CITY OF OAKLAND

CITY OF OAKLAND BROADBAND MASTER PLAN

[2025] OaklandConnect Municipal Broadband Network, Planning & Strategy

Kimley»Horn

Expect More. Experience Better.

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I. Acknowledgements

The development of the City of Oakland's Broadband Master Plan builds on the accomplishments and efforts of many talented, dedicated and passionate individuals who have committed themselves over the years to achieving digital equity in Oakland.

We deeply appreciate the input, participation, and support of community leaders, organizations, local businesses, and residents who shared their perspectives and experiences during public meetings, workshops, and surveys.

The contributors also recognize consultants from Kimley-Horn, who worked on this project and have assisted the City of Oakland on the planning, design and implementation of many vital capital improvement projects.

Finally, this plan recognizes the support and vision of those who came before and those to follow.

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KEY CITY OF OAKLAND DEPARTMENTS

Information Technology Department · Department of Transportation
Public Works Department · Department of Race & Equity · Finance Department
Department of Economic & Workforce Development · City Administrator's Office

#OAKLANDUNDIVIDED COALITION

Oakland Unified School District · Oakland Public Education Fund · Tech Exchange · Oakland Reach
Oakland Housing Authority · Homies Empowerment · Oakland Public Library · The Unity Council
Oakland NAACP · Oakland Thrives · Oakland Youth Commission · Kapor Foundation · Media Alliance
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Oakland Youth Council · California Alliance for Digital Equity · East Oakland Youth Development Center
San Francisco Foundation · Sydewayz Cafe · La Clínica de La Raza · Youth Uprising · Hack the Hood

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II. Executive Summary

Over 33,000 households in Oakland are estimated not to have residential broadband internet service. Deep, active community engagement starting during the pandemic shed light on the root causes of this digital divide: Internet affordability, access, and performance are the main barriers. Meanwhile, a duopolistic marketplace has resulted in a lack of investment in broadband infrastructure, leaving many Oaklanders paying more for less while the problems persist. This is digital exclusion in Oakland, and it overwhelmingly affects low-income families and Black and brown communities.

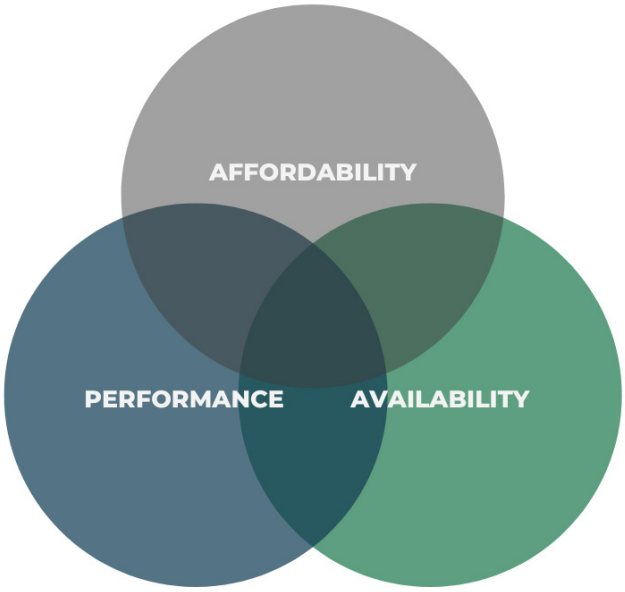
With the grant funding from the California Public Utilities Commission, the City of Oakland developed this Broadband Master Plan ("BMP") to analyze the Digital Divide in Oakland by understanding and explaining its root cause and proposing a solution to fill the gap: a City-owned Municipal Broadband Network.

The BMP includes eight sections:

- **Section 1. Introduction:** Provides an overview of the Digital Divide in Oakland and information about federal and state broadband funding opportunities.
- **Section 2. Broadband Master Plan Overview:** Discusses fiber optic technology and presents the vision of the BMP and incorporates past planning efforts.
- **Section 3. Community Voices:** Includes detailed analysis and firsthand feedback from community engagement work with Oakland residents impacted by the Digital Divide.
- **Section 4. The Challenge: Digital Exclusion in Oakland:** Presents results from primary and secondary research that explain the root causes of the Digital Divide in Oakland.
- **Section 5. Municipal Broadband Networks:** A Primer: Introduces the concept of a municipal broadband network (MBN), including case studies of successful examples, structures and models, and an analysis of current trends in MBNs.
- **Section 6. Current State of Public Broadband Infrastructure in Oakland:** Analyzes the current state of publicly owned fiber segments in Oakland, including opportunities and limitations and identifies the routes most suitable for use in an MBN.
- **Section 7. Advancing a Solution: OaklandConnect:** Details the City's grant proposal and award from the California Public Utilities Commission (CPUC) Federal Funding Account (FFA) program; an implementation roadmap for the Project; and incorporates information from the previous sections to envision a future where capital projects are integrated, and the network is expanded.
- **Section 8. Recommendations:** Provides strategic recommendations across two primary categories: Municipal Broadband and Digital Equity

Barriers to Broadband

The barriers of affordability, availability, and performance are inextricably linked. Monopolistic markets in low-income communities result in less affordable and less reliable Internet. With no market competitors, Internet service providers can set plan rates at the price of their choosing, leaving customers to either pay up or go without Internet. Without competitors, monopolistic providers are not incentivized to invest in updating antiquated infrastructure, which results in performance issues, including slow speeds, latency, and outages. Even when affordability is not a barrier for households, the outdated infrastructure present may not always be capable of achieving the advertised speeds of the most expensive plans. Community data suggests that those who pay more do not indicate higher satisfaction with their Internet service provider. These overlapping barriers demonstrate that there's not a one-size-fits-all solution to closing the Digital Divide; however, spotlighting the presence of these barriers in Oakland is a start.



Barriers to Broadband:

The Interconnectedness of Affordability, Performance, and Availability

An Alternative to the Status Quo

Municipal Broadband Networks (MBNs) have flourished all over the United States with over 330 operating as of 2020.[1] MBNs can increase competition and provide community benefits, such as municipal data services and subsidized rates and fees. To launch an MBN in Oakland, the BMP recommends pursuing a "hybrid" model where the City constructs a fiber network designed to deliver residential broadband service, and then enters into public-private partnerships with Internet Service Providers (ISPs) to: 1) deliver low-cost, high-speed service to residents; and 2) fund the maintenance of the network through fees and revenues.

To achieve this, the BMP does the following:

- Analyzes limitations and opportunities with existing publicly owned fiber infrastructure in Oakland and recommends segments for use in the MBN;
- Evaluates multi dwelling unit properties (MDUs) and community anchor institutions (CAIs) to locate ideal candidates for the initial MBN build;
- Explores trends in the broadband industry, such as fiber and conduit constructions standards and technologies such as next generation fixed wireless service, that have potential in the City of Oakland
- Provides frameworks to expand and sustain the network and the digital equity ecosystem in Oakland.

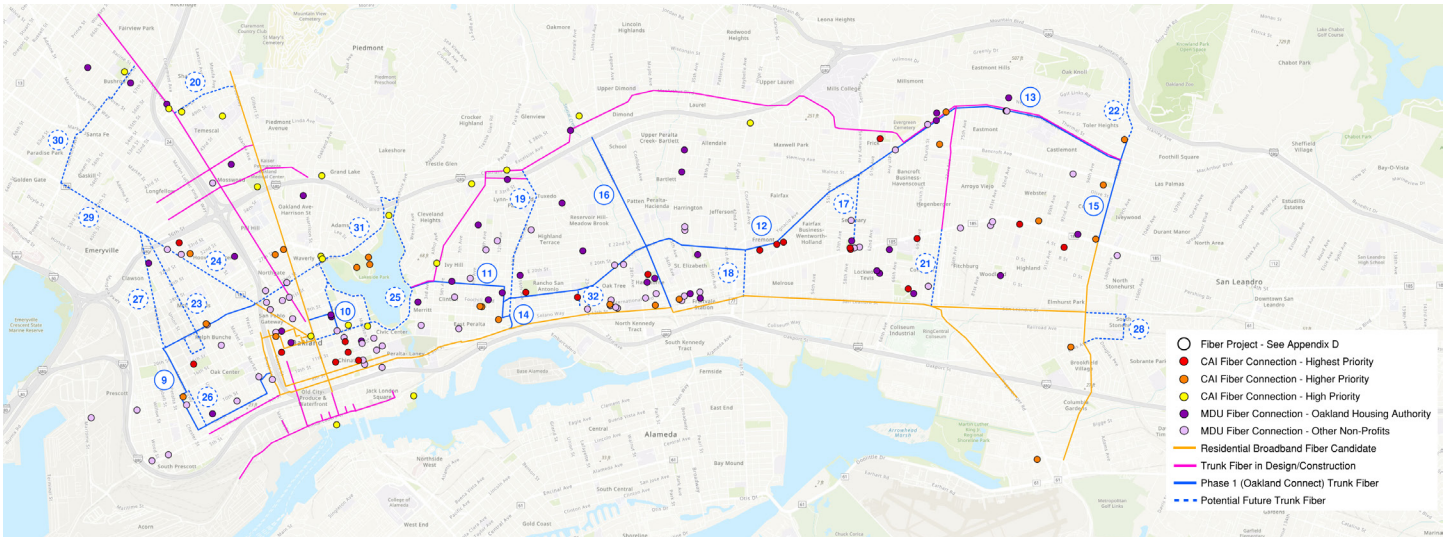
Oakland's Broadband Opportunity

In September 2023, the City submitted an application to the CPUC Federal Funding Account (FFA) Last Mile grant program, a competitive program that was oversubscribed more than 5.3X the allocated funding amount.

In July 2024, the City of Oakland was notified that the CPUC had selected their application for award in the first round in the requested amount of $14,026,946.15, with a City match of $1,563,126.85, for a total project amount of $15,590,073.00.

The BMP provides a high-level, detailed implementation plan and roadmap to design, construct and launch the OaklandConnect project, which is estimated to reach up to 2,500 households in Oakland Housing Authority affordable housing sites throughout West Oakland, Downtown, Fruitvale, and East Oakland.

The BMP looks into the future to imagine an outcome where all City capital projects are integrated into the OaklandConnect MBN, Public Private Partnerships (PPPs) are in place with wireline and wireless service providers -, thereby increasing competition. Where the MBN is healthy and sustainable, offering an affordable, cutting-edge alternative in the broadband space within Oakland.



The MBN includes recommendations across two broad categories: Municipal Broadband Infrastructure and Digital Equity.

Municipal Broadband Infrastructure Strategic recommendations include:

- Developing open-access middle mile, rooftop access, and Dig Once policies;
- Restoring and expanding OakWifi Public Wi-Fi service;
- Coordinating with the California Department of Technology regarding the State's Middle Mile Initiative;
- Pursuing additional grant opportunities;
- Operational & Maintenance Plans, and more.

Digital Equity Strategic recommendations include:

- Sustaining the Digital Equity ecosystem;
- Strengthening local policies that expand Internet access;
- Supporting and calling for State & Federal Digital Equity Policies.

Striving for Digital Equity

The City of Oakland's Broadband Master Plan serves as a blueprint for addressing digital exclusion and its impacts on Oaklanders. It presents a solution: a municipal broadband network designed to achieve more equitable access to affordable, high-speed internet. By leveraging existing public infrastructure, prioritizing un/underserved communities, and fostering partnerships with Oakland Housing Authority, other affordable housing providers, as well as community-oriented Internet service providers that can advance digital inclusion, the BMP demonstrates the potential for a MBN in Oakland to improve outcomes in the community by managing as a utility for economic, educational, and social progress. The OaklandConnect MBN will not, on its own, solve the digital divide. As they say, this is a marathon, not a sprint. Much more work—perhaps even tougher—lies ahead. Nonetheless, the BMP provides a roadmap to a more connected, inclusive, and resilient future.

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1. INTRODUCTION

The City of Oakland (herein referred to simply as "City") is located in Alameda County, California. Home to 436,504 residents at the time of writing, the City is one of the most racially diverse in the United States and is the cultural, economic, and social hub of the Eastern portion of the San Francisco Bay Area (colloquially known as the "East Bay").[2]

Oakland has a long history of innovation and entrepreneurship, with small businesses representing the majority of Oakland's economy while also hosting many large and influential multinational companies.[3] It is a vibrant community with a rich history of activism, civic leadership, and social progress. However, a legacy of racist federal, state, and local policies – including the exclusion of Black families from home ownership opportunities through redlining and the construction of an interstate freeway system that destroyed vibrant Black neighborhoods in West Oakland – is still evident today and can be observed in all facets of life, including how online and digital services are provided and accessed. These patterns of digital exclusion mirror demographic patterns of disparate access documented throughout the State.[4] As noted in the Greenlining Institute's report "On The Wrong Side of the Digital Divide," local geographic patterns are a result of historical redlining: the deliberate practice, carried out by both the government and private sector, of denying loans and investment in communities of color.[5] Although redlining has been illegal for decades, data investigations and community outreach reveal redlining persists, albeit in less immediately observable forms such as broadband infrastructure and service.

ACS Internet Connectivity

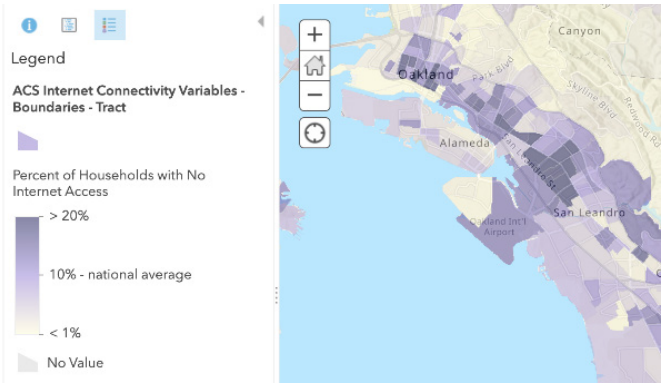


Figure 1: American Community Survey (ACS): Internet Connectivity Map

According to the American Community Survey, a bi-annual survey conducted by the US Census Bureau, over 33,000 households in Oakland lack access to reliable, high-speed Internet at home[6]

Results of School Digital Needs Assessment "Tech Check"

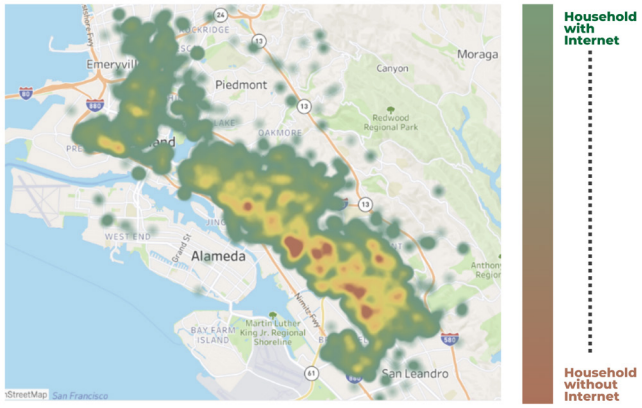


Figure 2: Oakland Unified School District (OUSD): Tech Check Survey Map

An annual technology survey completed by approximately 33,000 households with students enrolled in Oakland Unified School District (OUSD) in the 2023-2024 school year, one in four public school students lack access to the connectivity to complete assignments, apply to college, and fully access their education

Many historically underresourced neighborhoods in Oakland – like West Oakland, East Oakland, and Fruitvale among others – have experienced a disproportionately low broadband infrastructure investment which has had a continuous and deleterious impact on education and economic development (See **Figure 1** and **Figure 2**). As a result, these communities, where residents are more likely to be lower-income, Black and Brown, and speak English as a second language, are often excluded in the digital age.

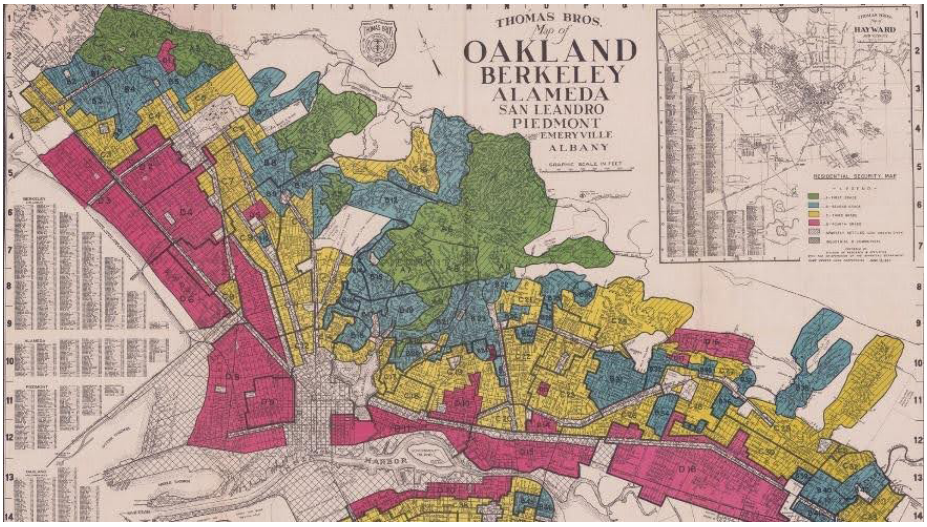


Figure 3: Home Owners Loan Corporation (HOLC) "Residential Security" Map from 1937[7]

1.1 What is the Digital Divide?

The term "Digital Divide" was coined in 1996 "to describe the chasm that purportedly separates information technology (IT) haves from have-nots."[8] As this document will demonstrate, the Digital Divide directly impacts many Oakland residents in negative and harmful ways.

The table below provides helpful definitions to distinguish between the terms Digital Divide, Digital Equity, and Digital Inclusion. All of these terms will be used in this document.

KEY TERM	DEFINITION
Digital Divide[9]	Gap between those people who have access to telecommunications and information technologies and those who do not – in particular, access to high-speed Internet, also known as broadband, that give users the ability to send and receive data at volumes and speeds that support a wide range of applications, including voice communications, entertainment, telemedicine, distance education, telework, ecommerce, civic engagement, public safety, and energy conservation.
Digital Equity[10]	Digital Equity is 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.
Digital Inclusion[11]	The activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of Information and Communication Technologies. This includes five elements of affordable, robust broadband Internet service; Internet-enabled devices that meet the needs of the user; access to digital literacy training; quality technical support; applications and online content designed to enable and encourage self-sufficiency, participation, and collaboration. Digital Inclusion must evolve as technology advances. Digital Inclusion requires intentional strategies and investments to reduce and eliminate historical, institutional, and structural barriers to access and use technology.

Table 1: Key Terms and Definitions

1.2 COVID-19 and Generational Federal & State Broadband Funding

The COVID-19 pandemic not only exposed America's Digital Divide but also deepened it, revealing stark disparities in internet access across communities. As remote work and online access to schooling became an instant necessity, individuals without reliable residential internet access were left behind in these critical areas of daily life.[12] This crisis also accelerated the ongoing trend of digitalization, where nearly all essential tasks — including online learning, job applications, civic engagement, and access to social services and telehealth — became dependent on reliable internet access. The pandemic underscored the urgent need for equitable broadband access to ensure that no one is excluded from participating in a digitally driven society.

With the inadequacies of U.S. Internet infrastructure laid bare, the Federal Government authorized unprecedented funding for broadband, primarily through two funding bills:

- The American Rescue Plan Act (ARPA) was a $1.9 trillion COVID-19 relief package signed into law on March 11, 2021. The bill included over $25 billion in direct broadband funding along with direct funding to state and local governments.[13]
- Then, on November 15, 2021, the Infrastructure and Jobs Act (IIJA), a $1.2 trillion package, was signed into law. The IIJA included $65 billion for broadband, largely divided into two categories: $14.5 million for the Federal Communications Commission (FCC) to administer the Affordable Connectivity Plan; and $42.5 billion for the Broadband, Equity, Access, and Deployment (BEAD) Program.[14] BEAD Funding includes $2.75 billion across three grant programs to support digital literacy, equity, and inclusion.[15]

The State of California, meanwhile, already had several well-established broadband grant programs available through the California Advanced Services Fund (CASF) and other agencies.[16] However, California was able to leverage ARPA funds to establish two new programs: the $3.25 billion Middle Mile Broadband Initiative (MMBI), led by the California Department of Technology (CDT), and the $2 billion Last Mile Federal Funding Account (FFA), a competitive grant program open to private and local government organizations, administered by the California Public Utilities Commission.[17] California is still in the process of creating programs for administering BEAD funding.

Taken together, these policies and programs have created a once-in-a-generation opportunity for governments at all levels (federal, state, local, tribal), in partnership with the private sector, to make investments in broadband infrastructure and service that can meaningfully address the Digital Divide, with the potential to eliminate it once and for all.

On July 11, 2024, the CPUC unanimously approved the City of Oakland's "Oakland Connect – Last Mile Connectivity for Oaklanders" project for awarding $14 million. The City will provide a $1.5 million match for a total of $15.5 million! This BMP will discuss the Oakland Connect project in detail in Section 7.[18]

2. BROADBAND MASTER PLAN OVERVIEW

This section will provide an overview of the key connectivity technologies that power modern broadband infrastructure while also offering a high-level summary of the Broadband Master Plan (BMP). It will outline past planning efforts, as well as the purpose and vision driving this strategic initiative.

2.1 Fiber Optics: The Speed of Light

Fiber optic networks are largely considered the most resilient transmission mediums for broadband networks due to the following:

- Higher bandwidth;
- Low attenuation;
- Immunity to electromagnetic interference;
- Security;
- Lightweight and compact; and
- Lower requirement for maintenance and upgrades.

GOOD TO KNOW: The City of Oakland utilizes fiber optics in much of its backhaul connectivity, for both inside plant (e.g. inside of buildings) and outside plant (e.g. rights-of-ways and within conduits) implementation and utilizes both multi-mode and single-mode applications

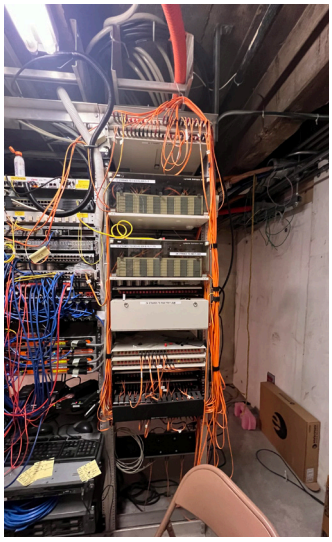
Fiber optics is the transmission of light down narrow strands of transparent optical fibers, typically made of glass but plastic has also been used. While the most common is in telecommunications, optical fibers have also been used in lighting applications, medicine, and sensors. Both the FCC and the National Telecommunications and Information Administration (NTIA) have put forth guidance and symmetrical speed thresholds that expressly advocate for optical fiber as the preferred communication method for which to deploy, through broadband funding programs such as the Broadband Equity Access and Deployment (BEAD).[19]

2.1.1 Types of Fiber Cables

Fiber optic cables consist of a central core made of glass or plastic, which serves as the pathway for light to travel through. The size of the core determines the mode of the cable, classifying it as either single-mode or multimode. In addition to the core, the cladding plays a crucial role by trapping and reflecting light back into the core, preventing signal loss. The cladding typically has a diameter of 125 microns (one micron is one-millionth of a meter) and is essential for maintaining the efficiency of light transmission within the cable.

Single-mode cores are 8-9 microns in diameter and therefore only transmit one mode. Single-mode applications are used for both indoor and outdoor deployments, and particularly for long-distance runs.

Multi-mode optical fiber has a much larger core at 50 or 62.5 microns and utilizes lasers or LEDs as its source of light. Multimode is used primarily within buildings as the larger core lends to higher latency and attenuation, the diminishing of light intensity over distance. Optical fibers made of plastic are also considered multimode with the largest core of 1 millimeter and used only in indoor connections.



The City of Oakland utilizes fiber optics in much of its backhaul connectivity, for both inside plant (e.g. inside of buildings) and outside plant (e.g. rights-of-ways and within conduits) implementation and utilizes both multimode and singlemode applications.

Good to Know: The City of Oakland has historically deployed multimode within its buildings and campus and is currently phasing out all legacy multimode cable runs and replacing them with single-mode cables. Optical fiber cable types are not compatible with each other; for example, you cannot fusion splice a single-mode strand onto a multimode strand due to the difference in core diameter, which would result in too great of light loss.

Subsea cables are typically low-count single-mode optical cables, which are ideal for the vast distances they cover at the bottom of the ocean.

Ribbon cables are designed with flat, side-by-side fiber strands, allowing for higher fiber density in a compact form. This arrangement enhances splicing efficiency, as a single splice can connect up-to twelve fibers simultaneously using specialized fusion splicers designed for ribbon cables. While the flat, flexible structure of ribbon cables is ideal for applications requiring high capacity and space efficiency, loose-tube designs are typically mechanically stronger and offer better resistance to bending, making them more suitable for environments where durability and flexibility are crucial.

Hollow core cables are primarily used in networks designed for high-frequency trading (HFT). Hollow core cables have a higher rate of light loss compared to single-mode or multimode cables and are not suitable for long-distance transmission. In high-frequency trading, speed is critical, as even a fraction of a second's delay in accessing the market can result in significant financial gains or losses.

2.1.2 Construction Methods

There are two main ways to install fiber optic cables: aerial construction and underground construction.

Aerial construction typically involves hanging fiber optic cables on utility poles. Two common techniques are used: strand-and-lash, where a thick steel rope is stretched between poles and the cables are attached to the rope, and self-supported fiber optic cables (ADSS), where the cables are directly supported between poles without additional reinforcement. Aerial construction is generally more cost-efficient and quicker to deploy, as it is less labor-intensive compared to underground methods. However, it is more vulnerable to damage from extreme weather events, such as tornadoes or hurricanes, especially in areas prone to inclement weather.

Good to Know: In Oakland, the majority of utility poles are owned by PG&E, with competitive local exchange carriers (CLECs) having predetermined access rights. Municipalities typically provide ministerial approvals for attaching cables to utility poles.

Underground construction involves burying the fiber optic cables, which provides protection from weather-related damage but is generally more expensive and time-consuming. Several methods are used for underground deployment:

- ***Direct-bury:*** *In this method, fiber optic cables are buried directly in the ground, often along long-distance routes such as railroads or highways where there is little residential development. This method is suitable for areas where the ground is unlikely to be disturbed and is often used in low-density areas. .*
- ***Trenched Conduit:*** This method involves digging a deep trench, placing a high-density polyethylene (HDPE) pipe in the trench to protect the fiber cables, and then sealing the trench. The HDPE pipe acts as an additional layer of protection against moisture and dirt. These pipes can converge at vaults (also called pull boxes or handholes), providing access to the cables for maintenance or repairs.
- ***Microtrenching:*** This method is quicker to deploy and involves making a shallow, narrow cut into the roadway, placing the fiber optic cables, and then covering the trench with asphalt. Microtrenching is especially popular for connecting buildings or homes to the main network in urban or suburban areas. It is an efficient and minimally disruptive method, often used for drop cables, which are low-count optical cables that connect homes and businesses to the broader network.
- ***Directional Boring/Drilling:*** Instead of digging an open trench along the entire length of the installation, this deployment technique involves drilling a horizontal bore along a predetermined underground path ranging from 500ft to 1,000ft., enabling the cable and/or conduit to be pulled through. Drilling depth can range from a depth of 3ft. to 10ft., depending on local regulations, existing underground infrastructure and utilities, and other factors. The primary benefit of this installation method includes less disruption to the roadways or sidewalks and faster deployment. However, without a direct line of sight into the trench, the installation requires skilled operators and precise calculations to avoid damage to existing underground utilities.

2.2 Types of Broadband Infrastructure

The table below describes broadband infrastructure technologies and highlights their advantages and disadvantages.

INFRASTRUCTURE TECHNOLOGY	TYPE	PROS	CONS
Copper, Coaxial	Wireline	• Inexpensive • Widely Available • Durable	• Limited by distance • Limited upload speeds • Vulnerable to signal interference
Fiber Optic	Wireline	• Speed (only limited by electronic equipment) • Not subject to weather/interference • Scalable • Future-Proof	• Most expensive capital expenditure costs • Requires end-to-end connections • Installation in Right-of-Way (ROW)
Satellite (e.g., Geostationary and Low-Earth Orbit)	Wireless	• Easy to deploy • Satellites technically cover all of the United States • Low maintenance costs	• Difficult for local government to manage • Subject to weather, space events, meteors, etc. • Constant need for more satellites to scale • High recurring leasing and subscription costs • Limited number of commercial providers
Traditional Fixed Wireless	Wireless	• Low cost • Licensed radio frequency bands are regulated by FCC, more stability • Unlicensed commonly available • Quick to deploy • Easy and low cost to manage	• Subject to weather • Requires unobstructed line of site • Limited range (1-2 miles to node)
Cellular / Mobile	Wireless	• Low latency, increased bandwidth • Data speeds and latency for IoT (Internet of Things) devices • Widely available • Commonly used • No capital costs for subscribers	• High recurring leasing costs for towers • Expensive to scale • Requires FCC licenses at high cost • Subject to extreme weather, large call/data volumes • Cellular service limited in hills, hard to reach areas

Table 2: Types of Broadband Infrastructure

2.2.1 Limitations of Certain Broadband Technologies

It's important to note that not all forms of internet access are equal. This BMP discusses the Digital Divide, its impacts, and possible solutions, it needs to be understood that the exclusive focus is on residential high-speed, broadband Internet service. Residential Internet service is delivered by an Internet service provider through a subscription plan to individual households at the property address level, similar to utilities like electricity and water.

- **Digital Subscriber Loop (DSL)** are copper lines deployed by phone companies before the early 2000s, is no longer considered a sufficient form of broadband.
- **Satellite internet** (e.g.,StarLink) can expand access, particularly in remote and rural areas, but its residential plans start at over $100 per month with introductory equipment ranging from $500-$700 —making it unaffordable for many and failing to address affordability as a key driver of the Digital Divide.[20]
- **Cellular/Mobile internet** (e.g., LTE hotspots or 5G home Internet offered by mobile carriers like AT&T, Verizon, and T-Mobile) have connections and speeds can be highly volatile and largely inconsistent - not unlike the user experience on a mobile device. All mobile and cellular internet users rely on the same cellular operable towers, and periods of high demand on the network can impact available bandwidth, forcing mobile providers to prioritize some users over others, often relegating lower-income consumers to the slowest performance.

Importantly, smartphones and tablets (e.g., iPhone and Android devices) are not a suitable replacement for computers, as many Internet sites are not mobile compatible, and functionality is limited. To illustrate this, imagine using only a smartphone to write a multiple-page essay for school; applying for an important job; or researching a complex topic (such as a medical problem or regulatory process). Research shows it is far more difficult to perform these tasks on a smartphone than on a computer.[21]

2.3 Purpose of the Broadband Master Plan

This Broadband Master Plan is funded by investments from ARPA, which were allocated to the State of California and administered by the CPUC. Specifically, the CPUC established a Local Agency Technical Assistance (LATA) grant program for local and tribal government organizations within California to use for the purpose of technical planning for broadband projects.[22] **In December of 2022, the City of Oakland was awarded a $500,000 LATA grant and charged with the development of a broadband baster plan as part of the scope**. (For reference: this document may be referred to as the "Broadband Master Plan", "BMP," or "LATA BMP").

The purpose of the Broadband Master Plan is to guide the development of a municipal fiber optic broadband network by the City of Oakland, aimed at delivering "Last Mile" internet service to Oakland residents. The BMP will outline a strategy for utilizing existing City broadband assets, such as fiber optic routes and network segments while leveraging state grant opportunities, broadband investments, and public-private partnerships to expand residential internet access in underserved and unserved communities. The plan will address key considerations for broadband infrastructure, including the integration of existing networks and the role of Community Anchor Institutions (CAIs), and will ultimately recommend routes and construction plans to enhance access throughout the city.

The BMP aligns with the Citywide goals of a responsive, trustworthy government and vibrant, sustainable infrastructure and can inform future planning efforts, such as the General Plan Update (GPU), IT Strategic Plan, and others.

2.3.1 Prior Planning Efforts

The BMP builds on previous planning efforts by the City, including the 2015 City of Oakland Fiber optic Network Master Plan and 2019 City of Oakland Fiber optic Network Master Plan Update.[23] [24]

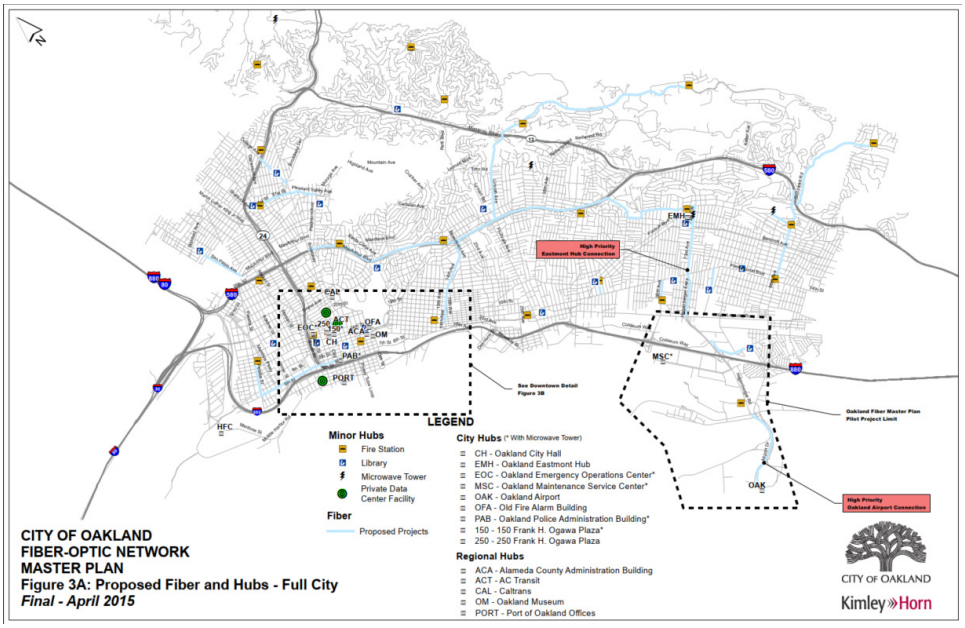


Figure 4 - 2015 Fiber Optic Master Plan

The 2015 Fiber Optic Master Plan noted that the City's fiber optic network was disjointed due to various City divisions leading their own fiber optic cable installation projects that focused on that division's needs (e.g. traffic signal communications, building connections, etc.) without consideration of joint City use. The 2015 Fiber Optic Master Plan documented and evaluated existing City fiber optic infrastructure, collected information on upcoming public agency fiber optic infrastructure within City limits and identified future fiber optic projects and priorities to position the City for strategic expansion of its network. The plan also laid out a vision for an integrated City-wide fiber optic network that supported City building network connections, as well as providing network reliability, and redundancy.

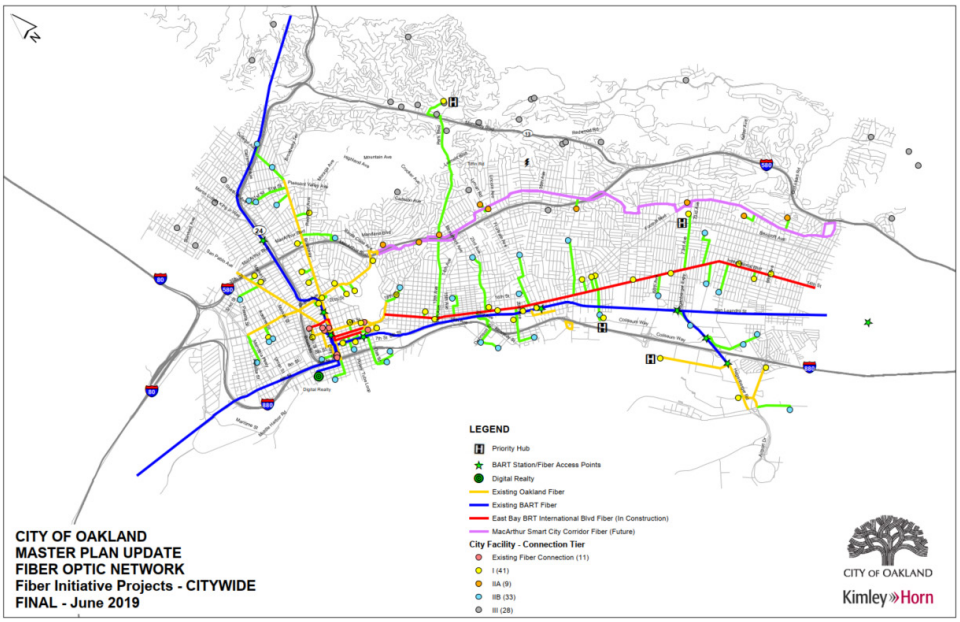


Figure 5 - 2019 Fiber Optic Master Plan Update

The 2019 City of Oakland Fiber optic Network Master Plan Update included current information for existing, planned, and proposed fiber communications infrastructure projects in Oakland and proposed a City-wide initiative project to provide fiber connections to all City municipal facilities. In addition, the 2019 update to the Fiber optic plan also developed preliminary policies and guidelines for use of the City's network for the community. Workshops with City departments were held to develop City policy guidelines for broadband development, including fiber optic infrastructure and high-speed wireless networks. The policy guidelines defined the broadband roles and responsibilities of various City departments, outside public agencies, and private companies.

