City of Palo Alto (ID # 12118)

Utilities Advisory Commission Staff Report

Report Type: New Business **Meeting Date: 4/21/2021**

Summary Title: Fiber Network Expansion Project

Title: Staff Recommends That the Utilities Advisory Commission Recommend the City Council Review and Provide Direction on Fiber Expansion for the City

From: City Manager

Lead Department: Utilities

Recommendation

Staff requests that the Utilities Advisory Commission (UAC) recommend that the Council:

1. Develop a community engagement platform including a broadband survey for residents and businesses;
2. Combine Phase 2 and Phase 4 of the Magellan contract to provide detailed engineering design of the City's fiber backbone and fiber-to-the-home (FTTH);
3. Explore public-private partnership opportunities and models for FTTH; and
4. Evaluate federal and state grant funding options for broadband infrastructure.

Executive Summary

On October 5, 2020, the City amended the contract with Magellan Advisors to accelerate the Fiber-to-the-Home (FTTH) business plan as part of the City 's Community and Economic Recovery workplan. As a result of the pandemic, the importance of affordable, fast, and reliable broadband service at homes and businesses became more apparent for telework, remote learning, telemedicine, and E-commerce. Magellan has completed the high-level design of the FTTH network and a broadband market assessment by small neighborhoods. Magellan has also developed cost and revenue models and different deployment scenarios ranging in costs from $22 - $28 million for the fiber backbone expansion and an additional $86 - $98 million for FTTH, depending on whether there is a public-private partnership and on the number of premises passed during the initial deployment.

Background

Since the early 2000s, the City has evaluated various business plans, construction cost estimates and operational models (including public-private partnerships) to expand the City's dark fiber network for citywide FTTH. Due to numerous factors, the City has been unable to move forward with implementation of citywide FTTH; nevertheless, given the essential need for broadband service and the escalating interest in deploying symmetrical gigabit-speed fiber

networks across the country, the City believes there may be renewed opportunities to build an all-fiber network in Palo Alto capable of serving both commercial and residential customers.

In 2001, the City Council approved a Fiber-to-the-Home ("FTTH") trial to determine the feasibility of providing citywide FTTH access in Palo Alto. The FTTH trial passed 230 homes and included 66 participants in the Community Center neighborhood. The purpose of the trial was to test the concept of fiber-to-the-home. The FTTH trial proved technical feasibility, but when initial investment and overhead expenditures were included in the calculation to create a business case, it was not profitable for the City and the trial was ended.

In 2006, the City issued a Request for Proposal (RFP) and negotiated with a consortium of private firms to build FTTH under a public-private partnership model. In 2009, Staff recommended that Council terminate the RFP process and negotiations due to the lack of financial resources of the private firms.

In 2013, the City Council decided that an important next step in advancing FTTH in Palo Alto was to develop a Fiber-to-the-Premises Master Plan and Wireless Network Plan, which recommended network designs in an engineering study with cost models and business models to deploy fiber and/or wireless networks. The Council initiative was titled "Technology and the Connected City." These plans were intended to establish a roadmap for either a third-party telecommunications service provider or the City itself building a citywide FTTH network and/or wireless network. The City Council also directed the City Manager to appoint a Fiber and Wireless Citizen Advisory Committee (CAC) to work with City staff on the Technology and the Connected City initiative. The Committee provided feedback regarding the development of fiber and wireless expansion plans.

In September 2015, staff presented a Fiber-to-the-Premises Master Plan and Wireless Network Plan to the City Council (Staff Report #6104). Staff and consultant recommended that the City should not directly pursue provision of retail services through FTTH. Instead, the recommendation was to issue a request for information to explore a public-private partnership structure. Under the partnership model, the City would build, own, and maintain the fiber infrastructure and engage with a private Internet Service Provider(s) to manage FTTH enterprise's operations and provide retail sales. Once again, staff recommended that Council terminate the RFP process due to the lack of financial resources of the private firms.

In August 2017, staff presented options to the City Council to pursue a conceptual plan for a municipal Fiber-to the- Node (FTTN) Network for fiber and broadband expansion (Staff Report #7616). Staff issued the FTTN RFP in June 2018 but did not award a contract because there were no viable responses.

In September 2019, staff reissued a new RFP for fiber network expansion aligning fiber with other City projects. The fundamental design principle was to fully leverage expansion of the fiber network to support a communications platform for Advanced Metering Infrastructure

(AMI), Supervisory Control and Data Acquisition (SCADA) system, and wireless communication for City Operations. This proposed approach would also become a springboard for FTTH because the City will be adding new telecommunication infrastructure which may reduce the incremental cost to extend fiber to the home.

The scope of work for the RFP was broken out into 4 phases as follows:

- Phase 1 - High-Level Design and Cost Estimate for AMI, SCADA, and Wireless Communications for City Field Staff and Other City Services
- Phase 2 - Detailed Engineering Design and Cost Estimate for AMI, SCADA, and Wireless Communications for City Field Staff and Other City Services
- Phase 3 - Business Case and High-Level Design for Fiber-to-the-Premises
- Phase 4 - Detailed Engineering Design and Cost Estimate for Fiber-to-the-Premises

Discussion

For the citywide high-level fiber backbone design, Magellan sought input from internal departments including Utilities, Public Works, Office of Emergency Services, Transportation, Information Technology and Community Services. The new citywide fiber backbone will connect and dedicate fibers to each department under a new high-capacity 432-strand fiber network. There are also fibers dedicated to commercial dark fiber and potential FTTH. The backbone is routed through neighborhoods and business districts to reduce FTTH costs. In addition, Utilities requested cost information for creating a new and separate 144-strand fiber backbone network to support electric substations, AMI, and SCADA for reliability, redundancy, and security reasons. The estimated cost of the two fiber backbone networks is between $22 million and $28 million depending on construction method, including the number and size of the fiber conduit. Pole replacement fees were not included in the estimate because pole loading analysis is not scheduled until phases two and four of the project. Expansion of the fiber backbone will provide the following anticipated benefits:

1. Electric utility modernization for AMI collectors and SCADA switches;
2. Smart City infrastructure supporting Emergency Preparedness, Public Safety, Transportation, Parks, and Parking;
3. Commercial dark fiber leasing; and
4. FTTH Broadband.

Business Case

The high-level question asked in the business case is: what will it take to make this business sustainable? Financially, the goal of Magellan's business case models is to determine at what point a business breaks even or becomes profitable. The "take rate" is a measure of how many subscriptions have to be sold and at what price. Obtaining viable market share and acquiring new customers is necessary to sustain a City FTTH offering. Maintaining the viability of the existing dark fiber offering is important to CPAU to avoid erosion of the customer base and existing revenues (approximately $2 million in net revenues per year).

Magellan established the FTTH business case goals by asking key questions such as: what are the minimum sustainable take rates for success citywide? What is the effect of market dynamics? What is the optimal fiber route and construction method to reduce cost of deployment? What is the ongoing impact of competition?

The first step in deploying fiber citywide is the Phase 1 project deliverable to identify costs and create a high-level design for a fiber backbone to support electric substations, AMI, SCADA, and wireless communications in the field. The citywide fiber backbone would be constructed to allow for the addition of FTTH deployment at a future date, depending on Council approval of subsequent phases of the project. Magellan provided a high-level analysis of the construction methods and costs for the citywide fiber backbone as follows:

- Total fiber backbone project
  - 65% underground construction
  - 35% aerial construction
  - 44 miles of total fiber construction throughout City
  - 432-count loose-tube fiber cable for City departments, fiber enterprise and broadband expansion
  - 144-count loose-tube fiber cable for electric, to support reliability, redundancy and future grid modernization growth
  - Construction sequencing to be determined in detailed engineering design (phases 2 and 4)

- Underground Construction
  - Directional drilling for the vast majority of the project
  - 24” to 36” depth unless Palo Alto has a greater depth requirement
  - 12” separation from other utilities unless Palo Alto has a greater separation requirement
  - Soft and hard surface restoration, erosion control per City standards
  - Detailed engineering design (phases 2 and 4) will codify all City requirements

- Aerial Construction
  - Strand and lash or installation of fiber in aerial duct
    - Pros
      - Aerial duct may protect fiber better from squirrels or other environmental damage
    - Cons
      - More difficult to cut into for access along fiber routes
      - May raise future costs of expanding the network due to additional labor required to cut the aerial duct for new access points

        - More visible on pole lines as it is thicker than strand and lash (One inch compared to two inches)

- Major Construction Cost Drivers
    - Total backbone construction between $22M - $28M depending on the conduit size chosen (2" versus 4")
    - Recent labor and materials rates from several qualified construction contractors with experience in the Bay Area
    - Underground directional drill labor – average rates
        - 2 2" Duct - $78.85/foot
        - 3 2" Duct - $97.59/foot
        - 1 4" Duct - $86.35/foot
        - 2 4" Duct - $131.41/foot
    - Underground labor accounts for 60%-70% of the total project
    - Total labor accounts for 85% - 90% of the total project
    - Final pole analysis and replacement costs need to be solidified to determine any additional costs for aerial

The Business Case evaluation for a FTTH deployment reviewed two models available to the City when considering a potential citywide fiber deployment: (1) City Internet Services Provider (ISP) and (2) Partner ISP. Magellan has identified specific advantages and disadvantages for each model as follows:

1. <u>City ISP</u>

Advantages

- City has total control over how internet services are provided to the community
- Control over pricing to residents and business
- Ownership of network affords the City a long-term asset to use for other applications
- City has access to low cost of capital

Disadvantages

- High execution risk and a steep learning curve
- City culture not accustomed to operating in a competitive environment
- Potentially higher operational cost structure
- Possible impact to City's debt rating

2. <u>Partner ISP</u>

Advantages

- City does not have to provide internet service
- No competitive, operational, or regulatory risk
- Ownership of network affords the City a long-term asset to use for other applications
- City has access to low cost of capital

Disadvantages

- City is responsible for most of the capital investment
- City has little control over actual services, yet provides most of the investment
- Relatively new model without track record
- Possible impact to City's debt rating

The financial models for a FTTH deployment were developed with consideration for two different models, City ISP and Partner ISP. The Partner ISP is a model where the City would enter into an agreement with an ISP to provide Internet services to residents.
Each model was developed to identify the overall costs, revenue projections, cost projections, debt requirements, renewal and replacement requirements, and a financial analysis determining both cash surplus and break even (in years). Also, Magellan developed a cash balance sensitivity analysis for each model based on varying take rate percentages, construction costs, and operating margins. Multiple construction contractors were contacted for construction bids and an average of these bids was calculated resulting in the following detail and summary table:

Capital Expenditure	City ISP (32% Take Rate)	Partner ISP (43% Take Rate)
Fiber Feeder Distribution	$65,871,477	$65,871,477
Fiber Drops	$9,017,280	$12,116,970
Data Center & Headend	$6,880,000	$2,500,000
Home Equipment & Installation	$3,870,000	$0
Business Equipment & Installation	$333,824	$0
Total Capital Costs	$85,972,581	$80,488,447
FTTH Working Capital Set Aside	$12,500,000	$6,000,000
Total Funding Required	$98,472,581	$86,488,447

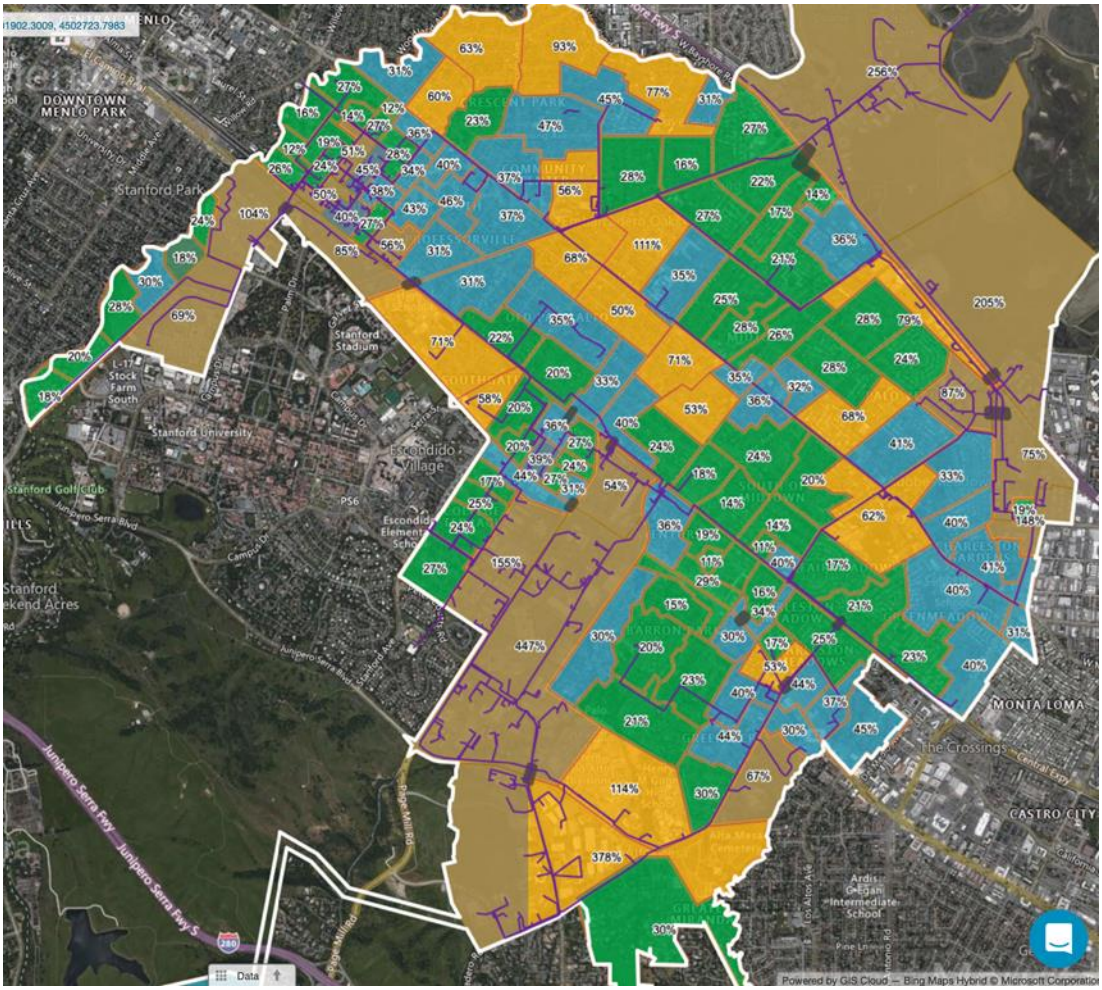
Key findings for both the City ISP and Partner ISP model were identified and listed by Magellan:

- Both models work under different circumstances
- Full buildout to 100% of homes in the City
- Reuse of existing fiber and deployment of new fiber backbone to serve business customers

- Companion capital projects, abandoned gas, undergrounding provides some value to reduce overall costs over time, but only incremental and not significant
- 100% citywide buildout is more achievable under a City ISP model than a Partner ISP model, assuming:
    - 30-year debt financing at a 3% interest rate
    - Utilization of the $30M fiber fund for backbone and working capital
    - Network deployment over 5 years
    - Retail rates similar to current market rates
    - 30% - 35% take rates (residential and business subscribers)
    - Ongoing O&M costs achieve a 55% operating margin
    - $90M - $100M in funding required
- Partner ISP model is also achievable under the following assumptions:
    - 30-year debt financing at a 3% interest rate
    - Utilization of the $30M fiber fund for backbone and working capital
    - Network deployment over 5 years
    - Wholesale rates to partner at $30 - $45 per subscriber
    - 35% - 50% take rates (residential and business subscribers)
    - $80M - $90M in funding required
- Financial commitments are similar between the two models
- City ISP model is more financially sustainable than Partner ISP model but may come with higher operating and execution risks to the City, which may result in more downside financial risk than the partner model.
- However, Partner ISP model requires the City to provide nearly the same amount of capital yet relinquish control over how the network is deployed and operated

Although both models would deploy fiber to the entire City, an incremental approach to deployment could allow the City to first target the areas with higher potential take rates to help minimize the amount of funding needed at the beginning of the project. The revenue realized from the initial deployment could then be reinvested each year to build out more of the fiber network in subsequent areas on an incremental basis. This model would eventually cover 100% of the City.

The following map illustrates the take rates that would be needed in each area to achieve break even based on Magellan's analysis. The green areas of the map would provide service to 14,159 households and 1,118 businesses while requiring a less than 30% average take rate. The blue areas would provide service to 10,105 households and 1,685 businesses but require a take rate between 30% and 50% on average. The yellow areas would deploy service to the remaining 3,695 households and 713 businesses in the City but would require an average take rate of over 50% to break even. The brown areas of the map are mostly businesses that are currently being served by the existing dark fiber network (purple lines). Additional fiber would be deployed in these areas on a customer demand basis.



When considering the City ISP, the outsourcing or contracting of specific functions should be considered. Some broadband functions are core competencies and can be easily managed by the City, while other functions are new and can be outsourced where the City doesn't have the expertise in-house. Subsequently, outsourced functions have the potential to slowly be brought in-house through hiring and as City staff becomes more comfortable with the day-to-day operations of the fiber network.

Many cities that have undertaken a FTTH network deployment have outsourced procurement activities, construction management, network inspections and monitoring, network turnup and launch, sales and marketing activities, and customer support and installations.

Financing

Magellan and the City are exploring various financing options for FTTH. Options include different combinations of the Fiber Fund reserves, ongoing commercial dark fiber revenues, contributions from the Electric Fund and other City Departments for the backbone network related to benefits received from the expanded fiber backbone, Electric Special Project reserve funding, bond financing, special assessment charge, and shared cost with other CIP projects.

Funding the FTTH Expansion	CITY ISP	PARTNER ISP
Funding Required		
FTTH Capital Expenditures	$85,972,581	$80,488,447
FTTH Working Capital Set Aside	$12,500,000	$6,000,000
Total Funding Required	$98,472,581	$86,488,447
Available Funding		
Balance of Fiber Fund for FTTH Expansion	$17,500,000	$17,500,000
Loan from Electric Special Projects Reserve	$15,000,000	$15,000,000
Total Available Funding	$32,500,000	$32,500,000
New Funding Required	$65,972,581	$53,988,447

Market Assessment

To fully inform the FTTH business case, Magellan has undergone an extensive analysis of the existing Palo Alto broadband market. The market is served by two major national providers: Comcast and AT&T. Comcast reports 100% homes passed in Palo Alto using Cable based broadband. "Homes Passed" refers to the carrier's ability and proximity to serve homes and businesses. This does not mean that these carriers have service to all of these homes and businesses, but it does refer to their ability to do so in an expedient manner. AT&T reports up to 28% FTTH availability within Palo Alto. Both AT&T and Comcast offer up to 1 Gigabytes download speeds and up to 25% upload speeds. Other carriers offer DSL based and fixed wireless service. Notably, AT&T claims 10,000 FTTH homes passed and 900 FTTB businesses. These numbers refer to their ability to serve customers, not necessarily customers currently served. AT&T market advantage is its use of true fiber to the home technology.
Comcast's strong suit is its use of DOCSIS.1, a technology that allows them to serve customers over conventional copper wire at fiber speed, but a reduced operational cost to the carrier.

