Special Purpose Local Option Sales Tax

Sales Tax Funding Community Investments

Athens-Clarke County Connectivity Enhancement Project Report

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PROJECT OVERVIEW

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LOCATION:
301 S. College Avenue
Athens, Georgia 30601

DATE OF REPORT:
May 30, 2023

STATEMENT OF PURPOSE:

The purpose of this report is to assist Athens-Clarke County in implementing the county's vision for broadband by providing Athens-Clarke County with the information needed to analyze, select, and implement the best solutions to improve broadband connectivity across the entire county. It is understood that reaching this goal may require a mix of technologies and phased build-out plans, partnerships with providers, public investment and flexibility, ingenuity, and innovation.

EXECUTIVE SUMMARY

Broadband deployment in the United States has seen two distinct pathways that can often be attributed to the urban/rural divide. Urban areas are more compact and typically offer access to a higher number of customers per constructed foot. These areas tend to have access to more robust networks that provide higher speeds and competitive service between multiple providers, however, many residents in urban areas face financial constraints preventing access to reliable internet. Rural areas, in contrast, have more limited networks, with fewer options and many more physical boundaries for deployment. Athens-Clarke County is an example of both scenarios existing in proximity. One of the biggest challenges to bridging the digital divide is determining the reason residents do not have access to the internet. This can usually be described by one of three things: lack of access meaning the infrastructure does not exist, lack of adoption meaning internet service is available but is not currently being utilized, or lack of affordability meaning internet service is available but is not affordable to all residents.

The goal of the Broadband Solution Report is to evaluate the needs of Athens-Clarke County related to broadband infrastructure and present solutions for increasing connectivity in the areas throughout the County with the greatest need.

Foresite Group conducted a strategy session with representatives of Athens-Clarke County, evaluated current broadband access throughout the County, conducted community engagement sessions along with a demand aggregation survey, and evaluated local broadband and telecommunications in the market. A needs case assessment and gap analysis were also performed to identify gaps in the County that can be improved by broadband.

Foresite Group identified three gaps related to broadband and three immediately actionable solutions for Athens-Clarke County.

Gap	Lack of broadband connectivity throughout the County
Gap	Low rate of residential broadband adoption
Gap	Connection needs for County buildings to fiber infrastructure
Solution	Extend service to unserved and underserved areas of the County
Solution	Coordinate with local ISPs
Solution	Enhance infrastructure policies and planning

Following the strategy session and assessment research, Foresite Group proposed moving into the network planning phase by designing a middle-mile ring and fiber-to-the-home (FTTH) network for the County. These designs would explore identified broadband gaps of the community by establishing a County backbone network and providing broadband access to unserved and underserved homes in the County. The high-level design portion of the project included activities such as local data collection, determining the network architecture and schema, field ride-out, and permit review. A bill of materials (BoM) was created for the high-level design that provided engineering, construction, and material estimates for the design which were utilized in the proforma to project a potential model for estimated return on investment (ROI), profit generation, and ongoing network maintenance and operation costs. Foresite Group explored potential grant opportunities, various governance and ownership strategies, and investigated potential strategies and incentives for third party participation. In addition to these efforts, Foresite Group reached out to various network providers to show the design, receive their feedback, and gauge their interest in potential participation.

Following the BoM, proforma, and strategy research, Foresite Group's final recommendation is for the County to focus on building a County middle-mile ring which would connect and provide service to current and future County facilities as well as anchor institutions. This should be accomplished through a public-private partnership model where the County would contribute funds to a network operator or owner to establish the fiber ring throughout the County.

STRATEGY SESSION MEETING

On June 29th, 2022, Foresite Group and representatives from Athens-Clarke County completed the strategy session for the Athens-Clarke County Connectivity Enhancement Project. The strategy session included:

- Introductions and a project overview
- Identifying key stakeholders
- Beginning community research
- Discussing funding methods
- Reviewing options for broadband expansion

Attendees: Kelly Girtz, Blaine Williams, Travis Cooper, Dodd Ferrelle, Madhuri Angadi, Mark Melvin, Keith Kelley, Mary Martin, Mike Hughes, JP Lemay, Doug Hansford, Kent Kilpatrick, Jeff Montgomery, Cecile Riker, Harrison Daniel, Brad McCook, Mike Wharton, Victor Pope, John Roseberg, Try McEleven, Jennifer Shaikun, Selah Gardiner, Howell McKinnon, Keith Sims, Amy Saxton, Aneush Ebrahimi, and Joseph D'Angelo.

Foresite Group Attendees: Lee Comer, Ashley Ball, Garrett Wates, Jeff Hindman, Thuy Le Ho (remote), Jarrett Miller (remote), and Chris Owens (remote).

Internet Service Provider (ISP) and Electric Member Cooperative (EMC) Representatives: Comcast, Jackson EMC, Parker Fibernet, and Truvista.

From the strategy session, Foresite Group was able to better understand the obstacles that Athens-Clarke County faces as it relates to broadband along with County goals that broadband could help achieve. These obstacles included lack of broadband in more rural areas of the County, serving both residential and business locations, planning for lasting technology within the County, providing connectivity for the public safety and County facilities along with planning for economic development such as healthcare, biotech, advance manufacturing, and film and audio projects.

The service providers shared their various obstacles to expanding broadband within the area. Obstacles included make ready cost and delays as well as securing funding for areas of low return.

It was identified that Foresite Group would reach out to the service providers for maps, expansion plans, and private development, issue a survey to community members, and conduct a demand aggregation for Athens-Clarke County.

NEEDS CASE ASSESSMENT

Lack of access to broadband internet is having a greater impact than ever before. As technology continues to evolve and expand, areas without sufficient bandwidth will face a growing disadvantage in terms of quality of life and economic growth. Consequentially, the demand for faster internet speeds and more reliable broadband infrastructure will grow. From 2010 to 2015 the FCC changed the definition of broadband from 4 Mbps (megabits) download and 1 Mbps upload to 25 Mbps download and 3 Mbps upload. Currently, there is pressure to increase the definition to as high as 100 Mbps symmetrical service.

The digital divide refers to the lack of opportunities to connect to the internet due to issues of access, affordability, or adoption: complete connectivity requires all three. If an area lacks infrastructure or if existing infrastructure has not been extended to reach individual households, there is a clear access gap. When a direct connection is available to an area but few people are subscribing to internet service, it suggests an issue with affordability or adoption.

Broadband Availability

Foresite Group collected broadband coverage information from various sources, including U.S. census data, telecommunications industry sources, and FCC broadband databases. The FCC collected broadband information by census block using Form 477 from all facilities-based providers who offer internet access including wireline, fixed wireless, and mobile broadband. However, the FCC's broadband data has faced criticism for its lack of accuracy in rural areas, as previous reporting guidelines allowed a census block to be classified as served even if only one address within that block had broadband service. To address this, the FCC released a new version of maps in November 2022 that reports internet service availability on a location basis. Despite its limitations, the FCC 477 dataset remains the most comprehensive available, and while it won't be the sole source of information, it will provide an initial understanding of internet service providers and speeds in Athens-Clarke County.

Broadband Technologies

Internet bandwidth is measured in megabits per second, or Mbps. This refers to the speed at which data packets can be received (downloaded) and sent (uploaded) from a personal computer or other connected device. For instance, streaming a television show primarily utilizes download bandwidth while sending an email with a large attachment would be utilizing upload bandwidth. An activity such as a video conference uses both download and upload speeds as the device is both receiving video and sending video to other devices. Asymmetrical broadband is where the download and upload speeds are not equal and most commonly the download speed will be higher than the upload. This is often seen in older technologies such as copper and coaxial. Symmetrical broadband refers to equal speeds between the received and the transmitted data. Higher symmetrical speeds are often preferred to support modern interactive applications and video services and are feasible through newer broadband technologies such as fiber.

In 2010, the FCC defined "broadband speeds" as 4 Mbps download/1 Mbps upload. In 2015, the FCC updated their broadband speed definition to 25 Mbps download/3 Mbps upload due to advances in technology, consumer demand, and internet service provider market offerings. There are many companies, consumer advocacy groups, and legislators who are urging the FCC to again increase the minimum definition for broadband to require higher speeds. There are numerous reasons driving the need for increased bandwidth including: evolving technologies for both consumers and businesses, proliferation of streaming video services, interactive gaming, distance learning and web conferencing, telehealth and telemedicine, COVID-19 challenges with home-based learning and remote workforce restrictions, bandwidth challenges in rural areas and underserved communities, and the evolving world marketplace where many other countries exceed the U.S. in broadband speeds. Congressional lawmakers have proposed various legislation to improve the broadband infrastructure in the U.S. and many federal funds, such as the USDA ReConnect Grant, call for a minimum broadband definition of 100 Mbps symmetrical speeds to qualify for the funds being made available.

Levels of service are important when considering broadband connection. Broadband connection is not necessarily a clear yes or no but rather a broad spectrum of speeds and reliability. The data collected from the FCC Form 477 is presented here in different speed tiers, “unserved” which corresponds with available speeds below 25/3 Mbps, “underserved” which corresponds with speeds between 25/3 Mbps and 100/20 Mbps, and “served” which corresponds with speeds greater than 100/20 Mbps. While “underserved” is still greater than the current FCC threshold for broadband service, it does not meet the requirements set forth by some funding opportunities, such as the USDA ReConnect Grant discussed in the previous paragraph. A location shown as served does not guarantee the availability of sufficient broadband service to every home within that census block but indicates that a provider has reported serving speeds within the indicated tier to at least one address within the census block.

FCC Data

According to the June 2021 FCC data release, over 99% the County should have access to at least one service provider that offers 25 Mbps download and 3 Mbps upload (figure 3.1). Less than 0.5% of Athens-Clarke County address points fall within blocks considered unserved. As discussed earlier, this does not necessarily mean all addresses within the blocks served are receiving service. Throughout the report, different datasets will be discussed to achieve a more complete picture of service throughout the county.

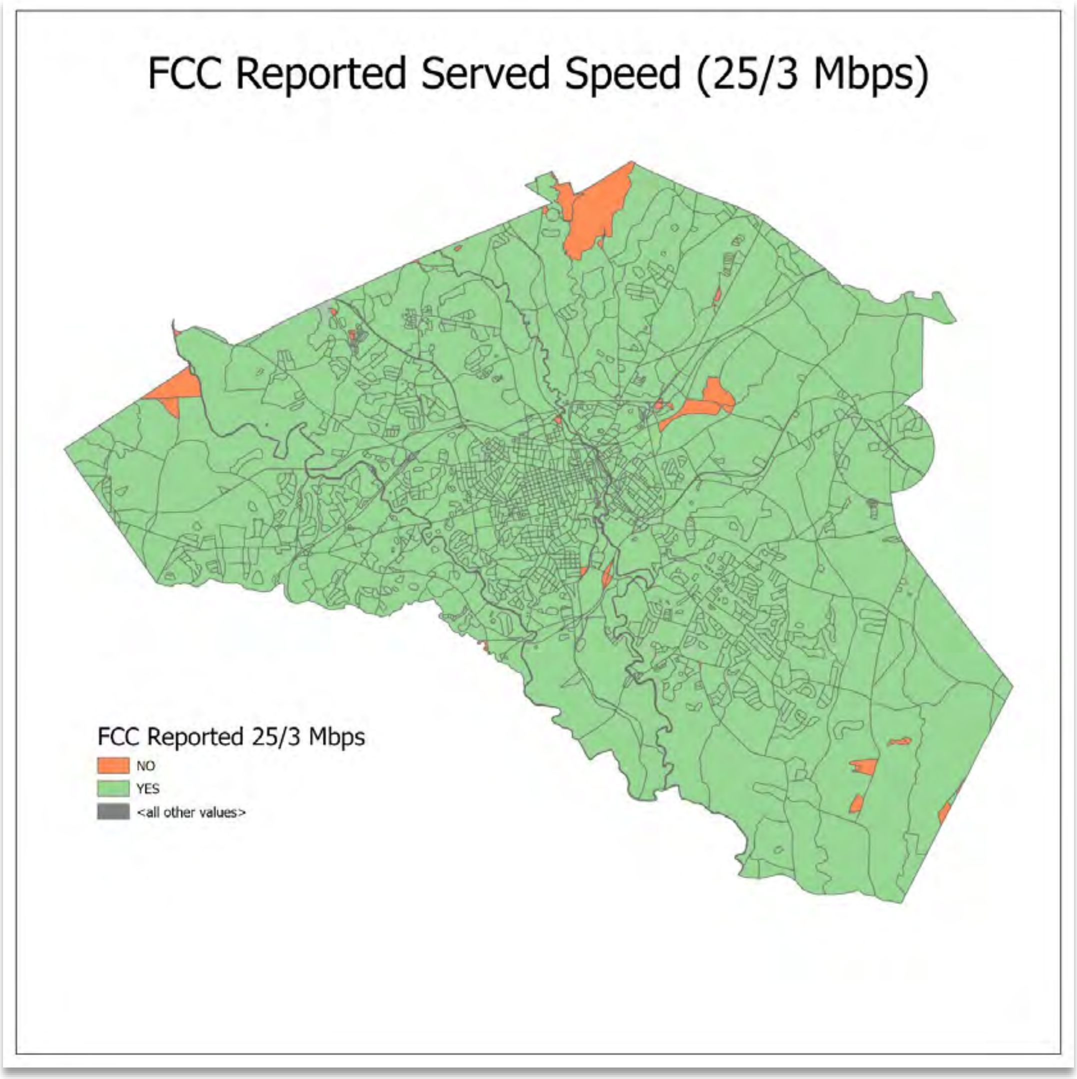


Figure 3.1

Although 25/3 Mbps is considered served by the current FCC standards, some government programs such as the USDA ReConnect Grant requires 100/100 Mbps to qualify for funds. While 100/20 is still short of the 100 symmetrical mark, if that speed it already offered, it would be sufficient service for meeting the demands of present and near future home services such as streaming, gaming, telehealth, and video conferencing for multiple devices at a time. There is not a dramatic difference in areas reported to be served by the benchmark speed and served speed, but there is some difference particularly in the southeastern corner of the county which can be seen in figure 3.2.

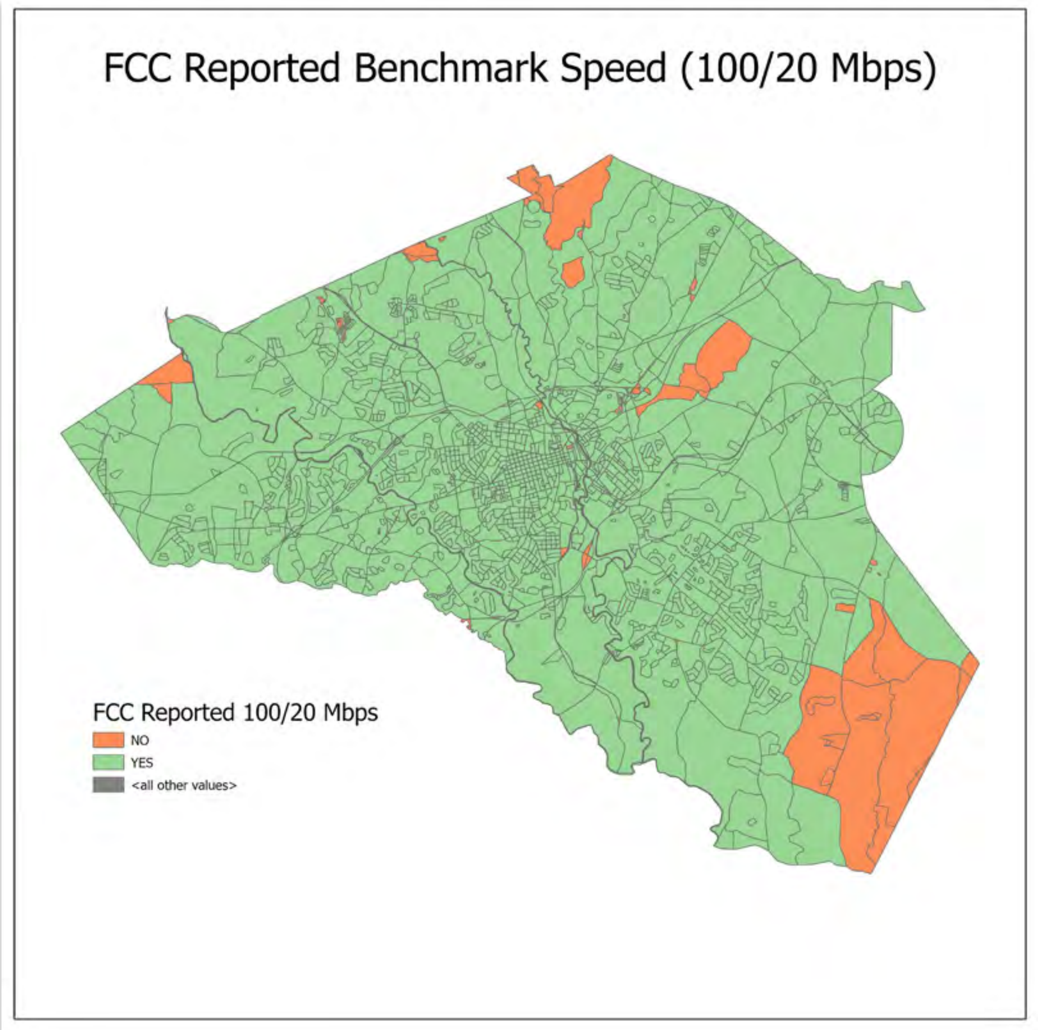


Figure 3.2

Fiber availability and availability of speeds considered served are quite different throughout the county. AT&T is the primary fiber service provider within the County. However, in August of 2022, Foresite Group performed a manual evaluation of 70 address points that fall within blocks reported as having access to fiber by the latest FCC, of those 70 addresses, 23 were unable to sign up for fiber service. This is not to say that within those blocks there is not some fiber available, but it does substantiate the theory that there is not 100% fiber coverage even within blocks reported as served by fiber service. This indicates that fiber estimates, and other coverage estimates, are most likely high. This was confirmed with the November 2022 FCC broadband map release that reported available service data on the individual location level. There were individual locations within fiber available blocks that did not have service available.

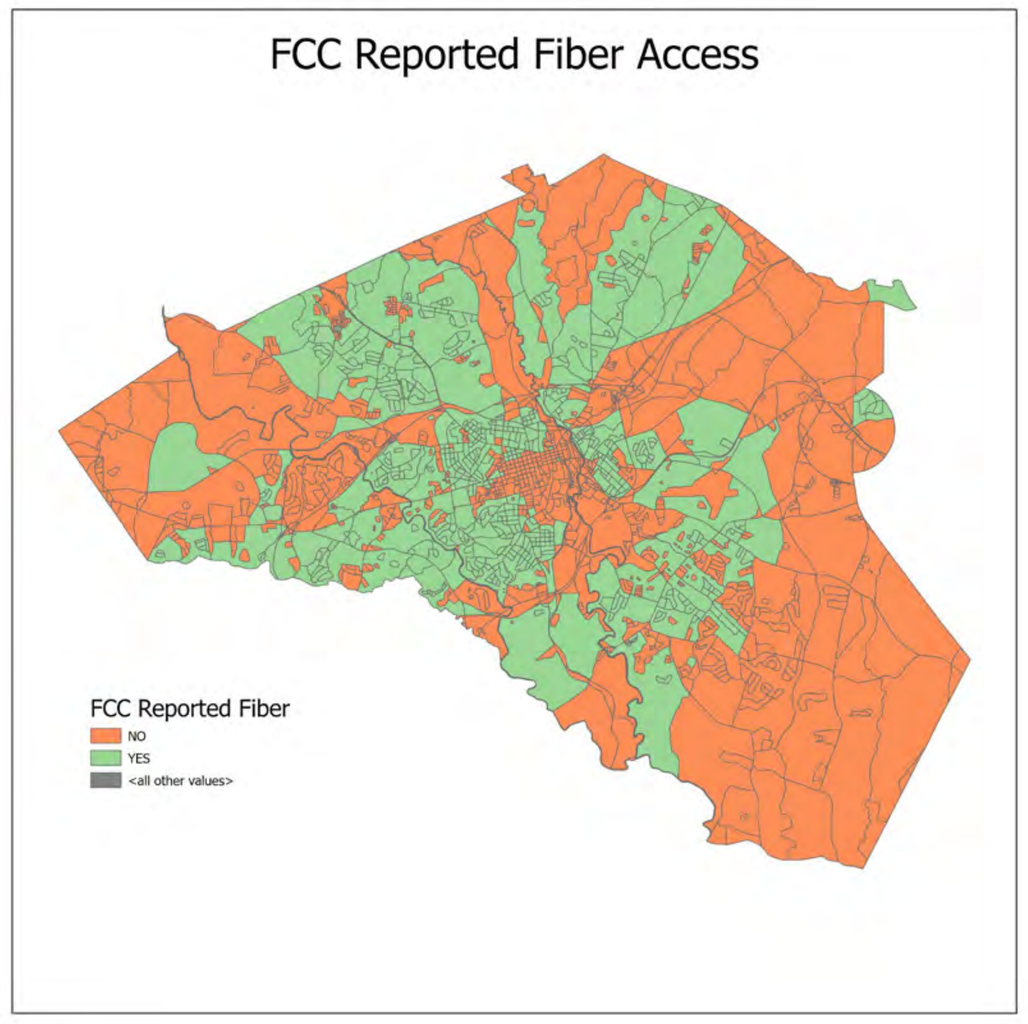
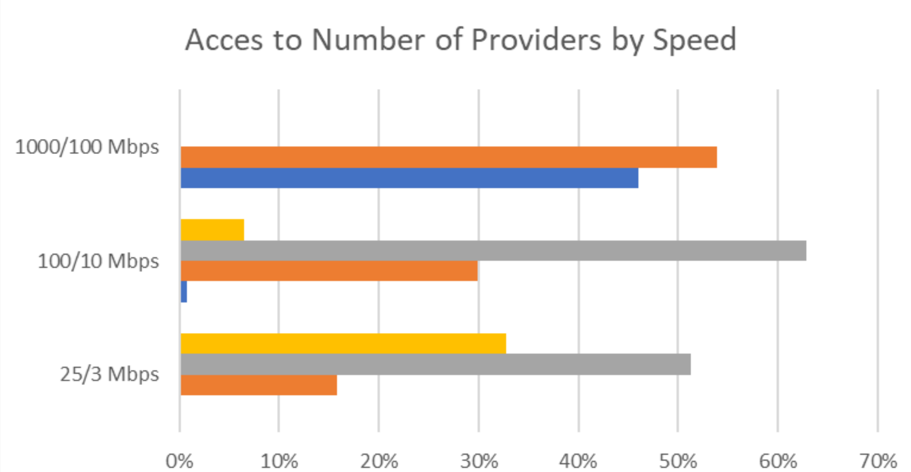


Figure 3.3

Figure 3.4 shows the number of providers available to Athens-Clarke County residents at different speed tiers, according to June 2021 FCC data. As previously stated, the FCC dataset likely has overestimations for each of the population percentages; however, this provides a good starting point with understanding what is available to the typical Athens-Clarke County resident. According to the FCC, an estimated 54% of residents have access to speeds of 1000/100 Mbps or greater, and when that speed is offered, it is nearly always a single service provider. In other words, there is little competition for the best possible service.

When looking at the 100/10 Mbps speed tier there is generally good coverage and more competition. Around 99% of the county reportedly has access to this speed and for about 70% of residents there are two or more providers to choose from offering this speed. This speed is closest to the benchmark tier of 100/20 Mbps. Which is sufficient for most present and near future residential uses.



	25/3 Mbps	100/10 Mbps	1000/100 Mbps
3+	32.75%	6.49%	0.00%
2	51.24%	62.83%	0.03%
1	15.83%	29.89%	53.92%
0	0.18%	0.79%	46.05%

Figure 3.4

AT&T and Charter appear to have the most expansive services across the county. FCC maps indicate some Comcast presence, but after testing a series of addresses, Foresite Group was unable to find a residential address where Comcast/Xfinity internet is available. This does not mean Comcast/Xfinity service is not offered, but any residential service offering seems to be extremely limited. Comcast/Xfinity is most likely offering commercial and government services with less residential options. Pricing and speeds found for primary service providers are provided in the figure 3.5.

Provider	Technology	Speeds	Pricing	Availability
AT&T	ADSL	5 Mbps	$55/mo	Low
		10 Mbps	$55/mo	Low
		25 Mbps	$55/mo	Low
	Fiber	300 Mbps	$55/mo	Medium
		500 Mbps	$65/mo	Medium
		1Gbps	$80/mo	Medium
		2 Gbps	$110/mo	Low
		5 Gbps	$180/mo	Low
Charter	Cable	500 Mbps	$39.99/mo	High
		1 Gbps	$59.99/mo	High
Comcast	Cable	50 Mbps	$30/mo	Low
		100 Mbps	$40/mo	Low
		300 Mbps	$55/mo	Low
		600 Mbps	$70/mo	Low
		900 Mbps	$75/mo	Low
		1200 Mbps	$80/mo	Low
Windstream	Cable	25 Mbps	$39.99/mo	Low
		50 Mbps	$39.99/mo	Low
		100 Mbps	$39.99/mo	Low

Figure 3.5

An additional resource used to analyze broadband connection in Athens-Clarke County is data collected from the Georgia Broadband Program (figure 3.6). This program utilizes data from providers on the address level, so it is more precise than the FCC 477 Map. This helps identify blocks that may appear served on the FCC map but have a high percentage of unserved addresses. The southeast area and the northern area of the county have a significant number of unserved addresses. According to the 2021 release of this dataset, there are 458 addresses that do not currently have access to any broadband service in Athens-Clarke County.

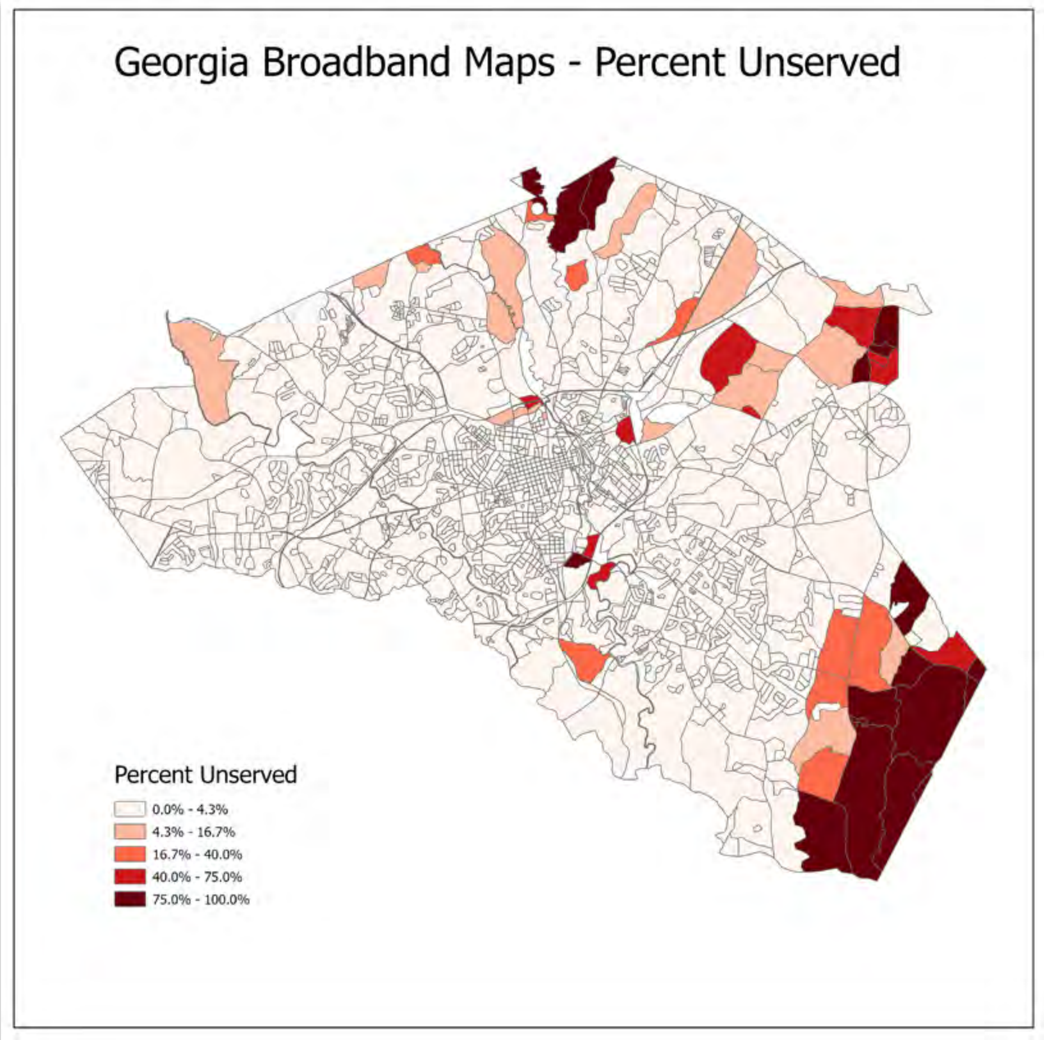


Figure 3.6

Fiberlocator

Residential fiber availability is limited throughout the county. The presence of fiber infrastructure is primarily concentrated within Athens proper, and some infrastructure running through the north and east of the county. Backhaul networks (also called long-haul networks) are used to transport local data to aggregation sites. If the City or other organization were contemplating a local network build, they would likely use one of the backhaul network providers for connectivity. Metro network telecommunications companies own or lease fiber infrastructure near large cities or industrial areas. They typically provide the high-speed connections required by businesses, utilities, and local ISP (Internet Service Provider) companies. They provide commercial high-speed connections that can operate as backhaul, middle-mile, and even last-mile networks to move customer information between data centers or other aggregation locations over very high-capacity fiber links. According to observations from FiberLocator (figure 3.7 & 3.8), Crown Castle and Windstream have the strongest fiber infrastructure presence in the County.

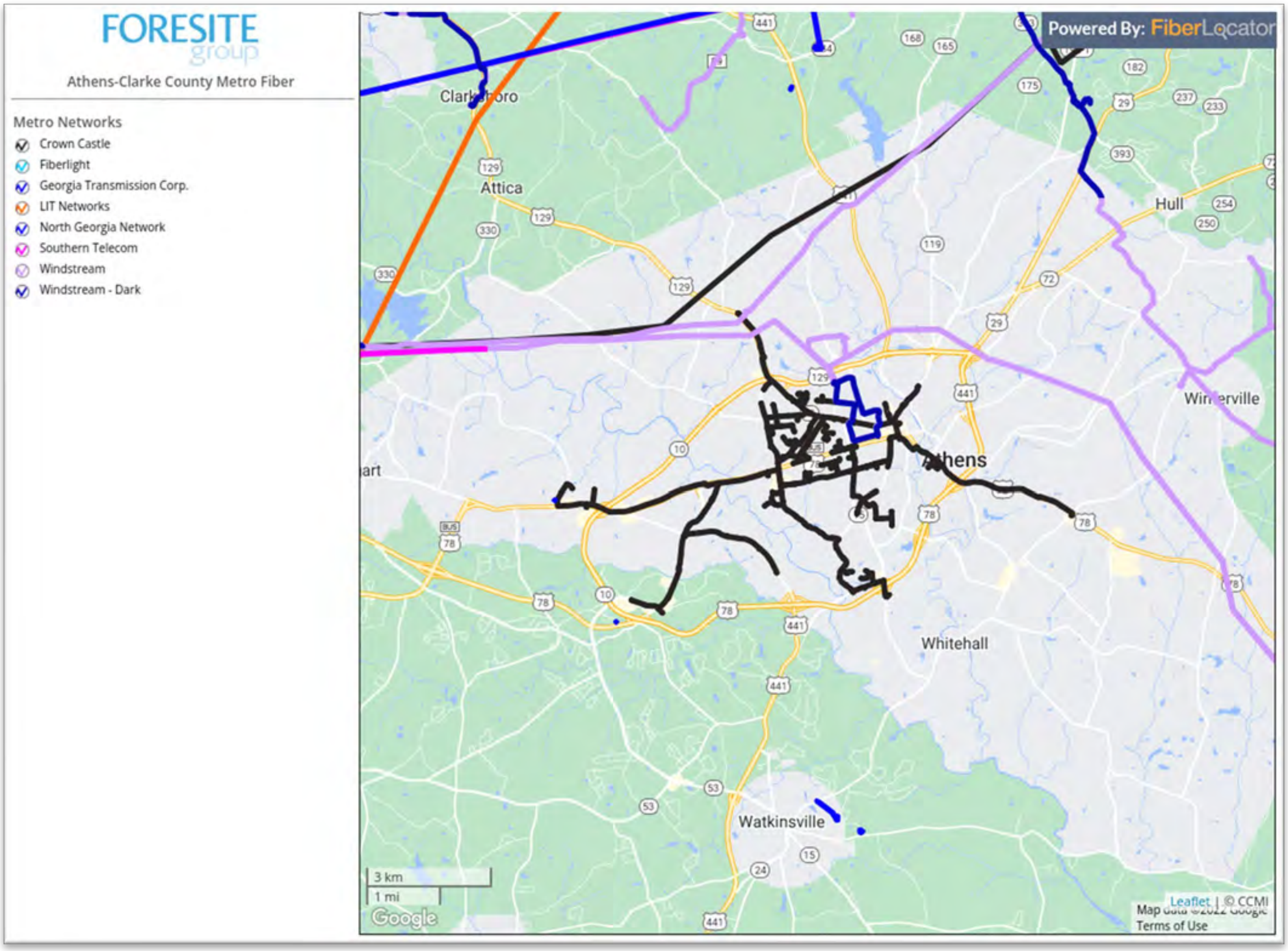
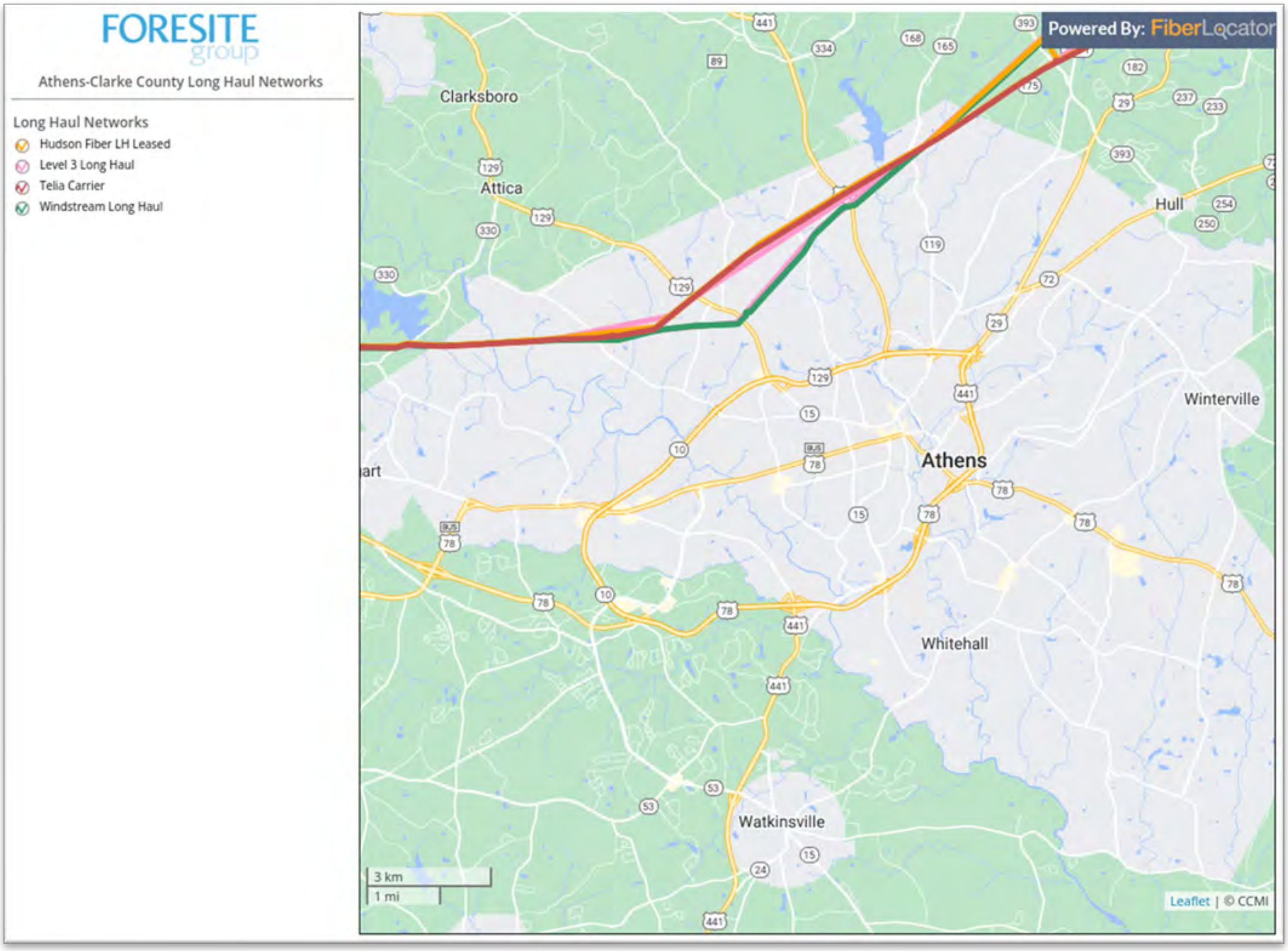


Figure 3.7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Athens-Clarke County Long Haul Networks
Long Haul Networks
Hudson Fiber LH Leased
Level 3 Long Haul
Telia Carrier
Windstream Long Haul
Powered By: FiberLocator
Clarksboro
Attica
Hull
Winterville
Athens
Whitehall
Watkinsville
3 km
1 mi
Leaflet | © CCMI

Figure 3.8

Broadband Subscription Estimates

Prior analysis in this report has primarily focused on the physical location of infrastructure and whether service at a particular speed is accessible or not. As other data sources are discussed, such as the American Community Survey data and US Census, there may be more discussion related to affordability and adoptability.

For an individual to subscribe to a broadband service three requirements must be met:

Accessible – the physical infrastructure is available to the end user
Affordable – the service must be offered at a price compatible with the end user's budget
Adoptable – the end user has the tools and skills to meaningfully utilize the broadband service

Figure 3.9 below shows estimates of households with no internet access. This is not very consistent with the FCC reported data or the Georgia Broadband Program Map, but there is a large area in the middle of the county where three census tracts all show over 20% of households having no internet access.

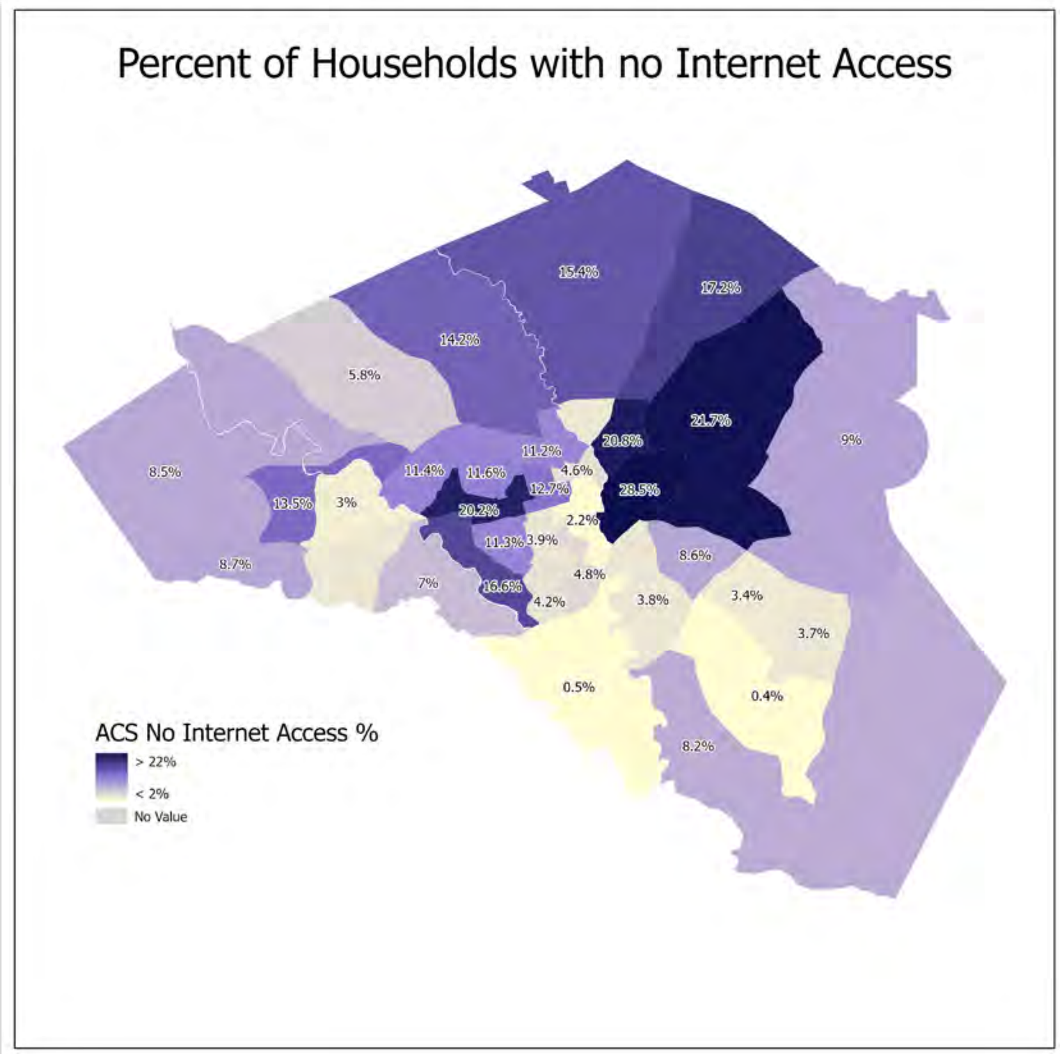

Figure 3.9

The American Community Survey was also used to pull provider statistics on broadband subscriptions by household (figure 3.10). This data from the 2020 ACS 5-year estimates shows that 71.9% of households have some broadband subscription. That leaves nearly 30% with no broadband plan at all. A portion of this 30% may have access to the internet through a cellular plan or satellite service, but still lack true broadband connectivity. Based on previously reviewed connectivity data, there seems to be a significant gap between where service is available and who is signing up for service. Moving forward, it is important to understand what is preventing the community from adopting broadband service. Is the service too expense? Is the community not convinced of the benefits of broadband service? The primary issue in Athens-Clarke County may be one of adoption and not access.

