Digital Access Plan

April 2023

Digital Access Plan

Contents

VISION STATEMENT 2

EXECUTIVE SUMMARY 3

KEY QUESTIONS 8

WHY SHOULD CHELSEA CONSIDER FIBER 8

DIGITAL EQUITY IN CHELSEA 13

FEASIBILITY ANALYSIS 18

MARKET ANALYSIS 24

NEXT STEPS 29

ADDENDUM 42

- I. Infrastructure Grants 42
- II. Network Architecture 44
- III. Comparison of Available Media 46
- IV. Municipal Network Models 49
- V. Risk Assessment 53
- VI. Community Engagement 58
- VII. Sample Project Manager Job Description 61
- VII. Example RFP: Chico, CA (Open Access Platform Partner) 62

GLOSSARY 68

SECTION 1

Vision Statement

Digital Access Plan

VISION STATEMENT

The COVID pandemic illuminated the fact that high-speed, quality internet access is an essential service that should be provided to every resident that wants it at a reasonable, affordable price. Sadly, the City cannot rely upon market forces to remedy this problem. Private broadband providers are unwilling to make the necessary investment when the demographics of a city do not lead to the sale of premium products with large profit margins. So, the City must seek alternative solutions to this problem where it can influence outcomes which are consistent with the principle that this is now an essential service.

SECTION 2

Executive Summary

Digital Access Plan

Executive Summary

This Digital Access Plan was initiated when Chelsea and counterparts in Revere and Everett worked with the Metropolitan Area Planning Council (MAPC) to submit a proposal for a "Build Better Broadband" grant solicitation sponsored by Connect Humanity. The combined team was selected as a grantee to work through a six-month analysis culminating in this report. The City of Chelsea has worked with EntryPoint Networks, Connect Humanity, and Biarri Networks to develop this analysis to help City leaders determine whether it is feasible and advisable to deploy and operate a municipally owned fiber network for the residents, businesses, and anchor institutions in the City of Chelsea. This report seeks to assist City leaders in understanding the operational implications, important risk factors, and a realistic cost framework for developing and operating City-owned fiber optic infrastructure.

Long-term objectives behind this analysis include:

- Improve Affordability
- Reduce or Eliminate the Digital Divide
- Create an Engine for Economic Development
- Manage the Fiber Optic Infrastructure as a Public Utility
- Increase Competition Through an Open Access Model
- Unbundle the Infrastructure and Services so the City will not Have to be a Service Provider
- Create Alignment with Users
- Establish Local Control Over Pricing and Reliability

This is a living document. If City leaders determine the project has sufficient merit, the planning process will continue toward a potential Citywide fiber deployment.

The Cost of Connectivity and the Digital Divide

The 2021 bipartisan congressional infrastructure bill (H.R. 3684, Infrastructure Investment and Jobs Act (IIJA)) defines digital equity as "the condition in which individuals and communities have the information technology capacity that is needed for full participation in the society and economy of the United States."

The primary impetus for the work that this report covers is that the City is seeking alternative solutions to existing gaps in digital connectivity. During COVID, Chelsea residents initially experienced infection at far greater rates than anywhere else in the state and country. As schools shuttered, students needed more bandwidth to participate meaningfully and consistently in educational activities. Residents who were fortunate enough to be able to work from home struggled with the quality and reliability of their connections. The City must rely on something other than market forces to remedy this problem. As the vision statement for this document emphasizes, private broadband providers have yet to be willing to make the necessary investments in long-term solutions when the demographics of a city do not lead to the sale of premium products with large profit margins.

Digital Access Plan

Digital barriers to full participation in society and the economy now impact access to healthcare, financial institutions, educational opportunities, and economic opportunities. Additionally, the trends are toward growing dependence on digital infrastructure. A companion document to this Digital Access Plan is the Digital Equity Research Report for Chelsea, Everett, and Revere, published by MAPC in October 2022. The key findings from the MAPC research* include the following:

- 19% of households do not have a wired internet connection. The average in the State of Massachusetts is 13%.
- 13.5% of households have access to the internet via a smartphone only.
- 19.1% of the community lives in poverty.
- 28% of the children in Chelsea live below the poverty line.

* https://www.mapc.org/wp-content/uploads/2022/10/Digital-Equity-Report.pdf. *This MAPC data comes from the 2021 American Communities Survey.*

This plan emphasizes three actions to drive real change in affordability and availability for the residents and businesses of Chelsea:

1. Begin treating the infrastructure as a public utility built on the assumption that the infrastructure and related services are now essential.
2. Unbundle the infrastructure and network maintenance and operations costs from services (internet access). This will allow the City to control the availability and affordability of the infrastructure without becoming a retail internet service provider.
3. Implement an open access model for service providers to foster competition and choice. The open access model will also play an important role in making the monthly cost affordable for subscribers. The feasibility of this plan can be compared as an alternative to the current business model offered by the incumbent operators like Xfinity/Comcast.

Economic Development

Because the economy is now digital, access to digital infrastructure is key to participation in the economy. The primary goals of a community-based network are to lower costs, improve reliability, increase the number of services available across the network, and make the network affordable for every business and individual. Each of these things is material to the local economy.

Current Incumbent Pricing

In Chelsea, most residents and businesses currently subscribe to several cable and telephone internet providers, including Comcast / Xfinity, Verizon DSL, and Starry Internet, with a large portion of the market share going to Comcast / Xfinity. Residential pricing for Comcast / Xfinity services starts at $65.00 per month for 50 Mbps down/5 Mbps up. Verizon DSL begins at 7.1 Mbps down/5 up for $74.99 per month. At the time of this report, Starry Internet pricing started at 30 down/30 up for $15.00 per month. It has since filed for bankruptcy on

February 21, 2023. Detailed incumbent pricing for residential and business can be found in the Market Analysis section of this plan.

Note: *The prices stated above are listed on the company websites. They are standard pricing, speeds are "up to" not guaranteed or symmetrical, and availability depends upon location.*

Projected Costs for a Chelsea Municipal Network

Projected Per Premise Infrastructure Cost – Using Census Numbers

The following cost projections are based on a year-one Citywide buildout and a total residential household count in Chelsea of 13,174. This modeling assumes a new drop for each household.

Project Total Costs – Based on Census Household Counts

Financial Pro-Forma of Full Project Costs – Two-Year Build - Ethernet Architecture

	100% Aerial	40% Buried/ 60% Aerial	100% Buried
Projected Cost Per Premise (Common and Drop)	$1,407	$1,578	$1,833
Estimated Subscribers	9,076	9,076	9,076
Total Projected Project Costs	**$12,773,104**	**$14,319,900**	**$16,640,093**

Per Household Projected Subscription Cost – Using Census Numbers

The following cost projections are based on a total of 13,174 households in Chelsea. This modeling assumes a new drop for each household. Under this modeling, the monthly cost for subscribers is projected to be as follows:

Projected Subscription Cost – Based on Census Household Counts

Projected Residential Services Monthly Costs	100% Aerial	40% Buried/ 60% Aerial	100% Buried
Infrastructure	$9.02	$10.11	$11.75
Maintenance and Operations	$21.00	$21.00	$21.00
ISP Services (Dedicated 1 GB Symmetrical)	$9.99	$9.99	$9.99
Monthly Total	**$40.01**	**$41.10**	**$42.74**

The recommended tools and the density of the number of households in the City present an opportunity to implement long-term sustainable solutions to help solve for the problems of affordability and access to reliable fiber optic infrastructure.

Government Grants

The Infrastructure Investment and Jobs Act (IIJA;H.R. 3684) and other federal legislation has allocated as much as $65 billion to the National Telecommunication and Information Administration (NTIA) to support broadband deployment in the United States. Most of that money will go to areas the Federal Communications Commission

(FCC) has classified as either entirely unserved or underserved (lacks high-speed broadband access of 100/20 Mbps). Most urban areas have been classified as served.

However, one eligible use is extending broadband service to multi-tenant buildings lacking high-speed broadband, including those in low-income, urban areas. Eligible Entities must give priority to residential buildings that (1) have a substantial share of unserved households or (2) are in locations in which the percentage of individuals with a household income is at or below 150 percent of the poverty line. A recommended next step is refining the available data regarding Chelsea premises that may be eligible under this rule.

Source: *Page 41 – https://broadbandusa.ntia.doc.gov/sites/default/files/2022-05/BEAD%20NOFO.pdf*

Inflation & Market Dynamics

Two market forces may have an unforeseen impact on the cost of deploying fiber-optic infrastructure in Chelsea. These are 1) inflation and 2) labor & materials supply. Inflationary pressures may be easing, but this is still a dynamic variable that requires attention. Because the federal government has allocated as much as $65 billion for broadband expansion, the capital flowing into this market segment impacts the availability of labor and materials. This will likely translate into higher costs for infrastructure deployment over the next three to five years.

Speed & Reliability

The report includes speed test data from m-LABs, a research consortium that tracks all recorded speed tests in a Google database. For 2022, the average speeds delivered by Xfinity/Comcast, the dominant ISP in Chelsea, are 85.25 Mbps download/11.25 Mbps upload.

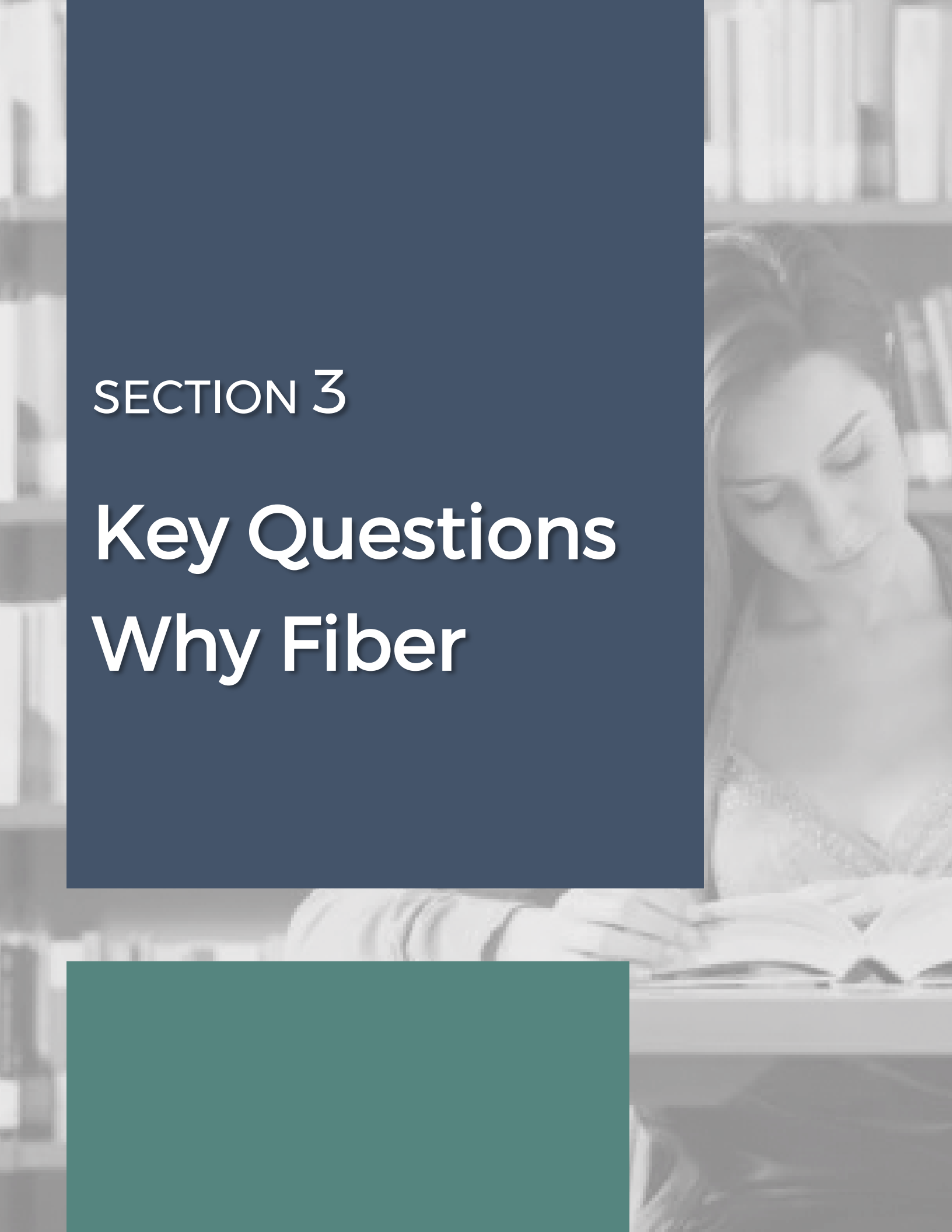
Next Steps

If City leaders determine that the plan has sufficient merit, follow-on steps are recommended to advance this initiative. The following actions with details are included in the Next Steps section of this document.

- Document the strategy for the following key decisions:
  - Ownership / Control: Decide the degree to which the City wants to control or influence the outcomes it desires for digital access.
  - Governance: Determine the governance structure that is appropriate to advance the City's objectives (City-owned – City-operated vs. City-owned – third-party operated)
  - Business / Operational Model: Decide whether a vertically integrated (single ISP) or an open access model aligns with the City's objectives.
- Prepare to apply for state & federal grants
- Formalize the selection of an operational model
- Work with the community throughout the process to raise awareness and engagement
- Conduct the business model request for proposal (RFP)
- Assume or procure the network operator role

Digital Access Plan

- Conduct the engineering request for proposal (RFP)
- Conduct the materials request for proposal (RFP)
- Conduct the construction request for proposal (RFP)
- Select project management for the project
- Finalize the project budget
- Finalize the phasing plan



SECTION 3

Key Questions Why Fiber

Digital Access Plan

Key Questions

1. Why should Chelsea consider building a municipal fiber-optic network?
2. What would a sustainable model look like for a municipal fiber network?
3. What are the next steps to advance the process?

1 Why should Chelsea consider building a municipal fiber-optic network?

Reliable digital infrastructure is vital to enable participation in today's economy. Broadband networks provide the road system in a digital economy. They are critical to nearly every function of a city's services and operations, from finance to transportation to emergency services. The importance of this infrastructure will only increase over time.

Similarly, businesses require reliable and fast digital infrastructure to connect with customers, ensure their supply chain, and continue to operate. The education and healthcare systems require digital infrastructure to connect with students or patients, to communicate between facilities, and ensure timely and appropriate services. Connecting to individuals from disadvantaged groups, either because of income, race, age, or language abilities, is even more critical to ensure these groups have full access and availability to benefit from today's digital society.

The incumbent model is intended to optimize profit for private companies rather than optimizing affordability, equity, and accessibility for all. As additional fiber deployment takes place in Chelsea, there is limited incentive for multiple private operators to install fiber in the same locations in the City, leading to more limited choices going forward. Due to the critical nature of digital infrastructure, ensuring a reliable and equitable network is a clear public policy concern. This places cities in a unique position to deploy an infrastructure asset that can have a far-reaching impact on all the systems that are important in a city.

Key limitations of the incumbent model include:
Incumbent infrastructure is treated as an amenity rather than essential.
The infrastructure and services are bundled together.
Today's digital roads are susceptible to monopoly control.
The interests of the incumbents are misaligned with the interests of subscribers.
There is no local influence over pricing, governance, or quality.
Current incumbent incentives have created the digital divide.

The deployment of a municipal fiber network would overcome these limitations. Like the City road network, deploying a municipal fiber network would provide equitable, reliable access to all residents and businesses, and continue to encourage competition. As the road network supports competition among various delivery services, a digital network could support competition among various internet service providers.

2 What would a sustainable model look like for a municipal fiber network?

The following opportunities to improve digital infrastructure are unique to a municipal entity and may enable long-term benefits in education, digital equity and inclusion, healthcare, public safety, efficient delivery of government services, and the general economy. Commercial internet service providers (ISPs) are unlikely to pursue any of these opportunities because they are contrary to profit motives and to existing incentives.

1) Improved Affordability

The dominant national ISPs have developed a business model that is "rent seeking" and sustained by controlling the infrastructure. Network control allows incumbents to impose premium pricing on network rents (ISP fees). The actions listed below can effectively overcome these "rent seeking" practices and drive down the cost of access in a meaningful way. These include:

1. Apply established municipal utility operational models for funding, construction, operation, and fees and leverage established municipal utility structures, tax exemptions, access to public grant funding, lower borrowing rates, and better liability treatment to drive costs down.
2. Put downward pressure on price by enabling dynamic competition between service providers via an open access network model.

3. Separate and optimize the key cost components of digital access into the three main network categories: (1) Capital Infrastructure Investment, (2) Monthly Maintenance & Operations Expenses, and (3) Monthly Internet Access Free from ISP.
4. Allow households in multi-tenant buildings to share the infrastructure, maintenance, and operations costs.
5. Allow subscribers to pay-off the cost of infrastructure and eliminate that line item once the infrastructure debt has been retired.
6. Leverage automation to lower operational expenditures.
7. State and federal grants targeted to offset the cost of deploying new fiber-optic infrastructure.

2) Sustainable Solutions for the Digital Divide

The 2021 bipartisan Congressional infrastructure bill (H.R. 3684) defines digital equity as "the condition in which individuals and communities have the information technology capacity that is needed for full participation in society and economy of the United States."