By national standards, Palo Alto is well served by AT&T and Comcast and by a small group of "boutique" providers such as Sonic.net. Pricing for a gigabit service is $95 for Comcast, $83 for AT&T and the City working with a partner is projected at $75/mo. Given the density of carrier services in Palo Alto, percentage of market share of "take rate" for a new entrant into Palo Alto Broadband market may range from 30% to 50%.

As with all business ventures, there is risk involved in all stages of development. The provision of telecommunication services comes with a series of risks that may make or break the business. The primary risks for the City arise from competing with a very aggressive private

sector industry that will fight to not lose a single customer. Private sector competition plus the City's ability to host and support a private sector offering are considered the greatest vulnerabilities of City-provided internet services. Three strong incumbents that pose a threat to a City-provided service include: AT&T (full city coverage), Comcast (full city coverage) and various smaller "boutique" carriers. These carriers will defend their market share by temporarily lowering their prices. The risks and liabilities to the City of being an Internet Service Provider are high, plus the startup and ongoing cost are high as well, but the bulk of the revenue would go the City. If the City engaged an outside firm to run the business, the City would have to share the profits with that business partner.

Policies

The City requested Magellan to perform an analysis of multiple telecommunications-related policies (Attachment A) to ascertain whether changes can be made that reduce construction costs and implementation time associated with fiber network expansion for the City of Palo Alto. Based on market research and input from staff, Magellan proposes the following recommendations.

- A Dig Once policy supporting full coordination in compliance with current ordinance provisions in Municipal Code Section 12.10.050 and 12.10.060 should be considered for adoption by the City Manager. Staff should focus on reaching out individually to the relatively few utilities that are not coordinating at present – the wireless companies and infrastructure providers. When the City participates in a project to install conduit it should pay reasonable incremental costs associated with placement of facilities for City use. Magellan recommends that Palo Alto authorize funding approval of $250k annually for future dig once shared excavation projects.
- For one touch make ready (OTMR), Magellan recommends that the City not act in advance of the California Public Utilities Commission (CPUC) rulemaking determinations for California, because it could expose the City to novel complaints and litigation expense.
- Magellan recommends that Palo Alto track micro-trenching efforts in other cities, as this construction methodology may have a further evolution. As broadband infrastructure construction teams evaluate the pitfalls of micro-trenching, improvements are likely to be implemented and may result in successful micro-trenching that could reduce construction costs and implementation time in the future.
- For multi-dwelling unit (MDU) housing access, Magellan recommends that CPAU implement a utility requirement that property developers include capacity for additional broadband providers to place additional fiber connections to serve residents of MDUs for new developments.

Next Steps

In order to proceed with a project of this magnitude, stakeholder buy-in and collaboration is essential. The City needs to know who the various stakeholders are and what they expect. The City's primary stakeholders are the residents and businesses. To understand these groups, Magellan will be designing a survey to collect essential data. The survey will seek perspectives and include very specific and detailed questions such a price sensitivity to service offerings. In synch with and beyond the broadband survey, the City will provide educational outreach and launch a community engagement platform regarding costs and benefits of the services offered.

Under phases two and four of the Magellan contract, Magellan will create a detailed engineering design to support network construction for both the fiber backbone and FTTH. Low level design will optimize initial routes and phases planned in the initial high-level design for cost, constructability, and complexity. Magellan will provide detailed fielding and walk-out of all routes to validate running lines, existing utilities, and constructability. Magellan will provide full make-ready engineering to determine costs for make-ready and pole replacement where required, as well as estimates on timeframes for these activities. The network design will call out methods of construction, cable sizes, vault locations, splice details, existing infrastructure, and slack locations. It will also identify all laterals, drops, and building entrances. For FTTP, Magellan will include optimal hut locations for fiber distribution and will allocate specific fibers for future broadband usage throughout the City. The design process will assess optimal redundancy modes for both the City's internal networks and FTTP networks to ensure high redundancy is always planned for in the design.

Magellan will assist the City with exploring opportunities for public-private partnerships with incumbent and/or new broadband providers and other local municipalities. Some of the key questions that will be addressed include:

- How will joint investment in broadband infrastructure be accomplished between the City and private sector organizations?
- What legal and operational structures should be considered by the City and private sector organizations in using the City's proposed infrastructure?
- How will the City balance private sector goals of revenue growth and profitability with public goals of providing affordable and available broadband services across the City?
- How will future system expansion be handled between the City and private sector providers, and what contributions will the parties make to this infrastructure?
- How will the City maintain neutrality and open interconnection policies with private sector providers, promoting a competitive environment that benefits the City's broadband user base?
- How will an oversight and management board be structured, who will seat the board and what powers and responsibilities will the board have to the project?

In addition to the American Rescue Plan, Magellan will assist the City in monitoring and pursuing federal and/or state funding for broadband infrastructure. Potential grants could be

used for broadband infrastructure deployment, affordable broadband programs, distance learning, telehealth, digital inclusion efforts, and broadband adoption activities.

Resource Impact

Funding for phases 2 and 4 of the detailed engineering design to support network construction for both the fiber backbone and FTTH is approximately $2 million. $500,000 will be funded by the Electric Fund and $1.5 million will be funded by the Fiber Fund. In addition to the detailed engineering design, Magellan will develop a community engagement platform, conduct residential and commercial broadband survey, and search for public-private partnership opportunities as tasks under Council-approved Phase 3.

Attachments:

- Attachment A: Telecommunications Policy Report
- Attachment B: Presentation

Attachment A

CITY OF PALO ALTO, CA

Broadband Policy Report

Magellan ADVISORS

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NOVEMBER 2020

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1. Background

THE PROJECT

The City of Palo Alto, through its utilities department, has operated and maintained an existing fiber-optic network for more than twenty years. The City of Palo Alto Utilities (CPAU) fiber network supports the broadband communications needs of the City and anchor institutions, such as schools and libraries, and some large commercial businesses. The City requested review of certain telecommunications-related policy areas as part of its overall project to prepare design and cost estimates for fiber optic networking expansion options including support for AMI, SCADA and wireless communications for Public Safety, Utilities and Public Works field staff.[1]

The City's "long-term goal"[2] is to provide for residents a citywide fiber-to-the-premises (FTTP) network for broadband communications. The intention is to use existing City-owned fiber optic infrastructure, including aerial and underground support assets, where feasible. This would involve work in public rights-of-way (PROW) and roadways, which in turn involves policy decisions regarding joint trenching ("Dig Once") and other construction methods ("micro-trenching"), "One-touch Make Ready" for attachment of communications facilities to utility poles, and standards for building entry to connect fiber optic facilities in the public right of away (PROW) to building premises. The ultimate focus of the policy review is to ascertain whether changes can be made that reduce construction costs and implementation time associated with fiber network expansion for the City of Palo Alto. Magellan Advisors performed such an analysis of these policy areas in concert with City Public Works and CPAU management staff, which is the subject of this Report. Magellan greatly appreciates the time devoted to this project by the managers and staff members of Public Works and CPAU.

OVERVIEW OF BROADBAND COMMUNICATIONS INFRASTRUCTURE

The term "broadband" refers to high-speed internet services that provide users high-speed data 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. Coax cable, DSL, fiber optic cable, WiFi and wireless are the primary broadband delivery systems used to meet these demands by connecting users to the internet. Six years ago, the Federal Communications Commission (FCC) considered then-

[1] City of Palo Alto Request for Proposal No. 176363, Fiber Network Expansion, Attachment B/Scope of Work, at page 5.
[2] *Id.*

existing demand for high-speed data and defined "broadband" speeds as at least 25 Mbps downstream and 3 Mbps upstream.[3] Many consider this definition to be inadequate and outdated. For example, more recently Governor Newsom set a "minimum broadband speed goal of 100 megabits per second download speed"[4] for the state which suggests the datedness of the FCC's definition of broadband speed. The COVID-19 pandemic has greatly accelerated the move of all aspects of life to the virtual online world through high-speed broadband connections.[5] The COVID-19 pandemic has greatly increased the importance of broadband for work, education and learning, health care, and delivery of government services.

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 is a basic requirement for essential connectivity necessary from the COVID-19 pandemic and 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

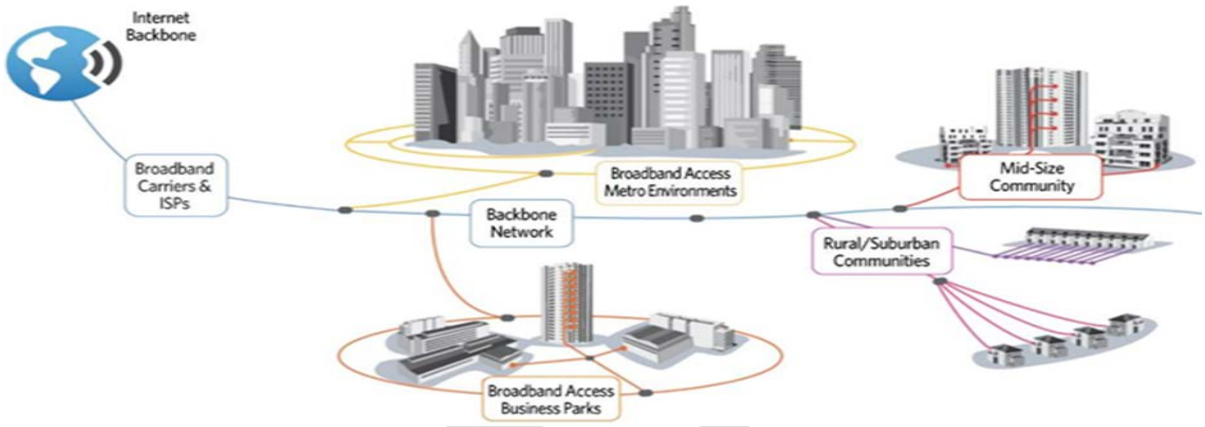
[3] 2015 Broadband Progress Report and Notice of Inquiry on Immediate Action to Accelerate Deployment; GN Docket No. 14-126, In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act; Federal Communications Commission, Released February 4, 2015. https://docs.fcc.gov/public/attachments/FCC-15-10A1.pdf

[4] Executive Order N-73-20; signed by Governor Newsom August 14, 2020.

[5] See, for example, Broadband for America Now, Jonathan Sallet, Senior Fellow, Benton Institute for Broadband and Society, October 2020, https://www.benton.org/sites/default/files/BroadbandAmericaNow_final.pdf and, What COVID-19 Underscores about How Broadband Connectivity Affects Educational Attainment, Johannes Bauer, Director, James H. and Mary B. Quello Center for Media and Information Policy at Michigan State University, Pew Charitable Trusts, December 7, 2020. https://www.pewtrusts.org/en/research-and-analysis/articles/2020/12/08/what-covid-19-underscores-about-how-broadband-connectivity-affects-educational-attainment

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 2-1. 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 connects 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 advertised speeds to users ranging from 100 Mbps and 10 Gbps. 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 2-2 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.

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Figure 2-2. Physical Bandwidth Capacity Comparisons

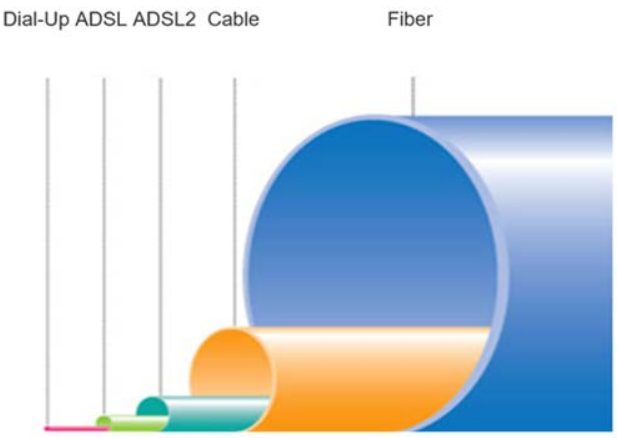
Dial-Up – 56Kbps
- *Legacy Technology*
- *Shared Technology*

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

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

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

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



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 increasing maturity of the network by 2035 where "the 5G ecosystem will have matured in terms of availability of equipment, deployment costs, and business case viability"[6]. 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.

[6] Study on Socio-Economic Benefits of 5G Services Provided in mmWave Bands, December 2018, GMSA, prepared for the ITU World Radiocommunication Conference, at p. 5. https://www.gsma.com/spectrum/wp-content/uploads/2019/10/mmWave-5G-benefits.pdf
See Also, The Impact of 5G: Creating New Value Across Industries and Society, White Paper published by the World Economic Forum, January 2020. https://www.pwc.com/gx/en/about/contribution-to-debate/world-economic-forum/the-impact-of-5g.html

- 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 frequency will work well in dense areas. This spectrum delivers the high speeds that are commonly associated with 5G in discussions.
- 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 trends indicate increasing private consumer adoption).

5G networks are distinguished from the present 4G technology by use of low power transmitters; 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, 5G wireless and fiber optics are considered to be complementary, rather than competing technologies.

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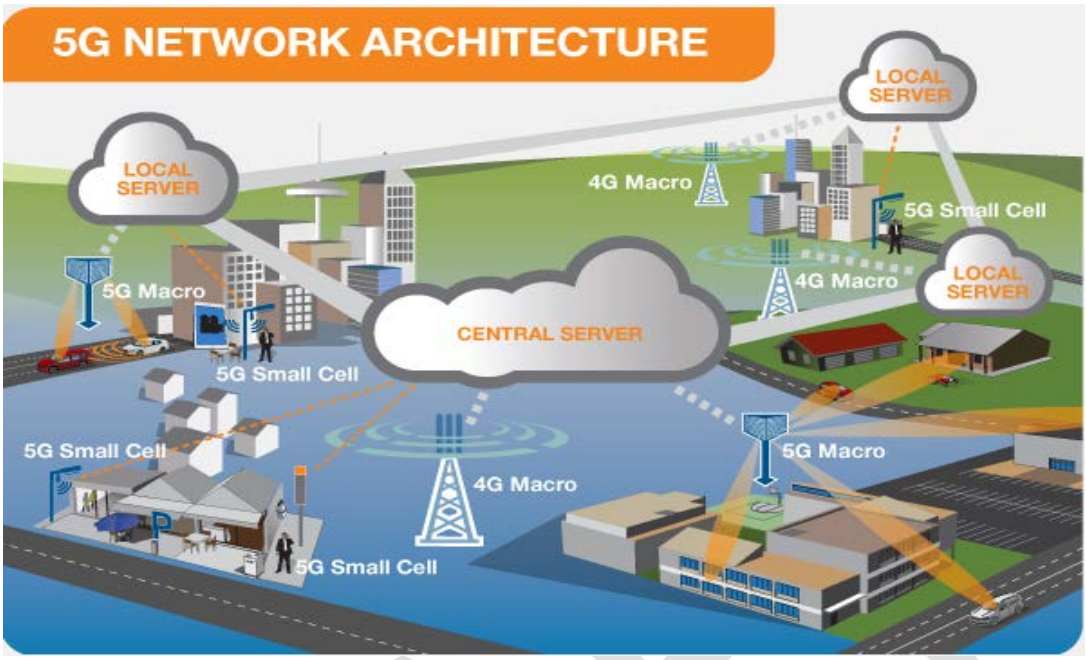
Figure 2-3. Diagram of 5G Infrastructure[7]



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."[8] The study estimates that the US investments in the range of $130 - $150 billion over the next 5-7 years in fiber infrastructure would be necessary to support the roll out of next generation wireless.

2. Dig Once/Joint Trench

The City of Palo Alto has stated a goal of "ubiquitous access to Gigabit-class broadband infrastructure".[9] Magellan Advisors is assisting the City in studying a multi-phase fiber optic network expansion plan which leverages the existing fiber network operated by CPAU. A phased approach to achieving FTTP can leverage the existing CPAU fiber network by adding fiber optic facilities in additional locations to support additional functions such as Advanced Metering Infrastructure (AMI), Supervisory Control and Data Acquisition (SCADA), and wireless communication for City field staff and other City services. The more robust fiber optic network can then be further leveraged under an approved business plan to extend FTTP

7 "EMF Explained 2.0", http://www.emfexplained.info/?ID=25916 , viewed February 28, 2021.
8 https://www2.deloitte.com/us/en/pages/consulting/articles/communications-infrastructure-upgrade-deep-fiber-imperative.html
9 City of Palo Alto Request for Proposal No. 176363, Fiber Network Expansion, Attachment B/Scope of Work, at page 5.

access on a citywide basis. To date, fiber has been extended to school district facilities. which brings fiber infrastructure closer to residential areas. Also, rebuild projects are ongoing for new aerial and underground ducts and conduit for fiber optic cables.

Fiber optic infrastructure includes conduit and ducts as well as the fiber optic cable and other infrastructure such as vaults, handholes and splice boxes. The fiber optic "glass" cable requires protection from environmental elements, cuts, natural disaster and being crushed. Use of conduits has evolved to provide this protection for fiber optic cables whether aerial or underground. Conduit sizes range from one inch in diameter to six inches or more.[10] Conduit facilities have a long life and provide "permanent" pathways for fiber optic cable where fiber optic cable can be easily re-routed or replaced if it becomes damaged or outdated.

Placement of these conduits, fiber optic cable and related infrastructure requires excavations and other work in the public rights-of-way (PROW). Such excavation inconveniences the public and damages roads and other infrastructure in the public rights-of-way. "Brownfield" excavations[11] to place fiber and conduit have numerous consequences and requirements especially in areas that already are developed with paved roadways and existing underground utilities. Additional "brownfield" excavations require notification of existing occupants of public rights way who must then locate and mark their existing utility infrastructure.[12] Excavation then occurs, cutting through existing paving and sidewalks (and hopefully not existing utilities by accident). Barricades, warning signage and covers must be deployed where people or vehicles may encounter the excavation. Every additional excavation creates risks of property damage, service outage, wasted public works resources, traffic disruption and accidents and an overall risk of negative impact on public safety and aesthetics. Without Dig Once coordination, these risks and consequences are worsened with each re-excavation. The object of Dig Once is to incur these risks only once and avoid future costs and risks from re-excavating any time a move, change, addition or upgrade of fiber facilities needs to occur.

Coordination among occupants of the PROW does occur today in Palo Alto – including the City's Public Works and Utilities departments, and jurisdictional utilities[13] (primarily through joint trenching agreements between the City and AT&T, Comcast and PG&E in Palo Alto).

