long-haul Fiber Routes Through Fairfield

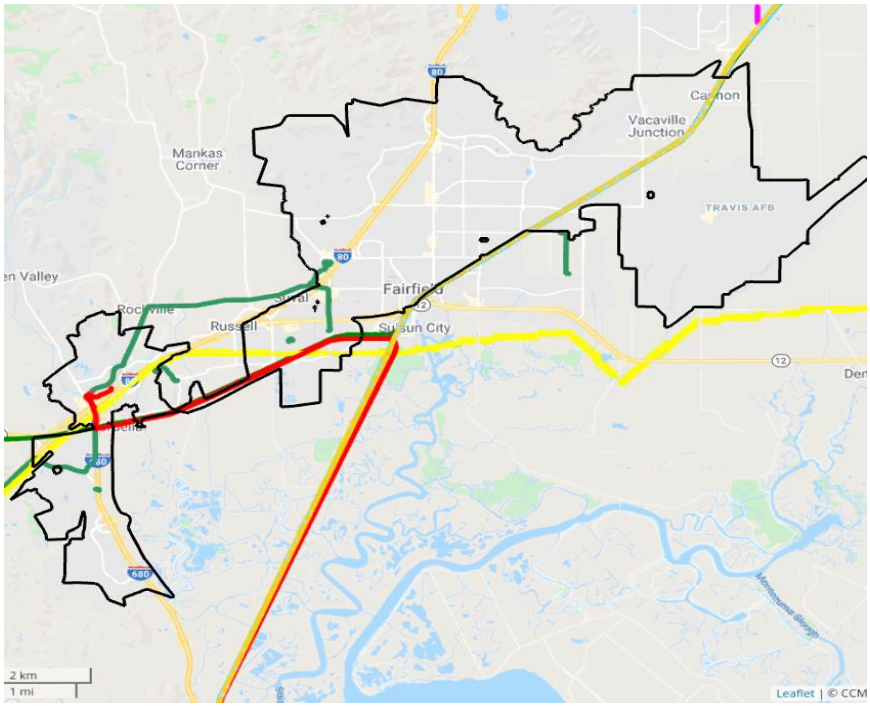


Figure 3-4. Metro Fiber Networks in the Fairfield Area

Broadband Services

Traditional cable and telephone companies generally do not share locations of their local network infrastructure. These assets are used for either customized "enterprise" services or standardized "mass market" services. Mass market services are typically divided between "business" and "residential" services. Therefore, we assess local assets in terms of providers' standard, mass market services, specifically broadband internet access.

Three companies—AT&T, Comcast, and EarthLink—provide wired broadband services in Fairfield, with a total of 21 different services offerings among them. EarthLink resells AT&T services, using the same physical access infrastructure. The average offering speed was 441.4/20[30], overall, 453.5/19.2 for residential and 336.8/18.6 for business, with respective average monthly recurring cost (MRC) of $103.31, $75.37, and $123.60.

The fastest offering was Comcast's residential 2,000/35 service, which cost $299.95 per month. The most expensive service was Comcast's 940/35 service for businesses, at $399.95 per month. On average, business service offerings were slower and more expensive. The least expensive offering was AT&T's residential 25/10 internet access with an MRC of $29.99.

AT&T also offered the most economical service: Its 1,000/25 offering for businesses and residents cost $0.07 per month per Mbps. The least economic offering was Comcast's "Starter Internet," which costs $69.95 per month for 35/5 connection. The average MRC per Mbps was $0.45.

The services that are actually available at specific locations can be quite different than what is generally offered by the providers. We randomly selected five residential locations and four business locations to assess availability. AT&T and Earthlink serve only one of the residential locations (1482 Driftwood Cir) and Comcast did not serve one of the business locations (5055 Business Center Dr, Suite 108).

Overall, the actual services were faster but more expensive than the offerings. Comcast's actual services were more economical than its offerings, and by far the most economical of all available services ($0.25 per Mbps per month compared to $4.98 on average). The caveat is that this is based on Comcast's 2 Gbps residential service, which costs $300 per month. Lower cost, slower services were less economical (i.e., consumers pay less but get much less so the per Mbps per month

[30] Download over upload is how broadband performance—which is commonly referred to as "speed," although the more correct term is "capacity"—is typically written. This figure represents 25 megabits per second (Mbps) download speed and 10 Mbps upload speed. We use this convention and the more common terms throughout this document.

costs increase). AT&T's available services, in contrast, were much less economical than its offerings. Its average MRC per Mbps was $8.68 and was as high as $26.25 per Mbps per month for a 1.5/0.831 business service.

[31] This service does not meet the accepted 25/5 benchmark for broadband service, and does not provide enough capacity to support most web apps or online content.

CHAPTER 4

Needs Assessment

CITY PLANS

The City's General Plan, which is currently being updated, is divided into multiple "elements." The most recently updated elements relate to land use (2016), housing (2014), open space (2013), and circulation or transportation (2012). Other key elements such as economic development, public facilities, and urban design have not been updated since 2002. As discussed below, these topics are addressed in smaller area plans for Texas Street and the new train station.

The older plan elements generally seek to align development of City assets with external development and growth in the local economy and population. Many of the goals and objectives emphasize "appropriateness" and balance. For example, an economic development objective is to "create an economic climate conducive to attracting new development and businesses which yield net social and economic benefits to the community." To this end, Fairfield's plans generally expect private development to fund facilities and services required by the community.

The goal of the 2012 Circulation element was "efficient, safe, and coordinated multi-modal circulation system that reduces environmental and social impacts of transportation systems, serves the needs of a variety of users and meets the social, economic development, and urban design needs of the community." Alternative transportation options, congestion reduction, parking and loading facilities, and local-regional transit network were objectives along with improving air quality and safety.

The City's housing goal in 2014 was "a high quality residential environment with a wide range of housing opportunities throughout the City affordable to a diverse population of renters, owners, and people with special needs." Physical rehabilitation, neighborhood revitalization, and upgrading living conditions for residents were the focus the City's housing plans.

Objectives in the 2016 Land Use element calls for "growth that is consistent with the provision of public facilities and services, that balances jobs and housing, and that does not result in the degradation of the natural environment. It emphasizes character and image, including agriculture, open space, and rurality, with a variety of housing options, mixed use, in-fill development, and "intensification in downtown and central Fairfield." The general vision of Fairfield as a livable city means "developing in a manner that promotes a more compact and efficient land use pattern, and places less emphasis on development that necessitates use of the automobile."

The City's 2016 water management plan estimates demand based on an over 30% increase in population over 25 years. The plan notes needs for demand management, improved facilities, and water recycling along with careful monitoring of water supplies in coordination with neighboring jurisdictions and state agencies.

The formal plan for the "Heart of Fairfield"—a 513 acre area between I-80 to the west and the railroad to the east that includes Downtown Fairfield, Solano County Government Center, and the Transportation Center—which is an extension of the general plan, was completed in 2017. Specifically, the City is planning a "road diet" to reduce the number of lanes along West Texas Street from I-80 and the transportation center to downtown, as part of the plans to bring more businesses, residents, and visitors into the area.

Development Focus Areas

The City's official development projections foresee over 3,000 residential units but Planning staff said developers are planning to build about 7,000 more than that. Nearly 5,000,000 square feet of commercial and industrial space are in the official projections. Industrial development opportunities tend to be in the southern portions of the City, along the rail line and interstates, and just to the west of the Air Force base. Some commercial development opportunities are scattered throughout the City's neighborhoods, along major thoroughfares. They are concentrated in the central business districts along North and West Texas Streets and in regional commerce centers along the freeways.

Northeastern Fairfield, north and west of Travis Air Force Base, including the new train station, Hawthorne Mill, and the Villages at Fairfield, is the primary development area. The Train Station Specific Plan is for commercial, high density residential, light industrial, and mixed use, including up to 6,800 housing units and 300 acres of industrial uses. The Hawthorne Mill plan includes up to 1,000 housing units in a range of residential properties with some commercial and public facilities and a large swath of greenspace. The Villages will be 1,830 housing units, primarily low-density single family residential with some medium- to high-density residential and green space along Manual Campos and the Linear Park and with a bit of commercial to the southeast on Clay Bank Road.

There are similarly diverse but smaller developments are planned for southwestern Fairfield in the Cordelia and Green Valley areas. These areas contain business parks, such as Green Valley Corporate Park, Green Valley Office Park and Fairfield Corporate Commons, for office and campus-style uses. Others, such as Solano Business Park and Busch Corporate Center, allow a variety of office, light industrial and flex space. The Tolenas Industrial Park has vacant properties that permit heavy industry and are rail served and South Cordelia Park is permitted for light industry. Over a third of the 1,000 acres in these parks is available.

