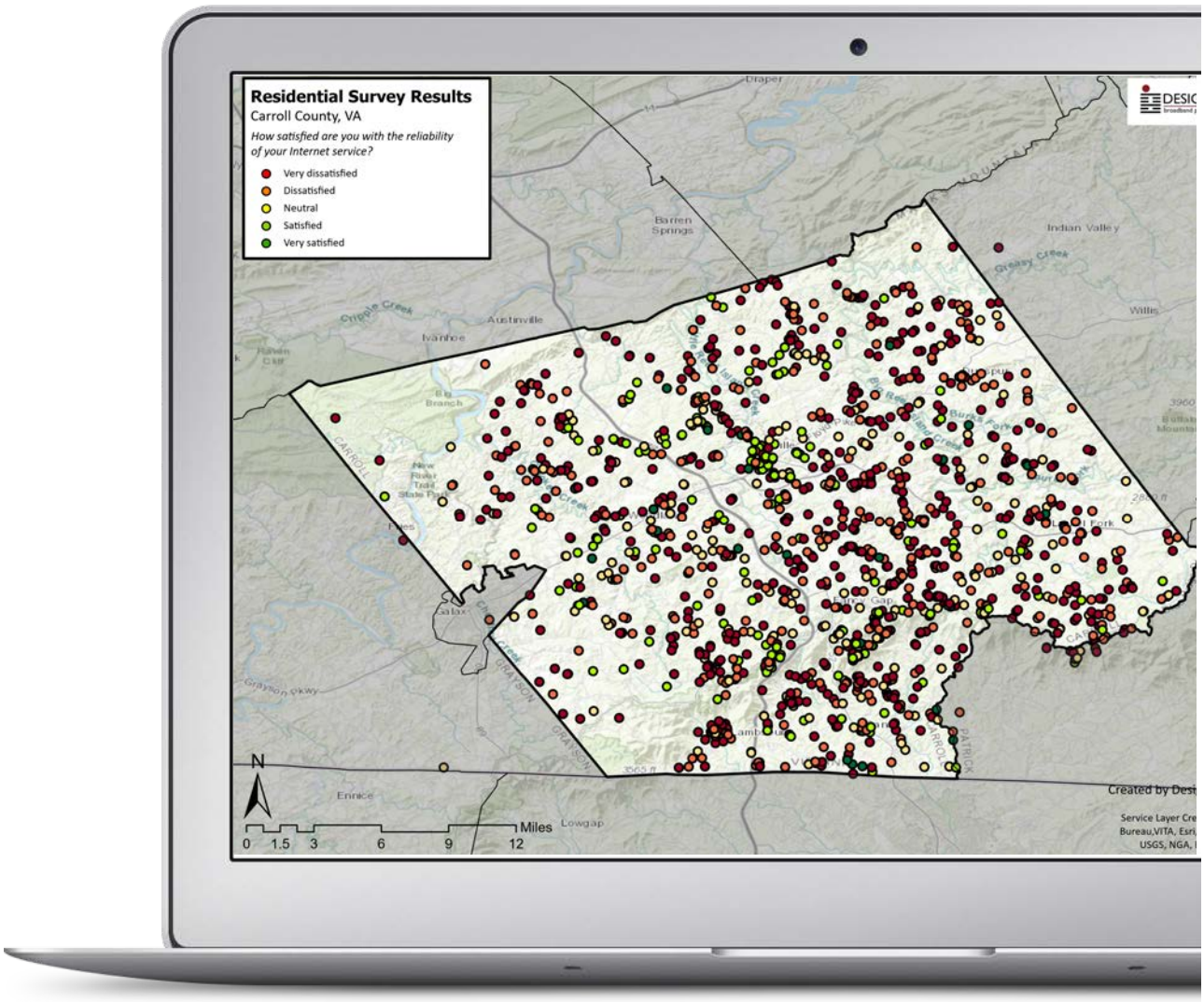
BROADBAND INFRASTRUCTURE ASSESSMENT

Carroll County, Virginia



DESIGN NINE
broadband planners

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1 EXECUTIVE SUMMARY

A broadband study of Carroll County began in early summer of 2021 and was completed in the fall of 2021. The study included meetings with stakeholders and interested parties in the county, interviews and meetings with businesses, meetings with county officials, and residential and business broadband surveys. The report has several key sections:

- **Technical and Asset Analysis** – Demographic data, tower and fiber assets in the county, underserved and unserved areas of the county, and geo-coded survey results.
- **Market, Current Use, and Gap Analysis** – A review of current service provider service offerings, speeds, and prices for those services and what bandwidth is available.
- **Broadband Surveys** – In Carroll County, both a residential broadband survey and a business broadband survey was distributed. A strong response was received.
- **Connectivity Solutions** – This section provides an overview of various technologies, including both broadband wireless and broadband fiber.
- **Preliminary Design and Cost Estimates** – Design and estimates of county-wide fixed point wireless network and fiber designs and cost estimates for three fiber projects.
- **Infrastructure Funding and Grant Opportunities** – A discussion of a variety of grant and funding strategies.

The survey data collected as part of this study indicates that residents and businesses are anxious for better Internet service. Because a very large number of often passionate comments were received, they have been included in a separate document.

- 88% of respondents are interested in having access to Gigabit fiber Internet.
- 94% believe that local government should help facilitate better Internet access.
- 40% of residents report the quality of Internet service is affecting where they choose to live.
- 80% of businesses indicated that the Internet is important to the success of their business.
- 73% of businesses reported that they need employees able to work from home.

1.1 SUMMARY OF FINDINGS AND RECOMMENDATIONS

Continue to work with The Wired Road. Use the findings and recommendations in this report to plan a multi-year set of goals with The Wired Road that can be realistically achieved using a basket of local, state, and Federal funding. The expanded wireless broadband and the proposed fiber to the home projects outlined in Section 9 of this report provide a road map for improved broadband and Internet service in underserved areas of the county.

Develop partnerships with WISPs and ISPs. WISPS and ISPs should be provided a copy of this report, and then be invited to meet to provide input on what infrastructure investments would enable them to expand service most efficiently. Local and regional WISPs may be able to provide insight into where towers are most needed and what they are willing to pay for tower space. WISP and ISP suggestions should help inform the broadband strategy for the County, noting that ISP/WISP demands may not always match the long term broadband needs of businesses and residents.

The County government should not become an Internet provider. The County should continue to work with The Wired Road's open access network to help private sector WISPs and ISPs expand their customer base..

Expand broadband service to improve cell service. With a good broadband connection, most cellphones now have WiFi calling features that allow residents and businesses to make cellphone calls even if their home or business is not near a cell tower. Expanding wireless broadband and fiber to the home in the county can improve cellphone service availability.

Seek Grant Funds. The Federal government has been steadily increasing the amount of grant funding available for broadband infrastructure, with USDA and HUD both having programs that are designed to help underserved and unserved areas construct new broadband infrastructure. Some Federal grant applications will be due in mid-spring of 2022, so planning for submitting grant proposals should begin in early January 2022. Covid relief funding (ARPA, American Rescue Plan Act) should also become available in early 2022. Because ARPA funding is expected to exceed the previous Covid funding program (CARES), Carroll's share of ARPA funds should be substantial and a portion of it could cover a large part of the needed broadband infrastructure improvements.

Manage Expectations. The current deficiencies in Internet access in the county took decades to develop, and the proposed improvements should be approached as a multi-year process, with an expectation of substantial improvements in access and availability in twelve to eighteen months.

Develop a long term funding strategy. Grants may not provide sufficient funds to reach the County's long-term goals. Evaluate longer term funding strategies, like using a special assessment, or implementing a very small increase in property taxes. Revenue would be earmarked exclusively for broadband improvements. Expansion of broadband in Carroll County will be most successful by recognizing that funding will come from a range of funding sources rather than a single source. Grants, public/private partnerships, some local funds, and other sources may all be needed to achieve success.

Grants can be extremely important in the early stages of an effort to support planning activities and/or to fund a first-phase build-out initiative. However, grants rarely allow spending on operational expenses. Grants should be used carefully as one-time cash injections to support very specific goals. Communities that have relied too heavily on "the next grant" as a key source of expansion or operational funding usually experience severe financial problems.

1.2 FUTURE-ORIENTED INFRASTRUCTURE

Affordable high speed Internet is essential to the future growth and prosperity of Carroll County. Over the past twenty years, Internet access has evolved from a luxury to a necessity. School students need Internet access to complete homework and to study. Online shopping can save energy and make it easier for the elderly and homebound to obtain the needs of every day life. Telemedicine and telehealth services and applications is revolutionizing health care, reducing costs, and allowing older citizens to live independently longer.

More and more workers and business people are working from home, either on a part time or a full time basis, and the Covid crisis has highlighted the critical need for reliable high performance Internet service for work, learning, and access to health services. New work from home job opportunities are growing rapidly, but most of those jobs require reliable, symmetric Internet service to qualify.

Many business employees are already trying to work more from home more often (e.g. one or two days per week) to reduce travel costs. Some major businesses in other parts of the U.S. are actively planning to have 20% of their workforce work full time from home to reduce employee travel costs and office energy costs. Corporate employees working from home require high bandwidth services to be connected to the office network and to use corporate videoconferencing systems. These corporate network services often require 10-50 Megabit ***symmetric*** connections.

Broadband has become essential community infrastructure.

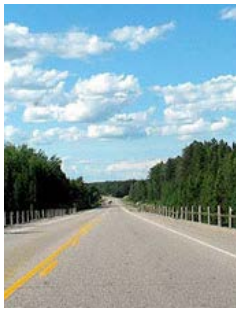
Just as communities had to take on the task of building and maintaining roads in the early twentieth century, communities must now provide digital road systems as a matter of community and business survival. These digital road systems must be designed with certain characteristics:

The communities of Carroll, with the right broadband infrastructure, can be attractive to an emerging new group of businesspeople and entrepreneurs that typically are well-educated, own their own businesses or work for large global corporations, and are making choices about where they lived based on family needs and interests, rather than business interests. This new breed of entrepreneurs and workers place a high value on the kinds of amenities that contribute to a good quality of life–traditional neighborhoods, vibrant downtown areas, a wide range of cultural and recreation opportunities, good schools, and a sense of place. These businesspeople and their families make relocation decisions based on quality of life only where there is abundant and affordable broadband, because broadband is the enabler of this new approach to personal and work life.

Given that the Covid crisis has created increased attention to fiber Internet service, these goals are modest. If Carroll County and The Wired Road can use ARPA funds, other grant opportunities, and some local funds to make carefully targeted passive infrastructure investments and to develop constructive public/private partnerships, most homes and businesses in Carroll County could have Gigabit fiber service within the next four to six years.

2 BROADBAND AS ESSENTIAL INFRASTRUCTURE

Governments build and manage roads, but don't own or manage the businesses that use those roads to deliver goods and services. There is true competitive pricing between competing service providers, and little or no government regulation is required.



The tremendous versatility of the Internet and the underlying technology bases now allows services that used to require their own, separate (analog) road system (voice telephony and TV services) to be delivered alongside other services like Internet access on a single, integrated digital road system.

If we managed overnight package delivery the way we manage telecom, UPS and Fedex would only deliver packages to residences and businesses where each delivery firm had built a private road for their exclusive use. We recognize immediately the limitations of such a business model–few of us would have overnight package delivery to our homes because the small number of packages delivered would not justify the expense of building a private paved road.

Before the rise of the automobile, most roads were built largely by the private sector. After cars became important to commerce and economic development, communities began building and maintaining roads because it became an economic development imperative to have a modern transportation system in communities.

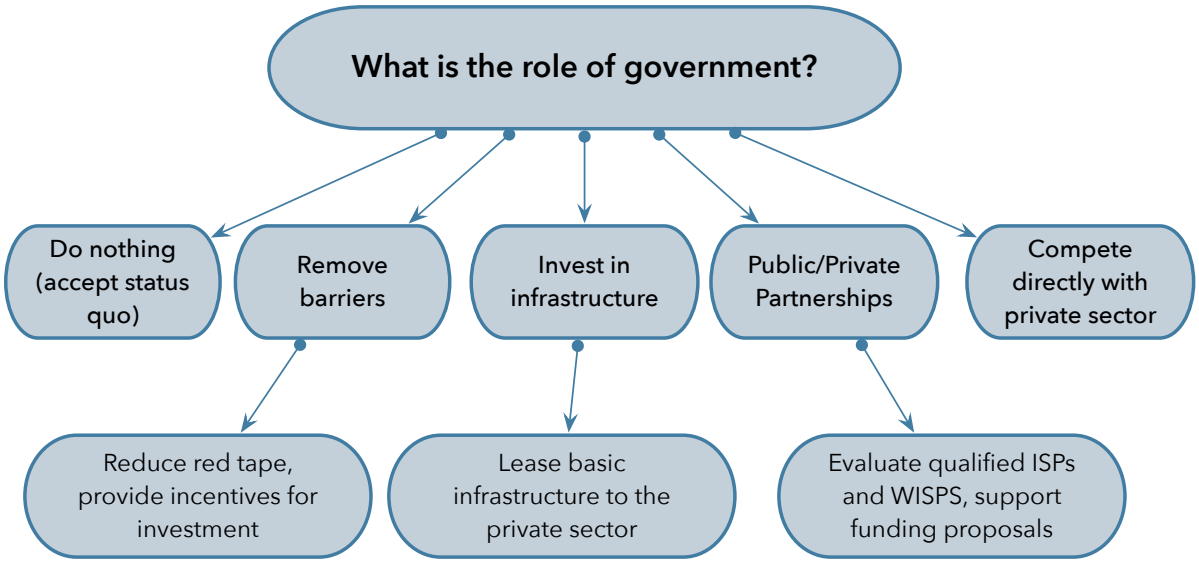
Before the rise of the Internet, digital networks were built largely by the private sector. As broadband has become critical to commerce and economic development, communities with digital roads are more competitive globally.

The time has come to recognize that it is inefficient and wasteful to build full duplicated digital road systems, which only raise the cost of telecom services to all public and private users. Networks that share capacity among a wide variety of public and private users have a lower cost of construction and a lower cost of operation–benefiting all users.

A UTILITY COMPARISON		
SHARED ROADS	SHARED AIRPORTS	SHARED TELECOM
Historically, roads have been built and maintained by the community for the use of all, especially private firms that want to use them to deliver goods and services.	Airports are built and maintained by a community or region as an economic and community development asset. Both public and private users benefit from the shared use of a single, well-designed airport	Duct and fiber may be installed and maintained by the community and/or a neutral owner/operator for the use of all, including private firms that want to use them to deliver goods and services.
Access to the community road system is provided by parking lots and driveways, built by property owners, developers and builders.	Airport assets like departure gates, ticket areas, and runways provide access to the airline services.	In the digital road system, access across private property to the community–wide network in the public right of way is provided by duct and fiber built by property owners and/or developers and builders.
The local government uses roads only to deliver government services. Local government does not offer services like overnight package delivery.	While the local government or a consortium of local governments typically own the airport facility, the local governments do not offer flight services.	Local government uses the digital transport system only to deliver government services. Government does not offer services like Internet access or Voice over IP.
Private sector businesses use roads so that their own cars and trucks can deliver goods and services to customers. Because businesses do not have to build and maintain roads, all businesses benefit directly by being able to reach more customers at less expense.	Private sector airlines are able to offer competitively priced airfares because of the shared cost of the airport terminal facilities. Each airline does not build its own airport (which would sharply increase the cost of airfare).	Private sector businesses use the digital transport system to deliver goods and services to customers. Because businesses do not have to build and maintain a digital road system, all service providers benefit directly by being able to reach more customers at less expense.
There are no road connection fees, and anyone may connect to the road system for free. Governments pay for the cost of maintaining roads largely from those that use the roads . Fees are proportional to use, from taxes on tires and gasoline.	Businesses and citizens do not pay a fee to access the airport facility. The cost of maintaining the airport facility is paid by the airlines, which bundle that cost into the price of airfare. Fees are proportional to actual use by flying customers. Airlines benefit because they do not have to build, own, and operate the airport directly. Those costs are shared across all users.	Any qualified service provider may connect to the digital road system for a nominal fee and begin to offer services, without any significant capital expense. Network capital and operating costs are recovered by charging service providers a small fee that is based on a percentage of their income from services offered over the system.

2.1 WHAT IS GOVERNMENT'S ROLE?

Successful improvements in broadband access, affordability, and reliability for Carroll County involves several decision points, as outlined in the illustration below. Government has several "first choice" options.



Do nothing is to accept that businesses and residents in the County will have to continue to use whatever is available, despite the cost and bandwidth limitations that limit what many are able to do online.

Government can **remove barriers** to private sector investment. This can be an effective and low cost strategy. Possibilities include reducing permit fees for fiber construction and tower installation, incentives to developers to install conduit and meet-me boxes in new residential and commercial construction, simplified permit requirements for utility pole installation on private property, and identifying areas of residential and business demand and sharing that information with providers.

The County can choose to **make investments in basic infrastructure** (e.g. a fiber network) and make that infrastructure available to the private sector via revenue-generating lease agreements.

The County can pursue **public/private partnerships** with technically qualified and financially stable ISPs and WISPs. Where appropriate, the County can channel grant funds to providers while will use the funds to build and manage new broadband infrastructure. Selected providers should be able to show technical competency and have a demonstrable track record of managing substantial fiber and/or wireless builds on time and within budget.

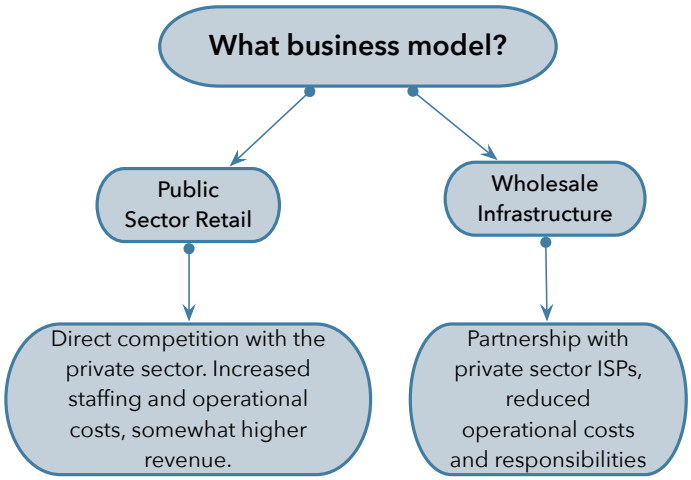
When communities have chosen the option to **compete directly with the private sector** by offering retail Internet, phone, and TV services lawsuits from incumbents often create difficulty moving forward as well as expensive legal fees.

2.2 THE SHARED INFRASTRUCTURE BUSINESS MODEL

Traditionally, the telecom services market has been vertically integrated, with telephone and cable companies owning the cable infrastructure (i.e. twisted pair copper cable for telephone, and coaxial copper cable for TV). These companies bundled analog services with their own infrastructure, which made sense when only one service could be delivered over the cable.

American residents and businesses needed two networks: one for voice telephone service, and one for television. The rise of the Internet and associated changes in technology led to digital services (voice, video, Internet) that could be delivered simultaneously over a single cable or wireless connection.

By the early 2000s, it was becoming apparent that it was inefficient and costly to have two competing "retail" cable systems (e.g. telephone, cable) delivering the same content and services—it was only creating higher costs for residents and businesses.



A new business model became possible: wholesale leasing of the cable/wireless infrastructure to private sector service providers, which unbundles the infrastructure from the services. A side effect of this unbundling is that it becomes much easier to determine what a customer is actually paying for a given service: in the vertically integrated 20th century model, with the cost of infrastructure maintenance bundled together with the services, it is much more difficult to determine what a service actually costs.

While a few communities have pursued the retail business model (typically building fiber to the home and business and selling retail Internet and other services directly to customers), most of these retail efforts have been by local governments that are also providing electric service—owning the utility poles is a significant cost advantage not available in most communities.

Within the wholesale business model, there are several different ways to generate revenue.

Passive Infrastructure Leasing – In this approach, the County makes investments in a few targeted passive infrastructure types, typically broadband towers, and optionally conduit and dark fiber. This kind of basic infrastructure has virtually no day to day maintenance and management responsibilities, and can be leased out to private sector Internet providers so that those companies can expand their service area and service quality more rapidly.

Lit Circuit Wholesale – In this approach, the network provides lit fiber circuits to providers, with one circuit allocated to each customer. Service providers are charged for the cost of each circuit. Service providers are responsible for their own customers and their own customer billing. Revenue is based on the number of customers who actually buy service (the take rate). Revenue is dependent on the marketing success of the service providers.

Utility Fee Wholesale – In this approach, every household and business in the community pays a monthly small utility fee. Service providers pay only a small fee for use of the network that is based on the total number of potential customers. In this model, the effective take rate from a revenue perspective is 100%. With this high take rate, the individual utility fee can be very modest because everyone pays something, rather than just those buying a service.

Features	Municipal Retail	Wholesale Infrastructure
Basic Concept	Generally more difficult to because of possible legal challenges from incumbent providers. Generally not an option in Massachusetts.	One or more private sector ISPs would use the infrastructure to sell their own services directly to residents and businesses. Can be a dark fiber approach, lit fiber approach, and/or wireless towers.
Government Involvement	Local government competes directly with the private sector for Internet service.	County involvement is limited to providing basic infrastructure to ISPs.
Management	Local government is responsible for management and operations. Most functions could be outsourced to a qualified third party entity.	ISPs responsible for virtually all day to day customer services and support. County only responsible for network and tower maintenance and repairs.
Competition	The incumbent telephone and cable providers would compete vigorously against local government service offerings.	Private sector ISPs would provide competition to the telephone and cable companies.
Service Options	Local government would sell only Internet. Businesses and residents could get TV and voice using their Internet connections.	ISPs would focus on high speed Internet, with some other service offerings like voice and business services.
Risks	The primary risk would be lawsuits from incumbent providers.	The lit network approach requires hard-nosed business management experience. It is important to identify prospective service providers early in the process.

In the wholesale infrastructure business model, local government investments are limited to basic transport infrastructure, including conduit, fiber, and network equipment. Services for businesses and residents are offered by private sector providers offering Internet, TV, telephone and other data services.

2.3 SERVICE PROVIDERS AND SHARED INFRASTRUCTURE

The wholesale infrastructure model, where the local government is NOT selling retail telecommunications services, has been resistant to legal challenges, with at least one hundred communities in the U.S. that lease infrastructure to private sector service providers. Communities that have been challenged in court are ones that chose to pursue the retail model, with customers purchasing retail services like Internet, TV, and phone directly from the town or city government. Lafayette, Louisiana is one of the best known examples. The City of Lafayette was sued by the incumbent telephone and cable company and won in court. The project is now more than ten years old, passed a 40% take rate target in 2017, and has begun expanding service outside the City limits. The City had a key advantage when starting the effort, because it is an electric city; owning the pole structure and being able to deploy the less expensive aerial fiber widely gave the project a distinct cost advantage.

The service providers that are usually most eager to become providers on a community-owned network are smaller local and regional providers. WISPs (Wireless Internet Service Providers) are usually quick to see the advantages of being able to deliver a superior Internet service over a modern fiber infrastructure with little or no capital expense on their part.

Once a community-owned network is under construction, it is typical that the incumbents, particularly the cable companies, begin lowering rates and offering special deals to customers to try to lock them in to multi-year contracts. There are two ways to approach this:

- If the announcement of construction of community-owned infrastructure lowers prices and improves service from the incumbents, that is an economic benefit to the citizens and businesses of the county. The new network, bringing new providers and a wider range of packages and pricing to citizens and businesses, creates the needed competition that motivates the incumbents to provide better prices and service.
- If the County does move forward, a modest but well through out information and education campaign about the benefits and advantages will be important to counter mis-leading information from the incumbents. Part of the effort must be to let citizens and businesses know not to sign long term contracts with the incumbents.

3 TELECOM ENVIRONMENT ANALYSIS

A wide variety of assets in Carroll County are identified in the following pages.

The included maps provide detail on the following:

Points of Interest – This information is used to identify key users of Internet services that could benefit from improved broadband infrastructure in the county. K12 schools, public safety facilities, fire and rescue locations, health facilities, and county facilities are included.

LMI/HUD Areas – Low and Moderate Income (LMI) and HUD-eligible areas often qualify for certain kinds of grants not available to other areas.

Towers – Of particular importance are towers, which can be divided approximately into two categories: publicly owned towers and privately owned towers. As a general rule, WISPs (Wireless Internet Service Providers) have found that the lease fees to obtain space on cellular towers is too high to justify the expected revenue from broadband Internet customers in the area around that tower. To improve broadband Internet coverage in rural areas of the county, some new towers are going to be needed, with very modest lease fees–to attract WISPs onto those towers.

The fixed point wireless network designs make the assumption that as a general rule, access to space on the cellular towers is too expensive, and so some new towers will be needed even where there may be an existing privately owned tower. If funding is developed for one or more of the county-wide wireless networks (or a portion of one of the county-wide networks), an early and important step would be to assess space availability on existing towers where the design has specified a tower. If some existing towers can be used rather than building a new tower, there would be significant cost savings.

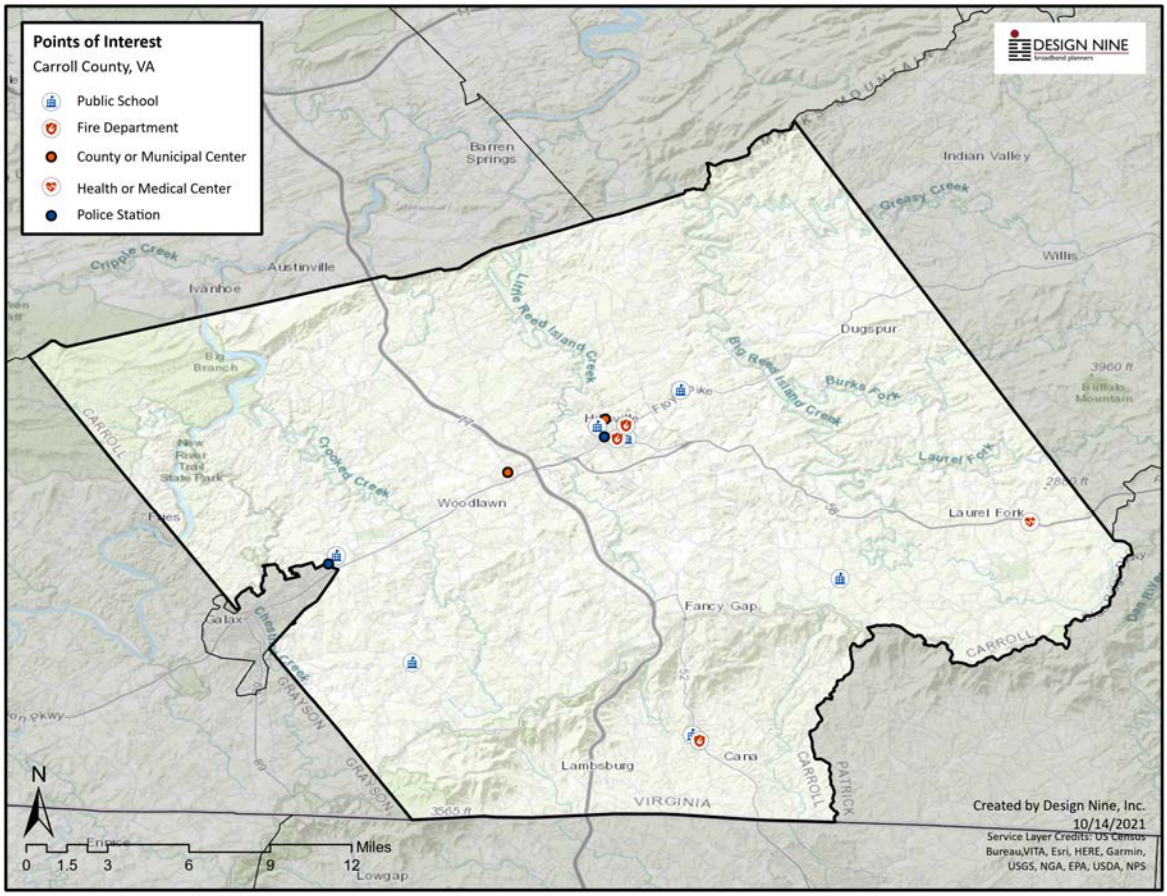
Fiber Routes – In most areas of the county, fiber routes are typically long haul routes passing through the county to other major metro areas and/or connecting only a few institutional and enterprise customers. Companies like Segra and Level3 have some local fiber available for business and institutional customers.

Service Levels – This map illustrates information on served, underserved, and unserved areas in the county obtained from FCC 477 reports. The data is self-reported by the service providers.

Cellular Coverage in the County – This data has been developed from data provided to the FCC by the cellular companies.

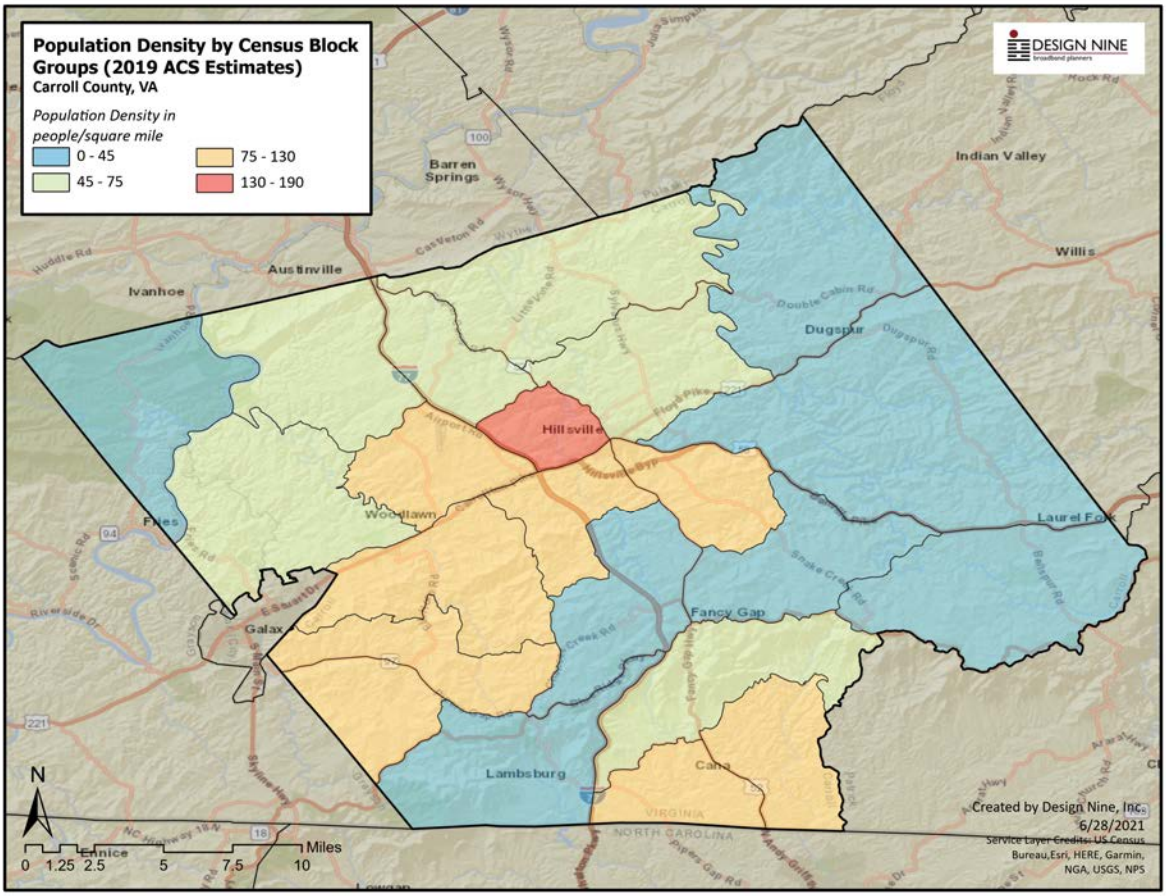
3.1 POINTS OF INTEREST

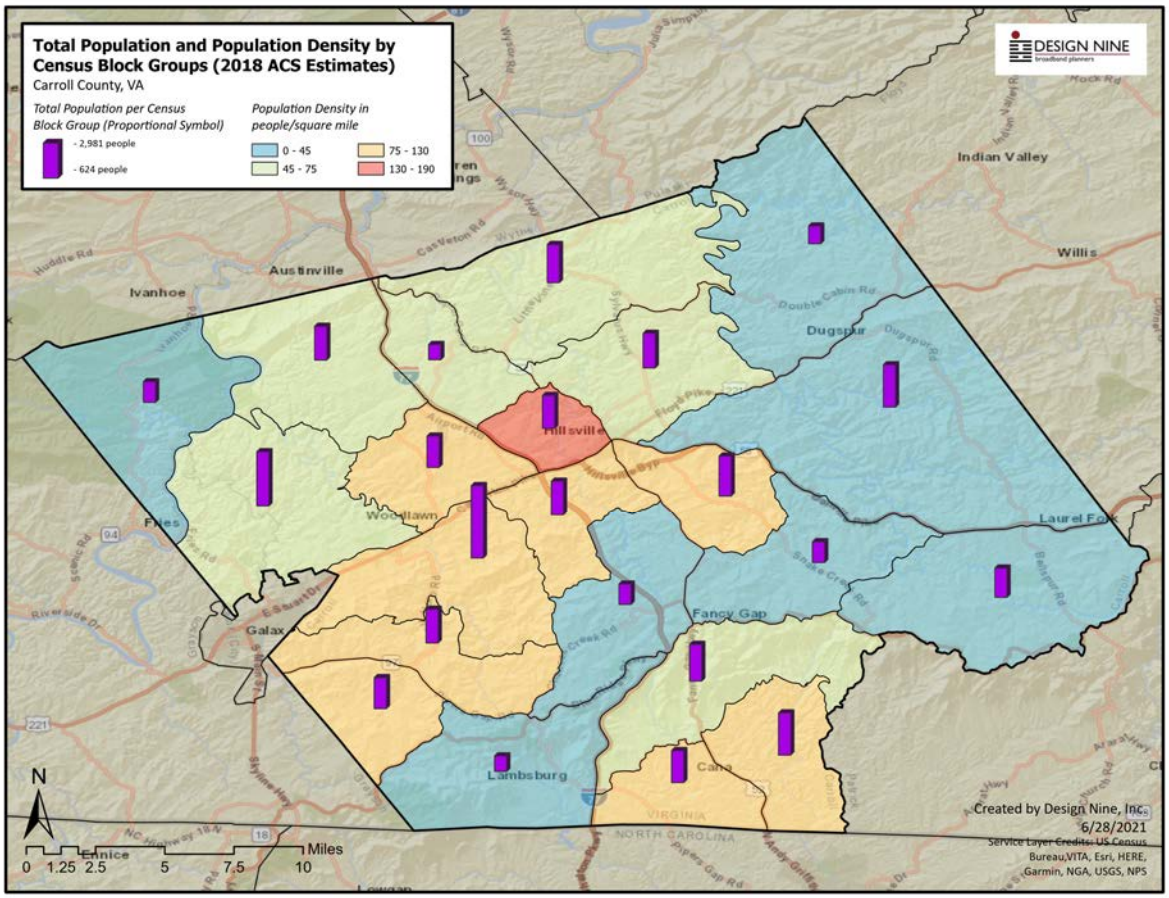
County facilities, municipal facilities, libraries, K12 and higher education facilities, fire and rescue stations, and public safety locations are all candidates to be anchor tenants for fixed point wireless and/or fiber services.



3.2 POPULATION AND DENSITY DISTRIBUTION

This map shows the population and density distribution in the county, by census block. This information can be helpful when working with service providers and when trying to identify what technologies are most appropriate for various areas of the county.

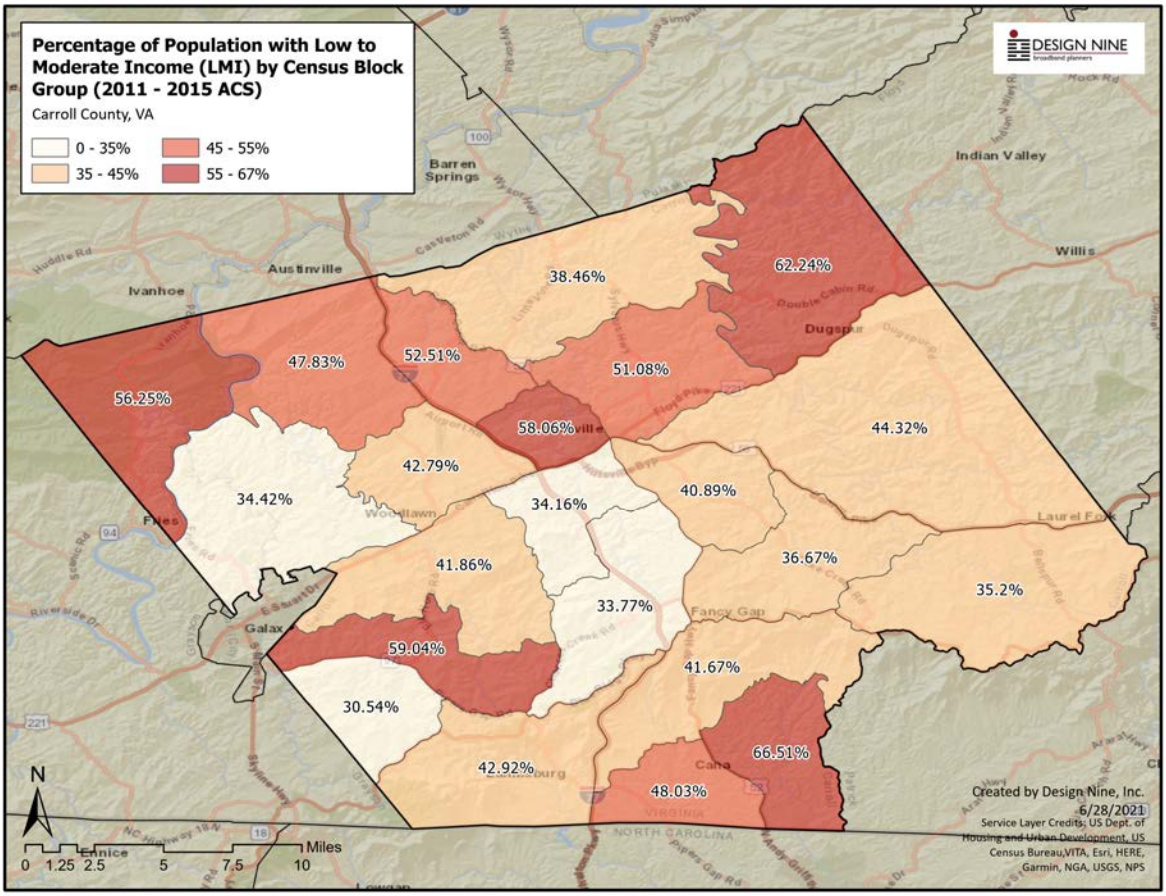



Total Population and Population Density by Census Block Groups (2018 ACS Estimates)
Carroll County, VA
Total Population per Census Block Group (Proportional Symbol)
- 2,981 people
- 624 people
Population Density in people/square mile
0 - 45
45 - 75
75 - 130
130 - 190
DESIGN NINE
broadband planners
Indian Valley
Willis
Austinville
Ivanhoe
Dugspur
Hillsville
Woodlawn
Fries
Galax
Fancy Gap
Laurel Fork
Lambsburg
Cana
VIRGINIA
NORTH CAROLINA
N
0 1.25 2.5 5 7.5 10
Miles
Created by Design Nine, Inc.
6/28/2021
Service Layer Credits: US Census Bureau,VITA, Esri, HERE, Garmin, NGA, USGS, NPS

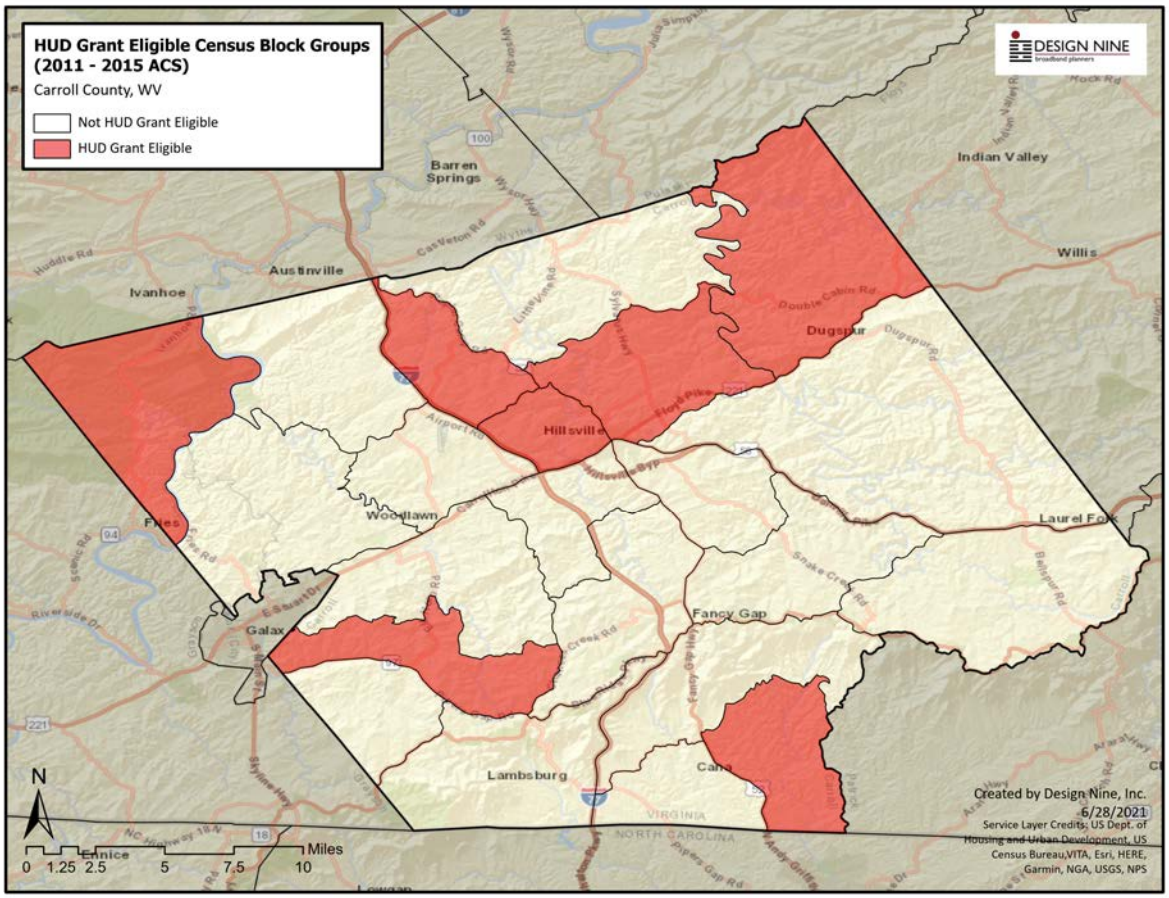
3.3 LMI AND HUD ELIGIBLE AREAS

HUD-eligible areas are determined by LMI (Low and Moderate Income) statistics—but can be different from census blocks in the county that meet LMI thresholds.

HUD-eligible census blocks can qualify for CDBG funding for telecom infrastructure projects.



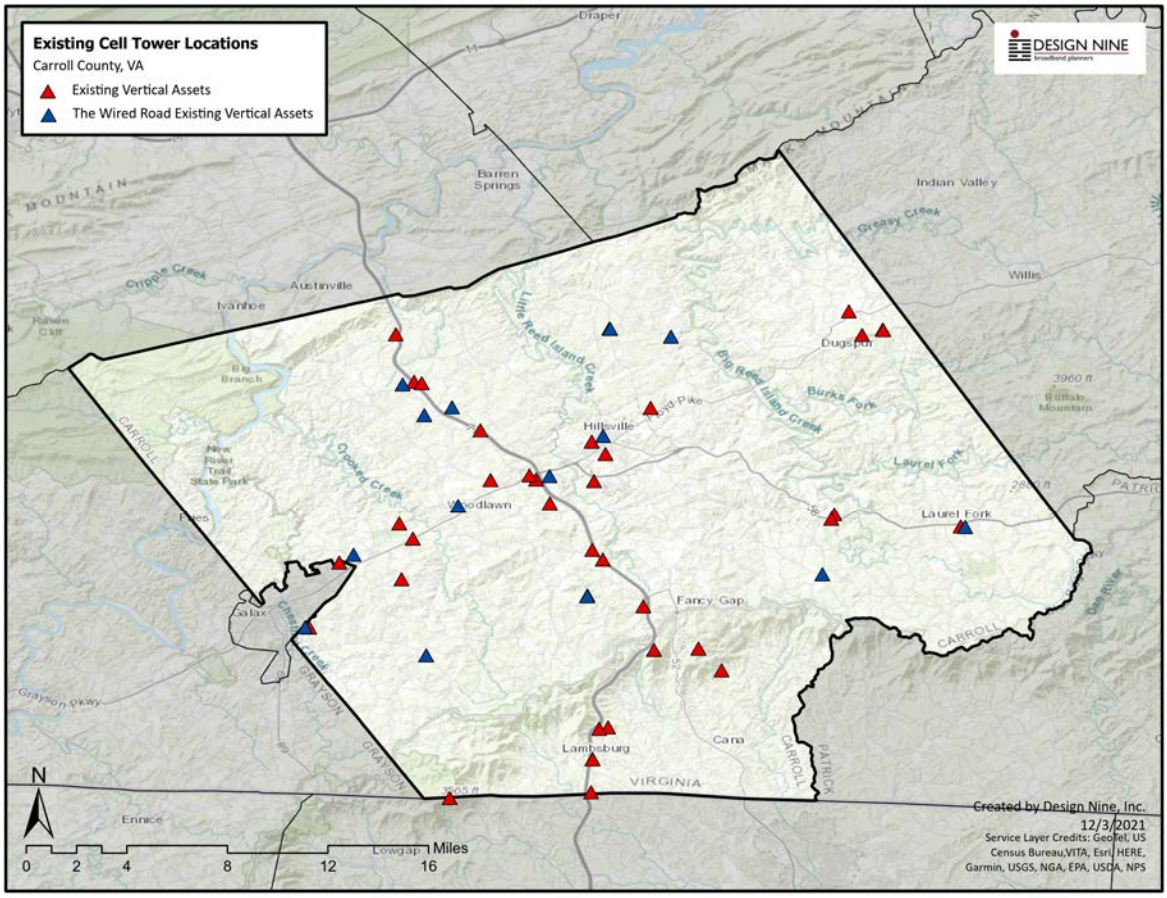
There are substantial areas of the county that can qualify for HUD grant programs.



3.4 TOWERS IN THE COUNTY

A variety of publicly-owned and privately owned towers are shown here. Tower data is collected from an FCC database, County data, the Wired Road and other public and commercial data sources. The FCC database usually includes most towers that are in a locality, and generally includes all or nearly all cellular towers. Tower ownership data is not always updated in a timely manner in the FCC database.

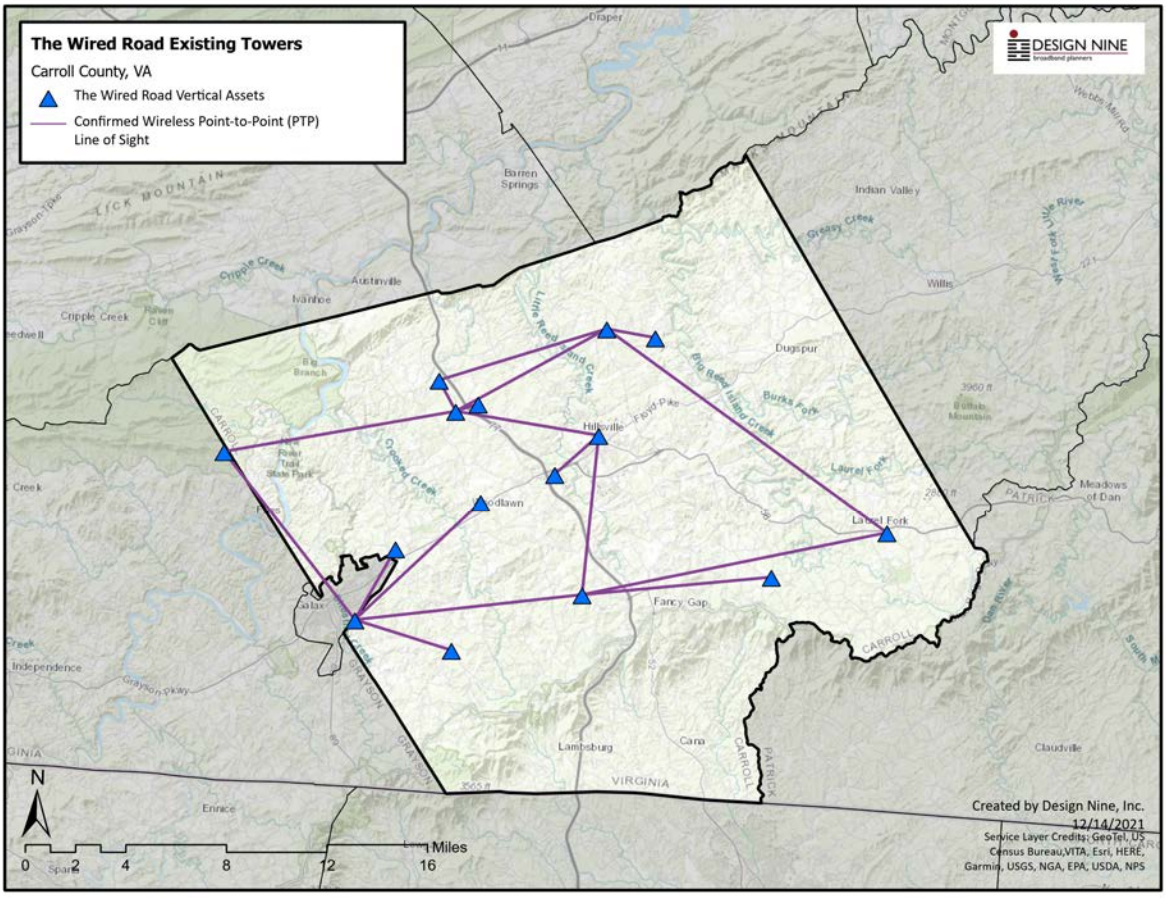
Towers can be divided approximately into two categories: publicly owned towers and privately owned towers. Publicly owned towers can be owned by local government, by regional authorities like the Wired Road, or by the state. In the county, privately owned cellular towers are the most common type of tower, and are generally clustered along major roadways and higher density population areas.



Many commercial towers, especially cellular towers, may have tower lease fees that are too high for a WISP (Wireless Internet Service Provider) to make a business case for putting fixed point broadband equipment on the tower. The cost to a WISP for getting on a privately owned tower often has to be checked on a case by case (tower by tower) basis.

To improve broadband Internet coverage in rural areas of the county, some new towers are going to be needed, with very modest lease fees—to attract WISPs onto those towers.

The map below highlights existing Wired Road towers and the point to point microwave links between those towers.



A second consideration for placing WISP equipment on a cellular tower is where space is available –that is, at what height? Space may be available at an affordable price, but the location on the tower may not be high enough to cover an area large enough for a decent number of customers.

This table provides additional detail on tower owners and tower locations. Height of the towers is in meters, as that is the way the Federal Communications Commission requires towers to be registered in their database. Not all companies provide the height of their tower when registering it.

FCC Registration Number	Tower Owner	Height (meters)	Street Address	Latitude	Longitude
NA	American Tower	Unknown	60 Double Cabin Rd, Dugspur, Va 24325	36.8396	-80.5935
1292731	Towercom Vi	89.9	Sylvatus Smith Highway, Hillsville, Va 24343	36.8298	-80.7312
NA	Diamond Communications	Unknown	1000 Dickerson Rd, Willis, Va 24325	36.8292	-80.574
1300678	Apex Towers	60.6	Near 1285 Dugspur Rd, Dugspur, Va 24325	36.8261	-80.5859
1224607	American Tower	68.2	941Z Rescue Rd (015644), Austinville, Va 24312	36.7992	-80.8436
1304681	Tillman Infrastructure	76.2	968 Rescue Rd,, Austinville, Va 24312	36.7984	-80.8392
1262105	US Cellular	74.6	Greenbrier Rd, Hillsville, Va 24343	36.7842	-80.7075
1233424	US Cellular	41.1	96 Oak Leaf Dr., Five Forks, Va 24343	36.7713	-80.8054
1293690	Pi Telecom Infrastructure	59.4	Cherry St, Hillsville, Va 24343	36.7648	-80.7414
NA	American Tower	Unknown	404 S Main St, Hillsville, Va 24343	36.7577	-80.7335
1295211	Apex Towers	59.4	98 Senior Rd, Woodlawn, Va 24343	36.7427	-80.7996
NA	Kgi Wireless	Unknown	926 Howlett St, Hillsville, Va 24343	36.7421	-80.7401
1227896	American Tower	73.7	Route 706 (015756), Woodlawn, Va 24343	36.7293	-80.7655
1290045	Cellco Partnership	91.4	281 Hoover Rd., Hillsville, Va 24343	36.7229	-80.6019
1301872	Apex Towers	59.4	Near 8697 Danville Pike, Hillsville, Va 24343	36.7202	-80.6036
1286528	Cellco Partnership	88.4	729 Commonwealth Rd, Galax, Va 24333	36.7175	-80.8521
1301873	Apex Towers	45.7	Near 281 Cardinal Circle, Laurel Fork, Va 24352	36.7158	-80.5292
1229363	American Tower	79.2	Glendale Rd, Woodlawn, Va 24333	36.7088	-80.8443
1227485	American Tower	74.1	3401 Stable Rd (15754), Hillsville, Va 24343	36.7024	-80.7411
1304680	Tillman Infrastructure	76.2	341 Baltimore Rd, Hillsville, Va 24343	36.6968	-80.735
1266065	US Cellular	45.7	195 N.A. Wineberry Dr, Galax, Va 24333	36.6951	-80.8866
1234417	US Cellular	68.6	322 Walkers Knob Rd, Woodlawn, Va 24381	36.6855	-80.8508
1268466	Virginia Department Of State Police	54.8	Beamer Knob Rd, Fancy Gap, Carroll County Va., Fancy Gap, Va 24328	36.6762	-80.7439
1229120	American Tower	74.3	228 Pottery Dr (16081), Fancy Gap, Va 24328	36.67	-80.7117
1040764	US Cellular	79.2	Off Tower Rd, Atop Ward Knob, Galax City, Va 24333	36.6578	-80.9039
1224563	Pinnacle Towers	56.4	State Route 1146, Hillsville, Va 24328	36.6458	-80.68

FCC Registration Number	Tower Owner	Height (meters)	Street Address	Latitude	Longitude
1041270	US Cellular	60.1	79 Cemetary Rd, Fancy Gap, Va 24328	36.645	-80.7056
NA	AEP	Unknown	State Rt 691, Hillsville, Va 24317	36.6333	-80.6667
1249104	Pegasus Tower	59.4	Rt. 854 William Dr, Cana, Va 24317	36.6006	-80.732
NA	Kgi Wireless	Unknown	726 Cedar Ln Rd, Cana, Va 24317	36.5998	-80.7371
1297458	Towercom Vi	59.4	Beauty Shop Rd, Lambsburg, Va 24317	36.5823	-80.741
1293526	VA State Police	60.6	160 Interstate 77, Lamsburg, Va 24351	36.5634	-80.7418
1265196	North Carolina State Highway Patrol	54.8	Fishers Peak, Hp-1098, Fishers Peak Rd, Galax, Va 24333	36.5601	-80.8231
NA	Crown Castle	Unknown	1000 Dickerson Rd, Willis, Va 24380	36.828875	-80.573725
NA	Crown Castle	Unknown	151 Farmers Market Road, Hillsville, Va 24343	36.74304	-80.77337
NA	Crown Castle	Unknown	2122 Pleasant View Road, Austinville, Va 24312	36.826458	-80.854081
NA	Crown Castle	Unknown	726 Cedar Lane Road, Cana, Va 24317	36.59975	-80.737056
NA	Crown Castle	Unknown	85 Airport Road, Hillsville, Va 24343	36.745388	-80.77726
NA	Crown Castle	Unknown	926 Howlett Street, Hillsville, Va 24343	36.742072	-80.740072
NA	Beyond Reach	Unknown	229 Old Pipers Gap Rd, Lambsburg, Va 24351	36.58222	-80.74083
NA	Carroll County	37	Oakland Elementary School, 4930 Pipers Gap Road	36.64190605	-80.8366135
NA	City of Galax	90	Galax Fire Tower, 403 Stoneman Knob Lane	36.65803451	-80.90624005
NA	Carroll County	30	Beamers Knob, 1149 Beamers Knob Road	36.67574003	-80.744
NA	The Wired Road Authority	24.4	Gladesboro Elementary School, 7845 Snake Creek Road	36.68835885	-80.60874055
NA	Carroll County Public Schools	12	Gladeville Elementary School, 3117 Glendale Road	36.6995614	-80.8784108
NA	Carroll County	30	Laurel Fork, 13146 Danville Pike	36.71548124	-80.52659567
NA	Carroll County Public Schools	12	Woodlawn School, 745 Woodlawn Road	36.72780781	-80.8182397
NA	Carroll County	12	Childcare Center, 564 Industrial Park Road	36.74499715	-80.76564616
NA	Carroll County	37	Carroll County Gov't Center, 605 Pine Street	36.76806756	-80.7348544
NA	Carroll County	41.1	Exit 19 Water Tank, 5031 Coulson Church Road	36.78001092	-80.83771022
NA	The Wired Road Authority / BRCEDA	27	Wildwood Industrial Park Tower, 426 Maynard Drives	36.78447754	-80.82174662
NA	Carroll County	12	Laurel Rescue Squad, 1542 Rescue Road	36.7976794	-80.8501568
NA	Carroll County	27	Sylvatus Water Tower, 163 Deer Ridge Road	36.82955936	-80.73080747

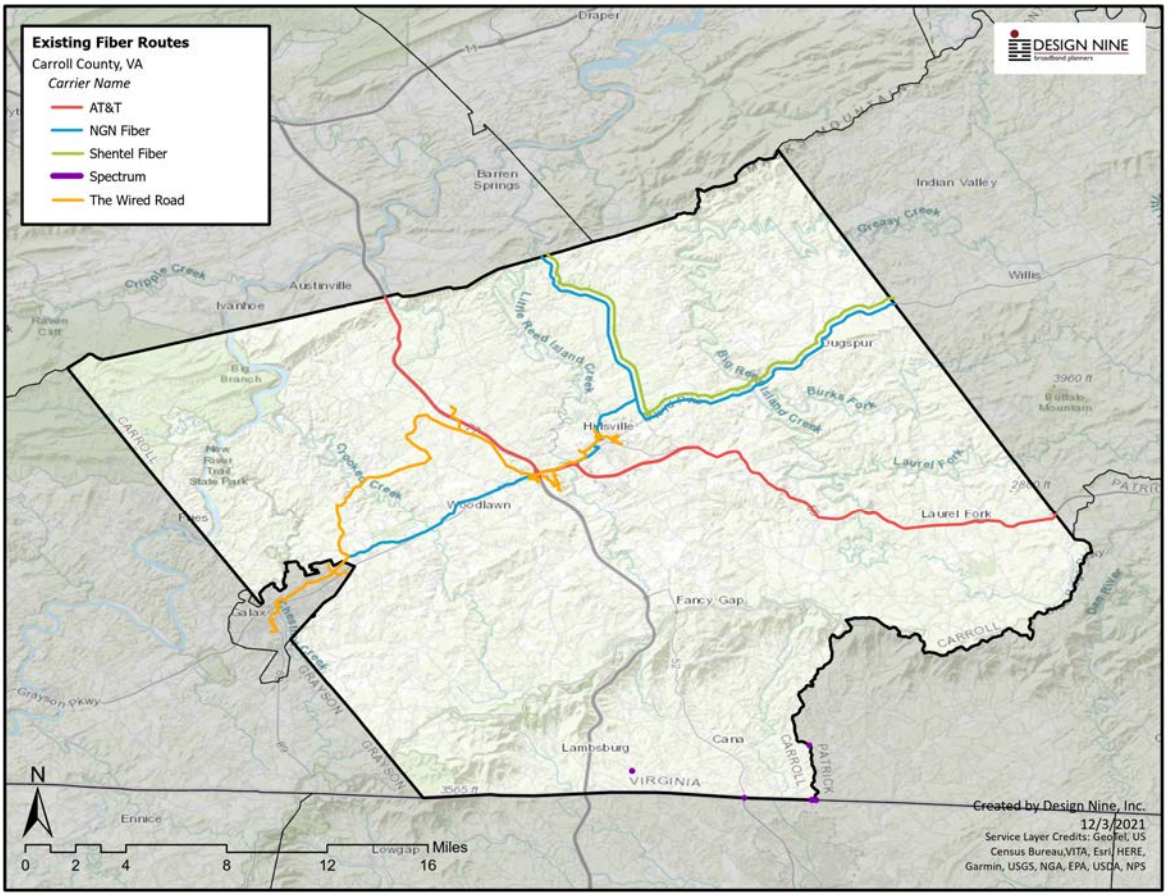
3.5 FIBER ROUTES IN THE COUNTY

Fiber route data is compiled from publicly available sources. Some telecom providers do not share their route data.