[10] Conduit infrastructure has been used for copper telecommunications facilities as well and such conduit is significantly larger given the relative size differences of cables consisting of twisted copper pairs versus fiber optic cables.
[11] "Brownfield" in the telecommunications context means deployment of upgraded or added telecommunications facilities where network facilities had been previously deployed, i.e., deploying fiber optic facilities where copper lines had previously been deployed. "Greenfield" telecommunications deployment is installation of network facilities where none had existed before, i.e., to serve a new subdivision or office park.
[12] Placement of fiber optic facilities in any "Greenfield" environments can be managed through the developer.
[13] California Public Utilities Code Section 7901 grants telecommunications companies the right to place facilities in the public rights-of-way as long as they don't interfere with public use of those rights-of-way.

The City has municipal code provisions which require such coordination. Section 12.10 addresses street cut fees generally and includes requirements for "Coordination with City" (Section 12.10.060) and submission of "Utility Master Plans" (Section 12.10.050). Establishment of underground utilities districts (Section 12.16) also requires coordination and utilizes the joint trenching practices contained in the City's joint trenching agreements. Magellan Advisors reviewed these ordinance provisions and joint trenching agreements and how they are implemented in practice to assess what further policy steps, if any, could be beneficially taken by the City to extend the practice of coordination of work in the PROW.

THE DIG ONCE CONCEPT

"Dig Once" is defined as policies and/or practices that foster coordination among entities (especially utilities) that occupy public rights-of-way, to minimize the number and scale of excavations when installing infrastructure (especially telecommunications[14]) in public rights-of-way as well as reduce costs. The costliest part of construction of fiber optic facilities in the public rights-of-way is the excavation and placement costs for the underground support structures – the material cost of the fiber optic cable and conduit itself is a relatively small percentage of the total cost. Dig Once accomplishes the goal of minimizing costs of constructing separate trenches and facilities – via shared costs of construction. There are number of estimates of cost savings in different settings, all of which 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 install 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.[15] Several different types of construction costs can be reduced by sharing, including traffic control and personnel, engineering and survey costs associated with location of facilities, environmental studies, and restoration costs. Notably the savings enumerated above are only the initial savings – further savings occur each time additional excavation is avoided so costs are repeatedly saved into the future when spare conduit placed in the initial Dig Once project can be used or reused via innerduct.

Dig Once has numerous substantial benefits, including promoting and supporting the placement and expansion 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 over aerial construction (which has its own drawbacks). Repeated cutting of

14 There are a number of telecommunications providers that seek permission to encroach on public rights-of-way, including cable TV companies, incumbent telecommunications companies, competitive telecommunications companies, and wireless communications companies.

15 GAO 12-687R Broadband Conduit Deployment, June 27, 2012, at page 5. https://www.gao.gov/assets/600/591928.pdf

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roadways and sidewalks substantially reduces the lifespan, durability and performance of those surfaces and thereby wastes public resources. Furthermore, there is limited space in the public rights-of-way which is further diminished by each separate excavation and trench or facilities placement by the City and the public utilities that serve the residents and businesses. Numerous competitive telecommunications providers are deploying or seek to deploy their own conduit pathways and fiber in the PROW such that it is becoming more congested. As the PROW becomes more crowded the installation costs go up and choices of construction methods are reduced. Gaining efficiencies in use of the PROW becomes even more important as fiber optic cable is more broadly deployed to provide high speed "gigabit" services needed by residents and businesses alike as well as to support the intensive effort underway now to connect "5G" wireless antennas to provide the high speed, high capacity, low latency wireless services for consumers. Finally, 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 – fiber optic cable can be pulled economically at any time given the existence of conduit infrastructure.

There are several installation methods for conduit which include plowing (often used for long hauls and FTTH), directional boring (which is less disruptive of the PROW), trenching (which involves excavating the length of the route for the conduit), and aerial placement on utility poles. Joint trenching can be accomplished by coordination of plans when telecommunications providers open the ground for projects, on either a voluntary basis among PROW occupants or a mandatory basis required by the City.

Dig Once implementation requires a planning and coordination process for construction projects in the public rights-of-way. When subsurface utility work occurs, led by any occupant of the PROW, it presents opportunities using dig once policies for the City to install new fiber in the right-of-way at reduced costs via coordination of work. 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 cable whenever the ground is opened, as expressed in recent proposed Congressional legislation. This concept is embodied in the Broadband Conduit Deployment Act of 2019, which requires the inclusion of broadband conduit during construction of any road receiving federal funding.[16]

POLICIES AND PRACTICES IN PALO ALTO

16 The Broadband Conduit Deployment Act of 2019, H.R. 2692, May 14, 2019. It is anticipated that this will be included in the "Moving Forward Act" (H.R. 2 "Infrastructure Bill") when it is reintroduced in the current Congress. https://www.govtrack.us/congress/bills/116/hr2692

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The City has recognized the many potential benefits of Dig Once practices and has maintained an interest in staying current on Dig Once policies to provide for future opportunities. Since 2003 the municipal code has required coordination between the City and public utilities on planned work in the PROW, which has occurred to a certain extent. Also, five years or so ago Google Fiber pressed Palo Alto and other cities on expansion of Dig Once practices but that push has diminished as Google is no longer pursuing large scale fiber builds. However, fiber optic cable remains the "gold standard" for high speed "gigabit" broadband service. In addition, installation of 5G wireless antennas requires fiber backhaul facilities to connect those antennas to the landline network.

The City's municipal code provisions in "Street Cut Fees", Section 12.10, were adopted to incentivize coordination of work in the PROW in recognition of both the prospective benefits of Dig Once coordination and wasteful costs and degradation of paved streets from excavations.

- Section 12.10.050 requires each occupant of the PROW to prepare and submit a "utility master plan" that shows the location of that utility's equipment and facilities in the PROW that are anticipated to exist in the next five years, with annual updates to show "planned major utility works" that will affect streets and the PROW. These utility master plans are considered to be confidential and used only for purposes of coordination of work.
- Section 12.10.060 requires coordination of work between the City and a public utility for work involving construction in streets and the PROW. The intent is to coordinate work under the City's five-year repaving plan and the utility's five-year master plan. When two or more parties have a "major excavation" planed in the same block they are to meet and confer to consider the feasibility of a joint operation. Furthermore, the City shall request that sufficient conduit be installed to accommodate "reasonably foreseeable future business growth needs".
- Section 12.10.010 provides the purpose for the "street cut fee": "Excavations in paved streets owned and maintained by the city degrade and shorten the life of the surface of the streets, and this degradation increases the frequency and cost to the public of necessary resurfacing, maintenance, and repair. It is appropriate that entities responsible for excavating into the city's rights-of-way bear this burden rather than the taxpayers of the city. In addition, establishment of a street cut fee will create an incentive for coordination of efforts in excavating the streets to install, repair and replace subsurface facilities and utilities." Chapter 12.10 of the Palo Alto Municipal Code is necessary for those instances where coordination did not occur for whatever reason.

Good coordination of excavation projects has evolved to be regular practice in certain areas, especially internal to the City. City departments have been meeting monthly to coordinate

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activities under these provisions and five-year plans are coordinated between Utilities and Transportation. The City budget process has been helpful for coordination as well. Projects in the PROW also appear to be well coordinated among the City, AT&T and Comcast by virtue of the joint trenching agreement to support undergrounding of utilities. The "Master Agreement for Installation of Underground Facilities in the City of Palo Alto" between the City, AT&T and Comcast provides for joint benefits for each of the parties from joint trenching for defined projects. The "Trenching Agent" performs certain duties on behalf of all participating parties including preparation of all documents for design, construction and installation of facilities, contracting under applicable competitive bidding requirements, merging comments and suggestions regarding the plans and specifications, calculating and allocating costs based on defined formulas, securing all permits, and performing all required trenching activities (excavation, backfill, compaction, disposal and restoration of surfaces). The agreement presently provides that for projects where the City is the Trenching Agent it must secure prior approval of the City Council when the City's share of costs will exceed $85,000. In sum, coordination of activities in the PROW works reasonably well among City departments and the two main telecommunications providers under an existing master agreement – AT&T and Comcast.

Coordination of excavation projects could also extend to other third parties if those third parties received entitlements to install facilities in the right-of-way. Examples of third parties include wireless companies such as Verizon, AT&T Wireless and T-Mobile, as well as the infrastructure providers with whom they contract, such as Crown Castle, Extenet and Mobilitie. However, coordination of excavation practices are not necessarily easy to establish, given the need to receive entitlements prior to construction and also likely due to the inherently competitive nature of wireless telecommunications services.

DISCUSSION AND RECOMMENDATIONS

Magellan Advisors discussed Dig Once and joint trench practices extensively in team meetings including the City's Public Works and Public Utilities department management and staff. This discussion included review of existing City practices and its ordinance provisions regarding submission of utility master plans and major works, and coordination requirements as compared to Dig Once ordinances and policy documents from other California cities. The meetings were very useful to the understanding of the potential and importance of Dig Once concepts in the current environment where the City is expanding its fiber optic network and wireless carriers are seeking to expand 5G wireless coverage and associated fiber optic backhaul facilities. Also, the meetings helped identify opportunities to consider beneficial aspects of Dig Once coordination within the City, currently cooperating utilities and any additional PROW occupants such as the wireless service providers who need fiber optic facilities for backhaul.

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The City's current ordinance provisions regarding coordination with the City and utility master plan submission compare well with the other city ordinances that were reviewed. Coordination of work in the PROW in Palo Alto is also made easier by the fact that "all" utilities (electric, gas and water, along with fiber optic services) are provided by CPAU, which has been coordinating for some time with the Public Works department street projects. Palo Alto is unique in this regard as most work in the PROW is done by City departments and can be coordinated among these departments. Compared to other cities there are relatively few other external occupants of the PROW to coordinate with – in this case, essentially consisting of telecommunications providers such as AT&T, Comcast, and wireless service providers (or their infrastructure providers).

The City can reasonably expect that construction costs and implementation time for fiber network expansion could be reduced with greater coordination of activity in the PROW which would allow conduit placement – especially at the point installation of fiber optic cable occurs to connect 5G wireless antennas for backhaul purposes. There was consensus on the team that a more formalized approach to Dig Once could leverage greater coordination of capital projects. Similarly, there will be opportunity to coordinate with other telecommunications infrastructure owners within Palo Alto. Discussions were held about whether this formalization should be in the form of an adopted ordinance or a more streamlined policy document. The working group determined that a Dig Once policy document rather than an amended ordinance would be the best fit for the City of Palo Alto. The reasons for this are several:

1. The City already has an existing ordinance requiring coordination, an internal Dig Once practice based on that coordination requirement, and relatively few external utilities will be working in the PROW. The City ordinance requires coordination of work in the PROW among all occupants of the PROW and annual submission of master plans for facilities from each utility as well as planned major projects. The work that remains is to ensure that greater coordination happens, especially among the newer telecommunications companies adding fiber optic facilities in the PROW. It is not clear that this coordination would happen sooner or better if the existing ordinance was amended than if City management and staff undertook additional coordination efforts using a policy statement to encourage and offer coordination with the newer entrants such as the wireless providers and their contracted infrastructure providers.
2. A high level of coordination already exists between City Public Works and Public Utilities departments as well as the incumbent providers (AT&T, Comcast and wireless providers including Verizon), although admittedly this coordination could be improved. The City of Palo Alto is unusually well positioned to accomplish this, relative to other cities, since much of the work done in the PROW is by City departments (Public Works and Public Utilities) that are already coordinating their plans and work.

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3. It is reasonable to communicate with additional PROW occupants using existing ordinance requirements and new policy guidance to foster greater coordination of excavation projects before seeking to incorporate more mandatory provisions in an amended ordinance.
   Ordinance amendment is considerably more time consuming and expensive than adoption of a policy by resolution or by the relevant City department under existing authorities, and it is not clear that resulting coordination would be better or faster under an amended ordinance than a policy statement. Policies can be updated and clarified based on experience faster than an ordinance which is important for practices affected by rapidly changing technologies – such as telecommunications technologies. Changes in fiber optic and wireless technologies suggest the likelihood of repeated updates as technologies evolve, which makes reliance on policy the better option.

Magellan's recommendations are:

1. A Dig Once policy supporting full coordination in compliance with current ordinance provisions in Municipal Code Section 12.10.050 and 12.10.060 should be considered for adoption by the City Manager.
2. Staff should focus on reaching out individually to the relatively few utilities that are not coordinating at present – the wireless companies and infrastructure providers. The outreach should attempt to foster greater sharing of plans on a confidential basis recognizing that obtaining a five-year plan is not realistic in the wireless industry. Prospects should be reassessed after fulsome conversations with the providers to begin relationship building. Note that there are other reasons wireless providers should be communicating and cooperating including OTMR considerations at some point, and antenna placement generally.
3. The Public Works Department should continue regular meetings of the coordination committee to plan excavation projects affecting the PROW. All occupants of the PROW should be expected to designate a person knowledgeable in local projects to participate on the coordination committee. Attention should be given as needed to encourage participation of those PROW occupants who have not previously been regular participants in project planning and coordination. The Public Works Department is expected to lead the meeting and present major City projects to the committee and invite participation and coordination. Other participants should not necessarily be expected to share their plans with the coordination committee as some level of confidentiality may be required. However, these participants should share project plans with City staff outside the coordination committee meeting using appropriate confidentiality protections to facilitate City planning and realization of cost efficiencies and public convenience.

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4. The City should focus on creation and maintenance of a "coordination database" which will contain GIS data on existing facilities owned or operated by PROW occupants, as well as regular updates with information on upcoming scheduled excavation. It is crucial to verify that good data exists in GIS to support planning activities with data updates where needed to fill in gaps. The City can then use this coordination database for planning excavation projects. Restrictions on access to this data will be appropriate considering "critical infrastructure" requirements as well as competitive concerns that will require some confidentiality at least in some cases.
5. All permits issued for work in the PROW should require submission of final "as-built" drawings in GIS compatible format to keep the coordination database up to date.
6. When the City participates in a project to install conduit it should pay reasonable incremental costs associated with placement of facilities for City use. These reasonable incremental costs should be calculated to provide benefit and cost savings for each party involved in the project to ensure coordination and participation is mutually beneficial.
7. When opportunities are identified, it is important that Palo Alto be prepared to capitalize on them by installing conduit whenever an excavation occurs in a "major" excavation project. Magellan recommends that Palo Alto authorize funding approval of $250k annually for this purpose. Based on current market rates for conduit deployment, this would net 2778 linear feet (about half a mile) of conduit. Alternatively, the City may opt to grant the Utilities Director or other designee the opportunity to use funds from another account and then reimburse it either during budget adjustments or year-end adjustments. It may also be included in the existing fiber budget. The current funding threshold is $85k, expenditures above which require City Council approval. Increasing this threshold to $250k could occur in the future when City policy direction has been established and doing so would require a separate ordinance update. This funding could be drawn from the Fiber Optics Enterprise Fund.

3. Pole Attachments and "One Touch Make-Ready" (OTMR)

The great majority of utility poles in the City of Palo Alto (approximately 5400 out of 6000)[17] are jointly owned by the City and AT&T and administered under a Joint Pole Agreement. Approximately 150 of the remaining poles are jointly owned by the City, AT&T and PG&E. The remaining poles are owned by the City. In certain areas fiber optic cable owned by CPAU is attached to utility poles in the safety clearance space. Other attachers, such as Comcast or

[17] Streetlights and associated poles are owned by the City, and number approximately 6700.

other telecommunications providers, under the terms of an approved MLA also attach communications facilities to these poles or would be eligible to do so under an approved MLA. "Make-ready" work generally consists of moving or rearranging existing wires and attachments to make space for new attachers or attachments. Among other things, make-ready work frequently involves moving wires or other equipment attached to a pole to ensure proper spacing between equipment and compliance with electric and safety codes. The emergence of competition in telecommunications has led to disputes between pole owners and communications companies that desire to use the poles to attach their distribution facilities. Regulations have evolved to address complaints from competitive communications companies which allege excessive time and cost for pole attachments and related make-ready work.

POLE ATTACHMENT REGULATION[18]

Section 224 of the Communications Act[19] addresses the subject of pole attachments. Although Section 224 was originally aimed at pole attachments by cable companies, the Telecommunications Act of 1996 expanded the range of pole attachments covered under Section 224 to include attachments by providers of telecommunications services, which now include broadband internet access providers, and granted cable companies and telecommunications providers an affirmative right of nondiscriminatory access to utility poles. Section 224 confers authority to the Federal Communications Commission to regulate pole attachment rates, terms and conditions, establish regulations, and enforce its rules and decisions. However, Congress provided specific authority to individual states to regulate pole attachments by invoking the provisions of Section 224(c) to opt out of the federal pole-attachment rules. Under what is commonly known as the "reverse-preemption" provision, a state may regulate the rates, terms and conditions for pole attachments by certifying to the FCC that the state's regulations meet specified criteria. *See* 47 U.S.C. § 224(c). The State of California does have the full array of pole attachment regulations and has exercised "reverse preemption". The state regulates pole attachments through rules and regulations administered by the California Public Utilities Commission (CPUC).

The FCC made substantial modifications to its pole attachment regulations in a recent order.[20] The FCC revised its rules and regulations on pole attachment "make-ready processes," including establishment of a "one-touch make-ready" process. This process is

[18] 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.
[19] 47 U.S.C. §224.
[20] *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment, Third Report and Order and Moratorium*, WC Docket No. 17-84 and WT Docket No. 17-79, released August 3, 2018. ("Third Report and Order") https://docs.fcc.gov/public/attachments/FCC-18-111A1.pdf

aimed at removing barriers to broadband deployment. The FCC found that significant savings in time and money can be achieved through the adoption of a one-touch make-ready (OTMR) process that allows the new attaching entity to use a single, qualified contractor to perform all the "simple" make-ready work for wireline attachments in the communications space on the pole. The Commission intends this to eliminate much of the need for the coordination and work of multiple work crews to sequentially perform necessary make-ready work with respect to communications facilities owned by various attaching entities.

The distinction between "simple" and "complex" is crucial. The FCC defines "simple" make-ready work as that where "existing attachments in the communications space of a pole could be transferred without any reasonable expectation of a service outage or facility damage and does not require splicing of any existing communication attachment or relocation of an existing wireless attachment."[21] The FCC defines "complex" make-ready, as "[t]ransfers and work within the communications space that would be reasonably likely to cause a service outage(s) or facility damage, including work such as splicing of any communication attachment or relocation of existing wireless attachments."[22] Given this definition, OTMR is not available to be performed above the communications space – in the public safety or electric space. Furthermore, OTMR is not available where the work involves relocation or rearrangement of electric facilities or involves wireless facilities. The OTMR provisions applicable to qualifying "simple" make-ready work include:

- Establishment of qualifications for contractors, and encouragement of utilities to create a list of qualified contractors for use by pole attachers – otherwise, attachers may use the FCC qualifications to hire qualified contractors.
- Establishment of rules for determination of completeness of pole attachment applications, and related time limits for that determination.
- Reducing the role of existing attachers in the make ready process and giving asset owners and new attachers more responsibility for decisions and actions. Existing attachers still must be notified and given the opportunity to have representatives present when the work is done.
- Establishment of procedures to be followed if equipment is damaged.