2.3.2 BMP Vision

The BMP is guided by the following Vision Statement:

> ***To develop a thriving community in Oakland by establishing fast, reliable, and affordable Internet access to residents and businesses; achieve Digital Equity by bridging the Digital Divide; and enable economic development through partnerships.***

Oakland residents need access to reliable, high-speed Internet as a utility service and 21st century civil right. Now more than ever, residents require robust connectivity at home to fully function in society. Yet, despite its growing importance, Internet access is still not universally available in Oakland.

While the City of Oakland, like other California municipalities, has no direct role in regulating Internet service providers, and control over encroachment and land use permitting for broadband projects, particularly in the public right of way, is limited, there are levers available for the City to consider.

First and foremost, the City owns its telecommunications assets, including fiber optic lines, conduit, and potential wireless sites. While this infrastructure was originally built to connect City facilities, it can be repurposed to support residential broadband, as outlined in this plan. The City can also implement policies that foster broadband infrastructure development and promote competition, providing more options for residents and businesses. In fact, the City is in a unique position to play an expanded role as an active participant in the development of broadband infrastructure.

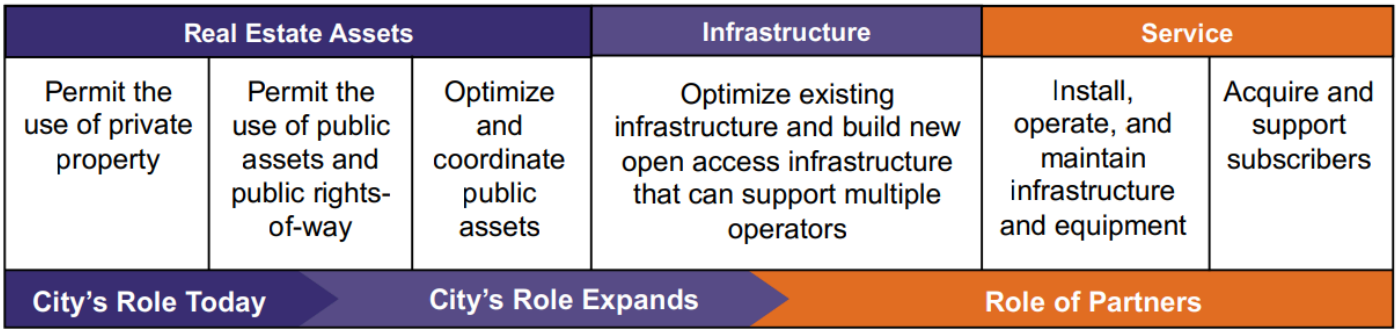
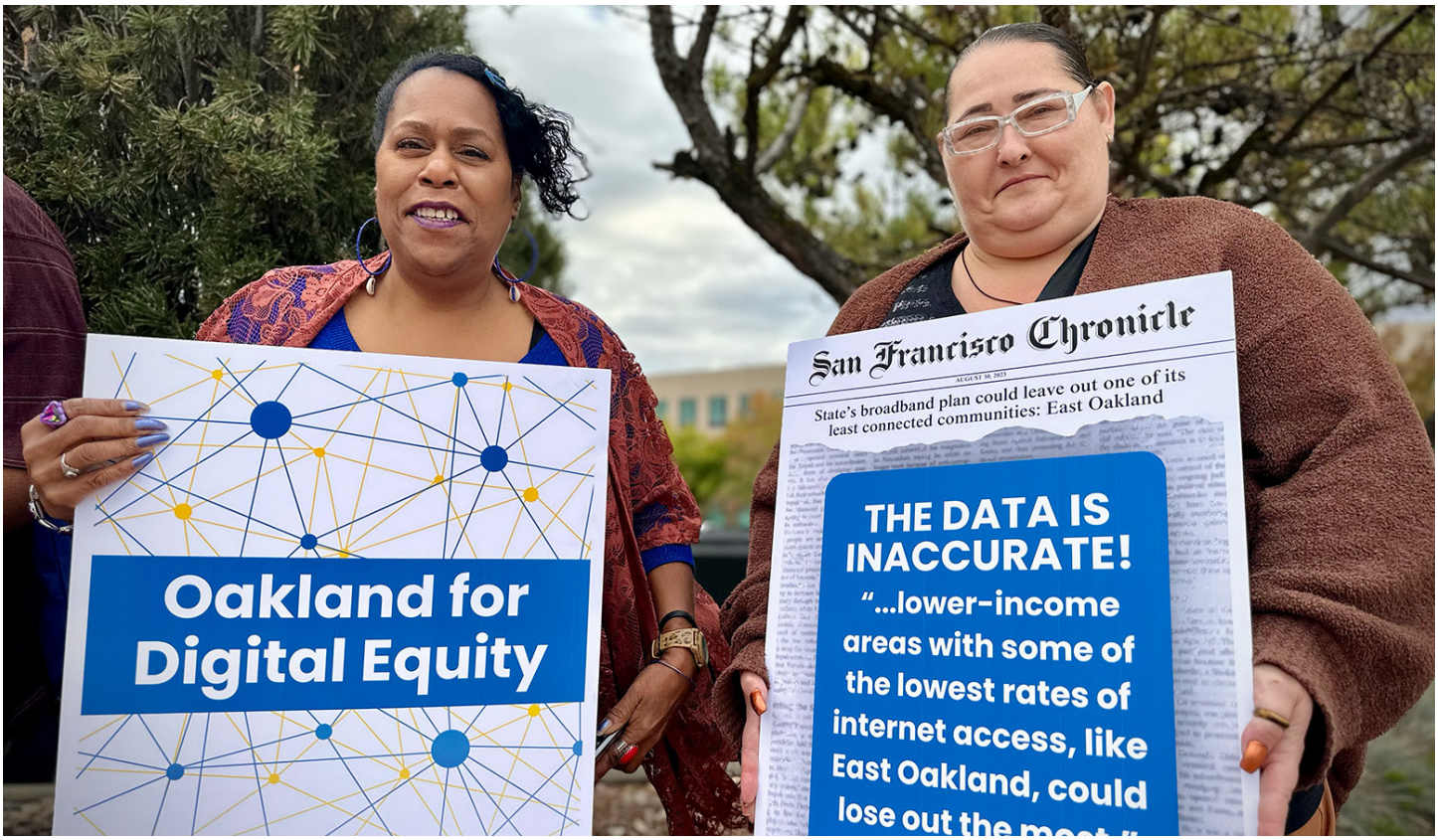


FIGURE 6: Expanded Role for the City in Broadband Delivery (Credit: City of New York)[25]

3. COMMUNITY VOICES



This Broadband Master Plan is grounded in the voices and lived experiences of the communities most impacted by the Digital Divide. By combining both qualitative and quantitative data, we ensure that the findings reflect our community's lived experience, which is only uncovered through authentic community engagement.

In Oakland, there is no one-size-fits-all approach when engaging with our community. With over 125 languages spoken and residents from diverse backgrounds, overcoming barriers to digital access requires a comprehensive, holistic strategy that actively involves the community at every stage and through multiple methods.

The City of Oakland acknowledges that, throughout history, "significant decisions have been made by municipal and regional governments with limited participation from communities of color."[26] To ensure that those patterns of exclusion are not repeated, the BMP adopted the following pillars:

- Listening actively and respectfully
- Partnering with community-based organizations
- Centering and empowering the community,
- Meeting the community where they are.

"Achieving equity requires that all Oakland residents have the opportunity to shape the policies and programs that impact their everyday lives."

- City of Oakland's Inclusive Community Engagement Strategy

3.1 Listening Actively and Respectfully

Active and respectful listening is the most critical pillar of community engagement. Active listening requires refraining from assumptions and projections regarding why communities end up and are kept on the wrong side of the Digital Divide. Listening to people's needs and experiences allows us to understand the problem from multiple perspectives and, together, develop better solutions to address the problems as experienced by different community members.

3.1.1 Interviews and Testimonials

By attending community events in East and West Oakland—neighborhoods in Oakland most affected by the Digital Divide—community partners had the opportunity to interview residents whose voices are often excluded. The interviews and testimonials gathered at school events, community festivals, and food distributions focused on residents' personal experiences with Internet access and community partners prioritized listening, only asking follow-up questions to ensure each story was accurately captured.

#OaklandUndivided's Connected Community Celebration, August 2023

COMMUNITY VOICES

"Sometimes you find an affordable plan [but] this provider can't reach your area for some reason."

"My home internet at times is not very secure because occasionally we lose signal and I have to contact the company to resolve that so that my daughters can finish their school work."

" ...intenté [instalar internet] con [compania de internet] pero no hay cobertura y [mi proveedor] era la única opción porque si realmente necesito y dependo de internet en casa."

"...I tried [to install internet] with [unnamed internet company] but there's no coverage there and [my current provider] was the only option I have because I really need and depend on home internet."

"My experience with the internet is a little difficult. I sometimes feel that internet companies provide you with the same speeds regardless of the price you pay"

"It is sometimes slow so I upgraded to fast, but it still cuts off out of nowhere, so it is still not that great."

"I'm disappointed most of the time with my internet service."

3.2 Partnering with CBOs and Civic Institutions

At the onset of the COVID-19 pandemic, the City of Oakland launched a Digital Equity coalition bringing together schools, community-based organizations, community anchor institutions, and private partners to solve the Digital Divide. Partnering with such a diverse group of trusted organizations, like Oakland Unified School District (OUSD), Oakland Housing Authority (OHA), Tech Exchange, and many others, has enabled connections to some of Oakland's hardest-to-reach communities. These partners, many of whom have been vital institutions in Oakland for decades, know their respective communities in-depth, can create scalable impact, and offer access to resources, such as data, capacity, and grants, that the City would not have otherwise.

3.2.1 Partner Highlight: OUSD

Tech Check Survey: When COVID-19 hit, OUSD needed to know how many students lacked access to home Internet. To do so, they developed a home tech needs assessment that is now integrated into the back-to-school form, tracking the technology needs of over 34,000 student households each year. This data allowed OUSD to tap into COVID- era federal funding and secure over $20M for school-loaned Chromebooks and data-enabled Hotspots. OUSD will be able to use this data to apply for future funding, such as E-rate, which will help cover a large portion of the cost for home-used hotspots, bringing much-needed resources to many Oakland households

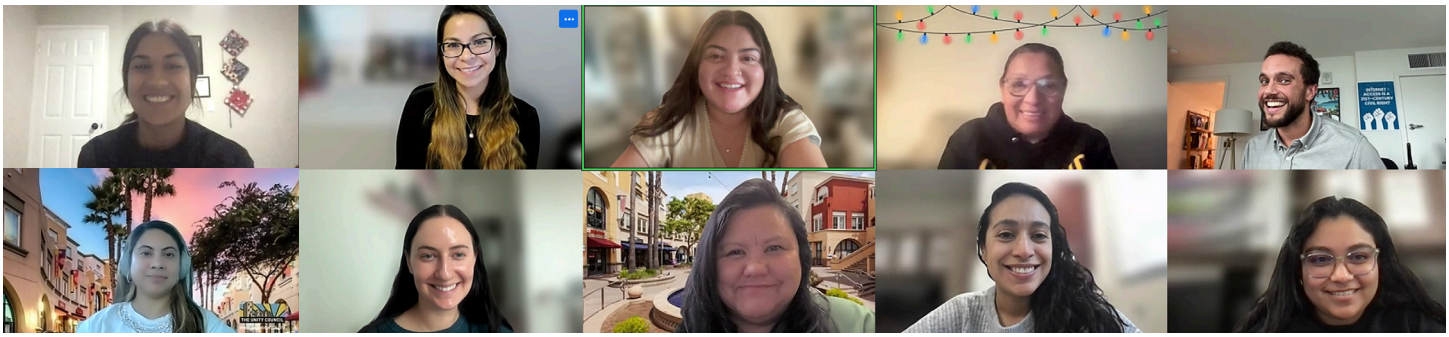
Home Technology Access	
Household Computer Does your household **own** a computer? *(This does **NOT** include tablets, iPads, readers, Kindles, smartphones, etc.)*	o Yes o No
Student Computer for Schoolwork Does your student always have access to a computer at home for schoolwork? "**Yes**" means your student has their **own** computer, or **always** has **access** to a home computer. "**No**" means your student does **not** have their own computer, or **does not always have access** to a home computer.	o Yes o No
Home Internet Access for Schoolwork Does your student have internet at home that is **fast** enough to attend Zoom meetings for parent conferences and stream educational videos **without interruption**?	o Yes o No

OUSD's home tech survey embedded in back to school registration form.

Hubble Speed Test Integration: OUSD deployed a proprietary tool that runs a speed test anytime a student opens a school-loaned device. To date, OUSD has run over one million speed tests, measuring internet performance throughout Oakland. Results from a preliminary analysis of these tests can be seen in **Section 3.4.1**. With performance data at scale, the City of Oakland was able to defend its $15 million public infrastructure project application against challenges from incumbent monopolies by demonstrating areas of high need in West Oakland, Fruitvale, and Deep East Oakland.

3.3 Centering and Empowering Community

Centering and empowering community means more than just giving people a seat at the table; it means building the table around them. By securing community presence in the spaces where solutions are being discussed, the BMP ensures that those most impacted by the Digital Divide have an active role in shaping decisions that affect their lives.



3.3.1 Community Engagement Coalition

Centering community can be facilitated by partnering with organizations that are already deeply engaged with the community. These partners are already tuned into the community, gaining insight into the digital access barriers their members face. As partners actively engage in community conversations, interviews and surveys aren't always necessary. Partners like Homies Empowerment, Hack the Hood, Oakland Reach, Families in Action, EOYDC, Oakland NAACP, Tech Exchange, The Unity Council, Youth Uprising, Kapor Foundation, and Common Sense have provided us with some of the most valuable insights around the digital barriers the community faces. They have also connected with members of the community who want to speak to decision-makers, enabling direct communication between those most impacted by the Digital Divide and their elected and appointed officials.

3.3.2 Roundtables and State Forums

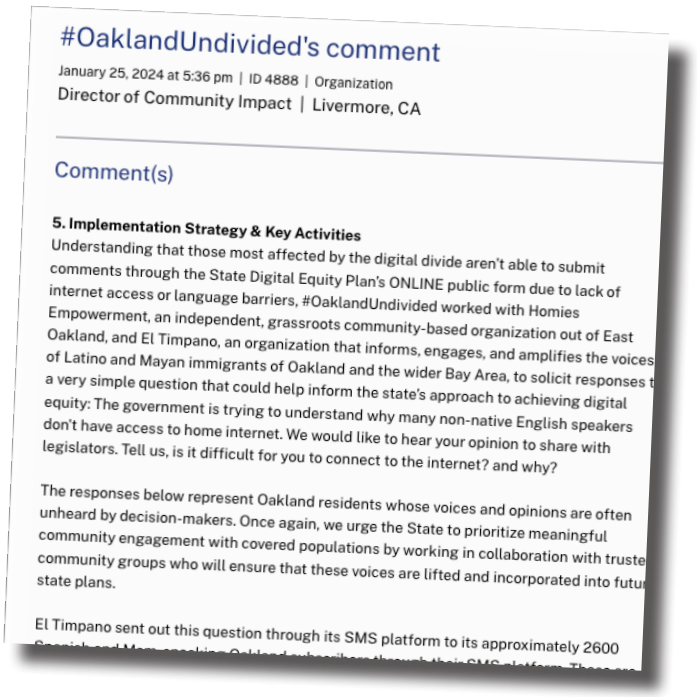
Stories give data points meaning. To ensure that decision-makers hear about residents' lived experiences, community members are invited to join roundtable conversations and participate in state forums, such as Broadband Advisory Council Meetings. During these events, community members are given the opportunity to share their everyday experiences with broadband access to those in power, such as CPUC commissioners. Inviting doesn't simply mean sending an invite with the time and address. It means facilitating their participation by eliminating the barriers that might keep them from attending, like providing transportation, helping them put together their comments, and compensating them for their time whenever possible.

Roundtable with CPUC Commissioner Houck and community partners

Hearing directly from residents allows decision-makers to ask follow-up questions, share potential solutions, and receive direct feedback. Ensuring the community is part of these conversations is crucial to holding officials accountable to responding to the community's real challenges.

3.3.3 Oakland Voices in the State's Digital Equity Plan

It's unrealistic to think that those without devices, reliable Internet, or access to digital skills training can provide feedback through an online portal or survey. When the portal to submit public comment for the State Digital Equity Plan opened, it proved challenging to get those whom this plan was created for to engage and provide feedback. To ensure that the feedback of the city's hardest-to-reach community was heard, partners like El Tímpano, a local news, information, and civic engagement organization created for and by Latino and Mayan immigrants in the Bay Area, stepped up. In partnership with the City, they sent a text to their 3,700+ subscribers, asking them about the challenges they face in accessing the Internet at home. Over the course of a week, 70 respondents were able to share their stories, which the City compiled and submitted to the State Digital Equity's portal, ensuring that the State heard directly from several of the covered populations they are focused on serving, including: Individuals with language barriers, Members of a racial or ethnic minority group, Individuals living in covered households, and Aging individuals (50+).



#OaklandUndivided's comment

January 25, 2024 at 5:36 pm | ID 4888 | Organization

Director of Community Impact | Livermore, CA

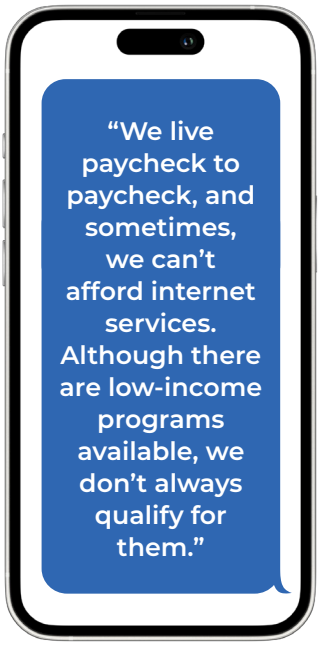
Comment(s)

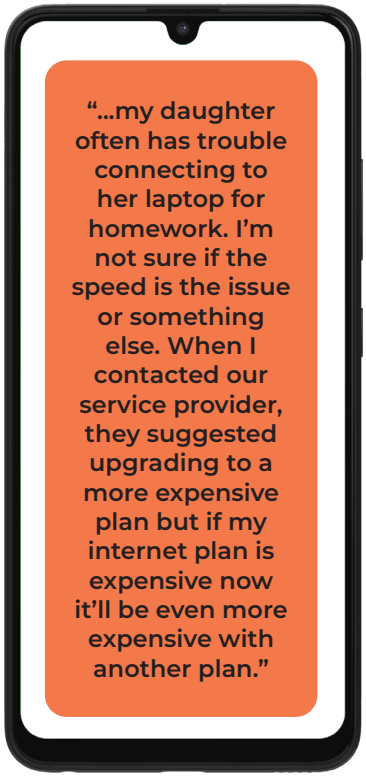
5. Implementation Strategy & Key Activities

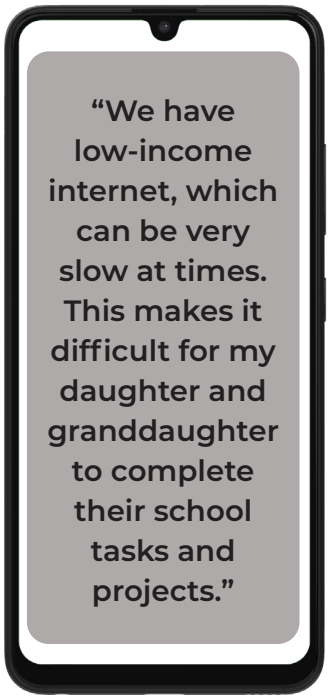
Understanding that those most affected by the digital divide aren't able to submit comments through the State Digital Equity Plan's ONLINE public form due to lack of internet access or language barriers, #OaklandUndivided worked with Homies Empowerment, an independent, grassroots community-based organization out of East Oakland, and El Timpano, an organization that informs, engages, and amplifies the voices of Latino and Mayan immigrants of Oakland and the wider Bay Area, to solicit responses t a very simple question that could help inform the state's approach to achieving digital equity: The government is trying to understand why many non-native English speakers don't have access to home internet. We would like to hear your opinion to share with legislators. Tell us, is it difficult for you to connect to the internet? and why?

The responses below represent Oakland residents whose voices and opinions are often unheard by decision-makers. Once again, we urge the State to prioritize meaningful community engagement with covered populations by working in collaboration with truste community groups who will ensure that these voices are lifted and incorporated into futu state plans.

El Timpano sent out this question through its SMS platform to its approximately 2600

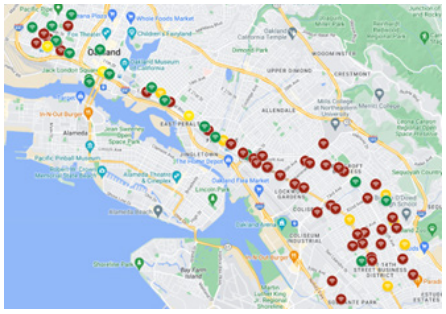






3.4 Meeting Community Where They Are

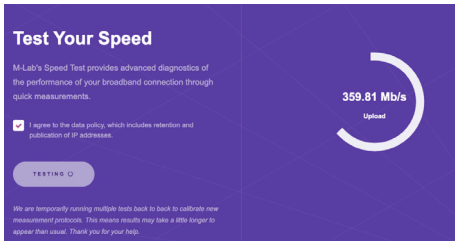
Simply creating an online survey is not authentic community engagement. To hear from the most underserved residents, it is crucial to know where to find them and meet them where they are – whether in person or through other accessible channels. This ensures that their voices, often overlooked, are heard.



3.4.1 Drive Testing Hotspots

A community partner reported that the families they serve were experiencing connection issues with the hotspots provided by their schools, prompting further investigation into the problem. It was understood that this issue was impacting families in East Oakland, and there was a desire to determine if other areas were facing similar challenges. After borrowing one of the hotspots and conducting speed tests across different neighborhoods in Oakland, the City and its partners were able to demonstrate that hotspot speeds were too slow to meet the standards required to be considered adequately served in Fruitvale, East Oakland, and West Oakland.

These findings gave OUSD the data needed to reach out to the Internet providers supplying the hotspots and ask what could be done to improve the service. In response, the Internet service provider replaced the slower devices with faster 5G hotspots that served students much better.



3.4.2 Speed Tests in Unit OHA and Site Visits

When the City learned that many housing authority properties were still relying on outdated copper wiring for Internet service, community partners worked with the Oakland Housing Authority to connect residents who were willing to participate in an at-home Internet speed study to the City. Residents from 17 affordable housing communities conducted internet speed tests, shared their internet bills, and completed a survey about their home internet experience. In-person visits ensured that speed tests were administered correctly and allowed community partners to listen and witness residents' experiences with their internet connection firsthand. The data showing the speeds residents were receiving was key in our advocacy efforts as we were able to communicate the community's lived experiences. The findings of this study are in **Section 4.3: Internet Performance**.

3.4.3 Attending Community Events

Building trust with community members requires showing up in spaces that they regularly attend and feel most comfortable. In-person engagement during community events is sometimes the only opportunity to talk to certain residents. Attending events like National Night Out, community festivals, and food distributions, among others, has allowed the City to share resources, like the discontinued Affordable Connectivity Program, ask for testimony about Internet experience, or simply engage in conversations around Internet access. To encourage residents to share their feedback, the City worked with partners to find ways to compensate them for their time and knowledge, which has proven to be a very successful strategy. To demonstrate that their time and contributions are valued, the City also followed up with participants to share how their input has been used and the impact it made.

3.5 Pillars in Action: A Case Study

Phone banking, where part-time employed community members make outbound calls to families to gather and share important resources and information, emerged as an essential tool during the COVID-19 pandemic.

Calls made: ~50,000 in 3 years

Answer rate (call and text): ~40%

Two-Way Interactions: ~19,000 households

Traditional communication platforms for family engagement (e.g., fliers, school messaging platforms) often failed to reach certain subgroups of students facing barriers such as limited digital literacy skills, non-native English speakers, and/or housing insecurity.

Since 2020, phone banking has proven to be one of the most effective methods of communication for the hardest-to-reach families. It has evolved to meet the emerging communication needs of the district which includes resource sharing, school engagement, and reminders. Phone banking encompassed all four pillars that guide our work as highlighted below.

Listening actively and respectfully	Partnering with community-based organizations	Centering and empowering the community	Meeting the community where they are
The role of phone bankers was to gather information and data, focusing on understanding household circumstances. The goal was to listen, learn, and build trust while sharing resources effectively. **Two-way communication:** A two-way communication channel encourages families to engage by calling back or texting with additional questions, helping to establish trust and providing an opportunity for families to seek additional resources from the school. Phone bankers left voicemails and followed up with text messaging to ensure continued support..	As a trusted anchor institution, OUSD leveraged its contact and demographic data to enable proactive, outbound calls. As a result, OUSD identified needs in their district, increased capacity building, and aligned resources to areas of greatest need. Through honest and open conversations, families shared personal barriers they were experiencing when accessing technology. As a result, civic institutions and trusted community partners have amplified the lived experiences of the community when advocating to policymakers.	Calls made to households with public school students shared resources and supported parents in becoming engaged with their student's school. For example, phone bankers helped families complete registration, download their school's parent communication and grade portals such as Aeries and Parent Square, fostering agency and access to important information. Additionally, families were notified of their eligibility for free devices and social benefit programs, like the Affordable Connectivity Program, and provided real-time enrollment support, empowering the community to benefit from under-utilized public benefit programs.	OUSD's approach is proactive. By initiating conversations and directly contacting families, OUSD is bringing the resources to families' homes, rather than waiting for families to seek them out themselves. **Intentional Staffing:** Phone banking staff were either bilingual (Spanish and English), Oakland residents, or parents of school-aged children. Hiring local, bilingual community members garnered responses from the Spanish-speaking community. In the 2023-2024 school year, Spanish was the first language for a quarter of the district's English learner students.[27] This approach removed language barriers, making it easier for families to engage with the school.

Table 4 - Pillars in Action - A Case Study

4. THE CHALLENGE: DIGITAL EXCLUSION IN OAKLAND

Access to the Internet has evolved into a fundamental pillar for education, employment, and daily life in the modern world. The inability to obtain reliable, affordable, high-speed Internet access effectively shuts individuals out from the opportunities of the twenty-first century, perpetuating a cycle of inequality and diminishing quality of life. Both quantitative and qualitative data gathered from Oakland residents and community partners underscore the persistence of substantial barriers to digital inclusion — barriers that disproportionately affect low-income households, Black and Brown communities, and residents of multi-dwelling units.

Input data from the community and partners revealed the following four major barriers to community access and achieving Digital Equity in Oakland:

- ***Internet Affordability*** *– The main barrier keeping Oakland residents offline is the unaffordable service rates.*
- ***Internet Availability*** *– Oakland residents have limited access to reliable infrastructure and Internet options, especially in affordable housing.*
- ***Internet Performance*** *– Residents often experience poor, unreliable connectivity.*
- ***Additional Considerations*** *– Device Costs, Digital Education and Tech Support*

Barriers to Broadband:

The Interconnectedness of Affordability, Performance, and Availability

The barriers of affordability, availability, and performance are inextricably linked. Monopolistic markets in low-income communities result in less affordable and less reliable Internet. With no market competitors, Internet service providers can set plan rates at the price of their choosing, leaving customers to either pay up or go without Internet. Without competitors, monopolistic providers are not incentivized to invest in updating antiquated infrastructure, which results in performance issues, including slow speeds, latency, and outages. Even when affordability is not a barrier for households, the outdated infrastructure present may not always be capable of achieving the advertised speeds of the most expensive plans. Community data suggests that those who pay more do not indicate higher satisfaction with their Internet service provider. These overlapping barriers demonstrate that there's not a one-size-fits-all solution to closing the Digital Divide; however, spotlighting the presence of these barriers in Oakland is a start.

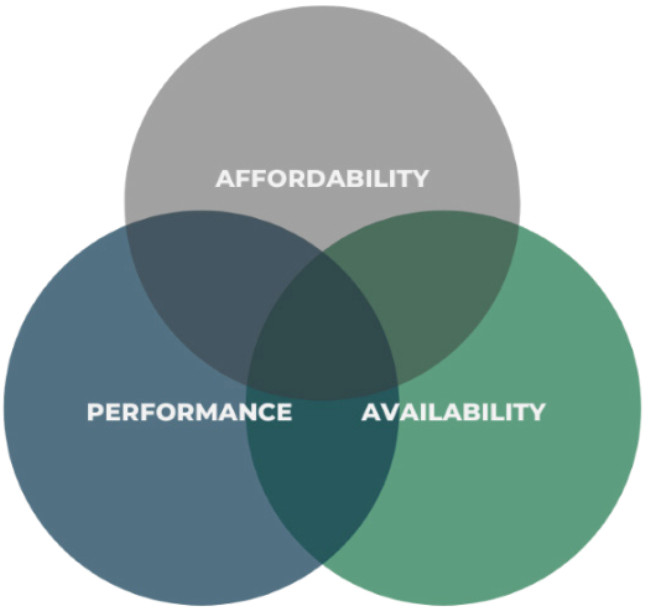


Figure 7: Barriers to Broadband

4.1 Internet Affordability

Many residents cannot afford the high cost of Internet service rates.

Income and race are the best predictors of Internet access, with higher-poverty communities and communities of color, on average, 20% less connected than higher-income, predominantly white communities.[28] Exacerbating this issue, broadband prices in California are among the highest in the country.[29] According to the California 2023 Statewide Digital Equity Survey, a joint effort between the California Department of Technology (CDT), the California Emerging Technology Fund (CETF), and the University of Southern California (USC), the high price of Internet is the number one barrier to connectivity averaging $83.60 per month.[30] Unsurprisingly, 77% of respondents to the California Department of Technology's online public survey cited cost as the main reason for not having an Internet connection at home.[31] In survey after survey, most people who don't have Internet at home say it's because it's too expensive.[32]

This affordability barrier affects low-income families and Black and brown communities the most. California's wealthiest households are 16 times as likely to have access to home Internet as the poorest households, and Latino households are only about one-third as likely to have access to home Internet as White households.[33]

4.1.1 Impact of a Monopolistic Marketplace

Many Californians do not have a real choice when it comes to their Internet service. The Greenlining Institute report "On the Wrong Side of the Digital Divide" also finds that broadband pricing costs in Oakland are inextricably linked to the pervasive monopolistic marketplace. Competition and fiber-based services are less widely available in low-income areas and communities of color, with the most severe deficits observed in census block groups that combine poverty and a large percentage of Black residents. The CPUC's 2018 Competition Report found that 35% of California households have access to only one provider offering service greater than 25/3 Mbps, and only 6.8% have access to three providers offering service greater than 25/3 Mbps.[34]

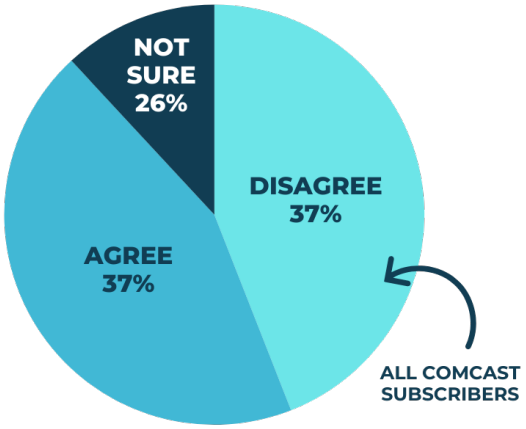
With only one provider option, residents have no choice but to pay the price set by the incumbent provider. This results in higher monthly bills compared to areas with Internet service provider competition. Not only are low-income consumers more likely to face a lack of alternatives, but they are disproportionately impacted by the burden of any debts accrued as they have no alternative if service is canceled due to their inability to pay a surprise bill.

4.1.2 Community Data: Cost is the Main Barrier

According to a 2023 survey of Oakland Housing Authority Multi-Dwelling Unit residents, 92% of respondents identified cost as one of the main barriers that keep them, or members of their community, from having home Internet. Some residents revealed being charged prices as high as $150 per month, including router rental and associated fees.

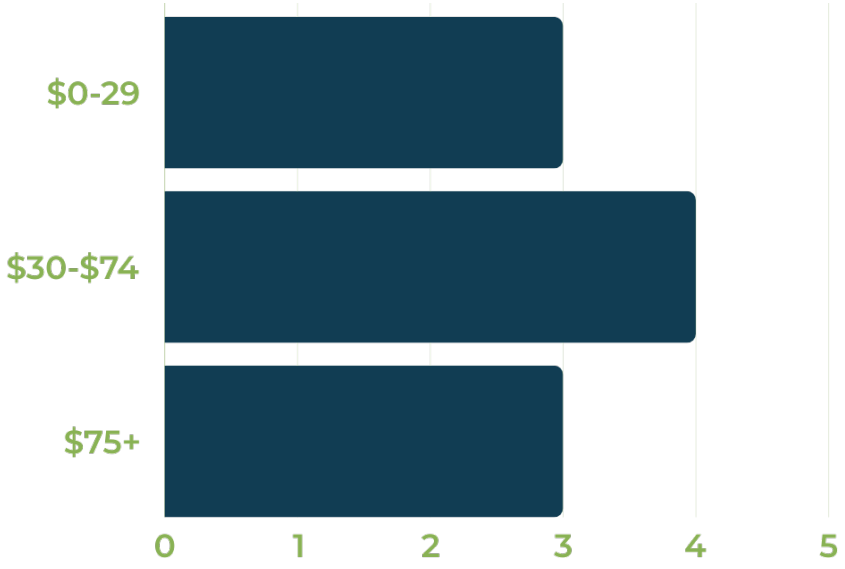
A significant number of survey participants also reported a lack of Internet choice. All survey respondents with the choice of **only one** Internet service provider were subscribers of Comcast, the incumbent provider that dominates our local market. Surveys also indicated that community members were unsure if there were other options available to them.

Participants who paid more for their Internet did not indicate greater satisfaction with the quality and speed of their plan (**Figure 5**). Participants who were subscribed to the $0-30 per month plan indicated a satisfaction rating of 3.1/5 (62%), while those paying above $75 indicated a satisfaction rating of 3.2/5 (64%). The lack of discrepancy between satisfaction ratings despite the vast differences in cost plans suggests that an increase in cost does not necessarily indicate an improvement in service quality or speed.



Question: I have different service providers (i.e. Comcast, AT&T, Sonic) that I can choose from.

Figure 8: Public Housing Resident Survey Results - Internet Choice



Question: On a scale of 1-5 (1=Extremely Poor, 5=Excellent) how would you rate the quality and speed of your plan?

Figure 9: Public Housing Resident Survey Results - Satisfaction Rating

4.1.3 Paying More For Less

National research indicates that low-income areas pay more for slower speeds.[35] An investigation of 38 cities in America by The Markup found that AT&T, Verizon, EarthLink, and CenturyLink disproportionately offered lower-income and least-White neighborhoods slow Internet service for the same price as speedy connections they offered in other parts of town. This study has been replicated in San Francisco with findings that slower plans in high-poverty neighborhoods cost about the same as high-speed plans in wealthier neighborhoods.[36]

Preliminary research from Oakland, comparing advertised prices from East and North Oakland addresses (**Figure 10**), indicates similar patterns of pricing disparities. The advertised price of this East Oakland address, located in 94606, offers one Internet plan option, "AT&T Internet Air", at $60 per month for speeds of 90-300 Mbps download speeds. However, at the North Oakland address, customers are offered a choice of three plans, all with promotional pricing. AT&T offers customers at this address a similarly priced plan, but with significantly higher speeds at 996.5 Mbps and lower latency at 12 milliseconds.