Persistent barriers to universal internet access, digital equity and inclusion, availability, affordability, and adoption are now public domain concerns. The internet has moved from being a luxury item to a necessary feature of modern life—like other utility infrastructure. The incentives for private industry are not aligned toward resolving persistent gaps and the solutions advanced by private industry have not addressed these critical public needs or provided effective sustainable solutions. Informed public policies coupled with targeted public investments are needed to provide lasting solutions. These public policies must be informed by the fact that reliable internet is now necessary for access to educational systems, economic activities, healthcare, public safety systems, and many other cultural and societal interactions.

3) New Economic Development Opportunities

We live in a digital economy. Communication infrastructure is now fundamental to commerce and economic development because it provides the foundation for the economy. Historically, economic development has followed investment in infrastructure for all major systems including transportation, water, sewer, or communications. Until now, municipalities have mostly remained independent of a governance role over digital infrastructure allowing private companies to decide where they will build, what they will build, the cost of services, and the kind of innovation that will happen on these systems. However, the network is now so fundamental to modern life and commerce that municipalities are increasingly taking a more active role over governance of and enabling new opportunities which depend on this infrastructure.

4) Fiber-Optic Infrastructure Treated as a Public Utility

Implementing fiber-optic networks managed as a public utility is consistent with the notion that this is essential infrastructure in the modern economy. Utility frameworks, such as roads, water, sewer, storm drains, and electricity, exist to support essential functions critical for societal success. Providing digital access as a public utility will result in maximum service at the lowest possible cost for residents, businesses, and anchor institutions. The current lack of adequate competition and the practice of treating this as an amenity rather than a utility affects affordability, ubiquity, equity, and quality of service.

5) Increased Competition Through an Open Access Model

Open access is a model that divides the infrastructure and services into two separate systems and then shares the infrastructure between multiple service providers, like road systems and airports. A key goal of an open access system is to lower costs and improve service by increasing choice and competition. For an open access system to realize its potential, it is critical for the infrastructure owner to be a neutral host of the infrastructure. The role of a neutral host is to control and manage the infrastructure without privileging one service provider over another. A true open access network depends on enabling robust shared infrastructure that is operated on a non-discriminatory basis. This model is analogous to the structure of deregulated electricity markets where the utility provides the distribution, and the supply can come from a wide range of options.

6) Unbundled Infrastructure and Services

The dominant national ISPs bundle the infrastructure and services together to insulate the infrastructure owner from outside service providers. An open access model depends on unbundling or separating the primary functions and network costs into three buckets: 1) Infrastructure Capital Deployment, 2) Ongoing Network Operations, and 3) Services. To optimize each function and to enable the City to become a neutral host, it is important to unbundle the key network functions and costs.

7) Alignment with Users

Residents, business owners, and visitors of Chelsea should receive maximum value for minimum cost. The City has established goals of enhancing livability, increasing economic development, ensuring equity, enabling important anchor institutions like healthcare and education, and caring for natural and human resources. As digital infrastructure becomes increasingly important to each of these things, the significance of alignment with the network owner and operator also increases. The City of Chelsea is aligned with the interests of residents and business owners to support a network that delivers maximum value for the minimum cost.

8) Local Control Over Pricing and Reliability

Local control over critical infrastructure allows for the needs of residents and business owners in Chelsea to drive policy and regulations. Today's dominant ISPs are nationwide companies that are not organized to align the network with local needs and interests. Digital infrastructure will be positioned to increase local value when it is owned and controlled by a local neutral host. The digital divide, education, economic development, public safety, and healthcare are all examples of local variables that can best be understood and addressed locally. Control over network infrastructure will allow Chelsea to leverage the power of the network in advancing communication solutions for these issues.

3 What are the next steps to advance the process?

The objective of this section is to provide a roadmap to City leaders for actions to take once approval to proceed is granted. City leaders must align with the vision for the overall project to be successful.

Digital Access Plan

A series of recommended actions and considerations are outlined in detail beginning on page 29.

SECTION 4

Digital Equity

Digital Equity in Chelsea

The City of Chelsea has worked with MAPC and the cities of Revere and Everett to conduct a formal digital equity needs assessment.

The digital equity plan developed by MAPC (October 2022) found that affordability and poverty were the main barriers to internet adoption in these three cities, with 70% of survey takers responding, 'Yes' to the question "Have you ever had to change or cancel your internet subscription because it was too expensive?" Additionally, "residents in these communities were experiencing average internet speeds much lower than available, advertised speeds, with some of the lowest average download speeds of any municipality in the region."

The MAPC Plan for eliminating the digital divide focuses on network access, equipment access, and digital literacy. Specifically, the plan advocates for:

> Removing barriers
> Augmenting the capacity of key stakeholders
> Improving digital technology literacy
> Promoting competition

The MAPC report defines digital equity as: A condition in which all individuals and communities have the information technology capacity needed for full participation in our society, democracy, and economy. Digital equity is necessary for civic and cultural participation, employment, lifelong learning, and access to essential services.

Other key findings from the MAPC research include:

- 19% of households do not have a wired internet connection. This is 6% higher than the average in the State of Massachusetts.
- 13.5% of households have access to the internet via a smartphone only.
- 19.1% of the community lives in poverty.
- 28% of the children in Chelsea live below the poverty line.

Note: *This MAPC data comes from the 2021 American Communities Survey.*

In addition to data from the American Communities Survey, MAPC surveyed residents in Chelsea, Revere, and Everett and received 2,165 responses. Chelsea residents represented 793 of the total responses. Of these, 49% were in English, and 49% were in Spanish, with additional responses in Arabic, Portuguese, and Haitian Creole. Based on the survey, Comcast has an 81% market share in Chelsea. 15.5% of survey respondents indicated they do not have an internet subscription. This is slightly lower (18%) than what is represented in the U.S. Census. The survey data also showed that 37% of survey respondents had to leave their homes to use the internet at another location because the internet at their home is unreliable. A key assertion in the MAPC research is that the incentives in the current system of private ownership of internet access is not organized to incentivize eliminating the quality and affordability gap as shareholder, not community, needs supersede other stakeholder

needs. This puts shareholder needs over stakeholder needs. Further, corporate or government subsidies are not a sustainable solution to the digital divide. This report holds that the infrastructure must be treated as essential utility infrastructure under local control to provide sustainable, long-term solutions for the digital divide.

Digital Equity

The City has done preliminary work on digital literacy, device access, digital skills, technical support, and digital navigators' assessment with MAPC. Still, it plans to expand this work via an application for grant support from the Massachusetts Digital Equity Partnerships Program and the Municipal Digital Equity Planning Program.

The MAPC Digital Literacy Plan is focused on the following digital literacy initiatives:

- Remove barriers that prevent universal access to reliable and high-speed (100 / 100 Mbps) internet.
- Augment the capacity of key stakeholders such as IT departments, school districts, libraries, community-based organizations, and municipal staff to address the digital divide.
- Ensure all residents who desire to improve their digital / technology literacy have a pathway to educational opportunities at various skill levels, offered in community-appropriate languages and settings.
- Promote competition among internet service providers offering broadband service.

Funding

The City is evaluating the possibility of using a combination of a Revolving Fund and grants to fund the digital infrastructure. The City has allocated $748,052 towards "access and ability to use high-speed, quality broadband internet at prices people can afford" through its American Rescue Plan Act (ARPA) funds community-based allocation process and anticipate there may be other opportunities for local matches for larger grants. The City will consider a tiered payment structure for subscribers based on ability to pay.

Construction & Operations

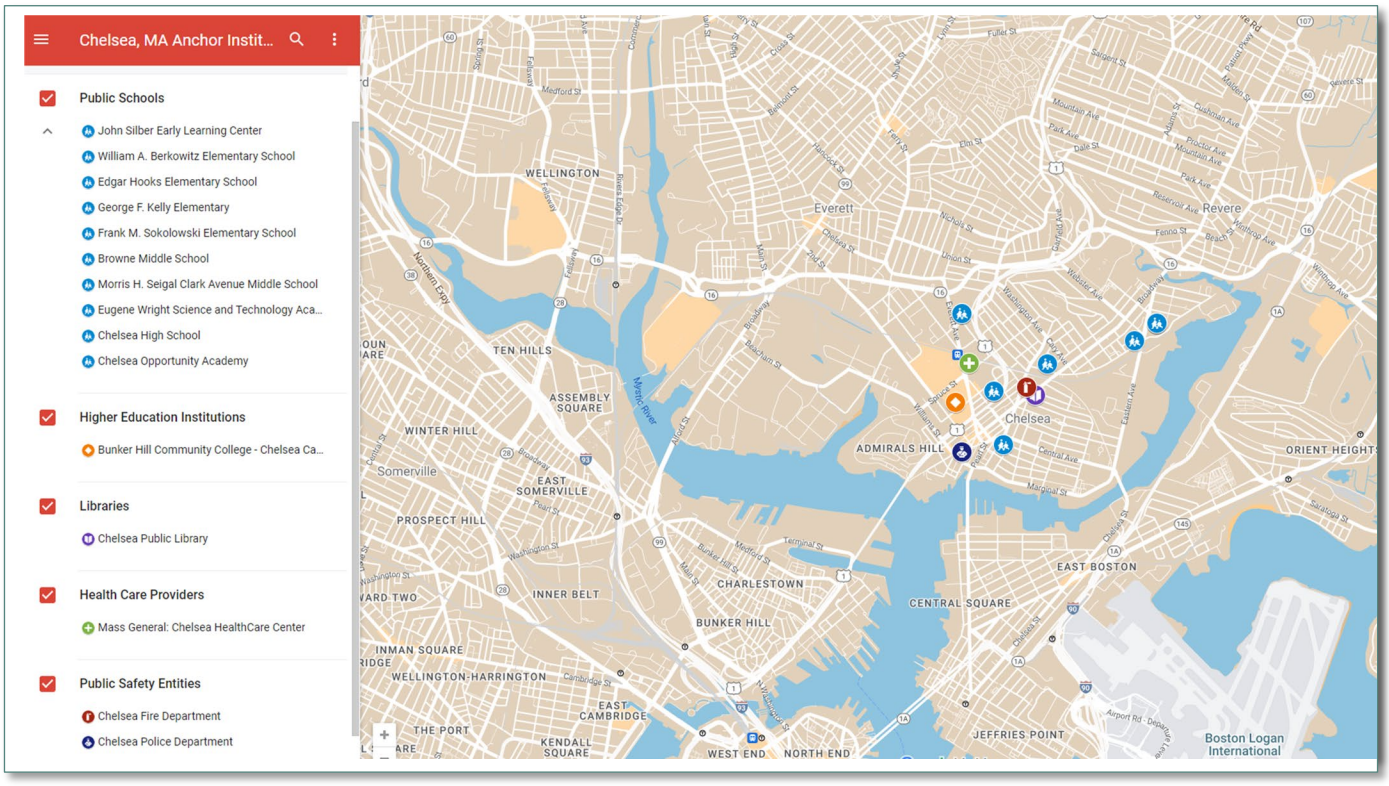
If it moves forward with a Citywide project, the City will conduct a public process to contract with a third-party construction firm to build the network. Network maintenance and operations would also initially be contracted to a third-party. At some point in the future, the City may hire internal staff to maintain the infrastructure.

Anchor Institutions

Section I.C.f. of the BEAD Notice of Funding Opportunity (NOFO) defines a community anchor institution (CAI) as an entity such as a school, library, health clinic, health center, hospital or other medical provider, public safety entity, institution of higher education, public housing organization, or community support organization that facilitates greater use of broadband service by vulnerable populations, including, but not limited to, low-income individuals, unemployed individuals, children, the incarcerated, and aged individuals. An Eligible Entity (the State Broadband Office) may propose to NTIA that additional types of institutions should qualify as CAIs within the entity's territory. The City will seek to work with these anchor institutions as customers, service providers, and locations to provide digital literacy education. A selection of these institutions is illustrated on the map below. Click here to access the interactive Google Map.

Source: *Page 11 – https://broadbandusa.ntia.doc.gov/sites/default/files/2022-05/BEAD%20NOFO.pdf*

Digital Access Plan



Demographics & Income

The following are key demographic and income statistics for the City of Chelsea:

- Total population – 40,025
- Race and ethnicity – 20% White, 66% Hispanic, 7% Black, 4% Asian, 3% Two or More
- Gender – 51% male, 49% female
- Median age – 33.8
- Less than high school graduate or equivalency – 32.7%
- Bachelor's degree – 20.9%
- Miles covered – 2.2
- People per square mile – 18,040
- Total households – 13,353
- Average household size – 2.9
- Properties that are owner occupied – 28%
- Persons below the poverty line – 22.5%
- Median household income – $64,782
- Median metro income – $99,039
- Median state income – $89,026
- Median national income – $67,521
- Number of households that have a computer – 89.9%
- Number of households with a broadband connection – 82.4%
- Number with a cellular data plan – 79.3%

* *Note: The difference between the household count and the premise count provided by Biarri is likely attributable to households living in multifamily dwelling units.*

- People with no internet subscription – 15%

Source: https://censusreporter.org/profiles/16000US2513205-chelsea-ma/

- Total Biarri premises – 4,557 (reference on page 15)
- Miles of conduit – 52

Current Broadband Offerings

Chelsea currently is subject to a near monopoly for internet coverage, with Xfinity / Comcast controlling nearly the entire residential market. There is some fiber deployment in the city, but it is limited to fiber to the node in the Comcast system and large businesses and institutions. Verizon currently has a presence in Chelsea but has a nominal market share.

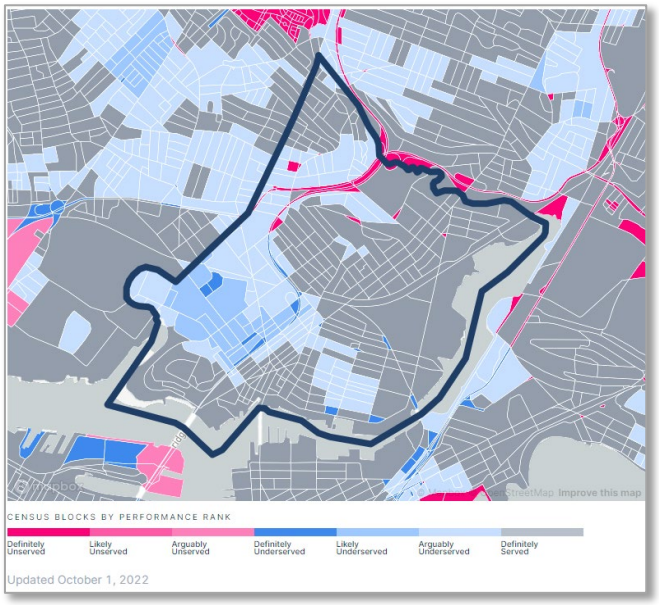
Many cities do not know where fiber is deployed. This may be due to past practices, incumbent refusal to release that information to a city, or other circumstances. We would note that not providing data to city officials about where fiber is, hampers a city's ability to know how to plan and improve local conditions. Companies should not be in the driver's seat regarding municipal planning. They should be a partner that is accountable and responsive to municipal and local governance entities—not just Federal.

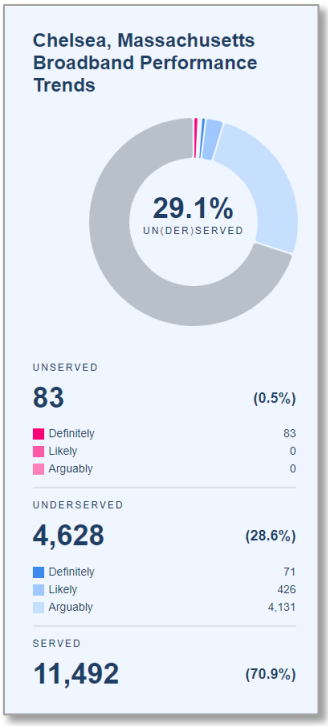
Readily found data on unserved and underserved citizens in cities, towns, townships, and municipalities is under dispute due to discussions about the latest information released by the Federal Communications Commission (FCC) in their broadband maps. According to FCC maps, the fastest typical speeds are 25 / 3 Mbps and indicate that many urban areas are served when they may be underserved and unserved. Many communities are finding errors, and the information we include in this report is from official sources. Each municipality must validate this data as it goes forward with official network development plans.

Broadband.Money audits tell a different story. The map on page 17 shows the total demand points and quality of broadband coverage in Chelsea. This map clearly outlines places most in need of improvement and can serve as a resource when considering improvement or expansion of broadband services. Click here to learn more.

The difference between the FCC's current mapping and the Broadband.Money audit estimates indicate the need to reconcile the under and underserved in each community.

Digital Access Plan





SECTION 5

Feasibility Analysis

Sustainable Financial Model & Feasibility Analysis

The feasibility of deploying municipal infrastructure is a function of comparing current market factors (pricing, customer satisfaction, services, speeds) to realistic projections for a City controlled infrastructure.

Financial Feasibility

A key objective of Chelsea is that the infrastructure must be available to everyone at affordable rates. Chelsea's pursuit of universal availability and affordability will lead to completely different outcomes than the current state for the businesses and residents of Chelsea.

- Estimated Current Internet Spend in Chelsea
- Projected Total Cost of Citywide Deployment
- Projected Cost per Household at 60% Take-Rate

Aggregate Internet Connectivity Cost in Chelsea Today

The following table provides a reasonable estimate of the amount of money the residents of Chelsea are paying for internet access today. This is based on a national median average of $74.99 from the Consumer Reports white paper on broadband pricing (Consumer Reports – November 17, 2022). This average does not include businesses and is meant to illustrate the current cash flow available to support a locally owned network and to underscore the fact that $9.7 million is leaving the community today. There is an opportunity to keep some of that locally.