OTMR allows the attaching service provider and approved contractors to perform all work needed to install equipment on the pole, including temporarily moving any equipment owned by the utility or other attachers, in a single trip to the pole. OTMR processes can be used when there is no reasonable expectation of a service outage or damage to existing equipment and no splicing and relocation of equipment. OTMR avoids what was in some cases months of waiting for each owner or attacher with equipment on the pole to move

[21] Third Report and Order, at paragraph 17.
[22] Third Report and Order, at paragraph 18.

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their assets individually. Various provisions of the FCC's OTMR order were appealed, but the Ninth Circuit recently found that the FCC acted within its authority in creating the new OTMR provisions.

"Secondary aspects" of the FCC OTMR regulations were challenged by various parties but the 9th Circuit Court of Appeals upheld the FCC's actions on this subject.[23] The OTMR rules therefore are applicable in the 29 states which do not have pole attachment regulations, but they are not applicable in California or the remaining 20 states which exercise their own authority over pole attachments. As described below, the CPUC is reviewing whether or not to adopt FCC-style OTMR regulations. It appears that some of the early OTMR activity at the CPUC included engagement by Google Fiber but it is not clear that the early level of engagement has continued.

POLICIES AND PRACTICES IN PALO ALTO

Magellan Advisors discussed OTMR extensively with Public Works and Utilities department management and staff, including discussion of FCC and CPUC pole attachment policies and practices. The Pole Attachment Standards of CPS Energy were also reviewed – CPS Energy serves the San Antonio Texas area, and may be the largest municipal electric utility in the US. CPS Energy has documented make-ready processes for "One Touch Transfer" which it developed under Texas law prior to the FCC's OTMR ruling. These processes closely resemble those adopted by the FCC.

Most of the utility poles in Palo Alto (5400 out of 6000) are jointly owned with AT&T under the terms of a Joint Pole Agreement. City of Palo Alto Utilities fiber is attached in the safety clearance zone on these utility poles, in space above other communications attachers. There is a stated process for handling attachment activity under the Joint Pole Agreement and the perception is that cooperation has been good for handling make-ready applications.

To date there has not been a high volume of make ready requests for new pole attachments. The volume is in single or double digits, and in clusters traceable to neighborhood activity. This level of activity appears to be well-managed within the Joint Pole Agreement process. There does not appear to be any surge of make-ready applications on the horizon, above current activity levels.

DISCUSSION AND RECOMMENDATIONS

Implementation of the FCC's OTMR regulations is occurring in the 29 states which have not exercised "reverse preemption" to take jurisdiction over pole attachment regulations.

[23] City of Portland v. United States, 969 F.3d 1020, 1049-1053 (9th Cir., 2020).

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However, California is one of the remaining states which has not yet implemented corresponding OTMR regulations — the CPUC has not yet concluded its regulatory process on utility pole matters. The CPUC has an open docket on utility pole issues[24] but has not yet reached any conclusions on OTMR. OTMR is a "track 2" issue, the CPUC-sponsored workshops for which have not yet started in earnest.[25] In particular, the issue of "should the Commission adopt, and if so in what manner, the FCC's One-Touch Make Ready rules" is an open issue with no progress to report from the investigation and rulemaking.

Magellan Advisors recommends that the City not act in advance of the CPUC rulemaking determinations for several reasons. First, there is not a high level of demand for OTMR in the City, so the benefits of undertaking development of OTMR processes and rules are likely minimal compared to costs. Second, undertaking the development of OTMR processes and rules now would likely expose the City to the costs of dealing with complaints and litigation on which it would be "going it alone" in advance of CPUC fact finding and decisions. OTMR in California is subject to some controversy and opposition that the CPUC is best suited to address, including opposition from unions and others to the FCC's OTMR based on various concerns including safety. Finally, Magellan Advisors does not see any present likelihood that introduction of a OTMR process would reduce construction costs and implementation time associated with fiber network expansion for the City of Palo Alto and in fact it would likely incur significant additional costs to develop and implement OTMR, without corresponding benefit.

4. Micro-Trenching

THE MICRO-TRENCHING CONCEPT

In recent years, "micro-trenching" has emerged as a new construction method for deploying fiber infrastructure. Whereas traditional standards call for fiber to be buried at least 24 inches below grade either with directional boring or trenching, micro-trenching uses thinner, shallower cuts averaging 8-10 inches in depth and 1-3 inches in width. Typically, these cuts are made either in the pavement, sidewalk or the joint between the pavement and guttering. Proponents of micro-trenching note that the shallower placement reduces construction cost,

[24] Order Instituting Investigation into the Creation of a Shared Database or Statewide Census of Utility Poles and Conduit in California, Investigation 17-06-027; and Related Matters, Rulemaking 17-06-028; Before the Public Utilities Commission of the State of California.

[25] Assigned Commissioner's Amended Scoping Memo and Ruling; Order Instituting Investigation into the Creation of a Shared Database or Statewide Census of Utility Poles and Conduit in California, Investigation 17-06-027; and Related Matters, Rulemaking 17-06-028; Before the Public Utilities Commission of the State of California; February 6, 2020, pages 4-5.

time, and disruption to the PROW, as well as limiting the potential for striking other utility lines that are buried deeper.

While micro-trenching has been used for some years, its success is as yet unproven, and there are instances of failure including a high-profile failure in Louisville, Kentucky[26]. Furthermore, the City did allow use of micro-trenching some years back and those locations are still causing problems currently. Many cities are rightly concerned about the use of micro-trenching because of the potential damage it can do to streets and sidewalks.

DISCUSSION AND RECOMMENDATIONS

Micro-trenching construction methods used in other cities were evaluated in consultation with Palo Alto's Public Works and Utilities departments. Due to concerns about potential for improper restoration of the public right-of-way and examples of failed micro-trenching approaches, Palo Alto and Magellan agree that the City's current reasons for disfavoring use of micro-trenching are reasonable and consistent with practices in other California cities. Specifically, although micro-trenching may result in reduced construction costs and implementation time, experience elsewhere suggests risks of damage to streets and other infrastructure in the PROW, vulnerability to damage to the fiber optic cable itself from repaving or other activity given its shallow depth, and varied experiences with micro-trenching projects suggests these costs may outweigh the benefits.

Magellan recommends that Palo Alto track micro-trenching efforts in other cities as this construction methodology may have a further evolution. As broadband infrastructure construction teams evaluate the pitfalls of micro-trenching, improvements are likely to be implemented and may result in successful micro-trenching that could reduce construction costs and implementation time in the future.

5. Building Entry Standards Multi-Unit Housing Access

POLICY AND PRACTICES IN PALO ALTO

CPAU has specified requirements for service connections for each type of utility service that it offers. The basic service connection requirements[27] may be summarized as follows:

[26] https://arstechnica.com/information-technology/2019/02/google-fiber-exits-louisville-after-shoddy-installs-left-exposed-wires-in-roads/

[27] CPAU Rules and Regulations No. 18 Utility Services and Facilities on Customer Premises, effective 10-21-2019.

1. The property to be connected has suitable access for appropriate CPAU infrastructure in public rights of way, easement, etc.
2. CPAU has approved the customer's application and plans.
3. The Applicant is compliant with all permit and inspection requirements and has installed the required facilities to receive service according to plan.
4. The Applicant has paid in full all required connection charges and fees.
5. CPAU retains ownership of all installed facilities and equipment, and the customer must exercise reasonable care to prevent damage to them.
6. Only CPAU employees or agents are allowed to connect or disconnect service.

Furthermore, there are special requirements that apply in addition to the general requirements, for connection of fiber optic services[28]. These requirements may be summarized as follows:

1. Engineering studies to determine routing and installation costs must be completed, paid for in advance by the Applicant. Applicable agreements must then be executed upon acceptance of the study and proposal.
2. CPAU will construct the connection upon payment of service connection fees and customer completion of all private property construction required to receive the fiber optic service.
3. Performance testing upon completion of the construction will be provided by CPAU.
4. The Applicant may request specific location of the demarcation point, to which CPAU service will be terminated. This location must be approved by CPAU and service to any other buildings on the parcel shall emanate from the demarcation point.
5. The basic protocol is for the landlord to meet CPAU in the PROW, customer side. Discretion is exercised whether CPAU will pull the fiber into the building or just hand it off. In the former case, conduit has to be in place with a functioning pull-rope.
6. The Applicant is prohibited from accessing any portion of the fiber backbone with the exception of the ends of the CPAU fiber which is extended into the demarcation point.
7. All equipment on the customer side of the demarcation point is to be installed and maintained by the Applicant. CPAU will install, own and maintain facilities in the PROW on condition that the Applicant maintains clear pathways from the property line to the demarcation point.
8. The Applicant will provide a suitable means for CPAU to place its seal on equipment installed on the Applicant's premises.

However, these requirements do not necessarily provide Multi-Dwelling Unit (MDU) residents with a choice of communications/broadband providers as up to this point property

[28] CPAUs Rules and Regulations No. 26, Special Fiber Optic Regulation, effective 7-1-2012.

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developers have not been required to provide infrastructure that will support additional broadband providers.

DISCUSSION AND RECOMMENDATIONS

Magellan Advisors has considered CPAU's requirements for connecting its facilities to a customer premise or MDU at which the Applicant desires CPAU's fiber optic services. The ultimate focus of Magellan's review is to ascertain whether changes can be made that reduce construction costs and implementation time associated with fiber network expansion for the City of Palo Alto. Similar to Dig Once the question arises whether it can be required that property developers include capacity for additional broadband providers to place additional fiber connections to serve residents of MDUs, by providing for appropriately sized conduit which includes innerduct. While it may not be economical to retrofit existing MDUs or office buildings with additional conduit/innerduct it is reasonable to consider such a requirement for new development. This could be implemented as a utility requirement for new construction such that the property developer is required to install sufficiently sized conduit (e.g., 4 inch) and quantity of four (4) one (1) inch innerducts, along with additional backboard space for terminating equipment for multiple broadband providers. Access to that conduit would be granted on a non-discriminatory and competitively neutral basis. This requirement as applied to new development and construction would have reasonable additional cost as it could be accomplished within construction plans before construction starts.

Magellan has compared CPAU's requirements to its knowledge of building entry standards in the industry. Magellan concludes that CPAU's requirements for existing and single-occupant premises comport with best practices observable elsewhere in the industry and therefore it is not necessary to change these requirements. CPAU's requirements already include the ability to work with the Applicant to meet requirements associated with at specific customer location.

6. Federal Policy Review[29]

FEDERAL REGULATION OF BROADBAND

[29] 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.

Due to federal preemption, [30] the FCC's approach to regulating broadband often determines the extent that state and local governments may also regulate broadband. However, the FCC has less ability to use its preemption powers to invalidate state laws which govern municipalities. Because municipalities are considered a creation of state law and agencies of the state, stricter rules apply which limit when federal law can preempt a state's ability to regulate its municipalities.[31] Accordingly, while it is important for a municipal provider to understand the interplay between federal and state law in governing broadband, state laws which apply specifically to municipal broadband are likely valid and not preempted by contradictory federal policy.[32]

Besides contradictory state laws which apply specifically to municipal broadband, FCC orders and regulations do have considerable ability to limit and determine state law in the area of communications, and a federal policy of deregulation generally limits state and local laws which would limit deployment of broadband infrastructure or have an anticompetitive effect. As discussed above in the introductory paragraph, in 2018, the FCC reclassified "broadband internet access service"—including both fixed and mobile service—as an "information service" instead of "telecommunications service," as each are defined in the Telecommunications Act of 1996 ("TA96").[33] This was a reversal of its 2015 Open Internet Order[34] in which the FCC initially classified broadband internet access service (both fixed and mobile) as a telecommunications service. The FCC described the effect of this reclassification as ending "utility-style regulation of the internet . . . ."[35] As classified as a "telecommunications service," broadband internet service was subject to many of the regulatory obligations of Title II of the Communications Act, and broadband internet service providers were generally subject to common carrier requirements.[36] In ending this utility-style regulation in favor of deregulation, the FCC announced its preemption of any state or local laws which would contradict this approach.[37]

[30] When commercial activities primarily occur interstate, as opposed to intrastate, Congress has the ability to regulate these commercial activities and invalidate state or municipal regulations which contradict or oppose the federal regulations. *See In the Matter of Restoring Internet Freedom (*In Re: Internet Freedom), 33 F.C.C. Rcd. 311, ¶¶ 194-204 (2018).
[31] *Tennessee v. Fed. Commc'ns Comm'n*, 832 F.3d 597, 610 (6th Cir. 2016) (citing *Nixon v. Missouri Mun. League*, 541 U.S. 125, 140 (2004)).
[32] *See id*. at 613.
[33] *See* In Re: Internet Freedom (interpreting 47 U.S.C. § 153(24), (53)).
[34] *Protecting and Promoting the Open Internet*, WC Docket No. 14-28, Report and Order on Remand, Declaratory Ruling, and Order, 30 FCC Rcd 5601 (2015) (*Title II Order*).
[35] *Id*. at ¶ 2.
[36] *Id*. at ¶¶ 37 – 57.
[37] We therefore preempt any state or local measures that would effectively impose rules or requirements that we have repealed or decided to refrain from imposing in this order or that would impose more stringent requirements for any aspect of broadband service that we address in this order. Among other things, we thereby preempt any so-called

In addition to defining what communication technologies are designated "telecommunications services" and "information services," the FCC otherwise interprets other provisions and definitions of the TA96, including defining different types of broadband services and infrastructure. Providers of broadband should familiarize themselves with the FCC's interpretations and guidance, as its classifications can determine which federal rules apply to specified broadband services, and the applicability of certain federal requirements can influence which state and local rules apply, to the extent such federal rules preempt the state or local law.

As the FCC considers "broadband internet access service" an "*information service*," and thus deregulated (as opposed to "*telecommunications service*" – i.e., basic telephone service – which are regulated as common carriers), it is important to note the FCC's current definition of "broadband internet access service," which it defines as:

> . . . mass-market retail service by wire or radio that provides the capability to transmit data to and receive data from all or substantially all Internet endpoints, including any capabilities that are incidental to and enable the operation of the communications service, but excluding dial-up Internet access service.
>
> The term "broadband Internet access service" includes services provided over any technology platform, including but not limited to wire, terrestrial wireless (including fixed and mobile wireless services using licensed or unlicensed spectrum), and satellite. For purposes of our discussion, we divide the various forms of broadband Internet access service into the two categories of "fixed" and "mobile." With these two categories of services—fixed and mobile—we intend to cover the entire universe of Internet access services at issue in the Commission's prior broadband classification decisions, as well as all other broadband Internet access services offered over other technology platforms that were not addressed by prior classification orders. We also make clear that our classification finding applies to all providers of broadband Internet access service, as we delineate them here, regardless of whether they lease or own the facilities used to provide the service. "Fixed" broadband Internet access service refers to a broadband Internet access service that serves end users primarily at fixed endpoints using stationary equipment, such as the modem that connects an end user's home router, computer, or other Internet access

""economic" or "public utility-type" regulations, including common-carriage requirements akin to those found in Title II of the Act and its implementing rules, as well as other rules or requirements that we repeal or refrain from imposing today because they could pose an obstacle to or place an undue burden on the provision of broadband Internet access service and conflict with the deregulatory approach we adopt today. *Id.* at ¶195.

> device to the Internet. The term encompasses the delivery of fixed broadband over any medium, including various forms of wired broadband services (e.g., cable, DSL, fiber), fixed wireless broadband services (including fixed services using unlicensed spectrum), and fixed satellite broadband services. "Mobile" broadband Internet access service refers to a broadband Internet access service that serves end users primarily using mobile stations. Mobile broadband Internet access includes, among other things, services that use smartphones or mobile-network-enabled tablets as the primary endpoints for connection to the Internet. The term also encompasses mobile satellite broadband services.[38]

The FCC has also listed certain services it does not consider "broadband internet access service," including: (i) data services which provide connectivity to a limited number of internet endpoints in conjunction with the offering of certain products or services such as "e-readers, heart monitors, or energy consumption sensors;" (ii) video or voice services provided by internet service providers, as these services are otherwise regulated; (iii) virtual private network (VPN) services; (iv) content delivery networks (CDNs); (v) hosting or data storage services; (vi) Internet backbone services (if those services are separate from broadband Internet access service, as these services have historically not been considered "mass market," because they usually do not provide the capability to transmit data to and receive data from substantially all Internet endpoints); (vii) premise owners such as coffee shops, bookstores, and airlines and providers of private end-user networks such as libraries and universities, and other businesses which acquire broadband Internet access service from an internet service provider in order to provide their guests and invitees Internet access on location; and (viii) personal Wi-Fi networks created by users of broadband internet access service who do not intentionally offer the benefit to others. Each of these are not considered service providers because they do not market and sell the broadband internet access to residential customers, small businesses, or other end-users such as schools and libraries.[39] A municipality which markets broadband internet access on a retail basis to its residents, businesses, and schools and libraries is likely to be considered a broadband internet access service provider by the FCC and subject to FCC regulations; therefore, any municipal provider of telecommunications services on a retail basis will need to familiarize themselves with the various FCC reporting, filing and other requirements regarding fees, reports and data. While the FCC's current regime supports deregulation and free-market principals in relation to these services, the agency is limited in its authority to preempt state laws related to municipalities, even if those state laws create greater restrictions than the federal regulations.

[38] *Id*. at ¶¶ 21-22.
[39] *Id*. at ¶¶23-25.

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FEDERAL REGULATION OF WIRELESS SERVICES

Wireless services and technology has been largely unregulated since its inception in the late 1980's – from a rate and tariff standpoint. However local authorities and the Federal Communications Commission have been in an ongoing jurisdictional battle over siting practices and zoning requirements for wireless facilities for some time, which will be discussed further below. At the center of the jurisdictional battle today is 5G wireless service.

The placement of wireless facilities is governed by an interrelated legal framework characterized by shared jurisdiction between state/local authorities and federal authority (the Federal Communications Commission or FCC). The past two decades have seen increasing federal preemption of state and local authority by the Federal Communications Commission (and Congress), most recently in its "Small Cell Order".[40] The U.S. Code provides the basis for federal preemption where it allows local authorities to regulate the "placement, construction, and modification" of wireless communications facilities but subject to certain limitations.[41] Those limitations include:

- City regulations may not "prohibit or have the effect of prohibiting the provision of personal wireless services"[42];
- City regulations may not "unreasonably discriminate among providers of functionally equivalent services"[43];
- 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"[44]; 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 facilities comply with the Commission's regulations concerning such emissions."[45]

In one specific area – radio frequency (RF) emissions – the Federal Communications Commission (FCC) has been assigned complete regulatory jurisdiction, under the 1996 Telecommunications Act which preempted local regulation of RF safety standards in favor of

[40] 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".)
[41] 47 U.S.C. § 332(c)(7)(A).
[42] 47 U.S.C. § 332(c)(7)(B)(i)(II).
[43] 47 U.S.C. § 332(c)(7)(B)(i)(I).
[44] 47 U.S.C. § 332(c)(7)(B)(iii).
[45] 47 U.S.C. § 332(c)(7)(B)(iv).

