CIT BROADBAND
CENTER FOR INNOVATIVE TECHNOLOGY

VIRGINIA'S MIDDLE PENINSULA

Broadband Study Recommendation

Findings and recommendations

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May 17, 2013

Disclaimer

Technology and telecommunications are changing rapidly every day. CIT Broadband has made our best effort to apply current knowledge and experience to the business and technical recommendations in this study. We believe the recommendations made in the first half of 2013 are accurate and representative of the current state of the broadband industry. These recommendations may not accurately represent broadband technology advances over time.

This study and associated broadband recommendations are for planning purposes only and are not intended to replace formal engineering studies that are required for broadband infrastructure implementation. This study information is not suitable for building a network or system and is not expressed nor implied.

Contents

Table of Figures

Executive Summary

In July 2012, the Thomas Jefferson Institute for Public Policy released its annual "Virginia Economic Forecast" report which stresses the importance of broadband and the need for lawmakers to pursue policies that will promote affordable, wide-spread broadband.

"To maximize the benefits to all of Virginia, broadband internet access has to be affordable, widely available, and deep in terms of its functional capacity. Undoubtedly, private sector firms and entrepreneurs need to lead this initiative with the Virginia government primarily providing a level playing field so competition and innovation can flourish."

In October 2012 staff of the Digital Policy Institute published an article highlighting the many ways that citizens can benefit by having broadband. These benefits include financial savings, entertainment savings, increased productivity, educational benefits, improved voice communications with savings, societal participation, informed electorate, healthcare access, improved public and emergency services, and enhanced environmental protection by reducing the carbon footprint of consumers and businesses. Entrepreneurs can save business startup costs by leveraging the Internet for online accounting services, marketing materials, voice-over-IP, developing their own business website, mobile applications to achieve productivity and efficiency, incorporating their business using online tools, and video conferencing to save in travel costs. There are significant reasons for every community to have broadband connectivity options.

The Middle Peninsula region identified several goals related to broadband service expansion including economic development, expanded education opportunities, improved healthcare, and telework options for their citizens. The region wants to explore opportunities to expand broadband service while avoiding long term debt and mitigate financial risk.

The region's strengths include having a regional broadband authority and having many existing vertical assets in close proximity to un-/under-served areas. There are weaknesses too, such as the majority of the region is very sparsely populated making the business case for broadband providers difficult to justify the investment. The region has opportunities in regards to wireless technologies with a number of wireless Internet service providers in the area including the recent partnership between King and Queen County and Gamewood Technologies.

Icon Broadband Technologies did a thorough assessment of the Middle Peninsula and Northern Neck Peninsula in 2008. Although some changes have occurred since 2008, those findings still have value for both areas in terms of future plans for fiber deployment when funding becomes available.

CIT's recommendation offers an alternative strategy to bringing broadband to un-/underserved areas. This strategy can co-exist with fiber technologies in the future and would provide citizens and businesses with a competitive broadband environment.

This document provides examples of various models for broadband deployment throughout the Commonwealth. In consideration of the Middle Peninsula's goals we recommend the region form a public-private partnership to build a wireless network throughout the region. Wireless broadband technology is the most cost effective technology to deploy in sparsely populated areas such as the Middle Peninsula. A partnership with a wireless provider will limit financial investment and risk by leveraging existing assets and provide the region with two public-private partnerships supporting wireless broadband networks. An alternate approach is for the region to work with King and Queen on expansion of their network but that approach does not provide the backup for the region as having two partnerships could accomplish. This document identifies the gaps in coverage throughout the region and identifies key vertical assets that could be leveraged by a wireless network to provide service as well as specific recommendations for stipulations of the partnership. CIT identified two areas that need at least one additional tower – northern Essex County and central King William County.

The Middle Peninsula localities – as with all regions throughout the Commonwealth – need to make modifications to local policies (zoning, building codes and permitting) to create a "broadband friendly zone". The recommended changes are detailed in this document and will lower deployment costs and expedite broadband deployment for all providers – wireline, such as cable and DSL, as well as wireless.

CIT recommends that the region's local government leaders partner with all incumbent providers – cable companies, telephone providers and wireless Internet service providers. Share with the providers the policy changes that are recommended in this document and determine if there are other barriers to broadband deployment. Share with the providers the findings of this study in regards to gaps in coverage and explore options for expanding all existing services to address the deficiencies.