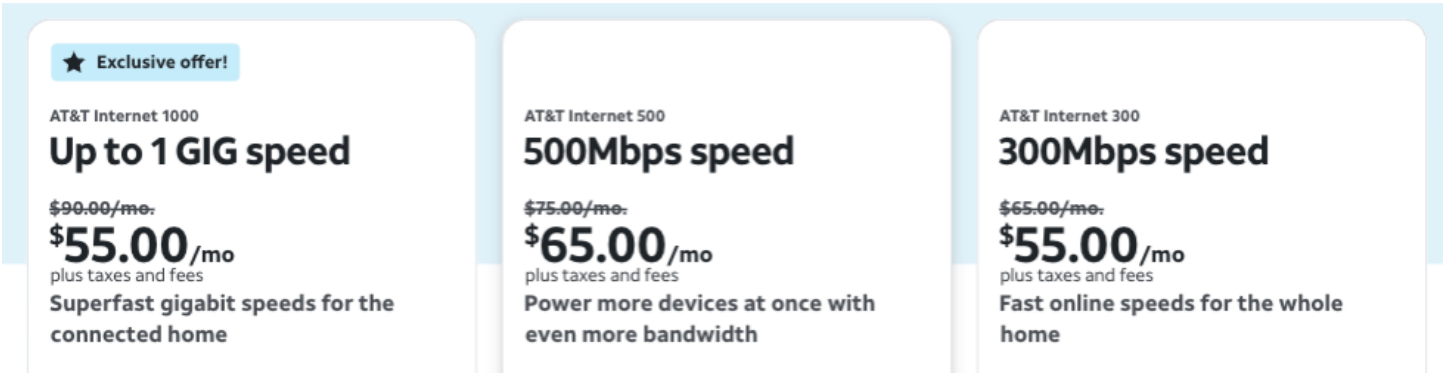


Figure 10: North Oakland Plan Options

In North Oakland, customers are offered their choice of Internet plans, all listed at promotional pricing. The address in North Oakland (94608), with a median household income of $114,286 and 61% people of color, are offered better prices, more options, faster speeds, and slower latency. Those at the East Oakland address (94606), with a median household income of $71,442 and 79% people of color, are offered only one plan option with download speeds and latency that is up to **4 times slower** than the AT&T customer in North Oakland would receive.

This data aligns with national trends that residents in lower-income and least-White neighborhoods receive slower Internet service for the same price as those offered in other parts of town.

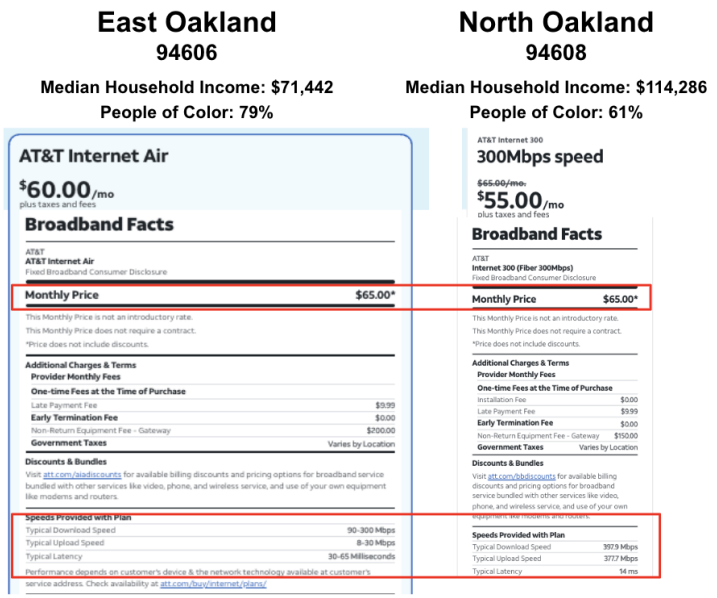


Figure 11: Comparing East and North Oakland

Same Bill, Slower Service: An AT&T Customer paying $65/month in East Oakland can expect download speeds and latency that is up to 4x slower than an AT&T customer paying the same rate in North Oakland.

4.1.4 Challenges with Low-Cost Offerings

State and federal broadband subsidy programs are one possible solution to solve the affordability crisis. An example of a federally funded broadband subsidy program is the Affordable Connectivity Program (ACP). Launched in December 2021, this monthly subsidy of up to $30 per month helped reduce the cost of Internet service for qualifying households but ended in May 2024 due to a lack of additional funds from Congress.

Though the ACP offered a much-needed benefit to many Oakland families, enrolling in the program proved cumbersome for many households and only saw an increase in enrollment after The City of Oakland, Oakland Unified School District, and #OaklandUndivided launched an ACP enrollment campaign to help address the issues households were having with the application.

The City of Oakland, Oakland Unified School District, and #OaklandUndivided led ACP enrollment campaign efforts in Oakland. While ACP enrollment was stagnant from July 2022 to February 2023, raising only a few percentage points, the launch of the campaign led to an increase in ACP enrollment from 39% to 55% in 8 months, surpassing the statewide enrollment of 47% of eligible households **(Figure 12)**. With 26,000 Oakland households enrolled in the program, this subsidy saved Oakland households **approximately $780,000 monthly**.[37]

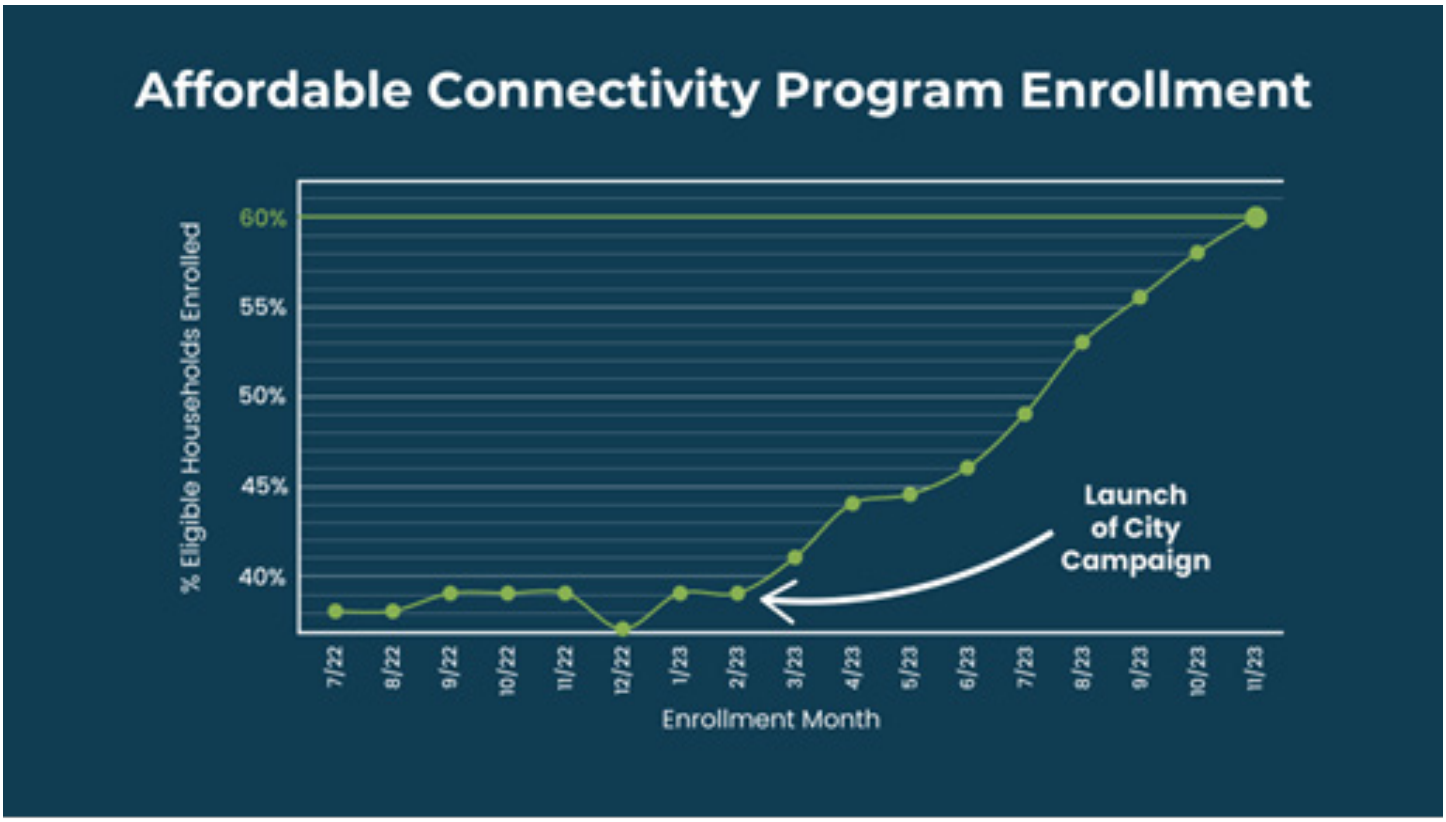


Figure 12: ACP Enrollment in Oakland, CA (7/22-11/23)

ACP enrollment increased by 16% with the launch of the City's enrollment campaign. With the expiration of the ACP program, the only subsidized program remaining is Lifeline. Lifeline offers a phone, Internet, or bundled service monthly discount of up to $9.25 for eligible subscribers. Those eligible include individuals 135% or less than the Federal Poverty Guidelines or those using SNAP, Medicaid, Supplemental Security Income (SSI), Federal Public Housing Assistance (FPHA), and Veterans Pension and Survivors Benefit.[38] Unlike ACP, not all Internet service providers offer the Lifeline discount, with only AT&T, Blue Casa, and Frontier Communications offering the Lifeline benefit in Oakland.[39]

As the ACP has expired and not all providers offer the Lifeline benefit, many customers' only remaining option is government-mandated low-cost plans. While many Internet service providers offer low-cost plans, narrow eligibility, cumbersome documentation, restrictions, and requirements limit enrollment.

- **Eligibility Criteria:** Eligibility criteria for enrollment into these plans vary but often include SNAP, SSI, up to 200% federal poverty level, or free and reduced lunch program (FRL) enrollment. However, many federal benefits are considered under-enrolled, often due to confusion about eligibility, application processes, or lack of awareness of the program. In addition, under California law, all applications and records relating to free and reduced-price meal eligibility are considered confidential.[40] Therefore, these records can only be accessed by officials directly connected with the provision of school meal programs, not outside entities like Internet service providers.
- **Cumbersome Documentation Requirements & Restrictions:** Many of these low-cost plans require cumbersome documentation requirements and restrictions. Residents may not be comfortable sharing documentation requirements, including taking a selfie with their ID, providing their social security number, or W-2. Restrictions may also include credit score thresholds and no outstanding debt on any existing accounts with that provider.
- **Other Issues:** Other problems with these plans include incredibly slow speed offerings, with many incumbent providers only offering low-cost plans at 50 Mbps. Furthermore, customers of these low-cost plans frequently report a lack of transparency with pricing. This includes hidden fees, such as a monthly Wi-Fi modem rental or self-installation fees, or being upsold to a higher cost plan. The Greenlining Institute's "Oakland Town Link Program Playbook" found that these programs are poorly marketed, resulting in a lack of awareness of low-cost options.[41]

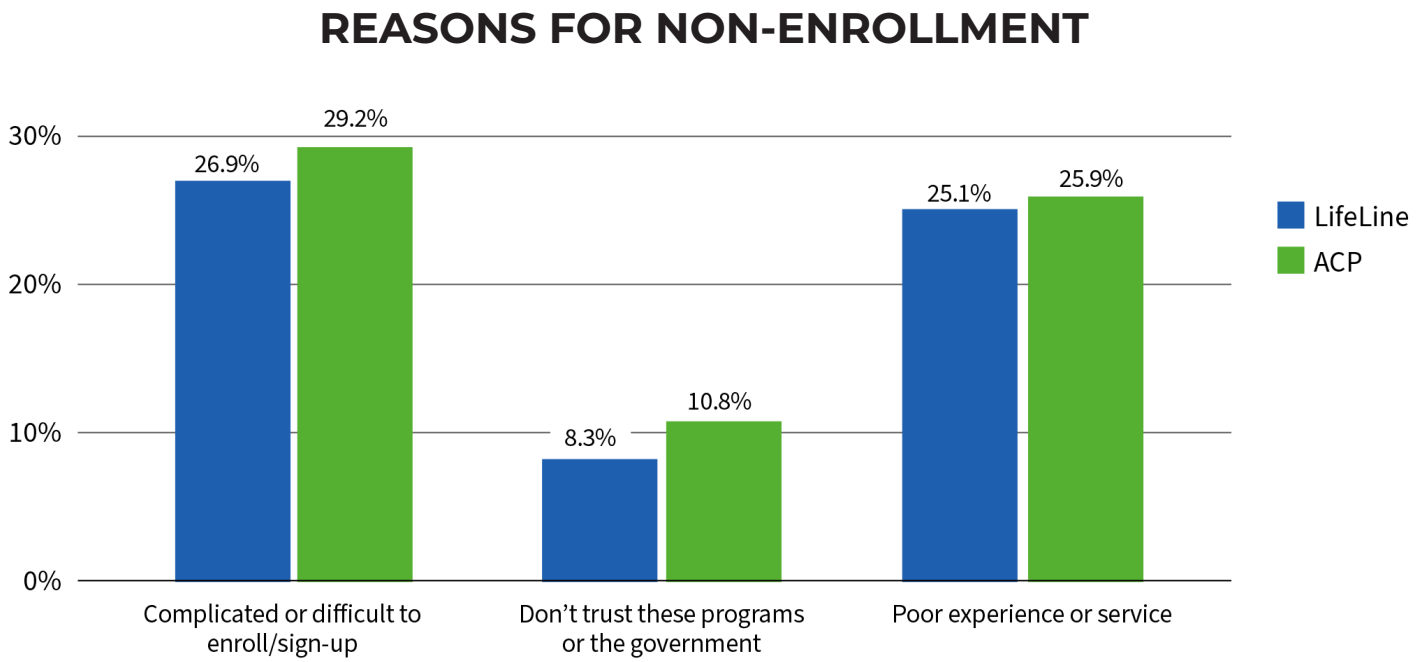


Figure 13: Reasons for Non-Enrollment/Usage (Credit: Greenlining)

Stark connectivity barriers persist in Oakland's low-income households. The Greenlining Institute's Town Link Program Playbook also found only 58% of surveyed households with an annual household income of $20,000 a year or less with Internet access subscribed to low-cost Internet plans.

4.2 Internet Availability

As will be discussed in **Section 5.5 Important Technology Trends**, telecommunications technology continues to evolve rapidly, making the provision of affordable, reliable, high-speed Internet more possible than ever before. This does not mean, however, that incumbent Internet companies are deploying this infrastructure equitably or with the goal of deploying universal, modern networks within their designated franchise areas. Thousands in Oakland reside in homes without any broadband infrastructure capable of delivering reliable, high-speed Internet.

4.2.1 Oakland Infrastructure Findings - Middle and Last Mile Networks.

4.2.1.1 Inadequate Middle Mile Networks:

Before an Internet service provider can serve a neighborhood, it must first identify a source of high-capacity bandwidth capable of serving the entire neighborhood, a local hub that connects back to the Global Internet. Composed of hundreds of strands of tightly wound fiberoptic cables, this middle mile infrastructure is the "Internet superhighway" that delivers the Internet into a community, enabling last mile networks that connect homes, businesses, schools, libraries, and clinics.

Oakland faces significant disparities in access to this middle mile fiber optic infrastructure, which is the foundation for virtually all Internet connectivity technologies. A relative dearth of companies providing middle mile infrastructure in Oakland gives providers unchecked ability to set the terms of use and high rates, effectively controlling which last mile providers can provide service in a community. This gatekeeping function will likely be exacerbated as the FCC will no longer require Incumbent Local Exchange Carriers (ILEC) to sell access to their middle mile network Unbundled Network Elements (UNEs).[42] In 2028, ILECs that currently are required to offer access to their dark fiber at just and reasonable rates will no longer be obliged to do so due to the FCC's elimination of the UNE requirements, potentially leading to further market consolidation as regional last miles providers, like Sonic, currently tap into this open access infrastructure and face uncertainty.[43]

Even now, the monopolization of Oakland's middle mile marketplace impedes new entrants that could deploy innovative technology. In one such example, BlocPower, an innovative Brooklyn-based tech startup, explored serving Oakland's highest-need communities by building an LTE network on the Citizens Broadband Radio Service (CBRS). This wireless communication framework allows shared access to the 3.5 GHz frequency band. However, BlocPower altered plans with deployment after rates for backhaul that were 5-10 times as expensive as in more competitive markets. These deployment costs would have to be passed along to the end user, eliminating the slim margins needed to build a network with equity-based pricing, absent change in Oakland's middle mile market.

While increasing the supply of affordable, open-access middle mile fiber is crucial to expanding Internet access, especially in low-revenue density, Flatland communities, the cost of deploying such infrastructure is exceedingly high in Oakland. An analysis performed by the California Alliance for Digital Equity of eleven middle mile contracts (build and lease) exceeding $2B in total agreement amounts reveal that leasing middle mile in Oakland costs $977K/mile, or nearly four times as expensive as comparable infrastructure in other markets—urban, rural, and tribal—across California.[44]

4.2.1.2 Last Mile Wireline Networks

Wireline networks connect homes and businesses to the Internet using physical cables. Wireline networks can be built from a combination of three different types of cable. The three types of cable include (1) copper (often phone lines, called Digital Subscriber Line technology), (2) coaxial (often used to deliver cable TV), or fiber optic cable (the highest-capacity, most reliable technology). The CPUC designates certain types of wired connection as "legacy technologies" copper telephone lines (typically using Digital Subscriber Line technology) or early versions of cable systems (coaxial cable types pre-dating CAT-6 and DOCISIS 2.0 or earlier). According to the CPUC, these technologies "may not provide reliable service because they typically lag on speeds, latency, and other factors, as compared to more modern technologies like fiber-optic networks."[45]

In much of Oakland's affordable housing, if wiring exists at all, it's often inadequate—decades' old copper cabling, repurposed from old phone lines that have degraded over time, or low-grade coaxial cables. In Oakland, 80% of the City's total 158,937 housing units were built before 1979 and 37.3% were built before 1939.[46] This older housing stock is more likely to rely on antiquated telecommunications infrastructure both in the walls of the residences, but also throughout the neighborhood.

The private market exacerbates the disparities in infrastructure. Incumbent providers, such as AT&T and Verizon, invest mainly where they face cable competition.[47] A UC Berkeley study found that median incomes were $41,000 higher where Internet companies choose to build fiber in California, and that's just one of many analyses documenting that companies routinely engage in "digital redlining"—bypassing low-income communities when they build or upgrade infrastructure.[48] The CPUC's Network Exam has replicated these findings for over a decade, demonstrating that incumbent monopolies divest in the communities deemed less worthy of investment.[49]

Importantly, ISPs cannot justify these decisions as purely economic. ISPs can yield significant returns by making the capital improvements to improve network architecture if they prioritize long-term investment. For example, Frontier Communication's shift away from a short-term framework towards a longer-term framework of ten years led to an expected 20% return on investment. Frontier will have had a projected return of $1 billion by 2031. Still, evidence suggests that Oakland's incumbent providers have deprioritized historically redlined communities like East Oakland, Fruitvale, and West Oakland for decades.

4.2.1.3 Mapping Infrastructure

State and Federal regulators require providers to report the locations where they can provide reliable, high-speed Internet. Locations where ISPs only deploy antiquated infrastructure or none at all are supposed to be designated as "unserved" through ISP self-reporting. With this data on locations that are served or unserved, the regulator then developed broadband availability maps that determined which areas are eligible for investment.[50] [51]

Unfortunately, overreliance on ISP reporting has resulted in broadband availability maps that systematically overreport service. ISPs are incentivized to overreport service because misinforming the government carries little penalty and the providers can use their own exaggerated claims of service availability to challenge and try to prevent would-be competitors from building infrastructure in areas that are underserved or unserved.[52] The problem is not that the ISPs lack more accurate data, as the same ISPs that over-report service at a location to the Federal government will accurately identify the location as unserved on their proprietary "address lookup tools". The scale of inaccuracy is alarming, in a recent review of the broadband maps, the CPUC identified 16,024 locations in California that were misidentified as served through this self-reported process, and this is only the tip of the iceberg.[53]

The asymmetry of data held by ISPs, resulted in a Federal Broadband Map that inexplicably identifies Oakland as 100% served [**Figure 14**], effectively precluding Oakland's least connected communities from accessing billions in Federal grants. The State's broadband availability map [**Figure 15**] is slightly improved, recognizing several hundreds unserved or underserved locations, presumably added through a validation process "using confidential subscriber data at the address level to ensure accuracy."[54]

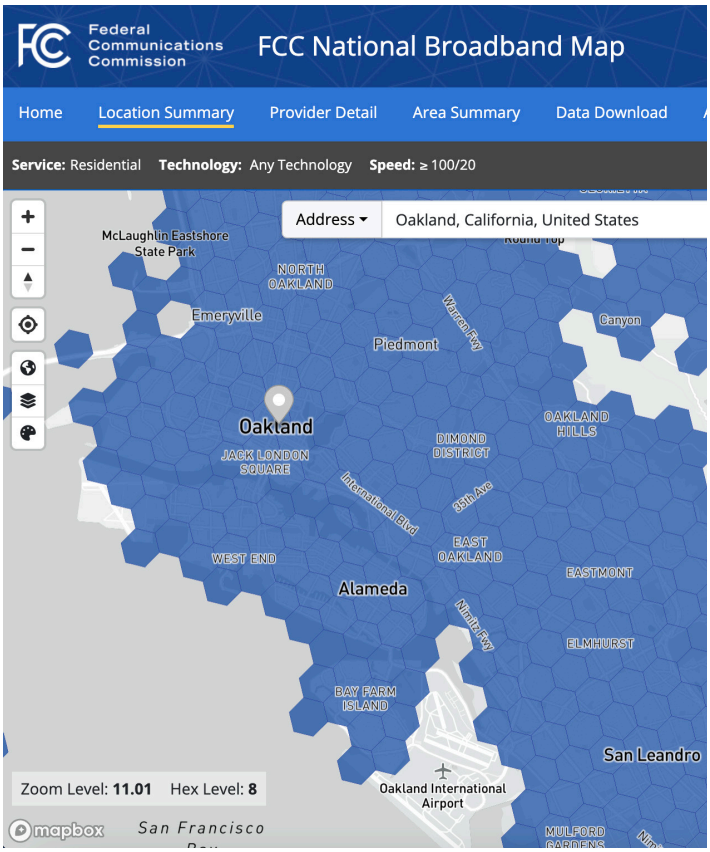


Figure 14: FCC National Broadband Map reporting 100% coverage in Oakland

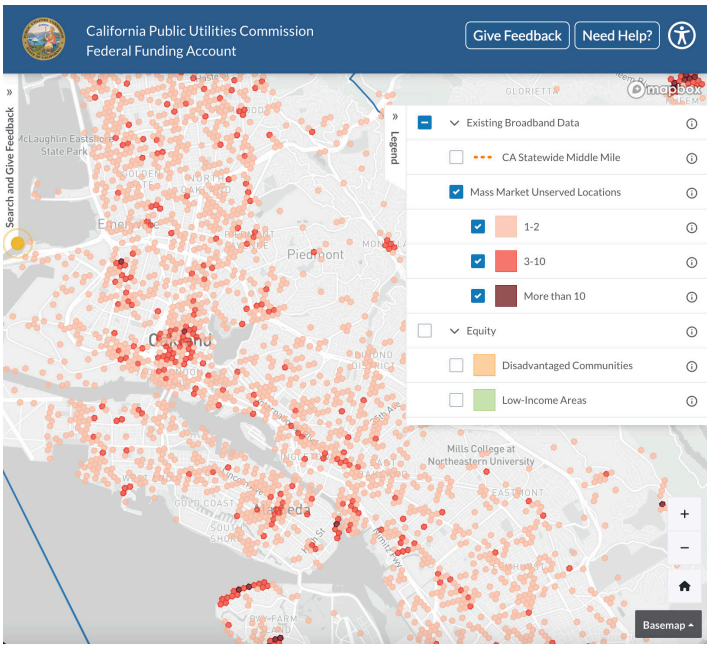


Figure 15: The CPUC's FFA Map (v2)

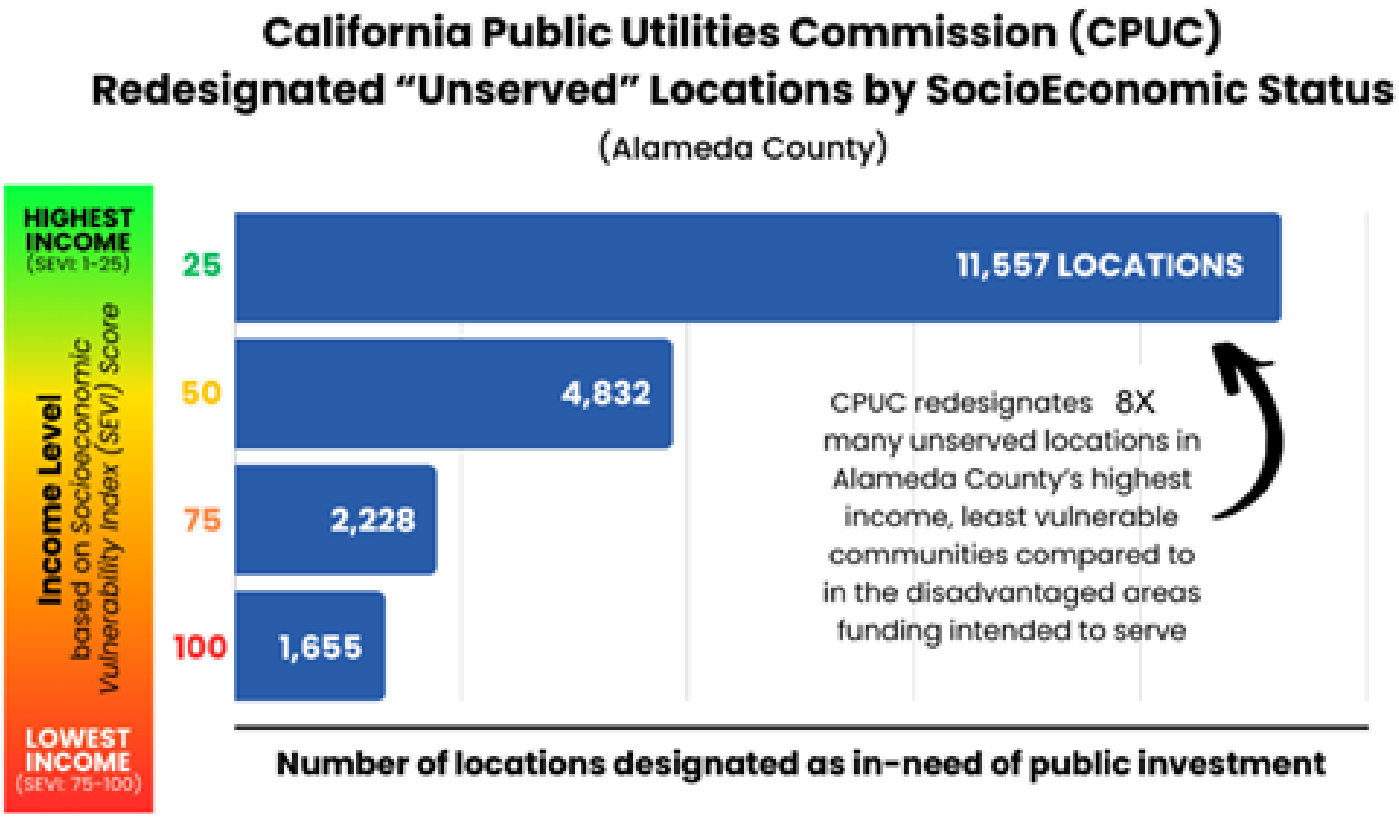


Figure 16: CPUC Redesignated "Unserved" Locations

Evidence suggests that this overreporting of service is not universally applied to all communities and demographic groups. An analysis of the California Broadband Availability Map in Alameda County, revealed that the wealthiest census tracts in the county—those most likely to enjoy private investment—were, according the ISPs self-reported data, in need of the most State funding. Until recently, communities lacked the capacity or technology to effectively refute overreporting at scale.

4.3 Internet Performance

Traditional definitions of digital inclusion have often been centered around the physical presence of broadband fiber (i.e. Internet availability) and not the accessibility of inclusive and culturally-competent outreach practices nor the end-user experience of Internet speeds (i.e. Internet performance). When these traditional definitions are utilized in meaningful and political ways, Oakland residents – especially those located in historically redlined communities like West Oakland, Fruitvale, and East Oakland – are left out, as arguments claim the mere presence of broadband justifies the classification of "connected." In collaboration with the City of Oakland, #OaklandUndivided launched a city-wide community engagement and speed analysis effort to challenge the notion that Oakland residents are fully connected.

In partnership with HubbleIQ, #OaklandUndivided has been granted access to a proprietary technology that allows them to catalog Internet connection speeds through an Internet-based web browser extension installed in publicly-loaned at-home computers. This initial set of analyses includes half a million individual speed tests collected over a two-month period from over 18,000 unique locations (summarized in **Figure 17**).

The initial set of analyses provided a descriptive assessment of Internet performance across Oakland. Using the CPUC's established threshold for broadband service–where locations should be characterized as underserved with connection download speeds <100 Mbps or unserved with connection speeds <25 Mbps–Oakland's performance is as follows:

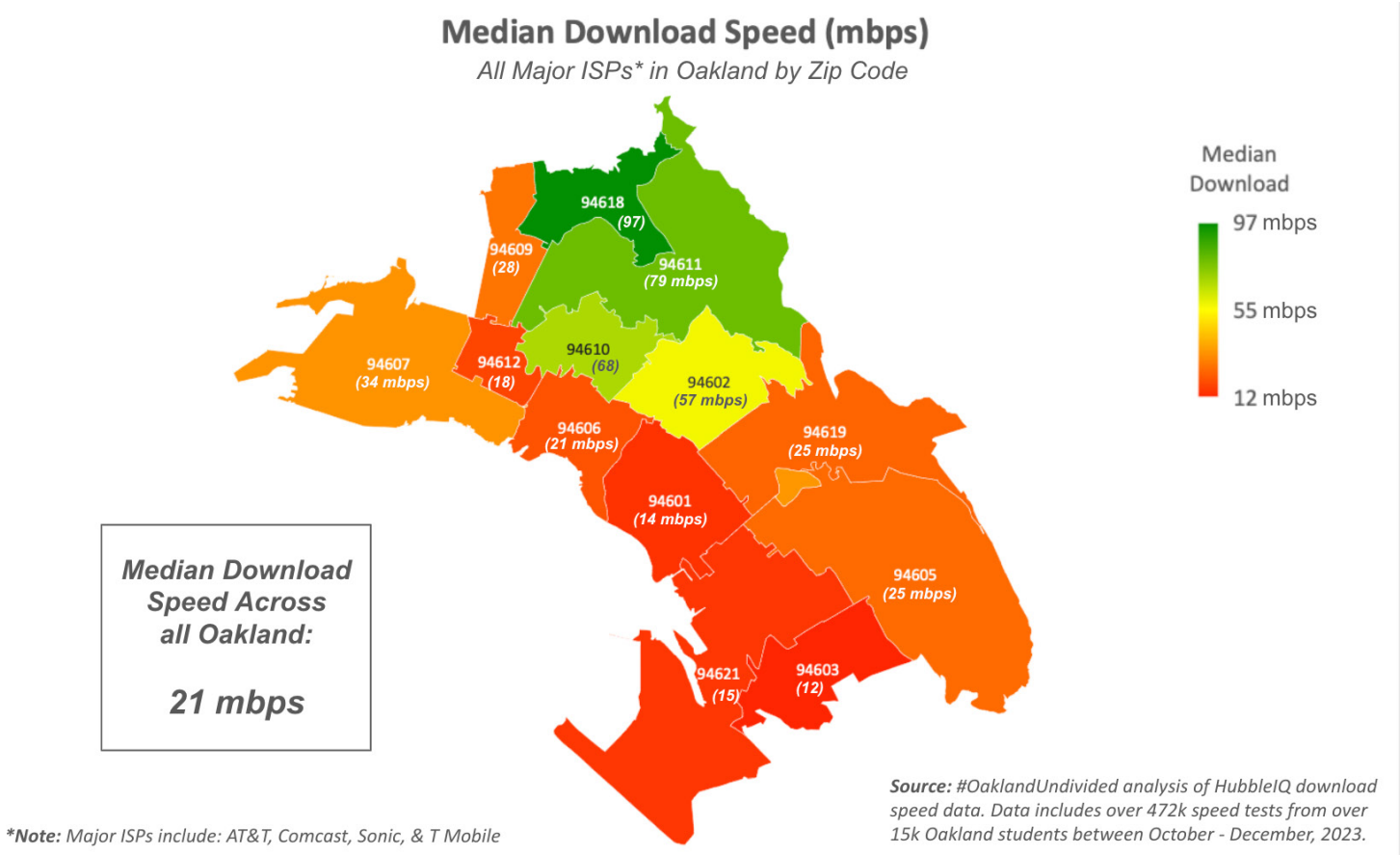


Figure 17: Median Download Speeds (Mbps) HubbleIQ Data

General Speed Characteristics:

- Average Download Speed: 80 Mbps
- Median Download Speed: 21 Mbps
- Percent of Connections Defined as Served:
  - Unserved: 53% of Internet speed tests
  - Underserved: 23% of Internet speed tests
  - Speed > 100 Mbps: 24% of Internet speed tests

Over half of the 500k speed tests ran came back with speeds less than 25 Mbps. Although the average speed (80 Mbps) approaches the federal definition of "served" (100 Mbps), the median recorded speed test was only 21 Mbps, which qualifies, based on federal guidelines, as "unserved," with considerable geographic variation. The zip-code-based variation in speeds mirror the 1937 Home Owners Loan Corporation redlining maps from 1937, established during discriminatory New Deal-era policies. From the end-user's perspective, 37% of the population tested accessing the Internet through a broadband connection (i.e. vs. a mobile connection) never experienced an Internet speed that would classify as "served".

4.4 Affordability, Availability, and Performance: A Focus on Oakland's Multi-Dwelling Units

Through a partnership with Oakland Housing Authority, the City now has a clearer understanding of how the three leading causes of the Digital Divide intersect to keep thousands of Oakland households offline, especially in multi-dwelling units, buildings or properties with multiple separate living spaces such as apartments. Expanding access to MDUs is a key component to bridging the Digital Divide, as Education Superhighway estimates 25% of those on the without access to reliable, high-speed Internet reside in affordable housing MDUs, and the majority of Oakland residents (~60%) live in rental units primarily in multi-dwelling units.[55] [56]

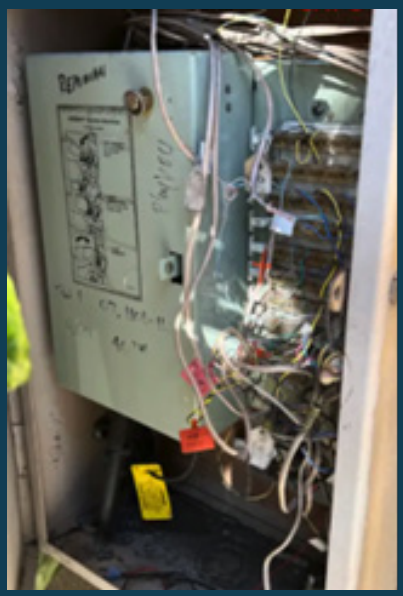
4.4.1 Availability

In December 2022, the Communications Workers of America Union (CWA) conducted an internal wiring assessment to evaluate the condition of the telecommunications infrastructure purporting to serve residents in Oakland's public housing. Physical inspection revealed poorly maintained network conditions, haphazard installation practices, and deferred maintenance. Of the twelve affordable housing complexes surveyed, eight properties relied on legacy infrastructure as defined by the state statute.[57]

PROPERTY #1

ISP-owned copper cable interconnects with CAT3 house cable

PROPERTY #2



ISP-owned copper cable interconnects with CAT3 house cable

PROPERTY #3

Ewire is legacy wiring used prior to CAT 2 & CAT 3. Coaxial cable is present but in disarray. Suspect major trouble based on cable management conditions.