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a uniform national RF safety standard under FCC jurisdiction.[46] "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."[47] 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 and placed jurisdiction in the hands of the FCC.

The FCC's Small Cell Order

The FCC's Small Cell Order 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 some state laws. 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.[48]

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.[49] 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.[50] 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.

The Small Cell Order was appealed to the Ninth Circuit Court of Appeals, which recently issued its Opinion[51] largely upholding the Small Cell Order but with one exception:

> The exception is the Small Cell Order provision dealing with the authority of local governments in the area of aesthetic regulations. We hold that to the extent that provision requires small cell facilities to be treated in the same manner as other types of communications services, the regulation is contrary to the congressional directive

[46] 47 U.S.C. § 332(c)(7).

[47] 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.

[48] Small Cell Order, at paragraph 50.

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

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

[51] City of Portland v. United States, 969 F.3d 1020, 1049-1053 (9th Cir., 2020).

> that allows different regulatory treatment among types of providers, so long as such treatment does not "unreasonably discriminate among providers of functionally equivalent services." 47 U.S.C § 332(c)(7)(B)(i)(I). We also hold that the FCC's requirement that all aesthetic criteria must be "objective" lacks a reasoned explanation.[52]

And:

> In sum, the requirement that aesthetic regulations be "no more burdensome" than those imposed on other technologies is not consistent with the more lenient statutory standard that regulations not "unreasonably discriminate." The requirement that local aesthetic regulations be "objective" is neither adequately defined nor its purpose adequately explained. On its face, it preempts too broadly. We therefore hold those provisions of Paragraph 86 of the Small Cell Order must be vacated.[53]

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[52] *Id.*
[53] *Id.*

The FCC Rules under the Spectrum Act

Prior to the Small Cell Order, the "Spectrum Act" [54] enacted by Congress in 2012 added new requirements and directives to the Federal Communications Commission (FCC) for processing and approval of wireless deployments. To implement the Spectrum Act, the FCC issued new regulations to interpreting the Section 6409(a) requirements and directives of the Act related to local authorities processing of applications for wireless communications facilities. In brief, 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" – which is defined as 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 is "substantial change" and implemented the statutory changes to "shot clock" regulations.

The FCC's "Clarification" Ruling

The FCC recently made another ruling which attempts to preempt local authority regarding placement of wireless facilities by "clarifying" "the meaning of our rules implementing Congress' decisions in section 6409(a) of the Spectrum Act of 2012" [55]. The Declaratory Ruling on June 10, 2020 has been appealed by numerous parties including state and local government organizations and entities.[56] Among other things the Declaratory Ruling purports to "clarify" existing FCC rules originally adopted in 2014 to implement the Spectrum Act. The cities challenge the FCC's ruling on the basis that it violates federal requirements for rulemakings, and is arbitrary, capricious and an abuse of discretion in seeking to change existing FCC rules regarding applicability of "eligible facilities requests".

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[54] *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).

[55] *In the Matter of Implementation of State and Local Governments' Obligation to Approve Certain Wireless Facility Modification Requests Under Section 6409(a) of the Spectrum Act of 2012*, WT Docket No. 19-250 and RM-11849, FCC 20-75 (released Jun. 10, 2020) ("Declaratory Ruling")

[56] Appeals include The League of California Cities, the League of Oregon Cities, and the cities of Glendora, Rancho Palos Verdes and Torrance in California, Texas Municipal League, Texas Coalition of Cities for Utility Issues, Michigan Municipal League, the US Conference of Mayors and many other cities.

Recommendations

1. DIG ONCE

1. A Dig Once policy supporting full coordination in compliance with current ordinance provisions in Municipal Code Section 12.10.050 and 12.10.060 should be considered for adoption by the City Manager.
2. Staff should focus on reaching out individually to the relatively few utilities that are not coordinating at present – the wireless companies and infrastructure providers. The outreach should attempt to foster greater sharing of plans on a confidential basis recognizing that obtaining a five-year plan is not realistic in the wireless industry. Prospects should be reassessed after fulsome conversations with the providers to begin relationship building. Note that there are other reasons wireless providers should be communicating and cooperating including OTMR considerations at some point, and antenna placement generally.
3. The Public Works Department should continue regular meetings of the coordination committee to plan excavation projects affecting the PROW. All occupants of the PROW should be expected to designate a person knowledgeable in local projects to participate on the coordination committee. Attention should be given as needed to encourage participation of those PROW occupants who have not previously been regular participants in project planning and coordination. The Public Works Department is expected to lead the meeting and present major City projects to the committee and invite participation and coordination. Other participants should not necessarily be expected to share their plans with the coordination committee as some level of confidentiality may be required. However, these participants should share project plans with City staff outside the coordination committee meeting using appropriate confidentiality protections to facilitate City planning and realization of cost efficiencies and public convenience.
4. The City should focus on creation and maintenance of a "coordination database" which will contain GIS data on existing facilities owned or operated by PROW occupants, as well as regular updated with information on upcoming scheduled excavation. It is crucial to verify that good data exists in GIS to support planning activities with data updates where needed to fill in gaps. The City can then use this coordination database for planning excavation projects. Restrictions on access to this data will be appropriate considering "critical infrastructure" requirements as well as competitive concerns that will require some confidentiality at least in some cases.
5. All permits issued for work in the PROW should require submission of final "as-built" drawings in GIS compatible format to keep the coordination database up to date.

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6. When the City participates in a project to install conduit it should pay reasonable incremental costs associated with placement of facilities for City use. These reasonable incremental costs should be calculated to provide benefit and cost savings for each party involved in the project to ensure coordination and participation is mutually beneficial.
7. When opportunities are identified, it is important that Palo Alto be prepared to capitalize on them by installing conduit whenever an excavation occurs in a "major" excavation project. Magellan recommends that Palo Alto authorize funding approval of $250k annually for this purpose. Based on current market rates for conduit deployment, this would net 2778 linear feet (about half a mile) of conduit. Alternatively, the City may opt to grant the Utilities Director or other designee the opportunity to use funds from another account and then reimburse it either during budget adjustments or year-end adjustments. It may also be included in the existing fiber budget. The current funding threshold is $85k, expenditures above which require City Council approval. Increasing this threshold to $250k could occur in the future when City policy direction has been established and doing so would require a separate ordinance update. This funding could be drawn from the Fiber Optics Enterprise Fund.

2. ONE TOUCH MAKE READY

Magellan Advisors recommends that the City not act in advance of the CPUC rulemaking determinations for several reasons. First, there is not a high level of demand for OTMR in the City, so the benefits of undertaking development of OTMR processes and rules are likely minimal compared to costs. Second, undertaking the development of OTMR processes and rules now would likely expose the City to the costs of dealing with complaints and litigation on which it would be "going it alone" in advance of CPUC fact finding and decisions. OTMR in California is subject to some controversy and opposition that the CPUC is best suited to address, including opposition from unions and others to the FCC's OTMR based on various concerns including safety. Finally, Magellan Advisors does not see any present likelihood that introduction of a OTMR process would reduce construction costs and implementation time associated with fiber network expansion for the City of Palo Alto and in fact it would likely incur significant additional costs to develop and implement OTMR, without corresponding benefit.

3. MICROTRENCHING

Magellan recommends that Palo Alto track micro-trenching efforts in other cities as this construction methodology may have a further evolution. As broadband infrastructure construction teams evaluate the pitfalls of micro-trenching, improvements are likely to be

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implemented and may result in successful micro-trenching that could reduce construction costs and implementation time in the future.

4. MULTI-UNIT HOUSING ACCESS

Magellan recommends that CPAU implement a utility requirement that property developers include capacity for additional broadband providers to place additional fiber connections to serve residents of MDUs, by providing for appropriately sized conduit which includes innerduct. While it may not be economical to retrofit existing MDUs or office buildings with additional conduit/innerduct it is reasonable to consider such a requirement for new development. This could be implemented as a utility requirement for new construction such that the property developer is required to install sufficiently sized conduit (e.g., 4 inch) and quantity four (4) one (1) inch innerducts, along with additional backboard space for terminating equipment for multiple broadband providers. Access to that conduit would be granted on a non-discriminatory and competitively neutral basis. This requirement as applied to new development and construction would have minimal additional cost as it could be accomplished within construction plans before construction starts.

Magellan Advisors has considered CPAU's requirements for connecting its facilities to a customer premise at which the Applicant desires CPAU's fiber optic services. The ultimate focus of Magellan's policy review is to ascertain whether changes can be made that reduce construction costs and implementation time associated with fiber network expansion for the City of Palo Alto. Magellan has compared CPAU's requirements to its knowledge of building entry standards in the industry. Magellan concludes that CPAU's requirements for existing and single-occupant premises comport with best practices observable elsewhere in the industry and therefore it is not necessary to change these requirements. CPAU's requirements already include the ability to work with the Applicant to meet requirements associated with at specific customer location.

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Attachment B

CITY OF PALO ALTO

Fiber Expansion Project
Presentation to the UAC

April 21, 2021

CITY OF PALO ALTO

Magellan ADVISORS

AGENDA

RECAP FROM OUR LAST MEETING

SECTION 1 – FIBER BACKBONE EXPANSION

- Why Should the City expand its fiber backbone
- How should the City do so?

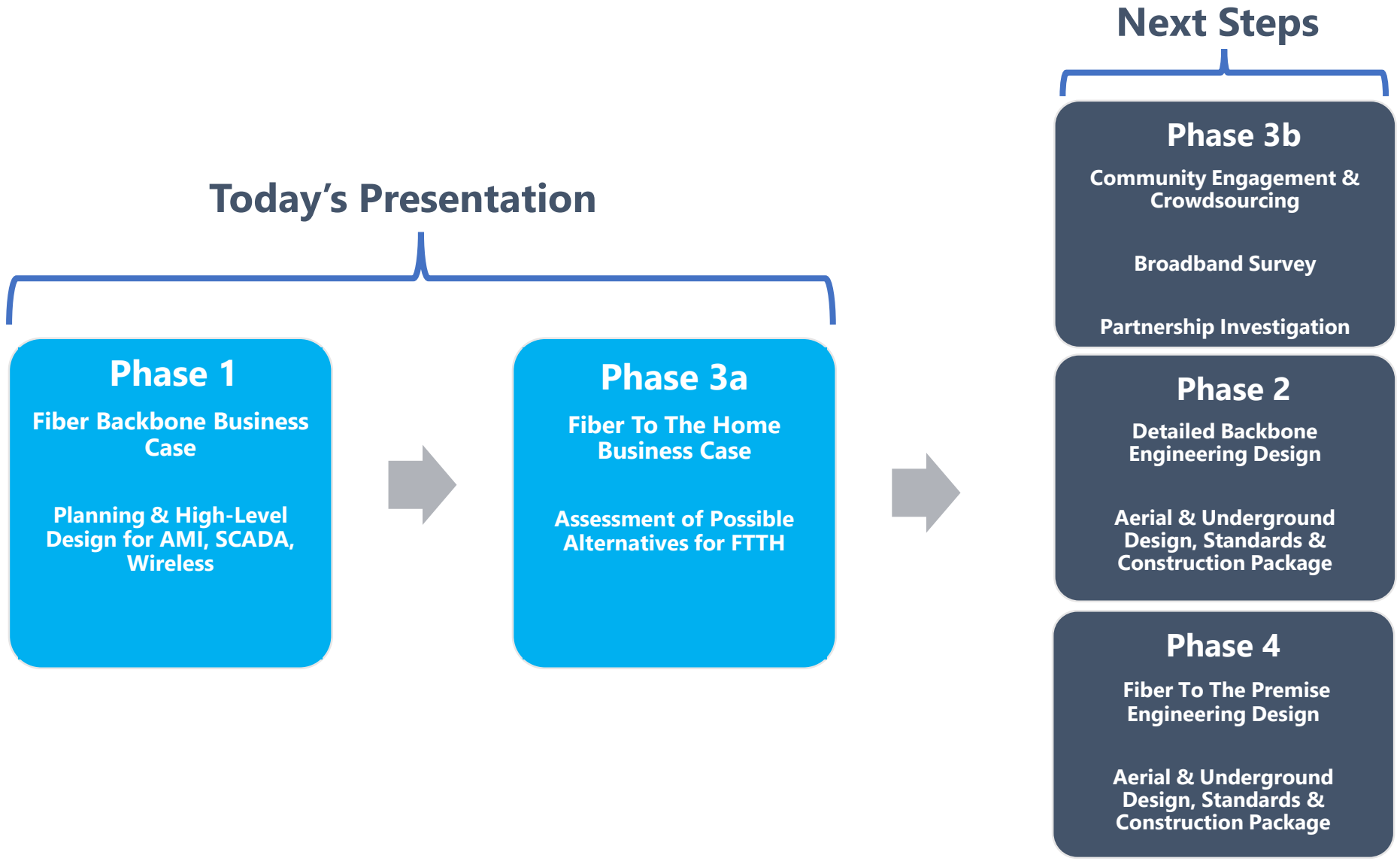
SECTION 2 – FTTH EXPANSION

- What Broadband Opportunities Exist for the City?
- What would it take for the City to provide broadband?

RECOMMENDATIONS & NEXT STEPS

- Community Engagement
- Partnership Investigation
- Detailed Engineering (Phases 2 and 4)
- Explore Federal Grant Options

RECAP FROM LAST MEETING



FIBER BACKBONE EXPANSION

FIBER BACKBONE EXPANSION

WHY SHOULD THE CITY EXPAND ITS FIBER BACKBONE?

Fiber is essential infrastructure for everything that cities do…

- Essential utilities (electric, gas, water, wastewater, storm drain, fiber)
- Energy management
- Public safety
- Traffic management
- Smart parking
- Climate management
- Electrification
- Economic development
- Planning & permitting
- Smart city and the Internet of things

And support external stakeholders too…

- Local schools
- Libraries
- Regional collaboration
- Residents and businesses

By reducing cost and improving capabilities

FIBER BACKBONE EXPANSION

THE ORIGINAL FIBER BACKBONE

1996

Original Fiber Backbone

Built to Connect City Facilities

25 Years Later

Served the City's needs well beyond its original purpose

2021

- $4M+ Annual Revenues
- $30M Reserve Fund
- Connects All City Facilities
- Connects CPAU Substations
- Connects Water Facilities
- Connects Traffic Signals
- Connects PAUSD School Facilities
- Well connected business parks
- 220+ Business Customers

FIBER BACKBONE EXPANSION

BENEFITS OF THE NEW FIBER BACKBONE

UTILITY MODERNIZATION

- Support more reliability and resiliency
- Support robust AMI
- Efficient management of plant resources

SMART CITY INFRASTRUCTURE

- City IT
- Parks
- Emergency Preparedness
- Education
- Public Safety
- Transportation
- Smart Parking

COMMERCIAL FIBER LEASING

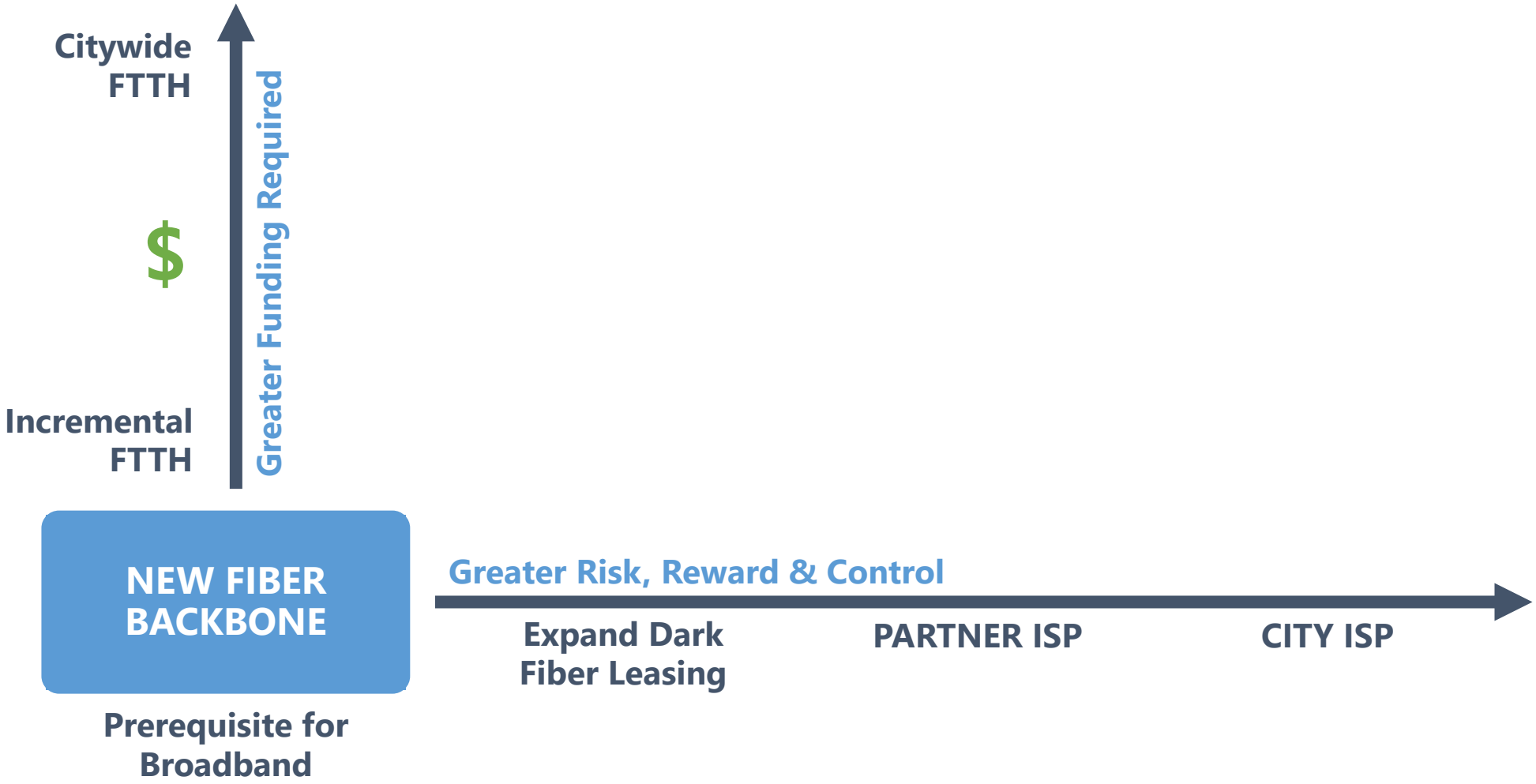
- Support economic development goals
- Lower the cost of doing business in Palo Alto
- Expand choice for local businesses