CIT recommends the region's community leaders work with existing community organizations to provide digital literacy training options for broadband adoption and utilization. This document includes a section on education resources for awareness and adoption many of which are online and could be marketed through existing community channels. The true benefits of broadband for a community cannot be realized without proper education as there are a number of citizens that do not see the need for connectivity. The lack of online access will limit the resources available to assist citizens and can limit education and job opportunities.

Finally, the region must answer two major questions:

1) What role does the Middle Peninsula Planning District Commission or the Broadband Authority want to take in broadband expansion efforts?
2) What model does the region want to follow in terms of a public-private partnership?

CIT strongly believes the Middle Peninsula has two very good options for proceeding with a fixed wireless broadband solution to expand broadband services for the citizens of the region. Answering the above questions will determine which option is best for the region.

The Middle Peninsula Region

The Goals

The Middle Peninsula and specifically the Planning District has indicated the following goals for their area:

- Broadband options for all citizens, ideally a competitive broadband environment
- Adequate broadband bandwidth to support local businesses connectivity needs
- An environment that stimulates economic development and presents an attractive environment for businesses and entrepreneurs
- Quality education for K-12, college and continuing adult education
- Quality healthcare available locally including telehealth support
- Broadband bandwidth to support teleworking

Essentially the Middle Peninsula wants to do everything they can to improve the community and ensure that no one is left behind in today's global economy because of where they live and the lack of broadband connectivity.

In a study and assessment performed in 2008 the area also identified goals that included the following:

- Do not increase current workloads of local government staff,
- Mitigate financial risk,
- Avoid long-term debt obligations, and
- Avoid overbuilding where infrastructure exists and agreement can be reached to leverage existing and new infrastructure for mutual benefit.

The prior goals are very realistic and the assumption here is they do still apply today.

The Champion

A well-informed, passionate and persistent local champion is essential to any community initiative. This person or group will drive the initiative and rally the support of community stakeholders which include residents, business owners, community anchor institutions and government officials.

This recommendation report presents options for broadband expansion and can serve – in conjunction with the previous study conducted in 2008 -- as a strategic broadband plan for the Middle Peninsula district. However, plans are only valuable if there are people willing to

devote their time and energy to ensure the communities are committed and participating to execute the plan. A local champion is the person or group that will drive the community to implement the recommendations and take action. The Champion will rally the community and community organizations to expand broadband awareness, adoption and utilization while demonstrating the broadband service demand that exists in the region. These efforts will help make the business case for the providers and ensure the population leverages the available service to improve their lives.

It is recommended that the Middle Peninsula Broadband Authority be the champion. This group has the connections to local government officials, the understanding of the needs, the organizational structure to create partnerships and the ability to manage the efforts required to expand broadband options for the community.

Commonwealth Models & Legislation

Virginia Models

Types of Models

There are many case studies available across the nation demonstrating the creative ways communities have worked to bring broadband to their areas. There are approximately 70 municipal-owned networks across the nation. Municipal network success can often be measured in terms of new jobs and lowering incumbent pricing. Most municipal networks are based on the municipal owned utility. The challenge is typically marketing against the incumbent provider and to attaining the cash-flow needed to sell 'triple play' – phone, Internet and cable TV – as most customers want to bundle services. Municipal networks are costly in the early years due to the costs of building the infrastructure and typically there are many legal fees spent on court cases with incumbents.

Another still emerging model is the public-private partnership model. These partnerships can be structured in many ways depending on the amount of control the public body wants to maintain over the network. Success with partnerships is better measured in regards to telehealth, education, telework, etc. and not as much in revenue for the public organization. Public bodies typically do realize telecom savings by leveraging the network for telecom and facility connectivity. Generally these partnerships are found more in rural areas and tend to be based on terrestrial wireless solutions. The major challenges are terrain and tree canopy as these land features block radio signals.

Following are just a few summary examples of each type of model with more details available in the Appendix. There are many more examples of these various models across Virginia and the nation, as this is not intended to be a comprehensive list.

