City of Palo Alto

City Council Staff Report

(ID # 12117)

Report Type: Action Items   **Meeting Date: 5/24/2021**

Summary Title: Fiber Network Expansion Project

Title: Review of the Fiber Network Expansion Plan and Fiber-to-the-Home (FTTH) Business Case, Provide Feedback on FTTH Business Model, and Direction That Includes Building Community Awareness, Engagement and Survey, and Funding Options

From: City Manager

Lead Department: Utilities

Recommendation

Staff and the Utilities Advisory Commission (UAC) recommend that the City Council approve and direct staff to pursue build out of the City fiber backbone in a manner designed to support citywide Fiber-to-the-Home (FTTH), including approve the near-term 12-month workplan outlined in the report and establish a City-operated Internet Service Provider (ISP) model to offer FTTH service within five years.

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.

Approval of the staff and UAC recommendations would result in direction to staff to:
1. Perform the following tasks by March 31, 2022:
    a) Combine Phases 2 and 4 of the Magellan contract (C20176363) to provide detailed engineering design of the City's fiber backbone and FTTH distribution network;

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b) Complete a detailed City-operated ISP model, to include a combination of insource and outsource functions;

c) Complete a residential and commercial broadband survey;

d) Complete a risk and mitigation analysis of City-operated ISP model; and

e) Determine the best financing model, including availability of federal and state funding options.

2. Establish a City-operated Internet Service Provider (ISP) model to offer FTTH service within five years, and

Per Council prior direction as part of the Community and Economic Recovery work plan, staff will prioritize and accelerate community education and engagement regarding FTTH.

Staff and Magellan presented the FTTH business case to the Utilities Advisory Commission (UAC) on April 21, 2021 (Staff Report #12118). The UAC discussion focused on the City ISP versus Partner ISP business models, community education and engagement, risks, costs, and financing options. The UAC voted unanimously (7-0); as shown in the draft minutes, to recommend building out the fiber backbone and establishing a City-operated ISP.

The UAC discussion focused on:

1. Build out fiber backbone to support citywide FTTH: The fiber backbone will support the Advanced Metering Infrastructure (AMI), Supervisory Control and Data Acquisition (SCADA), and wireless communication for City field staff and other City services (i.e. public safety, transportation, parking, and parks). It will also provide the foundation to support FTTH and will reduce the overall FTTH construction cost.

2. Establish City-operated ISP model providing FTTH service within five years: Given the low capital cost differential of $5.5 million between City ISP ($86.0M) compared to Partner ISP ($80.5m) and potential revenue upside of $23.5M in 20 years of City ISP ($38.7M) compared to Partner ISP ($15.2M), staff agrees that effort should be directed solely towards the City ISP model. In addition, under the City ISP model, the City will have control of pricing and internet service offerings. The City ISP model is recommended to consist of both insource (i.e. customer service, billing, engineering, sales) and outsource functions (i.e. installation, field service, maintenance).

3. Accelerate and complete community education and engagement: The UAC and staff recommend enhanced community education and engagement prior to the residential and commercial broadband survey. One initiative of the City's community and economic recovery workplan is to pursue expanded community engagement for FTTH. The City will partner with Magellan to develop a communication and education plan including development of a web-based customer engagement platform, leveraging community partners engaged on this effort, and offering other ways to engage and informing such as online surveys will help the City assess options for expanding access to affordable high-speed fiber-optic internet service throughout the community.

4. Explore financing options: Evaluate various financing options to fund City-operated ISP FTTH deployment and conduct risk and sensitivity analysis to validate financial sustainability of City ISP FTTH model.

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. City ISP
   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
- Bond rating uncertainty since it's a significant amount to finance for the FTTH. A low rating will increase the financing costs

2. Partner ISP
   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
   - Bond rating uncertainty since it's a significant amount to finance for the FTTH. A low rating will increase the financing costs