BROADBAND FTTH

- The foundation to support any FTTH
- Backbone costs are put towards FTTH
- Scalable platform to meet long term needs of the community

FIBER BACKBONE EXPANSION

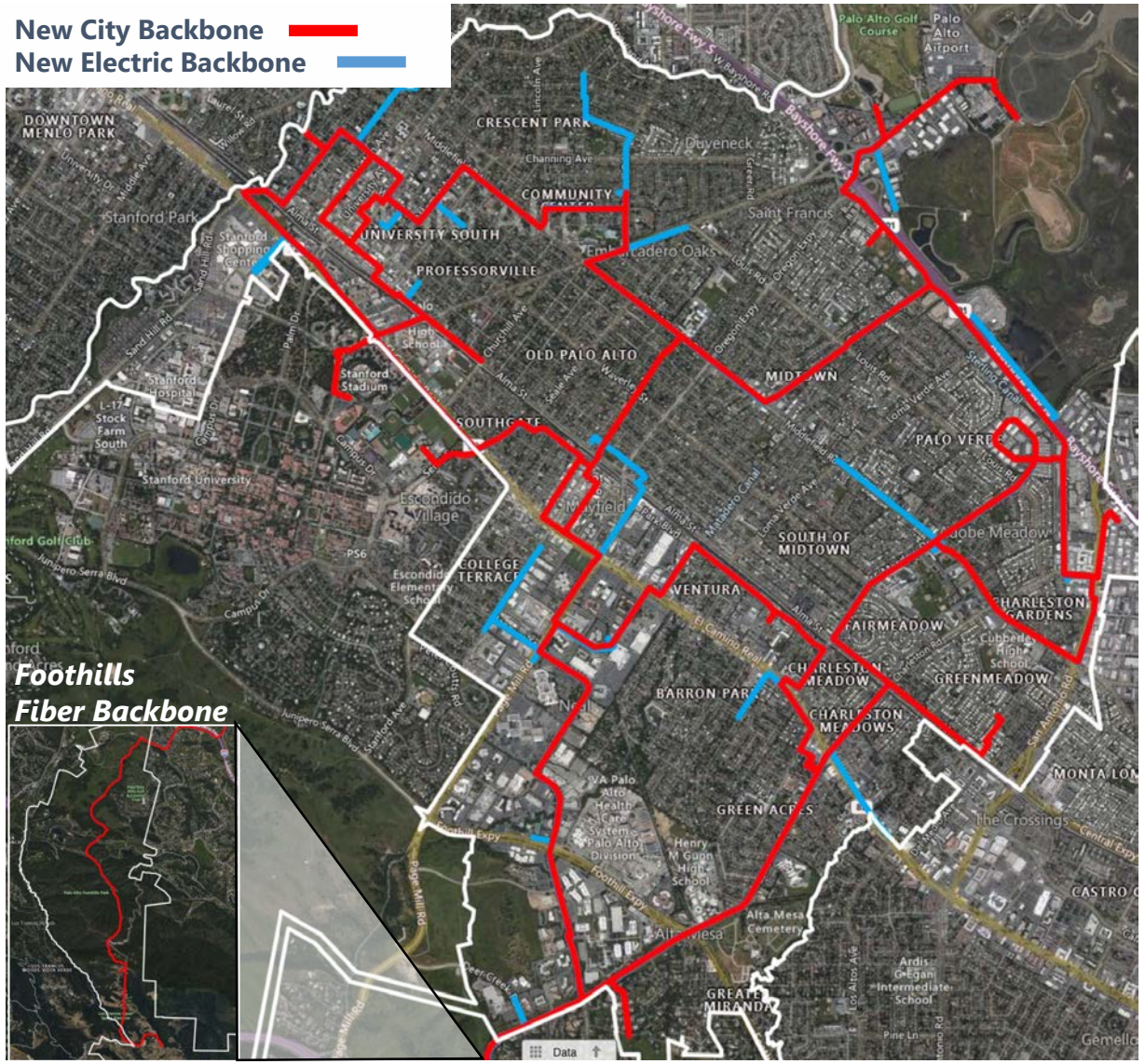
FTTH BUSINESS CASE



FIBER BACKBONE EXPANSION

NEW FIBER BACKBONE DESIGN

- 432 strand fiber for City departments, fiber enterprise and broadband
- 144 strand fiber for electric to maximize reliability and security
- 43 miles of total fiber backbone
- Dedicated fibers for every department
- Dedicated fibers for commercial fiber leasing
- Dedicated fibers for future FTTH
- Routing through neighborhoods and business districts to reduce FTTH costs
- Utilizes abandoned gas infrastructure where feasible



FIBER BACKBONE EXPANSION

FIBER BACKBONE COSTS

	Low Estimate	High Estimate
Total Construction Costs	**$22,219,561**	**$28,059,212**

(Includes 20% Contingency on Labor & Materials)
(Pole loading & replacement fees not included, currently under review)

FTTH BUSINESS CASE

FTTH BUSINESS CASE

HOW WE GOT HERE…THE PROBLEM

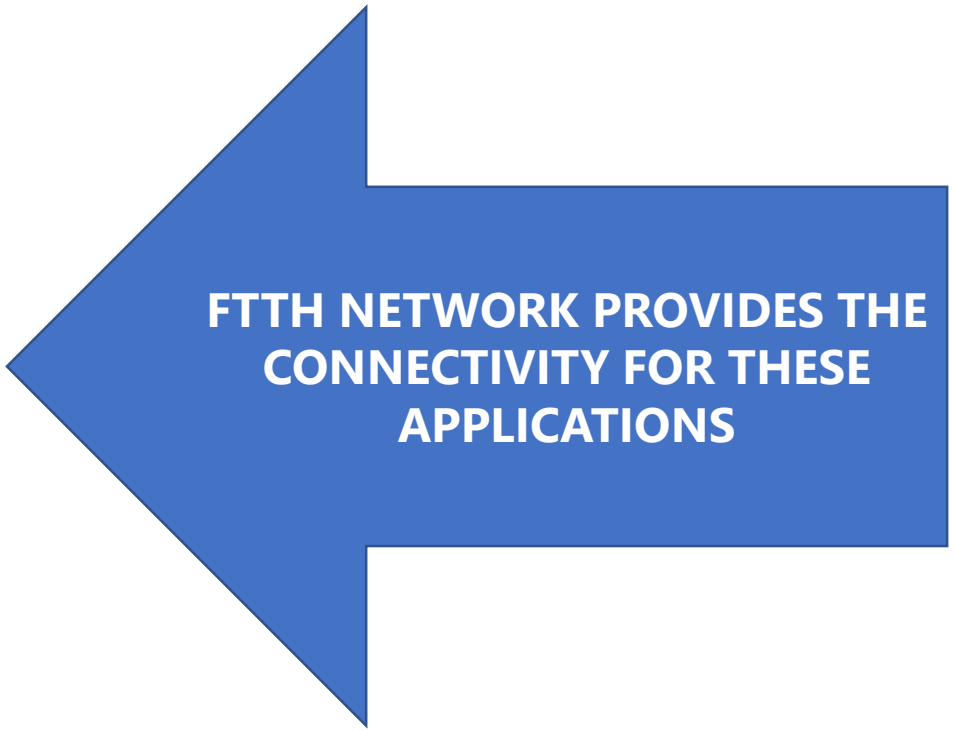
- Do residents and businesses have equal access to high-speed internet?
  - Services are not evenly distributed throughout the City for all providers
  - "Your mileage may vary" based on where you live in the City
- Do residents and businesses have choice?
  - In some cases, more than one option exists
  - In other cases, only a single provider is available
- Are prices affordable given the monopoly/duopoly market?
  - When consumers have alternatives, providers must compete on price

FTTH BUSINESS CASE

BEYOND JUST BROADBAND

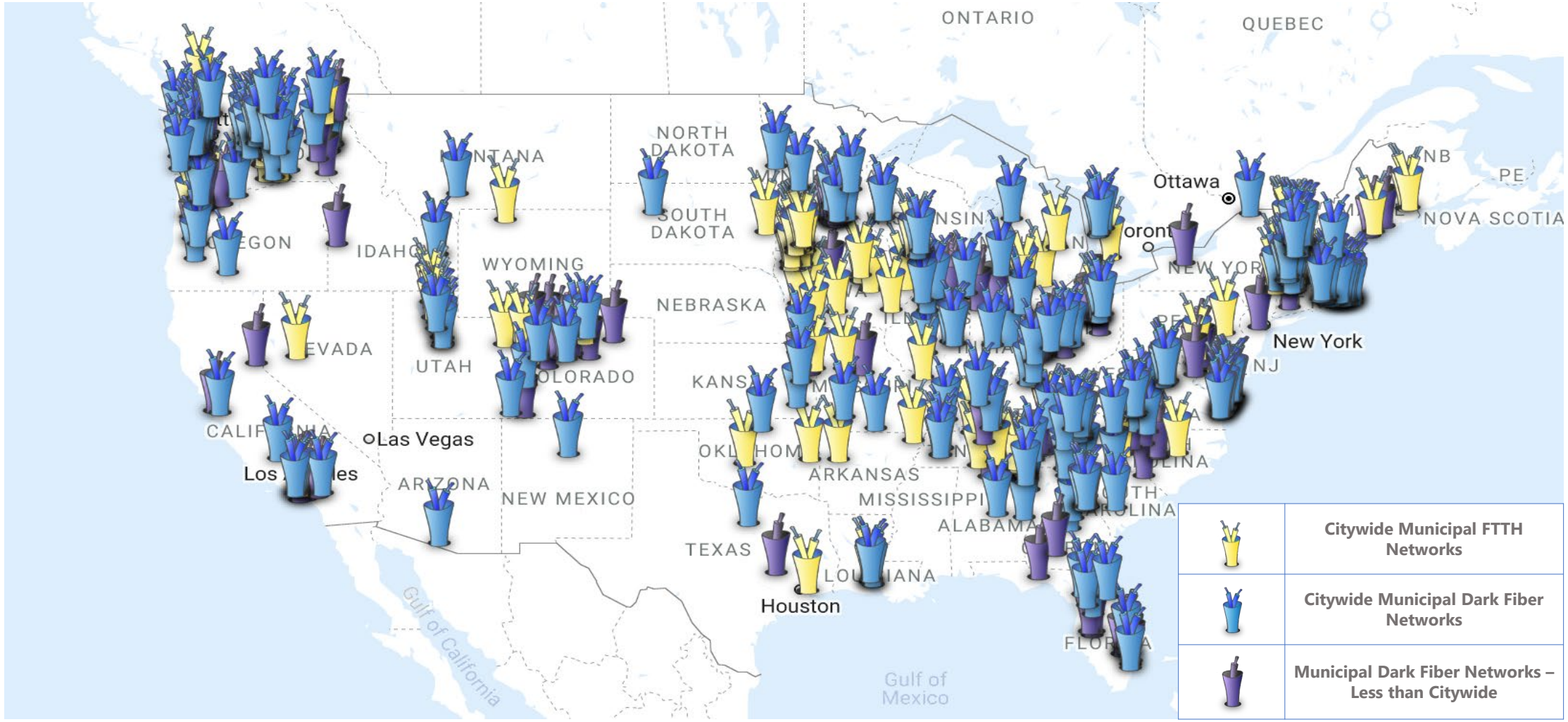
Like the fiber backbone, FTTH provides a platform more than just high-speed internet

- Grid/AMI modernization
- Energy management
- Public safety
- Traffic management
- Smart parking
- Climate management
- Work from home
- Learn from home
- Electrification
- Economic development
- Planning & permitting
- Smart city and the Internet of things



FTTH BUSINESS CASE

WHAT ARE OTHER COMMUNITIES DOING ABOUT IT?



FTTH BUSINESS CASE

WHAT ARE OTHER COMMUNITIES DOING ABOUT IT?

	63	City ISP
	286	City Provides Wholesale or Dark Fiber
	71	Partner ISP

FTTH BUSINESS CASE

QUESTIONS ANSWERED BY THE BUSINESS CASE ANALYSIS

- What benefits could be achieved?
- What are the market dynamics and how do they impact the business case?
- What are the costs and what advantages/disadvantages drive costs?
- Are there ways to reduce costs?
- What are the minimum take rates needed?
- What scenarios result in a feasible business case?
- What variables must hold true in these scenarios?

TWO BUSINESS MODEL OPTIONS FOR FTTH

FTTH BUSINESS CASE

TWO BUSINESS MODEL OPTIONS FOR FTTH

Business Case	Advantages	Disadvantages
City ISP	• City has total control over how internet services are provided to the community • Control over pricing to residents and business • Ownership of network affords the City a long-term asset to use for other applications • City has access to low cost of capital • Contract services with key vendors to lower costs	• High execution risk and a steep learning curve • City culture not accustomed to operating in a competitive environment • Potentially higher operational cost structure • Possible impact to debt rating
Partner ISP	• City does not have to provide internet service • No competitive, operational or regulatory risk • Ownership of network affords the City a long-term asset to use for other applications • City has access to low cost of capital	• City is responsible for most of the capital investment • City has little control over actual services, yet provides most of the investment • Relatively new model without track record • Possible impact to debt rating

FTTH BUSINESS CASE FINDINGS

MARKET ASSESSMENT – COMPETITIVE RATES

Could the City Provide Competitive Rates? Yes.

Speed Tier	Competitor 1	Competitor 2	City Proposed Rate (Or through Partner)
1 Gigabit	$95	$83	$85
600 Megabit	$85	N/A	$75
100 Megabit	$45	$59	$45

FTTH BUSINESS CASE FINDINGS

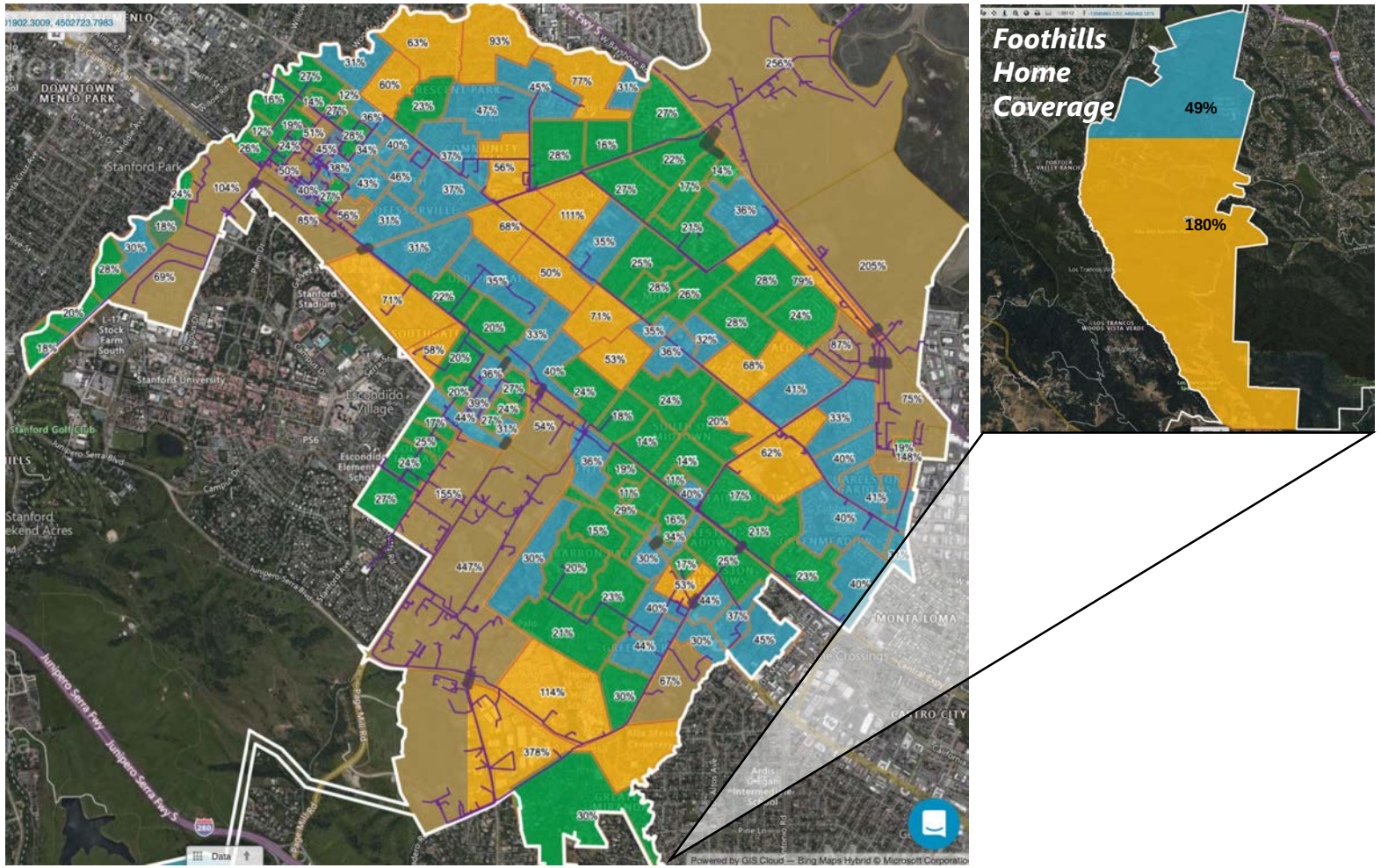
TAKE RATES NEEDED TO ACHIEVE BREAK EVEN

< 30% Take Rate
- 14,159 Household
- 1,118 Businesses

> 30% and < 50% Take Rate
- 10,105 Households
- 1,685 Businesses

> 50% Take Rate
- 3,695 Households
- 713 Businesses

Commercial-Only Areas
- Deploy incrementally
- Dark fiber already exists
- About 1,000 businesses



Purple lines show existing fiber in commercial areas

FTTH BUSINESS CASE

SAMPLE TIMELINE FOR FTTH

Engineering Design/Marketing

June 2021 – Dec 2022

Operations Staffing & Data Center

Jan 2022 – Dec 2022

Construction

June 2022 – May 2026

Customer Activation

- Phase 1: Jan 2023
- Phase 2: Jan 2024
- Phase 3: Jan 2025
- Phase 4: Jan 2026

FTTH FINANCIAL REVIEW

CAPITAL SUMMARY – CITY ISP & PARTNER ISP

Capital Expenditure	CITY ISP (32% Take Rate)	PARTNER ISP (43% Take Rate)
Fiber Feeder Distribution	$70,348,302	$70,348,302
Less: Use of New Fiber Backbone for FTTH	$4,476,825	$4,476,825
Revised Fiber Feeder Distribution	$65,871,477	$65,871,477
Fiber Drops	$9,017,280	$12,116,970
Data Center & Headend	$6,880,000	$2,500,000
Home Equipment & Installation	$3,870,000	$0
Business Equipment & Installation	$333,824	$0
Total Capital Costs	**$85,972,581**	**$80,488,447**