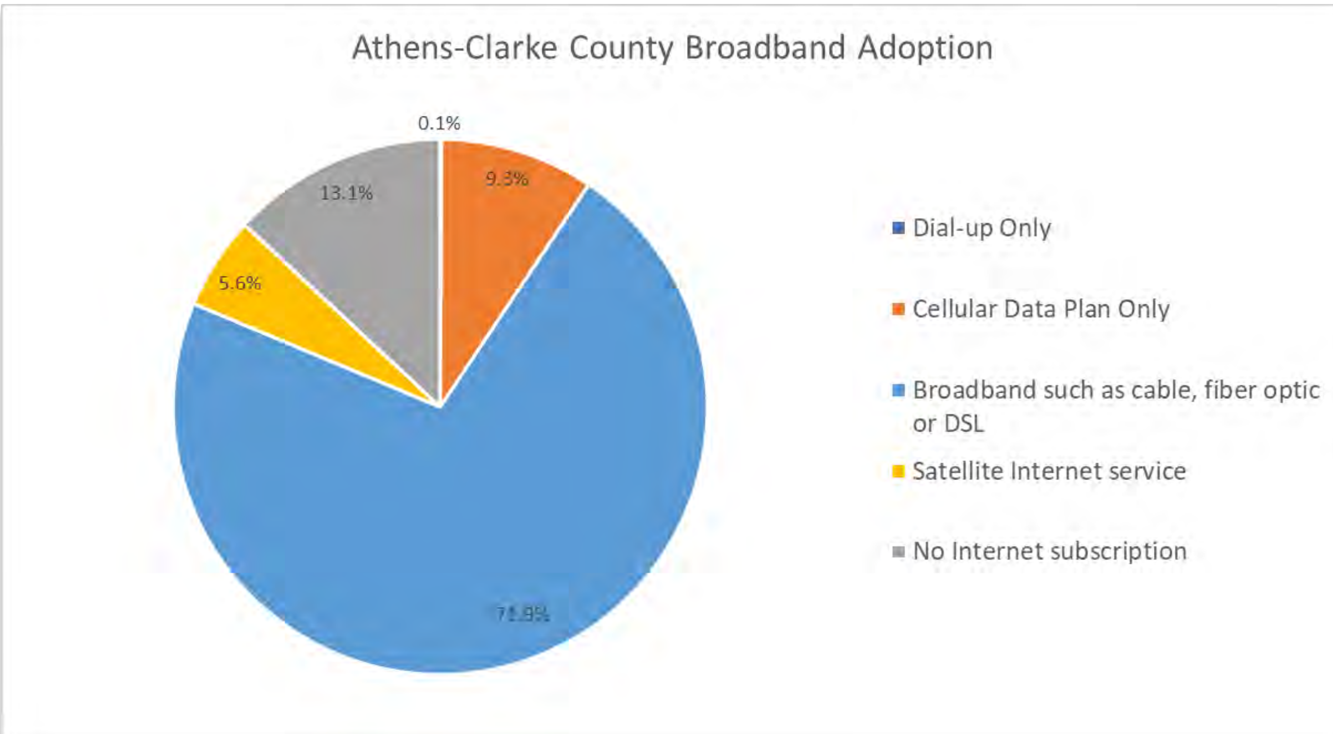

Figure 3.10

Additional County Needs

Athens-Clarke County is a community of more than 120,000 citizens in northeast Georgia. It sits about 65 miles east of Atlanta and is one of the fastest growing metro regions in the United States. Athens is the most urbanized area in the County and is considered the center of employment, culture, education, and business activity. The County is also home to The University of Georgia and several large institutional employers like Piedmont Athens Regional Hospital and St. Mary's Healthcare System. The County has seen steady population growth over time and is projected to continue as The University of Georgia expands. The number of students living in the area has had a major impact on the community, with half the County's population being under the age of 26.

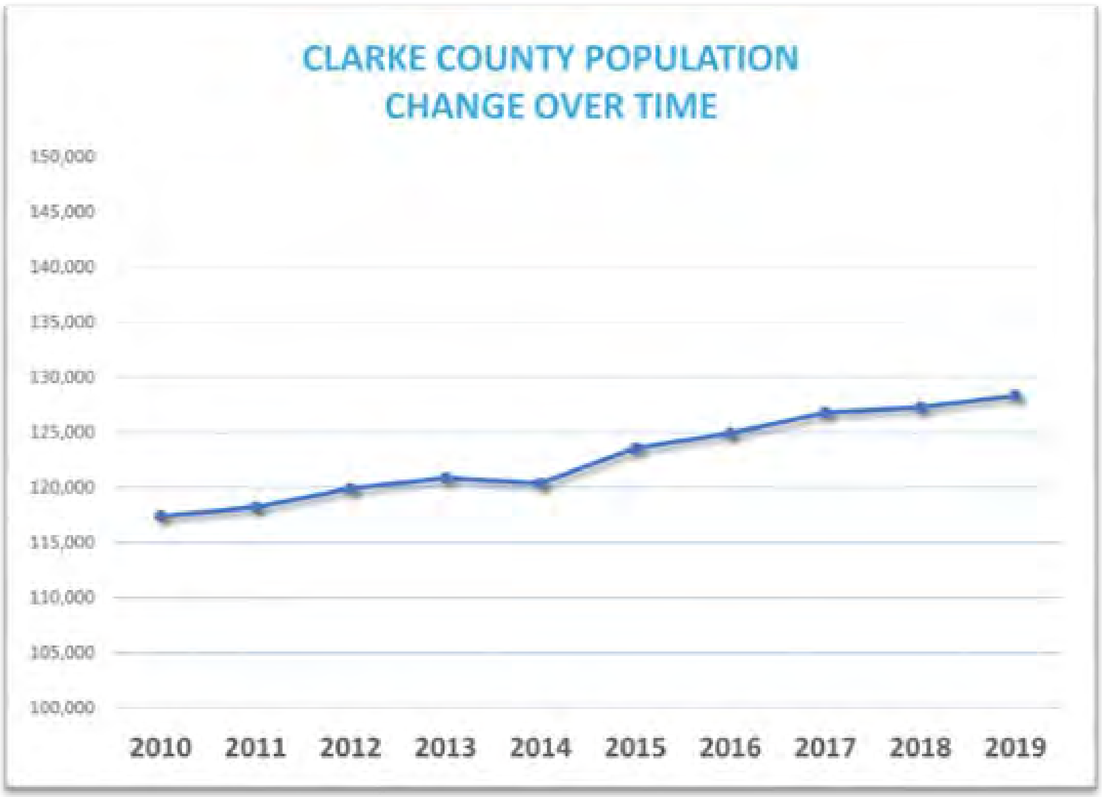

Figure 3.11

To keep pace with the demands of a fast-growing community, the County must focus on the need for universal access to broadband services for all residents. Because broadband's applications are so wide ranging, it can deliver services that touch every social determinant of health. In this report, we will discuss examples of how broadband and the services it enables are tied to economic stability, education, social support, and overall health of individuals and communities.

Demographic statistics also suggest Athens-Clarke County is struggling with an elevated poverty rate. When the Envision Athens Action Agenda was written in 2017, close to 37% of residents lived below the poverty line. When this figure was adjusted for the college aged population, the rate decreased to 28%. More recent data has seen a decrease in poverty rates in Athens-Clarke County; however, despite these improvements it still ranks in the top half of Georgia counties.

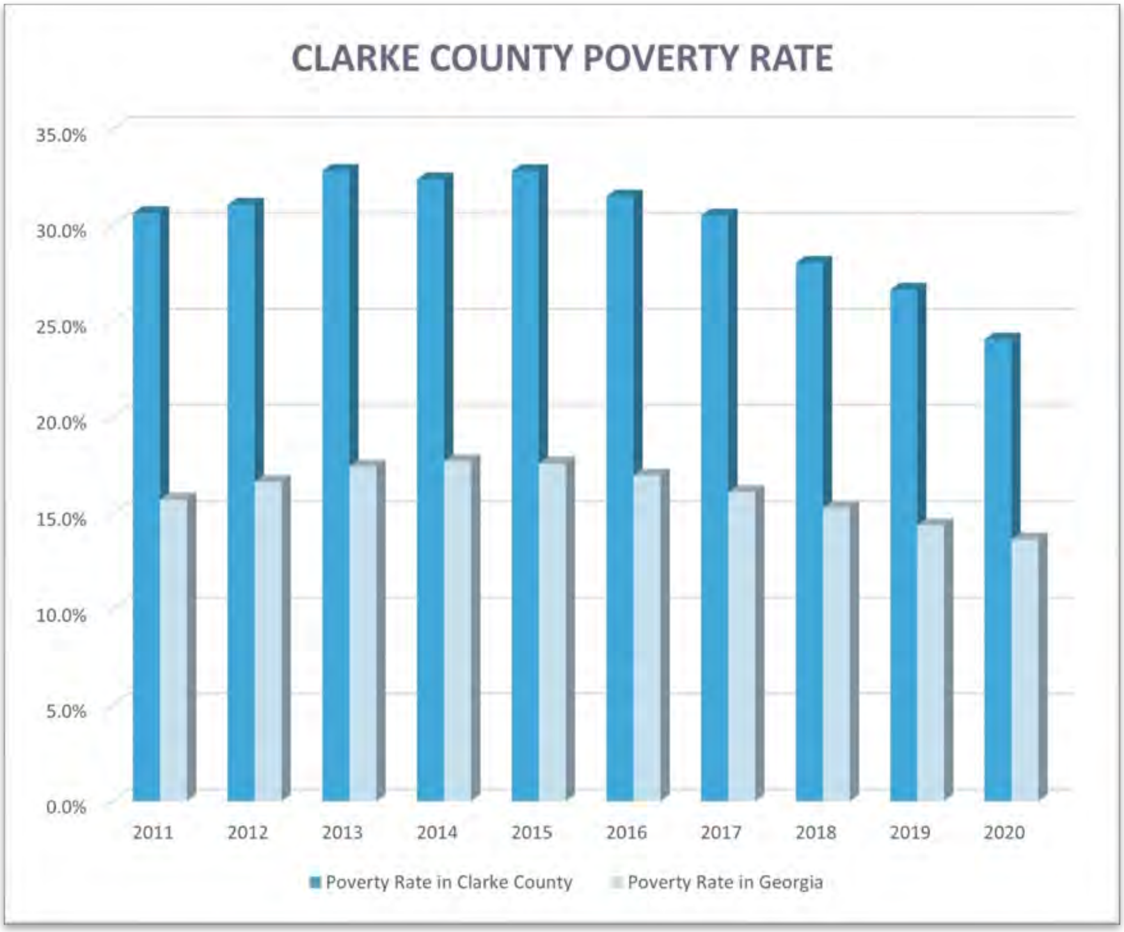

Figure 3.12

Envision Athens noted an increase in the rate of residential construction which appeared to mostly consist of multifamily developments designed specifically for students. The report observed a 0% vacancy rate for senior housing in Athens-Clarke County, meaning this type of housing is likely in need of added supply. Single householder dwellings grew by 27% from 2000. This was the largest growth of any segment and was driven by the community's younger overall population associated with the major university. The County has a positive net commuting flow with more than 40,000 workers commuting into the County while only 18,000 workers commute out of the County. It was revealed that only about 20,000 people were reported to live and work in the County, and about 60% of County residents rent versus owning homes. Other impacts on economic development are the region's lack of direct interstate access and limited availability of industrial and commercial properties. The U.S. Census Bureau reported Athens-Clarke County median household income in 2020 was $39,713. Single-family housing construction has decreased, and workforce housing is needed as home sale prices are out of reach for many families to afford.

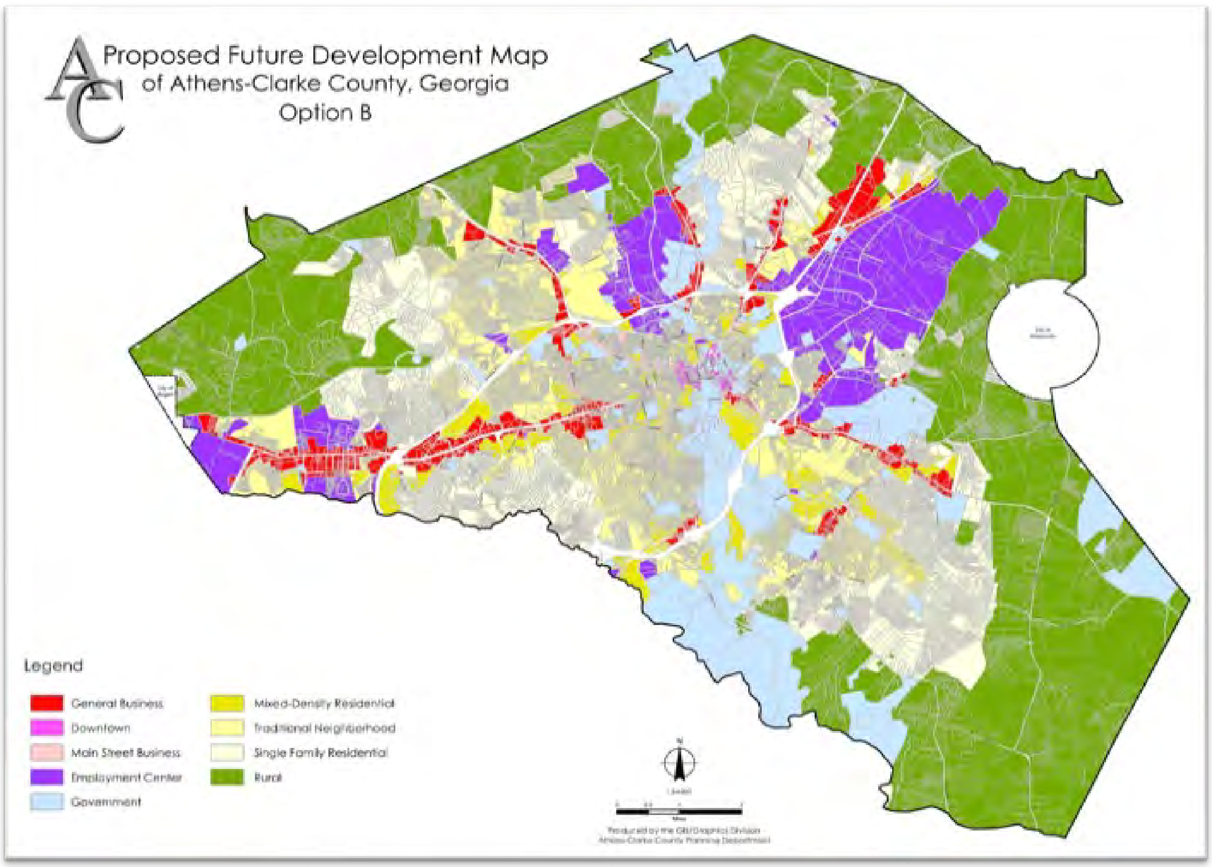

Figure 3.13

To accommodate the growing population, the County should ensure that its community anchor institutions are served by a municipal fiber network. In Athens-Clarke County there are sixty-six addresses identified as community anchor institutions including police stations, fire stations, and government offices. Forty-one of the sixty-six addresses are currently served by a mixture of County and ISP (internet service provider) fiber. It has been noted that much of the existing fiber is single mode fiber and considerations should be made for necessary updates. Broadband needs of the whole County will be discussed in greater detail later in this document, as well as recommendations for a network route which would better serve the needs of all residents and community anchor institutions.

DEMAND AGGREGATION

The demand aggregation process for the Athens-Clarke County, Georgia broadband study began on August 12th, 2022, and concluded on October 3rd, 2022. The demand aggregation survey helped to gather feedback from the community about their technology needs, existing or future internet service cost, satisfaction with services, and service availability. A survey flyer and link were posted to the Athens-Clarke County website along with a video overview of the survey. In person community engagement sessions about this process were held on September 14th, 2022, at the Athens-Clarke County Library and on September 17th, 2022, at Athens-Clarke County Fire Department Station #7. Survey flyers were also distributed to community schools. A total of 952 surveys were recorded, with 931 responses from a unique address. A total of 9 broadband champions, local advocates in the community, offered their support to spread the word about the survey. The demand aggregation survey included up to 25 individual questions relating to broadband, ranging from "Do you have internet service today?" to "How important is internet service availability and/or internet speed when choosing a location to live?".

Respondents were asked to conduct an internet speed test on their home internet connection by connecting their computer directly into the modem through an ethernet cable or standing near their router while taking the speed test.

The following figures show the responses received for each question asked in the survey.

Survey and Speed Test Results

Figure 4.1 displays the areas where demand aggregation survey responses were received and their corresponding broadband definition. Each pinned location represents a broadband speed (Unserved, Underserved, or Served) as defined by the Federal Communications Commission (FCC) categorized if the respondent participated in the internet speed test portion of the survey.

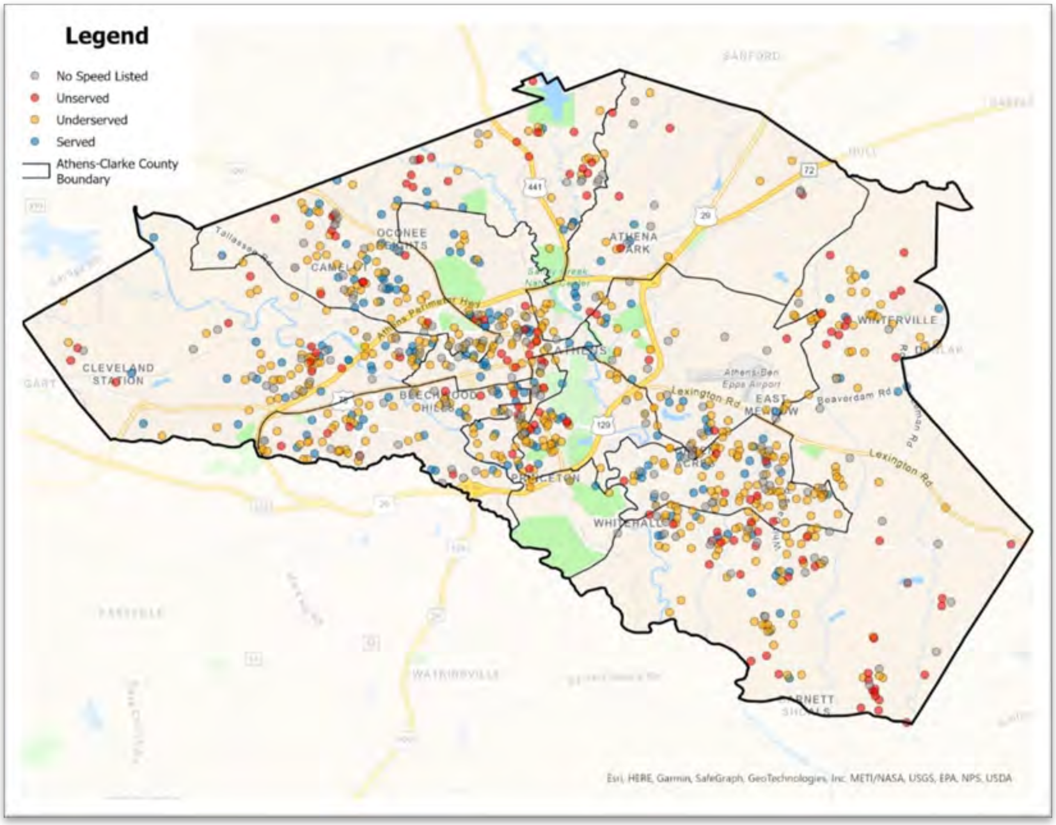

Figure 4.1

Unserved	FCC Broadband Definitions Underserved	Served
Less than 25 Mbps Download	Greater than or equal to 25 Mbps but less than 100 Mbps Download	Greater than or equal to 100 Mbps Download
Less than 3 Mbps Upload	Greater than or equal to 3 Mbps but less than 20 Mbps Upload	Greater than or equal to 20 Mbps Upload

Figure 4.2

Of the survey respondents, 98% currently have internet service. Of the respondents who did not have internet service, 50% of respondents indicated price was a factor while 36% indicated that lack of availability was the reason they did not have service.

Figure 4.3 shows the breakdown of current speeds recorded by survey respondents through an internet speed test. 17% of respondents either did not have internet access or did not complete the speed test. Of the speed tests taken, only 48% met the current FCC definition of served. Since this differs from the FCC data reporting the percentage of population served as 98%, it appears that coverage is not as accessible as the block-level reported data would make it seem, or the consumer experience of the internet speeds is not consistent with the speeds advertised by providers.

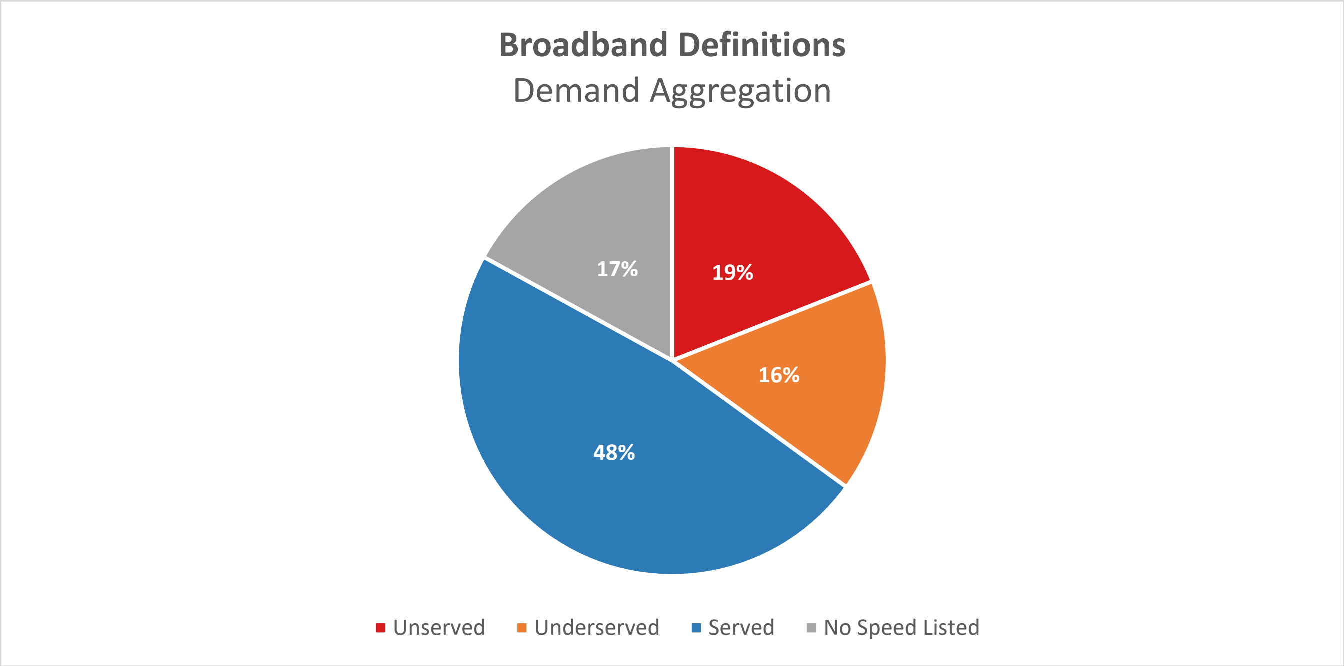

Figure 4.3

Internet service providers (ISPs) that respondents currently purchase internet services from can be found in Figure 4.4. Cellular providers have been excluded from provider table.

Internet Service Provider	Respondents	Percentage of Respondents
AT&T	257	31%
Comcast	7	1%
Spectrum	553	67%
Windstream	13	2%

Figure 4.4

Figure 4.5 displays the distribution of answers to the questions on satisfaction with current internet cost, current internet reliability, and current internet speed. 75% of respondents were satisfied with the cost of their current internet service, 76% of respondents were satisfied with the reliability of their current internet service, while 52% of respondents were dissatisfied with their current internet speed.

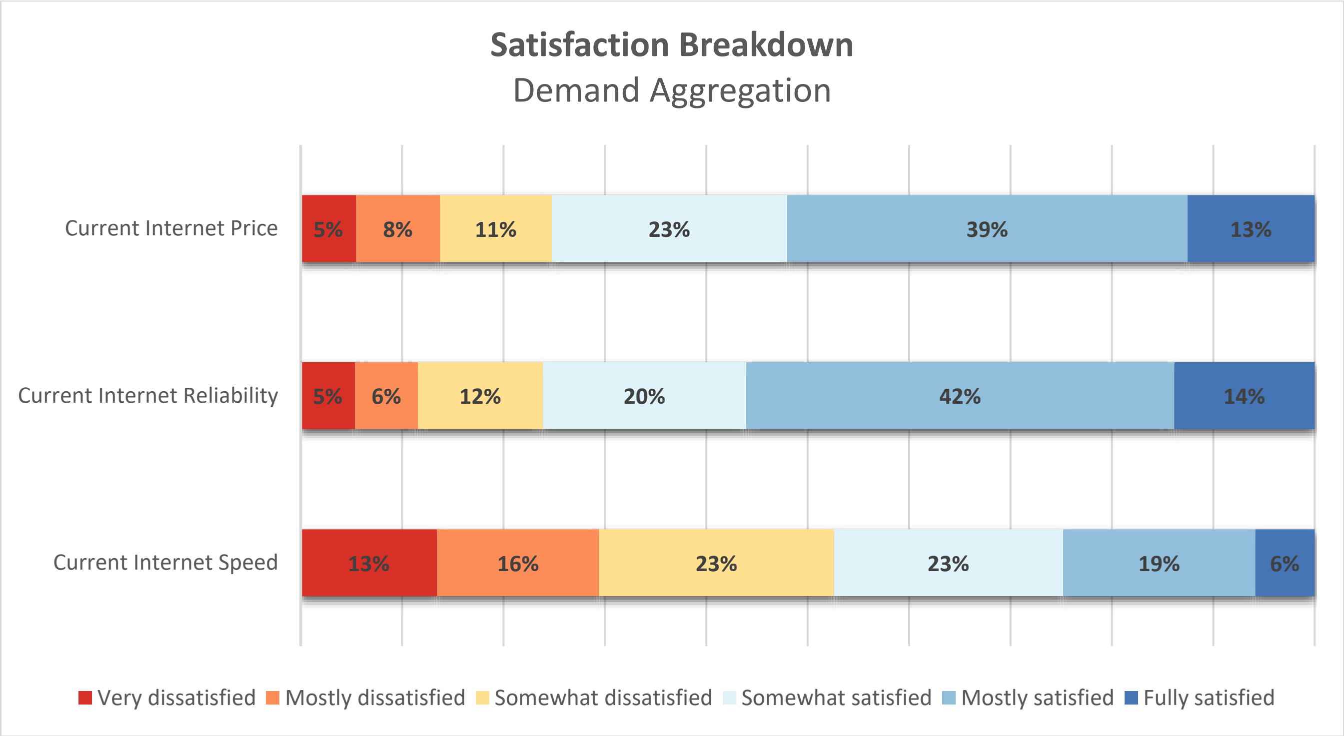

Figure 4.5

Figure 4.6 and Figure 4.7 display the most desired bandwidths and which building type they apply to: single-family home versus multi-dwelling units such as apartments. For both categories, over 65% of respondents identified that they would prefer 500 Mbps or 1 Gbps plans which infers a desire for increased bandwidth.

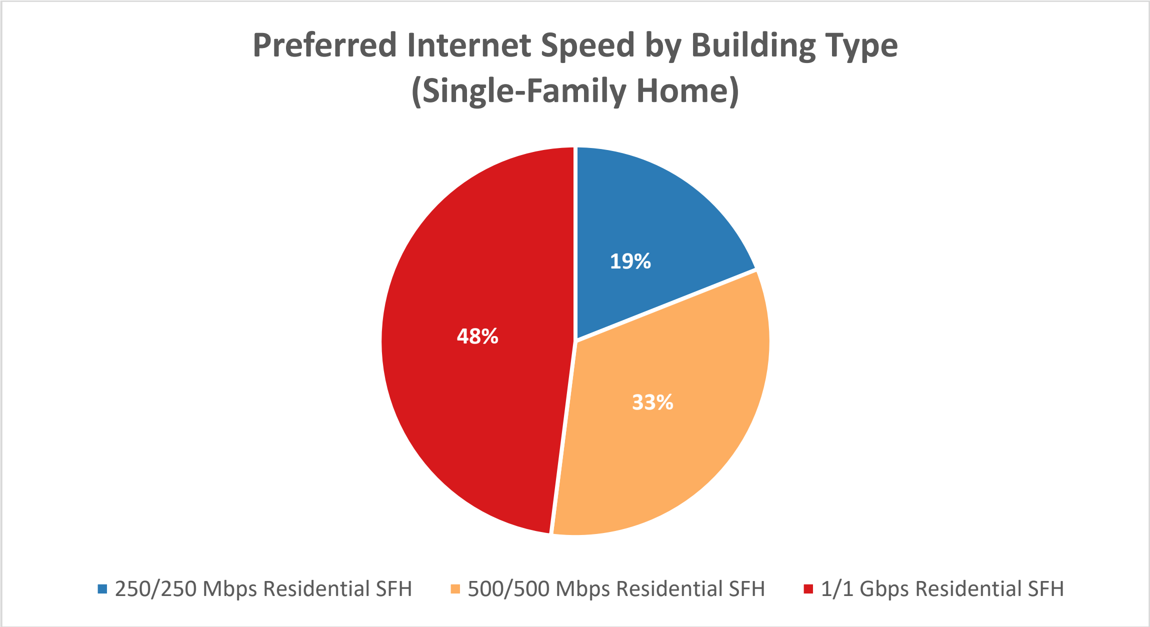

Figure 4.6

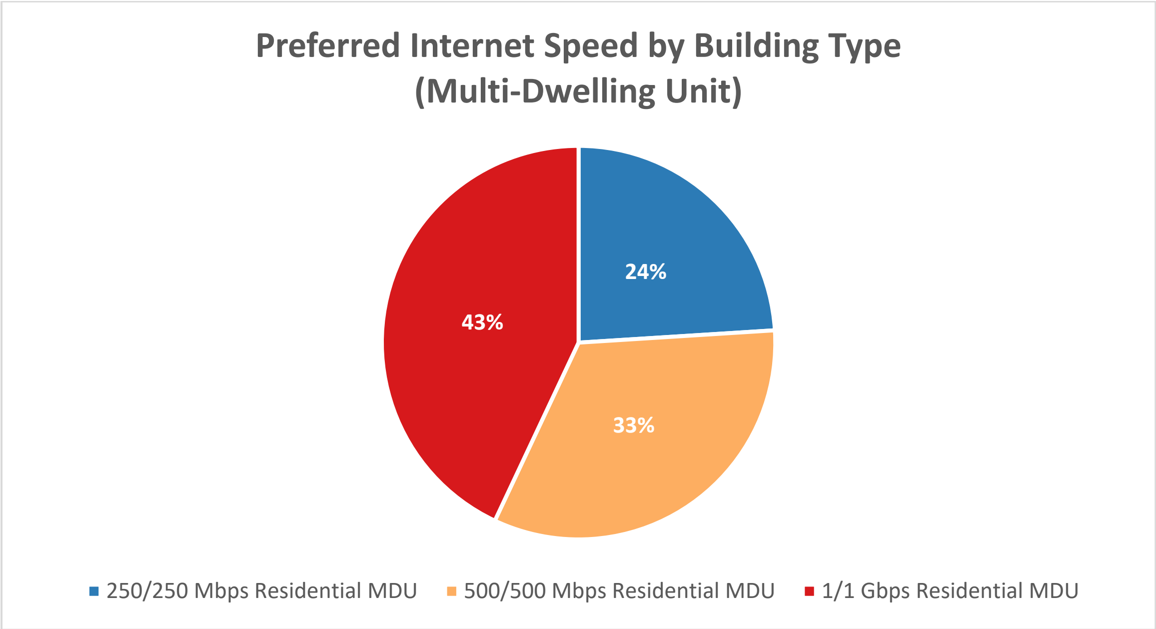

Figure 4.7

Figure 4.8 shows that 11% of respondents answered that they currently receive some type of federal government assistance (SNAP, Medicaid, WIC, etc.). This indicates that respondents may qualify for programs like the Affordable Connectivity Program (ACP), which aids in securing internet access for low-income families.

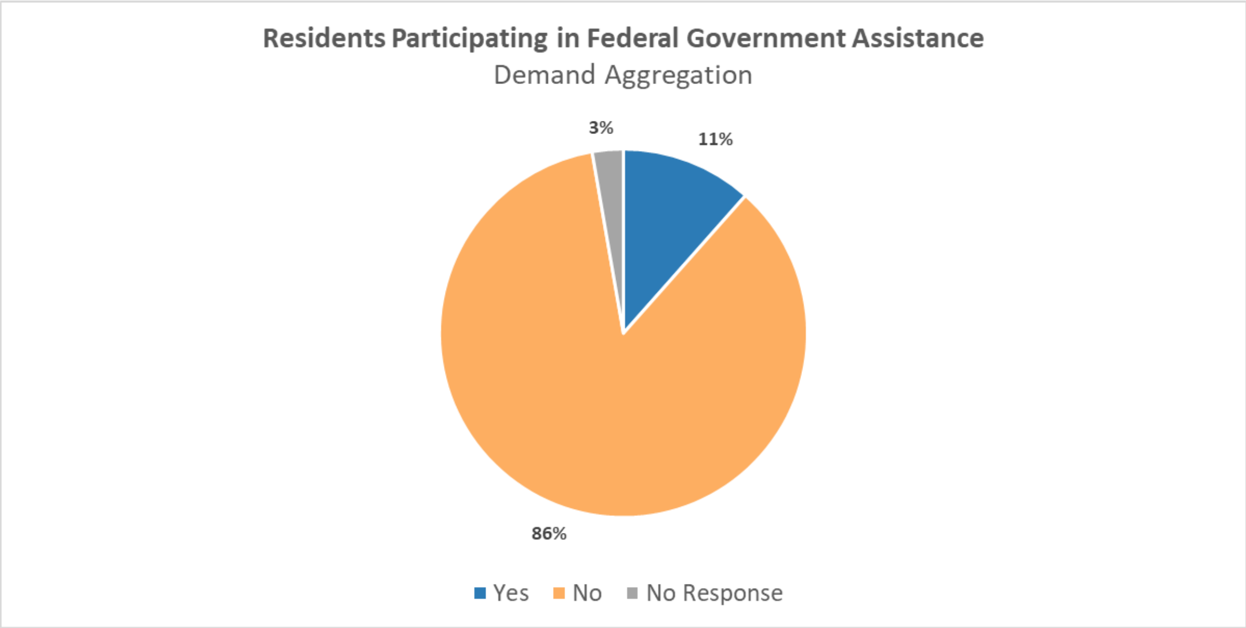

Figure 4.8

When asked about their monthly internet service cost, 31% responded they were paying $80 or more a month, 42% indicated they were paying $60-79 a month, and 18% indicated they were paying $40-59 a month. Additional responses are listed in Figure 4.9.

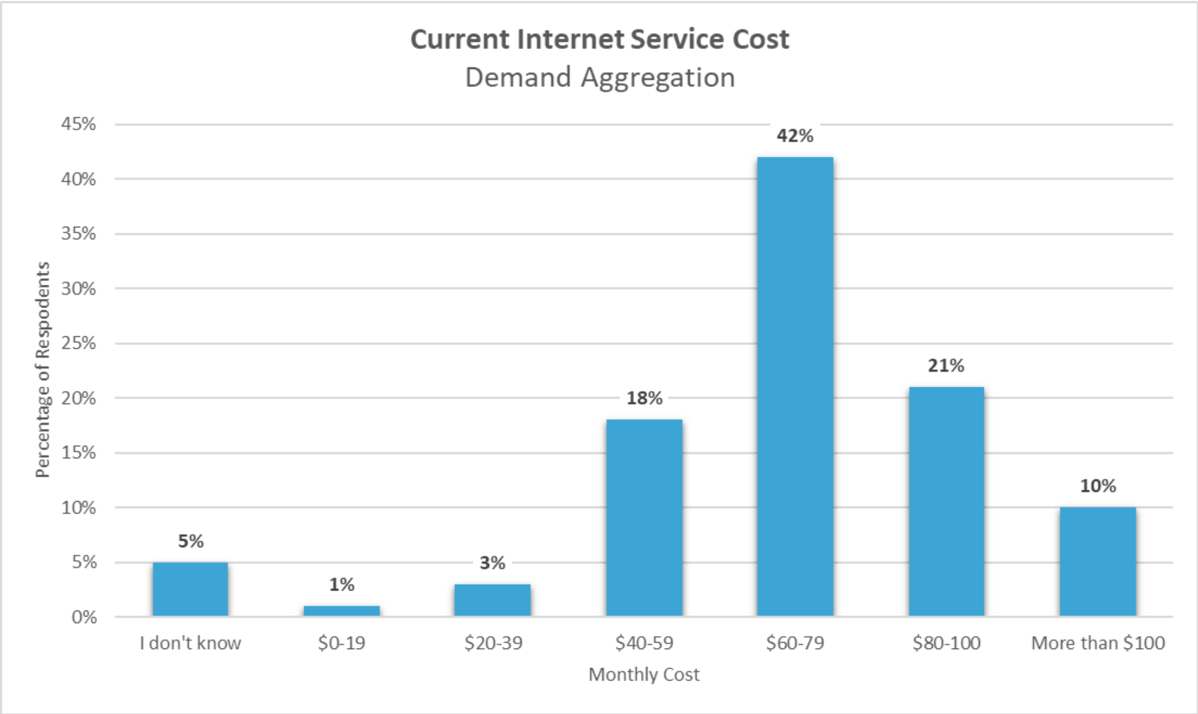

Figure 4.9

When asked if better internet service were available to you, how much would you feel is appropriate for this improved service per month, most respondents answered that the preferred range would be between $50-$89. Figure 4.10 displays additional price preferences.

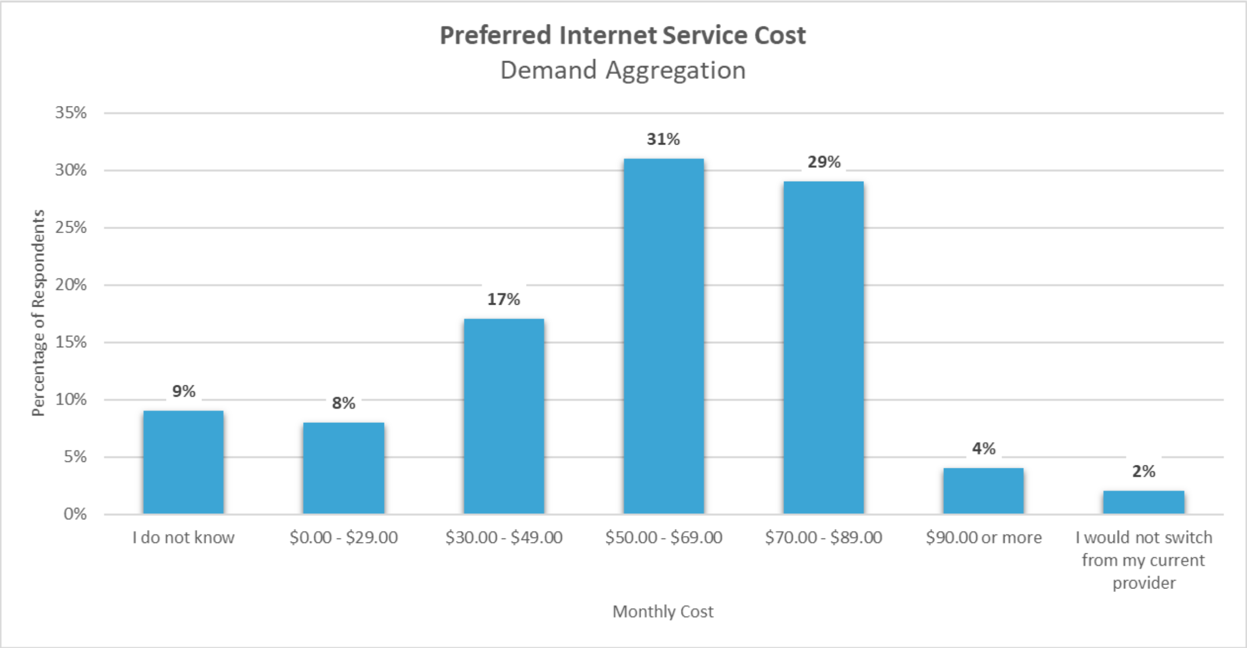

Figure 4.10

Current Internet Usage

33% of respondents answered that they mostly used their home internet for streaming services while 30% of respondents answered that they mostly used their home internet for work purposes. Additional responses can be seen in Figure 4.11.

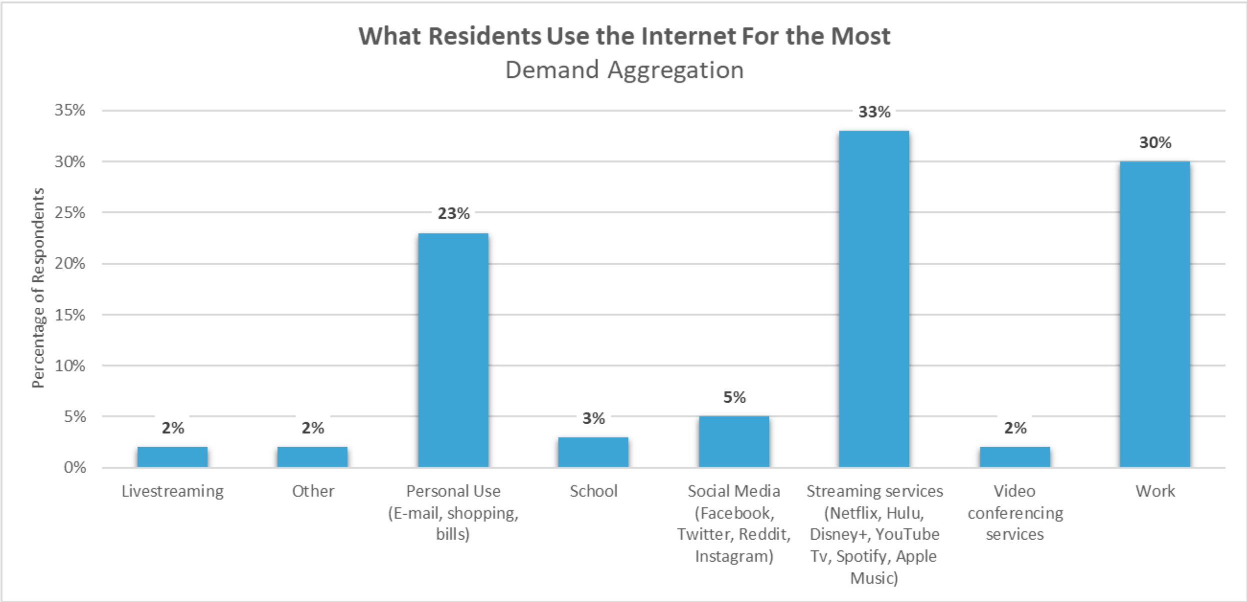

Figure 4.11

When asked about the importance of internet availability in deciding where to live, 58% of respondents said that internet service availability was very important when deciding where to live while 24% responded that it was most important when making their decision. Additional responses can be seen in Figure 4.12.

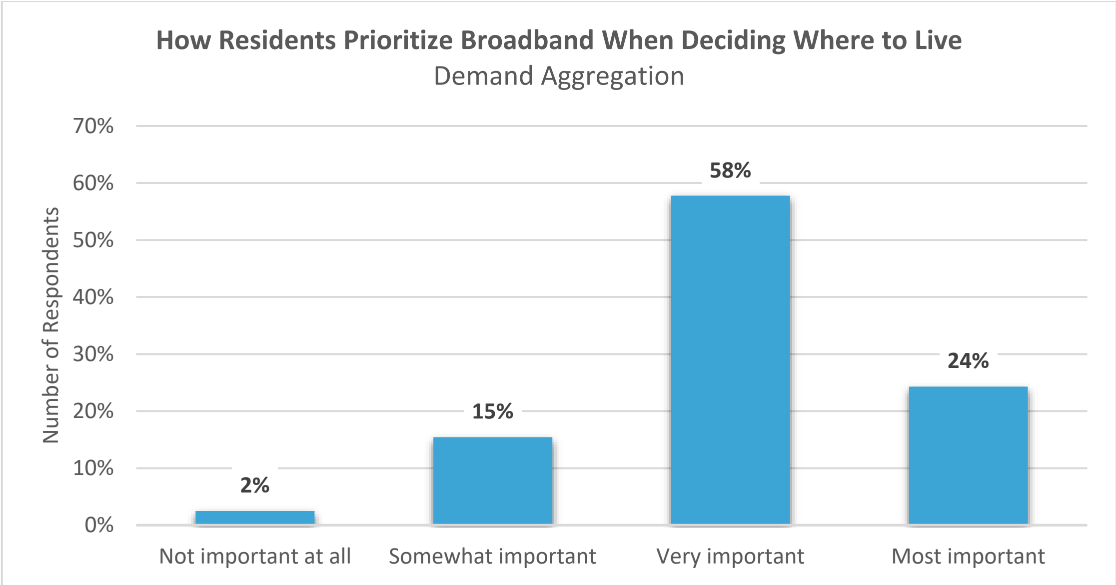

Figure 4.12

37% of those surveyed answered that they utilize their internet for school with 44% of those households having two or more people using it for these purposes. Figure 4.13 shows that 70% of those who use their Internet for schooling purposes use it five or more days a week.