Most fiber routes, not only in the county but throughout the country have been designed as long haul point to point fiber routes between population centers. This means that even if a fiber cable passes down a rural road or a residential area, it has not been designed for residential or small business fiber to the premises.

In Carroll County, most of the fiber routes shown on the map below are through routes that do not provide local fiber service, with the exception of a few K12 school and industrial connections.

The Wired Road fiber can provide residential and business connections over nearly all of its fiber routes.



3.6 SERVED, UNDERSERVED, AND UNSERVED AREAS

The areas on the map below have been identified using FCC (Federal Communications Commission) 477 data. The map also shows the three areas (outlined in red) where fiber pilot studies were done as part of this work (see Section 7). Service providers, including incumbent telephone and cable companies, file a 477 report with the FCC to identify where their service is available and at what speed, using the FCC designations :

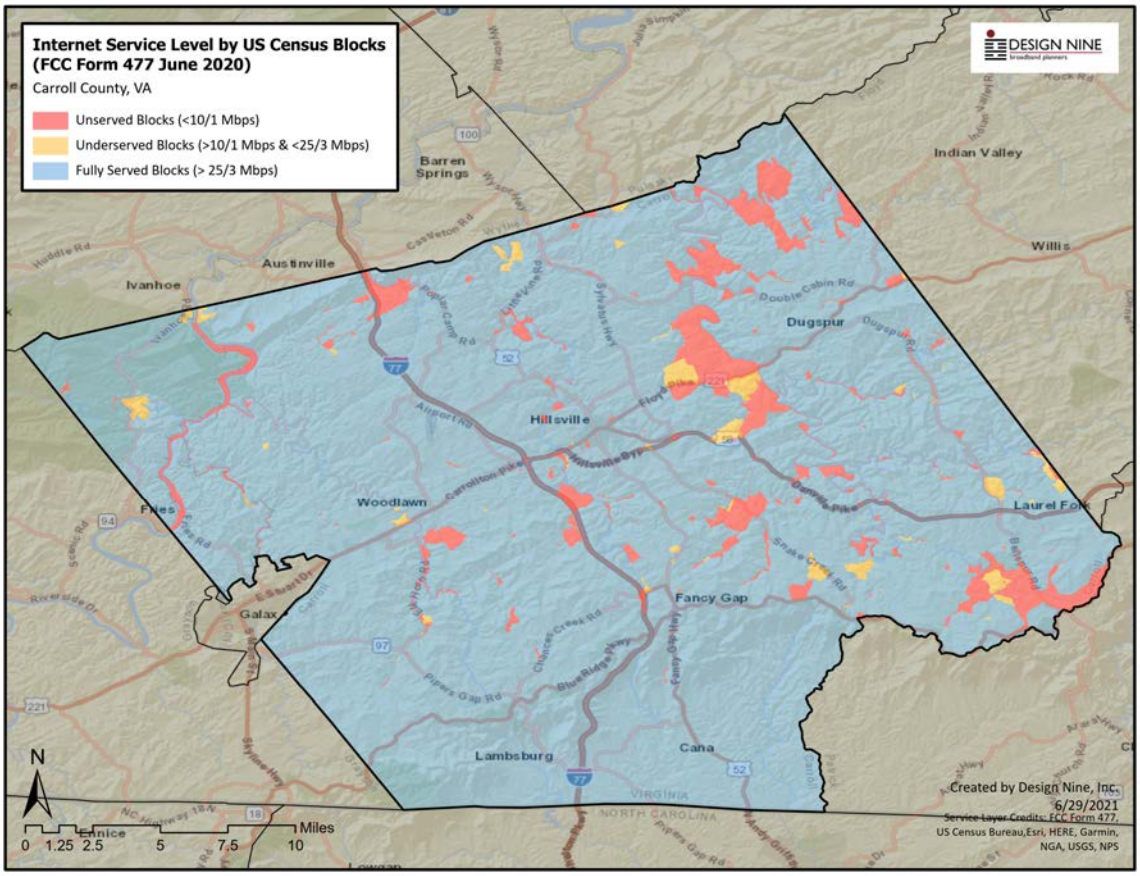
Unserved – Less than 10 Megabits down/1 Megabit up

Underserved – At least 10 Megabits down/1 Megabit up and less than 25 Megabits down/3 Megabits up

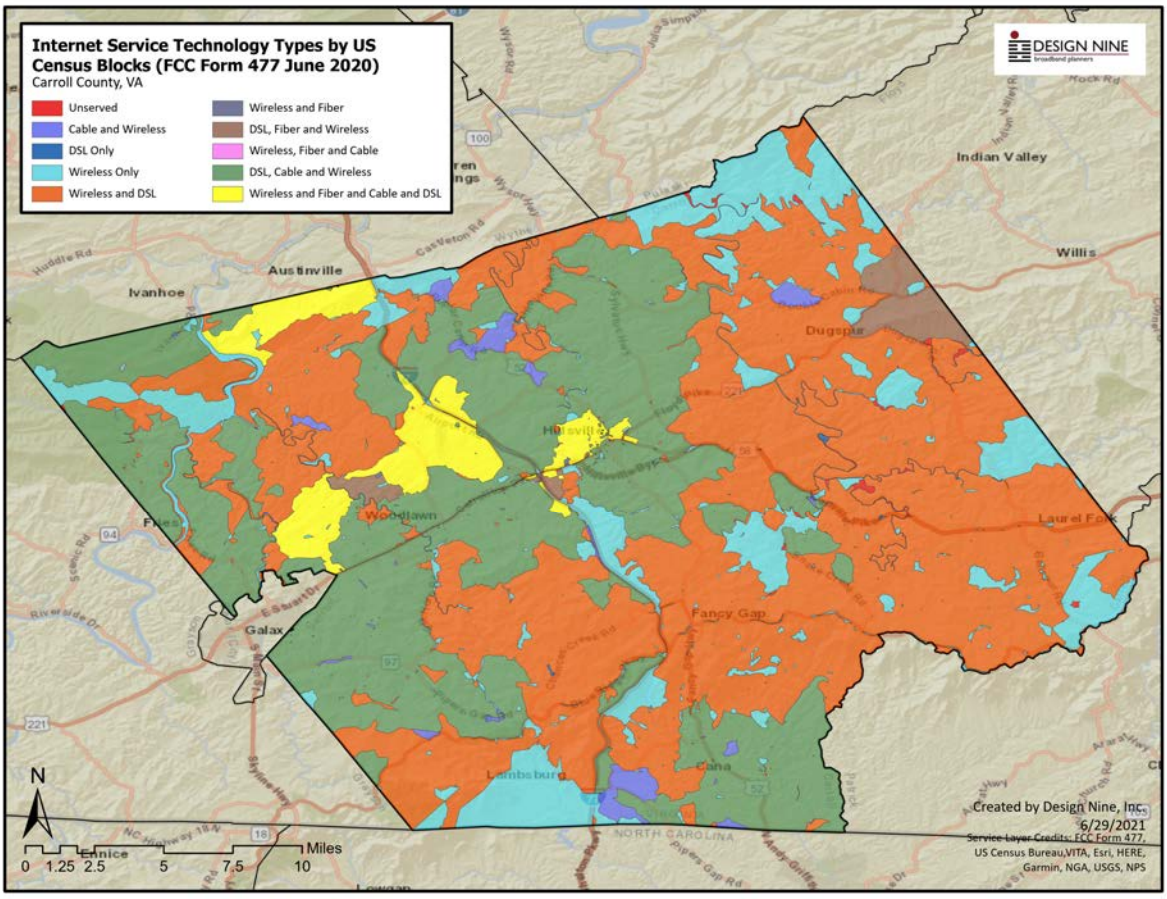
Served – Equal to or better than 25 Megabits down/3 Megabits up

There are two problems with the 477 data:

- The data is self-reported by the providers, who typically report their most optimistic Internet speeds. In practice, customers may not always get the reported speeds.
- A single customer receiving service in a census block means that the provider can indicate that the entire census block is counted. So if one household receives 25/3 service, all households in that census block are counted as receiving that level of service.



While the FCC data indicates that the entire county is fully served, there is wide variance in the kind and type of service available to households in the county. Fixed point wireless Internet is widely available, and in most areas with wireless service, DSL is also available.

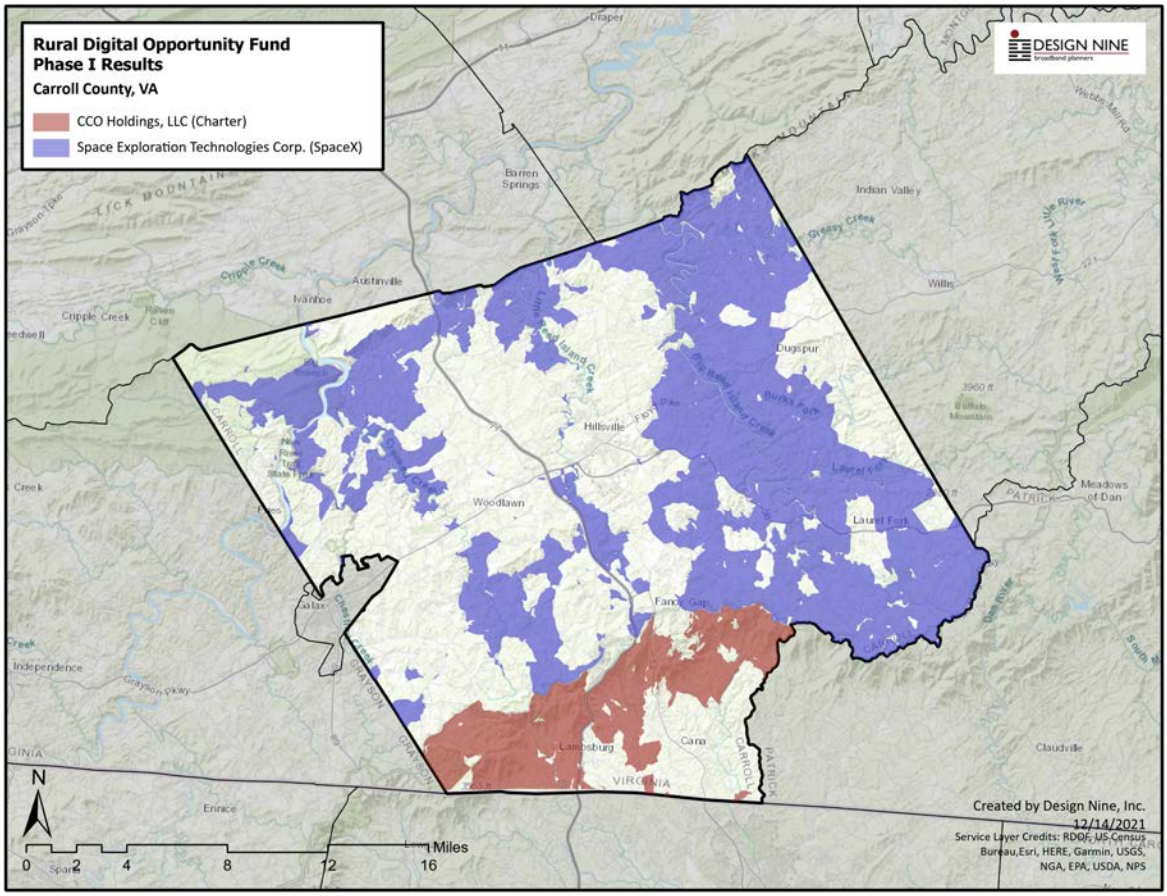


3.7 RDOF AWARDS IN THE COUNTY

The map below shows the recent RDOF (Rural Digital Opportunity Fund) awards made in Carroll County.

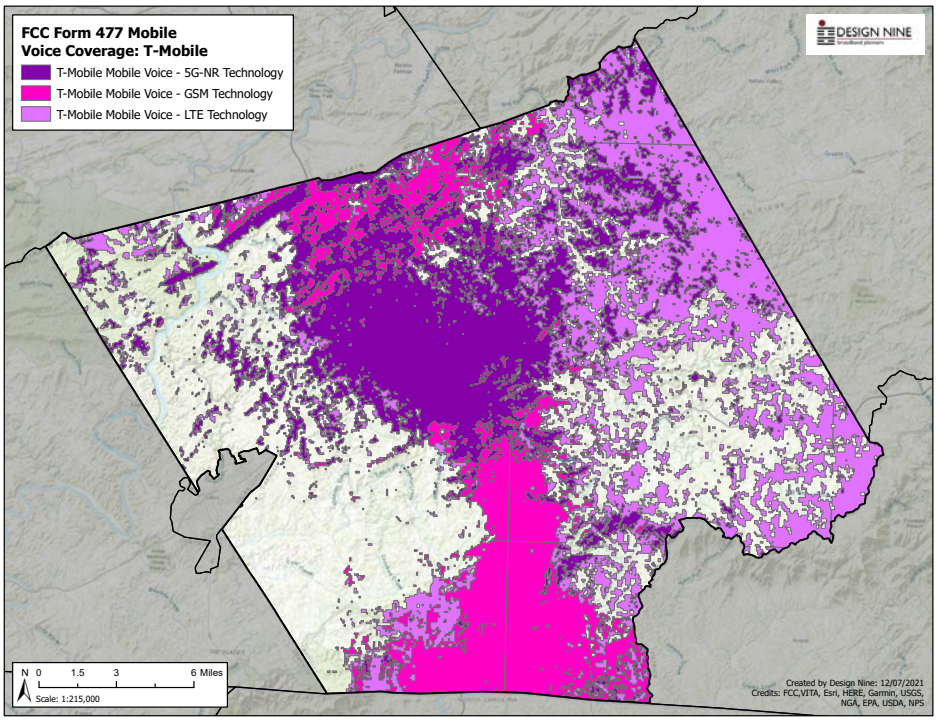
RDOF awards are made over a ten year period, with the funds released 10% at a time each year. Once an RDOF award is made for a particular area, no further RDOF funds will be awarded in that area for ten years. The long timeline for RDOF expenditures means that some areas that are included in the award may not receive upgraded service for nearly a decade.

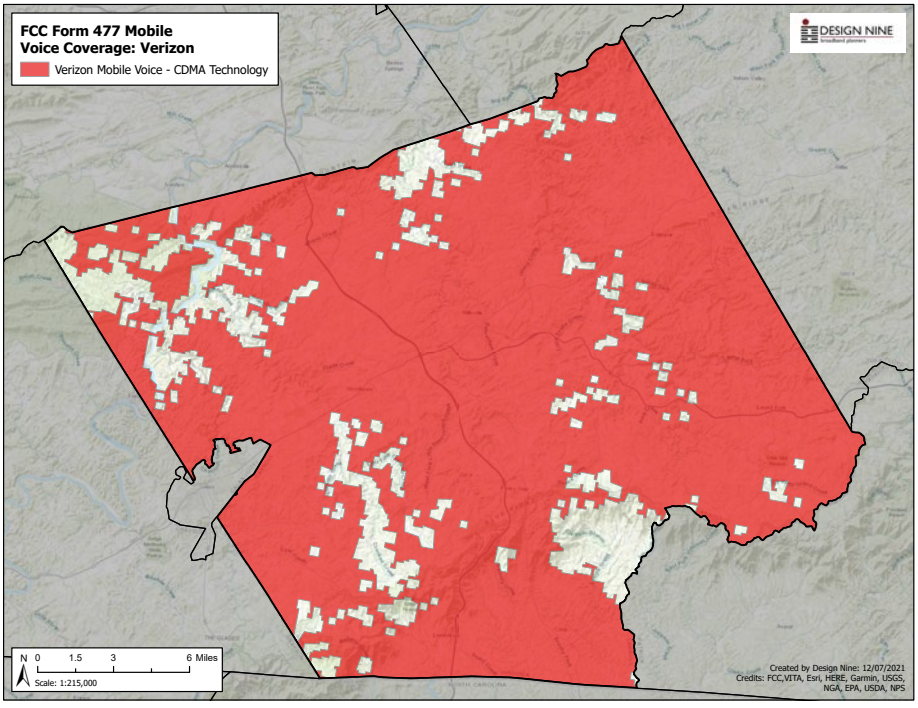
While SpaceX was awarded large parts of the county for its Starlink system, it should be noted that this is low earth orbit (LEO) Internet, and is not a terrestrial network. Starlink customers have to have a small satellite disk installed to receive the service. Reports from beta testers of the Starlink service have been generally positive, and the service is substantially better than the traditional geosynchronous satellite Internet that has been available for many years. For remote rural customers that have long driveways and/or are in remote areas of the county, Starlink can provide much improved broadband Internet access.

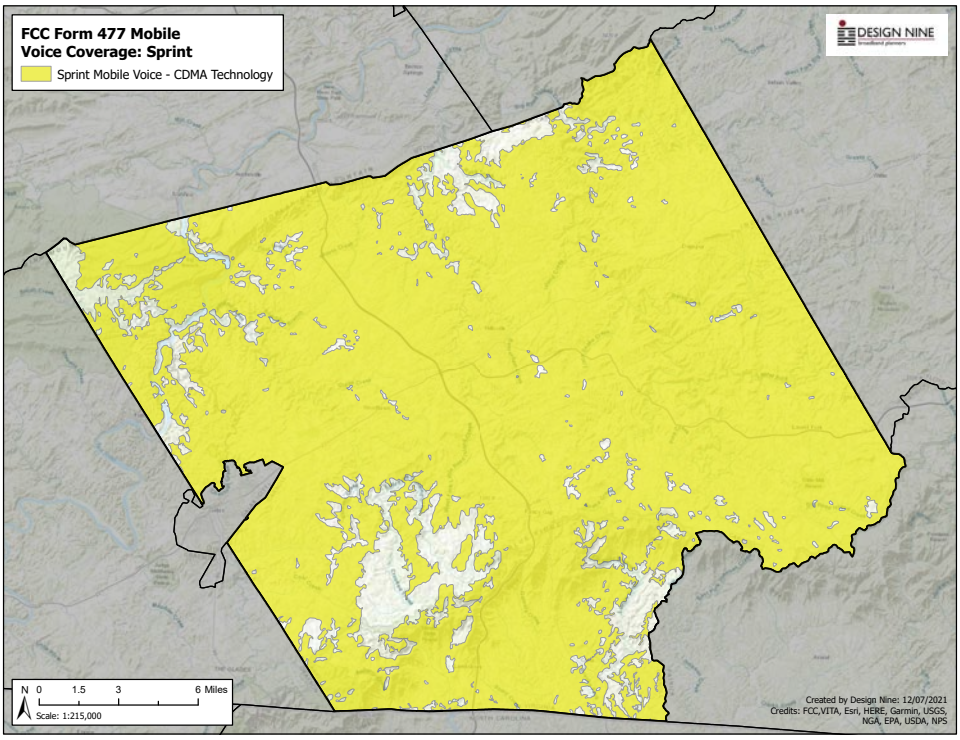


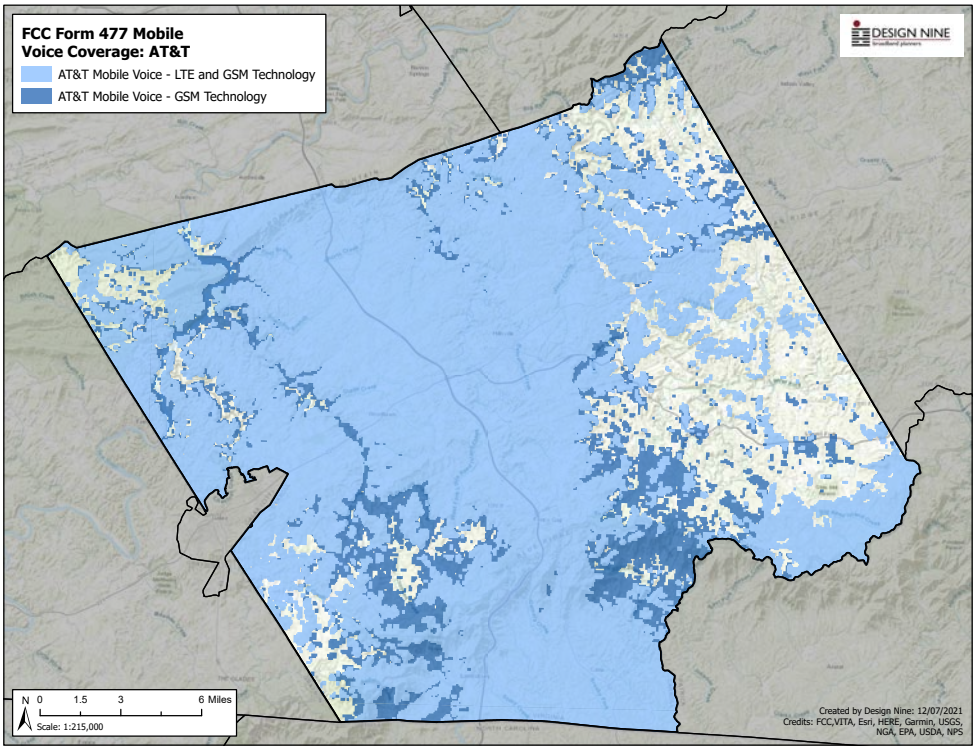
3.7 CELLULAR COVERAGE IN THE COUNTY

The maps below and on the following pages show the cellular voice and data coverage in the county from the four largest providers. The data is taken from the FCC, and the cellular providers self report their coverage– which is often optimistic, especially in rural areas of the county. Cellular data coverage is nearly identical to the voice coverage.






FCC Form 477 Mobile
Voice Coverage: Sprint
Sprint Mobile Voice - CDMA Technology
DESIGN NINE
N 0 1.5 3 6 Miles
Scale: 1:215,000
Created by Design Nine: 12/07/2021
Credits: FCC,VITA, Esri, HERE, Garmin, USGS,
NGA, EPA, USDA, NPS


FCC Form 477 Mobile
Voice Coverage: AT&T
AT&T Mobile Voice - LTE and GSM Technology
AT&T Mobile Voice - GSM Technology
DESIGN NINE
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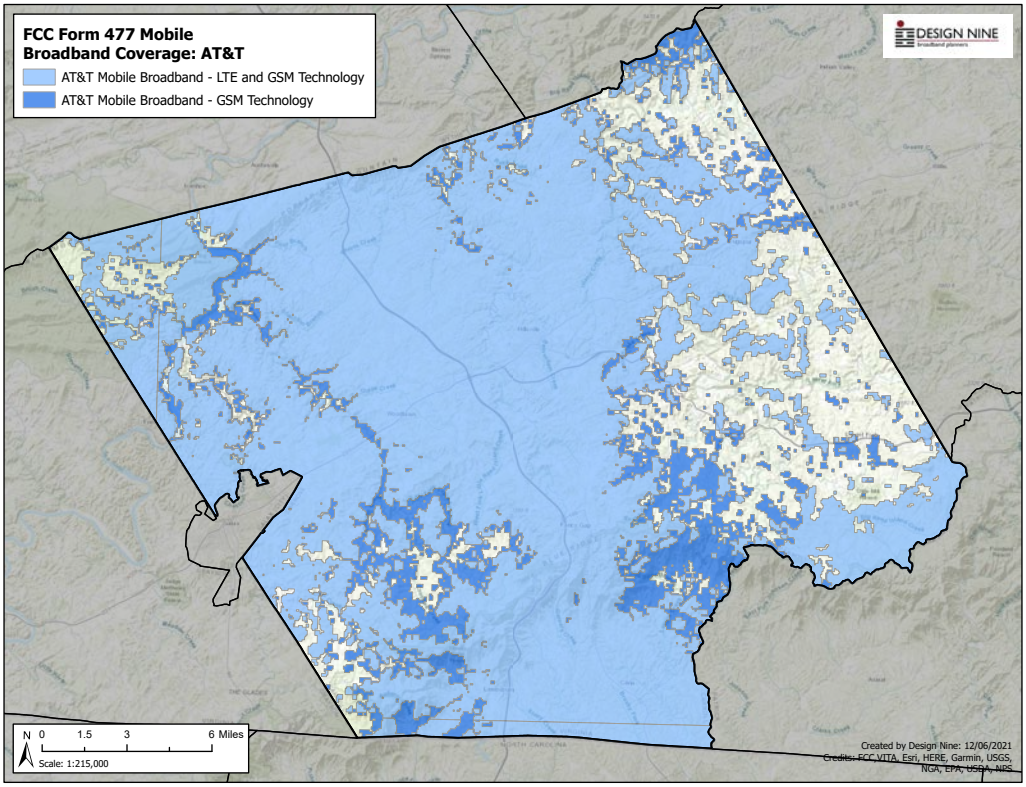
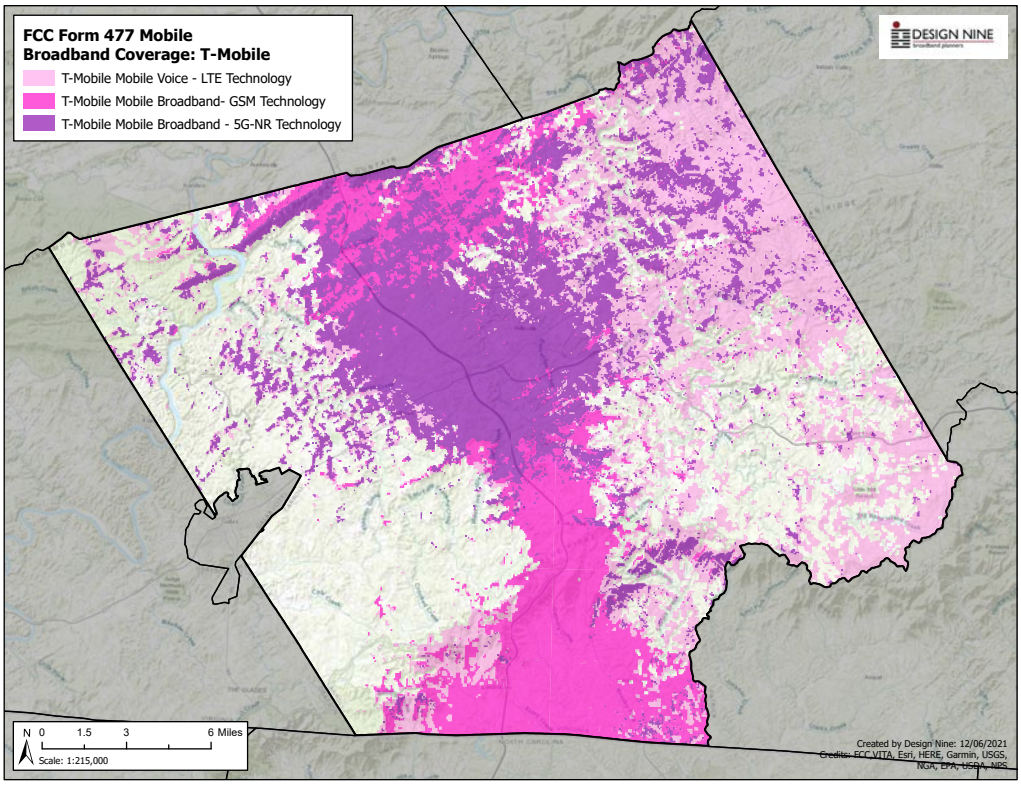
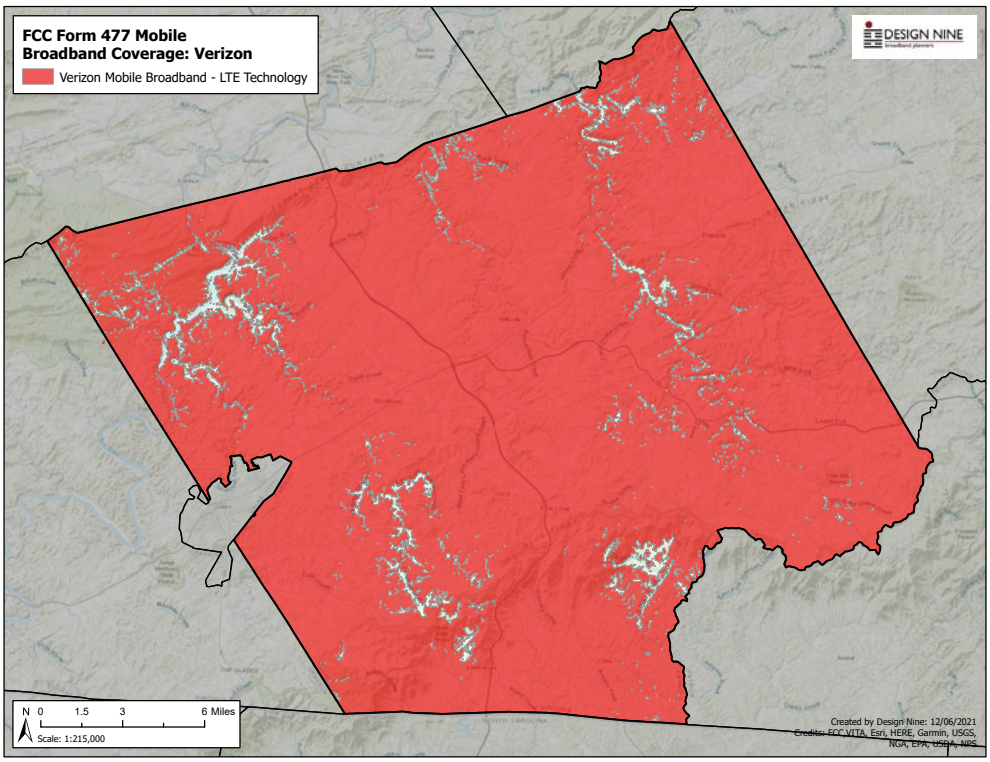
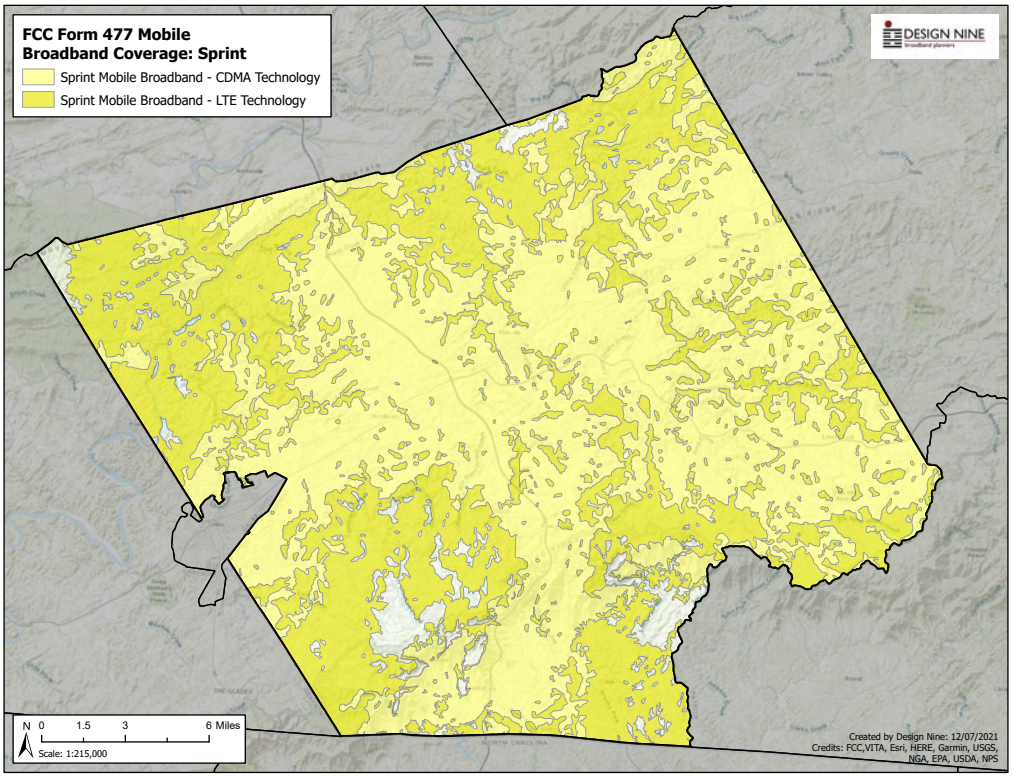
Scale: 1:215,000
Created by Design Nine: 12/07/2021
Credits: FCC,VITA, Esri, HERE, Garmin, USGS,
NGA, EPA, USDA, NPS


FCC Form 477 Mobile
Broadband Coverage: AT&T
AT&T Mobile Broadband - LTE and GSM Technology
AT&T Mobile Broadband - GSM Technology
DESIGN NINE
N 0 1.5 3 6 Miles
Scale: 1:215,000
Created by Design Nine: 12/06/2021
Credits: FCC,VITA, Esri, HERE, Garmin, USGS,
NGA, EPA, USDA, NPS


FCC Form 477 Mobile
Broadband Coverage: T-Mobile
T-Mobile Mobile Voice - LTE Technology
T-Mobile Mobile Broadband- GSM Technology
T-Mobile Mobile Broadband - 5G-NR Technology
DESIGN NINE
N 0 1.5 3 6 Miles
Scale: 1:215,000
Created by Design Nine: 12/06/2021
Credits: FCC,VITA, Esri, HERE, Garmin, USGS,
NGA, EPA, USDA, NPS


FCC Form 477 Mobile
Broadband Coverage: Verizon
Verizon Mobile Broadband - LTE Technology
DESIGN NINE
N 0 1.5 3 6 Miles
Scale: 1:215,000
Created by Design Nine: 12/06/2021
Credits: FCC,VITA, Esri, HERE, Garmin, USGS,
NGA, EPA, USDA, NPS


FCC Form 477 Mobile
Broadband Coverage: Sprint
Sprint Mobile Broadband - CDMA Technology
Sprint Mobile Broadband - LTE Technology
DESIGN NINE
N 0 1.5 3 6 Miles
Scale: 1:215,000
Created by Design Nine: 12/07/2021
Credits: FCC,VITA, Esri, HERE, Garmin, USGS,
NGA, EPA, USDA, NPS

4 CURRENT AND FUTURE DEMAND ANALYSIS

4.1 HOW MUCH BROADBAND IS ENOUGH?

Bandwidth needs for the past several years have been growing by an estimated 30% per year and show no sign of slowing.

This means residential and business bandwidth needs are doubling every three years.

As computers and associated hardware (e.g. video cameras, audio equipment, and VoIP phones) become more powerful and less expensive, new applications and services are continually emerging that drive demand for more bandwidth.

"Next generation" is the term used to describe future planning for network connectivity and infrastructure. Next-generation broadband reaps substantial benefits. There are several key benefits of Next-generation broadband:

- Dramatically faster file transfer speeds for both uploads and downloads.
- The ability to transmit streaming video, transforming the Internet into a more visual medium.
- The means to engage in true-real time collaboration.
- The ability to use many applications simultaneously.
- The ability to maintain flexible work schedules by being able to work from home on a part-time or full-time basis.
- The ability to obtain health-related services for an occasional illness and/or long term medical services for chronic illnesses.

Clearly, consumers have a strong interest in a visual medium from when and wherever they are. YouTube is the second most popular search engine after Google, which demonstrates the need to support the infrastructure to transmit streaming video. In addition to video streaming, true real-time collaboration also provides an effective way for people to interact from wherever they are. People can engage in a two-way real-time collaboration so that fruitful, visual conversations can be held between friends, family, business associates from the state, country, or internationally.

Because of fiber networks, employees have the capability of working from home. Findings suggest that if all Americans had fiber to the home, this would lead to a 5% reduction in gasoline use, a 4% reduction in carbon dioxide emissions, $5 billion in lower road expenditures, and 1.5 billion commute hours recaptured.

In Carroll County today, many residents and businesses are still relying on copper-based services. The bandwidth tables on the following pages show what is likely to be needed over the the next several years in terms of bandwidth. The existing copper infrastructure is going to become a limiting factor in economic development.

4.2 JOB AND WORKFORCE CHALLENGES

There are many areas and communities in the county that can be attractive to an emerging new group of businesspeople and entrepreneurs that typically are well-educated, own their own

businesses or work for large global corporations, and are making choices about where they lived based on family needs and interests rather than business interests.

This new breed of entrepreneurs and workers places a high value on the kinds of amenities that contribute to a good quality of life, such as traditional neighborhoods, vibrant downtown areas, a wide range of cultural and recreation opportunities, good schools, and a sense of place.

These businesspeople and their families make relocation decisions based on quality of life only where there is abundant and affordable broadband, because broadband enables this new approach to personal and work life.Most residents and businesses in Carroll County currently have, at best, Internet service that meets the FCC definition of "fully served," which is 25 Megabits down/ 3 Megabits up bandwidth. Some more recent grant programs are finally pushing higher speeds, with 100 Mbps down, 20 Mbps up as a more realistic target.

However, what has become painfully clear during the Covid pandemic is that this definition of "fully served" is not adequate to support many kinds of work from home activities. During the Covid lockdown, it was common to have both spouses trying to work from home while K12 and/or college age children were also trying to use video-heavy distance learning resources.

When home-based workers need to connect to a corporate VPN (Virtual Private Network), bandwidth requirements can increase even more. Work from home and business from home activities should have, at a minimum, a symmetric service of at least 10 Megabits download and 10 Megabits upload speeds. Higher speed service could include service levels like 25 Megabits down/10 Megabits up. The critical requirement is an upload speed that supports work from home.

If the goal is to enhance business access to broadband, there can be no upper limit on the definition of broadband. Saying that broadband (as an example) is 5 Megabits/second of bandwidth or 10 Megabits/second is to tell the residents and businesses in the county that there will be limits on their work and job opportunities.

Broadband is a community and economic development issue, not a technology issue. The essential question is not, "What system should we buy?" or "Is 5G wireless better or cheaper than fiber?" Instead, the question is:

"What do businesses of and home-based workers of Carroll County need to be able to compete globally over the next thirty years?"

In short, the county today has "little broadband" in the form of DSL limited cable modem service, along with a very limited amount of "big broadband" in the form of fiber to some businesses and residents. If the county makes investments in broadband and telecommunications infrastructure, it is absolutely critical that those investments are able to scale gracefully to meet business and economic development needs for decades. To close that gap between the FCC definitions and what the county needs to support future work opportunities and to support K12 and higher education school work, the county needs the following:

Broadband Services, Technologies, and Needs

BROADBAND SERVICE	TARGET DATE	TECHNOLOGY	WHERE NEEDED
25 Mbps download 3 Mbps upload	2022	Wireless	As much of the county as possible, given funding constraints
25 Mbps download 10 Mbps upload	2023	Wireless	In many locations in the county
1 Gbps download 1 Gbps upload	2023	Fiber	In some business and commercial areas
100 Mbps download 20 Mbps upload	2023	Fiber	In many locations in the county
100 Mbps download 100 Mbps upload	2024	Fiber	Available to a minimum of 50% of residents and businesses in the county

Two key concepts that should drive Carroll County public/private partnerships and infrastructure investments in telecom are:

"Broadband" is not the Internet

Bandwidth is not a fixed number

Broadband and "the Internet" are often used interchangeably, but this has led to much confusion. Broadband refers to a delivery system, while "the Internet" is just one of many services that can be carried on a broadband network. The challenge for the County is to ensure that businesses and homes have a broadband network with sufficient bandwidth to deliver all the services that will be needed and expected within the next three to four years, including but not limited to "the Internet."

The economic impact can include the following effects:

- Difficulty retaining some existing businesses. As business bandwidth needs continue to increase over the next several years, some businesses may need to move out of the area to ensure that they have the right bandwidth to support their business operations.
- Difficulty attracting new businesses. New businesses interested in some of the advantages of the county, like low cost of living, good recreational opportunities, and good workforce ethic, may be deterred by the cost and limited bandwidth available, and therefore choose other areas to locate.
- Difficulty keeping younger workers and families in the county. Younger workers and families tend to be heavy users of Internet services, and real-estate agents are reporting that younger house buyers are reluctant to live in areas with poor Internet service. **Note that a significant percentage of respondents to the residential survey (43%) indicated that Internet availability or lack of it was affecting where they choose to live.**
- Reductions in real estate value. Homes with poor Internet service are more difficult to sell, leading to lower prices, negatively impacting county income from property taxes.

4.3 BUSINESS BANDWIDTH NEEDS

The table below shows bandwidth consumption for several types of businesses and a projection of the bandwidth needed 5 and 10 years out. The Covid pandemic has had the effect of dramatically increasing the number of home-based works and has also affected business travel decisions. More and more businesses will invest in high definition (HD) quality business videoconference systems to reduce the need for travel and to maintain high quality communications with a dispersed workforce. These HD systems require substantial bandwidth; a two-way HD video conference requires 20-25 Mbps during the conference, and a three-way conference requires 30-35 Mbps during the conference.

Business Bandwidth Needs

	LARGE BUSINESS		SMALL BUSINESS		HOME BASED WORKER	
DESCRIPTION	A larger business with about 50 workstations.		A small business with 10 to 15 employees, and 7-10 workstations.		One or two people working from home.	
	Concurrent Use	Mbps	Concurrent Use	Mbps	Concurrent Use	Mbps
Telephone	20	5	5	1.5	2	0.5
Credit Card Validation	4	4	1	1		0
Security System	1	5	1	2	2	2
Internet	50	500	7	10.5	2	20
VPN Connection	20	100	5	50	2	5
Data Backup	5	7.5	1	10	2	10
Web Hosting	1	2		0		0
Workforce Training (online classes)	5	20	1	10	2	10
HD Video-conferencing	20	125	2	20	2	10
Totals		**768.5**		**105.0**		**57.5**
5 YEARS FROM NOW	3-10 Gbps		250-500 Mbps		100-200 Mbps	
10 YEARS FROM NOW	10 + Gbps		2-4 Gbps		500-750 Mbps	

As more workers are moved to home-based offices, the business location must provide network access (Virtual Private Network (VPN)) to employees working from home. These home-based workers will make extensive use of videoconferencing to attend routine office meetings remotely and to enhance communications with co-workers, including videoconferences with other home-based workers in the company. A VPN network providing remote access to just two or three home-based employees could require 50 Mbps of bandwidth during normal work hours.

4.4 RESIDENTIAL BANDWIDTH NEEDS

The table below depicts the bandwidth needed for typical residential services which are available now or will be available in the near future. The Covid pandemic has illustrated the shortcomings of cable Internet services, in which the upload and download speeds are highly asymmetric.

For home-based workers, upload speeds need to be equal to or nearly equal to download speeds. Current cable Internet systems are not able to deliver symmetric or near symmetric service. Today's shared networks (cable and wireless in particular) rely on the "bursty" nature of traffic to provide services to end users. If all end users were consuming their advertised maximum bandwidth, today's cable and DSL networks would grind to a halt.

Residential Bandwidth Needs

	RESIDENTIAL DAYTIME		EARLY EVENING		EVENING & LATE NIGHT	
DESCRIPTION	Work from home, K12 distance learning and home schooling, telemedicine, streaming video		Increased Internet use as children arrive home from school and employees from work.		Peak television and Internet use. Multiple TV's are on, phone and computer being used.	
	Concurrent Use	Mbps	Concurrent Use	Mbps	Concurrent Use	Mbps
Telephone	1	0.25	1	0.25	1	0.25
Work From Home	1	10	1	10	1	10
HD TV	1	4	2	8	2	8
Security System	1	2	1	2	1	2
Internet	1	1.5	1	1.5	2	3
Online Gaming	0	0.25	1	5	2	10
VPN Connection	0	0	1	2	1	2
Data Backup		0	1	5	1	5
Telehealth	1	4	1	4	1	4
Distance Learning/ home schooling		0	1	10	1	10
Videoconferencing		0		0		0
Average needed bandwidth		**15-25**		**25-35**		**20-35**
Five years from now	50-75 Mbps		60-90 Mbps		50-100 Mbps	
Ten years from now	150-300 Mbps		200-350 Mbps		175-250 Mbps	

Existing cable modem network users are overwhelming the digital cable networks that were upgraded as little as three or four years ago, and the firms have had to artificially reduce the bandwidth available for certain kinds of high bandwidth services (e.g. peer to peer file sharing). Some cable providers have even run into capacity issues with the TV portion of their networks, and some consumers have observed that some HD TV channels have been so highly compressed that picture quality has been noticeably degraded.

4.5 CURRENT AND FUTURE USES AND SERVICES

When analyzing future service needs, it is important to take into account ALL services that may be delivered over a broadband connection. Broadband is not a service – it is a delivery medium. Using roads as an analogy, broadband is the road, not the trucks that use the road. Internet access is a service delivered by a broadband "road," and that Internet service is just one of many services that are in demand. Today, congestion on broadband networks is not due just to increased use of email and Web surfing, but many other services.

This means that current DSL, wireless, and cable modem services are completely inadequate for future needs. Current DSL offerings are in the range of one Mbps to three Mbps for most residential users, three Mbps to five Mbps for business DSL users, and there are severe distance limitations on DSL. Higher bandwidth is possible, but as the DSL bandwidth goes up, the distance it can be delivered goes down.

Typical wireless broadband (not cellular data service) offerings are in the range of 5 Mbps to 10 Mbps. Some wireless providers are rolling out 10-20 Mbps services. As bandwidth increases, the cost of the equipment also increases, and even a 20 Mbps service is well short of the FCC definition of broadband: 25 Mbps down and 3 Mbps up.

Across the U.S., current average bandwidth for cable modem services is typically 10 to 25 Mbps, with cable companies promising much more using the phrase "up to..." to obscure actual bandwidth being delivered.

The challenge for the area is to ensure that the businesses, residents, and institutions have a telecommunications infrastructure in place that will meet future needs.

Distance learning, entertainment, and video conferencing are three major applications of internet video. Distance learning from home with live video feeds requires high-performance two to five Mbps connections in the near term, the next two to four years. Over the next four to seven years, there will be many distance-learning courses that will incorporate live HD two-way video feeds, enabling students to participate in classroom discussions at a much higher quality level. Distance learning could be an important home-based application for workforce training and retraining.

U.S. homes now have more than half a billion devices connected to the Internet, according to a study by the NPD Group. Furthermore, the average number of connected devices per household is 10 and growing rapidly. This is more than three times the average number of people per household.

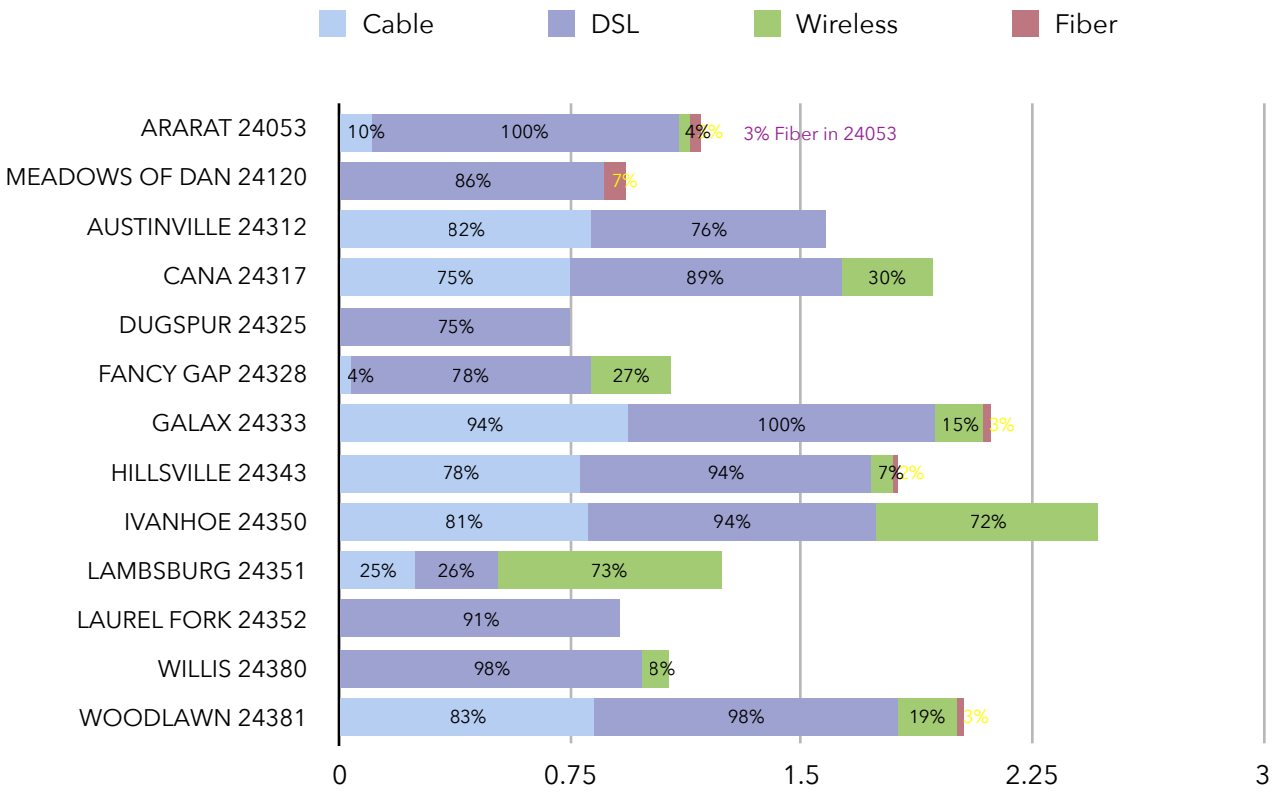
5. SERVICE PROVIDER ANALYSIS

In In a February 2021, Consumer Reports Survey, 75% of Americans said they need uninterrupted access to the Internet seven days a week[1]. The following information shows citizens get Internet service and how much they pay for it.

Nationally, Consumer Reports found in their Summer 2021 Broadband Survey, "Fifteen percent of American households only have access to the internet through their smartphone data plan and one in 20 use DSL or dial-up to access the internet. Three percent of Americans say their household does not have access to the internet."[2] Our chart shows estimates of available broadband technology types in Carroll County

Our data is assembled from public sources, Decision Data which combines FCC data and data from social media and Broadband Now. Zip code boundaries are not aligned with local government jurisdictions, and some zip code data may include areas outside the county. The information in these charts is current as of August 2021.

Estimates of available broadband technology type in the county

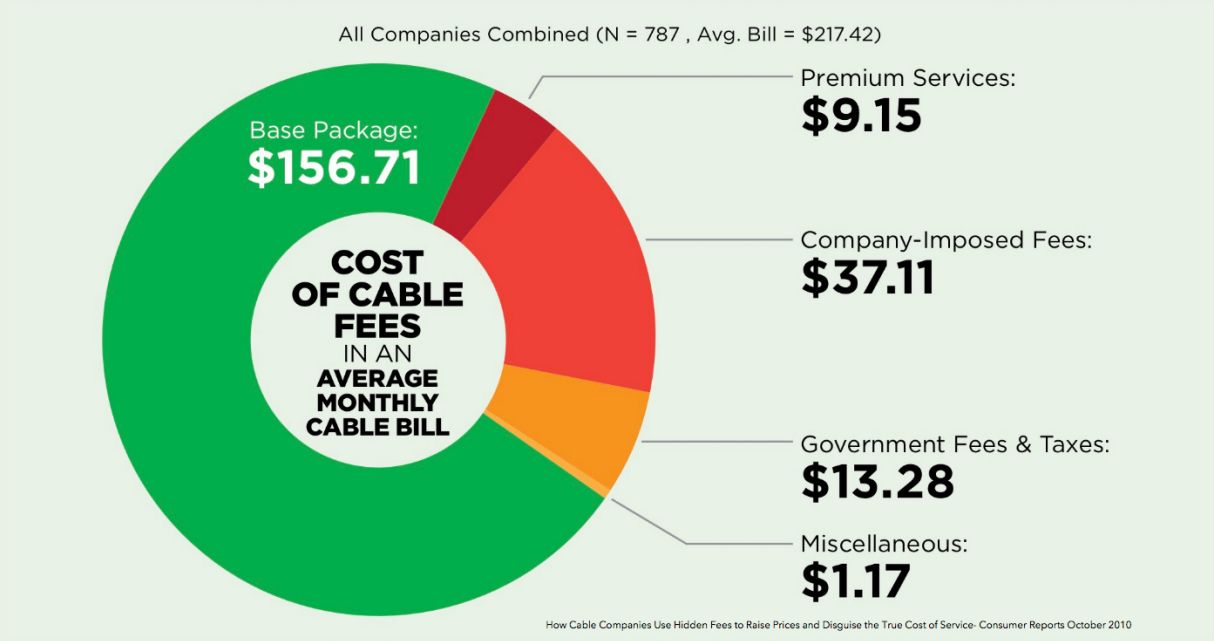


[1] Consumer Reports- Research Snapshot February 2021, The Importance of Broadband Internet

[2] Broadband Survey, Consumer Reports, July 2021

Percentages of customers receiving different kinds of service can change. Our pricing information includes all the service providers that have been discovered with services to 1% or more residents living in zip codes with at least 5% or more of their population in Carroll County. Lumos Fiber has

Figure A: Cost of Cable Fees in an Average Monthly Cable Bill (2018)



the lowest availability in Carroll County at 1.03% in zip code 24333.

According to a 2019 Consumer Reports study[3], the national average advertised price for standard triple play services of Internet, television, and telephone across the country is $156.17. Because of fees and taxes, the actual national average bill is $217.42. Nationally, consumers get an average of 24% added to their bill. Data caps which were turned off early in the pandemic are back[4] and will increase prices for heavy users. Hidden fees are spreading across many broadband services.

It has become normal to find a statement such as this in fine print terms and conditions, "Equipment, installation, taxes and fees, including regulatory recovery fees, Broadcast TV Fee (up to $19.45/mo.), Regional Sports Fee (up to $14.45/mo.) and other applicable charges extra, and subject to change during and after the term agreement."[5] The Broadcast TV Fee was $14.95 six months ago. The Regional Sports Fee was $8.75 per month at the same time.

"Nearly half (47 percent) of U.S. TV viewers state they do not subscribe to "traditional cable," and among those that do, 44 percent are planning to drop cable or cut back on services over the next

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[3] Cord Cutting Continues, Fueled By High Cable Pricing, Consumer Reports' Survey Finds 9/17/2019

[4] Consumer Reports -Get Ready for Cable TV and Internet Price Hikes and Data Caps in the New Year 12/21/20

[5] Xfinity terms and conditions- Carroll County, VA, 8/24/21

year. Of the viewers who have already cut the cord, more than half (59 percent) claim that they are unlikely to go back."[6]

The table below illustrates the estimated telecom expenditures, public and private, over the next thirty years. Over that time period, **nearly $900M** will be spent on telecom services. This shows that there is money for broadband, but most of it is placed in envelopes every month and much of it leaves both the county and the state. Redirecting as little as 5% of those funds could build fiber to every home and business in Carroll County.

Telecom Expenditures - Carroll County, VA

Total Households	12,357			
Businesses	409			
Estimated Internet Access Type	Households using Cell Phone for Internet	Households with "little" broadband DSL	Households with Cable Modems	Households with no Internet
Household Percentage	9%	42%	32%	17%
Number of households	1,112	5,190	3,954	2,101
Average monthly telecom expenditures	Cell Phone for Voice/Internet $90 Cable/satellite TV: $65 bundle	Cell Phone $70 Phone: $13 Satellite TV: $60 Broadband Internet: $45	Cell Phone $70 Phone $15 TV $43 Broadband Internet $45	Cell Phone, no Internet, $70 Cable/satellite TV: $65
Monthly Cost of Services	$155	$188	$173	$135
Annual household cost	$1,860	$2,256	$2,076	$1,620
Annual cost all households	$2,068,562	$11,708,505	$8,209,002	$3,403,118
30 year expenditure	$62,056,854	$351,255,139	$246,270,067	$102,093,534
Total residential expenditures	$761,675,594			
Total Estimated Cost of Hidden Fees	$112,286,873			
Total Business Costs	$25,398,900			
Total expenditures	**$899,361,367**			

[6] The Future of TV, The Trade Desk, June 2021

5.1 LOCAL PRICING DATA

This information provides pricing data and services available from providers in Carroll County. Prices, availability and promotional offers change frequently and sometimes vary depending on street address. Information was compiled using a variety of public sources and Internet Service Provider (ISP) websites including Decision Data which combines FCC data and data they collect from social media and Broadband Now. Exact availability requires customer names and specific street addresses. Internet Service Providers showing less than 1% coverage or ones that cannot be verified are not shown in the following data.

Summary of Service Provider Data - Carroll County, VA

	Least Expensive Internet Only Service	Least Expensive Internet Only Service Meeting 25/3	Least Expensive Triple Pay Package Meeting 25/3
CenturyLink DSL	$50	N/A	N/A
Citizen's Telephone DSL	$55.05	$79.95	N/A
Citizen's Telephone Cable	$39.95	$79.95	$158.05
Spectrum Cable	$67.99	$67.99	$137.97
Xfinity Cable	$50	$50	$116
Citizen's Telephone Cooperative Fiber	$49.95	$49.95	$128.05
Wired Road-Lingo Fiber	$59.99	$59.99	$124.98
Lumos Fiber	$59.99	$59.99	$136.49
Wired Road-1 Point Communications Fiber	$54.95	$54.95	N/A
All Points Wireless	No pricing available		
Wired Road- Lingo Networks Wireless	$49.95	$69.95	N/A
FastLink Wireless	$39.99	$99.99	N/A
Wired Road- 1-Point Wireless	$29.95	$49.95	N/A
HughesNet	$59.99	$59.99	N/A
Viasat	$84.99	$119.99	N/A
Starlink	$99	$99	N/A

All the information available at the time of the report is included in this table. If a table cell has no information, that information was not found. However, if there is no information in the "One-time Fees," it does not necessarily mean there are no one-time fees. It just means that information on the one-time fees could not be found on the company's public website.

NOTE: Many ISPs do not provide upload speeds. This table indicates that no upload speed was discoverable by the abbreviation 'NA' (Not Available).