Internet Spend in Chelsea Today

Average monthly cost of home internet connectivity in U.S. today is $74.99

Number of Households w/ broadband	10,803
Average Monthly Internet	$74.99
Annual Internet Spend	$9,721,404
20 Year Internet Spend	$194,428,073

Assumes 18% of households in Chelsea do not have a dedicated or wired connection.

Digital Access Plan

Projected Monthly Cost to Subscribers

A target outcome for this planning effort is to put the City in a position to leverage grant and appropriation opportunities to lower the cost of new infrastructure and then finance the remaining infrastructure cost over 20 years.

The main cost categories for deploying and operating broadband networks are:

- Infrastructure Capital Costs (Financed over 20 years)
- Network Maintenance & Operations (Monthly Utility Fee)
- Services (Paid Directly to Service Providers)

To optimize the subscriber cost for each category, it is recommended that the costs are separated and transparent to each stakeholder (subscriber, network operator, and service provider). In this model, the billing for infrastructure and network maintenance and operations comes as two separate line items in a bill from the City. The preferred billing mechanism for services would be done directly from the ISPs by credit card. If an automated payment to the service provider is a barrier for some residents, we can evaluate listing the services as an additional line item on the City billing notice. In the recommended open access model, the ISPs will be in a marketplace, and subscribers will be able to switch ISPs on demand. A key objective will be to have ISPs in the marketplace that qualify for the Affordable Connectivity Program (ACP) subsidy to further improve affordability.

Per Household Projected Subscription Cost – Using Biarri Numbers

The following cost projections are based on Biarri's network design which focused on the cost of building fiber optic infrastructure to 4,557 physical premises in Chelsea. This design generates a bill of materials (BOM), which details the materials (e.g., fiber, conduit, splice boxes) needed to build infrastructure to each premise. The first table below does not account for the total number of households. In Chelsea, there are between 3.0 – 3.5 households per premise, which will positively impact the cost per household when analyzed on a cost per household vs. a cost per premise basis. Under this modeling, which is specific to Chelsea, the monthly cost for subscribers is projected to be as follows:

Projected Subscription Cost – Based on Biarri Premise Counts

Projected Residential Services Monthly Costs	100% Aerial	40% Buried / 60% Aerial	100% Buried
Infrastructure	$16.92	$19.31	$22.89
Maintenance and Operations	$21.00	$21.00	$21.00
ISP Services (Dedicated 1 GB Symmetrical)	$9.99	$9.99	$9.99
Monthly Total	**$47.91**	**$50.30**	**$53.88**

Per Household Projected Subscription Cost – Using Census Numbers

The following cost projections are based on a total of 13,174 households in Chelsea. This modeling assumes a new fiber drop for each household, which is likely a conservative number because the cost structure will benefit from the efficiencies of doing multiple fiber drops at the same time to get to the average of three households per premise. Under this modeling, monthly subscriber costs are projected to be as follows:

Projected Subscription Cost – Based on Census Household Counts

Projected Residential Services Monthly Costs	100% Aerial	40% Buried / 60% Aerial	100% Buried
Infrastructure	$9.02	$10.11	$11.75
Maintenance and Operations	$21.00	$21.00	$21.00
ISP Services (Dedicated 1 GB Symmetrical)	$9.99	$9.99	$9.99
Monthly Total	**$40.01**	**$41.10**	**$42.74**

It is recommended that the City pursue a network that is 100% buried fiber to improve reliability and lower long-term maintenance and operations costs. A buried network is more expensive to install. Still, the total cost of ownership may be equivalent to an aerial fiber network, and buried networks are more reliable and easier to maintain. As the City moves from the current high-level network design to a construction-ready design, it will become clear whether it is feasible to build a network that is 100% buried.

Projected Citywide Infrastructure Capital Costs

The total projected construction costs for a Citywide deployment are summarized in the table below. These numbers assume that construction techniques and routes will largely avoid other utility infrastructure, rock, and other impediments. These numbers can change significantly if contractors face significant unknown or known variables that represent a significant impact on construction timelines. Capital costs for three scenarios are provided: 1) a 100% aerial network deployment, 2) a 40% buried / 60% aerial network, and 3) a 100% buried network at a 60% take-rate and an interest rate of 4.5%. These capital costs include all network materials and electronics, including the edge device that goes into the premises of each household. This modeling does not include a Wi-Fi router for each premise. The projections below do not account for the possibility that the infrastructure costs will be reduced by federal or state grants or other appropriations.

Per Premise Projected Infrastructure Cost – Using Biarri Numbers

The projections in the first table reflect the year-one capital cost and are based on the Biarri network design, which included 4,557 physical premises in Chelsea. These numbers do not account for the average number of households per premise. For example, some apartment buildings—often known as multi-dwelling units or MDUs—have multiple households per "premise." This is an important data point because the monthly cost for subscribers will be driven by the number of households rather than the number of premises. Under this modeling, the total cost per premise is projected to be as follows:

Digital Access Plan

Project Total Costs – Based on Biarri Premise Counts

Financial Pro-Forma of Full Project Costs – Year-One Build - Ethernet Architecture

	100% Aerial	40% Buried / 60% Aerial	100% Buried
Projected Cost Per Premise (Common and Drop)	$2,641	$3,014	$3,573
Estimated Subscribers	2,734	2,734	2,734
Total Projected Project Costs	**$7,220,494**	**$8,240,276**	**$9,768,582**

Note: *The modeled aerial costs do not include the possibility of pole replacement fees or other unexpected make-ready charges.*

Per Premise Projected Infrastructure Cost – Using Census Numbers

The following cost projections are based on a year-one Citywide buildout and a total residential household count in Chelsea of 13,174. This modeling assumes a new drop for each household, likely a conservative number because the cost structure will benefit from the efficiencies of doing multiple drops at the simultaneously to get to the average of three households per premise. This modeling is the most relevant framing and drives the total project cost up because of the significant increase in drops for each household:

Project Total Costs – Based on Census Household Counts

Financial Pro-Forma of Full Project Costs – Two Year Build - Ethernet Architecture

	100% Aerial	40% Buried / 60% Aerial	100% Buried
Projected Cost Per Premise (Common and Drop)	$1,407	$1,578	$1,833
Estimated Subscribers	9,076	9,076	9,076
Total Projected Project Costs	**$12,773,104**	**$14,319,900**	**$16,640,093**

Note: *The modeled aerial costs do not include the possibility of pole replacement fees or other unexpected make-ready charges.*

Common: The shared fiber infrastructure in a neighborhood that runs from a drop to the closest aggregation hut.
Drop: The fiber that runs from the street to the side of the premise (home or business).
Make-ready: Before an internet service provider (or any entity) can add a new attachment or line to a utility pole, the existing attachments may need to be moved around so that the pole can be made ready to handle a new attachment or line.

Digital Access Plan

Why Take-Rate is Important to Total Infrastructure Cost

Take-rate is a variable that is critical to project success because the operational sustainability of a project depends on crossing a certain take-rate across a broad number of subscribers, translating into an attractive and affordable cost per premise. At this point, no formal analysis has been completed.

The following table illustrates the impact of the take-rate on the total cost per premise under an 60% aerial and 40% buried network with a take-rate of 60% as neutral on impact.

Take-Rate Modeling

Take-Rate	Cost/Sub	Subscribers	Par = 60% Take-Rate
40.00%	$2,069	5,270	($398)
45.00%	$1,936	5,928	($265)
50.00%	$1,830	6,587	($159)
55.00%	$1,743	7,246	($72)
60.00%	**$1,671**	**7,904**	**$0**
65.00%	$1,610	8,563	$61
70.00%	$1,557	9,222	$114
75.00%	$1,512	9,881	$159
80.00%	$1,472	10,539	$199

Network Management and Operations

The work required for network operations includes network monitoring, network management, outside plant repairs, and new customer installations. The City is recommending that the City own the network and outsource operations to a third-party. It also makes sense for the open access partner to provide customer support, the network operations center (NOC) support, monitoring, and troubleshooting. We suggest utilizing a public process to select a local group to manage an outside plant—which includes physical repairs, splicing, new customer connections, maintenance of the physical asset, and emergency response for the physical plant. We have budgeted $21.00 per subscriber per month to cover the cost of maintenance and operations. This number includes fees for suppliers including the open access partner, the third-party partner handling the physical or outside plant, and the middle mile operator.

Below is an itemized breakdown of the monthly M&O subscriber fee.

Residential M&O per Month	Fee
NOC	$2.50
Contract M&O	$11.45
Open Access SaaS	$2.50
Middle Mile	$1.00
Reserves	$3.55
Total	**$21.00**

Digital Access Plan

Take-Rate

Take-rate is a key consideration with financial feasibility. Take-rate is the percentage of potential subscribers who are offered the service who subscribe. Feasibility is a function of take-rate. Take-rate is a function of creating value and effectively communicating that value to subscribers. Higher take-rates lead to lower shared infrastructure costs.

Chelsea is an urban city with relatively high density. Projected costs are provided for both an aerial and buried implementation. The aerial projections do not include an analysis or cost projection for pole make-ready work.

If Chelsea can achieve the projected take-rate of 60% (the number used for financial modeling), the projected monthly aerial / buried combination rate of $41.19 per month for 1,000/1,000 Mbps would represent a savings of $72.76 per month over the premium cable offering from Xfinity/Comcast of 1200 / 20 Mbps.

Ultimately, feasibility will depend on the quality and effectiveness of community engagement to educate residents on the value proposition of a locally controlled and municipally sponsored network.

Financial Modeling Assumptions

Financial modeling analysis is based on the following demographic information for the City of Chelsea:

<u>Tables Based on Biarri Data</u>

Total Potential Premises: 4,557
(Households and Businesses)

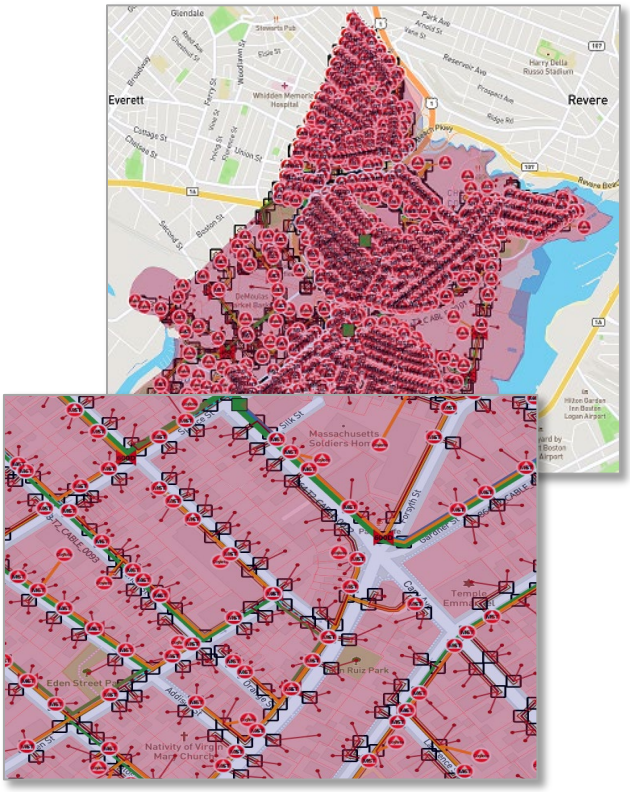
Subscribers @ 60%: 2,734

<u>Tables Adjusted for Households and Businesses in Chelsea</u>

Total Potential Subscribers: 15,127
(Households and Businesses)

Subscribers @ 60%: 9,076

Biarri Networks develops end-to-end technical solutions that accelerate the design and deployment of fiber, broadband, and 5G networks. They blend 21st-century best practices in software engineering with civil engineering and infrastructure development. They simplify and accelerate the work of upgrading and building telecommunications networks across the globe. Biarri Networks performed the feasibility level design for the Chelsea study which informed the financial modeling assumptions.



Sample of Biarri designs in Chelsea

SECTION 6

Market Analysis

Market Analysis

Incumbent Offers and Pricing

In Chelsea, most residents and businesses currently subscribe to several cable and telephone internet providers. The content below comes from the websites of these incumbent providers.

Residential

Comcast / Xfinity

Comcast / Xfinity advertises the following residential services in Chelsea on their website:

Speed (Mbps) [Down / Up]	Promotional Rate [Conditions Apply]	Standard Pricing [+ Taxes and Fees]	Install [Fee]
50/5	N/A	$65.00	TBD
100/10	N/A	$83.95	TBD
300/10	N/A	$89.99	TBD
600/12	$103.95	$103.95	TBD
900/18	$109.00	$109.00	TBD
1200/20	$113.95	$113.95	TBD
6000/30	$299.95	$299.95	TBD

Taxes and fees often represent an additional (10% - 15%) of standard pricing.
Shared Network – Speeds are "up to" and are not guaranteed.
Speeds are not symmetrical.
Modem with Wi-Fi – $14.00 per month.
Cancellation charges may apply.
Contract may be required.
Availability depends upon location – not available in all areas.

Verizon DSL

Verizon advertises the following residential services in Chelsea on their website:

Speed (Mbps) [Down / Up]	Promotional Rate [Conditions Apply]	Standard Pricing [+ Taxes and Fees]	Install [Fee]
7.1-15/.5	N/A	$74.99	Self-Install
25-50	N/A	$60.00	Self-Install

Taxes and fees often represent an additional (10%-15%) of standard pricing.
Speeds are "up to" and are not guaranteed.
Speeds are not symmetrical.
Phone line required – Additional $34.99 per month.
Availability depends upon location – not available in all areas.

Digital Access Plan

Starry Internet

Starry Internet advertises the following residential services in Chelsea on their website:

Speed (Mbps) [Down / Up]	Promotional Rate [Conditions Apply]	Standard Pricing [+ Taxes and Fees]	Install [Fee]
30/30	N/A	$15.00	Included
200/100	N/A	$50.00	Included

Taxes and fees often represent an additional (10%-15%) of standard pricing.
Speeds are "up to" and are not guaranteed.
Speeds are not symmetrical.
Availability depends upon location – not available in all areas.
Note: Starry filed for bankruptcy on February 21, 2023.

Business

Comcast Business

Comcast Business advertises the following business services in Chelsea on their website:

Speed (Mbps) [Down / Up]	Contract Period	Promotional Pricing [+ Taxes and Fees] For Contract Term	Standard Pricing [+ Taxes and Fees]	Equipment [Required]	Install [Fee]
35/5	2-Year	$69.95	$69.95	ID	ID
100/15	2-Year	$119.94	$129.94	$19.95	Included
100/15	3-Year	$116.61	$139.94	$19.95	ID
200/20	2-Year	$144.94	$149.94	$19.95	ID
200/20	3-Year	$146.61	$169.94	$19.95	ID
300/30	2-Year	$184.94	$189.94	$19.95	ID
300/30	3-Year	$186.61	$209.94	$19.95	ID
600/35	2-Year	$214.94	$219.94	$19.95	ID
600/35	3-Year	$226.61	$269.94	$19.95	ID
940/35	2-Year	$264.94	$269.94	$19.95	ID
940/35	3-Year	$273.27	$309.94	$19.95	ID

ID = Insufficient Data

Taxes and fees often represent an additional (20%-30%) of standard pricing.
Shared Network – Speeds are "up to" and are not guaranteed.
Speeds are not symmetrical.
Availability depends upon location – not available in all areas.

Digital Access Plan

Verizon Business

Verizon Business advertises the following business services in Chelsea on their website:

Speed (Mbps) [Down / Up]	Contract Period	Standard Pricing [+ Taxes and Fees]	Equipment (required)	Install [Fee]
5 DSL	2-Year	$99.00	ID	ID
10 4G	ID	$99.00	$9.72	$49.00
25 4G	ID	$129.00	$9.72	$49.00
50 4G	ID	$229.00	$9.72	$49.00

ID = Insufficient Data

Taxes and fees often represent an additional (10%-15%) of standard pricing.
Speeds are "up to" and are not guaranteed.
Speeds are not symmetrical.
Modem with Wi-Fi – $15.00 per month.
With 4G plans $9.72/mo. or $349.99 one-time fee.
Availability depends upon location – not available in all areas.