4.4.2 Anti-Competitive Practices in Multi-Dwelling Units

Internet companies employ several anti-competitive practices that make reliable, high-speed Internet less available to Oakland Residents. The practices include:

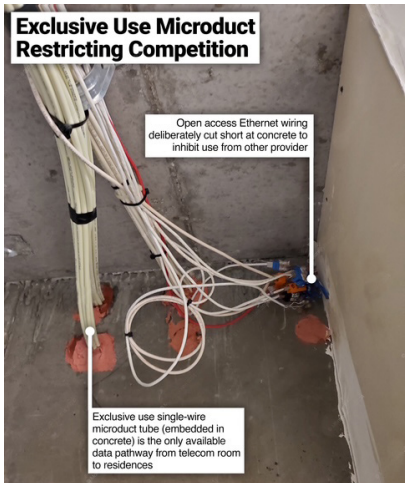
4.4.2.1 Exclusivity Agreements

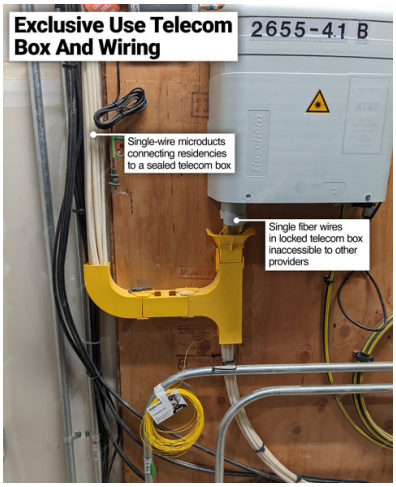
Internet companies enter agreements with housing developers to install broadband infrastructure in exchange for exclusive access to residences. These agreements benefit developers by enabling them to pass on capital costs of broadband installation onto the Internet company, and many ISPs include “compensation agreements” that can exceed $15,000 to the property developer. Preliminary reports from consumers and smaller, new entrants into Oakland’s broadband market have already identified over 60 MDUs monopolized by a single provider. While this agreement benefits the developers and Internet companies, it corners consumers, limiting their options, oftentimes resulting in worse service at higher rates.

4.4.2.2 Facility-Based Monopolization

Installers for incumbent monopolies employ tactics that skirt Oakland’s Internet Choice Ordinance and FCC regulations that require internal wiring (“home run cable”) to remain accessible to competitors.[58] [59]

Recognizing that other providers rely on access to the internal wiring, installers will make neutral cabling inaccessible by running single-wire microducts that terminate in locked junction boxes or concrete or even deliberately cut cabling short to prevent use by another provider. Absent clear building and installation standards, ISPs will continue to skirt regulation and effectively monopolize MDUs.





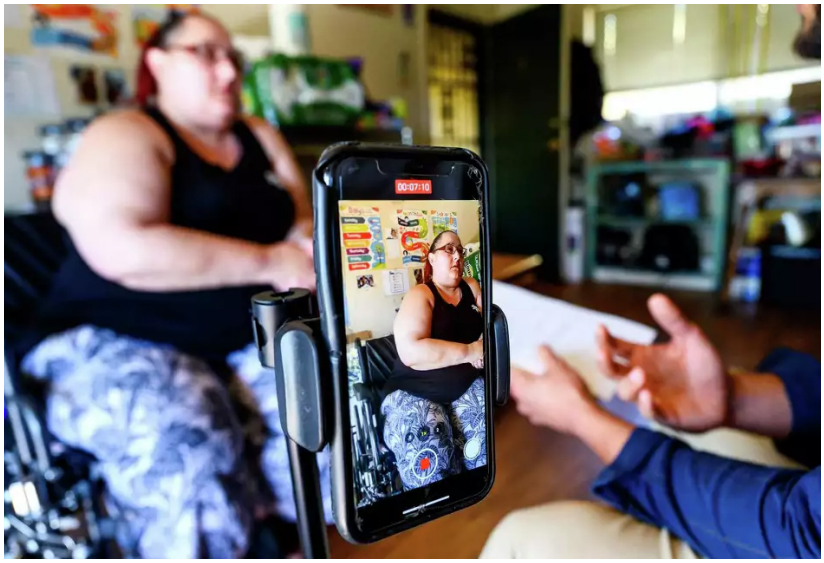
4.4.2.3 Blocking Competition through Legal Action and Lobbying

Incumbent Internet providers leverage their considerable political influence and legal departments to block investments in areas where they exert market dominance. For example, Oakland’s two largest incumbent providers—AT&T and Comcast—filed formal legal challenges to block a $15M State broadband infrastructure investment to bring free and low-cost Internet to affordable housing MDUs in Oakland’s least connected, highest poverty communities. The industry lobby doubled its budget in FY 25, in part, to block protections against digital discrimination.

Without competition to incentivize network upgrades, many of these service providers rely on legacy infrastructure that has been poorly maintained for decades.

4.4.3 Performance and Affordability

Residents only receive a fraction of the advertised speed. While gaps in infrastructure can make it technologically impossible to deliver high-speed Internet, even where adequate infrastructure exists, Internet companies regularly throttle the bandwidth traveling through the infrastructure, a practice referred to as "oversubscribing." In areas without competition, incumbent monopolies have no market incentive to deliver the data throughout that residents have paid to receive.



The Affordable Housing Speed Tests Pilot Study done in partnership with Oakland Housing Authority, mentioned in **Section 3.4.2**, was conducted from May to September of 2023. Participants, the majority of whom were public housing residents, provided their Internet bill and ran a speed test to measure the discrepancy between the advertised speed of their plans and the actual speed delivered to devices.

Census Tract	Advertised Speed Purchased (Download)	Actual Speeds from In home Download Speed Test (Mbps)	Actual Download Speed/ Advertised Speed (%)
Fruitvale Household #1	400	28	7%
East Oakland Household #1	500	82	16%
West Oakland Household #1	1000	36	4%
West Oakland Household #2	800	82	10%
West Oakland Household #3	500	39	8%

TABLE: Affordable Housing Speed Tests Pilot Study Results

The table above demonstrates that while nearly every resident pays for speeds at or above 100 Mbps, **none are served (i.e., no participants receive over 100 Mbps)**. Some residents receive as little as 4% of their advertised speeds, and costs vary greatly by census tract, which do not necessarily correlate with speed.

Residents also reported frequent outages and service interruptions. In fact, 85% of survey respondents experienced interruptions to service at least once a month.

4.5 Additional Considerations & Digital Education

While access to Internet affordability and availability are crucial components of Digital Equity, culturally responsive tech support, digital learning opportunities and affordable devices are complementary services needed for comprehensive access. According to the Greenlining Institute's The Oakland Town Link Program Playbook Report, many Oakland residents continue to face significant barriers to digital literacy. This gap in skills is further reflected by the fact that up to a quarter of survey respondents expressed a lack of confidence in performing key online tasks such as searching for jobs online. This lack of digital competence hinders their ability to fully utilize available technological tools and resources.

Given the varying levels of digital literacy across Oakland and the City's rich cultural diversity, offering culturally tailored services is essential. This is especially true for low-income and immigrant communities, who often face additional barriers when navigating online systems. Without support that acknowledges these barriers, many community members remain excluded from opportunities.

In addition to digital literacy challenges, the high cost of devices is an added barrier for low-income households. According to the California Department of Technologies Broadband for All Action Plan, 33% of survey respondents reported not having Internet access at home due to "Nobody in my household has a desktop, laptop, or tablet computer". Furthermore, the study highlights that 43% of households rely solely on smartphones to access the Internet, which limits their ability to fully engage with digital resources. Consequently, securing high quality, low cost devices is a crucial component of achieving Digital Equity.[60]

4.5.1 Community Spotlight

Tech Exchange is a local nonprofit organization dedicated to bridging the Digital Divide in Oakland and a community hub directly addressing the need for affordable devices and digital literacy training. Tech Exchange provides essential services, including free or low-cost refurbished computers, affordable Internet options, and culturally responsive digital literacy courses in multiple languages. By equipping community members with both the tools and the skills needed to succeed in an increasingly digital world, Tech Exchange plays a key role in fostering a digitally inclusive community and empowering individuals to succeed.

For more details on their work, visit https://www.techexchange.org/.

5. Municipal Broadband Networks: A Primer

As has been discussed thus far, the Digital Divide exists as a direct consequence of the monopoly/duopoly nature of Internet Service Providers that pervades most metropolitan areas in the United States. Typically, duopoly/monopoly incumbent companies, left to their own devices, prioritize their own bottom lines while perpetuating forms of digital discrimination.

Also, as demonstrated in previous sections of this BMP, this occurs through underinvesting in low-income areas, overcharging for low-performance service, and using their industry cloud to stifle competition while lobbying for favorable laws and treatment at all government levels. Without intervention, such practices will almost certainly continue, and the Digital Divide will persist without change.

As it turns out, the public sector can play a key interventionist role in addressing the challenges inherent to the existing broadband market by building Municipal Broadband Networks (MBNs)

5.1 Benefits of Municipal Broadband Infrastructure

A municipal broadband network can provide public benefits by making Internet service more reliable, available, and affordable. This can be achieved through increased competition, partnerships to utilize municipal infrastructure, and by focusing investments in areas of the highest need. There are many additional benefits from constructing municipal broadband infrastructure discussed below.

Increased Capacity

Capacity in optical fiber means excess bandwidth available for future use, that is represented by the amount of available fiber strands not in use in any one cable. The proposed capacity will meet or exceed operational requirements for City use cases (e.g., connecting City facilities to broadband), which is an improvement over existing network capability. Capacity should be designed specifically to handle the broadband demands for metropolitan residential Internet service capable of serving thousands of households.

Smart City Services

Urban areas that utilize digital technology and data analytics to optimize infrastructure and service delivery to improve the quality of life of residents, sustainability, and efficiencies are referred to as “smart cities.” Potential benefits that align with the concepts of “smart cities” include utilizing the fiber optic network for transportation use cases such as include traffic signal synchronization, cloud-based transit signal priority, integrated corridor management, video sharing, and regional control of traffic signals during emergencies. There will also be enhanced communications redundancy, which will improve reliability of broadband service. In addition, broadband infrastructure can be used for video cameras, sensors, and other Internet-of-Things devices and services.

Integration with Existing City Infrastructure

The proposed broadband network can leverage existing communications infrastructure and investments already made by state, regional, and local agencies (e.g., State Broadband Middle Mile). A coordinated investment in communications infrastructure, similar to "Dig Once" style approaches, can help reduce duplication of efforts between regional agencies (MTC, Caltrans, California Department of Technology) and City projects. Also, the broadband infrastructure network will add new communication connectivity alternatives in areas where private broadband infrastructure is not currently reliable or available. In the future, the network can reduce the need for the City to lease communications infrastructure services to City facilities, reducing ongoing costs to the City's budget).

Social Benefits

While individuals benefit directly from access to affordable, reliable residential high-speed Internet service, research has shown numerous social benefits are associated with having such access. These include:

- **More Job Opportunities and Wage Growth:** 84% of recent job seekers have applied to a job online and were re-employed 25% faster than those without access.[61] [62]
- **Better Educational Opportunities and Academic Outcomes:** Students with the Internet at home performed a full grade letter ahead and are 38% more likely to plan to attend college than their peers without access.[63] [64]
- **Improved Health and Wellbeing:** Hospital stays that could have been avoided with appropriate care are 1.5 times higher in the least connected counties compared to other counties.[65] There are also $147-$187 transportation and productivity cost savings per visit with telehealth as well as reduction in missed appointments and reliance on emergency services.[66]
- **Additional Benefits:** Civic Engagement, Emergency Preparedness, Social Wellbeing, Entertainment and More;

5.2 Models for Municipal Broadband

For the purposes of this BMP, municipal broadband networks can be generalized into three main categories. These are: **Passive, Hybrid, and Full-Service**. Each category will be discussed below.

PASSIVE MODEL	HYBRID MODEL	FULL SERVICE MODEL
The Passive Model can be described as one where a government establishes funding mechanisms that channel public funding into existing low-income Internet programs offered by national and statewide ISPs, such as Comcast's Internet Essentials. The Affordable Connectivity Program (ACP), as described in **Section 4.1.4**, is a form of the Passive Model wherein the federal government approved $14 billion in funding through the FCC that eligible recipients could apply toward qualified broadband Internet service. As further described in **Section 4.1.4**, with organized support, the ACP was successful in expanding residential Internet service in Oakland. Unfortunately, the ACP funding ran out and has not been renewed by the federal government. Low-income programs like Internet Essentials face criticism for being difficult to register for and maintain. When the service launched, as a condition for regulatory approval of Comcast's acquisition NBCUniversal in 2011, the California Emerging Technology Fund (CETF) filed a public comment with the FCC stating, "Comcast makes the sign-up process long and cumbersome." By one estimate, only 13 percent of the eligible low-income population in the United States has been connected through Internet Essentials.[67] As such, while the Passive Model is attractive for its efficiency, there are multiple drawbacks as governments have little control over how the programs are implemented; the programs require organized support to maximize their adoption and impact; and public funding sources may not be permanent leaving residents in the dark when funding runs out	The Hybrid Model describes approaches where the public sector takes a more active approach in developing and delivering broadband service. Often this includes scenarios where broadband infrastructure is constructed and owned by the public sector but managed and maintained by a third-party operator, who will act as the service provider. These arrangements are often constituted as "Public Private Partnerships" and can ensure the government retains ownership and ultimate control over the network, empowering the community to take proactive steps toward addressing the Digital Divide. While the public sector remains financially responsible for the network's initial construction and build-out, the partnership with a third-party operator(s) allows for the sharing of ongoing operating and maintenance expenses. This collaboration helps to balance the City's financial commitments while benefiting from the operational efficiency and scalability that an experienced third-party provider can provide. These models often catch on because state and local government tend to have existing assets that can form the foundation of broadband infrastructure. For example, transportation systems often have fiber optic lines installed in the public ROW to interconnect their systems (e.g., traffic signals, bus and rail stations, etc.) in a centralized hub for configuration and management of the transportation network. This fiber and/or empty conduit (a/k/a innerduct) can then be utilized for broadband purposes. The Hybrid Model is the most common form for a municipal broadband network as the government agency maintains ownership of the infrastructure; can generate revenue from licensing agreements; can add conditions into PPP agreements such as price caps that service providers must adhere to; and do not require managing customer service, marketing, and end-user networking. However, this model does typically require ongoing maintenance of the public infrastructure, which will be discussed in **Section 5**	The Full-Service Model includes examples such as Chattanooga EPB described above where the public sector creates an ISP and competes in the open market with private sector companies. As mentioned, this is a rarer form of municipal broadband given its up-front and ongoing investment costs. To properly run a revenue-generating utility means having customer service representatives to troubleshoot hardware and software issues alongside billing inquiries, ensuring minimal downtime of service through a Network Operations Center, or NOC, to mitigate outages, providing Internet services that are priced competitively, and establishing parity of service. This necessitates the need for ongoing management of marketing, customer service, and networking. For infrastructure alone, a preliminary study commissioned by #OaklandUndivided and performed by BlocPower estimated that a fiber-to-the-premise network in Oakland could cost "$2 billion or more."[68] While this was an extremely high-level and generalized estimate, the point stands that a full-service model solution is cost-intensive and comes with significant risks of failure

Table: Municipal Broadband Network Models

5.2.1 Case Study: A Hybrid MBN in the State of Virginia

One example of a hybrid municipal broadband network is the Eastern Shore of Virginia Broadband Authority (ESVBA). Accomack and Northampton Counties in Virginia were treated as a broadband "island" with Chesapeake Bay to the west and the Atlantic Ocean to the east creating geographic barriers to constructing broadband infrastructure. To address this issue, which impacted residents in these communities, the counties authorized a new public entity: structured as a joint power authority, ESVBA was seeded with funding from both counties and a grant from the Federal Department of Commerce Economic Development Administration.

The project began in 2007 to construct fiber backhaul and middle mile to unserved communities in their jurisdictions. Developed as an open-access network, ESVBA attracted numerous ISP partners to use the network.[69] As of today, ESVBA has deployed almost 320 miles of fiber and provides broadband to 350 schools, businesses, and other buildings.[70]

The success of ESVBA shows the benefits of the hybrid MBN model where local governments can leverage their own existing infrastructure, identify seed funding, secure larger federal and state grant funding, and use it to construct and maintain an open access fiber optic network in public-private partnership agreements with multiple service providers, thereby ensuring competitive, affordable high-speed Internet service is widely available throughout their communities.

5.3 Public Wi-Fi Networks

Municipal broadband networks often utilize free, public Wi-Fi as supplementary to traditional Internet provider home services. Per the **"GCTC Public Wi-Fi SuperCluster Blueprint"** published in 2017 through a collaborative effort under the National Institute of Standards and Technology, "municipal Wi-Fi system[s] aren't new: provide free, high-speed Internet to your community, close the Digital Divide, shrink the homework gap, and give consumers a free, public option for Internet service.[71]

In-home residential Wi-Fi coverage using public Wi-Fi has largely not been realized due to range and coverage limitations of wireless services (often limited by line-of-sight requirements and interference) as well as the costs associated with such a large-scale deployment. Regardless, free, publicly owned Wi-Fi networks have found a thriving niche as a public service and can be frequently accessed in parks, downtown and commercial areas, schools, transit systems, community centers, civic centers, libraries, and other public spaces

5.3.1 Case Study: OakWiFi Public Wi-Fi Network

In 2020, the City of Oakland published a report titled "**A Case for Digital Inclusion**" that analyzed the impacts of the Digital Divide on historically underserved communities in Oakland and called for the creation of a City-led Digital Inclusion program focusing on Internet Access, Advocacy and Awareness, and Devices.[72]

The paper discussed the importance of the Bus Rapid Transit (BRT) fiber optic system, installed by AC Transit, in a multi-jurisdictional effort with the City of Oakland, the City of San Leandro, and the State of California Transportation Department (CalTrans), as the primary backhaul for a planned public Wi-Fi network.

Launched in the Summer of 2021 with City-approved ARPA funding, "OakWifi" was a phased development of thirteen free, public Wi-Fi coverage zones in West, Downtown/ Lake Merritt, and deep East Oakland, As the BRT backhaul was installed along International Blvd, running approximately east-to-west through communities such as Central/East Oakland, Eastlake, Fruitvale, Downtown, and West Oakland; OakWifi was able to reach thousands of Oaklanders in the most underserved areas of the City.

OakWifi was designed as "Wi-Fi to the door" service, meaning it would blanket the outdoors with wireless coverage and could "reach to doorsteps" of residential homes.

> *In its first year, OakWifi experienced a huge volume of usage and was an overwhelming success. A total of 148TB of data was transferred over 1,000 access points, with an average rate of 40Mbps for every device connected. A total of 148TB over one year equates to an average of 12.33TB every month*

OakWiFi reached thousands of daily active users at its peak. However, outages began occurring when unplanned fiber cuts occurred. The BRT fiber deployment used "microtrenching" methods in significant portions of the fiber cable route in major thoroughfares making the fiber vulnerable to damage, particularly during excavation projects within the ROW. The BRT network also lacked redundancy to reroute traffic, thus impacting all downstream connections.

At the time of this writing, OakWifi is in limited operation. Given its benefit to and substantial use by the community, the City of Oakland seeks reevaluate OakWiFi and discover other options for backhaul to restore its operations, as well as its current configuration to be more targeted in areas that aide community anchors such as a public park or destination areas with high concentration of pedestrian activity.


Piedmont
18
1
Oakland
2
COUNCIL DISTRICT 2
3
4
5
6
7
8
9
11
12
13
COUNCIL DISTRICT 4
COUNCIL DISTRICT 6
Alameda
Alameda Harbor
Palo Seco Creek
Redwood Creek
Sausal Creek
Bravo Vista
San Leandro Creek
Oakland Int'l Airport
San Leandro

5.4 Additional Considerations: Municipal Broadband Governance

The governance structures below are provided for reference.

Multi-Jurisdictional Partnerships

To help offset capital costs and expand function and overall benefits, jurisdictional partnerships have been a popular way to gain a multitude of benefits and maximize addressing a variety of needs for a region. In this manner, multiple organizations may share deployment/construction, operations, or maintenance responsibilities through agreements that outline each partner's roles and responsibilities. These are typically programs with relatively few partners and shared infrastructure assets. Projects involving two or three stakeholders, such as sharing of fiber capacity in exchange for rights-of-way, fall into this category. Examples include many of the fiber sharing agreements in the Bay Area or transfer of responsibility for traffic signal operations and/or maintenance among two parties.

An example of this governance structure is the BART and BAIFA Telecommunications Reciprocal Use Agreement from 2015. The BART and BAIFA paid for fiber sharing by reciprocally licensing the use of their respective fiber equipment in the paths designated in the agreement. Additionally, BAIFA agreed to install new fiber to be owned by BART.

Joint Powers Authorities (JPA)

Although not exclusive to California, Joint Powers Authority are prevalent throughout the State due to particular legal mechanisms that make JPA governance structures widely utilized. A JPA provides an oversight structure that addresses risks through formal, legal agreements and policies. A JPA is typically established for large, complex programs that involve many agencies and for which a clear lead agency may not exist. Establishment and ongoing management of a JPA is the most comprehensive and resource intensive option. Formal policies and documents including memorandums of understanding (MOU), partnerships agreements, and funding agreements are required for JPA creation. Benefits include the potential of a rotating Board of Directors that spreads the time commitment among agencies and a more robust management structure.

An example of this governance structure is the Bay Area Regional Interoperable Communications System (BAY-RICS) Joint Powers Authority. This JPA is between the City of Oakland, City of San Francisco, City of San Jose, the nine Counties of the Bay Area, and the County of Santa Cruz. This group oversees 17 BayLoop Microwave sites throughout the Bay Area that make up a high-capacity network originally created to support public safety services.

Broadband Facilitator

In the facilitator role, the focus is creating a more favorable environment through streamlining the permitting process, "dig once" policies, providing rights-of-way access to publicly owned vertical assets (e.g., streetlights), and even aiding private sector providers in marketing campaigns through public outreach. This can support any of the primary models.

Internet Cooperatives

Cooperatives are member-owned organizations that are formed to provide services to their community members. Cooperatives often operate as democratic governance models with members voting on decisions and leadership. Similar to the facilitator role business model, an Internet cooperative spearheaded by community members through a grassroots effort. While the cooperative model would not be orchestrated by the City, championing and fostering community-led efforts could be a viable governance structure and would allow for suitable solutions to scale over time. The cooperative model is not new and numerous examples of community-led practices exist around the country. Nonetheless, capital and organizing empowerment of residents is key.

5.5 Important Technology Trends in MBNs

The following section provides an evaluation of important industry trends of broadband technology, including benefits, cost considerations, and specific details relevant to the MBNs

5.5.1 Wired Infrastructure

- **Fiber Optic Cable & Conduit -** Fiber optic cable is the most relevant broadband medium to the City of Oakland because of its fast data transmission rates, reliable connections, and scalable network access.
- **Micro-Trenching -** Micro-trenching is a construction strategy that minimizes fiber installation cost, as a typical micro-trench trench is between one-half to two inches wide and two feet deep. Though this method still requires physical construction, it is estimated that micro-trenching costs less than half of typical trenching. However, there are severe drawbacks since the conduits are installed closer to the ground surface making the conduit far more vulnerable to surface damage. Cities are also concerned that the narrow width may create hazards to bicyclists if the surface treatment, typically within the shoulder of the road used in bike lanes, settles unevenly. Given its limitations, microtrenching is often used within residential streets that experience less vehicular traffic or frequent roadwork as opposed to major thoroughfares. Through California State Bill 378, micro-trenching is officially recognized as a fiber installation strategy. The City of San Francisco has developed a micro-trenching design standard in alignment with the recently adopted state-wide policy approving micro-trenching.[73] The City of Oakland is in the process of drafting for micro-trenching standards and requirements for use within Oakland City limits.
- **Installation in Existing Infrastructure -** The installation of fiber cables in existing infrastructure (e.g., sewer line, signal interconnect, street lighting) aims to minimize the cost of additional construction while maximizing access for residents and users through leveraging an existing city-wide infrastructure system. Though installation costs would be minimized, potential breaks in the existing conduit could impact the fiber cable and require complicated maintenance coordination, compared to traditional independent conduits. Fiber cable could be mounted to the top or bottom of the inside of a sewer line pipe. If a top mounted cable is cut, the fallen cable could block the sewage system. A bottom mounted sewer strategy removes the potential for sewer blockage but would be subject to consistent sewer processing. Cities such as Pacific Grove, California and Quincy, Illinois have adopted this strategy.
- **Shared Duct Bank -** A shared duct bank for pull boxes provides capacity for future broadband usage and delineates infrastructure by owner (i.e., ISP, City of Oakland, transit agency, etc.). Installation of a common duct bank for pull boxes requires a marginal, additional capital investment while increasing capacity for future expansion and reducing the need for future rework. This strategy is recommended for areas expecting future development growth and is expected to reduce City maintenance costs. The City of Oakland has employed this as part of the East Bay Bus Rapid Transit project, as implemented by AC Transit. The City has also explored shared ducts with private companies and other public agencies, such as East Bay Municipal Utility District.

5.5.2 Wireless Infrastructure

Wireless technology has made considerable strides and innovation to remain competitive with fiber deployments. Wireless deployments are more cost-effective overall and far easier to deploy than optical cable

- Fixed Wireless & Next-Generation Fixed Wireless Access (NgFWA)

Wireless can be used for Middle Mile (backhaul) and Last Mile and is proven to be a viable option for residential broadband deployment. Wireless networks also use fiber optic networks for middle mile/backhaul, making deployments versatile and adaptable to different conditions. Traditional fixed wireless networks require a direct line of sight to the physical connection point and have ranges from approximately 1-5 miles. Wireless last mile can leverage rooftops on medium-to-high-rise buildings, including public facilities, to create a mesh network, thereby extending coverage many miles. Wireless has low maintenance cost and can support high-density connections, making it a great option for broadband deployments.

> *An example of an existing Wireless Last Mile deployment is Cruzio Internet, a local Internet Service Provider in the County of Santa Cruz, CA. The County issued a broadband grant with ARPA funding for $500,000 and selected Cruzio for the deployment. Cruzio was able to connect twenty (20) sites serving up to 4,000 households.*[74]

Next-Generation Fixed Wireless Access (NgFWA) is an innovative advanced grouping of technologies such as 5G and millimeter wave in the wireless spectrum used for broadband service. ngFWA can reach speeds of a gigabit or higher. NgFWA is suitable for installation within dense urban areas since there is limited physical construction necessary. Through dynamic beamforming, connectivity is initiated in multiple paths to allow for transmitting base nodes and receiving remote nodes to reflect and diffract surrounding obstacles such as trees and buildings. NgFWA has the capacity to leverage its “Multiple Input, Multiple Output” (MIMO) technology, robust non-line-of-sight (NLoS) capabilities, noise cancellation and utilization of advanced 5G capabilities - enabling higher bandwidth, lower latency, and more robust connectivity. This allows for reliability and scalability when using data-intensive applications like streaming, gaming, and remote work.

5.5.3 Federal Communications Commission (FCC) Guidance

The FCC has released various policies to help guide the usage of different bands. In 2023, the 12.7-13.25 GHz band was expanded to be available for terrestrial wireless services, such as future 6G services. This spectrum was previously identified as reserved for other needs. The expanded use of this band increases support for faster speeds and wider coverage.

Similarly, in 2023, Section 15.255 was amended to release the 51-71 GHz band to allow for both mobile and fixed field disturbance sensor (FDS) devices / radars to operate within this spectrum. Most recently, in 2024, the 6 GHz Band was released for wi-fi management systems and other unlicensed broadband operations usage.

6. CURRENT STATE OF PUBLIC BROADBAND INFRASTRUCTURE IN OAKLAND

This section will discuss existing publicly owned fiber optic infrastructure installed within the City of Oakland's geographic boundaries. The city municipal government owns and operates several fiber optic networks and maintains conduit/duct pathways, including its downtown campus network. Other public sector agencies that have a physical presence in Oakland have also constructed and maintained fiber optic routes and conduit, including Bay Area Rapid Transit (BART), the County of Alameda, AC Transit, and the Port of Oakland.

In addition, state agencies such as CalTrans, also have constructed and own conduit and fiber in Oakland. In many cases, these public sector entities have put partnerships in place with the Oakland municipal government to allow shared usage of fiber optic and conduit infrastructure.

The following will provide background and context for these various fiber routes, including ownership, and strand allocation, and available capacity. This analysis will also include high-level summaries of the advantages and disadvantages of these publicly owned networks. The section will conclude by identifying routes that have the highest potential to be used in a new City of Oakland municipal broadband network designed to deliver residential Internet service.

6.1 Analysis of Existing Public Broadband Infrastructure

Over the past approximately twenty years, the City has been able to obtain grants and leverage partnerships with other public agencies to install high- capacity 96-strand and 144-strand single-mode optical fiber (SMFO) routes along several key corridors for communications to City traffic signal controllers and traffic monitoring cameras. **Figure 18** provides an overview of publicly owned fiber optic cables that have been installed within Oakland City limits. After installation, the entirety of new fiber optic cables are typically owned and operated by the City, with some instances where the installing agency maintains ownership of the cable and provides the City with limited capacity for future use.

Fiber strands are typically used for traffic signal controllers and cameras connected to the City's traffic signal server and video management server located at the EOC Data Center. The last 2-3 tubes (24-36 strands) of these fiber trunklines are reserved for City IT projects, such as data center connectivity, and the City has used some for City building connections for public broadband uses (connected to the City's server room on the 8th floor of 150 FOP).

Additional details on the various fiber trunklines are provided in **Appendix A Existing Fiber Network Project List**, including *Project Name, Source, End, Cable Size, Owner, Use, etc*. **Figure 19** shows a zoomed- in version of **Figure 18**, focusing on the Downtown Campus Network. An overview of the other public agencies' fiber assets is provided below.

This will provide an analysis of City-owned fiber, including identifying limitations and opportunities as it relates to their potential in a residential municipal broadband network.

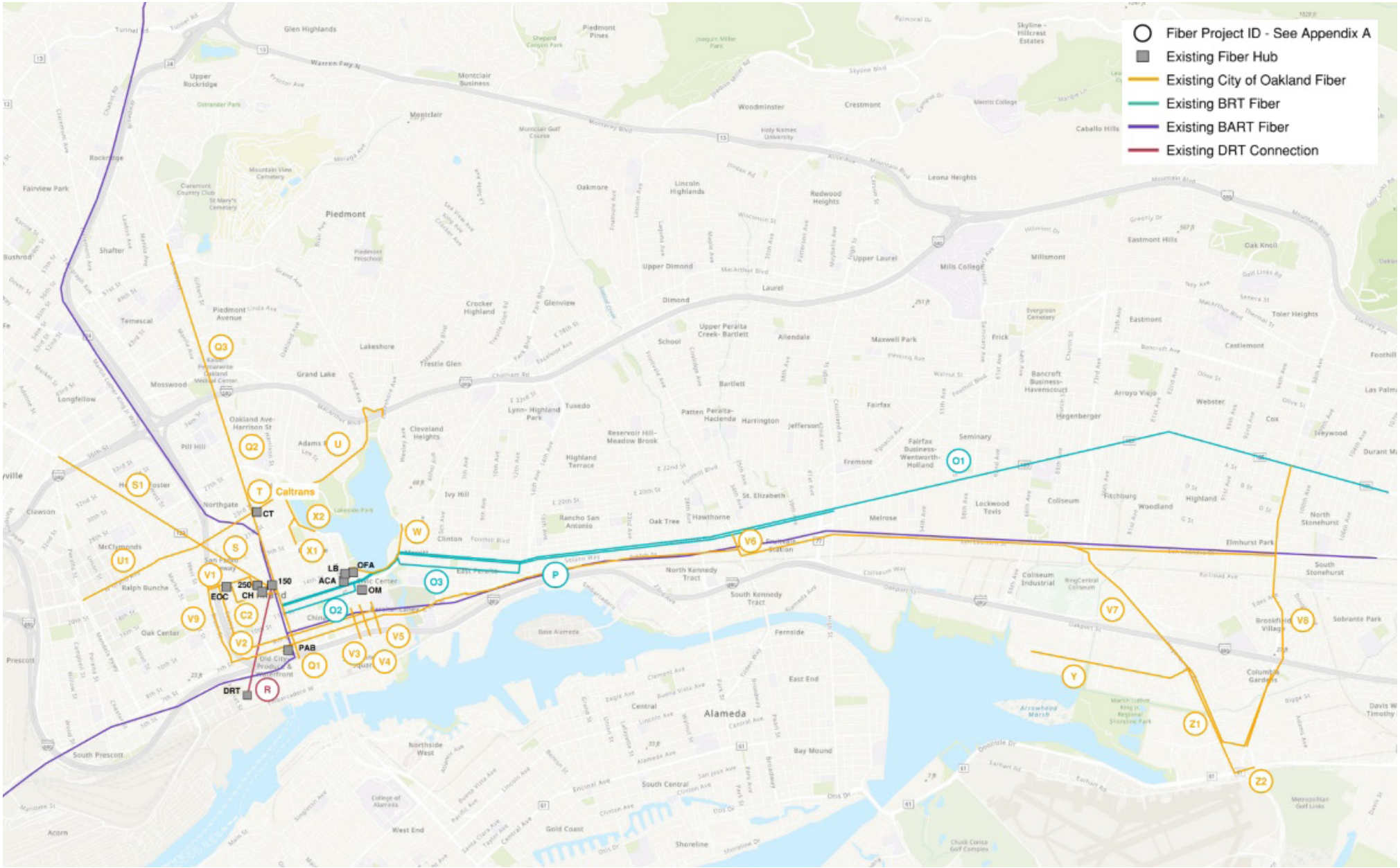


Figure 18: Existing Publicly-Owned Fiber in Oakland

6.1.1 City of Oakland Fiber Optic Infrastructure

The City's downtown fiber network was primarily set-up to connect City buildings in the downtown area. The City's core campus fiber network connects the City's data centers located at the **Emergency Operations Center (EOC) at 1605 Martin Luther King, Jr. Way** and **150 Frank H. Ogawa Plaza (FOP)** to City Hall and **250 Frank H. Ogawa Plaza**.

150 FOP provides connections to the City's primary internet service providers and a fiber connection through City Hall to the Digital Realty Data Center (DRT) on 2nd Street near Jack London Square that provides multi-cloud connectivity for the City. Other key City downtown buildings include the **Police Administration Building (PAB)** and **Oakland Main Public Library**, as well as inter-agency connections to the **Alameda County Administration Building and the Oakland Museum of California**. Key fiber junction points for the City's network are located at the City Hall basement and the "Old Fire Alarm" building.

Limitations

The existing City network has several limitations for adapting it for residential broadband use. A summary of these limitations follows:

- Many of the legacy fiber-optic connections between downtown City buildings utilize multimode fiber-optic cable (MMFO) instead of single-mode fiber-optic cable (SMFO). SMFO is generally preferred over MMFO because of the increased network capacity and distance between buildings that can be achieved.
- The City has limited (typically 12-strand or 24-strand) SMFO connections dedicated to downtown building connections, and these links are essentially at capacity without room for further expansion.
- The recent transportation-focused fiber projects were designed for connection to City infrastructure (e.g. intersections) and do not have fiber access vaults that have convenient access for residential buildings. Creating more access points will involve adding fiber vaults on the existing trunkline in front of buildings or adding branch conduits and cables from existing fiber vaults at intersections.
- The recent transportation-focused fiber projects lack standardization in design and installation. Some fiber is placed in City signal interconnect or street light conduits, while some is placed in shared infrastructure with other agencies, which complicates fiber access and/or making network changes. For example, the BRT fiber network consists of multiple microducts owned by separate agencies that are installed in a shared conduit and common pull box.
- The City of Oakland does not have dedicated staff or contracts for fiber repair, and thus fiber communications breaks cannot be repaired in a timely manner. Although traffic signals can operate satisfactorily without communications, such delays are unacceptable for a residential broadband network.

Opportunities

The recent transportation-focused fiber projects offer the following opportunities to support residential broadband use:

- These fiber cable trunklines are installed on key corridors that reach key neighborhoods in West Oakland, Fruitvale, and East Oakland. These trunklines could be used as part of a residential broadband distribution ring.
- These fiber cable trunklines are connected to the City's downtown buildings for ready access to the City's data centers and the City's connection to DRT.
- These projects typically only use 12-24 strands of the trunk fiber, so there is available capacity for other uses. Generally the last 2-3 tubes (24-36 strands) of these fiber trunklines have been reserved for City IT future projects.