Utility Owned Fiber

Municipal utilities are positioned to more easily deliver FTTP (fiber-to-the-premise) as they already own connections to all facilities to either serve water or electricity. These organizations still have some cultural shifts to add broadband to their service line as it requires different skill sets to market, install and support than either water or electricity.

Rural Telecom Digital Subscriber Line (DSL)

Rural telecommunications companies are typically some of the fastest at delivering broadband over copper wires known as Digital Subscriber Line (DSL). These rural telecom companies have historically benefited from the Federal Universal Service Fund (USF) which was created to spur development in rural areas.

Public-Private Partnership

Public-Private partnerships have been created between local governments and private broadband providers as well as between local/regional Broadband Authorities and private providers. Typically the local government or authority will contribute infrastructure and or funding while the private provider designs, builds, operates and maintains the broadband network. These partnerships result in a win-win situation by providing broadband options to citizens while also supporting business growth of the provider.

Authority or Co-op Owned Open Access Fiber Network

Some regions of Virginia have open-access fiber networks to incent broadband service deployment over fiber. Typically these builds are headed by either a broadband authority or an electric/utility co-operative. The fiber network is referred to as "open access" because the intent is for any broadband provider to be able to leverage the fiber for transport of their services to extend their services beyond their own infrastructure.

Authority Owned and Operated Wireless

A few broadband authorities have chosen – as legislation clearly supports – to build and operate their own wireless broadband network. These networks leverage existing government-owned towers in addition to construction of new towers and provide service to community anchor institutions as well as citizens. A recent example of this model is the partnership formed by King and Queen County with Gamewood.

Municipal Utility Broadband over Power Lines

In 2005 Manassas became the first implementation of broadband over power lines (BPL) in the nation. This system uses the electrical grid and wiring in the homes to deliver the broadband connection. Communications Technology, Inc. in Chantilly initially operated the network for the city, but in 2008 the city took it over. The service is less costly and not as fast as DSL or cable but certainly better than dial-up. The city stated in 2010 the service was costing $170,000 annually and decided to end the service. At the time of termination the service had approximately 520 residential and business customers.

Applicable Legislation

Federal Legislation

The Federal Communications Act of 1996 had a goal of allowing anyone to enter into any communications business and to allow any communications business to compete in any market against other providers. This act provides local governments zoning authority over the deployment of wireless telecom facilities. Local governments cannot discriminate or inhibit deployment of wireless telecom infrastructure.

The Federal government formally recognized the importance of broadband to education, economic development and healthcare with the signing of the Broadband Data Improvement Act in 2008. This bill was written to improve the quality of the federal and state data regarding the availability and quality of broadband services and to promote the deployment of affordable broadband services to all parts of the nation. It supported, among other items, the efforts by states to expand broadband services.

In 2009 the American Recovery and Reinvestment Act specifically provided states with funding to collect broadband service data and map availability. Many states, like Virginia, obtained funding to expand their state broadband initiative beyond the data collection and mapping. Virginia's broadband initiative includes efforts to assess Health Information Technology use (e.g. telehealth, electronic health information exchange, electronic health records, etc.), assess e-Commerce use and adoption, development of a Community Broadband Planning Strategies guide, assessment of the impact of broadband on the healthcare and employment of Virginia veterans, and radio frequency propagation modeling.

State Legislation

Virginia has been active for many years passing legislation that eases broadband deployment and the most notable of that legislation is following.

Virginia Wireless Service Authorities Act (2003)

Authorizes any locality to create a wireless service authority, which may provide qualifying communications services as authorized by Article 5.1 (§ 56-484.7:1 et seq.) of Chapter 15 of Title 56. The authority shall have many of the powers typically granted to authorities, including the issuance of revenue bonds.

High-speed and Broadband Internet Access in Underserved Areas (2006 – HB 400)

This bill adds a provision in the Governor's Development Opportunity Fund to allow grants or loans for the purpose of installing, extending, or increasing the capacity of high-speed or broadband internet access. The bill also amends § 2.2-2238.1 to require the Virginia Economic Development Partnership Authority to review and evaluate, in its program developed under the section, existing industrial sites and infrastructure that will provide broadband or high-speed internet access to rural and underserved areas of the Commonwealth.