Note: *Market research was conducted in June 2022*

Digital Access Plan

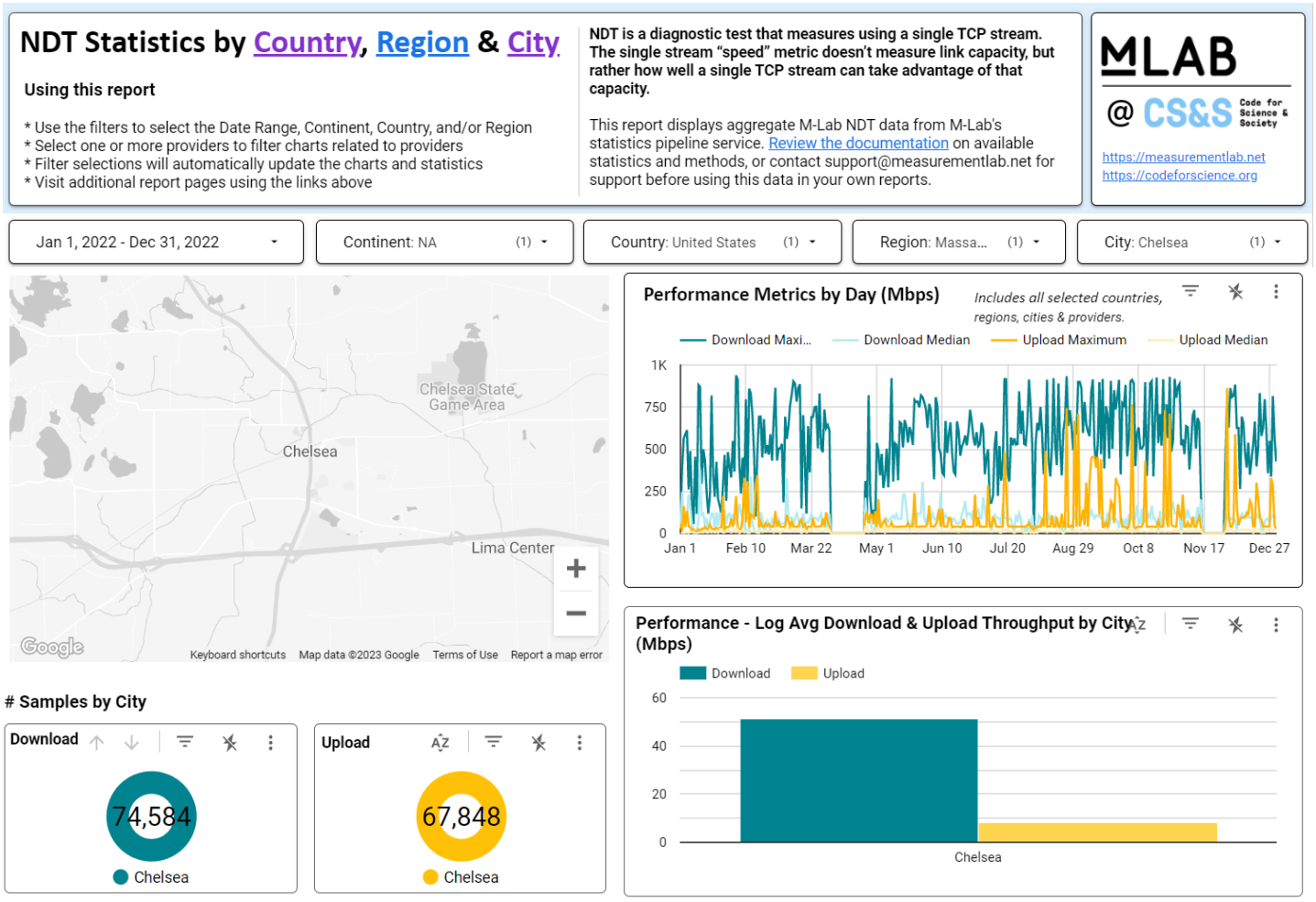
Speed Test Data

M-Lab is a research consortium that provides open data from speed tests across the United States. Academic, scientific, and public interest research organizations rely on M-Lab's open data. Every time an individual runs a speed test through an open source integration of M-Lab's tools, the data is saved in Cloud Storage hosted by Google and made available to the public via BigQuery. The data below is the speed test results for Chelsea from January 1, 2022, to December 31, 2022.

74,584 Speed Tests captured in Chelsea during 2022

The average speeds delivered by the ISPs in Chelsea are:

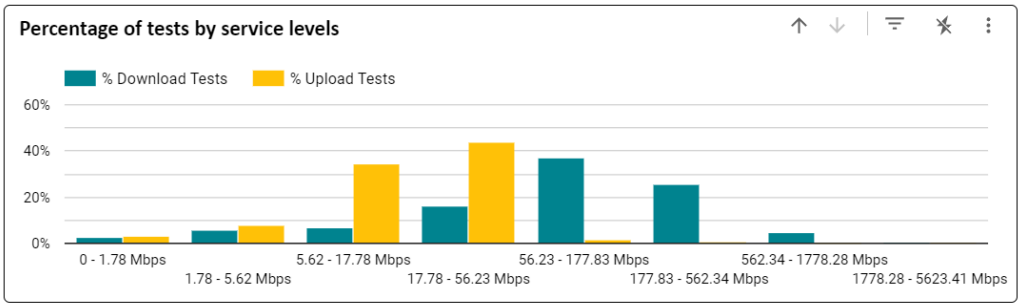
- > Xfinity/Comcast = 85.25 download/11.25 upload
- > Verizon Business (MCI Comm) = 3.21 download/0.61 upload
- > Verizon Wireless (Cello Partners) = 11.21 download/1.77 upload
- > Starry, Inc = 72.02 download/18.48 upload
- > T-Mobile = 32.74 download/2.85



Digital Access Plan

NDT statistics used in this report are provided as daily histograms, consisting of the percentage of measurements within a range of "service levels" or speed ranges.

The chart on the right presents the histogram of tests that measured at these levels over the selected date range and locations, across all providers.

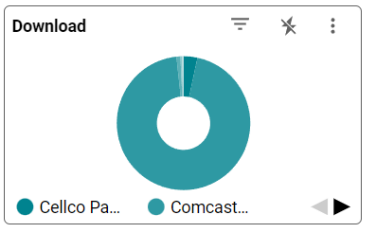


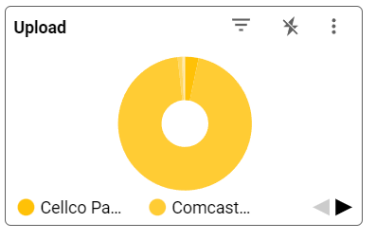
Provider Statistics

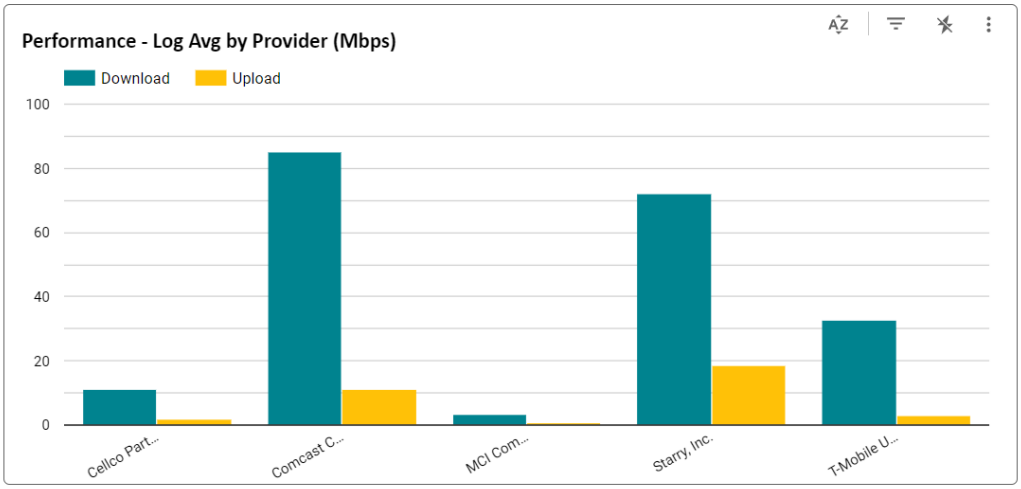
Provider: Cellco Partnership DBA ... (5)

In the NDT dataset, each test is associated with the Autonomous System operating the IP address from which each test was conducted. This may be different than the ISP that offers service.

Samples by Provider







SECTION 7

Next Steps

Next Steps

The objective of this section is to provide a roadmap to City leaders for actions to take once a decision has been made to move forward. City leaders must be aligned with the vision for the overall project to be successful.

Current Strategy

The growing number of municipally owned networks is a response to the misalignment between private incentives and the essential nature of access in modern society. Incumbent operators have been free to establish most of the rules governing their infrastructure and services, including service levels, maintenance standards, network reinvestment, and service territories with little to no municipal oversight and accountability. Alternatively, public entities are perfectly positioned to be a neutral host of fiber optic infrastructure organized to enable competition and lower costs while also ensuring local people are covered.

THE IMPORTANCE OF STRATEGY

As state and federal grant opportunities evolve, municipalities are positioning themselves as favorably as possible to attract funding into their jurisdictions to enable meaningful change.

Three key questions will provide direction to subsequent phases of the decision-making process. These require careful consideration before endorsing a specific implementation model for expanding broadband access.

KEY DECISIONS

1) **Ownership / Control:** Decide the degree to which the City wants to control or influence the outcomes it desires for digital access.
2) **Governance:** Determine the governance structure that is appropriate to advance the City's objectives.
3) **Business / Operational Model:** Decide whether a vertically integrated (single ISP) or an open access model aligns with the City's objectives.

KEY DECISION #1: INFRASTRUCTURE OWNERSHIP

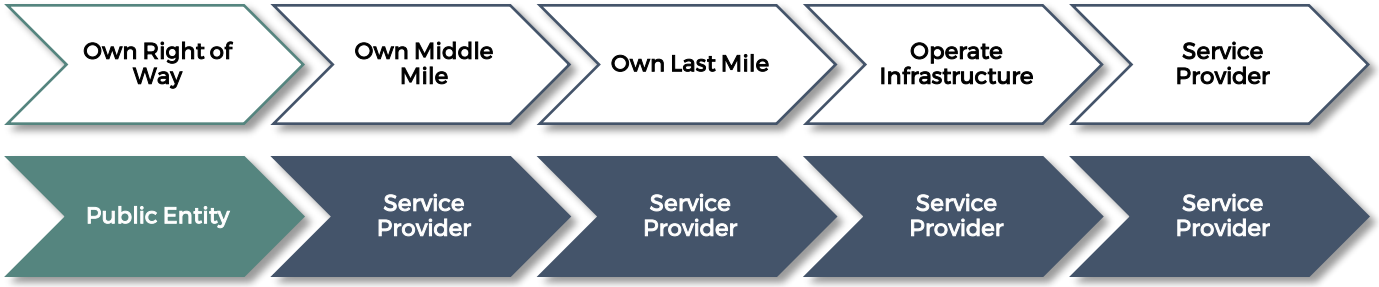
Chelsea's proposed digital infrastructure will be owned by a private company, a public entity (the City), or a hybrid private-public partnership (PPP). Each of these is explained below.

Private Network Ownership

The easiest course for a city is to do nothing and allow private companies to continue to own and operate internet infrastructure. Private companies who own the infrastructure dictate which business model is used and typically select a model to maximize the company's return on investment rather than emphasizing public benefit. The dominant model used by most providers in the industry is a vertically integrated model with a single service provider operational model where consumers have access to privately owned infrastructure supporting one provider's services.

Digital Access Plan

Figure 1: The Existing Deployment and Operation Model

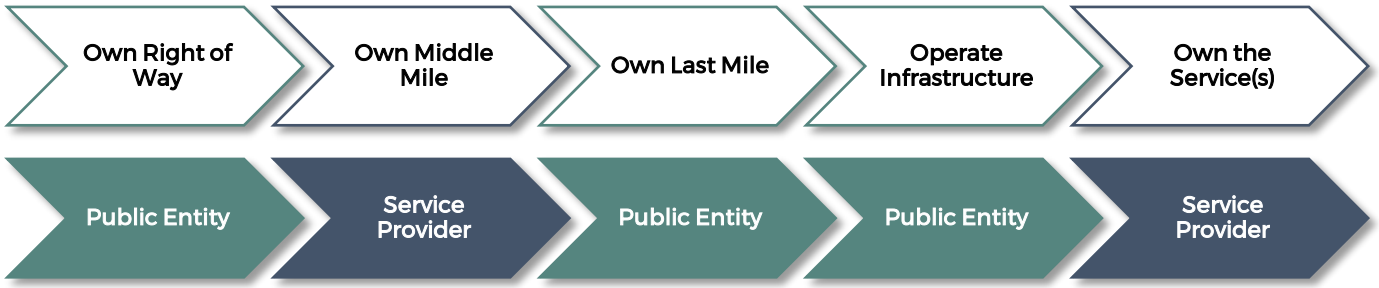


A single internet service provider often dominates rural areas because costs are higher due to greater distances and a lack of population density. Consumers may have access to multiple internet service providers in denser urban areas. Still, these entities compete through facilities-based competition—by building siloed infrastructure that they use exclusively.

Public Network Ownership

Public ownership of network infrastructure can produce many tangible benefits for individuals and communities. Public owners have greater incentives to solve the digital divide. Costs can be lower if the network is operated as a non-profit enterprise and the public entity increases competition through an open access system. It is more likely that the City is aligned with residents on what they want from the network (e.g., low cost, high reliability, abundant bandwidth) than a third-party owner. Third-party owners will always be motivated first by the survival of their organization (e.g., profits, financial reserves), while the City's focus is on making the system self-sustaining and adding value. The City also has much broader and different interests related to broadband infrastructure. These include economic development, livability, public safety, education, healthcare, emergency communications, smart grid, efficient government services, environmental stewardship, universal access, and smart city applications. All these things are now network-dependent, and the value from the network to the City aligns perfectly with the interests of constituents who subscribe to the network.

Figure 2: Municipal Infrastructure Ownership and Operation Model



Additionally, the public entity will not have to get permission or incur new expenses whenever it wants to connect the network to a new service or application. Furthermore, public ownership of the network will allow the City to optimize the network for local needs rather than organizing the operation to serve a national market.

Digital Access Plan

Locally owned public infrastructure protects the community from a private owner operating as an unregulated monopoly or selling the network to a monopoly operator. It also makes the network operator accountable to subscribers via an election cycle where subscribers are empowered to influence outcomes. Finally, the network will have significant value once it is built. The local community can share that value.

The figure below summarizes some differences between privately owned and publicly owned infrastructure.

Figure 3: Public vs. Private Broadband Models Summary

Public

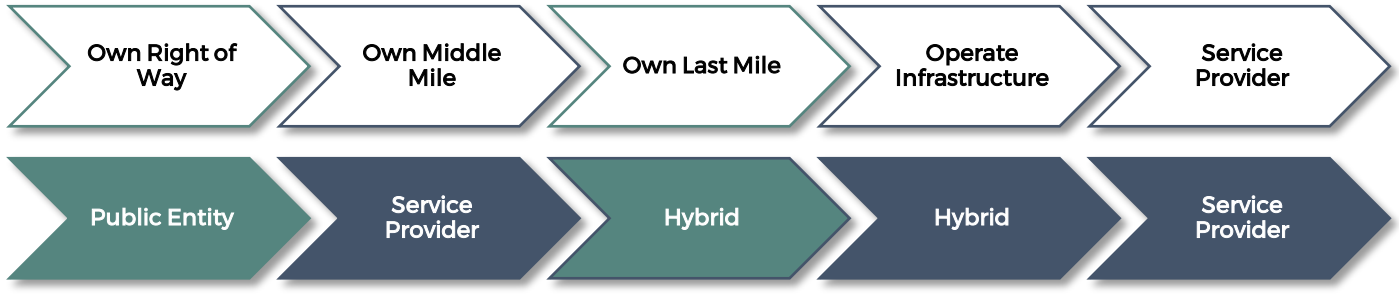
> Customers are Key Stakeholders
> Not-for-Profit
> Assets Held Publicly
> Public Board Meetings
> Elected Board Approves Budget
> Local Control

Private

> Investors are Key Stakeholders
> For Profit
> Assets Held Privately
> Private Board Meetings
> Private Board Sets Rates
> Investor Control

Hybrid Ownership and Operations

Figure 4: Hybrid Deployment and Operation Model



Hybrid ownership and operational models are emerging but are now in their infancy. An example of this model is a special purpose entity or special purpose vehicle (SPV). An SPV is a legal entity established to separate an asset, subsidiary, or financial transaction from a larger corporation or government agency. These are typically created to help isolate risk in a transaction or manage the risks associated with the development of an asset. A special purpose entity can also be established for collaborations between a government agency and a privately owned company via a public-private partnership (PPP).

An SPV may be a politically acceptable vehicle for managing risk for infrastructure projects. It can help local governments complete projects sooner since the private company may have the resources needed to complete an infrastructure project and may be less encumbered by public sector operational processes. SVPs can vary based on their founding legal and financial agreements. The specific role can be unique to the partnership between the government agency and the private entity.

Ownership Decision Making

The following guidelines may be helpful to the municipality as its leaders determine whether private, public, or hybrid ownership is right for them.

1. If the City's key priorities are to limit ownership and operational responsibilities and is willing to forgo any level of control or ownership, then pure private models should be given favorable consideration.
2. If the City's broadband goals include universal access for all residents and reliable digital access to providers and services, models that provide for public or hybrid ownership of the local infrastructure should be given favorable consideration.
3. If long-term municipal funding is available for construction of broadband facilities through a revenue bond or property assessment vehicle, then models that provide for public ownership of the local infrastructure should be given favorable consideration.
4. If the City desires to limit ownership and operational responsibilities but would like to maintain some level of control and the possibility of future public ownership, then hybrid models should be given favorable consideration.
5. If the City desires to facilitate a shift away from facilities competition to competition among service providers, then public or hybrid ownership should be given favorable consideration.

KEY DECISION #2: GOVERNANCE MODEL

Governance includes the statutory frameworks that define what is possible and not possible for a city that seeks to own and operate this infrastructure and the policies and operational processes that a city imposes on itself, third-party partners, and subscribers.

The State of Massachusetts allows the municipality to own, operate, and function as an internet service provider if desired.

The following information outlines statutory and non-statutory governance considerations as the City determines how it would govern the infrastructure and services. The ownership and business model strategies the City Council selects to increase broadband access will narrow the options for the governance structure. For instance, some structures will be more suitable for municipally owned infrastructure, while others will better support privately owned infrastructure.

If the City pursues a hybrid ownership model, governance will be specified in the agreement between the parties.