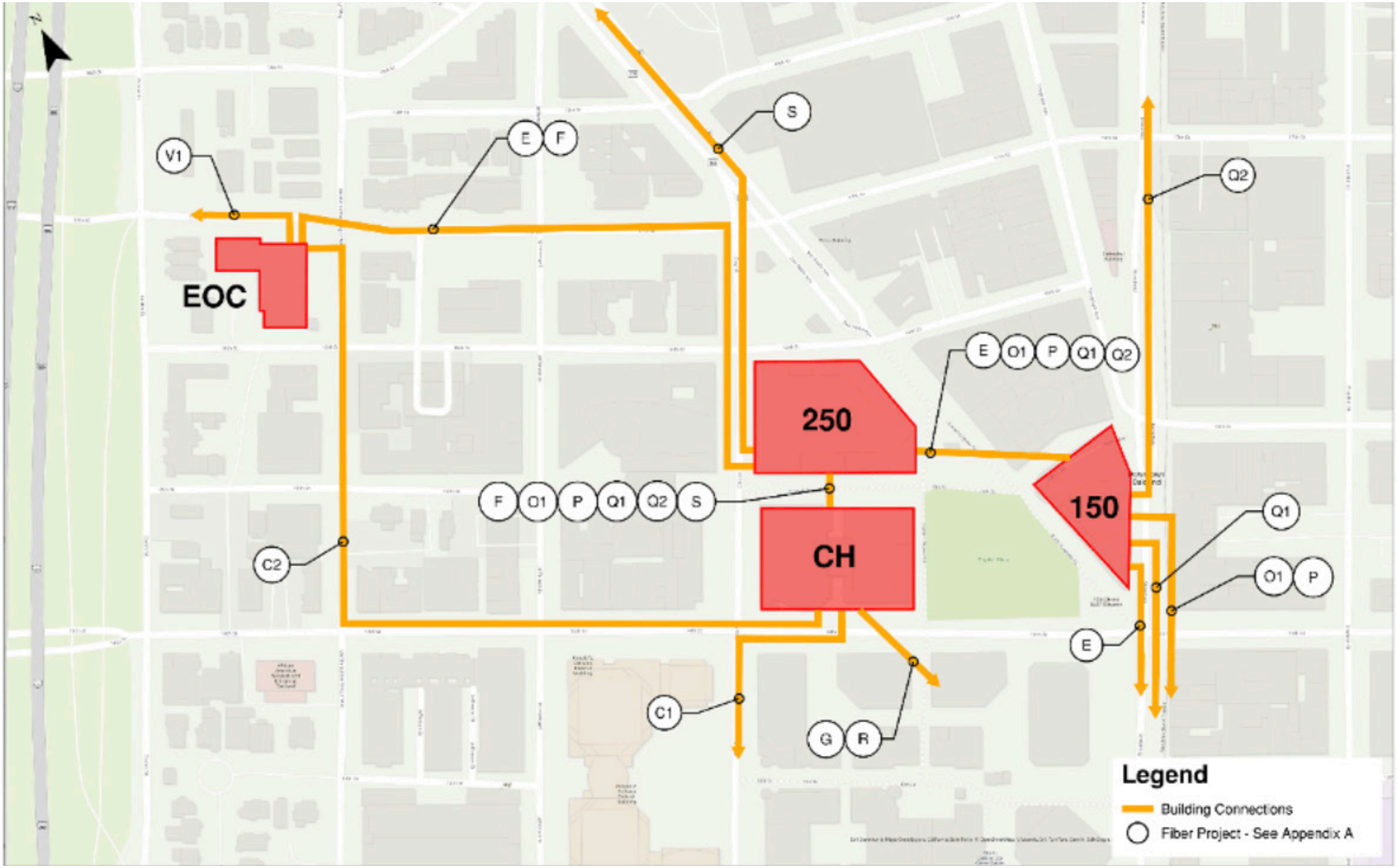


Figure 19: City of Oakland Downtown Campus Building Connections

6.1.2 AC Transit

AC Transit has installed new fiber-optic trunk cable in existing and new City conduits to support transit and traffic signal corridor operations along major transit corridors as part of the Line 51 RAPID and East Bay Bus Rapid Transit (BRT) projects and included cables owned and used by City, AC Transit and Caltrans. The BRT project also installed a fiber connection between the City's 150 FOP facility and AC Transit Administrative offices.

The AC Transit Line 51 Project provided the following fiber cables for the City's use:

- Broadway: Cable Q3 (96-strand)

The AC Transit BRT Project provided the following fiber cables for the City's use:

- Broadway/14th/International: Cable O1 (144-strands) and Cable P (144-strand)
- Oak St: Cable O2 (48-strand)

Limitations	*Opportunities*
▪ Some AC Transit BRT fiber has been placed in shallow signal interconnect conduits or microtrenches that are easily disturbed and cut. As a result, the BRT fiber network suffers from numerous cuts that disrupt network reliability and availability . The fiber-optic cable that is owned by AC Transit is intended for AC Transit use only and cannot be used by the City without an agreement between the City and the District. ▪ The AC Transit-150 FOP fiber connection is a short run without additional access points. It is intended to be used for potential future coordination of traffic signal and transit signal priority (TSP) operations and not for residential broadband.	▪ Since AC Transit project fiber connects to City facilities, City buildings, and City fiber cables, there is an opportunity to leverage its reach for expanding the City's network to new areas.

6.1.3 Caltrans

Caltrans has installed new fiber-optic trunk cable along the City of Oakland roadways parallel to Interstate 80 and Interstate 880 to facilitate proactive traffic and incident management for these corridors. Caltrans also owns its own fiber-optic cable connected to Caltrans Dynamic Message Signs, CCTV cameras, detection stations, and other freeway traffic control devices. These fiber cables are connected to field hubs with a leased line connection to the Caltrans downtown office. Caltrans also utilizes some strands in Oakland-owned fiber cable for center-to-center connections between Caltrans, the City of Oakland, and the Port of Oakland to support traffic operations.

The Caltrans I-80 ICM Project provided the following fiber cables for the City's use:

- San Pablo Avenue: Cable S (72-strand) and Cable S1 (24-strand)
- Grand Avenue: Cable U (24-strand) and Cable U1 (24-strand)

The Caltrans I880 ICM Project provided the following fiber cables for the City's use:

- Brush St/7th Street/San Leandro Blvd: Cable V2 (144-strand)
- Hegenberger: Cable V7 (144-strand)
- 98th Ave: Cable V8 (144-strand)

Limitations	*Opportunities*
■ Caltrans-owned fiber is focused on freeway and arterial operations and is generally terminated at field devices and field hubs. It does not connect to City buildings or City fiber. ■ Some of the Caltrans I-80 ICM project fiber provided to the City has a low strand count (24-strand) that allows little capacity to support residential broadband uses. ■ The I-80 ICM project fiber on San Pablo Avenue provided to the City has limited reach (downtown to Grand Avenue)	■ The I880 ICM fiber trunkline provided to the City provides high- capacity connection from the City's downtown fiber network to deep east Oakland and can be leveraged as an alternate fiber route to the AC Transit BRT fiber line. The I880 ICM project is currently using the first 2 tubes (24-strands). The last 3 tubes (24-36 strands) of the I-880 ICM fiber trunkline have been reserved for City IT use. ■ While limited in length, the I80 ICM Fiber trunkline on San Pablo Avenue has multiple tubes of dark fiber that could be utilized for City IT use. Some strands have been used to support the initial deployment of OakWiFi (Zone 1 and Zone 18).

6.1.4 BART

BART has their own fiber-optic cables running throughout the BART system in support of their transit operations, and it is the City's understanding that it has access to dark strands within the BART fiber network for City use. The City has a 24-strand connection from City Hall to the BART 12th Street Station that is used to connect the City network to the Digital Realty Trust commercial data center facility.

Limitations	*Opportunities*
■ BART fiber is typically accessed only at BART stations. ■ The City is not currently using BART fibers, and access/use details would need to be confirmed, including whether residential broadband services are a qualified use. (Written documentation of agreement has not been found.)	■ The City may have permission and access to use City may be able to use BART fibers to support center-to-center connections between City hubs in support of broadband residential use.

6.1.5 Port of Oakland

The Port of Oakland (Port) has installed 144-strand and 48-strand SMFO cables to support their security network and security devices throughout the Port maritime operations area with connections to the City's EOC and PAB for security use. Due to their security use, these cables are not generally available for use by other agencies or for other non-security purposes.

Limitations	*Opportunities*
■ Port of Oakland fiber use is limited to security applications. Residential broadband is a qualified use. ■ Port of Oakland downtown fiber is not readily accessible for connections outside of City buildings.	■ The City of Oakland had the rights to use 24-36 strands of the Port cable installed between the City's downtown buildings and terminated strands in 150 FOP, 250 FOP, EOC, and City Hall. These strands could be used to extend City fiber connections between buildings to provide internet and DRT connections to the fiber trunklines extending out from downtown.

6.2 State Middle Mile Broadband Initiative

The Middle-Mile Broadband Initiative is a partnership between the California Department of Technology (CDT), its Office of Broadband and Digital Literacy, and Golden State Connect Authority that assembled a Middle-Mile Advisory Committee. This partnership oversees the development, construction, acquisition, maintenance, and operation of the network. This open-access network, which received $3.25 billion from Senate Bill 156, aims to bring equitable high-speed broadband service to all California residents. This initiative is a key component of California's Broadband For All Action Plan which sets a long-term goal of ensuring that all Californians have high-performance broadband available at home, schools, libraries, and businesses.[75] Open-access means that users will connect on equal economic and service terms. Users include internet service providers and public entities. This approach will get more capacity at lower costs, which benefits the communities served by users.

The MMBI will have significant routes through Oakland (depicted in **Figure 20**) with the opportunity to collaborate with the State on splice box locations and possible fiber huts where State and City middle mile fiber could be co-located. The purpose of a fiber hut is to allocate space to support local connections. Huts have been strategically planned for the purpose of supporting last-mile network connectivity to the middle mile.[76] Huts are crucial to the delivery of high-performance broadband internet to homes, housing complexes, libraries, businesses, and other community institutions.

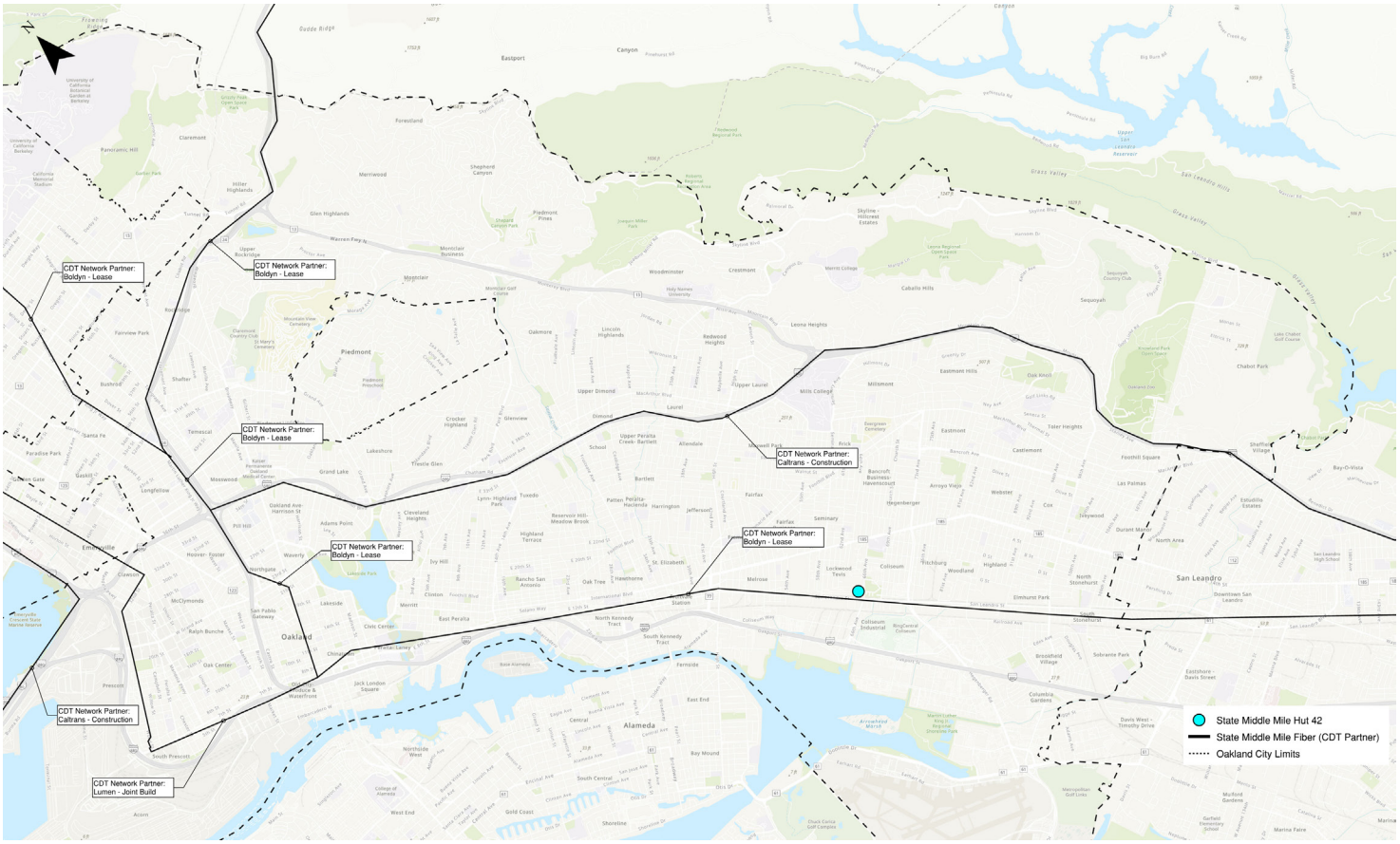


Figure 20: State Middle Mile Fiber Network Routes in Oakland

6.3 Residential Broadband Fiber Candidates

Taking all this information into account, the City worked to narrow down the existing fiber routes to identify those that would be most useful for supporting residential broadband deployment. The following traits aided this analysis:

- Fiber-optic cables that are able to be accessed by the City, connected to City fiber hubs and run into key areas that could easily be accessed for local fiber connections.
- Fiber-optic cables in good condition and installed in conduit depth of 2 feet (min) to minimize the risk of fiber cuts that would result in network service disruption. Fiber-optic cable installed by microtrenching, or shallow conduits are not good candidates for residential broadband fiber.
- Fiber-optic cables with unused fiber strands (24 strands minimum, 36 strands preferred). Generally, fiber-optic cables of less than 72-strands are not good candidates for residential broadband fiber.
- **Figure 21** shows the existing fiber trunklines that are candidates to support residential broadband deployment. These cables are listed below (See **Appendix A** for additional details):

Figure 21 shows the existing fiber trunklines that are candidates to support residential broadband deployment. These cables are listed below (See **Appendix A** for additional details):

CORRIDOR	FIBER CABLE ID	TOTAL STRAND COUNT
Broadway	Q1, Q2, Q3	96 strands
San Pablo Ave	S	72 strands
Clay St/ 14th St	C2	144 strands
17th St/ Brush St/ 7th Street/ San Leandro Ave	V1, V9	144 strands
Market St/ 8th Street	V2	144 strands

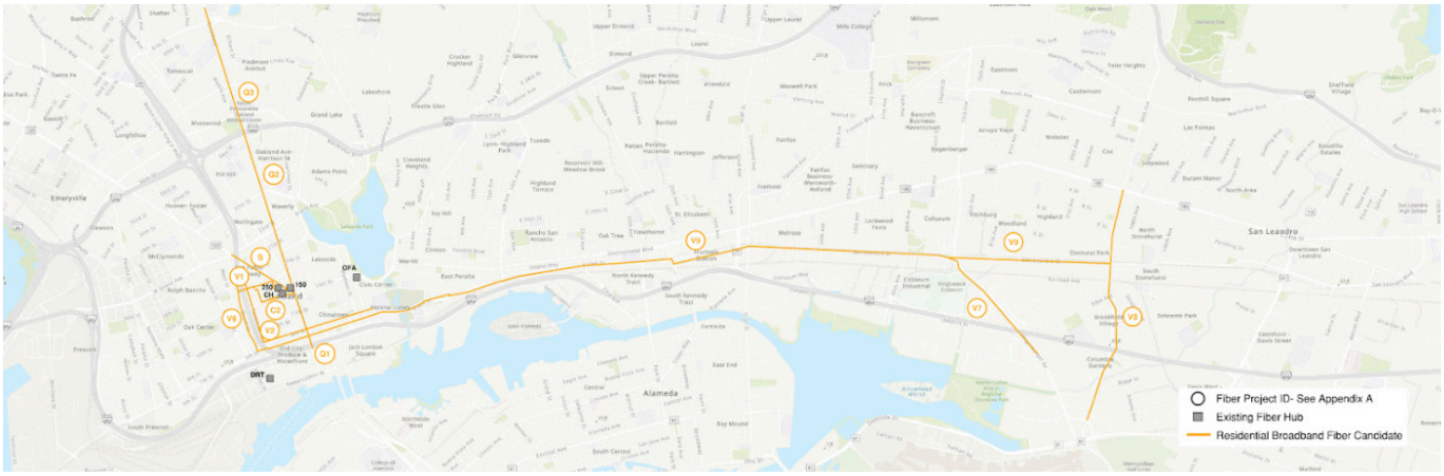


Figure 21: Residential Broadband Fiber Candidates

6.4 Common Themes from Private Partner Outreach

To better understand the opportunities and challenges for working with ISPs to advance last-mile connectivity in Oakland, the City conducted outreach in Fall 2022 and Summer 2024.

The Request for Information (RFI) Broadband & Digital Literacy Program Partner Oakland and more targeted Oakland Broadband Last-Mile Connectivity Planning and Design Project Internet Service Provider Survey collected feedback from ISPs that helped inform potential areas of collaboration and future opportunities.[77]

Based on a review of responses from 16 different ISPs, the following themes were identified.

- **Use of City fiber network is beneficial to increase reach**. While some national ISPs did not identify the benefit of using City fiber assets, smaller ISPs indicated they would leverage the City Fiber network, if available, potentially including City-owned high-speed routers, and collaborate on future City fiber projects to expand coverage. The primary benefit to them would be to reach further customers in a cost-effective manner.
- **Access to City vertical assets to place and mount equipment**. Some ISPs requested to use City vertical assets such as rear easement, towers, rooftops, buildings, and poles to expand network coverage. These needs were identified in the feedback.
- **Streamlined permitting and construction process for ISP deployment**. To expedite permitting timeline and minimize inspection fees, ISPs mentioned the desire for clear guidelines and specifications. Ideally, the permitting process would outline expectations for different scenarios, such as use of City vertical assets, installation of assets in City sidewalk or roadway, and use of City fiber assets. City construction details are requested to expedite design. Considerations for blanket permitting access and microtrenching installation standards were identified.
- **Outreach assistance for potential customers**. Regional ISPs highlighted that Oakland's broadband market is dominated by national ISPs, which makes it harder for smaller ISPs to identify and reach customers. These barriers make entering the market more difficult. Further, recouping capital investment in low-income areas can be challenging without financial assistance.

7. Advancing A Solution: The OaklandConnect Municipal Broadband Network

This section will bring together all the elements thus far discussed in the BMP by introducing and proposing a solution: a municipal broadband network constructed and owned by the City of Oakland, designed to enable the delivery of free or low-cost residential high-speed to residents in Oakland as an alternative to the incumbent provider's status quo.

This effort will be discussed in the subsections below, including the City of Oakland's Oakland Connect project, as submitted to the CPUC FFA Last Mile grant program and awarded in July 2024; the implementation of the Oakland Connect Project, including consideration of additional information that has presented in this BMP; and finally, this section will conclude by looking ahead into the future to conceptually imagine what the Oakland Connect residential broadband network could become in the future.

7.1 The Oakland Connect FFA Project Submission

As discussed in **Section 1.2**, in 2021, California Governor Gavin Newsom signed Senate Bill 156, allocating $6 billion of state funding sources and federal ARPA funds to expand broadband access, improve affordability, and ensure connectivity for all Californians. An unprecedented investment of $2 billion was allocated towards funding last mile infrastructure to broadband serviceable locations throughout California; this was administered by the CPUC under the Federal Funding Account Last Mile Infrastructure program, also known as FFA.

As part of the FFA program, the CPUC published an updated statewide broadband map intended to identify every unserved and underserved location in the state. Riddled with the systemic inaccuracies explained in **Section 4.2.1.3**, the FFA Broadband map understated need in Oakland while overstating eligible locations in wealthy, demonstrably served areas like Livermore and Pleasanton. As such, the County of Alameda, where Oakland is the county seat, was allocated $24.5 million in potential grant funding in the CPUC's final decision on the FFA program.[78] While systemic mapping inaccuracies persist, the Oakland Connect team's advocacy, highlighting the extensive on-the-ground need, prevailed. As such, Oakland was awarded their FFA project in the first round of funding.

Urban Counties (31)			
	Population Unserved	**County**	**Allocation** = $5 million + $1,640.37218 per unserved resident[27]
1	11,898	Alameda	$24,517,148.20

7.1.1 Developing the Proposal

In early 2023, the City of Oakland's Information Technology Department and #OaklandUndivided began developing an application for the FFA program, with the submission window expected to be opened in July 2023.

To form the network, the team evaluated three categories of sites and facilities that could be used as the basis for the FFA project. These are 1) Existing Fiber Hubs and Routes within the City of Oakland; 2) Community Anchor Institutions (CAIs) that are not currently connected to City fiber that could be used to construct a network into greater parts of Oakland; and 3) Multi-Dwelling Unit properties where fiber could reach residents directly.

These analyses and results are described in greater detail below and were conducted throughout the project application process to gain a fuller understanding of what a potential municipal broadband network could look like in Oakland through the FFA funding available.

7.1.1.1 Existing Fiber Hubs & Routes

The facilities listed below were analyzed and determined to have satisfactory fiber connections to serve as potential hubs for the municipal broadband network. These hubs currently house network connections that are essential to the existing fiber optic network. The networks and the facilities they are in are City owned and/or operated with enough space to store new equipment. .

- Lionel J. Wilson Building – 150 Frank Ogawa Plaza
- Dalziel Building – 250 Frank Ogawa Plaza
- Emergency Operations Center – 1605 MLK, Jr Way
- Oakland City Hall – 1 Frank Ogawa Plaza
- Police Administration Building – 455 7th St
- Oakland Maintenance Service Center
  (City of Oakland Municipal Service Yard) - 7101 Edgewater Dr
- Old Fire Alarm Building – 1310 Oak St

These facilities are shown as grey boxes in Figure 22 below.

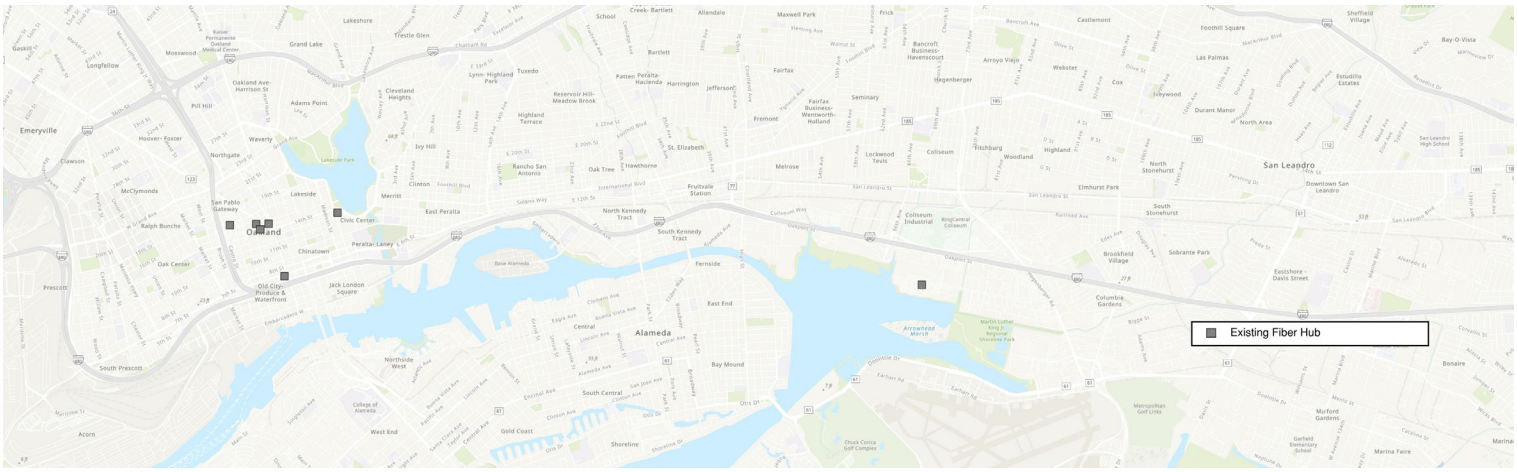


Figure 22: City Fiber Hub Facilities

7.1.1.2 Community Anchor Institutions

Community Anchor Institutions (CAIs) are a primary location for fiber hubs and connectivity due to the community impact of providing connected service to that location. According to the CPUC, a CAI is a school, library, health clinic, health center, hospital or medical provider, public safety entity, institution of higher education, public housing organization, or community support organization that facilitates the greater use of broadband services by vulnerable populations including low-income individuals, unemployed individuals, children, incarcerated individuals, and aged individuals. Many CAIs are institutions owned by public agencies, typically for public good. Community Anchor Institutions serve a vital role in municipal broadband networks, as discussed in **Section 5**. The team working on the Oakland Connect proposal evaluated potential City CAIs that could be added to the existing fiber and routes in new construction. This would enable the expansion of the fiber routes to cover a much larger area of Oakland. Specifically, the team identified City CAIs such as fire stations, head start centers, libraries, and recreation centers shown in **Figure 23 below**.

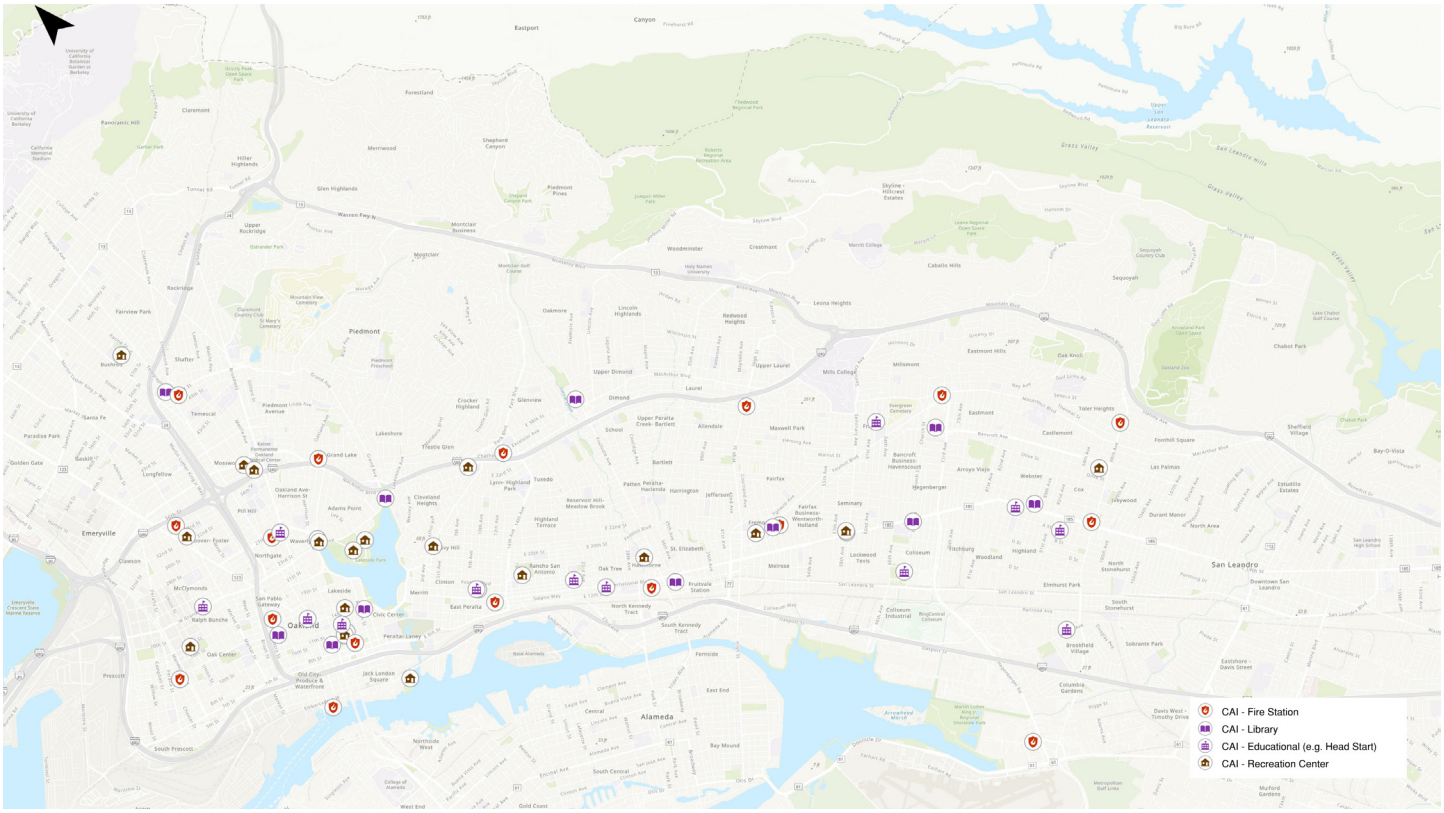


Figure 23: Potential City Community Anchor Institutions (CAIs)

7.1.1.3 Multi-Dwelling Units (MDU)

Expanding broadband access to Multi-Dwelling Units (MDUs) would be a key component of bridging the Digital Divide in Oakland and making a project proposal to the CPUC. The team had already been collaborating with the Oakland Housing Authority (OHA) on other broadband initiatives and thus it made sense to extend this collaboration to the FFA grant proposal.

For background, the Oakland Housing Authority (OHA) provides subsidized housing to nearly 16,500 families in Oakland, administering the Department of Housing and Urban Development's Section 8 program. They also own and oversee the management of hundreds of units of legacy public housing and develop new affordable housing in partnership with other affordable housing nonprofits. It should be noted that while the City of Oakland and the Oakland Housing Authority are trusted partners on many projects, they are separate agencies with their own management and governance structures.

Figure 24 below shows locations of MDUs owned by OHA and other non-profit groups in Oakland.

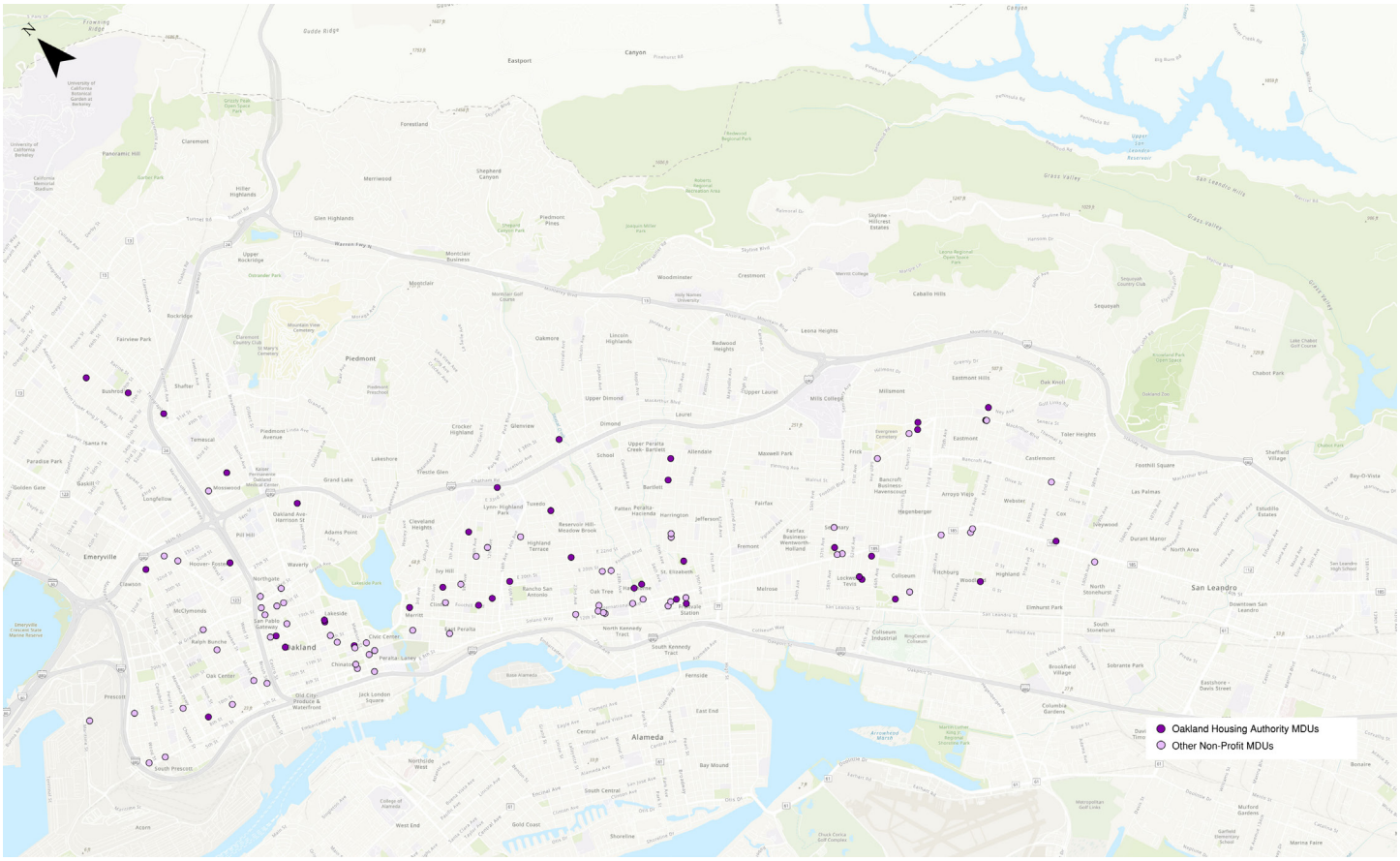


Figure 24: Potential Multi-Dwelling Units (MDUs).

7.1.2 Proposal Finalization & Submission

With these pieces in place, the team developed a proposal (while leveraging technical assistance through the CPUC LATA grant) to directly connect to OHA properties and City-owned community anchor institutions (CAIs) to a mix of existing City-owned fiber and new fiber to areas identified in the City's Equity Indicators report including parts of East Oakland, West Oakland, Downtown, and Fruitvale.[78]

The team met with City of Oakland departments to discuss the opportunity and finalize the comprehensive proposal.

In September of 2023, the City of Oakland submitted the "Oakland Connect - Last Mile Connectivity for Oaklanders" project for consideration, requesting $14,026,946.15 with a City match of $1,563,126.85 for a total project amount of $15,590,073.00.

The project included the following elements:

- Phase 1 (OaklandConnect) Trunk Fiber
- Proposed use of existing City fiber (AC Transit BRT)
- Proposed hub connections
- Proposed CAI connections
- Proposed OHA MDU Connections
- Proposed State Middle Mile Connections

PROJECT DESCRIPTION: A City-owned hybrid middle mile/last mile network, consisting of 12.85 miles of new middle mile fiber (144-count SMFO cable), 11.75 miles of existing City municipal fiber (144-count) for middle mile, and 9.28 miles of new last mile fiber connections (12-strand SMFO cable) in disadvantaged and unserved areas. The City's middle mile ring will include connections to the State's middle mile network. The proposed network would connect 2,544 un/underserved households located within 27 of Oakland Housing Authority's (OHA) affordable multi-dwelling units (MDUs) in West Oakland, Downtown, Fruitvale, and East Oakland. The work would include in-building wiring improvements for OHA locations that need restructuring of in-unit installs, where legacy wiring has made it impossible for a new ISP to connect. OaklandConnect would also provide last-mile connections to 14 community anchor institutions (CAIs), nine public safety buildings, and 302 mass market unserved locations. In addition to the 27 MDUs and 2,544 households served by the project, the route will facilitate future last-mile connections to an additional 12 MDUs operated by non-profit organizations, 4,578 businesses, and would support fixed wireless networks that could serve tens of thousands of additional unserved residents. From the east, the proposed route will connect to the City's existing network at 98th Ave and International Blvd in East Oakland, heading north to Foothill Blvd and west along Foothill Blvd to 23rd Ave in Fruitvale, with a spur to the State middle mile network at Fruitvale Ave. Once constructed, the City will formally solicit proposals from qualified Internet Service Providers (ISPs) to enter into agreements to lease the City's network to deliver Internet service to customers in accordance with CPUC requirements for bandwidth speeds, latency, and pricing.[79]

7.1.3 CPUC Award Decision

The FFA program was vastly oversubscribed meaning that applications for funding far outstripped funding available. Based on data available from the CPUC FFA portal, AT&T applied for $129.6 million of funding in Alameda County, more than 5.3x the allocated amount of $24.5 million. The median income was 3x higher in some of the applications than the City of Oakland's proposal.