The "Heart of Fairfield" area lies between northeast and southwest Fairfield, along with the City's Opportunity Zones. Covering 1.43 square miles—Census tracts 2526.05, 2526.06, and 2526.07—centered around North Texas Street, the Opportunity Zones are areas in which capital gains can be invested and are exempt from federal income taxes. The NorthBay Medical Center and Solano Town Center Mall are located immediately west of the Opportunity Zone and a few blocks north of the "Heart of Fairfield," with the Civic Center campus in between. The Linear Trail bisects these areas, connecting northeastern and southwestern areas of Fairfield, from Solano Community College to Air Base Blvd.

CONNECTIVITY REQUIREMENTS

The City of Fairfield requires network connections throughout its municipal operations to achieve the planned goals and objectives. Most of these requirements are concentrated around the Civic Center campus, where City administrative offices, City Council chambers, Information Technology, and Police headquarters are located. These requirements have been met via a microwave-based wide-area network (WAN), discussed above. Fairfield needs to replace this network and was transitioning key sites to AT&T Dedicated Ethernet at the time of this analysis for that purpose.

The essential requirements are for access to applications on internal servers and to data and services via the internet. This includes the City's decade old Avaya VoIP system. Fairfield's primary applications are TRAKiT for permitting and planning (online software-as-a-service, including service request management), Cayenta financial software, and NorthStar utility billing software, both of which are Harris Computer Systems products accessed via the City's LAN. The City also uses GIS, TRAKiT permitting and inspection software, and a range of other applications that need to be accessed remotely or mobile as well as on-site.

Public Works has the most extensive connectivity requirements simply because it maintains and operates so many of the City's assets: buildings, sewer, stormwater, and water infrastructure, streets, traffic facilities, and vehicles. The department has a SCADA system and traffic management system, although many of the devices in both systems are stand-alone. Public Works has many personnel working in the field on projects, etc. It also manages solid waste services, which are provided under a franchise by a private company. They noted desire for real-time traffic management and cameras on buses. They expressed concern about interference with the 900 MHz radio links they use for traffic and utility management and 5G cellular services.

Community Development is responsible for wide range of municipal functions—including building codes, inspections, and permitting, business assistance and economic development, and housing programs—but its network requirements

seem to be minimal beyond LAN connections. Department personnel noted opportunities to condition development with conduit installation to ensure developers' plans are in line with the City's plans prior to building. The City already requires its two major developers to install one 3-inch conduit in the new residential developments.

Fairfield Police use NetMotion VPN software along with a range of network access media, particularly cellular data services and Wi-Fi, to connect their vehicles into the City's wide-area network WAN. All police vehicles have data terminals, everyone in the department has cell phones, and the mobile command center can act as a mobile hotspot. Every officer has a body camera that downloads data via dock at the station, some cars have thumb print readers, and the Police are considering using drones with streaming video. The department's four locations, including Crime Lab, are interconnected via the WAN. They connect to the Solano County Sheriff's department and, through it, to the State of California. There are Student Resource Officers in schools but they can't access school security video. The City has numerous safety cameras. The Police would like more but data storage costs are prohibitively high. The City does not do video arraignment.

The Fairfield Fire Department conducts inspections and training as well as responding to incidents. The department receives around 14,000 calls a year about three-quarters of which are medical—and does extensive analysis of incidents and responses. Along with emergency medical services (EMS), the Fire Department handles fire inspections and investigations, hazardous materials, and search and rescue. Four of the five Fairfield Fire Stations are connected to the microwave WAN and have City Wi-Fi. The fifth is on the Civic Center campus and is connected via campus fiber. All fire stations have iPads but those aren't used in the vehicles. One station is slated to be moved in the near future because of facility limitations, another station will be added, and others will receive updates.

The department did about 3,000 inspections via tablets and were using mobile data terminals in vehicles, which had to be abandoned due to connectivity issues: Firefighters change vehicles and most work is outside the vehicles. Due to challenges accessing online maps while in transit, firefighters produce their own maps for use when they are dispatched. They have attempted to do video conferencing so fire fighters don't have to take turns attending meetings in-person but were unable to get the technology to work adequately.

Fire has heavy requirements of dispatch due to the nature of their work, including need for rapid response—they must be on-site in less than 7 minutes 90% of the time—and numerous interactions. Geo-location of personnel via cellphone or radio would be very useful for the department. Generally, Fire Department leaders felt

they could not depend on network connectivity, which in turn impacts financial issues such as insurance rates and the need to build fire stations.

The Parks and Recreation Department has five main facilities: An adult recreation center located adjacent to the Civic Center campus, a community center in the Civic Center, and an aquatic center and sports center located at Alan Witt Park on West Texas St in the "Heart of Fairfield." The department also operates three Neighborhood Centers, two golf courses with clubhouses, a 6-mile long linear trail park through the center of town, a 633-acre regional park, a nature education center, and numerous neighborhood parks. The department's programs are equally diverse and rich, and continue to develop. Specifically, the "Node 4 project" involves converting a 15,000 sq. ft former bowling alley at North Texas St and East Tabor Ave on the Linear Trail to host a preschool, homework programs, and afterschool activities with police activity for community safety.

Almost all interaction between the Parks and Recreation Department and public can be done electronically online and via social media to give more access to the public. For example, registrations to classes are online but the public can still register in person during business hours. The department has technology for people to use, and is adding a computer lab. All facilities have open public Wi-Fi. The Wi-Fi is important as the department rents venues for events such as weddings or training classes. Unfortunately, the connectivity seems to vary, particularly during heavy weather, and be generally weak. Fairfield has a large lower income population that has limited access to technology, so the department has been trying to bridge that digital divide. At the same time, they're trying to "get away from tech and get outdoors."

City departmental leaders and key personnel expressed concerns about having the capabilities to manage a City-wide fiber network. At the same time, the possibility of fiber infrastructure in strategic locations was welcomed as it is seen as necessary. The City's needs for fiber seemed to focus on minimizing requirements of the microwave network. The integrity and security of the City's network were clearly key concerns. Public Works indicated that if the fiber is in the streets the City would probably want ownership of conduit and fiber that connects traffic signals and streetlights. If the City were to own additional fiber infrastructure, personnel recognized, a third party would need to be contracted for splicing and repairs.

CHAPTER 5

Network Vision

The foundation of this Broadband Development Plan is a vision for a citywide fiber network to meet the needs of the City and to support economic development opportunities by improving connectivity in key commercial corridors. This infrastructure could also be used as a broadband distribution network. Magellan considered the following inputs in making these route recommendations, in preparation for new fiber connections to key City facilities. Where possible, route fiber backbone:

1. Within 3 blocks of City facilities, preferably through/to the Civic Center campus, past schools and major County buildings.
2. Along major corridors, passing as many traffic signal control boxes as possible, particularly intersections with traffic cameras.
3. Through business areas, including Opportunity Zones and Tax Increment Financing (TIF) areas.
4. Pass nearby, or go through, industrial parks.
5. Create one or more rings, covering both the northern and southern areas of the City.
6. Consider GIS layers provided by City, including:
    - City Facilities
    - Closed Circuit TV (CCTV) / Security Cameras
    - Microwave tower locations
    - Traffic signal cabinets
    - Fire stations, police stations
    - Water fittings, control valves, and other possible network distribution options
7. Outside of City
    - Towers outside City boundaries – including two microwave towers
    - Direct paths along major arteries.