Digital Access Plan

STATUTORY COMPARISON

The following is a summary of the two primary governance structures available to cities and towns in Massachusetts. The City should seek legal advice to determine which structure is best for its funding and operational strategy.

CONSIDERATION	ENTERPRISE FUND	MUNICIPAL LIGHT PLANT (MLP)
MGL specifically allows operation of fiber-optic utility	No	Yes
Books and audit	Accounts are separate from general fund but still within City books and audited with City accounts	Separate set of books; audited separately from City accounts
Budget approval, including use of business income	City Council	MLP manager under the direction of the MLP board
Long-term contract approval	City Council	MLP manager under the direction of the MLP board
Depreciation reserve	Held within enterprise fund accounts under control of City Council	Held within MLP accounts under control of MLP manager and MLP board
Income and expenses	All gross income and expenses must be entered into accounts	May subcontract out to Coop or third-party and only include net income in books
Regulation / Oversight	DLS, however, G.L.c. 25C, § 6A prohibits regulation of internet and VOIP	Normally DPU or DTC, however, both declined, citing that G.L. c. 25C, § 6A prohibits regulation of internet and VOIP

OTHER CONSIDERATIONS

The following considerations may be relevant to the City's governance decision-making.

Maximizes Funding Opportunities

Successful models can draw from multiple funding sources that maximize opportunities, including the ability to apply for state and federal grants and loans and leverage other funding mechanisms such as bonds should be given critical consideration.

Long-Term Stability

The long-term stability of the selected model is essential. Sustainable and predictable long-term outcomes are critical when selecting the preferred model(s).

Required Authorities
The legal authorities of the selected model are critical. The ability to carry out the required actions must be explicitly provided in statute to avoid legal challenges and the financial losses they incur.

Risk Mitigation
Each model has a level of risk associated with a combination of unique participants. Risks related to the various models include subscriber churn (when customers stop using a reoccurring service), take-rate (percent of the available market that subscribes to a service), technology, community engagement, cost models, timeline, and design risks depending on the model.

Flexibility
Models with flexible statutory requirements have implementation advantages over more rigid models. Short-term flexibility can provide the ability to change and adapt as needed or desired resulting in better outcomes than less flexible models.

Required Initial Investment
Some models can achieve sustainable outcomes with minimal investment(s). This will have the effect of minimizing risks while at the same time creating a safety net for future investments.

Implementation Simplicity
Models that reduce implementation complexity related to design, installation, maintenance, and operation will improve efficiencies and result in more successful outcomes.

Cross-Jurisdictional Collaboration
The digital divide is agnostic to borders. In many cases, having a model that allows for regional collaboration is beneficial. The ability to encourage and develop regional consensus should be considered in determining effective governance models. Regional project paths require that projects can span across unincorporated and incorporated territories. Some models natively have this ability, while others will require a combination of two structures to provide regional project paths. Regional projects will require stakeholder consensus, influencing the City Council's ability to affect regional outcomes.

POLICY & OPERATIONAL CONSIDERATIONS

Opt-In (Voluntary Participation)
Will residents be able to voluntarily participate, or will the infrastructure be treated like other utilities where connection to the infrastructure is mandatory? Voluntary participation is more politically tenable.

Billing
Does the City have other utility billing processes, and can broadband be added to those mechanisms? If not, how will billing be handled for the capital cost, the maintenance and operations cost, and the ISP services? Also, how will billing be handled for residents that may not have a banking relationship or are not connected to modern digital financial transaction systems?

Treating the Infrastructure as an Improvement to Property

When a resident connects to municipal water, sewer, or other utility infrastructure, the connection is treated as an improvement to the property. The resident is obligated to pay off the infrastructure upfront or overtime. However, the incumbent facilities-based competition model does not impose a commitment to the infrastructure.

Customer Premises Equipment

It is common for the initial cost of the equipment that goes into the customer's home to be included in the initial capital cost. Will the replacement cost of that equipment be the customer's responsibility, or will it be financed through the maintenance and operations budget?

Customer Support

If the City pursues an open access model, how will support be handled to minimize frustration for the subscriber?

KEY DECISION #3: OPERATIONAL MODEL

Choosing the right operational model depends on the roles of the market participants in the broadband value chain. For this report, three possible roles are in focus:

1. The Physical Infrastructure Provider
2. The Network Operator
3. The Service Provider(s)

Different business models arise depending on which roles the market participants take within the operational model. The following summarizes key considerations for important network attributes for the main operational models.

Model → Attributes ↓	Vertically Integrated	Dark Fiber Leasing	Manual Lit Fiber	Automated Lit Fiber
Ownership	Same entity owns the infrastructure, operations, and services	A neutral host owns and operates the infrastructure to the curb; the ISP owns the drop	A neutral host owns and operates infrastructure but does not own services	A neutral host owns and operates infrastructure but does not own services
Closed vs. Open	Infrastructure is closed to outside service providers	Mixed—the backbone is open; the drop is closed	Infrastructure is open to outside service providers	Infrastructure is open to outside service providers
Retail vs. Wholesale Services	A single ISP is offered on a retail basis	Multiple ISPs are offered wholesale	Multiple ISPs are offered wholesale	Multiple ISPs are offered wholesale
Bundling of Roles – Are the three primary roles separated?	All three roles are bundled together—	Mixed	Ownership and operation of the infrastructure is	All three roles are unbundled

	vertically integrated		unbundled from the services	
Neutral Host	No	Mixed—the backbone is owned by a neutral host; the drop is owned and operated by the service provider	Yes	Yes
Facilities-Based Competition vs. Services-Based Competition	Facilities-Based Competition	Mixed—backbone network is open to multiple services; the drop is not open	Services-Based Competition	Services-Based Competition
Provisioning	The owner / operator manually provisions services	The service provider manually provisions services	The operator manually provisions services	The subscriber provisions services via automation
Virtualization	Each service requires a physical fiber	Each service requires a physical fiber	Each service requires a physical fiber	Many services can be delivered across a single fiber strand
Multiple Services Simultaneously	One service at a time	One service at a time	One service at a time	Multiple services at a time
Hardware-Defined vs. Software-Defined	Hardware	Hardware	Hardware	Software
Examples	Comcast, Charter, AT&T, Frontier, Verizon	Huntington, AL, Westminster, MD	Utopia SiFi Networks	Ammon, ID, Chico, CA Eagle, ID Mountain Home, ID

f

Definitions

Ownership: Digital infrastructure will be owned by a private company, a public entity (the City), or a hybrid private-public partnership (PPP).

Closed vs. Open: Open access combines a business model and architecture that creates a single shared infrastructure operated by a neutral host, which gives service providers open, wholesale access at fair, reasonable, and equal terms. A city is perfectly positioned to function as a neutral host. Closed infrastructure does not allow outside service providers onto the infrastructure. This results in a single ISP offering with facilities-based competition.

Open infrastructure allows for third-party service providers which typically leads to services-based competition.

Facilities-Based Competition: Industry incumbents always follow a facilities-based model. This means that every service provider is required to construct their exclusive infrastructure to compete in a market. This increases the barriers to entry, puts more infrastructure in crowded infrastructure channels, and results in higher consumer costs. Incumbent industry models almost follow a vertically integrated model with single ownership for the infrastructure and services offered to end users.

The alternative to facilities-based competition is services-based competition. This occurs when service providers compete on a single shared infrastructure, preferably owned, and operated by a neutral host that treats all service providers equally. An important goal of a neutral host should be to lower the barriers to entry to accelerate competition.

Provisioning: The provisioning of new services can either be done by the network owner/operator, the service provider, or the subscriber. The concerns for the subscriber include whether alternative services are available, how long a new service takes to be provisioned, and whether an appointment with a technician is required.

Virtualization: A technical term that describes using software to separate traffic to enable more than one service to be delivered across a single fiber strand. Virtualization is commonly used in data centers but is less common in fiber-to-the-home networks.

Multiple Services Simultaneously: A virtualized network can deliver multiple services simultaneously. A network that is not virtualized will not be able to deliver more than one service at a time. This capability will grow in importance as smart city applications gain traction.

Retail vs. Wholesale Services: The infrastructure is available to all market participants under equal conditions in an open access network. This requires a neutral party rather than a service provider to own and operate the infrastructure.

Bundling of Roles: If one market participant takes or bundles all three roles, it functions in a vertically integrated model. Unbundling or separating the three primary roles (infrastructure, operations, and services) is an enabling requirement for a true open access network. It is necessary to optimize the functionality and cost of each role. Unbundling allows the infrastructure to be operated by a neutral party (neutral host). The "unbundling" of roles does not necessarily result in the "unbundling" of subscriber costs. Establishing a clear separation of roles and responsibilities within the operational model requires successfully unbundling subscriber costs.

Hardware vs. Software-Defined Management: The distinction between hardware-defined and software-defined is an emphasis on how resources are pooled and managed. For the subscriber, this translates into key concerns like how long it takes to make needed network changes, the cost for these changes, and whether the subscriber captive to a single hardware vendor. In general, it is faster and less expensive to make changes in software than in hardware and a software-defined network can be liberated from vendor lock-in.

Operational Model Summary

In January 1999, the City of Portland, and Multnomah County, Oregon, filed a lawsuit to block AT&T's acquisition of a local cable network. Oregon public officials said they would approve the transfer if AT&T agreed to open its broadband assets to competition. The 9th U.S. Circuit Court of Appeals ruled that providing high-speed internet access is very different from the cable television business and should not be subject to the same set of regulations, and AT&T and other large incumbents were not required to open their existing infrastructure to competing service providers.

One result of this ruling has been a gradual decrease in regulations over telecommunication services over time. Another result has been that the vertically integrated model became entrenched as the de facto internet access model because legacy cable and telephone companies had the enormous advantage of existing infrastructure that could deliver the internet to the public. Comcast operates in Chelsea under this model.

The inherent limitation of the single provider model is that it gives customers few choices and naturally trends toward monopoly control for the provider that can offer the greatest bandwidth. Alternatively, open access networks are growing in popularity for public infrastructure owners because the model improves choice, competition, and affordability and works in rural and urban settings.

The most advanced open access networks support multiple service providers delivering services simultaneously over the network. End users can freely view the services and their associated costs and subscribe at any time. Service providers can create new categories of services, and subscribers can easily subscribe to them via an online marketplace without assistance. Additionally, the implementation is in software and can support rapid change and integration. The introduction of network automation enables self-service provisioning for stakeholders and creates a more open environment, improving adoption and reducing costs.

Source: https://www.lightreading.com/gigabit/fttx/debunking-the-open-access-myths/a/d-id/720514]

Identifying Service Providers

Identifying the best fit for service providers will depend on the ownership and operational models selected. Finding service providers will not be difficult regardless of the model selected, but the chosen partners should align with operational objectives.

Federal Policy and Opportunities

Numerous federal programs have demonstrated a clear preference for open access fiber.

The Reconnect Loan and Grant Program will not fund legacy copper or wireless systems, only fiber by listing a requirement for 100 Megabits symmetrical service. The program awards extra points for applications meeting public ownership and open access requirements.

Source: https://www.usda.gov/reconnect

The recent NTIA Middle Mile Grant Program was open to public entities, also requiring fiber and favoring open access in scoring.

Source: *https://broadbandusa.ntia.doc.gov/sites/default/files/2022-05/MIDDLE%20MILE%20NOFO.pdf]*

NTIA's Broadband Equity, Access, and Deployment Program (BEAD) will open to applications from public entities, prioritizing the deployment of fiber and encouraging scoring that favors open access on the part of the state offices overseeing the application and award processes. For example, it can be used to extend broadband service to multi-tenant buildings lacking high speed broadband, including those in low-income, urban areas. As part of their goal of broadband deployment to all unserved and underserved locations, Eligible Entities may fund deployment of Wi-Fi infrastructure to multi-family buildings that either entirely or partially lack high-speed broadband access (100 / 20). Eligible Entities must give priority to residential building that (1) have a substantial share of unserved households or (2) are in locations in which the percentage of individuals with a household

income at or below 150 percent of the poverty line applicable to a family of the size involved is higher than the national percentage of such individuals.

Source: Page 41 – https://broadbandusa.ntia.doc.gov/sites/default/files/2022-05/BEAD%20NOFO.pdf

Formalize the Selection of an Operational Model

There are downstream architecture and business plan decisions that require model selection. This makes selecting the operational model an important next step for Chelsea. This will require stepping through the formal process of presenting the options outlined in this report to the broader committee and City leaders, providing technical support to inform the decision-making process. The final selection should be memorialized in the meeting minutes and properly documented to inform the procurement process that will follow.

BEYOND THE THREE KEY DECISIONS

Business Model RFP

Once City leaders have decided on a preferred direction for (1) ownership, (2) governance, and (3) business model, we recommend conducting a public process (request for proposal (RFP), request for information (RFI), or request for qualifications (RFQ)) to select a solution partner for the selected business model. Whether the City is pursuing a single ISP model or an open access model, this is an appropriate next step because the partner needs to advise the City on network design, network architecture, equipment selection, quality control on construction, provisioning and turn-up of network electronics, selection of other key partners, and general project oversight. It will be appropriate to organize the RFP to identify a solution partner for the implementation of the business model as the owner's representative for the overall project.

It is important to select a partner with the demonstrated technical expertise necessary to guide and manage downstream procurement processes with the City's oversight and approval.

***Note:** As an example, a copy of the RFP issued by the City of Chico, California is provided in the Addendum.*

Additional Procurement

Once selected, the business model partner can assist with organizing the specifications and solicitations for a public process (request for proposal (RFP), request for information (RFI), or request for qualifications (RFQ)) for the following:

- **Assume or Procure the Network Operator Role**
  If Chelsea selects an operational model where it will assume the network operator role, clear responsibilities will need to be assigned, and resources will need to be allocated within Chelsea to establish the workforce and expertise necessary to perform network architecture, oversee design, select materials and equipment for cost modeling, and so forth.

  If network operations are outsourced to a third-party, selecting a partner with the demonstrated ability to support the desired operational model and business plan at this stage is critical to achieving desired outcomes. The technical and economic ability to deliver desired functionalities will be directly related to the network provider's capabilities. Procuring this partner will be required to complete applications for state, federal, or private funding.

- **Design / Engineering RFP**
  Select a design / engineering firm. The design process includes developing construction-ready plan documents, refining cost modeling based on network design, and initiating the make-ready process for utility pole attachments for aerial portions of the network.

- **Materials RFP**
  Provide technical assistance in organizing a solicitation for network materials.

- **Construction RFP**
  Select a design / engineering firm and help prepare the technical specifications for the construction work

- **Project Management**
  The business model partner will need to provide high-level project management for the project, but will not be onsite daily to manage timelines, project milestones, and work schedules to name a few. If the City is going to handle project management internally, the business model partner can be an advisor to assist internal project leadership. If the City outsources project management, the business model partner can assist in organizing the specifications for a public process (request for proposal (RFP), request for information (RFI), or request for qualifications (RFQ)) to select a project management partner and then collaborate with that partner throughout the construction process.

  Key project management skills and knowledge may include, but are not limited to:

  - Managing fiber optics projects and budgets, directing construction in accordance with the approved design, and coordinating work with other staff and design team members.
  - Interfacing with City staff, participants, and local government officials.
  - Reviewing project design as needed and coordinating adjustments to support constructability and budget outcomes.
  - Reviewing work products, quality control, and budgeting.
  - Mentoring, developing, and supervising staff.
  - Providing core project management functionality.

Project Budget

Developing a budget that can be trusted requires a process of moving from projected costs to hardened costs. This process includes a collaboration between City staff, the business model partner, and the engineering / design partner working together to develop a construction-ready design. This construction-ready design will be the basis for the construction RFP. The design will be refined once a construction partner is selected. Still, the construction-ready design should be 98% accurate.

Phasing

The business model partner can assist with refining the phasing options being considered and provide financial analysis on these options. The primary phasing decision will be whether to build as quickly as possible or pursue

an extended process which may be necessary due to internal constraints. Potential internal considerations specific to Chelsea may include:

- Leveraging planned road construction of City water system and install conduit
- Leveraging planned sidewalk construction of City water system and install conduit
- Build in conjunction with other large construction or public works projects in Chelsea
- Strategically select neighborhoods most impacted by affordability constraints

The City can do aerial or underground and is expressing a preference for a buried network, initially using conduit placement in conjunction with ongoing public works projects.