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.
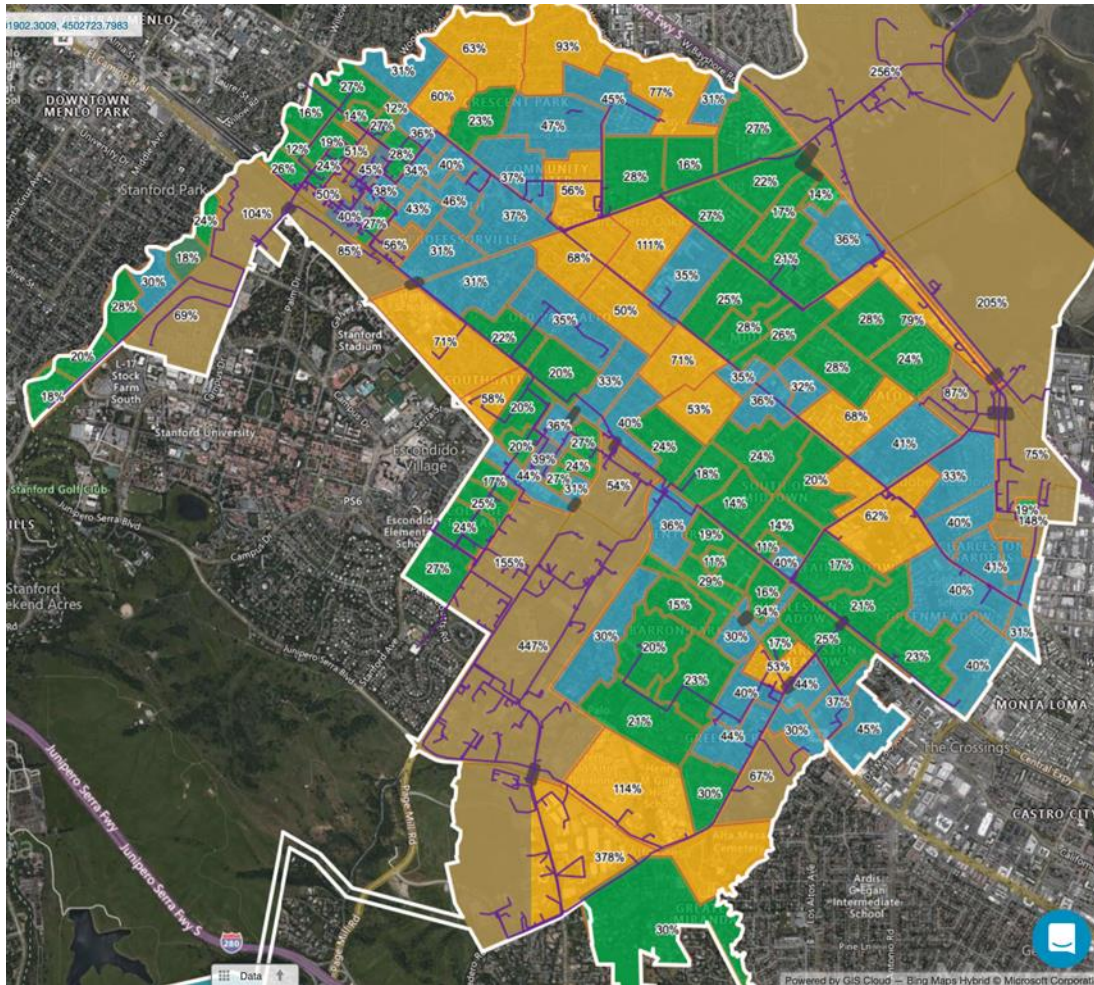
When considering the City ISP, the outsourcing or contracting of specific functions should be considered. Some broadband functions are core competencies and can be easily managed by the City, while other functions are new and can be outsourced where the City doesn't have the expertise in-house. Subsequently, 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 (Broadband Policy Report) 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 from the FTTH services that could be provided. 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?

Magellan will assist the City in monitoring and pursuing federal and/or state funding for broadband infrastructure, including potential funding within the American Rescue Program Act (ARPA). 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. If Council approves of the detailed engineering design, staff will return to Council with a contract amendment for Magellan and a budget approval ordinance by June 21, 2021. In addition to the detailed engineering design, Magellan will partner with the City to develop a FTTH community education and engagement plan. Council approved $200,000 for FTTH community engagement as part of the City's community and economic recovery plan. After the detailed engineering design is completed, staff will return to Council in Q2 2022 with the refined cost estimate for the fiber backbone and FTTH distribution network, a business plan identifying operational and maintenance expenses for City-operated ISP, and different funding options for FTTH.

Environmental Review
Council approval of actions to design, model, assess risks, and develop cost estimates for the proposed fiber network expansion project and City-operated fiber internet service are categorically exempt from the California Environmental Quality Act (CEQA) pursuant to Section 15306 (Information Collection) of the CEQA Guidelines because the services consist of data collection, research, and evaluation as part of a study leading to an action that the City has not yet approved or funded. The City will conduct an environmental assessment of subsequent project phases, as needed, prior to implementation.