LakeCounty

LAKE COUNTY DIGITAL GROWTH INITIATIVE

LAKE COUNTY

BROADBAND & DIGITAL EQUITY ACTION PLAN

APPENDIX E. POTENTIAL FIBER EXPANSION MODELS

Contents

There are a spectrum of fiber expansion models the County may consider to increase fiber availability

Overview

Appendix E provides on overview of potential future models the County may consider to expand broadband and fiber infrastructure in Lake County. The spectrum of models range from a full publicly-owned fiber network to completely privately owned and operated networks (the current state). The intermediary models demonstrate varying degrees of county investment and intervention, highlighting the diverse strategies available for fiber and broadband expansion. Each model is explored further in the subsequent pages which include detail on estimated cost, benefits and challenges, implementation considerations, and case studies.

The estimated costs for the different fiber expansion models are based on engineering estimates provided by our engineering partner, Jules Madison. The costs are intended to be high-level estimates and include numerous assumptions that are outlined on pages 10-12. Determining more accurate costs for each model will require a comprehensive study that includes network designs, deeper analysis of existing infrastructure, and detailed cost modeling.

Overall, the County can use this research to further evaluate potential future solutions for expanding fiber access. When evaluating the different models, the County should consider the following decision factors:[1]

- **Capital Availability:** Is there sufficient funding available to support the upfront capital and on-going operational expenditure of the project?
- **Existing Infrastructure:** Is there existing infrastructure that can be utilized to build the network?
- **Partnership Options:** Are there potential ISP partners that are interested in expanding fiber infrastructure in Lake County?
- **Objective and Risk Tolerance:** Is there strong local support for the County to build and own a fiber network? Is there a focus on meeting strict financial targets and ensuring predictable financial outcomes?

Spectrum of potential fiber expansion models

	Model	Description
1	**Full Publicly Owned FTTP network**	The County funds, builds, and operates a full Fiber-to-the-Premises (FTTP) network that connects residents and businesses countywide.
2	**Publicly Owned, Privately Serviced**	The County funds and builds a full FTTP network and partners with a private entity to operate the network and provide service to customers.
3	**Publicly Owned Fiber Middle-Mile**	The County funds, builds, and operates a countywide middle-mile fiber network that connects government buildings and community anchor institutions.
4	**Publicly-Owned Conduit Network**	The County funds, builds, and maintains a countywide conduit network that it can lease to ISPs for the purpose of providing fiber connections to residents and businesses.
5	**Public Financing of Private Infrastructure**	The County awards grants to ISPs who make binding commitments to deploy fiber infrastructure and provide service to residents and businesses.
6	**Private Developer Open Access Network**	The County can provide a private entity access to its right of ways to fund, build and operate an open access fiber network connecting residents and businesses.
	Full Private Broadband [Current State]	The County relies on private investment to expand fiber and broadband infrastructure.

High County Investment & Intervention

Low County Investment & Intervention

Source: US Ignite Report

Publicly funded, built, and operated full Fiber-to-the-Premises network

Full Publicly Owned FTTP Network	
Description	The County funds, builds, and operates a full Fiber-to-the-Premises (FTTP) network that connects all residents and businesses countywide.
Benefits	• **Affordability:** The county will have more control over pricing and can potentially provide more affordable service options to residents.[2] • **Universal Access:** A county-owned network can provide service to all residents regardless of location or profitability concerns. • **Economic Development:** A fiber network can have a positive impact on the local economy through job creation and productivity gains.[2] • **Speed & Reliability:** A fiber network provides faster, and more reliable speeds compared to other broadband technologies.[3]
Challenges	• **Cost:** A county-owned network requires significant upfront and on-going capital expenditure. • **Risk:** A county-owned network can expose the County to significant risk, especially if the County does not have the financial resources to operate and maintain the network in the long-term.[4] • **Competition:** The county-owned network will face competition from incumbent ISPs in subscribing customers to the network. • **Expertise:** The county may not have the expertise needed to build, operate and maintain a FTTP network effectively.
Estimated Costs	The construction of a countywide FTTP network is estimated to cost **upwards of $1.5 billion** (approx. $7,000 cost per passing). This estimate does not include the **operational expenditure** of creating a new department to manage the day-to-day operations and provide service.*