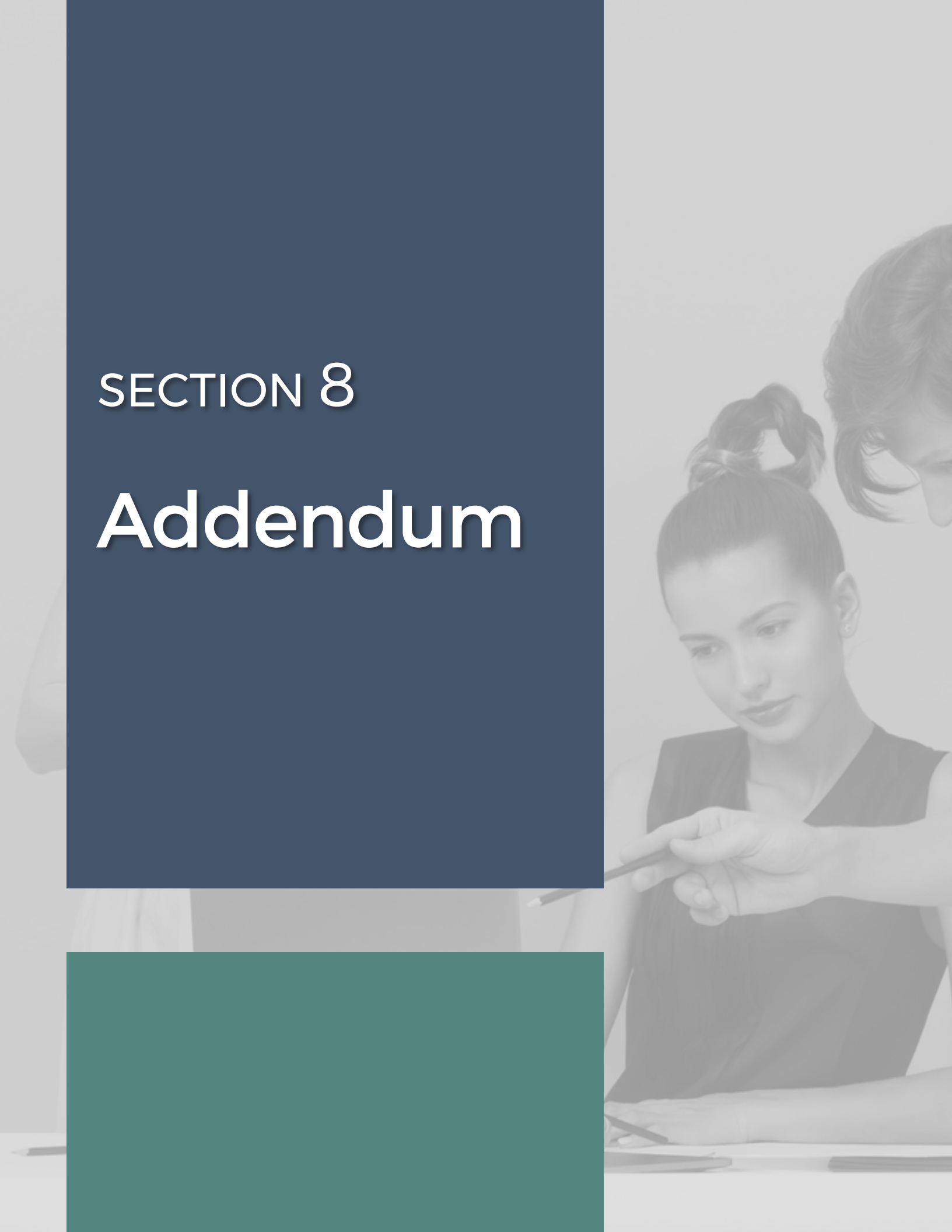
Work with State Agencies to Streamline Processes

Multiple touchpoints with various state offices and authorities represent opportunities for improving outcomes for potential network subscribers. These include procurement, regulatory, and financing processes. The Massachusetts Broadband Institute (MBI) could become a helpful partner in advancing these initiatives. The City should work with state agencies to improve processes for at least the following processes and functions:

- Create a procurement vehicle that municipalities could use to qualify bidders.
- Provide structural advocacy and technical assistance in procurement, so municipalities aren't duplicating efforts and competing for limited resources.
- Pursue legislation to expand the statutory tools available to cities to build municipal networks.
- Review and guide RFP documents.

SECTION 8

Addendum



Addendum

The content in the Addendum provides additional detail related to:

- > Infrastructure Grants
- > Network Architecture
- > Media Comparison
- > Business Model Options
- > Risk Assessment
- > Community Engagement
- > Sample: Project Manager Description
- > Example: Chico, CA RFP (Open Access Platform Partner)

Infrastructure Grants

The City and its partners should pursue all available federal and state broadband grant opportunities that may be a fit for Chelsea's proposed project.

Potential supplementary capital sources may include:

- > Coronavirus State and Local Fiscal Recovery funds – American Rescue Plan Act (ARPA)
- > Infrastructure Investment and Jobs Act (IIJA)
- > State Grants
- > Other

American Rescue Plan Act (ARPA)

American Recue Plan Act (ARPA) funds may be used to make necessary investments in broadband infrastructure, which has been shown to be critical for work, education, healthcare, and civic participation during the public health emergency. The final rule broadens the set of eligible broadband infrastructure investments that recipients may undertake to address challenges with access, affordability, and reliability.

Source: *https://home.treasury.gov/system/files/136/SLFRF-Final-Rule-Overview.pdf*

Infrastructure Investment and Jobs Act (IIJA)

President Biden's Infrastructure Investment and Jobs Act (IIJA) seeks to ensure every American has access to reliable high-speed internet. Broadband internet is necessary for Americans to do their jobs, to participate equally in school learning, health care, and to stay connected. Yet, by one definition, more than 30 million Americans live in areas where there is no broadband infrastructure that provides minimally acceptable speeds – a particular problem in rural communities throughout the country. And, according to the latest Organization for Economic Cooperation and Development (OECD) data, among 35 countries studied, the United States has the

second highest broadband costs. The Bipartisan IIJA will deliver $65 billion to help ensure that every American has access to reliable high-speed internet through a historic investment in broadband infrastructure deployment. The legislation will also help lower prices for internet service and help close the digital divide, so that more Americans can afford internet access.

Source: https://www.whitehouse.gov/bipartisan-infrastructure-law/]

Individual State Broadband Grants

Broadband Equity, Access, and Deployment (BEAD) Program Funding includes $42.45 billion for a new program focused on connecting underserved areas by distributing money through state grants. The legislation gives the National Telecommunications and Information Administration (NTIA) 180 days to establish the program and develop funding guidelines. It is unclear how long after those states will begin awarding broadband grants.

Each of the 50 states will receive an initial allocation of $100 million from the $42.45 billion pot, with additional funding to be distributed based on coverage maps that have yet to be put out by the Federal Communications Commission (FCC). To receive funding, each state must submit a five-year action plan that identifies locations that should be prioritized for support; outlines how to serve unconnected locations; and assesses how long it would take to build out universal broadband.

Affordable Connectivity Program (ACP)

The $14 billion Affordable Connectivity Program (ACP) is a targeted subsidy which provides up to $30 per month for qualifying households. However, analysis done by the City of Baltimore in 2021 found that only 40.7% of city residents have access to a broadband subscription. This means that nearly 96,000 individuals Citywide do not have access to a broadband subscription. Additionally, 33.3% or 75,000 residents do not have access to a computer. The federal subsidy program was designed to address both challenges. However, according to the FCC's data, only 34,734 households in the Baltimore area had registered for the federal subsidy at the time of the analysis. Three barriers identified by a Baltimore task force were that the subsidy seemed "too good to be true," providers promoting the subsidy through marketing materials, and sales representatives attempting to upsell customers. A key takeaway from the Baltimore task force that is relevant for Chelsea and other cities with a known digital divide gap was that a "trusted point of contact for community members to call made it easier to help wary residents enroll in the program." Additionally, having resources available to help overcome language barriers also made It easier to get residents enrolled. Chelsea may be able to access funds from a Digital Equity Grant to function as a digital navigator to help people sign up for the ACP subsidy.

Source: https://www.benton.org/headlines/baltimore-and-emergency-broadband-benefit-program

Overview of Network Financing Considerations

Historic levels of funding for digital infrastructure seek to close existing gaps, support public ownership, and encourage open access. Public opinion supports treating digital access just like roads, bridges, water, sewer, and power. Combining these key aspects will provide Chelsea with a fiber optic access utility capable of providing maximum service, including reliability and accessibility, for the least cost.

Digital Access Plan

Network Architecture

Network architecture has a meaningful impact on network reliability. The description below covers variables that should be considered for network reliability.

The two main network designs are Switched (Active) Ethernet and Passive Optical Networks (PON). The key difference between these two models is that PON is a shared infrastructure (32, 64, or 128 neighbors share a connection) and ethernet gives subscribers their own connection.

Switched Ethernet Network

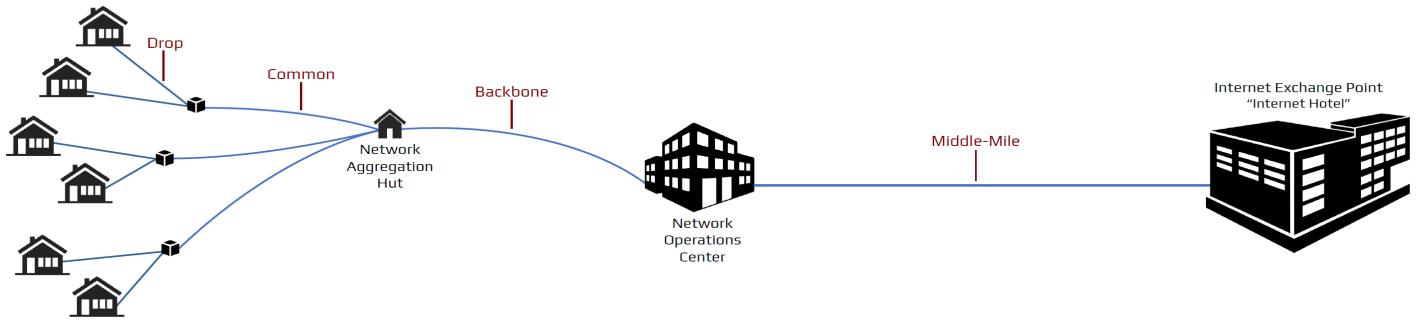
The switched ethernet architecture provides a dedicated connection for each customer rather than a shared connection and the customer experience is significantly better than in a shared architecture during periods of network congestion because the throughput of a switch-based architecture is superior to a shared architecture during times of network congestion.

Passive Optical Network (PON)

Passive Optical Networks (PON) make use of Time Division Multiplexing (TDM) technologies to create a bus or shared architecture with performance very similar to coaxial cable installations. In a PON network, splitters are placed in the field and a single fiber connection is shared between 32, 64, or 128 premises. This shared architecture may result in packet loss during periods of peak usage. Additionally, upgrading individual connections relies on complicated vendor specific solutions, if possible. It can also be more difficult to isolate and troubleshoot faults in a PON network because of the topology. PON equipment suppliers also use proprietary management platforms to establish long term vendor lock-in.

Proponents of PON architecture will argue that PON is less expensive than an ethernet design. That was true historically. This change in pricing differences was driven by the fact that all data center deployments use switched ethernet architectures and the enormous growth of data centers over the past 20 years has driven down the cost of ethernet electronics.

Network Segments – Definitions & Costs Allocations



Digital Access Plan

Drop = The drop is the fiber that runs from the street to the premise (home or business).

Common = The common is the shared fiber infrastructure in a neighborhood that runs from a drop to the closest aggregation hut.

Backbone = The backbone fiber runs from an aggregation hut back to the network operations center.

Middle Mile = The middle mile is usually third-party fiber that runs from the network operations center to the closest internet exchange point. The cost of the middle mile is included in the monthly maintenance and operations (M&O) utility fee and is borne by all network subscribers.

Internet Exchange Point = An internet exchange point is the central point where all internet traffic flows for routing. This is analogous to the role of a central post office for the U.S. postal system.

Comparison of Available Media

The primary media used for internet access today in the United States includes DSL, coaxial cable, wireless, and fiber optic cable.

DSL stands for Digital Subscriber Line, and it is one of the technologies used to provide internet connectivity to homes and businesses. DSL uses existing telephone lines and a transceiver, or modem to bring a connection into a home or business and allows the household to use the internet and make telephone calls at the same time. Verizon is the incumbent telephone company in Chelsea and uses DSL technology. DSL is asymmetrical (the download speed is much faster than the upload speed), is a dedicated connection capable of download speeds up to 100 Mbps depending on the DSL standard, copper line age, and distance. Most consumers accessing the internet via DSL experience speeds between 5 – 25 Mbps.

Coaxial Cable uses copper cable designed with one physical channel that carries the signal surrounded by a layer of insulation and then another physical channel, both running along the same axis – hence the coaxial name. Coaxial cable is primarily used by cable TV companies to connect transmission facilities to customer homes and businesses to deliver cable TV and internet access. Comcast/Xfinity is the incumbent cable company in the Chelsea area. Coaxial cable is asymmetrical and shared between up to 200 customers or more. The most recent cable standard of DOCSIS 4.0 can provide up to 10 Gbps in shared bandwidth depending on supported standards and other environmental factors. The standard currently implemented in Chelsea is 3.1 and the maximum speed available is 940 Mbps. In addition to the limitation of sharing among many customers, another limitation of coaxial infrastructure is that the signal begins to degrade after 300-400 feet.

Fiber Optic Cable sends information down strands of glass known as optical fibers which are less than the size of a human hair. These fiber optic strands can transmit 25 Tbps today and researchers have successfully demonstrated a transmission experiment over 1045 km with a data-rate of 159 Tbps.

Source: https://phys.org/news/2018-04-fiber-transmission.html

Fiber optic cables carry information between two places using optical (light-based) technologies which convert electrical information from the computer into a series of light pulses. Fiber optic cable is capable of symmetrical speeds up to 25 Tbps and the signal can travel as far as 60 kilometers, or approximately 37 miles, without degrading. Fiber optic infrastructure is also less expensive to deploy than any other existing wireline infrastructure. Because the difference in capacity between fiber optics and alternative media is so significant, fiber optics should be the foundational media for any new broadband infrastructure project when financially feasible.

Wireless Internet access is made possible via radio waves communicated to a person's home computer, laptop, smartphone, or similar device. Wireless internet can be accessed directly through cellular providers like AT&T Wireless, Verizon Wireless, T-Mobile, or by a wireless internet service provider (WISP). Wireless reliability can be affected by poor weather conditions and may require line of sight.

5G is the 5th generation of technology used in cellular networks and refers to a standard for speed and connection. Because of the extensive marketing around the emergence of 5G, many people wonder whether 5G will replace fiber optic cables. In fact, 5G depends on fiber optic infrastructure. All wireless technologies

work better the faster they get back to fiber optics. 5G is not broadcast on a single frequency, rather there are several frequencies used by 5G networks and these different frequencies have different advantages and disadvantages – depending on the application.

- **Low-band 5G** operates between 600-850 MHz. This is only moderately faster than 4G with speeds between 50-250 Mbps and offers similar coverage areas for each cell tower.

- **Mid-band 5G** operates in the 2.5-3.7 GHz range and delivers speeds between 100-900 Mbps. While offering less range per cell tower, this type of 5G is going to be the most common implementation of 5G networks for many years to come. It is a compromise between network speed and range in both medium-density urban areas and less dense rural regions.

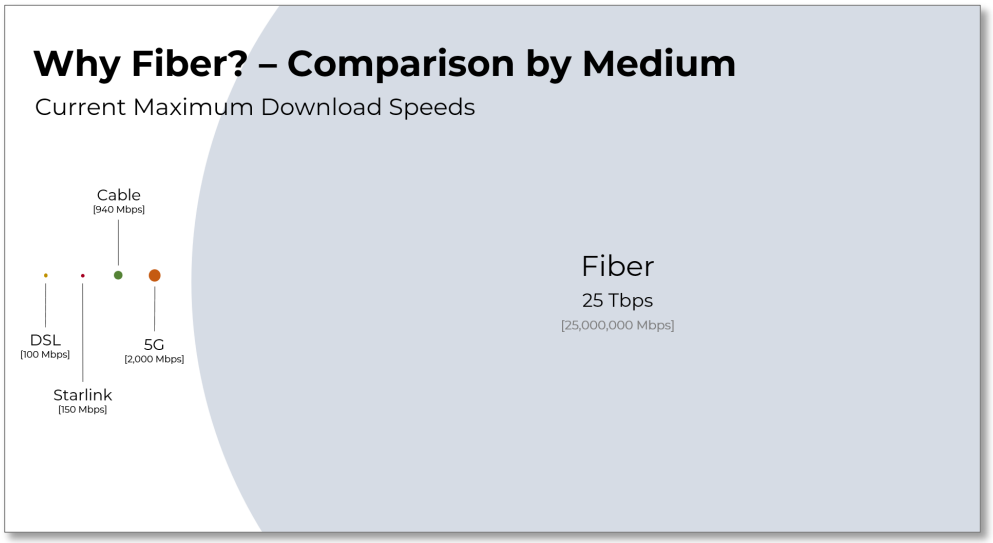
- **High-band 5G** is the band that is most associated with 5G. Operating at 25-39 GHz, this is known as the "millimeter wave" spectrum and delivers gigabit speeds (currently tested as high as 3 Gbps). The millimeter wave transmitters have a very limited range and require the deployment of many small transmitters. Each transmitter connects to fiber optics.

  ***Source**: https://www.businessinsider.com/what-frequency-is-5g*

Satellite Internet is a wireless internet connection that is available nearly everywhere in the U.S. While it is relatively slow in comparison to cable or fiber optic connections, satellite internet access is faster than some DSL options. This makes it a good option for some rural premises.

Satellite internet speeds range from 1 Mbps – 100 Mbps for download speeds and it is common to have latency and packet loss issues because the signal must travel to space and back. Satellite internet providers include HughesNet, ViaSat, and Starlink. These providers DO NOT promote themselves as a solution for suburban or metro areas.

Satellite internet does require special equipment, including a satellite dish that connects to a communication satellite in space.



Wi-Fi is common in homes and commercial buildings and is a way to deliver a network connection from a network hub over a wired connection to wireless devices via a wireless access point. Most people access the internet over a wireless connection, but it is important to remember that wireless connectivity ultimately depends on a wired connection and wireless access works best the faster it gets back to a wire. The Institute of Electrical and Electronics Engineers (IEEE) developed the Wi-Fi standard.