During the CPUC's formal Challenge phase, both Comcast and AT&T separately challenged the Oakland Connect project claiming their service was available throughout the project area. The City entered rebuttals and the CPUC ultimately dismissed both challenges, determining that (1) Comcast & ATT overstated coverage in their objection, citing the companies' own websites, and (2) that "City of Oakland cannot viably serve all the unserved locations in the project area without serving areas where objectors provide competing services."[80] The challenges were also covered by the Mercury News.[81]

On July 11, 2024, at the CPUC Voting Meeting at its headquarters in San Francisco, CA, the CPUC Board of Commissioners, in its first round of funding decisions for the FFA program, unanimously approved a resolution awarding the Oakland Connect project the full requested amount of funding. The meeting was attended by staff from the City of Oakland, Oakland Housing Authority, members of the Oakland Undivided Coalition, and other community members supporting the Oakland Connect project. CPUC President Alice Reynolds was quoted saying, "the Federal Funding Account – and these projects – are a shining example of our state's Broadband For All values and objectives."[82]

Video from the meeting including the public comments is available online.[83]

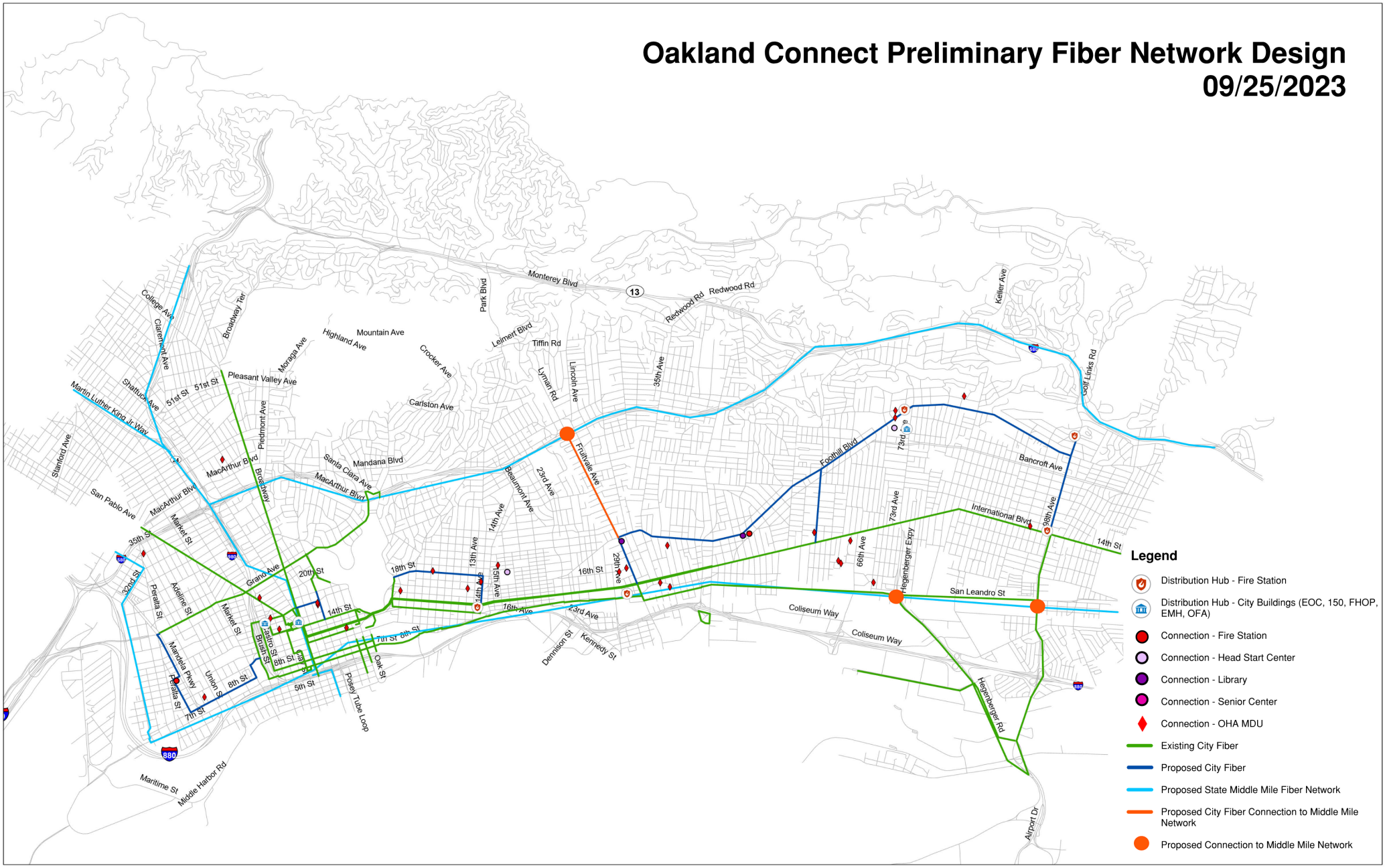


Figure 25 - OaklandConnect project map as submitted to the CPUC

7.2 OaklandConnect Implementation Roadmap

The OaklandConnect project is a complex, ambitious effort and will require several milestones to be successful. This deadline for completion of the network per the CPUC and federal guidelines is December 31, 2026. This section will discuss these milestones and the sequence in which they should occur over the next 24 months. Pre-work included formal City Council acceptance of the grant funding, which occurred on September 17, 2024.[84] City matching funds from Measure U were allocated in the City's adopted 2023-2025 biennial budget.[85]

7.2.1 Step 1. Design & Engineering Phase

The first major step on the Project is the Design and Engineering phase of the project. Design and engineering involves performing research and planning to develop detailed, industry standard construction plans and requirements for the Project. The design and engineering agreement was approved by the City Council on December 3, 2024 and is expected to be executed in early 2025. The design and engineering phase may take up to 4 months to complete.[86]

The steps below include the major milestones in the design & engineering phase

Municipal Broadband Network Requirements

The following requirements reflect the current understanding of the City's Middle Mile fiber, City Last Mile fiber, and the State Middle Mile Connection fiber networks and how they intersect. Each network is described below:

- ***City Middle Mile*** – Middle mile are the segments of fiber that are installed in the public ROW and are owned and maintained by the City of Oakland. Residential broadband segments aim to be used to provide high-speed Internet service in un/underserved areas. The middle mile is planned as an "open-access" network meaning that any provider or operator can enter into an agreement with the City to utilize fiber strands within the network. The City Middle Mile as proposed will consist of 12.85 miles of new middle mile fiber connecting to 11.75 miles of existing City municipal fiber for a total of 24.6 miles. The City middle mile will be designed in a network topology that incorporates "rings" or "loops," a configuration that, in certain segments, connects to form a single, unbroken path. This ensures redundancy as data can flow in both directions and, if a cut occurs, data can resume flowing in the other direction. This is a broadband standard and recommended practice for municipal broadband network design. (Planned Standard: 144-strand fiber count SMFO)
- **City Last Mile** – Last mile fiber is constructed by the City of Oakland to connect anchor institutions, fiber distribution hubs, and multi-dwelling units (MDU), residential, business, and other properties to the City middle mile. Last mile is installed on property sites and inside buildings. The City Last Mile as proposed will consist of 9.28 miles. It may be owned by the City of Oakland or the private property owners, depending on the ultimate arrangement. (Planned Standard: 12- strand fiber count SMFO)
- ***State Middle Mile Connection*** – The State of California is constructing its own middle mile network with large segments planned to run through the city of Oakland. The OaklandConnect Project contemplates interconnecting with the State Middle Mile at various points throughout the city. The State's middle mile is also open-access. The State Middle Mile construction is ongoing.
- ***Pull Boxes and Access Points*** – As part of this network development, installation of pull boxes and access points at key locations along the ring will be crucial to provide convenient network access for ISPs and other providers.

Route Modification & Repairs

The Design & Engineering phase is when a project can be modified from the initial conceptual design to account for unknown or new information, such as updated findings, limitations, constraints, and opportunities. As discussed in **Section 6.1.2**, the BRT route, along International, has been identified as vulnerable due to its shallow depth and other factors. Since the preliminary conceptual network design was prepared in September 2023, the City has learned of additional impacts to the route and has determined that the impacts have made the line unsuitable for use in a residential broadband network.

As further identified in **Section 6.1.3**, the City has access to the I-880 ICM fiber, which has been identified as an opportunity for municipal broadband use. As the I-880 ICM fiber runs directionally in the same manner (east-to-west) as BRT and, at many points along the route, is geographically close by, it has the potential to serve as an alternative to BRT. **Figure 26** below shows a revised Project map based on using the alternative I-880 ICM route.

In addition, existing fiber routes need to be inspected and may require repairs in order to bring them to the operational standards necessary for a residential broadband network. This work should be incorporated in the Design & Engineering phase.

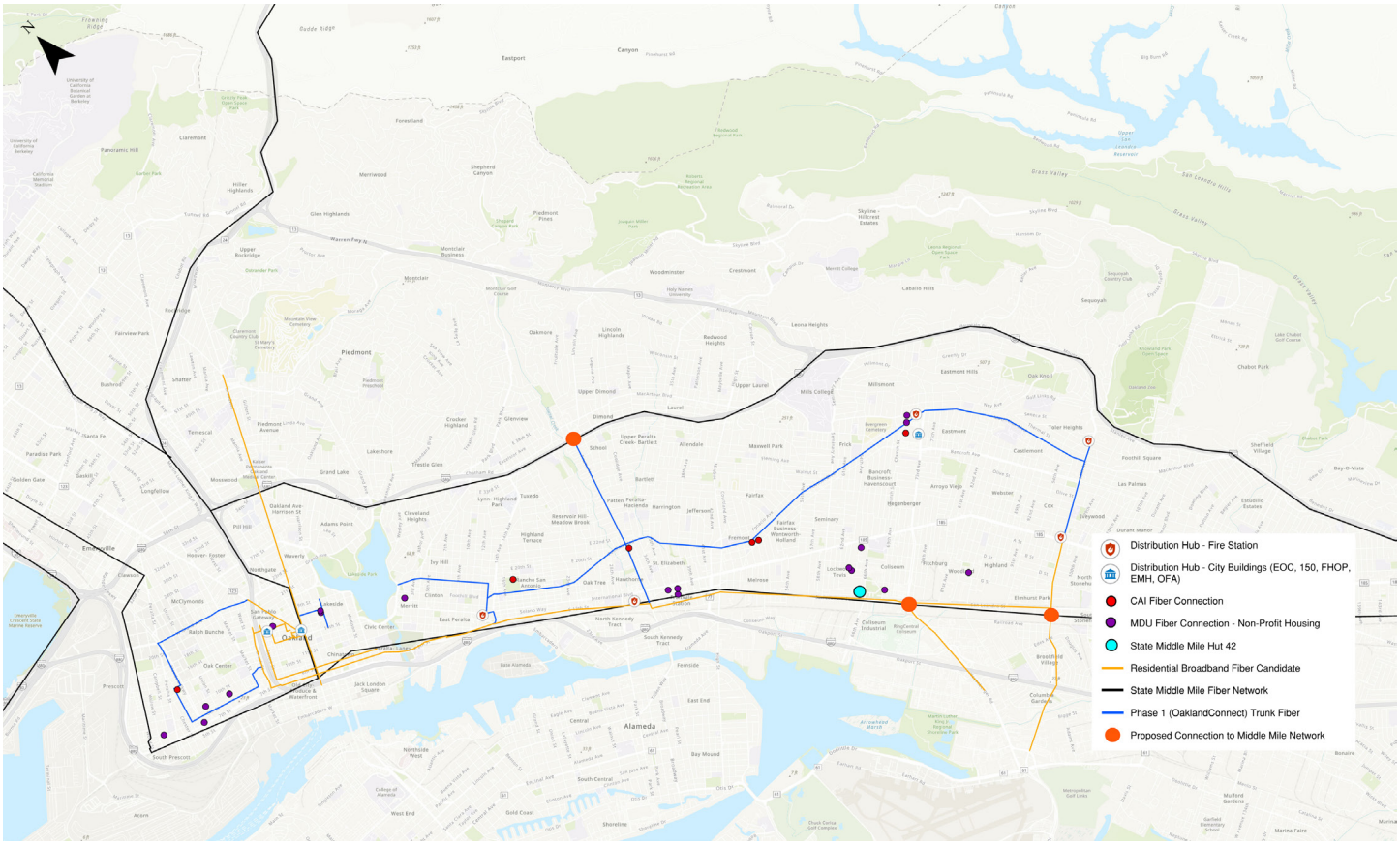


Figure 26 - Proposed OaklandConnect Fiber Network Revised

Finalize MDU Properties & Construction Agreements

The Design and Engineering phase will also identify the Last Mile segments, including routes along privately owned property, that will connect the City middle mile to City-owned CAIs and OHA MDU sites. As the OaklandConnect team further analyzes the potential OHA properties to connect during this phase, the team will need to finalize the property list and draft agreements between the City and OHA for construction approval.

As mentioned elsewhere in this BMP, ownership of land and affordable housing properties in Oakland can vary across different entities, including landowners, building owners, property managers, and other parties that may be in long term property leases. As the City will need to enter into construction agreements with private property owners to install broadband infrastructure on their property, the more entities that are involved, the more complicated these agreements can become.

As such, the OaklandConnect team should continue working with OHA to develop a finalized list of property sites that are owned entirely by OHA. This will comprise the construction agreement between OHA and the City.

7.2.2 Step 2. Construction Process

When the design and engineering phase is complete, the City will issue a Request-for-Proposal/ Request-for-Qualification to solicit construction bids for the project. This will follow the standard public works contracting bidding procedures and procurement processes. ITD will need to coordinate closely with Oakland Public Works, OakDOT, and other City departments and agencies to ensure the construction process is compliant with Oakland codes and standards.

For the health and long-term vitality of the OaklandConnect network, it is integral that the construction specifications be consistent with commercial-grade broadband infrastructure standards. Typical construction methods for broadband conduit and fiber are to use directional drilling, 36” below finished grade (in order to be deeper than existing utilities), with minimum 4” diameter conduit. Similarly, built-in resiliency can be achieved with redundant paths, proper constructions methods, standards, and documentation will also strengthen the system.

Bid documents, once ready, will be published online on the City’s website.[87] The City typically awards the Construction to the lowest-responsive bidder who will be required to complete necessary contract documentation and obtain encroachment, excavation, and building permits necessary for construction. This is planned as an ITD project with City engineers available, as needed, to support the construction phase and to answer design questions from the City inspectors.

Once started, the construction process is expected to take 12 months to complete..

7.2.3 Step 3. Public-Private Partnerships with ISPs

The OaklandConnect Project is envisioned to fit under the hybrid model of municipal broadband networks, as discussed in **Section 5.2**. The City will construct and own the open-access middle mile in the public ROW; last mile connections to City CAIs; and enter into agreements with private property owners for last mile segments to serve households.

Furthermore, the City will make dark fiber leases available to ISPs to provide high-speed Internet service in accordance with the CPUC and federal guidelines for the grant.

Considerations for such partnerships include, first and foremost, providing wireline gigabit fiber service to MDU households included in the buildout; contract vehicles for accessing and utilizing City dark fiber; and potential fees, licenses, and revenue plans. For example, the City can charge a fair market rate or subsidized license fee to access its middle mile fiber; use an "in kind" approach to provide access to its fiber in return for other ISP services that benefit the community; or the City may negotiate a revenue-sharing arrangement. These approaches are typical in MBN public-private partnerships. It is imperative that the City establish a model that is financially sustainable over the long term and provides value to all parties involved.

As discussed in **Section 6.4**, the City conducted a RFI in 2022 and received responses from several ISPs, both wireline and wireless providers. In evaluating these responses, the City should look for potential ISP partners that share the City of Oakland's commitment to digital equity and have a track record of success in public-private partnerships. These evaluations should happen concurrently with the construction processes such that ISP agreements are entered into prior to the construction being completed, so that ISP partners are able to hit the ground running and deliver service as soon as fiber is available.

7.2.4 Step 4. Go-Live & Public Outreach

Construction projects require final inspections and approvals to determine work was performed satisfactorily and in accordance with the construction plans and documents. It is envisioned that the middle mile will be completed first, followed by City CAI connections, and then MDU connections. The City should work with its ISP partners to plan for sites to "go-live" as fiber becomes available until all sites are connected and fully operational. This will last the duration of the project, or at least six months after the construction phase is completed.

After the project is complete and sites are operational, the City should coordinate with its ISP partners on public outreach and marketing to raise awareness of the new, free or low-cost service. This may include additional surveys to identify needs in the community and opportunities to increase adoption of the network.

7.2.5 Step 5. Ongoing Maintenance Plans

Perhaps the most challenging element of any municipal broadband network project is the need for ongoing maintenance, including the middle and last mile segments. The City must consider models that are cost-effective and sustainable. Oftentimes, municipalities maintain their MBNs using revenue from license fees or revenue sharing from the network. However, it is possible that ISP partners may want to take over maintenance responsibilities entirely to ensure more timely responses and repairs are made. Cities sometimes also support their MBNs with funding from their general funds.

> *While many options exist, one thing is certain: without a comprehensive and sustainable maintenance structure, the OaklandConnect project could be at risk of disruptions and outages and, ultimately, closure. .*

Maintenance Plans will need to be cross-departmental involving ITD, OPW, and OakDOT as well as other City agencies. The section below will provide technical information that should be considered in a comprehensive maintenance plan.

Maintenance & Operational Specifications

Effective communications of operations and maintenance responsibilities will be crucial to maintaining network operations. These responsibilities can be categorized as the following areas:

- Preventative Maintenance
- Operations and Maintenance support
- System Interruption

The following list summarizes typical activities associated with each category along and provides additional details. See **Appendix B** for coordination flow between the tasks.

Preventive Maintenance

- **Develop Checklist** - Define tests/ways to identify gaps
- **Routine Checkups** - Conduct and document preventative maintenance checks against developed checklist. Update checklist as necessary
- **Equipment Replacement** - End of service, end of life

Operations and Maintenance Support

- **Develop IP scheme** - Consider future expansion
- **Assign IP address to devices** - Based on IP scheme
- **Document Configuration** - Network Equipment and End Devices at inception and record any updates/changes
- **Fiber strand assignments** - Assign for City and partners considering future needs and expansion. Update assignments in response to new projects, emergency repairs, and design changes

System Interruption (* O&M support to be incorporated as needed)

- **Respond and process reports** - Receive and process calls/reports of system interruption (i.e. from preventative maintenance, user, partner etc.) and coordinate next steps
- **Investigate/Troubleshoot reports*** - Determine if the device, comm, or physical network is damaged. Identify approach depending on damaged item
- **Repairs or replacement** - Reference as-builts and other support documents. Coordinate with correct maintenance group depending on troubleshooting results. External coordination as needed based on location of repair
- **Configure communication and end devices*** - Following a repair/replacement, as needed
- **Standalone Test** - Confirm end device working and transmitting/receiving data
- **Network Test** - Confirm communication network device functioning and communicating
- **System Test** - Confirm end-to-end functionality (Operator to Device)
- **Verify repairs** - Third party to confirm validity of test results

7.2.6 High Level Implementation Summary

The table below will summarize the implementation roadmap that has been discussed in the section. Construction activities may overlap where possible, and dates and activity windows are planned timeline estimates.

1.	**Design & Engineering Phase** ▪ Finalize Routes & Repairs ▪ Finalize OHA and City CAI properties, agreements ▪ Finalize Network requirements and design	**Summer 2025**
2.	**Construction Phase** ▪ Public Works Bidding ▪ Contract execution ▪ Traffic Plans, USA Marking ▪ Inspections and final sign off	**12-18 Months**
3.	**Public Private Partnerships with ISPs** ▪ Identify wireless and wireline partners with shared interest in digital equity ▪ Execute agreements for broadband infrastructure access, including revenue and fee structure ▪ Include ISP requirements in network design	**6 Months**
4.	**Go-Live & Public Outreach** ▪ Work with City Communications on public outreach, including social and print media ▪ Consider additional surveys or workshops to further raise awareness ▪ Support ISP partners with marketing plans	**Dec. 2026**
5.	**Ongoing Maintenance** ▪ Work with City Communications on public outreach, including social and print media ▪ Consider additional surveys or workshops to further raise awareness ▪ Support ISP partners with marketing plans	**2027+**

Table: City Broadband Implementation Timeline

7.3 OaklandConnect: Future Expansion and Possibilities

The preceding sections have discussed the OaklandConnect project and provided a high-level summary of the implementation necessary to bring the Project to fruition. This section will look out into the future to identify opportunities and possibilities that could expand and grow OaklandConnect as the City continues its development and plans to address the Digital Divide in Oakland.

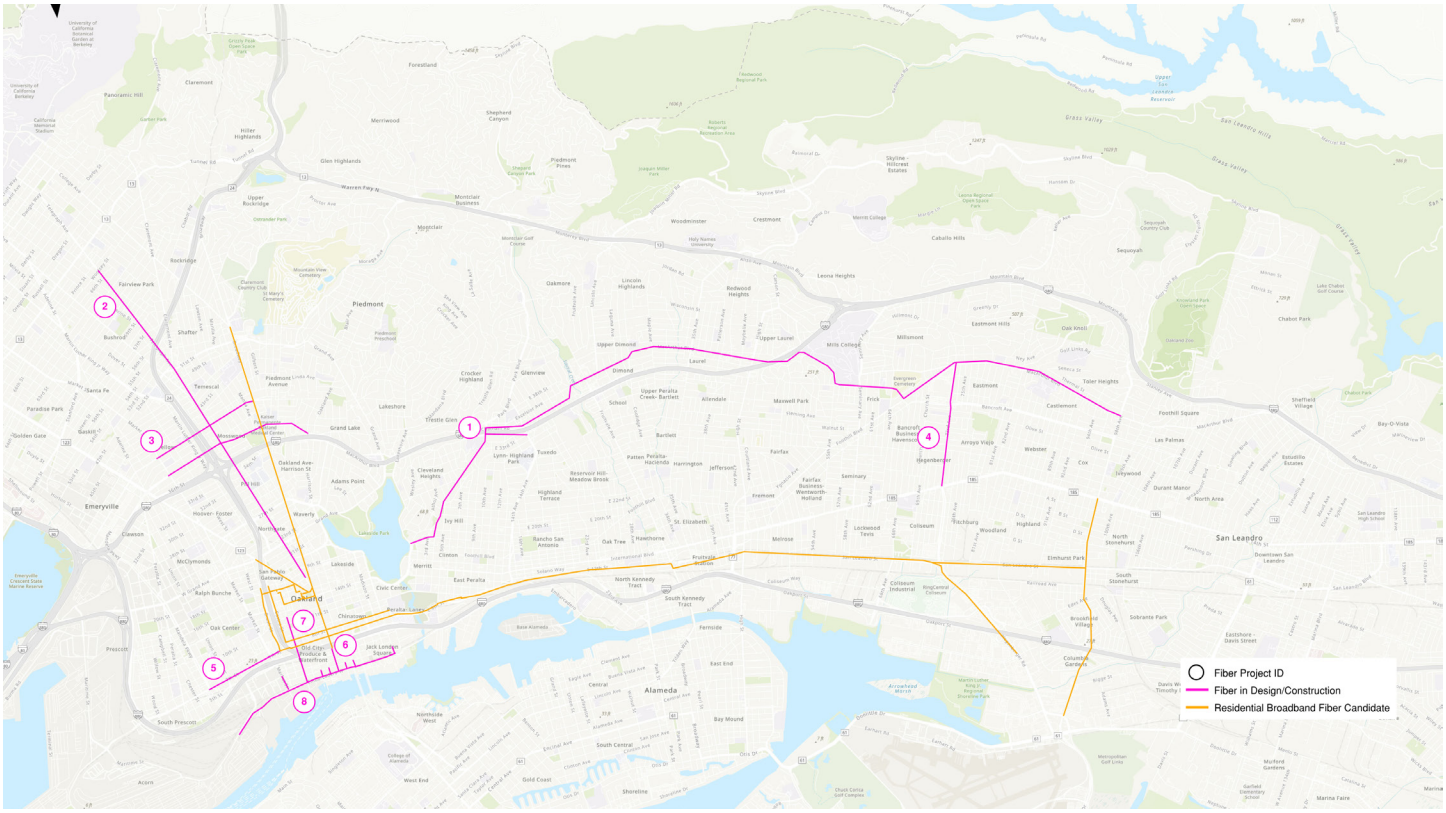
7.3.1 City Transportation Projects with Fiber in Design or Construction

The Oakland Department of Transportation currently has several projects in development that could be integrated with the MBN to provide residential broadband service, in addition to their primary purpose as transportation systems. Many of these projects required 24" minimum cover for conduit and directional boring or trenching construction methods, which are suitable for broadband network extension segments. See **Appendix C** for the City of Oakland Conduit Construction standard.

These routes should be incorporated into the OaklandConnect middle mile, simply to secure further redundancy and sustainability. Additionally, there is opportunity to achieve the following:

- Expanding free or low-cost residential service
- Adding Priority Business Corridors as defined by the Activate Oakland Commercial Corridor Map[88]
- State Middle Mile Fiber connections
- Passing CAIs and additional MDUs

Figure 27 below highlights fiber projects in design or construction. The numbers on the figure correspond to the project list below.



PROJECT ID	PROJECT NAME	Project Locations/ Elements	PROJECT OBJECTIVES	STATUS	FIBER LENGTH (FT)
1	MacArthur Smart City Corridor 1	New fiber trunk on MacArthur Blvd from Lake Merritt Park to 73rd Ave	Provide communications for traffic signals on MacArthur Blvd	In Design/ Construction	41400
2	TPI3 Telegraph Ave Rapid Corridors Project	New fiber trunk on Telegraph Ave from City Hall to Oakland City Limits	Provide communications for traffic signals on Telegraph Ave	In Design/ Construction	12350
3	MacArthur Smart City Corridor 2	New fiber trunks on MacArthur Blvd	Provide communications for traffic signals on MacArthur Blvd	In Design/ Construction	12800
4	73rd Active Routes to Transit	New fiber trunk on 73rd Ave from MacArthur to International	Provide communications for traffic signals on 73rd Ave	In Design/ Construction	6100
5	7th St ATP	New fiber trunk on 7th St from Brush to Mandela	Connect signals along 7th St, provide OakWiFi redundant path for West Oakland	In Design/ Construction	3950
6	Broadway Streetscape Improvements	New fiber trunk on Broadway from 2nd to 5th	Enhance bus operations, pedestrian safety, and the fiber optic network	In Design/ Construction	1200
7	MLK Streetscape Improvements	New trunk fiber on MLK from 2nd to 12th	Enhance bus operations, pedestrian safety, and the fiber optic network	In Design/ Construction	3350
8	Embarcadero West Rail Safety and Access Improvements	New trunk fiber on Embarcadero from Market to Oak St	Construct a multi-use path and implement safety improvements at eight at-grade crossings	In Design/ Construction (Preliminary)	11200

7.3.2 Equity Analysis for Future CAI Fiber Connections

As the City expands its middle mile fiber, CAIs within 1,000 feet of City fiber trunk lines (existing or in design/construction) should be considered for potential fiber connections and to serve as network hubs for the City fiber network. A priority analysis of 63 eligible CAI sites was conducted for this BMP to determine an equity score. The ranking formula was developed utilizing the following data sources:

- CPUC Designation: BEAD Eligibility, Served or Unserved
- 2020 Census: Average income in the past 12 months
- 2020 Census: Poverty level in the past 12 months
- 2020 Census: Race
- 2020 Census: Households utilizing Food Stamps/Supplemental Nutrition Assistance Program (SNAP)
- CPUC: Socioeconomic Vulnerability Index (SEVI)
- Activate Oakland Commercial Corridor Designation

Based on this formula, equity priority designations were given of ***High Priority, Higher Priority***, or ***Highest Priority***. **Figure 28** shows the 21 ***High Priority*** fiber connections, 20 ***Higher Priority*** fiber connections, and 22 ***Highest Priority*** fiber connections along existing City fiber routes.

> ***Note to Readers***: *This formula is by no means intended to be prescriptive; rather it was developed to provide a thoughtful way of evaluating the potential future expansion locations. The City should develop a formal methodology to determine expansion sites. This methodology is provided as a reference or starting point for future discussions.*

Appendix E – Community Anchor Institution (CAI) Fiber Connection by Priority lists the 63 potential fiber hub connections along with their equity considerations and equity priority designation based on the hypothetical ranking formula.

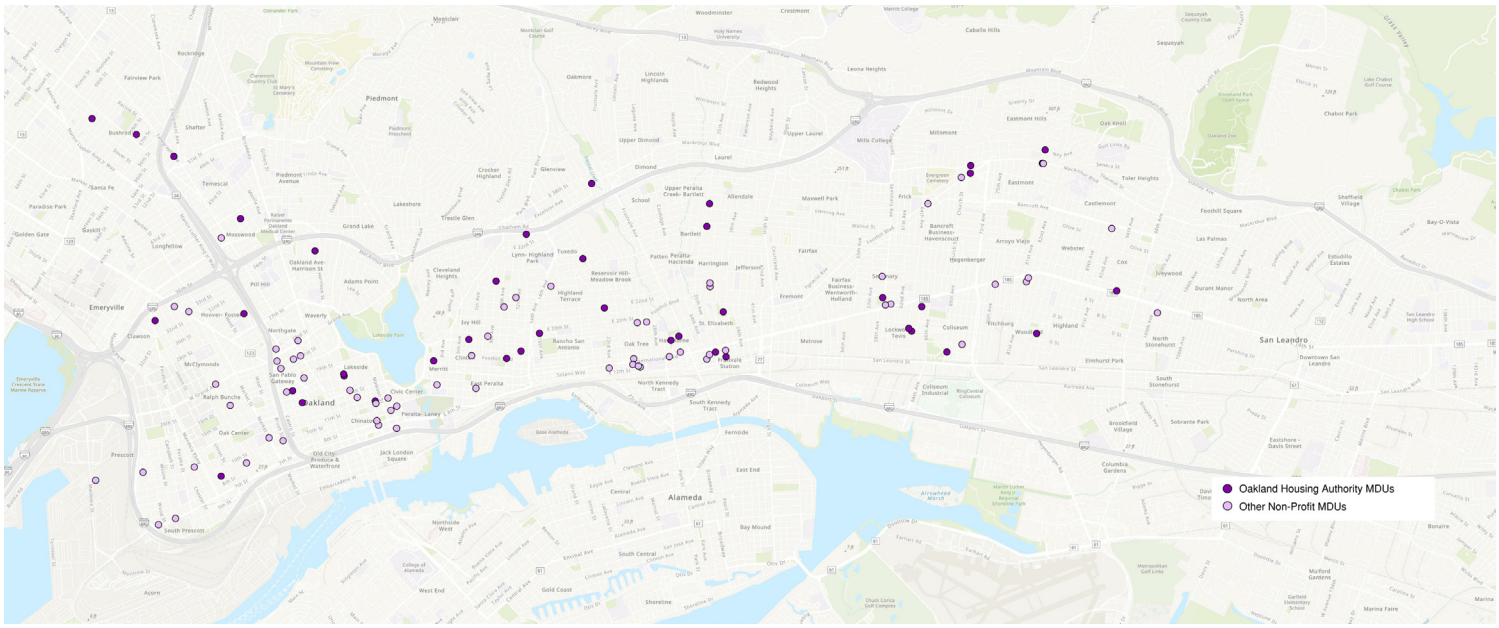


Figure 28 - Community Anchor Institutions (CAI) Fiber Connection by Priority.

7.3.3 Conceptual Wireless Network

As discussed in **Section 5.5.2**, fixed wireless is rapidly innovating and expanding the functionality and sophistication of residential wireless last mile service. This BMP recommends that the City evaluate potential Wireless Internet Service Providers (WISPs) as ISP partners in the OaklandConnect project. To provide an overview of the potential of a "wireless overlay" on the fiber network, the BMP developed a methodology to determine potential service coverage.

Potential Wireless Hubs

The following building types could be suitable for wireless root access points (i.e., sites connected to fiber that provide root service in a mesh network topology):

- CAIs over 5 stories tall
- MDUs over 5 stories tall
- Fire stations
- Other potential locations:
  - CAIs 1-5 stories tall
  - MDUs 1-5 stories tall
  - Siren Towers

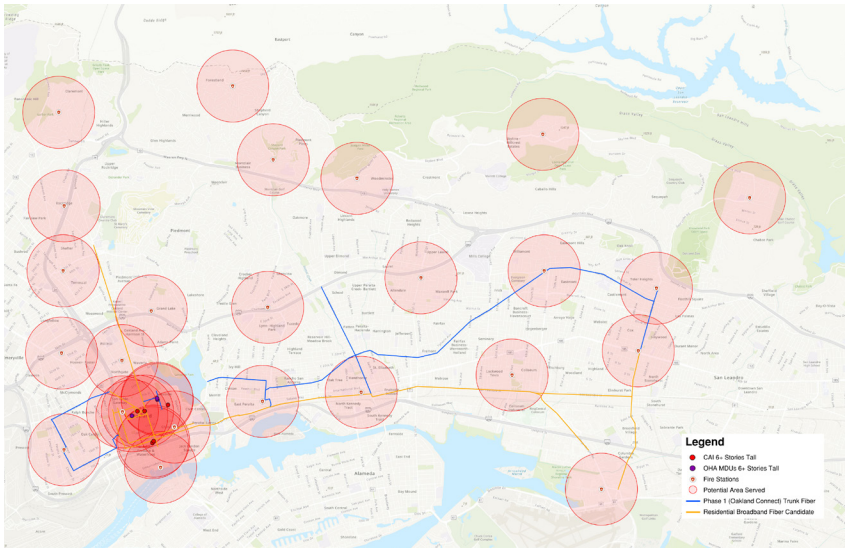


Figure 29 - Potential Wireless Hubs

These buildings are sufficiently tall or have radio towers that would allow them to serve as wireless hubs. In addition to Oakland's twenty-six fire stations, there are three OHA MDUs and five CAIs listed in **Appendix F** that are potential wireless hub candidates. Each potential wireless hub would be able to serve any residential homes, local businesses, MDUs, or CAIs within a half mile radius. These areas are represented by the red circles in **Figure 29** above.

Additional facilities at higher elevations (e.g., in the Oakland hills) may also be used as a wireless hub. Wireless hubs will be prioritized by providing service to the maximum number of MDUs and CAIs that do not have fiber connections.

> *Based on this analysis, it is not out of the realm of possibility that a WISP could reach thousands of households and businesses in Oakland by leveraging the MBN and buildings that will be developed as part of the OaklandConnect project.*

Wireless Partnership Agreement & Permitting Considerations

A series of workshops were held with relevant City departments to identify issues and solicit input for requirements applying to third-party installation of wireless equipment on city facilities and to streamline the approval process.

The discussion included the following topics:

- Required documentation (e.g. photo simulation, equipment specification sheet, construction drawings, attachment details)
- Electrical use and connection to existing electrical system
- Maintenance (Scheduled versus emergency)
- Building Access (including prior notice)
- Historical Review
- Fees

Based on these workshops, a sample rooftop master license agreement (MLA) was developed. The City may need to consider its existing policies for wireless deployment in order to support and facilitate ISP partners working to address market gaps and inconsistencies. For example, the MLA should state the requirements for private partners to install, operate, and maintain communications equipment, including antennas, radio, cabling, and mounts. The MLA also outlines additional topics including but not limited to the following:

- Site Agreements
- Non exclusiveness of Permit
- Term of Site Agreement
- Interference
- Indemnification, Release of Claims
- Insurance

A Site License Agreement will be needed in addition to the MLA. Each city-owned property will have a unique Site License Agreement, and additional agreements may also need to be made for MDUs owned by OHA or any other non-profit organizations.

7.3.4 The Future of OaklandConnect: Art of the Possible

Bringing everything together, **Figure 30** puts forth a vision that integrates the entire OaklandConnect project with existing City fiber, CAIs, future fiber builds, and the State Middle Mile. The labels correspond to the project list in **Appendix D**. This project list summarizes the cost for the City to build-out this fiber network. **Figure 31** and **Figure 32** show a magnified version, focusing on West/Downtown Oakland and East Oakland, respectively.