Virginia Public-Private Education Facilities and Infrastructure Act; Provision of Wireless Broadband Services (2007 – HB 2381)

This bill specifies that the Virginia Public-Private Education Facilities and Infrastructure Act can be used for projects related to the technology and infrastructure necessary to deploy wireless broadband services to schools, businesses, and residential areas. The bill also authorizes the Virginia Resources Authority to fund wireless broadband projects.

State Owned Communications Towers; Broadband Service (2008 – HB 1329)

Requires state agencies to lease or convey a license or other interest in a state-owned communication tower for which they are responsible to qualified providers of wireless broadband service in order to deploy broadband Internet service in areas of the Commonwealth that do not have access to terrestrial broadband or radio frequency Internet service. The requirement is subject to the provider presenting a spectrum and certified structural analysis of the tower and proof that the tower satisfies all applicable local government requirements. The conveyance shall require payment of such consideration as the Director of the Department of General Services deems appropriate and which is commensurate with the consideration paid for use of comparable space on similar towers. This bill is identical to SB 206.

Virginia Resources Authority; Broadband Services (2008 – HB 632)

The bill clarifies that the Virginia Resources Authority may be used as a funding mechanism for all projects involving the provision of broadband services, and not just those utilizing wireless broadband technologies.

Office of Telework Promotion and Broadband Assistance (2008 – HB 1017)

Codifies Executive Order 35 (2006) creating the Office of Telework Promotion and Broadband Assistance under the Secretary of Technology. The goals of the Office are to encourage telework as a family-friendly, business-friendly public policy that promotes workplace efficiency and reduces strain on transportation infrastructure. In conjunction with efforts to promote telework, the Office shall work with public and private entities to develop widespread access to broadband services. The provisions of this act expire on July 1, 2018.

Broadband Advisory Council (2009 – HB2423/SB1336)

This establishes the Governor's Broadband Advisory Council. The purpose of the Council shall be to advise the Governor on policy and funding priorities to expedite deployment and reduce the cost of broadband access in the Commonwealth. The council shall be staffed by the Office of Telework Promotion and Broadband Assistance. Technical amendments to the bill adjust the membership of the Council.

Virginia Broadband Infrastructure Loan Fund (2009 – HB 2665)

Creates the Virginia Broadband Infrastructure Loan Fund. The Fund would be administered by the Virginia Resources Authority. Money in the Fund would be used exclusively for the financing of broadband infrastructure projects undertaken by a local government. Priority for loans would be given to projects that will utilize private industry in operating and maintaining the projects where private involvement will provide cost savings, to projects that serve two or more local governments, and to projects in unserved areas.

Municipal Networks and "Triple-Play"

Most municipal networks find their customers want to bundle services such as subscribing to Internet and phone, or Internet and Cable TV, or "triple play" meaning all three services – phone, Internet and Cable TV. Virginia has legislation that limits a municipality from providing cable TV services. Virginia allows municipal electric utilities to become certificated municipal local exchange carriers and to offer all communications services that their systems are capable of supporting (except for cable services), provided that they do not subsidize services, that they impute private sector costs into their rates, that they do not

charge rates lower than the incumbents, and that they comply with numerous procedural, financing, reporting and other requirements that do not apply to the private sector. (*VA Code §§ 56-265.4:4, 56-484.7:1*). In order to provide cable service, a municipality must first obtain a report from an independent feasibility consultant demonstrating that average annual revenues from cable service alone will exceed average annual costs *in the first year of operation*, as well as over the first five years of operation. (*VA Code § 15.2-2108.6*) This requirement, without more, makes it impossible for any Virginia municipality other than those providing the service prior to December 31, 2002 (e.g. Bristol) to provide cable service, as no public or private cable system can cover all of its costs in its first year of operation.

Current State of Broadband in the Middle Peninsula

Broadband in the Area

The Middle Peninsula consists of six counties and a few towns. The Middle Peninsula Broadband Authority was formed in 2010 and now includes all counties except for King and Queen. The following table provides statistics from the National Broadband Map for each of the counties including a ranking of each within the state based on two metrics: ranking based on counties with more than one wireline provider, and ranking based on speed minimum of 3Mpbs download and 768Kbps upload. There are a total of 134 counties listed in these rankings.