Upload vs Download Speeds

In addition to the fact that fiber optic cable will offer exponentially greater bandwidth than DSL and coaxial cable, fiber optic cable also offers the ability to deliver symmetrical speeds. In an asymmetrical connection, the download speeds are much faster than upload speeds.

Upload speed is the amount of data a person can send in one second and download speed is the amount of data a person can receive in one second. Upload speeds can be especially important for businesses, including home-based businesses or people who work from home. It is also important for telemedicine and online schooling to ensure good picture quality with video calls. Applications that depend on good upload speeds include sending large files, cloud applications like Microsoft 365/One Drive, Google Docs, Dropbox, VoIP, FaceTime, Skype, Zoom, WebEx, Microsoft Teams video calls, hard drive backups, and in-house web hosting.

Digital Access Plan

Municipal Network Models

Municipal Broadband Models Comparison

To compare the various models that exist in the United States today, the following model variables are important to understand:

Broadband Network Models

> Vertically Integrated – Privately Owned & Operated
> Publicly Owned & Privately Operated
> Publicly Owned & Operated

Access

> Closed Networks (Single ISP)
> Open Access Networks (Multiple ISPs)
    - Dark Fiber
    - Lit Manual
    - Lit Automated

Note: Definitions are provided on pages 48 and 49 below.

A mix of prominent municipal fiber optic projects was selected to illustrate the types of models that have been deployed. The following comparison summarizes different approaches to funding and operating municipal broadband infrastructure and services followed by a description of the advantages and disadvantages of each.

Municipality	Population	Model Type	Open vs. Closed	Dark vs. Lit	Manual vs. Automated	Take-Rate	Cost of 1 Gig
Chattanooga, TN	179,139	Electrical Utility ISP	Closed	Lit	Manual	60%	$68.00
Lafayette, LA	126,000	Electrical Utility ISP	Closed	Lit	Manual	40%	$99.95
Westminster, MD	19,000	City Fiber, Private ISP	Closed	Lit	Manual	20%	$89.99
Huntsville, AL	194,585	Dark Fiber Open Access	Closed	Dark	Manual	No Data	$70.00
Sandy, OR	10,000	Municipal ISP	Closed	Lit	Manual	60%	$59.95
Longmont, CO	86,000	Electrical Utility ISP	Closed	Lit	Manual	55%	$69.95
Ammon, ID	17,000	Automated Open Access	Open	Lit	Automated	65%	$47.50
Monmouth, OR	15,083	Municipal ISP	Closed	Lit	Manual	80%	$129.65
Lexington, KY	321,959	Private Partner Owned	Closed	Lit	Manual	No Data	$59.95
Santa Monica, CA	110,000	Dark Fiber Business Only	Closed	Lit	Manual	N/A	N/A
Fort Collins, CO	165,000	Electrical Utility ISP	Closed	Lit	Manual	No Data	$59.95
UTOPIA	150,000+	Manual Open Access	Open	Lit	Manual	15%	$70.00

Disclosure: *Ammon, Idaho is a client of EntryPoint Networks.*

Ownership Considerations

Vertically Integrated - Privately Owned & Operated

A private owner designs, builds and operates a network. The private builder and operator controls pricing, the business model, architecture, and assumes all the risk and does the work of overseeing design, project management, construction, customer acquisition and operations.

This model leaves the community vulnerable to the private owner operating as a monopoly or selling the network to a monopoly operator. A national or regional private operator reduces the ability of the subscriber to influence the policies, practices, and pricing of the operator. Historically, private owners have not demonstrated a willingness or ability to solve the digital divide.

Publicly Owned & Privately Operated

A community (e.g., city, town, or county) owns the network and utilizes a third-party operator to maintain and operate the network. The primary value of publicly owned infrastructure is that the network will not be under the control of an unregulated, or semi-regulated private company, which is not accountable or vulnerable to an election cycle where subscribers are empowered to influence outcomes. A private operator may be more expensive for subscribers due to the additional cost for profit. However, this depends on variables like efficiency, the cost of employment, and the percentage the operator takes for profits. Public owners have greater incentives to solve the digital divide. The private operator has limited risk because it does not need to recover a capital investment.

The current model suggests that each ISP builds their own infrastructure. That is not necessary with fiber optics. One good fiber network will provide up to a 100-year infrastructure. Multiple fiber networks will only drive up the costs for consumers and will provide no new or added value to the community.

Publicly Owned & Operated

A neutral host such as a city or county owns and operates the network. This model protects the community from a private owner operating as an unregulated monopoly or selling the network to a monopoly operator. It also makes the network operator accountable to subscribers via an election cycle where subscribers are empowered to influence outcomes. Public owners have greater incentives to solve the digital divide.

Access Model Considerations (Single ISP vs Open Access)

Single ISP – Closed Access

This model is primarily the most common infrastructure built out today and mainly provides advantages only to the ISP. A single ISP does not expand choice or competition and may be more expensive for subscribers than an open access model.

Dark Fiber Open Access

Dark fiber open access is a model where infrastructure is built to the curb and the subscriber then selects an ISP as its provider. The ISP finishes the connection to the home with its own infrastructure and electronics. Operating a dark fiber network is less complicated than operating a lit network and the dark fiber model also enables public ownership of infrastructure. While the dark fiber model increases choice for consumers, the

downside is that the subscriber and operator give up control over last mile infrastructure. For example, giving up control over the drop from the curb to the premise. The dark fiber model therefore limits the usability of each strand of fiber. With an isolated dark fiber connection, the range of possible services and service attributes is limited to services offered by the ISP controlling the drop to the premise. The dark fiber model also does not scale efficiently due to difficulty in anticipating the required fiber count to meet the demand. This can create significant complications for the network operator.

Lit Fiber – Manual Open Access

Lit Fiber – Manual Open Access is a model where the network is lit end to end. This means the network operator places and controls the electronics at both ends of the network. Switching internet service providers can be requested from a web portal and may appear to be automated but the network provisioning is done manually. A manual open access network increases choice for consumers. However, it does not necessarily produce the desired effects of competition if the business model presents barriers to competition. Operating a manual open access network is more complex than operating other models because of the requirement for human management of network tasks and any increase in the number of service providers operating on the network adds to network complexity.

Lit Fiber – Automated Open Access

Lit Fiber – Automated Open Access is a model where the network operator places electronics at both ends of the network and subscribers can dynamically select service providers in real-time. Software-defined networking is used to automate various network management tasks. In this model, multiple service providers can deliver services simultaneously and independently across a single wire. When a subscriber selects a new service provider, the provisioning is done using automation and therefore happens on-demand. Automated provisioning creates a marketplace for services which includes ISPs and private networks for other services. The ability to switch service providers on demand increases choice and competition. This network model also includes the ability to provide local network resilience via local communications if connections over the middle mile are down.

Disclosure: *EntryPoint Networks owns and operates a SaaS model automated open access solution and is a technology solution provider in these networks.*

Massachusetts Municipal Fiber Networks

There are several cities in Massachusetts operating fiber optic networks under the authority of a Local Improvement District. Existing municipal networks in Massachusetts include:

Municipality	Model Type	Public vs Private ISP & M&O	Residential Gig	Commercial Gig
Concord, MA	Municipal Light Plant	Municipal ISP & M&O	$89.95	Call for Pricing
Leverett, MA	Municipal Light Plant	Third-Party ISP & M&O	$83.40	$299.95
Taunton, MA	Municipal Light Plant	Municipal ISP & M&O	$69.95	Call for Pricing
New Salem, MA	Municipal Light Plant	Third-Party ISP & M&O	$85.00	$110 - $260
Shutesbury, MA	Municipal Light Plant	Municipal ISP & M&O	$75.00	Call for Pricing

Wendell, MA	Municipal Light Plant	Third-Party ISP & M&O	$99.00	$99.00
Peabody, MA	Municipal Light Plant	Closed	$89.95	$299.95
Westfield MA	Municipal Light Plant	Third-Party ISP & M&O	$69.95	$84.95 - $399.95

Whip City Fiber is a third-party network operator for several small Western Mass towns. Whip City was created and is operated by Westfield Gas & Electric in Western Massachusetts. Whip City partners with and provides services to Municipal Light Plants in Westfield, Alford, Ashfield, Becket, Blandford, Charlemont, Chesterfield, Colrain, Cummington, Goshen, Heath, Leyden, New Ashford, New Salem, Otis, Plainfield, Rowe, and Washington.

Risk Assessment

The City seeks to understand the primary risks of building and operating a municipal fiber optic network and to actively manage those risks not only during construction but also on an ongoing basis during network operations.

The following is an analysis of the main risk factors facing the City of Chelsea if it pursues its fiber-to-the-premise deployment. Eleven risk factors are identified:

1. Take-Rate Risk
2. Subscriber Churn Risk
3. Project Execution Risk
4. Equipment and Technology Risk
5. Community Engagement Risk
6. Cost Modeling Risk
7. Timeline Risk
8. Regulatory Risk
9. Middle Mile Risk
10. Pole Attachment & Make-Ready Risk
11. Network Aggregation Huts

Take-Rate Risk

Take-rate risk (demand risk) is the risk that the City builds out the network and ends up with fewer subscribers than expected.

Likelihood: Take-rate risk is an important risk factor and is a function of the value proposition of the network and how well that value proposition gets communicated and managed before, during, and after construction. High take-rates lead to lower network costs for subscribers. This creates a virtuous cycle where lower costs lead to higher take rates. The reverse is also true.

Impact: Positive take-rates and performance will compound to the benefit of all stakeholders. Negative take-rates lead to higher costs and churn which create a negative spiral that compounds until the network is not sustainable.

Mitigation: To mitigate take-rate risk, demand aggregation must be managed before, during, and after construction and give consumers a value proposition that makes them voluntarily committed to the network infrastructure.

Subscriber Churn Risk

Subscriber churn is the risk that customers sign up and then do not remain subscribers to the network.

Likelihood: Today, customers are primarily motivated by cost, speed, and customer service. Churn is possible and is a consequence of the customers pursuing an option to get better value from an alternative solution. The likelihood of churn is higher if a new market solution simply replicates the incumbent model.

Impact: The impact of churn on the network is potentially catastrophic if it reaches a level where the capital and operational cost abandoned infrastructure cannot reasonably be shared by remaining subscribers.

Mitigation: The risk of churn goes down under a business model where 1) the customer connection is treated as an improvement to the property, and 2) the value proposition is strong enough to make the customer committed to the network.

Project Execution Risk

Project execution risk includes the risks related to fulfilling expectations for strategy, planning, project management and fulfillment of the project plan and operational execution.

Likelihood: Project execution failure is possible and is a function of the effectiveness of project planning, management, controls, and execution.

Impact: The severity of impact is in proportion to the effectiveness of project management and execution. A worst-case scenario is one where project execution affects the value proposition, which in turn affects take-rate and churn.

Mitigation: This risk is reduced by hiring or partnering with skilled project managers and key strategic partners and creating alignment among key team members on the project and operational plans. Further, it is important to develop project controls that are monitored and reported to senior leadership monthly. State agencies could also provide technical assistance, execution standards, and monitoring to mitigate project execution risk.

Equipment & Technology Risk

Equipment & technology risk includes both software and hardware solutions and is the risk that equipment failure rates are higher than expected, major software bugs are unresolved, operational reliability is lower than expected, and/or that the technology lifecycle leads to faster obsolescence than is expected.

Likelihood: Solutions with short deployment histories, unreliable references, unclear quality assurance and test procedures, weak professional teams, and poorly architected scalability abstractions present increased equipment and technology risk.

Impact: The impact of this risk category is moderate because it is possible to vet both software and hardware systems to assess this risk. The base technology of the network will be fiber optic cable and that has sufficient history to present a minor risk to the project. Remaining risks include electronics and software systems.

Mitigation: Implement thorough due diligence processes with trained professionals to scrutinize references, architecture, software abstractions, quality control systems and the professional histories of vendors being considered. State agencies or an entity like MBI could provide technical assistance and oversight to mitigate equipment and technology risk.

Community Engagement Risk

Community engagement includes the marketing, education, and communication processes and strategies used to inform residents and businesses about the value proposition offered by the network. It also can refer to the level of engagement with a community to educate them about digital inclusion, digital skills, and the benefits of using a network for socio-economic development.

Likelihood: Community engagement risk is possible but something that can be managed and monitored through proactive engagement. Poor planning, management and execution increases the level of risk. Community engagement can be handled by internal City staff. However, the risk increases if staff member resources are inadequate for a project of this size. There are external marketing professionals available to assist with the community engagement processes. With the right amount of training, there is limited risk if digital skills, and digital equity and inclusion training has taken place frfore the network is rolled out or during network roll-out.

Impact: Community engagement is a key driver of project success due to the relationship between community engagement and take-rate. It is also a key driver for uptake and continued use of the network for work, school, and social purposes.

Mitigation: Leverage the skills of marketing professionals and provide sufficient resources to make it easy for residents to learn the basic value proposition through a variety of education and communication strategies.

Cost Modeling Risk

Cost modeling risk is the risk that the financial modeling performed significantly misstates actual design, construction, and/or operational costs.

Likelihood: There is enough industry data to reasonably validate cost estimates. However, there is significant market volatility currently due to supply chain disruptions and labor supply pressures.

Impact: Cost overruns can have a meaningful impact on network construction and sustainability.

Mitigation: Risk is reduced by validating financial assumptions against industry assumptions, market conditions, and accounting for local economic variables. As inflation and demand for materials drive market demand pressure in the short-term, state procurement of electronics and materials may help mitigate the impact through economies of scale.

Timeline Risk

The benefits of building the network at an accelerated pace and include the following:

1. Each phase requires legal, financing, and accounting transaction costs. Building the network with fewer phases will lower the overall transaction costs for the project.
2. Building at a faster pace will result in an accelerated time to break-even.
3. An accelerated timeline reduces the potential for unexpected movement in interest rates.

Likelihood: Costs are likely to be higher for an extended buildout period. However, there may be execution risk exposure for accelerating the buildout, depending on the experience and capacity of the construction partner.

Impact: Costs will be incrementally higher for an extended buildout schedule and maintenance and operations will have a longer ramp to sustainability.

Mitigation: The City can manage the buildout schedule following a cost/benefit analysis of the options. An important consideration is alignment with construction partners. If the City is going to outsource construction,

it should consult with potential construction partners about alternative construction schedules to make sure that the City's strategy is amenable to key construction partners.

Regulatory Risk

Regulatory Risk is the risk that state or federal regulations become an impediment or barrier to the City successfully building or operating a municipal network. The Chelsea City Attorney should prepare a separate analysis describing the City's legal authority to build, own, and operate broadband infrastructure as well as information on Massachusetts statutes and regulatory rulings applicable to municipal broadband.

EntryPoint has not sought a legal opinion on this, nor do we have an attorney on staff, but our reading of the state regulation is that the City of Chelsea is explicitly allowed to borrow money to establish a telecommunications system under the Municipal Light Plant statute and several cities and towns are exploring alternative governance models.

Likelihood: Historically, incumbent operators have taken legal action to stop several municipalities from building a competing network whenever they have a legal basis for doing so. It seems clear that cities in Massachusetts have a legal basis for Chelsea to build this infrastructure as summarized above and the likelihood of a legal challenge is relatively low. Several towns have implemented the MLP governance model, and the Department of Revenue ("DOR") Division of Local Services ("DLS") has issued guidance that municipalities may utilize other organizational structures (besides MLP) to own, operate, and provide broadband infrastructure and services to customers. Several cities and towns are planning to utilize an Enterprise Fund governance structure, but this model has not been implemented yet.

Impact: If a claim were to be brought against Chelsea, it could take a meaningful amount of time and cost to contest or appeal the claim—but this is unlikely.

Mitigation: It is important for the City Solicitor's Office to summarize their findings of relevant Massachusetts statute for City leaders.

Middle Mile Risk

Middle mile risks include the following:

1) Lack of redundant options on divergent paths
2) Pricing risk – the cost of connecting to middle mile carriers
3) The risk of being stranded or isolated without a viable path to an internet exchange point

Likelihood: Chelsea will likely have multiple middle mile paths back to an internet exchange point in the Metro Boston Region.

Impact: The middle mile risks listed above could have a significant impact on network success but all of them have a low likelihood of occurring because of Chelsea's location.

Mitigation: The City can mitigate and possibly eliminate middle mile risk by building redundancy to the network by having multiple backhaul providers or multiple independent paths back to an internet exchange point.

Pole Attachment & Make-Ready Risk

Pole owners can cause unexpected and significant impact on costs or timeline due to delays in make-ready and pole attachment work.

Likelihood: Because Chelsea does not own the utility poles in its service area, this risk is important. There may be poles that need replacement or repair which will add to the total cost of the project.

Impact: Make-ready work for pole attachments can have a meaningful impact on costs and timeline if the pole owners are non-responsive or want the City to replace old poles.

Mitigation: The City can manage the pole attachment process or pursue a buried network – which is more expensive up front but has many long-term maintenance advantages and should be considered.

Network Aggregation Huts

The City of Chelsea has a limited footprint of real estate assets which may increase the difficulty of identifying suitable locations for aggregation huts in City neighborhoods.

Likelihood: The likelihood of this risk can be clearly identified during low-level and construction-ready design phases. The City will need to potentially collaborate with schools or other community organizations to solve this problem.

Impact: The worst-case scenario would be that any fiber runs that cannot be aggregated into a neighborhood hut will need to either go into smaller cabinets out in the field or designed for a homerun to the network's central office. This may increase the cost of fiber materials.