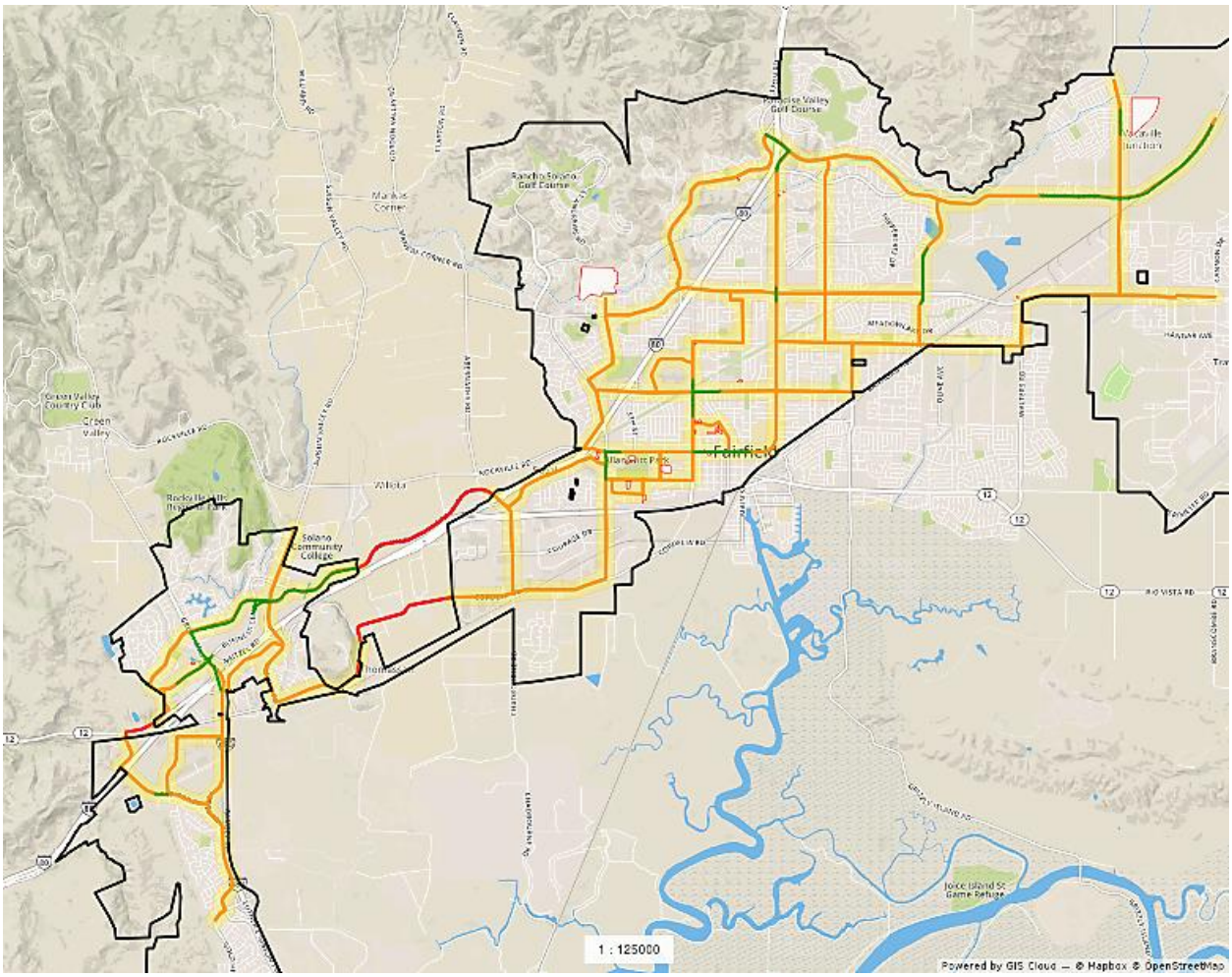
CONCEPTUAL ROUTE DESIGN

Considering these inputs, Magellan developed the following conceptual routes for proposed new backbone fiber for Fairfield. The backbone fiber would include 144-strand single-mode fiber. Most of the backbone would be within City limits, but some segments between the northeast and southwest portions of the City are most effectively, and least expensively, run through County property, along Suisun Parkway and along Cordelia Road.

Table 5-1 summarizes the 57.7 miles of proposed backbone fiber paths, shaded yellow and red.

Table 5-1. Proposed Fairfield Conceptual Network Fiber Backbone Lengths

Fairfield Backbone Fiber	Length (linear feet)	Length (Miles)	Proportion
Within City	286,432	54.2	94.0%
Outside of City	18,256	3.5	6.0%
	304,688	**57.7**	



City Boundaries
Existing Fiber
Future Fiber
Future Fiber Outside City Boundaries
Buffer area for analysis of fiber route

Figure 5-1. A Network Vision for the City of Fairfield

When construction is underground, two 4-inch (2x 4") conduit ducts would be placed, consistent with dig once guidance; the second duct could be leased to local providers or other companies. Hand holes would be placed approximately every 600' and straight splices would be made approximately every 5000'. Construction

pricing estimates include placing conduit at a minimum depth of 24", and soft surface restoration of roadways.

When construction is aerial, lashing to poles would be in the communications space, below the power space, consistent with fundamental safety recommendations by National Electrical Safety Code (NESC).

Construction Cost Estimates (Backbone)

Based on this network vision, the following estimated backbone construction costs are provided as a baseline, providing one basis for assessing the value of private partner proposals. Costs include the following assumptions:

- 144-strand fiber on all backbone segments.
- 60% of backbone fiber would be aerial, due to large number of utility poles (more than 1,800) within the City. This 60% metric for aerial is used for both City and County backbone construction.
- 40% of backbone fiber would be underground, to a minimum depth of 24", with two four-inch conduits placed.
- Prevailing wage will be paid for appropriate labor categories based on California Department of Industrial Relations (DIR), based on current wage determinations for Solano County, 2020-1 Wage Determination.
- Fully loaded unit costs are calculated and used to scale to total backbone construction costs. All in costs, including materials and appropriate prevailing wage, are approximately $42.93 per linear foot for underground backbone and $8.79 per linear foot for aerial. Unit costs are summarized in Table 5-2.

Table 5-2. Unit Costs for Construction Cost Estimates

Per Foot Underground, all in	Per Foot Aerial, all in	Per 500' UG lateral
$42.9289	$8.7871	19,039

Table 5-3 summarizes fiber backbone construction metrics, based on aerial / underground assumptions, both within and outside of the City.

Table 5-3. Fairfield Backbone Construction Metrics (Estimated)

Backbone Core	TOTAL LENGTH	UG Backbone	Aerial Backbone
Totals (within City):	286,432	114,573	171,859
TOTALS (outside City):	18,256	7,302	10,954
TOTAL CONSTRUCTION METRICS:	304,688	121,875	182,813

Magellan estimates that, were City build its own backbone fiber network, total construction costs within Fairfield would be approximately $6.429 million, with an additional $410,000 for construction outside City limits, for total backbone construction costs of $6.839 million.

Table 5-4 summarizes estimated fiber backbone construction costs, were City to build its own fiber network.

Table 5-4. Fairfield Backbone Construction Costs (Estimated)

Construction Costs		Cost	Cost	Linear feet	Linear feet
Backbone Core	TOTAL COST	UG Backbone	Aerial Backbone	UG Backbone	Aerial Backbone
Totals (within City):	$6,428,627	$4,918,488	$1,510,139	114,573	171,859
TOTALS (outside City):	$409,734	$313,484	$96,250	7,302	10,954
TOTAL CONSTRUCTION COSTS:	$6,838,361	$5,231,972	$1,606,389	121,875	182,813

The fiber backbone routes suggested in this Network Plan are a vision of the end state backbone. However, note that this should not be interpreted as an implementation plan. The network infrastructure might be constructed by the City but the vision is for private companies to build out most of it and provide portions of the infrastructure to the City in lieu of fees or swap for use of public assets.

Estimates of construction costs are preliminary engineering costs, assuming City were to construct its own fiber network. For actual costs, final engineering analyses must be performed, scope finalized, and formal quotes received. The estimated costs are comparable to what a private company would spend to build the envisioned network, although they could likely economize. Therefore, these estimates can be seen as "worst case scenario" or the maximum amount that would need to be invested in Fairfield to create the envisioned network.

BUSINESS MODEL OPTIONS

Selecting the right broadband business model for local government is highly dependent on several factors that will suggest the most appropriate option for the organization. For example, understanding the community needs, knowing the competitive market factors that define what infrastructure options fit well within the community, and determining organizational and operational capabilities of the

local government all play into the selection process. Equally important is an understanding of the financial commitments and risk and reward that participating organizations are willing to support to fund and sustain a successful broadband initiative.

Figure 5-2. Inputs to Selecting the Right Broadband Business Model

The commonly implemented business models fall on a continuum that ranges from low risk, low investment options to higher risk, high investment options. Figure 5-3 (below) illustrates this continuum. Moving along the continuum of business model options involves increasing degrees of risk and reward: risks in terms of financial, operational, and regulatory risk; rewards in terms of community benefits, revenue generation, and over potential for profit. Moving "up" the continuum generally requires increasing levels of investment and implies greater local government participation in the delivery of broadband services. Public policy and infrastructure only options are considered "passive" business models, where the government does not operate a broadband network as compared to "active" models such as Government Services Providers, Open Access Providers, and Retail Provider Options, where the government operates a broadband network. Public-private partnerships are not classified as a specific business model but instead fall along the continuum because these partnerships take many forms. Local governments must determine which business models meet their organization's risk/reward tolerance to achieve the community's broadband goals.