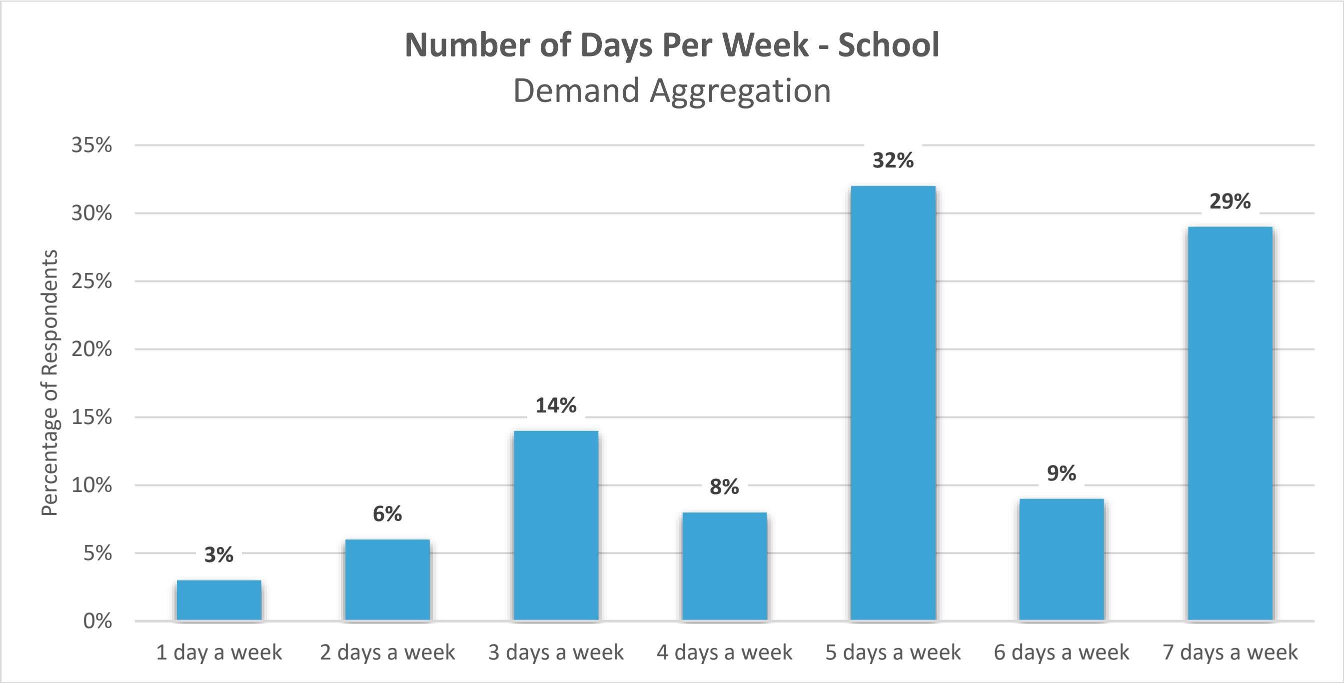

Figure 4.13

76% of those surveyed answered that they currently utilize their internet to work from home or for business related items with 53% of those households having two or more people using it for these purposes and 72% use it for five or more days a week (Figure 4.14).

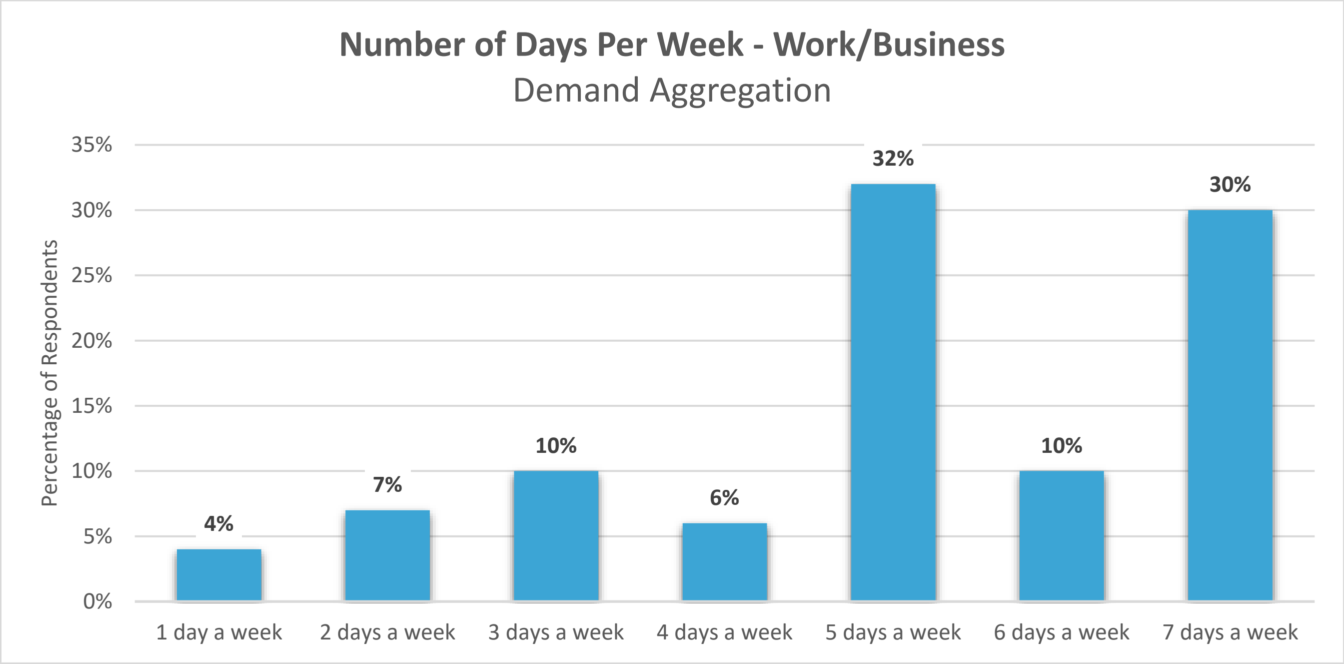

Figure 4.14

Figures 4.15 displays the total number of devices per household. 57% responded that they own five or more devices that utilize the internet.

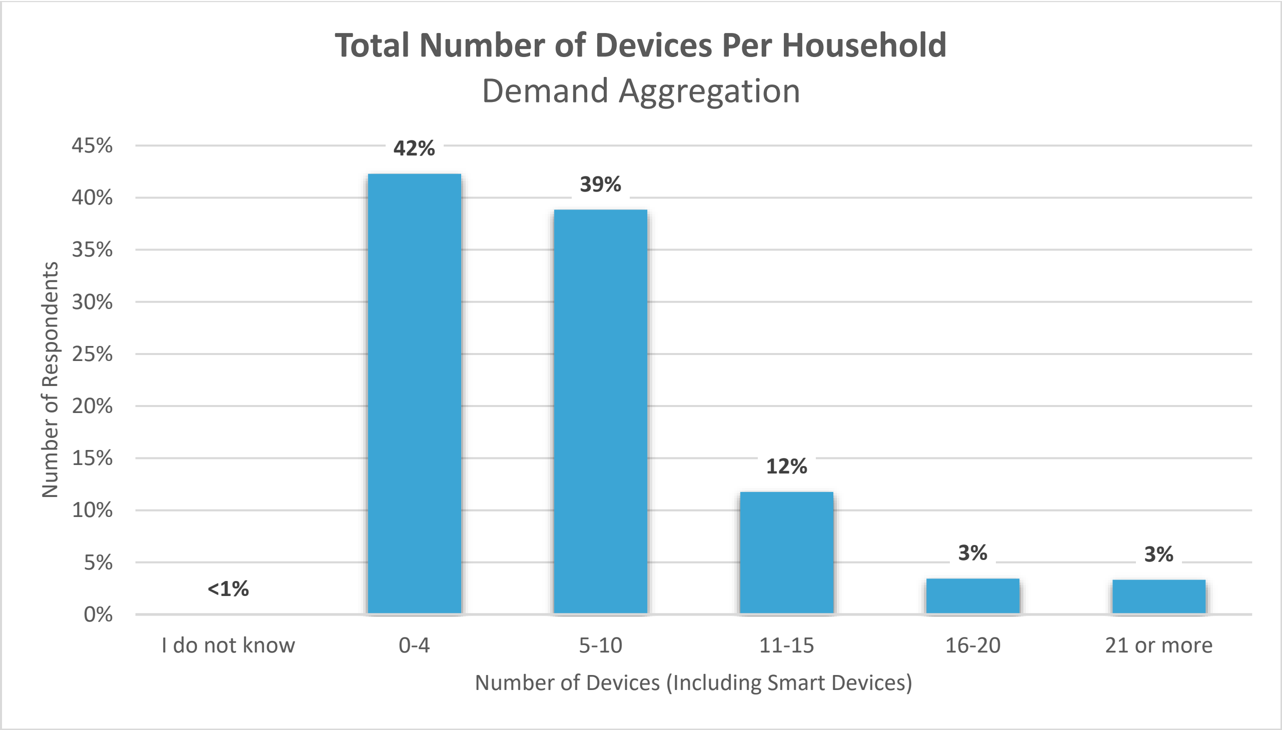

Figure 4.15

GAP ANALYSIS

The following gaps and solutions were identified through the strategy session, needs case assessment, and broadband research phases of this project. Along with the three gaps there are three actionable solutions the County can capitalize on through investment in fiber infrastructure.

Gaps

Following the strategy session and broadband assessment, Foresite Group identified three gaps related to broadband service and infrastructure within Athens-Clarke County. These range from the accessibility of service for all residents to general infrastructure planning.

Lack of Internet Connection in Throughout County

After analyzing multiple data sources containing broadband connectivity and infrastructure information, as well as discussions with current internet service providers (ISPs) in the area, Foresite Group is proposing the exploration of a design to help the County plan and prioritize next steps and incentives for extending broadband connectivity to the unserved and underserved areas. Foresite Group has identified areas displaying the greatest need in the northern and southern portions of the County. These areas are the most rural parts of the County where incumbent providers have little incentive to extend service and new providers are unlikely to establish a footprint due to a lack of return on investment.

Low Rate of Residential Broadband Adoption

Even in areas where internet connection is available, there appears to be a gap in service subscriptions. When comparing the FCC data from June 2021 and the American Community Survey data, it is estimated that over 98% of the County has access to cable internet service at a reported speed of greater than the "served" threshold of 100/20 Mbps; however, only 72% of households appear to be subscribing to this service. This may be due to affordability, limitation in digital skills, or lack of interest in internet services.

Connection Needs for County Buildings to Fiber Infrastructure

The existing municipal fiber network does not connect all sixty-six community anchor institutions in the County to fiber service. Most notably, several fire stations and one police substation are not connected to fiber. Community anchor institutions are spread across the County, with some in hard-to-reach rural areas. If the backbone ring proves to be feasible, it should be used as an opportunity to improve connection to County-owned facilities. Improved connection can include faster speeds available to County facilities, increased redundancy, and higher autonomy over the network if the County is the infrastructure owner which could result in cost savings or revenue generation.

Solutions

The following solutions provide actionable items the County can use to address the broadband gaps identified in the previous section.

Extend Service to Unserved and Underserved Areas of the County

Community anchor institutions provide essential services and vital information to residents; however, a connected County government cannot effectively serve the community without its residents being connected as well. A solution would be to plan a fiber network route using community anchor institutions as a guide, but also ensure the route provides the opportunity to serve as many residential addresses as possible. This can be achieved by sizing the fiber cables to be able to scale to serve the entire county and leave strategic future access points along the route. This will ensure network capacity to serve new developments for the growing population.

Foresite Group will pursue a design consisting of two elements, a backbone ring that would connect County facilities and expand middle-mile access for providers and a fiber-to-the-home (FTTH) design that models how the backbone network would be utilized to reach unserved or underserved locations. The FTTH design will be used to create a business model, determine feasibility, and prioritize areas of the County based on current user experience, provider reported services, and cost.

A high-level cost estimate will be generated based on the design. The cost estimate will include pricing for engineering, materials and labor, and capital expenditures. The goal would be for Athens-Clarke County to use this design and cost estimate to partner with ISPs to extend service to unserved and underserved locations. Foresite Group will model the feasibility of the build out of the full design and understand most important areas in the County to target with network expansion.

Coordinate With Local ISPs

Athens-Clarke County has an opportunity to coordinate with local and state governments on their planned infrastructure projects such as road improvements and water projects. By notifying local ISPs of upcoming infrastructure projects and coordinating with the various entities to allow a window for ISPs to complete broadband construction, this can reduce the construction costs that local ISPs encounter when expanding or improving their network. Lower construction costs will allow local ISPs to expand their network farther while consistent permit application processes can increase "speed to market".

The County should also engage with local providers to ensure programs like the FCC's Affordable Connectivity Program are being utilized and advertised by local internet providers.

Enhance Infrastructure Policies and Planning

The County should consider implementing a dig-once policy for all public construction projects that involve breaking ground in the public Right-of-Way. This would include the installation of conduits and handholes for broadband use. These conduit runs should be for the entirety of the impacted Right-of-Way and should, at a minimum, include dedicated conduits for the County's own use, conduits available for leasing purposes and spare conduit. The County could incorporate a construction moratorium for a reasonable amount of time to minimize any additional construction that might impact County maintained streets. In turn, the County would make the installed conduit available to any service provider, in a non-discriminatory way, for use in installing telecommunication service to residents and businesses to help with any perceived burden the construction moratorium might cause.

As a variation of the dig-once policy, the County could consider incorporating an open-trench policy. Along with requiring County-owned and leasable conduit to be installed on all public projects, the County could invite existing and prospective telecom providers to participate and take advantage of ongoing construction to install their privately-owned conduits in the same trench. Interested providers would need to contribute to the effort, which would help reduce some of the project's costs. This option would give incumbents an opportunity to enhance their infrastructure but keep it under their management. At the same time, the County-owned infrastructure would provide an opportunity to newcomers and help bolster a more competitive broadband market.

For reference, listed below are links to existing municipal dig once policies. The Gonzales, CA Dig Once Policy is straightforward and lists the types of projects that would require the installation of a spare conduit for the City of Gonzales, CA. The policy also specifies the standards for the conduit type and installation. Dig Once/Open Trench policies from other municipalities are provided with this gap summary. The list of communities used for reference is included below:

- Salinas, CA
- Gonzales, CA
- Santa Cruz, CA
- Breckenridge, CO

In addition to the implementation of these policies, the County should consider planning broadband expansion with other capital improvement projects. This would allow the County to deploy conduit infrastructure while saving on the cost of a separate conduit installation project. An asset would be developed that the County could use to either lease out to incumbent ISPs to reach high priority areas with fiber or for their own County purposes.

BROADBAND NETWORK – HIGH LEVEL DESIGN

Selecting the optimal network model for a community requires evaluating models based on cost for deployment, topographical barriers, and subscriber distribution. Two components were evaluated to determine the best-fit option available. These components are discussed in the following sections.

Last-Mile Network

A "Last-Mile" network is a term given to a broadband distribution network that delivers internet service from a service provider's hub location, commonly referred to as a central office or CO, directly to a customer. This type of network offers direct service to customers and can be deployed via both wired cable and wireless alternatives. Wired options include service through traditional copper cables, coaxial cables, and fiber optic cables. Wireless alternatives include over-the-air services including fixed wireless and satellite broadband.

Wired options are considered more reliable in terms of internet speeds offered and low-latency service. Latency refers to the time it takes data to pass between two points in a network. The longer time it takes, the slower the response and slower service feels on the client side. Lower latency is a requirement for more advance internet applications, such as video conferencing and telemedicine. Low latency is one of the strongest aspects of a wired network. These networks, however, require the physical deployment of cables and infrastructure and are more costly to build-out, especially when trying to reach remote locations. The most common wired networks include:

- Fiber-to-the-Home (FTTH): An FTTH network consists of deployment of entirely fiber-optic cable networks that interconnect customers to a provider's central office. FTTH networks offer the highest possible speeds and low-latency service via a dedicated connection to the customer. The biggest downside is that the equipment required to offer the service is more costly than other types.

- Coaxial: A coaxial network relies on offering internet service through the same coaxial cables that offer television service in most areas. An advantage of this network type is it can use existing coaxial cable networks that have been deployed in developed areas and may require less capital investment on augmenting the system. Its biggest drawback is that internet service shares a "common pipe" through a cable, which can reduce the speed and quality of service delivered when multiple customers are sharing the cable.

- Hybrid Fiber Coax (HFC): A HFC network utilizes fiber optic cables for the headend and feeder distribution systems and coaxial cables for the customer's end connection. A HFC network allows cable providers to leverage their existing coaxial network to provide internet and telephone services. HFC networks are more reliable than coaxial networks and have minimal signal loss over distances. However, HFC networks are not able to provide the high speeds or symmetrical speeds that FTTH networks offer. HFC networks also share the same drawback of a coaxial network, sharing a common pipeline with multiple subscribers as explained in the coaxial network description.

- Asymmetric Digital Subscriber Line (ADSL): An ADSL network consists of usage of copper cables that are traditionally used to deliver telephone service and can be augmented to offer internet service. Like coaxial networks, ADSL networks can leverage existing copper networks to deliver the service. ADSL networks, however, have stricter distance limitations than the other two wired networks, the signal degrades the longer it travels through the existing plant. Copper networks also tend to degrade faster than the other two and are considered mostly obsolete in the modern landscape.

Wireless alternatives have the advantage of requiring less physical infrastructure deployment to provide service. Because the primary delivery method is "over the air" the primary investment is the equipment required for both transmission and reception of the signal. Conversely, wireless alternatives tend to offer services with lower speeds and higher latency than wired alternatives. Distance and physical barriers are also a limiting factor for availability and the level of service offered. The most common wireless networks include:

- Fixed Wireless: A fixed wireless broadband network is a network that delivers internet connectivity over the air via transmission from a fixed distribution point, usually a cellular antenna tower. As the term "fixed" specifies, both the transmission point and reception point utilize equipment that is fixed in place and provides a consistent distance for signal delivery. These networks are useful in remote and rural areas because they forgo the need for installation of physical cable between client and central office, and their fixed nature ensures a consistent level of quality. Fixed wireless networks are limited in service offered by distance and can be impacted by physical barriers to direct line of sight, such as buildings and tree canopies.

- Satellite: A satellite broadband network offers internet service over-the-air via transmission from a satellite in orbit around the Earth. This network has the advantage of being able to reach customers at nearly any location due to its direct line of sight from orbit and lack of distance limitation. Satellite internet service, however, tends to suffer high-latency due to the distance the signal must travel. The service is also affected by weather conditions in the atmosphere, which is a limitation faced by no other alternative.

Middle-Mile Network

A "middle-mile" network is a network that acts as an intermediary connection between one or multiple last-mile network(s), which directly connect to customers, and a "first-mile" network that connects a single region to other regions. The middle-mile is an often-overlooked component of any regional broadband network that can have a large impact on the reliability of service offered and expansion interest of current or new providers in an area.

For internet service in a broadband network to function properly the network must have access to carrier cross-exchange sites, commonly referred to as Point-of-Presence or POPs. These POPs are locations where multiple carriers can set up equipment that allow interconnection between different networks. POPs include equipment set up by long-haul carriers that operate via the first-mile network, which make internet connection possible from region to region. POP sites traditionally are in denser, more developed urban areas, where multiple networks meet. This allows for easier deployment of new or improved networks in urban areas already saturated by existing providers. In contrast, rural areas tend to lack POP sites, forcing existing and proposed rural networks to work their way back to urban areas to provide connection. Because last-mile providers are focused on connecting as many potential clients as possible capital expenses related to connecting back to POP sites are not often a top priority. When costs associated with routing back to a POP site are considered, it often results in excessive amounts that disincentivize investment and deployment. As a result, legacy providers tend to avoid building out to these areas, and available services tend to be limited to satellite and fixed wireless providers who can provide limited coverage via radio transmission.

A middle-mile network acts as a bridge between these two elements. The middle-mile network, which can also be referred to as a "regional backbone" provides high-level transit service through a region, which can allow interconnection between existing or newly proposed provider hubs and existing POP sites. Middle-mile networks traditionally are used to offer wholesale connectivity service and are not used to serve potential customers directly. Rather, they allow a last-mile operator to deploy a new local "central office" site from which they can build out and offer service to new customers. Additionally, it can help wireless internet service providers, or WIPSs, by delivering high-capacity broadband service to existing antenna sites and augmenting the service capability of fixed broadband alternatives.

When adequately deployed, a middle-mile network can greatly enhance telecom expansion interest in a region. It helps lower the amount of capital expenditure required to enhance or create a new network and entices investment from both legacy providers and new providers who saw a barrier to entry.

Athens-Clarke County Middle-Mile and Fiber-to-the-Home Network

Following analysis of design options and consulting with parties of interest, a set of key determinations for the network were determined:

- Athens-Clarke County has a vested interest in enhancing broadband availability throughout the unserved and underserved portions of the County.

- Athens-Clarke County has expressed they would prefer experienced 3rd Party ISPs to own or operate a network that provides direct service to residential or business customers.

- Athens-Clarke County has expressed a preference for underground infrastructure. This preference is supported through environmental impacts, overall topography, and soil composition.

- Make ready and permitting considerations were evaluated.

With these determinations in mind, Foresite Group will explore the development of a FTTH network connected through a backbone ring. Due to the density of populated areas and the physical separations by rivers, major highways and natural topographical boundaries, the design will consist of a single backbone ring, anchored by seven point of presence sites, or huts, to feed a FTTH network within a defined serving area around each hut.

The backbone ring will encircle the project area providing connectivity between hut sites via an 864-count fiber optic cable, with availability for direct service to anchor institutions which could include municipal service buildings and schools, as well as health and safety facilities. In addition, the backbone fiber cable can provide fiber connectivity for existing and future cell tower locations, and available spare dark fibers available for lease or expansion of future technologies.

Each hut is centrally positioned within a serving area boundary determined by geographic boundaries, number of required fiber services, and physical distance from the hut to the furthest service point.

The FTTH network will extend from the hut location utilizing various fiber optic cable sizes to provide feeder fiber to individual fiber distribution hubs, FDH cabinets, within the hut serving boundary. Each FDH will have a defined service boundary that is based on efficient cable pathing and groupings of service points. From the FDH cabinet the last mile connection to the customer service point is provided.

An overview of the backbone and FTTH network design within the recommended area of consideration is presented in figure 6.1 and figure 6.2.

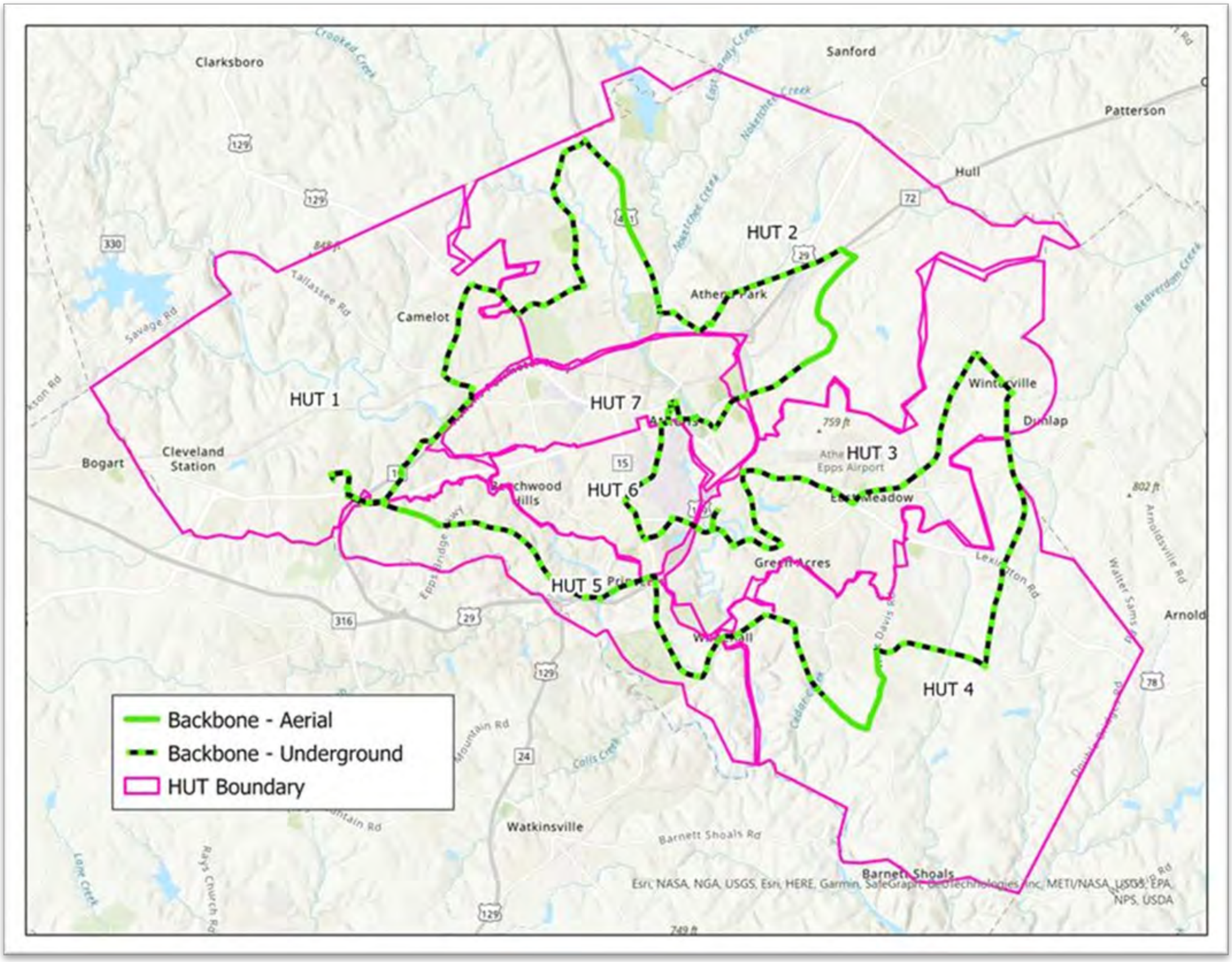

Figure 6.1 – Middle-mile network and Central Office Locations with Service Area Boundaries

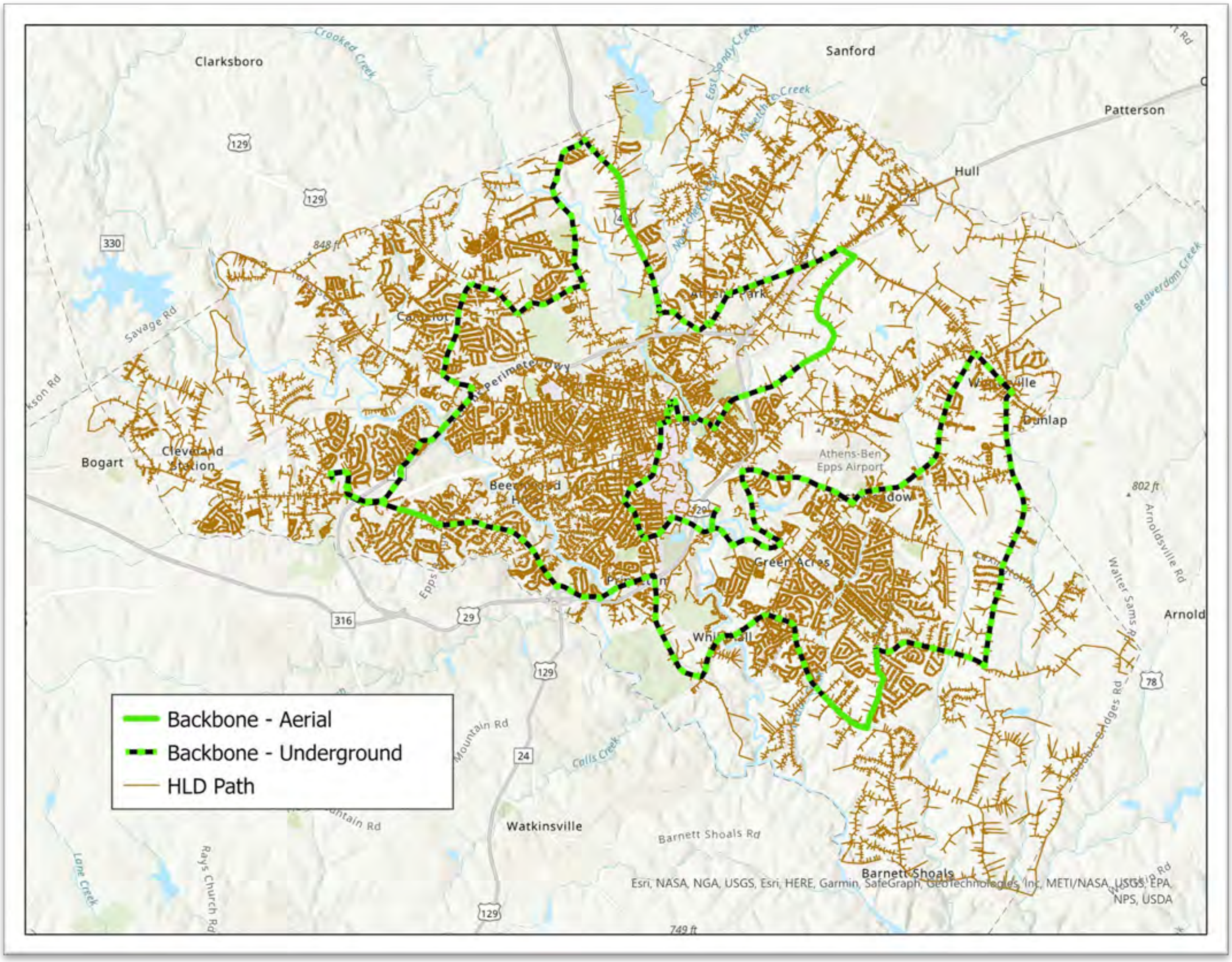

Figure 6.2 – Fiber-to-the-home feeder and distribution with service areas

Address Verification

The process of address verification is necessary to identify and classify all address points that require service within the HLD plan area. Address verification has a direct impact on the overall HLD in terms of cable routing and cable sizing.

The process begins with acquiring available parcel and address point data from the County. This data is then uploaded to a GIS database. All relevant information provided with the address points such as full address and zoning (residential/commercial/government) is uploaded as well, if available.

Once this data is uploaded, a point-by-point evaluation is performed to verify the data against desktop map sources and the most up to date available aerial imagery. The following items are verified and populated within each address point to be used later in the HLD process for demand requirements and cable sizing:

- Address Type – Residential, Business, Government, Cell Tower
- Address Unit Count - Single-Family Unit, Duplex, Triplex, Multi-Dwelling Unit (#), Single-Business Unit, Multi-Business Unit, Government, Vacant Lot
- Number of Fibers Required
- Type of Fiber Required – Split or Unsplit

In the case of vacant parcels, further research is completed through County zoning data and evaluation of surrounding parcels to determine the number of fibers required. If the County has an established zoning or density code in place this will be applied according to parcel size to allocate fibers required for future development. In instances where vacant parcels exist within otherwise developed areas the fibers required are based on the surrounding properties' address type and address unit count.

Field Ride Out

The purpose of a field ride out, is to review areas of a high-level design (HLD) in the field for constructability, or ease of construction, and capture data not attainable from desktop review or other data sources. The field ride out process began with the completion of the high-level design along with a desktop review of cable routing utilizing online map sources for both aerial and street view imagery. Polygon areas defined which streets to ride out for constructability review within a field data collection map. A field ride out team was then deployed to evaluate the polygons. The field ride out for the Athens-Clarke County HLD consisted of approximately 100% of the overall project area.

In the aerial environment, pole routes were evaluated for available attachment space and the extent of make ready engineering (MRE) required to attach. These pole routes were marked in the field ride out map as either viable or not viable. When marked nonviable, this initiated an environment change from aerial placement to underground cable placement. In the underground environment, routes were reviewed to determine if underground construction was possible. If viable, previously unknown pole routes were found along an underground design route they were noted and considered for aerial cable placement.

In addition to constructability, other items were considered when identifying an area for field ride out which included available existing network data, service availability derived from broadband speed tests and FCC data, and any information regarding future network builds. During the field ride out, these areas were evaluated for visible existing fiber infrastructure, new fiber infrastructure currently under construction, and the proximity of the area to existing service that would indicate potential future expansion. If fiber service was found to be present or appeared to be pending, this information was applied to the HLD update and these areas were considered for removal from the overall HLD plan.

Once the physical ride out portion of field ride out was complete the data received from the field ride out team was reviewed, and applicable updates were made to the HLD. These updates included adding service areas based on new construction, removing and altering route sections due to constructability issues, changes of environment for cable placement, and removal of service areas where existing or pending service was found.

MARKET DRIVEN DEMAND TOOLS

During the initial phases of the project, Foresite Group researched and ingested information from a variety of public and private data. Once data was gathered, Foresite Group's high-level design team categorized groups of address points based on geographic features, road routes, address counts, and address density to determine approximate design areas referred to here as "fiberhoods." These fiberhoods represent a grouping of service points associated with a fiber distribution hub (FDH cabinet). Distribution hubs were placed in each fiberhood area, then a conceptual design was created. These designs were then tied together to form a high-level design for the entire county. Foresite Group then used a combination of data gathered throughout the previous phases of the project to establish priority levels for fiberhood areas. Three distinct aspects were considered:

1. User Experience – Demand aggregation responses from Athens-Clarke County residents
    - Download speed test results
    - Willingness to upgrade service
2. Cost Factor – Number of addresses passed per road mile
    - Count of addresses within each fiberhood
    - Number of road miles within each fiberhood
3. FCC Data – Information provided by internet service providers about the quality and coverage of their networks.
    - Estimated fiber availability

These three categories and five elements were used to produce one composite priority score for each fiberhood within the County boundary, known as a priority fiberhood zones. Overall, there is little fiber-to-the-home within the design area. Instead, most connection types are cable. While most fiberhoods' median speed tests were greater than the unserved threshold of 25/3 Mbps, few were greater than the underserved threshold of 100/20 Mbps; therefore, most fiberhoods could be categorized as underserved.

The following table provides an overview of how priority levels align with corresponding scores and colors on the map. In the fiberhood model, scores can range from 5 at the lowest priority and 25 at the highest priority. In Athens-Clarke County, 24 was the highest score of any fiberhood while 9 was the lowest score, not counting areas that lacked enough information to determine appropriate priority grades.

Priority Level	Zone Score	Color	Fiberhood Count
High	20-24	Red	10
Medium-High	17-19	Red-Orange	30
Medium	15-16	Orange	33
Medium-Low	12-14	Yellow-Orange	47
Low	7-11	Yellow	18
Insufficient Data	n/a	Grey	25

Figure 7.1

Various priority levels associated with each fiberhood are shown in Figure 7.2. Observations are provided for each hut specific to its associated fiberhoods and hut-level fiberhood map. Tables showing the overall priority score and relevant attributes that contributed to the grading of the fiberhoods can be found in **Appendix G**.

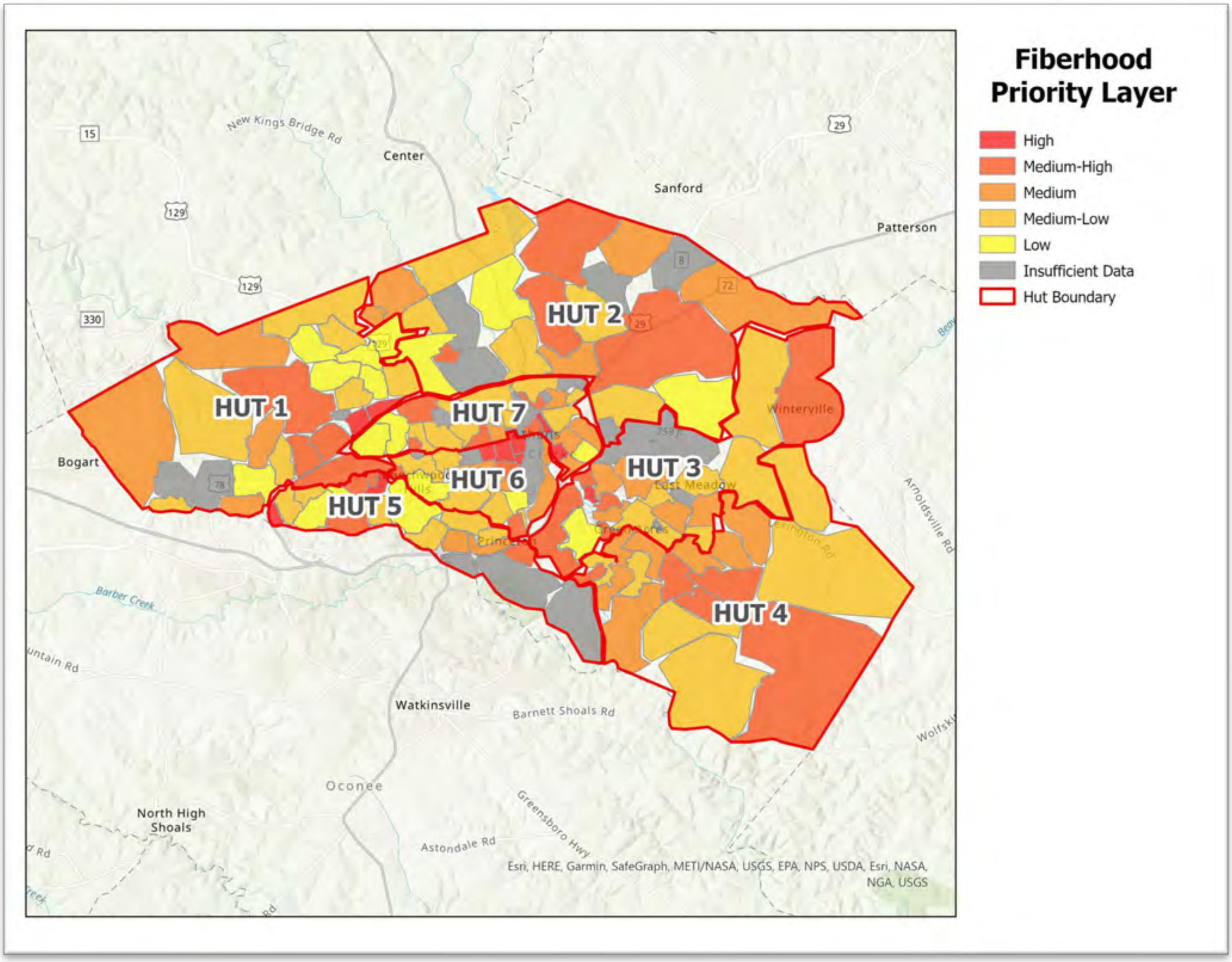

Figure 7.2

Hut 1

Hut 1 is located on the north-western side of the county. It contains two high priority fiberhoods, 1-A and 1-B. It has a high mix of priority levels. 1-A and 1-B appear to be high priority because of their density and lack of access to fiber connection.

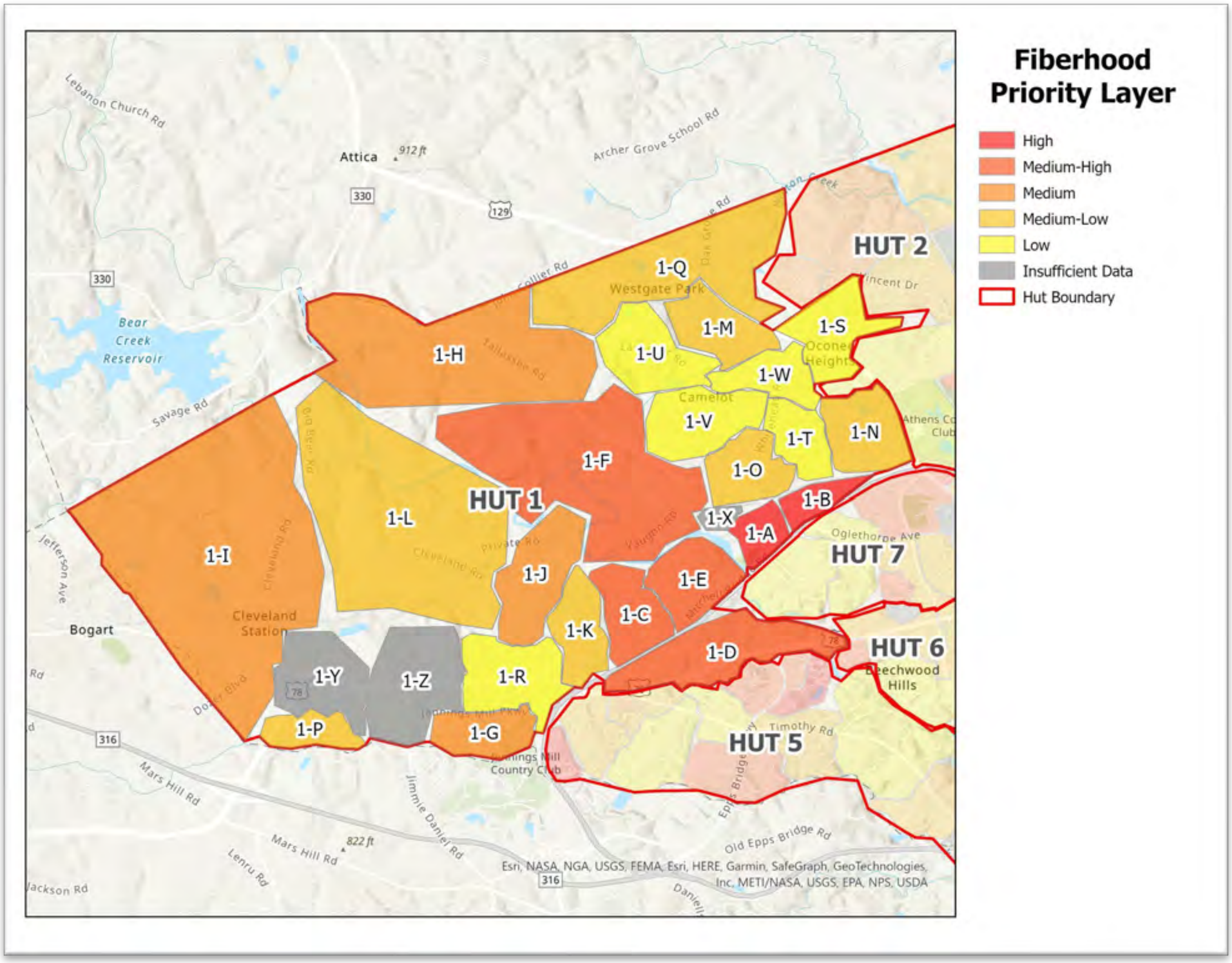

Figure 7.3

Hut 2

Hut 2 is located on the north-eastern side of the county. While it shows a high mix of priority levels, no fiberhood presents at the highest priority level. Fiberhoods 2-B, 2-C, and 2-D all have relatively low service speeds and survey results indicated a high willingness to upgrade services.