Case Study Snapshot	
Chattanooga, TN *Population: 184,086* *Households: 76,508*	Chattanooga is cited as often one of the most successful examples of municipal broadband. In 2010, the city-owned utility, EPB launched the first citywide 1G network to provide fiber service to all county locations. At the time of construction, the network was expected to cost ~$220M. EPB received a $111M award from the U.S Department of Energy to subsidize the network. EPB faced numerous lawsuits from telecommunications companies such as Comcast. In 2015, the network was upgraded to offer 10G speeds and later in 2022 to 25G.
Wilson, NC *Population: 47,606* *Households: 19,535*	Wilson, a city in northeastern North Carolina, developed its own citywide fiber-to-the-premises network called Greenlight. The project began in 2008 and was financed using $29M in Certificates of Participation (COPs). The project received significant legislative backlash from ISPs including AT&T and Century Link who pursued campaigns to restrict competition in the state.

Implementation Considerations

- **Take Rates:** Take rate, or the percentage of customers with access to the network who choose to subscribe, will have an impact on the networks' revenue.[5]
- **Permits:** The County will need to obtain permits from numerous entities including IDOT, local municipalities, environmental agencies, railroads etc.).
- **Network Topology:** The County will need to access whether underground or ariel fiber is most feasible for this project.

Key Takeaways

Full publicly owned FTTP networks have generally been pursued by municipalities that have either existing backbone infrastructure, sufficient access to capital, strong community support, experience operating a utility and/or limited options for ISP partners. While some areas have been able to leverage federal grant funding to subsidize the cost, the majority of municipalities have financed a full FTTP network using general obligation bonds.

** Methodology and assumptions used to determine the estimated cost are provided on page 10.*

Publicly funded and built, privately operated and serviced full Fiber-to-the-Premises network

Publicly owned, privately serviced FTTP Network	
Description	The County funds and builds a FTTP network that connects residents and businesses countywide. The County enters into a partnership with a private ISP where the county retains ownership of the network, and the partner leases access to the fiber infrastructure, manages the network and provides service to residents and businesses (based on the Westminster Model).[6]
Benefits	• **Control:** The County will retain ownership of the entire FTTP network. • **Universal Access:** The county network can provide service to all residents regardless of location or profitability concerns. • **Risk Sharing:** Under this model, risk there will be shared between the county and the private entity that will operate and service the network. • **Expertise:** The County would not need expertise in managing the operational and customer service aspects of the network.
Challenges	• **Cost:** A fiber network requires significant upfront and on-going capital expenditure. • **Partner:** The County will need to identify a partner that is willing to engage in this type of agreement. • **Lease Fee:** The county will need to agree on a lease fee with the partner that will make the project feasible for both the county and the partner.[6]
Estimated Costs	Under this model the build-cost will be the same as the full county-owned FTTP model (detailed on page 4). However, the County will save on overhead costs as it will not need to operate the network or provide service. The construction of a countywide FTTP network is estimated to cost **upwards of $1.5 billion** (approx. $7,000 cost per passing).*

Case Study Snapshot	
Westminster, MD *Population: 20,393* *Households: 7,736*	In 2012, Westminster leveraged Carrol County's 160-mile fiber backbone network, to build a city-wide FTTP network. The project cost $21M and was financed through bonds. The city partnered with ISP, Ting to serve as the operator and service provider. Under the contract the City retains ownership of the entire dark fiber infrastructure. Ting leases the dark fiber from the City and provides services to residents. Ting pays a monthly "per passing" fee based on the number of premises that the network passes and the lease fee increases based on the number of subscribers—incentivizing Ting to sign-up residents.[4]
Leverett, MA *Population: 1,794* *Households: 776*	In 2011, the town issued a $3.6M general obligation bond to fund a full FTTP network. Leverett separated the project into steps and entered into multiple contracts with different private entities to build, operate, maintain and provide service on the network. Leverett owns the entire FTTP infrastructure. To ensure that prices are affordable for customers Leverett does not charge the service provider, Crocker Communications, for utilizing the FTTP network.