The following table does not include service data from MetroCast cable provider as they have just begun participating in the Virginia broadband availability data collection with April 2013 data submission, which has not yet been published to the National Broadband Map. MetroCast is providing service to large portions of Essex, Middlesex and Mathews. Not including this service provider in the following data definitely skews the ranking of all three of those counties as their ranking would be higher for having an additional provider and the percentage of population served by cable would be much higher.

Locality	Sq. Miles	Pop.	Housing Units	Pop Density	# Wire Prov	# of Wireless Prov	% Pop served by DSL	% Pop served by Cable	% Pop served by Mobile Wireless	Rank of VA Counties >1 Wireline Provider	Rank of VA Counties w/ speed min 3/768
King & Queen	312	6,978	3,437	22.3654	1	4	21.8%	9.1%	87.9%	**131**	**126**
Mathews	240	9,002	5,678	37.5083	2	5	48.4%	76.2%	92.8%	**104**	**73**
Middlesex	198	11,014	7,169	55.6263	1	4	88.5%	0.0%	97.9%	**84**	**81**
King William	269	16,427	6,714	61.0670	3	5	76.5%	44.4%	96.7%	**77**	**89**
Essex	271	11,415	5,910	42.1218	1	3	81.6%	0.0%	96.7%	**75**	**105**
Gloucester	271	37,274	16,044	137.542	3	6	91.6%	45.0%	96.7%	47	**74**

Population density plays a significant role in the business case for providers – particularly wireline – to expand services. Gloucester County – as expected – is far better positioned in the area based on number of providers and speeds available. Conversely King and Queen County has a much lower ranking and also the least population density.

King and Queen County formed their own wireless authority in November 2012 and have formed a public-private partnership to begin delivering fixed wireless (WiMax) broadband service to their citizens. They are leveraging their public radio system towers for deployment of the wireless equipment and the coverage plan shows the majority of the county as serviceable. The equipment used for this wireless system has the capability to broadcast service up to 12 miles for near-line-of-sight (NLoS) and 18 miles for line-of-sight (LoS) from the tower transmitter. The partnership contracts were completed in August 2012 with a 5 year term that is then renewable in 1 year term increments. The pricing packages are included in the current providers table below in the *Existing Broadband Services* section.

King and Queen County owns the majority of the towers and the wireless equipment while Gamewood designs, installs, operates and maintains the network. This partnership includes a revenue sharing model as well so the county will recover their investment. The wireless network is based on a fiber connection to one tower and then a microwave backhaul connection to the other three towers. There may be potential for King and Queen County to expand the network to other areas of the region and sharing of vertical assets would be instrumental to that expansion.

Demand Aggregation

Accelerate Virginia Results

In conjunction with Virginia Tech's e-Corridors Accelerate Virginia program, we attempted to conduct a speed test throughout the region in April 2013. The purpose of a speed test campaign is to validate the providers' reported coverage areas and services. Through this campaign we are able to capture unmet citizen demand for broadband services through the reporting of "dead zones", areas with no broadband service available. Unfortunately without a regional sponsor the results were minimal limiting our analysis. We received only 69 speed tests and 2 reported dead zones (in Aylett and Center Cross). The majority of the speed tests were conducted by citizens of King William and Middlesex counties. The following table shows the number of tests by type of location and reported download speed. The highlighted rows are considered "broadband" speeds.

Download Speed	Business	Education	Government	Residential	Grand Total
<1 Mbps	1		1	20	22
<3	1		1	20	22
>3		1		5	6
>4				3	3
>6				1	1
>10		1	1	2	4
>15		1		8	9
>20				1	1
>30		1			1
Grand Total	**2**	**4**	**3**	**60**	**69**

Following is a map depicting the locations of the reported speed tests and the two reported dead zones (red dots).