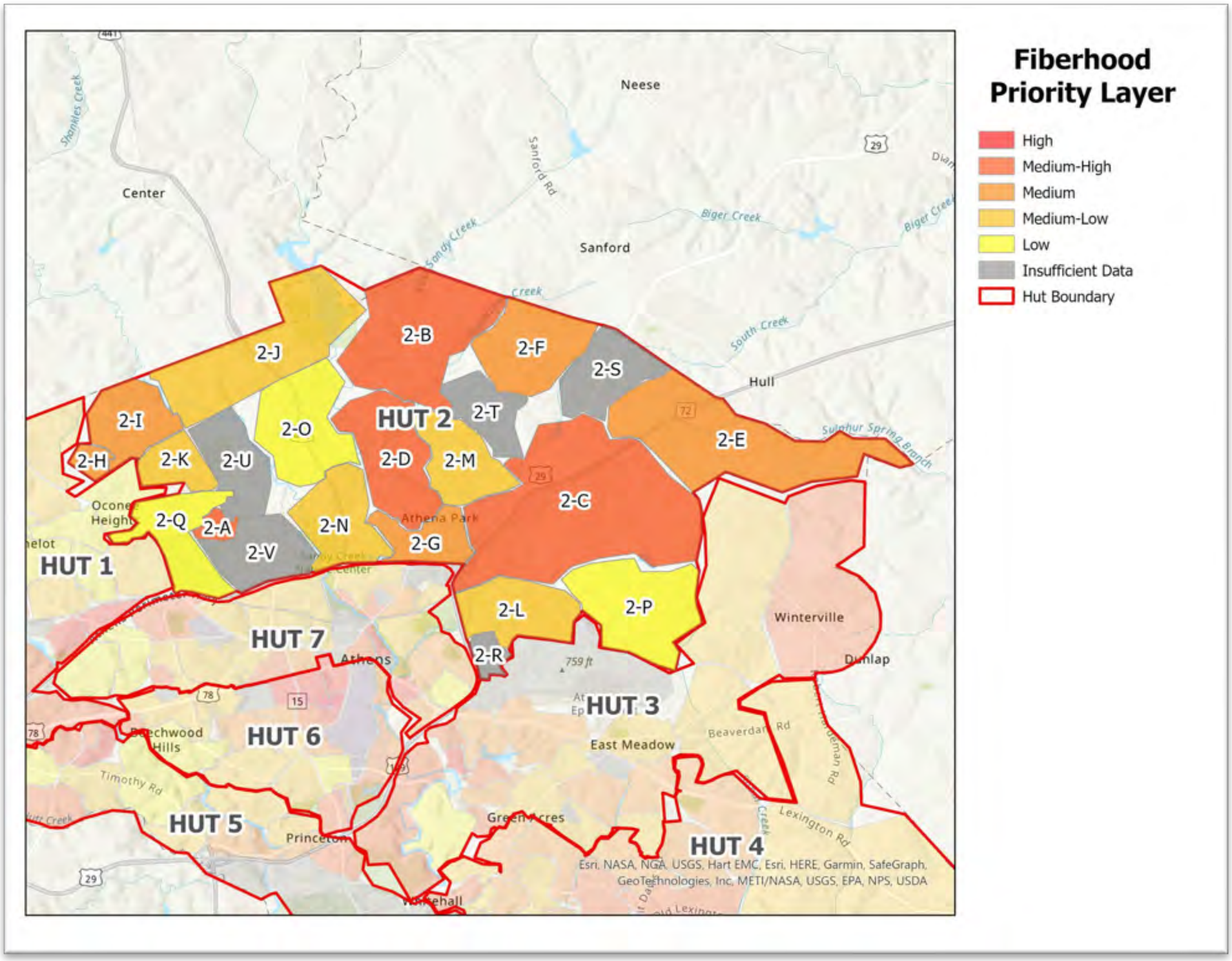

Figure 7.4

Hut 3

Hut 3 is in the central-eastern part of the county. It skews higher priority than most other huts with few low-priority areas across the boundary. The western most side of the hut which boarders huts 5, 6, and 7 have the highest concentration of high and medium-high priority areas. This appears to be associated with density and low access to fiber connectivity.

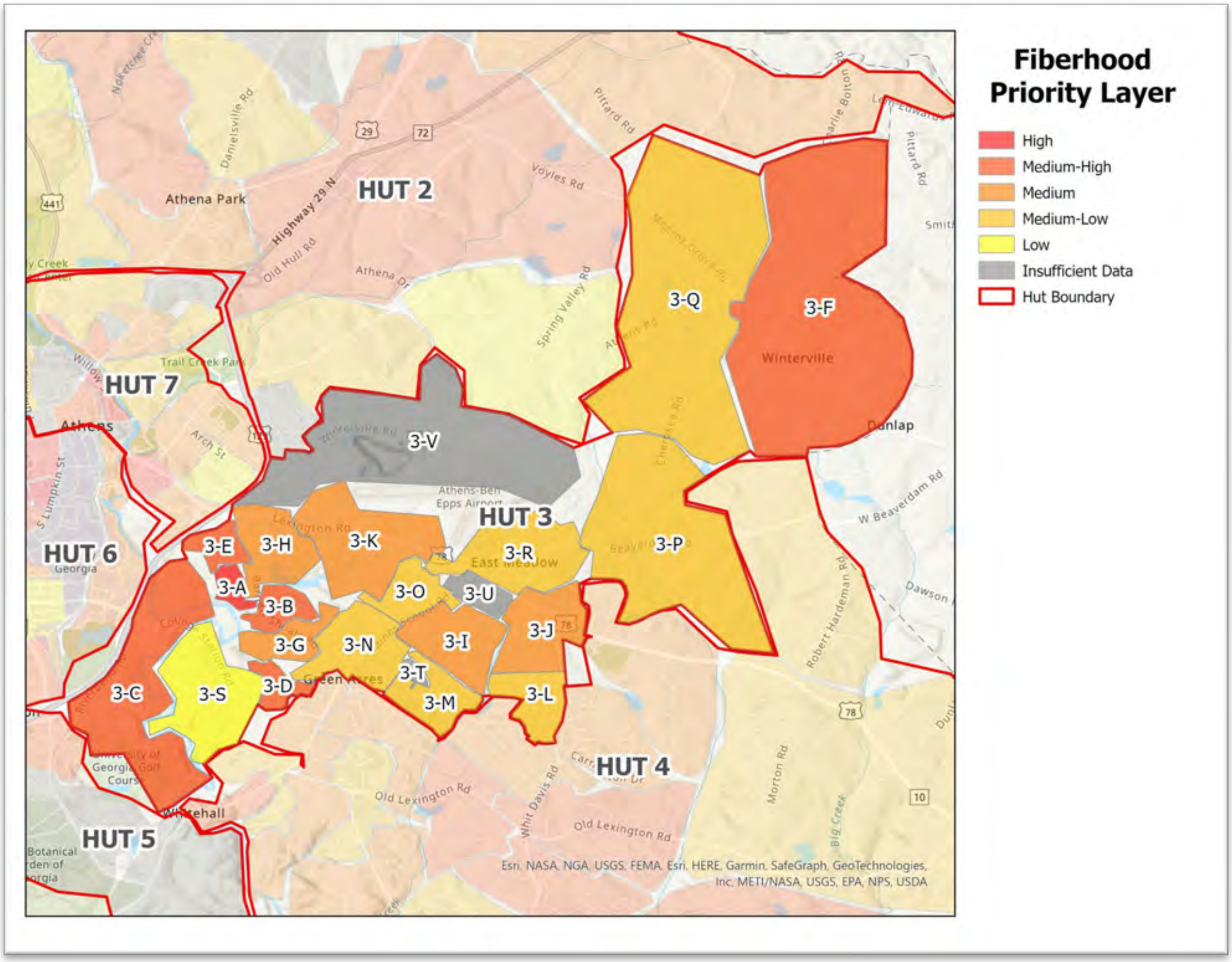

Figure 7.5

Hut 4

Hut 4 is in the southeast corner of the county. It has a high concentration of medium-high priority areas. 4-A, 4-B, 4-C, and 4-D, all received relatively slow speed test results from the demand aggregation. Lack of density and probable high-build cost is the primary reason this area isn't considered in the highest priority group.

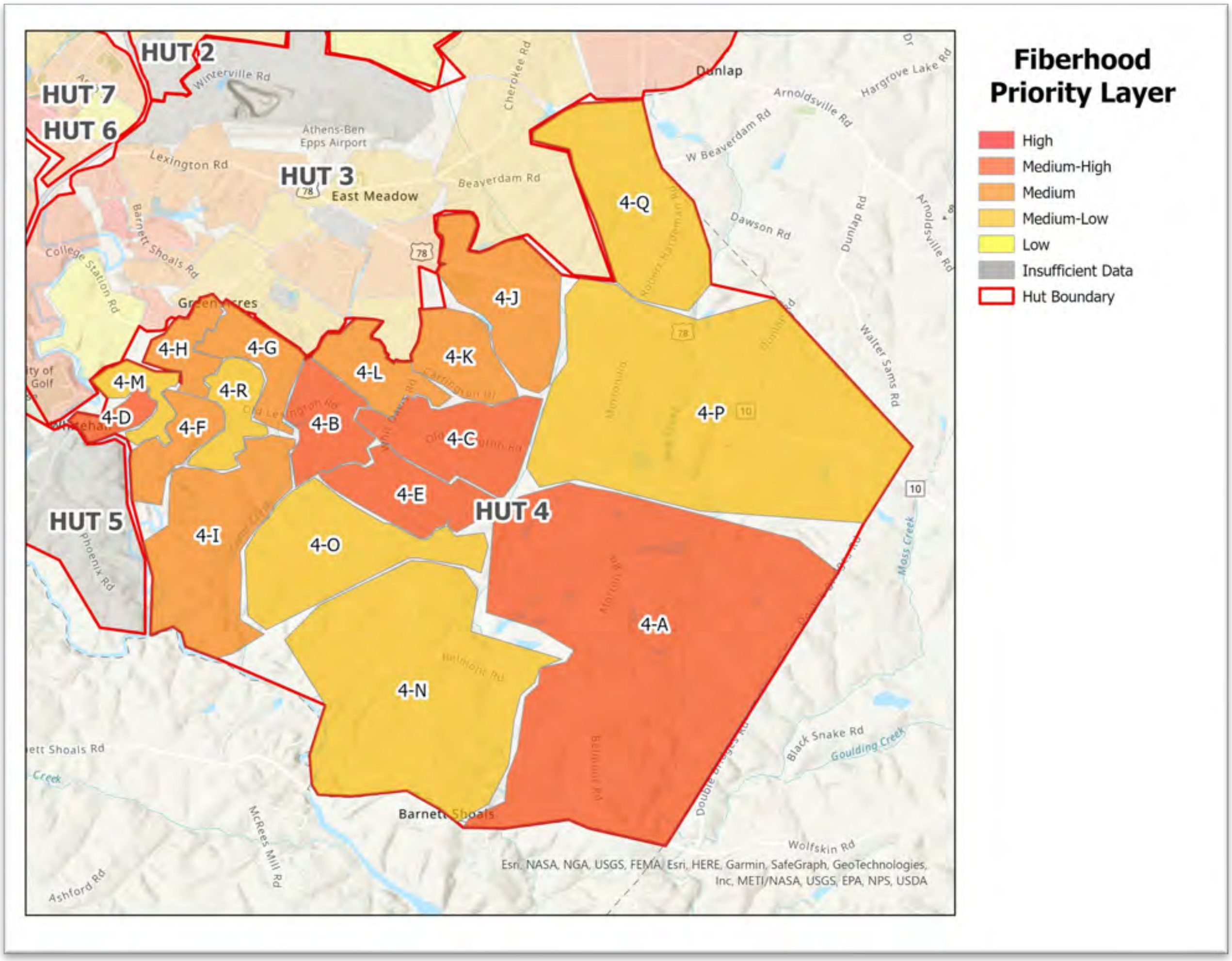

Figure 7.6

Hut 5

Hut 5 is located on the western edge of the county. It generally displays higher density than the four fiberhoods previously discussed. 5-A and 5-B both presented slow download speed test results from the demand aggregation, both are relatively dense and show a high willingness to upgrade services.

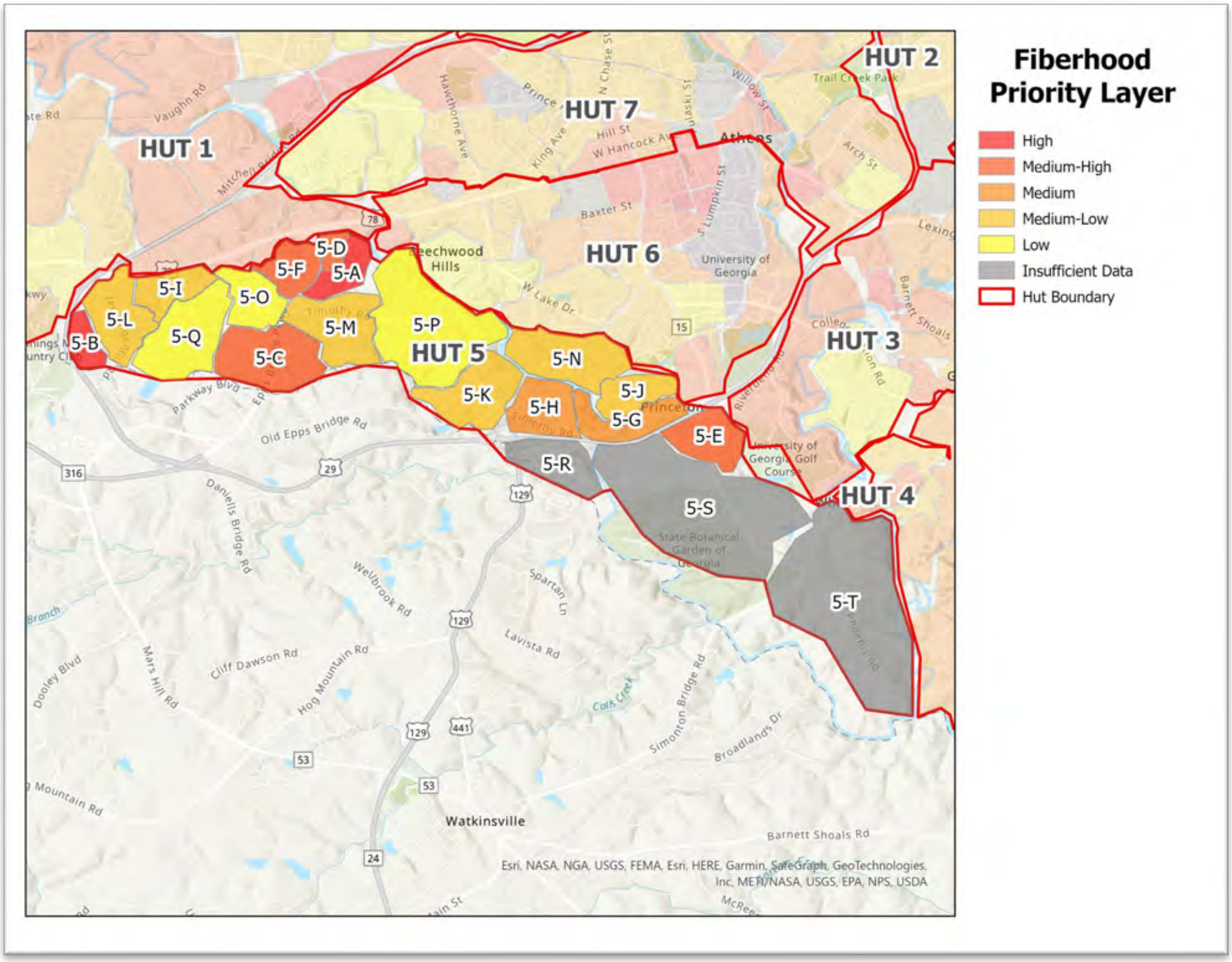

Figure 7.7

Hut 6

Hut 6 is centrally located in the county. Areas in this hut considered medium-low and low priority typically displayed a high percentage of fiber access. Fiberhoods 6-A, 6-B, and 6-C, are high-density and have low access to fiber.

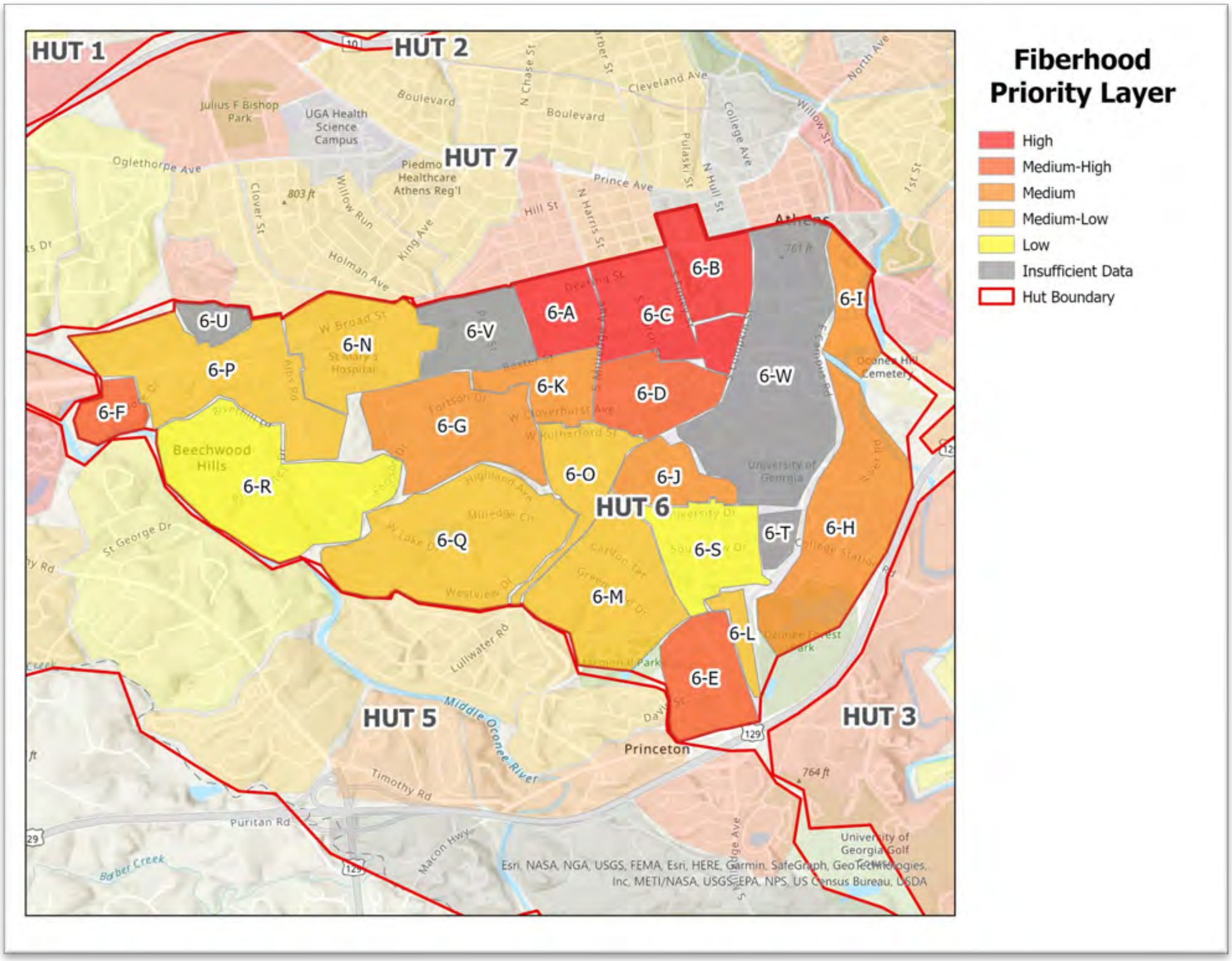

Figure 7.8

Hut 7

Hut 7 is also centrally located in the county. There are two high priority fiberhoods within this hut. They represent smaller pockets than the high priority fiberhoods in hut 6 but face similar obstacles since they are high density and have little access to fiber services.

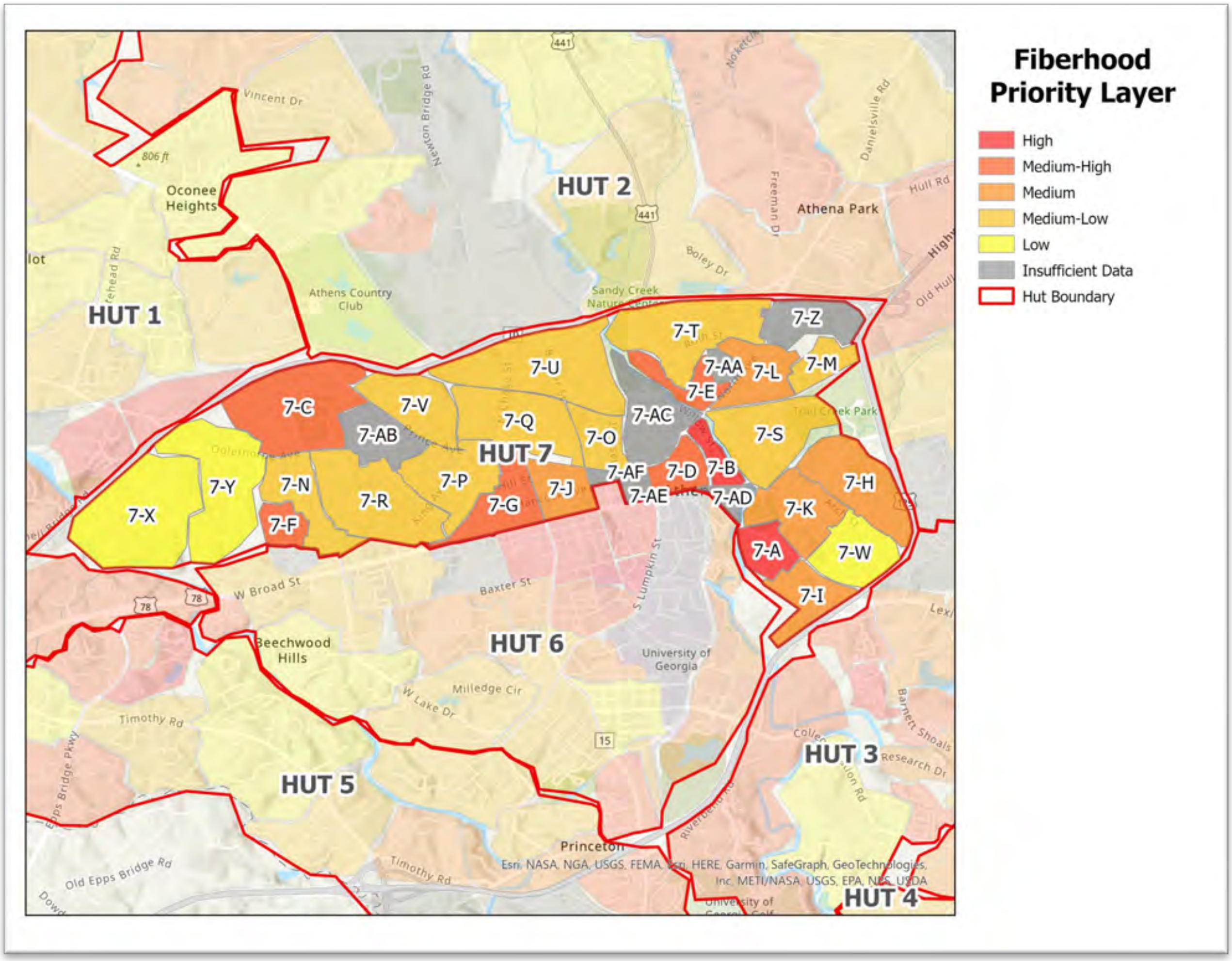

Figure 7.9

BILL OF MATERIALS AND PROFORMA

A bill of materials has been created to provide a comprehensive listing of estimated labor and material costs expected from the proposed buildout. In addition, a proforma has been prepared which provides a look at the overall expenditure and revenue expected from the development and operation of the network over a 30-year period. FTTH Network connected through a backbone ring.

Bill of Materials

The included bill of materials, or BOM, for the proposed backbone and FTTH network is based on high-level estimates of assumed construction material and labor costs associated with the project. These estimates are tentative and based on the routes and design environments established in the **Broadband Network - High-Level Design** section of this report. This BOM is meant to provide a high-level breakdown of construction costs and help in determining the overall cost of the project when requesting financial aid. It includes both labor and material cost estimates, based on the competitive rates of the current telecom industry. These costs have been modeled on the hut level as well as some examples that include the highest priority fiberhoods throughout the County. As a high-level overview, the estimated construction costs of network are below.

Network Name	Proposed Aerial	Proposed Underground	Proposed Fiber Optic Cable	Estimated Total Cost
Hut 1	$80,436	$18,713,011	$10,459,399	$29,252,846
Hut 2	$42,457	$14,115,143	$8,416,692	$22,574,292
Hut 3	$0	$11,253,834	$6,624,315	$17,878,149
Hut 4	$15,976	$11,739,787	$6,304,631	$18,060,394
Hut 5	$16,285	$4,940,569	$2,231,096	$7,187,950
Hut 6	$2,643	$8,509,136	$5,037,512	$13,549,291
Hut 7	$0	$4,007,310	$1,710,200	$5,717,511
Backbone Ring	$38,050	$8,541,941	$4,083,072	$12,663,063

Figure 8.1

It should be noted that the costs and materials listed in this bill of materials are estimates based on a high-level design. Should the network design and construction be implemented, a more detailed design would be required which may result in costs and amounts that diverge from this BOM. A more detailed breakdown of the Athens-Clarke County Broadband Solution – Bill of Materials are available in **Appendix C – Bill of Materials** of this report.

Proforma

The prepared proforma is a model which provides a cost vs revenue comparison of estimated costs for design, construction, and operation over a 30-year period. This helps to visualize how the finances of the network might look like. Proformas have been prepared for each of the seven huts along with a proforma to show the cost to build the backbone network. The components and assumptions made to prepare the proforma model are discussed in further detail below.

Capital Expenditure

The proforma models capital expenditure to include all costs for the development and deployment of the fiber network. This includes all planning and design effort conducted by engineering vendors as well as all labor and material costs associated with the construction vendors.

- **Planning and Assessment Effort**: Planning and assessment effort for this proposal includes a single strategy session and kick-off meeting which will include all parties that have a stake or involvement in the project.
    - The model estimates a one-time cost of **$81,120.00** for this phase for all efforts.

- **Design and Engineering Effort**: Design and engineering effort covers the cumulative costs of one, or multiple, engineering vendors.
    - Design is estimated to vary between approximately 6 and 12 months.
    - The model assumes that design and production of construction documents require 6 months for each hut. Construction document production is expected to start approximately 2 months after design begins.

Network Name	Duration (Months)	Engineering Design Cost	Engineering Construction Document Cost
Hut 1	6	$656,669.71	$395,590.27
Hut 2	6	$701,020.13	$444,288.77
Hut 3	6	$604,806.38	$338,642.30
Hut 4	6	$671,641.68	$412,030.08
Hut 5	6	$499,464.05	$222,972.29
Hut 6	6	$491,358.72	$214,072.32
Hut 7	6	$556,497.55	$285,597.31
Backbone Ring	6	$616,250.78	$351,208.70

Figure 8.2

- The model assumes design management and overhead costs for the vendor to run for an additional 6-month period, and it includes management of start-up, production, and close-out efforts of the project. These durations are estimated to be 12 months for each hut.

- **Construction Effort**: Construction effort covers the cumulative costs of one, or multiple, construction vendors.
  - Construction efforts are estimated to vary between 11 and 17 months. The overall build is estimated to be a 92% to 8% ratio of underground to aerial construction and both methods are expected to be design concurrently.
  - For underground construction the model assumes:
    - 2-4 construction crews depending on the hut
    - Each crew can install approximately 1400 ft of cable and conduit per day.
    - Crews are working 5 days a week, 48 weeks per year.
  - Based on the above rate the installation of underground conduit and cable is estimated to vary between approximately 5 and 12 months, with an additional 3 months for cable installation and splicing effort.
  - For aerial construction the model assumes:
    - 1 or 2 construction crews, depending on the hut
    - Each crew can install approximately 1400 ft of cable and strand per day.
    - Crews are working 5 days a week, 48 weeks per year.
  - Based on the above metric the installation of aerial strand and cable is estimated to vary between approximately 1 and 4 months for huts where aerial construction is applicable with an additional 2 months for cable installation and splicing effort.

Network Name	Aerial Construction		Buried Construction	
	Duration (Months)	Cost	Duration (Month)	Cost
Hut 1	4	$267,601	11	$16,200,971
Hut 2	6	$458,219	10	$12,983,742
Hut 3	3	$9,750	11	$14,514,771
Hut 4	4	$232,940	12	$16,466,853
Hut 5	3	$405,053	8	$16,769,367
Hut 6	0	$0.00	8	$8,970,712
Hut 7	3	$11,811	9	$28,435,420
Backbone Ring	4	$711.793	15	$17,871,909

Figure 8.3

- The model estimates monthly costs of **$30,000.00** and **$3,000.00** for management and overhead respectively, with durations varying between 10 and 18 months.

Network Name	Duration (Months)	Construction Management Cost	Construction Overhead Cost
Hut 1	14	$420,000	$42,000
Hut 2	13	$390,000	$39,000
Hut 3	14	$420,000	$42,000
Hut 4	15	$450,000	$45,000
Hut 5	11	$330,000	$33,000
Hut 6	11	$330,000	$33,000
Hut 7	12	$360,000	$36,000
Backbone Ring	18	$540,000	$54,000

Figure 8.4

- **Total Costs**: Total capital expenditure costs are expected to vary approximately between $13,070,022.50 and $34,606,432.43 with overall total project costs estimated at $171,960,447.83.

Network Name	Total Cost
Hut 1	$22,543,025
Hut 2	$18,854,109
Hut 3	$19,217,700
Hut 4	$21,873,611
Hut 5	$20,782,299
Hut 6	$13,070,023
Hut 7	$34,606,432
Backbone Ring	$21,013,249
Total Overall Cost	**$171,960,448**

Figure 8.5

Capital Investment

Capital investment refers to the initial funds that are required to be invested into the network to cover the construction of the project. These can be introduced as a single lump-sum or gradually introduced yearly throughout the life of the project. The source of investment varies and can include capital invested directly by interested parties, third-party investors, or government grants. The proforma models third-party investment as the primary source of capital investment for the project. The third-party investments are being modelled as a one-time, first year investment per hut. The model also accounts for a one-time, $3,700,000 investment from Athens-Clarke County which would be applied to the construction of the backbone ring.

Grant Funding

Although grant funding options are potentially available for aid in funding the project, these options were not accounted for in this proforma. At the time of this report most grant opportunities are either near the end of their application window or have guidelines and rules that are still being developed. As such, it is too difficult to accurately model how grant funds would be incorporated to the project. Additionally, this proforma aims to present what could be considered a "worst case" scenario for the project, where third party investment would be crucial, and the potential risks and rewards associated with it. Should applicable grant funding be determined, these funds would typical cover approximately 50% of the project amount and require a 50% match from the network owner. Further details about possible grant opportunities and recommendations are discussed in the **Business Model and Financing Alternatives** section of this report.

Operational Expenditures

Operational expenditures refer to costs related to management and maintenance of the network after its completion. These costs do not apply directly to its design or deployment and can be one-time or continuous fees.

- This proforma models a one-time fee of **$50,000.00** related to all legal deal developments that would be needed at the onset of the project.

- One-time setup fee for business engine of $425,000 and one-time fee for marketing and branding startup of $50,000

- It also models at continuous "operations and maintenance" fee which covers the monthly cost of hiring and maintaining an operations and maintenance (O&M) subcontractor. Because the designed network operates as a middle-mile network, O&M costs are expected to be reduced and the model estimates a monthly cost of **$15,200.00** applied once a month, every month after construction completion. This is estimated to start the first month after construction is completed and projected until Month 240. Other recurring cost include Marketing and Branding Recurring Fees $2,200 per month for 44 months and office space and equipment fees $2,750 per month for 240 months.

- Continuous operational costs are not covered by any of the capital investments and will have a consistent cost of approximately **$305,400.00** per year, every year after year 3.

Revenue

Revenue was modeled based on the following assumptions:

- $100/month subscription fee
- 40% take rate
- Return on investment per hut ranged from 10 – 18 years

Network Name	Demand Points	Take Rate	Estimated Connected Locations	Estimated Monthly Income	Projected ROI
Hut 1	7,997	40%	3,199	$3,838,560	10 Years
Hut 2	6,388	40%	2,555	$3,066,240	10 Years
Hut 3	5,265	40%	2,106	$2,527,200	12 years
Hut 4	5,879	40%	2,352	$2,821,920	12 Years
Hut 5	3,665	40%	1,466	$1,759,200	18 years
Hut 6	4,774	40%	1,910	$2,291,520	10 Years
Hut 7	8,774	40%	3,510	$4,211,520	12 years

Figure 8.6

Overall ROI

The above model is dependent on the construction of the regional backbone ring that will bridge the FTTH network of each hub to the existing first-mile network connecting the region. Under this proposal where backbone ring will be built by the FTTH network owner, an overall ROI can be estimated based on the total costs and expenses of the entire network, backbone included. When modeled as one completed construction project, there is still an expectation of an ROI of 13 years, eliminating the need to model alternative approaches of bridging between the FTTH and the first-mile network.

BUSINESS MODEL AND FINANCING ALTERNATIVES

Deployment of a broadband network can be seen as a very difficult task due to the general scope and requirements expected of one. Broadband networks that cover large regions, such as rural counties, have the added challenge of requiring heavy capital investment upfront for a network that is likely to serve a limited subscriber base. It is very important for prospective network owners or managers to be well informed on the various existing alternatives for business models and financing opportunities that are available.

Business Model - Options

There are various business models which offer differing degrees of ownership, management, and investment options for interested parties. For a government body interested in developing a broadband network, proper selection of a business model is strongly defined by its desire to control the trajectory of its development, as well as its own level of interest in owning or operating the network. The following business model alternatives were considered:

Option 1 – Infrastructure Ownership and Leasing Model

Description:

An infrastructure ownership and leasing model is a business model where an entity, such as Athens-Clarke County, owns fiber and conduit infrastructure within a given area and they lease out dark fibers within the network to local organizations or private service providers.

Details of this type of business model are:

- Athens-Clarke County would be the owner of the network infrastructure (cable, conduit, handholes, manholes, and other miscellaneous components) but the only service it operates is its own internal network.
- The fiber network contains additional "dark fibers" which are unused and unlit optical fibers. These dark fibers can be accessed at different locations within the network and can provide additional connections or services.
- Athens-Clarke County leases the dark fibers in a non-discriminatory manner to any public or private institution that wishes to utilize them to provide service to clients or to enhance their existing networks.
- Public institutions not directly managed by the entity (such as school districts) are generally considered as 3rd parties in this model and are not directly served by the owner's internal services.
- Athens-Clarke County may also lease out existing, vacant conduits for a public or private 3rd party to use for installing their own fiber cable.
- Leasing is typically done on a "per footage" basis of used infrastructure.

Advantages:

- Athens-Clarke County is only responsible for the ownership of the physical infrastructure and does not need to own or manage any broadband services outside of its own internal needs.
- Leased fiber/conduit agreements can be a consistent source of revenue for Athens-Clarke County.
- Leasing agreements would allow Athens-Clarke County to control the terms and limits though which 3rd parties must abide by when creating their networks.

Disadvantages:

- Athens-Clarke County would be responsible for the management of the infrastructure regarding physical faults or damage.
- A 3rd party operations and maintenance (O&M) vendor would most likely be necessary.

Case Study:

- **Santa Clarita, CA** – Santa Clarita is a city in Los Angeles County in California. It is the third largest city in the county, with a population of over 200,000 as of 2020, and is home to such attractions as the Six Flags Magic Mountain theme park. In 2002 Santa Clarita first installed fiber for the purpose of managing traffic signals and street cameras. This network gradually expanded to over 70 miles of coverage. The city took advantage of this fiber infrastructure, of which only one-third of its capacity was being used to serve traffic lights and cameras and used the spare fiber to interconnect all their municipal facilities. The city originally entered into an agreement with Freedom Dark Fiber Networks (now Wilcon) in which they lease out dark fibers on their network to serve businesses. After being acquired by Wilcon in 2013, the city renegotiated the contract and extended its duration as well as the promise of additional coverage to even more potential businesses beyond the ones already being served. The city did not establish any exclusivity with Wilcon, so additional dark fibers are still available for lease.

- **Merit, Michigan** – The non-profit Michigan Educational Research Information Triad (MERIT) was created in 1966 by Michigan State University, Wayne State University, and University of Michigan to seek state funds for inter-university computer communications, an endeavor spanning the practical history of the internet. It started deploying fiber rings as early as 2003 to link the campuses via private owned fiber, and in 2010 as part of the American Recovery and Reinvestment Act (ARRA) program extended its fiber infrastructure across the state of Michigan through the REACH-3MC fiber project which emphasized connecting rural and underserved communities. Starting in 2021, Highline Internet leveraged the dark fiber in Merit's Network to bring 1 Gig internet to Michigan's Upper Peninsula. Access to Merit's high-performance middle-mile fiber infrastructure enabled Highline's unprecedented speed-to-market for its FTTH service.

- **Burbank, CA** – The city of Burbank laid its first fiber in 1986 for its water and power services and established the ONE Burbank dark fiber network in the late 1990's to lease fiber to Hollywood studios such as Warner Bros and Disney. The revenue generated in turn is being used to provide better connectivity to the city's schools and public facilities. In doing so, Burbank has all but eliminated past telecommunications expenses, lowering cost by 95%. Recently Burbank has begun using ONE Burbank as backhaul for free Wi-Fi service throughout the city. The city also credits the dark fiber network for helping to retain and attract business.

Option 2 – Infrastructure Ownership and Provider Model

Description:

This model is like the above-mentioned infrastructure ownership and leasing model, in which a government jurisdiction owns the fiber cable and conduit infrastructure and leases out dark fibers to 3rd party service providers. The difference is, in addition to providing service to their own structures and institutions, the government jurisdiction also offers service to community anchor and public institutions within their jurisdiction. These community anchors typically include school districts, higher learning institutions, public utilities, and public safety institutions, which might not be directly administered by the institution.

Details of this type of business model are:

- The government jurisdiction is the owner of the network infrastructure (cable, conduit, handholes, manholes, and other miscellaneous components) but the only service it operates is its own internal network.
- Community anchors and public institutions, such as school districts, public safety institutions, and public utilities, not directly managed by the government jurisdiction are also offered 1st party service as part of this model.
- The fiber network contains additional "dark fibers" which are unused and unlit optical fibers that have been placed. These dark fibers can be accessed at different points of the network and can provide additional connections or services.
- The government jurisdiction leases the dark fibers in a non-discriminatory manner to any public or private institution that wishes to utilize them to provide service to clients or to enhance their existing networks.
- The government jurisdiction may also lease out existing, vacant conduits for a public or private 3rd party to use for installing their own fiber cable.
- Leasing is typically done on a "per footage" basis of used infrastructure.

Advantages:

- Athens-Clarke County would only be responsible for the ownership of the physical infrastructure and does not need to own or manage any broadband services outside of their own internal needs and anchor institutions.
- Leased fiber/conduit agreements can be a consistent source of revenue for the jurisdiction.

Disadvantages:

- Athens-Clarke County would be responsible for the management of the infrastructure regarding physical faults or damage.
- A 3rd party operations and maintenance (O&M) vendor might be necessary.
- Serving community anchor and public institutions adds some additional management requirements as opposed to the infrastructure ownership and leasing model.

Case Study:

- **Seminole County, FL** – Seminole County is a county in central Florida, located northeast of Orlando and has a population of 466,695 as of 2020. In 1992 the County's Traffic Engineering department started an effort to upgrade the lines serving their traffic signals from copper cables to fiber optic cables, which offered higher capacity and better protection from lightning strikes that were causing problems for their network. Over the next 20 years the County continued to gradually expand their fiber network by taking advantage of road expansion projects to lay down more fiber cable throughout the county. The Traffic Engineering Department recognized the benefit this fiber network could have for other county agencies and invited them to join. By mid-2000 it was considered common for multiple non-county agencies, including educational institutions and city public service agencies to be on the County's network. The County has considered expanding access to the network to third-party ISPs to enhance broadband coverage in the county, but there are some jurisdictional limitations that complicated the matter, and they tabled it for the time being. The County has recently restarted to explore their options to expand further beyond just the community anchor institutions.

- **Wilson, North Carolina** – Wilson, a city of 49,000 in eastern North Carolina, once enjoyed the distinction of being the tobacco capital of the world faced serious challenges when manufacturing and the tobacco industry began moving out of the region. The city's leaders turned their focus towards local investment including the city's information infrastructure. Efforts were made to negotiate with the existing internet provider Time Warner Cable including an offer to partner with TWC to build the FTTH that was rejected by the national company. After a proposed partnership with EMBARQ (now CenturyLink) also fell through, Wilson decided to go it alone and in 2008 began building a citywide FTTH network called Greenlight. Financed by the city the network was completed on budget in January 2009, a year ahead of schedule, and Wilson became the first gigabit city in the state. Wilson realized that a municipally owned fiber network no only offered more control over the quality and speed of internet access for residents, it also provided a potential engine for economic growth. By 2012, they had completed a fiber ring linking every school in the county, connected the area's largest employer with gigabit service, and deployed Wi-Fi hotspots for public use in the downtown area and at the airport, library, and sports complex. Officials calculated it saved the community more than a million dollars per year – money that stayed in the local economy. Even those who kept TWC as a provider enjoyed lower, more stable prices and better speeds due to the new competition. The fast, reliable network attracted new businesses like Los Angeles-based ExodusFX which chose Wilson over Kansas City's Google Fiber network. By the summer of 2020 the Greenlight network was nearing a take rate of almost 45%, offering symmetrical internet up to 1Gps as well as considerations for low-income residents. Through smart investment and planning, Wilson built a network capable of serving the city and the surrounding area for decades to come.

Option 3 – Public-Private Partnership (P3) Model

Description:

A public-private partnership model, or P3, is a business model where a government jurisdiction partners up with one or more private organizations and jointly plan, build, manage, and maintain a fiber optic network within their own jurisdiction. These partnerships allow for multiple parties to combine their areas of expertise into the joint goal of building a viable broadband network. Government jurisdictions will usually contribute their reglementary expertise and larger capital financing capabilities, and private organizations will contribute their expertise at building, managing, and operating a fiber network.

Details of this type of business model are:

- The government entity involved generally has full or partial jurisdictional authority or existing relationships with those jurisdictions over the area intended to be served and acts as the primary party of interest.
- Private organization bring various opportunities to the partnership which can include:
- Network design and construction experience.
- Plant operations and maintenance experience.
- Capital investment opportunities.
- All interested parties need to determine their preferences and organize their expectations and responsibilities before any actual activities may begin.