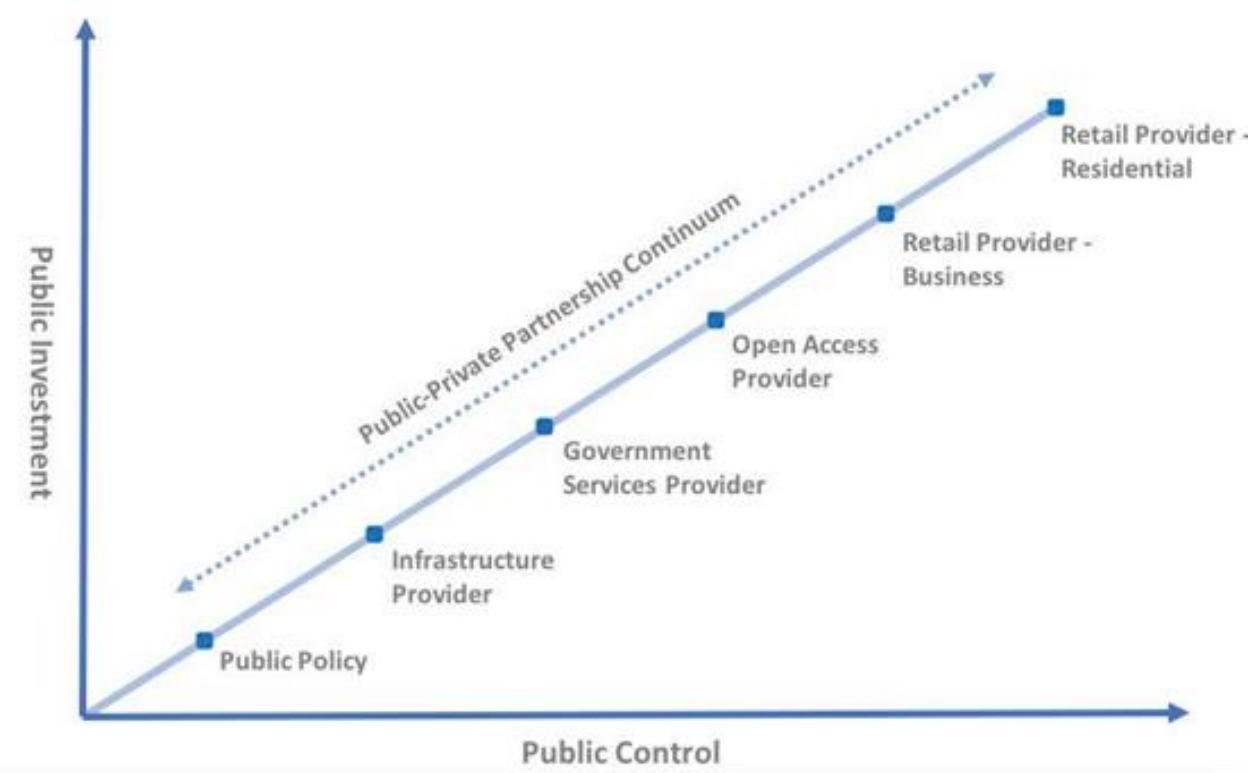


Figure 5-3. Continuum of Municipal Broadband Business Models

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

Table 5-5 illustrates the differences among the business models that can be utilized to achieve the City's broadband goals. While there are variations of each model, they generally fall into the categories described. Today, the City of Fairfield has many key features of a "passive" Government Broadband Business Model. The following section describes each business model and examples of local governments that have implemented them.

Table 5-5. Comparison of Municipal Broadband Business Models

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

RECOMMENDED APPROACH

Due to the capital investment, operational needs, and organizational structure required for government active models, Magellan does not recommend that Fairfield begin its program with such an endeavor. Rather, the City should ease into its broadband program with a government passive partnership-focused model to decrease the need for up-front capital, allowing the City to invest incrementally

over time. Specifically, the City of Fairfield should operate a passive government broadband model through a combination of policy to guide development in the public right-of-way, gradually expanding the City's infrastructure through joint build opportunities, and promoting targeted investment by private internet service providers.

This approach calls for the City to encourage investment through broadband-friendly policy initiatives and allowing the use of City assets in order to lower the barriers of market entry by broadband providers. Magellan recommends the City enter into non-exclusive relationships with multiple parties, promoting competition that will keep costs lower for end users. Simultaneously, the City should take advantage of joint build opportunities, planned capital projects, and other activity in the public right-of-way to expand its own broadband assets such as conduit and fiber.

Use of City Assets

In this model, costs for construction of the fiber, lateral conduit and fiber are borne primarily by selected public-private partners (P3s). Fairfield would make its broadband assets such as conduit and poles available to these partners in return for discounted services, service commitments, and other community benefits. Partnership models will vary based on the individual needs of each party.

In some cases, the partners may pass through a negotiated proportion of gross revenues, as a revenue share, which could be as high as a 60%/40% split, with 40% going to Fairfield, or as low as 95%/5%, with 5% going to the City. In other cases, there may not be a revenue share, but other in-kind benefits such as connecting City facilities or providing the City fiber and/or conduit may be negotiated.

Such considerations should be reviewed as a part of a competitive bidding process in which the City issues an RFP to evaluate partnership options. Potential partners who identified interest in deploying within Fairfield and key considerations for evaluating partnerships are provided later in this Plan.

Opportunistic Expansion of City Infrastructure

At the same time, Fairfield should focus its efforts on expanding its own broadband assets such as conduit and fiber through opportunities for joint build. While Magellan estimates that the cost for building the envisioned network at $6.839 million, the costs of construction can be reduced significantly by deploying conduit and/or fiber in conjunction with private providers or other utilities working the public right-of-way. Many cities in California have seen the benefits of in-kind and joint build strategies in which local government partners with private telecommunications providers to expand broadband access. Examples include:

Table 5-6. California In-Kind and Joint Build Agreements

City	Type	Partner	Status
Carlsbad	In-Kind	Crown Castle	Network in deployment
Chula Vista	In-Kind, Joint Build	Media 3	Discussions ongoing
Concord	In-Kind	Verizon	Discussions ongoing
Huntington Beach	In-Kind	Crown Castle, Phillips	Agreement in Place
Paso Robles	Joint Build	Digital West	Contract in Negotiation
Sacramento	In-Kind	Verizon	Agreement in Place
San Leandro	In-Kind	Common Wireless	Agreement in Place
Santa Ana	In-Kind, Joint Build	AT&T, Crown Castle, Verizon, T-Mobile	Discussions ongoing

Key to this strategy is the Dig Once ordinance that Magellan has assisted the City with developing. The ordinance requires regular meetings with utilities doing work in the public right-of-way to review opportunities for strategically expanding broadband assets. Because the City's ultimate goal is to connect as many locations as possible, all work in the PROW could be considered, but the City should prioritize projects that align with the Network Vision. In addition, if any capital projects are planned for these areas, fiber and/or conduit should be deployed any time that open trenching occurs.

PROSPECTIVE PARTNERS

In the course of conducting this study, Magellan engaged with a variety of service providers, several of whom showed interest in partnering with or providing services in the City of Fairfield. The opportunities for Fairfield range from interest in deploying 5G wireless through pole attachment agreements, to working with fiber infrastructure providers to expand a presence and connect City facilities, to leveraging City assets to connect users with high-speed end user wireless broadband. Interest and opportunities are detailed in the below chart and subsequent paragraphs.

Table 5-7. Prospective Network Service Provider Partners

Provider	Services	Interest	Opportunities	Follow Up
Common Wireless	Wireless ISP	High	Use of facilities in City for towers. in-kind fiber, connectivity.	Engage with Common as soon as possible about opportunities to partner.
Sifi	Fiber ISP	High	Submitted unsolicited proposal to install fiber throughout the City	Continue discussions about partnership opportunities.
Zayo	Fiber Infrastructure	Medium	Connect facilities, in-kind fiber, bring in partner for camera storage. Work with Common to build WISP network.	Engage with Zayo as soon as possible about opportunities to partner
Sonic	Fiber and Cable ISP	Medium	Bring in new competitive provider to market. Utilize City assets and policies to expand broadband.	Implement broadband-friendly policies that will attract more interest from Sonic and similar smaller ISP's.
Comcast	Cable ISP	Low	Conduit leasing, joint trenching	Continue engagement about business demand as density increases
CenturyLink		Low	Demand from large anchors, conduit leasing, joint trenching	Engage large businesses about demand for role as network anchors
ATT	Wireless & 5G	Low	Pole attachments and in-Kind Fiber	Implement Dig Once & Telecom Ordinance, Negotiate MLA
Verizon	Wireless & 5G	Low	Pole attachments and in-Kind Fiber	Implement Dig Once & Telecom Ordinance, Negotiate MLA
Sprint/ T-Mobile	Wireless & 5G	Low	Pole attachments and in-Kind	Implement Dig Once & Telecom Ordinance, Negotiate MLA

Common

Common Networks is a San Francisco-based wireless internet service provider (WISP) that was founded in 2016.[32] It provides high-speed broadband via last mile wireless to residents and small businesses in the cities of Alameda, San Leandro, Santa Clara, San Joe and Sunnyvale, with plans to expand into other regions including unincorporated Alameda County. Common primarily looks for a mix of assets and a friendly environment from cities in order to determine new service territories. The ISP maintains partnerships with cities including San Leandro, where they lease fiber from LIT San Leandro. Common has a history of working with other municipalities that needed connectivity to municipal assets and through a partnership they have provided backhaul to all city sites.