Implementation Considerations

- **Partner Interest:** Before pursuing this model, the County will need to engage potential partners to determine whether there is interest in this type of public-private partnership.
- **Permits:** The County will need to obtain permits from numerous entities including IDOT, local municipalities, environmental agencies, railroads etc.)
- **Network Topology:** The County will need to access whether underground or ariel fiber is most feasible for this project.

Key Takeaways

Like the full FTTP network model, this model requires significant upfront capital expenditure to construct and maintain a countywide network. Contracting with a third party to service and operate the network could reduce operational expenditure. For this model to be a feasible option, the County would need to engage entities to understand whether there are interested partners willing to enter into an agreement to provide service and operate the network.

** Methodology and assumptions used to determine the estimated cost are provided on page 10.*

Publicly funded, built, and operated middle-mile fiber network to connect government buildings and community anchor institutions

Publicly Owned Fiber Middle-Mile	
Description	The County funds, builds and operates a countywide middle-mile fiber network that connects government buildings and community anchor institutions (CAIs).
Benefits	• **Last-mile Connections:** The County can leverage its middle-mile network to encourage ISPs to provide last-mile FTTP connections to residents and businesses. • **Competition:** By lowering the cost for last-mile deployment a middle-mile network can increase competition in Lake County.[7] • **Reliable Connectivity**: The County can provide public buildings and community anchor instructions with reliable, high-speed fiber connectivity to power their operations.[7]
Challenges	• **Cost:** A County-owned fiber middle-mile network requires significant upfront and on-going capital expenditure. • **Revenue:** The revenue of a middle-mile network will likely be limited to public buildings and CAIs. • **Operation:** A new department would need to be created to manage the operation of the network and provide service to public buildings and CAIs.
Estimated Costs	The construction of a county-wide middle-mile fiber network that connects 1,000 government buildings and CAIs is estimated to cost **upwards of $530 million**, using the same feeder/ring footage assumptions as the full FTTP network.*

Case Study Snapshot	
Urbana-Champaign, IL *Population: 223,265* *Households: 91,862*	The cities of Urbana and Champaign and The University of Illinois created a consortium called UC2B to expand broadband infrastructure. In 2010, UC2B received a $22.5M award from the NTIA and a $3.5M award from the State of Illinois. In addition, UC2B partners invested $3.4M of their own funding to build over 180 miles of middle-mile fiber network that connects over 250 CAI's. As a pilot, the project also provided FTTP connections to 1000 households in low-income areas. In 2013, UC2B partnered with iTV-3 (bought by I-3 broadband) to be the network provider and service provider. Additionally, iTV-3 agreed to expand the network by leasing the existing fiber infrastructure and network equipment from UC2B to build last-mile connections (which iTV-3 owns).
Cook County, IL *Population: 5,109,252* *Households: 2,110,498*	In 2014, South Suburban Mayors and Managers Association and Cook County partnered to develop a fiber middle-mile network along I-57. They received a $6.1M grant from the State of Illinois and Cook County provided $10M of its own funding. They partnered with Urbancom.net to operate the network. Urbancom.net also constructed and operates a co-location data center that can house servers for CAIs.

Implementation Considerations

- **Municipal Buy-In:** Villages and cities will need to agree to be a part of the network.
- **Open Access:** The County can consider operating the network as open access, which would allow multiple providers to lease portions of the network, thereby increasing competition.
- **BEAD:** Through the BEAD program or future state funding, Illinois may provide grants to support the buildout of infrastructure to connect CAIs that currently lack access to broadband at speeds of 1000/1000 Mbps or greater.