Wireline Internet service provider comparison for Carroll County, VA

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Services & Incentives
CenturyLink Pricing disclosure	For all speeds up to 100 Mbps with Price For Life Rate requires paperless billing. Additional taxes, fees, and surcharges apply. Get the fastest internet s						
	CenturyLink provided modem may be required for Internet; lease (up to $15/mo. fee + tax) or one-time purchase option (up to $200 + tax). Self-installation, if available at customer's location, may b selected. Tech installation fee (up to $125) may apply, if selected by customer or is required due to network technology at customer location. If install requires copper bury or aerial delivery, a one-time will apply ($300 for bury; $150 for aerial); fee could be higher after property assessment, but custom will be advised prior to install.						
CenturyLink	$50	Price for life No Contract	See Note above	1.5/0.5	None		Prepaid Internet Only-Paperless billing
CenturyLink	$50	Price for life No Contract	See Note above	1.5/NA	None		Postpaid Internet Only-Paperless billing
Citizen's Telephone Cooperative DSL	$55.05			1.5/NA	None		Internet Only
Citizen's Telephone Cooperative DSL	$75.05			3.0/NA	None		Internet Only
Citizen's Telephone Cooperative DSL	$95.05			6.0/NA	None		Internet Only
Citizen's Telephone Cooperative Cable	$39.95			10/NA	None		Internet Only Free modem & Installation

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Services & Incentives
Citizen's Telephone Cooperative Cable	$59.95			25/NA	None		Internet Only Free modem & Installation
Citizen's Telephone Cooperative Cable	$79.95			50/NA	None		Internet Only Free modem & Installation
Citizen's Telephone Cooperative Cable	$158.05			50/NA	None		Internet, TV- 23 Channels, and Phone with unlimited Local & Long Distance
Citizen's Telephone Cooperative Cable	$198.05			50/NA	None		Internet, TV- 65 Channels (Analog), and Phone with unlimited Local & Long Distance
Citizen's Telephone Cooperative Cable	$208.05			50/NA	None		Internet, TV- 180 Channels, and Phone with unlimited Local & Long Distance
Citizen's Telephone Cooperative Cable	$218.05			50/NA	None		Internet, TV- 200 Channels, and Phone with unlimited Local & Long Distance
	Spectrum is including $50 Emergency Broadband benefit as their promo pricing with inco restrictions until money runs out						
Spectrum Cable	$67.99	$17.99		30/NA	None		Internet only- free activation and modem
Spectrum Cable	$79.99	$29.99, two year		50/NA	None		Internet only- free activation and modem
Spectrum Cable	$99.99	$49.99 one year		200/NA	None		Internet only- free activation and modem
Spectrum Cable	$119.99	$69.99 one year		400/NA	None		Internet only- free activation and modem
Spectrum Cable	$137.97	$87.97 one year for TV, two for Internet		50/NA	None		Internet, 125+ TV Channels, Unlimited Calling to most of the world

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Services & Incentives
Spectrum Cable	$167.97	$117.97 one year for TV, two for Internet		50/NA	None		Internet, 175+ TV Channels, Unlimited Calling to most of the world
Spectrum Cable	$187.97	$137.97 one year for TV, two for Internet		50/NA	None		Internet, 125+ TV Channels, Unlimited Calling to most of the world
All Spectrum TV services include a statement similar to this	Spectrum Internet® 50 + Spectrum Voice®: Spectrum TV® Select standard rates apply after yr 1. Spectrum Internet® 50 standard rates apply after yr 2. Spectrum Voice® standard rates apply. Taxes, fees and broadcast surcharge up to $17.99/mo extra and subject to change during & after the promotional period; installation/network activation, equipment and additional services are extra.						
Xfinity	$50	One year contract Year One $20 Year Two $46 with paperless & auto pay	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	50/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet Only $26 monthly discount for twelve months. $10 discount for enrolling in paperless and automatic billing

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Services & Incentives
Xfinity	$76	One year contract Year One $40 Year Two $66 with paperless & auto pay	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	100/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet Only $26 monthly discount for twelve months. $10 discount for enrolling in paperless and automatic billing
Xfinity	$86	One year contract Year One $50 Year Two $76 with paperless & auto pay	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	200/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet Only $26 monthly discount for twelve months. $10 discount for enrolling in paperless and automatic billing
Xfinity	$96	One year contract Year One $50 Year Two $76 with paperless & auto pay	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	400/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet Only $36 monthly discount for twelve months. $10 discount for enrolling in paperless and automatic billing $50 Visa Prepaid Card

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Services & Incentives
Xfinity	$106	One year contract Year One $60 Year Two $76 with paperless & auto pay	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	800/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet Only $36 monthly discount for twelve months. $10 discount for enrolling in paperless and automatic billing $75 Visa Prepaid Card
Xfinity	$116	One year contract Year One $70 Year Two $106 with paperless & auto pay	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	1200/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet Only $36 monthly discount for twelve months. $10 discount for enrolling in paperless and automatic billing $100 Visa Prepaid Card
Xfinity	$116	One year contract Year One $50 Year Two $66 with paperless, auto pay & multi-product discount	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	50/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet , Basic TV 10+ Channels, and Xfinity Voice $10 promo discount $40 multi-product discount $10 Auto-pay discount

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Services & Incentives
Xfinity	$136	One year contract Year One $60 Year Two $86 with paperless, auto pay & multi-product discount	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	100/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet , Basic TV 10+ Channels, and Xfinity Voice Internet , Basic TV 10+ Channels, and Xfinity Voice $26 promo discount $40 multi-product discount $10 Auto-pay discount
Xfinity	$186	Two year contract Year 1-2 $90 Year 3 $136 with paperless, auto pay & multi-product discount	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	200/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet , Extra TV 125+ Channels, and Xfinity Voice $46 promo discount $40 multi-product discount $10 Auto-pay discount
Xfinity	$196	Two year contract Year 1-2 $90 Year 3 $146 with paperless, auto pay & multi-product discount	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	400/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet , Extra TV 125+ Channels, and Xfinity Voice $56 promo discount $40 multi-product discount $10 Auto-pay discount

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Services & Incentives
Xfinity	$206	Two year contract Year 1-2 $100 Year 3 $156 with paperless, auto pay & multi-product discount	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	800/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet , Extra TV 125+ Channels, and Xfinity Voice $56 promo discount $40 multi-product discount $10 Auto-pay discount
Xfinity	$216	Two year contract Year 1-2 $110 Year 3 $166 with paperless, auto pay & multi-product discount	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	1200/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet , Extra TV 125+ Channels, and Xfinity Voice $56 promo discount $40 multi-product discount $10 Auto-pay discount
Xfinity	$236	Two year contract Year 1-2 $130 Year 3 $186 with paperless, auto pay & multi-product discount	Limited to 3 devices. 1 device included, additional devices $5/ mo. per device . XFi Gateway $14, XFi or XFi Complete $25 monthly includes unlimited data	1200/NA	1.2 TB 50 GB will be added $10 each 50 GB plus tax. Charges will not exceed $100 each month or unlimited for $30/ mo		Internet , Preferred TV 200+ Channels, and Xfinity Voice $56 promo discount $40 multi-product discount $10 Auto-pay discount

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Services & Incentives
	All Xfinity TV Plans include this statement: "Broadcast TV Fee (up to $19.45/mo.), Regional Sports Fee (up to $14.45/mo.) and other applicable charges extra, and subject to change during and after the term agreement."						
Citizen's Telephone Cooperative Fiber	$49.95			1,000/500	150	Internet Only $5 per 50 GB increment	
Citizen's Telephone Cooperative Fiber	$69.95			1,000/500	400	Internet Only $5 per 50 GB increment	
Citizen's Telephone Cooperative Fiber	$89.95			1,000/500	800	Internet Only $5 per 50 GB increment	
Citizen's Telephone Cooperative Fiber	$109.95			1,000/500	1.5 TB	Internet Only $5 per 50 GB increment	
Citizen's Telephone Cooperative Fiber	$129.95			1,000/500	3 TB	Internet Only $5 per 50 GB increment	
Citizen's Telephone Cooperative Fiber	$149.95			1,000/500	6 TB	Internet Only $5 per 50 GB increment	

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Services & Incentives
Citizen's Telephone Cooperative Fiber	$128.05			1,000/500	150	Only $5 per 50 GB increment	Internet, TV- 23 Channels, and Phone with unlimited Local & Long Distance
Citizen's Telephone Cooperative Fiber	$188.05			1,000/500	1.5 TB	Only $5 per 50 GB increment	Internet, TV- 23 Channels (Analog), and Phone with unlimited Local & Long Distance
Citizen's Telephone Cooperative Fiber	$238.05			1,000/500	1.5 TB	Only $5 per 50 GB increment	Internet, TV- 180 Channels, and Phone with unlimited Local & Long Distance
Citizen's Telephone Cooperative Fiber	$258.05			1,000/500	3.0 TB	Only $5 per 50 GB increment	Internet, TV- 180 Channels, and Phone with unlimited Local & Long Distance
Citizen's Telephone Cooperative Fiber	$288.05			1,000/500	6.0 TB	Only $5 per 50 GB increment	Internet, TV- 200 Channels, and Phone with unlimited Local & Long Distance
Lingo Fiber	$59.99			100/20			Internet Only
Lingo Fiber	$69.99			250/40			Internet Only
Lingo Fiber	$99.99			500/40			Internet Only
Lumos Fiber	$145			1,000/50			Internet Only
Wired Road-Lingo Fiber	$124.98	Includes $10 two product discount		100/20			Internet, Basic TV 100+ Channels and Phone with Unlimited LD
Wired Road-Lingo Fiber	$134.98	Includes $10 two product discount		250/40			Internet, Basic TV 100+ Channels and Phone with Unlimited LD
Wired Road-Lingo Fiber	$164.98	Includes $10 two product discount		500/40			Internet, Basic TV 100+ Channels and Phone with Unlimited LD

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Services & Incentives
Wired Road-Lingo Fiber	$209.99	Includes $10 two product discount		1,000/50			Internet, Basic TV 100+ Channels and Phone with Unlimited LD
Wired Road-Lingo Fiber	$134.98	Includes $10 two product discount		100/20			Internet, Premium TV 100+ Channels including movie channels and Phone with Unlimited LD
Wired Road-Lingo Fiber	$219.99	Includes $10 two product discount		1,000/50			Internet, Premium TV 100+ Channels including movie channels and Phone with Unlimited LD
Wired Road-1-Point Fiber	$54.95			25/5			
Wired Road-1-Point Fiber	$99.95			100/10			
Lumos Fiber	$59.99			200/200			Internet Only
Lumos Fiber	$74.99			500/500			Internet Only
Lumos Fiber	$89.99			1000/1000			Internet Only
Lumos Fiber	$136.49			200/200			Internet, TV-32 Channels, Unlimited LD
Lumos Fiber	$151.49			500/500			Internet, TV-32 Channels, Unlimited LD
Lumos Fiber	$166.49			1000/1000			Internet, TV-32 Channels, Basic Phone
Lumos Fiber	$186.49			200/200			Internet, TV-165 Channels, Basic Phone
Lumos Fiber	$201.49			500/500			Internet, TV-165 Channels, Basic Phone
Lumos Fiber	$268.49			1000/1000			Internet, TV-165 Channels, Unlimited LD,WiFi

Provider	Monthly Cost	Promo Rate & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Services & Incentives
1-Point Communications Fiber (via Wired Road network)	Only web info is services starting as low $25.95 per month						

Wireless Internet service provider comparison for Carroll County, VA

Provider	Monthly Cost	Promo & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Incentives & Notes
All Points Broadband Wireless	No web pricing info						Only available I 8.43% of zip 24380
FastLink Coummunications -Wireless	$39.99			3/1		No contract $225 install 1 year contract $150 install	
FastLink Coummunications -Wireless	$59.99			5/1		No contract $225 install 1 year contract $150 install	
FastLink Coummunications -Wireless	$79.99			10/2		No contract $225 install 1 year contract $150 install	
FastLink Coummunications -Wireless	$89.99			15/2		No contract $225 install 1 year contract $150 install	
FastLink Coummunications -Wireless	$99.99			30/3		No contract $225 install 1 year contract $150 install	
Wired Road-Lingo Networks Wireless	$49.95	2-year		10/NA	Unlimited		With 2-year contract $149 install waived

Provider	Monthly Cost	Promo & Contract Length	Other Monthly Fees	Download /Upload Speed (Mbps)	Data Cap (GB/ Month)	One-Time Fees	Incentives & Notes
Wired Road- Lingo Networks Wireless	$59.95	2-year		25/NA	Unlimited		With 2-year contract $149 install waived
Wired Road- Lingo Networks Wireless	$69.95	2-year		50/NA	Unlimited		With 2-year contract $149 install waived
Wired Road- Lingo Networks Wireless	$79.95	2-year		100/NA	Unlimited		With 2-year contract $149 install waived
Wired Road- Lingo Networks Wireless	$52	No Contract		10/NA	Unlimited	$149 Install	
Wired Road- Lingo Networks Wireless	$62	No Contract		25/NA	Unlimited	$149 Install	
Wired Road- Lingo Networks Wireless	$72	No Contract		50/NA	Unlimited	$149 Install	
Wired Road- Lingo Networks Wireless	$82	No Contract		100/NA	Unlimited	$149 Install	
Wired Road- 1- Point Wireless	$29.95			10/1			
Wired Road- 1- Point Wireless	$49.95			25/5			

Satellite Internet service provider comparison for Carroll County, VA

Provider	Monthly Cost	Promo & Contract Length	Other Monthly Fees	Download/Upload Speed (Mbps)	Data Cap (GB/Month)	One-Time Fees
HughesNet	$59.99	$39.99 for first six months. 24 month commitment required. Up to $400 ETF	$14.99 equipment lease it you don't purchase	25/3	After 10 GB (speeds drop to 1-3 Mbps)	Purchase pricing is $249.99 to purchase or $99 lease activation- instant lease savings of $99- limited time $100 prepaid card for

Provider	Monthly Cost	Promo & Contract Length	Other Monthly Fees	Download/Upload Speed (Mbps)	Data Cap (GB/Month)	One-Time Fees
HughesNet	$69.99	$49.99 for first six months. 24 month commitment required. Up to $400 ETF	$14.99 equipment lease it you don't purchase	25/3	After 20 GB (speeds drop to 1-3 Mbps)	Purchase pricing is $249.99 to purchase or $99 lease activation- instant lease savings of $99- limited time $100 prepaid card for
HughesNet	$99.99	$79.99 for first six months. 24 month commitment required. Up to $400 ETF	$14.99 equipment lease it you don't purchase	25/3	After 30 GB (speeds drop to 1-3 Mbps)	Purchase pricing is $249.99 to purchase or $99 lease activation- instant lease savings of $99- limited time $ 100 prepaid card for
HughesNet	$149.99	$129.99 for first six months. 24 month commitment required. Up to $400 ETF	$14.99 equipment lease it you don't purchase	25/3	After 50 GB (speeds drop to 1-3 Mbps)	Purchase pricing is $249.99 to purchase or $99 lease activation- instant lease savings of $99- limited time $100 prepaid card for
Viasat	$84.99	$64.99 for first three months 24 month contract	$12.99/ month (modem)	12/3	40 GB priority data	Setup Fee- Unknown- equipment purchase instead of lease $299.99-Setup Fee- Unknown
Viasat	$119.99	$84.99 for first three months 24 month contract	$12.99/ month (modem)	25/3	60 GB priority data	Setup Fee- Unknown- equipment purchase instead of lease $299.99-Setup Fee- Unknown
Viasat	$169.99	$119.99 for first three months 24 month contract	$12.99/ month (modem)	30/3	100 GB priority data	Setup Fee- Unknown- equipment purchase instead of lease $299.99-Setup Fee- Unknown
Viasat	$249.99	$169.99 for first three months 24 month contract	$12.99/ month (modem)	30/3	100 GB priority data	Setup Fee- Unknown- equipment purchase instead of lease $299.99-Setup Fee- Unknown

Provider	Monthly Cost	Promo & Contract Length	Other Monthly Fees	Download/Upload Speed (Mbps)	Data Cap (GB/Month)	One-Time Fees
Starlink	$99	Carroll County targeted for service in mid to late 2021	Unknown but has $50 shipping cost and $29.10 estimated tax for equipment	100/40	None	$99 Deposit Required $499 for the Starlink Kit, which includes a mounting tripod, a WiFi router, and a terminal to connect to the satellites. Shipping estimate is $50. Taxes are estimated at $40.49

* Starlink service has just gone from beta to standard service but availability is still by address only so Starlink may not be available in all areas. Early reports from beta testers have been generally positive. Reported speed test results vary, but many users are reporting 10 to 50 Megabit download speeds and upload speeds of 5 to 20 Megabits. Some users have seen higher speed test results. Latency is much lower than traditional geostationary satellite services like HughesNet and Viasat, but latency is still much higher than terrestrial fiber Internet connections. If pricing remains similar to what is being charged for early users, Starlink could be a very significant improvement for rural residents and businesses. It is targeted for the Carroll County area in mid to late 2021. However, we are tracking some Southwest Virginia customers who have been waiting over a year for their orders to be fulfilled.

6 CARROLL RESIDENTIAL SURVEY RESULTS

During the summer and fall of 2021, a broadband survey was conducted in Carroll County as part of a county wide study in broadband needs. The online (Web) version of the survey was publicized on social media, the County Web site, and a Postal Service mailing to all households. Residents were encouraged to complete the survey online or fill out and return the paper version by surface mail. Businesses were encouraged to complete a separate business-focused survey, and the results of that are included later in this report.

A total of 1,486 responses were collected in the residential survey—roughly 12% of all households in Carroll County responded to the survey. Not all responders answered every question. Note that because of rounding, not all percentages sum exactly to 100%. Many comments were received and are included in the appendices.

Some of the key findings from the results are listed below.

97% of respondents are interested in faster and more reliable Internet service

75% of residents are "dissatisfied" or "very dissatisfied" with current Internet speeds

98% of respondents said that they believe the County government should help facilitate better broadband

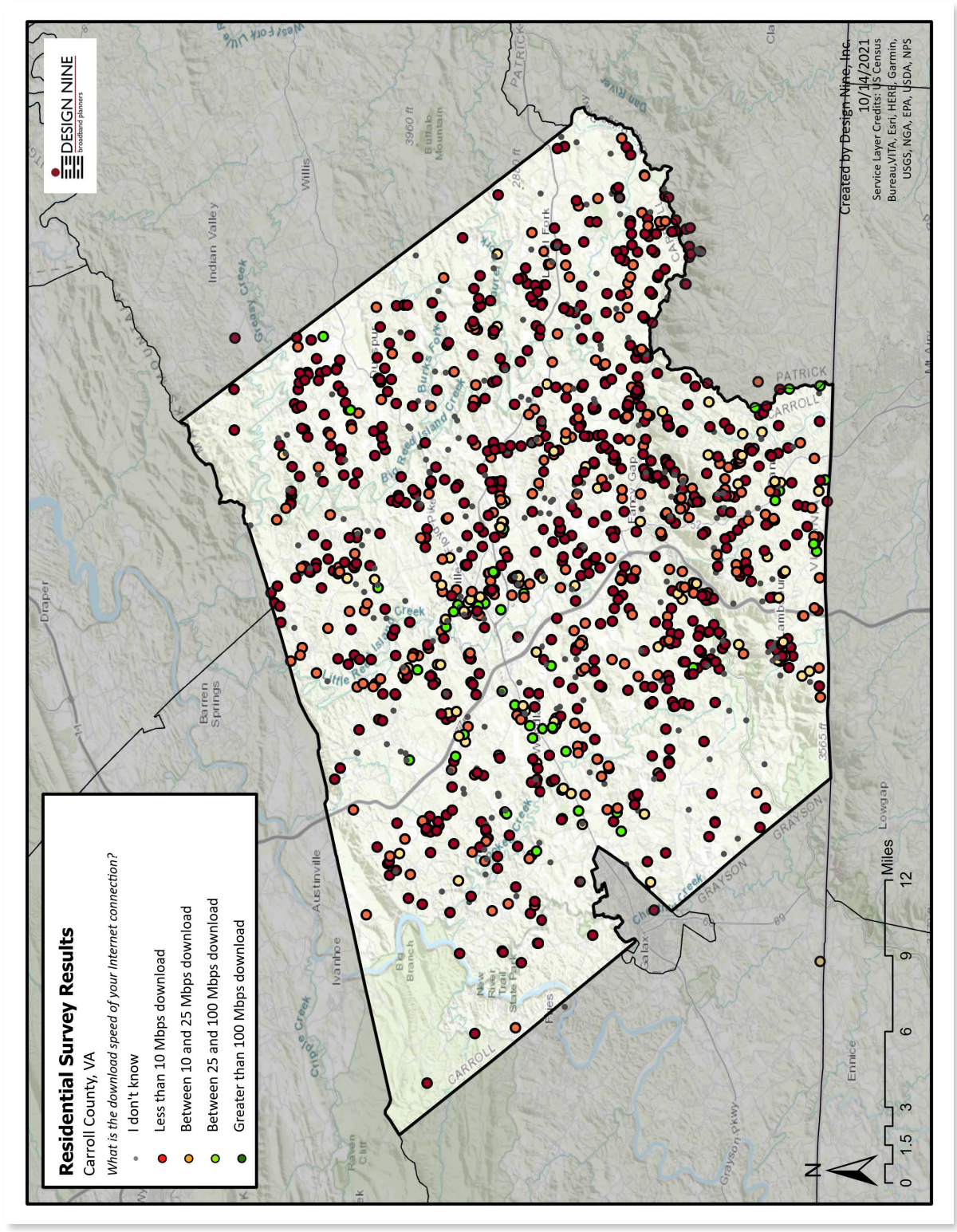
19% of residents have 9 or more Internet-connected devices in their home

89% of respondents report they have trouble using common Internet services

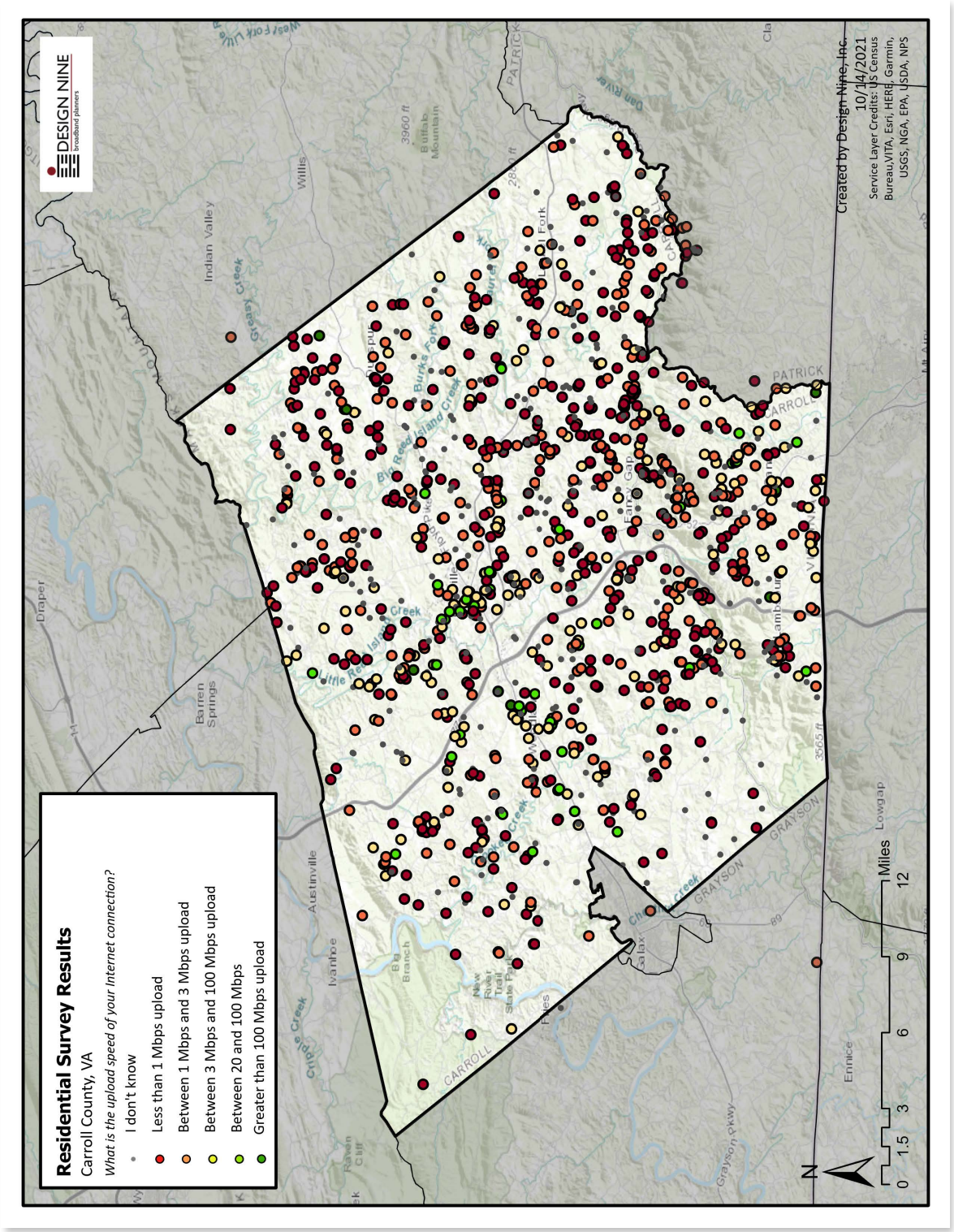
43% indicate that availability of broadband Internet is affecting where they choose to live

6.1 DISTRIBUTION OF RESIDENTIAL SURVEY RESPONSES

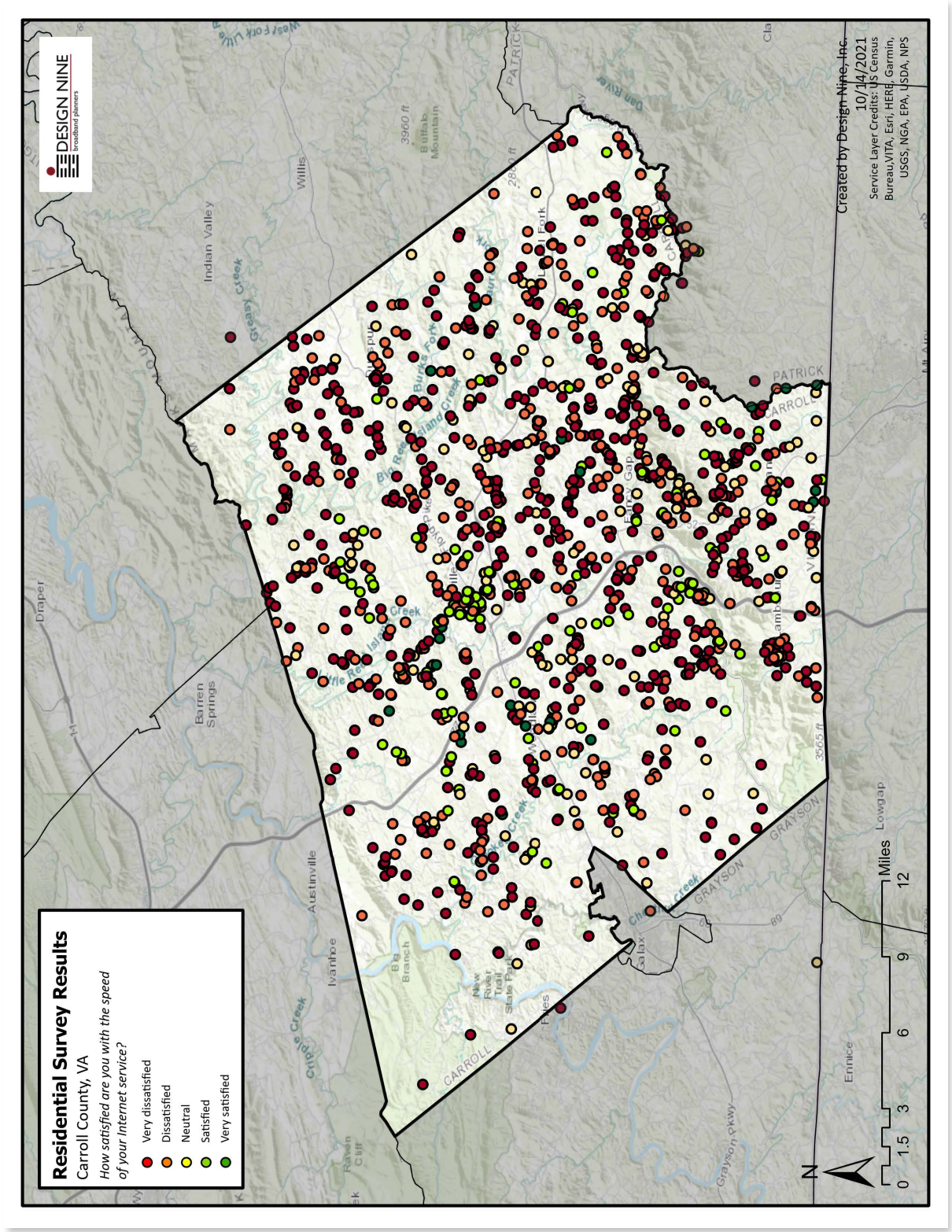
The map below shows the geographic distribution of responses to the residential survey, coded according to the *download speed* of their Internet connection (Question 9).



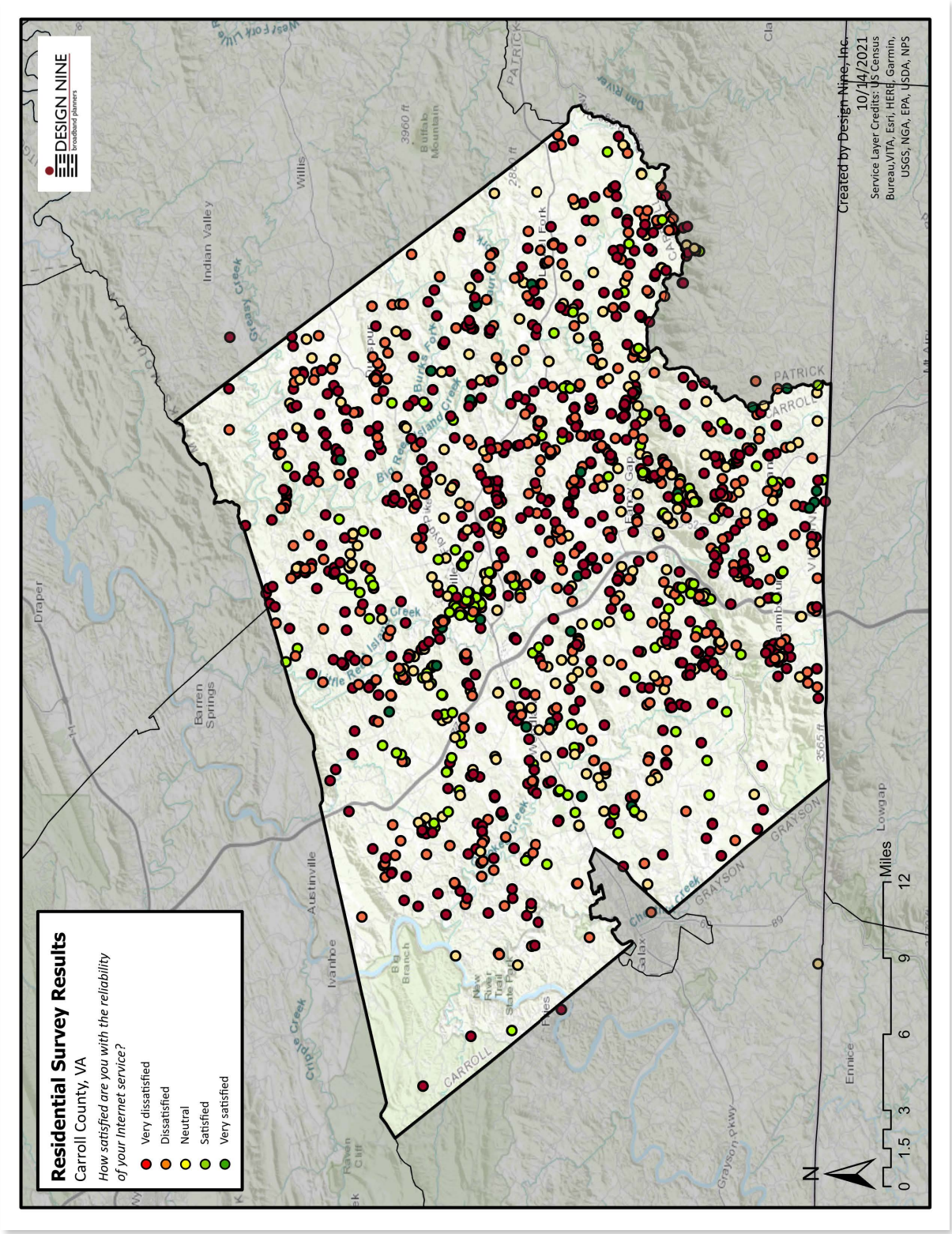
The map below shows the geographic distribution of responses to the residential survey, coded according to the *upload speed* of their Internet connection (Question 10).



The map below shows the geographic distribution of responses to the residential survey, coded according to their satisfaction with the *speed* of their existing Internet service (Question 12).

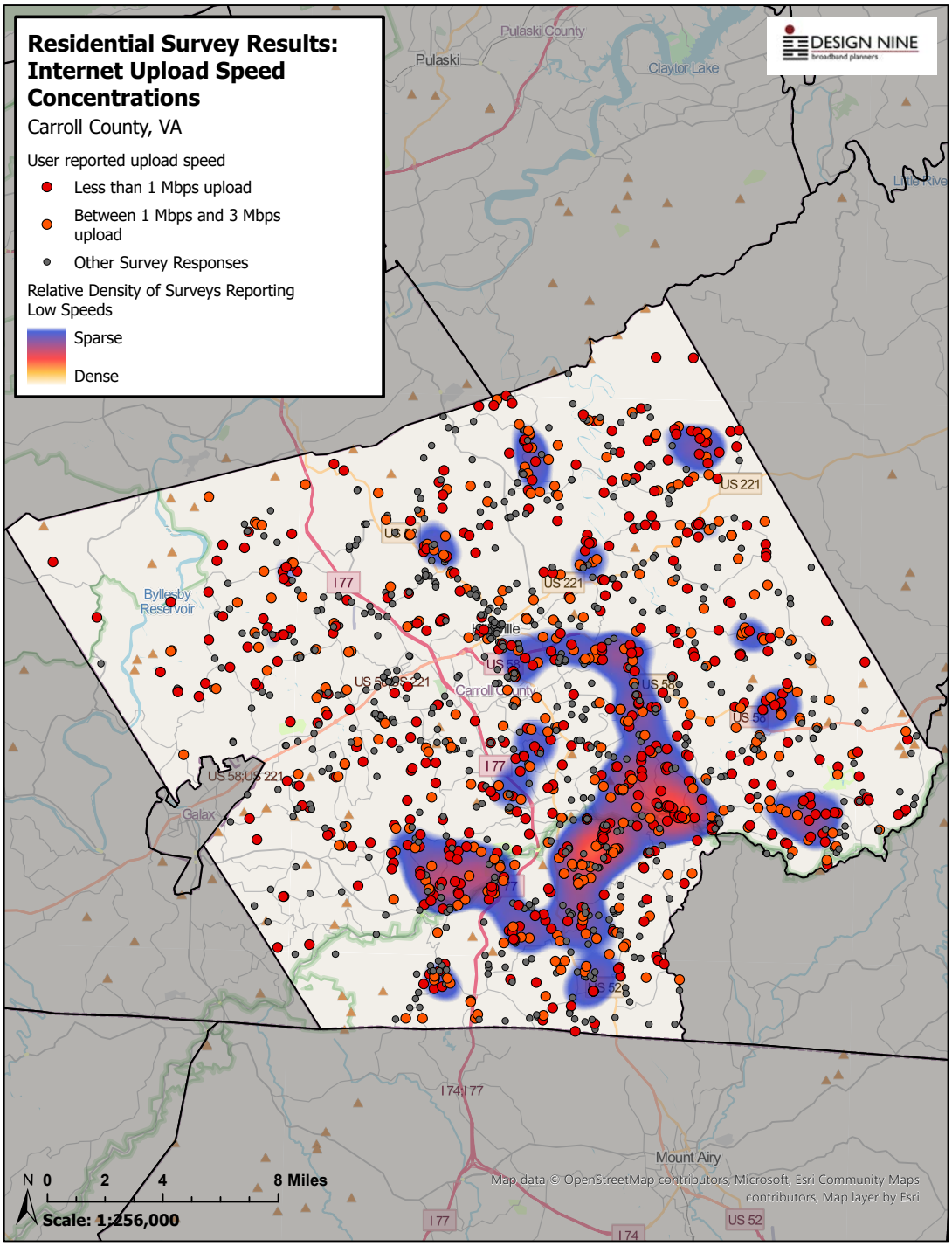


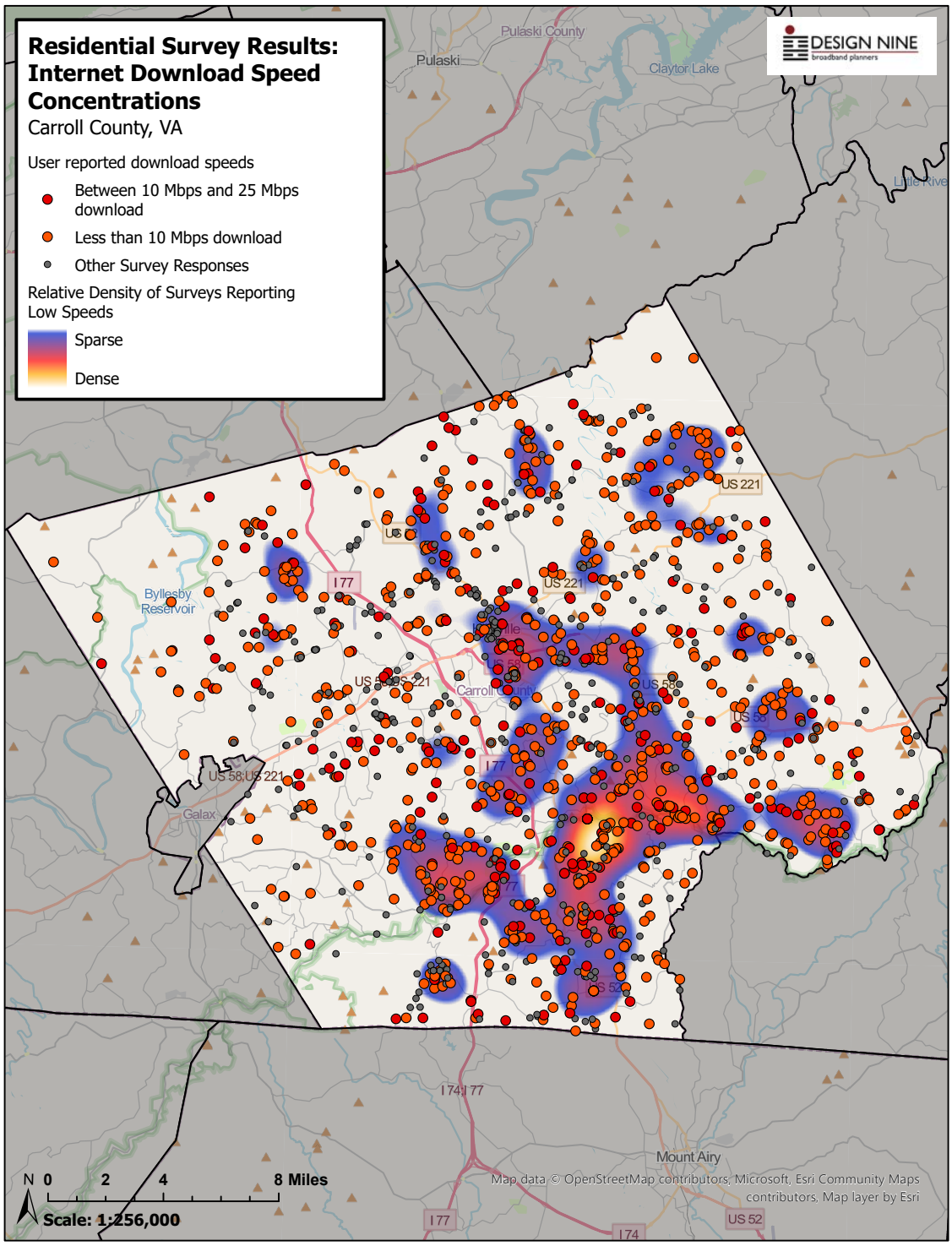
The map below shows the geographic distribution of responses to the residential survey, coded according to their satisfaction with the *reliability* of their existing Internet service (Question 13).



6.2 SURVEY DATA ANALYSIS OF UN/UNDERSERVED AREAS

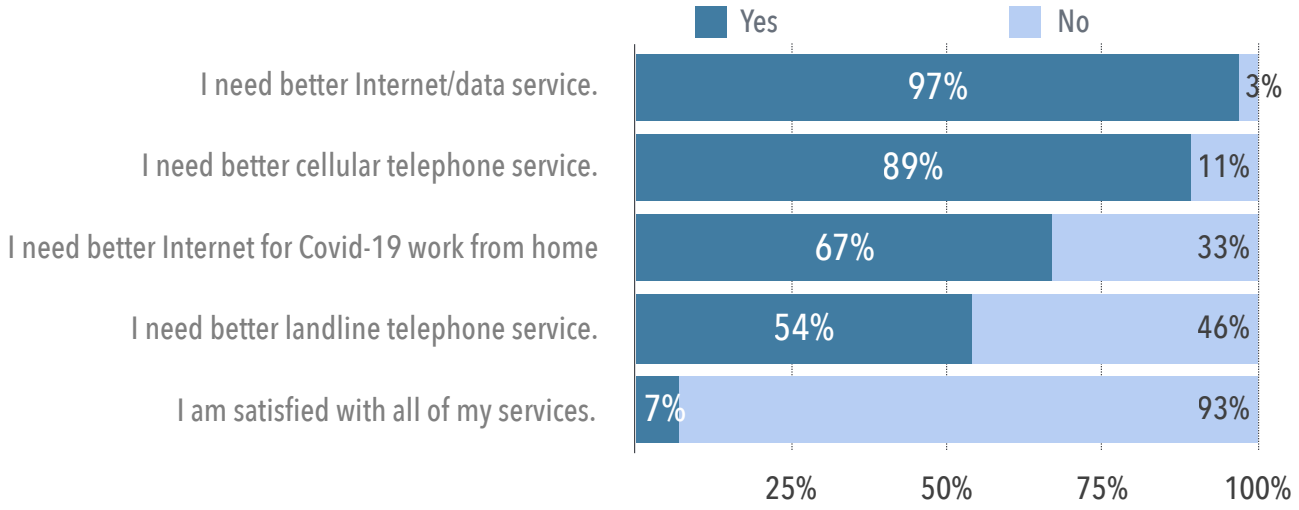
These maps used the survey data collected on upload and download speeds to identify areas of the county that have the poorest service.




Residential Survey Results: Internet Download Speed Concentrations
Carroll County, VA
User reported download speeds
Between 10 Mbps and 25 Mbps download
Less than 10 Mbps download
Other Survey Responses
Relative Density of Surveys Reporting Low Speeds
Sparse
Dense
DESIGN NINE
broadband planners
Pulaski County
Pulaski
Claytor Lake
Byllesby Reservoir
I 77
US 221
US 58
Carroll County
Galax
I 74
Mount Airy
US 52
N
0
2
4
8 Miles
Scale: 1:256,000
Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri

6.3 RESIDENTIAL SURVEY SUMMARY DATA

1. Select the items you agree with below



2a. Total number of adults in household

None	1	2	3	4	5	6	7+
4	217	976	195	57	10	7	6
0%	15%	66%	13%	4%	1%	0%	0%

2b. Total number of K-12 Students in the house hold

None	1	2	3	4	5	6	7+
856	189	145	39	11	3	1	6
68%	15%	12%	3%	1%	0%	0%	0%

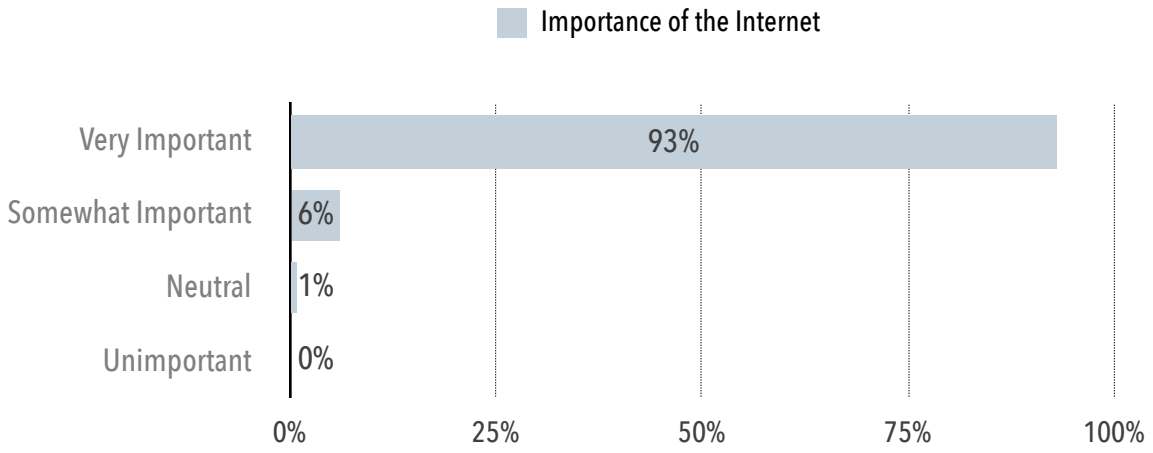
2c. Total number of college students in household

None	1	2	3	4	5	6	7+
978	199	31	5	0	0	0	1
81%	16%	3%	0%	0%	0%	0%	0%

2d. How many total Internet users in household

None	1	2	3	4	5	6	7+
14	156	595	223	193	81	24	17
1%	12%	46%	17%	15%	6%	2%	1%

3. How important is Internet access to you or your household?



4. How much do you spend each month for ALL telecom services? This would include any fees for services like phone, TV, and Internet. Do not include cellphones.

$50 or less	$50 to $75	$75 to $100	$100 to $150	$150 to $200	More than $200/month
94	136	209	322	289	415
6%	9%	14%	22%	20%	28%

5. How much do you pay just for Internet access each month?

No Internet	I only use free hotspots	$10 to $20	$21 to $40	$41 to $60	$61 to $80	More than $80/ month	I don't know
116	23	12	64	320	323	538	65
8%	2%	1%	4%	22%	22%	37%	4%

6. What type of Internet do you have at home?

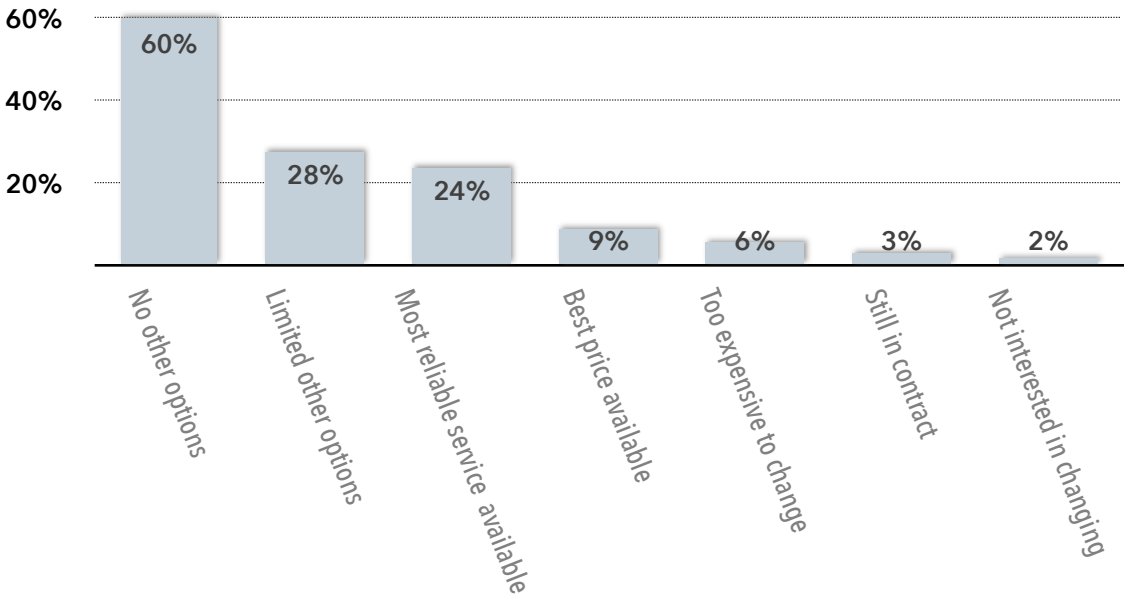
DSL line	461	43%
Satellite	249	17%
Cellular wireless	210	14%
Cable modem	173	12%
Wireless ISP	94	6%
No Internet	91	6%
I don't know	86	6%
Other	74	5%
Dial-up	16	1%
Fiber	11	1%

Other internet types responses:

Many comments were received. Because of the volume of replies, these comments can be found in Appendix B.

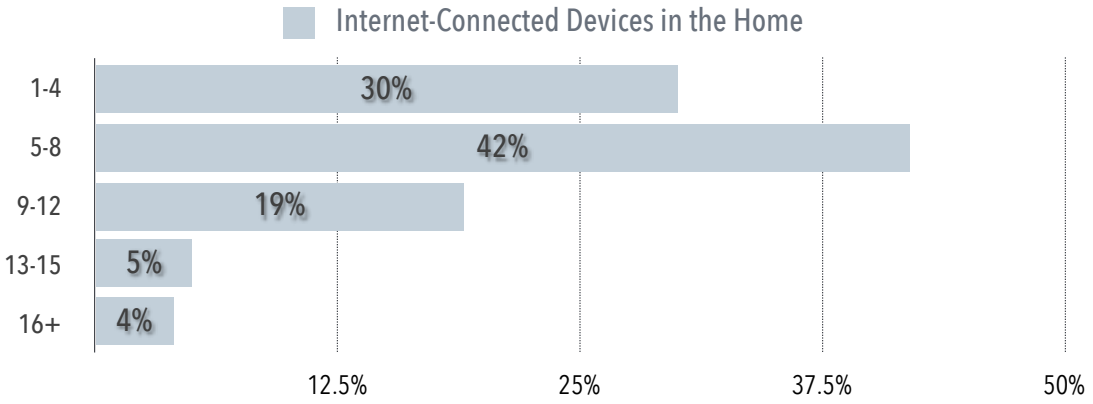
7. Based on the type of Internet connection you selected above, why do you still have it? (select all that apply)

60% of respondents indicated they have no alternative to their current Internet provider



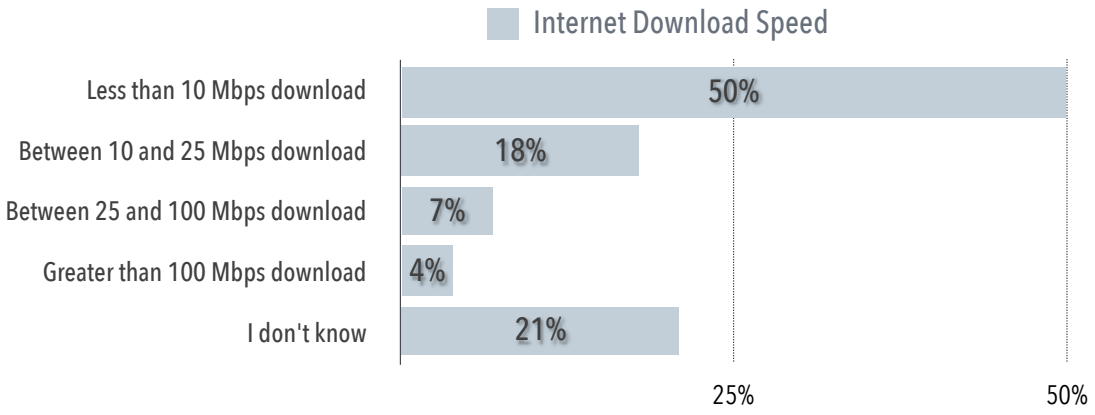
8. How many devices (for example computers, cellphones, smart TVs) connect to the Internet in your household?

28% of residents have 9 or more Internet-connected devices in their home



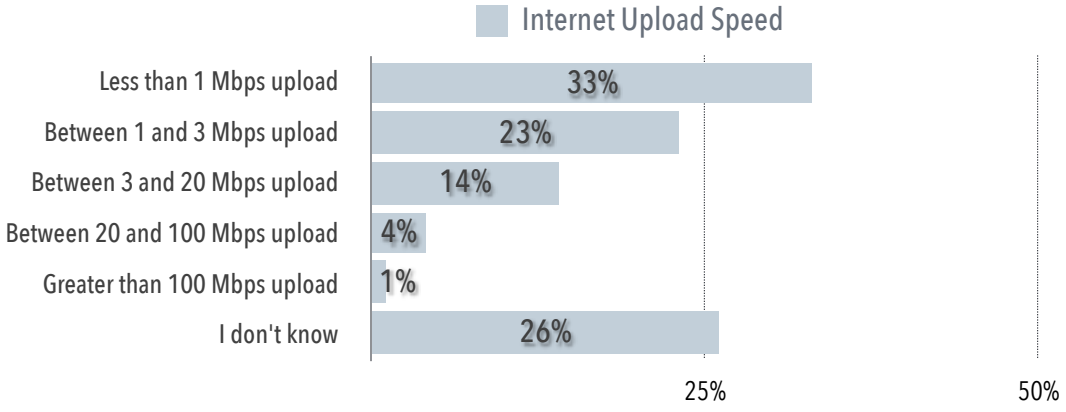
9. What is the download speed of your Internet Connection?

Only 11% of residents can confirm that they have Internet service that meets the FCC definition of adequate broadband service (25 Meg down, 3 Meg up). It is not unusual that many respondents do not know their exact Internet speeds.



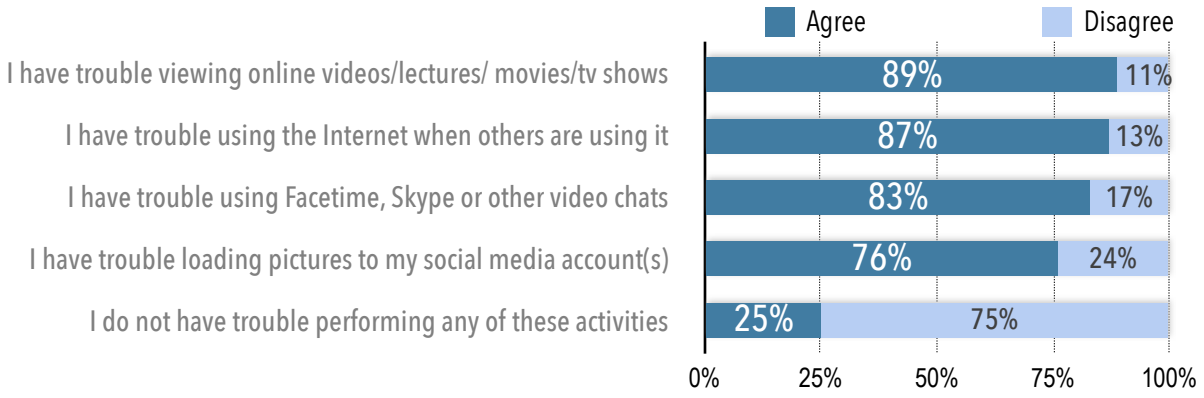
10. What is the upload speed of your Internet Connection?

Only 19% of residents have Internet service that meets the FCC definition of adequate broadband service (25 Meg down, 3 Meg up). It is not unusual that many respondents do not know their exact Internet speeds.

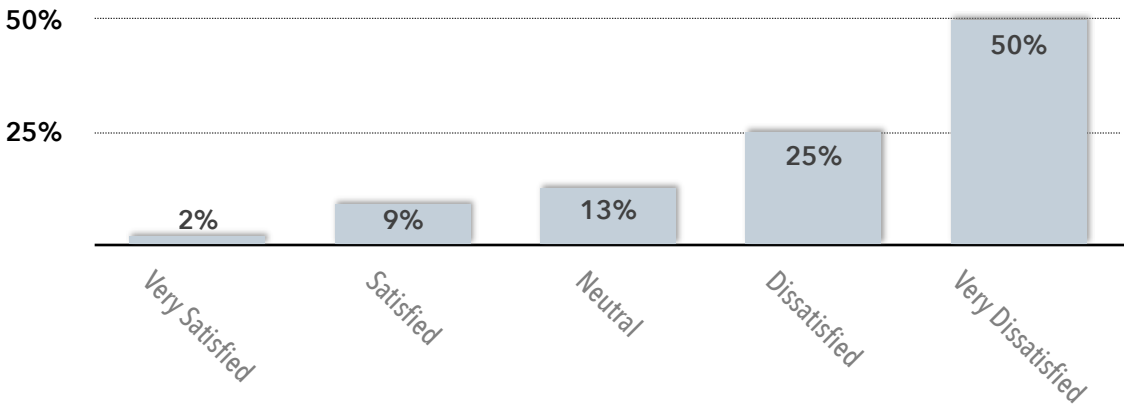


11. Select the items you agree with below

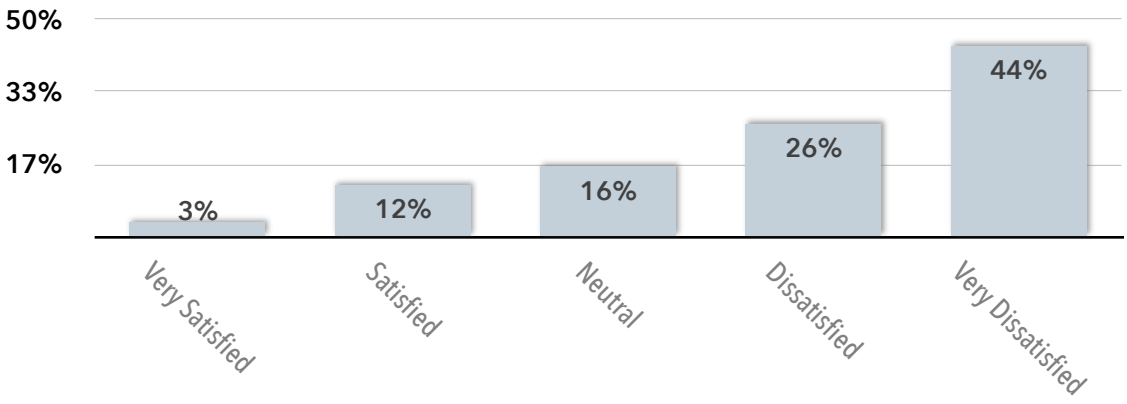
More than 80% of respondents report they have trouble using common Internet services



12. How satisfied are you with the speed of your internet service?



13. How satisfied are you with the reliability of your internet service?



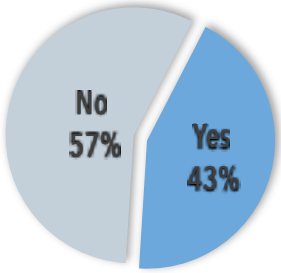
14. Select all items you use the Internet for now

Streaming video and TV services (Netflix, Hulu, Disney, etc.)	1,124	76%
Online Backup (files, photos, music)	930	63%
Learn about Covid-19 pandemic issues and information	820	55%
VoIP Internet phone (Vonage, Skype, FaceTime, etc.)	760	51%
Work from home during Covid-19 pandemic	693	47%
Homework/Schoolwork/Distance learning	671	45%
Telemedicine or tele-health	622	42%
Home security (cameras, video doorbells, etc.)	514	35%
Online gaming	418	28%
Smart speakers (Alexa, Homepod, Google Assistant, etc.)	188	13%
Other	188	13%

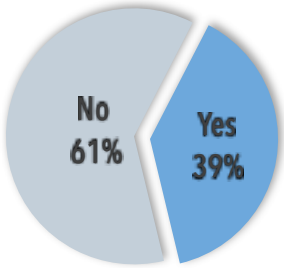
A large number of responses to "Other uses" was received and these can be found in Appendix C.