Common is very interested in expanding its infrastructure and service offerings to the City of Fairfield. Fairfield is a strong contender for next metros to receive services, and the company has planned launches in new desirable metros for 2021. Fairfield's location between the Bay Area and Sacramento coupled with its density makes the City an advantageous location for a new service territory.

Common commonly partners with communities to gain access to assets that include school buildings, towers, parks and recreational facilities, and city buildings. The City of Fairfield could utilize this opportunity to partner with Common to bring new connections to City facilities through negotiations with Common as they utilize the City's vertical assets to build their network out in Fairfield.

Common would consider a variety of scenarios for partnership; one example would be handing over 1 GB ethernet port and access point as a quid pro quo for asset lease. The City and/or other regional partners such as schools could allow Common to use assets such as rooftops, towers, poles, and even hilltops or green space in parks to house network equipment. Common already maintains a strong partnership with Zayo, who has a fiber presence in the City, and a joint partnership may be possible to achieve goals for both providers and Fairfield.

Common considers itself primarily a residential provider but has become a great alternative for small businesses including those that currently reside in the "Heart of Fairfield". 10-15% of Common's market is small commercial customers. The company provides a range of service pricing and tiers, standard pricing for 300Mbps symmetrical is $89 a month.

[32] https://www.common.net

Common noted that their investment is anywhere between $4 - 6 million in a particular City, which includes a storage facility. They hire local field technicians and warehouse supervisors, and also hire many professionals from the local area that participate in the workforce making a significant economic impact in the Cities in which they deploy.

Common is interested in continuing conversations with the City as soon as the Fairfield is ready.

Sifi

Sifi Networks is a privately owned company based in New Jersey that funds, builds, and deploys fiber optic infrastructure. In general, SiFi uses an "open access" model whereby multiple service providers can use the network to deliver retail internet and complementary telecommunications and entertainment services. SiFi partners such as Nokia and Henkels are leaders in their areas of expertise, however SiFi has not yet executed on a project here in the states to date. Sifi has approached several cities in California with unsolicited proposals to deploy network infrastructure at little or no cost to the cities. Agreements have been struck with the cities of Fullerton, Simi Valley, Placentia, Rancho Cordova, and Pittsburg.

The City of Fairfield also recently received an unsolicited proposal from Sifi proposing construction of fiber infrastructure using microtrenching to create a more competitive broadband market. While the details of this proposal are not entirely clear, Sifi has worked with other cities to establish in-kind agreements in which the cities provide accelerated permitting, waived fees, and streamlined construction schedules for cost savings in return for Sifi providing services to connect City facilities, free or reduced cost public wi-fi, and other community benefits.

Magellan encourages the City to continue discussions with Sifi using the recommendations for partnership evaluation (below) contained in this Plan.

Zayo

The Zayo Group is a nationwide fiber infrastructure company with long haul, middle mile and last mile fiber infrastructure throughout the US and the state of California. Zayo provides communications infrastructure services, including fiber and bandwidth connectivity, colocation and cloud infrastructure to its customers. Zayo considers itself a "Tier 1 ISP." Its customers or "partners" range from large communications companies such as Verizon and ATT, to community stakeholders, local governments and large bandwidth consumption businesses.

Zayo indicates that it maintains a close relationship with Solano County. The County is a Zayo customer that utilizes a route on Union Street. Zayo's assets in

Fairfield are detailed in the asset assessment and include a variety of routes, strand count and above and underground assets.

Fairfield has been active as of late for Zayo, particularly from an enterprise standpoint. As with common, Zayo sees the value of Fairfield's position as a beltway from the Bay with a lot of residential movement and representatives noted that "lots of businesses are moving there as well from bay area".

Zayo is interested in learning more about the City's specific connectivity and bandwidth needs, as well as the City's appetite for managing a network. The City should engage in additional conversations with Zayo about how the provider could develop a partnership that allows it to garner a business case that benefits both the City and Zayo including access to enterprise customers or additional Zayo partners including a possible partnership with Common Networks. A partnership between the City of Fairfield and Zayo could range from building and deploying and managing with Cisco equipment built in, dark fiber assets, IRU lit services, or fiber swaps.

One additional advantage that Zayo brings is the company's existing partnerships, including a key partner that can support the video storage needs of the City's large camera system. Zayo maintains relationships with wireless providers who utilize their network for backhaul, allowing them to gage what large wireless providers such as T-Mobile and Verizon may plan to do in Fairfield. Zayo can utilize this knowledge and understanding of City needs to create opportunities that bring a successful network plan for all.

The City should continue conversations with Zayo Group in order to determine how a key partnership could be developed.

Sonic

Sonic is an ISP and telecom carrier based in Santa Rosa, CA. Sonic operates as a competitive location exchange carrier (CLEC) in the San Francisco Bay Area, Sacramento, and Los Angeles. It provides a range of copper, DSL and fiber-based IP services including voice and data. Sonic currently has a presence in the City of Fairfield; its current infrastructure in Fairfield comes from the lease of dark fiber from a colocation in AT&T's central office. It delivers copper based e-services through that POP including leased copper, DSL and ethernet over copper to deliver voice and internet. However, representatives from Sonic indicate that Fairfield is out of the company's core area and that it has no fiber deployment plans or engineering plans in Fairfield.

Although Sonic does not currently have plans to expand into Fairfield, it does encourage the City to continue to develop and implement broadband-friendly policies that attract new competitive broadband providers to the region. Sonic

believes there are three primary levers of deployment-centered policy that the community could engage in including a Dig Once policy, a trenching policy that includes microtrenching standards, and procurement policies that encourage new market entrants.

Comcast

Comcast is part of a communications conglomerate that includes NBC and Universal Pictures. Originally a cable television system operator, it grew through acquisitions including Time Warner Cable in 2014. It is headquartered in Philadelphia, PA, and now provides a full range of telecommunications, including enterprise network services and voice services. Comcast indicates that anywhere they provide services, they can deliver 1Gbps broadband.

While Comcast has historically been focused on residential service, it is now pursuing opportunities to coordinate with cities on economic development by offering service to industry parks, downtown areas, in-fill, and housing developments. Generally, Comcast looks to deploy in areas with business density. Representatives from Comcast state that density in Fairfield is not currently high enough to prompt additional investment.

However, Comcast is interested in opportunities to use or lease conduit or to drop its own conduit during road and utility improvements. The company's representative also mentioned that Comcast has overhead along a lot of the Linear Park trail and would like to have an annual encroachment permit for routine maintenance/small jobs.

CenturyLink

CenturyLink is a global technology company headquartered in Monroe, Louisiana that offers communications, network services, security, cloud solutions, voice and managed services. The company is a member of the S&P 500 index and the Fortune 500.

CenturyLink owns fiber infrastructure in Fairfield and already serves some larger businesses, including the Jelly Belly factory off of Highway 12 in the southwest of the City. According to representatives from the company, there are no immediate plans to expand infrastructure or service offerings at this time. CenturyLink states that it has researched the cost of deployment within the City and based on the current environment, the business model does not produce an ROI that justifies expansion.

However, CenturyLink is open to further conversations with the City about the possibility of bringing more services and infrastructure to Fairfield. In particular, if the City or another large entity became an anchor on their network, CenturyLink would be able to expand its services to other smaller businesses. Additionally, as

more businesses decide to move to Fairfield, a critical mass of demand could give CenturyLink good cause to reevaluate options for expanding its infrastructure and service offerings.

Fairfield should continue conversations with CenturyLink about expanding services in Fairfield.

Wireless Providers

Nationwide wireless cellular providers including AT&T, T-Mobile/Sprint, and Verizon are already operating in Fairfield and, with the coming of 5G, are likely to be expanding their assets over the next several years. The cellular services these companies provide is not considered broadband, although 4G and 5G LTE can achieve broadband speeds.