FTTH FINANCIAL REVIEW

FUNDING SUMMARY– CITY ISP VERSUS PARTNER ISP

Funding the FTTH Expansion	CITY ISP	PARTNER ISP
Funding Required		
FTTH Capital Expenditures	$85,972,581	$80,488,447
FTTH Working Capital Set Aside	$12,500,000	$6,000,000
Total Funding Required	**$98,472,581**	**$86,488,447**
Available Funding		
Balance of Fiber Fund for FTTH Expansion	$17,500,000	$17,500,000
Loan from Electric Special Projects Reserve	$15,000,000	$15,000,000
Total Available Funding	$32,500,000	$32,500,000
New Funding Required	**$65,972,581**	**$53,988,447**

FTTH FINANCIAL REVIEW

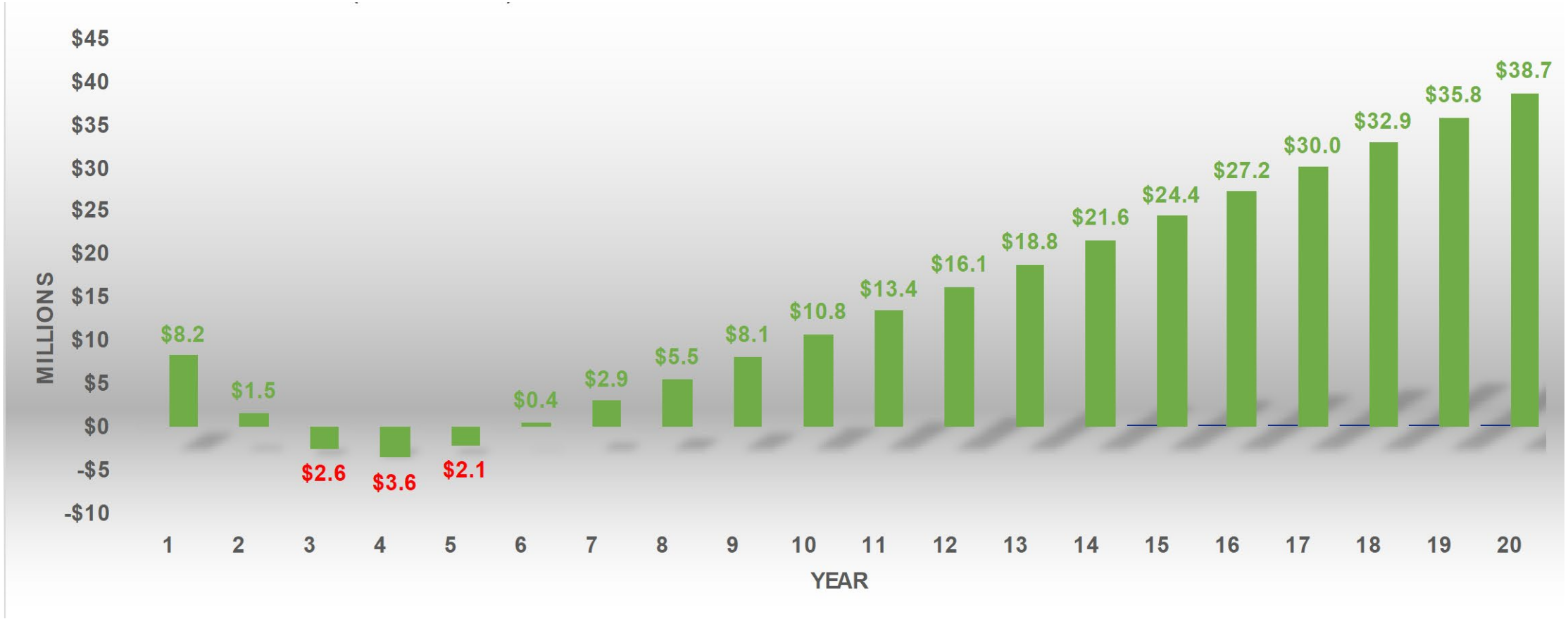
FINANCIAL SUMMARY

EXISTING COMMERCIAL DARK FIBER BUSINESS PROJECTED REVENUES

FTTH FINANCIAL REVIEW

FINANCIAL SUMMARY

FTTH BUSINESS NET REVENUES – CITY ISP



FTTH FINANCIAL REVIEW

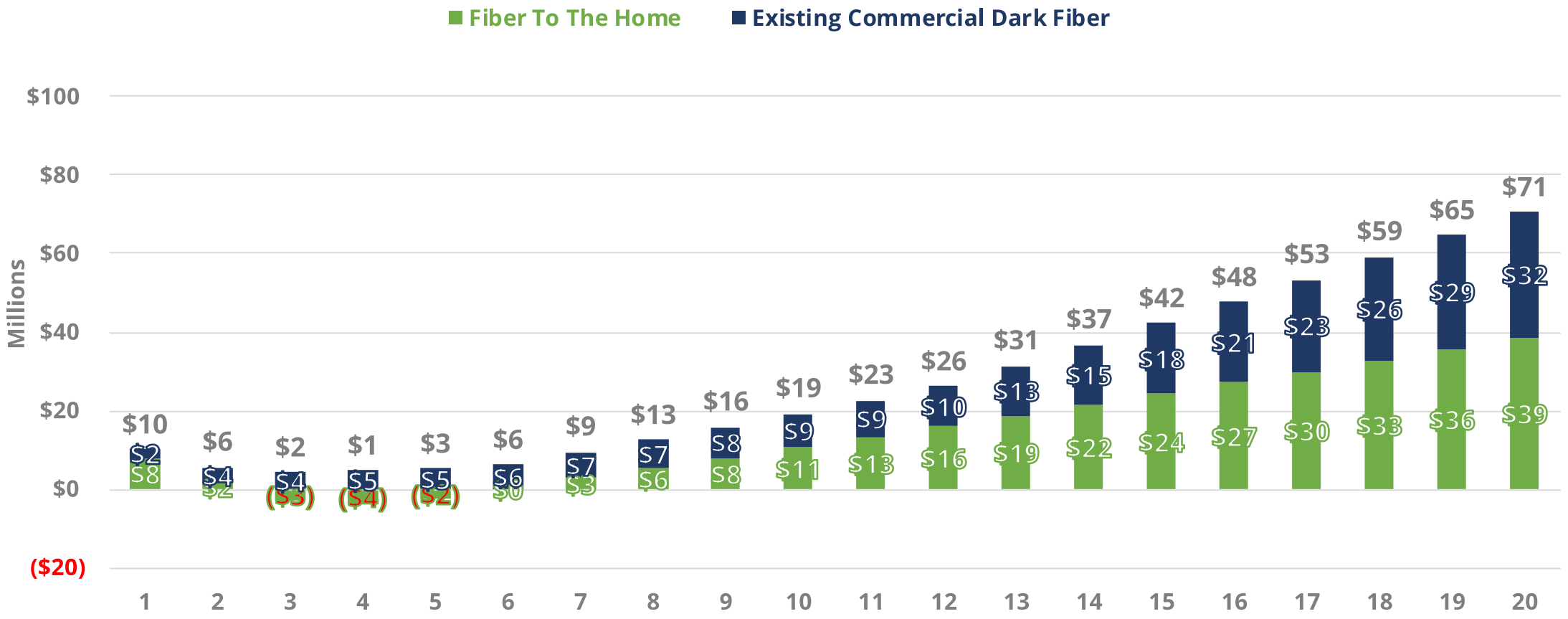
FINANCIAL SUMMARY

FTTH BUSINESS NET REVENUES – PARTNER ISP

FTTH FINANCIAL REVIEW

FINANCIAL SUMMARY

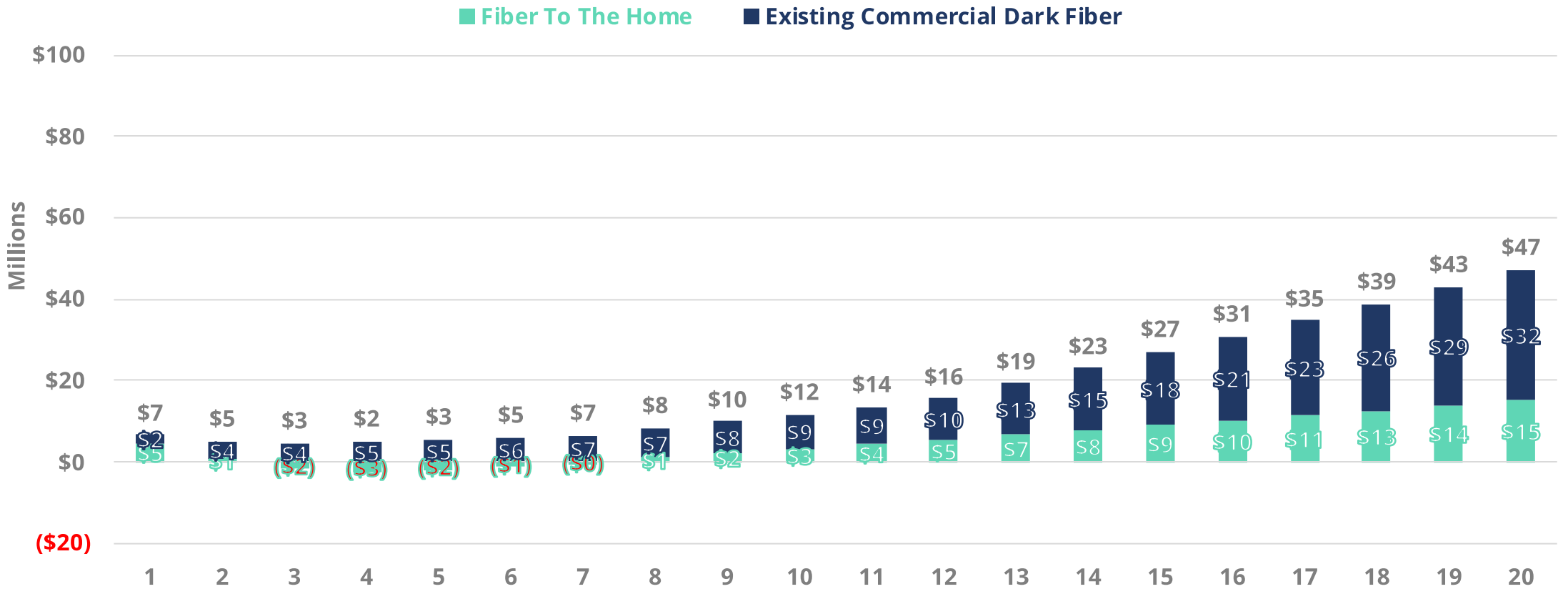
FTTH & EXISITNG COMMERCIAL DARK FIBER – CITY ISP



FTTH FINANCIAL REVIEW

FINANCIAL SUMMARY

FTTH & EXISITNG COMMERCIAL DARK FIBER – PARTNER ISP



FTTH BUSINESS CASE

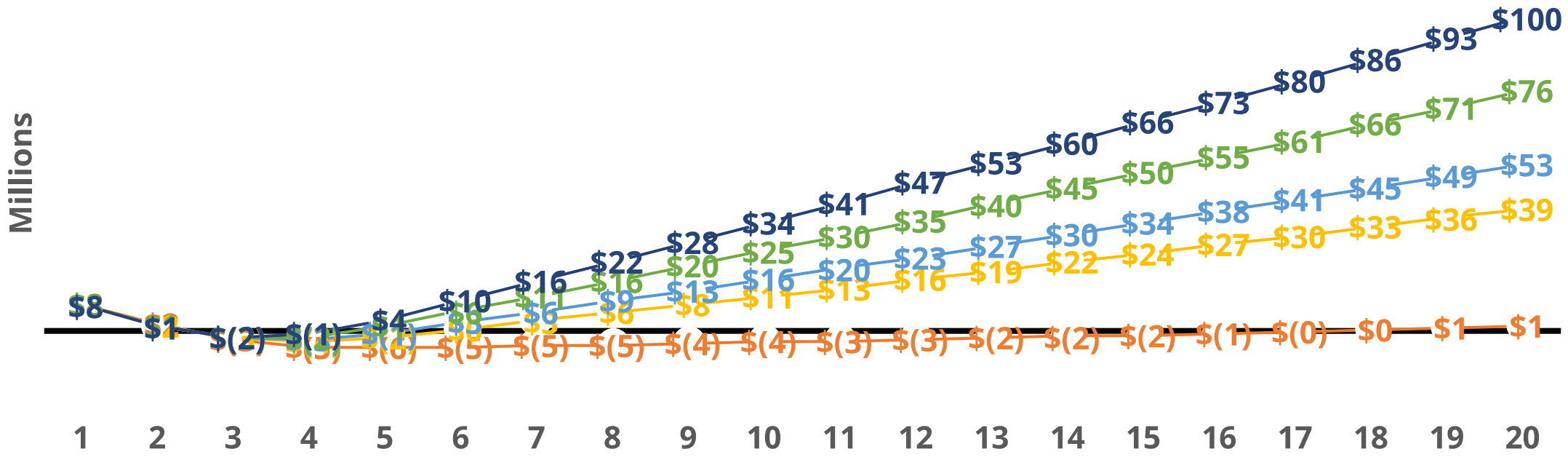
IDENTIFICATION OF KEY RISKS

Variable	Base Case	Risk	Risk Mitigation
Retail Prices	Within 5% of market rates	Competitive forces force reduction to retail rate - 10% max reduction	Reduce Price to match competitors (AT&T, Comcast)
Take Rates	32% - Very Conservative Compared to Other muni-owned and Operated Systems	Major construction delays, operational or competitive issues - Reduces take rate to 25%	Work to Increase take rate to 45% through efficient execution (outsourcing staff), sales and marketing, great customer experiences, increase bandwidth to 2G or higher
Operating Costs	45% of gross revenues, commensurate with other muni-owned and operated systems	Increase to 60% due to higher costs of labor	Consider outsourcing to offset high labor costs
Construction Costs	Construction costs at $15 / foot aerial (higher than comparable projects in the Bay Area) Construction costs at $100 / foot underground	Construction costs increase to $120/foot underground Construction costs increase to $20/foot Ariel - significant pole replacement required	Consider modifying City construction policies to enable contractors to build more productively. Blanket permitting, increase permitting and locate resources, increase construction workday hours, outsourcing to reduce costs. Consider managing materials directly if the City has available resources.

FTTH FINANCIAL REVIEW

FINANCIAL SUMMARY

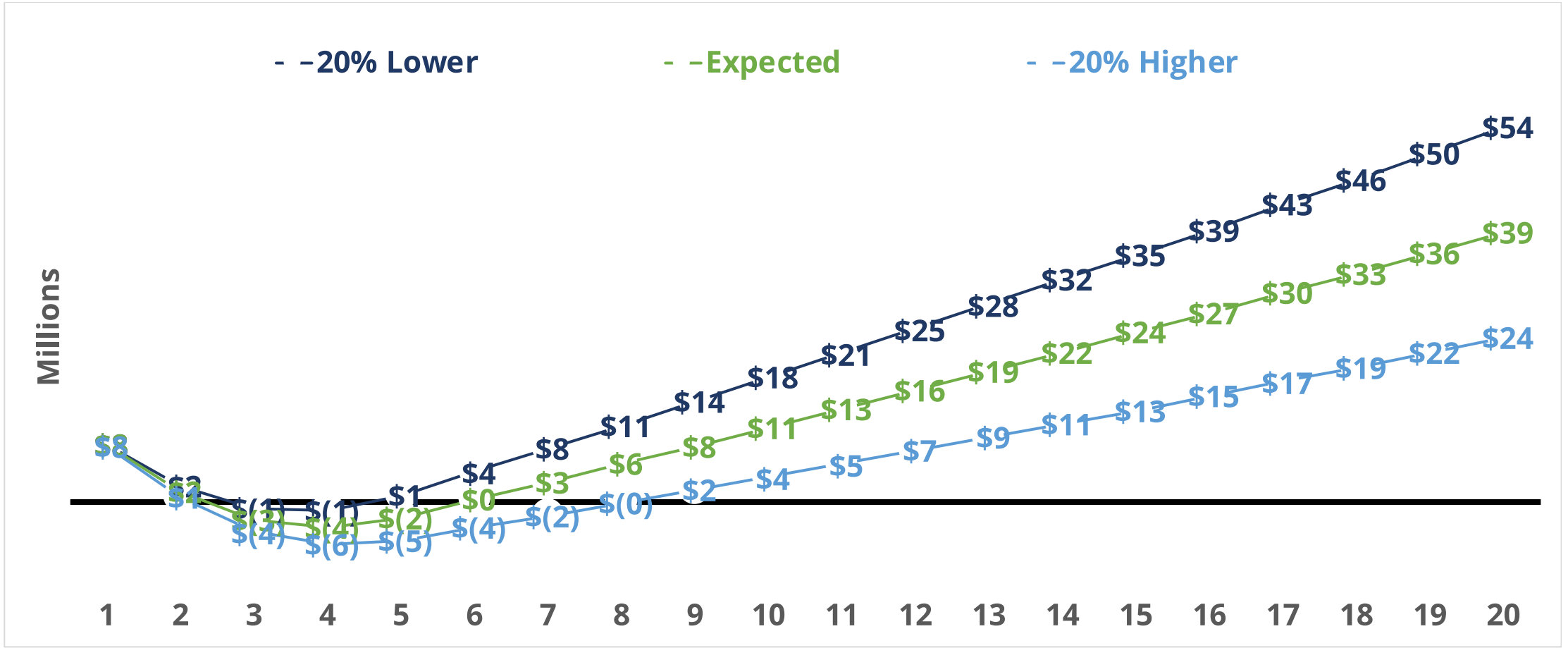
NET REVENUES AT DIFFERENT TAKE RATES – CITY ISP