Key Takeaways

A county-owned middle-mile fiber network could improve connectivity at public institutions, schools, public safety buildings and other CAIs. Additionally, the network could be leveraged to enter into agreements where ISPs lease the county-owned infrastructure and build last-mile connections to serve residents and businesses. Often, cities and counties that have built middle-mile fiber networks, such as Cook County's Southland Fiber Network, have chosen to partner with a private entity to operate and maintain the network.

** Methodology and assumptions used to determine the estimated cost are provided on page 11.*

Publicly funded, built, and maintained conduit network

Publicly Owned Conduit Network Model	
Description	The County funds, builds and maintains a countywide conduit network that passes all residents and businesses. The county can lease the conduit space to ISPs interested in building FTTP connections to residents and businesses.
Benefits	• **Lease Revenue:** The County can earn revenue by leasing conduit space to private ISPs interested in expanding FTTP connections.[8] • **County-owned Fiber:** The County can choose to concurrently install fiber with conduit in certain areas to support future connectivity needs. • **Redevelopment Efforts:** When feasible the county can utilize existing redevelopment efforts to install conduit at lower costs.
Challenges	• **Cost:** A County-owned conduit network requires significant upfront capital expenditure and additional on-going maintenance expenditure. • **Utilization:** To ensure the conduit is being utilized to expand FTTP connections to residents and businesses, the County will need to engage and identify ISPs interested in running fiber cables through the conduit and providing service.
Estimated Costs	The construction of a county-wide conduit network is estimated to **cost upwards of $800 million.** A more cost-effective option may be to utilize a phased approach that leverages planned excavation projects to lay conduit on the ground via a joint trench. Laying conduit utilizing joint trenching can result in cost savings of approximately 57% (see: Dig Once).

Case Study Snapshot	
Lincoln, Nebraska *Population: 292,627* *Households: 116,362*	In 2012, the city of Lincoln began using the redevelopment of its downtown to deploy conduit along right of ways. The city expanded its network through a gradual process and by 2016 had spent $1.2M building and maintaining the 300-mile-long conduit network. In 2015, Allo Communications agreed to lease the City's conduit to provide FTTP connections to residents and businesses. In exchange for leasing the conduit, Allo is required to pay lease fees and abide by the the City's Broadband Franchise Ordinance.
West Des Moines, Iowa *Population: 68,726* *Households: 30,775*	In 2020, West Des Moines entered into a partnership with Google Fiber where the city is responsible for funding and building a citywide conduit network and in exchange Google Fiber commits to connecting all residents and business with fiber. The City is investing $60M through bond funding to lay 1000 miles of open access conduit that can be used by any ISP, not just Google Fiber. The City intends to recoup the cost by charging access fees from ISPs that use the conduit. Google Fiber has committed to paying $16M in access fees.

Implementation Considerations

- **ISP Interest:** The County will need to engage ISPs to gauge their level of interest in leasing county-owned conduit to provide last mile fiber connections. By obtaining by-in from ISPs the County can enact partnerships to build last mile connections early on.
- **Dark Fiber:** The County may choose to place dark fiber in the conduit, which can then be leased to private entities or used for the county's own purposes.

Key Takeaways

Conduit are reinforced tubes that surround and protect fiber optic cables. By installing conduit underground, the County could reduce costs for ISPs interested in deploying fiber connections, thereby encouraging private investment in Lake County. Although building an entire countywide conduit network will require approximately $800 million in up-front capital expenditure, the County could reduce costs by utilizing planned redevelopment projects to lay down conduit when the ground is already being excavated (see: Dig Once Policy).