AT&T currently serves the City itself with a dedicated ethernet switch, as well as offering residential internet services in some locations (see Market Assessment section of this Plan). While representatives of AT&T expressed a high level of interest in the wireless and broadband policies being developed by Fairfield, the company did not divulge any plans for providing additional wireline services in the City.

Similarly, T-Mobile/Sprint and Verizon both expressed interest in the new policies that will affect their rollout of 5G facilities, but neither has plans for providing broadband via wireline connections.

However, these wireless providers and the third parties that provide fiber to backhaul mobile data are likely to be excavating public rights-of-way to deploy additional fiber that will support 5G small cell facilities in the coming years. They will also be interested in using City assets such as streetlights for mounting new devices.

Fairfield should partner with these wireless providers for mutually beneficial joint builds, permitting considerations, and in-kind use of assets that support the community and the Network Vision.

This study strongly recommends that, in addition to implementing broadband-friendly policies, the City engage in discussions with the providers that expressed a high level of interest to attract their investment in the City.

THE BUSINESS CASE FOR PARTNERS

The essence of Fairfield's business case to partners is "you will be more profitable here." To attract investment, the City must show that businesses can get a better return on that investment than putting that money elsewhere, whether that be another community or publicly traded securities. There are two basic ways companies increase profits: by charging more and by spending less. To align with

businesses' desire to spend less, Fairfield must not be in the position of having higher costs for internet and other network services. Indeed, the City needs competitively priced (i.e. lower cost) connectivity compared to other places to attract businesses and professionals who require broadband.

In the same vein, Fairfield wants high quality network services, which means the City doesn't want providers to under-invest in equipment and infrastructure. Nor does the City want providers to skimp on personnel because that would likely result in poor service. And, the City wants good entry-level jobs like customer service associates and high-paying jobs like network technicians. Dual goals for network services should be great service and local jobs.

Therefore, the business case must be built on lowering capital costs and new business opportunities. Fairfield must show providers that they can get more business at lower costs. There are two general ways that the City can do this: First, the City can reduce capital costs by facilitating and directly supporting or subsidizing infrastructure development. Second, the City can increase broadband business opportunities via business attraction, business creation, and demand aggregation activities.

Facilitating infrastructure development involves allowing use of public assets, expediting permits, doing joint-builds, and/or minimizing fees. Fairfield currently has limited assets—poles and towers that are not fiber-connected. Consider bundling these assets for providers: The more they use, the lower the unit costs to use each one. Also, prioritize fiber builds that will connect City-owned assets, as this increases their usefulness to providers.

The policy improvements being made by the City with Magellan's assistance will expedite permitting, creating a clear process that is reasonably simple for applicants and City personnel. Clear guidelines and standards, which Magellan has provided for Fairfield, are critical for expedited permitting. Align and integrate inspections with construction process to minimize delays and rework.

Joint-builds involve either allowing providers to place privately owned network infrastructure into public capital improvements by coordinating builds with multiple providers (who will likely be direct competitors), or by simply covering part of the cost of private construction. The last option is preferable for providers but must have clear value for taxpayers. For example, the City can get valuable assets deployed at a huge discount by paying providers to include them in the build. The City could even offer to handle restoration, which can be a huge cost to providers, in return for fiber strands or even just conduit.

Increasing business opportunities can be accomplished by directly purchasing services or by arranging for local businesses and consumers to purchase services.

The City can basically commit to purchase services from a company that invests in Fairfield. This may or may not be enough of an opportunity to drive investment. The City can create a larger opportunity by aggregating demand of multiple local public institution. This would involve an inter-local agreement to jointly procure connectivity by entities such as the college, county, courts, school districts, neighboring cities, and non-profit organizations.

Attracting network investment is economic development in itself, but it can also be a powerful tactic for more traditional economic development. The City should work with developers and providers to condition new developments with network infrastructure. The City could leverage that infrastructure to have partners offer discounted high-capacity, high-reliability services in those areas, making them more attractive to business, industry, and residents. Simply having access to competitive options—three or more providers rather than the typical choice of cable- or telephone-based connectivity—can be a significant differentiator for site selection.

Remote workers and startups can add up to huge economic impacts, particularly due to multiplier effects of them spending locally and strengthening the local talent pool. These tactics involve more but smaller-scale prospects than traditional economic development. They also tend to be more focused on developing enterprises and people already in the community rather than attracting non-local businesses to the area. Fiber-fed, wireless-saturated physical sites such as co-working spaces, flex office space, and incubators are necessary for this strategy as fiber-fed industrial and commercial spaces are necessary for traditional economic development. It is also important for having programs and resources for home-based businesses and telecommuting. All of these represent small but high-value customers for providers so having a large number of prospects is more important for this strategy than traditional economic development.

The City must actively make the business case to providers. This means taking a comprehensive, coordinated approach that facilitates investment AND increasing opportunities. Expedited permitting and entrepreneur support, as examples, are clearly very different municipal functions but they are interdependent and both directly feed into the business case for providers. Partnerships that support the full range of business opportunities are going to have greater return to Fairfield taxpayers than focused, limited partnerships. That said, providers often focus on particular market spaces and types of customers. Therefore, it will be incumbent on the City to develop a portfolio of partners who will actively participate in Fairfield's network infrastructure development plans.

CRITERIA FOR PARTNERSHIP EVALUATION

There are several guidelines that the City should consider when evaluating opportunities for partnerships with telecommunications providers. Generally, as discussed above, Fairfield should seek provider partners who will actively participate in community and economic development as well as work with the City to achieve its network vision.

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

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

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

New investment and infrastructure: Where possible, the City should give preference to providers who are deploying new infrastructure that follows newly adopted guidelines and follows the City's new standards for wired and wireless infrastructure. The two simple reasons are that (a) this represents new investment rather than milking legacy infrastructure to avoid additional costs and (b) new infrastructure will be better aligned with public interests, higher-capacity, and more reliable.

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

Revenue Sharing: As stated earlier in this report, partners may offer revenue sharing for the use of City assets. The percentage will vary depending on the terms of the agreement; Magellan has seen anywhere from 5% to 60% in favor of the City. In any case, as with all proposals, revenue sharing estimates should be heavily

vetted including assumptions for take rates and ramp periods and should be evaluated against fair market rates for the use of City assets.

CHAPTER 7

Recommendations and Roadmap for Network Development

The City of Fairfield has abundant municipal and related assets, and is in a prime geographic location. Although the City has few network assets - the fiber assets are small segments with low strand counts and the microwave network is overdue for technology refresh – possibilities exist for opportunistically expanding broadband.

Despite its limited network assets, Fairfield has other community assets in abundance and is geographically positioned for strong growth. Many of the City of Fairfield's plans will drive—but also require—advanced connectivity. Commercial and residential developments, for example, will require network infrastructure to deliver internet services. Municipal functions and services such as traffic management and utilities will need to expand with development, which will require additional connectivity. As growth pressures mount, City goals such as enhancing livability and preserving agricultural land use will greatly benefit from technology: many forms of alternate transportation and small-scale/high-value agriculture require fast, flexible connectivity. Effectively all of the City's operations are creating increased need for connectivity.

The success of a road diet depends on effective intelligent traffic management, which requires signals and sensors to be integrated into a system via a network. Businesses, households, and individuals attracted to the area will require network connections, too. Most land use requires or can accommodate network infrastructure. Objectives such as retaining agriculture and rural character ironically depend on technology. People generally don't want to live and simply can't work where they don't have good connectivity. Water management measures benefit from—if not necessitate—data or internet connections. The technology is needed to effectively manage services to a growing population comprised of persons who depend on internet and smartphone applications.

In light of the growing needs for connectivity in City operations and community needs, several departments see the benefits of expanding City-owned broadband infrastructure, with the goal of eventually connecting all arterials and traffic signals in Fairfield. Although it is not economical to immediately begin building the $6.8 million network envisioned in this Plan, the City should begin taking steps to encourage investment from private providers and, simultaneously, take advantage of joint build and in-kind opportunities to expand the City's own infrastructure.

As Fairfield grows, network service providers will want to tap into the local market. Their ability to do so will depend on their cost to deploy infrastructure. The City

can simultaneously lower these costs and drive municipal revenue if it has assets in place for providers to use. Conduit, fiber, poles, and towers could all serve as supporting facilities for network infrastructure. These facilities can be economically developed as the City builds and maintains its extensive transportation and utility infrastructure. Network facilities can be built into new developments and deeded to the City. Due to Fairfield's geographic shape, proximity to other cities (particularly Suisun, Vacaville, and Vallejo), and role as Solano County seat, Fairfield also has opportunities to collaborate with other jurisdictions, which likely have parallel requirements and face similar constraints.