Advantages:

- Public-private partnerships allow for more even distribution of financial and management responsibilities among multiple parties and helps to minimize expenditures from each party.
- P3s provide opportunities for smaller ISPs that might otherwise find the cost of entry into the market too burdensome.
- If Athens-Clarke County does not wish to own and maintain a network, this would allow an easier time separating the responsibility while still retaining key deciding interest in the direction the network's development takes.

Disadvantages:

- Effort requires striking a balance between the interests and expectations of multiple parties that can easily become complicated to navigate.

Case Study:

- **Medina Fiber** - Medina Fiber is a locally operated internet service provider powered by Lit Communities. In 2013, Medina County completed the build out of an open access middle-mile fiber ring, which brought connectivity to large and midsize businesses across the county—but not residents and small businesses. Medina Fiber was founded to partner with Medina County Fiber Network (MCFN) in solving that problem and building a FTTH/B network across the county which will connect 50,000 residents and businesses.

- **Holly Springs, NC** – Holly Springs is a town in North Carolina located southeast of Raleigh and with a population of 36,595 as of 2020. In mid-2014 the town decided to invest in their own fiber network to serve their own institutions and save financially by avoiding the need to pay a third-party for the service. North Carolina law prohibits government institutions within the state from directly offering internet services to customers, so the city had to consider other options. In 2015, the city entered into an agreement with Toronto-based company Ting, who agreed to provide 1 Gbps service in the city, using the city's own fiber network as a base and growing out its own last-mile. Ting now reaches out to residents and business across the town and offers 1 Gbps service.

- **Delta Electric Power Association, Mississippi** – When the Mississippi legislature went about tackling their rural broadband access problem, they turned to the state's rural electric co-ops. Many of which had been preparing broadband rollout and were looking for funding. Using the grants provided under the CARES Act, the state provided these private, independent electric utilities the funding needed to move forward which their builds. Headquartered in Greenwood, Delta Electric serves the most rural and sparsely populated region of the state. It is using $10 million of its own matching funds and partnering with Conexon, a broadband company specializing in electric co-op fiber builds, the not-for-profit company completed a pilot project in northern Carroll County, and announced plans to expand to surrounding areas when the project was complete.

Option 4 – Open Access Model

Description:

An Open Access Model is a Broadband Network where the government entity both owns and operates the lit network's infrastructure. The entity is responsible for the operation and maintenance of both the physical infrastructure (such as fiber optic cable and splice enclosures) and the active electronic equipment that transmits light through the network. The lit network offered by the government entity is considered "transport" service, which can be offered to internet service providers for their use. The government entity opens the network up for any interested third-party to offer internet service that will reach end users within the network.

Details of this type of business model are:

- The government entity is the principal owner of both the passive (fiber cable and conduit) and active (electronic equipment) network infrastructure.
- The government entity opens the network for interested third parties to offer internet service through it. Government entity treats ISPs wishing to use their network in a neutral and non-discriminatory manner.
- Government entity is responsible for planning and building out the network, including any future additions to reach new potential customers.
- Government entity is responsible for the day-to-day maintenance of the network and will be responsible for responding to any requests from the ISPs about their network being affected.

Advantages:

- An Open Access Model affords the government entity greater control over network coverage and ensuring all end users they are targeting to be served will have service.
- This business model is optimal for government entities that already operate an active fiber network within their jurisdiction but aren't yet offering any service to end clients.
- Enticing multiple ISPs to use their network can create a competitive environment that may benefit potential customers served by the network.
- Enticing multiple ISPs to use their network can provide government entities with an additional source of revenue.

Disadvantages:

- Open Access Model generally requires the government entity that adopts it to own and be responsible for the construction and maintenance of both the infrastructure and active fiber equipment.
- Government entity will have higher operating costs because of this network.
- Any buildout effort to reach new customers will be responsibility of the network owner.
- Financial success of the network often depends on factors outside of the government entity's control, including service level of the ISPs offering service through their network.

Case Study:

- **NoaNet, Washington State** – Northwest Open Access Network (NOANet) is a non-profit telecom organization founded in 2000 by a group of Washington State Public Utility Districts (PUD) for the purpose of enhancing broadband service in the underserved and unserved sections of the state. They act as a middle-mile, statewide network that offers wholesale broadband to hundreds of communities and businesses across all counties in the state. The company began at a time when investment in broadband was mainly focused along the I-5 corridor between Seattle and Portland and areas in rural Washington state were losing support. Rural PUDs had started to invest in their own regional fiber networks but interconnection across the state was hard to come by. Taking advantage of the Bonneville Power Administration's (BPA) initiative to lease out its statewide dark fibers if they served all districts where BPA had fiber, the PUDs collaborated to form a telecom company to lease and operate along the BPA fiber network. This company would go on to become NOANet, who in the present day operates more than 3,300 miles of fiber throughout Washington state and connects anchor institutions and independent communication networks to each other.

- **UTOPIA Fiber** – UTOPIA (Utah Telecommunication Open Infrastructure Agency) Fiber is a group of 11 Utah cities that joined together in 2004 to build, deploy, and operate a fiber to the home (FTTH) network to every business and household within their communities. The UTOPIA network allows subscribers to connect to the world in ways they have never experienced before, providing blazingly fast internet speeds, phone, and television services. Using an active Ethernet infrastructure and operating at the wholesale level, UTOPIA supports open access and promotes competition in all telecommunications services. UTOPIA Fiber's 19 service areas represent nearly 28% of all communities in the United States that can enjoy 10 Gigabit service on a publicly owned network.

Infrastructure Grants and Loans

Capital expenditure costs are some of the strongest barriers to the development and deployment of a new broadband network. The initial costs often act as a barrier to entry for small and new ISPs and limit the ability for legacy providers to expand further. This is even more pronounced in rural areas, where expected return on investment (ROI) for providers is so minimal that it disincentivizes new developments. The issue with bridging the urban/rural broadband divide has been a priority for lawmakers at both the state and federal level for years and has resulted in historic and unprecedented amounts of government funding becoming available. There are higher levels of broadband funding today than any time in recent history and fully understanding the programs available is critical to creating any new network. The following financial opportunities were evaluated:

Affordable Connectivity Program (ACP)

Granting Organization(s): US Federal Communications Commission (FCC)

Status: Open

Description:
The Affordable Connectivity Program (ACP) is an FCC benefit program that helps ensure households can afford the broadband needed for work, school, healthcare, and more. The benefit provides a discount of up to $30 per month toward internet service for eligible households and up to $75 per month for households on qualifying Tribal lands. Eligible households can also receive a one-time discount of up to $100 to purchase a laptop, desktop computer, or tablet from participating providers if they contribute more than $10 and less than $50 toward the purchase price. The ACP is integral for bridging gaps in the digital divide by making quality broadband service more affordable to families in need. It is also helpful for providers, because it increases the pool of potential customers. Oftentimes, providers offer an affordable service plan that is entirely or nearly entirely covered by the ACP benefit. This is an important resource for getting households much needed internet service and creating opportunities for work from home and education that otherwise would not be possible.

Requirements:

- Eligible households must apply for ACP at www.affordableconnectivity.gov.
- Eligible households must select a service plan from a participating internet service provider.

Advantages:

- Reduces the monthly cost of internet service through participating providers.
- Allows households internet access who might otherwise not be able to afford monthly internet.
- Eligible households can purchase a computer or tablet through their provider at a reduced cost.
- Current providers within Athens-Clarke County such as AT&T, Comcast, Spectrum and Windstream all participate in the ACP program.
- ACP participation increases the number of potential subscribers for ISPs.

Disadvantages:

- Not all internet service providers participate in the program.
- Application process has multiple layers and may be tough to navigate.

Broadband Equity, Access, and Deployment (BEAD) Program

Granting Organization(s): Federal Level - National Telecommunications and Information Administration (NTIA) State Level – Georgia Broadband Program

Status: Open

Description:
The Broadband Equity, Access, and Deployment program (BEAD) will provide federally funded grants for the purpose of broadband planning, deployment, mapping, equity, and adoption. Funding is available to all U.S. States and Territories, as well as Native American Tribal Lands. It will be the responsibility of each state government entity to manage and disseminate the grant funding within their jurisdictional boundaries. The primary goal of the grants is to fund opportunities to "bridge the gap" and improve broadband availability in all unserved (less than 25/3 Mbps) areas of the jurisdiction. Underserved areas (less than 100/10 Mbps) will qualify as well if all unserved areas within the jurisdiction have been addressed. In Georgia, BEAD funds will be administered by the Georgia Broadband Program.

The NTIA announced that Georgia was awarded nearly $5 million in planning funds to develop the Georgia Broadband Office. NTIA will announce the funds available for each state in June of 2023.

Available Funding:
The BEAD Program provides $42.45 billion to expand high-speed internet access by funding planning, infrastructure deployment, and adoption programs. Georgia anticipates receiving a projected $1 billion in BEAD funding.

Requirements:

- At the Federal Level only governing entities (States, Districts, Territories, Commonwealths, and Native American administered Tribal Lands) are eligible to request and receive BEAD funding. Each entity will be expected to have a minimum of $100 million allocated as potential funds.
- States will be responsible for evaluating, applying for, and administering grant funds for "subgrantees" at the local level.
- BEAD does not currently define what may constitute "subgrantees", but it defines that it may not exclude "a cooperative, nonprofit, public-private partnership, private company, public or private utility, or local government" from eligibility.
- Funding allotment will be determined by the number of "unserved" and "underserved" broadband service locations defined by the June 2023 FCC National Broadband Map.
- The BEAD Grant program establishes a 5-year window for completion. Primary grant holders (i.e. States) must provide NTIA with a 5-year plan that outlines all BEAD related proposals within their jurisdictions, including all awarded subgrantees who will perform the work.
- Final Plan to NTIA is expected within 1 year of funds being awarded. Awarded subgrantees will have 4 years to complete the proposed buildout, with an option for a 1-year extension if appropriate circumstances are met.
- An awarded grant will have the following obligations:
  - Service providers must offer at least 100 Mbps downstream and 20 Mbps upstream and latency less than or equal to 100 milliseconds.
  - Service providers must offer at least one "low-cost broadband service option" for eligible subscribers.
  - Service providers must deploy and commence providing broadband service to customers within four (4) years of receiving the funds.

    - Service providers laying fiber optic cables and/or conduit must include interspersed conduit access points at regular and short intervals.
    - Service providers must provide at least 25% of the project's cost.
    - Service providers must comply with a "Buy American" requirement that deployed networks use at least 55% domestic materials.
    - Service providers must notify the public of broadband services and highlight benefits of their improvement.
    - Service providers who are no longer able to provide the service must be able to sell the network capacity at a reasonable price.
    - Service providers must provide access to broadband service to each customer in a reasonable and non-discriminatory manner.
- Eligible Broadband Projects:
    - Deploying and/or upgrading broadband networks for "unserved service projects" and "underserved service projects."
    - Deploying and/or upgrading broadband network facilities for "eligible community anchor institutions."
    - Data collection, broadband mapping, and planning. (A maximum of 5% of funds can go towards this effort)
    - Installing internet and Wi-Fi infrastructure or providing reduced-cost broadband within a multi-family residential building.
    - Broadband adoption.
    - Training and workforce development.
    - Other uses, including Digital Equity programs by States.
    - Funds will not be awarded if other grants have been awarded to the location.

Advantages:

- The BEAD program grants directly address the needs of "unserved" and "underserved" communities, which is the primary target of the improvement efforts that Athens—Clarke County is currently pursuing.
- The BEAD program contains the historically largest amount of a federal funds allocated for the development and enhancement of broadband infrastructure in the United States to date. While highly competitive, it is expected to provide the largest financial opportunity for rural deployment.
- State-level broadband offices better understand the needs of intra-state jurisdictions and make it easier to present a compelling case for a grant.
- Projects awarded BEAD grants will have a 4-year window for completion.

Disadvantages:

- State broadband offices will need to develop local procedures that comply with NTIA guidelines, which are likely to extend further beyond that timeframe.
- Award allocation is dependent on provider reported data which have historically been overstated and inaccurate. This data is based on advertised speeds and not the speeds subscribers experience in their homes.
- Georgia awards will be dependent on the Georgia Broadband Availability Map (figure 12.1). This information provided in this map is largely provided by ISPs. Clarke County currently shows 1% unserved and would require the county to submit challenges to the current map's results.
- A challenge process for the Georgia Broadband Map has not yet been released.
- "Buy American" requirements risk supply chain constraints which can delay deployment of the project.
- Grants favor "fiber optic deployment" projects and might disregard fixed wireless broadband deployment projects.
- Any potential funding for fixed wireless is limited to just "licensed spectrum" which has limited availability and is mostly allocated to larger providers.

Figure 12.1

ReConnect Loan and Grant Program

Granting Organization(s): U.S. Department of Agriculture (USDA)

Status: Open

Description:
Per Internet for All, the ReConnect Program helps expand high-speed internet service to rural areas. It provides nearly $2 billion in loans and grants to help pay capital costs for infrastructure projects. This includes construction and improvements, as well as facilities and equipment.

Available Funding:
ReConnect Program – First Round - $607.88 million
ReConnect Program – Second Round - $808.44 million
ReConnect Program – Third Round - $1.67 billion
ReConnect Program – Fourth Round - $40.22 million to date
ReConnect Program – Fifth Round - to be determined

Requirements:

- Service providers awarded funds through the ReConnect program must offer a minimum service of 100Mbps symmetrical.
- To be eligible, an area cannot be located within a city, town or incorporated area with a population of 20,000 or more.
- At least 50% of households in the proposed funded service area must lack 100/20Mbps service.
- The proposed network must be capable of providing broadband service to every premises located in the PFSA at the time of application submission at the speed defined in the latest FOA.
- A rural area is any area that is not located in a city, town, or incorporated area that has a population of greater than 20,000 inhabitants or an urbanized area contiguous and adjacent to a city or town that has a population of greater than 50,000 inhabitants.
- An area must not overlap with areas previously funded by any other Rural Utilities Service telecommunication programs if those areas have sufficient broadband access and must not have any pending applications for USDA Rural Utilities Service programs,
- Award amounts include:
  - 100% grant up to $25 million
  - 50% loan and 50% grant combination up to $25 million each
  - 100% loan up to $50 million
- Eligible Funding Purposes
  - To fund the construction or improvement of facilities required to provide fixed terrestrial broadband service.
  - To fund reasonable pre-application expenses.
  - To fund the acquisition of an existing system that does not currently provide sufficient access to broadband (eligible for 100 percent loan requests only).

Advantages:

- Program helps expand broadband for rural communities.
- Corporations, limited liability companies, cooperatives, and state or local government can apply

Disadvantages:

- The current Georgia Broadband Map (figure 12.1) shows the rural areas of Athens-Clarke County as served and would need to be challenged by the County.
- Very few areas within Athens-Clarke County would be eligible for Reconnect. Two small pockets currently qualify as rural: north of Bogart and the surrounding Winterville area. The shaded area in figure 12.2 would not qualify as rural per Reconnect rules.

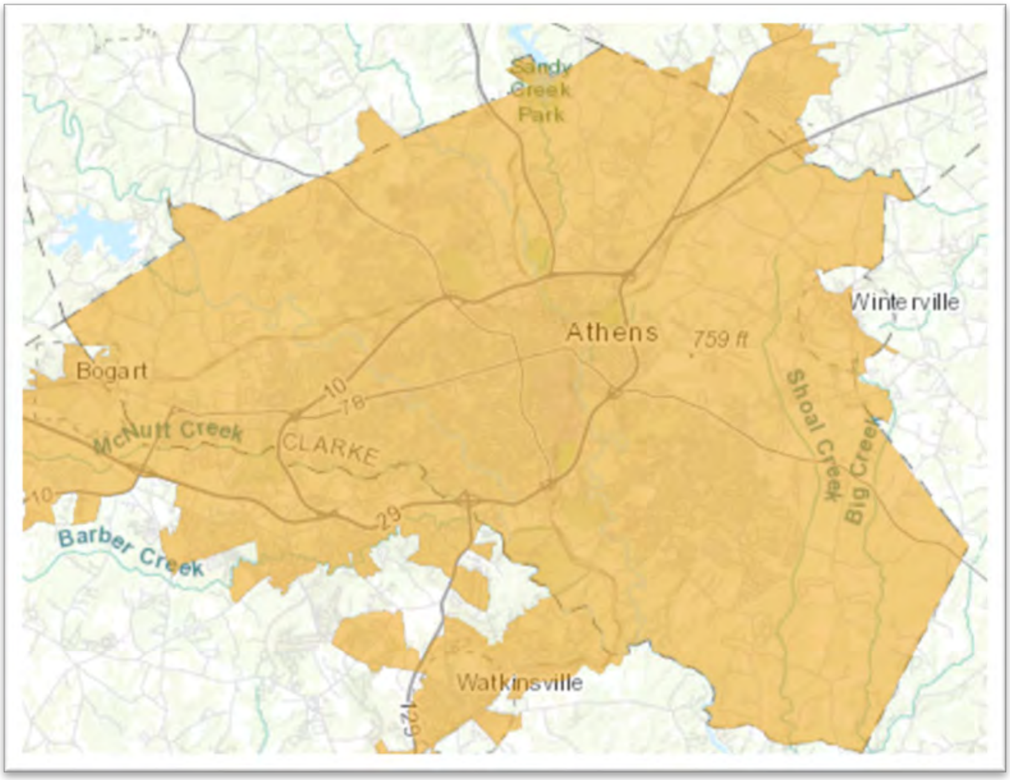

Figure 12.2

RECOMMENDATIONS

Following analysis of options for business models and financing opportunities, and after consulting with parties of interest, a set of key determinations was reached:

- Athens-Clarke County is not actively pursuing operating a broadband network or offering service as a competitor to existing internet service providers. Their main interest would be collaborating with providers to ensure ubiquitous connectivity for the County.
- The County has currently dedicated $3,717,858 from SPLOST 2020 Project 22 funding to be applied to broadband expansion.
- Multiple internet service providers have indicated interest in providing service to the County wide middle-mile ring or expanding fiber-based internet service in portions of the County.
- Although state and federal broadband maps show a high percentage of served coverage throughout the county, speed test results and consumer feedback from the demand aggregation survey indicate a higher degree of gaps in coverage.
- ARPA and RDOF grant allocations for the County include several unserved locations although few to none have been constructed.

With these determinations in mind, it is recommended that the County focus on partnering with ISPs to educate the community on the benefits of broadband and how to secure it. Resources should be dedicated to educating residents who currently have access to broadband service yet do not subscribe as they may not understand the benefits of broadband. There should also be a focus towards educating the community on programs that reduce affordability obstacles for broadband services such as the Affordable Connectivity Program (ACP). The County should also advocate to state and federal governments for the extension of ACP funding.

It is recommended that Athens-Clarke County construct a county middle-mile ring and improve existing fiber located along the future ring. This should be done by utilizing the $3.7 million allotted for broadband infrastructure and an establishment of a public-private partnership. The County should pursue this by releasing an RFP for interested parties for the county middle-mile ring.

It is advised that the County should stay up to date on the Georgia state broadband map challenge process as it develops. The state broadband map will be utilized when awarding federal funding, such as the BEAD programs, and needs to accurately reflect Athens-Clarke County residents broadband speed experience. In the meantime, the County should encourage residents to submit challenges to the FCC broadband map on an individual basis if they do not believe the reported service levels are accurate service options available to them or services they currently receive. Challenges can be submitted for both the location of service points and the services available at those points. Information on this challenge process can be found on the FCC website and in **Appendix H.**

The final recommendation is for the County to continue conversations with existing providers to expand current networks and new providers who are interested in entering the market. Providers have expressed interest in both entering the market to provide service for the community as well as participate in a County middle-mile ring. It is also recommended that a monthly meeting be established with representatives from local ISPs so the County can advocate for residents and relay areas lacking adequate broadband services or customer experience.

APPENDIX A – GLOSSARY OF TERMS

Asymmetric Digital Subscriber Line (ADSL) - A network that consists of usage of copper cables that are traditionally used to deliver telephone service and can be augmented to offer internet service.

Backbone - Backbone networks move data and internet traffic from Backhaul aggregation locations into neighborhoods and business districts; also known as Middle-mile networks.

Backhaul – Backhaul consists of national and regional networks that aggregate and transport terra-bytes of data through long distance fiber systems. These networks interconnect thousands of data centers, central offices, and internet peering locations around the country.

Bandwidth – the volume of data per unit of time that a transmission medium can handle, the larger the bandwidth, the faster you can move a certain amount of data.

Broadband – a type of high-speed data transmission via copper or fiber optic cable in which a single cable can carry a large amount of data at once. Broadband is usually always on and therefore available for use. Because fiber transmits data much faster than copper, new broadband installations use fiber. However, many US legacy networks include copper cables.

Central Office – a facility where subscriber home and business lines are connected to a local loop.

Coaxial – a network that relies on offering internet service through the same coaxial cables that offer television service in most areas.

Conduit – a tube or trough for protecting wiring.

Copper Cable – data transmission medium made of copper that carries electric signals.

Data Center – a facility where an organization or service provider centralizes their necessary computing resources.

Data transfer – the process of using computing technologies to transmit or transfer electronic or analog data from one computer to another.

Digital Subscriber Line (DSL) – DSL is a wireline transmission technology that transmits electrical data signals over traditional copper telephone lines installed in homes and businesses.

Download – receiving data or a file from the internet on your computer.

Federal Communications Commission (FCC) – the FCC regulates interstate and international communications by radio, television, wire, satellite, and cable.

Fiber Distribution Hub (FDH) – a physical enclosure that hosts optical splitting equipment and functions as a hub for service distribution.

Fiber Infrastructure – includes fiber optic cable, conduit, vaults, cabinets.

Fiber Optic Cable – high-speed data transmission medium made of glass or plastic filaments that carry light beams.

Fiber to the Home (FTTH) – consists of deployment of entirely fiber-optic cable networks that interconnect customers to a provider's central office. FTTH networks offer the highest possible speeds and low-latency service via a dedicated connection to a customer's home.

Fiberhood - a geographic grouping of service points (addresses) and a fiber distribution hub (FDH cabinet).

Fixed Wireless – Fixed wireless technology is a method of delivering broadband speeds without the need for physical wiring into a home or business. Fixed wireless leverages the convenience of cellular signals which require no wiring along with the powerful capacity of fiber or other high capacity backhaul methods.

Frequency – the rate of radio signals per second; typically measured in hertz.

Georgia Broadband Program – coordinates and establishes broadband programs to increase economic, education, and social opportunities for Georgia citizens and businesses. The initiative provides for the expansion of broadband infrastructure and services through new state and local broadband planning policies.

Gbps – Gbps stands for gigabits per second and is a measure of internet bandwidth. 1 Gbps is equal to 1,000 Mbps.

Hybrid Fiber Coax (HFC) - A HFC network utilizes fiber optic cables for the headend and feeder distribution systems and coaxial cables for the customer's end connection.

High-Level Design (HLD) – Preliminary design of a fiber network created at a market-wide level that identifies potential path and design elements.

Hub - Gathering point of a particular element within a fiber network. Hubs are present in all tiers of a network.

Hut - A small, free-standing structure that allows for the storage of active equipment to serve a fiber network; a group of Fiberhoods.

Internet of Things (IoT) – network of connected devices that communicate and exchange data. This can include anything from vehicles to home appliances and on-street sensors.

Internet Service Provider (ISP) – a company that provides access to the internet to customers which can be any combination of individuals, companies, government entities and non-profit organizations.

Last-mile – Last-mile networks are smaller telecommunication cables located inside neighborhoods or directly outside businesses. Last-mile network includes the service drop cable that enters your home or business.

Mbps – Mbps stands for megabits per second and is a measure of internet bandwidth.

Middle-mile – Middle-mile networks move data and internet traffic from Backhaul aggregation locations into neighborhoods and business districts; also know as backbone networks.

National Telecommunications and Information Administration (NTIA) - located within the Department of Commerce, is the Executive Branch agency that is principally responsible by law for advising the President on telecommunications and information policy issues.

Network – a group of two or more computers linked together with cabling and/or radio waves.

Point of Presence – the location where two or more different communication devices connect to each other; an access point, location, or facility that connects to and helps other devices establish a connection with the internet.

Proforma - utilizes data and assumptions to show the cost breakdown of a future project.

Request for Proposal (RFP) - a document that communicates requirements and solicits proposals for a desired solution.

Return on Investment (ROI) – a measure used to evaluate the profitability of an investment, the ratio of net profit over the total cost of an investment.

Satellite Internet – satellite internet service is a wireless technology that relies on small dish-style antennas to transmit and receive data signals from terrestrial locations to satellites orbiting the earth. Providers use licensed Radio Frequency (RF) spectrum to transmit signals.

Scalability – the capability of a communications network to handle a growing amount of data or its potential to be enlarged to accommodate that growth.

Small Cell – infrastructure that transmits data to and from a wireless device and consists of small radio equipment and antennas that can be placed on structures such as streetlights, sides of buildings or poles.

Spectrum – the radio frequencies allocated to the mobile industry and other sectors for communication over airwaves.

Symmetrical – a symmetric internet connection means the download and upload rates are the same in both directions.

Teleconference – a conference with participants in different locations linked by telecommunications devices.

Telehealth – the provision of healthcare remotely by means of telecommunications technology.

Transmission – the process of sending data over a communication medium to one or more computing, network, communication, or electronic devices**.**

Upload – sending data or a file from your computer to the internet.

Video streaming service – an on demand online entertainment source for TV shows, movies and other streaming media.

Wide Area Network (WAN) – a group of two or more computers that extend over a large geographical distance linked together by copper or fiber optic cabling and/or radio waves.

Wi-Fi – wireless technology used to connect computers, tablets, smartphones and other devices to the internet.

Wireless Internet Service Provider (WISP) - a company that provides access to the internet to customers which can be any combination of individuals, companies, government entities and non-profit organizations by means of wireless networking.

APPENDIX B – DIG ONCE AND OPEN TRENCH POLICY EXAMPLES

Salinas, CA Dig Once Policy

RESOLUTION NO. ________ (N.C.S.)
A RESOLUTION ESTABLISHING A POLICY REDUCING UNDERGROUND EXCAVATION FOR COMMUNICATIONS INFRASTRUCTURE WITHIN THE CITY RIGHT OF WAY

WHEREAS, the city of Salinas desires to comply with all mandates regarding public utilities as imposed upon it by state and federal law; and

WHEREAS, it is determined that there is a need for wireless telecommunication facilities in the city of Salinas, and the city of Salinas chooses to use its police power and land use planning authority to regulate such facilities; and

WHEREAS, the City of Salinas has an interest in preserving its streets and roadways for their intended purpose, while minimizing interruptions to the flow of traffic; and

WHEREAS, the City of Salinas currently regulates the installation of wireless telecommunication facilities proposed above ground to be placed in the public right of way in accordance with Resolution No 20810 (N.C.S.); and

WHEREAS, the proposed requirements for excavation of permits and entitlements relative to such projects respond to recent changes in laws concerning regulation of wireless telecommunication facilities and provide mechanisms for the City to maintain an aesthetically pleasing community environment, protect the safety and welfare of Salinas residents, minimize degradation of the residential character of neighborhoods, streets, and roadways, and require the best available design to eliminate visual impacts while ensure that adequate public services and facilities are constructed to accommodate the needs of Salinas residents; and

WHEREAS, pursuant to the California Environmental Quality Act ("CEQA"), the proposed requirements for wireless telecommunication facilities in the public right of way are exempt per section 15061(b)(3), as there is no potential to cause a significant effect on the environment; and

NOW, THEREFORE BE IT RESOLVED by the Salinas City Council that the following policy requirements for all underground communications infrastructure within the public right of way are adopted with the purpose of preserving the health, safety, and welfare of the City's residents and City property, as follows:

1. The purpose of this Resolution shall be to encourage the growth of underground communications infrastructure facilities while preserving the integrity of the City of Salinas' ("City") streets.
2. The City has an obligation to comply with all applicable state and federal authority pertaining to utilities and telecommunications, and intends for this Resolution to be interpreted so as to comply with all such authority.

3. The City has an interest in promoting increased connectivity and emerging technology to its City residents and businesses, as well as to businesses seeking growth opportunities within the City limits.
4. In recognition of the need to provide emerging technology to the historically underserved areas of the City, and in further recognition of the need to minimize public inconvenience and traffic, and to preserve the integrity and lifespan of City streets, all construction, reconstruction, repaving of a City right of way shall include a provision for the installation of a public utility infrastructure, such as conduit, tube, duct, or other device designed for enclosing telecommunications wires, fibers, or cables, wherever practical and feasible. Such infrastructure shall be installed in accordance with City regulations, requirements and specifications, including but not limited to the Salinas Municipal Code, as directed by the Director of Public Works or his/her designee. Such excavation shall not take place more than once on a particular City street within a 5-year period.
5. To the extent feasible, the Director of Public Works or his/her designee shall notify (or require an applicant for such work to notify) all known telecommunications service providers of an impending excavation and afford all such service providers the opportunity to utilize the excavation to install, upgrade, co-locate, repair or improve their telecommunications facilities during such an excavation project. Any such notice shall be provided at least 30 days prior to the commencement of excavation. All service providers utilizing the same excavation shall be responsible for their proportionate share of the excavation costs, including but not limited to the costs of permitting. Such excavation shall not take place more than once on a particular City street within a 5-year period.
6. A permit for excavation shall be required and will be charged based on staff time spent at the rate in effect as established by the duly adopted fee schedule for engineering plan review.
7. The Director of Public Works or his/her designee may exempt projects from these requirements where it is determined that it is not practical or feasible. Requests for an exemption must be made in writing with an explanation as to why the project is not feasible. Cost shall not be the determining factor whether a project is feasible or practical. A determination from the Director of Public Works is the final administrative determination of the matter and is not appealable.
8. The Director of Public Works or his/her designee shall have primary responsibility for enforcement of this policy. Pursuant to the Salinas Municipal Code, excavations not in accordance with this policy shall be considered noncompliant encroachments which have been declared a public nuisance and which are subject to abatement, removal, and enjoinment by the City of Salinas, as well as by any other remedies provided by law.

PASSED AND APPROVED this 15th day of November 2016 by the following vote:
AYES:
NOES:
ABSENT:
ABSTAIN:

____
Joe Gunter, Mayor
ATTEST:

____
Patricia M. Barajas, City Clerk

Dig Once Policy For Public Works Projects in Gonzales, CA

Attachment A
DATE: February 1, 2016
FROM: Gonzales City Council
SUBJECT: "Dig Once" Policy for Public Works Projects in Gonzales

1. Unless waived by the Public Works Director on the basis of undue burden, or an unfavorable cost-benefit analysis, or the consideration of other relevant factors, Gonzales will install or have installed communications conduit whenever the City undertakes or authorizes the following types of projects:
    a. New street, road, sidewalk, bike path, or other transportation infrastructure construction.
    b. Maintenance, repaving or other significant work on the above infrastructure.
    c. Excavations for the purpose of installing utilities, including but not limited to communications, electrical, gas, water, waste water, storm drainage.
    d. Other excavations, or work on public property on in the public right of way that provide a similar opportunity to install conduit for future use at a low additional cost.
2. The Public Works Director will work with other local agencies to establish common standards for the type, size, and number of conduits and associated fixtures to be installed. Until these standards are established, a single conduit will be installed with the following specifications, unless the Public Works Director or Project Manager determines otherwise:
    a. A minimum inside diameter of 2-inches.
    b. Made of PVC Schedule 40 material (color orange).
    c. Laid to a depth of not less than 18 inches below grade in concrete sidewalk areas, and not less than 30 inches below finished grade in all other areas when feasible, or the maximum feasible depth otherwise.
    d. When feasible, installed so fiber optic cable maintains a minimum bend ratio of 20-times the cable diameter.
    e. When practicable, furnish with pull tape and an external locate wire no more than 3-inches above the conduit.
3. When determining if a particular specification is feasible or practicable, the Public Works Director or Project Manager will take into account the added cost, the length of the conduit installed (and therefore its potential future value), the impact on the overall project, and other relevant factors.
4. Because communications facilities are needed to monitor, manage, and provide security for Public Works specifically, and to support Public Safety and Economic Development in general, the cost of purchasing, installing, and documenting the conduit may be included in the cost of the overall project. However, other sources of funds may also be used if available.
5. Conduit installed by or on behalf of the City, will be owned by the City.

A record of all City-owned conduits will be maintained, and transferred into a geographic information system (GIS) whenever feasible.

ORDINANCE NO.
ORDINANCE ADDING CHAPTER 12.25 TO SANTA CRUZ COUNTY CODE RELATING TO TELECOMMUNICATIONS INFRASTRUCTURE IMPROVEMENTS

The Board of Supervisors of the County of Santa Cruz ordains as follows:

SECTION 1

Chapter 12.25 of the Santa Cruz County Code is enacted to read as follows:

TELECOMMUNICATIONS INFRASTRUCTURE IMPROVEMENT ORDINANCE

Sections:

12.25.010 Purpose and Findings.
12.25.015 Definitions.
12.25,020 Telecommunications Infrastructure Improvement.
12.25.025 Implementation.
12.25.030 Exemptions.
12.25.035 Enforcement.
12.25.040 Violations.
12.25.045 Severability.
12.25.050 Effective Date.
12.25.055 No Conflict with Federal or State Law.
12.25.060 Preemption.

12.25.010 Findings and intent.

A. It is the intent of the County of Santa Cruz, in enacting Chapter 12.25, to streamline and simplify the process of installing and upgrading telecommunications equipment throughout the County, and to encourage improvement and modernization of telecommunications infrastructure.

B. Access to modern telecommunications infrastructure is vital for communication, education and economic development.

C. It is the desire of the County to foster a fair and level playing field for all market competitors that does not disadvantage or advantage one service provider or technology over another.

D. The County seeks to promote widespread access to the most technologically advanced telecommunications services for all County residents and businesses in a nondiscriminatory manner regardless of socioeconomic status.

E. It is the responsibility of the County to protect and control access to public rights-of-way.

F. The County has a duty to ensure that all service providers utilizing County property, facilities or rights-of-way comply with all applicable state and local health, safety and other laws.

G. It is consistent with the County's goals and values to encourage investment in telecommunications infrastructure to help close the digital divide.

H. It is necessary to update County policies and practices to recognize the authority of the California Public Utilities Commission as established in state and federal statutes.

B. It is the desire of the County to assess fees sufficient to recover the actual costs of providing services but not to discourage improvement of necessary infrastructure.

12.25.015 Definitions.

A. For the purposes of this Chapter, the following definitions apply:
   1. "Telecommunications" refers to data, voice, video or other information provided by wire, fiber optic cable or other technology.
   2. "Facilities" and "Infrastructure" refers to wires, cables, conduit, switches, transmission equipment or other equipment for use in transmitting or processing telecommunications services or for providing support or connection to such equipment.
   3. "Rights-of-way" refers to the area upon or adjacent to any County-owned road, highway or rail line or along or across any of the waters or lands owned or controlled by the County.
   4. "Service providers" refers to any person, company, corporation or other entity providing data, voice, cable, video or other information services by wire, fiber optic cable or other technology.
   5. "Excavation" refers to any process which removes material from the ground through digging, drilling, boring or other activity for the purpose of installing utilities, infrastructure or other structures or equipment.
   6. "Conduit" refers to a tube, duct or other device or structure designed for enclosing telecommunication wires or cables.
   7. "Reconstruction" refers to any project which repairs **or** replaces fifty percent or more of an existing road, highway or rail line.

12.25.020 Telecommunications Infrastructure Improvement

In recognition of the need to provide local residents and businesses within the community with the infrastructure required to meet their telecommunications needs, all construction, reconstruction or repaving of a County right-of-way will include provisions for the installation of telecommunications cable, conduit and other related equipment wherever practical and feasible. Where appropriate, telecommunications infrastructure shall be installed in or adjacent to County rights-of-way in conformance with current County standards. County staff will work with contractors to identify most cost-effective approach consistent with County requirements. If a project includes excavation in or adjacent to a County right-of-way, installation of or upgrades to telecommunications cable, conduit or other infrastructure will be included as needed. **All** installations shall conform to the size, shape, location and other specifications as determined by the Director of Public Works.

12.25.025 Implementation.

No less than 60 days before this ordinance takes effect, the County of Santa Cruz shall email, fax, mail or deliver a copy of it to all telecommunications service providers and other affected entities doing business within the unincorporated County of Santa Cruz,

12.25.030 Exemptions.

A. The Director of Public Works, or the director's designee, may exempt projects from the requirements of this chapter where compliance is found to be not practical or feasible. Requests for an exemption shall be in writing, and the Director's or the director's designee's decision shall be final.

B. An exemption application shall include all information necessary for the Director of Public Works or the director's designee to make a decision, including but not limited to documentation showing factual support for the requested exemption.

C. The Director of Public Works or director's designee may approve the exemption application in whole or in part, with or without conditions.

12.25.035 Enforcement.
Enforcement of this ordinance shall be as follows:

A. The Director of Public Works, or designee, shall have primary responsibility for enforcement of this ordinance and shall have authority to issue citations for violation of this chapter. The Director, or designee, is authorized to establish regulations or administrative procedures to ensure compliance with this chapter.
B. A person or entity violating or failing to comply with any of the requirements of this chapter shall be guilty of an infraction.
C. The County of Santa Cruz may seek legal, injunctive, or any other relief to enforce the provisions of this chapter and any regulation or administrative procedure authorized by it.
D. The remedies and penalties provided in this chapter are cumulative and not exclusive of one another.
E. The Director of Public Works or designee may inspect the premises of any construction, reconstruction, repaving or excavation project to verify compliance with this ordinance.

12.25.040 Violations.
Violations of this ordinance shall be enforced as follows:
Violation of this chapter is hereby declared to be a public nuisance. Any violation described in the preceding paragraph shall be subject to abatement by the County of Santa Cruz, as well as any other remedies that may be permitted by law for public nuisances, and may be enforced by injunction, upon a showing of violation.

12.25.045 Severability.
If any word, phrase, sentence, part, section, subsection, or other portion of this chapter, or any application thereof to any person or circumstance is declared void, unconstitutional, or invalid for any reason, then such word, phrase, sentence, part, section, subsection, or other portion, or the proscribed application thereof, shall be severable, and the remaining provisions of this chapter, and all applications thereof, not having been declared void, unconstitutional or invalid, shall remain in full force and effect. The County of Santa Cruz hereby declares that It would have passed this title, and each section, subsection, sentence, clause, and phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses, or phrases had been declared invalid or unconstitutional.

12.25.050 Effective Date.
This ordinance shall become effective three (3) months after the date of final passage by the County of Santa Cruz Board of Supervisors.

12.25.055 No Conflict with Federal or State Law.
Nothing in this ordinance shall be interpreted or applied so as to create any requirement, power, or duty in conflict with any Federal or State law.

12.25.060 Preemption.
The provisions of this chapter shall be null and void if State or Federal legislation, or administrative regulation, takes effect with the same or substantially similar provisions as contained in this chapter. The Board of Supervisors shall determine whether or not identical or substantially similar statewide legislation has been enacted or regulations issued.

SECTION II

This ordinance shall take effect and be in force six months from the date of adoption.

Dig Once Ordinance Town of Breckenridge

I. **PURPOSE AND OBJECTIVES**

A. Purpose: to provide principles and procedures for the coordination of construction Excavation within any public Rights of Way, and to protect the integrity of the Rights of Way and road system.

B. Objectives. Public and private uses of Rights of Way for location of Utilities employed in the provision of public services should, in the interests of the general welfare, be accommodated; however, the Town must insure that the primary purpose of the Rights of Way, namely the safe and efficient passage of pedestrian and vehicular traffic, is maintained to the greatest extent possible. In addition, the value of other public and private installations, Facilities and properties should be protected, competing uses must be reconciled, and the public safety preserved. The use of the Rights of Way corridors for location of Facilities is secondary to these public objectives. This ordinance is intended to assist in striking a balance between the public need for efficient, safe transportation routes and the use of Rights of Way for location of Facilities by public and private entities. It thus has several objectives:

1. To ensure that public health, safety, and welfare is maintained and that public inconvenience is minimized.
2. To facilitate work within the Rights of Way through the standardization of regulations.
3. To conserve and fairly apportion the limited physical capacity of the public Rights of Way held in public trust by the Town of Breckenridge.
4. To promote cooperation among the Applicants and Permittees (as defined herein) and the Town in the occupation of the public Rights of Way, and work therein, in order to (i) eliminate duplication that is wasteful, unnecessary or unsightly, (ii) lower the Permittee's and the Town's costs of providing services to the public, and (iii) minimize Rights of Way Excavations.

II. **DEFINITIONS**

For this Chapter the following words shall have the following meanings:

A. "Applicant" means an owner or duly authorized agent of such owner, who has applied for a Permit to Excavate in the Rights of Way.

B. "Town" means town of Breckenridge, Colorado.

C. "Conduit" means a single enclosed raceway for cables, fiber optics or other wires, or a pipe or canal used to convey fluids or gases.

"Developer" means the person, partnership, corporation, or other legal entity who is improving property within Town and who is legally responsible to the Town for the construction of improvements within a subdivision or as a condition of a building permit or other land use or development authorization.

A. "Town Engineer" means the Town Engineer of the Town or his/her authorized representative.

B. "Emergency" means any event which may threaten public health or safety, or that results in an interruption in the provision of services, including, but not limited to, damaged or leaking water or gas conduit systems, damaged, plugged, or leaking sewer or storm drain conduit systems, damaged electrical and communications facilities, and advanced notice of needed repairs is impracticable under the circumstances.

C. “Excavate” or “Excavation" means any Work in the surface or subsurface of the Rights of Way, including, but not limited to opening the Rights of Way; installing, servicing, repairing, or modifying any Facility(ies) in or under the surface or subsurface of the Rights of Way, and restoring the surface and subsurface of the Rights of Way.
D. “Facilities” means, including, without limitation, any pipes, conduits, wires, cables, amplifiers, transformers, fiber optic lines, antennae, poles, ducts, fixtures and appurtenances and other like equipment used in transmitting, receiving, distributing, offering, and providing broadband, utility and other services.
E. "Landscaping" means materials, including without limitation, grass, ground cover, shrubs, vines, hedges, or trees and nonliving natural materials commonly used in landscape development, as well as attendant irrigation systems.
F. “Major Work” means any reasonably foreseeable Excavation that will affect the Rights of Way for more than five (5) consecutive calendar days.
G. “Owner” means any Person, including the Town, who owns any Facilities that are or are proposed to be installed or maintained in the Rights of Way.
H. “Permit” means any authorization for use of the Rights of Way granted in accordance with the terms of this ordinance, and other applicable laws and policies of the Town.
I. “Permittee” means the holder of a valid Permit issued pursuant to this Chapter and other applicable provisions of applicable law for Excavation in the Rights of Way.
J. “Person” means any person, firm, partnership, special, metropolitan, or general district, association, corporation, company, or organization of any kind.
K. “Rights of Way” means any public street, road, way, place, alley, sidewalk or easement, that is owned, held or otherwise dedicated to the Town for public use.“Work” means any labor performed on, or any use or storage of equipment or materials, including but not limited to, construction of streets and all related appurtenances, fixtures, improvements, sidewalks, driveway openings, street lights, and traffic signal devices. It shall also mean construction, maintenance, and repair of all underground structures such as pipes, conduit, ducts, tunnels, manholes, vaults, buried cable, wire, or any other similar Facilities located below surface, and installation of overhead poles used for any purpose.
L. “Work” means any labor performed on, or any use or storage of equipment or materials, including but not limited to, construction of streets and all related appurtenances, fixtures, improvements, sidewalks, driveway openings, street lights, and traffic signal devices. It shall also mean construction, maintenance, and repair of all underground structures such as pipes, conduit, ducts, tunnels, manholes, vaults, buried cable, wire, or any other similar Facilities located below surface, and installation of overhead poles used for any purpose.