** Methodology and assumptions used to determine the estimated cost are provided on page 12.*

Publicly funded, privately built, owned and operated Fiber-To-The-Premises network

Public Financing of Private Infrastructure Model	
Description	Through a **County-run Request for Proposals (RFP) process**, the County awards grants to ISPs who make binding commitments to deploy and operate fiber infrastructure. The ISPs awarded through the RFP would retain ownership of the network. To ensure that awarded ISPs advance the County's goals, the RFP can include requirements such as serving all homes in an area with fiber and providing affordable internet plans.[9]
Benefits	• **Cost Effective:** Through a competitive RFP process the County can award the ISP(s) that provide the best value to the county. • **Stipulations:** The County can include requirements for awards to ensure that County digital equity goals are being met (ex. digital literacy requirements, ACP participation, affordable internet plans). • **Operational Expenditure:** The County would only incur a one-time capital expenditure in the form of an award to one or more ISPs.
Challenges	• **Lack of Control:** The County would not own any fiber infrastructure and would not have direct control over affordability of internet service. • **High Costs:** There is potential that the costs for ISP's are higher than anticipated, resulting in a smaller buildout than expected.
Estimated Costs	The cost for this model will vary widely depending on the scope of the RFP (number of locations being served) and bids received from ISPs. Under a competitive RFP process the County can consider providing funds that range anywhere from 25% to 100% of the cost of deployment.

Case Study Snapshot	
Scott County, KY *Population: 57,153* *Households: 21,347*	In 2021, Scott County entered into an agreement with Charter (parent company of Spectrum) to provide FTTP connections to 5,000 residents. Charter committed to an $18M investment to expand fiber infrastructure. The County contributed $3M in capital contributions, a point-of-contact liaison to facilitate company-county efforts, permitting assistance, access to county infrastructure and assets and support in applying to grant programs. The County receive bids from 6 potential partners and ultimately selected Charter.
Campbell, Kenton, & Boone Counties, KY	In 2021, three Kentucky Counties entered into an agreement with Cincinnati Bell to deliver FTTP connections to approx. 207,000 addresses. Cincinnati Bell committed to investing $181M and in exchange the counties provided the following capital contributions: Boone County - $13.6 million to serve 40,000 addresses, Campbell County - $4.5 million to serve 17,600 addresses, and Kenton County- $10.8 million to serve 37,000 addresses.

Implementation Considerations

- **Budget:** The County would need to decide how much funding it is willing to grant ISPs.
- **Target Areas:** The County should identify general target areas for build-out to structure the scope of the RFP and solicit responses that will address key gaps.
- **RFI/RFP Process:** The County can first issue a Request for Information (RFI) to identify best suited partners and then issue a formal RFP to shortlisted ISPs.

Key Takeaways

This approach could allow the County to expand fiber infrastructure access to residents and businesses without engaging in the construction and on-going operation of a fiber network. Additionally, through collaboration with a private entity, the County could secure a larger investment with a limited budget. Lastly, this approach allows for funds to be disbursed relatively quickly compared to the other broadband models, which is important if the County were to utilize ARPA funding. To note, other municipalities have utilized ARPA funds for similar purposes.

Privately funded, built and operated open access Fiber-to-the-Premises network

Public Financing of Private Infrastructure Model	
Description	The County and local municipalities can provide a private developer access to its right of ways to develop an open access FTTP network. The private developer would own, build and operate the FTTP network and provide other ISPs open access to utilize its fiber cables to provide service to residents and businesses in Lake County.
Benefits	• **Cost:** The County would have no upfront or on-going expenditure under this model. • **Open Access:** An open access network increases consumer choice and can encourage more affordable broadband service options through increased competition.[10] • **"Smart City" Initiatives:** Private developers operating in this space can provide municipalities with infrastructure that enables smart city/IOT applications.
Challenges	• **Lack of Control:** The County would not own any fiber infrastructure and would not have control over prices. • **Locations:** The County would not be able to control which locations in the County are served by fiber. This opens up the potential for some hard to connect locations remaining unserved by fiber.
Estimated Costs	The County would not assume any costs under this model. Private entities would be responsible for building and servicing the network.