RECOMMENDATIONS FOR PHASING DEVELOPMENT

Although this Plan does not make direct recommendations for which segments of the Network Vision should be deployed first, the City should develop criteria and guidelines to develop network infrastructure based on opportunities and City priorities. Fairfield should take two complementary approaches to phasing. On one hand, Fairfield should prioritize types of assets for connection. This means essentially working through the list enumerated below. On the other hand, the City should target development based on the number of items included from this list. So a project that connects a few city facilities, safety, traffic and water assets, and new property developments along a major corridor would take priority over a project that connects all city facilities.

1. ***City Facilities:*** A primary benefit of a fiber network is to save the City money on its telecommunications spending and to allow for better connectivity to enable quicker, more efficient delivery of services. Therefore, the network segments that connect City facilities should be the first priority when deciding how to phase the deployment of network assets. Of particular interest are any sites that are currently connected via microwave or other leased circuits. Once connections to those locations are completed, the City should consider whether to connect other sites such as parks.
2. ***Safety Cameras and Traffic Signals:*** The City's long-term plans to connect every traffic signal in Fairfield should be considered as well. Any segments that will begin these upgrades to the current signal system are priorities.
3. ***Commercial Corridors:*** To attract and retain businesses, key commercial corridors such as those along N. Texas Street and W. Texas Street should have abundant wired infrastructure. Light and utility poles should be wired as well as buildings and public spaces.
4. ***New Developments:*** Building on policy changes the City is currently effecting, Fairfield should condition new real estate development with network infrastructure. At very least all new developments should include conduit and vertical assets. Ideally, developers should deploy fiber. All of these assets

should be deeded to the City along with sidewalks, streets, water, and other infrastructure.

5. ***Water Facilities:*** Fiber and wireless assets should be incorporated into water projects. Two (2) 2-inch conduits should be a minimum specification for any new mains, and a single conduit should be included with anything smaller. The City should consider placing backbone fiber cables with all water mains, too. Deploy wireless low-power wide-area network interfaces with sensors and servo controls as part of the Water Division's SCADA system.

ROADMAP TO ACHIEVE THE NETWORK VISION

The City of Fairfield should take a holistic approach to development of a citywide broadband infrastructure to enable economic development and growth in support of the City's vision of being a top-tier city in California and the region. As mentioned earlier, Fairfield's leadership has two primary options on its approach: whether to passively wait for investment, or selectively and strategically focus its investment spending, leveraging those efforts with contributions in capital and services from the private sector. Magellan believes the latter approach is more likely to succeed.

To achieve this, with appropriate planning and proper incentives, the City can leverage those investments by collaborating with private entities to enhance broadband capabilities and increase fiber connectivity for its own operations, and for businesses. Using its own capital spending, streamlined processes and offers of use of City assets, Fairfield could negotiate with private entities for complementary investment. While the providers have expressed little interest in Fairfield capital investment without the promise of immediate return, creative negotiations would likely tip the balance and spur investment. Longer-term, that combined investment can reduce Fairfield's operating costs and, by enabling more broadband choice for local businesses, enhance perception of the City's support for businesses.

Fairfield's Information Technology (IT), Public Works (PW), and Community Development (CD) groups should form a Leadership Team in detailed planning of this roadmap. Besides internal City groups, efforts at building synergistic support for this roadmap should also include Solano County, especially their PW and IT groups.

Roadmap suggestions for the leadership team include the following, which can be performed in parallel, or in specific sequence yet to be determined. During all these steps, Fairfield should keep in mind the driving principle behind the roadmap: that City assets, policies, and any offers support the expansion of the network, with contributions both from the City and from private providers.

New Policies

First, Fairfield can implement new policies to encourage investment. Fairfield has many advantages in creating a set of incentives for complementary private investment. Fairfield controls its right of way and can influence private sector behavior via permitting.

1. Accelerate New Policy Implementation – Implementing new policies quickly can create incentives and spur private sector behavior.
    - Dig Once with Joint Trench – with this policy implemented, the City can leverage its current public works capital plans, Caltrans projects, improvements along train lines, and road improvement projects. The City can offer the opportunity for private providers to place their own fiber and conduit while streets are open and these projects are performed, at a small fraction of the costs the providers would pay on their own.
    - Development Agreements – Modifying the standard Development Agreements to require conduit be placed within new developments could reduce costs for laying fiber for providers. Many other cities have done this, either in specific development zones, or on a blanket basis citywide.
2. Asset Use and In-Kind Exchange – The City has a wide variety of assets for which it could offer licenses to use in exchange for fiber investment by private companies. The City could offer discounted use of assets in exchange for encouraging offering of more, or less expensive broadband plans.

New Revenue Streams

Fairfield may also look to create new revenue streams utilizing existing assets. By implementing License Agreements and other policies that Magellan has assisted in developing, the City will see new revenues from recurring annual fees paid to City in return for rights to mount 5G attachments on streetlights and other City-owned vertical assets, such as towers. 5G attachments, due to their technologies, will require greater density than 4G and other macro attachments. The City has a significant number of streetlights.

While the FCC safe harbor amount is $270 per pole per year (an amount that cannot be challenged by a wireless carrier), many municipalities in California have successfully negotiated higher annual fees. The City is currently undergoing processes to develop fees that are commensurate with the costs of maintaining the streetlight inventory and other direct costs related to supporting the program. Additionally, should the current FCC rulemaking be overturned as a result of the ongoing appeals process, much higher annual license fees could be charged, generating additional revenue that the City could then reinvest into City-owned broadband assets such as conduit and fiber. Discussions about in-kind

arrangements in which Fairfield grants mounting rights for 5G attachments on streetlights in return for investment in additional fiber and conduit infrastructure will also be considered as these agreements are negotiated.

Guiding Investment and Partnership Considerations

Fairfield should explore opportunities to partner with companies interested in entering or expanding their presence in Fairfield. Common, a wireless ISP based in San Francisco, represents a prime partnership opportunity for Fairfield. Zayo has key assets in the area and has expressed interest in partnering with the City to expand their presence in the market. CenturyLink and Sonic, both of which provide retail wired broadband services, are also willing to consider investing in the area if the City acts as an anchor tenant and brings in other local public agencies. SiFi has discussed deploying fiber infrastructure in Fairfield. There are several wireless ISPs in the area that are interested in expanding. Lastly, although the cellular providers have said they have no plans to expand in Fairfield, such investment is practically inevitable. The City should methodically develop all of these relationships with an eye towards either generating revenue from the providers as customers or partnering with them to develop network infrastructure.

Fairfield can also initiate a program to aggregate local demand. By polling local businesses, and developers in new areas, Fairfield can present pockets of demand that can tilt the investment decision for private providers. Providers are always looking for concentrated pockets of demand which help them internally justify an investment. Coupled with the incentives suggested earlier, providers may choose to invest in new infrastructure. A variant of this is for Fairfield to approach the Fairfield-Suisun Unified School District (FSUSD) to determine whether the schools may look for complementary broadband services alongside CENIC.

Efforts to seek investment from providers may be led by the City's Community Development department. Additionally, the City could consider issuing an RFP to identify and evaluate the available partnership opportunities with interested parties such as Common Networks, Sifi, Zayo, and others.

Opportunistic, Incremental Expansion

Fairfield should focus on opportunistically expanding its own conduit network. As public works and traffic initiatives proceed, Fairfield could choose to install new conduit at very small marginal costs to the overall costs of the project. The conduit could then be leased to local providers or other businesses. In addition, the conduit could be used to offer access to providers to install their own fiber. Shared conduit, with dedicated fiber, can create much competition, improving options, and improving the price / value metric for broadband offerings.

Fairfield should take advantage of opportunities to expand its own fiber network assets through joint build with other entities doing work in the public right-of-way. As with the opportunistic expansion of conduit assets, there will be significant cost savings if opportunities arise in which the City can lay conduit or fiber. Projects to be considered for such incremental, opportunistic expansion include:

- ***Wireless Carriers:*** Because the deployment of 5G requires additional fiber for backhaul, major carriers such as AT&T, T-Mobile/Sprint, and Verizon are likely to be performing extensive work in the public right-of-way over the coming years. Fairfield should discuss each providers' deployment plans when negotiating License Agreements to gain an understanding of how that work matches with the Network Vision, negotiating joint build considerations when possible.
- ***Utilities and Other Entities in the PROW:*** In coordination with implementing the Dig Once ordinance, the City should implement practices that align with its purpose, including holding quarterly meetings with utilities and other entities doing work in the public right-of-way to discuss potential joint build opportunities. The City should determine its approach to taking advantage of these opportunities as they arise including how costs will be split and a method of setting aside funds to be used for that purpose. In addition to the quarterly meetings, the City's permitting process should be updated to include a review for potential broadband joint build activities, with IT and Public Works actively involved in evaluating each opportunity.
- ***Development Agreements:*** IT and Public Works should also be involved in the review of development agreements. In many cases, it may be appropriate to negotiate the installation of broadband infrastructure to connect newly constructed areas of the City. These also present opportunities for the City to deploy new conduit and/or fiber.
- ***Capital Projects:*** Broadband should also be a major consideration in any capital projects being planned by the City itself. Roadwork, water projects, and a variety of other activities present prime opportunities for conduit and/or fiber to be place in open trenches. Any instance in which the City is digging at least 24 inches is a prospective joint build project. As with other joint build opportunities, the City should develop processes for IT and Public Works to review all capital projects that may be opportunities to expand the City's broadband infrastructure, making technology an integral part of planning and prioritizing projects.