15. High speed, affordable Internet influences where I choose to live?

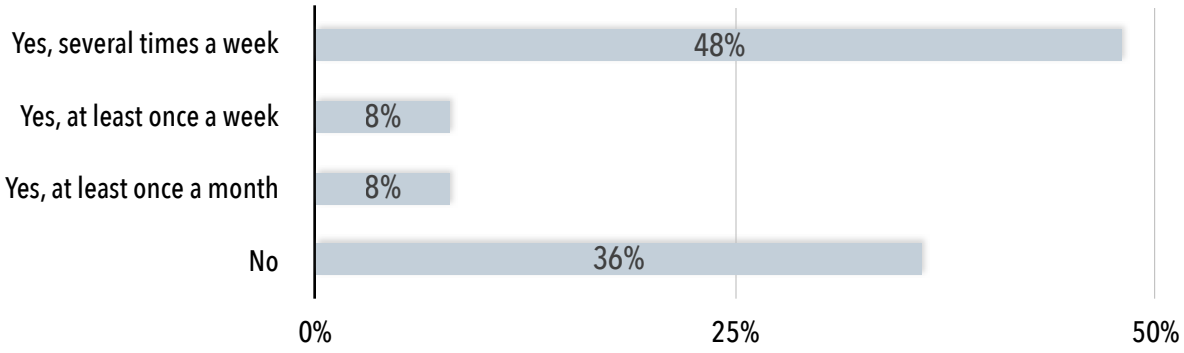
Availability of broadband Internet is affecting where people choose to live. The response of of 43% is typical of many communities. Internet availability can impact home prices and community development.



16. Has the Covid-19 crisis had a negative economic impact on your household?



17. Does anyone in your household use / need the Internet to complete school assignments, participate in distance learning, or receive job training course work?

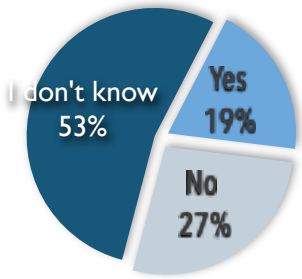


18. Who is your Internet Service provider?

Some responses included more than one provider.

CenturyLink	669	48%
Other	242	17%
Satellite Internet	152	11%
Comcast/Xfinity	122	9%
US Cellular	86	6%
Cellphone hotspot	74	5%
T-Mobile	37	3%
Lingo	8	1%
Citizens Coop	4	0%
1Point	2	0%
Citizen's Telephone Cooperative	0	0%
Shentel	0	0%
PemTel	0	0%
TDS Telecom	0	0%
Sunset/Optinet	0	0%

19. Do you have data limits (caps) on your current Internet service?

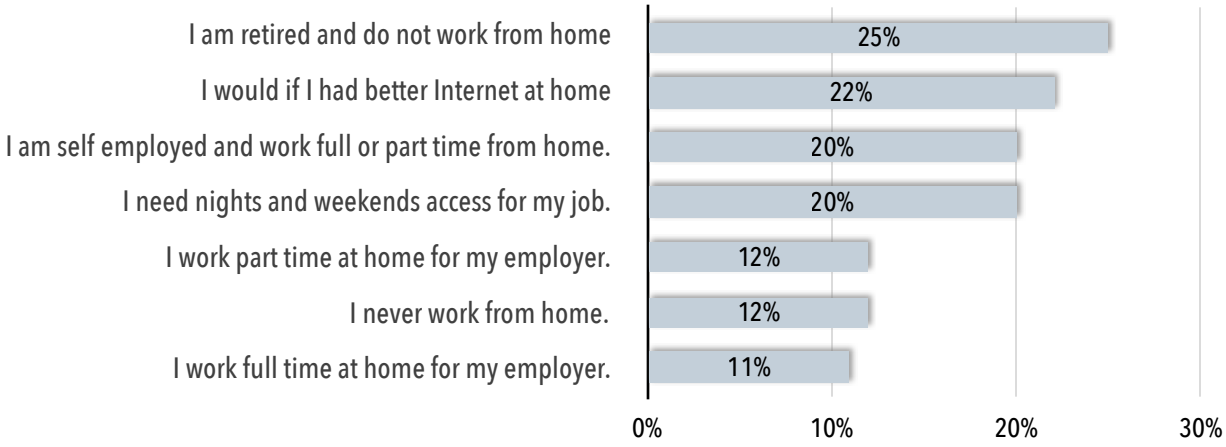


20. If you have data caps, have you exceeded those caps?

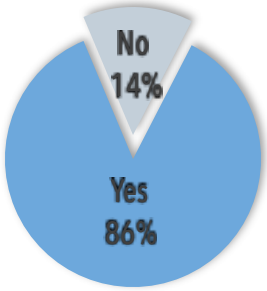
Yes	6%
No	17%
I do not have data caps	29%
I don't know	48%

21. Do you work from home?

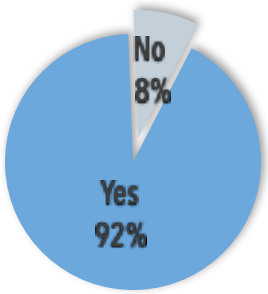
43% report working from home part or full time—the Internet has made residential neighborhoods into business districts. Home-based jobs and businesses reduce traffic congestion and reduce road maintenance. This is also a high number relative to past surveys we have conducted, and undoubtedly the Covid crisis has caused this number to rise.



22. I am interested in high speed fiber cable delivered internet service?



23. Should your county government help facilitate better and more affordable broadband services?



24. Any Other Comments

Many comments were received. Because of the volume of replies, these comments can be found in Appendix D.

7 CARROLL BUSINESS SURVEY RESULTS

During the Summer of 2021, a broadband business survey was conducted in the Carroll County, Virginia as part of a county wide study in broadband needs. The online (Web) version of the survey was publicized on social media. Businesses were encouraged to complete the survey online or fill out and return the paper version by surface mail. A total of 42 responses were were collected from businesses in the County. Not all responders answered every question. Some key findings from the results are listed below.

93% of business respondents want better Internet access

98% of respondents said that they believe the County government should help facilitate better broadband

88% indicated that the Internet is important to the success of their business over the next five years

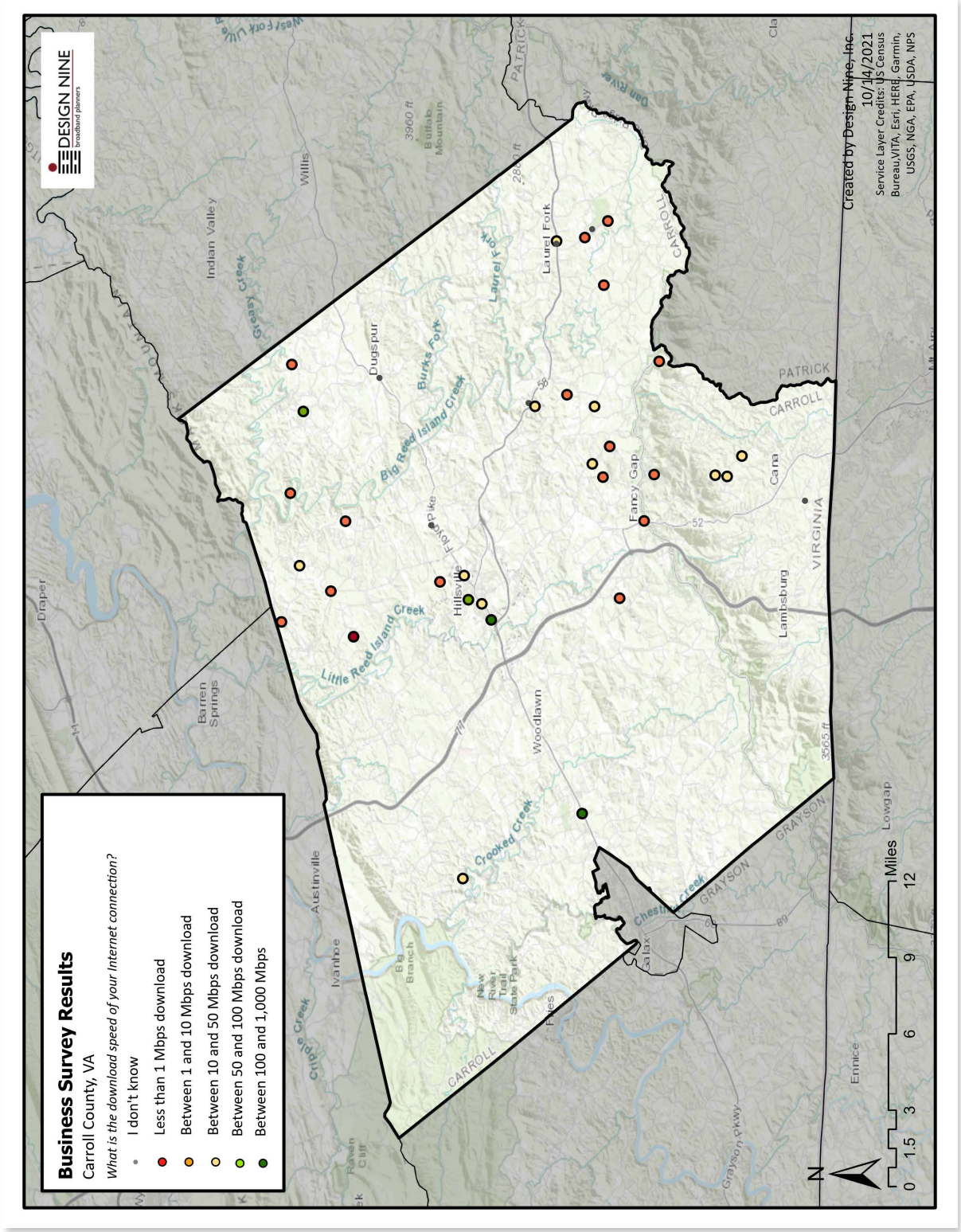
Only 12% of businesses are "satisfied" or "very satisfied" with their current Internet service

46% of the businesses that responded are home-based

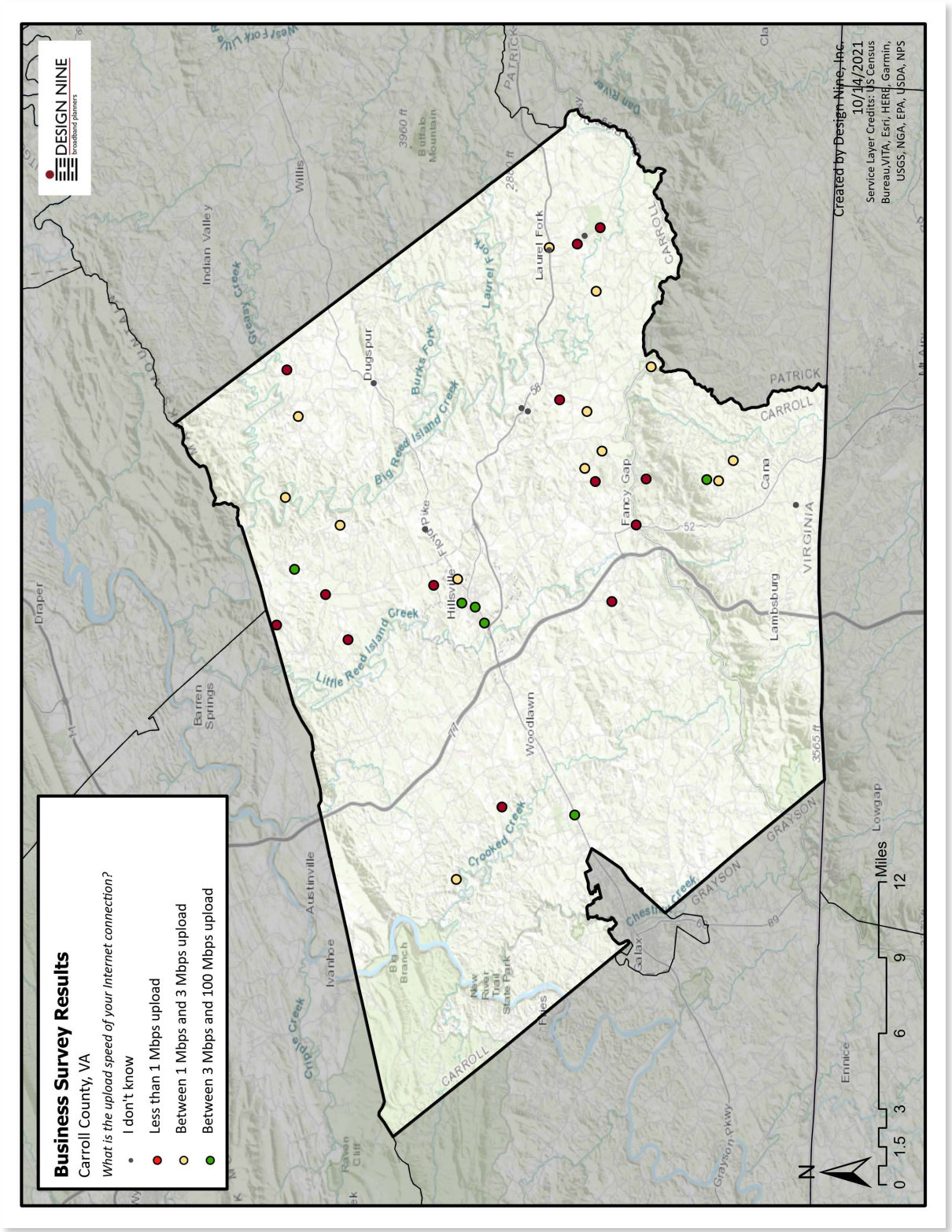
37% of businesses that responded need employees to be able to work from home

Home-based workers and businesses need affordable Internet access

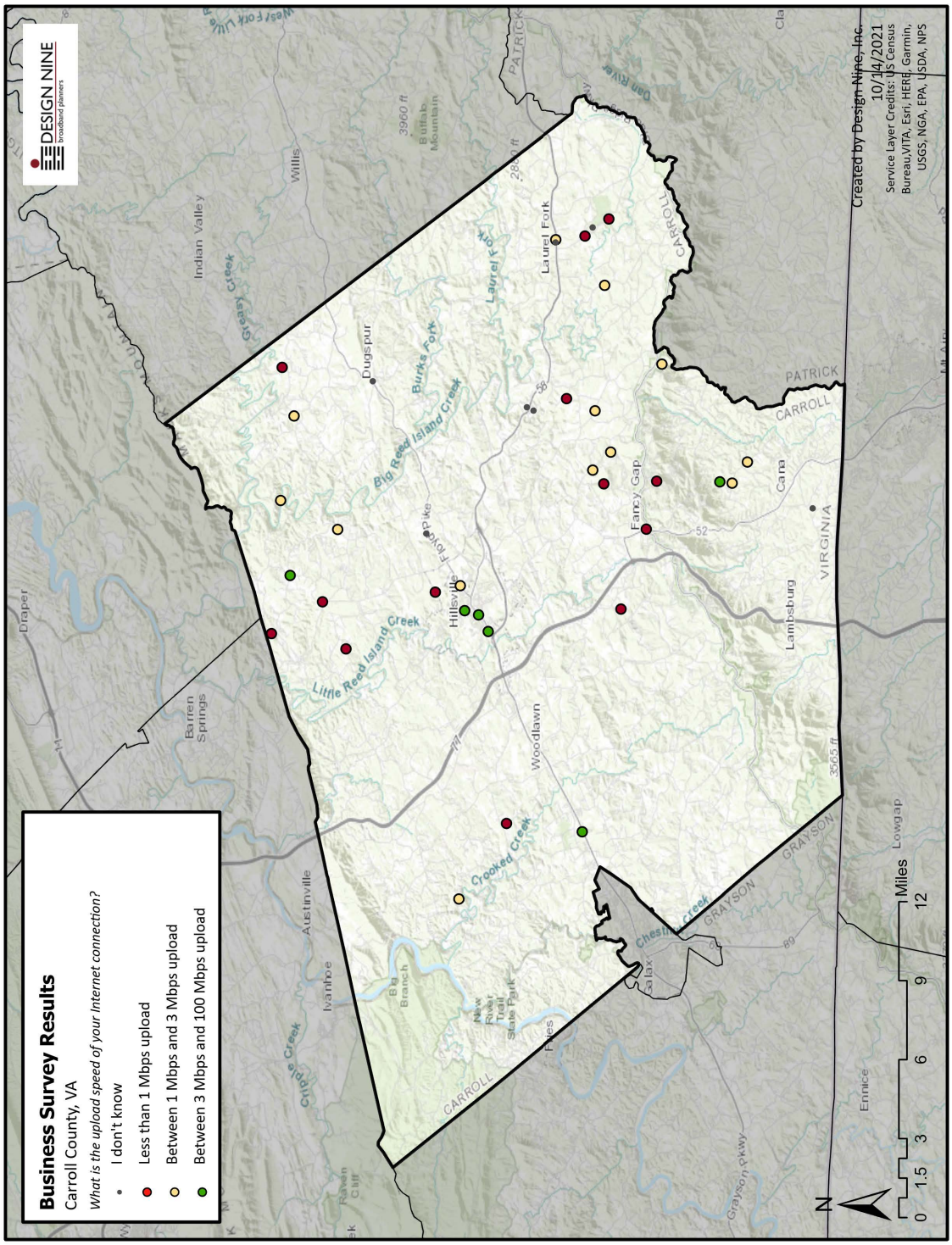
7.1 DISTRIBUTION OF BUSINESS SURVEY RESPONSES



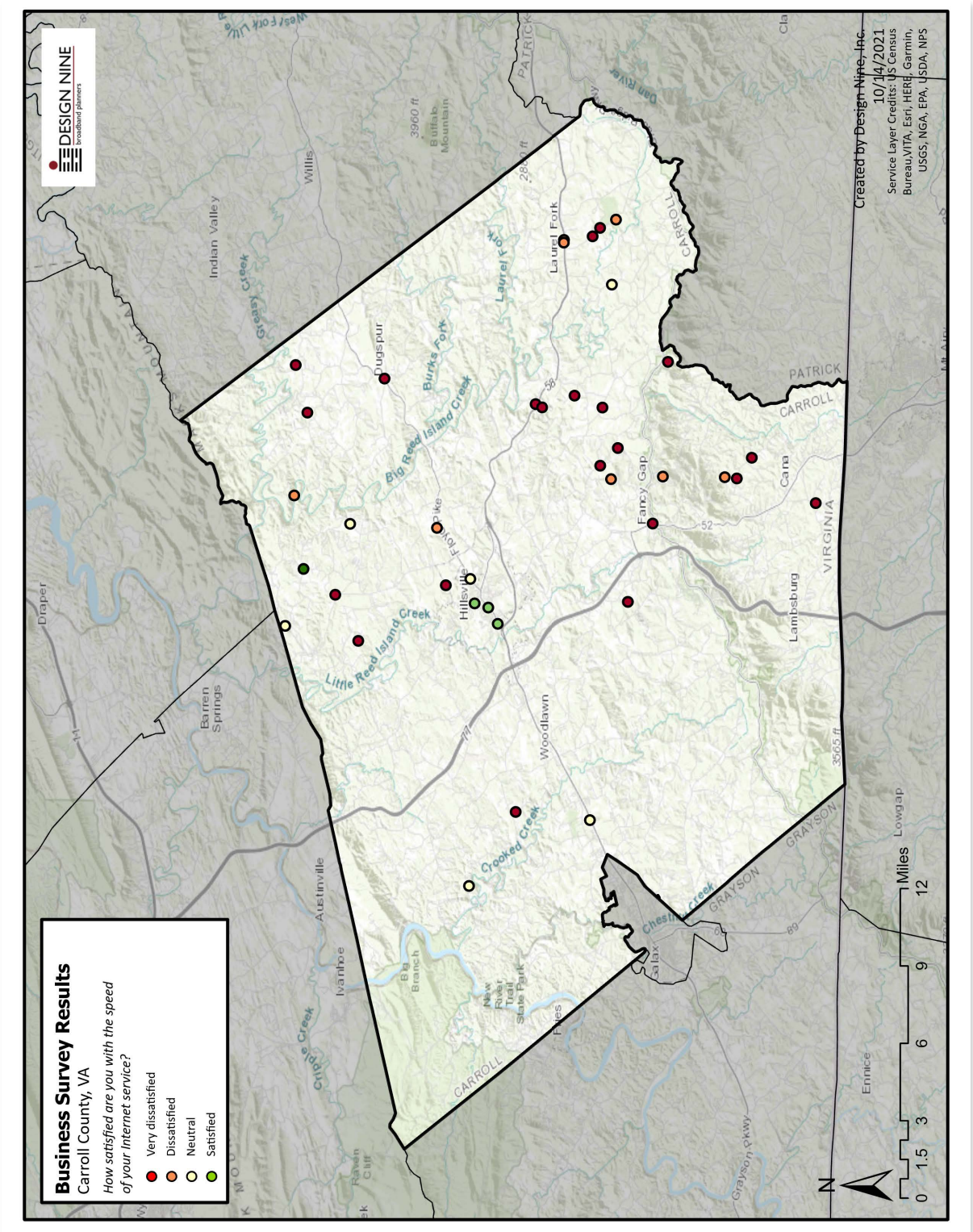
The map below shows the geographic distribution of responses to the business survey, coded according to the *download* speed of their Internet connection (Question 10).



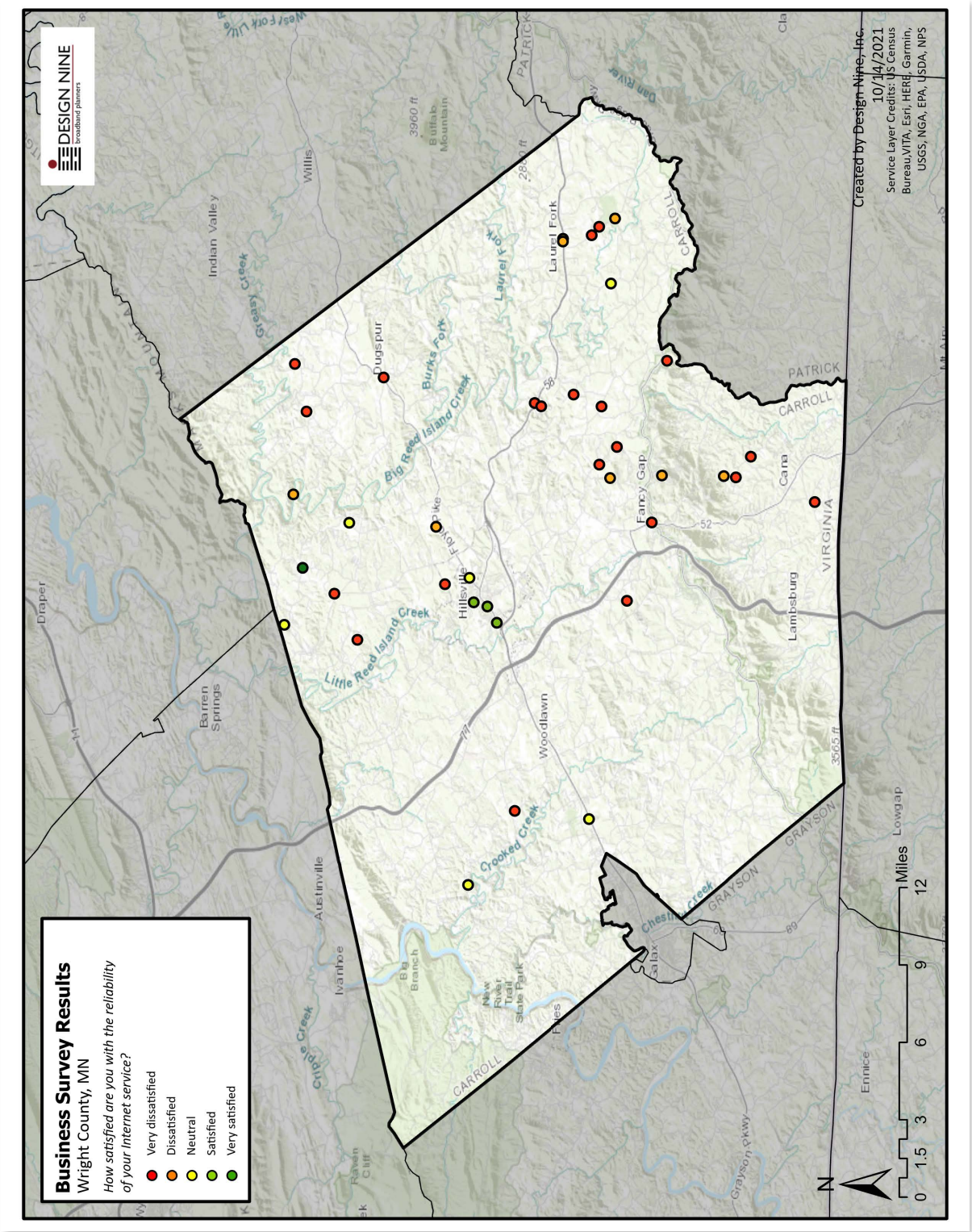
The map below shows the geographic distribution of responses to the business survey, coded according to the *upload* speed of their Internet connection (Question 11).



The map below shows the geographic distribution of responses to the Business survey, coded according to their satisfaction with the *speed* of their existing Internet service (Question 12).



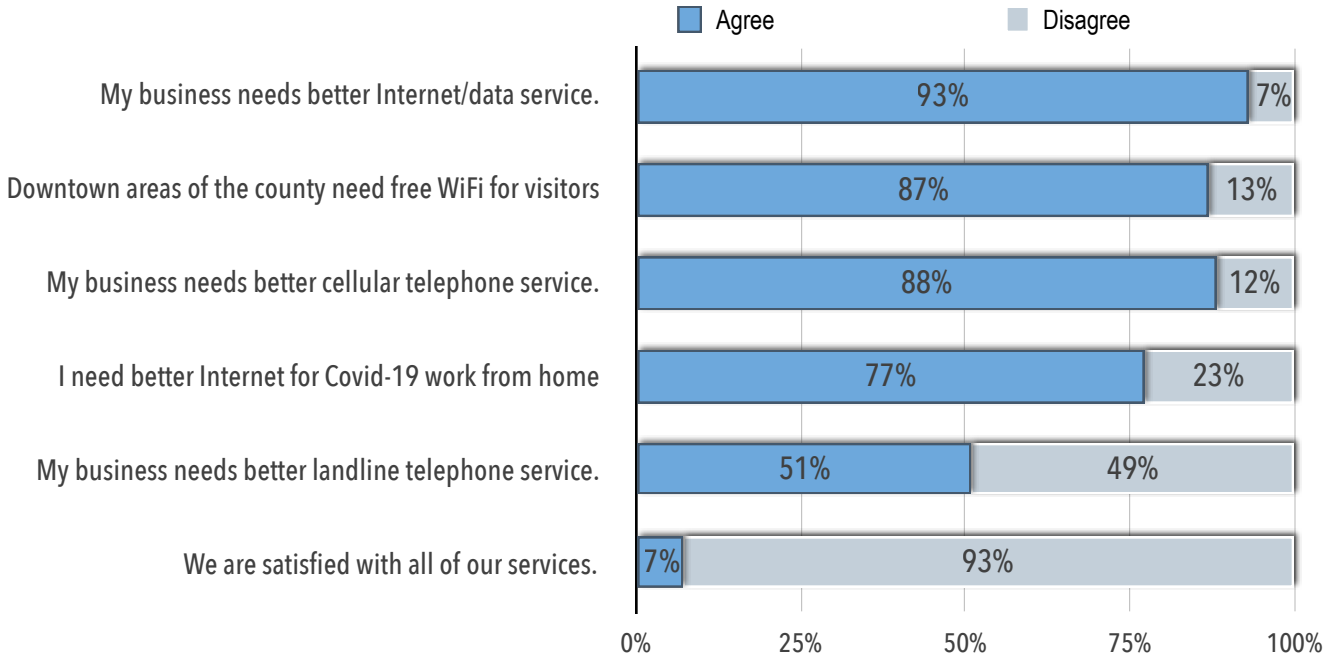
The map below shows the geographic distribution of responses to the Business survey, coded according to their satisfaction with the *reliability* of their existing Internet service (Question 13).



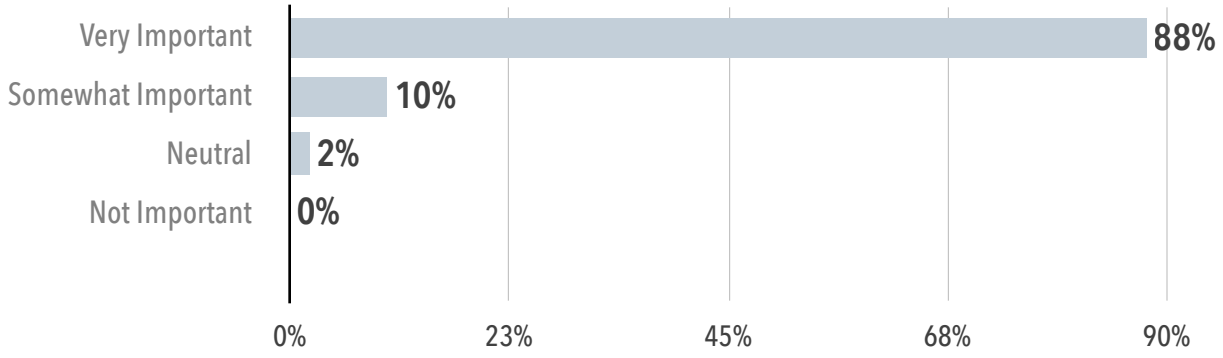
7.2 BUSINESS SURVEY SUMMARY DATA

1. Select the items you agree with below

A large number of businesses indicated that the downtown areas of the county could benefit from free WiFi for visitors and shoppers.



2. How important do you think Internet technology will be for the success of your business over the next five years?



3a. Total number of employees

1 to 10	85%
11 to 40	12%
41 to 80	0%
81 to 150	2%
Over 150	0%

3b. Total number of Internet users

1 to10	90%
11 to 40	5%
41 to 80	0%
81 to 150	2%
Over 150	2%

4. If you are a business, what type? (select all that apply)

Other	11	26%
Professional / Office	7	17%
Retail / Wholesale	5	12%
Medical	5	12%
Agriculture/Forestry	4	10%
Construction / Maintenance/ Repair	3	7%
Non-Profit	3	7%
Manufacturing	3	7%
Restaurant/Food Service	2	5%
Communications/Technology	2	5%
Educational	2	5%
Government	0	0%

Other types of businesses

- Automotive Service
- Security consulting for counterfeit prevention.
- Post Construction, Residential, and Commercial Cleaning Services in which I have to do invoices, payroll, taxes, estimates, etc with internet. My area is very slow and I have complained numerous times to Century Link and we even sold them a piece of land to put the box on and it still does not work good.
- Golf Resort
- Real Estate
- Automotive shop
- Machine shop
- Church
- Photographer
- Personal residence
- Garage and Small Engine Shop
- Short term vacation rental

5. Is this a home-based business?

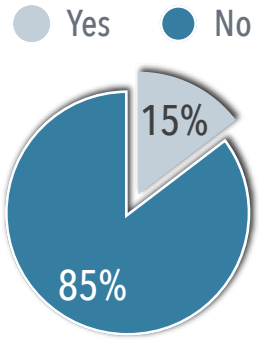
Yes	No
19	22
46%	54%

46% of the county businesses that responded are home-based

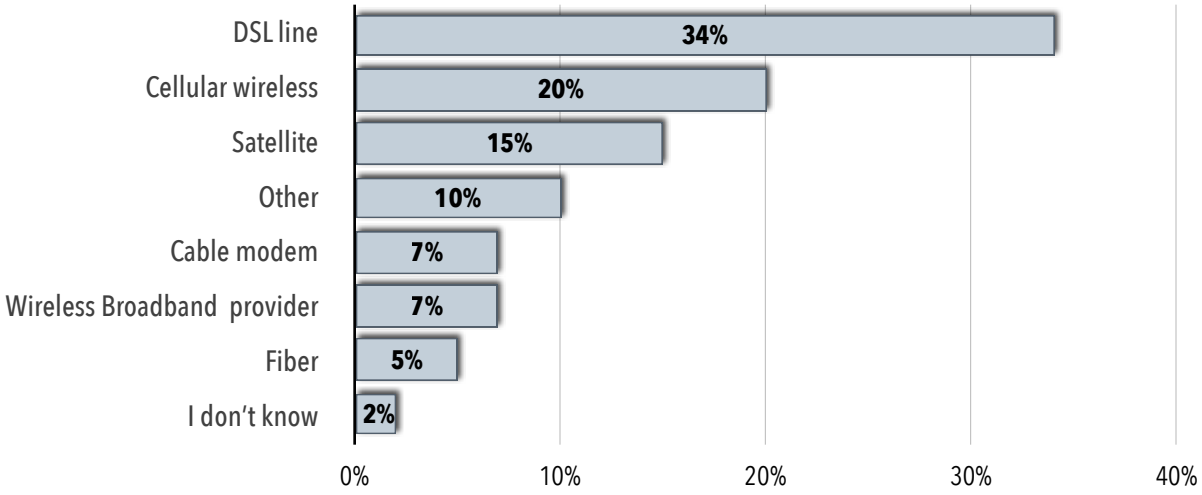
6. How much do you pay now for Internet access each month?

$0 to $100	$101 to $150	$151 to $500	$501 to $1,000	$1,001 to $5,000	$5,000 or more	I don't know
16	12	10	0	0	0	2
40%	30%	25%	0%	0%	0%	5%

7. Are you satisfied with what you pay for Internet service?

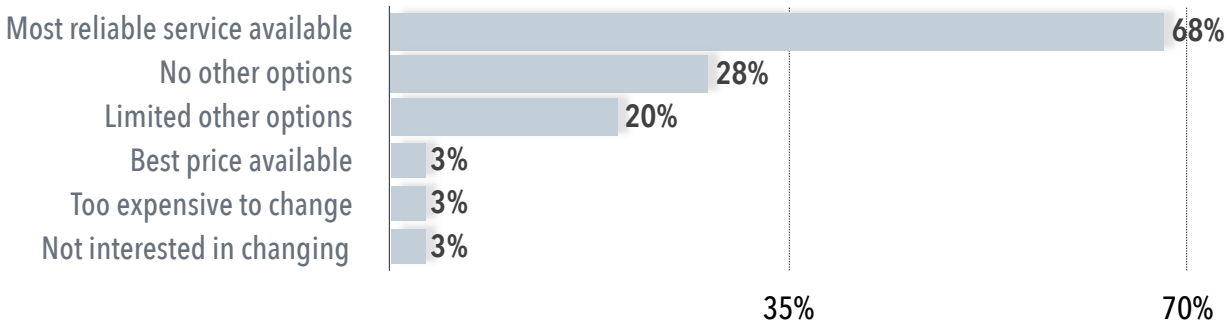


8. What type of Internet do you have?



9. Based on the type of Internet you selected above, why do you still have it?

Respondents could choose more than one option.



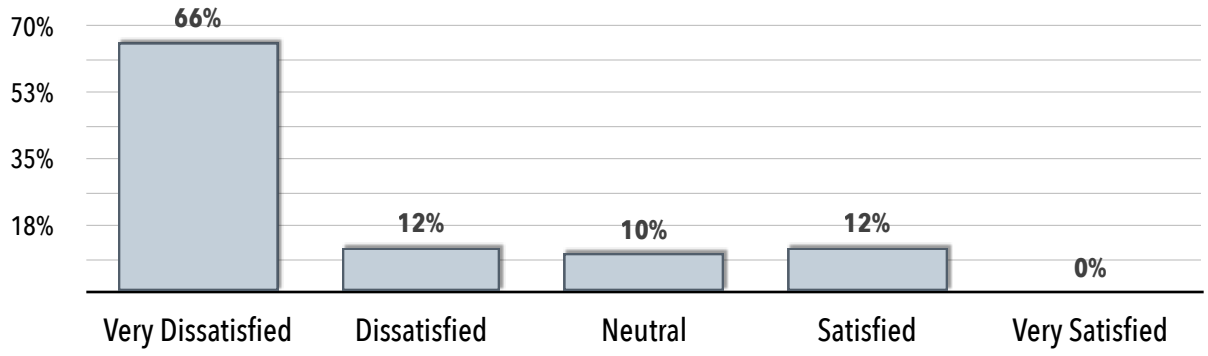
10. What is the download speed of your Internet connection? (A Gigabit is 1000 Megabits (Mbps)

Less than 1 Mbps	1-10 Mbps	10 - 50 Mbps	50-100 Mbps	100 - 1,000 Mbps	1,000+ Mbps (Gigabit)	I don't Know
1	18	11	2	2	0	6
3%	45%	28%	5%	5%	0%	15%

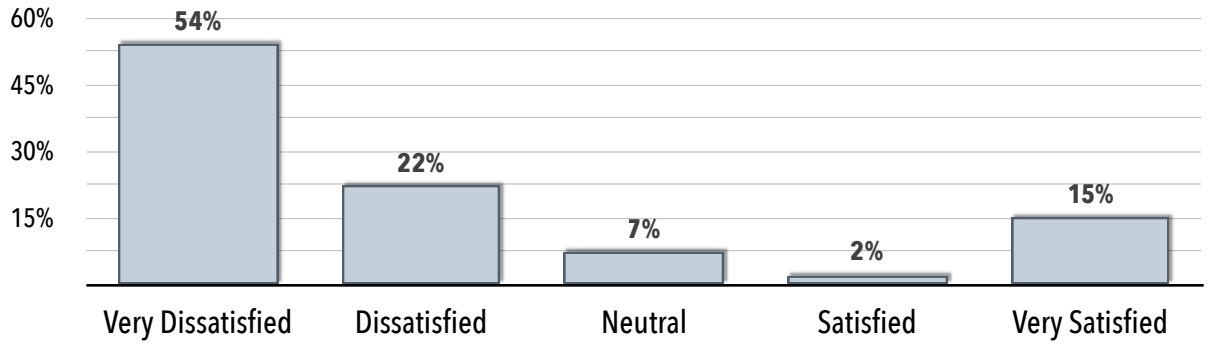
11. What is the upload speed of your Internet connection? (A Gigabit is 1000 Megabits (Mbps)

Less than 1 Mbps	1 - 3 Mbps	3 - 100 Mbps	100+ Mbps	I don't Know
14	14	6	0	7
34%	34%	15%	0%	17%

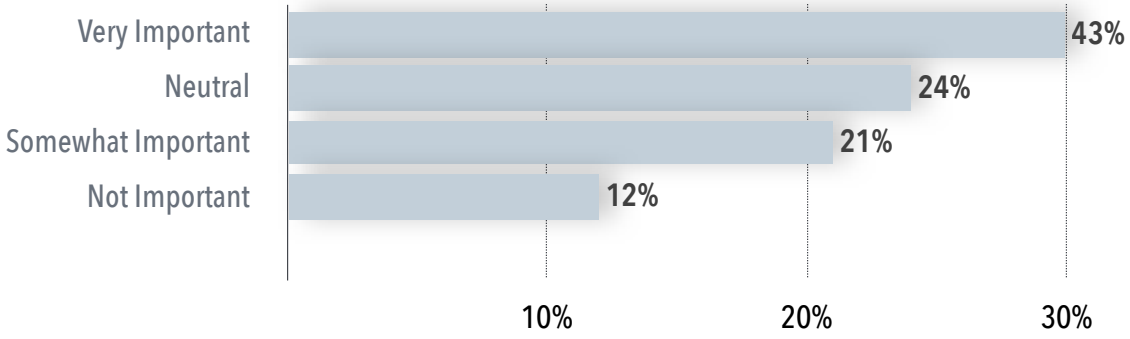
12. How Satisfied are you with the speed of your Internet service?



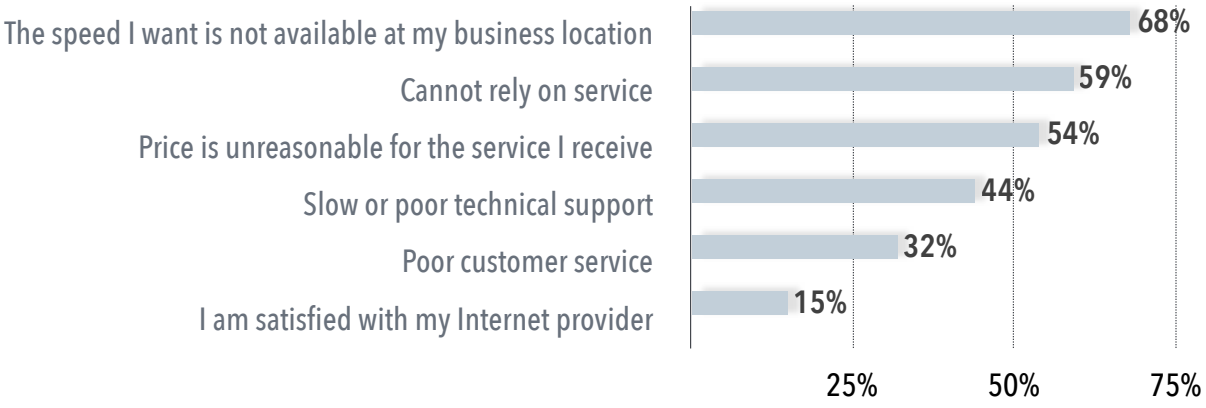
13. How Satisfied are you with the reliability of your Internet service?



14. How important is a redundant or second Internet connection to your business?



15. Please select all that apply to your current Internet provider



16. Select all the items you use the Internet for now(Select all that apply)

Online Backup (files, photos, music)	32	76%
Social media (Facebook, LinkedIn, Twitter, etc.)	29	69%
Ordering / managing inventory	27	64%
Processing credit card / debit card transactions	23	55%
Receiving and processing online orders	21	50%
Monitor / control security, alarms, health, processes, etc.	20	48%
VoIP Internet Phone(Vonage, Skype, etc.)	16	38%
Cloud-based business, accounting or other services	15	36%
Provide free WiFi service to customers	9	21%
Other	9	21%

Other uses for the Internet

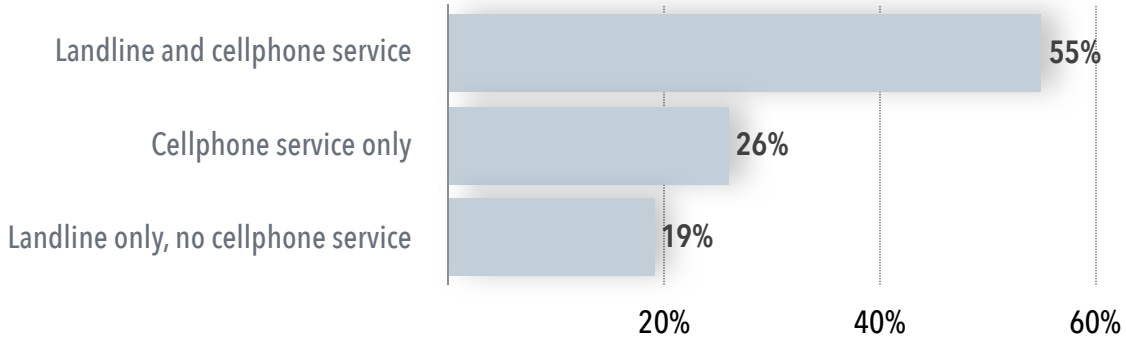
- Electronic Health records
- Bank transactions
- Limited I usually have to wait til I get to work or up the road to upload. I like to use youtube for learning tools and it may or may not work depends if it rains the internet and land phone does not work or if it does it makes noises or hangs up.

- Website hosting. Media creation. Education. Support of state and federal contracts. High traffic video conferences.
- Making bills and ordering car parts on line.
- Live Streaming our Church Services (which we are currently unable to do)
- Online research via remote access of county courthouse records.
- Sending large image and video files to clients.
- Zoom meetings
- Credit Card use at gasoline pumps use the internet connection, have to use computer to look up parts for garage and small engine shop.
- For entertainment and work purposes for guest who stay at our vacation rental.

17. Who is your Internet Service provider?

CenturyLink	21	53%
Satellite Internet	6	15%
Other	4	10%
Comcast/Xfinity	4	10%
US Cellular	2	5%
Cellphone hotspot	1	3%
Lingo	1	3%
Citizens Coop	1	3%
T-Mobile	1	3%

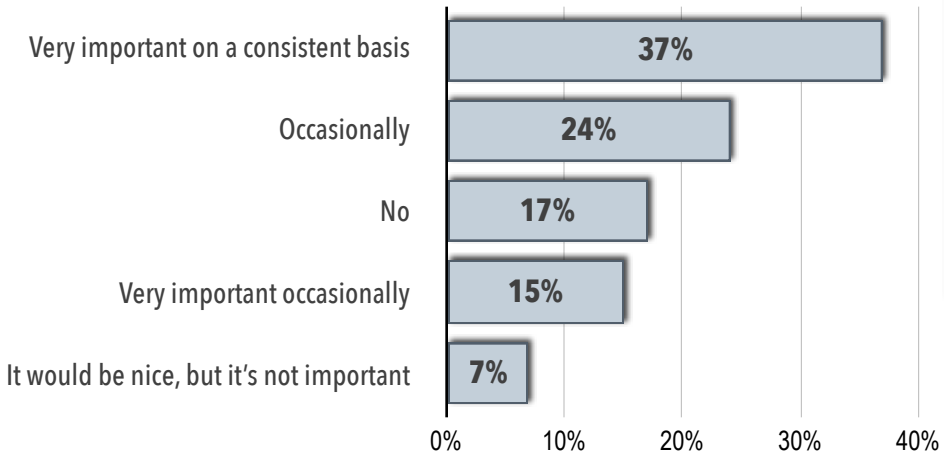
18. What kind of telephone service do you have?



19. Do you or your employees use a VPN (Virtual Private Network) to obtain remote access for your work or to a company network?

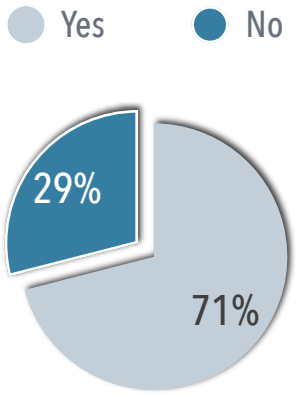
Yes	No	I Don't Know
9	31	2
21%	74%	5%

20. Do you or your employees need or want to work from home?

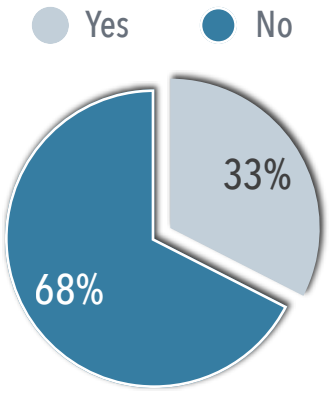


61% of businesses that responded need employees to be able to work from home

21. Does limited Internet access at employees' residences impact your business?



22. Do the existing internet service options impact your business's decision to relocate or stay in the County?

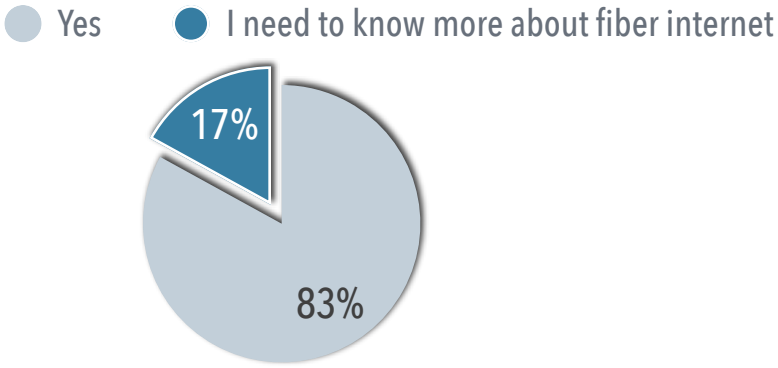


If yes, briefly state why:

- I grew up in Fancy Gap, VA. I've moved back from Florida to be near family, but fear I must leave again because I am a software/web developer and I literally cannot complete most tasks from my home office. I head down to Mt. Airy, NC to complete a large part of my workdays because our DSL connection cannot handle even small file uploads.
- Floyd has great internet would love to relocate over the county line.
- Our lack of a consistent and high speed connection is limiting the throughput of $100,000 dollars in transactions a year. This equates to less taxes paid to the county. We hold local county government responsible for this circumstance which has been an issue for decades. In the year 1999, we had a better connection in Surry County, NC than we do now, this is disappointing. It is confusing to citizens of this county, why Floyd county for example, has been able to build infrastructure in an even more rural setting, and smaller population per mile. Clearly, it was a priority for them, if not for family considerations, our business would immediately relocate.
- Due to limited and/or poor quality internet service would stop many business' from coming to the county. It will drive my next decision to move to a better location.
- Hard to conduct business in today's environment without reliable internet.

- The business is stationary, but a fair amount of the work for my business is managed from home. Availability of internet at my home may affect my willingness to live in Carroll County.
- Would like to relocate to a different location due to poor internet access
- Considering a move if internet/phone does not improve significantly.
- We had already moved to the County prior to realizing how bad (little) the internet options and service was.
- Have been here 75 years, not going to move because of Internet.
- WE have no option to relocate as we own the rental property and have no desire to sell

23. Are you interested in fiber delivered Internet Service?



24. Should the County government facilitate better and more affordable broadband services?

Yes	No
41	1
98%	2%

25. Any Other Comments

- I love this area, but I originally moved away because DSL could not support my career. I came back with the conviction to travel to Mt. Airy, NC to complete my work during the day, but it is outlandish that even simple tasks cannot be completed because CenturyLink is my only option. I've lived across about a dozen towns/cities on the East Coast over the past decade and this is the only area where I am unable to complete any work from my home and must travel 30 minutes to complete even simple tasks.

- Our internet service supports my business. Better internet access is always desired but the internet is so much better at my office than at our house that it seems wonderful. My thought is that I'm sure that internet speeds etc are better in more populated areas but we are satisfied and it works for us. Anything that would make it better would obviously help our business.
- We use electronic health records to chart for our patients. Having slow upload and download speeds hurt our efficiency. Consistent interruptions also make it very difficult to chart, schedule, and prescribe for our patients.
- Obviously, free market economics and deregulation has not served this county well in expanding high-speed broadband access. The impact of COVID-19 only amplified this issue. Frequently, I am forced to use the public library, whose connection cannot support a video call.
- Cell service and internet service in Fancy Gap area is almost non-existent.
- It would be a tremendous blessing to have speeds fast enough to live stream all of our services. Many of our members are unable to attend service in person due to health related issues and Covid.
- CURRENTLY USING A MIFI DEVICE TO BACK UP SATELLITE INTERNET. SERVICE IS SPOTTY AND VERY EXPENSIVE COMPARED TO MOST URBAN AREAS. THE STANDARD SHOULD BE COMBINED PHONE, INTERNET AND TV AAS A BUNDLED SERVICE.
- What happened to the 'Wired Road' internet service?? Who benefited from it's installation?
- The slow internet connection I have now has affected how much business I've been willing to take on. It simply takes too long to deliver images and videos to clients with how slow my internet is now. I really hope something will come of this because we have been hearing plans to serve our area better since 2017! So far it's just been a lot of talk and no action.
- Centurylink is terrible. Not reliable, download is like watching grass grow and up load forget it! SLOW!!!
- In today's technology driven economy is is imperative that small, and large (to even a greater extent) businesses have the necessary capability of conducting daily operations (many of which are internet based or driven). If these simple resources are not available, companies will not relocate to areas such as Carroll County. Furthermore, companies already in the county will have issues with expansion and/or growth without the simple things such as reliable, fast internet services to run said business. Improving the availability and speed of these services will benefit the local business, which in turn will grow and hire more workers and bring in other supporting businesses which will create a larger tax base for the county. It's a win-win for everyone in Carroll.
- This cannot happen soon enough. Thank you.
- Couldn't connect to the site to test speed
- WE have lost several bookings because of the internet as internet is not sufficient for guest to work from the property. It is also no sufficient to stream TV which is important to our guest.

8 TECHNOLOGY ASSESSMENT

8.1 OVERVIEW OF THE TECHNOLOGY

In large portions of Carroll County, broadband wireless will be an important strategy for improved Internet access for businesses and residents. But both fiber and wireless technologies and systems are going to be important to meet the goal of improving access to broadband. The rest of this section provides more detail and some specific build out strategies.

Businesses and residents may obtain Internet service:

- With a small radio directly attached to their home or business that receives a signal directly from a towers owned by a private provider, from a County-owned tower (e.g. shared with public safety use), or from a community-owned tower (e.g. a coop).
- With a small radio attached to a utility pole (60 or 70') to improve line of sight to a tower.
- With a small radio directly attached to their home or business that receives a signal from a "community" utility pole. The "community" pole will receive a signal from a distant tower and redistribute it locally to a cluster of customers (typically within a half mile).
- With a fiber connection to the fiber installed in areas where economic development is important, and in other areas as additional fiber network segments are added.

The table below summarizes how fiber and wireless can work together in a variety of ways.

Distribution Type	Access Type	Capacity
Wireless	Wireless	Typical customer connection starting at 5 to 10 Megabits, can be higher, with 50 Meg connections common. More dependent on the capacity of the wireless Distribution link.
Wireless	Fiber	Users can have fiber Gigabit connections locally, but total throughput dependent upon the capacity of the wireless link, which can be up to a Gigabit, depending on distance and budget.
Fiber	Fiber	Any amount of bandwidth needed, with standard connection typically a Gigabit (1,000 Megabits).
Fiber	Wireless	Typical customer connection starting at 5 to 10 Megabits, can be higher, with 50 Meg connections common.

8.2 WIRELESS TECHNOLOGIES

WISPs (Wireless Internet Service Providers) use a wide variety of radio frequencies to deliver fixed point wireless broadband. By "fixed point," this means that these systems are not designed to support roaming in the way that cellular voice/data radios are (that is, mobile phone and data services).

Fixed point broadband is broadcast from a tower to individual homes and businesses (fixed points). Most of the frequencies used require clear line of sight between the tower and the location where service is desired.

Hilly topography can work for or against good wireless broadband service. Towers located on the tops of hills and mountains can provide service over a larger area than a tower in relatively flat terrain, but hills also block the signal. A residence can be a short distance from a large tower, but heavy tree cover or an intervening hill will block service. The solution to this can be addressed in several ways:

More larger towers of 180' to 300'

The taller the tower, the wider the coverage, but as tower height increases, the cost of the tower also increases. Towers taller than 199' require a light at the top to make them visible to low-flying aircraft, and lighted towers are more expensive to erect, and the bulbs have to be changed periodically at significant expense. Many broadband towers are 180' to avoid the additional cost of lighting.

Small cell broadband utility poles

Small cell broadband utility poles, often called community poles, are shorter towers or utility poles of typically 60' to 80', located in or very near a cluster of homes. The towers can be wooden utility poles or relatively low cost steel monopoles or steel lattice towers. These towers are located to get above local tree cover so that clear line of sight to a distant taller tower is available. Local access point radios provide service to homes and businesses with line of sight to the pole. In many parts of Carroll County, these are going to be an important part of a strategy to get better broadband to rural residents and businesses.

Variety of radio frequencies

WISPs are beginning to deploy a wider range of licensed and unlicensed radio frequencies to overcome distance, bandwidth, and line of sight issues. Traditional 2.4 Ghz and 5.7 Ghz WiFi and WiMax frequencies are being supplemented or replaced with LTE and CBRS licensed broadband frequencies that provide better bandwidth and will tolerate light tree cover better (2.5 Ghz, 3.5-3.7 Ghz). Some WISPs are also using lower frequencies (e.g. 900 Mhz) that will travel farther and will also provide better penetration in light tree cover.

8.3 EMERGING WIRELESS TECHNOLOGIES

MIMO Wireless

MIMO (Multiple Input, Multiple Output) describes a variety of technologies that can be summarized as using more than one receive and transmit antenna for wireless data applications. Wireless protocols that are using the MIMO concept include IEEE 802.11n (Wi-Fi), IEEE 802.11ac (Wi-Fi), 4G, LTE (Long Term Evolution), and WiMAX. Each of these protocols use the MIMO technology to increase the amount of available bandwidth in a given section of radio frequency spectrum.

New hardware is required to make effective use of MIMO. While the technology increases wireless bandwidth, the typical amount of bandwidth being used by wireless devices is also increasing rapidly. Some applications where MIMO is likely to provide noticeable improvements are in home

wireless routers, where the effective throughput will be able to better handle the demanding bandwidth requirements of HD and 4K video streams. MIMO is slowly being developed for use with cellular smartphones, but both the phones and the cell tower radios have to be upgraded to support MIMO.

LTE/4G/5G

LTE (Long Term Evolution) is a set of protocols and technologies designed to improve the performance of voice/data smartphones. Like MIMO, both the user phone and the cell tower radios have to be upgraded to support LTE improvements. In 2013, only 19% of U.S. smartphone users were able to take advantage of LTE speeds, although that percentage has been increasing rapidly since then, and more than 85% of the U.S. cellular towers have been upgraded to LTE. As noted previously, the actual bandwidth available to a smartphone user is highly variable and depends on distance from the cell tower, the number of smartphones accessing the same tower simultaneously, and the kinds of services and content being accessed by those users.

The primary purpose of cellular bandwidth caps is to keep cellular users from using too much bandwidth and degrading the overall service. While LTE and MIMO improvements will improve overall cellular service, these technologies are not going to replace fiber to the home and fiber to the business.

In 2017, new fixed broadband wireless systems entered the marketplace using LTE frequencies, and many WISPs have begun to replace existing wireless radio systems with LTE equipment. These LTE systems do not provide any cellular voice services; they are designed specifically to support only broadband/Internet service.

In our conversations with both vendors of these systems and WISPs that have begun deploying them, we get two different stories. The vendors have been conservative in discussing the improvements, while some WISPs have been taking single user test results and suggesting that they will be able to deliver higher speeds at greater distances to all users.

To achieve the full benefit of 5G technology, more fiber is needed.

There is little debate that the LTE equipment offers higher bandwidth, at somewhat greater distances, and with somewhat better penetration of light foliage and tree cover. Over the next two to four years, most WISPs will change out most of their existing radio systems for the improved LTE radios. Perhaps the most significant advantage of LTE fixed point broadband is its ability to provide better performance when clear line of sight between the customer and a tower is not available. LTE provides better penetration of light to moderate tree cover and other line of sight obstacles.

The official standard for 5G radio technologies was release in 2019, and many metro areas of the country now have 5G radio systems. It is worth noting that many smartphones, even some late model smartphones, do not have 5G support built in.

5G does bring much higher speeds to wireless broadband (e.g. it might be able to deliver 30 to 50 Meg of bandwidth consistently). But 5G has significant limitations that do not make it a good solution in rural areas of the U.S.

The fact that 5G can deliver much higher bandwidth means that 5G cell sites will require fiber connections. This is going to effectively limit 5G deployments to denser urban environments where both customers and fiber are plentiful.

There is no free lunch in the physics of radio frequencies. The higher bandwidth of 5G means that cell sites need to be closer together because the 5G frequencies do not travel as far as existing 4G/LTE frequencies currently being used by the cellular industry. Most users will have to be within 500 to 1,000 feet to receive 5G service.

Some experts estimate that more than a million miles of new fiber will have to be deployed just to support the 25 largest metro areas in the U.S. 5G will not appear overnight.

Many cell sites per square mile are needed to make 5G widely available in a given area. If, as an example, about 25%, or 119 square miles of the county is underserved, very conservatively, 1,000 or more cell sites would be needed to provide good coverage (as many as nine or ten cell sites per square mile).