Case Study Snapshot	
SiFi Open Access City Fiber Networks	SiFi Networks is a private entity that funds, builds and operates open access fiber networks in cities across the US. The company builds citywide networks that pass all residents and businesses. SiFi's open access networks allow for multiple ISPs to connect to the network and provide service to residents, thereby increasing competition. Cities in 11 states have agreements with SiFi including; • **Fullerton, CA:** It is SiFi's first completed network and passes 54,000+ locations. • **Kenosha, WI:** Through a $100M investment, SiFi is building a network that provides 40,000 locations access to 10G speeds. • **Rockford, IL:** Through a $200M investment, SiFi is building a network that provides 78,000 locations access to 10G speeds.

Implementation Considerations

- **Company Interest:** The County will need to identify private entities that are interested in investing in an open access network throughout the county
- **Permits:** The County will need to grant the private entity complete access to its ROWs and will likely need to provide the private entity with a designated contact that facilitates permitting.

Key Takeaways

There are a limited number of companies in the US that are building privately owned open access networks. SiFi is an example of a private developer that is investing in open access fiber networks in the US, with its first "FiberCity" in Fullerton, California being completed in 2021. SiFi is also constructing "FiberCity" open access networks in Kenosha and Rockford. To determine whether a private open access model can be implemented countywide is feasible, Lake County can hold preliminary discussions with to gauge interest with developers such as SiFi or Intrepid.

Methodology and Supporting Research

Publicly, Funded, Built and Operated Fiber-to-the-Premises Network

To determine estimated cost for constructing a countywide FTTP network without any design or engineering study, we relied on a FTTP analysis performed by Wave Direct for a comparable area in Ontario, California. Using the design from the Wave Direct analysis, we were able to estimate the likely footage of the feeder and distribution cables that would be needed for a network in Lake County. Wave Direct projected that a network passing 1,550 would require ~94,000 ft of feeder cables and ~114,000 ft of distribution cables. Using the Wave Direct cable footage to location ratio we can roughly estimate the footage of the cables needed to construct a countywide FTTP network in Lake County (detailed in the table below).

	Wave Direct	Lake County
Locations	1,550	215,632 (total BSLs)
Feeder/Ring Footage (LF)	94,280	13,115,990
Distribution Footage (LF)	114,290	15,899,730

Based on the footage estimates above, the network would pass a home or business, on average, every 135ft. This is a reasonable assumption given the geographical nature of the county and the fact that in dense urban areas the network would pass more homes per LF than in more rural areas. Using this high-level design and network footage assumption, we can estimate that the cost of constructing a county-wide FTTP network will be upwards of $1.5 billion. The breakdown of the estimated cost is provided in the table below:

Line	Work Description	UOM	Unit Rate - Labor	Unit Rate - Materials	Combined Unit Rate	QTY	Extended
1	Conduit Placement	LF	$ 17.00	$ 3.00	$ 20.00	29,015,720	$ 580,314,400.00
2	Handhole Placement	EA	$ 1,800.00	$ 1,200.00	$ 3,000.00	24,180	$ 72,539,300.00
3	Fiber Splicing - Mainline	EA	$ 7,000.00	$ 564.00	$ 7,564.00	1,451	$ 10,973,745.30
4	Fiber Splicing - Lateral	EA	$ 3,000.00	$ 312.00	$ 3,312.00	5,803	$ 19,220,012.93
5	Tracerwire Placement - Pulling	LF	$ 0.84	$ 0.16	$ 1.00	29,015,720	$ 29,015,720.00
6	Fiber Cable Placement	LF	$ 1.50	$ 2.00	$ 3.50	31,917,292	$ 111,710,522.00
7	FDH Install (w/Pad)	EA	$ 7,500.00	$ 10,000.00	$ 17,500.00	86	$ 1,504,518.81
8	Fiber Drop and Install	EA	$ 2,000.00	$ 500.00	$ 2,500.00	215,632	$ 539,080,000.00
9	Restoration - Asphalt	SF	$ 18.00	$ 2.00	$ 20.00	362,697	$ 7,253,930.00
10	Restoration - Concrete	SF	$ 25.00	$ 5.00	$ 30.00	725,393	$ 21,761,790.00
11	Restoration - Softscape	SF	$ 1.00	$ 0.25	$ 1.25	14,507,860	$ 18,134,825.00
12	Test Station/Marker Post Placement	EA	$ 150.00	$ 50.00	$ 200.00	24,180	$ 4,835,953.33
13	Maintenance	LF	$ 0.20	$ -	$ 0.20	29,015,720	$ 5,803,144.00
14	Permits/Fees/Engineering	LF	$ 2.00	$ -	$ 2.00	29,015,720	$ 58,031,440.00
15	Budget Contingency (20%)	LS	0%				$ -
						Total	$ 1,480,179,301.38
						Per Foot	$ 51.01