The routes included in the Network Vision map should be priorities, with City facilities connected first. In order to respond to joint build opportunities, the City of Fairfield could consider keeping a fund available for piecemeal fiber expansion projects to be pursued. A Broadband Fund may be established for this purpose and

any revenue generated from the leasing of other assets such as streetlights and conduit could be deposited for reinvestment.

Funding Sources

Federal and State Grants and Loans

Fairfield should pursue state and federal funding to leverage its capital expenditures. Generally, Fairfield should be prepared to apply for and monitor broadband funding opportunities. Several funding programs are being defined now for next year. We expect new sources of public funding to develop. Specifically, the City should consider the Department of Commerce Economic Development Agency ("EDA"), Economic Adjustment Assistance Program, from the CARES Act.

The CARES Act was passed in 2020 to assist communities with the COVID-19 crisis and appropriated additional funding to the tune of 1.5B for the Federal Economic Development Agencies Economic Adjustment Assistance Program, distributed by region. No funding deadline exists, and the funding will be highly competitive to local governments and universities. This is a short-term opportunity, Fairfield should thoroughly read the Notice of Funding Availability (NOFA) and contact its regional representative for next steps in developing an application. If the City doesn't pursue this opportunity, it should at least consider it an example of and template for future funding opportunities, and prepare accordingly.

Municipal Debt Financing

Fairfield can also consider debt financing, as either general obligation or revenue bonds. Portions of the proposed routes could be funded via debt financing, including downtown, northeast near Travis Air Force Base, and in the southwest section. Debt financing is certainly an option for broadband expansion in later phases once specific designs and plans are completed.

Local governments and their development authorities regularly issue general obligation bonds and revenue bonds to finance infrastructure. Several communities across the country have used this option to finance broadband. There have been federal legislative efforts to explicitly allow private activity bonds to be used for qualified broadband projects and to provide for tax credit payments to issuers of tax-exempt bonds used to finance broadband infrastructure projects. While networks do not qualify as exempt facilities under the U.S. tax code, related infrastructure such as water and sewer do. Bond issuances are very labor-intensive and require detailed plans as well as support of public officials. While they may be legally and politically difficult, bonds can be an effective means of drawing in outside investment.

Private Equity Funding

Lastly, private equity and public market financing has been used to build many networks. Fiber is a valuable real asset, particularly when it interconnects metro areas, provides route diversity, or enables providers to reach under-served markets. Internet service providers are conduits for this investment, but investors may be interested in owning fiber infrastructure. Opportunity Zones, real estate investment trusts, and similar investment mechanisms can also be conduits for private investment in local broadband infrastructure. Grant funds and local public investment can and should be used as catalysts for private investment.

NEXT STEPS

1. ***Complete, adopt, and implement improved policies for network asset development.*** With Magellan Advisors' assistance, the City of Fairfield has developed guidelines and standards for wired and wireless infrastructure, the template for a Master License Agreement for use of public assets for wireless services, and a Wireless Ordinance. Fairfield's policy team, including staff from Public Works, IT, Community Development, and the City Attorney's Office, should finalize the draft documents, circulate these to providers for their review, and submit to City Council and the Planning Commission for approval.
    - Finalize documents with review from City Attorney and leadership
    - Submit for industry review and collect feedback
    - Take documents to Planning Commission and to Council for 1st/2nd reading
    - Determine costs for licensing fees based on cost of permitting and maintaining assets
    - Determine approach to encroachment including cost sharing structure for joint builds
    - Negotiate Licensing Agreements with carriers

2. ***Designate a department and position to coordinate and lead network infrastructure development.*** Someone within City government needs to take ownership of and be accountable for network development to succeed (i.e., achieve the network vision described in this plan). The activities necessary for success do not align fully with any one department's purpose. While Public Works would surely lead any development of City-owned assets and IT would use them for internal connectivity, Community Development seems to be the best overall home for coordinating network development as it depends of external partnerships and implementation of development-related policies.
    - Designate a department to lead execution of this Plan
    - Maintain an inventory of existing assets such as conduit and streetlight poles that could be offered for use by broadband providers

- Retain GIS files (provided by Magellan) of the Network Vision to be referenced during permitting and development processes

3. ***Develop and release an RFP for assistance developing, evaluating, and finalizing partnerships with providers.*** City personnel are fully employed with current responsibilities and lack the expertise needed to deal with providers. Therefore, the City should seek consultants to develop partnerships on their behalf. Magellan Advisors recommends that this process include a community survey and stakeholder interviews to ascertain requirements and willingness-to-pay as an input to partnership development.
   - Develop an RFP to solicit responses from interested parties
   - Solicit investment by aggregating demand among large anchor institutions and other businesses
   - Engage in conversations with interested parties including Common Networks, Sifi, and Zayo about their needs and business models

4. ***Enter non-exclusive agreements with partners to expand broadband in the City.*** The City should take a provider-neutral approach because, as the old saying goes, "everyone's money is the same." The overall goal should be to get as much investment as possible to cover as much of the area as possible, which generally means accommodating as many providers as possible. That said, partnerships involve shared effort, shared risk, and shared rewards. Companies that aren't willing to collaborate with the City can't be considered true partners.
   - Evaluate partnership opportunities using considerations provided in this report
   - Enter non-exclusive agreements with partners to expand broadband in the City

5. ***Evaluate and pursue investment opportunities that align with City priorities and the network vision described in this report.*** Direct investment by private-sector partners is just one means of developing network infrastructure. Fairfield can very economically deploy network infrastructure in conjunction with other capital improvements. There have recently been substantial federal and state funds available for broadband development, and we expect there to be much more. Network infrastructure can be a great investment for municipal bonds and private equity. All of these investments are complementary: The prospects for any one type of investment are increased by having other types. This reality reinforces our recommendation for taking a comprehensive, coordinated approach. Priorities should include connecting:

- City Facilities
- CCTV Cameras and Traffic Signals
- Commercial Corridors
- New Developments
- Water Facilities

6. ***Create workflows to review capital projects, permits, and development agreements to economically build network infrastructure.*** Changing internal processes can be hard work. Drive these changes by focusing on the outcome: More investment in more network infrastructure from more sources with the greatest possible return to the City and local taxpayers.
    - Establish technology and broadband infrastructure as an integral component of plans for City projects
    - Implement quarterly meetings with utilities and other entities working in the public right-of-way
    - Establish processes for IT and Public Works to review permits, development agreements, and capital projects for broadband expansion opportunities
    - Map all capital projects, commercial developments, moratoriums, and permits in the public right-of-way

7. ***Set aside funds for deploying additional conduit and fiber as opportunities arise.*** Budgetary discipline can be even more challenging than changing processes but having a modest network infrastructure fund can be critical for economical network development. The time required to approve and allocate funds will likely result in many missed opportunities to develop infrastructure at a fraction of what it would cost to develop on its own.
    - Consider reinvesting funds generated through 5G license agreements for the use of vertical assets
    - Maintain and use the fund according to cost sharing policy for joint build approach
    - Track federal and state grant opportunities for expansion of broadband infrastructure including EDA, FCC, and CASF funds.

8. ***Involve the County, other local institutions, and regional stakeholders in network development efforts.*** There is strength in numbers. By aggregating and cultivating demand, the City can attract much larger investments. The benefits and value of network infrastructure multiply with every organization and site connected. Involving other stakeholders minimizes risks for private investors and providers and is often a key consideration in federal and state funding. By

leading local and regional network planning efforts, the City of Fairfield positions itself to get the most investment and largest benefits from broadband development.

- Create a regional broadband working group that includes representatives from public agencies, community anchors such as schools and hospitals, public safety, transportation partners, and representatives from the business community
- Leverage the demand and assets of these parties to attract additional investment from interested broadband providers
- Develop a regional vision that targets areas for investment and strategies for expanding infrastructure using the guiding principles of this Plan.