FTTH FINANCIAL REVIEW

FINANCIAL SUMMARY

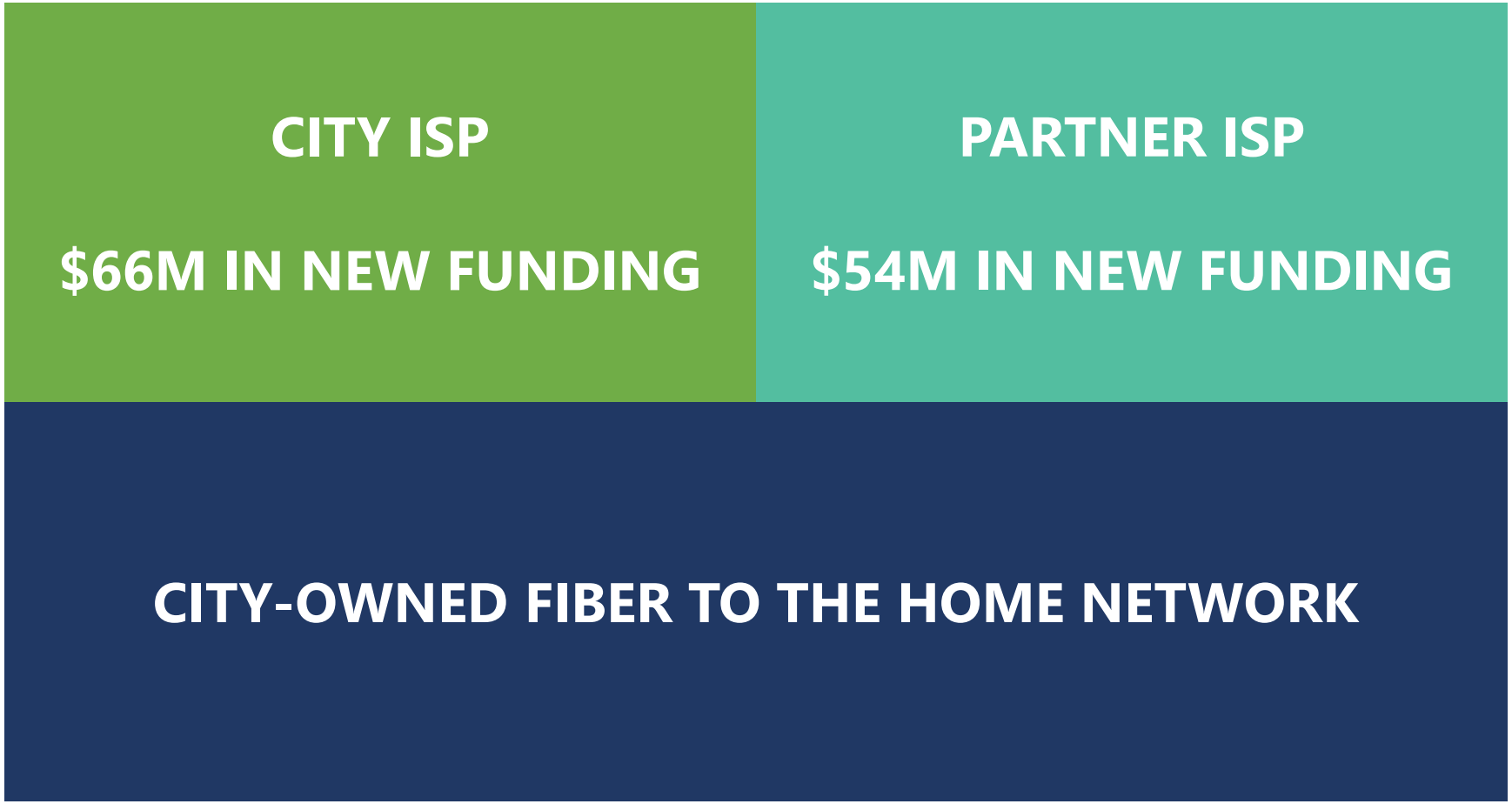
NET REVENUES AT DIFFERENT CONSTRUCTION COSTS – CITY ISP



FTTH BUSINESS CASE

BUSINESS CASE SUMMARY

TWO BUSINESS MODEL OPTIONS FOR FTTH



FTTH FINANCIAL REVIEW

INCREMENTAL DEPLOYMENT

Could the City deploy FTTH without taking on new bonding?

- **Incremental buildout over a longer period**
- **Reinvest excess revenues back into expansion**
- **Utilize companion projects wherever possible to reduce costs**

FTTH BUSINESS CASE FINDINGS

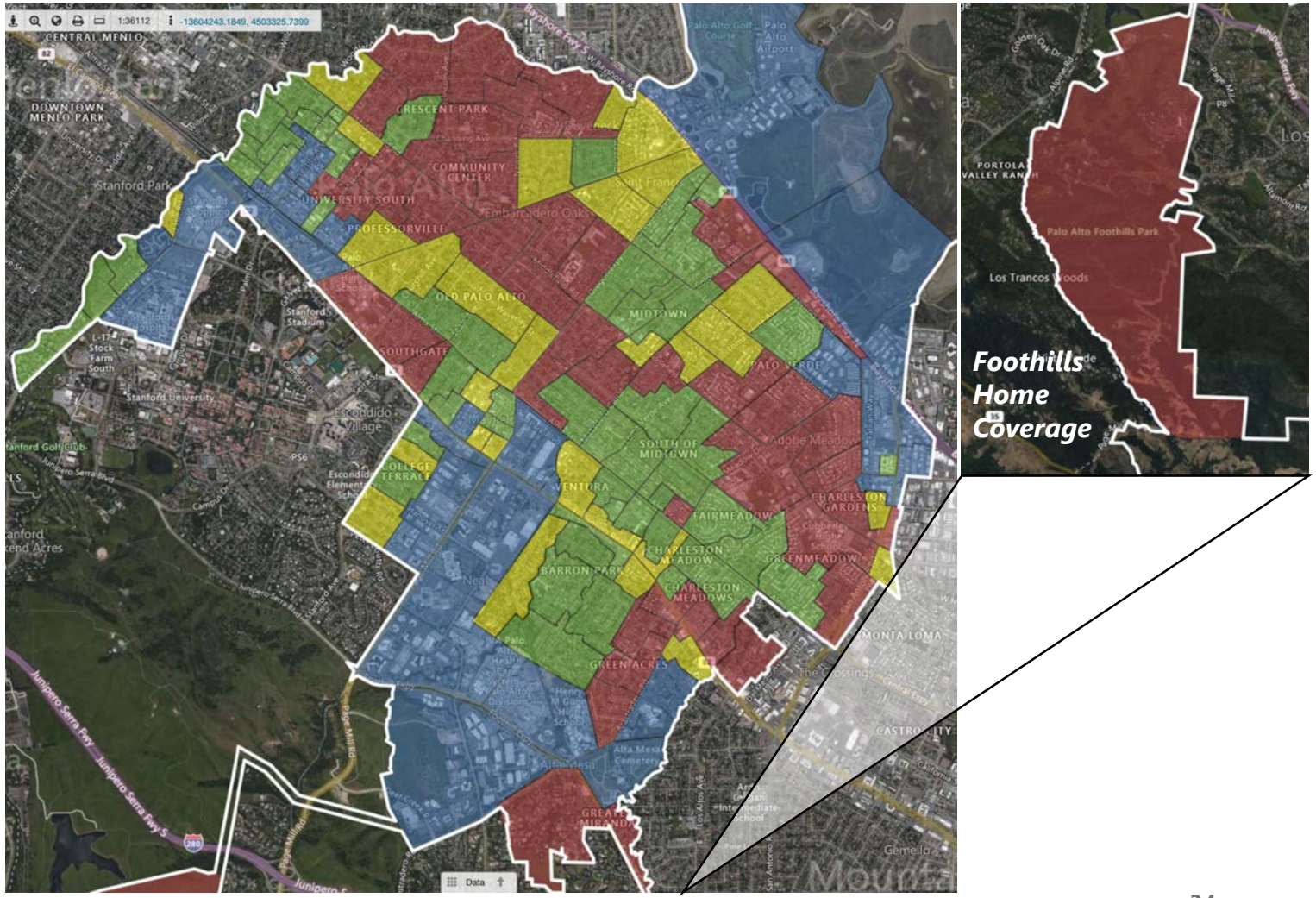
INCREMENTAL DEPLOYMENT

FIRST 3 YEARS
12,412 Households
558 Businesses

YEARS 4-10
7,092 Households
537 Businesses

ALTERNATIVE DEPLOYMENT
7,000 Households
209 Businesses

Commercial-Only Areas
Deploy incrementally
Dark fiber already exists
About 1,000 businesses



FTTH FINANCIAL REVIEW

INCREMENTAL DEPLOYMENT

Funding Strategy (Sources & Uses)

First Phase of Incremental Build – Years 1-3	
Residential Premises with Access	12,412 Homes
Total Business Premises with Access	558
Capital Expenditures	$29,234,145
Working Capital Set Aside	$2,000,000
Total Funding Required	$31,234,145
Funded By:	
Balance of Fiber Fund for FTTH Expansion	$17,500,000
Loan from Electric Special Projects Reserve	$15,000,000
Total Funding Available	**$32,500,000**

FTTH FINANCIAL REVIEW

INCREMENTAL DEPLOYMENT

Funding Strategy (Sources & Uses)

Future Phases of Incremental Build – Years 4-10	
Residential Premises with Access	7,092; 19,504 Total
Total Business Premises with Access	537, 1,095 Total
Capital Expenditures	$21,781,512
Working Capital Set Aside	$0
Total Funding Required	$21,781,512
Funded By:	
Annual Free Cash Starting in Year 3	$3,000,000
Total Funding in Years 4-10	**$21,000,000**

FTTH FINANCIAL REVIEW

INCREMENTAL DEPLOYMENT

Results

- City could provide FTTH to 70% of homes and businesses without any bonding
  - Initial deployment to about 46% of homes and businesses
    - Services available within the first 3 years
    - $32M in total funding
  - Incremental deployments totaling 25% of homes and businesses
    - About 1,000 homes per year in years 4-10
    - Funded by $3 million a year in free cash in years 4-10 ($21M total)

FTTH FINANCIAL REVIEW

INCREMENTAL DEPLOYMENT

Results

- About 7,000 homes and 209 businesses remaining
- Most expensive to build to and lowest density
- Requires another $38 million in capital expenditures
- Look for opportunities for:
  - Undergrounding, companion projects, abandoned infrastructure
  - New technologies, partners
  - Grant opportunities, other incremental funding sources

FTTH BUSINESS CASE

BUSINESS CASE SUMMARY

1. **Bond**

- **Buildout to 100% of homes & businesses in 5 Years**

2. **No Bond**

- **Buildout to 13,000 homes & businesses in 3 years**
- **Buildout to another 7,500 homes & businesses in 10 years**
- **Alternative strategies to fund the remaining 7,500 homes & businesses**

FTTH NEXT STEPS

- **NEXT STEPS - APPROVED**
  - **Community Engagement**
  - **Broadband Survey for Residents & Businesses**
  - **Explore Partnerships**
- **NEXT STEPS – RECOMMENDED**
  - **Detailed Engineering (combine Phase 2 & Phase 4)**
  - **Explore Federal Grant Options**

QUESTIONS?

Fiber Expansion Project
Update to UAC

April 21, 2021 *DRAFT INFORMATION*

CITY OF PALO ALTO

Magellan ADVISORS

SUPPLEMENTARY SLIDES

FTTH BUSINESS CASE PROCESS

NEW FUNDING REQUIRED

Develop Base Case
Citywide FTTH Deployment
Retail or Partnership

Refine Costs
Eliminate areas where existing dark fiber exists
Reuse of existing infrastructure
Cost reductions from new fiber backbone

Minimize New Borrowing
Incorporate existing fiber fund
Utilize existing dark fiber revenues
Add electric special projects reserve

Consider Options with No New Borrowing
Citywide deployment with new debt
Incremental deployment without debt

Create Final Scenarios
Develop the most feasible options
Comprehensive financial models

FTTH BUSINESS CASE

OUTSOURCING NON-CORE FUNCTIONS

FUNCTION	INSOURCE	OUTSOURCE
Project Implementation (Construction mgmt, inspections, integration)		X
Sales & Marketing	X	
Customer Management (Account service, billing, help desk)	X	
Technical Support		X
Network Operations		X
Outside Plant Maintenance	X	
Finance & Accounting	X	
Billing	X	
Engineering		X

OUTSOURCING NON-CORE FUNCTIONS

- Some broadband functions are core and can be easily managed by the City
- Others are new and can be outsourced where the City doesn't have the expertise
- Over time, outsourced functions can be brought in-house
- Many cities outsource the implementation as a turnkey project
  - Procurements
  - Construction management
  - Inspections
  - Network turnup and launch
  - Sales and marketing ramp up

FTTH FINANCIAL REVIEW

FIBER TO THE HOME FINANCIAL REVIEW

What we'll cover today

- Detailed costs for the construction of the FTTH network
- Detailed costs for operations and management of broadband
    - Retail and partnership options
- Factors that impact financial sustainability
    - Retail and partnership options
- Review of the live working financial models
- Questions and clarifications

FTTH FINANCIAL REVIEW

CITY ISP

Revenue Drivers

Residential & Business Rates	Distribution	Monthly Rate
1 Gigabit	20%	$85.00
500 Megabit	60%	$75.00
100 Megabit	5%	$45.00
Average Business Monthly Rate	15%	$200.00
Take Rates		
Residential Take Rate		32%
Business Take Rate		32%
Ramp Up Over Years		**Ramp Up**
Take Rate Ramp Year 1		0%
Take Rate Ramp Year 2		20%
Take Rate Ramp Year 3		50%
Take Rate Ramp Year 4		80%
Take Rate Ramp Year 5		100%

FTTH FINANCIAL REVIEW

CITY ISP

Cost Drivers – Operations (Insourced)

Annual Operating Costs	Values	Percent of Costs
Staffing	$ 2,060,361	48%
Plant Operations & Maintenance	$ 351,742	8%
Equipment Maintenance	$ 172,000	4%
Software Maintenance	$ 120,000	3%
Facilities Maintenance	$ 125,000	3%
Vehicle Maintenance	$ 35,000	1%
Pole Rental (50% of Pole Rental Paid by Fiber Business)	$ 500,000	12%
Utilities & Office Expenses	$ 101,985	2%
Legal & Professional Services	$ 152,978	4%
Reporting & Compliance	$ 101,985	2%
Wholesale Internet Access	$ 185,000	4%
Sales & Marketing	$ 203,971	5%
Promotions & Discounts	$ 101,985	2%
Miscellaneous	$ 101,985	2%
Total Operating Costs	**$ 4,313,993**	**100%**

FTTH FINANCIAL REVIEW

CITY ISP

Cost Drivers – Staffing (Insourced)

Staff Person	Quantity	Fully Loaded Cost	Total Cost
Customer Service Rep	2.00	$ 120,003	$ 240,006
Service Techs	2.00	$ 111,539	$ 223,077
Customer Service Supervisor	0.50	$ 121,550	$ 60,775
Billing Tech	1.00	$ 110,500	$ 110,500
Financial Controller	0.50	$ 139,230	$ 69,615
Network Designer	1.00	$ 132,600	$ 132,600
Network Engineer	2.00	$ 155,363	$ 310,726
Install Tech	1.50	$ 113,152	$ 169,728
Maintenance Tech	1.50	$ 107,185	$ 160,778
Field Services Manager	1.00	$ 186,303	$ 186,303
Sales & Marketing Manager	1.00	$ 186,303	$ 186,303
Engineering Manager	1.00	$ 209,950	$ 209,950
	15.00		$ 2,060,361

FTTH FINANCIAL REVIEW

CITY ISP

Insource & Outsource - Functions

Staff Person	Insource	Outsource
Customer Service Rep	X	
Service Techs		X
Customer Service Supervisor	X	
Billing Tech	X	
Financial Controller	X	
Network Designer		X
Network Engineer		X
Install Tech		X
Maintenance Tech		X
Field Services Manager	X	
Sales & Marketing Manager	X	
Engineering Manager	X	

FTTH FINANCIAL REVIEW

CITY ISP

Insource & Outsource – Impact on Operating Costs

	Insource	Outsource	Savings
Annual Operating Costs	**$4,313,993**	**$3,451,195**	**$862,798**

FTTH BUSINESS CASE

RISK MATRIX

	COST	TIME	SERVICE QUALITY
LOW	Controllable operating costs are higher than anticipated	Competitors use delay tactics to slow the City's project	Competitors step up their game to improve customer service
MEDIUM	Long-term cost escalation is higher than anticipated	Construction delays result in longer lead times for service	Competitors increase speeds without increasing prices
HIGH	Construction cost overruns require more capital from the City	Significant construction delays impact lead times substantially, impacting customer perceptions and lowering take rates	Operational challenges result in lower service quality resulting in less subscribers and lower revenues

FTTH FINANCIAL REVIEW

PARTNER ISP ECONOMICS

Higher retail rates make partner less competitive and reduce take rates, lowering City revenues

Higher wholesale rates squeeze partner's profit margin and/or raise retail rates

Retail Customer

Customer Pays $75

Partner ISP

$35 Covers Partner's Operating Expenses & Profit Margin

Partner Pays $35

City

$35 Covers City's Debt Services and Limited Operating Costs

FTTH FINANCIAL REVIEW

COST COMPARISON

Cost Drivers – Operating Costs

	City ISP		Partner ISP	
Operating Costs	Total Cost (Mature Operation)	Percent of Total Costs	Total Cost (Mature Operation)	Percent of Total Costs
Staffing	$2,060,361	45%	$440,000	33%
Plant Operations & Maintenance	$351,742	8%	$351,742	27%
Equipment Maintenance	$172,000	4%		
Software Maintenance	$120,000	3%		
Facilities Maintenance	$125,000	3%		
Vehicle Maintenance	$35,000	1%	$35,000	3%
Pole Rental	$744,000	16%	$500,000	38%
Utilities & Office Expenses	$101,985	2%		
Legal & Professional Services	$152,978	3%		
Reporting & Compliance	$101,985	2%		
Wholesale Internet Access	$185,000	4%		
Sales & Marketing	$203,971	4%		
Promotions & Discounts	$101,985	2%		
Miscellaneous	$101,985	2%		
Total Operating Costs	**$4,557,993**	**100%**	**$1,326,863**	**100%**

FTTH FINANCIAL REVIEW

COST COMPARISON

Cost Drivers - Staffing

	City ISP			Partner ISP		
Staff Person	Quantity	Fully Loaded Cost	Total Cost	Quantity	Fully Loaded Cost	Total Cost
Customer Service Rep	2.00	$ 120,003	$ 240,006			
Service Techs	2.00	$ 111,539	$ 223,077			
Customer Service Supervisor	0.50	$ 121,550	$ 60,775			
Billing Tech	1.00	$ 110,500	$ 110,500			
Financial Controller	0.50	$ 139,230	$ 69,615			
Network Designer	1.00	$ 132,600	$ 132,600	1.00	$ 132,600	$ 132,600
Network Engineer	2.00	$ 155,363	$ 310,726			
Install Tech	1.50	$ 113,152	$ 169,728			
Maintenance Tech	1.50	$ 107,185	$ 160,778	1.50	$ 107,185	$ 160,778
Field Services Manager	1.00	$ 186,303	$ 186,303	1.00	$ 186,303	$ 93,152
Sales & Marketing Manager	1.00	$ 186,303	$ 186,303			
Engineering Manager	1.00	$ 209,950	$ 209,950			
TOTAL STAFFING COSTS	**15.00**		**$ 2,060,361**	**3.5**		**$ 440,122**

FTTH BUSINESS CASE

SAMPLE TIMELINE FOR FTTH – INCREMENTAL DEPLOYMENT