The estimated cost does not include the cost of creating a new department to manage the operation of the network and provide service to customers. To note, the cost does include a budget contingency of 20% to account for unexpected expenses or unforeseen issues that occur during the construction/implementation phase and a budget for the maintenance of the network for one year.

Methodology and Supporting Research

Publicly, Funded, Built and Operated Middle Mile Fiber Network

The total cost of the county-wide middle mile fiber network will be subject to buy-in on the municipal level. The County would first need to engage individual cities/villages to determine their interest in being a part of the network and establish agreements. Additionally, to accurately price the network, the County will need to determine the number/type of buildings that will be connected to the middle-mile network.

To estimate a high-level cost for the middle-mile fiber network, we utilized the same method and assumptions as the full countywide FTTP network (we assumed that the feeder/ring footage of the middle-mile network will be the same as in the full FTTP network). Additionally, we assumed that the network would connect 1,000 buildings or approximately 19 buildings per municipality. Based on these assumptions the total estimated cost of constructing a middle-mile fiber network that connects 1000 government buildings and CAI's is upwards of $530 million. The breakdown of the estimated cost is provided in the table below:

Line	Work Description	UOM	Unit Rate - Labor	Unit Rate - Materials	Combined Unit Rate	QTY	Extended
1	Conduit Placement	LF	$ 17.00	$ 3.00	$ 20.00	13,115,990	$ 262,319,800.00
2	Handhole Placement	EA	$ 1,800.00	$ 1,200.00	$ 3,000.00	10,930	$ 32,789,975.00
3	Fiber Splicing - Mainline	EA	$ 7,000.00	$ 564.00	$ 7,564.00	656	$ 4,960,467.42
4	Fiber Splicing - Lateral	EA	$ 3,000.00	$ 312.00	$ 3,312.00	2,623	$ 8,688,031.78
5	Tracerwire Placement - Pulling	LF	$ 0.84	$ 0.16	$ 1.00	13,115,990	$ 13,115,990.00
6	Fiber Cable Placement	LF	$ 1.50	$ 2.00	$ 3.50	14,427,589	$ 50,496,561.50
7	FDH Install (w/Pad)	EA	$ 7,500.00	$ 10,000.00	$ 17,500.00	52	$ 910,000.00
8	Fiber to Municipal BLG and Install	EA	$ 10,000.00	$ 750.00	$ 10,750.00	1,000	$ 10,750,000.00
9	Restoration - Asphalt	SF	$ 18.00	$ 2.00	$ 20.00	275,436	$ 5,508,715.80
10	Restoration - Concrete	SF	$ 25.00	$ 5.00	$ 30.00	406,596	$ 12,197,870.70
11	Restoration - Softscape	SF	$ 1.00	$ 0.25	$ 1.25	7,541,694	$ 9,427,117.81
12	Test Station/Marker Post Placement	EA	$ 150.00	$ 50.00	$ 200.00	10,930	$ 2,185,998.33
13	Maintenance	LF	$ 0.20	$ -	$ 0.20	13,115,990	$ 2,623,198.00
14	Permits/Fees/Engineering	LF	$ 2.00	$ -	$ 2.00	13,115,990	$ 26,231,980.00
15	Budget Contingency (20%)	LS	20%				$ 88,441,141.27
						Total	$ 530,646,847.61
						Per Foot	$ 40.46

The total estimated <u>does not</u> include the cost of creating a new department to manage the operation of the network and provide service to public institutions. To note, the cost <u>does include</u> a budget contingency of 20% to account for unexpected expenses or unforeseen issues that occur during the construction/implementation phase and a budget for the maintenance of the network for one year.