This "grand vision" represents considerable financial investment and human capital to construct, implement, and maintain the various segments into a cohesive whole. Infrastructure projects take many years to build and once complete, need care and nurturing to continue to grow. The network would provide low-cost fiber Internet service to thousands of residents in Oakland. While there are numerous potential risks that could prevent this plan from coming to fruition, the City of Oakland has the opportunity to build a sustainable and connected future for all Oaklanders. **Considering the benefits and immense potential it offers, the BMP recommends pursuing it.**

After all, the only alternative to creating change is allowing things to remain the same.

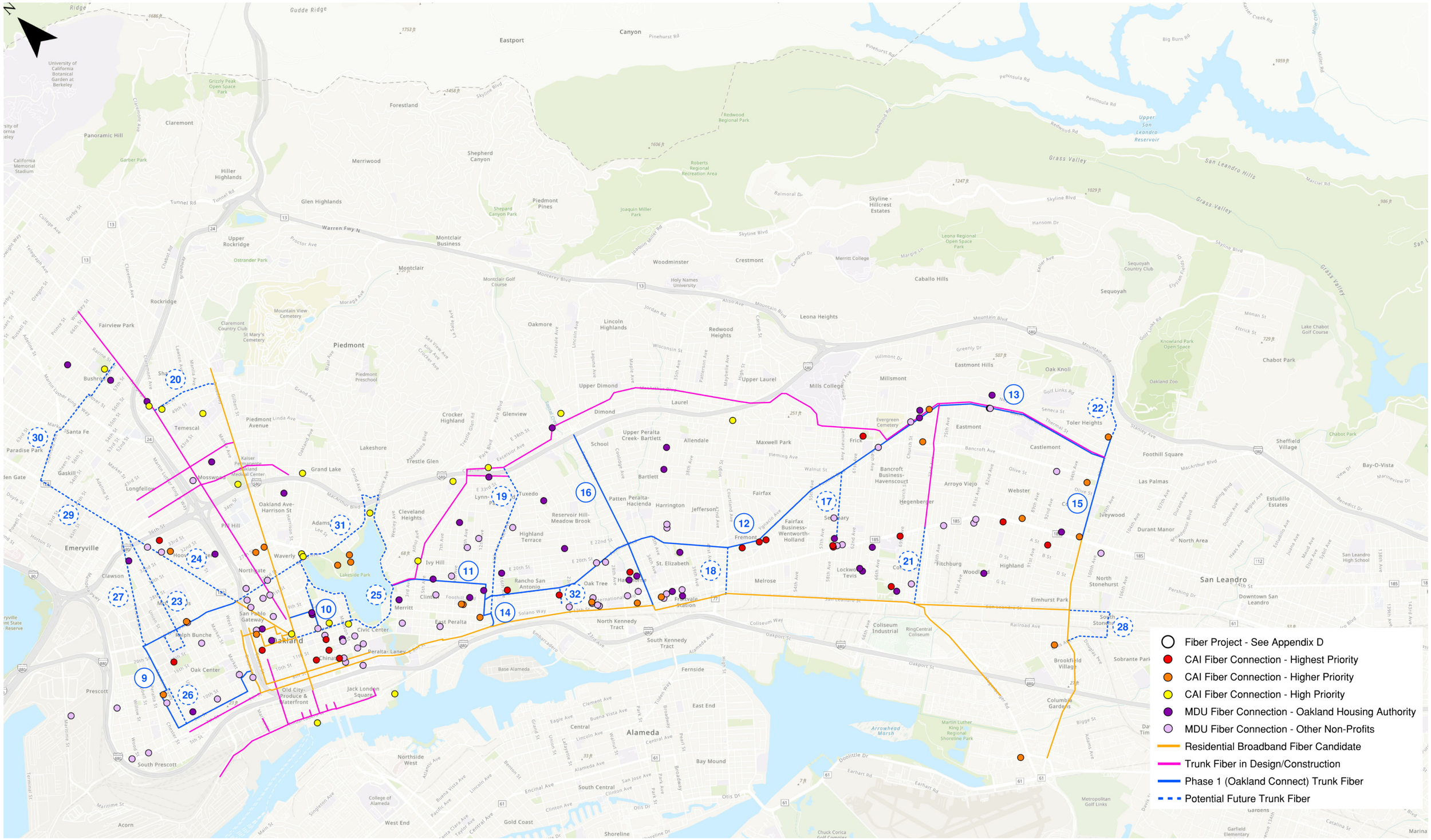


Figure 30: Future Residential Broadband Fiber Network

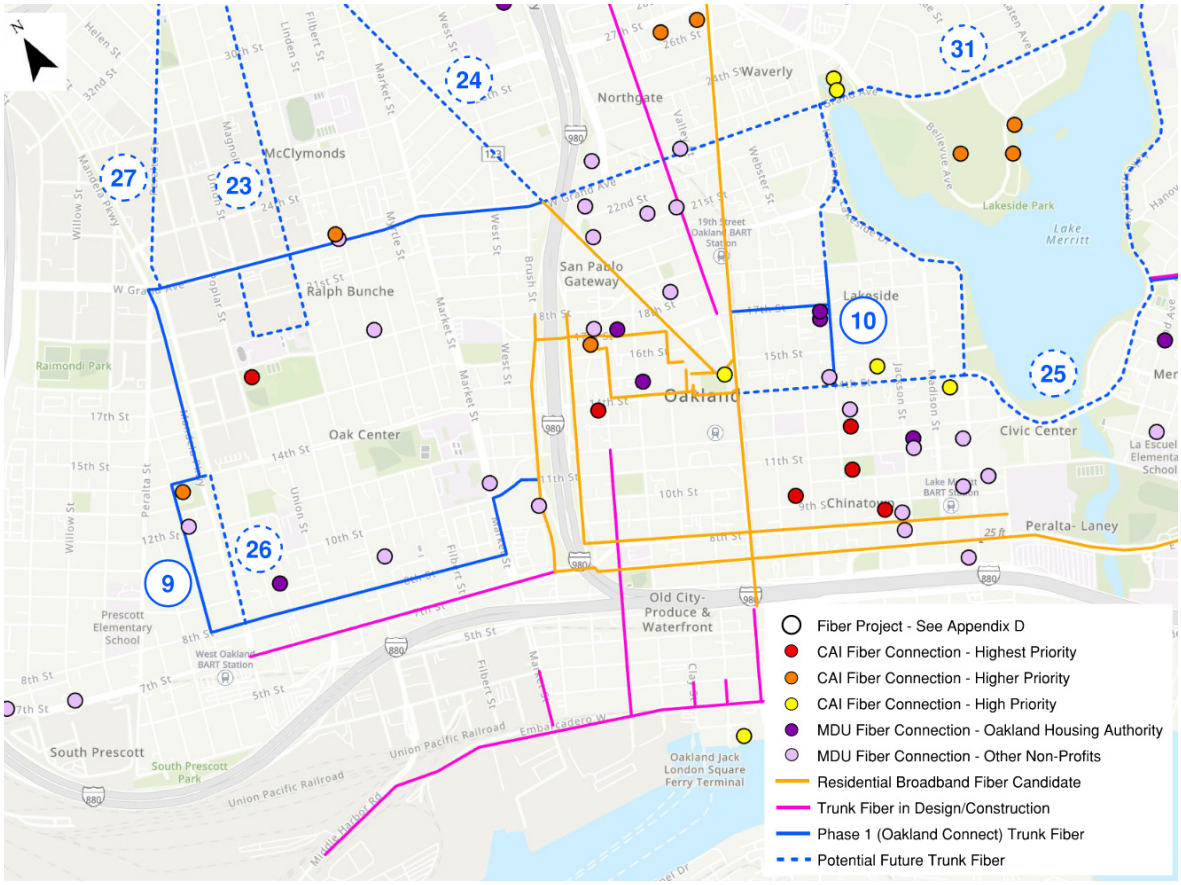


Figure 31 - Future Residential Broadband Fiber Network – Downtown and West Oakland

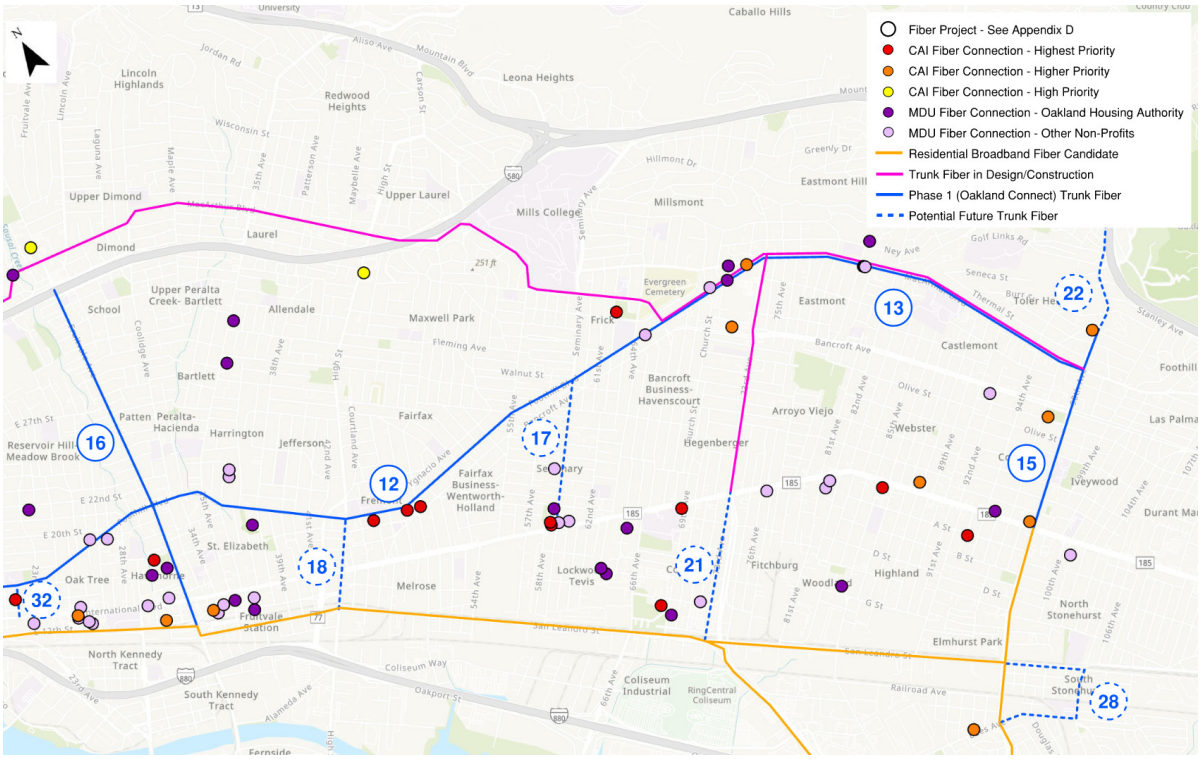


Figure 32 - Future Residential Broadband Fiber Network – East Oakland

8. RECOMMENDATIONS

This section will present specific recommendations that build on the ideas and concepts that have been discussed in the preceding sections of this Master Plan. The recommendations are broken into two primary categories:

Municipal Broadband Strategy Recommendations which are focused on policies, operational procedures, and partners that support the planning, construction, and maintenance of the City's broadband network and wireless assets.

Digital Equity Strategy Recommendations which are focused policies, administrative actions, and City partners that strive to promote and sustain digital inclusion activities throughout the City.

Recommendations at a Glance

Municipal Broadband Strategic Recommendations	
1	Build the OaklandConnect Municipal Broadband Network
2	Develop an Open Access Middle Mile policy
3	Develop a Rooftop Access policy
4	Develop a "Dig Once" policy
5	Restore OakWiFi and Explore Connecting Public Spaces
6	Coordinate with the State on the Middle Mile Initiative
7	Track & Pursue Federal & State Funding Opportunities
8	Develop Maintenance & Operations plans
9	Integrate planned and future City fiber projects with OaklandConnect MBN
10	Utilize OaklandConnect for Municipal Network Transport Services
Digital Equity Strategic Recommendations	
1	Sustain the Digital Equity Ecosystem in Oakland
2	Strengthen Local Policies to Expand Internet Access
3	Support State & Federal Digital Equity Policies

8.1 Municipal Broadband Strategic Recommendations

1. Build the OaklandConnect Municipal Broadband Network.

Section 7.2 provides a high-level implementation roadmap of the major milestones necessary to implement the OaklandConnect project utilizing the $14.01 million CPUC FFA grant funds and available City Measure U funds. This Master Plan recommends pursuing a hybrid MBN where the City will own the infrastructure and enter into open-access agreements with private partners to deliver Internet service.

The implementation includes the design & engineering phase; construction phase; public-private partnerships with ISPs; and public outreach. For more detail, please refer to **Section 7**.

2. Integrate planned and future City fiber projects with OaklandConnect MBN

Section 7.3 presents a tremendous opportunity for the City to integrate its planned capital projects that include fiber and telecommunications infrastructure with the OaklandConnect MBN. To achieve this vital outcome, City Departments and Agencies such as ITD, OPW, OakDOT, Finance, CAO, and others can collaborate to develop a process to identify such projects and include OaklandConnect integrations in their design, construction, and funding plans.

Future City facilities and CAIs are contemplated in the Equity-Based Expansion Framework that was developed for this Broadband Master Plan: This framework is intended as a starting point for discussion around future plans for network expansion.

3. Utilize OaklandConnect for Municipal Network Transport Services

As the OaklandConnect fiber network will interconnect at several City facilities (identified as CAIs), there will be multiple opportunities to utilize the network for municipal transport services such as data and telecommunications.

- **Wireline Municipal Service**. City facilities can be connected to the internal City IT network using fiber in the OaklandConnect network as the primary connection routes.
- **Wireless Municipal Service** The City can also explore using wireless backhaul to reach City CAIs to provide basic connectivity in lieu of leased services from telecommunications firms.

These efforts can lead to the City realizing annual cost-savings through a decrease of reliance on recurring third-party connectivity services.

4. Develop an Open Access Middle Mile policy

The City middle mile broadband fiber, including planned and existing routes, are envisioned as an "open access" system meaning that telecommunications and Internet providers can utilize the network on a non-discriminatory basis. In order to effectuate this, the City can develop and authorize an Open Access Middle Mile policy that any provider can execute with the City to use the network. There are several key terms that need to be considered in such a policy:

- **Whether fiber is "lit" or "dark."** With lit fiber, the City owns and maintains the electronic infrastructure and connectivity and provides access to wavelengths. Dark fiber is not connected to electronic infrastructure and is delivered as physical strands of fiber. There are tradeoffs: dark fiber is less complex to maintain than lit fiber but may generate less revenue given that a single fiber strand can carry multiple wavelengths.
- **License fees for fiber**. License fees vary based on lit or dark fiber and should be based on current market rates.
- **Service Requirements** for Internet speeds, latency, and pricing, in accordance with CPUC Federal Funding Account guidance.
- **Maintenance**. The fiber policy should include maintenance responsibility and service level expectations.
- **Administration of middle mile agreements**. The City must determine a process and the appropriate department to accept, process, execute, and administer middle mile agreements.

5. Develop a Rooftop Access policy

This BMP has identified a major opportunity for the City to pursue fixed wireless solutions and partners to deliver affordable Internet service to tens of thousands Oakland residents. In order to achieve this, the City can make its rooftop infrastructure available to partners to install antennas for wireless systems. The rooftop policy should also be open-access and can be thought of as complementary to the middle mile fiber policy. Policy considerations include:

- **Non-exclusivity.** The agreement should allow for colocation of multiple carriers and antennas.
- **Electrical needs**. Antennas will need dedicated electrical service.
- **Maintenance and building access**. Providers will typically need to perform maintenance on their wireless infrastructure and emergency repairs may be needed during non-business hours.
- **Fees and charges**. The City will need to establish a fee structure to utilize its rooftops.

As part of this effort, the City developed a draft rooftop MLA (dated 11/22/2022) for consideration during future workshops. Before publishing the MLA, the City should consult with stakeholders to ensure alignment and input from the following departments: Facilities-Building Maintenance, Real Estate, City Attorney, Planning, Building, Historical Preservation.

- **Existing wireless policy**. The City's municipal code, Chapter 17.128 - TELECOMMUNICATIONS REGULATIONS contains rules that may apply with wireless partners. These rules should be evaluated as it relates to a rooftop access policy.
- **Administration of rooftop agreements**. The City must determine a process and the appropriate department to accept, process, execute, and administer middle mile agreements.

6. Develop a "Dig Once" policy

A dig once policy coordinates the installation of conduit and fiber infrastructure for construction projects to maximize the benefits to the community of construction work and realize cost savings. Considerations include:

- **City departmental coordination:** City departments should review permit applications for an excavation, encroachment, use, or other type of permit that involves utility infrastructure construction, road resurfacing, excavation, or similar work. In addition, when a proposal is received or developed for the purpose of accessing City-owned, broadband infrastructure, the responsible department should notify ITD.
- **City Participation:** If the City decides to participate in a construction project, it must determine budgetary responsibility. Municipalities are typically responsible for the incremental cost of adding their own conduit and appurtenant facilities to the project. "Incremental cost" includes the cost of the materials needed by the City and any additional labor costs, but does not include other allocated costs. When conduit, fiber or other facilities are deemed necessary in a development/redevelopment project that is subject to a discretionary permit, such installation can be included as a condition of the permit, at the permittee's cost.
- **Indefeasible Right of Use:** When a City-owned asset is leased or otherwise made available to a third party for telecommunications purposes, and the project involves the installation of fiber optic cable, then the third party will be required to convey a license to the City (typically, an indefeasible right of use) for the use of 24 strands of fiber, over the full extent of the project, including segments not attached to or enclosed in City assets, as a condition of the contract. The license will be coterminous with the contract. The third party is responsible for ongoing maintenance and operations except those that relate directly to the City's use of the fiber.

7. Restore OakWiFi and Explore Connecting Public Spaces

Section 5.3 discussed the OakWifi Public Wi-Fi Network and its impact on the community. Encompassing more than eight square miles, the OakWifi mesh design utilized more than 1,100 wireless access points within 13 designated areas or zones. Unfortunately, OakWifi has largely been inoperable due to damages to the BRT fiber.

In the short-term, during the construction of the OaklandConnect MBN, the City should evaluate methods to restore OakWifi connectivity. This can be done by utilizing alternative fiber routes and reconnecting sections of the OakWifi network.

In the long-term, the City can explore how free, public Wi-Fi can be deployed in public gathering spaces, such as parks, recreation and community centers, plazas, temporary housing sites, and more. For example, districts like Jack London Square and Lake Merritt bring together thousands of locals and tourists every day to work, shop, eat, and play. Deploying free Wi-Fi in areas like these would benefit the community while still maintaining a focus on addressing the digital divide.

8. Coordinate with the State on the Middle Mile Initiative

As detailed in **Section 6.2**, the State is building a statewide middle mile network with significant routes through Oakland. It is recommended to continue coordinating with the State (specifically the California Department of Technology and their partners) relating to the State Middle Mile build-out in Oakland. For example, the State has already engaged the City about potential fiber huts locations. The City should support these construction efforts as they present opportunities to co-locate City and State middle mile systems to facilitate interconnectivity between the two systems. This will benefit ISPs using the networks and can enable joint maintenance operations, as required.

9. Develop Maintenance & Operations plans

Broadband operations and maintenance (O&M) are vital to OaklandConnect's health, longevity, and success. The City currently lacks documentation and data that is needed to manage its broadband assets. Identified issues include:

- Existing City-owned fiber optic circuit conditions are unknown and proper documentation doesn't exist in a standardized form.
- Fiber circuit data is often shared as "tacit knowledge" that is not formally documented.
- Fiber circuit information is oftentimes incorrect due to updates made during or since deployment that are not documented.

Considerations for maintenance plans include:

- **Clear delineation of roles & responsibilities between City departments and agencies** for operations, maintenance, and ongoing funding, delineated and incorporated by reference into applicable City policies and procedures (**See sample Operations and Maintenance responsibility matrix is in Appendix B**.)
- **Maintain GIS logging and build a Network Operations Center (NOC). The City should establish a repository in the City GIS system** of all city-owned optical circuits, beginning with circuits leaving the FOP campus, EOC, and Edgewater campus to connect to different city assets**.** This geodatabase can grow to include:
  - Fiber optic cables
  - Conduit and appurtenant facilities
  - Towers and tower sites
  - Communications facilities and services belonging to third parties that are used by the City
  - Real estate, poles and other assets leased to third parties for telecommunications purposes

NOTE: To develop cross-departmental maintenance policies and procedures, Appendix G includes a list of questions that can be used to facilitate workshops across City departments.

- Third party network data provided to the City in conjunction with such leases

    - **Incorporating Other Telecommunications Data:** Other telecommunications related data, such as those available through a future electronic plans submission program or collected by other agencies or provided by telecommunications companies, will also be incorporated into this geodatabase.

- **Network Operations Center (NOC)**. In conjunction with a GIS database, the City can explore building a NOC where all network assets, including fiber connections, electronics, and wireless equipment are monitored. A NOC can be a physical location or virtual using sophisticated software.
- **Emergency and On-Call Contractors**. The City must be prepared for fiber outages (e.g., unplanned cuts, vandalism, and other damages). Having emergency on-call contractors is one way to respond quickly to these types of incidents.

    - **Coordination with the State and partner agencies**. The State of California will be maintaining its middle mile network with substantial portions in Oakland. The City can explore cooperative agreements with State agencies for ongoing maintenance & operations of both City and State middle mile segments. In addition, the City should continue working with public partners such as BART, AC Transit, and others where joint operations are beneficial.

    - **OakWifi Maintenance**. If the public Wi-Fi network is restored as is recommended, maintenance and operations plans will need to include OakWifi access points.

    - **Maintenance Funding**. Earlier sections discuss possibilities for funding ongoing operations. The BMP recommends utilizing revenue from private partners to fund the ongoing maintenance of the network.

- ***Execute a broadband maintenance plan***, internal to the City. As part of this effort, the City developed a draft list of municipal fiber network responsibilities (dated 12/01/2023) for consideration during future workshops. Potential responsibilities to be discussed include system interruption, preventative maintenance, equipment configuration, and fiber strand assignments. Before publishing the responsibilities, the City should incorporate input from relevant departments and leadership.

10. Track & Pursue Federal & State Funding Opportunities

Broadband infrastructure has garnered policy and media attention in recent years, which has come along with increased funding for broadband development. The City should continue to ***leverage state and federal funding opportunities*** to expand the City broadband network, to connect community anchor institutions and MDUs, and enable low- and no-cost Last Mile connectivity for businesses and residents. Most notably, the Broadband Equity Access, and Deployment (BEAD) and California Advanced Services Fund (CASF) program should be pursued by the City to achieve the actions described in previous sections. The City should also leverage opportunities to incorporate fiber deployment into other grant funded capital investment projects.

8.2 Digital Equity Strategy Recommendations

1. Sustain the Digital Equity Ecosystem in Oakland

Residents in West Oakland and East Oakland have experienced a disproportionately low investment in communications infrastructure for decades, a legacy of redlining. This has a continued impact on education, healthcare, workforce, and economic development. For the first time, a coalition of diverse organizations has come together to champion Digital Equity for Oaklanders, we must seize this opportunity.

The City of Oakland should strengthen and continue to leverage its partnerships with these trusted community-based organizations and anchor institutions to expand access to devices and connectivity. By applying the following strategies, Oakland will be well-equipped to continue advocating and securing funding for residents.

- **Support anchor institutions and community partners to leverage and maximize funding opportunities.** With the end of COVID-era funding, it's more important than ever to support the City's existing Digital Equity coalition, which includes organizations like Tech Exchange, The Unity Council, Oakland Public Library, and Community Tech Network. These groups provide critical services such as digital literacy workshops, refurbished devices, and local tech support, yet often face limited budgets and resources.[89] To address the Digital Divide and resource constraints in Oakland, the City could serve as a centralized grant and funding resource hub, taking a more active role in promoting private, state, and federal funding opportunities related to digital access and offering direct assistance, or connections to application support services. The City could also facilitate bulk device purchasing through grant proposals, making technology more accessible and affordable for the community.
- **Understand the Digital Divide through the lived experience of residents.** Data is power. Oakland should continue to collaborate with partners to gather data at scale around digital access. This can be done by integrating needs assessments into existing data collection procedures. Working with partners such as the libraries, Oakland Unified School District, Oakland Housing Authority, and others, can ensure broad participation from community members. This data can serve as a reliable source of truth and play a crucial role in countering misleading narratives about the Digital Divide, keeping the focus on the real experiences of those directly affected by it.
- **Convene & coordinate locally and regionally:** To foster alignment and collaboration between the City and its partners, the City must find ways to bring this coalition together regularly. These convenings should include the following departments: Race and Equity, Economic and Workforce Development, Human Services, Housing and Community Development, and Information Technology. Leveraging funding sources like the Digital Equity Competitive, Capacity, or CASF (California Advanced Services Fund) can help sustain the digital support network, but even without this type of funding, the City can explore ways to facilitate regular convenings. These convenings can also serve to harness the community's collective power to push back against powerful industry lobby groups, giving the community a stronger voice to advocate for digital policies that truly address their needs.

2. Enhance & Strengthen City Policies to Expand Internet Access

Structural barriers in the broadband market persist. Anticompetitive behavior stifles competition and prevents a functioning broadband marketplace. The City should continue to leverage its diverse ecosystem, political will, and partnerships to adopt and implement policy that expands Internet access as a 21st-century necessity and utility.

- **Internet Choice Ordinance** – In September of 2021, the City of Oakland adopted a municipal ordinance Section 8.66 of the Oakland municipal code, that gives residents in the City of Oakland the right to select the ISP of their choice to serve their residence. Under Section 8.66, any certified ISP with an order for Internet service from a resident of a rental property in the City of Oakland may offer Internet service to that resident, and property owners may not deny access to that ISP. In addition to Section 8.66, federal regulation adopted by the Federal Communications Commission prohibits telecommunications carriers and cable providers from enforcing exclusive service agreements, exclusive revenue-sharing agreements, and graduated revenue-sharing agreements they may have entered into with property owners.[90]

The City of Oakland launched an online Report Internet Choice Violation Tool in 2024 for Oakland residents to self-report potential violations of this ordinance, enabling the City to identify dozens of properties that required formal notifications before adhering to the ordinance.[91] (See **Appendix H** for an example of a formal notification letter.)

Moving forward, the City should identify opportunities to raise awareness of the ordinance amongst property managers, residents, and ISPs. The City must continue to issue formal notifications to property managers that deny reasonable requests for access, and in the event that an property manager continues to refuse access, the City of Oakland can use its police power to facilitate opportunities for access to multiple occupancy buildings by communication service providers to enable occupants to obtain communications services from the providers of their choice, while respecting the rights of property owners.

- **Update City Building Standards to Improve Market Competition –** Monopolistic broadband markets in Oakland, as noted in this document, have led to poor infrastructure maintenance and increased costs for residents. Updating housing policies within the City can prevent monopolization of broadband services while ensuring better maintenance of infrastructure, yielding better prices for residents.

- Updating city building standards will ensure that developers and property owners are in compliance with the Internet Choice Ordinance aforementioned as well as the Federal Communications Commission (FCC) law passed in February 2022. This FCC law prohibits service providers from entering or enforcing agreements for exclusive revenue-sharing with owners of MDUs. This law also prohibits the operator from selling the wiring to the building owner and leasing it back for exclusive use.

The following recommendations were made in partnership with CTC consulting and Progress Public Affairs. The proposal incurred two rounds of feedback from industry experts, specifically with circulation through Sam Francisco Housing Action Coalition, a nonprofit housing advocacy organization. Industry partners believe that the added costs of including fiber Internet connectivity to each housing unit should be nominal for new construction projects. While some industry respondents shared concerns about technology requirements, industry acknowledged that they refer to low-voltage consultants for all internal wiring needs. A major low-voltage consultant for Bay Area developers responded in favor of cities adopting this proposed policy.

A local Internet service provider noted that, for new builds, this policy adds an estimated additional cost per unit of **$171.07**. This is a nominal cost when affordable housing in Oakland is estimated at $800,000. See **Appendix I** for recommended policy language.

3. Support State & Federal Digital Equity Policies

The City should utilize its public affairs agency to keep abreast of all state and federal bills pertaining to Digital Equity. The research collected by the City can serve as a critical resource in informing future federal and state digital equity bills. Furthermore, City employees have the technical expertise to serve as both a consultant and witnesses pertaining to the impact of these bills, as requested.

- **Broadband Mapping & Funding Eligibility –** By 2027, the State of California will make an $8B Internet infrastructure investment intended to direct critical resources to communities bearing the brunt of the Digital Divide. To allocate this once-in-a-generation investment, State and Federal regulatory agencies are responsible for generating maps that indicate which communities are prioritized for investment. As explored in **Section 4.2.1.3**, the maps systematically understate the lack of adequate networks in lower-income, predominantly BIPOC communities.
    - To develop maps that more accurately represent the actual lived experience of residents, the City should continue to support efforts to do the following:
- Partner with trusted anchor institutions to collect broadband availability and performance data at scale
- Advocate for the PUC and CDT to recognize community-sourced data (like the Hubble speed tests) as valid indicators of network performance
- Engage in the challenge process, submitting data to redesignate inaccurately classified broadband serviceable locations of the CPUC Broadband Map and the Federal Communications Commission' (see **Figure 14 and Figure 15**)
- Leverage local, regional, and State coalitions to advocate funding statutes to prioritize un- and underserved areas, including urban communities
- **Support Implementation of the State Digital Equity Plan –** The State of California published a statewide digital equity plan that calls for collaboration with trusted partners, such as local government organizations. The City should continue to track and partner with the state on digital equity programs, as opportunities arise.
- **Federal Funding Advocacy –** As discussed in **Section 4.1.3** with support from the Oakland Digital Equity Ecosystem partners, the FCC's American Connectivity Plan (ACP) peaked with ***26,000 Oakland households enrolled in the program, resulting in Oaklanders saving approximately $780,000 in Internet bills per month!*** The results, frankly, speak for themselves. Sadly, this funding expired earlier this year. The City should continue to advocate for refunding this and similar subsidy programs that support digital inclusion and equity goals.

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9. APPENDICES

Appendix A - Existing Fiber Network Project List

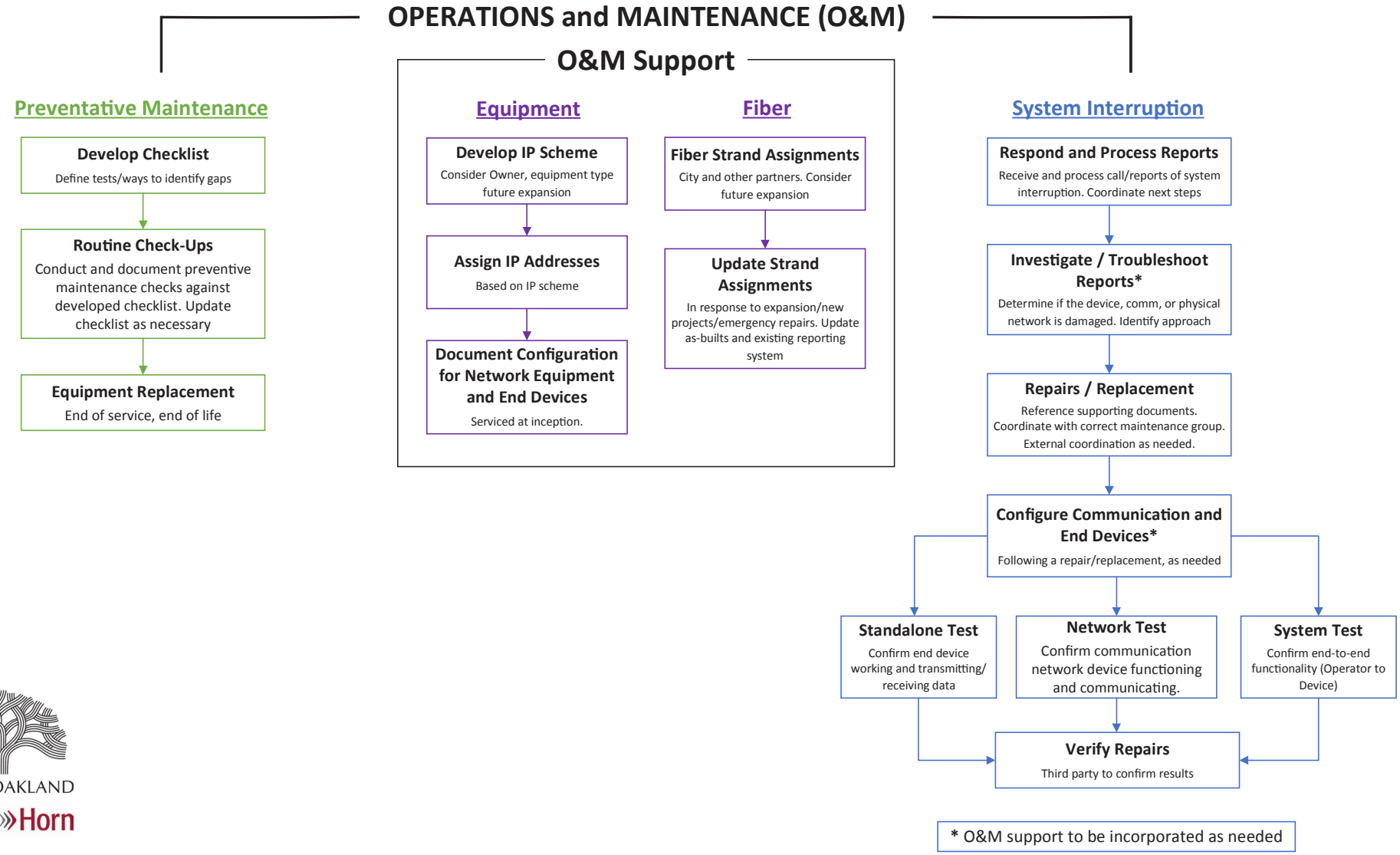
PROJECT ID	PROJECT NAME	SOURCE	END TERMINUS	CABLE SIZE	OWNERSHIP	OPERATOR	STREETS	PLAN DATE	USE	NOTES
C2	City of Oakland - TMC Project	City Hall	Emergency Operations Center	144 SMFO	City	City	Martin Luther King Jr Way 14th St	2007 est.	City of Oakland Traffic Signal System	Port of Oakland uses some strands (DAC)
C3	Port of Oakland - DAC	C1	Police Administration Building	24 SMFO	City	City	Washington St	2015 est.	Port Security/ Traffic Operations Network	
D	Port of Oakland - FITS	SP10	Harbor Facilities Complex	144 SMFO	Port	Port	Maritime St	5/31/2019	Port Security/ Traffic Operations Network	
E	Port of Oakland - Security Network Redundancy	Emergency Operations Center	HFC	144 SMFO	Port	Port	Broadway BART Facilities	11/12/2013	Port Security/ Traffic Operations Network	City of Oakland uses strands
F	Port of Oakland - Security Network Redundancy	City Hall	Emergency Operations Center	96 SMFO	Port	Port	17th St Clay St	11/12/2013	Port Security/ Traffic Operations Network	City of Oakland uses strands
G	City of Oakland BART Connection	City Hall	12th St BART Station	144 SMFO	City	City	Crossing 14th St	2013 est.	City Access to BART fibers - DRT connection?	
H1	Port of Oakland - SLC	Hub 2	SP27	144 SMFO	Port	Port	Maritime St	9/28/2017	Port Security/ Traffic Operations Network	
H2	Port of Oakland - SLC	SP27	SP28	144 SMFO	Port	Port	Maritime St	9/28/2017	Port Security/ Traffic Operations Network	
I	Port of Oakland - SLC	Hub 1	HFC	144 SMFO	Port	Port	Railroad Boundary	9/28/2017	Port Security/ Traffic Operations Network	
J	Port of Oakland - SLC	Hub 1	SP27	144 SMFO	Port	Port	14th St	9/28/2017	Port Security/ Traffic Operations Network	
K1	Port of Oakland - SLC	Hub1	SP30	144 SMFO	Port	Port	Railroad Boundary	9/28/2017	Port Security/ Traffic Operations Network	
L	Port of Oakland - SLC	SP21	Hub 2	144 SMFO	Port	Port	Bataan St	9/28/2017	Port Security/ Traffic Operations Network	
M	Port of Oakland - FITS	SP10	Hub 4	144 SMFO	Port	Port	Maritime St	5/31/2019	Port Security/ Traffic Operations Network	