For rural areas, the cost of 5G service may be one of the most significant obstacles. The cellular carriers see the increased customer bandwidth use possible on 5G networks as a major revenue opportunity. While they will increase the "standard" bandwidth package for monthly service, bandwidth caps and rate limiting is likely to keep 5G cellular customers bills high.

Many rural areas of Carroll county has poor or no cellular voice/data service, and somewhat counter-intuitively, more fiber can solve that problem. Cell towers need fiber backhaul connections to provide the best cellular data performance, and so rural fiber will also help address the issue of poor cellular service.

White Space Broadband

White space broadband uses some of the frequencies that were formerly used by analog TV channels. These lower frequencies travel farther and provide better penetration of light foliage. Microsoft has been supporting a number of community white space experiments, and has promised much wider support for this technology, but there are few other users, equipment is still relatively expensive, and few WISPs have ventured into this still largely experimental technology. A Microsoft white space project in southern Virginia, although still underway, serves less than three hundred households and is still regarded as experimental. Other white space pilot projects have reported good results. One ISP experimenting with the technology has indicated that their trials with white space equipment has been able to deliver 50 Meg/50 Meg service.

Low Earth Orbit (LEO) Satellite Internet

The Elon Musk-funded Starlink effort began offering "beta test" service in late 2020. There is a one time equipment and installation fee of $499, and a monthly fee of $99. The company is promising download speeds of between 50 Meg/sec and 100 Meg/sec and upload speeds of up to 20 Meg/sec. Latency is lower than traditional satellite Internet services. If the prices remain reasonable, this is likely to become a much better alternative to the older satellite Internet services.

In early fall of 2021, Starlink announced that the company would be moving the service out of beta, which would make the service more available to more users. The service has received generally favorable reviews from beta users in terms of speed and reliability. It will be important mostly for rural users who have line of sight problems for terrestrial fixed point wireless and for households and businesses that are completely outside the coverage area for fixed point wireless. There have

been reports of long delays between the time a customer orders service and the equipment is actually installed.

Millimeter Wave Service

Millimeter wave services use a variety of very high frequency wavelengths in range of 30 Ghz to 300 Ghz. An emerging wireless broadband service that uses the term "millimeter wave" covers very short wavelengths in the 71-76 GHz, 81-86 GHz, and 92-95 GHz (70/80/90 GHz) bands. These shorter wavelengths permit the use of very small antennas while still being able to provide high directivity and high gain. A primary advantage of the smaller antennas is the ability to use more of them and to make each individual antenna highly directional. The higher frequencies also permit transmission of much higher bandwidth. However, the higher bandwidth rates are distance limited.

In early testing in 2020, U.S. Cellular was able to demonstrate speeds of 100 Mbps at distances of three miles using 5G radio equipment (5G equipment is also close to the millimeter wave spectrum using lower frequencies of 24 Ghz, 28 Ghz, and 39 Ghz for some equipment). Radio equipment tests are often conducted in optimum conditions, and in real world conditions, the practical distance may be lower and the bandwidth may be lower, where buildings and trees can degrade or block the radio signals.

8.4 DARK FIBER AND LIT FIBER

About Dark Fiber

Dark fiber is installed in conduit underground and/or hung on utility poles. It is called "dark" because no network electronics are installed to "light" the fiber (using small lasers in a fiber switch). For small municipal/local government fiber installations, dark fiber has a significant advantage in terms of management—very little ongoing operational responsibility is required.

Dark fiber is leased out to service providers, who install their own network electronics in cabinets or shelters attached to the fiber cables. The providers typically lease fiber pairs between the cabinet and their customers, and are responsible for all equipment-related management and maintenance. Dark fiber networks can be used by service providers to provision either Active Ethernet or GPON services to their customers.

Dark fiber networks do not generate large amounts of revenue, but this is offset by very low maintenance costs—primarily an emergency break-fix arrangement with a local or regional firm qualified to splice fiber. Emergency break-fix contracts are usually based on a time and materials basis, so there is little or no expense if there are no fiber breaks.

Other costs include "locates," which are called in to Mis Utility 811 and are performed by either the local Public Works department or a private sector contractor. For small fiber networks, locate costs are generally modest.

About Lit Fiber

A "lit" fiber network includes the network electronics needed to transmit data over the fiber (using the small lasers in a fiber switch, hence there is light traveling over the fiber cable). In a lit network, "lit circuits" are leased out to service providers rather than fiber pairs. The muni/local government/community network provides the network electronics, which reduces costs for the service provider—meaning they are able to pay higher lease fees for the circuits they use to deliver services (like

Internet) to their customers. Lit networks generate more revenue, but also have higher expenses because the network electronics have to be monitored and managed on a 24/7/365 basis (this task can usually be outsourced at reasonable cost). However, very small fiber deployments often do not pass enough homes or businesses to generate sufficient revenue to cover the higher costs.

Like dark fiber, a lit network incurs break-fix and locate costs as well.

8.5 THE MEET-ME BOX CONCEPT

In some of the larger towns, some smaller communities, rural neighborhoods, and subdivisions, "meet me" boxes could be installed. A meet me box is a telecom cabinet with fiber cables installed between the cabinet and nearby homes and/or buildings. Providers only have to reach the meet-me box, lowering their costs. Both wireline and wireless providers can use this infrastructure. This approach can also be used to provide fiber services in business and industrial parks. A small Virginia county installed five miles of fiber in their business park and was able to attract a Tier One provider to provide service to an existing business (a manufacturing plant that was going to leave if the county did not help them get better Internet service).

The dark fiber approach minimizes operational costs. Service providers would install their own equipment in the cabinet and would pay a small monthly lease fee for the fiber strands they use to connect customers to their services.

For a meet-me box installed in a "main street" area (e.g in an alley behind commercial/retail buildings) with relatively inexpensive and short fiber drop cables into nearby buildings, the lower end of an installation might start at $35,000. For a box installed in a rural sub-division that requires distribution conduit/fiber and drop cables, the cost to connect 25 homes might start at $175,000 on the low end and increase as the number of homes connected increases. Larger numbers of homes or businesses will each add to the cost, but adding more connected premises also increases the value of the infrastructure and increases the revenue potential.

8.6 TERRAIN CHALLENGES

The propagation study map studies that are included later in this report illustrate the challenge of providing adequate fixed point wireless Internet service in Carroll County. The mountainous terrain throughout the county shows that many towers and community poles will be needed to near an adequate solution using fixed point broadband wireless. In some areas, the difficulty of obtaining line of sight for a radio link between two locations may dictate using fiber in place of wireless. A combination of taller towers and shorter community poles may be needed to provide good service to most areas of the county.

As an example, in Grant, Virginia, a group of about one hundred homes received a fiber to the home solution that utilized high performance microwave backhaul. This was a Wired Road project funded by a USDA grant, and community has had fiber service for more than five years. In Section 8 of this report, we have provided examples of fiber to the home projects in rural parts of the

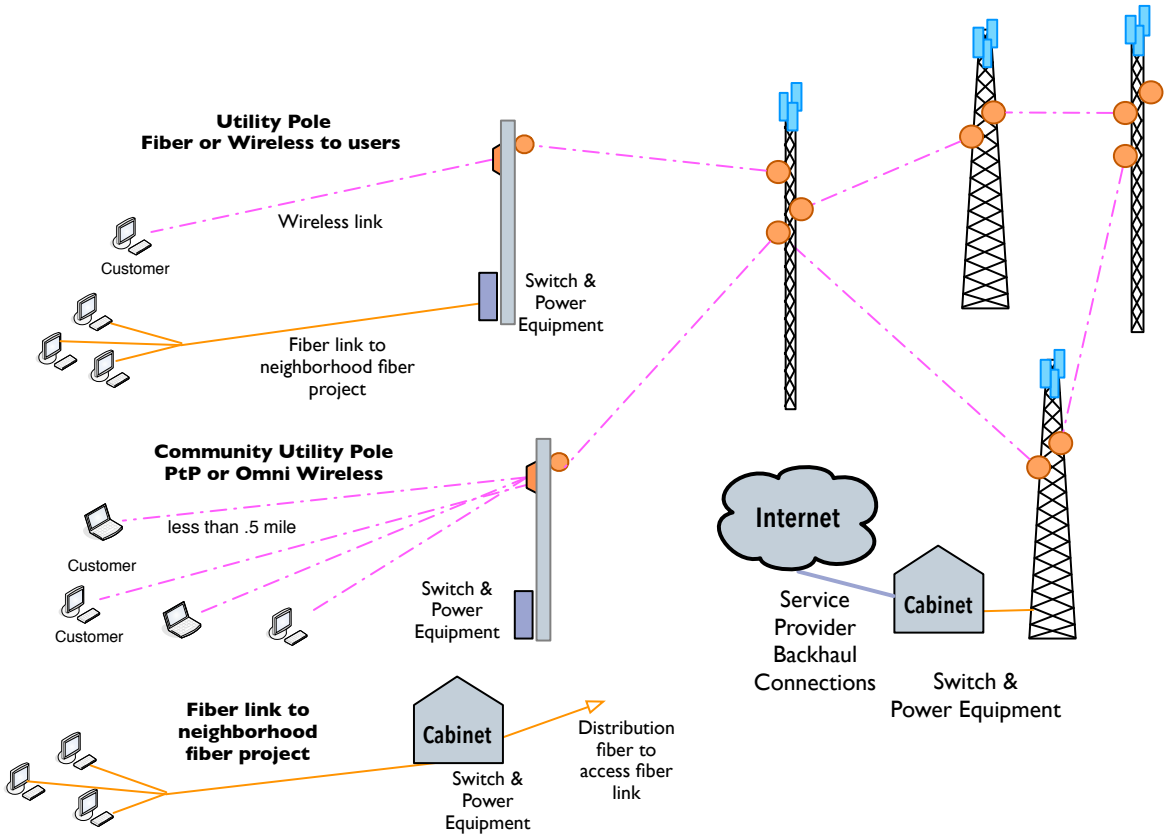
county, using a tower location for network backhaul and extending fiber service from the tower to nearby homes and businesses.

8.7 CONNECTIVITY SOLUTIONS

Both wireless and fiber networks, as well as legacy copper-based networks, all share three primary components. How these are designed and deployed can vary greatly, but all networks have these three parts in some form.

- The **Core Network** provides access to the Internet, a place for service providers (ISPs) to distribute their services locally on the network, and for larger institutional and business customers to meet service providers. Carroll County has both landline and wireless service providers, but there are still areas that are underserved. Each of these providers has their own Core Network, but wireless broadband could be more widely available if additional county-owned towers were available to the private sector providers.
- The **Distribution** portion of the network connects the Core Network with collections of users. A Distribution network can include both fiber and wireless portions of a network.
- The **Access or Last Mile** portion of the network connects residential users and businesses to the network, and like the Distribution network, that connection will be by fiber or by a wireless link.

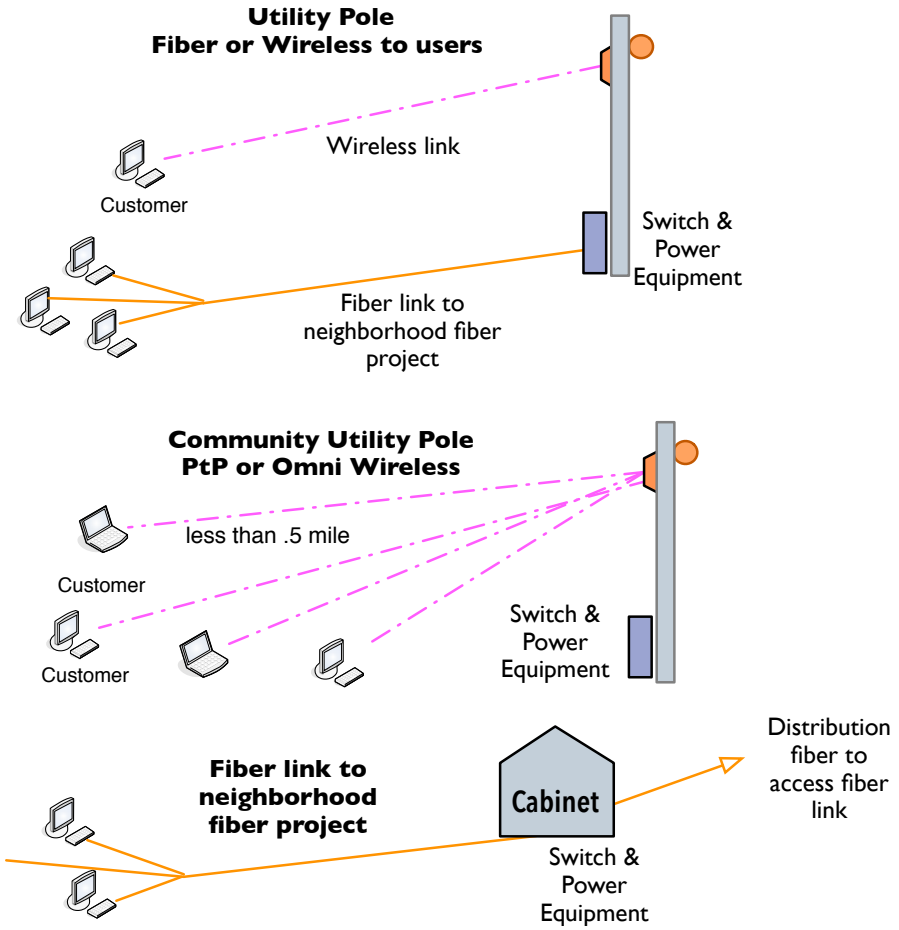
The illustration below shows the full range of technology options (fiber and wireless) and how they can be connected together in various ways to meet the diverse needs of the county. More detail is provided on the following pages.



Last Mile Access

The Last Mile Access is the portion of the network that connects customers to their service provider and the Internet. Both broadband wireless and fiber links can be utilized to provide service. There are several ways that customers can receive service:

- Service providers can install their own local access radios on the Distribution towers, using both point to multi-point and point-to-point radios to deliver service to their customers.
- A single user utility pole (or inexpensive steel lattice tower) can be installed on the property of a single resident or business. A radio at the top of the pole receives service from another tower site (typically one of the Distribution towers).
- A utility pole (or inexpensive steel lattice tower) can be installed near a cluster of homes (e.g. a rural residential sub-division, several homes in close proximity on a rural road). Service providers can install their point to multi-point radios on this pole and provide economical service to several customers from a single pole.
- A utility pole (or inexpensive steel lattice tower) can be installed in a rural subdivision. A service provider installs a point to point radio on the pole, and fiber cable can be run from the pole past several homes to offer fiber service with wireless backhaul.
- Customers near existing fiber can have a fiber drop installed directly to their home or business.



Distribution Network

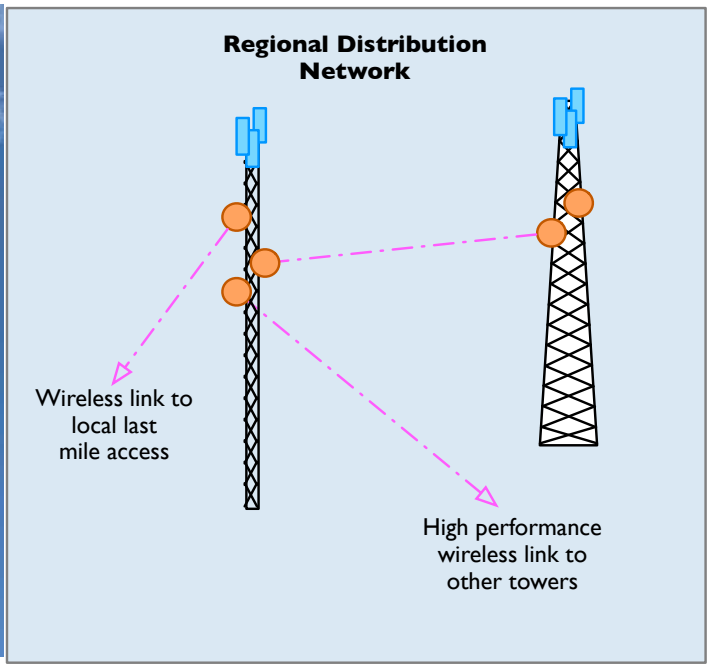
Distribution is the portion of the network between the Distribution sites to the Last Mile Access portion of the network. It is desirable for each distribution site to have a connection back to more than one Distribution site (tower) on a redundant ring. This ring topology protects against hardware failure at the port level and does provide some protection if one of the tower to tower wireless links is disabled by an equipment failure.

These tower sites are typically 120′ to 180′ tall to provide the height needed to enable Line Of Sight (LOS) between towers, and for local access, to enable service providers to mount point to multi-point radios on the towers.

Towers taller than 199′ become subject to FAA regulations because the height can be a potential hazard to airplanes. Towers that exceed 199′ usually have to be painted (alternating red/white) and have a blinking light at the top. These requirements increase the long term maintenance costs, but the taller towers can improve line of sight to other towers.

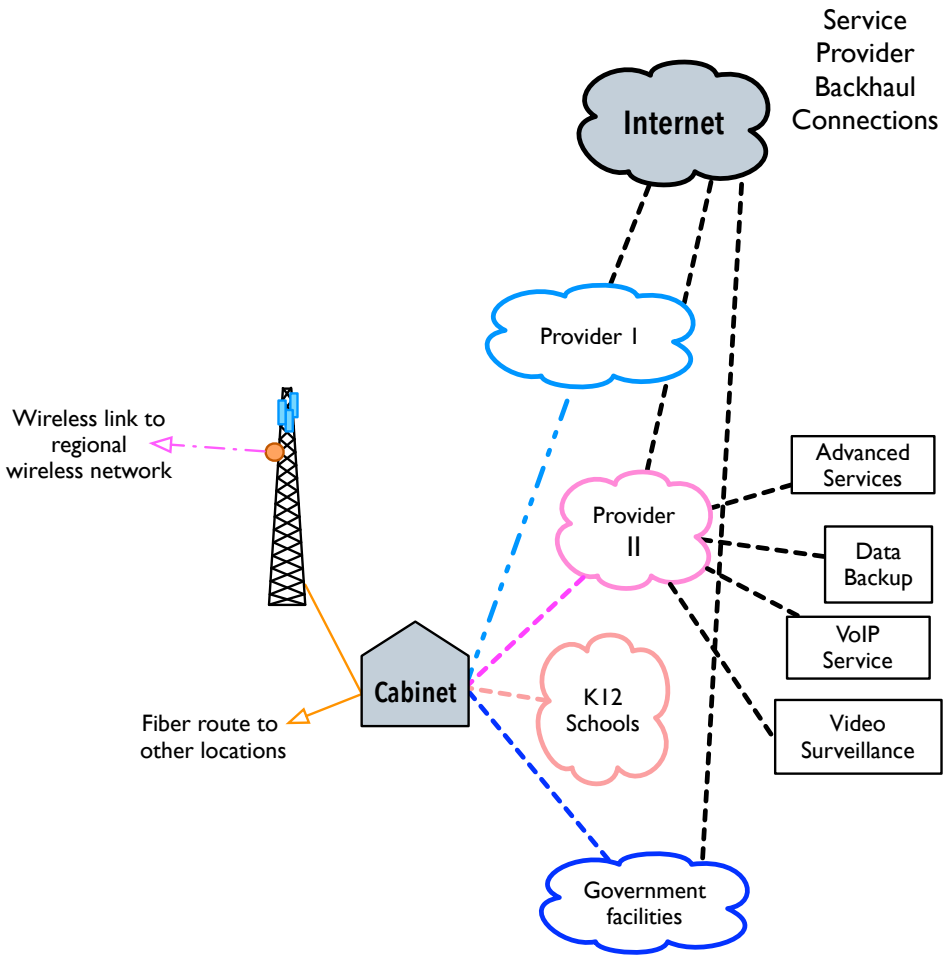
The towers can provide two functions:

- Space for backhaul connections to other towers in the county.
- Space for local access radios to provide Internet access within 2-3 miles of the tower (or farther with good Line Of Sight).



Core Network and Service Providers

In the past, the telephone company switch office (Central Office, or CO) has provided that function. Today, many communities have either a community-owned data center or a privately owned data center that offers an affordable range of options for customers of broadband services.



The Co-Location facility provides a meet point for various public and private fiber cables and networks to inter-connect. A local facility with space available for both public and private uses could help attract additional private sector investments (e.g. a long haul fiber provider wants connect to this facility because of increased access to customers).

A colocation facility is a controlled environment (i.e. secure, heated, and air-conditioned) room with Internet access through wired and/or wireless systems. The colocation facility is a place where fiber, wireless, and copper-based network facilities meet. It is equipped to house high-end network equipment, servers, and other electronic gear.

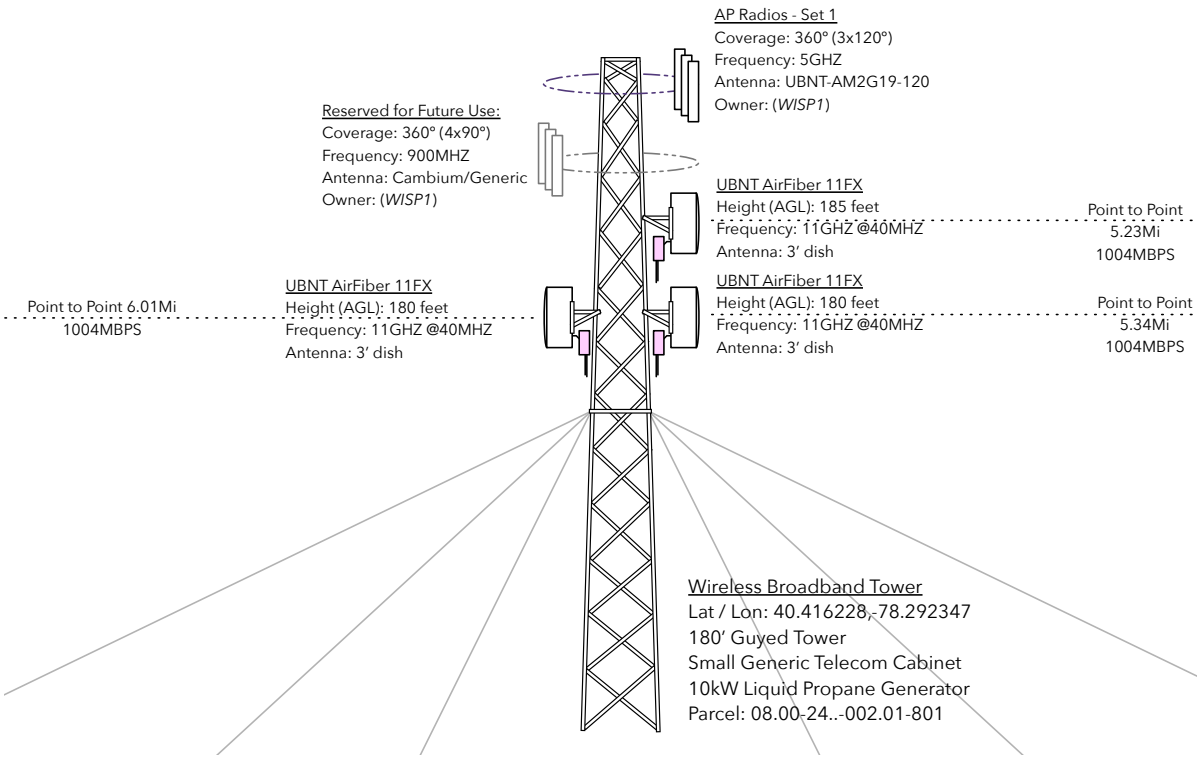
A variety of middle layer network components and services can be located within the co-lo including, for example, directory services, replicated content servers, routing services, and other elements needed to deliver new multimedia services to the home and small office from multiple, competing providers.

Characteristics of the colocation facility are:

- A reliable source of AC electric power is required, with backup UPS (Uninterruptible Power Supply) service, and additional power backup available by an onsite generator is desirable.
- Controlled access to the facility (e.g. by electronic keycard) 24 hours/day, seven days a week. Service providers need to be able to gain access to the equipment room as needed, and work activities performed at night or on weekends is common.
- Racks for locating network equipment and servers, and optionally locked cages for equipment racks.
- Sufficient cooling capacity for the network's current and long-term needs. Equipment rooms require both a cool air input vent and an air return vent.

8.8 WIRELESS NETWORK ARCHITECTURE

The diagram below shows an example of the equipment typically placed on a tower, and details about the equipment that is planned. Several sets of Access Point radios can be placed on a tower operating in different frequencies, and can be owned/operated by multiple WISPs. Point to point radios link this tower to several other sites.



When developing wireless networks there are several categories of costs at each site. Construction of the network will incur site related costs at each tower site including:

- Site development - clearing the site of trees and vegetation, construction of a tower road for access to the site, and strict adherence to all erosion and sediment control measures required by the Owner.
- Passive site equipment - In most cases, a network cabinet will be installed and a new power service will need to be run to it. At each site there will be a generator and most likely a propane tank also installed. Reliable power systems will be installed inside the cabinets, and other equipment management solutions will be installed in the cabinet for network equipment.
- The tower itself - new towers in this estimate are designed as 180' guyed towers. A guyed tower is usually a small profile lattice type tower that is supported by guy wires at several points on the tower. Guyed towers usually have a smaller visual profile than self supporting towers because they are narrow from the top all the way to the base. Self supporting towers will have the same lattice type structure but the tower widens as you get closer to the base. If the tower base is obscured by trees all around, a self supporting tower may be preferred. Some sites may require design changes based on site conditions. Other types of towers such as monopoles

could be considered for this project, especially if the owner is working with cellular providers on developing a site.

- Network equipment such as Point to Point radios, routers, switches, and access point equipment will be installed during the construction of this network. Since the network has built in redundancy the configuration will need to support automatic failover and other high-level network functions. In addition to the networking expertise needed to configure large networks such as this the contractor(s) configuring the network will need to understand spectrum management, wireless signal propagation, and other physical aspects specific to wireless networks.
- Permitting - depending on the locality developing a wireless site usually requires extensive permitting processes that require a relatively long timeline and professional services.

8.9 SMALL CELL BROADBAND POLES

Line of sight issues are a constant problem for rural residents and businesses, as clear line of sight (or near line of sight) is required for fixed wireless Internet services. Even newer technologies like white space and LTE systems work better with clear line of sight to distant towers.

The increased use of wooden utility poles is already common in some other areas of the country, and increased use of this technique to get the customer CPE radio/antenna above tree cover is a relatively simple solution.

The utility poles would normally be placed on private property, subject to existing or updated ordinances governing the placement of wooden utility poles. The local government would have no responsibility for maintenance and repairs.

The cost of placing an eighty foot pole can range from a low of about $2,000 to $7,000 or more, depending on permitting, engineering requirements, and the location of the pole. Some municipalities provide "by right" permitting of these poles if they are placed on private property, which can reduce the cost of installing them.

Because these are placed on private land, local government would not have

SITE	DESCRIPTION	TOTAL COST
Dugspur Tower	A new 180' tower constructed on private land that is bought or leased on the hill north of Dugspur Rd. Approximately 1.5 miles east of Dugspur. Tower to complement existing Wired Road wireless coverage by serving rural addresses in and around Dugspur. Service Provider to Install wireless equipment. Point to point line -of-sight to both of the other new towers as well as to at least one existing Wired Road tower.	$230,781
Silver Leaf Road Tower	A new 180' tower constructed on private land that is bought or leased next to Silver Leaf Road. Tower to complement existing Wired Road wireless coverage by serving rural addresses Between Dugspur and Laural Fork. Service Provider to Install wireless equipment. Point to point line -of-sight to both of the other new towers as well as to at least one existing Wired Road tower.	$230,781
Danville Pike Tower	A new 180' tower constructed on private land that is bought or leased next to Danville Pike approximately 5 miles east of Hillsville. Tower to complement existing Wired Road wireless coverage by serving rural addresses Between Hillsville and Laural Fork. Service Provider to Install wireless equipment. Point to point line -of-sight to both of the other new towers as well as to at least two existing Wired Road Tower.	$240,138

$701,700

to provide any direct funding. However, the localities could encourage wider use of this option with a public awareness campaign developed in partnership with wireless providers. Local banks could be encouraged to provide low cost financing of the poles so that property owners could make a small interest and principal payment monthly over several years to reduce the financial impact.

This strategy requires minimal financial support from the County and that it has the potential of improving broadband access in rural areas of Carroll County quickly. The County should work with WISP partners to promote this option to improve access to new and existing wireless broadband towers.

8.10 NANO-CELL AND WIFI CALLING SERVICE

A common complaint in Carroll County is the poor cell service in many areas. In some parts of the county, there may be adequate broadband service via DSL or fixed point wireless Internet, but poor cellular phone/data service. There are now two solutions to improving rural cellular service that do not involve the expense or difficulty of attracting and/or building more cellular towers.

WiFi Calling – This approach takes advantage of the WiFi Calling feature that is now common in many late model cellphones. Once the phone is connected to a WiFi network (e.g. in the home using the home's broadband Internet service), the phone will automatically route the call over the WiFi network–phone calls and text work normally, as if the phone is connected to a cellular tower.

Nano-cell Calling – Poor or no cellular service in rural areas can be addressed by promoting the wider use of "nano-cell" devices. These small pieces of equipment are connected to the DSL or wireless broadband connection and provide improved cell service in the home or business. The working distance of these devices is limited, and service generally drops off once you leave the house itself (it may work for some short distance in the yard). These devices work very well and do not require an upgrade to a newer phone.

The cellular providers do not always promote the use of these devices, so many cellular users who would benefit from their use are not aware that this option is available. The device averages around $200 retail, but the cellular providers often provide substantial rebates (50% discount or more) and in some cases may provide them at no charge.

The improved wireless broadband service will also support use of WiFi calling and/or nano-cell devices.

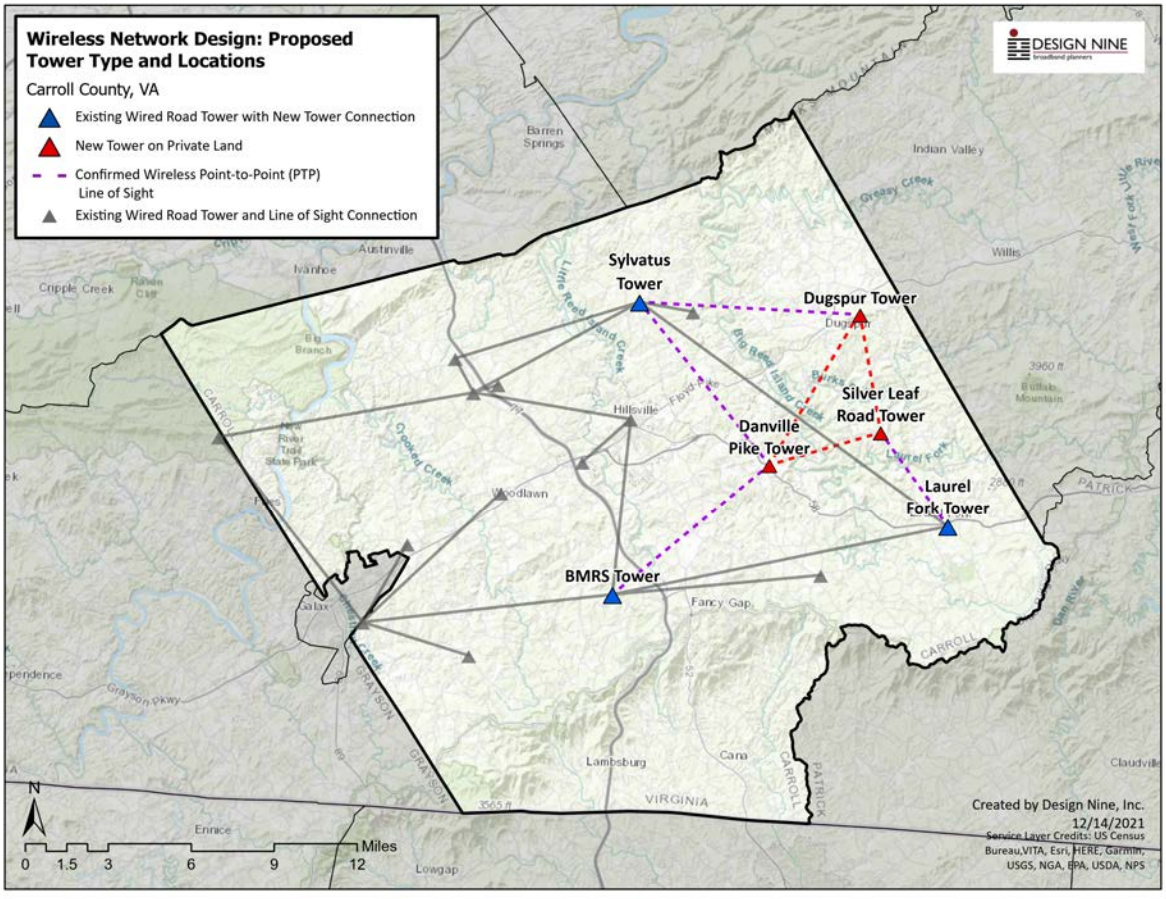
This strategy is important because improved broadband service can also improve cellular service without the need for more cellular towers, especially in parts of the county where cellular providers have not been able to make the business case for more towers.

9 BROADBAND CONNECTIVITY PROJECTS

This section describes a county-wide fixed point wireless solution for Carroll County as well as four rural fiber to the home projects.

9.1 WIRELESS NETWORK TOWER DESIGN

The network design in this section provides an affordable tower network in the portions of the county that have the poorest service. In partnership with the Wired Road, the County could facilitate funding additional towers that could serve a significant portion of the county. Wireless propagation studies were used to calculate coverage areas, and those studies included calculations that evaluated terrain and foliage coverage in the county. Where line of site to the



proposed towers is poor, additional households and some small unserved pockets could be added by placing inexpensive utility poles.

This design assumes grant funds will be used to build the towers, and the Wired Road would manage the radio network. Internet service would be provided by the existing Wired Road private

sector service providers. Connectivity between towers would be provided by high performance microwave links and would enable a wide area broadband wireless network that would provide wireless customers with a minimum of 25 Meg down and 3 Meg up meeting the FCC "fully served" definition.

The wireless network design consists of three new towers and uses three existing Wired Road towers (Sylvatus, BMRS, and Laurel Fork). The dotted lines indicate point to point connections between each tower, which creates a single county-wide broadband network. The point to point connections (the dotted lines) have all been calculated to have adequate line of sight between towers and poles.

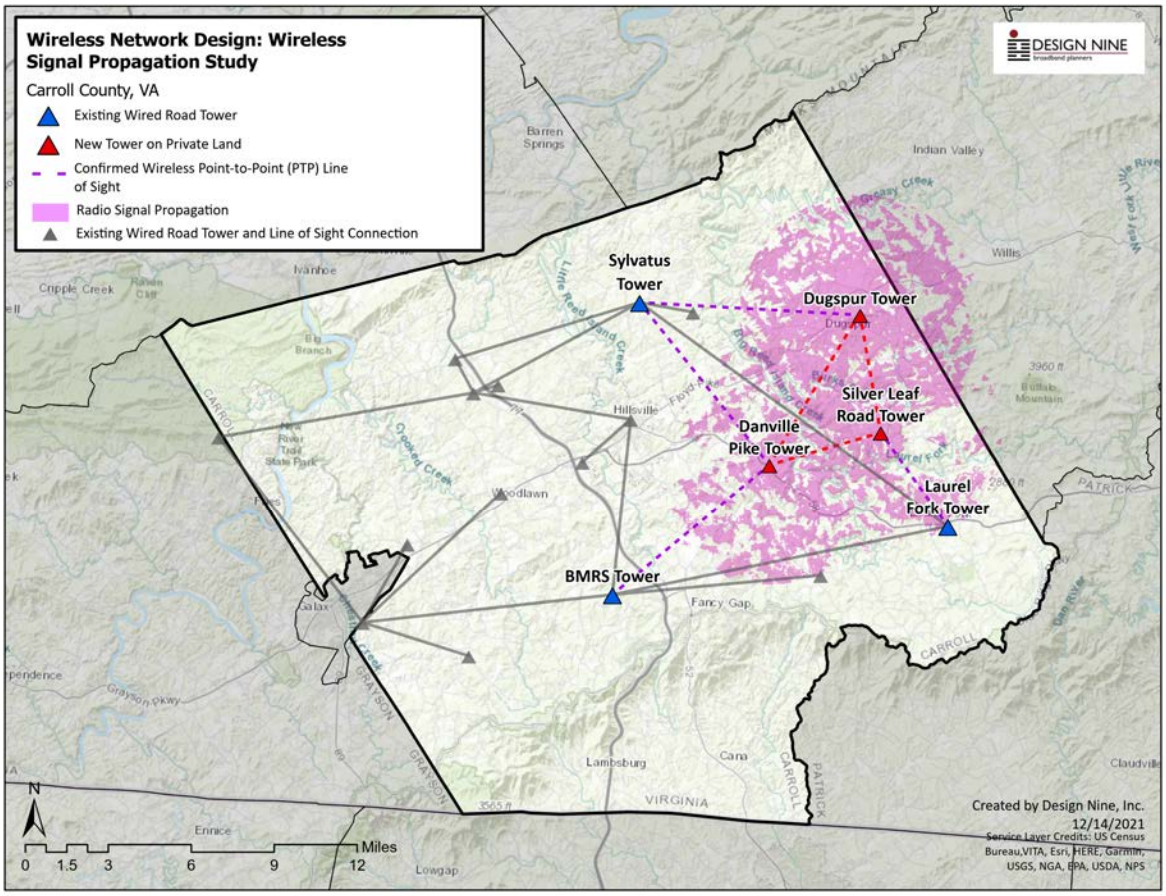
SITE	DESCRIPTION	Tower Cost	Site Acquisition	Point to Point Radio Connections	TOTAL COST
Dugspur Tower	A new 180' tower constructed on private land that is bought or leased on the hill north of Dugspur Rd. Approximately 1.5 miles east of Dugspur. Tower to complement existing Wired Road wireless coverage by serving rural addresses in and around Dugspur. Service Provider to Install wireless equipment. Point to point line -of-sight to both of the other new towers as well as to at least one existing Wired Road tower.	$184,713	$18,000	$28,069	$230,781
Silver Leaf Road Tower	A new 180' tower constructed on private land that is bought or leased next to Silver Leaf Road. Tower to complement existing Wired Road wireless coverage by serving rural addresses Between Dugspur and Laural Fork. Service Provider to Install wireless equipment. Point to point line -of-sight to both of the other new towers as well as to at least one existing Wired Road tower.	$184,713	$18,000	$28,069	$230,781
Danville Pike Tower	A new 180' tower constructed on private land that is bought or leased next to Danville Pike approximately 5 miles east of Hillsville. Tower to complement existing Wired Road wireless coverage by serving rural addresses Between Hillsville and Laural Fork. Service Provider to Install wireless equipment. Point to point line -of-sight to both of the other new towers as well as to at least two existing Wired Road Tower.	$184,713	$18,000	$37,425	$240,138

$701,700

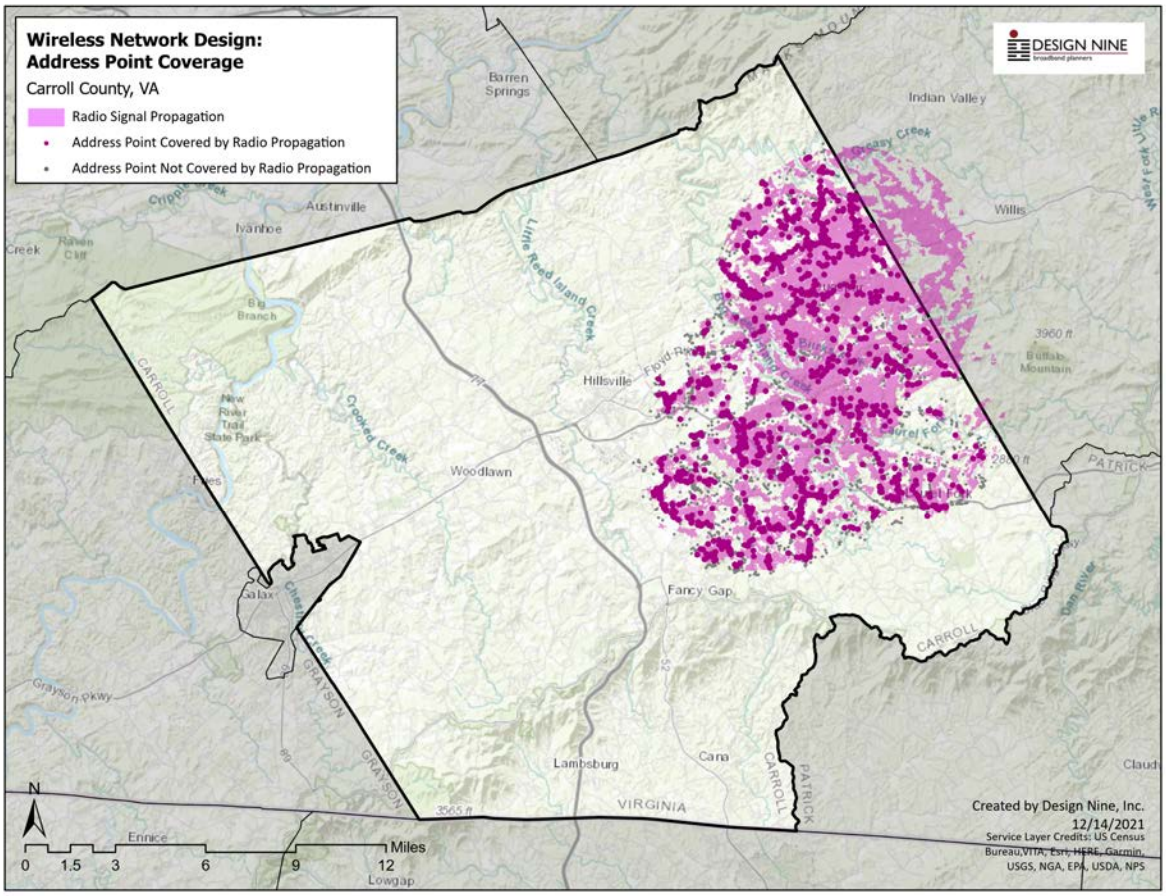
In this design, there are three tower locations that may require placement on private land. In most cases, the proposed tower locations can often be shifted from one parcel to another without affecting line of sight to other towers, but once an exact parcel has been identified, it will be important to validate that the proposed line of sight to other towers has not been affected. It is also possible that negotiating a site lease agreement with a land owner could take longer than the 3-5 months needed to prepare the site and erect the tower.

The map below shows the estimated radio signal propagation for the wireless project. Colored triangles indicate the type of tower site being developed.

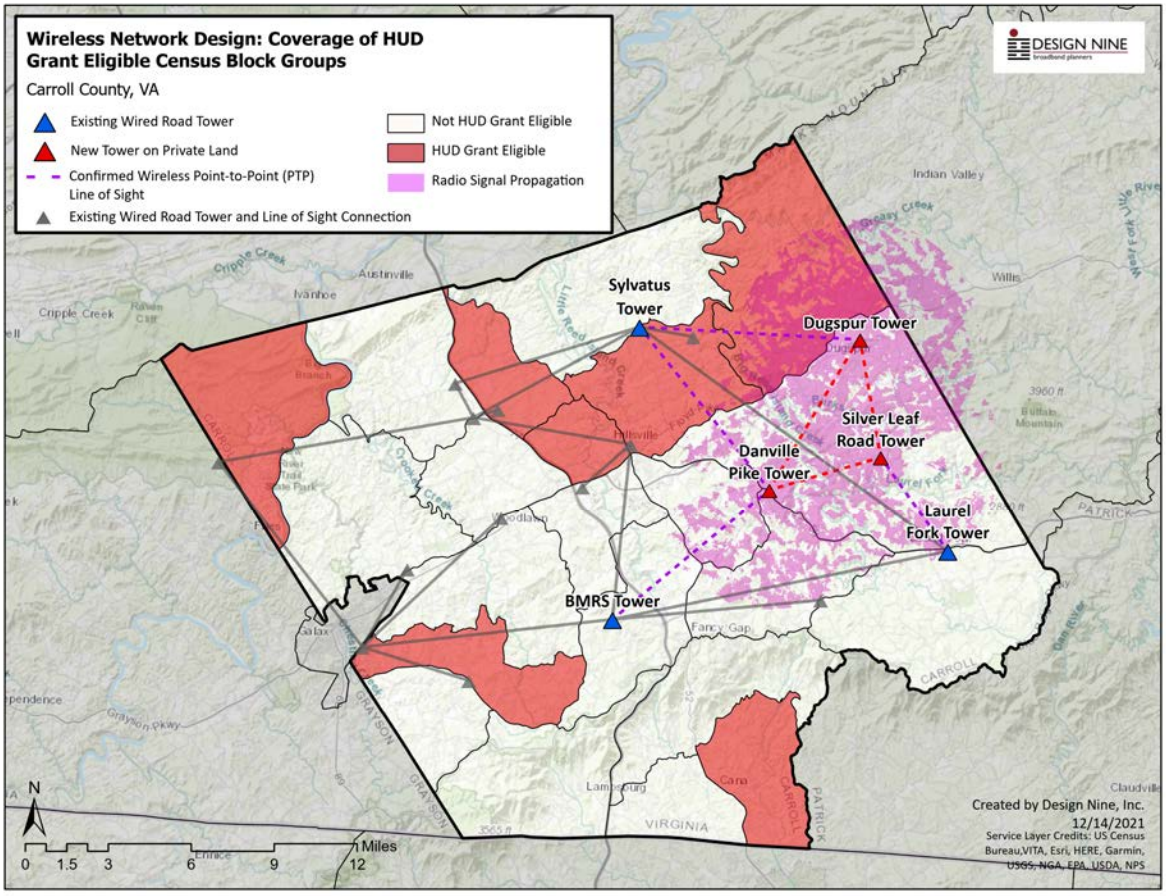
This design is intended to optimize coverage in the east-central area of the county with some of the poorest existing Internet service.



This map shows the estimated signal coverage and includes the address points (households) that can potentially receive service within those shaded propagation areas. It is important to note that the propagation software does make an estimate of foliage and terrain when calculating signal propagation, trees, buildings, and other obstacles near a residence or business could degrade or limit coverage. In many cases, a wooden utility pole placed near the premises may improve line of sight to a tower and enable improved service.



This map shows the estimated propagation of the proposed wireless network, overlaid on areas of the county that are eligible for HUD grants. Unfortunately, the areas with poor service are outside the HUD-eligible areas.



9.2 TOWER AND WIRELESS NETWORK DEVELOPMENT ACTIVITIES

This section identifies the key tasks and timelines associated with developing the tower sites and expanding the network.

Tower Site and Tower Development Process

ACTIVITY	DESCRIPTION	DISCUSSION	TASKS
Assess and inventory prospective tower sites in designated areas for the three new towers.	Some grant applications for wireless towers will require specific locations for towers.	Use report data to identify where towers are needed.	• Appoint someone to lead tower site effort. • Assemble a list of locations from report data. • Begin meeting with property owners to determine willingness to provide space for tower and availability of road access and electric service. • Collect site agreements.

Tower Site and Tower Activities

TASKS	MONTHS											
	1	2	3	4	5	6	7	8	9	10	11	12
Appoint site identification team												
Collect prospective sites												
Meet with property owners												
Collect site agreements												

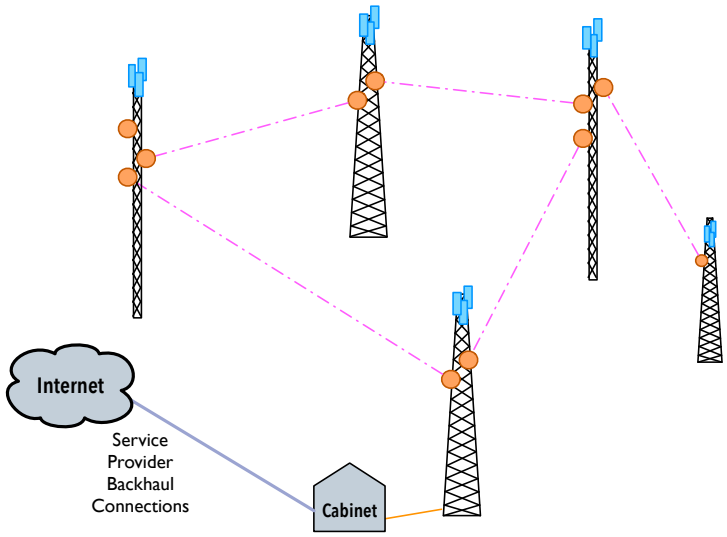
9.3 TOWER COST DETAIL

About Wireless Tower Cost Estimates

The line items for each named tower include the cost of the tower, site preparation, estimated cost of electric service, generator cost and placement, cost of the tower, and labor to assemble and erect the tower, and backbone equipment.

This section of the report provides an estimate of the cost of using existing towers to provide improved Internet access. The diagram below shows the logical design of a five-tower network. Four of the five towers have adequate line of sight between the towers to build a fully redundant ring between the towers, which will provide much more reliable service, because a single tower or equipment failure will not affect service.

Any placement of new towers should be preceded by a careful viewshed analysis of how much area/users are likely to be able to receive service. Site acquisition and site preparation costs can affect the overall cost of such a project. Existing county properties (e.g. fire/rescue stations, county parks, dump transfer sites, etc.) may be candidates for towers. Note that existing towers may require an engineering study to confirm that additional antennas can be added without exceeding the tower load limits.



Existing Tower Improvements

For existing towers owned by the state, the county, or other stakeholders that might be candidates for project use, modest upgrades to equipment at the base of the tower would be needed to make them broadband-ready.

Upgrades to existing towers typically may include adding or upgrading generators, additional cabinet or shelter space for service provider equipment, and sometime fencing and physical access changes.

Note that this estimate represents a worst-case scenario. If the site already has a generator that can be used by a new WISP co-locating on the tower, that could reduce the cost by as much as $7,500. If no road improvements are needed and existing electric service does not require a new H-frame and meter, another savings of up to about $3,000 is possible. If the tower has a current certification (i.e. had a formal engineering inspection), additional savings are possible, bringing the best-case cost to about $11,000 to $12,000.

Existing Tower Development and Improvements (Fit-up)

ITEM/PROJECT	UNITS	UNIT COST (LOW)	UNIT COST (HIGH)	COST (AVG)
Tower Study / Survey	1	$4,500	$7,000	$5,750
Site Development (Clearing, Road Improvements, etc.)	1	$0	$1,500	$750
Small Telecom Cabinet AmProd AM47P-2636-24RU or Equivalent	1	$6,000	$7,500	$6,750
10kW Liquid Propane Generator	1	$4,000	$6,000	$5,000
Cabinet Foundation and Installation	1	$2,500	$4,000	$3,250
New Power Service / Installation (assumes power available on-site)	1	$1,500	$2,500	$2,000
Power System Installation Labor	1	$300	$500	$400
Generator Installation Labor	1	$1,250	$1,700	$1,475
Propane Service Installation - tank and install by local gas company	1	$750	$1,250	$1,000
Poject management				$10,000
Total:				$36,375

New Tower

New towers have a range of configurations and cost options. This estimate is for a new 180 ft bare tower with no radio equipment. If located on existing county properties, the time needed to plan for construction can be shortened. If site acquisition or a site lease of private property is required, purchase or lease negotiations can add several months to the process. Note that a full permitting process may be required even if a new tower is placed on existing county-owned property. The permit process can add 60 to 120 days to the time needed to put a new tower in service.

New Tower Costs (180' Guyed)

ITEM/PROJECT	UNITS	UNIT COST (LOW)	UNIT COST (HIGH)	COST (AVG)
Labor and Contracting: $82,640				
Site Development (Clearing, Road Improvements, etc.)	1	$15,000	$15,000	$15,000
New Power Service / Installation	1	$1,250	$3,450	$2,350
180' Guyed Tower Construction Labor & Contracting	1	$50,000	$74,750	$62,375
Cabinet Installation Labor	1	$600	$1,150	$875
Power System Installation Labor	1	$300	$575	$438
Generator Installation Labor	1	$1,250	$1,955	$1,603
Materials: $35,735				
180' Guyed Tower Construction Materials	1	$17,500	$27,500	$22,500
Small Telecom Cabinet	1	$4,000	$6,000	$5,000
Cabinet Foundation and Installation Materials	1	$1,000	$1,500	$1,250
10kW Liquid Propane Generator	1	$4,000	$6,000	$5,000
Spare Fuses	1	$10	$20	$15
Power System Installation Materials	1	$20	$40	$30
Samlex 1000W Inverter	1	$350	$450	$400
Samlex SEC1230-UL Battery Charger	1	$200	$300	$250
100ah 12v Non Spillable Backup Battery	4	$250	$350	$1,200
DC Voltage Monitoring Device	1	$40	$60	$50
Unmanaged Rack Mount PDU (6O)	1	$35	$45	$40
Total:				$118,375
Project Management, Network Design				$37,500
Site Engineering, Surveying, Viewshed Analysis, Etc.				$9,500
Misc Fees, Technical Services				$7,500
Contingency				$11,838
TOTAL:				$184,713

New Community Pole

A single wooden utility pole or inexpensive steel lattice tower with a line-of-site wireless connection to a 180 ft tower and local access radios could provide access to any residence with line of sight within a half mile or more. This would spread the cost of pole construction and equipment costs across several households or businesses. There are many areas in the county where there is a cluster of homes along a relatively short stretch of road. All of those homes could share the use of a single local utility pole access site.

If there were twenty homes that could receive service and the cost of the pole and equipment was $12,000, each household connected would have a one-time cost of $600. There could be a matching grant program where each county could provide 50% of the cost of putting the pole and equipment in place, and the balance would have to be developed from other sources. Some localities are using this concept to offer WISPs exclusive access to the pole in return for a portion of the construction costs.

Pole costs vary depending upon what equipment is installed. Point-to-point link radio costs vary with distance from a nearby tower. More information is contained in Chapter Six - Small Cell Broadband Poles.

Neighborhood Pole Costs

ITEM/PROJECT	UNITS	COST (LOW)	COST (HIGH)	COST (AVG)
Site Development (Clearing, Road Improvements, etc.)	1	$0	$2,000	$1,000
3x3 NEMA Box	1	$300	$600	$450
New Power Service / Installation	1	$500	$1,250	$875
60' Wooden Utility Pole Construction Materials	1	$2,500	$3,500	$3,000
Unmanaged Rack Mount PDU (6O)	1	$35	$45	$40
60' Wooden Utility Pole Construction Labor & Contracting	1	$2,000	$3,000	$2,500
Neighborhood Pole Coordination and Project Management				$5,000
Total:				$12,865

Point-to-Point Links

The table below show the cost of a backhaul radio installation, with one licensed radio set (AirFiber 11FX). The licensed radios are less susceptible to interference and have higher bandwidth. A regional backhaul network between towers has several desirable characteristics:

- It reduces the cost to providers of being able to affordably offer service on all the towers.
- It increases the reliability and robustness of the WISP services because of the ring design (on at least four of the towers).
- County government data and/or public safety services could also be carried on the backhaul network to provide improved access to some remote facilities.
- K12 schools may be interested in having a redundant network to improve reliability of their existing fiber connections. This can be especially important during periods when online standardized testing is taking place.

A tower in a larger network may have one, two, or several backhaul radios included, and number of radios depends on the tower's location in the network and how many other towers it is connected to using point to point link pairs.

Licensed PTP Radio - Single Side - AirFiber 11FX

ITEM/PROJECT	UNITS	UNIT COST	COST
AF11X Radio	1	$799	$799
AF11-CA Adapter Kit	1	$49	$49
AF11FX Duplexer	2	$199	$398
AF11 X Antenna 11GHz, 35dBi	1	$379	$379
FCC Licensing	0.5	$2,000	$1,000
Shipping @ 5%	1		$131
Point to Point Link Assembly, Installation, Alignment, and Testing	1	$3,600	$3,600
Project Management, NIIT	0.5		$3,000
TOTAL			$9,356

9.4 ESTIMATED TIMELINES FOR COMPLETION

Each kind of project will have its own timeline, and will vary widely depending on the type of funding. Grant-funded projects may need six months to one year to plan and apply for funding, depending on where in the grant cycle the network owner commits to applying for a grant and the length of time that the grant agency takes to review and approve grants.

Tower improvements and construction times can be dependent on weather (more weather related delays are likely in late fall through early spring) and on procurement. Most grant-funded projects require careful attention to a public procurement process, which can add 90 to 180 days to the timeline.

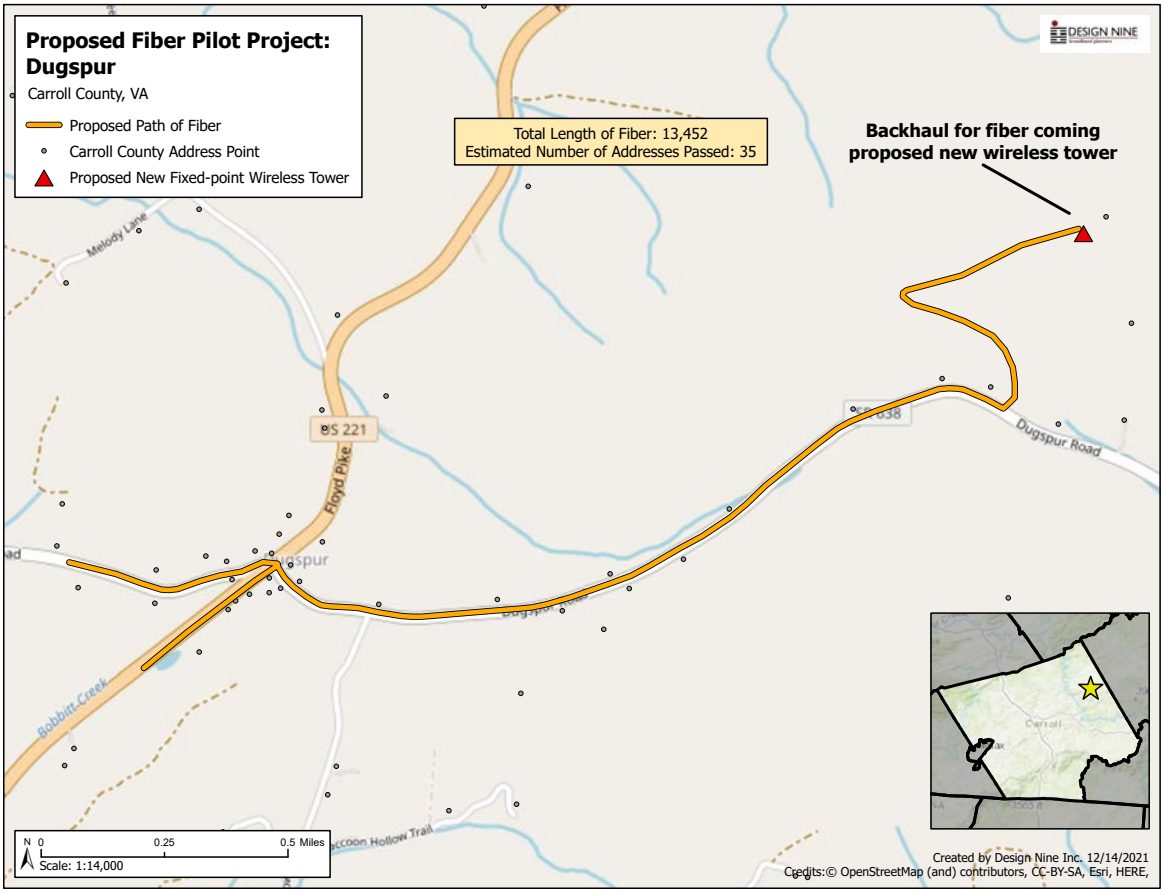
NOTE: In 2022, because of the large number of broadband projects throughout the U.S. that will receive funding, supply chain delays and slow delivery of materials could have an unpredictable impact on project completion times. We strongly recommend ordering materials as early as possible.