M. “Fee per Access Line” means the Right-of-Way compensation methodology that is replacing the percent of gross revenue formula historically used in franchise/rental agreements for local exchange Internet Service Providers where a fee is assessed per access line.
N. “Flat Annual Fee” means Right-of-Way compensation to ensure a known revenue amount annually. A yearly escalator or inflation factor to adjust the annual fee for increases in service provided or leased by the Town

O. "Franchise Agreement" means an agreement executed to manage the occupant of public right-of-way. This ordinance included the rules, rights, and fees associated with using public property for private purpose and are applicable for those right-of-way occupants that provide service(s) to the Town's jurisdictions.

P. "In-kind Service" means services received by the Town that can be negotiated in addition to or in lieu of cash to be used over a period, or infrastructure to be specified and installed.

1. *Types of In-Kind Services*
   1. "Wireline" means Fiber optic conduit, inner ducts, dark fiber, equipment to "light" the fiber, equipment maintenance and/or upgrading; operations of communications equipment, future upgrades, cost-free or reduced fee communications services etc.
   2. "Wireless" means space on private towers for equipment, installation of public sector antennas, construction of equipment sheds and installation of support equipment, back-up service or redundancy, wireless call box installation, cost-free or reduced fee communications services on private system etc.

Q. "Linear Foot Fee" means a compensation methodology that is utilized when rights-of-way occupants require space along a specific route or for a limited purposed with the Town's rights-of-way.

III. TOWN OF BRECKENRIDGE PROJECTS

A. Unless waived by the Town Engineer based on undue burden, or an unfavorable cost benefit analysis, or the consideration of other relevant factors, The Town of Breckenridge will install or have installed communications conduit whenever the town undertakes or authorizes the following types of projects:

1. New street, road, sidewalk, bike path, or other transportation infrastructure construction.
2. Major maintenance, repaving, or other significant work on the above infrastructure.
3. Excavations for repairing or installing utilities, including but not limited to communications, electrical, gas, water, storm drainage.
4. Other excavations, or work on public property on in the public right of way that provide a similar opportunity to install conduit for future use at a low additional cost.
5. When determining if a specification is feasible or practicable, the Town Engineer will take into account the added cost, the length of the conduit installed (and therefore its potential future value), the impact on the overall project, and other relevant factors.

B. Because communications facilities are needed to monitor, manage, and provide security for Town to support Public Safety and Economic Development in general, the cost of purchasing, installing, and documenting the conduit may be included in the cost of the overall project. However, other sources of funds may also be used if available.

C. Conduit installed by or on behalf of the Town, will be owned by the Town.

A record of all Town-owned conduits will be maintained the Public Works Department, and transferred into the Town's geographic information system (GIS).

IV. SPECIFICATIONS

A. The Town will work with local agencies to establish common standards for the type, size, and number of conduits and associated fixtures to be installed. Until these standards are established, a single conduit will be installed. The "Dig Once Conduit specification" can be obtained from the Town Engineer.

1.

V. **POLICE POWERS**

A. Permittee's rights hereunder are subject to the police powers of the Town, which include the power to adopt and enforce ordinances, including amendments to this ordinance, and regulations necessary to the safety, health, and welfare of the public. A Permittee shall comply with all applicable ordinances and regulations enacted, or hereafter enacted, by the Town or any other legally constituted governmental unit having lawful jurisdiction over the subject matter hereof. The Town reserves the right to exercise its police powers, notwithstanding anything in this ordinance or any Permit to the contrary. Any conflict between the provisions of the ordinance or a Permit and any other present or future lawful exercise of the Town's police powers shall be resolved in favor of the latter.

VI. **JOINT PLANNING AND CONSTRUCTION; COORDINATION OF PLANNED EXCAVATIONS**

A. Excavations in the Town's Rights of Way disrupt and interfere with the public use of those Rights of Ways and can damage the pavement and Landscaping. The purpose of this section is to reduce this disruption, interference, and damage by promoting better coordination among Applicants and Permittees making excavations in Town's Rights of Way and between these Persons and the Town. Better coordination will assist in minimizing the number of Excavations being made wherever feasible, and will ensure the Excavations in Town's Rights of Way are, to the maximum extent possible, performed before, rather than after, the resurfacing of the Rights of Way by the Town.

B. Any Permittee owning, operating, or installing facilities in Town Rights of Way, providing water, sewer, gas, electric, broadband, communication, video or other utility or utility-like services, coordinate with the Town Engineer. If the town has an interest in install conduit in the same location the permittee shall charge the town the direct cost associated with install conduit as described in section IV. Failure to coordinate with the Town Engineer will compromise the Permittee's ability to work in the right of way.

C. The Town Engineer shall review the major excavation plan and identify conflicts and opportunities for coordination of Excavations. The Town Engineer shall notify affected Owners and Permittees of such conflicts and opportunities to the extent necessary to maximize coordination of Excavation. Each Applicant for a Permit shall coordinate, to the extent practicable, with each potentially affected Owner and Permittee to minimize disruption in the Rights of Way.

D. The Town may disclose information contained in a Permittee's excavation plan to any public or private entity planning on conducting Excavation activities in the Rights of Way only on a need-to-know basis in order to facilitate coordination among excavators and to avoid unnecessary Excavation in the Rights of Way. To the maximum extent permissible under the Colorado Open Records Act, as amended, the Town shall not otherwise disclose to the public any information contained in a excavation plan submitted by a Permittee that is proprietary, trade secret or is otherwise protected from disclosure; provided, however that the Town shall have no duty to decline to disclose any information that the Permittee has not identified on its face as proprietary, trade secret or otherwise protected from disclosure. The Town shall notify a Permittee of any request for inspection of public records that calls for disclosure of any excavation plan on which any information has been identified as proprietary, trade secret or otherwise protected from disclosure. The Town shall consult with its legal counsel regarding any such request and shall inform the affected Permittee either that the Town will refuse to disclose the protected information or, if there is no proper basis for such refusal, that the Town intends to disclose the requested information unless ordered otherwise by a court.

E. In performing location of Facilities in the Rights of Way in preparation for construction under a Permit, Permittee shall compile all information obtained regarding its or any other Facilities in the Rights of Way related to a Permit, and shall make that information available to the Town in a written and verified format acceptable to the Town Engineer. If the Permittee fails to provide the locate information requested by the Town, the Town may obtain this information and charge the Permittee the actual costs for obtaining the information.

VII. **JOINT EXCAVATION**

A. Public Entity and Special Districts Excavators. Whenever two or more public entity excavators propose Major Work in the same block within a year, such Work shall be performed by one public entity excavator when practical. The participants to the excavation shall pay their pro rata share of the Work, or as otherwise agreed to by the affected public entities. For purposes of this subsection, the public entity excavators shall be treated as a single Permit Applicant and shall submit one application.

B. Private Entity Excavators. Whenever two or more private entity excavators propose Major Work in the same block, such Work shall be performed by one private entity excavator. For purposes of this subsection, the private entity excavators shall be treated as a single Permit applicant and shall submit one application. If the town has an interest in install conduit in the same location the permittee shall charge the town the direct cost associated with install conduit as described in section IV.

C. Public Entity Excavator and Private Entity Excavator. Whenever a public entity excavator(s) and a private entity excavator(s) propose Major Work in the same block the Department shall condition Permits for such Work in a manner that maximizes coordination and minimizes the total period of construction. If the town has an interest in install conduit in the same location the permittee shall charge the town the direct cost associated with install conduit as described in section IV.

VIII. **CONSTRUCTION OF NEW STREETS**

A. Intent. The intent of this section is to provide for the construction of infrastructure sufficient to allow broadband communications entities desiring to deploy Facilities in the future to do so by pulling the same through the conduit and appurtenances installed pursuant to this section and without Excavating within the Rights of Way. This section is not intended to require Owners of broadband Facilities or other conduit to install additional ducts or conduit in existing Rights of Way; rather, it is intended to require those constructing public streets, including the Town and Developers, to provide and install such conduit and appurtenances as may be necessary to accommodate future broadband needs within the Rights of Way without further Excavation.

B. Requirements—Adoption of Standards. Whenever any new public street is constructed, whether by the Town as a public works project or by a Developer or other private party in conjunction with development, the following shall be required:

1. In all new local streets serving or abutting residential development a minimum of two 2” conduit shall be installed by the party constructing the street as described in section IV.
2. In all new collector or arterial streets serving or abutting residential development, and in all new streets serving or abutting nonresidential development, a minimum of four 2” shall be

installed by the party constructing the street; provided however that at the discretion of the Town Engineer, the number and size of the conduit and spacing of pull box may be modified to address the reasonably known plans and/or demand for broadband capacity in these locations.

3. In addition to installing conduit, the party constructing the street will be required to install such vaults and other appurtenances as may be necessary to accommodate installation and connection of broadband Facilities within the conduit.
4. All construction and installation shall be accomplished according to construction standards adopted by the Town. The construction standards shall be adopted with due consideration given to existing and anticipated technologies and consistent with industry standards.
5. All Facilities installed by Developers or other private parties pursuant to this section shall be conveyed and dedicated to the Town with the dedication and conveyance of the public street and/or Rights of Way.
6. All installation costs shall be the responsibility of the party constructing the public street.

C. Fees. The Town reserve the right to charge reasonable fees for the use of conduit installed pursuant to this section, to the extent consistent with and as limited by federal and state laws. Any such fees shall be established by resolution or ordinance.

This Ordinance shall take effect immediately upon [insert language appropriate in accordance with City policy]

INTRODUCED, READ, ADOPTED ON FIRST READING AND ORDERED PUBLISHED, as provided by law, by the Town Council of the Town of Breckenridge at its regular meeting held on the_ day of , 201 .

Name and Title

ATTEST:

Town Clerk

READ, ADOPTED ON SECOND READING, AND APPROVED this_ day of ___, 201__

APPENDIX C – BILL OF MATERIALS

Athens-Clarke County Broadband Solution - Bill of Materials

BACKBONE RING

TOTAL $ 623,983.14

AERIAL CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Material Cost	Labor Cost	Per Unit	Extended
AR-01	Install Strand & All Associated Pole Line Hardware	Per Cable Strand Ft.	44,342	$ -	$ 0.99	$ 0.99	$ 43,898.58
MA-02	6 M Strand (Material Only)	Per foot	48,777	$ 1.36	$ -	$ 1.36	$ 66,336.72
MA-03	Poles Attached (For Framing Hardware and labor)	Each	222	$ 13.72	$ -	$ 13.72	$ 3,045.84
AR-11	New Build Aerial, Fiber Plant (DF/AF)-1st 2 cables PRI	Per Cable Strand Ft.	44,342	$ -	$ 1.39	$ 1.39	$ 61,635.38
						TOTAL AERIAL CONSTRUCTION	***$ 174,916.52***

UNDERGROUND CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Material Cost	Labor Cost	Per Unit	Extended
MU-01	2" Conduit	Per foot	641,100	$ 5.49	$ -	$ 5.49	$ 3,519,639.00
UG-02	Directional Bore, 2" diameter Conduit	Per Cable Trench Ft.	582,819	$ -	$ 11.42	$ 11.42	$ 6,655,792.98
MU-23	Medium Vault, HDPE up to 30"x48"x36"	Per Vault	202	$ 1,454.93	$ -	$ 1,454.93	$ 293,895.86
UG-42	Install Medium Vault, HDPE up to 30"x48"x36"	Per Vault	202	$ -	$ 1,355.49	$ 1,355.49	$ 273,808.98
MU-45	STANDARD CABLE MARKER - POST TYPE	Per	1,166	$ 61.94	$ -	$ 61.94	$ 72,222.04
						TOTAL UNDERGROUND CONSTRUCTION	***$ 10,815,358.86***

FIBER

Job Code	Work Function Description	UOM	Est. QTY	Material Cost	Labor Cost	Per Unit	Extended
MF-09	96 Fiber Cable	Per foot	315,143	$ 1.98	$ -	$ 1.98	$ 623,983.14
MF-25	Fiber Enclosure 450-D	Per Enclosure	58	$ 665.27	$ -	$ 665.27	$ 38,585.66
FI-23	Fiber Enclosure Installation 450-D (One at FDH + 432 & 288 splices)	Per Enclosure	58	$ 384.29	$ 200.00	$ 584.29	$ 33,888.82
MF-31	50'/100' AF/DF Slack Loop (either side of splice)	Each	476	$ 99.00		$ 99.00	$ 47,124.00
FI-41	Fiber Acceptance & Validation Testing -- See Description	Each	31,649	$ -	$ 5.00	$ 5.00	$ 158,245.00
FI-03	Fusion splice optical fiber Ribbon (1-144)	Per Ribbon	187	$ -	$ 57.07	$ 57.07	$ 10,672.09
FU-01	Install Fiber Cable in Conduit PRI	Per Cable Trench Ft.	582,819	$ -	$ 3.50	$ 3.50	$ 2,039,866.50
MF-08	864 Fiber Cable	Per foot	335,792	$ 13.54	$ -	$ 13.54	$ 4,546,623.68
FI-06	Fusion splice optical fiber Ribbon(433-864)	Per Ribbon	2,451	$ -	$ 38.53	$ 38.53	$ 94,437.03
						TOTAL FIBER CONSTRUCTION	***$ 7,593,425.92***

Athens-Clarke County Broadband Solution - Bill of Materials

HUT 1

TOTAL $ 16,468,572.55

AERIAL CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
AR-11	New Build Aerial, Fiber Plant (DF/AF)-1st 2 cables PRI	Per Cable Strand Ft.	53,996	$ 1.00	$ -	$ 1.00	$ 53,996.00
AR-01	Install Strand & All Associated Pole Line Hardware	Per Cable Strand Ft.	53,996	$ 0.65	$ 0.18	$ 0.83	$ 44,905.77
						TOTAL AERIAL CONSTRUCTION	***$ 98,901.77***

UNDERGROUND CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
MU-01	2" Conduit	Per foot	652,397	$ -	$ 5.49	$ 5.49	$ 3,581,659.53
UG-02	Directional Bore, 2" diameter Conduit	Per Cable Trench Ft.	652,397	$ 11.42	$ -	$ 11.42	$ 7,450,373.74
MU-45	STANDARD CABLE MARKER - POST TYPE	Per	1,305	$ -	$ 61.94	$ 61.94	$ 80,831.70
MU-21	MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	3,583	$ -	$ 63.38	$ 63.38	$ 227,090.54
MU-22	Small Vault, HDPE up to 17"x30"x24"	Per Vault	198	$ -	$ 860.53	$ 860.53	$ 170,384.94
MU-23	Medium Vault, HDPE up to 30"x48"x36"	Per Vault	1,103	$ -	$ 1,454.93	$ 1,454.93	$ 1,604,787.79
MU-24	Large Vault, HDPE up to 36"x76"x42"	Per Vault	62	$ -	$ 2,668.44	$ 2,668.44	$ 165,443.28
UG-40	Install MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	3,583	$ 50.00	$ -	$ 50.00	$ 179,150.00
UG-41	Install Small Vault, HDPE up to 17"x30"x24"	Per Vault	198	$ 473.50	$ -	$ 473.50	$ 93,753.00
UG-42	Install Medium Vault, HDPE up to 30"x48"x36"	Per Vault	1,103	$ 499.39	$ -	$ 499.39	$ 550,827.17
UG-43	Install Large Vault, HDPE up to 36"x76"x42"	Per Vault	62	$ 941.71	$ -	$ 941.71	$ 58,386.02
						TOTAL UNDERGROUND CONSTRUCTION	***$ 14,162,687.71***

FIBER

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
MF-03	48 Fiber Cable	Per foot	65,805	$ -	$ 1.12	$ 1.12	$ 73,701.60
MF-04	72 Fiber Cable	Per foot	58,798	$ -	$ 0.50	$ 0.50	$ 29,399.00
MF-05	144 Fiber Cable	Per foot	123,977	$ -	$ 2.44	$ 2.44	$ 302,503.88
MF-06	288 Fiber Cable	Per foot	53,910	$ -	$ 5.22	$ 5.22	$ 281,410.20
MF-02	24 Fiber Cable	Per foot	143,165	$ -	$ 0.83	$ 0.83	$ 118,826.95
MF-09	96 Fiber Cable	Per foot	25,265	$ -	$ 1.98	$ 1.98	$ 50,024.70
MF-07	432 Fiber Cable	Per foot	9,697	$ -	$ 6.92	$ 6.92	$ 67,103.24
FU-01	Install Fiber Cable in Conduit PRI	Per Cable Trench Ft.	366,861	$ 3.50	$ -	$ 3.50	$ 1,284,013.50
						TOTAL FIBER CONSTRUCTION	***$ 2,206,983.07***

Athens-Clarke County Broadband Solution - Bill of Materials

HUT 2

TOTAL $ 13,441,960.54

AERIAL CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
AR-01	Install Strand & All Associated Pole Line Hardware	Per Cable Strand Ft.	216,488	$ 0.65	$ 0.18	$ 0.83	$ 180,042.25
						TOTAL AERIAL CONSTRUCTION $	***180,042.25***

UNDERGROUND CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
MU-01	2" Conduit	Per foot	576,896	$ -	$ 5.49	$ 5.49	$ 3,167,159.04
UG-02	Directional Bore, 2" diameter Conduit	Per Cable Trench Ft.	576,896	$ 11.42	$ -	$ 11.42	$ 6,588,152.32
MU-45	STANDARD CABLE MARKER - POST TYPE	Per	1,154	$ -	$ 61.94	$ 61.94	$ 71,478.76
MU-21	MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	2,613	$ -	$ 63.38	$ 63.38	$ 165,611.94
MU-22	Small Vault, HDPE up to 17"x30"x24"	Per Vault	155	$ -	$ 860.53	$ 860.53	$ 133,382.15
MU-23	Medium Vault, HDPE up to 30"x48"x36"	Per Vault	890	$ -	$ 1,454.93	$ 1,454.93	$ 1,294,887.70
MU-24	Large Vault, HDPE up to 36"x76"x42"	Per Vault	48	$ -	$ 2,668.44	$ 2,668.44	$ 128,085.12
UG-40	Install MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	2,613	$ 50.00	$ -	$ 50.00	$ 130,650.00
UG-41	Install Small Vault, HDPE up to 17"x30"x24"	Per Vault	155	$ 473.50	$ -	$ 473.50	$ 73,392.50
UG-42	Install Medium Vault, HDPE up to 30"x48"x36"	Per Vault	890	$ 499.39	$ -	$ 499.39	$ 444,457.10
UG-43	Install Large Vault, HDPE up to 36"x76"x42"	Per Vault	48	$ 941.71	$ -	$ 941.71	$ 45,202.08
						TOTAL UNDERGROUND CONSTRUCTION $	***12,242,458.71***

FIBER

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
MF-03	48 Fiber Cable	Per foot	91,309	$ -	$ 1.12	$ 1.12	$ 102,266.08
MF-04	72 Fiber Cable	Per foot	69,788	$ -	$ 0.50	$ 0.50	$ 34,894.00
MF-05	144 Fiber Cable	Per foot	138,695	$ -	$ 2.44	$ 2.44	$ 338,415.80
MF-06	288 Fiber Cable	Per foot	50,059	$ -	$ 5.22	$ 5.22	$ 261,307.98
MF-02	24 Fiber Cable	Per foot	172,502	$ -	$ 0.83	$ 0.83	$ 143,176.66
MF-09	96 Fiber Cable	Per foot	33,081	$ -	$ 1.98	$ 1.98	$ 65,500.38
MF-07	432 Fiber Cable	Per foot	10,679	$ -	$ 6.92	$ 6.92	$ 73,898.68
						TOTAL FIBER CONSTRUCTION $	***1,019,459.58***

Athens-Clarke County Broadband Solution - Bill of Materials

HUT 3

TOTAL $ 14,524,521.02

AERIAL CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
AR-01	Install Strand & All Associated Pole Line Hardware	Per Cable Strand Ft.	2,279	$ 0.65	$ 0.18	$ 0.83	$ 1,895.33
						TOTAL AERIAL CONSTRUCTION $	***1,895.33***

UNDERGROUND CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
MU-01	2" Conduit	Per foot	602,471	$ -	$ 5.49	$ 5.49	$ 3,307,565.79
UG-02	Directional Bore, 2" diameter Conduit	Per Cable Trench Ft.	602,471	$ 11.42	$ -	$ 11.42	$ 6,880,218.82
MU-45	STANDARD CABLE MARKER - POST TYPE	Per	1,205	$ -	$ 61.94	$ 61.94	$ 74,637.70
MU-21	MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	2,421	$ -	$ 63.38	$ 63.38	$ 153,442.98
MU-22	Small Vault, HDPE up to 17"x30"x24"	Per Vault	141	$ -	$ 860.53	$ 860.53	$ 121,334.73
MU-23	Medium Vault, HDPE up to 30"x48"x36"	Per Vault	740	$ -	$ 1,454.93	$ 1,454.93	$ 1,076,648.20
MU-24	Large Vault, HDPE up to 36"x76"x42"	Per Vault	74	$ -	$ 2,668.44	$ 2,668.44	$ 197,464.56
UG-40	Install MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	2,421	$ 50.00	$ -	$ 50.00	$ 121,050.00
UG-41	Install Small Vault, HDPE up to 17"x30"x24"	Per Vault	141	$ 473.50	$ -	$ 473.50	$ 66,763.50
UG-42	Install Medium Vault, HDPE up to 30"x48"x36"	Per Vault	740	$ 499.39	$ -	$ 499.39	$ 369,548.60
UG-43	Install Large Vault, HDPE up to 36"x76"x42"	Per Vault	74	$ 941.71	$ -	$ 941.71	$ 69,686.54
						TOTAL UNDERGROUND CONSTRUCTION $	***12,438,361.42***

FIBER

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
MF-03	48 Fiber Cable	Per foot	32,360	$ -	$ 1.12	$ 1.12	$ 36,243.20
MF-04	72 Fiber Cable	Per foot	28,739	$ -	$ 0.50	$ 0.50	$ 14,369.50
MF-05	144 Fiber Cable	Per foot	129,652	$ -	$ 2.44	$ 2.44	$ 316,350.88
MF-06	288 Fiber Cable	Per foot	23,430	$ -	$ 5.22	$ 5.22	$ 122,304.60
MF-02	24 Fiber Cable	Per foot	174,107	$ -	$ 0.83	$ 0.83	$ 144,508.81
MF-09	96 Fiber Cable	Per foot	30,070	$ -	$ 1.98	$ 1.98	$ 59,538.60
MF-07	432 Fiber Cable	Per foot	10,679	$ -	$ 6.92	$ 6.92	$ 73,898.68
FU-01	Install Fiber Cable in Conduit PRI	Per Cable Trench Ft.	376,300	$ 3.50	$ -	$ 3.50	$ 1,317,050.00
						TOTAL FIBER CONSTRUCTION $	***2,084,264.27***

Athens-Clarke County Broadband Solution - Bill of Materials

HUT 4

TOTAL $ 16,699,792.81

AERIAL CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
AR-11	New Build Aerial, Fiber Plant (DF/AF)-1st 2 cables PRI	Per Cable Strand Ft.	45,207	$ 1.00	$ -	$ 1.00	$ 45,207.00
AR-01	Install Strand & All Associated Pole Line Hardware	Per Cable Strand Ft.	45,207	$ 0.65	$ 0.18	$ 0.83	$ 37,596.40
						TOTAL AERIAL CONSTRUCTION	***$ 82,803.40***

UNDERGROUND CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
MU-01	2" Conduit	Per foot	690,567	$ -	$ 5.49	$ 5.49	$ 3,791,212.83
UG-02	Directional Bore, 2" diameter Conduit	Per Cable Trench Ft.	690,567	$ 11.42	$ -	$ 11.42	$ 7,886,275.14
MU-45	STANDARD CABLE MARKER - POST TYPE	Per	1,382	$ -	$ 61.94	$ 61.94	$ 85,601.08
MU-21	MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	2,674	$ -	$ 63.38	$ 63.38	$ 169,478.12
MU-22	Small Vault, HDPE up to 17"x30"x24"	Per Vault	158	$ -	$ 860.53	$ 860.53	$ 135,963.74
MU-23	Medium Vault, HDPE up to 30"x48"x36"	Per Vault	902	$ -	$ 1,454.93	$ 1,454.93	$ 1,312,346.86
MU-24	Large Vault, HDPE up to 36"x76"x42"	Per Vault	37	$ -	$ 2,668.44	$ 2,668.44	$ 98,732.28
UG-40	Install MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	2,674	$ 50.00	$ -	$ 50.00	$ 133,700.00
UG-41	Install Small Vault, HDPE up to 17"x30"x24"	Per Vault	158	$ 473.50	$ -	$ 473.50	$ 74,813.00
UG-42	Install Medium Vault, HDPE up to 30"x48"x36"	Per Vault	902	$ 499.39	$ -	$ 499.39	$ 450,449.78
UG-43	Install Large Vault, HDPE up to 36"x76"x42"	Per Vault	37	$ 941.71	$ -	$ 941.71	$ 34,843.27
						TOTAL UNDERGROUND CONSTRUCTION	***$ 14,173,416.10***

FIBER

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
MF-03	48 Fiber Cable	Per foot	58,766	$ -	$ 1.12	$ 1.12	$ 65,817.92
MF-04	72 Fiber Cable	Per foot	49,506	$ -	$ 0.50	$ 0.50	$ 24,753.00
MF-05	144 Fiber Cable	Per foot	149,730	$ -	$ 2.44	$ 2.44	$ 365,341.20
MF-06	288 Fiber Cable	Per foot	68,347	$ -	$ 5.22	$ 5.22	$ 356,771.34
MF-02	24 Fiber Cable	Per foot	116,701	$ -	$ 0.83	$ 0.83	$ 96,861.83
MF-09	96 Fiber Cable	Per foot	25,628	$ -	$ 1.98	$ 1.98	$ 50,743.44
MF-07	432 Fiber Cable	Per foot	25,699	$ -	$ 6.92	$ 6.92	$ 177,837.08
FU-01	Install Fiber Cable in Conduit PRI	Per Cable Trench Ft.	372,985	$ 3.50	$ -	$ 3.50	$ 1,305,447.50
						TOTAL FIBER CONSTRUCTION	***$ 2,443,573.31***

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TOTAL $ 17,174,419.79

AERIAL CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
AR-11	New Build Aerial, Fiber Plant (DF/AF)-1st 2 cables PRI	Per Cable Strand Ft.	15,909	$ 1.39	$ -	$ 1.39	$ 22,113.51
MA-02	6 M Strand (Material Only)	Per foot	9,011	$ -	$ 1.36	$ 1.36	$ 12,254.96
AR-01	Install Strand & All Associated Pole Line Hardware	Per Cable Strand Ft.	9,011	$ 0.99	$ -	$ 0.99	$ 8,920.89
						TOTAL AERIAL CONSTRUCTION	***$ 43,289.36***

UNDERGROUND CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
MU-01	2" Conduit	Per foot	420,490	$ -	$ 5.49	$ 5.49	$ 2,308,490.10
UG-02	Directional Bore, 2" diameter Conduit	Per Cable Trench Ft.	382,264	$ 11.42	$ -	$ 11.42	$ 4,365,454.88
MU-45	STANDARD CABLE MARKER - POST TYPE	Per	513	$ -	$ 61.94	$ 61.94	$ 31,775.22
MU-21	MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	1,650	$ -	$ 63.38	$ 63.38	$ 104,577.00
MU-22	Small Vault, HDPE up to 17"x30"x24"	Per Vault	75	$ -	$ 860.53	$ 860.53	$ 64,539.75
MU-23	Medium Vault, HDPE up to 30"x48"x36"	Per Vault	466	$ -	$ 1,454.93	$ 1,454.93	$ 677,997.38
MU-24	Large Vault, HDPE up to 36"x76"x42"	Per Vault	48	$ -	$ 2,668.44	$ 2,668.44	$ 128,085.12
UG-40	Install MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	1,650	$ 50.00	$ -	$ 50.00	$ 82,500.00
UG-41	Install Small Vault, HDPE up to 17"x30"x24"	Per Vault	75	$ 473.50	$ -	$ 473.50	$ 35,512.50
UG-42	Install Medium Vault, HDPE up to 30"x48"x36"	Per Vault	466	$ 499.39	$ -	$ 499.39	$ 232,715.74
UG-43	Install Large Vault, HDPE up to 36"x76"x42"	Per Vault	48	$ 941.71	$ -	$ 941.71	$ 45,202.08
						TOTAL UNDERGROUND CONSTRUCTION	***$ 8,076,849.77***

FIBER

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
FU-01	Install Fiber Cable in Conduit PRI	Per Cable Trench Ft.	2,584,717	$ 3.50	$ -	$ 3.50	$ 9,046,509.50
MF-04	72 Fiber Cable	Per foot	25,720	$ -	$ -	$ -	$ -
MF-05	144 Fiber Cable	Per foot	55,896				
MF-06	288 Fiber Cable	Per foot	13,861				
MF-07	432 Fiber Cable	Per foot	1,123	$ -	$ 6.92	$ 6.92	$ 7,771.16
						TOTAL FIBER CONSTRUCTION	***$ 9,054,280.66***

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TOTAL $ 8,970,712.32

AERIAL CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
				$ -	$ -	$ -	$ -
						TOTAL AERIAL CONSTRUCTION	$ -

UNDERGROUND CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
MU-01	2" Conduit	Per foot	382,264	$ -	$ 5.49	$ 5.49	$ 2,098,629.36
UG-02	Directional Bore, 2" diameter Conduit	Per Cable Trench Ft.	382,264	$ 11.42	$ -	$ 11.42	$ 4,365,454.88
MU-45	STANDARD CABLE MARKER - POST TYPE	Per	513	$ -	$ 61.94	$ 61.94	$ 31,775.22
MU-21	MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	2,036	$ -	$ 63.38	$ 63.38	$ 129,041.68
MU-22	Small Vault, HDPE up to 17"x30"x24"	Per Vault	129	$ -	$ 860.53	$ 860.53	$ 111,008.37
MU-23	Medium Vault, HDPE up to 30"x48"x36"	Per Vault	550	$ -	$ 1,454.93	$ 1,454.93	$ 800,211.50
MU-24	Large Vault, HDPE up to 36"x76"x42"	Per Vault	93	$ -	$ 2,668.44	$ 2,668.44	$ 248,164.92
UG-40	Install MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	2,036	$ 50.00	$ -	$ 50.00	$ 101,800.00
UG-41	Install Small Vault, HDPE up to 17"x30"x24"	Per Vault	129	$ 473.50	$ -	$ 473.50	$ 61,081.50
UG-42	Install Medium Vault, HDPE up to 30"x48"x36"	Per Vault	550	$ 499.39	$ -	$ 499.39	$ 274,664.50
UG-43	Install Large Vault, HDPE up to 36"x76"x42"	Per Vault	93	$ 941.71	$ -	$ 941.71	$ 87,579.03
						TOTAL UNDERGROUND CONSTRUCTION	***$ 8,309,410.96***

FIBER

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
FU-01	Install Fiber Cable in Conduit PRI	Per Cable Trench Ft.	107,143	$ 3.50	$ -	$ 3.50	$ 375,000.50
MF-05	144 Fiber Cable	Per foot	78,118	$ -	$ 2.44	$ 2.44	$ 190,607.92
MF-04	72 Fiber Cable	Per foot	12,773	$ -	$ 0.50	$ 0.50	$ 6,386.50
MF-06	288 Fiber Cable	Per foot	13,622	$ -	$ 5.22	$ 5.22	$ 71,106.84
MF-07	432 Fiber Cable	Per foot	2,630	$ -	$ 6.92	$ 6.92	$ 18,199.60
						TOTAL FIBER CONSTRUCTION	***$ 661,301.36***

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TOTAL $ 28,447,230.63

AERIAL CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
AR-01	Install Strand & All Associated Pole Line Hardware	Per Cable Strand Ft.	304	$ 0.99	$ -	$ 0.99	$ 300.96
MA-02	6 M Strand (Material Only)	Per foot	335	$ -	$ 1.36	$ 1.36	$ 455.60
						TOTAL AERIAL CONSTRUCTION	***$ 756.56***

UNDERGROUND CONSTRUCTION

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
MU-01	2" Conduit	Per foot	560,643	$ -	$ 5.49	$ 5.49	$ 3,077,930.07
UG-02	Directional Bore, 2" diameter Conduit	Per Cable Trench Ft.	509,675	$ 11.42	$ -	$ 11.42	$ 5,820,488.50
MU-45	STANDARD CABLE MARKER - POST TYPE	Per	685	$ -	$ 61.94	$ 61.94	$ 42,428.90
MU-21	MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	3,112	$ -	$ 63.38	$ 63.38	$ 197,238.56
MU-22	Small Vault, HDPE up to 17"x30"x24"	Per Vault	136	$ -	$ 860.53	$ 860.53	$ 117,032.08
MU-23	Medium Vault, HDPE up to 30"x48"x36"	Per Vault	915	$ -	$ 1,454.93	$ 1,454.93	$ 1,331,260.95
MU-24	Large Vault, HDPE up to 36"x76"x42"	Per Vault	98	$ -	$ 2,668.44	$ 2,668.44	$ 261,507.12
UG-40	Install MST Pedestal 10x10x10 (MST not in vault) May be put in on DF	Per unit	3,112	$ 50.00	$ -	$ 50.00	$ 155,600.00
UG-41	Install Small Vault, HDPE up to 17"x30"x24"	Per Vault	136	$ 473.50	$ -	$ 473.50	$ 64,396.00
UG-42	Install Medium Vault, HDPE up to 30"x48"x36"	Per Vault	915	$ 499.39	$ -	$ 499.39	$ 456,941.85
UG-43	Install Large Vault, HDPE up to 36"x76"x42"	Per Vault	98	$ 941.71	$ -	$ 941.71	$ 92,287.58
						TOTAL UNDERGROUND CONSTRUCTION	***$ 11,617,111.61***

FIBER

Job Code	Work Function Description	UOM	Est. QTY	Labor Cost	Material Cost	Per Unit	Extended
FU-01	Install Fiber Cable in Conduit PRI	Per Cable Trench Ft.	4,686,136	$ 3.50	$ -	$ 3.50	$ 16,401,476.00
MF-05	144 Fiber Cable	Per foot	90,312	$ -	$ 2.44	$ 2.44	$ 220,361.28
MF-04	72 Fiber Cable	Per foot	15,348	$ -	$ 0.50	$ 0.50	$ 7,674.00
MF-06	288 Fiber Cable	Per foot	29,751	$ -	$ 5.22	$ 5.22	$ 155,300.22
MF-07	432 Fiber Cable	Per foot	6,438	$ -	$ 6.92	$ 6.92	$ 44,550.96
						TOTAL FIBER CONSTRUCTION	***$ 16,829,362.46***

APPENDIX D – DATA DICTIONARY

Address – File Geodatabase Feature Class

Name: Address
Alias: Address
Feature Dataset: HLD
Feature Type: Simple
Geometry Type: Point
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
TYPE	TYPE	Text	TRUE	Address_Type		50
COMMENTS	COMMENTS	Text	TRUE			200
STATUS	STATUS	Text	TRUE	Address_Status		50
WOID	WO_ID	Text	TRUE			50
UNITNUMBER	UNIT_NUMBER	Text	TRUE			50
CITY	CITY	Text	TRUE			50
STATE	STATE	Text	TRUE			50
ZIPCODE	ZIP_CODE	Text	TRUE			50
FGID	FG_ID	Text	TRUE			50
GlobalID	GlobalID	Global ID	FALSE			
FULLADDRESS	FULL_ADDRESS	Text	TRUE			300
STREETNUMBER	STREET_NUMBER	Text	TRUE			50
STREETNAME	STREET_NAME	Text	TRUE			125
STREETSUFFIX	STREET_SUFFIX	Text	TRUE			15
LANDUSE	LAND_USE	Text	TRUE			125
SHAPE	SHAPE	Geometry	TRUE			
UNITCOUNT	UNITCOUNT	Short	TRUE			
NUMFIBERS	NUMFIBERS	Short	TRUE			
LONGITUDE	LONGITUDE	Double	TRUE			
LATITUDE	LATITUDE	Double	TRUE			
CUSTOM1	CUSTOM1	Text	TRUE			255
CUSTOM2	CUSTOM2	Text	TRUE			50
CUSTOM3	CUSTOM3	Double	TRUE			

HLDFiber– File Geodatabase Feature Class

Name: HLDFiber
Alias: HLDFiber
Feature Dataset: HLD
Feature Type: Simple
Geometry Type: Point
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
PLACEMENT	NAME	Text	TRUE	Type_Name		50
CATEGORY	CABLE_CATEGORY	Text	TRUE	Cable_Category		50
COMMENTS	COMMENTS	Text	TRUE			200
SIZE	SIZE	Short	TRUE	Fibercount		
CUSTOM1		Text	TRUE			300
CUSTOM2		Text	TRUE			300
CUSTOM3		Long	TRUE			
created_user		Text	TRUE			255
created_date		Date	TRUE			
last_edited_user		Text	TRUE			255
last_edited_date		Date	TRUE			
SHAPE	SHAPE	Geometry	TRUE			
STATUS	STATUS	Text	TRUE	Physical_Status		50
SHAPE_Length		Double	TRUE			

HLDHUB – File Geodatabase Feature Class

Name: HLDHUB
Alias: HLDHUB
Feature Dataset: HLD
Feature Type: Simple
Geometry Type: Point
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
NAME	HUBNAME	Text	TRUE			50
LATITUDE	LATITUDE	Double	TRUE			
LONGITUDE	LONGITUDE	Double	TRUE			
COMMENTS	COMMENTS	Text	TRUE			300
TYPE	TYPE	Text	TRUE	HUB_Type		50
SHAPE	SHAPE	Geometry	TRUE			
GLOBALID	GLOBALID	Guid	TRUE			
RING	HUBRING	Text	TRUE			50

HLDRoute – File Geodatabase Feature Class

Name: HLDRoute
Alias: HLDRoute
Feature Dataset: HLD
Feature Type: Simple
Geometry Type: Line
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
CATEGORY	NETWORKTYPE	Text	TRUE	Cable_Category		100
STATUS	STATUS	Text	TRUE	Physical_Status		50
GLOBALID	GLOBALID	Guid	TRUE			
COMMENTS	COMMENTS	Text	TRUE			500
CONDUITSIZE	CONDUITSIZE	Text	TRUE			50
PLACEMENT	PLACEMENT	Text	TRUE	Type_Name		15
SHAPE	SHAPE	Geometry	TRUE			
CUSTOM1	CUSTOM1	Text	TRUE			50
CUSTOM2	CUSTOM2	Text	TRUE			50
CUSTOM3	CUSTOM3	Double	TRUE			
SHAPE_Length		Double	TRUE			

HLDSpliceClosure– File Geodatabase Feature Class

Name: HLDSpliceClosure
Alias: HLDSpliceClosure
Feature Dataset: HLD
Feature Type: Simple
Geometry Type: Point
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
NAME	NAME	Text	TRUE			50
PLACEMENT	PLACEMENT	Text	TRUE	Type_Name		50
TYPE	TYPE	Text	TRUE	SPLICE_USE		50
COMMENTS	COMMENTS	Text	TRUE			300
CUSTOM1		Text	TRUE			300
CUSTOM2		Text	TRUE			300
CUSTOM3		Long	TRUE			
created_user		Text	TRUE			255
created_date		Date	TRUE			
last_edited_user		Text	TRUE			255
last_edited_date		Date	TRUE			
SHAPE	SHAPE	Geometry	TRUE			
LATITUDE	LATITUDE	Double	TRUE			
LONGITUDE	LONGITUDE	Double	TRUE			
GLOBALID	GLOBALID	Guid	TRUE			

HLDStructure – File Geodatabase Feature Class

Name HLDStructure
Alias HLDStructure
Feature Dataset HLD
Feature Type Simple
Geometry Type Point
HasZ No
HasM No
Attachments No Attachments

Field Name	**Alias**	**Data Type**	**Allow Null**	**Domain**	**Default Value**	**Length**
OBJECTID	OBJECTID	Object ID	FALSE			
SIZE	SIZE	Text	TRUE			50
STATUS	STATUS	Text	TRUE	Physical_Status		50
PLACEMENT	PLACEMENT	Text	TRUE			50
COMMENTS	COMMENTS	Text	TRUE			50
GLOBALID	GLOBALID	Guid	TRUE			
CUSTOM1		Text	TRUE			300
CUSTOM2		Text	TRUE			300
CUSTOM3		Long	TRUE			
created_user		Text	TRUE			255
created_date		Date	TRUE			
last_edited_user		Text	TRUE			255
last_edited_date		Date	TRUE			
SHAPE	SHAPE	Geometry	TRUE			
LATITUDE	LATITUDE	Double	TRUE			
LONGITUDE	LONGITUDE	Double	TRUE			

CROArea – File Geodatabase Feature Class

Name: CROArea
Alias: CROArea
Feature Dataset: CRO
Feature Type: Simple
Geometry Type: Polygon
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
NAME	NAME	Text	TRUE			50
COMMENTS	COMMENTS	Text	TRUE			500
GlobalID	GlobalID	Global ID	FALSE			
created_user	created_user	Text	TRUE			255
created_date	created_date	Date	TRUE			
last_edited_user	last_edited_user	Text	TRUE			255
last_edited_date	last_edited_date	Date	TRUE			
SHAPE	SHAPE	Geometry	TRUE			
CUSTOM1	CUSTOM1	Text	TRUE			255
CUSTOM2	CUSTOM2	Text	TRUE			255
CUSTOM3	CUSTOM3	Double	TRUE			
SHAPE_Length		Double	TRUE			
SHAPE_Area		Double	TRUE			

CRONotesLine – File Geodatabase Feature Class

Name: CRONotesLine
Alias: CRONotesLine
Feature Dataset: CRO
Feature Type: Simple
Geometry Type: Line
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
COMMENTS	COMMENTS	Text	TRUE			1000
GlobalID	GlobalID	Global ID	FALSE			
created_user	created_user	Text	TRUE			255
created_date	created_date	Date	TRUE			
last_edited_user	last_edited_user	Text	TRUE			255
last_edited_date	last_edited_date	Date	TRUE			
SHAPE	SHAPE	Geometry	TRUE			
INVESTIGATIONNEEEDED	INVESTIGATIONNEEEDED	Text	TRUE	Yes/ No		50
DESIGNREVIEWNEEDED	DESIGNREVIEWNEEDED	Text	TRUE	Yes/ No		50
TYPE	TYPE	Text	TRUE			50
CUSTOM1	CUSTOM1	Text	TRUE			255
CUSTOM2	CUSTOM2	Text	TRUE			255
CUSTOM3	CUSTOM3	Double	TRUE			
SHAPE_Length		Double	TRUE			