PROJECT ID	PROJECT NAME	SOURCE	END TERMINUS	CABLE SIZE	OWNERSHIP	OPERATOR	STREETS	PLAN DATE	USE	NOTES
N	Port of Oakland - FITS	SP14	Hub 3	144 SMFO	Port	Port	7th St	5/31/2019	Port Security/ Traffic Operations Network	
O1	AC Transit East Bay BRT	City Hall	International Ave/42nd Ave	144 SMFO	City	City	12th St Lake Merritt Blvd International Blvd	10/3/2016	City of Oakland Traffic Signals	Shared conduit with Caltrans and/or AC Transit
O2	AC Transit East Bay BRT	Broadway	Oak St	48 SMFO	City	City	11th St	10/3/2016	City of Oakland Traffic Signals	Shared conduit with Caltrans and/or AC Transit
O3	AC Transit East Bay BRT	1st St	14th Ave	24 SMFO	City	City	12th St	10/3/2016	City of Oakland Traffic Signals	Shared conduit with Caltrans and/or AC Transit
P	AC Transit East Bay BRT	City Hall	International Ave/105th Ave	144 SMFO	City	City	12th St Lake Merritt Blvd International Blvd	10/3/2016	City of Oakland Building Connections (IT)	Shared conduit with Caltrans and/or AC Transit
Q1	Broadway Interconnect Project	City Hall	Broadway/5th Ave	96 SMFO	City	City	Broadway	8/30/2010	City of Oakland Traffic Signals	
Q2	Broadway Interconnect Project	City Hall	27th Ave	96 SMFO	City	City	Broadway	8/30/2010	City of Oakland Traffic Signals	
Q3	AC Transit Line 51 RAPID	27th Ave	College Ave	96 SMFO	City	City	Broadway	4/2/2014	City of Oakland Traffic Signals	
R	DRT	City Hall	Digital Realty (DRT)		City	City				
S	I-80 ICM	City Hall	W. Grand Ave	72 SMFO	City	City	San Pablo Ave	4/11/2011	City of Oakland Traffic Signals	Port of Oakland uses some strands for connection to Caltrans (FITS)
S1	I-80 ICM	W. Grand Ave	MacArthur Blvd	24 SMFO	City	City	San Pablo Ave	4/11/2011	City of Oakland Traffic Signals	
T	I-80 ICM	Caltrans Building	Cable U	288 SMFO	Caltrans	Caltrans	W Grand Ave	4/11/2011	Port Oakland Connection to Caltrans (FITS)	
U	I-80 ICM	San Pablo Ave	Lakeshore Ave	24 SMFO	City	City	W Grand Ave	4/11/2011	City of Oakland Traffic Signals	Port of Oakland uses some strands for connection to Caltrans (FITS)

PROJECT ID	PROJECT NAME	SOURCE	END TERMINUS	CABLE SIZE	OWNERSHIP	OPERATOR	STREETS	PLAN DATE	USE	NOTES
U1	I-80 ICM	Mandela Pkwy	San Pablo Ave	24 SMFO	City	City	W Grand Ave	4/11/2011	City of Oakland Traffic Signals	
V1	I-880 ICM North Alameda Segment	Emergency Operations Center	Brush St	144 SMFO	City	City	17th St	5/1/2017	City of Oakland Traffic Signals	
V9	I-880 ICM North Alameda Segment	18th St	I-880	144 SMFO	City	City	17th St Brush St 7th St E 12th St E 8th St San Leandro St	5/1/2017	City of Oakland Traffic Signals	36 strands reserved for IT
V2	I-880 ICM North Alameda Segment	18th St	I-880	144 SMFO	City	City	Castro St 8th St	5/1/2017	City of Oakland Traffic Signals	
V3	I-880 ICM North Alameda Segment	7th St	5th St	24 SMFO	City	City	Jackson St	5/1/2017	City of Oakland Traffic Signals	
V4	I-880 ICM North Alameda Segment	7th St	5th St	24 SMFO	City	City	Madison St	5/1/2017	City of Oakland Traffic Signals	
V5	I-880 ICM North Alameda Segment	7th St	5th St	24 SMFO	City	City	Oak St	5/1/2017	City of Oakland Traffic Signals	
V6	I-880 ICM North Alameda Segment	12th St	International Blvd	12 SMFO	City	City	Fruitvale Ave	5/1/2017	City of Oakland Traffic Signals	
V7	I-880 ICM North Alameda Segment	San Leandro St	Edgewater Dr	144 SMFO	City	City	Hegenberger Rd	5/1/2017	City of Oakland Traffic Signals	
V8	I-880 ICM North Alameda Segment	International Blvd	Doolittle Dr	144 SMFO	City	City	98th Ave	5/1/2017	City of Oakland Traffic Signals	
W	12th St Reconstruction Project	Oak St	E 18th St	144 SMFO	City	City	Lake Merritt Blvd 1st Ave		City of Oakland Traffic Signals	
X1	Lakeside Green Streets Project	Grand Ave	Thomas J Berkley Way	24 SMFO	City	City	Harrison St	2/18/2016	City of Oakland Traffic Signals	
X2	Lakeside Green Streets Project	Harrison St	Jackson St	24 SMFO	City	City	Lakeside Dr	2/18/2016	City of Oakland Traffic Signals	
Y	Oakland Airport ITS	Edgewater	Empire Rd	144 SMFO	City	City	Edgewater Dr Hegenberger Rd Airport Access Rd 98th Ave	11/1/2010	City of Oakland Traffic Signals	
Z1	Oakland Airport ITS	Pardee	Doolittle Dr	12 SMFO	City	City	Hegenberger Rd	11/1/2010	City of Oakland Traffic Signals	
Z2	Oakland Airport ITS	98th Ave	Doolittle Dr	12 SMFO	City	City	Airport Access Rd	11/1/2010	City of Oakland Traffic Signals	

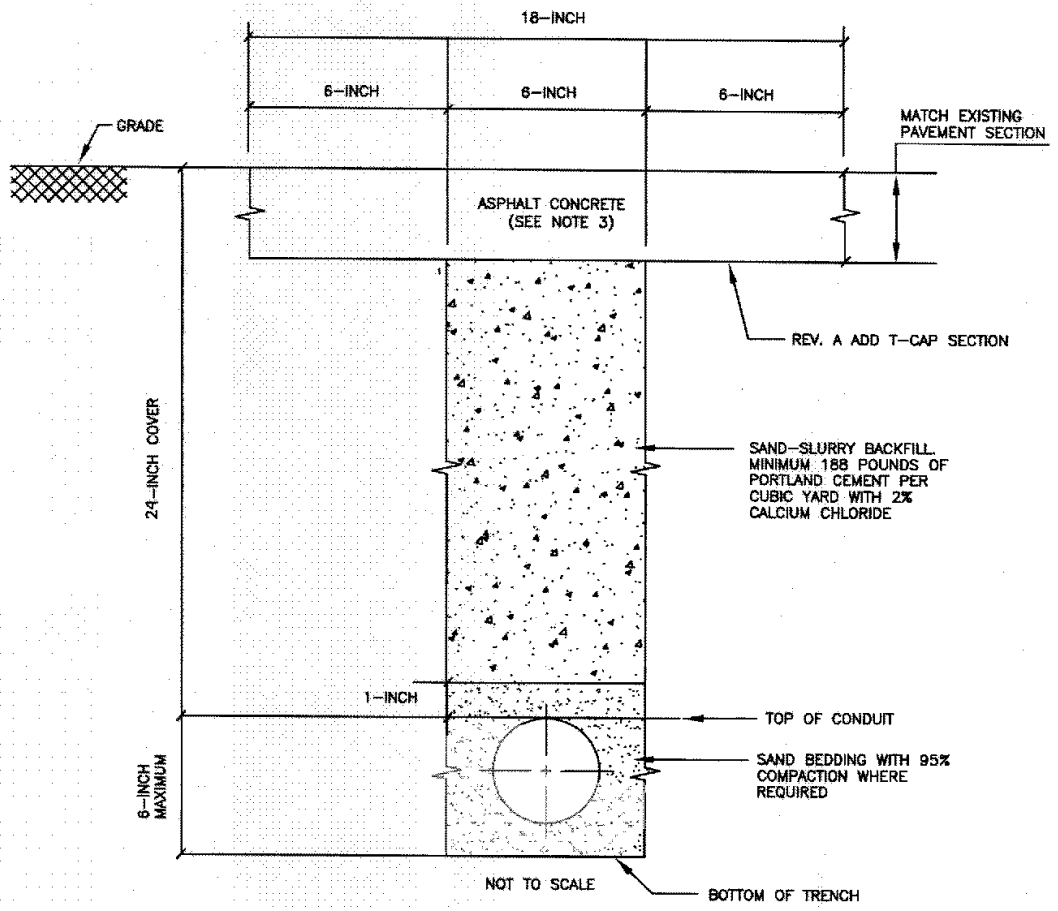
Appendix B - Operations and Maintenance Responsibility Matrix (sample)

Oakland Fiber Network Responsibilities



CITY OF OAKLAND
Kimley»Horn

Appendix C City of Oakland Conduit Construction Standard



NOTES:

1. THIS TRENCH DETAIL IS FOR STREET LIGHT AND TRAFFIC SIGNAL ONLY.
2. ALL DIMENSIONS ARE MINIMUM, UNLESS OTHERWISE NOTED
3. DELIVERY TAGS FOR ASPHALT CONCRETE, PORTLAND CEMENT CONCRETE AND BACKFILL MATERIAL SHALL BE SUBMITTED TO THE ENGINEER ON DEMAND. DELIVERY TAGS SHALL INDICATE THE MATERIALS SPECIFIED.
4. ASPHALT CONCRETE PAVING SHALL BE TYPE III D AR4000. ASPHALT CONCRETE PAVING SHALL BE MECHANICALLY COMPACTED WITH A WACKER BS 60Y VIBRATORY RAMMER OR APPROVED EQUAL. 95% RELATIVE COMPACTION SHALL BE REQUIRED. PAVING SURFACE SHALL BE FREE OF IRREGULARITIES.
5. PERMITTEE MAY ELECT TO ELIMINATE SAND BEDDING AND ENCASE CONDUIT IN SLURRY BACKFILL.

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CITY OF OAKLAND	PUBLIC WORKS AGENCY ELECTRICAL SERVICES DEPARTMENT		
TYPICAL CROSS SECTION FOR ROCKWHEELING AND TRENCH PAVING DETAIL	REGISTERED PROFESSIONAL ENGINEER PAUL M. A. CHAN NO. E9079 Exp. 9/30/08 ELECTRICAL STATE OF CALIFORNIA — REGISTERED ELECTRICAL ENGINEER	PWA ELECTRICAL SERVICES MANAGER DATE : JUNE 2002 REV. A DATE: SEPTEMBER 2005	DWG. E-92

Appendix D - Future Broadband Infrastructure Projects

PROJECT ID	PROJECT NAME	PROJECT LOCATIONS/ELEMENTS	PROJECT OBJECTIVE	STATUS	FIBER LENGTH (FT)	DEPENDENCIES
9	Oakland Connect - West Oakland	New fiber trunk through West Oakland on 8th St and Mandela Parkway	Provide redundancy to Existing City fiber, passes 4 public MDUs, highest priority business corridor	Funded	9450	
10	Oakland Connect - Downtown Oakland	New fiber trunk through downtown Oakland on 17th St from Broadway to Harrison, and on Harrison St from 19th to 14th	Provide redundancy to Existing City fiber, passes 3 public MDUs	Funded	2600	
11	Oakland Connect - East Peralta	New fiber trunk on 1E 18th St from Lakeshore Ave to 13th and on 13th from E 8th to E 18th	Provide redundancy to Existing City fiber, passes 5 public MDUs	Funded	5750	
12	Oakland Connect - Foothill Blvd	New fiber trunk on Foothill Blvd from Fruitvale to 73rd	Provide redundancy to Existing City fiber, passes 10 public MDUs, highest priority business corridors	Funded	26300	
13	Oakland Connect - MacArthur Blvd	New fiber trunk on MacArthur Blvd from 73rd to 98th	Passes 2 public MDUs, connect other Oakland Connect segments	Funded	8250	
14	Oakland Connect - OakWiFi Circumvent - 14th Ave	New fiber trunk along 12th St and 14th Ave from 13th Ave to International Blvd	Provide redundancy to existing City fiber used for OakWiFi	Future	1050	
15	Oakland Connect - 98th Ave	New fiber trunk on 98th Ave from International to Cherokee	Provide redundancy to Existing City fiber	Funded	4900	
16	Oakland Connect - Fruitvale Ave	New fiber trunk on Fruitvale Ave from International to MacArthur	Potential connection to State Middle Mile	Funded	6400	State Middle Mile
17	Oakland Connect - Seminary Ave	New fiber trunk on Seminary Ave from International to Foothill	Provide redundancy to Oakland Connect and Existing City fiber, passes 4 public MDUs	Funded	3550	
18	OakWiFi Circumvent - High St	New fiber trunk along High St from San Leandro St to Foothill Blvd	Provide redundancy to existing City fiber used for OakWiFi, potential State Middle Mile connection	Future	2150	Oakland Connect - Foothill Blvd
19	14th Ave	New fiber trunk on 14th Ave from International Blvd to MacArthur	Provide redundancy to existing City fiber, potential connection to State Middle Mile, passes 2 public MDUs	Future	7050	MacArthur Blvd
20	51st St	New fiber trunk on 51st St from Telegraph Ave to Broadway	Provide redundancy to existing City fiber	Future	3100	Telegraph Ave

PROJECT ID	PROJECT NAME	PROJECT LOCATIONS/ELEMENTS	PROJECT OBJECTIVE	STATUS	FIBER LENGTH (FT)	DEPENDENCIES
21	73rd Ave	New fiber trunk on 73rd Ave from San Leandro St to International Blvd	Provide redundancy to existing City fiber, potential connection to State Middle Mile, passes 1 public MDU	Future	3550	"State Middle Mile 73rd Active Routes to Transit"
22	98th Ave (East)	New fiber trunk along 98th ave from Burr St to I-580	Connection to State Middle Mile	Future	2950	"State Middle Mile Oakland Connect - 98th Ave"
23	Adeline St	New fiber trunk along Adeline St from San Pablo Ave to 16th St, returning to Grand Ave along Poplar St	Highest priority business corridor, provide redundancy to existing City fiber	Future	7300	
24	San Pablo Ave	New fiber trunk in existing conduit along San Pablo Ave from	Increase fiber from existing 24 SMFO to 144 SMFO for capacity to support residential broadband connections	Future	6180	
25	Lakeshore Ave	New fiber trunk creating a ring around Lake Merrit on Lakeshore Ave and Lakeside Drive, and connecting to existing City hubs along 14th St	Provide redundancy to Existing City fiber, potential State Middle Mile connection	Future	16740	
26	Mandela Pkwy	New fiber trunk along Mandela Pkwy from 8th St to Grand Ave	Provide redundancy to Oakland Connect - West Oakland fiber	Future	1950	Oakland Connect - West Oakland fiber
27	Peralta St	New fiber trunk on Peralta St from Grand Ave to San Pablo Ave	Provide redundance to existing City fiber, potential connection to State Middle Mile, passes 1 public MDU	Future	5550	San Pablo Ave
28	San Leandro Loop	New fiber trunk along San Leandro St from 98th Ave to 105th Ave, along 105th Ave to Edes Ave, and along Edes Ave to 98th Ave	Redundant loop through highest priority business corridor, potential State Middle Mile connection	Future	4950	
29	San Pablo Ave	New fiber trunk on San Pablo aver from MacArthur Blvd to Stanford Ave	Connect Existing San Pablo Ave fiber to proposed Stanford Ave Fiber	Future	4650	Stanford Ave
30	Stanford Ave	New fiber trunk on Stanford Ave from San Pablo Ave to Telegraph Ave	Potential connection to State Middle Mile, passes 1 public MDU	Future	6750	Telegraph Ave
31	Grand Ave	New trunk fiber in existing conduit along Grand Ave from MacArthur Blvd to Mandela Pkwy	Increase fiber from existing 24 SMFO to 144 SMFO for capacity to support residential broadband connections	Future	14060	
32	Munson Way	New fiber trunk on Munson Way from International Blvd to Foothill Blvd	Provide redundance to Oakland Connect fiber, passes one CAI	Future	800	Oakland Connect

Appendix E - Community Anchor Institution (CAI) Fiber Connection by Priority

Name	CATEGORY	ADDRESS	Oakland BEAD CAI List Status	CPUC Designation	BEAD ELIGIBILITY	MEDIAN HOUSEHOLD INCOME	% BELOW POVERTY LEVEL	% NON-WHITE	% HOUSEHOLDS RECEIVING FOOD STAMPS	CPUC SEVI SCORE	BUSINESS PRIORITY CORRIDOR	TOTAL EQUITY SCORE	OVERALL EQUITY PRIORITY
Asian Branch Library	Library	388 - 9th St, #190	BEAD Eligible	Unserved	Eligible	32077	30%	91%	30%	0.85359	Highest	22	Highest
Lincoln Square - Recreation Center	Recreation Center	250 10th St	Unresolved	Served	Ineligible	32077	30%	91%	30%	0.85359	Highest	22	Highest
Rainbow Teen Center	Recreation Center	5818 International Blvd	BEAD Eligible	Unserved	Eligible	46019	31%	91%	35%	0.867921	Highest	22	Highest
Frank G. Mar Head Start Center	Educational	274 12th St	BEAD Eligible	Unserved	Eligible	32077	30%	91%	30%	0.85359	High	21	Highest
Martin Luther King, Jr. Branch Library	Library	6833 International Blvd	Served	N/A	N/A	44100	21%	90%	32%	0.909181	Highest	20	Highest
Fire Station 12	Fire Station	822 Alive St	BEAD Eligible	Unserved	Eligible	34417	26%	90%	29%	0.691687	Highest	20	Highest
Digital Arts & Culinary Academy	Recreation Center	5818 International Ave	Unresolved	Served	Ineligible	46019	31%	91%	35%	0.770223	High	20	Highest
Lion Creek Head Start	Educational	6818 Lion Way Ste 110	BEAD Eligible	Unserved	Eligible	44100	21%	90%	32%	0.934011	Medium	19	Highest
San Antonio CDC Head Start	Educational	2228 E 15th St	Served	N/A	N/A	51292	19%	91%	26%	0.867921	Highest	18	Highest
DeFremery Pool	Recreation Center	1269 18th St	Unresolved	Served	Ineligible	46031	33%	81%	34%	0.693172	Medium	18	Highest
Melrose Branch Library	Library	4805 Foothill Blvd	Served	N/A	N/A	57961	22%	93%	29%	0.878802	Medium	17	Highest
Fremont Pool	Recreation Center	4550 Foothill Blvd	Served	N/A	N/A	57961	22%	93%	29%	0.878802	Medium	17	Highest
Firehouse #18	Utility	1700 50th Ave	Served	N/A	N/A	57961	22%	93%	29%	0.878802	Medium	17	Highest
85th Avenue Head Start Center	Educational	8501 International Blvd	Served	N/A	N/A	54000	26%	91%	19%	0.877859	High	17	Highest
Concordia - Girls Inc.	Educational	3000 62nd Avenue	Not on City List	N/A	N/A	45500	18%	90%	18%	0.820473	Medium	16	Highest
African-American Museum & Library	Library	659 14th St	BEAD Eligible	Unserved	Eligible	45560	18%	81%	22%	0.783938	High	16	Highest
San Antonio Recreation Center	Recreation Center	1701 E 19th St	Served	N/A	N/A	69097	19%	89%	27%	0.693172	Highest	16	Highest
Head Start Day Care Center	Educational	1270 93rd Ave	Unresolved	Served	Ineligible	66602	17%	93%	13%	0.876381	High	15	Highest
Sanborn (Carmen Flores) Recreation Center	Recreation Center	1637 Fruitvale Ave	Unresolved	N/A	N/A	55000	17%	90%	18%	0.899991	High	15	Highest
Fire Station 05	Fire Station	934 34th St	Served	N/A	N/A	95011	30%	70%	21%	0.767654	Highest	15	Highest
Fire Station 27	Fire Station	8501 Pardee Dr	BEAD Eligible	Unserved	Eligible	70769	15%	88%	22%	0.804169	High	14	Higher
Eastmont Branch Library	Library	7200 Bancroft Ave Suite 211	BEAD Eligible	Unserved	Eligible	80114	16%	92%	16%	0.837525	Highest	14	Higher
Fire Station 20	Fire Station	1401 98th Ave	Served	N/A	N/A	54698	16%	94%	15%	0.889298	High	14	Higher
Sun Gate Head Start Center	Educational	2563 International Blvd	Unresolved	Served	Ineligible	64879	17%	76%	17%	0.724534	High	14	Higher
Fire Station 13	Fire Station	1225 Derby St	Unresolved	Served	Ineligible	64879	17%	76%	17%	0.724534	High	14	Higher
Cesar Chavez Branch Library	Library	3301 E 12th St	BEAD Eligible	Unserved	Eligible	64879	17%	76%	17%	0.724534	High	14	Higher
Franklin Head Start	Educational	1010 East 15th St	BEAD Eligible	Unserved	Eligible	61204	19%	84%	21%	0.80617	Medium	14	Higher
Franklin Recreation Center	Recreation Center	1010 East 15th St	BEAD Eligible	Unserved	Eligible	61204	19%	84%	21%	0.842015	Medium	14	Higher
Elmhurst Branch Library	Library	1427 88th Ave	Served	N/A	N/A	54012	14%	94%	14%	0.907177	High	13	Higher
Fire Station 23	Fire Station	7100 Foothill Blvd	Served	N/A	N/A	80114	16%	92%	16%	0.837525	Highest	13	Higher
Verdese Carter Recreation Center	Recreation Center	9600 Sunnyside St	Served	N/A	N/A	54698	16%	94%	15%	0.889298	Medium	13	Higher
West Oakland Teen Center	Recreation Center	3233 Market St	Served	N/A	N/A	95011	30%	70%	21%	0.767654	Medium	13	Higher
Brookfield Head Start Center	Educational	9600 Edes Ave	Served	N/A	N/A	70769	15%	88%	22%	0.804169	Medium	12	Higher
Fire Station / Storage Facility	Recreation Center	1270 93rd Ave	Unresolved	Served	Ineligible	66602	17%	93%	13%	0.413199	Medium	12	Higher

Name	CATEGORY	ADDRESS	Oakland BEAD CAI List Status	CPUC Designation	BEAD ELIGIBILITY	MEDIAN HOUSEHOLD INCOME	% BELOW POVERTY LEVEL	% NON-WHITE	% HOUSEHOLDS RECEIVING FOOD STAMPS	CPUC SEVI SCORE	BUSINESS PRIORITY CORRIDOR	TOTAL EQUITY SCORE	OVERALL EQUITY PRIORITY
Lake Merritt Garden Center	Recreation Center	666 Bellevue Ave	BEAD Eligible	Unserved	Eligible	69984	18%	58%	14%	0.851761	Medium	12	Higher
Fire Station 01	Fire Station	1605 MLK, Jr Way	Unresolved	Unserved	Eligible	115750	19%	76%	13%	0.704761	High	12	Higher
Fire Station 04	Fire Station	1235 East 14th St	BEAD Eligible	Unserved	Eligible	56763	13%	75%	14%	0.83134	Medium	11	Higher
Fire Station 03	Fire Station	1445 14th St	Served	N/A	N/A	96200	19%	70%	24%	0.728362	Medium	11	Higher
Broadway Early Head Start	Educational	2619 Broadway St	BEAD Eligible	Unserved	Eligible	104226	12%	62%	11%	0.742227	High	10	Higher
Fire Station 15	Fire Station	455 27th St	Unresolved	Served	Eligible	104226	12%	62%	11%	0.742227	High	10	Higher
Fire Station 26	Fire Station	2611 98th Ave	Served	N/A	N/A	84135	13%	88%	17%	0.718494	Medium	10	Higher
West Grand Head Start	Educational	1058 West Grand Ave	Unresolved	Served	Ineligible	88304	16%	69%	11%	0.842015	Medium	10	Higher
Rotary Nature Center	Park	568 Bellevue Ave	Unresolved	N/A	N/A	69984	18%	58%	14%	0.490868	Medium	10	Higher
Junior Center of Art and Science	Recreation Center	558 Bellevue Ave	Not on City List	N/A	N/A	69984	18%	58%	14%	0.490868	Medium	10	Higher
Head Start Main Office 5th Floor	Educational	150 Frank Ogawa Plaza	Unresolved	Served	Ineligible	74931	12%	74%	19%	0.358173	Low	9	High
Malonga Casquelourd Center for the Arts (Alice Arts Center)	Recreation Center	1428 Alice St	Unresolved	Served	Ineligible	89021	0%	66%	12%	0.490868	High	7	High
Main Library	Library	125 14th St	BEAD Eligible	Unserved	Eligible	89021	0%	66%	12%	0.490868	Medium	6	High
Mosswood Recreation Center	Recreation Center	3612 Webster St	Unresolved	Served	Ineligible	115045	9%	41%	4%	0.877859	Medium	6	High
Fire Station 17	Fire Station	3344 High St	Served	N/A	N/A	113438	16%	65%	5%	0.420794	Medium	6	High
Central Kitchen	Educational		Unresolved	Served	Ineligible	84063	18%	47%	5%	0.184718	Low	6	High
Downtown Oakland Multipurpose Senior Center (Veteran's Memorial Hal	Recreation Center	200 Grand Ave	Unresolved	Served	Ineligible	84063	18%	47%	5%	0.184718	Low	6	High
Jack London Aquatic Center	Recreation Center	115 Embarcardero	Unresolved	N/A	N/A	148235	1%	58%	2%	0.691687	Medium	5	High
Live Oak Swimming Pool	Pool	1055 Mac Arthur Blvd	Unresolved	Served	Ineligible	105222	8%	58%	6%	0.402924	Medium	5	High
Fire Station 08	Fire Station	463 51st St	Served	N/A	N/A	93121	11%	52%	11%	0.44396	Low	5	High
Dimond Branch Library	Library	3565 Fruitvale Ave	BEAD Eligible	Unserved	Eligible	114083	11%	53%	16%	0.407906	Low	5	High
Bushrod Recreation Center	Recreation Center	560 59th St	Unresolved	Served	Ineligible	95078	10%	46%	5%	0.29554	Medium	4	High
Fire Station 02	Fire Station	29 Jack London Sq	Not on City List	N/A	N/A	176103	12%	48%	0%	0	Medium	4	High
FM Smith Recreation Center	Recreation Center	1969 Park Blvd	Served	N/A	N/A	112656	13%	55%	7%	0.33898	Medium	4	High
Fire Station 10	Fire Station	172 Santa Clara Ave	Served	N/A	N/A	126075	9%	44%	3%	0.443531	Medium	3	High
Fire Station 16	Fire Station	3600 13th Ave	Served	N/A	N/A	151860	3%	46%	5%	0.297496	Medium	2	High
Temescal Branch Library	Library	5205 Telegraph Ave	Served	N/A	N/A	164000	7%	38%	6%	0.35119	Low	2	High
Lakeview Branch Library	Library	550 El Embarcadero	BEAD Eligible	Unserved	Eligible	115156	8%	49%	3%	0.187946	Low	2	High
Studio One	Recreation Center	365 45th St	Served	N/A	N/A	115045	9%	41%	4%	0.358173	Low	2	High

Appendix F - Potential Wireless Hubs

NAME	ADDRESS	NUMBER OF STORIES	BUILDING TYPE
Jefferson Oaks Apartments	1424 Jefferson St	6	OHA MDU
Harrison Towers	1621 Harrison St	12	OHA MDU
Harrison Street Senior Housing	1633 Harrison St	6	OHA MDU
Hall of Justice-County Offices & Courts	600 Washington St	6	Office
Malonga Casquelourd Center for the Arts (Alice Arts Center)	1428 Alice St	7	Recreation Center
Hall of Justice-Police Administration Bldg	455 7th St	8	Office
Lionel J. Wilson Building	150 Frank Ogawa Plaza	8	Office
Dalziel Building	250 Frank Ogawa Plaza	6	Office
Fire Station 01	1605 MLK, Jr Way	2	Fire Station
Fire Station 02	29 Jack London Sq	3	Fire Station
Fire Station 03	1445 14th St	3	Fire Station
Fire Station 04	1235 East 14th St	2	Fire Station
Fire Station 05	934 34th St	1	Fire Station
Fire Station 06	7080 Colton Blvd	2	Fire Station
Fire Station 07	1006 Amito Dr	2	Fire Station
Fire Station 08	463 51st St	3	Fire Station
Fire Station 10	172 Santa Clara Ave	2	Fire Station
Fire Station 12	822 Alive St	2	Fire Station
Fire Station 13	1225 Derby St	2	Fire Station
Fire Station 15	455 27th St	2	Fire Station
Fire Station 16	3600 13th Ave	1	Fire Station
Fire Station 17	3344 High St	1	Fire Station
Fire Station 18	1700 50th Ave	3	Fire Station
Fire Station 19	5776 Miles Ave	2	Fire Station
Fire Station 20	1401 98th Ave	2	Fire Station
Fire Station 21	13150 Skyline Blvd	1	Fire Station
Fire Station 22	751 Air Cargo Road	3	Fire Station
Fire Station 23	7100 Foothill Blvd	1	Fire Station
Fire Station 24	5900 Shepherd Canyon Rd	2	Fire Station
Fire Station 25	2795 Butters Dr	1	Fire Station
Fire Station 26	2611 98th Ave	2	Fire Station
Fire Station 27	8501 Pardee Dr	2	Fire Station
Fire Station 28	4615 Grass Valley Rd	1	Fire Station
Fire Station 29	1016 66th Ave	2	Fire Station

Appendix G - Fiber Network Maintenance Workshop Questions

Develop list of questions to be discussed during workshops with City staff. Questions that could be discussed during the workshops include:

- How does the City currently handle optical network data and information and how is that stored and shared?
- How does the City make decisions today about how and why they deploy fiber optic infrastructure for both on-campus and OSP deployments?
- What departments and uses deploy fiber optic infrastructure and what is their current process for doing so?
- What is the process for cross-departmental review of deployment?
- What are the gaps in process for any and all of the above?
- Does the City have staff trained to operate and maintain broadband infrastructure?
- Is the City able to allocate funds and staff to operate and maintain broadband infrastructure?
- For a jurisdiction partnership or JPA, what cities/counties/organizations would Oakland be interested in partnering with?
- Would the City be interested in sharing O&M costs with a third-party operator?
- What funding model is most appropriate for City broadband infrastructure operations and maintenance?

Appendix H - Formal Internet Choice Notification (sample)

CITY OF OAKLAND

150 FRANK H. OGAWA PLAZA, SUITE 7335 * OAKLAND, CALIFORNIA, 94612
INFORMATION TECHNOLOGY DEPARTMENT **(510) 929-2410**

[Date]

To Whom It May Concern,

We write to you today to share information about your rights and the rights of your residents regarding Internet service providers (ISPs) in your building. The City of Oakland is working to ensure that all of our residents have access to high-quality, affordable Internet. Our property owners and managers are key to this goal.

In September of 2021, the City of Oakland adopted a municipal ordinance, Section 8.66 of the Oakland municipal code, that gives residents in the City of Oakland the right to select the ISP of their choice to serve their residence. Under Section 8.66, any certified ISP with an order for Internet service from a resident of a rental property in the City of Oakland may offer Internet service to that resident, and property owners may not deny access to that ISP.

In addition to Section 8.66, federal regulation adopted by the Federal Communications Commission prohibits telecommunications carriers and cable providers from enforcing exclusive service agreements, exclusive revenue-sharing agreements, and graduated revenue-sharing agreements they may have entered into with property owners.

The City of Oakland has been notified that one or more occupants at [ADDRESS] have requested service, but their chosen ISP has been denied access to the property to provide that service. The City of Oakland has also been informed that the chosen ISP may have been told that [ADDRESS] has an exclusivity agreement with a provider that already offers service in the building. These denials of access are in violation of Section 8.66, and exclusive service agreements with telecommunications carriers and cable providers violate the FCC's rules.

Under Section 8.66.130, occupants at [ADDRESS] and their chosen ISP may have recourse against the property owner, including for monetary relief equal to the greater of actual financial damages or $1,000, as well as attorneys' fees. Continuing to deny service requests and failing to come to an agreement with an ISP with pending service requests from occupants at [ADDRESS] may also subject the property owner to civil penalties of up to $500 for each day such a violation is committed or continues, as set forth in Section 8.66.150.

We therefore encourage you to revisit any previously denied requests for Internet services at [ADDRESS] and confirm to our office that any such requests will be honored, as required by Section 8.66.

We also encourage you to review your agreements with existing telecommunications carriers or cable providers offering service at [ADDRESS] to ensure that those agreements are not in violation of the FCC's prohibition on exclusive service agreements, exclusive revenue sharing agreements, and graduated revenue sharing agreements.

Please confirm by [Date] that you will comply with the aforementioned laws and Internet service requests will be honored. All Oaklanders deserve and are legally entitled to their choice of ISP.

Regards,

[Signature]

[Name]

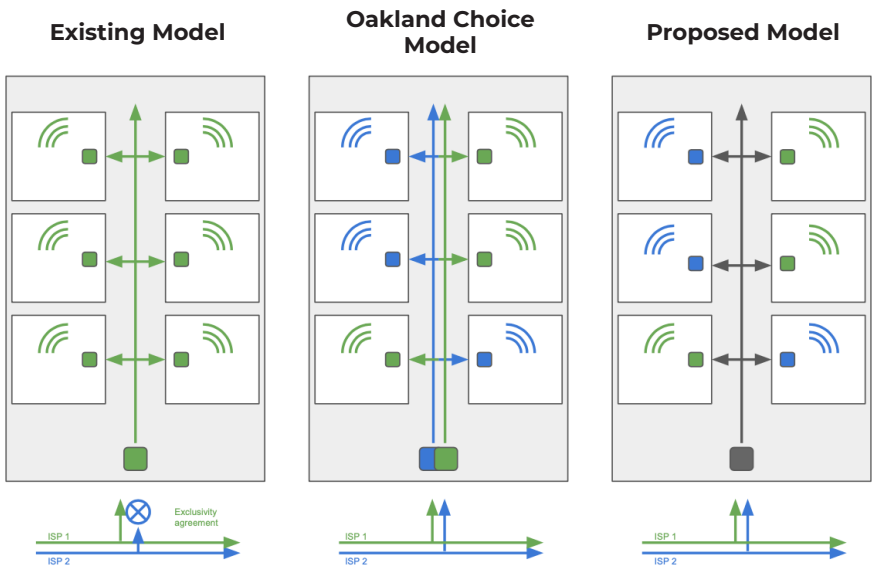
City of Oakland

Information Technology Department, Broadband Division

Appendix I - Proposed Housing and Community Development Policy for Updating City Building Standards

Proposed Housing and Community Development Policy for Updating City Building Standards:

- **Access to broadband service**: Projects must ensure that each unit is capable of reliably receiving broadband service, which is defined by this program as Internet access services offering speeds that meet or exceed 100/100 Mbps, or the most current broadband definition speed standard set by the Federal Communications Commission, whichever broadband service speeds are greater.
- **Competitive access network design**: Projects must ensure that each entity offering broadband service to residents in the project building can use the in-building facilities installed under this NOFA to connect those services to each unit in the building upon a resident's request. The project must ensure competitive access by installing, owning, and controlling the following in-building facilities:
  - In-building wiring of CAT6A or better from the minimum point of entry (MPOE) to a communications room or other accessible location that is sufficient to support broadband service to each unit at speeds that reliably meet or exceed 100/100 Mbps.
  - Wiring from the distribution frame connected to each unit should have a length of no more than 328 feet and be placed in a raceway or conduit with a minimum width of 1 inch.



  - Project should not enter into a building access, building entry, marketing, or similar agreement with a broadband service provider that provides the broadband service provider exclusive access or exclusive use of any of the project's in-building facilities such as fiber wiring, home run wiring, in-unit wiring, or other facilities that would prohibit a different broadband service provider to effectively provide service to a customer. An exception should only be considered if the project will enter a bulk contract with a broadband service provider to provide either free or highly discounted below-retail broadband service to all residents of the property.
  - Project should not enter into a building access, building entry, marketing, or similar agreement with a broadband service provider that includes anti-bulking language prohibiting the project from offering free or highly discounted service to residents (e.g. - free wi-fi network).

- **Digital inclusion**: As an element of the project's Residential Service Plan, projects are strongly encouraged to:
  - Supply and maintain computers in a common area
  - Provide free Wi-Fi-based broadband services in at least common areas
  - Provide free broadband service to each unit
  - Provide education and information about federal and state broadband affordability programs, including but not limited to the Affordable Connectivity Program and federal and California LifeLine programs
  - Offer computing and digital skills training opportunities
  - Provide a space for residents to use provided computers and obtain training and tutoring.