Broadband Construction Timetable

Project Type	Project Execution Planning	Project Procurement	Project Engineering and Construction	Total Estimated Timeline
Improvements to existing towers	2-3 months	3-4 months	2 months	7-9 months
New towers of 180 ft	4-6 months	4-5 months	4-8 months	12-19 months
Small cell community broadband poles	3 months	2 months	2 months	7 months
Public WiFi Hotspot	3 months	1 month	1 month	5 months
Point to point tower backhaul links	2-3 months	3-5 months	1-2 months	6-10 months
Fiber to the home/ business projects	4-6 months	4-6 months	6-12 months	14-24 months

9.5 DUGSPUR FIBER PILOT

This fiber to the home study provides insight into the cost of delivering fiber Internet service to residential neighborhoods. Data collected from the residential broadband survey indicated this area needed better Internet. Internet service would be delivered from the (new) Dugspur tower, with about 2.5 miles of fiber to the home passing at least thirty-five residences.



Carroll County Fiber Pilot - Dugspur Tower Route Overview

0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	2.55
2	Number of Handholes Installed	27
3	Splice Closures Installed	7
4	Cabinets Installed	1
5	Number of Buildings Connected	13
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	2%
8	Trenching - Percentage of construction installed by trenching	5%
9	Boring - Percentage of construction installed by horizontal drilling.	63%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	30%
13	Aerial Info	2% Aerial is estimated to account for water body crossings and other obstacles to construction.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

Carroll County Fiber Pilot Dugspur Tower Cost Summary

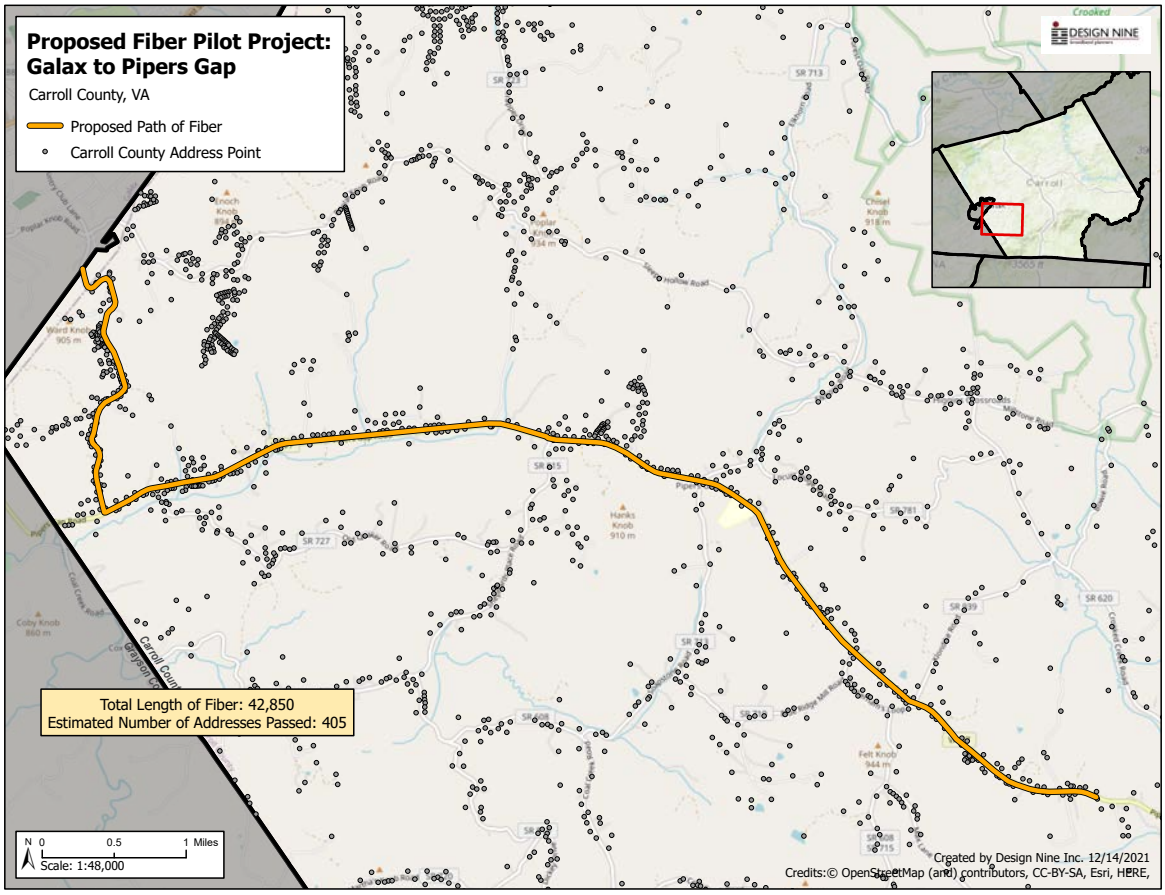
0	ITEM/PROJECT	ESTIMATED
1	Carroll County Fiber Pilot Dugspur Tower Construction Materials	$64,493
2	Carroll County Fiber Pilot Dugspur Tower Distribution Labor	$171,782
3	Carroll County Fiber Pilot Dugspur Tower Structures, Cabinets, and Equipment	$26,030
4	Carroll County Fiber Pilot Dugspur Tower Drop Construction	$13,088
5	Network Construction Subtotal	**$275,392**
6	Project Mgmt, Network Engineering, Integration, and Testing	$33,047
7	Misc Fees, Advertising, Technical Services	$2,754
8	Bookkeeping and Administration	$2,065
9	Engineering, Permitting	$19,523
10	Legal Costs	$688
11	Other Costs Subtotal	$58,078
12	Project Total	**$333,470**
13	Contingency at 5%	$16,673
14	Project Total (with contingency)	**$350,143**

Carroll County Fiber Pilot Dugspur Tower SF424 Summary

0	ITEM/PROJECT	ESTIMATED
1	Administrative and legal expenses	$2,754
2	Land, structures, rights-of-way, appraisals, etc.	$0
3	Relocation expenses and payments	$0
4	Architectural and engineering fees	$28,090
5	Other architectural and engineering fees	$19,523
6	Project inspection fees	$4,957
7	Site work	$0
8	Demolition and removal	$0
9	Construction	$249,362
10	Equipment	$26,030
11	Miscellaneous	$2,754
12	SUBTOTAL (sum of lines 1-11)	**$333,470**
13	Contingencies	$16,673
14	SUBTOTAL	**$350,143**
15	Project (program) income	**$0**
16	TOTAL PROJECT COSTS (subtract #15 from #14)	**$350,143**

9.7 PIPERS GAP FIBER PILOT

This fiber to the home study provides insight into the cost of delivering fiber Internet service to rural residential neighborhoods. This route is about eight miles and would pass at least four hundred homes. This fiber route could be connected to existing Wired Road fiber near Hillsville.



Carroll County Fiber Pilot - Pipers Gap Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Carroll County Fiber Pilot 1 - Pipers Gap Construction Materials	$219,226
2	Carroll County Fiber Pilot 1 - Pipers Gap Distribution Labor	$575,964
3	Carroll County Fiber Pilot 1 - Pipers Gap Structures, Cabinets, and Equipment	$26,030
4	Carroll County Fiber Pilot 1 - Pipers Gap Drop Construction	$146,125
5	Network Construction Subtotal	**$967,345**
6	Project Mgmt, Network Engineering, Integration, and Testing	$116,081
7	Misc Fees, Advertising, Technical Services	$9,673
8	Bookkeeping and Administration	$7,255
9	Engineering, Permitting	$62,167
10	Legal Costs	$2,418
11	Other Costs Subtotal	$197,595
12	Project Total	**$1,164,940**
13	Contingency at 5%	$58,247
14	Project Total (with contingency)	**$1,223,187**

Carroll County Fiber Pilot - Pipers Gap Route Overview

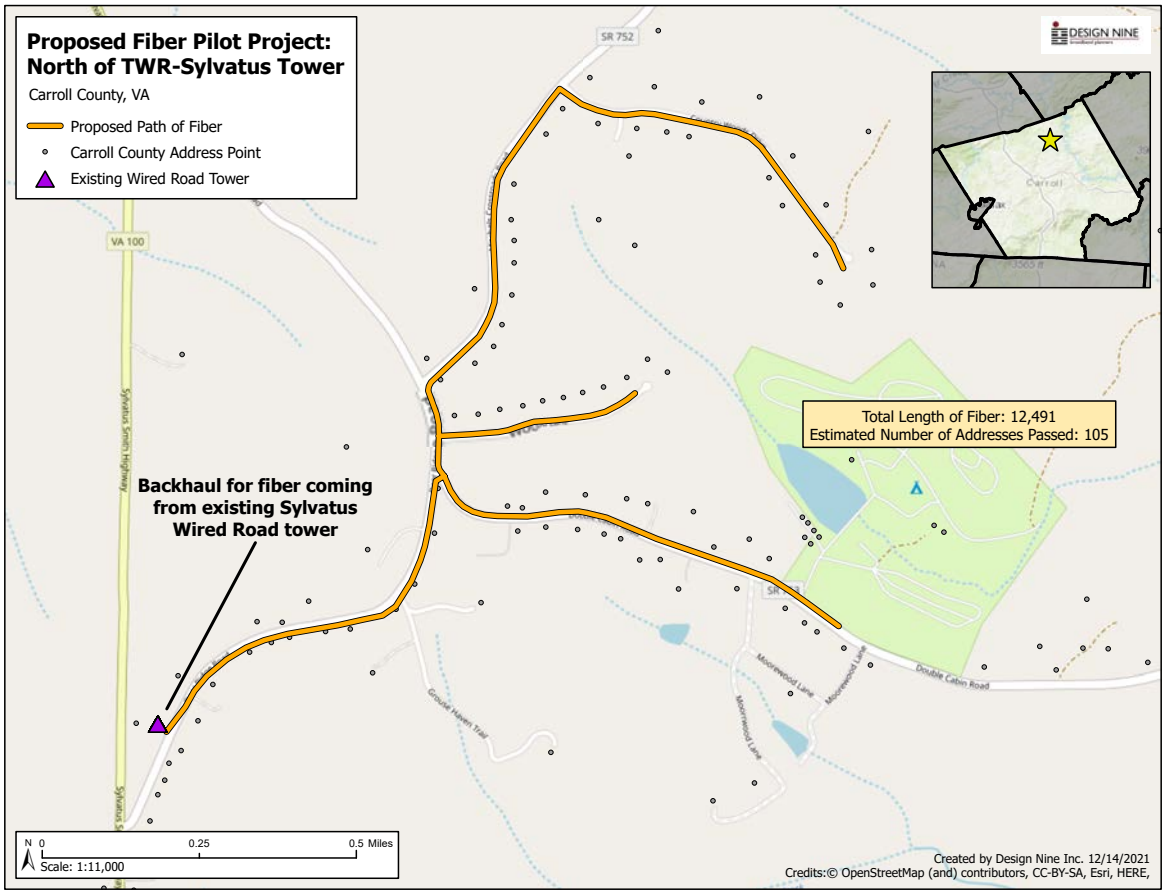
0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	8.12
2	Number of Handholes Installed	86
3	Splice Closures Installed	71
4	Cabinets Installed	1
5	Number of Buildings Connected	142
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	2%
8	Trenching - Percentage of construction installed by trenching	5%
9	Boring - Percentage of construction installed by horizontal drilling.	63%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	30%
13	Aerial Info	2% Aerial is estimated to account for water body crossings and other obstacles to construction.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

Carroll County Fiber Pilot 1 - Pipers Gap SF424 Summary

0	ITEM/PROJECT	ESTIMATED
1	Administrative and legal expenses	$9,673
2	Land, structures, rights-of-way, appraisals, etc.	$0
3	Relocation expenses and payments	$0
4	Architectural and engineering fees	$98,669
5	Other architectural and engineering fees	$62,167
6	Project inspection fees	$17,412
7	Site work	$0
8	Demolition and removal	$0
9	Construction	$941,315
10	Equipment	$26,030
11	Miscellaneous	$9,673
12	SUBTOTAL (sum of lines 1-11)	**$1,164,940**
13	Contingencies	$58,247
14	SUBTOTAL	**$1,223,187**
15	Project (program) income	**$0**
16	TOTAL PROJECT COSTS (subtract #15 from #14)	**$1,223,187**

9.8 SYLVATUS NORTH FIBER PILOT

This fiber to the home study provides insight into the cost of delivering fiber Internet service to real residential neighborhoods. This route uses about 2.4 miles of fiber to pass an estimated 105 homes in the area north of the Sylvatus water tower. Internet service would be provided via the existing Sylvatus Wired Road connection.



Carroll County Fiber Pilot - North of TWR-Sylvatus Tower Route Overview

0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	2.37
2	Number of Handholes Installed	25
3	Splice Closures Installed	19
4	Cabinets Installed	1
5	Number of Buildings Connected	37
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	2%
8	Trenching - Percentage of construction installed by trenching	5%
9	Boring - Percentage of construction installed by horizontal drilling.	63%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	30%
13	Aerial Info	2% Aerial is estimated to account for water body crossings and other obstacles to construction.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

Carroll County Fiber Pilot - North of TWR-Sylvatus Tower Cost Summary

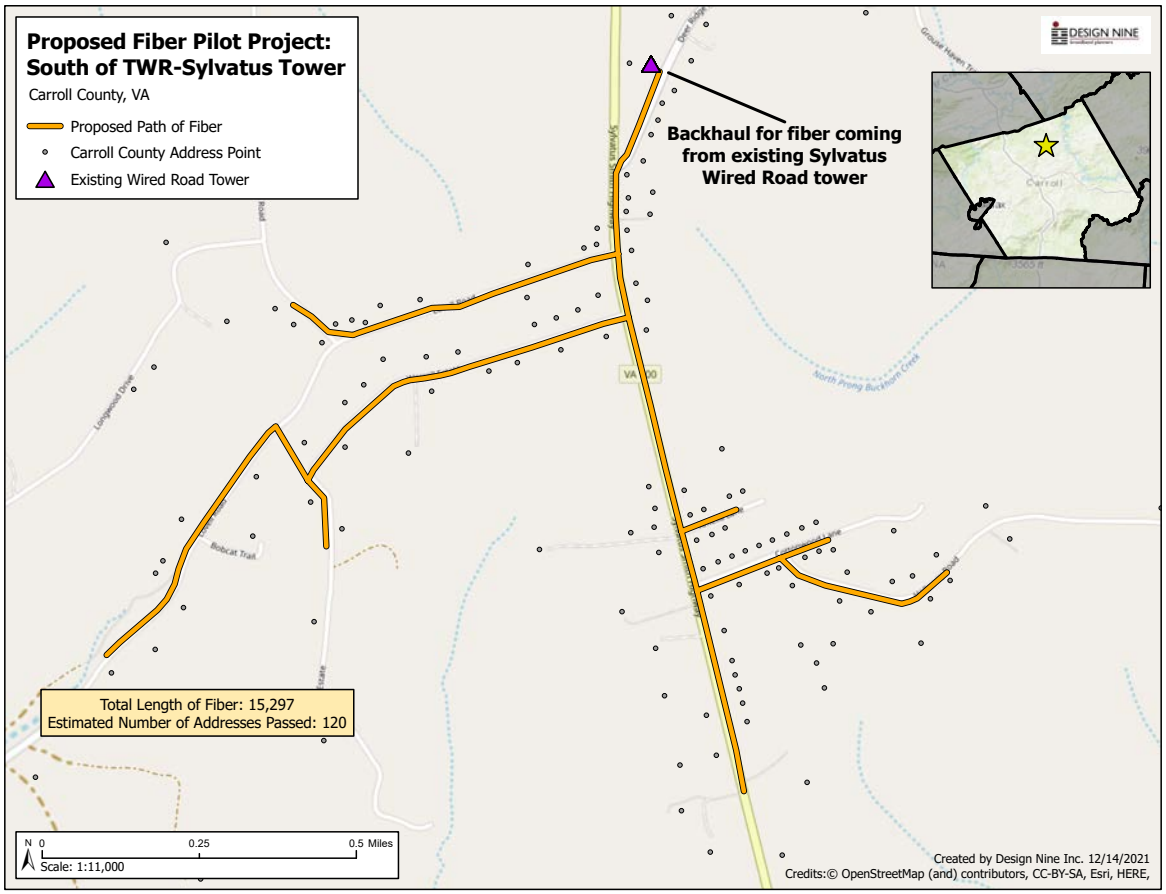
0	ITEM/PROJECT	ESTIMATED
1	Carroll County Fiber Pilot - Construction Materials	$63,980
2	Carroll County Fiber Pilot - Distribution Labor	$172,446
3	Carroll County Fiber Pilot - Structures, Cabinets, and Equipment	$26,030
4	Carroll County Fiber Pilot - Drop Construction	$37,988
5	Network Construction Subtotal	**$300,444**
6	Project Mgmt, Network Engineering, Integration, and Testing	$36,053
7	Misc Fees, Advertising, Technical Services	$3,004
8	Bookkeeping and Administration	$2,253
9	Engineering, Permitting	$18,145
10	Legal Costs	$751
11	Other Costs Subtotal	$60,207
12	Project Total	**$360,651**
13	Contingency at 5%	$18,033
14	Project Total (with contingency)	**$378,683**

Carroll County Fiber Pilot - North of TWR-Sylvatus Tower SF424 Summary

0	ITEM/PROJECT	ESTIMATED
1	Administrative and legal expenses	$3,004
2	Land, structures, rights-of-way, appraisals, etc.	$0
3	Relocation expenses and payments	$0
4	Architectural and engineering fees	$30,645
5	Other architectural and engineering fees	$18,145
6	Project inspection fees	$5,408
7	Site work	$0
8	Demolition and removal	$0
9	Construction	$274,414
10	Equipment	$26,030
11	Miscellaneous	$3,004
12	SUBTOTAL (sum of lines 1-11)	**$360,651**
13	Contingencies	$18,033
14	SUBTOTAL	**$378,683**
15	Project (program) income	**$0**
16	TOTAL PROJECT COSTS (subtract #15 from #14)	**$378,683**

9.9 SYLVATUS SOUTH FIBER PILOT

This fiber to the home study provides insight into the cost of delivering fiber Internet service to rural residential neighborhoods. This route is approximately 2.9 miles and would pass an estimated 120 homes. Internet service would be provided via the existing Sylvatus Wired Road connection.



Fiber Pilot - South of TWR-Sylvatus Tower Route Overview

0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	2.9
2	Number of Handholes Installed	31
3	Splice Closures Installed	21
4	Cabinets Installed	1
5	Number of Buildings Connected	42
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	2%
8	Trenching - Percentage of construction installed by trenching	5%
9	Boring - Percentage of construction installed by horizontal drilling.	63%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	30%
13	Aerial Info	2% Aerial is estimated to account for water body crossings and other obstacles to construction.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

Fiber Pilot - South of TWR-Sylvatus Tower Cost Summary

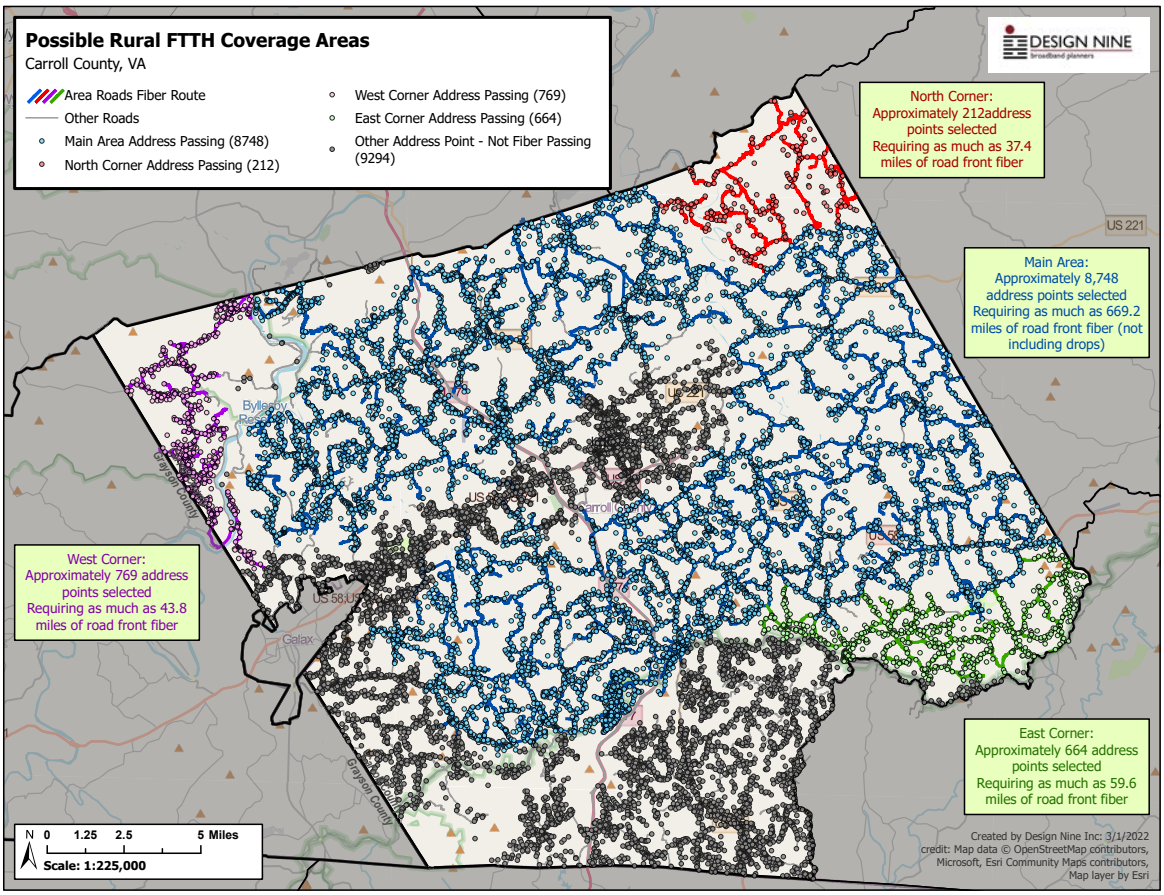
0	ITEM/PROJECT	ESTIMATED
1	Fiber Pilot - South of TWR-Sylvatus Tower Construction Materials	$77,697
2	Fiber Pilot - South of TWR-Sylvatus Tower Distribution Labor	$206,928
3	Fiber Pilot - South of TWR-Sylvatus Tower Structures, Cabinets, and Equipment	$26,030
4	Fiber Pilot - South of TWR-Sylvatus Tower Drop Construction	$43,175
5	Network Construction Subtotal	**$353,829**
6	Project Mgmt, Network Engineering, Integration, and Testing	$42,460
7	Misc Fees, Advertising, Technical Services	$3,538
8	Bookkeeping and Administration	$2,654
9	Engineering, Permitting	$22,202
10	Legal Costs	$885
11	Other Costs Subtotal	$71,739
12	Project Total	**$425,568**
13	Contingency at 5%	$21,278
14	Project Total (with contingency)	**$446,846**

Fiber Pilot - South of TWR-Sylvatus Tower SF424 Summary

0	ITEM/PROJECT	ESTIMATED
1	Administrative and legal expenses	$3,538
2	Land, structures, rights-of-way, appraisals, etc.	$0
3	Relocation expenses and payments	$0
4	Architectural and engineering fees	$36,091
5	Other architectural and engineering fees	$22,202
6	Project inspection fees	$6,369
7	Site work	$0
8	Demolition and removal	$0
9	Construction	$327,799
10	Equipment	$26,030
11	Miscellaneous	$3,538
12	SUBTOTAL (sum of lines 1-11)	**$425,568**
13	Contingencies	$21,278
14	SUBTOTAL	**$446,846**
15	Project (program) income	**$0**
16	TOTAL PROJECT COSTS (subtract #15 from #14)	**$446,846**

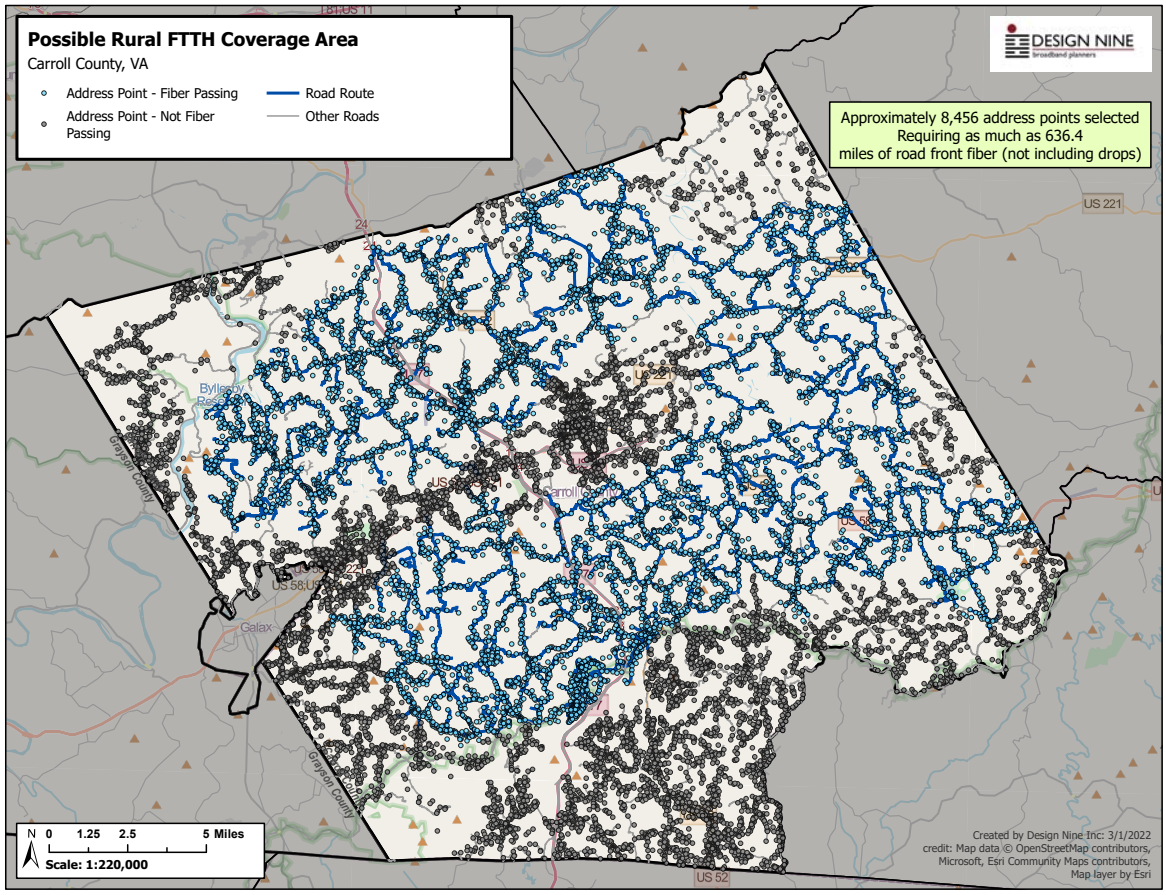
10 COUNTY-WIDE FIBER STUDY

This section provides maps and cost estimate detail for a county-wide fiber project, using primarily aerial fiber installed on existing utility poles. The study has used local roads to provide an estimate of the distance required to pass most homes in the county. Utility pole routes do not always follow the roads exactly, and the actual built distance on utility poles could be slightly less than the estimates provided here.



10.1 CENTRAL COUNTY COST ESTIMATE

The map below shows the calculated homes passed in the central portion of the county. The construction would pass about 8,500 homes and businesses.



Carroll County Rural Aerial FTTH-Main Area Route Overview

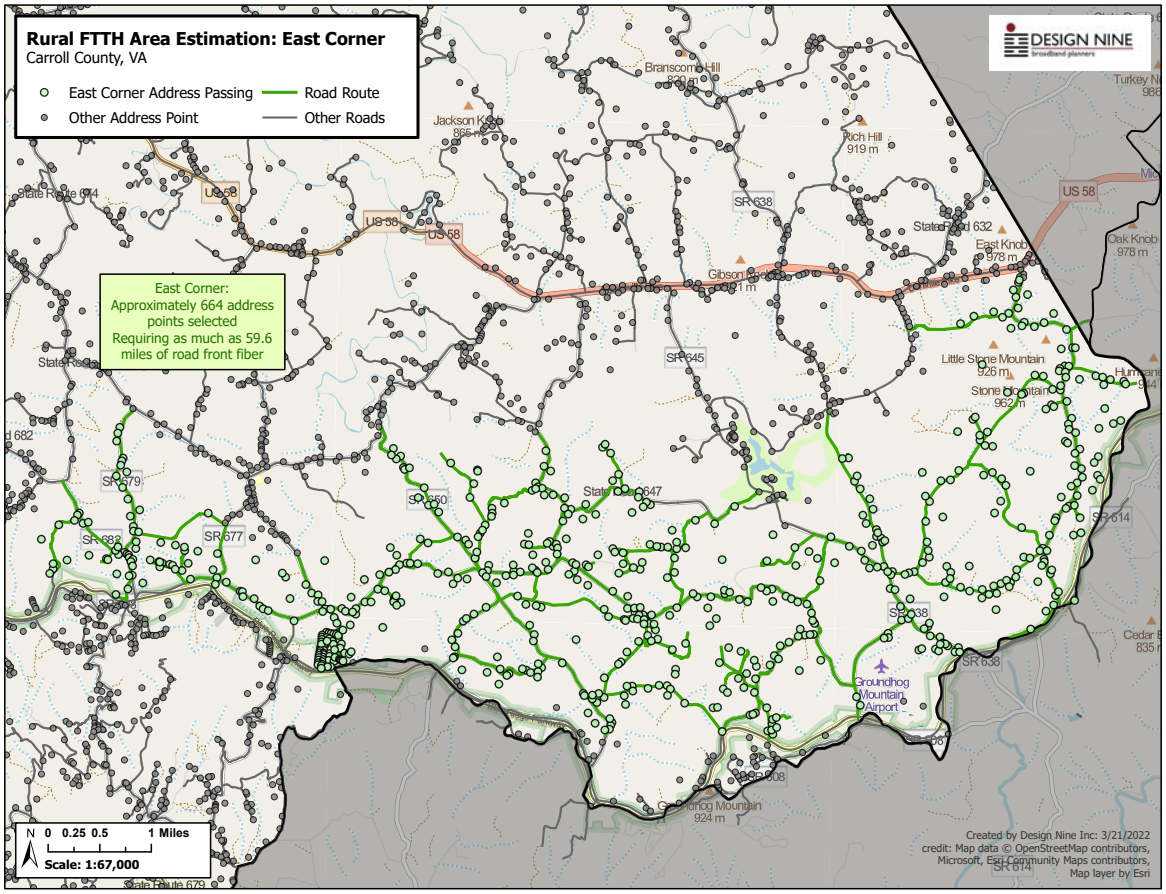
0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	669.2
2	Number of Handholes Installed	884
3	Splice Closures Installed	1,531
4	Cabinets Installed	67
5	Number of Buildings Connected	3,062
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	90%
8	Trenching - Percentage of construction installed by trenching	2%
9	Boring - Percentage of construction installed by horizontal drilling.	8%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	0%
13	Aerial Info	90% Aerial is estimated for a primarily aerial project.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

Carroll County Rural Aerial FTTH-Main Area Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Carroll County Rural Aerial FTTH-Main Area Construction Materials	$10,415,742
2	Carroll County Rural Aerial FTTH-Main Area Distribution Labor	$29,512,700
3	Carroll County Rural Aerial FTTH-Main Area Structures, Cabinets, and Equipment	$2,249,485
4	Carroll County Rural Aerial FTTH-Main Area Drop Construction	$2,839,925
5	Network Construction Subtotal	**$45,017,851**
6	Project Mgmt, Network Engineering, Integration, and Testing	$5,627,231
7	Misc Fees, Advertising, Technical Services	$50,000
8	Bookkeeping and Administration	$12,500
9	Engineering, Permitting	$5,123,395
10	Legal Costs	$75,000
11	Other Costs Subtotal	$10,888,127
12	Project Total	**$55,905,978**
13	Contingency at 5%	$2,795,299
14	Project Total (with contingency)	**$58,701,277**

10.2 EAST CORNER OF THE COUNTY ESTIMATE

In the southeast corner of the county, the homes per mile is fairly high, which will help reduce the overall cost of getting fiber to those residences.



Carroll County Rural Aerial FTTH-East Corner Route Overview

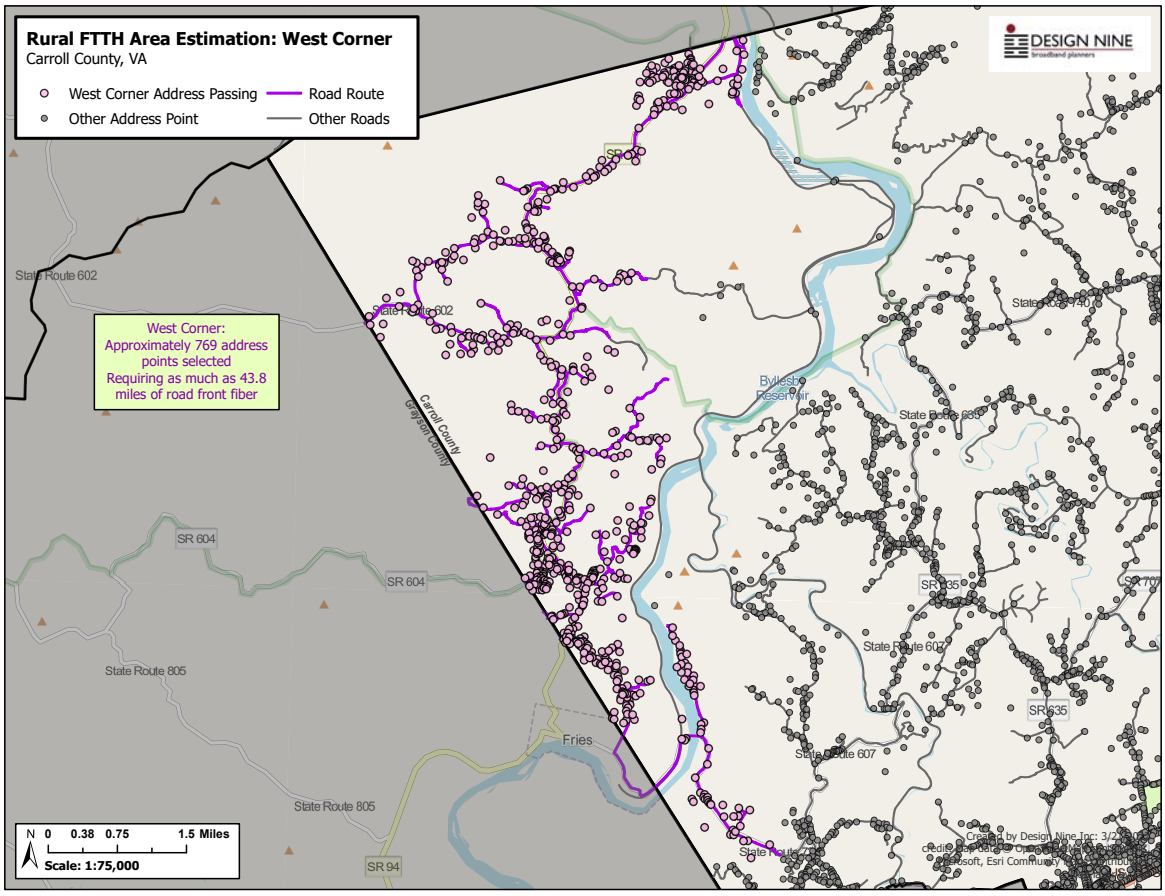
0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	59.6
2	Number of Handholes Installed	79
3	Splice Closures Installed	117
4	Cabinets Installed	6
5	Number of Buildings Connected	233
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	90%
8	Trenching - Percentage of construction installed by trenching	2%
9	Boring - Percentage of construction installed by horizontal drilling.	8%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	0%
13	Aerial Info	90% Aerial is estimated for a primarily aerial project.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

Carroll County Rural Aerial FTTH-East Corner Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Carroll County Rural Aerial FTTH-East Corner Construction Materials	$922,011
2	Carroll County Rural Aerial FTTH-East Corner Distribution Labor	$2,620,197
3	Carroll County Rural Aerial FTTH-East Corner Structures, Cabinets, and Equipment	$206,143
4	Carroll County Rural Aerial FTTH-East Corner Drop Construction	$215,988
5	Network Construction Subtotal	**$3,964,338**
6	Project Mgmt, Network Engineering, Integration, and Testing	$495,542
7	Misc Fees, Advertising, Technical Services	$50,000
8	Bookkeeping and Administration	$12,500
9	Engineering, Permitting	$456,298
10	Legal Costs	$75,000
11	Other Costs Subtotal	$1,089,340
12	Project Total	**$5,053,678**
13	Contingency at 5%	$252,684
14	Project Total (with contingency)	**$5,306,362**

10.3 WEST AREA OF THE COUNTY ESTIMATE

In the western corner of the county, most residences are clustered close to the local roads, and the homes per mile density is higher than in some other areas of the county, which can help control the cost of construction.



Carroll County Rural Aerial FTTH-West Corner Route Overview

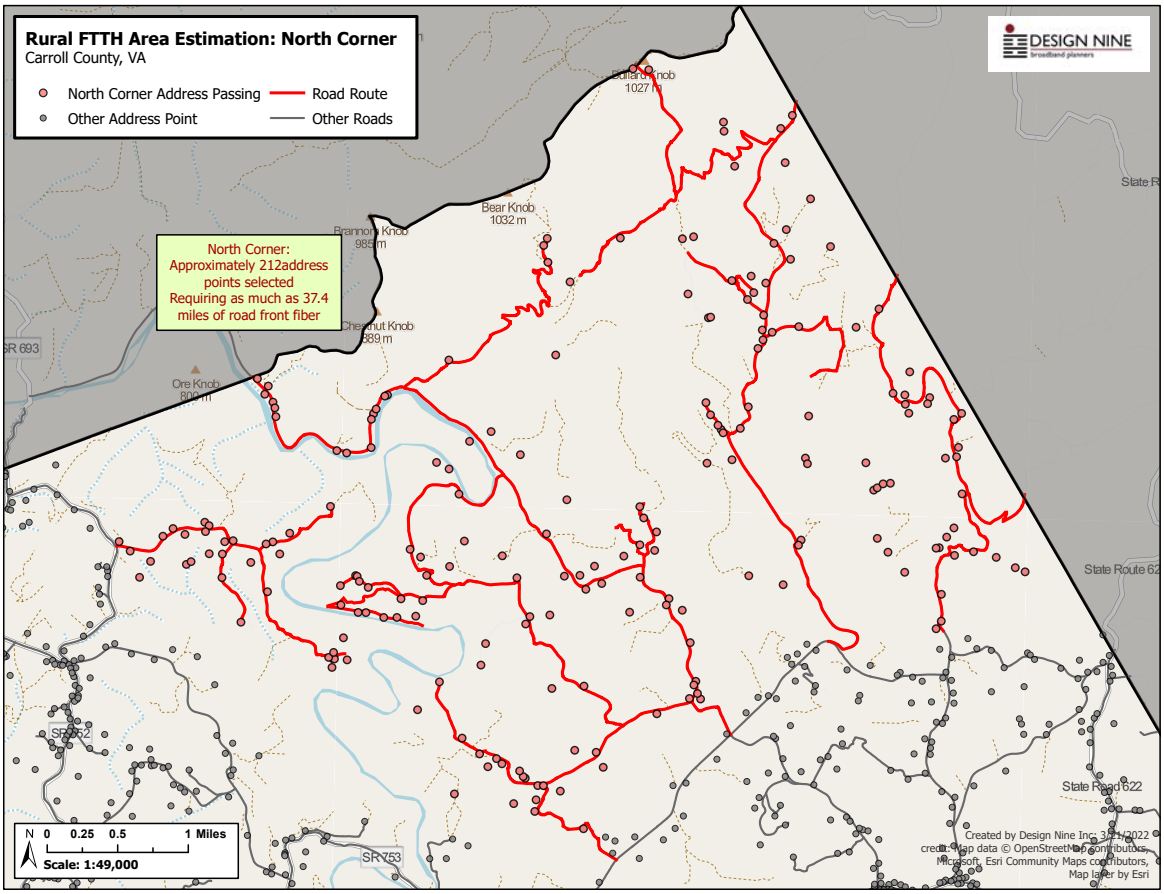
0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	43.8
2	Number of Handholes Installed	58
3	Splice Closures Installed	135
4	Cabinets Installed	5
5	Number of Buildings Connected	270
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	90%
8	Trenching - Percentage of construction installed by trenching	2%
9	Boring - Percentage of construction installed by horizontal drilling.	8%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	0%
13	Aerial Info	90% Aerial is estimated for a primarily aerial project.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

Carroll County Rural Aerial FTTH-West Corner Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Carroll County Rural Aerial FTTH-West Corner Construction Materials	$693,584
2	Carroll County Rural Aerial FTTH-West Corner Distribution Labor	$1,978,174
3	Carroll County Rural Aerial FTTH-West Corner Structures, Cabinets, and Equipment	$182,025
4	Carroll County Rural Aerial FTTH-West Corner Drop Construction	$250,425
5	Network Construction Subtotal	**$3,104,209**
6	Project Mgmt, Network Engineering, Integration, and Testing	$388,026
7	Misc Fees, Advertising, Technical Services	$50,000
8	Bookkeeping and Administration	$12,500
9	Engineering, Permitting	$335,333
10	Legal Costs	$75,000
11	Other Costs Subtotal	$860,859
12	Project Total	**$3,965,068**
13	Contingency at 5%	$198,253
14	Project Total (with contingency)	**$4,163,321**

10.4 NORTH CORNER OF THE COUNTY ESTIMATE

The north corner of the county has a number of homes that are a substantial distance from the local roads, but since virtually all homes have electric service, the fiber connection could be brought to those residences on the electric utility poles.



Carroll County Rural Aerial FTTH- North Corner Route Overview

0	ITEM/PROJECT	VALUE
1	Miles of Fiber / Conduit Installed	37.4
2	Number of Handholes Installed	50
3	Splice Closures Installed	38
4	Cabinets Installed	4
5	Number of Buildings Connected	75
6	Take Rate - Percentage of the Buildings Passed who are connected	35%
7	Aerial - Percentage of construction expected to be installed on utility poles.	90%
8	Trenching - Percentage of construction installed by trenching	2%
9	Boring - Percentage of construction installed by horizontal drilling.	8%
10	Slot Cutting - Conduit installed in street by special methods.	0%
11	Rock Saw - Required where rock prevents the use of other methods.	0%
12	Direct Bury - Conduit installed by direct bury methods (plow, vibratory plow)	0%
13	Aerial Info	90% Aerial is estimated for a primarily aerial project.
14	Other Notes	Estimated labor rates are based upon common rates seen for recent medium sized rural projects.

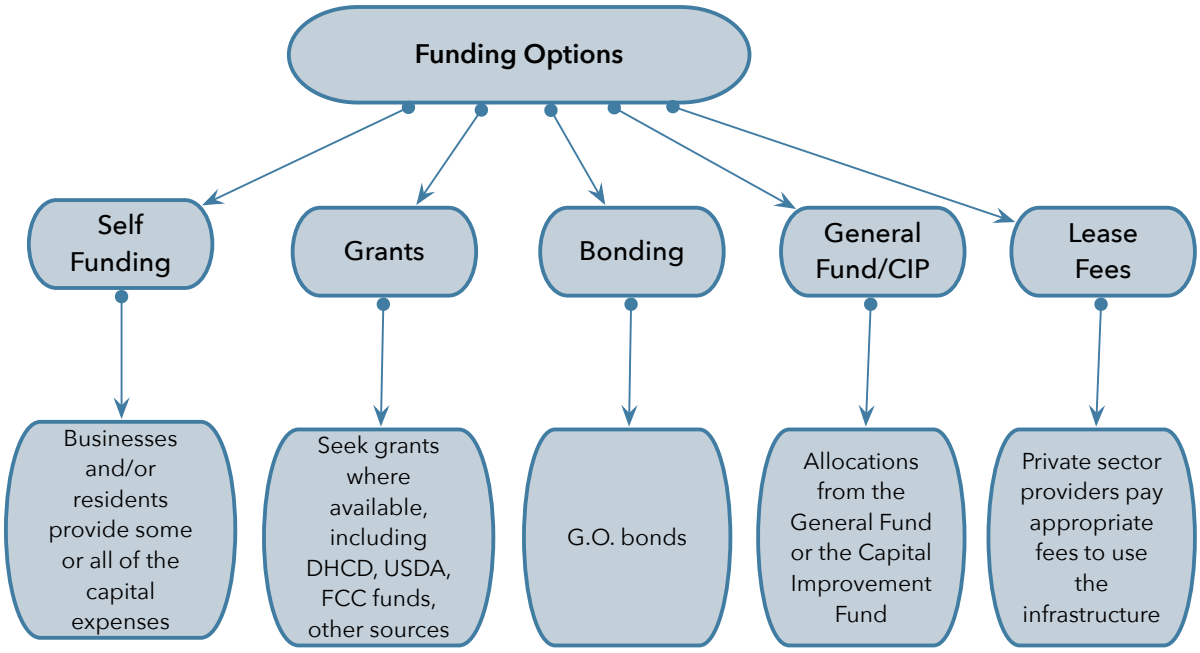
Carroll County Rural Aerial FTTH- North Corner Cost Summary

0	ITEM/PROJECT	ESTIMATED
1	Carroll County Rural Aerial FTTH- North Corner Construction Materials	$567,269
2	Carroll County Rural Aerial FTTH- North Corner Distribution Labor	$1,613,326
3	Carroll County Rural Aerial FTTH- North Corner Structures, Cabinets, and Equipment	$131,808
4	Carroll County Rural Aerial FTTH- North Corner Drop Construction	$69,363
5	Network Construction Subtotal	**$2,381,765**
6	Project Mgmt, Network Engineering, Integration, and Testing	$297,721
7	Misc Fees, Advertising, Technical Services	$50,000
8	Bookkeeping and Administration	$12,500
9	Engineering, Permitting	$286,334
10	Legal Costs	$75,000
11	Other Costs Subtotal	$721,555
12	Project Total	**$3,103,320**
13	Contingency at 5%	$155,166
14	Project Total (with contingency)	**$3,258,486**

11 INFRASTRUCTURE FUNDING AND GRANT OPPORTUNITIES

It is important to note that any investment by county government in broadband infrastructure should be focused on passive infrastructure. Passive infrastructure can be leased to private sector service providers, generating long term revenue for maintenance and expansion..

These assets will have a conservative life span of thirty years or more (e.g. wireless towers, conduit, fiber cable). These types of infrastructure investments create hard assets that have tangible value and can then be leveraged for additional borrowing. The demand for services and the associated fees paid for those services will provide the revenue that will pay back loans over time. There is ample time to recoup not only the initial capital investment, but also to receive regular income from the infrastructure.



The financing of local government and/or community-owned telecommunications infrastructure faces several challenges with respect to funding.

- Not all local governments are willing to commit to making loan guarantees from other funding sources like property taxes, because the idea of community-owned telecom infrastructure has a limited track record and therefore a higher perceived risk.
- Similarly, citizens are not always willing to commit to the possibility of broadband fees or higher taxes that may be needed to support a telecom infrastructure initiative, for many of the same reasons that local governments are still reluctant to make such commitments: perceived risk and a lack of history for such projects.

- Finally, banks and investors are also more skeptical of community telecom projects because of the relative newness of the phenomenon. By comparison, there are decades of data on the financial performance of water and sewer systems, so the perceived risk is lower.

Somewhat paradoxically, the cost of such a community digital road system is lower when there is a day one commitment to build to any residence or business that requests service. This maximizes the potential marketplace of buyers and attracts more sellers to offer services because of the larger potential market. This is so because:

- Service providers are reluctant to make a commitment to offer services on a network without knowing the total size of the market. A larger market, even if it takes several years to develop, is more attractive.
- Funding agencies and investors that may provide loans and grants to a community network project want to know how the funds will be repaid and/or that grants will contribute to a financially sustainable project. Knowing that the size of the customer base is the maximum possible for a service area helps reduce the perceived risk for providing loans and grants.

11.1 VIRGINIA FUNDING OPPORTUNITIES

The Virginia Telecommunications Initiative (VATI) continues to receive steady increases in annual allocations from the state legislature. VATI funds are typically disbursed for public/private partnerships between a Virginia locality and a qualified ISP or WISP. Some match is required. For 2022, applications are due in August (2022). VATI awards vary widely in size. ARPA funds for 2022 should become available in late winter or early spring of 2022.

11.2 ARPA (AMERICAN RESCUE PLAN ACT) FUNDING

The American Rescue Plan Act of 2021, is the biggest federal funding program for broadband projects. ARPA has $350 billion in funding. Each state receives an ARPA fund allocation, and how much is targeted toward broadband initiatives will be decided by a state legislative committee and/or the governor of the state.

The 2020 CARES (Coronavirus Aid, Relief, and Economic Security Act) funding was typically distributed by state governments to localities (e.g. counties, towns, cities), which were then able to make decisions on how to spend the money within both the state and Federal guidelines attached to the funds.

ARPA funding has fewer requirements and "strings" attached than many other Federal broadband grant programs, and Carroll County should make obtaining ARPA funds for county broadband projects a priority in late 2021 and early 2022.

The Virginia Commonwealth Connect Web site has extensive information on grant programs, legislation, partnerships, and related broadband information (https://www.commonwealthconnect.virginia.gov/).

11.3 HUD COMMUNITY DEVELOPMENT BLOCK GRANTS

The U.S. Housing and Urban Development CDBG State Program allows the Commonwealth of Virginia to award grants to smaller units of general local government (e.g. counties, towns) that develop and preserve decent affordable housing, to provide services to the most vulnerable in our

communities, and to create and retain jobs. In recent years, CDBG funds have been successfully used for broadband infrastructure development where the local government applicant can show the improvements meet the general guidelines of the program—so grant funds have to spent in low and moderate income areas.

Over a 1, 2, or 3-year period, as selected by the grantee, not less than 70 percent of CDBG funds must be used for activities that benefit low- and moderate-income persons. In addition, each activity must meet one of the following national objectives for the program: benefit low- and moderate-income persons, prevention or elimination of slums or blight, or address community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community for which other funding is not available. More information is available here (https://www.hud.gov/program_offices/comm_planning/communitydevelopment/programs).

11.4 USDA RECONNECT PROGRAM

The ReConnect program is a new funding program managed by the USDA Rural Development Office. This program is sometimes called the USDA e-Connectivity pilot program. Grant applications can be a combination of 100% grant, 50% grant/50% loan, or 100% loan. $1.1 billion has been allocated to the program for 2022, and a wide variety of entities can apply, including non-profits, coops, and state and local governments.

As much as $200 million will be available for loans, with another $250 million allocated for loan/grant combinations. A $350 million fund will be distributed with a 25% matching requirement and another $350 million in grants with without a match, for projects in tribal and socially vulnerable communities. Applications are due in the spring of 2021, and USDA will begin accepting applications in late 2021. More information is available here: (reconnect.usda.gov). A mapping tool is available on the Web site to show areas that are eligible. To qualify as an eligible area, households must have less than a minimum of 10 Megabit down/1 Megabit up broadband service.

11.5 911 FEES

Improved broadband access in the county can improve household access to 911 services by using broadband Internet to carry 911 voice calls, using one or more strategies to include:

WiFi calling – now a commonly available feature on new cell phones. WiFi calling switches voice telephone call from the cellular network to a nearby WiFi Internet network seamlessly. The reduces the need for additional large cell towers in low density areas of the county.

Nano-cell Devices – Nano-cells are a small box attached to a home wireless router. The nano-cell, which is typically obtained from the cellular provider, enables a cellphone to operate inside the home or business even if there is no cell tower near by.

A modest increase in the 911 fee to improve 911 access in rural areas of the county could generate funds to support additional broadband towers and community poles, but this approach would require legislative changes at the state level—which has been a topic of discussion in Charleston. See the tables above in the Special Assessment section of this chapter.

11.6 OPPORTUNITY ZONES

An Opportunity Zone is an economically-distressed community where new investments, under certain conditions, may be eligible for preferential tax treatment. Localities qualify as Opportunity Zones if they have been nominated for that designation by the state and that has been approved by the Internal Revenue Service. Opportunity Zones are designed to create tax incentives for private investors to make investments that can encourage economic development and job creation in distressed communities. Opportunity Zones would be of most use for Internet Service Providers who could use the tax benefits to make a business case to improve Internet access in a qualifying area (zone).

Opportunity Zones are defined by census tract, and the Census Bureau's Geocoder online tool can provide census tract ID numbers. A link to the list of currently qualified census tracts can be found on this page (https://www.cdfifund.gov/opportunity-zones). Carroll County has designated Opportunity Zones in the Hillsville area.

11.7 BONDING

Revenue bonds are repaid based on the expectation of receiving revenue from the network, and do not obligate the local government or taxpayers if financial targets are not met. In that respect, they are different from general obligation bonds. Many kinds of regional projects (water, sewer, solid waste, etc.) are routinely financed with revenue bonds. We believe many community projects will eventually finance a significant portion of the effort with revenue bonds, but at the present time, the limited financing history of most community-owned broadband networks has limited using revenue bonds.

Selling revenue bonds for a start up municipal network can be more challenging because there is no financial or management history for the venture. Bond investors typically prefer to see two or three years of revenue and expenses and a track record of management success. It would be advisable for the county to have an early conversation with qualified municipal bond counsel to assess the viability of this approach. ***However, the Covid crisis and the subsequent increase in demand for better broadband seems to encouraged the bond market to regard muni broadband financing as less risky than in past years.***

Obtaining funding using revenue bonds requires an excellent municipal credit rating and an investment quality financial plan for the operation and management of the network. Revenue bonds must be used carefully, and a well-designed financial model is required to show investors that sufficient cash flow exists to pay back the loans.

General obligation bonds are routinely used by local governments to finance municipal projects of all kinds. G.O. bonds are guaranteed by the good faith and credit of the local government, and are not tied to revenue generated by the project being funded (i.e. revenue bonds). G.O. bonds obligate the issuing government and the taxpayers directly, and in some cases could lead to increased local taxes to cover the interest and principal payments. Some bond underwriters have indicated a willingness to include telecom funds as part of a larger bond initiative for other kinds of government infrastructure (e.g. adding $1 million in telecom funds to a $10 million bond initiative for other improvements).

In discussions with bond underwriters, it has been suggested that it would be easier to obtain bond funds for telecom if the telecom bonding amount was rolled into a larger water or sewer bond, or some other type of bond request that are more familiar to the bond market.

11.8 RDOF/CAF2 FUNDING

The second round of the FCC Connect America Fund (CAF2) (Rural Digital Opportunity Fund) continues to provide funds to incumbent and competitive service providers. The funds must be used in unserved or underserved areas as defined by Federal census blocks. To be eligible, a census block could not have been served with voice and broadband of at least 10/1 Mbps (based on Form 477 data) by an unsubsidized competitor or price cap carrier.

The FCC published the final eligible census blocks for the auction on February 6, 2018. The final areas were based on FCC Form 477 data as of December 31, 2016 (the most recent publicly available FCC Form 477 data at the time). So there is a time lag between the determination of a qualifying census block or blocks and the schedule for submitting a bid to serve those areas. The first round of funding was announced in early 2021, and was immediately met with widespread criticism. SpaceX (Starlink) was awarded almost $900 million, and it may have to return some of those funds because the company appears to have included some ineligible census blocks. Many large incumbents also received substantial awards when some smaller ISPs that might have offered competition to the incumbents received much less or no funds.

Because many CAF2 qualifying areas are only served by low performance DSL (e.g. less than 10/1 Mbps service), incumbent carriers use the awards to upgrade DSL switches, which is not a long term solution. More recently, competitive carriers are applying for CAF2 funds to provide higher performance broadband wireless and in some cases fiber to the home. Because the use of CAF2 funds are so restricted, it has not had as much impact as many hoped. The FCC, as of fall 2021, has not announced the rules for the second round of funding.

11.9 LEASE FEES

Initiatives like tower access and access to local government-owned conduit and fiber can create long term revenue streams from lease fees paid by service providers using that infrastructure. The City of Danville, Virginia has recovered their entire initial capital investment from lease fees paid by providers on the nDanville fiber network.

11.10 COMMUNITY REINVESTMENT ACT

The Community Reinvestment Act (CRA) was developed forty years ago to encourage banks and savings institutions to help meet the credit needs of their local communities, with a focus on low and moderate income areas of those communities. The Federal agencies that oversee private banks assign a CRA rating to each institution. Banks are often looking for well-planned community efforts that need loans. Such loans can improve a bank's CRA rating.

The CRA was revised in 2016 to encourage banks to support community broadband efforts. A community broadband project may be able to get some loan financing from a local bank that wants to get credit for their CRA work.

11.11 CONNECTION FEES

Tap fees, pass by fees, and connection fees are already commonly used by local governments for utilities like water and sewer. The revenue share model can be strengthened from additional sources of revenue, including one time pass by fees, connection fees and sweat equity contributions. It is important to note that the Coop Membership Fee can be treated as a connection fee in whole or in part.

Pass By Fees – Pass by fees could be assessed once the fiber passes by the property, just as some communities assess a pass by fee when municipal water or sewer is placed in the road or street– and the fee is assessed whether or not the premise is connected, on the basis that the value of the property has been increased when municipal water or sewer service passes by. At least one study has indicated that properties with fiber connections have a higher value by $5,000 to $7,000 that similar properties without fiber access.

One Time Connection Fees – A one time connection fee can be assessed to property owners (e.g. residents and businesses) when the fiber drop from the street to the premise is installed. This is similar to the kinds of connection fees that are typically charged when a property is connected to a municipal water or sewer system. The fee is used to offset the cost of the fiber drop and the Customer Premise Equipment (CPE) needed to provide the operational access to the network. The connection fee can be modest (e.g. $100) or it can be a larger percentage of the actual cost of the connection. Fiber CPE may range from $250 to $350 and a fiber drop may cost from $200 for a premise very close to the distribution fiber passing along the property to $1,000 or more if the premise is hundreds of feet from the road. One variant would be to charge a minimum connection fee for up to some distance from the road (e.g. $100 for up to 75' and $2 for each additional foot).

There is already some data that indicates that residential property values increase by as much as $5,000 to $7,000 if fiber broadband services are available, so pass by fees can be justified on the basis of increased property values accruing to the property owner. Given the novelty of this approach, pass by fees may need more time to become an accepted finance approach, but tap fees (for installing the fiber cable from the street or pedestal to the side of the home or business) may be easier to use, especially for businesses that may need improved broadband access. Tap fees have the potential of reducing the take rate in the early phases of deployment, but as the value of the network becomes established, it is likely that there will be much less resistance to paying a connection fee.

11.12 NEW MARKETS TAX CREDIT

New markets tax credits are a form of private sector financing supported by tax credits supplied by the Federal government. The New Markets Tax Credit (NMTC) Program permits taxpayers to receive a credit against Federal income taxes for making qualified equity investments in designated Community Development Entities (CDEs). The CDEs apply to the Federal government for an allotment of tax credits, which can then be used by private investors who supply funds for qualifying community projects. Substantially all of the qualified equity investment must in turn be used by the CDE to provide investments in low-income communities.

The credit provided to the investor totals 39 percent of the cost of the investment and is claimed over a seven-year credit allowance period. In each of the first three years, the investor receives a credit equal to five percent of the total amount paid for the stock or capital interest at the time of

purchase. For the final four years, the value of the credit is six percent annually. Investors may not redeem their investments in CDEs prior to the conclusion of the seven-year period.