Methodology and Supporting Research

Publicly, Funded, Built and Operated Countywide Conduit Network

To estimate the cost for a county-wide conduit network that passes all residences and businesses in the county, we used the same method and assumptions as the full countywide FTTP network (we assumed that a countywide conduit network would require the same footage as the full FTTP network). Based on these assumptions the total estimated cost of constructing a countywide conduit network is upwards of $800 million. The breakdown of the estimated cost is provided in the table below:

Line	Work Description	UOM	Unit Rate - Labor	Unit Rate - Materials	Combined Unit Rate	QTY	Extended
1	Conduit Placement	LF	$ 17.00	$ 3.00	$ 20.00	29,015,720	$ 580,314,400.00
2	Handhole Placement	EA	$ 1,800.00	$ 1,200.00	$ 3,000.00	24,180	$ 72,539,300.00
3	Tracerwire Placement - Pulling	LF	$ 0.84	$ 0.16	$ 1.00	29,015,720	$ 29,015,720.00
4	Restoration - Asphalt	SF	$ 18.00	$ 2.00	$ 20.00	362,697	$ 7,253,930.00
5	Restoration - Concrete	SF	$ 25.00	$ 5.00	$ 30.00	725,393	$ 21,761,790.00
6	Restoration - Softscape	SF	$ 1.00	$ 0.25	$ 1.25	14,507,860	$ 18,134,825.00
7	Test Station/Marker Post Placement	EA	$ 150.00	$ 50.00	$ 200.00	24,180	$ 4,835,953.33
8	Maintenance	LF	$ 0.15	$ -	$ 0.15	29,015,720	$ 4,352,358.00
9	Permits/Fees/Engineering	LF	$ 2.00	$ -	$ 2.00	29,015,720	$ 58,031,440.00
10	Budget Contingency (20%)	LS	0%				$ -
						Total	$ 796,239,716.33
						Per Foot	$ 27.44

The total cost does include a budget contingency of 20% to account for unexpected expenses or unforeseen issues that occur during the construction/implementation phase and a budget for the maintenance of the network for one year. Compared to the Full FTTP network the county would have lower recurring overhead costs, however, the conduit infrastructure will still need maintenance.

Key Broadband Terms

Term	Definition
Backbone	A major high-speed transmission line that strategically links smaller high-speed Internet networks across the globe.
Backhaul	The portion of a broadband network in which the local access or end user point is linked to the main Internet network.
Conduit	Conduit are reinforced tubes that surround fiber optic strands to keep them protected.[1]
Dark Fiber	Fiber that is in place but not being used for broadband services. (“non-lit” fiber)
Fiber Technology	A flexible hair-thin glass or plastic strand that is capable of transmitting large amounts of data at high transfer rates as pulses or waves of light.
Fiber-to-the-Premises Network	The term fiber-to-the-premises refers to the delivery and connection of fiber optics directly to a home or building.
Last-Mile Infrastructure	The technology and process of connecting the end customer’s home or business to the local network provider.
Lit Fiber	An active fiber optic cable capable of transmitting data.
Middle-Mile Infrastructure	The connection between a local network, also called a “last mile” connection, and the backbone Internet network.
Open Access	Networks that offer wholesale access to network infrastructure or services provided on fair and reasonable terms with some degree of transparency and nondiscrimination.
Rights-of-Way (ROW)	ROW are legal rights to pass through property owned by another. ROW are frequently used to secure access to land for digging trenches, deploying fiber, constructing towers and deploying equipment on existing towers and utility poles.
Take Rates	Take rate refers to the Percentage of customers with access to the network who choose to subscribe.[2]

All definitions are sourced from NTIA’s Broadband Glossary, unless noted otherwise.; [1] AeroUSA [2] NTIA

Sources

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