CRONotesPoint – File Geodatabase Feature Class

Name: CRONotesPoint
Alias: CRONotesPoint
Feature Dataset: CRO
Feature Type: Simple
Geometry Type: Line
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
COMMENTS	COMMENTS	Text	TRUE			750
TYPE	TYPE	Text	TRUE			50
GlobalID	GlobalID	Global ID	FALSE			
created_user	created_user	Text	TRUE			255
created_date	created_date	Date	TRUE			
last_edited_user	last_edited_user	Text	TRUE			255
last_edited_date	last_edited_date	Date	TRUE			
SHAPE	SHAPE	Geometry	TRUE			
INVESTIGATIONNEEDED	INVESTIGATIONNEEDED	Text	TRUE	Yes/ No		50
DESIGNREVIEWNEEDED	DESIGNREVIEWNEEDED	Text	TRUE	Yes/ No		50
OFFSET	OFFSET	Double	TRUE			
PLACEMENT	PLACEMENT	Text	TRUE			50
SURVEYSTATUS	SURVEYSTATUS	Text	TRUE			50
TIEDOWNSTATION	TIEDOWNSTATION	Double	TRUE			
OFFSETFROM	OFFSETFROM	Text	TRUE			50
TIEDOWNPOINT	TIEDOWNPOINT	Text	TRUE			50
CUSTOM1	CUSTOM1	Text	TRUE			255
CUSTOM2	CUSTOM2	Text	TRUE			255
CUSTOM3	CUSTOM3	Double	TRUE			
LATITUDE	LATITUDE	Double	TRUE			
LONGITUDE	LONGITUDE	Double	TRUE			

CRONotesPolygon – File Geodatabase Feature Class

Name: CRONotesPolygon
Alias: CRONotesPolygon
Feature Dataset: CRO
Feature Type: Simple
Geometry Type: Polygon
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
COMMENTS	COMMENTS	Text	TRUE			750
GlobalID	GlobalID	Global ID	FALSE			
created_user	created_user	Text	TRUE			255
created_date	created_date	Date	TRUE			
last_edited_user	last_edited_user	Text	TRUE			255
last_edited_date	last_edited_date	Date	TRUE			
SHAPE	SHAPE	Geometry	TRUE			
INVESTIGATIONNEEDED	INVESTIGATIONNEEDED	Text	TRUE	Yes/ No		50
DESIGNREVIEWNEEDED	DESIGNREVIEWNEEDED	Text	TRUE	Yes/ No		50
TYPE	TYPE	Text	TRUE			50
CUSTOM1	CUSTOM1	Text	TRUE			255
CUSTOM2	CUSTOM2	Text	TRUE			255
CUSTOM3	CUSTOM3	Double	TRUE			
SHAPE_Length		Double	TRUE			
SHAPE_Area		Double	TRUE			

CROStructure – File Geodatabase Feature Class

Name: CROStructure
Alias: CROStructure
Feature Dataset: CRO
Feature Type: Simple
Geometry Type: Point
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
TYPE	TYPE	Text	TRUE	CRO_TYPE		50
STATUS	STATUS	Text	TRUE	Physical_Status		50
PLACEMENT	PLACEMENT	Text	TRUE	CRO_PLACEMENT		50
COMMENTS	COMMENTS	Text	TRUE			500
GlobalID	GlobalID	Global ID	FALSE			
created_user	created_user	Text	TRUE			255
created_date	created_date	Date	TRUE			
last_edited_user	last_edited_user	Text	TRUE			255
last_edited_date	last_edited_date	Date	TRUE			
SURVEYSTATUS	SURVEY_STATUS	Text	TRUE	Address_Status		20
SHAPE	SHAPE	Geometry	TRUE			
SUBTYPE	SUBTYPE	Text	TRUE			50
OWNER	OWNER	Text	TRUE			50
INROAD	INROAD	Text	TRUE	Yes/ No		50
OFFSET	OFFSET	Double	TRUE			
OFFSETFROM	OFFSETFROM	Text	TRUE			50
TIEDOWNSTATION	TIEDOWNSTATION	Double	TRUE			
TIEDOWNPOINT	TIEDOWNPOINT	Text	TRUE			50
CUSTOM1	CUSTOM1	Text	TRUE			255
CUSTOM2	CUSTOM2	Text	TRUE			255
CUSTOM3	CUSTOM3	Double	TRUE			
LATITUDE	LATITUDE	Double	TRUE			
LONGITUDE	LONGITUDE	Double	TRUE			

Permit_Polygons – File Geodatabase Feature Class

Name: Permit_Polygons
Alias: Permit_Polygons
Feature Dataset: Telecom
Feature Type: Simple
Geometry Type: Polygon
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
FGID	ID	Text	TRUE			50
WORKORDERID	WO_ID	Text	TRUE			50
STATUS	STATUS	Text	TRUE	Permit_Status		50
PERMITID	PERMIT_ID	Text	TRUE			50
PERMITNAME	PERMIT_NAME	Text	TRUE			50
PERMITTYPE	PERMIT_TYPE	Text	TRUE			50
PERMITENTITY	PERMIT_ENTITY	Text	TRUE			50
TOTALMILEAGE	TOTAL_MILEAGE	Short	TRUE			
COMMENTS	COMMENTS	Text	TRUE			300
CUSTOM1	CUSTOM1	Text	TRUE			300
CUSTOM2	CUSTOM2	Text	TRUE			300
CUSTOM3	CUSTOM3	Double	TRUE			
created_user	created_user	Text	TRUE			255
created_date	created_date	Date	TRUE			
last_edited_user	last_edited_user	Text	TRUE			255
last_edited_date	last_edited_date	Date	TRUE			
GlobalID	GlobalID	Global ID	FALSE			
SHAPE	SHAPE	Geometry	TRUE			
SHAPE_Length		Double	TRUE			
SHAPE_Area		Double	TRUE			

PLAN_Boundaries – File Geodatabase Feature Class

Name: PlanningBoundary
Alias: PLAN_Boundaries
Feature Dataset: Telecom
Feature Type: Simple
Geometry Type: Polygon
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
FGID	FG_ID	Text	TRUE			50
TYPE	TYPE	Text	TRUE	PLAN_TYPE		50
TOTALADDRESS	TOTAL_ADDRESS	Short	TRUE			
TOTALMXU	TOTAL_MXU	Short	TRUE			
TOTALSFU	TOTAL_SFU	Short	TRUE			
COMMENTS	COMMENTS	Text	TRUE			250
CUSTOM1	CUSTOM1	Text	TRUE			300
CUSTOM2	CUSTOM2	Text	TRUE			300
CUSTOM3	CUSTOM3	Long	TRUE			
created_user	created_user	Text	TRUE			255
created_date	created_date	Date	TRUE			
last_edited_user	last_edited_user	Text	TRUE			255
last_edited_date	last_edited_date	Date	TRUE			
GlobalID	GlobalID	Global ID	FALSE			
SHAPE	SHAPE	Geometry	TRUE			
WORKORDERID	WO_ID	Text	TRUE			50
SHAPE_Length	SHAPE_Length	Double	TRUE			
SHAPE_Area	SHAPE_Area	Double	TRUE			

Pole – File Geodatabase Feature Class

Name: Pole
Alias: Pole
Feature Dataset: Telecom
Feature Type: Simple
Geometry Type: Point
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
FGID	ID	Text	TRUE			50
WORKORDERID	WO_ID	Text	TRUE			50
PHYSICALSTATUS	STATUS	Text	TRUE	Physical_Status		50
POLEID	POLE_ID	Text	TRUE			50
SURVEYSTATUS	SURVEY_STATUS	Text	TRUE	Survey_Status		50
SURVEYTYPE	SURVEY_TYPE	Text	TRUE			50
FIELDER	FIELDER	Text	TRUE			50
DESIGNER	DESIGNER	Text	TRUE			50
SEQUENCENO	SEQUENCE_NO	Double	TRUE			
HEIGHT	HEIGHT_FT	Double	TRUE			
CLASS	CLASS	Double	TRUE			
MATERIAL	MATERIAL	Text	TRUE			50
COMMENTS	COMMENTS	Text	TRUE			300
TOPOFPOLE	TOP_OF_POLE	Double	TRUE			
TRANSFORMER	TRANSFORMER	Text	TRUE	Yes/ No		50
BASECIRCUMFERENCE	BASE_CIRCUMFERENCE	Double	TRUE			
LOWESTPWRTYPE	LOWEST_PWR_TYPE	Text	TRUE	Elec_Type		50
LOWESTPWRHEIGHT	LOWEST_PWR_HEIGHT	Double	TRUE			
PROPLOWESTPWR	PROP_LOWEST_PWR	Text	TRUE			50
PWRRISER	PWR_RISER	Double	TRUE			
PROPPWRRISER	PROP_PWR_RISER	Text	TRUE			50
PWRANCHOR	PWR_ANCHOR	Double	TRUE			
PROPPWRANCHOR	PROP_PWR_ANCHOR	Text	TRUE			50
PWRGUY	PWR_GUY	Double	TRUE			
PROPPWRGUY	PROP_PWR_GUY	Text	TRUE			50
DRIPLOOP	DRIP_LOOP	Double	TRUE			
PROPDRIPLOOP	PROP_DRIP_LOOP	Text	TRUE			50
STLIGHTHEIGHT	STREETLIGHT_HEIGHT	Double	TRUE			
PROPSTLIGHT	PROP_STREETLIGHT	Text	TRUE			50
STLIGHTLOOP	ST_LIGHT_LOOP	Double	TRUE			
PROPSTLIGHTLOOP	PROP_ST_LIGHT_LOOP	Text	TRUE			50
POA1_TYPE	POA1_TYPE	Text	TRUE	POA_TYPE		50

POA1_HEIGHT	POA1_HEIGHT	Double	TRUE			
PROP_POA1	PROP_POA1	Text	TRUE			50
POA1_COMMENT	POA1_COMMENT	Text	TRUE			200
POA2_TYPE	POA2_TYPE	Text	TRUE	POA_TYPE		50
POA2_HEIGHT	POA2_HEIGHT	Double	TRUE			
PROP_POA2	PROP_POA2	Text	TRUE			50
POA2_COMMENT	POA2_COMMENT	Text	TRUE			200
POA3_TYPE	POA3_TYPE	Text	TRUE	POA_TYPE		50
POA3_HEIGHT	POA3_HEIGHT	Double	TRUE			
PROP_POA3	PROP_POA3	Text	TRUE			50
POA3_COMMENT	POA3_COMMENT	Text	TRUE			200
POA4_TYPE	POA4_TYPE	Text	TRUE	POA_TYPE		50
POA4_HEIGHT	POA4_HEIGHT	Double	TRUE			
PROP_POA4	PROP_POA4	Text	TRUE			50
POA4_COMMENT	POA4_COMMENT	Text	TRUE			200
POA5_TYPE	POA5_TYPE	Text	TRUE	POA_TYPE		50
POA5_HEIGHT	POA5_HEIGHT	Double	TRUE			
PROP_POA5	PROP_POA5	Text	TRUE			50
POA5_COMMENT	POA5_COMMENT	Text	TRUE			200
POA6_TYPE	POA6_TYPE	Text	TRUE	POA_TYPE		50
POA6_HEIGHT	POA6_HEIGHT	Double	TRUE			
PROP_POA6	PROP_POA6	Text	TRUE			50
POA6_COMMENT	POA6_COMMENT	Text	TRUE			200
POA7_TYPE	POA7_TYPE	Text	TRUE	POA_TYPE		50
POA7_HEIGHT	POA7_HEIGHT	Double	TRUE			
PROP_POA7	PROP_POA7	Text	TRUE			50
POA7_COMMENT	POA7_COMMENT	Text	TRUE			200
POA8_TYPE	POA8_TYPE	Text	TRUE	POA_TYPE		50
POA8_HEIGHT	POA8_HEIGHT	Double	TRUE			
PROP_POA8	PROP_POA8	Text	TRUE			50
POA8_COMMENT	POA8_COMMENT	Text	TRUE			200
RISERPRESENT	RISER_PRESENT	Text	TRUE	Yes/ No		50
RISERTYPE	RISER_TYPE	Text	TRUE			50
RISERCOUNT	RISER_COUNT	Double	TRUE			
RISEROWNER	RISER_OWNER	Text	TRUE			50
RISERCOMMENTS	RISER_COMMENTS	Text	TRUE			200
BONDEXIST	BOND_EXIST	Text	TRUE	Bond_Exist		50
ATTACHSIDE	ATTACH_SIDE	Text	TRUE	Attach_side		50
CLAMPTYPE	CLAMP_TYPE	Text	TRUE	Clamp_Type		50
POLETILT	POLE_TILT	Double	TRUE			
LAT	LAT	Double	TRUE			
LONG	LONG	Double	TRUE			

NEARESTADDRESS	NEAREST_ADDRESS	Text	TRUE			200
EQFKEY	EQ_FKEY	Text	TRUE			50
LOWESTPWRLABEL	LOWEST_PWR_LABEL	Double	TRUE			
PWRRISERLABEL	PWR_RISER_LABEL	Double	TRUE			
DRIPLOOPLABEL	DRIP_LOOP_LABEL	Double	TRUE			
STREETLIGHTLABEL	STREETLIGHT_LABEL	Double	TRUE			
POA1LABEL	POA1_LABEL	Text	TRUE			50
POA2LABEL	POA2_LABEL	Text	TRUE			50
POA3LABEL	POA3_LABEL	Text	TRUE			50
POA4LABEL	POA4_LABEL	Text	TRUE			50
POA5LABEL	POA5_LABEL	Text	TRUE			50
POA6LABEL	POA6_LABEL	Text	TRUE			50
POA7LABEL	POA7_LABEL	Text	TRUE			50
POA8LABEL	POA8_LABEL	Text	TRUE			50
CUSTOM1	CUSTOM1	Text	TRUE			300
CUSTOM2	CUSTOM2	Text	TRUE			300
CUSTOM3	CUSTOM3	Long	TRUE			
created_user	created_user	Text	TRUE			255
created_date	created_date	Date	TRUE			
last_edited_user	last_edited_user	Text	TRUE			255
last_edited_date	last_edited_date	Date	TRUE			
GlobalID	GlobalID	Global ID	FALSE			
SHAPE	SHAPE	Geometry	TRUE			
OWNER	OWNER	Text	TRUE			50

SlackLoops – File Geodatabase Feature Class

Name: SlackLoop
Alias: SlackLoops
Feature Dataset: Telecom
Feature Type: Simple
Geometry Type: Point
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
FGID	FG_ID	Text	TRUE			50
WORKORDERID	WO_ID	Text	TRUE			50
PLACEMENT	PLACEMENT	Text	TRUE	Type_Name		50
FIBERCOUNT	FIBERCOUNT	Short	TRUE	Fibercount		
LENGTH	LENGTH	Short	TRUE	SlackLoop		
LENGTHLABEL	LENGTH_LABEL	Double	TRUE			
CABLENAME	CABLE_NAME	Text	TRUE			50
STRFKEY	STR_FKEY	Text	TRUE			50
CABLEFKEY	CABLE_FKEY	Text	TRUE			50
CUSTOM1	CUSTOM1	Text	TRUE			300
CUSTOM2	CUSTOM2	Text	TRUE			300
CUSTOM3	CUSTOM3	Long	TRUE			
created_user	created_user	Text	TRUE			255
created_date	created_date	Date	TRUE			
last_edited_user	last_edited_user	Text	TRUE			255
last_edited_date	last_edited_date	Date	TRUE			
GlobalID	GlobalID	Global ID	FALSE			
SHAPE	SHAPE	Geometry	TRUE			

BOC – File Geodatabase Feature Class

Name: BOC
Alias: BOC
Feature Dataset: Basemap
Feature Type: Simple
Geometry Type: Line
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
CUSTOM1	CUSTOM1	Text	TRUE			50
CUSTOM2	CUSTOM2	Text	TRUE			50
CUSTOM3	CUSTOM3	Double	TRUE			
DATA_SOURCE	UTILITY_SOURCE	Text	TRUE			50
SHAPE	SHAPE	Geometry	TRUE			
SHAPE_Length		Double	TRUE			

Building Outline – File Geodatabase Feature Class

Name: Building_Outline
Alias: Building Outline
Feature Dataset Basemap
Feature Type: Simple
Geometry Type: Line
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
CUSTOM1	CUSTOM1	Text	TRUE			50
CUSTOM2	CUSTOM2	Text	TRUE			50
CUSTOM3	CUSTOM3	Double	TRUE			
DATA_SOURCE	UTILITY_SOURCE	Text	TRUE			50
SHAPE	SHAPE	Geometry	TRUE			
SHAPE_Length		Double	TRUE			

City Boundary– File Geodatabase Feature Class

Name: City_Boundary
Alias: City Boundary
Feature Dataset Basemap
Feature Type: Simple
Geometry Type: Polygon
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
NAME	NAME	Text	TRUE			50
CUSTOM1	CUSTOM1	Text	TRUE			50
CUSTOM2	CUSTOM2	Text	TRUE			50
CUSTOM3	CUSTOM3	Long	TRUE			
DATA_SOURCE	DATA_SOURCE	Text	TRUE			50
SHAPE	SHAPE	Geometry	TRUE			
SHAPE_Length		Double	TRUE			
SHAPE_Area		Double	TRUE			

County Boundary– File Geodatabase Feature Class

Name: County_Boundary
Alias: County Boundary
Feature Dataset Basemap
Feature Type: Simple
Geometry Type: Polygon
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
NAME	NAME	Text	TRUE			50
CUSTOM1	CUSTOM1	Text	TRUE			50
CUSTOM2	CUSTOM2	Text	TRUE			50
CUSTOM3	CUSTOM3	Long	TRUE			
DATA_SOURCE	DATA_SOURCE	Text	TRUE			50
SHAPE	SHAPE	Geometry	TRUE			
SHAPE_Length		Double	TRUE			
SHAPE_Area		Double	TRUE			

Easement– File Geodatabase Feature Class

Name: Easement
Alias: Easement
Feature Dataset: Basemap
Feature Type: Simple
Geometry Type: Polygon
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
TYPE	TYPE	Text	TRUE			50
CUSTOM1	CUSTOM1	Text	TRUE			50
CUSTOM2	CUSTOM2	Text	TRUE			50
CUSTOM3	CUSTOM3	Long	TRUE			
DATA_SOURCE	DATA_SOURCE	Text	TRUE			50
SHAPE	SHAPE	Geometry	TRUE			
SHAPE_Length		Double	TRUE			
SHAPE_Area		Double	TRUE			

EOP– File Geodatabase Feature Class

Name: EOP
Alias: EOP
Feature Dataset: Basemap
Feature Type: Simple
Geometry Type: Line
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
CUSTOM1	CUSTOM1	Text	TRUE			50
CUSTOM2	CUSTOM2	Text	TRUE			50
CUSTOM3	CUSTOM3	Double	TRUE			
DATA_SOURCE	UTILITY_SOURCE	Text	TRUE			50
SHAPE	SHAPE	Geometry	TRUE			
SHAPE_Length		Double	TRUE			

Parcel– File Geodatabase Feature Class

Name: Parcel
Alias: Parcel
Feature Dataset: Basemap
Feature Type: Simple
Geometry Type: Polygon
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
FIPS	FIPS	Double	TRUE			
PARCEL_ID	PARCEL_ID	Text	TRUE			50
PARCEL_ADDR	PARCEL_ADD	Text	TRUE			150
PARCEL_CITY	PARCEL_CITY	Text	TRUE			50
PARCEL_ZIP	PARCEL_ZIP	Text	TRUE			50
PARCEL_STATE	PARCEL_STATE	Text	TRUE			50
OWNER	OWNER	Text	TRUE			50
OWNER_ADDR	OWNER_ADDR	Text	TRUE			150
OWNER_CITY	OWNER_CITY	Text	TRUE			50
OWNER_ZIP	OWNER_ZIP	Text	TRUE			50
OWNER_STATE	COMMENT	Text	TRUE			50
COMMENT	COMMENT	Text	TRUE			250
CUSTOM1	DATA_SOURCE	Text	TRUE			50
CUSTOM2	CUSTOM2	Text	TRUE			50
CUSTOM3	CUSTOM3	Double	TRUE			
DATA_SOURCE	DATA_SOURCE	Text	TRUE			50
SHAPE	SHAPE	Geometry	TRUE			
SHAPE_Length		Double	TRUE			
SHAPE_Area		Double	TRUE			

Railroad– File Geodatabase Feature Class

Name: Railroad
Alias: Railroad
Feature Dataset: Basemap
Feature Type: Simple
Geometry Type: Line
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
NAME	Name	Text	TRUE			50
CUSTOM1	CUSTOM1	Text	TRUE			50
CUSTOM2	CUSTOM2	Text	TRUE			50
CUSTOM3	CUSTOM3	Double	TRUE			
DATA_SOURCE	DATA_SOURCE	Text	TRUE			50
SHAPE	SHAPE	Geometry	TRUE			
SHAPE_Length		Double	TRUE			

Street– File Geodatabase Feature Class

Name: Street
Alias: Street
Feature Dataset: Basemap
Feature Type: Simple
Geometry Type: Line
HasZ: No
HasM: No
Attachments: No Attachments

Field Name	Alias	Data Type	Allow Null	Domain	Default Value	Length
OBJECTID	OBJECTID	Object ID	FALSE			
NAME	NAME	Text	TRUE			50
CUSTOM1	CUSTOM1	Text	TRUE			50
CUSTOM2	CUSTOM2	Text	TRUE			50
CUSTOM3	CUSTOM3	Long	TRUE			
DATA_SOURCE	DATA_SOURCE	Text	TRUE			50
SHAPE	SHAPE	Geometry	TRUE			
SHAPE_Length		Double	TRUE			

Addresses – Domain

Name: Address_Status
Field Type: Text
Domain Type: Coded Value

Code	Description
Verified	Verified
Not Verified	Not Verified

Name: Address_Type
Field Type: Text
Domain Type: Coded Value

Code	Description
SFU	Single Family Unit
Duplex	Duplex
Triplex	Triplex
Quadplex	Quadplex
MDU	Multi-Dwelling Unit
SBU	Single Business Unit
MBU	Multi-Business Unit
School	School
Church	Church

HLDFiber – Domain

Name: Type_Name
Field Type: Text
Domain Type: Coded Value

Code	Description
AERIAL	AERIAL
BURIED	BURIED

Name: Cable_Category
Field Type: Text
Domain Type: Coded Value

Code	Description
Drop	Drop
MST	Multiport Service Terminal Tail
Distribution	Distribution
Feeder	Feeder
Backbone	Backbone

Name: Fibercount
Field Type: Short
Domain Type: Coded Value

Code	Description
12	12
24	24
48	48
72	72
96	96
144	144
192	192
216	216
288	288
360	360
432	432
576	576
864	864
1	1

Name: Physical_Status
Field Type: Text
Domain Type: Coded Value

Code	Description
Proposed	Proposed
Existing	Existing
Removed	Removed
Leased	Leased

HLDHUB – Domain

Name: HUB_Type
Field Type: Text
Domain Type: Coded Value

Code	Description
HUB	HUB
CO	CENTRAL OFFICE
POP	POINT OF PRESENCE

HLDRoute – Domain

Name: Cable_Category
Field Type: Text
Domain Type: Coded Value

Code	Description
Drop	Drop
MST	Multiport Service Terminal Tail
Distribution	Distribution
Feeder	Feeder
Backbone	Backbone

Name: Physical_Status
Field Type: Text
Domain Type: Coded Value

Code	Description
Proposed	Proposed
Existing	Existing
Removed	Removed
Leased	Leased

Name: Type_Name
Field Type: Text
Domain Type: Coded Value

Code	Description
AERIAL	AERIAL
BURIED	BURIED

HLDSpliceClosure – Domain

Name: Type_Name
Field Type: Text
Domain Type: Coded Value

Code	Description
AERIAL	AERIAL
BURIED	BURIED

Name: SPLICE_USE
Field Type: Text
Domain Type: Coded Value

Code	Description
RE	REEL END
MCA	MID CABLE ACCESS
VIRTUAL	VIRTUAL

HLDStructure – Domain

Name: Physical_Status
Field Type: Text
Domain Type: Coded Value

Code	Description
Proposed	Proposed
Existing	Existing
Removed	Removed
Leased	Leased

CRONotesLine – Domain

Name:Yes/ No
Field Type: Text
Domain Type: Coded Value

Code	Description
Yes	Yes
No	No

CRONotesPoint – Domain

Name: Yes/ No
Field Type: Text
Domain Type: Coded Value

Code	Description
Yes	Yes
No	No

CRONotesPolygon – Domain

Name:Yes/ No
Field Type: Text
Domain Type: Coded Value

Code	Description
Yes	Yes
No	No

CROStructure – Domain

Name:CRO_TYPE
Field Type: Text
Domain Type: Coded Value

Code	Description
Telecom	Telecom
Gas	Gas
Electric	Electric
Water	Water
Pole	Pole
Other	Other
Service_Side	Service Side

Name: Physical_Status
Field Type: Text
Domain Type: Coded Value

Code	Description
Proposed	Proposed
Existing	Existing
Removed	Removed
Leased	Leased

Name:CRO_PLACEMENT
Field Type: Text
Domain Type: Coded Value

Code	Description
Grass	Grass
Concrete	Concrete

Name: Address_Status
Field Type: Text
Domain Type: Coded Value

Code	Description
Verified	Verified
Not Verified	Not Verified

Name: Yes/ No
Field Type: Text
Domain Type: Coded Value

Code	Description
Yes	Yes
No	No

Permit_Polygons – Domain

Name: Permit_Status
Field Type: Text
Domain Type: Coded Value

Code	Description
Not Started	Not Started
In Production	In Production
Check Request	Check Request
Ready for Submission	Ready for Submission
Entity Review	Entity Review
Respond to Entity Review	Respond to Entity Review
Permitted	Permitted
Complete – Move to CDs	Complete – Move to CDs
On Hold	On Hold
Canceled	Canceled

PLAN_Boundaries – Domain

Name: PLAN_TYPE
Field Type: Text
Domain Type: Coded Value

Code	Description
CABLE	CABLE
NAP	NAP
FAP	FAP

Pole – Domain

Name: Physical_Status
Field Type: Text
Domain Type: Coded Value

Code	Description
Proposed	Proposed
Existing	Existing
Removed	Removed
Leased	Leased

Name: Survey_Status
Field Type: Text
Domain Type: Coded Value

Code	Description
NOT STARTED	NOT STARTED
ON HOLD	ON HOLD
COMPLETE	COMPLETE

Name: Yes/ No
Field Type: Text
Domain Type: Coded Value

Code	Description
Yes	Yes
No	No

Name: Elec_Type
Field Type: Text
Domain Type: Coded Value

Code	Description
SECONDARY	SECONDARY
NEUTRAL	NEUTRAL
PRIMARY	PRIMARY
CROSSARM	CROSSARM
SECONDARY CROSSARM	SECONDARY CROSSARM
3 SPOOL RACK	3 SPOOL RACK

Name: POA_TYPE
Field Type: Text
Domain Type: Coded Value

Code	Description
TELCO	TELCO
CATV	CATV
FIBER	FIBER
DROP	DROP
AF	AF
ATT	ATT
OTHER	OTHER
CLIENT	CLIENT

Name: Bond_Exist
Field Type: Text
Domain Type: Coded Value

Code	Description
Yes	Yes
No	No
Multiple	Multiple

Name: Attach_side
Field Type: Text
Domain Type: Coded Value

Code	Description
Roadside	Roadside
Interior	Interior

Name: Clamp_Type
Field Type: Text
Domain Type: Coded Value

Code	Description
CC-1	CC-1
DD-1	DD-1
FDE-1	FDE-1
FGA-3-18"	FGA-3-18"
FGA-3-24"	FGA-3-24"
FGA-3-36"	FGA-3-36"
FOS	FOS
FOS-AG	FOS-AG
FOS-T	FOS-T
MSS-1	MSS-1
SD-3	SD-3
SD-4	SD-4
VANG	VANG

SlackLoops – Domain

Name: Type_Name
Field Type: Text
Domain Type: Coded Value

Code	Description
AERIAL	AERIAL
BURIED	BURIED

Name: Fibercount
Field Type: Short
Domain Type: Coded Value

Code	Description
12	12
24	24
48	48
72	72
96	96
144	144
192	192
216	216
288	288
360	360
432	432
576	576
864	864
1	1

Name: SlackLoop
Field Type: Text
Domain Type: Coded Value

Code	Description
25	25
50	50

APPENDIX E – NETWORK ARCHITECTURE HANDBOOK

PART 1 – PROJECT OVERVIEW

1.1 – GENERAL INFORMATION

This Broadband Engineering Architecture Handbook is provided for personnel and contractors as a guideline to the engineering, construction, and fiber optic links placement/test acceptance. No one document can be all-inclusive and personnel and contractors are expected to use industry standards and sound judgement to conduct all operations herein.

1.2 – PROJECT ARCHITECTURE SUMMARY

- Network Architecture: N/A
- Architecture Split: N/A
- Hierarchy Tiers: 2

TIER 1 – FEEDER (F1)	
Feeder Hub(s):	Central Office(s)
Hub Capacity:	10,000 user per Hub
Cable Size(s):	144ct, 288ct, 432ct, 864ct
Spare Fiber Count:	48 fibers
Cables Taper:	Yes

TIER 2 – DISTRIBUTION (F2)	
Distribution Hub(s)	N/A
Hub Capacity:	N/A
Tier 2 Hub Split?:	N/A
Hub Split Ratio:	N/A
Spare Port(s):	N/A
Unsplit Port(s):	N/A
Cable Size(s):	48ct
Spare Fiber Count:	12% cable size fibers
Cables Taper:	No
Parallel Cable Threshold:	1000 ft

1.2.1 – Design Considerations

- OSP Network Architecture (Part 2 of this document)
- OSP Design Guidelines (Part 3 of this document)

1.3 – PROJECT COMPONENTS SUMMARY

1.3.1 – Fiber Cable

Material	Description
48 ct FOC	
144 ct FOC	
288 ct FOC	
432 ct FOC	
864 ct FOC	

1.3.2 – Conduits

Material	Description
1.25 in. dia.	
2 in. dia.	
4 in. dia.	

1.3.3 – Handholes/Manholes

Material	Description
24" x 36" x 24" HH	
30" x 48" x 24" HH	
30" x 60" x 30" HH	
36" x 60" x 36" HH	
36" x 76" x 42" HH	
48" x 48" x 48" MH	
48" x 72" x 72" MH	
48" x 96" x 96" MH	

1.3.4 – Poles

Material	Description
35 – C3	

1.3.5 – Strand

Material	Description
6.6M	¼" EHS Suspension Strand
10M	3/8" EHS Suspension Strand
16M	7/16" EHS Suspension Strand
25M	½" EHS Suspension Strand

1.3.6 – Splice Closure

Material	Description
TE FOSC 450B	
TE FOSC 450C	
TE FOSC 450D	
TE FOSC 600D	

1.3.7 – Slack Loops

Material	Description
50'	@ underground/buried splice locations and all 90deg changes in route
75'	@ aerial splice locations and one side of all 3 lane or greater road crossings in aerial and underground environments
100'	@ aerial splice locations and slack placement every 1500' along route in aerial and underground environments

1.3.10 – Miscellaneous Components

Material	Description
Locate Wire	
Marker Poles	
Risers	
Guys & Anchors	

PART 2 – OSP NETWORK ARCHITECTURE

2.1 – NETWORK TOPOLOGY

2.1.1 – Network Topology Overview

The proposed network is based on a Middle-Mile Optical Network technology that follows the ITU Telecommunication Standardization Sector (ITU-T) G.984.x specification. The topology references the Central Office as the "start" of the network and progresses to demand points or Premise at the "end" of the network. When referring to signal flow or component placement, the term "upstream" is defined as closer to the Central Office and "downstream" as closer to the Premise or "end" of the network.

For deployment, outside plant network components have a preferred buried/underground placement for Feeder (F1) and Distribution (F2) segments of the network. Underground storage structures are placed for all transitions between cable sizes, splice locations, transitions at 90° intersections, and at other strategic locations where future access is required. Buried placement will consist of placement of new underground conduits, handholes and manholes. Any aerial placement will primarily consist of existing pole routes with power and/or telecom cable routes present. Installation of new strand will be used. New pole placement will be the next preferred option where terrain conditions permit it.

The primary route of the Feeder (F1) will consist of an 864ct fiber FOC along the entirety of the route with a 432ct FOC cable stub placed at predetermined splice locations. The Distribution (F2) segments of the network will access the Feeder (F1) via the 432ct FOC cable stub.

2.1.2 – Network Hierarchy

To understand the organization and layout of the proposed fiber network more easily, hierarchies are used to characterize it based on tiers of service. These tiers are sequential from the highest-level (Tier 1) down to the lowest, most individual level (Tier 2). The characteristics of each tier are elaborated upon below.

2.1.2.2 – Tier 1 or Feeder (F1) Hierarchy

Tier 1, or Feeder hierarchy, is the next level of hierarchy directly below the network backbone. This tier acts as the primary arterial tier for the fiber network and connects a single Central Office/Feeder Hub to various Distribution Hubs that are served by it. Tier 1 sub-divides the entire network into coverage "boundary areas" with one Central Office or Feeder Hub set as its center. A network of Distribution Hubs, which serve as the end point of Tier 1 hierarchy and starting point of Tier 2 hierarchy, are laid out within the coverage area of this boundary. A network of fiber cable and outside plant elements connects each of these Distribution Hubs back to the CO/FH for its service area. Fiber cables in this tier are still in the "pre-split" portion of the network and a single fiber strand can carry data to serve as many as 32 subscribers.

2.1.2.3 – Tier 2 or Distribution (F2) Hierarchy

Tier 2, or Distribution hierarchy, is the next level of hierarchy directly below the Feeder level. As its name implies, it functions as the distribution arm of the network, distributing service from centralized hub points to delivery points near the subscriber locations. Tier 2 further subdivides the boundary areas from Tier 1 into Distribution Areas, with a single Distribution Hub set as its center. Distribution Hubs are the first point of split for a distributed split network and only point of split for a centralized split network. Each Distribution Hub Area has a network of local distribution points, known as Terminal Hubs, which serve as the end point of Tier 2 hierarchy and the starting point of Tier 3 hierarchy. A network of fiber cable and outside plant elements connect each of these Terminal Hubs back to the Distribution Hub for its service area.

2.2 – NETWORK ELEMENTS & STRUCTURES

Chapter 2.2 of this manual further defines the individual elements and structures that make up the fiber network. It provides detailed descriptions of each component and specific naming conventions used to identify the component. The name is used to uniquely identify several attributes about the component.

In many cases, an Element or Structure can be placed in multiple sections of the network. Additional placement rules, guidelines and recommendations are covered in Chapter 3.3 of this manual.

Please note that not all Elements or Structures in the network require a name.

2.2.1 – Feeder Hub

The Feeder Hub is the highest-level element of the entire fiber network. They are specialized facilities providing conditioned space to house both passive gear and active electronics providing connectivity between the local market and a remote POP or other distant optical transport backbone. These facilities provide co-location space to host multiple network providers, internet service providers (ISPs), or network tenants. It may also support direct point-to-point fiber networks from routers, switches, or other active equipment. Feeder Hubs can have different names based on their use and size of coverage areas, such Central Office (CO), Point of Presence (POP) and Fiber Hut. The Feeder Hub functions as the main component of the Tier 1-Feeder hierarchy and one or multiple of them are interconnected with each other to serve an entire market area. They also function as the initial point of the Tier 1-Feeder hierarchy. Each Fiber Hub has a coverage area, referred to as a Feeder Hub Boundary (FHB).

2.2.1.1 – Central Office (CO)

Large Feeder Hubs are often classified as Central Offices or COs. COs are often their own individual buildings or part of a larger building and can serve the largest number of subscribers within a network. Depending on its size, a single market can be served by just one or multiple COs, and each CO has its own coverage area, referred to as a Feeder Hub Boundary (FHB).

2.2.1.2 – Point of Presence (POP)

A Point of Presence, or POP, is a specific type of CO within the fiber network which hosts equipment that directly connects the fiber network to other networks and the national backbone. A fiber network requires at least on POP site present but multiple POPs may also be used for markets of greater size of subscribers and to provide redundancy in the case of severe outages.

2.2.1.3 – Fiber Hut

A Fiber Hut, sometimes also referred to as a Remote, acts as a smaller-scale Central Office. Like COs, they are often their own individual building but are much smaller in size and can provide enough equipment to serve a smaller number of subscribers than a CO. Fiber Huts are often used in addition to the CO in markets where the subscriber counts exceed the capacity of the CO but the surplus does not merit an additional CO.

2.2.3 – Fiber Optic Cable

Fiber optic cables of varying types and capacity are used in all tiers of the fiber network and are used for various uses including back-office support, distribution, and client service. The fiber count within a single cable varies by design and can be as small as single (1) fiber to serve a single client or multiple fibers, usually designed in bundles of 12, which are commonly referred to as “Ribbons.” The most common fiber cables are sized in multiples of 12 and the most common sizes are:

- 12
- 24
- 48
- 72
- 96
- 144
- 288
- 432
- 864

Fiber cables for each tier are described below.

2.2.3.3 – Tier 2 or Distribution Fiber Cable

Fiber optic cables in the Distribution tier are meant to provide a connection between a Tier 1 Feeder Cable and an end user structure such as fire stations and county or city services buildings. Cable sizing in this tier will be set 48ct to maintain sufficient building entry for ring services (data transfer and backup), point to point services(telephone/internet), and to maintain sufficient future spare count.

- Cables used in this tier will be: 48ct, 96ct, 144ct, 288ct, 432ct.
- Can be installed in either aerial or underground environments.
- Splice Enclosures are used along the length of (MCAs) or at the end of Reel-Ends (REs) cable legs and allow connection to cable extensions and laterals.

2.2.3.4 – Tier 1 or Feeder Fiber Cable

Fiber optic cables in the Feeder tier are meant to link the CO to Tier 2 Distribution cables and access points along the network. These cables are generally large count ribbon fiber such as 864, 432, 288, and 144. The fiber quantity can taper along the Tier 1 route as fiber is allocated to each building or access location.

- Cables used in this tier: 864ct.
- Can be installed in either aerial or underground environments.
- Each leg can have smaller lateral cables that taper off from the main cable and can extend the coverage area of a single cable leg.

2.2.4 – Splice Enclosures

Splice Enclosures are prefabricated casings that act as "joint points" for a fiber cable network. They allow for the protection of fiber cables that have become exposed to the environments after going through fusion splicing of fibers. They are generally weather resistant and can be used in both indoor and outdoor environments. Splice Enclosures mark points on a cable where two or more fiber cables are spliced together and are a part of the first three tiers (F0, F1 and F2) of the fiber network.

Splice Enclosures come in different sizes depending on the location to be used and size and quantity of cables to share a single enclosure.

Splice Enclosures can be installed in both aerial and underground environments. Aerial Enclosures are attached to an aerial strand on a pole line and are physically exposed to the elements. Underground Enclosures should always be installed in a protected environment, such as a handhole.

Splice Enclosures are classified as either Reel-End (RE) enclosures or Mid-Cable Access (MCA) enclosures. Both types and their uses are elaborated below.

2.2.4.1 – Reel-End (RE)

Splice Enclosures classified as "Reel-End (RE)" are enclosures that connect 2 or more fiber cables at the end point of each cable. They are primarily used with long haul cable installations where full cable reel lengths are insufficient to cover the full length of the route and a secondary cable needs to be used to complete the run. Cables spliced together at REs can be the same size or can involve downsizing of cable sizes if demand has tapered down by the point they happen. REs can be found in all tiers (F1 and F2) of the fiber network.

- Tier 1 (Feeder, F1) & Tier 2 (Distribution, F2) – REs is used for extending F1 cables where cable reel length is not enough for a route. They also allow for tapering down cable sizes and connecting to lateral cables when needed.

2.2.4.2 – Mid-Cable Access (MCA)

Splice Enclosures classified as "Mid-Cable Access (MCA)" are any enclosures used along any length of a single cable. They are used when cuts into a cable, commonly referred to as "Ring Cuts," are performed in order to access and splice fibers in that cable at locations other than reel-ends. In addition to accessing the cable, one (1) or more additional cables can be spliced into the primary cable at this point. MCAs can be found in both the F1-Feeder and F2-Distribution tiers of the fiber network.

- Tier 1 (Feeder, F1) – MCAs are used at Tier 2 locations along F1 cable routes and are used to splice together F1 fibers to their assigned Tier 2 location.

- Tier 2 (Distribution, F2) – MCAs are used along F2 cable routes to allow the connection of laterals to primary cables.

2.2.6 – Slack Loops

Slack Loops, while categorized as their own separate element, are physically part of the fiber cable element of the network. A Slack Loop, also referred to as a coil or storage loop, is the coiling of defined footage of fiber cable in order to give the cable "slack." Slack on a cable loosens it and lowers the tension that occurs during installation. Slack loops serve multiple uses within a fiber network such as adding extra cable length for maintenance and for allowing access to the fiber cable for fiber splicing purposes.

- Slack Loops are used on cables of all sizes in the 2 tiers of the network (F1 and F2).
- Slack Loops can be installed in both aerial and underground environments.
- Slack Loops in underground environments should be installed in protected environments, such as handholes or vaults.

2.2.7 – Conduits

Conduits are hollowed out plastic tubes that are installed in underground environments. Commonly made of either PVC or HDPE, conduits allow for the installation of fiber cables within them and protect the cable from the physical environment. Conduits come in varying sizes and can allow for the installation of 1 or multiple cables depending on the cable sizes. All underground cables shall be installed within conduits.

2.2.8 – Underground Storage Structures

Underground Storage Structures are a network element that provides physical protection for outside plant equipment in underground environments. This generally consists of a protected, enclosed cavity in the ground that has room for the storing of equipment like fiber cable storage loops and splice enclosures. Storage Structures are normally placed at the end point of conduit routes and serve multiple purposes, including storing equipment, providing "pull points" for fiber cable installation and access for emergency maintenance. Two primary types of Underground Storage Structures (Handholes and Manholes) are used. Their name varies depending on its use as defined below.

2.2.8.1 – Handholes

Handholes are Underground Storage Structures that are large enough to store equipment but do not allow a person full entry into the enclosed space. Handholes are generally prefabricated structures that come in a variety of pre-designed sizes and provide protection from the underground environment around it. As the name indicates "handholes" generally only have enough room for worker hands to enter and any work performed on plant equipment stored in it must be removed and performed outside of it.

Prefabricated Handhole lids are also custom designed and offer varying levels of protection depending on its type. The most common are:

- Light Duty: These lids are the lightest and are for use in areas that see no vehicular traffic and only pedestrian traffic might be involved. It should be used in grassy areas where limited foot traffic is expected.
- Tier 15: These lids are primarily used in locations where non-deliberate heavy vehicular traffic occurs only occasionally. Should be used for handholes installed on green strips or sidewalks that primarily see pedestrian traffic and very rare, non-incidental vehicular traffic.
- Tier 22: These lids are primarily used in locations where non-deliberate heavy vehicular traffic might occur more commonly than Tier 15 locations. It should be used for handholes on driveways or within parking lots.
- H-20: Traffic Rated lids that allow for active vehicle traffic. Should be used for any construction within a motorized roadway.

Handholes are a more economical storage structure option and are easier to install and design.

2.2.8.2 – Manholes

Manholes are Underground Storage Structures that are large enough to both store equipment and allow a person full entry into the enclosed space. Manholes are much larger in size than Handholes and are normally more rigid structures, typically made of reinforced concrete. At their largest, Manholes can have "room-size" enclosed storage space. Manholes can be prefabricated or cast-in-place depending on situations and are more costly to install than Handholes. Manhole lids are most commonly Traffic Rated (H-20).

2.3 – NETWORK NAMING CONVENTIONS

Chapter 2.3 of this manual defines the naming schemes used by various elements of the fiber network. Naming schemes are designed to be unique for each element of the plant and maintain a hierarchical logic in associating components in whatever tier they are a part of. Naming schemes used as part of the architecture are expanded upon below.

2.3.1.1 – Feeder Hub Naming

Feeder Hubs are identified by a common identifier for the market and a sequential number for each Hub.

ABT[Sequential Number]

- Examples:
  - ABTA01
  - ABTA02

2.3.1.2 – Feeder Hub Boundary Area Naming

Feeder Hub Boundary Areas will share the same name as their Feeder Hub.