Throughout the life of the NMTC Program, the Fund is authorized to allocate to CDEs the authority to issue to their investors up to the aggregate amount of $19.5 billion in equity as to which NMTCs can be claimed.

These tax credits can be quite useful, and there may be some areas that qualify. However, it can take up to a year or more to apply and then finally receive NMTC-related cash. This can be a useful long term source of funds.

11.13 SPECIAL ASSESSMENT/SERVICE DISTRICT

Communities like Bozeman, Montana and Leverett, Massachusetts have been funding broadband infrastructure improvements with special assessments (in Leverett, $600/year for five years), and in Bozeman, TIF (Tax Increment Funding) is being used in some areas to add telecom conduit, handholes, and dark fiber. In some localities, it is possible to levy a special assessment in a service district designated for a particular utility (like broadband) or other kind of public service.

Charlemont, Massachusetts intends to add an $11/month assessment to every household to build a town-owned Gigabit fiber network that will pass every household in the community. A town-wide vote supported this funding approach. Put in perspective, the average cost of a large, single topping pizza in the U.S. is currently $9 to $12.

Two small cities in Utah are currently evaluating the potential of a $10-12 utility tax levied on every household and business to finance a full fiber to the premises build out, including a modest "free" Internet service that would be adequate for email and light Web use. Most households will probably choose to select a higher performance Internet package from a private provider on the network. A $5/month special assessment (the cost of one large pizza) on every household in Carroll County could raise as much as $15 million for broadband over twenty years—enough to take Gigabit fiber to nearly every home and business.

The tables below shows the kind of funds that could be generated over several time periods. If ten dollars per month were collected from each household for thirty years, it would easily finance the immediate build out of Gigabit fiber that would pass nearly all homes and businesses in each county.

Individual Service District Examples				
Monthly Assessment Amount	Fifty Homes Five Year Assessment	Fifty Homes Ten Year Assessment	100 Homes Five Year Assessment	100 Homes Ten Year Assessment
$5	$15,000	$30,000	$30,000	$60,000
$10	$30,000	$60,000	$60,000	$120,000
$25	$75,000	$150,000	$150,000	$300,000
$50	$150,000	$300,000	$300,000	$600,000

A lesser amount (e.g. $2/month over twenty years) would easily finance the immediate build out of a comprehensive wide area wireless tower network in each, as well as some fiber infrastructure.

Carroll County Special Assessment Examples		
Monthly Assessment Amount	Twenty Year Assessment	Thirty Year Assessment
Number of Households	12,357	
$1	$2,965,680	$4,448,520
$2	$5,931,360	$8,897,040
$5	$14,828,400	$22,242,600
$10	$29,656,800	$44,485,200

11.14 PROPERTY TAX INCREASE

While raising taxes can be politically very difficult, a very small incremental increase in property taxes, with the increase clearly earmarked specifically designated for broadband development (.e.g. one-quarter cent) might be possible to sell to citizens and businesses.

The table below illustrates a hypothetical example of what funds might be raised for broadband improvements with a sample county-wide assessed property value.

	Sample Assessed property value	Broadband increment	Annual Broadband Fund	Ten Year Aggregate	Twenty Year Aggregate	Thirty Year Aggregate
1/4 of one cent	$7,000,000,000	$0.0025	$157,500	$1,575,000	$3,150,000	$4,725,000
1/2 of one cent	$7,000,000,000	$0.0050	$315,000	$3,150,000	$6,300,000	$9,450,000
1 cent	$7,000,000,000	$0.0100	$630,000	$6,300,000	$12,600,000	$18,900,000

11.15 GRANT APPLICATION ACTIVITIES

Activity	Description	Discussion	Tasks
Develop a grant application	The grant application process, from start to award announcement, can be nine to twelve months.	Broadband grant application requirements have become more stringent over time, with more grant agency oversight and review. Careful planning is essential to develop a successful application.	• Once a grant opportunity has been identified, review grant requirements to determine if the project can qualify. For example, some grants require two years of financial history. • Identify regional agency that will assist • Begin contacting potential ISP partners. • If the project qualifies, identify at least two people to take the lead to prepare application. • Prepare a task list of all grant materials requirements and identify data needed. • Develop a timeline for developing sections of the grant. • Identify requirements for letters of support and matching funds and develop timeline to solicit and collect commitments. • Complete all sections of grant application with assistance from public and private partners. • Submit grant application.

Typical Timeline	Months											
Tasks	1	2	3	4	5	6	7	8	9	10	11	12
Determine grant qualifications												
Appoint grant team												
Create grant task list												
Prepare timeline and assign tasks to partners												
Identify matching fund requirements and letters of support to solicit and collect as needed												
Complete all sections of the grant application												
Submit grant												
Grant agency review												
Awards announcement												

12 PARTNERSHIP OPPORTUNITIES

Because nearly all telecom infrastructure includes some use of public right of way, public/private partnerships are always a requirement for broadband infrastructure. Among Carroll County and private entities like ISPs and WISPs, the more common synergies are:

- The need for more bandwidth,
- The need for more affordable bandwidth, and
- The need for more affordable bandwidth to be more widely available.

Potential project partners include:

The Wired Road

Carroll County has been part of the Wired Road regional broadband authority since its founding in 2007. Carroll received some of the first broadband towers constructed with the initial grant funds, and since then, the Wired Road has installed and upgraded additional wireless broadband infrastructure in the county, as well as adding substantial fiber infrastructure, including a fiber link between Hillsville and Galax. The Wired Road is a natural partner for the county. The Wired Road provides full time 24/7/365 network management, operations, and maintenance of all Wired Road infrastructure in Carroll County at no direct cost to the county, and the network is operated on an open access basis with two competitive providers.

ISPs and WISPs

Internet Service Providers (ISPs) and Wireless Internet Service Providers (WISPs) are important partners, as they will be the companies leasing tower space and/or conduit/fiber infrastructure.

Throughout the U.S., many WISPs are aggressively pursuing public-private partnerships (PPPs) with county governments. These partnerships may include a variety of strategies: collaboration on a grant opportunity, shared costs of developing a new tower site, revenue sharing, fee waivers, and other sorts of cost and revenue sharing. The advantage of this kind of PPP is that the WISP typically is responsible for most of the day-to-day management of the network assets.

The county can pursue public/private partnerships with technically qualified and financially stable ISPs and WISPs as well as the Wired Road. Where appropriate, the County can channel grant funds to providers while will use the funds to build and manage new broadband infrastructure.

Selected providers should be able to show technical competency and have a demonstrable track record of managing substantial fiber and/or wireless builds on time and within budget. It will also be important for any public/private partnership agreement have a claw-back agreement. When public funds are transferred to a private company, the County should have the ability to "claw back" the built infrastructure for a minimum of five to ten years.

Conditions for a claw back could include bankruptcy of the ISP, sale to a third party (where substantial profit taking leverages the public funds), poor service, unreasonably high cost of service, and/or poor service reliability.

Public Safety

The Sheriffs department, fire, and rescue departments all need better access to broadband and improved wireless voice/data communications. Throughout the United States, public safety voice and data communications systems are being upgraded, often at staggering cost. Many of the upgrades include new towers to eliminate "holes" in the served area where first responder, fire, and rescue radios do not work. Combining public safety needs with community broadband needs can bring new sources of funding and cut costs, sometimes dramatically. Elected officials may need to take the lead in this area to ensure that public safety officials work collaboratively with the broadband efforts.

The availability of public-safety towers and/or new towers can enable new services and applications for police, fire, and rescue in Carroll County. Secure WiFi hotspots can be set up around and near the towers, so that reports can be filed from the field using the WiFi Internet connection. Other communities that have done this have found that it saves time and keeps patrol cars out in the field longer.

There are often grants available for public-safety voice and data communications improvements, like new towers and upgrades to existing tower facilities, that could also support the broadband initiative. Any public-safety tower or communications expenditure should be analyzed to determine if the expenditure can also support expanded broadband access in the county.

K12 Schools

Carroll County schools have adequate broadband service at existing school locations. But K12 students often lack adequate Internet service at home, and some schools are careful not to assign homework that requires Internet access. Parents consistently report on the burden of having to drive children to a public library or some other WiFi hotspot to get Internet access for school work. The County should work with the schools to apply for education grant funds to achieve this goal, and to keep K12 parents informed about broadband activities.

County Businesses

Businesses in the county and the local Chamber of Commerce chapters have an important role to play as advocates for the broadband work of the County. At both the county and state level, businesses that need more affordable and better broadband should ensure that elected officials understand the urgency. The County, as part of its broadband awareness efforts, should ensure that local businesses are kept up to date with work activities, grants, and other efforts (e.g. attend CoC meetings at least quarterly to report on the work of the County).

APPENDIX A: GLOSSARY

Active network: Typically a fiber network that has electronics (fiber switches and CPE) installed at each end of a fiber cable to provide "lit" service to a customer.

Asymmetric connection: The upload and download bandwidth (speed) are not equal. Cable Internet and satellite Internet services are highly asymmetric, with upload speeds typically 1/10 of download speeds. Asymmetric services are problematic for home-based businesses and workers, as it is very difficult to use common business services like two way videoconferencing or to transfer large files to other locations.

Backhaul: Typically refers to a high capacity Internet path out of a service area or locality that provides connectivity to the worldwide Internet.

Colo facility: Colo is short for Colocation. Usually refers to a prefab concrete shelter or data center where network infrastructure converges. A colo or data center can also refer to a location where several service provider networks meet to exchange data and Internet traffic.

CPE: Customer Premises Equipment, or the box usually found in a home or business that provides the Internet connection. DSL modems and cable modems are examples of CPE, and in a fiber network, there is a similarly-sized fiber modem device.

Dark fiber: Dark fiber is fiber cable that does not have any electronics at the ends of the fiber cable, so no laser light is being transmitted down the cable.

Fiber switch: Network electronic equipment usually found in a cabinet or shelter

Fiber Optic Splice Closure: See **FOSC**.

FOSC: Fiber Optic Splice Closure. Typically a water and air tight cylindrical container where fiber cable is split open to allow splicing (connecting together) of fiber strands for a drop to a premises.

FTTH/FTTP/FTTx: Fiber to the Home (FTTH), Fiber to the Premises (FTTP), and Fiber to the X (FTTx) all refer to Internet and other broadband services delivered over fiber cable to the home or business rather than the copper cables traditionally used by the telephone and cable companies.

Handhole: Handholes are open bottom boxes with removable lids that are installed in the ground with the lids at ground level. The handholes provide access to fiber cable and splice closures that are placed in the handhole. Handholes are also called **pull boxes**.

IP video: Video in various forms, including traditional packages of TV programming, delivered over the Internet rather than by cable TV or satellite systems.

Latency: The time required for information to travel across the network from one point to another. Satellite Internet suffers from very high latency because the signals must travel a round trip to the satellite in stationary orbit (22,500 miles each way). High latency makes it very difficult to use services like videoconferencing.

Lit network: A "lit"network (or lit fiber) is the same as an active network. "Lit" refers to the fact that the fiber equipment at each end use small lasers transmitting very high frequency light to send the two way data traffic over the fiber.

MST: Multiport Service Terminals are widely used in fiber to the home deployments to connect individual home drop cables to larger distribution cables on poles or in handholes. Pre-connectorized drop cables snap into the MST ports and do not require any splicing.

Passive network: Refers to infrastructure that does not have any powered equipment associated with it. Examples include wireless towers, conduit (plastic duct), handholes, and dark fiber.

Pull boxes: Pull boxes (also called handholes) are used to provide access to fiber cable and splice closures. They are called pull boxes because they are also used during the fiber cable construction process to pull the fiber cable through conduit between two pull boxes.

Splice closures: Splice closures come in a variety of sizes and shapes and are used to provide access to fiber cable that has been cut open to give installers access to individual fiber strands. Splice closures are designed to be waterproof (to keep moisture out of the fiber cable) and can be mounted on aerial fiber cable or placed underground in handholes. Also called **FOSC**s.

Splicing: The process of providing a transparent joint (connection) between two individual fiber strands so that laser light passes through. A common use of splicing is to connect a small "drop" cable of one or two fiber strands to a much larger (e.g. 144 fiber strand) cable to provide fiber services to a single home or business.

SCADA: Supervisory Control and Data Acquisition. Used by the electric utility industry and some other utilities (e.g. water/sewer) to manage their systems.

Symmetric connection: The upload and download bandwidth (speed) is equal. This is important for businesses and for work from home/job from home opportunities.

Virtual Private Network: A VPN creates a private, controlled access link between a user's computer and a corporate or education network in a different location. VPNs are often encrypted to protect company and personal data. VPNs usually require a symmetric connection (equal upload and download speeds) to work properly.

APPENDIX B: RESIDENTIAL OTHER INTERNET TYPES

These are the responses received from Question 8 on the Residential Survey: What type of Internet do you have at home?

- Fastlink
- I have DSL through Centurylink and Satellite through HughesNet - neither of which work very well
- A hotspot box with very limited amount of gigs per month. Only last a few days.
- I have Viasat and centurylink, since internet is imperative in our home.
- Point-to-point wireless.
- ISP via Xfinity / Comcast
- My Neighbors and I have no internet at all . None of the phone company's will bring us nothing to our little Valley . I know there is money to be made for an internet company if we could just get it here. This is 2021 and we are living in the stone age. We also live in a very nice place very convenient to great places and we are without here . I had to send my son to school the last year of school with no internet to do his school work during quarantine.
- Hughes Net
- I AM WITH FASTLINK COMMUNICATIONS HERE IN CANA, VA. WIFI SERVICE
- We have cell phone hot spot and Satellite...neither is dependable
- We use our cellular phone hotspots
- Mobile hotspots
- Fastlink via microwave dish
- Comcast
- We have no internet. Century link is only 1 mbps and Hughes net prices is not worth the price and don't work half the time. We have no other options.
- Mobile hotspot
- have service thru century link (landline phone provider), have a modem for wifi.....is up to 1.5 MPBS
- Verizon hot spot from phone
- We have internet through Century Link. It's not dial up, but I don't know kind it is. The bill says broadband.
- CenturyLink
- Modem from CenturyLink connected through our landline phone
- Cellular hotspot
- Internet is not available at my address
- Whatever century link says they are charging us for…. High speed… but we do not get what we pay for.
- Fastlink
- We do not have Internet access at home-because the only Internet in our area is from satellites which cost over $100 a month.
- Also have a Cellular hotspot to supplement because of limited speed.
- Century Link sold as 'twisted pair' claiming 10 MB but when installed it was not available and only delivered less than 3 MB
- Hotspot device

- Cell wireless
- No internet providers are available at my address. I have to use very expensive and unreliable cell phone data/hotspots.
- CenturyLink, think it is DSL but not sure. Had satellite, but it was horrible.
- Xfinity
- Hot spots from two different cellular providers
- We have DSL, Satellite and cellular wireless services.
- Verizon jetpack
- I have to use my data plan for my phone, and reception is iffy and temperamental.
- We have Hughes Net and it SUCKS! They made all these promises that it would work and we got stuck in a 2 year contract paying for crap! We can't even do google classroom or anything "live" through school as all it does is buffer. I can hook up with my hot spot on phone but it sucks the data dry quickly and it is VERY costly!!!!
- Satellite and three different cellular services, none of them are reliable.
- Need internet to work laptops for work. Moved here recently and tried calling 6 providers and all told me none was available for me. Have to use library access or our cell phones.
- I have a router through U.S cellular
- No internet available at this home
- In this day and century, Internet access is vital. It is interesting to own a home where cell service in terrible and internet service is non existent.
- We have a small dish with FastLink that pings the tower at Fishers Peaks.
- Century link
- We only have it on our phone. Too many people on CenturyLink and Cable company said we was too far from the road to run a cable!!! Will not use Satellite Internet
- We need internet
- very spotty sevice use phone data when can
- Mobile phone hot spot
- We have dsl supplemented with a very unstable cell based modem from nomad
- We hot spot from our phones.
- Cellular Hotspot
- 5 spot
- Not sure what mine's called. I have to have line of sight to the lingo tower at Beamer's knob. It's the only internet we can get.
- Century Link
- CenturyLink
- Comcast (Xfinity)
- I have unreliable DSL+ multiple us cellular routers and hotspots. I need multiple networks to switch between as none is reliable and we all work from home online. I also have a deposit down on Starlink and offered to personally pay multiple company's to extend their service area to ky home. All declined. I also had my flower bed dug up over a year ago so fiber could be run through my yard bit I am not able to subscribe... this is a big pain point for me and I am exploring moving my business and possibly my family to an area with better options
- I'm not sure, it's from Century Link
- AT&T router
- (Satellite - Viasat Company)
- CenturyLink

- Viasat is better than Hughes but our only options and are horrible.
- We use our cellular phone hot spots for our internet
- Century link phone line
- Sprint hot spot
- Line of site access from Beamer Knob cellular tower.
- I have Us Cellular box and Hughes Net
- Comcast
- Also Wireless ISP from 2 different companies for a total of 3 different Internet providers, all sub par.
- CenturyLink had no service available for a telephone landline or internet service to my home when I moved 3 years ago. I have an 'extender' to connect to my parents' CenturyLink internet, which is probably a 30-40 yard jump that results in poor/dropped connections and minimal internet access for online banking, remote work, videos, etc.
- Century link or Hughes net
- DSL and paid cellular hotspots because the DSL does not support what we need for bandwidth
- Fastlink
- Fastlink
- Nomad Internet for Travelers/rural areas without internet service
- Hotspot on cell phone using cellular data. Unlimited data is included in plan but to have enough data to stream tv services and work from home, it requires an extra line.
- I have HugesNet. It works better than some others I've tried but still continues to drop important calls many times.
- Don't have yet. Planning to build 2022.
- ViaSat and it is working pretty well
- Open sky and still slow-
- Have DSL & Satellite and cellular hotspot
- hotspot
- CenturyLink internet
- Paid for high speed internet through CenturyLink however he became slower than dial up so I cancelled the service for this address
- Had to improve to Fiber in order for the internet connection to work to utilize internet options for music and worship for church services. Since choir is not an option since COVID Also utilize internet to help teach Sunday school lessons CenturyLink would not work effectively in order to access internet for music and worship for church services, would just buffer.
- line of site microwave
- wi fi
- Satellite plus cellular wireless from 2 different carriers, one being a LTE installed with a router and the other a mobile hotspot.
- Century Link
- CENTURY LINK 'HIGH'SPEED
- 'Broadband'
- I use the hotspot on my phone. Satellite is not an option as I cannot use it for work. No other options than to use the hotspot on my phone.
- Mobile hotspot
- Think it is DSL but not sure.

- No fast whatever it is. Extremely slow and when my daughter & family come to help on the farm they cannot stay long because they need fiber to continue working online
- I work from home and need two services, one as a backup. I have both DSL and satellite.
- ViaSat
- CenturyLink DSL Verizon Wireless
- Fastlink
- US cellular orbi
- We have DSL from Centurylink AND satellite from Viasat
- century link
- Verizon wifi with our current cellular plan.
- Cant get internet
- Century Link
- We have to have two separate services just to get things done. One is Cable modem and the other is wireless ISP.
- CenturyLink and Satellite
- We need internet service in our area. None available
- I'm thinking your company should already know what landline phone services are available - and thus should know what the cost per household these products and services are.
- I use a T-Mobile Hot spot (100gb) device ,and the hot spot option on our T- Mobile phones. We can get 4g LTE. This option only became available last year. Expensive and limiting.
- My neighborhood has no cell signal we can't get landline phones because the main phone lines are old and laying on the ground in places no DSL service is available nor any other internet phone or cell service! we are living in dangerous situations here incase we m need emergency services like 911.our only option is satellite TV and Viasat satellite internet which is awful speeds and price! I have brought this to the attention of the board of supervisors many times and they have had a grant several years ago to fix this intern et problems for us citizens and the money was spent somewhere else or worse! ALSO WE GOT SEVERAL MILLION IN COVID GRANTS for immediate upgrades when schools closed due to Covid and still nothing has been done they hav
- I have century link internet and is very slow, almost worthless. but i need internet for banking and ordering life saving medications. Xfinity is in site of my house , about 200 yards. They wont come and hook us up'
- Just use my phone's hotspot which has limited data and speed.
- there is only one provider for internet and it is too expensive to afford, only the rich people can afford it. If you have to have internet forever (like electric) it needs to be affordable.
- Centurylink
- I use a hot spot from sprint
- I want internet, but CenturyLink dsl is not worth it.
- Verizon wireless
- mobile hotspot
- No internet available at my home per conversation with Century Link. Have a Hugesnet satellite but the speed is too slow to use.
- Hughnet
- We have a modem from phone company, Century Link.
- Hot spot on my cell phone
- Wireless router from cell phone service.
- Hot spot

- Mobile hotspot
- Wifi
- I think satellite.
- Through phone line from CenturyLink.
- Comcast Internet
- Internet bos from us cellular
- Wireless from CenturyLink (worst!!)
- CenturyLink broadband
- Through telephone line
- HughesNet
- Cellphone hot spot
- I have both Satellite and Cellular. Both are poor.
- Cell phone hot spot
- hot spot sprint
- Century Link with landline
- HSI Modem Wired on Bill
- Hot spot on phone
- Cell phone hotspot

APPENDIX C: RESIDENTIAL OTHER USES

These are the responses to Question 14 on the Residential Survey: Other uses of the Internet

- Professional Development webinars, such as Google Meet, Zoom, etc. use the internet for both hosting and participating in these apps. Also use Canvas LMS for online teaching.
- Shopping, email, social media, research,
- general surfing, entertainment
- I work from home even before COVID.
- Self-employed
- We use Zoom for religious meetings every day.
- smart thermostat
- Banking and paying bills
- "Research
- Online shopping
- Social media
- Manage Airbnb listing"
- Making invoices
- online banking, bill pay, account management etc...
- Zoom and Webex meetings
- Checking work email from home and remote office computer operation.
- Only have cell service and it doesn't work half the time
- Need wifi for my cell phone to work.
- Must use online programs daily for work.
- If we COULD, we would like to use Internet for security, video services, as well as Smart speakers.
- Just getting information from the internet about products
- Read Winston-Salem and New York newspapers.
- I try to use internet for these services but can’t do it because of bad connection and speed.
- Paying bills, online shopping, online banking
- We have to use the hot spot on our cell phones since no internet is offered to us
- Roku
- research, shopping, social media
- Work from home, not because of COVID-19.
- TV Streaming
- Work from home
- email, social media, general information lookup.
- Online Futures Day Trading
- Banking, credit monitoring, texting, sending audio files, updating software and operating systems. Keep up with the news and weather.
- Centurylink can not provide ANY internet service as they are running in "exhaust" and are not taking any new internet customers at my address.
- I am retired, but I still need reliable internet. I have health issues! I recently tried to contact my doctor using telehealth, but was unable to do so because of "poor" internet connection and speed.

- If we had reliable, affordable service, I'd use it for home security.
- I would use the internet for streaming, taking online courses, but the download speeds do not support it.
- E-mail, contact with Dr. Offices, Zoom
- Social Media
- Energy saving thermostat
- With our current job, online access to the internet is EVERYTHING! We only have one provider in this area and the service is not good at all. Please help us. This has been a problem for too many years.
- We tried home security, but the internet was too slow.
- self employment/income tax business to transfer information
- Kids tablets or chrome books
- Home business
- Small business website hosting
- I would do all the above but my internet is too slow to do any of it. I have to connect to my cellular data
- Working from home not related to COVID-19.
- "Most of this I have to use my HOT SPOT on my phone for!
- HughesNet doesn't work with these things…I've called customer service and discussed it with them."
- I've worked remotely for years and will continue to do so after Covid.
- My daughter just started college back in August, and she has trouble with zoom online classes where she has to meet with her teachers. She has trouble loading her assignments.
- I need internet to access pay stubs and do things. I need for work it's all online
- Searching the internet, email, social platforms, news.
- I would love to have home security but my internet is so awful I doubt it would work. I can't use any streaming services and it's so slow I can't even download a single movie. I can't watch a 5 minute YouTube video without multiple interruptions.
- "I use for online banking only. check info on web.
- From 2am to 8am we have unlimited data, if you use after those times you use date that is limited on which if you use all data for month it goes at slowest speeds."
- Look up things
- We want to work from home but are unable to due to the speed of the internet.
- shopping
- Smart TV
- Reading news online and downloading for offline reading.
- Informational manuals, Banking & bill pay.
- Hue light control
- e-mail, news, research
- Pre school learning
- Cell signal extender, social media, internet access
- tv
- Required by my job in order to telecommute
- Hydrow streaming, uploading sermons, 2-3 adults working from home, 2 full time.
- We don't have internet service offered!
- Surfing

- shopping
- News, local events
- Banking, QVC, Amazon, Weather, More, Medicine
- can not stream.
- Bill paying
- Smart lights.
- I work from home (not specific to the pandemic)
- Managing all financial accounts and banking services
- I would like to stream video but am unable to do so.
- "Paying bills
- Ordering items online"
- Health accounts
- I'm unable to use any streaming tv service. I would if I could. Internet is just awful.
- Thermostat, fire alarm, leak detector
- I strictly work from home.
- Have worked from home for over 14 years and require a business account with CenturyLink just to be able to work
- Communication: facebook, messenger, e-mail
- World/National/Local news; online banking
- Our grandkids come and uses our internet some for their school work.
- Operate a business also out of this location-need internet for banking, accounting, tax filing, etc.
- We would use Zoom, Skype, Netflix, streaming services, home security, smart speakers, etc., if better internet service were available.
- News, research, Journals, Audible, podcasts
- We had to discontinue our home security system due to lack of service
- World/National/Local News and weather; online banking
- General internet surfing.
- "ONLINE BANKING
- WEB SURFING
- ONLINE SHOPPING
- EMAIL"
- No internet
- I can't do these due to such crappy internet.
- Unable to do these things due to poor service!
- "Streaming music
- Social media
- News"
- ZOOM
- I worked from home pre-COVID. The lack of dependable Internet has caused work calls to be dropped and interrupted downloads/uploads.
- cpap data
- communication
- Retired but still do real estate part time and need internet connection that is reliable.
- Oh my have Internet on my cell phone which is sketchy
- email, social media, other research/browsing, online shopping, paying bills & managing accounts

- I have an online support group and its important to have a good internet connection. Plus I also use it for paying bills
- general use such as social media, paying bills, online shopping. We live far away from lots of options when it comes to buying basic items. Online sadly has become the most reliable source for many things that local retailers say they cannot make money keeping in their stores.
- I work from home. I Have to have internet to do my job.
- Online Banking; Online BillPay; Online Purchasing/Ordering; Social Media; general research for the home (Recipes/Gardening/Medical, etc.)
- Internet was no slow to utilize for work at home, have another house I go to work from home
- "Utilize internet to help conduct church services since COVID
- older service with Centurylink would not work had to upgrade to Fiber internet to have the speed to not buffer during the church services"
- 911 support
- info, banking, shopping
- We would love to be able to stream and have a smart house, including security cameras but do not have those now due to internet speeds.
- Browsing
- "cell phone works only trough wifi
- if we do not have electricity, we have no information at all"
- Shopping
- wifi calling. no phone signal in our area.
- Online banking, bill paying, shopping and finding information needed for various things such as news not on TV.
- I use it for a web based business, to avoid dr office and to work from home, but it unreliable and takes 1-3 weeks to get worked on when you have a problem... waiting for them to work on it now, after they "repaired a home phone on our road earlier in the week.
- Email, banking, personnel research
- "Order supplies and maint. parts for the farm.
- Access our work email from home.
- We could do work related online classes and training if we had better internet."
- Banking, shopping, communication with family and friends, paying bills, news, audiobooks, research, church communication
- There are a great many things on this list we would like to do but can't because the only internet we have is by tethering a device to out cellphone. Cell reception is spotty and speeds are marginal at best
- "Shopping
- Weather alerts
- Power outage notifications"
- Social media, research for work, home business
- Better cell reception
- Business use - credit card machine, faxing, and other business uses
- Banking, bill paying, news, shopping, church services, self help learning, audio books
- Smart TV
- communication and social media
- watching youtube
- e-mail, news, managing finances, directions

- Shopping, education, general news, internet phone
- I have little to no cell service. My only phone connection to 911 or any other phone based services is via my WiFi connection. Land line service at my address is horrible. Totally unreliable.
- Cant get internet.
- "email
- music stream"
- Bill pay
- "Communication involving volunteer activities
- Work involved with community volunteer organizations (church, foundations, etc)
- On-line banking
- Communication with family who live away from area"
- Ordering parts for repair shop
- how about email , people.
- I would live to use it for security, telehealth, etc. But the speed is so bad it's not possible.
- Work from home
- "local TV
- news broadcasts"
- research, facebook, ect..
- online research, reading, entertainment, shopping for items unavailable in this area
- Browsing web sites, banking/bill pay
- banking, paying bills, online purchases, a lot of research. I could go on, but just about everything really. There are a number of things we don't do with the internet due to the service being so poor.
- Pleasure, pay bills
- Banking, financial transactions, weather info.
- I have 2 businesses and I need fast hone internet and phone to run both of them
- Lifelong learning courses
- zoom meetings
- Banking and keeping tax records.
- Bill pay
- keeping in touch with family
- Email, word processing, phone messaging, cell phone use.
- "Bible Studies from time to time on Zoom.
- Taking online classes.
- Doing continuing education for my job."
- Would like to do online streaming with friends and facetime but internet is extremely unreliable to even watch a stream.
- "I would use voip, but internet speed is not good enough.
- Actually I would use it for all items list, but the dsl internet is too slow to be used for anything more than basic browsing."
- I would use the internet for most of the things listed, if the internet service was able to provide the needed speed and reliability.
- I would used the internet for more of the services listed above if my internet speed was better.
- I telecommute using a significant amount of data each month and I also operate a small business from home, which also takes up a lot of bandwidth. I am limited by my satellite internet provider to 25gb/month, after which the service (already slow at 25mbps) slows significantly.

- Purchase necessary items that are not available locally.
- AWS, Azure, GCS, VPN
- shopping, email
- Job training from home
- Work from home
- Can not stream. Too slow
- Run a business.
- Facebook, youtube
- Information, bill paying, email.
- Permanent work from home
- Work from home - Permanently
- Gave up - Have to drive to town.
- Basic networking/email/social media
- Need internet (affordable) service
- Heart monitoring machine.
- News, WX, research, podcast
- Facebook, youtube
- Paying bills
- I don’t have internet
- This is a business.
- Ruko
- Work
- Email, weather
- We cannot have Netflix because of service.
- None
- We can't use any streaming services.
- "RE: internet speed. Waited several minutes for test results but ongoing wait.
- In addition to occasional Zoom business meetings, primary internet use is access to news sites, emails, texts."
- banking
- Portal
- Sending/receiving files
- Not able to use it for something - too slow.
- News, weather, Facebook
- Home business
- General internet use
- Internet is my straight talk phone hot spot.
- Shopping and social media
- required access for special needs individuals
- Business
- Research for work
- Email
- Basic online
- business
- no internet
- social media

- social media
- don't have internet
- Mainly just FaceBook and email
- email, online research, shopping
- email, google
- Volunteer committee work
- Ebay
- no internet
- Financial management
- No Internet, I have to go to local library
- daughter teleworks from my home
- pay monthly bills
- running credit cards for my massage office
- researching
- work is most critical
- Bank business
- email, shopping, taxes, banking
- alarms, outside video camera
- email, general info/google, news, online ordering

APPENDIX D: RESIDENTIAL OTHER COMMENTS

These are the comments received from Question 24 on the Residential Survey: Any other comments?

- We used to live on the other side of 52 near the NC/VA and had Spectrum internet. I have up to 100MB internet for $59.00/ month and we never had issues with their service. They actually ran cable and put in a new box down our road from the main road. When I called them about our new location we couldn't do this because it was so far from the main road (52) it would cost a lot of money but if everyone on our road needed it they would. I am happier with Fastlink but it has been rocky to get here for the last year but I would still like to pay a little less. Internet at our house is a necessity.
- Have been waiting for spectrum to extend service to my area.
- The service we have is adequate for us. Future residents may have more needs. We need to keep up with this type of service to make this area desirable.
- Currently my internet speed is 1.5 mbps from CenturyLink. Where I live, I'm less than 1 mile from being able to receive Spectrum out of Surry County, NC and access 100 mbps, or more. This is still in Carroll County, VA with a Cana, VA address. It is very unfair for many of the citizens in Carroll County.
- The world is interconnected now so high-quality internet access is a necessity. I shop online, work online, and seek medical care online. I also use it to check on family members. With the spread of infectious variants, having the world at my keyboard is crucial to my life.
- Internet use woukd greatly expand if speeds were increased.
- Maybe state, Carroll county could use funds for feeding programs that are community based that are more important.
- I am a former IT professional who recently retired and moved to the area. Although we love the mountains, our neighborhood, and so much else, fast & reliable internet connectivity is critical to both of us. We had to get a second CenturyLink DSL line installed in our house, which is dedicated for my wife's work from home job. I consider myself quite knowledgeable about Internet speed, connectivity, upload/downloads, etc. I would be happy to offer my services to volunteer for any projects involving bringing higher speed internet to my area! Thank you.
- At my age (73), I expect to die before Carroll County provides high speed internet to my address.
- Get off your seat and do some about this issue. You let century link get away with what they do in the county and you have not went after the state and federal money sent out to improve internet service.
- I would be willing to pay as much or more than I am now for reliable strong internet service. Centurylink goes out continuously during the day and HughesNet is dependent on the weather and has data limits. I work from home and often have to work late into the night because even with 2 internet connections I will find myself without internet.
- Children need internet not only to do homework but also for when classes are virtual. There is also a small business at the home and internet is needed daily to help it run efficiently. It is a huge expense to commute to somewhere to use internet. It is detrimental to a child's education and to a small business to not have internet at home.

- Internet and phone service is terrible. Dropped calls, no service, internet service comes and goes. You cannot count on the service being there when you need it. No choices. We pay a premium for spotty service. We need choices that will allow us to be safe and is reliable.
- With the Pandemic, we NEED reliable internet. If one of us has a zoom meeting, the others stay off that internet. Heavy rain, fog, etc makes Viasat useless. Our Century link connection is drop line, even though we are a mile and a half from the county road. Centurylink refuses to put a cable in. We have to pay for two different internet providers to get just barely reliable internet My granddaughter uses it for school. We use for religious meetings and keeping in touch with family and friends. Our Centurylink telephone service is really bad. Often the people we call say they can't hear us above static on the line. Cellphone service is poor here, so we try to use WiFi to boost our ability to text.
- Centurylink goes out with almost all thunder storms. We are left with no WiFi or phone services typically from a week to 10 days. They do not adjust our bill and charge for a while months service even when the line is dead.
- We've been waiting for this survey for 15 years. Land-based cable services or fiber need to be implemented in Lambsburg
- I've been waiting for good Internet to come to my area since I was in elementary school in the early 2000's. 21 years later and here we are, still with no Internet that's worth anything and I live within 5 minutes of Hillsville Elementary School. Somethings wrong with that picture to me. I think it's about time something usable comes to the Dugspur community.
- Fiber internet for Carroll County is very important for the community of Carroll and will continue to only become more important. I'm a lucky to have cable internet. I purchased my house based on the availability of high speed internet. While I have high speed internet the data caps thru Comcast end up making my bill usually $40 a month higher than usual. I have 2 kids who use the internet for school almost daily. One of my children has some severe medical issues and relies on the internet at times for video Teleconferencing his doctors.
- need now
- Please consider us for internet .
- century link is a poor provider of any service. their customer service is as bad as any service I deal with.
- I am a nursing student with 3 children. We ALL had to virtually learn in 2020. My Zoom classes would be interrupted constantly and my children had to request paper packets due to our internet. I currently have to go to my mother's house to complete online simulations for class because my internet will not load the program! We have no other option. I would love to stream tv shows and movies but can't. We pay $120 a month for internet that works half the time. Please help!!!
- Since I moved to Carroll County from Wisconsin, I have not had access to the internet. I have pleaded for companies to provide internet, and after 3 years, I would hope Dugspur comes out of the Stone Age and gets better internet. It has affected my ability to work safely from my home during the pandemic, and my ability to work on my part time creative career.
- I am an IT professional and the lack of good internet service at a reasonable price limits my income opportunities. I live in Cascade Mountain Resort and lack of cellular and internet service is a big problem for many people here. I am aware of several people that did not buy homes here for that reason.

- Very difficult and expensive for internet. Only one choice really CenturyLink. Hughes Net is horrible. I really hope you can help the situation at the bottom of Fancy Gap mountain. Bring it on. I cannot wait.
- I pay 107 per month with Centurylink for landline and internet. Can't use the phone during a storm due to constant static ,the internet comes and goes especially in the afternoon. Yesterday it took 8 minutes to upload 6 pictures. They say everything is working correctly. Both services are unreliable and for what I pay a month the level of service is ridiculous
- Can't participate in zoom calls very well. Too much lag time between me and other participants to be able to be an active participant. Cell service is Verizon and it is not an option for internet. The coverage where I live is almost non-existent.
- NOTHING REALLY TO ADD, EXCEPT: WOULD RATHER KNOW ABOUT PUBLIC WATER FOR ALL HERE IN CANA, VIRGINIA, RATHER THAN THE INTERNET AND A CURE FOR COVID-19. OTHER THAN THAT I'M GOOD..
- We do not have a choice in this location - Century link stops about two houses up from us one way, fiber optic came in the other direction and stopped one house from us. Hughesnet is expensive and slow, but only choice. We cannot stream movies with our internet. Cell phone coverage is not much better.
- One of the campaign promises from different politicians in previous state elections was broad band service. The internet has almost become a necessity. We pay bills, Bank, use patient portal for health provider, and shop on-line. We need help in Dugspur.
- The only internet available to us right now is Hughes Net or Viasat satellite internet. We've had Hughes Net before and it's crap. Definitely not worth the price tag. We do better just using our cellular data, although it's not much better.
- I have no options which is ridiculous in 2021
- I have recently been considering moving due to the lack of internet in the area because we don't have access to keeping up with current technology.
- Dugspur can not get internet. I need for my kid. Any help?
- I would suggest that on your next survey you provide a QR code link to the survey the link is long and cumbersome. Also, use a form that has return postage on it so it could just be filled out and dropped back in the mail. I suspect several people filled out the survey and then tossed it in the trash since it requires a unusual size envelope and postage.
- The only thing the county should do to improve internet services in the county is reduce the barriers to entry for competitors by including removing/shortening applications, reducing/eliminating fees, and default approvals to applications. The county shouldn't spend any more money or resources on the matter.
- Centurylink Internet is terrible. Extremely slow. Cannot stream anything except at the very lowest resolution. Would be willing to pay more for fast, reliable service.
- As long as it's great service and reasonable prices. Comcast is is a job. They are to high on their prices and it's without TV. Have to have it for work. Century Link does not offer enough download and upload to work 100% from home.
- CenturyLink is awful and unreliable, we have the fastest speed they offer here. There ar no other good options.
- CenturyLink DSL is terrible. Can only get 3Mb service but rarely get over 1Mb. The service is down randomly and can't get any better service. Waiting on StarLink as an option.
- Rural living definitely limits access to Internet and availability of entertainment and even cellular service which is VERY important to senior adults.

- I am very dissatisfied with everything about my internet.
- Please help our area with some real internet capabilities at an affordable price.
- We also own property on Harmies Bottom Road in Laurel Fork that is not eligible for internet service. Please do all you can to improve internet service in Carroll County. It is vital for this county to grow and prosper.
- Please hurry! I'd like to see it before I die.
- Thank you for doing a survey and striving to improve internet in Carroll County. We really need it.
- We really need internet here on Buckwoods rd. Century link has very low mbps
- We are getting fleeced by satellite internet companies. We pay over 160 a month and the internet never works. There are never any providers that will offer services in our area. There should be a way to monitor these companies in rural communities about the rates they charge versus the services they provide.
- We moved to Dugspur in May of 2020 moving from Floyd where we had citizens internet that provided affordable internet that provided for our household with no issues. Upon moving into carroll county we learned that satellite internet was our only choice and was the worst internet experience we've ever had. Even though we have full clear view of the sky the satellite internet didn't work most days and if was cloudy outside there was ZERO signal. Currently using a mobile hotspot from Verizon. The cost over satellite is way more affordable and weather conditions doesn't effect the signal but even though it's unlimited data but the high speed is capped at 30GB per month which is used up in a few days and the bandwidth of the device is very little only allowing us to use one device at a time and the speeds are extremely reduced after the high speed data limit. We have a computer that we haven't touched in over a year due to poor internet that has just been collecting dust because we know it's a waste of time to try to use our computer. We love our home and location but at times we feel like we are in the stone ages because the lack of quality internet and desperate for a solution. Currently enrolled for Starlink for when it comes available in the area but a solution for us is a dire need that we're desperately waiting for
- I would love to have better internet and better cell service (we have a cell signal amplifier in our house) where we live and I would be willing to pay more for that service. Our youngest son is now in college so we don't have as many people, on a consistent basis, accessing the internet at our house but there are still times when there are 5 or more of us trying to access the internet. My oldest son works in Erie, PA but has worked from home quite a lot during the COVID pandemic and he is not able to professional function at our house. He has to come into my office to have meetings and perform his work capabilities. Thank you for considering this.
- Centurylink is the worst. We do not have a house phone and/or internet because the phone was always out of order and the internet was useless.
- We own this home, but do not live there. We spend a great deal of time there working. We only have capability for a landline phone and very, very limited cell service. This area of the county definitely needs improvement and upgrades in all areas of technology and communication.
- This is the highest priority problem for my household.
- The cell phone lack of service affects us more. If we are going to pay for cell phone service we should be able to get better service in all areas of this county.
- Thank you for looking into this. I used to have home at Fancy Gap, and there was almost no service there, even with the hotspot.
- I want cheaper internet service, and more options of companies to offer better rates, etc.

- We need competition in this area. CenturyLink internet is slow and unreliable. We cannot get cellular data to work here most of the time and the cellular telephone only works in certain areas of our home.
- We have several areas of our community where we have been forgotten as far as internet providers go. It's 2021 everyone deserves a reliable high speed internet.
- A. Very limited choice of internet providers in southern Carroll County west of I-77. Comcast will not extend cable line, wireless ISP must be line-of-sight and satellite is little better than dial-up because of latency. All are extremely expensive. B. Centurylink is without a doubt one of the worst phone companies for customer service. We suffer from 4 - 6 outages a year and consistently degraded line quality (noise and hum). Local telco personnel tell us that CLink will not upgrade equipment in Carroll unless forced to by State Corporation Commission as this area is a very low revenue producer for them. C. Appreciate fact that Carroll County is looking into this problem and wants to do something, but I really do think that help must also come from the state/federal level in order to facilitate more and better quality providers to enter this market. Thank you for hearing our views
- would love to have options. centurylink is a joke.
- CenturyLink is undoubtedly, unquestionably, the worse internet provide on Earth. No one, anywhere is as bad as they are. Our service is 1.45mb and the only thing worse than it's slowness is it's unreliability.
- The county, satellite, and cell phone companies promise all kinds of improvements with internet service and we have yet to see that happen in the past 15 years. Any improvements would be welcome.
- # 23 - as long as the cost of the service is paid for personally and not by taxation!
- My child would benefit in her school if we was able to have better internet. This survey also includes my mother's address of 2928 Bellspur Road Laurel Fork Va 24352
- Please get us better internet. I have lived here 18+ years and never had anything more than satellite internet.
- Our land line telephone is constantly giving us trouble
- We previously had Centurylink and we paid for internet service and phone service that only worked half the time. I was so thankful our home phone service was working when my mother passed away so I could call 911. Also, we had to get our landline back through them because of our internet wasn’t working we could call 911 if we needed too.
- please note that we have grandchildren who use our internet for school. We have made inquiries to Century Link (our only option) for years asking for higher speed. The response we get is 'it's not available in your area'. Although I would hope the county government would be the advocate for improved internet, I do not think the county should have to pay. After all -- one of Warner's specific promises during the last election was that he would make certain every area of Virginia has better access to high-speed internet.
- It's a shame that it takes Government to bring internet service to the rural parts of the county. But it is gladly welcomed by us. The phone company has ignored repeated calls by many of us for so long, all but begging for DSL service on the phones lines. I hope this actually brings something to fruition. If not Starlink is planning to cover SWVA by the new year. I won't write my personal opinion of Centry Link, because it might be too colorful for some, but to say it mildly, (they suck).
- Please help

- I again cannot get Internet except for satellite services. These cost too much money and do not allow me to do all I need to do on the Internet. I am a teacher and make a lot of digital items. I have to work at school long hours to accomplish this goal.
- Please give us an internet choice that works.
- Internet service is so slow that we don't even bother to try to do things like streaming video. We're also plagued with frequent outages. Would love to have a faster and more reliable connection as long as the cost is reasonable.
- I believe it is important to specify what high speed internet is. To me it is at least 25Mbps down and 5Mbps up.
- Our national economy is rapidly moving to being based more and more online. Employment, education, even health care, have become more dependent on internet access. Even retirees are demanding better internet services - from finance and investing to social interaction, particularly in the COVID-19 era. Evolving like electricity, telephone service, and public water and sewer services, reasonably priced reliable high speed internet access has become an 'essential' for many households and the demand is growing.
- Our previous internet provider failed us for a couple of weeks and we had satellite installed, we found out how vital internet access is for us, we missed most of the news on hurricane Ida and the pullout from Afghanistan. Plus our landline was out also so we had a time getting anything done,
- We need better internet and cell service
- I do not have a data limit, however, if I did, I would never reach that limit because of poor service and 'VERY LIMITED' speed! The ONLY internet service I am able to get is only 0.3 Mbps upload and less than 2 Mbps download.
- Carroll County is failing its citizens in regards to reliable Internet service. How can the county expect to have modest growth when Internet service isn't available? Our children deserve better service in order to compete in today's world.
- Thank you for doing this! I work full-time from home as an IT systems administrator, and the CenturyLink DSL is far too slow, and cuts out multiple times every day. CenturyLink refuses to perform any maintenance on the network and has recently sold its rural customers (including those in Carroll County) to a private equity firm which has made no commitments to improve the network. Fiber-to-the-home service is desperately needed here. I had this when I lived in Bristol (through Point Broadband) and the service was exceptional.
- In 2021 you need reliable and affordable internet to survive, kids need it to do online school, applying for jobs, video visits for doctors, entertainment and socialization. I moved to my current home but was unaware that no company will provide internet service at my address. I live 2 miles from Hwy 52 and 3 miles from I-77. Centurylink & Spectrum provide service within a mile of my home but refuse to extend coverage. Sometimes I need to work from home but I have to use cellular data which is slow and has data caps.
- Before moving to Fancy Gap, I had Spectrum Cable in Statesville. I had 40 mbps internet and 80 channels of TV for about $80.00 per month. I would be VERY happy to have that again up here!
- I recently reached out to xfinity to get a quote for internet and they quoted me $6000 to extend their service 500ft to my home. I am stuck with centurylink and I have the fastest package they provide for my home.
- We are planning to sell and move out of the county to Knoxville, Tennessee, (after 40 years in Carroll County), if our internet services do not improve by May 2022. We can see Rt 100 (which has water, cable, and internet) from our deck. It is less than 1 mile from our home. Sadly, the weak

internet service existing currently devalues our real property. It is critically important for Carroll County government to facilitate the development of multiple broadband internet backbones in Carroll County. Many prospective residents (and the same for many small business) do not locate to Carroll County once they discover the inadequate internet services. At one time it was a high priority for Virginia government to provide an internet backbone to its rural areas. Sadly, the 'last mile' was never completed by service providers, and it appears the state government did not make that a requirement.

- I have reservations about the county government getting involved. Everyone is becoming more dependent on internet services. Our needs would be better served through company competition in the private sector.
- If there is not high-speed internet access, new businesses will not consider Carroll County as a location. if there is to be any upgrade in medical services, it is mandatory that the locality have high-speed internet.
- Century Link has failed to provide us with dependable phone and internet service. They should not have any part in our future communications.
- I work from home and have to have internet and the speed has made it difficult with covid and remote learning.
- My speed is 3 mbps and it's useless.
- We've noticed that since covid, people working & doing schoolwork from home, has slowed down our mobile hotspot. We used to get 3 & 4 bars and now we get 1-2 bars. We really need fiber internet in our rural communities!!
- My Centurylink connection works pretty well. We have no problem watching video and generally accessing web pages. It is a bit slow compared to our connection where we used to live which was fiber to the house and worked at about 20 mbs down and 2 mbs up. I think the fiber speed at my old location was fine for anybody.
- This should have been done when you signed the contract with the internet service provider in West Virginia! Why not go with citizens cable that has fiber optic internet in Floyd county! Ridiculous!!!!!!!!!
- I live within less than 10 miles from Hillsville and cannot get any form of internet besides satellite. I also cannot get cellular services without a booster and then it still does not work as it should.
- We are in the year 2021!! We have been sending people to space for years, why are these rural areas being neglected?! County officials pockets are getting fatter everyday and we are stuck in the Stone Age over here in the country
- Access to internet is the new telephone service. I do not have a land line telephone, because I use cellular. My bills come to me via e-mail…I do my banking online…I do work from home on occasion…in order to watch television, I need the internet. Today, you got to have it and it needs to be reliable and capable (fast).
- Broadband Internet is a necessity. It should be fixed ASAP.
- Need it NOW!!!!!!!
- We need better, reliable internet services in our area.
- Desperately need better services in our area.
- Would love high speed internet, but would not like 5G.
- Xfinity is generally reliable and can carry adequate speed if you are willing to pay high prices. We need fiber optic and competition regarding internet, TV and internet phone services. Century Link is a joke for both phone and internet even in the town of Hillsville. The internet is critical to the success of many working adults and virtually all students and educators. The need and

demand for quality internet increases virtually every year. We need competition to make internet, tv and internet phone affordable and functional in Hillsville and Carroll County. Fiber optic would be fantastic! Thanks for the survey and the opportunity to provide information. We are already far behind in residential technology. Let's make this a priority to get this fixed and move our community into the 21st Century! Thank You!

- I'm so exhausted from complaining to CenturyLink about our service that I have just about given up. It would be great to have reliable phone and internet service in our small rural community. I'm thrilled that this survey is going around.
- This area is in dire need of better Internet service. With the pandemic in full swing, people need to know things and access their banking or other Internet needs such as paying their bills. Education is important as we have a 6-year-old who is in the first grade and he is schooled by us.
- This is a major issue in our area. It is very frustrating to pay almost $300 for internet and TV services monthly and rarely be able to watch TV without it buffering every few seconds. It is also extremely inconvenient that the internet doesn't even work when it is cloudy or rainy, (when you're most likely to be watching TV or using devices.) I am a teacher and need to have reliable internet at home. Last year during COVID, I had to take my laptop to other locations to be able to post online assignments. My husband would work from home more if our internet would cooperate. We have tried multiple times to get a better and more affordable internet service, however, there are NO options available. This is such an issue that we have considered moving several times, even though we don't really want to. I am not one to EVER complain but this is ridiculous and I hope that something will be done about it. Thank you for your time and consideration!!
- Would love to see internet speed and coverage get better for our community, teachers, kids, and workers. Thank you for looking into this!
- Need better cellular coverage more than anything. Horrible cellular service at my residence.
- I think especially with covid & the possibility of kids going back virtually we need better internet. I do think the internet parents were able to afford made a negative impact on their overall grades. Examples : assignments didn’t arrive on time or items that were completed showed up as not done. I know this to be a fact because I helped my children submit work, then it showed up as incomplete. We need better choices for the less unfortunate but working families.
- We really need a better source for faster internet service!!!!!
- Due to the failing existing internet infrastructure, StarLink is becoming a very appealing option. That being said, an equivalent land based service would ultimately win in the eyes of a consumer, due to existing familiarity and capabilities.
- Broadcast internet (example: Wired Road) DOES NOT WORK. Too many mountains and trees that interrupt the signal. We need fiber line, to residences.
- We are very satisfied with Lingo, years ago fiber optic was ran through our street however nothing was ever hooked up or made mention to us about it. Lingo has provided awesome service and a price would have to be beat before we could change but so many on our road are without internet because nothing picks up here on the first end of Mt Zion.
- I am a carroll resident on edge of the county and we have century link and it very unreliable with very inconsistent speeds and there customer service is the worse. I would 100 month for just 25 mbs consistent service.
- I'm willing to pay for reliable broadband service. Century Link is NOT it. Fast Link service can be temperamental. Thank you!

- We would take ANY access to ANY internet that worked!!! Spending $80 a month and getting scammed into 24 months by HughesNet with promises of working internet sucks! I needed something for the kids for school and thought they were on the up and up and kept hearing "Hold on, Dugspur is gonna get internet. Be patient, it's coming." You can only be patient so long .. this is frustrating! Getting home late at night from kids ball practices/games then having to LEAVE home to go sit in a local parking lot to connect to "local" internet access so the kids can get on Google classroom to do homework!! We should not have to do this! This is unfair whereas other counties and localities have internet access and don't have to leave the comfort of their home!! We can't even get Disney+!!!! How much does that suck??? No online gaming! No Netflix! No Hulu! Zip, zilch! Help! My children deserve internet! They literally go to work with me ALL summer long so they can access the schools internet and YouTube, etc.! Now, isn't that sad!!!
- My wife is a teacher and due to no internet available she had to drive several miles to her moms house just to teach her virtual classes. PLEASE we need internet. My kids need internet for their school work. I have tried century link and Hughes net and nothing works here. Please.
- I had to sell my established business of 17 years and $2M annual income because of lack of infrastructure. I have been unwilling to open another online venture due to the lack of reliable internet and cellular services in Dugspur, VA
- Options are very limited here and Fastlink has a strangle-hold on the high-speed market in my opinion. While it's a good service, more options would certainly foster competitive pricing. I used to have gigabit internet in GA for what I pay to get 30/5 Mbs in Cana. I really appreciate this initiative.
- I live in Cana, and it is a rural area. My daughter needs internet for her college, because she has no in person classes at all because of Covid-19. Finding internet was very challenge, because where we live some internet companies don't come that far up the road, or internet companies want us to pay $300 and some dollars to buy their equipment. We already pay U.S Cellular $400 some dollars a month for the internet, but we have to do it, and it takes a big chuck of money out of my husband's check. We have to let some bills go to pay others.
- Sometimes, in addition to the answers above, grandchildren need to us our internet for school work. Last school year, they were here at least one day a week for virtual learning.
- I work from home and I am often frustrated with outages and internet speeds
- With the technology of today, there is no reason why Carroll County doesn't have high speed internet available to anyone
- While my Internet is great, because it is cable, many others in the community struggle. It is difficult for students to have virtual school days when Internet access is so slow.
- We need reliable internet in this county and not just for the people who live near hwy 52
- Cana is in desperate need to better internet options that are more affordable.
- Speeds are always less than 1.5 MPs Supposedly high speed but always slow. Goes down frequently. Century link customer service is horrible.
- Not sure on question 23!! Not sure if that is a county government problem!!
- Internet is now the most important item in life, as once was a landline telephone.
- Century Link has a monopoly over out area, making it impossible to get anything else. I'm regularly using my cellular data because the WiFi does not work. My download is 0.8 mbps and my upload is 0.2 mbps. That is very low!
- My century link service goes down every time it rains. Every single time. I pay $100 a month, and my employee had to provide a hot spot at backup. Comcast is 1/2 mile from my home, but will

not service my house. Having Comcast / xfinity, if there are no new offerings by that point, will be a primary factor in selecting our next home.

- We are very lucky to live where cable service is available-and-that we can financially afford the cost. For us to rely on cellular signal service to access the internet via cell phone (or make a phone call), we have to go outside and walk up a hill to get a decent signal! Easy access to the internet for all citizens is akin to the need a century ago for access to electricity!
- Would love to be able to get any kind of internet at my house right now. Very disappointed that only options I currently have is satellite internet or century link dial up.
- I am happy with FastLink, however I am always interested in better.
- We need better internet in our county! Y'all keep raising taxes but give the citizens nothing! We have kids who need internet due school, we need internet for TV in our area, it's needed for work and for health reasons for telemedicine appointments!
- It is absolutely insane it has taken this long for anyone to do something about the desperate need in this area.
- Something really needs to be done about the internet in underserved areas, especially the South West Virginia area. I feel that most government spending for internet is spent in higher populated areas in Northern Virginia and we are left with unsatisfactory options like DSL or worst Satellite Internet.
- We need better service please. If we go virtual school again there's no way my kids can learn effectively with in and out reception and paused videos from their teachers.
- We have unlimited usage but between low speed and often being unavailable its a joke!
- Century Lino tell me I can't get faster service. I can't even send a picture.
- Fastlinks is a very good option for those unreachable by fiber if within sight of their towers. They are affordable with no caps. I had Hughes net which was horrible.
- I am an educator
- The internet we have now is all we could get 1.5 mbps because we are more than 300 feet from the line. Something most definitely needs to be done in our county for better internet, with school going virtual on and off my kids cannot do their work from home like they need to be able to because what internet we do have is too slow.
- Satellite Internets service is expensive and provider limits data usage to 10 gigs/month. Service is very slow once that threshold is reached. Internet service is frequently lost during severe weather. Customer service from provider is poor, English is seldom CSRs native language.
- We need something besides being over charged for services that don't work
- Part of the issue is a sluggish service due to too many people and too few options. We need more reliable options and updated equipment. In this day and age, access to updated technology is key for all areas of life - health, emergencies, education, employment, and entertainment. Wherever you live, access should be readily available, usable 24/7, and updated - without fear of being sluggish or not working at all.
- I'm not sure about the County government facilitating better and more affordable broadband services if it means our taxes will increase. We already pay enough taxes.
- Living in the mountains, I am in constant fear of being cut off from everything due to the lack of dependable internet.
- We moved last fall and this was the best internet option we could get for the houses that were on the market.
- CenturyLink is horrible. They have overloaded the distribution box in my area. It never worked. House sits wrong for satellite internet and us cellular internet is unreliable.

- Present DSL service is very poor and does not make normal DSL speeds. Usually less than 1 meg down
- Internet use is critical for everyone. Those with slow, poor or no internet connections are not keeping up with society's changing communication and information technologies. That could be life threatening. Carroll County is falling way behind the rest of the country.
- Prior to moving here in 2020, I had VOIP phone for over 12 years (Washington State). After two months of trying, the VOIP company and I decided it wasn't feasible. I have to use an old ART Microcell (3G technology) to get reliable cell phone service. AT&T doesn't support it anymore and the WiFi isn't strong enough to enhance the signal
- Now days internet is a necessity it is very sad to see it being so expensive and unreliable or non existing.
- We need better internet in Carroll County, PERIOD!!!!!
- The real problem in this area is poor cell phone signal
- 5G is toxic to the human body.
- With technology changing on a daily basis, it is a necessity to have internet access to become a more informed citizen of the community. There is no acceptable reason for any tax paying constituent to be without access to internet service providers. Century Link will no longer offer service to our development, although poor quality, due to it being a private road and they feel it is not financially rewarding for so few residents. Living in a rural area should not make a difference. We are not represented equally by the local or federal governments when it comes to grants or spending to better our living standards. This is 2021, not 1952..
- I would suggest removing Century Link from Carroll County. The are I live when I tried to get Century Link I was informed that the hub was full even though there has been service at the home before and includes when I had service as well. They have very poor service but hold the customers hostage cause there is not any other providers for us.
- I wish we could have Comcast out this way. Apparently, there are 3 other services that have taken this area and Comcast is not one of them.
- I am elderly and live alone. I have no cellular service at my residence and no internet connectivity. I am only able to get cell service in a particular spot in my back yard. I am unable to have medical alert system (Life alert, eg.) which I would definitely benefit from. Also, would very much like to be able to face time with my family and participate in social media. With the pandemic, I have not been able to see my family very much. If I had internet capability, my children who are able to work from home would be able to stay with me when needed. Please make this happen!
- It's shameful that Carroll county doesn't have better internet access. You need to do whatever you can to get it here for the whole county
- I work for the County full time and I'm a full time college student, my wife works in medicine and from home some days. Our internet is capped and overpriced forcing us to pay for unlimited. Both our children use the internet for school assignments as well.
- We need fiber optics near our home. I would like to go back to school for medical coding but cannot because I only have 1.5 mgps - terrible
- Please provide support for effective internet speed. The world is changing and my job is never going back to 100% in person. I must have reliable internet to maintain my career.
- The lack of choice for internet and phone service leaves us at the mercy of the few providers in the area. A landline phone should be within the means of all residents. We rely on our landline for medical emergencies as cell service is unavailable or unreliable on our road. Although we are

not engaged in work from home, I do participate in online learning and science research. Greater upload speeds would ensure I could backup my work to the cloud.