Mitigation: The City will either need to work with community partners (like schools),utilize cabinets out in the field, or follow a design that runs all fiber strands back to the home office. The optimal solution can be identified in the construction ready design work.

Community Engagement

Evaluation & Education

Document the current state of broadband and determine the level of interest among residential users and business owners.

Community Survey

A survey for residents and business owners was conducted to determine the level of interest in a municipal fiber network. Education and promotion programs should be influenced by ongoing survey engagement and response.

Publish Educational Information

Leverage website content specific to the municipal fiber program to outline the core message of broadband as a local utility that offers lower costs, an increase in choice, subscriber control, and fosters digital inclusion. Use customized videos to educate online visitors on topics such as: functionality of the community fiber network, options for services, frequently asked questions (FAQ's), and more.

Mapping Community Interest

Distribute an "I am interested" sign-up form with associated heat map where residential and business property owners can register as someone interested in municipal fiber.

Work with the community to map the number of community organizations providing broadband skills and training, and digital navigator training to continue training and/or to use these organizations as outreach organizations.

Marketing & Promotion

Utilize press releases to promote the municipal fiber network, driving traffic to the fiber website with the goal of educating community members, generating interest, and encouraging community participation. Use all available social media platforms (e.g., Facebook, Instagram, Twitter) to promote the fiber network.

Work with local organizations to get the word out through digital navigators and other like-minded organizations.

Neighborhood Entrance and Yard Signs

As construction (fiber build) begins in a neighborhood, Chelsea can post signs at neighborhood entrances announcing the construction and letting residents know they can still sign-up to get connected while crews are in the neighborhood.

As homes are connected in the neighborhood, yard signs can be placed in the yards of subscribers indicating that the home now enjoys a fiber broadband connection.

Grassroots Engagement

Webinars & Open House Events

Chelsea can use webinars and open house events to educate residents and business owners about the fiber project, ask questions, become educated about the business model, infrastructure, and costs.

Webinars and open houses are promoted using utility bill inserts, press releases, public service announcements, local news reports, City websites, social media platforms, and more.

Webinars and open house events are intended to educate residents, promote the network, and identify fiber champions in the various neighborhoods (fiber zones).

Fiber Champions

Fiber champions are individuals that demonstrate a voluntary commitment to promoting the network within their neighborhood. Fiber champions may be incentivized by a practice of building to those neighborhoods that have the highest level of engagement or demand (initial fiber zones are connected in order of take-rates—highest to lowest). Fiber champions assist sign-up efforts within their designated neighborhood (fiber zone). They organize and lead neighborhood meetings where neighbors can learn about the Chelsea fiber program. Chelsea leaders and employees provide support to the fiber champions in their efforts. Fiber champions drive conversations and contractual commitments of neighbors via the door-to-door sales and education campaign.

A Chelsea Community Broadband Committee could provide an advisory governance role and could be composed of a champion from each neighborhood to represent a diversity of views and lived experiences.

Door-to-Door Campaign

Individuals representing the local network contact residents and business operators within the planned footprint to answer questions and ascertain the potential subscribers' interest in participating. [Yes (Opt-in) or No (Opt-out)].

This direct person-to-person contact gives everyone in the community an opportunity to ask questions, clarify understanding, and express a level of interest in participating.

To maximize the effectiveness of this process, door hangers are distributed to every home and business prior to canvassing a neighborhood. These inform property owners that a representative will be stopping by to explain the value proposition, answer questions, and determine the level of interest from potential subscribers.

Door-to-door campaigns are very effective in giving people an opportunity to learn and ask questions in a one-on-one interaction.

It is important to support this effort with public notifications, press releases, mass emails, websites, social media sites, mobile applications, and other community outreach venues. This may include outside professional marketing and/or public relations firms.

Chelsea's CBOs currently employ door knockers to talk to residents about issues they are facing, and services residents might be eligible for. These groups could contribute to community engagement and door-to-door efforts.

Commissions for a door-to-door campaign can be funded by a sign-up fee or wrapped into the infrastructure installation cost.

Sample Fiber Optic Project Manager Description

Job Description Example

JOB TITLE: Fiber Optic Project Manager

Position Summary

We are looking for an efficient Project Manager to contribute to and support the planning and execution of fiber optic projects. The ideal candidate will have a well-rounded knowledge of all aspects of broadband projects and will spearhead project efforts and guide the team from inception to completion. Primary responsibilities will include monitoring project progress, following up with stakeholders on the completion or delay of project phases, scheduling meetings, and maintaining project documents and reports. The Project Manager will report to <insert title>.

Education and Experience

Bachelor's degree in project management, business administration, a related discipline, or a minimum of <insert number> years' experience in fiber optic construction management. Municipal fiber optic construction experience is highly desirable.

Skills, Knowledge, and Abilities

Serves as the main point of contact for day-to-day interactions throughout the implementation process. Familiarity with both inside and outside plant including but not limited to fiber optic design, costs, splicing, termination, jumpers, testing, cabling, optics, equipment, racking, enclosures, vaults, ducts, storage, boring, trenching, plowing, restoration, and aerial installation. Able to read, interpret, and oversee the implementation of fiber optic plans and specifications as well as understand the project scope, verify technical requirements, coordinate internal and external resources, assist in managing procurement, ensure appropriate milestones are met, and ensure overall successful project deployment. Exceptional written and verbal communication skills. Experience with project management software and geospatial tools is a plus.

CITY OF CHICO

REQUEST FOR PROPOSAL (RFP)

Automated Open Access Platform

Issue Date:	07-14-22
Proposal Due Date:	08-05-22 by 4:00 PM PDT

1. Submission

The due date and time to submit a proposal by is August 5th by 4:00 PM PDT.

The City's proposal and question submission method will be via https://www.publicpurchase.com.

Proposers must ensure any externally referenced or linked information is included directly in the proposal to ensure it is accurately considered.

It is the responsibility of the proposer to see that any proposal submitted shall have sufficient time to be received by the Information Systems division prior to proposal due date and time.

2. General

A. Proposal Submissions

All proposals must be signed by an authorized representative of the vendor.

B. Proposal Withdrawal

Proposals may be withdrawn by written request received before the hour set for the opening. After that time, the vendor may not withdraw proposals for a period of ninety (90) days from the date of the opening.

C. Late Proposals

It is the responsibility of the vendor to see that any proposal submitted shall have sufficient time to be received by the Information Systems division prior to the proposal due date and time.

D. Right Reserved

The right is reserved by the City of Chico to reject any or all proposals or to waive any informality or technical defect in a proposal.

E. Compliance with Laws

All proposals shall comply with current federal, state, and other laws relative thereto. Vendor further agrees that the services proposed comply with all applicable Federal and State Occupational Safety and Health laws, standards for regulations, and that vendor will indemnify and hold the City harmless for any failure to so conform.

F. Reference to Selected Vendor

The terms vendor, supplier, proposer, or contractor may be used interchangeably in these specifications and shall refer exclusively to the Vendor(s) with whom the City enters into a contract as a result of this request for proposal.

G. Inquiries

Vendors are required to use https://www.publicpurchase.com to post clarifying questions. Inquires via email or phone to staff members are discouraged as they are less timely and effective.

Vendors may submit inquiries up to 24 hours before the submission deadline. Staff will attempt to answer all questions in a timely manner but it is the Vendor's responsibility to ensure questions are posted timely to ensure staff responses can be incorporated.

H. Award of Base Proposal or Alternate Proposal

The City of Chico reserves the right to award either the Base Proposal or any Alternate or Optional Proposals offered, whichever is in the best interest of the City.

I. "Piggyback" Clause

Vendors are requested to indicate on the Proposal if they will extend the pricing, terms and conditions of this proposal to other government agencies if the Vendor is the Successful Vendor. If the Vendor agrees to this provision, other agencies may enter into a contract with the Vendor for the purchase of the services and commodities described herein based on the terms, conditions, prices, and percentages offered by the Vendor to the City.

Minor changes in terms and conditions may be negotiated by participating agencies following this award.

3. Scope

The City of Chico is looking for a qualified Vendor to provide an Automated Open Access Platform that will play a crucial role in delivering a network that addresses the four objectives as defined in the Chico Broadband Master Plan:

A. Improve the Affordability of Internet Access
B. Enable Competitive Internet Service Provider Options for residents and businesses
C. Pursue Infrastructure that will provide the needed speeds and reliability for 50+ years
D. Address the gaps in digital access and equity (Digital Divide)

The platform and all related hardware and software must be capable of supporting a minimum of one gigabit symmetrical active ethernet services to business and residential customers. While the primary focus of this platform is the delivery of internet services, the City recognizes the platform will be capable of delivering many diverse services.

4. Evaluation of Proposals and Scoring of RFP

Vendors will be evaluated based on their ability to deliver the services outlined in this RFP. A committee will evaluate and recommend from all proposals based on the following criteria:

A. Range of related services provided. (45 points)
B. Experience related to applicable deliverables. (25 points)
C. Fiscal impact to the City. (30 points)

The City, at its discretion, may request an oral interview, clarifying questions, and/or demonstration of platform with the Vendors as part of the evaluation of the proposals.

5. Specifications

A. Required Platform (F)eatures & Vendor (S)ervices

i. (F) Subscriber view, ISP view, and network operator view of platform
ii. (F) Customer-initiated enrollment in services
iii. (F) Customer can add/remove services autonomously (without Vendor or service provider involvement)
iv. (F) Multiple ISPs able to service a single location using the same CPE
v. (F) Platform integration with ACP eligibility verification
vi. (F) Capable of servicing up to 125,000 customers

B. Preferred Platform (F)eatures & Vendor (S)ervices

i. (F) Marketplace offering automated enrollment in additional services such as television, telephone, medical, smart home, alarm systems, cyber security, etc.
ii. (F) Point-to-point and point-to-multi-point private ‘circuits’ between locations
iii. (F) Platform two-way integration with utility billing solution
iv. (F) Platform integration with fiber asset management solution
v. (F) Platform integration with trouble ticket solution

vi. (F) Platform integration with network management/monitoring solution
vii. (F) Platform integration with a managed WiFi service or ability to provide end user managed WiFi
viii. (S) Network Operations Center professional services
ix. (S) Project Management professional services
x. (S) Supply chain logistics, hardware and materials sourcing or resale, and related professional services
    1. Vendor may be asked to help acquire hardware or materials whose availability impacts platforms implementation. Disclose a cost or percentage that will be added to any hardware or materials in addition to any billable staff time.

C. Deliverables

i. Section explaining the platform's range of related services
ii. Section explaining Vendor's experience delivering those services
iii. Section summarizing all pricing for a 4,000 customer network for a 5-year period, showing each year individually
    1. For simplicity, assume 0 customers in year 1, two thousand in year 2 and four thousand in year 3
iv. Section detailing hardware, software, licensing, etc. requirements of proposed solution and any known or suspected risks such as hardware availability
    1. For example, if a Vendor's solution depends on a specific brand/model of CPE, are there any supply chain/etc. concerns
v. Section describing the process and related costs for a service provider (for example an ISP) to offer their services on the marketplace
vi. Separate spreadsheet listing each item in 5.A and 5.B with the following columns:
    1. Feature Name (5.A.i, 5.A.ii, etc.)
    2. Description
    3. Unit Cost
    4. Annual Cost per Year (1, 2, 3, 4, 5)
    5. Unit (per year, per address, per customer, per parcel, per Fiber Utility staff member, per linear foot, per hour, etc.)
    6. Pricing Term (time Vendor will guarantee pricing)
        a. If static pricing isn't possible, a defined inflator would be preferred
    7. Supported vendors/software/integrations

6. Vendor's References

Vendors will provide (3) recent clients which are applicable examples of similar work performed by their firm, which demonstrate their ability to provide services in accordance with the specifications in Section 5. References must include the following information for each example: agency name, individual contact, address, phone number, year work was performed, description of work.

The City reserves the right to contact each of the references listed for additional information regarding their qualifications.

7. Attestation

Award shall be based upon the evaluation criteria included with this document. Where there is a discrepancy between words and figures, WORDS SHALL GOVERN.

The undersigned Vendor agrees to provide Automated Open Access Platform and related materials and/or services in accordance with the specifications. I/We have stated herein the services and fees that I/we will furnish and deliver as specified.

Name of Vendor (Person, Firm, Corp.)

Address

Telephone

Email

Name and Title (Print)

Signature of Authorized Representative

Date

SECTION 9

Glossary

Glossary

Industry Terms and Abbreviations

Term	Description	Definition / Narrative
Aerial	Fiber-optic network cables installed on existing utility poles	Aerial fiber deployments are one of the most cost-effective methods of installing fiber cables. Rather trenching and/or boring for underground installations, operators can simply use existing pole infrastructure to deploy the cables.
Asymmetrical	Broadband download and upload speeds are not the same	An asymmetrical connection does not have equal download/upload speeds. For example, 60 / 3 means 60 Mbps download and 3 Mbps upload speed.
Bit	Binary digit	The most basic unit of data in telecommunications and computing. Each bit is represented by either a 1 or a 0 in binary code.
Buried	Fiber-optic network cables installed underground in conduit	Buried fiber deployments, unlike aerial, are protected from weather damage by being buried below the freezing point in the ground.
Microtrenching	Fiber strands in conduit are placed in a 2”-3” wide trench that is usually cut in asphalt roadways or sidewalks.	Microtrenching is a fiber network construction technique that lays the protective conduit that houses the fiber strands below and at the side of a roadway. It requires much less digging and much less disruption than other network building methods.
Digital Divide	Digitally unserved and/or underserved neighborhoods and/or demographic - typically lower-income and rural communities	The gulf between those who have ready access and affordability to the internet, and those who do not.
DOCSIS	Data Over Cable Service Interface Specification	An international telecommunications standard that permits the addition of high-bandwidth data transfer to an existing cable television (CATV) system.
DSL	Digital Subscriber Line	A technology for the high-speed transmission of digital information over standard phone lines.
Fiber	Fiber-optic	Thin flexible fibers with a glass core through which light signals can be sent with very little loss of strength.
Gb or Gig	Gigabit = 1,000,000,000 bits or 1,000 megabits	A unit of information equal to one billion (10^9) or, strictly, 2^{30} bits.
Gbps	Gigabits per second	Billions of bits per second.
GHz	Gigahertz	One billion hertz, especially as a measure of the frequency of radio transmissions or the clock speed of a computer.

Digital Access Plan

Term	Description	Definition / Narrative
Internet Exchange Point	IXPs or IXes or internet exchange hotel	Internet exchange points (IXes or IXPs) are common grounds of IP networking, allowing participant internet service providers (ISPs) to exchange data destined for their respective networks.
ISP	Internet service provider	A company that provides subscribers with access to the internet.
K or Kb	Kilobit(s)	A unit of computer memory or data equal to 1,024 (2^{10}) bits.
Mb or Meg	Megabit = 1,048,576 bits	A unit of data size or network speed, equal to one million or 1,048,576 bits.
Mbps	Megabits per second	Millions of bits per second.
MHz	Megahertz	One million hertz, especially as a measure of the frequency of radio transmissions or the clock speed of a computer.
Middle Mile	Middle mile communications provider	In the broadband internet industry, the "middle mile" is the segment of a telecommunications network linking a network operator's core network (central office) to the nearest internet aggregation point.
mLAB	Measurement lab	M-Lab provides the largest collection of open Internet performance data on the planet.
NTIA	National Telecommunications and Information Administration	NTIA is the Executive Branch agency that is principally responsible for advising the President of the United States of America on telecommunications and information policy issues.
PON	Passive optical network	A passive optical network, or PON, is designed to allow a single fiber from a service provider the ability to maintain an efficient broadband connection for multiple end users.
Symmetrical	Broadband download and upload speeds are the same	A connection with equal download and upload speeds. For example, with a 500 / 500 Mbps fiber internet connection you get 500 Mbps of download AND 500 Mbps of upload speeds.
Take-Rate	The percentage of subscribers in a network	A tabulation of broadband penetration rates. The calculation is determined by dividing the number of subscribers by the total number of potential subscribers in a network footprint.
Tbps	Terabits per second	Trillions of bits per second.
8K Video	Ultra-high-definition video	Television resolutions of 7,680 pixels horizontal x 4,320 pixels vertical.

Open Access Network Terms

Term	Description	Definition / Narrative
Backbone	Shared fiber infrastructure from aggregation point to network operations center	The backbone fiber runs from an aggregation hut back to the network operations center.
Common	Shared fiber infrastructure from drop to the closest aggregation point	The common is the shared fiber infrastructure in a neighborhood that runs from a drop to the closest aggregation hut.

Digital Access Plan

Term	Description	Definition / Narrative
Drop	Segment of the fiber network from the street into the home or business	Drop is the fiber that runs from the street to the premise (home or business).
Middle Mile	Shared fiber infrastructure from the network operations center to the internet exchange point	The middle mile is usually third-party fiber that runs from the network operations center to the closest internet exchange point. The cost of the middle mile is included in the monthly M&O utility fee and is borne by all network subscribers.
Network Operator	Department or company that manages the network physical infrastructure	The organization that manages the network physical infrastructure on a day-to-day basis. The network operator may or may not be the owner of the physical network infrastructure.
Service Provider	A company that offers services to consumers on the network	A company or organization that offers services (ISP and other) over the open access physical network infrastructure.
Subscriber	A customer/consumer on the network	Household or business that participates as a subscriber on the network.

THANK YOU

For Your Consideration

Connect Humanity

ENTRY POINT NETWORKS

www.entpnt.com

Biarri Networks