ABT[Sequential Number]

- Examples:
  - ABTA01
  - ABTA02

2.3.2 – Tier 1 – Feeder Tier (F1) Naming

Elements in the Feeder tier are primarily defined by either the Feeder Hub Name or the FDH Name.

2.3.2.1 – F1 Fiber Cable Naming

Fiber cables in the Feeder Tier will be identified by the name of the Feeder Hub they egress from and an ID callout that identifies it as a Feeder Cable along with a sequential cable number.

[Feeder Hub Name]-FE[Sequential Cable Number]

- Examples:
  - ABT01-FE01
  - ABT02-FE03
- All cables within a Feeder Hub Area Boundary share the same Feeder Hub name.
- "FE" is a general ID that identifies it as a Feeder cable.
- Each main leg has a sequential number that starts at "01."
- Lateral cables that diverge from a main cable have a decimal value after the cable's sequential number.
- Examples of Lateral Cables:
  - ABT01-FE01.01
  - ABT01-FE01.02
  - (Both cables are laterals of cable ABT01-FE01)

2.3.2.2 – F1 Splice Enclosure Naming

Fiber Enclosures in the Feeder Tier will be identified by the Cable name and an Enclosure type ID with a sequential number.

[F1 Cable Name]-RE/MCA[Sequential Number]

- Examples:
  - ABT01-FE02-MCA02
  - ABT01-FE01-RE01
- Splice Enclosures should be named after the primary cable at the splicing point.
- RE & MCA are ID callouts that identifies the splice closure as either a Reel-End or a Mid-Cable Access.
- Sequential Number starts at "01" and max out at the total number of enclosures along the same cable name.
- Each named cable should have a sequential number, starting at "01" and capping out at the max number of terminals.

2.3.3 – Tier 2 – Distribution Tier (F2) Naming

2.3.3.1 – F2 Fiber Cable Naming

Fiber cables in the Distribution Tier will be identified by the name of the Splice Closure they egress from and an ID callout that identifies it as a Distribution Cable along with a sequential cable number.

DT[Sequential Cable Number]

- Example:
  - ABT01-FDH01-DT02
- “DT” is a general ID that identifies it as a Distribution cable.
- Each main leg has a sequential number that starts at “01.”
- Lateral cables that diverge from a main cable have a decimal value after the cable’s sequential number.
- Examples of Lateral Cables:
  - ABT01-DT01.01
  - ABT01-DT01.02
  - (Both cables are laterals of cable ABT01-DT01)

2.3.3.2 – F2 Splice Enclosure Naming

Fiber Enclosures in the Distribution Tier will be identified by the cable name and an Enclosure type ID with a sequential number.

[F2 Cable Name]-RE/MCA[Sequential Number]

- Examples:
  - ABT01-FDH02-DT01-MCA03
  - ABT01-FDH01-DT02-RE01
- Splice Enclosures should be named after the primary cable at the splicing point.
- RE & MCA are ID callouts that identifies the splice closure as either a Reel-End or a Mid-Cable Access.
- Sequential Number starts at “01” and max out at the total number of enclosures along the same cable name.
- Each named cable should have a sequential number that starts at “01.”

2.3.6 – Underground Structure Naming

Underground Structure naming is independent of most other previous elements and they are defined by being either part of Tier 1 or Tier 2.

2.3.6.2 – All Other (F1 & F2) Tier Structure Naming

Structures in all other tiers are associated with the Feeder Hub Area Boundary they fall within. identified by a Feeder Hub Area Boundary name an ID callout identifying the structure type, along with a sequential number.

[Feeder Hub Area Boundary Name]-HH/MH[Sequential Cable Number]

- Examples:
  - ABT01-HH0002
  - ABT02-MH0003
- All Structures, not part of the Backbone tier, that are within a Feeder Hub Area Boundary share the same Boundary name.
- “HH/MH” are ID callouts that identify the structure as either a Handhole or a Manhole.
- The Sequential numbers for each type structure are 4-digit, start at “0001” and cover the entire fiber market.
- Manholes and Handholes sequence numbers are independent of each other.

2.3.7 – Conduit

Conduits are identified by the name of the 2 structures a conduit segment is connecting and a general ID identifier with a sequential number.

[Structure Name #1]-[Structure Name #2]-CD[Sequential Number]

- Examples:
  - ABT01-HH0002-ABT01-HH0003-CD02
  - BB-MH0001-BB-MH0002-CD01
- Backbone tier structures should not interact with all other tier structures.
- “CD” is an ID callout that identifies the segment as a conduit.
- The Sequential number for each conduit starts at “01” and caps out at the max number of conduits sharing the same segment between 2 structures.
- All conduits are assumed to “break” at each structure for the purpose of inventory tracking.

2.3.8 – Slack Loop

Slack loops are identified by the name of the cable only.

[Fiber Cable Name]

- Examples:
  - ABT01-ABT02-BB
  - ABT01-FE03
  - ABT01-FDH01-DT03.1

2.3.9 – Poles

Poles are identified by an ID callout identifying them as a pole and a pole number.

P-[Pole Number]

- Examples:
  - P-254892
  - P-UNK001
- Pole numbers should refer to existing field pole numbers as reference.
- Poles that do not have existing numbers should be demarked with "UNK" for unknown and sequential numbers starting at "001."

2.4 – Demand Allocation

Chapter 2.4 of this manual covers the rules governing demand allocation within the network. Demand Allocation refers to the potential subscribers identified by address and service type. Each identified demand point has varying fiber needs associated to it. Demand points are given anticipated fiber allocation requirements at the High-Level Design level to best account for proper distribution of an entire network. Demand points, identified as address types, and their requirements are further elaborated on below.

2.4.1 – Subscriber Address Type Definitions

- Government Buildings (GB) – GBs are any city/county-operated buildings that provide services to the public, such as police stations, fire stations, schools, libraries, and government office buildings. GBs will be allocated a minimum of 48ct FOC for first entry in design.

- Cell Tower Sites (CTS) – CTSs are any vertical structure supporting a cellular, wi-fi, or microwave antennae, such as monopole, guyed towers, water towers, buildings, etc. CTSs will be allocated a minimum 48ct FOC for first entry in design, with sizing based on a minimum service provider occupancy of 3, and 8 fiber strands per service provider.

2.5– Glossary & Terms

Chapter 2.5 of this manual provides a listing of the most common terms discussed within the network architecture and defines them.

Active E – Active Ethernet. A network topology that uses active equipment and maintains dedicated fiber strands from central office to subscribers.
Bore Pit – A hole dug in the ground at the start and end points of directional boring activities.
Cabinet – Physical cabinet for storage of fiber equipment. See also: FDH.
CD – Construction Drawing. Plan drawings that show proposed outside plant design elements and instructs construction contractors on how these elements should be built.
CO – Central Office. Free-Standing structure that hosts active equipment that provides internet connectivity service to subscribers using fiber network.
Conduit – Hollow tubes installed underground that provide protection to buried fiber cable.
CRO – Construction Ride Out. The process of field evaluating proposed design routes and elements to validate proposed path, identify obstacles and recommend alternatives.
dB – Decibels. A measure of the signal strength of a signal travelling through a fiber optic strand.

Directional Bore – Underground construction method that allows for guided tunneling underneath the earth and permits curving movements to avoid obstacles. It has movement control but involves a large setup footprint.

DPLX – Duplex. A multi-dwelling unit that has 2 separate dwelling units sharing the same structure.

Drop Cable – Fiber cable specifically designed to connect subscribers to the fiber network through terminal points.

F0 – Fiber Network Tier 0 – Portion of fiber network that covers Backbone level elements.

F1 – Fiber Network Tier 1 – Portion of fiber network that covers Feeder Hub level elements

F2 – Fiber Network Tier 2 – Portion of fiber network that covers Distribution Hub level elements

F3 – Fiber Network Tier 3 – Portion of fiber network that covers Terminal Hub level elements.

F4 – Fiber Network Tier 4 – Portion of fiber network that covers Drop Hub level elements.

FDH – Fiber Distribution Hub – Physical enclosure that hosts optical splitting equipment and functions as a hub for service distribution.

Fielding – Process of physically gathering detailed information of existing field conditions.

FOC – Fiber Optic Cable. Multiple fiber optic strands bundled together within a plastic casing which protects them from the environments.

Fiber Optic Strand – A single strand of glass (optical fiber) which allows for the transmission of data through light travelling in both directions.

GB – Government Building. Buildings that house government-operated services for the public, such as police stations, fire stations, schools, and hospitals.

GPON – Gigabit Passive Optic Network. A network topology that uses passive equipment to split data signals emitted from an active site into various signals that can serve multiple subscribers from a single fiber. This network type has the capability of delivering 1 Gbps data as a dedicated service.

HH – Handhole. Underground Storage Structure that can store fiber equipment in a protected environment but is not large enough to allow personal entry into the enclosed space.

HLD – High Level Design. Preliminary design of a fiber network created at a market-wide level that identifies potential path and design elements. See also Schematic-Level Design.

HOA – Homeowners Association.

Hub – Gathering point of a particular element within a fiber network. Hubs are present in all tiers of a network.

Hut – Small, free-standing structure that allows for the storing of active equipment to serve a fiber network, similar to a Central Office.

ISP – Internet Service Provider. A company or entity that provides access to the internet for both residential and business customers.

LBU – Large Building Unit – A commercial or office structure or structures that host 11 or more units.

Make-Ready – Process of preparing a utility pole to receive a new attachment.

MDU – Multi-Dwelling Unit. Two (2) or more individual dwelling units that share a single structure and premise.

MH – Manhole. Underground Storage Structure that can store fiber equipment in a protected environment and is large enough to allow personal entry into the structure.

Micro Trench – Underground construction method that involves shallow-depth trenching of 1 or 2 inches in width and can be applied in various environments.

Missile Bore – Underground construction method that involves underground, linear tunnelling using a pneumatic or hydrological bore-head. Has a small setup footprint but lacks directional control.

MRA – Make Ready Assessment. The preliminary evaluation of existing utility poles to determine feasibility of aerial construction.

MRE – Make Ready Engineering. The evaluation and design of new/proposed attachments to utility poles for compliance with structural, safety, and NESC requirements. PLA is a component of MRE.

MST – Multiport Service Terminal. Prefabricated, fiber access enclosure that has multiple, physical access ports that allow mechanical connection of individual drop cables.

MST Tail – Prefabricated fiber cable attached to an MST that can be spliced to the fiber cable network and comes at manufactured lengths.

Network Architecture – The rules, topology and network elements that define and govern a fiber optical network.

OH – Overhead. Any installation that uses aerial outside plant environment.

OLT – Optical Line Terminal. Endpoint hardware device in a passive optic network, located on the service provider side.

Open Trench – Underground construction method involving digging linearly along a proposed path at a fixed depth and leaving enough space for conduit or fiber cable installation within the created trench. Cable and conduit need to be installed by being laid in the trench after cutting.

Optical Split – The physical act of splitting the light-transmitted data travelling through a single optical fiber strand.

Optical Splitter – Device that uses a prism to physically split light-transmitted data from a single optical fiber strand into various, equally weaker signals.

OSP – Outside Plant. Physical elements of a fiber network built in the public right-of-way and connecting Central Offices to subscribers.

Pass-through – The act of bypassing a structure or equipment.

Pass-through Fiber – Fiber optic strand that bypasses an optical splitter and maintains signal strength.

PD – Permit Drawing. Plan drawings that show proposed outside plant design elements for the purpose of requesting construction permits from applicable, permit-granting jurisdictions. PDs should be tailored to the requirements of each individual jurisdiction.

PLA – Pole Loading Analysis. Evaluation of the impact of cable and messenger strand tension forces on the structural integrity of a pole. PLA also requires evaluation of wind, storm and snow loading on poles in addition to loads from cables, strand, and other equipment (transformers, cross messengers, etc.).

Plow – Underground construction method involving simultaneous trenching and installation of cable or conduit. Plowing involves using a vibrating blade to split the ground and cut a narrow slit that gets packed as the plow moves along quickly.

PON – Passive Optic Network. A network topology that uses passive equipment to split data signals emitted from an active site into various signals that can serve multiple subscribers from a single fiber.

POP – Point of Presence. Central Office within a fiber network that acts as a connection point between a local network and other networks or the national internet backbone.

Pre-Connectorized – Also referred to as "pre-terminated." A term used to refer to fiber optic cable that has factory manufactured components with connectors already attached that would eliminate the need for splicing. These most often included modular terminals and mechanical connectors for drops.

Remote – Other term for a Hut. (See Hut)

Ribbon – Ubiquitous term that represents a bundle of 12 fibers within a fiber optic cable, regardless of being loose-tube or ribbonized.

RSB – Religious Service Building. Building that offers religious services, such as churches, mosques or synagogues.

SBU – Small Business Unit. A commercial or office structure that hosts between 1 and 10 units.

Schematic-Level Design – Basic design that includes only the most basic and essential components at a simplistic level of detail. See also HLD.

SFU – Single-family Unit. A single dwelling unit that occupies a detached structure.

Slack – Minimizing tension on cable or messenger wire.

Slack Loop – A coil of fiber cable placed along cable routes for future access, maintenance, or expansion purposes. Can be placed on both aerial and underground environments.

Slack Span – A segment of aerial messenger and/or cable installed between 2 poles with reduced tension applied at the poles.

Splice Enclosure – Prefabricated, weatherproof encasement used to protect stripped fiber optic cable and fiber optic splices from the environment.

Splice Sheets – A document that details fiber splicing information at individual splice points.
Splice Tray – A tray designed to provide a place to store the fiber cables and splices and prevent them from becoming damaged or being misplaced.
Subscriber – Potential clients within a fiber network that have fiber requirements defined by their address type.
Tension – Linear installation that has force being applied on both ends.
Virtual CRO – High-level Construction Ride-Out performed from a desktop environment.
TH – Townhouse. Single or multi-storied houses that share one or two walls with adjacent properties but have their own entrance.
UG – Underground. Any installation that uses underground outside plant environment.
Underground Storage Structure – Enclosed underground space that allows for the storage of fiber equipment and protects it from the environment.
Utility Pole – A tall pole with the capability to carry electrical and telecom wirelines and equipment above the ground.
VL – Vacant Lot. A predefined parcel of land that does not have a current use.

PART 3 – OSP DESIGN GUIDELINES

3.1 – High-Level Design (HLD)

Chapter 3.1 of this manual provides a detailed explanation of the High-Level Design component of the Fiber Network Design process. A High-level Design is the preliminary step of the design process and involves a market-wide evaluation of design rules and market conditions to provide a "schematic-level" design which includes the most essential and basic elements of the network. This chapter will provide a definition of the requirements of what constitutes a High-level Design, as well as provide general guidelines for its creation and final delivery.

3.1.1 – High-Level Design Definition & Requirements

The High-Level Design, or HLD, is the first iteration of the proposed fiber optic network. As the name implies it involves a "high-level" review of the entire market and creation of a basic blueprint to be used during the more detailed steps further along in the design process. The HLD should be prepared as a first step taking into consideration the entire market and all interconnected elements. Once approved, it should provide the general template to be followed for all subsequent phases. After an HLD has been approved, any additional network elements or extensions will require its own HLD be created and approved before being incorporated into the in-progress design.

The final product of an HLD should incorporate the following requirements:

- **<u>Real Estate Review</u>** – An initial Real Estate Review of the market is needed in order to determine available locations for the placement of data centers, central offices or other key components of the fiber network. The main goal is the establishment of Central Office sites, which serve as the heart of the fiber network design. These are components that need to be constructed outside the public right-of-way and often involve the leasing of or purchasing of private property for this particular use. Another goal is to establish the location of outside plant (OSP) equipment, such as cabinets and wireless antennas that can be placed in public rights-of-way, utility easements, private property or attached to joint use poles. The size of the equipment, ease of ingress and egress and public safety would need to be considered to determine the locations of the outside plant equipment.

- **Market Structure Inventory Assessment** – A Market Structure Inventory Assessment is a review of existing outside plant network infrastructure elements within the market footprint. It is important to assess existing aerial and underground infrastructure when conducting preliminary route design, as it helps to minimize the overall cost of a proposed fiber network.

- **Preliminary Design** – Preliminary Design is the primary component of the High-Level Design phase. This phase incorporates the information collected in the three phases above and develops a preliminary route and equipment roadmap for the fiber network at a market-wide level. The formal fiber network preliminary design requires the following components:
    - Identification of all potential subscribers as "subscriber points" within entire network market footprint.
    - Identification of Feeder Hub/Central Offices locations and establishing Feeder Hub Coverage Area Boundaries for each.
    - Design of preliminary fiber path based on shortest path to serve all subscribers in the coverage area and to determine the preferred design environment (aerial vs underground).
    - Preliminary sizing of fiber cables in Tiers F1, F2 and F3 to meet market demand needs.
    - Design of preliminary locations and sizing of FDH cabinet locations and establishment of FDH Coverage Area Boundaries for each.
    - Design of preliminary locations for splice enclosure and MSTs along the design path.

- **Preliminary CRO** – A Preliminary Construction Ride Out is a high-level "Virtual CRO" conducted from a desktop environment, such as Google Street View. Preliminary CRO is used to verify the validity of proposed fiber path and determine if constructability of either aerial or underground environments. This step aims to minimize potential adjustments or full redesigns to the path after field surveys at a later stage.

- **Make-Ready Assessment** – A Make-Ready Assessment (MRA) is a high-level visual review of the utility poles to verify their economic viability for new attachments. At this stage, MRA is meant to provide a cost assessment of the aerial routes. This step aims to identify viable pole routes, while avoiding pole routes that will require costly power and/or communication rearrangements and/or pole changeouts.

- **Preliminary Cost Assessment** – A Preliminary Cost Assessment evaluates the elements of all phases above and establishes an estimated cost of labor and materials to build out the fiber network. This preliminary estimate won't be a final number and should be conservative to provide enough room to address unforeseen circumstances.

PART 4 - CONSTRUCTION METHODS

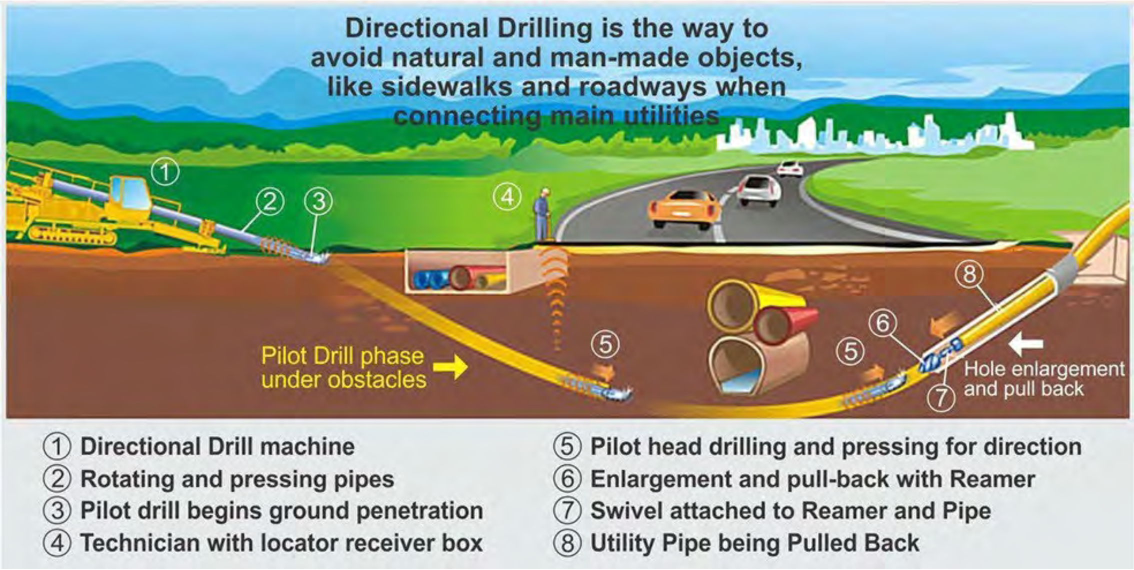
4.1 Underground/Buried Installation

4.1.1 Directional boring

Boring or Horizontal directional drilling is used in the installation of utility pipelines and conduits.

A pilot borehole is drilled along a pre-determined bore path from the surface with minimum disturbance. Directional Boring is mainly used for making crossings under rivers, roads, and existing structures, with the purpose of installing pipes and conduits to transport different types of fluids and materials.

Directional Boring is a way to get utilities from one point to another without destroying the existing ground or obstacles that are in between the two points. Directional drilling goes above and beyond traditional trenching; connecting utilities and services in places that traditional trenching is impossible.



4.1.2 Open Cut Trenching

Open cut trench excavation is the traditional and most popular method for utility construction, repair, or replacement. Open cut trench excavation consists of opening up the surface of the ground to the required depth for installing a pipe; typically, a minimum of 36” depth below grade is recommended. This method is usually the least expensive method if the pipe is located under non-pavement areas. If the open cut trench excavation is in a non-pavement area, the excavation can be backfilled with soil and surface vegetation restored by seed or sod. When the open cut trench excavation is located under pavement the existing pavement must be saw cut and removed, the excavation filled with granular backfill (compacted stone or sand to prevent settlement), and the pavement must be replaced and the end of the pipe repair or replacement.

4.1.3 Cable (Conduit) Plowing

Plowing is another method utilized in the installation of utility cables and conduits.

Plowing uses a plow blade that is pulled through the ground using a strong wire cable attached to a tracked towing unit. The blade runs through the ground at a pre-set depth to create a trench in which the cable or pipe is placed immediately after before the soil has time to fill the trench.

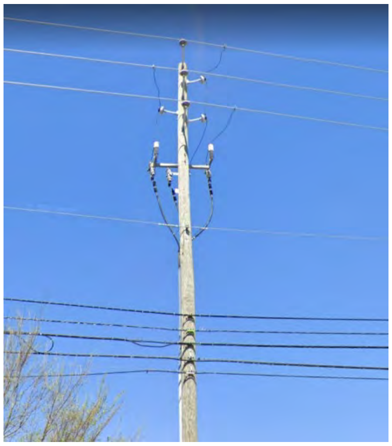
Although plowing has a greater surface disturbance than Directional Boring, it has less disturbance than Open Cut Trenching. In addition, Plowing is an efficient and cost-effective method of cable or conduit placement in more rural or less densely populated environments. Due to fewer below ground obstructions to the cable/plow path the plowing method allows for faster placement and less surface repair once the cable/conduit has been placed.

4.2 Aerial Installation

- Aerial fiber installation is recommended in locations where poles are existing and for difficult underground crossings. The aerial fiber is supported between poles by being lashed to a wire messenger strand.

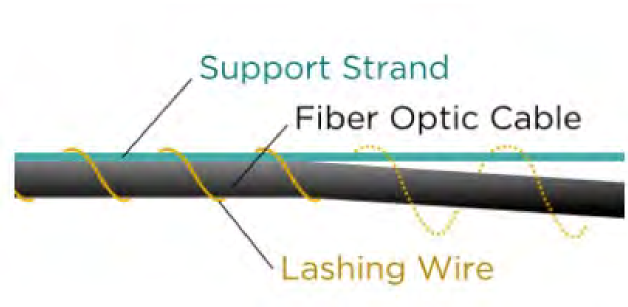
Aerial attachments must adhere to the National Electric Safety Code (NESC) in order to preserve structural integrity of the pole and to protect public safety. Traditionally, communications cables are attached in an area of the pole below the lowest power attachment with a minimum separation of 40 inches. This requirement can vary based on the voltage of the lowest power attachment or specific standards of the power owner. These requirements apply to minimum separation between attachments on the pole (power, comms, lighting, etc.), midspan clearances between poles, anchoring and guying, etc. If the poles are owned by private utility companies (Entergy and AT&T), the County would need to negotiate pole attachment agreements with the utilities and apply to attach to the poles.

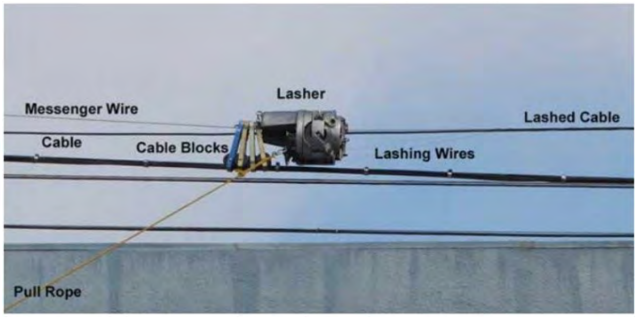
- Typical positioning of communications cables on a joint-use pole with the top portion occupied by a power provider. In the image below the communications cables are the bottom five attachments.



4.2.1 Lashed Cable

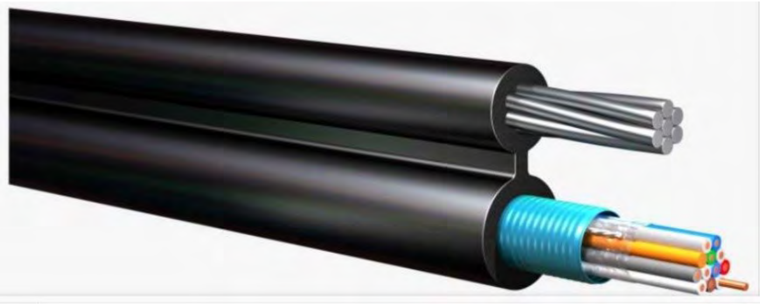
Typical aerial cable placement involves attaching a messenger strand or wire between poles and securing the cable to the messenger strand with a lashing wire. Using the lashed cable method allows for future placement of additional cables on an individual messenger strand. The size of the messenger strand, existing field conditions and the size of the new cable will determine if the existing messenger strand can support additional cables.





4.2.2 Self-Supporting Cable

Self-supporting cable does not require a separate messenger strand as the strand is including in the cable sheath construction. Placement of aerial cable using self-support allows for faster placement since the cable and messenger strand are placed at the same time. However, self-supporting cables are limited in size and do not allow for “overlashing” new cables. Additional cable placements would require a separate pole attachment of a new messenger strand or new self-support cable.



4.3 Underground vs Aerial Installations (Pros and Cons)

Aerial fiber installation is one of the most cost-effective methods of deployment to the customer when existing pole infrastructure can be utilized. This avoids digging up roads to bury cables and conduit. However, aerial fiber cable is exposed to the weather and will strain and break if exposed to extreme wind and large temperature variation and ice loading. Once pole attachment agreements are in place, Make Ready Engineering (MRE) would have to be completed. MRE is the process of assessing the pole and attachment conditions and identifying the relocation of any existing attachments required to create space for the new fiber placement and adhere to minimum separation requirements. It is one of the biggest hurdles in aerial construction because it can create massive delays as the utility requesting a new attachment must wait for each telecommunication utility with existing attachments to respond to the make-ready request.

Buried fiber deployments are virtually immune to wind and ice damage because they are buried below the layer where the soil freezes. In the long term, underground deployments are often more reliable, especially where poor weather is common. The disadvantages of buried installations are the high cost of underground construction and potential damages by other utilities while digging in the area. These future damages and costs can be reduced by maintaining an accurate database of the network, as well as complying with line locate requests when other utilities propose new construction.

APPENDIX F – VENDOR ASSESSMENT

As a defining principle, Foresite Group is vendor agnostic and simply seek out the highest quality products and services appropriate for a unique deployment. Foresite Group has compiled the following list of vendors and contacts, categorized by product and/or service to assist the County in assessing options supporting any program needs.

Active Electronic Equipment Manufacturers

Nokia: www.networks.nokia.com

Fujitsu: www.us.fujitsu.com

Ciena: www.ciena.com

Adtran: www.adtran.com

Juniper: www.juniper.net

Infrastructure Materials (e.g., fiber, splice cases, fiber Distribution HUBs, vaults, etc.)

Material Distributors

Graybar: www.graybar.com
Brandon Knee
817-213-1395
Brandon.Knee@graybar.com

Power & Tel Supply: www.ptsupply.com
Lisa Stanley
901-866-3232
Lisa.Stanley@ptsupply.com

WESCO: www.wesco.com
Josh Bailey
(205) 951-4601
jobailey@wesco.com

Walker & Associates: www.walkerfirst.com

Fiber Cable Manufacturers

Corning: www.corning.com

AFL: www.aflglobal.com

Splice Case Manufacturers

CommScope: www.commscope.com
Craig Tindle
334-275-8601
craig.tindle@commscope.com

Corning: www.corning.com

Preformed Line Products-PLP: www.preformed.com
JR Smith, Sales Mgr, Broadband Eng
417-205-0415
jrsmith@preformed.com

Channell: www.channell.com
Philip Goebel (SouthEast Rep)
423-805-0866
pgoebel@channell.com

Fiber Serving Terminal Manufacturers

Corning: www.corning.com

CommScope: www.commscope.com
Craig Tindle
334-275-8601
craig.tindle@commscope.com

AFL: www.aflglobal.com
Distribution HUBs Manufacturers

Distribution HUBs Manufacturers

CommScope: www.commscope.com
Craig Tindle
334-275-8601
craig.tindle@commscope.com

AFL: www.aflglobal.com

Conduit Manufacturers

Duraline: www.duraline.com

United Poly Systems: www.unitedpolysystems.com

Blue Diamond: www.bdiky.com

Vault Manufacturers

Channell: www.channell.com
Philip Goebel (SouthEast Rep)
423-805-0866
pgoebel@channell.com

Charles Industries: www.charlesindustries.com

Old Castle: www.oldcastleinfrastructure.com

Aerial Construction Hardware

Preformed Line Products-PLP: www.preformed.com
JR Smith, Sales Mgr, Broadband Eng
417-205-0415
jrsmith@preformed.com

Construction Contractors: Aerial Construction, Underground Construction and Splicing

Cable East: www.cable-east.com
Adam Rickabaugh, Program Mgr
470-499-5001
adam.rickabaugh@cable-east.com

Ervin Cable Construction: www.ervincable.com

Mears: www.mears.net

Data Service Providers

AT&T: www.att.com

Spectrum: www.spectrum.com

Xfinity/Comcast: https://www.xfinity.com/national/

Parker FiberNet: https://parkersystems.net/

IoT (Internet of Things) Services and Vendors

Gunshot Detection

Shot Spotter: www.shotspotter.com
Gunshot detection

3xLOGIC: www.3xlogic.com
Gunshot detection

ZeroEyes: www.zeroeyes.com
Gunshot detection

Livewire Digital: www.livewiredigital.com
Info/Entertainment Kiosks

Meridian Kiosks: www.meridiankiosks.com
Info/Entertainment Kiosks

Message Point Media: www.mpmedia.tv
Info/Entertainment Kiosks

Touchsource: www.touchsource.com
Info/Entertainment Kiosks

I&E Company: www.iekiosk.com
Info/Entertainment Kiosks

Siemens: www.siemens.com
Sensoring and monitoring systems for all utilities. In-Building solutions include automation, energy, fire safety, compliance, integration and monitoring services, and security services.

Hexagon: www.hexagongeospatial.com
Software for City Management, 911 Emergency Solutions, Lidar Solutions, Sensors

Advanced Kiosks: www.advancedkiosks.com
Interactive & Wayfinding Indoor/Outdoor Kiosk Manufacturer with Multi-Market Solutions

Eaton: www.eaton.com
Smart lighting and controls, EV charging, Utility and Grid Solutions

Wireless Providers

Nokia: www.networks.nokia.com
Equipment provider

CommScope: www.commscope.com
Equipment provider, managed Wi-Fi services through Arris

Calix: www.calix.com
Managed in-building Wi-Fi

Verizon: www.verizon.com

AT&T: www.att.com

Spectrum: www.spectrum.com

Crown Castle: https://www.crowncastle.com/

APPENDIX G – FIBERHOOD TABLES

Name	Final Grade	Addresses	Fiber Access Percentage	Download Speed (Mbps)	Upload Speed (Mbps)	Willingness to Upgrade Service
1-A	20	685	0.0%	202.0	11.2	81.25
1-B	20	119	0.0%	79.9	11.4	100.00
1-C	19	326	0.0%	79.0	12.4	90.91
1-D	18	684	75.1%	184.0	164.8	100.00
1-F	17	469	18.1%	76.5	9.3	57.14
1-E	17	597	0.0%	236.8	14.2	75.00
1-G	16	644	89.3%	297.0	162.2	87.50
1-H	16	609	34.2%	217.6	18.0	75.00
1-J	15	358	50.0%	278.4	20.3	80.00
1-I	15	497	10.9%	139.9	9.2	66.67
1-L	14	269	18.2%	249.1	13.0	75.00
1-K	14	498	4.6%	215.8	58.4	53.13
1-M	14	338	62.7%	87.5	101.1	68.75
1-Q	12	318	54.7%	177.0	18.0	72.22
1-P	12	353	88.1%	187.4	252.0	75.00
1-N	12	342	100.0%	190.5	13.0	80.00
1-O	12	348	46.0%	237.9	14.1	65.91
1-R	11	527	70.2%	340.7	10.9	50.00
1-S	11	379	80.7%	180.8	143.5	66.67
1-V	10	294	81.3%	166.7	16.7	67.86
1-W	10	343	91.5%	222.7	124.6	64.29
1-U	10	307	100.0%	140.5	14.8	55.00
1-T	10	271	100.0%	310.5	189.2	50.00
1-X	<Null>	149	0.7%	<Null>	<Null>	<Null>
1-Y	<Null>	332	20.8%	<Null>	<Null>	<Null>
1-Z	<Null>	440	74.5%	<Null>	<Null>	<Null>

Name	Final Grade	Addresses	Fiber Access Percentage	Download Speed (Mbps)	Upload Speed (Mbps)	Willingness to Upgrade Service
2-A	18	466	63.9%	194.5	95.6	81.25
2-B	18	360	9.7%	60.8	8.4	70.00
2-C	18	462	40.7%	49.1	11.0	100.00
2-D	17	463	82.7%	47.0	7.1	83.33
2-E	16	371	18.6%	116.8	7.7	91.67
2-F	16	380	94.2%	5.7	0.5	100.00
2-G	16	552	43.1%	441.1	22.4	100.00
2-H	15	400	27.5%	224.0	71.5	66.67
2-I	15	356	69.1%	56.0	3.5	69.44
2-J	14	300	25.0%	125.0	10.5	82.69
2-K	13	392	100.0%	262.0	109.7	83.33
2-L	13	672	45.4%	340.8	7.5	50.00
2-M	12	419	97.4%	122.6	92.4	75.00
2-N	12	292	76.7%	406.6	22.5	79.17
2-O	11	399	94.5%	178.0	6.6	62.50
2-P	10	439	54.4%	173.1	10.8	53.13
2-Q	7	281	95.4%	182.8	72.8	37.50
2-R	<Null>	328	88.7%	<Null>	<Null>	<Null>
2-S	<Null>	610	43.0%	<Null>	<Null>	<Null>
2-T	<Null>	375	100.0%	<Null>	<Null>	<Null>
2-U	<Null>	313	86.9%	<Null>	<Null>	<Null>
2-V	<Null>	102	47.1%	<Null>	<Null>	<Null>

Name	Final Grade	Addresses	Fiber Access Percentage	Download Speed (Mbps)	Upload Speed (Mbps)	Willingness to Upgrade Service
3-A	21	523	0.0%	80.7	7.1	66.67
3-B	19	589	57.7%	457.9	21.5	100.00
3-C	18	716	34.5%	273.0	14.7	83.33
3-D	18	631	64.2%	135.1	7.6	62.50
3-E	17	345	0.0%	249.4	11.2	75.00
3-F	17	642	27.3%	97.1	18.1	67.86
3-G	16	321	36.4%	154.3	10.7	75.00
3-H	16	427	1.4%	192.0	17.8	75.00
3-I	15	362	29.3%	267.8	79.5	75.00
3-J	15	416	99.0%	38.7	21.3	50.00
3-K	15	463	42.1%	223.8	15.5	75.00
3-L	14	320	36.9%	117.0	12.0	61.36
3-M	14	394	100.0%	188.3	20.1	81.25
3-N	14	457	96.1%	215.1	17.0	75.00
3-O	14	606	89.3%	185.9	12.2	60.00
3-P	14	417	17.5%	154.2	11.9	68.75
3-Q	14	440	0.0%	130.5	9.5	69.32
3-R	12	440	85.0%	145.9	63.1	62.50
3-S	10	365	80.3%	167.3	158.3	65.63
3-T	<Null>	221	69.2%	<Null>	<Null>	<Null>
3-U	<Null>	449	59.5%	<Null>	<Null>	<Null>
3-V	<Null>	437	58.4%	<Null>	<Null>	<Null>

Name	Final Grade	Addresses	Fiber Access Percentage	Download Speed (Mbps)	Upload Speed (Mbps)	Willingness to Upgrade Service
4-A	19	391	0.00%	36.4	3.1	88.75
4-B	18	311	11.58%	47.5	10.4	63.24
4-C	18	388	7.47%	77.3	18.0	77.27
4-D	17	457	72.65%	28.1	7.8	50.00
4-E	17	386	0.00%	141.9	11.8	83.33
4-F	16	536	22.01%	148.3	14.2	60.71
4-G	16	357	91.04%	70.1	21.5	81.25
4-H	16	279	100.00%	90.6	17.1	100.00
4-J	15	451	66.74%	134.0	13.0	75.00
4-K	15	383	0.00%	218.1	11.4	69.44
4-L	15	642	70.72%	110.2	11.3	61.54
4-I	15	426	57.51%	108.2	13.5	76.92
4-N	14	337	0.00%	142.4	13.3	70.83
4-M	14	332	48.80%	153.4	61.6	75.00
4-P	14	339	0.00%	40.7	1.3	43.75
4-O	14	229	0.00%	243.3	14.0	72.73
4-Q	13	378	0.00%	452.8	22.0	50.00
4-R	13	324	77.47%	205.0	13.7	87.50

Name	Final Grade	Addresses	Fiber Access Percentage	Download Speed (Mbps)	Upload Speed (Mbps)	Willingness to Upgrade Service
5-A	22	506	21.7%	33.7	20.4	100.00
5-B	21	669	100.0%	33.2	11.5	93.75
5-C	19	376	37.5%	52.8	10.1	93.75
5-D	19	363	0.0%	454.4	20.0	100.00
5-E	17	690	78.8%	247.6	16.2	87.50
5-F	17	601	88.0%	185.2	17.4	81.25
5-G	16	311	0.0%	73.2	6.1	41.67
5-H	16	267	2.2%	413.8	15.5	83.33
5-J	13	444	21.4%	152.2	14.6	35.00
5-K	13	417	78.9%	221.8	145.1	68.75
5-L	13	438	86.8%	148.6	6.7	62.50
5-M	13	252	73.0%	334.4	10.6	75.00
5-N	13	303	100.0%	82.8	21.6	77.50
5-O	11	169	93.5%	160.5	22.5	79.17
5-P	10	274	100.0%	106.6	34.9	56.25
5-Q	9	302	100.0%	176.9	66.6	59.62
5-R	<Null>	329	0.0%	<Null>	<Null>	<Null>
5-S	<Null>	315	95.6%	<Null>	<Null>	<Null>
5-T	<Null>	142	30.3%	<Null>	<Null>	<Null>

Name	Final Grade	Addresses	Fiber Access Percentage	Download Speed (Mbps)	Upload Speed (Mbps)	Willingness to Upgrade Service
6-A	21	192	0.0%	43.9	10.0	83.33
6-B	20	642	0.0%	276.6	15.3	75.00
6-C	20	663	0.0%	137.7	38.6	79.17
6-D	19	583	29.7%	119.4	11.3	75.00
6-E	18	688	72.5%	85.2	11.5	66.67
6-F	17	453	81.7%	114.1	11.1	75.00
6-G	16	668	57.8%	198.2	113.6	78.57
6-H	16	434	0.0%	252.2	22.2	75.00
6-J	15	347	81.0%	67.0	13.4	68.75
6-K	15	372	94.4%	228.4	105.9	83.33
6-L	14	350	88.0%	338.0	11.3	75.00
6-M	14	475	100.0%	182.4	54.1	86.84
6-N	14	335	77.6%	397.1	22.9	100.00
6-O	14	445	97.3%	103.6	35.6	62.50
6-P	13	447	87.7%	5.0	5.0	25.00
6-Q	12	394	100.0%	176.5	55.3	70.83
6-R	11	367	84.7%	198.1	74.9	69.44
6-S	10	322	97.8%	157.5	44.5	66.67
6-T	<Null>	314	67.2%	<Null>	<Null>	<Null>
6-U	<Null>	504	26.6%	<Null>	<Null>	<Null>
6-V	<Null>	428	10.3%	<Null>	<Null>	<Null>
6-W	<Null>	220	17.3%	<Null>	<Null>	<Null>

Name	Final Grade	Addresses	Fiber Access Percentage	Download Speed (Mbps)	Upload Speed (Mbps)	Willingness to Upgrade Service
7-A	24	556	0.0%	88.2	10.9	91.67
7-B	20	457	0.0%	552.0	22.6	100.00
7-D	19	704	9.7%	100.5	400.8	0.00
7-C	19	474	67.5%	48.1	17.6	75.00
7-F	18	464	100.0%	99.7	10.9	75.00
7-E	18	263	69.6%	11.4	3.3	75.00
7-G	18	670	47.5%	113.2	6.1	75.00
7-J	16	344	23.8%	76.5	9.6	54.17
7-H	16	644	63.7%	148.6	12.9	62.50
7-I	16	317	4.4%	342.8	11.4	75.00
7-K	15	387	78.6%	189.9	10.8	87.50
7-L	15	587	36.3%	163.7	12.9	43.75
7-M	14	308	0.0%	282.6	22.0	0.00
7-P	14	341	75.7%	129.1	49.9	78.57
7-N	14	443	67.5%	245.9	14.2	75.00
7-O	14	541	100.0%	143.2	16.4	56.25
7-R	13	662	97.3%	261.9	138.6	71.88
7-Q	13	651	96.8%	156.8	64.5	62.50
7-S	12	463	100.0%	331.3	164.2	62.50
7-T	12	643	85.1%	262.4	165.9	68.75
7-U	12	446	81.6%	161.4	8.4	70.83
7-V	12	426	100.0%	259.8	231.7	60.42
7-X	10	440	100.0%	194.5	108.2	65.00
7-Y	10	320	78.4%	238.9	62.3	59.09
7-W	10	346	90.8%	276.7	196.1	50.00
7-Z	<Null>	460	2.6%	<Null>	<Null>	<Null>
7-AA	<Null>	322	73.9%	<Null>	<Null>	<Null>
7-AE	<Null>	335	0.0%	<Null>	<Null>	<Null>
7-AF	<Null>	314	0.0%	<Null>	<Null>	<Null>
7-AC	<Null>	531	26.4%	<Null>	<Null>	<Null>
7-AD	<Null>	465	0.0%	<Null>	<Null>	<Null>
7-AB	<Null>	350	86.6%	<Null>	<Null>	<Null>

APPENDIX H – FCC MAP CHALLENGE PROCESS LINKS

Single Location Challenge

https://help.bdc.fcc.gov/hc/en-us/articles/10475216120475-How-to-Submit-a-Location-Challenge-

Bulk Fabric Challenge

https://help.bdc.fcc.gov/hc/en-us/articles/8103890293275-How-to-Format-a-Bulk-Fabric-Challenge

https://help.bdc.fcc.gov/hc/en-us/articles/13308560752155-How-to-Submit-a-Successful-Bulk-Fabric-Challenge-

https://help.bdc.fcc.gov/hc/en-us/articles/11587546422427-Challenge-Resolution-Information-for-Bulk-Fabric-Challengers

Availability Challenge

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