- This has big a huge problem for this area for so long. I don't understand why no other options are available. I was quoted over 3 thousand to extend cable lines to my home and gladly agreed to pay that company for this. More than worth it. Unfortunately they canceled that work order stating my address was 'unserviceable'.
- I'm not sure if I want the government getting involved. It seems like everything they get involved with cost more money or higher taxes.
- To whom it may concern, We desperately need better options for internet and cellular service providers. Century Link is our only option as Verizon stops at Snake Creek Rd. and it is horrible! We pay monthly for pretty much nothing. Our upload speed is only 0.315 Mb/s and download speed is 3.059 Mb/s and after we reach a certain point, it slows to even more of a crawl which is pretty much a halt. As far as cellular service, we live literally within 3 miles from the cell tower but our reception is horrible. Our phones drop calls frequently in our home and to download anything we normally have to drive towards the tower. My husband gets work emails 24/7, but they don't always come through on his phone because of our signal here, which can cause terrible delays and missed communication. We also homeschool our children, so we use the computer for school quite frequently. I am constantly downloading worksheets and learning videos for them, most of which take forever and most we do not get to watch because they freeze. Please, help us and bring better service to the Springwillow Dr section of Hillsville. Thanks in advance, Penny B
- Carroll County is doing a disservice to its residents by not fighting the companies that have contracts with Carroll for internet service to do a better job. Comcast ran a line less than two miles from our home down Rt 58 and told everyone in Laurel Fork that it would never be available to us and the line was going to Martinsville.
- No DSL, cable or fiber available in over a mile radius of our home. WISP service blocked by trees & terrain. Waiting for Starlink to exit Beta. Other counties have made arrangements with Starlink to provide service to their residents. Carroll should consider same!!
- Slow and erratic internet makes it impossible to upload files to cloud services, a service I would like to be able to use. Our internet and phone are very prone to frequent outages as well as erratic internet speeds while phone service is often static-filled. We have no other alternative. I pay for 6 Mbps and am lucky if I get that for most of the day. I also just learned that if I cancel or downgrade my phone service, my internet options automatically is reduced to 3 Mbps. So to get the promise of 6 Mbps, I pay $139 monthly. This is unacceptable.
- Can we expect internet in our area any time soon?
- If tax's don't go up?
- Our Internet is connected with 37 Sunnyvale Road.
- I have been waiting for internet in my area that is affordable. I had Hughes Net for a while and it was so bad and expensive. Please bring something affordable to my area so I can work at home a few days a week as well as stream. Thank you.
- This survey should have been conducted before sinking so much money into the Wired road. The Wired Road seems to be such a waste of money thus far. Miles of fiber optic installed and very few customers. What can be done fix the Wired Road? Maybe the Wired Road should be sold? Maybe in the private sector there would be someone capable of making it a real solution to the people in this area? Maybe underground fiber wasn't a good solution for this area? Maybe a wireless network would be better? Maybe construct a network of towers in strategic places tall

enough to lease space on the tower to cell providers. I see the towers the Wired Road has installed at some schools and wonder if they're really even being used. Last I heard the County Schools won't even use the Wired Road. Last I heard the County Administration doesn't really even use the Wired Road. I wonder how Grayson County's endeavor with the power company to deploy a wireless network is going? Good luck!!

- If the county acquired affordable broadband services, I would possibly purchase it instead of using Citizens in Floyd.
- Aspen drive connects to Joy ranch rd and forest oak rd. Both roads have access to better internet (Comcast/xfinity) but on aspen the only option is centurylink. They only offer my household 1.5mbps and that's ridiculous. There are multiple residents on this road who have children in school and the need here is great. It will influence if I stay in Carroll county or not.
- Please bring gigabit internet to my home :)
- Internet connection is awful where I live! Hopefully this will improve soon!
- Please help us with internet. We had to drive into town (20 mins away) in order for both children to access the internet for school last year while virtual.
- I live 8 miles from my brother I have high speed internet but he can't get it on emory rd in Hillsville VA so silly it is
- We would not have moved here if we had known the internet was so horrible and century link couldn't give us internet service. We have been on their waiting list for 2 years now. But the landline is so horrible I doubt the internet would be much better than what I have now. We don't have good cell service but we're going to depend on using our internet for internet calling when home. We do have a landline with Centurylink except it goes out ALL THE TIME and if it rains we are without service for days. We are actively looking to move because of the lack of internet. I love my home and love the small community. However, this is ridiculous. I live 6 miles from town and can't get internet from anyone but satellite. My husband needs to upload and download mp3's for his business and with 0.856 Mb/s upload and 1.7 Mb/s downloads we can't and have to go sit in the car on the edge of town for cell service to use for his job. We can't live like this. I don't want to move. We don't have a choice. Again I was told Centurylink has internet out here and there are 'no lines available' WHAT DOES THAT MEAN???? The people who lived here before us had internet thru them. Couldn't back out of the contract on the house. I am in school for my Family Nurse Practitioner and could be a provider in your area (which you need desperately) and have to go to work to upload a paper or download an assignment. PLEASE provide your residents the ability to get high-speed internet. Hillsville would pull in more businesses and profit for Carroll County. Sorry needed to say this!
- Am hoping to work from home but rarely have cellphone connection and hotspot is insufficient. We totally support the county working to provide service
- Thanks!
- I struggle to be able to successfully work from home. Due to my download speed I am frequently unable to make video calls. Also as part of my job I am required to upload videos to the internet. It takes 5 hours to upload a 15 minute video. I have recently upgraded my cellphone to unlimited data because my internet cannot handle more than one device at at time well.
- This is supposedly an entrepreneurial zone in Virginia. Inadequate internet is not only essential to the people living here, but to those who might move to the region were they able to work remotely, sustain home-based businesses, etc.
- My download speed is approximately 1.5 Mbps and upload is approximately 0.5 Mbps.

- We are Living in the dark ages in this county. We can not attract or keep our young families in this area without excellent internet service. So many people work from home for major employers or to create their own home based businesses in counties all around us. It's no wonder why people leave Carroll County, this county is far behind our neighbors.
- Struggle most days to get any cellular service
- Internet is very unreliable in my area. I am a full time college student and never know if the internet will work when I need it. Also, if anyone is on the phone, I lose connection and my school work gets shut off.
- We need affordable internet that is reliable
- I am a Realtor in Hillsville and I am aware of MANY homes not being purchased directly due to no internet. The home values are not what they are in Floyd, for example, due directly to Internet service. I've personally lost over a million in sales this year due to the lack of internet. I personally have 4-6 mbps at my home on Fancy Gap Hwy and Chances Creek but I have Fiber Optic on the poles in front of my home. CenturyLink says I have access of up to 60 but when I order it they cancel it and say I do not have access. It's a HUGE problem in Carroll County in general. I personally am going to have to sell my home because of internet access. Please help. Mickie Smart.
- Yes I think there should be more choices available for landline and Internet
- Please improve, version tower access.
- There are so many areas in this county that have basically no internet or it functions so limited with no corrections from the source Centurylink. We even have phone issues regularly with our internet l. We also have very limited cell service so it is not feasible for other options
- My internet service is so poor, it varies from room to room. It feels like 1990 here…. I have to shut my internet off, switch between my data plan and the internet and many times power my devices off to reach the internet. All. Day. King.
- CenturyLink customer service is awful. For the amount of money they charge - the service should be better.
- I have lived in multiple places throughout my life in carroll county and they have all had terrible internet service that was over priced. It was when i worked in another state and had cable internet service that was cheaper and faster than anything ever provided here that i realized what a rip off that has occurred for the citizens of carroll county. It's a long over due change that i hope the county takes seriously and implements changes quickly to remedy the situation.
- I feel as if I am being left behind in internet service. Please help
- We need more choices for our phone and internet services.When it rains our home century link phone does not work.Please try to get more choices in our community it would help.We cannot buy Netflix or any other streaming services because of poor service in our area.
- We are unable to access the most basic of services. No face time, dropped calls, can't upload pics or Skype. Have to do Marco Polo to keep in touch with our granddaughter and we can't even pull that up most days. Frustrating.
- we use our smart phones ,no wifi
- Our son has online college classes and when we have exceeded our hot spot data for the to month he has to go elsewhere to complete his assignments/watch lectures. I work from home occasionally. We have a Sprint hot spot because it is the only cell phone service we have here. We have to place it in the front window in order to get service. We have Verizon cells, but no service at home. We had hughesnet for several years, but there were a lot of issues with it.

- I live in the Hillsville town limits and do not have access to the Comcast/xfinity service. It is on my street but stopped 400 feet from our home. Was told it would cost over $5,000 to install 400 feet up hill to our house and we would have to pay the costs. Unbelievable that we are in a town and county without reliable ISP. we recently moved back to my hometown from Tampa FL. I've had to "retire" since moving here because I can't do my high tech job anymore. And really it's not "high tech"in Tampa but in Hillsville it is considered that. My opportunities are limited to none in Carroll County. As a result of CVID, I lost my $135 K job and am afraid to look for another position because internet is not reliable. I have to work from home because I am the only caregiver for my special needs daughter. So the lack of internet is impacting my quality of life and my daughters. It's impacting our financial future. It's impacting my "retirement " and ability to "live" a full life with my daughter.
- I've been working from home for 11 years. I moved from Baywood, in Grayson County, to Woodlawn just to get faster Internet.
- I greatly appreciate the board taking the time and effort to help provide a better internet option.
- Where we currently reside the only internet service available is through satellite. This service is unreliable and we are unable to use streaming services. In order to watch television we also have satellite. We also do not have cell service in our area, so we have to have a landline. It is pretty expensive for us to have media/communication services in our home.
- My current internet service provider is junk. Poor service. Poor quality. Poor customer service. And absolutely no interest in changing. The county should take steps to correct this. I am all for the free market. But when the market is only one provider, steps have to be taken to correct the imbalance.
- Better internet service to my address will also improve the value of my property.
- Carroll County needs affordable high speed Internet access to all areas in the count . When virtual schooling is required due to COVID or inclement weather, all students and teachers do not have equal access to the Internet, but as a county we already know this. Trying to work from home is almost impossible if trying to upload videos or large files. And who are 1 point ,Sunset, Lingo, and Shentel? Do these providers exist in Carroll County?
- Can't use what I have to view Netflix or anything on TV, Internet doesn't work half the time. Something else would be nice or to at least have other options.
- Phone keeps dropping calls. This is annoying, especially if you have been on hold for an hour in some ridiculous Q.
- Centurylink stops half a mile before my house in Dugspur. I live on 221 a major highway, hard to believe in the year 2021 I still don't have internet access. Please please help us at my address it's so hard with kids and only using a hotspot for internet access. Thank You so much for trying to correct this.
- I was told by spectrum they would have fiber optic available to me in less than six months of me moving into my home, that was nearly a year ago. There satellite service I have rarely works properly, so I have to go other places in order to get finished my assignments for my job.
- Im so tired of paying 90.00+ a month for seriously crappy internet!!! Please do something about this!! It ridiculous!!! Im canceling hughs Monday and paying for our hot spots on cell phones!!
- They should have done this a long time ago!!! We are way behind other counties. What our school system expected us to be able to do during virtual learning was ridiculous with the limited services we have. Century link does not come out here and the places it does go, it is terrible. Even simple home phone service is terrible. As much money as our county spends on things, they should find resources to get better access here.

- Both Century Link and Hughes Net are lousy ISPs.
- Faster internet would greatly increase the attractiveness of Carroll county for relocation and remote businesses.
- We've repeatedly tried to get broadband, and even offered to pay for the line to be run from our home. Lack of decent Internet has all but destroyed our farm business, and our ability to Invest effectively to the point where we've starting looking for new property out of county. Our daughter had to drop all classes due to her inability to get online. We cannot use zoom or Skype unless it's 2-4am. The amount we spend monthly trying to make it work would easily equal a mortgage payment for a 300k home. PLEASE, fix this issue! We love where we live, and enjoy being productive citizens of the community, and have no desire to move, but have found it increasingly impossible to do anything online, especially since the pandemic. If this is an issue that will take years to resolve, we will have to move.
- HELP!!
- We need this! I have 3 adult children and this is a big reason that they can't live in Carroll County.
- Cable internet would be great but there are parts of the county that cable is not accessible to.
- As the public schools have depended on distance learning this past year, as a community, we became more aware of the limitations of our own systems. Expanded opportunities would become more widely available if the local data infrastructure were better equipped, reliable, and faster. Sometimes even basic phone service is so terrible that I get clearer calls on the cell phone than using the landline. Thank you for looking into this broadband project.
- Internet all but nonexistence with the current services.
- Citizens-Coop is working with Floyd County government to provide access to all people in the County with gigabit internet, cost offset with federal funding through the Alternative Connect America Cost Model program. There are federal and Commonwealth initiatives to support rural broadband and I hope this project will identify them to Carroll County Supervisors and Administrator. The vision in Floyd County is that the cost per home = $1,800, and that Citizens customers will have a one-time $199 charge. Surrounding counties and communities are way out in front of Carroll providing decent broadband. Carroll County has the highest taxes and fewest services. High taxes and lack of broadband are key reasons why our County can't attract businesses.
- CenturyLink is a joke and so is US Cellular. We basically have no reliable internet service. I live within sight of 58 and cannot conduct a Google meet without being cut off. We cannot stream anything. Google photos won't upload even when left running all night. We might as well have dial up. We average a CenturyLink service call probably once a month. It is a constant annoyance and no where near worth what I pay each month.
- I am satisfied with Comcast, but think the price is too high.
- If it increases our taxes then forget it. Hillsville taxes are already unfair. Everyone within a 100-mile radius has a negative opinion of hillsville because of its ridiculous double taxation on property, stupid $25 stickers that we don’t even receive and serve no purpose, the high water bills, and the monopoly that Appalachian Power has on the town because the town is too scared to provide options on electricity suppliers. Let’s not even get started on that trading post the mayor uses as a front for his drug operations and money laundering. We’ve heard all about him losing all that money, imposing a town tax that no other town implements, and then miraculously finding the money but keeping the tax. How shady is that. We can’t wait to move.

- Satellite internet is a joke when we are trying to stream internet movies/shows/work related video calls. It requires unimaginable patience to google one item when we need. Please get any cable or fiberoptic internet service available in this area.
- Please don't raise our taxes like crappy Hillsville.
- Please help. Our service goes down regularly.
- We both work remotely and make it work using DSL/hit spots/cellular data, but it would be amazing if we could get access to fiber internet.
- It's absurd that the county has zero options for internet in some places. It's past time for internet to be brought to every home in the county. We pay higher and higher taxes every single year with no improvements.
- Where I live centurylink is all we can get and the speeds are not enough when you have multiple people who online game and stream shows we've tried Hughenet and the data cap gets exceeded within days when online gaming and updating games. It'd be nice to get xfinity like my friends.
- CenturyLink sucks! They are so unreliable. It seems like the service goes down the same time every week, sometimes for a few minutes but other times it's for several days. If I turn my cellular hotspot on I can get 15-20% faster speeds but unfortunately it additional $40 a month and the AT&T service is still a little unreliable at times.
- Answer 23 depending upon economic impact
- I am fortunate to live where good internet service is available. This is not true for most of the county. I believe it would be extremely beneficial to economic development in the county.
- I don't rely on government for many things, however, internet access should be equivalent to electric grid access. It is impossible to function in the modern world as a student, business, or individual without fast reliable internet. We do not have fast reliable access and there are no options currently available to get it. The government at all levels has failed in our area.
- Having visited with retired pastor in Floyd County and .2 mi off road, I was shocked and jealous he had 440 Mbps optic cable at his home! We are lucky, with Sprint/T-Mobile tower on Hwy 58 the past two years to finally get any service (and must use a hotspot for that).
- It is essential for every household in the county to have a fast, affordable broadband internet service.
- More affordable is the key here. Spectrum is expensive, but they are the best.
- Please help us!
- I have a Hillsville address but am across the line in Doe Run in Patrick County. Can we be covered by this proposed expansion.?
- No government involvement. conflict of interests
- Since we are rural it would be great to have excellent internet. Thank you for the survey. Nice to hear that Carroll County is interested in helping us.
- My husband needs better service for his pacemaker to connect we cut with medical services
- We have actually considered moving out of carroll county due to lack of internet services. We are dependent upon cell phone hotspots to work from home and have already subscribed to the most costly (most gb) data plan with our cell provider.
- Download speed at best is 1.1Mps
- We are in a situation where if internet is not working we do not have phone service and if there is an emergency we cannot notify 911. We are constantly loosing service due to lighting and modem being damaged. We have a whole house serger a still loose modem. It takes days to

get internet back up waiting on modem. It is a dangerous situation for us as we have health issues that could require emergency service.

- I would love to have better internet but also don't want to destroy forest and other lands to get it. Could you please tell us how it would be installed? electric land easements?
- bigger government is never the answer. The county struggles managing funds for what they are responsible for currently. I do not want them trying to become an ISP.w the fiber road wifi on power poles is also not the right answer it is just the cheap answer. Who is going to repair those routers on the poles when they break? Underground lines rarely break if properly installed and not hit by someone digging in the ground.
- We have family members doing school online AND working full time remotely online (all needing streaming capability and upload/download speed for interactive video calls). Even though we pay for both DSL and cellular internet service, this is still a *daily* struggle with unreliability and our slow internet speeds. Help is desperately needed and would be GREATLY appreciated!! Thank you!!
- We are only in Carroll County part time, so do most of our streaming and work-from-home out of the county. To be honest, CenturyLink is better than our Verizon DSL and landline service in rural Montgomery County, VA
- Our provider tells us its our router and it has been change about 7 times. I had to retake this survey 4 times because it said I didn't have service. That is if it goes this time. If not I will try on my phone.
- This is the second time I have completed this for and tried to send it the First time I got disconnected from the internet and didn't realize it until I tried to send the form and buy that time it had vanished so, yes we do need bette internet service. Century link could care less about their customers. I tried to drop my home phone and keep my internet but they said I could not do that so I had to get rid of both. Now some of my wireless devices will not connect or others will not stay connected to my wireless hot spot.
- The broadband service needs to be affordable and actually provide the service that you are paying for. When you are paying for high speed internet then you should have high speed internet not be slower than dial up internet.
- We live right off of Mitchell's Crossroads. The people less than 5 minutes down the plateau where we live can get CenturyLink, but we cannot. We have called and asked for years. Satellite costs too much and does a terrible job. We cannot enjoy our Netflix or Amazon Prime subscriptions, because our Internet is interrupted before one movie or show finishes buffering. We need better Internet at a price we can afford.
- Broadband needs to be affordable and truly a high speed connection
- Have more options with competitive rates.
- Would love to have access to faster service that was more affordable. I am doubtful that everyone could agree on how to implement this. Hope it works out, would be a good selling point to attract potential employers. As long as people didn't think it was 'socialism' it might work out, lol
- Had I known that broadband internet wasn't available at the land I purchased, I never would have built my home there. I never even knew that it was possible for it not to be available in this day and time!!! The past 8 years have been a nightmare with only cell phone hotspots. My son struggled with online learning for an entire year during covid-19 because of terrible cell phone hotspots and I dread it if we ever have to go back to that. Please, please, get broadband to my house!!! Thank you!

- I am currently enrolled in Old Dominion University, working on my bachelors degree from home, I am strongly considering moving out of the area because it is beginning to seem like we are never going to get good enough internet here. Please get our residents the internet they need to be able to live in current society! Thank you!!
- I live in a very rural area with NO option of good internet service. Only option we have is satellite internet and its horrible. It goes out when theres heavy fog, rain, sleet and snow. I have contacted other internet service providers for this area especially Centurylink for the last 25 years. NO such luck. So please bring us better internet in this area. Thank you for listening.
- I just want to be able to have better internet where I live because I do a lot online like looking up college info to go, online gaming, call my friends and I use it as a means of communication when my phone is down to be able to talk to people as i am unable to go out or use other forms of contact incase I have an issue with my knee or lower back.
- This study and action on internet connectivity and speed is way overdue
- We do not have a good solution for internet.
- With recent changes to CenturyLink's service limits from the demarc on Route 608, I would not qualify for DSL service if my service was ever disconnected. Even though I have had DSL service with CenturyLink since it first became available. This was due to compliance with federal regulations - CenturyLink reduced the maximum distance of servicing from the demarc from 22,000 feet to 16,000 feet. This is for the miserable service speed of 3 mpbs. We desperately need better options in Cascade Mountain and much of Carroll County.
- Prefer commercial competition so to have better prices, service and product but unless there is a need or possible profit companies providing broadband services will not come then you are left with government facilitate. Personally, I prefer less government intervention
- sad that internet is so unreliable -virtual school doesn't work if there is no service. Repair service is a week to two weeks without service. richterry2001@yahoo.com
- I contacted Spectrum just the other day to see if they were coming to this area. They asked about where I lived and measured the distance between their tower. It turns out that I am just over ½ mile away, but was told that one has to be within 250 ft of towers to get service. CenturyLink has such an old infrastructure and they are my home phone carrier, every time it rains almost I either have loss of phone or static on the line. US Cellular is mobile carrier. I have a 4g phone but am lucky if home to get 3g. Most of the time it is 1g or less. Also my cell phone drops call here at home, so I am forced to have a phone service for my house! I hope you can read that I am frustrated to no end. I cannot stream any videos or have difficulty and never get to watch videos or movies.
- The lack of reliable, high speed internet access is an economic drain on our community. I have highly compensated family members working from home, who love the area, but will not relocate to Carroll County because of the lack of reliable high-speed internet. With the availability of work from home, and internet-based cottage industries, and a wealth of talent in our age 20-50 population, we are missing out on a significant opportunity to elevate the standard of living, support our young entrepreneurs, and broaden our tax base. The internet is essential for all businesses.
- I usually try not to exceed my monthly usage limit due to the increase in cost if I go over the limit.
- We recently moved here and have no other option besides the 'Up to 3 Mbps' package from CenturyLink. Personally, I attend college and complete the majority of my work online. Having better Internet would be great, and fiber gigabit internet would be a dream come true. My family

and I would happily pay more if it meant we had better service because we have no cell service where we live, so internet is a must.

- I seem to remember a survey much like this years ago. Since nothing has really improved county-wide, I'm guessing the county government either took no action or delayed long enough to warrant commissioning another survey. Let's see if any action is taken from the results of this one. Hopefully it won't be Wired Road with their wireless solution that was supposed to help fund a fiber rollout. Carroll missed an opportunity getting AEP to help, like they are doing for Grayson. Personally, I'd like to see Citizens Coop encouraged to build out their fiber more in Carroll like they've done in Floyd.
- Please seek grants to help facilitate better Internet service. Century Link has problems. During the past 6 months, I have been without telephone, Internet for at least 3 weeks. It usually takes a week to get Internet restored after a storm, power outage, etc. I would love to be able to use streaming services. In my area, I do not have cell service so when my Internet, landline is down, I am truly off-the-grid. The Internet is so slow when I connect to wi-fi to text, I cannot upload or download attachments or pictures. I am billed for 'high-speed' Internet but as you can see, that is not what I am getting. On the positive side - at least I can check my e-mail and access the Internet (most of the time).
- More competition needed
- being retired, we need access to WIFI for emergencies and information at all times, even when there are power outages. No power, no internet, no phone, totally stranded.
- WHEN?
- Many homes in my neighborhood would sign up for reliable high speed internet service if it were available. Everyone needs this and demand for it will not decline.
- There are no other providers here outside of Centurylink. Hughes Net is a terrible service with hidden fees, terrible latency and quickly cap your speed to the max speed Centurylink provides here of 1.5Mbps. Starlink is very expensive and unknown if it would work here due to many hills and woodland trees. Centurylink (Lumen Technologies) has also recently sold the local telephone lines to a private equity firm Apollo Global Management, we all fear this private equity group will in time greatly raise prices to get back their investment and let the telephone lines fall into even worse conditions since sparse population of customers here may lead to negative return profits. We would not know the results of this until late 2022.
- we are in a analog zone
- I think that the county should make the county open to competition DSL that is controlled by centurylink is a total waste of money.Any money spent toward Centurylink for any service considering their up keep and a 2-3 week lead time on any repair to a phone line, base speed that should be 1.5 or better that rarely exceeds 500 kbps, broad competition either wired or wireless must be facilitated. There are 5 house holds on this road alone and 2 have school aged children that need it to do work, that do not have internet because it is a waste of money since it cannot be relied on. Verizon wireless is spotty here and depending on weather, works some days and doesn't someday, but even it is more reliable than centurylink dsl. So if something is to be done through governmental channels, please take this into consideration.
- I think in response to question 23, yes government should play a role in making opening up the county to have more options. Also, I would think that there should have already been enough complaints within the county pointed towards centurylink when there are no other options in rural areas I think its awful...
- Definitely more affordable is needed.

- The download and upload speeds above were taken during the day. The internet is barely usable at night. Watching an online movie is not possible.
- My area has been waiting since 2005 for Carroll County to come up with ANYTHING. What is the Wired Road doing with any grants they receive. This is ridiculous.
- I have lived here at my family farm for most of my life. We currently have cell phone/data through US Cellular and without the $400 signal booster we would have no phone signal at all. Most days we still do not have enough signal to use the internet. I have asked about high speed internet service from our local land line phone service provider(Century Link) for the last 12 years and have been told several times that it will probably never happen because the lines would need updated and there are not enough houses in our area for them to justify the upgrade costs! Satellite service is expensive and we have heard that people in the area have problems with slow service during the day with it also. Needless to say we are frustrated in Fancy Gap! Thank You for listening.
- We need fiber optic availability in our area!!
- I will help anyway that I can.
- Quite often grandchildren come to use the internet and need reliable internet for high school and college assignments. We use the internet for banking, social media, news (on-line newspapers) communication with friends and family, communicating with church members, research, genealogy research, church services (Facebook and Zoom), shopping for groceries to avoid covid infection in crowd at Wal-mart, shopping in general, setting up appointments with doctors, reviewing medical results, file taxes, etc. We use the internet daily. Our service has been very unreliable.
- Our area of Carroll County has no decent internet options. We have tried to get CenturyLink to bring DSL to our area for almost 15 years with no luck. I finally canceled my home phone line because they were in no hurry to help us. We tried satellite internet once....wild blue. Expensive and slower than my mother's DSL. And crazy data caps. We would love to have fast reliable internet to allow our household to use all the modern devices like ring, Alexa, Smart TV, streaming, and much more!
- Why do we have no internet or good service in my area?!
- I have family that lives just two miles away and has no options for internet other than Hughes Net satellite. Cable was going to charge $20,000 to run lines
- Thanks for the survey
- Instead of tax payers paying for the shit hole waste of money called wildwood or filling their own pockets they could use the money to provide better internet services to the people. There are people in the county that don't have access at all to any internet
- I'm pleased that Carroll County is seeking to upgrade internet and phone service. We need better landline phone and cell phone service as well. We have no cell service here at our house, and our landline has a buzz, especially when it is raining or wet.
- I am a teacher and see the need for the entire county, especially out lying areas such a Laurel Fork, to have better service.
- In today's world & times everyone's needs access to high speed internet for work, educational and Healthcare opportunities
- I love where I live but have limited options for cell and internet service. I cannot get a native cell signal on my property and so would like to be able to use a Network Extender. However, that device requires a minimum of 5Mb download and I only get 2-3 maximum from CenturyLink. Also the CenturyLink reliability is not acceptable. I experience 3-4 outages per summer that can

last days due to lightning activity. I use Hughesnet satellite for a backup but that is expensive and the latency almost makes it unusable. I am VERY interested in all internet options that might be available to me. Thank you.

- I know for a fact that our county is surrounded by fiber optic data lines and a neighboring county has an independent fiber isp that offers true and reliable Gigabit service for less than what we pay Comcast for Gigabit speed. We pay for 1 Gig speeds but often don't ever achieve more than 1/3rd of the claimed speed at any given time. We have all current and top end cable modem and router equipment as well. And we've tried leased equipment and owned equipment with no noticeable change to our speeds, both uploading and downloading.
- Century Link is a joke.
- Internet and cell service are terrible here. One reason we are looking to move.
- Please bring broadband to our area! We are only covered by CenturyLink, and we're at the end of a line- even the set-up pages to get the service connected load so slowly the connection times out and so it's impossible to use CenturyLink. We've contacted them repeatedly to request improved connection in our area but they haven't provided it. We've tried Hughes Net, it's too slow for our purposes and the data caps are a problem. Our only option is cellular hotspots and we meet the data caps so quickly it only meets our needs part of each month. I'm a full-time caregiver for a disabled individual and we need internet services for all the needs above. Thank you!
- We desperately need faster, more reliable internet. I work from home full time, my kids need to be able to use the internet for homework assignments and our internet is SLOW. PLEASE get better/faster/more reliable internet for our area!!
- I know many residents in Cana only have access to providers such as Century Link/Lumen. Their service is terribly slow and unreliable. The customer service/repairs given by Century Link/Lumen is even worse.
- Thank you!
- I need to find a more cost effective way to have Cell Phone, TV and internet services to stay in this county.
- Centurylink Sucks and Viasat is very expensive AND not reliable
- I would prefer that private businesses compete to provide the services. I feel that government involvement will create more problems than it will solve.
- We effectively do not have internet even though we pay an exorbitant fee for what we have. Hughesnet is fully aware that it delivers service at a far lower quality than it advertises and charges me for but just doesn't care. It abuses its position as the only available option. I would personally pay $10,000 to have cable lines run down to my house but it would cost more than that. As a result, my wife and I both go to our house in Blacksburg whenever we have to work. We would be at our Dugspur house all the time if there were half decent internet. The situation is like back in the 50's when some rural areas still didn't have electricity.
- Poor and unreliable cellphone connection is very annoying. Usually have to drive miles away to get reliable connection, yet sometimes can do so from my own driveway.
- Anything other than century link, very poor customer service. No other options for our area.
- As an older, retired couple with limited/none cell phone service in our home we are especially concerned that our CenturyLink service has not been reliable. We only have a dial tone half the time and numerous complaints have resulted in very poor response. We just recently cancelled this land line leaving us with limited access in case of emergency.

- Its a little hard to watch a Yahoo commercial and the person is getting internet service in Alaska but I cant get it in Laurel Fork. I am a nurse and they are doing away with renewing your license by mail. Now, because I cant renew my license by mail I have to find someplace outside my home to renew my license. I am really not comfortable with putting a credit card number out there on a computer thats not mine. I do feel like the county needs to do something about that. It's like Laurel Fork is stuck in the way back machine while everyplace else is moving on . More and more things are now on line but you cant do it if you live where I live.
- Hughes net internet for email, apps and cellular service is poor at best. I worry about an emergency and having no service to contact emergency services--fire, ems/ambulance, police---and having a very bad outcome.
- Many people in my family have no access to any internet services other than satellite which is so expensive they cannot afford it. We really need to bring this county up to speed with providing internet services to all. Although I have no young children in school there are many who do and it makes it difficult for them to do homework and keep up with all their school work.
- Carroll County we need good inexpensive internet service for Fancy Gap area PLEASE!!!!!!!!!!!!
- I believe that the County would benefit greatly by providing or facilitating improved internet access and speed. Having moved from a larger populated area, I feel that it would bring more people to the county, both residential and business therefore bolstering the counties overall economic stability.
- As I understand the situation, Centurylink cuts corners instead of updating internet service relating to speed in my area. This came from one of their techs so I believe this to be true.
- Our family desperately needs a reliable internet service.
- Glad to see that County is examining this issue and the need for broader access for internet services in our area.
- Internet access has become a critical part of infrastructure. Those living in rural areas where there is low housing density suffer from access to services. Selection of an appropriate service is key. Choosing services like BPL (Broadband over Power Lines) significantly impacts other services. (e.g. interference to first responder communications networks, backup communications services such as amateur radio, etc.) Gigabit Fiber has potential, but how will the lines be put in to support low housing density areas?
- Providing internet service is not the government's job. Various incentives could be offered to corporations for providing broader service, particularly to rural clients.
- Please help us get better internet!!!!
- centurylink services for both the home landline and internet are constantly off and on and off again due to the reliance on above ground wires affected by high winds along route 52.
- Improving internet access is vitally important for our area. I know of people who wanted to move here, but have been put off by the inaccessibility of quality internet service. I welcome the prospect of faster, better service.
- I still can't believe that more than half the people in Cana don't even have access to cable tv and internet. Century Link is a poor excuse for an internet provider, they can't give you even 10 mega bits per second while I have 400 .
- I am a teacher for the school system, when went virtual it was impossible for me to distance learn from home. Our download and upload speed are less than 1. We need more access in Fancy Gap.
- Would have a positive impact on the community

- There are a lot of services I am unable to take advantage of because of lack of internet options. I currently have to use my phone as a hotspot. I'm an educator and need better service.
- I actually have to keep two internet services. I have satellite internet through Viasat, and I have a Century Link hookup in case the weather interrupts the satellite service. I work from home and have to have the internet to do my job. We pay over $260 a month and still the internet is not reliable.
- cell phone service in this location is spotty. My personal service is usually very reliable. Others using a different carrier at this location have very poor or NO service.
- County needs to quit wasting money on studies and surveys and empower the 'broadband authority' (Wired Road) that they already own part of to expand services....
- This has been too long in coming. It should have been done years ago. Citizens have been told of different plans that were going to happen 'next year' or 'in the next five years' with nothing happening. I appreciate that there is some action being taken. Thank you.
- Help! We're in a rural area with limited cell service and few options for internet. Reliable internet will only become more important as we maneuver thru these difficult times.
- Comcast was in neighborhood not too long ago and extended services to other houses but again stops at the address before midnight house.
- Being a small business operating from home it is extremely frustrating to have such poor internet. The cell service does not work at home, so the cell phone uses wifi. CenturyLink is more reliable than HughesNet, but is very slow. HughesNet can text faster, but is unable to do wifi calling, as its latency is so long. Between the two I can function, but it is very difficult, and streaming most movies or any entertainment is impossible on most sites. If internet was placed along the power lines as the old phone lines were it would be simple to get high speed internet everywhere power goes. It would make my life SO much better to have internet speeds greater than 20-30 MPS. Higher would be awesome!
- Please get internet service in my area
- define the term 'facilitate'. It may be good thing, if the county could get together with local providers to engineer better access, affordability, and reliability. However, I would have reservations agreeing to item 23, as I would not place an antenna on my home, nor do I feel that the county should have any financial incentive, motivation or profit from facilitating any improved internet access.
- I do not use my computer a lot, but for what I'm paying for, I should be able to use it anytime I need to. Some days I have internet and some days I don't. My neighbors are the same way. An example of lack of internet is my neighbor (Century Link) has a granddaughter that lives in Boone, NC. Because of health issues she has been coming to her grandparents and helping on the farm. She started this semester in North Carolina State University. During the summer when she needed to correspond with the college, she would have to go all the way home to Boone because her grandparents Century Link internet was not strong enough for her to do what she needed. This happened several times this summer. Century Link needs to be made to update their systems and/or bring some competition be brought into the county. I hope you are successful with what you are doing.
- No cell service regardless of the provider. One internet option and its complete garbage. spotty at best and goes out when it rains. max speed 5mbps at about 3am when other users up and down the line are asleep. people advertise 5g nowadays yet i cant even get enough signal to send a text or make a phone call from home. its 2021. Why is this still an issue? its ridiculous. please help.

- One more reason we need reliable internet service is so we can switch our phone to a service that relies on a good internet connection. Our phone service is not good and the repair service can't seem to find the problem. This is ongoing. Please help our county.
- Tmobile in home would be a great solution for a lot of people in laurel fork and there's already fiber ran to the new AT&T tower on nursery rd. It would have also been nice if century link would have given us the option to run the fiber out to the end of the road and provide fiber to everyone on the path but they did not and will not.
- There is a gated community 500 yards from my house that has fiber.. they do not offer fiber to resident around the gated community.
- The past 4+ years we have lived here we have had the worst internet service we have had in many years. And the worst part is not the slow speeds but how unstable our DSL/internet connection is. It is not unusual for our DSL Link to drop out multiple times per day, and sometimes multiple times per hour. This is due to too much noise (line interference) degrading the signal strength, and I cannot get Century Link to do anything about it. They have to be one of the worst companies on this planet, but Carroll County already knows this. I realize that DSL/copper is an old, outdated, and basically dead, internet tech. I suppose that is why Century Link does not want to invest more dollars into this, as well as probably why they keep selling out. I understand Lumen now has it and has already made a deal to get rid of it. We desperately need new and much better internet tech in this county, as they are now doing in Grayson County.
- T-Mobile is my only option at this time. My land line with century link is very static when we have bad weather. Internet running on phone line hardly ever works. Please help us with a better option for our area! Thanks for the survey to voice my opinion.
- There is still many areas in the county where landline telephone service is not reliable that have inadequate cell coverage and no internet available. I know people in these areas that WANT good reliable internet service but still don't have it.
- The county government has been essentially indifferent to the quality of internet service, out of ignorance and incompetence. We will be lucky if they manage to take advantage of the funding that has now become available. Carroll County has been outmatched by all the surrounding counties. Like much of rural America, we are in the dark ages when it comes to internet service, and our elected officials have so far done close to nothing about it.
- Thank you for the survey. We hope that our community will see better communications in the near future.
- there has been millions of dollars in grant money gave to our board of supervisors to fix these problems and several years before the covid during and after the covid and they have gave us nothing! where has all that money went to? its a mystery to us all and a crime ti use grant money for reasons other than specified!
- We are grandfathered in to exceed internet, no other internet available on my road, neighbors are unable to get it, they have tried multiple companies
- Hugesnet says no data limit, but very quickly the data is used up, and I must buy additional data 'tokens' or the speed slows to a crawl. With additional data tokens I pay over $120 each month and still cannot stream or view videos. Really bad and really expensive internet. 2. If we'd known how bad the only choice for we have for internet was going to be, we might not have moved here at all.
- I built a house in Dugspur 20 years ago, planning on moving permanently here when infrastructure caught up. Still has not happened. As a result, particularly of really no internet service available other than using a very weak Verizon signal on phone as a hotspot, My

permanent residence is still in North Carolina. During Covid we had hoped to use Dugspur as full time residence but cannot as I cannot do my job without broadband service. I often have used the Pavilion a Wellness Center or stat in my truck on main street just to get a strong enough signal so cellular hotspot provides enough bandwidth to work. Our grown kids spend less time up here partially as neither can access desired applications due to lack of internet. I am President of a consulting company and had hoped to grow business in VA but have put that on back burner due to lack of broadband availability. My only option is to relocate and if so no guarantee it would be in Carroll Cty. I plan on retiring in 3 years, if situation remains as it is, it will not be in Carroll County. With more and more people wanting to work form home, lack of internet outside Hillsville proper is stifling growth. I have several friends in Charlotte who have asked about moving near us and I always have to caution about access to internet. For remote workers that is a deal breaker. cannot think of a more pressing need to county in this day and age. I have friend living in similar rural areas in NC near Sparta with fiber optic high speed. If they can do it why cant we??????

- I had Comcast internet service at my former residence and did not realize how good I had it. Our only choice now is Hughesnet satellite. It is slow, unreliable, and almost criminally overpriced. Our landline telephone is CenturyLink and the call quality is bad but it at least works. Our cell service provider is Verizon and whether we can get an adequate signal at our house is a question of luck. Ordinarily we must drive to a hilltop about 1/4 mile away to have a decent chance of being able to make a call. TV service with DirecTV is adequate but expensive. It would be great if the County could use its power to strong arm these providers into offering adequate internet/cell/TV service at reasonable prices..
- my house is the second from LAST on my road that can get internet services delivered right now. Xfinity says they 'can't' (or won't) deliver internet services to anyone further down my road. All those other users have to use mobile hotspot data or satellite to get internet.
- Comcast/Xfinity is in sight of my house, my house and my neighbors would gladly hook to it even if it cost more.
- Need good, reliable, fast and affordable internet.
- We have had issues with our modem/router for several years now. Not having fiber optics in our area would be a great help. We have no other affordable option other than CenturyLink. They have poor customer service. Anything else would be out of our price range. We are both retired and have two adult children still living at home.
- We need improved landline telephone service, internet service, cable service and a more robust cellular network in these parts. Service issues (reliability of getting a signal, a/v quality of said signal) and costs (would competition lower prices?) are the primary concerns in an atypically hilly area.
- PLEASE do something to help us have better Wifi/internet options. I moved back from Richmond & it's impossible to do work. My son has had to go back to Lynchburg to do his online college courses because he couldn't get sufficient wifi here at the house to be able to do his online classes.
- Government regulation is not a good idea. They tend to degrade everything they touch. Leave it in the hands of the private sector and let free enterprise work it out.
- Please update the service to rural areas-you have to have internet for everything and it is not available to everyone. I keep my grandchildren after school and they need internet to learn
- We had to cancel our internet because we could never use it due to poor quality

- We have almost no service in our area We have very few companies that will even provide service I had 2 children that need service daily to complete school work.
- Century Link does not offer internet service to me but they do for the neighbors who live on Buffalo View Rd., which is right behind me. They don't seem to care whether several homes on Snake Creek Rd. have access to their service! It is very frustrating!
- We have limited slow internet options and zero and I mean ZERO cell service
- How many more years do we have to pay due to your poor money management choices? Get us internet.
- The county needs better internet service that doesn't cost a lot. When you only have one option where you live for internet service and it doesn't perform as it should then the government has to intervene.
- The stability of Century Link is not reliable. I constantly deal with it going up and down daily. We cancelled our Satellite television because of the cost of TV, Internet and telephone combined. We installed an antenna to reduce the cost.
- I live in an area with no option except the mobile Hotspot or Hughes net. Have tried Hughes net and it was horrible. I need internet for my job and for when my grand daughter is here to do homework.
- It would be a great service to the entire area of the Twin Counties to have a better more reliable internet. Comcast fiberoptic lines are just a quarter mile up the road and they refuse to bring it down Iron Ridge. We home school our son and when our daughter comes of age we wish to do the same, so we do rely on good internet not just for gaming or streaming movies but for educational videos, file sharing, building learning plans, and to connect via zoom or other online chat room services for advice or learning plans or to buy supplies online that are needed for in home schooling. Thank you and I hope this area can finally have good internet services for all residents of Carroll County.
- Where we live, CenturyLink is the only option for internet, we are at the end of the road and monthly our internet doesn't work for some reason or another. Our neighbors never have an issue; this has been ongoing the whole time we have had internet in the last almost 9 years. Its literally robbery to pay what we do and receive what we do. My son lost connection just about every single time he had to get online for virtual learning with his teacher and do Google meets. That was with only his one device connected and everything else we has manually disconnected or turned off.
- Prior to the Covid outbreak we had 300 MBPS service thru Comcast and it met our needs. Once Covid closed the office I work in and I needed to work from home 300 MBPS initially continued to suffice. When Comcast added numerous households with school children to their system we saw an immediate impact on the service we were receiving. In order to work from home and continue viewing streaming video services we upgraded to Gigabit service which initially addressed our issues however we are now back to enduring slow speeds in both directions, apparently the backhaul is saturated. We often have buffering issues when watching television, our cloud Hulu DVR service struggles to push down content without interruptions and computer services have slowed to a crawl. Would we be interested in fiber connectivity? You bet we would as long as we could afford it and the backhaul pipe is adequate.
- My family lives on a secondary road but a moderately populated secondary road (Snake Creek) and we have no option other than satellite internet/TV. In the year 2021. Very frustrating.
- I want, want, want gigabit fiber internet service

- I've been lied to for over 22 years that high speed internet was coming next year. It's 2021 for Christ Sake. The lack of high speed internet availability adversely affects Carroll's ability to compete for jobs and keep our children here with the availability to earn a descent wage.
- 2021, the tech exists and is not cost prohibitive, please make it happen.
- I can't understand why I don't have access to High speed internet with Century Link. But I have called them numerous times and they tell me the only internet available is Hughesnet for my address. With Century Link you can't get anybody on the phone that knows anything about this area. A local Century Link employee told me that I should have access to HS internet through them for the address that I live, but when I call Century Link they tell me it is not available for my address. Carroll County government should hold the local internet company accountable and provide a better service for citizens.
- i tried to get internet from centurylink for about 15 years. many promises but no action.
- Only said yes to county offer better broadband is for more hot spots outside of downtown to help bring in more tourists/$ into area
- The extremely poor quality of internet services affects the economy and the real estate values of this county. Carroll County should facilitate better and more affordable broadband services for all age groups. We pay a fee which is included our telephone bill every month for universal access. Universal Access fee is designated for providing internet access to rural areas such as Carroll County. We as citizens of Carroll County urge the Carroll County Government to apply for these funds or any other funding to facilitate broadband services here.
- Century Link customer service is terrible. Signal keeps dropping and inconsistent. Takes a week to get technician when issues, then 2 out of 3 times scheduled did not come. When did come, made problem worse. Then must wait an almost a week to get them scheduled back. Sometimes signal decent, sometimes non-existent. When call for service, get passed from one agent to another where you start over explaining issue again. Son lost job due to inconsistent internet signal.
- I think the County would ultimately benefit if residents have better access to reliable internet that is fast enough for students and people working from home. This is needed and will help the young people especially but also the old who need telemedicine etc.
- My internet and land line always has problems when we have heavy rains and it takes my provider (CenturyLink) days to address the problem. Internet providers should not be allowed have non compete clauses, this makes it impossible to get good phone or internet services in my area.
- Without Gigabit, our current population is destined to remain in the 2000's where it is now. This core resource is the same as electricity - no power - no industry - no internet - no advancement/ no industry/ no employment
- Quality internet is critical for the future of our children's education and ability for many adults to work. Without fast reliable internet, Carroll county will fall further behind the rest of the state and country. It's absolutely critical, now and in the future to have good quality internet. I have had Gigabit fiber in North Carolina and it made a world of difference in our lives
- Without question, we need better, affordable internet to continue to live in this area.
- All I have is a hotspot and it is very unreliable.
- CenturyLink has lied forever about high speed internet!!
- I have a family of 4, two professional parents who work from home, an elementary and Pre-K aged children. We are currently evaluating options for moving out of Carroll County to other, nearby counties, who do have governments who have already facilitated fiber-level services for

their constituents. Having fiber-level service available throughout Carroll County will help ensure the long-term viability of the county vs leading the county into a slow death spiral and an increase in the average age of the population as younger, would-be, leaders leave for more prosperous opportunities.

- Really need internet options and cellular service signal.
- Rural area people need better cell phone services and home internet.
- No internet
- As soon as I can I will move to N.C. because of internet.
- We need a cell phone signal.
- Big problem!!!
- How soon will it be available?
- Best money the Co. could spend!
- As soon as pandemic is over probably will move to N.C.
- Two grandchildren rely on our internet to do school work.
- I hope something works out to provide a better internet service to Fancy Gap. Our cell phone service is bad too.
- We are planning to spend more time in Carroll as both of us retire.
- Considering moving - Internet service is one of several reasons.
- CenturyLink is awful. Very unhappy with them. Need better service.
- The county as a whole has very few options for internet services. We previously lived farther from the the town of Hillsville and were limited to only CenturyLink which provided subpar speeds and bandwidth for a household with multiple users. We recently moved and were able get xfinity which has much better service than CenturyLink. But I do feel that their price is higher than it would be if there were any serious competitors in the area. Internet is a huge part of how we communicate, entertain ourselves and interact with work and school. It needs to be expanded in this area if the county wishes to see fewer people leave for more populous areas.
- We have phone lines that were installed in the 1900s.
- We can get wifi but no cell phone service.
- Get CenturyLink out of Carroll Co. They suck!!!
- We were told we would have better internet by spring 2021 and still don't!!
- It's very frustrating when you can't use your laptop or iPad & iPhone while watching TV. It interferes.
- CenturyLink has been saying better service is coming to us - but they've said this for 11 years since we moved to the family homeplace.
- I do not feel I get the speeds that I am paying for with my provider.
- Would like to see more media info re: the fiber internet service.
- CenturyLink service here is very slow when it actually works at all. Numerous issues with no service on both internet and landline phone.
- Need affordable high speed internet please improve!
- The Link on reverse does not lead to this survey.
- We have never had reliable internet services since we moved here in 2007!
- The town, state, and federal government gives to everyone who won't work & those who do work should have internet.
- Harvest Rd. has no basic internet, according to Hugesnet and all area carriers! You can't buy it 'for a million dollars' according to Huges!!! (No infrastructure.)
- Landline phone service needs to be upgraded. Fancy Gap not good.

- We need-minimum towers that serve all phones throughout the city.
- Cannot wait until there are more choices including cellular.
- It's a shame that it is 2021 and the only option some people have is dial-up unless they spend a fortune on satellite internet!
- Night & evening is worse in our area. Dropping constantly.
- This county has the worst access to anything (internet/phone) in this area and maybe all southwest Virginia!
- We need HELP!
- We use cellular data to access internet if want to use - phone, text, email, access internet.
- Affordability is secondary to function for us. Cheaper is great but need for good speed is first.
- We do some doctor appointments via Zoom & need better services. Also, church & family visits.
- Some of these questions need work.
- My location is horrible for all services.
- Living in a big city 10 years ago I had 25mbps download and 10mbps upload, I moved here and we had to quit our YouTube & Photography business because to upload a 30 minute video took 7 days only for it for it to get an error before finishing. Moving is not an option. I've begged for better internet and I get told the same thing, 'sorry, there's nothing we can do' it's 2021 there is absolutely no reason why internet should be as slow as a snail crawling through cold molasses. Carroll County... ALLLLLL of Carroll County needs access to high speed internet. It's ridiculous to only get 10 mbs download and barely 1 mbs upload in 2021. Somebody somewhere needs to do something and get us out of the dinosaur ages. Especially with Covid and children in school.
- Comcast takes blatant advantage of their monopoly in this area to charge high prices for service that rarely if ever approaches advertised speeds. I would go to almost any other high speed provider immediately if one were available.
- Our actual speed is 1.5 mbps download and 0.5 mbps upload, which is unreliable to do anything other than basic browsing. It's the fastest speed available at my address. However, I am not interested in changing ISPs so hopefully Centurylink will work with you to accomplish installing a fiber network.
- Carroll County VA would gratefully benefit with improved county wide broadband.
- Centurylink has been robbing people blind for years now. Twice they have 'upgraded' the system and charged more saying it allows higher speeds when speeds continue to drop as they add more subscribers without making improvements. We pay for up to 10MGPS but very rarely see even 1 download or upload speed. They have done this to everyone in the county and should be forced to help improve the services at their cost.
- Everyone should be able to access the internet.
- Anything to make our county look more pro-business is a good thing!!
- Please get us better internet, we need/deserve it. Thank you.
- Please bring it to our road!
- Excited to get better service
- My current internet bill is greater than $500/month!!! I am willing to pay $5k connection fee to get a gigabyte connection to my house. My upload speeds are about 0.1MBS in the afternoon!!
- Had to do a lot of research to get reliable internet access after moving here 6 years ago. Land line phone service was undependable. Cell service was nonexistent until purchasing Weboost antenna. Having Fastlink internet service has been immensely helpful for cell phone service using wifi. Had to call 911 a year ago for a medical emergency.

- My name is Scott Edelman. I purchased this house for my sister-in-law and her daughter. Both are disabled. When I bought the house, there was internet with CenturyLink. It worked fine with streaming Netflix. After closing I called CenturyLink for service. They said that the area was over subscribed and even though the house had internet with them, CenturyLink would not provide internet to me. This made me go to satellite at a cost of $179/month. We need high speed internet at an affordable price at this house!
- We have to get cell booster to get signal. Cannot make or receive cell calls.
- Poor phone and internet service.
- I have no internet
- My daughter in Floyd Co. has Citizens fiber lightning fast.
- Should also offer trash pickup.
- Better internet would be so beneficial to my family. Thanks.
- Please help the speed.
- Our students deserve better! The county overall has poor internet access. Family members must come to my house for internet to complete school work, watch movies, and general internet access. They need reliable internet.
- We've been told internet is currently not available at our home. It would be great to have a service available!
- We have one-two bars of cellular service for use of all devices with Verizon hot spots, but zero with ATT. Overall, marginal service. But many in our vicinity have none. When we go back to our primary residence in Louisiana (for only three months per year), in-house internet is like a miracle! Great service there, no high speed limits. But do realize urban is different than rural.
- have no internet service
- rural area need internet more than cities or towns because we just cant pop in a restaurant or facility and be a guest user
- better internet in my area would be a huge help. my grand daughter is a college student and she has to travel because of internet.
- when the grandchildren come to stay they do virtual learning from here
- this has been promised over 15 years. should get on it
- poor poor service in town limits
- it is so slow. i cannot even load my email (my computer works fine if other services are used)
- our internet is incredibly slow to the point where it is almost unusable. our speed is around 500 kbs despite paying for 'high speed' internet through centurylink
- we need better internet. service is only .05 mbps
- internet is currently not available at my location
- we are desperate for better internet options. we need infrastructure
- have gone without service for over a week at a time after rain waiting for service. we constantly experience problems with center link phone lines. down every time it rains and must call for a technician to come out. problem is always up the hill in their lines
- i cant get tv. cellular or radio service good
- i feel like i live in a third world country in regard to internet access
- due to health devices we have to have it
- We have no other options for internet in my area. The phone lines are outdated and need to be replaced and I have to call centurylink often to have problems fixed. It's very aggravating. Other options would be a true blessing!!! Especially with having school aged kids that have to do

homework using internet. During COVID when schools were closed my kids would have to drive somewhere else to do school work.

- If you had done pre-maintenance and already had better service before COVID you might not be in this problem now.
- We love Carroll County Va and do not want to change anything about it. That is why we moved here.
- Thank you!
- Would like to know all about it, the cost to have a computer but no internet.
- All of my neighbors complain about the internet service in our area. We need more choices, better service.
- I'm currently on a wait list for Starlink service that sound promising.
- Internet is the future.
- We need better internet.
- CenturyLink doesn't even have cable to my address, just telephone lines.
- Need reliable service!
- I am without any land line service or internet service on average at least 1 week a month or more.
- Very few options mean higher prices and mediocre service.
- Need affordable & dependable internet!
- We need better internet very bad!
- Need to have better service!
- How soon can we get better service!
- If the same lines are used for internet don't see how it'll get improved.
- The grandkids need to use our internet to do school work.
- Why can't fiber optic cable be accessed for internet that is in place in county?
- No tax increases
- Who benefits from 'The Wired Road'?
- Improve cellular coverage.
- Should try to get affordable fiber internet in rural areas
- Better access might get better jobs in area
- Please act now! NO HALF MEASURES!!
- Better internet is a MUST.
- Our only option is CenturyLink and there is a charge for everything. If their router/modem goes out a new one is $200. In past year we have had 2 and now need another! :(
- I have worked from home but not at this time.
- Have tried to get internet with different companies. Comcast said it would cost us $5,000 to run the line 50 ft from our house. Tried HughesNet for a week and didn't work.
- We don't have any other options. We don't even have CenturyLink here
- The Wired Road Concept is a joke... we're better off with Dixie Cups and a string
- Hubbard recently retired - wonderful trucking company and had to go to cell phone area to get local information for work due to no internet. Help us!! We cannot get Internet or cell phone coverage at our home
- My grandson does schoolwork at our house occasionally
- We have 85 gbs of high speed internet a month. We tried to get CenturyLink but they never gave us service or helped
- Internet access along 221 from Big Reed Bridge to Dugspur is limited and slow and in my case unavailable.

- We live in the country so satellite is the only source we have for decent service and still has drawbacks
- We need faster internet in Fancy Gap. Thanks
- Broadband service would be a great boost to the community.
- With technology today there should be no hindrance to quality and cost effective communication services.
- Internet in this area is functionally useless. CenturyLink makes it impossible to report on outages in a reasonable amount of time.
- I will be willing to have a monthly fee.
- I have no internet options except cell phone. We need internet!
- Century Link sucks?
- I am not very techno-savvy. Cannot perform many services online.
- century link sucks
- Thank you!
- Looking for affordable internet as most options are overpriced and slow when more than one person on at a time.
- I have good service now. It could be better.
- CenturyLink is the worst service provider we have ever encountered.
- I need internet without cutting down 20 trees! help!
- Our area is in desperate need of reliable, affordable broadband internet.
- Have no access - Impacts my ability to function
- I only have Verizon phone service that I use as a hotspot for computer and I-pad. Dugspur needs a working internet!
- thank you
- Please do something to improve internet and cell service to this area. It is horrible.
- Cannot use Alexa, etc. What I have is not good but the best available that I can afford.
- Many areas in our county have poor service.
- I shouldn't have to fill out this form to facilitate services that should be common place. It's 2021, let's get real
- I work from home and I am on the computer all day. When I do not have internet access it puts me behind which causes me to have to make up my time at night and on the weekends. I know there are a lot of people that need more reliable internet access due to work and school. The pandemic has made a big impact on the way we are living now and we need to make accommodations accordingly. Thank you for taking the time to address this situation.
- Had CenturyLink, terrible lines and service.
- Any help getting internet is greatly appreciated. The neighbor and I tried for years to get Internet kids grown and moved as soon as possible because no Internet.
- I lose my internet service at least 4-5 times a week.
- Please help. I have tried satellite, didn't work.
- Cautious about political interference.
- I do not have internet service because it is not available for this area. Sometimes I can stream sometimes if I stand in a certain area.
- 1. I have tried to get internet service from CenturyLink for the past ten years - never have been able to get it! 2. I have to go 10 -13 miles to local library to use internet. 3. Need internet at home to take classes 4. I have 5 grandkids who need internet to visit/stay with me, 3 of these are homeschool students from public school

- Cana needs more internet options
- Please bring Surry Communications to Fancy Gap. CenturyLink and satellite are garbage
- Much, much needed improvement in internet services.
- We regularly have to drive elsewhere to find internet service good enough to conduct business.
- Please bring fiber SOON!
- What happened to 'The Wired Road' Internet service? Who benefits?
- I can only get 2 Mbps download in 2021 is crazy. Our county is in the stone age!
- I am a computer/internet geek! CLink sucks on BR Parkway!
- There needs to be availability, internet without other implications
- In general, internet is BAD.
- We need better Internet service we have0.5 Mbps. I asked CenturyLink to put in fiber they said NO
- CenturyLink just came within a mile of my house and will go no closer. Praying for StarLink at this point.
- Cell phone will not work here
- Rural areas need more attention! From broadband internet providers
- I have tried to use Dishnet, HughesNet both poor. Now I have Sprint hotspot - still poor. Please help!!
- We need it now. HughesNet is Terrible.
- I have actually considered selling our home and moving so that I could work from home.
- Need more options in internet service
- Seems like a sales pitch is coming :)
- Only dialup is available where we live
- Comcast OK but very expensive - $99 a month just for internet
- I cannot conduct business effectively as is. We cannot effectively stream, our speed is so slow that it is difficult to upload or download files, I cannot conduct virtual web meetings, cannot install a home security system. We pay a lot for internet and tv but cannot utilize them effectively. ($56/mo for land line phone since the satellite internet service is delayed and we have to have something since our cell phone service is non-existent, $135/mo for slow Hughesnet satellite internet (supposed to be 25mbs but rarely is so and sometimes is out of service esp. with weather), $164/mo for Direct TV that cannot be utilized fully). We cannot switch to streaming services as do not have the internet speed to do so.