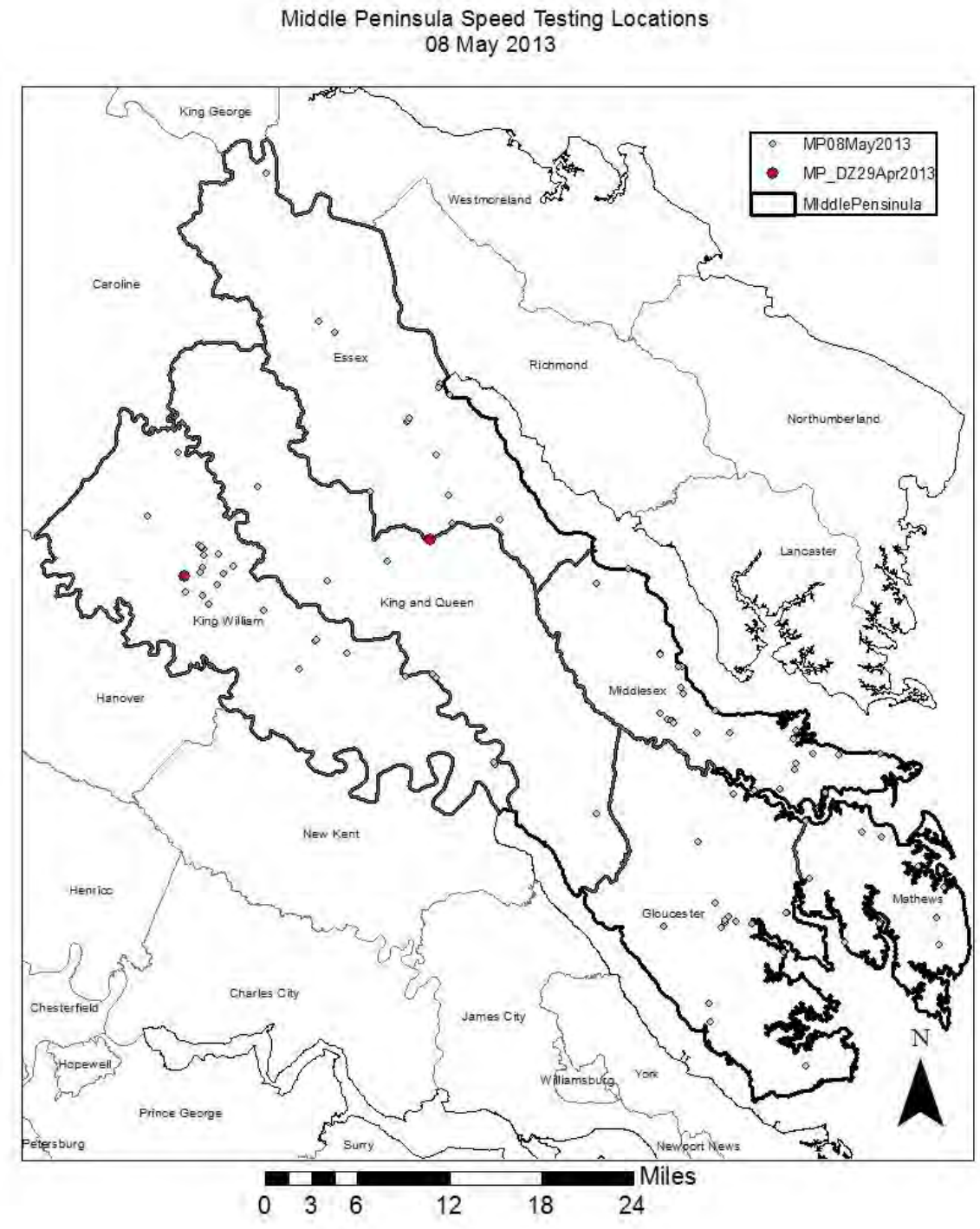

Figure 1 Reported Speed Tests and Dead Zones

Community Anchor Institutions

Community Anchor Institutions (CAIs) are facilities in the community that need broadband connectivity to provide essential services and enhance community life. These facilities include:

- Colleges and universities
- Hospitals and health-care facilities
- K-12 Schools and private schools
- Libraries
- Local Government offices
- Public safety facilities

One of the goals of the National Broadband Plan is to ensure that all CAIs have low-cost broadband connectivity. Additionally these facilities represent consistent broadband demand for an area and can be key in demonstrating to providers the unmet demand.

The Middle Peninsula has 156 CAIs which include 1 community college, 9 libraries, 29 healthcare facilities, 38 government facilities, 30 public safety facilities and 45 schools. Based on a previous study of the area conducted in 2008, the area's education and healthcare facilities have the greatest unmet demand. The list compiled during this study can be found in the appendices.

The following map view shows the cable and DSL coverage in respect to the various community anchor institutions in the Middle Peninsula region.

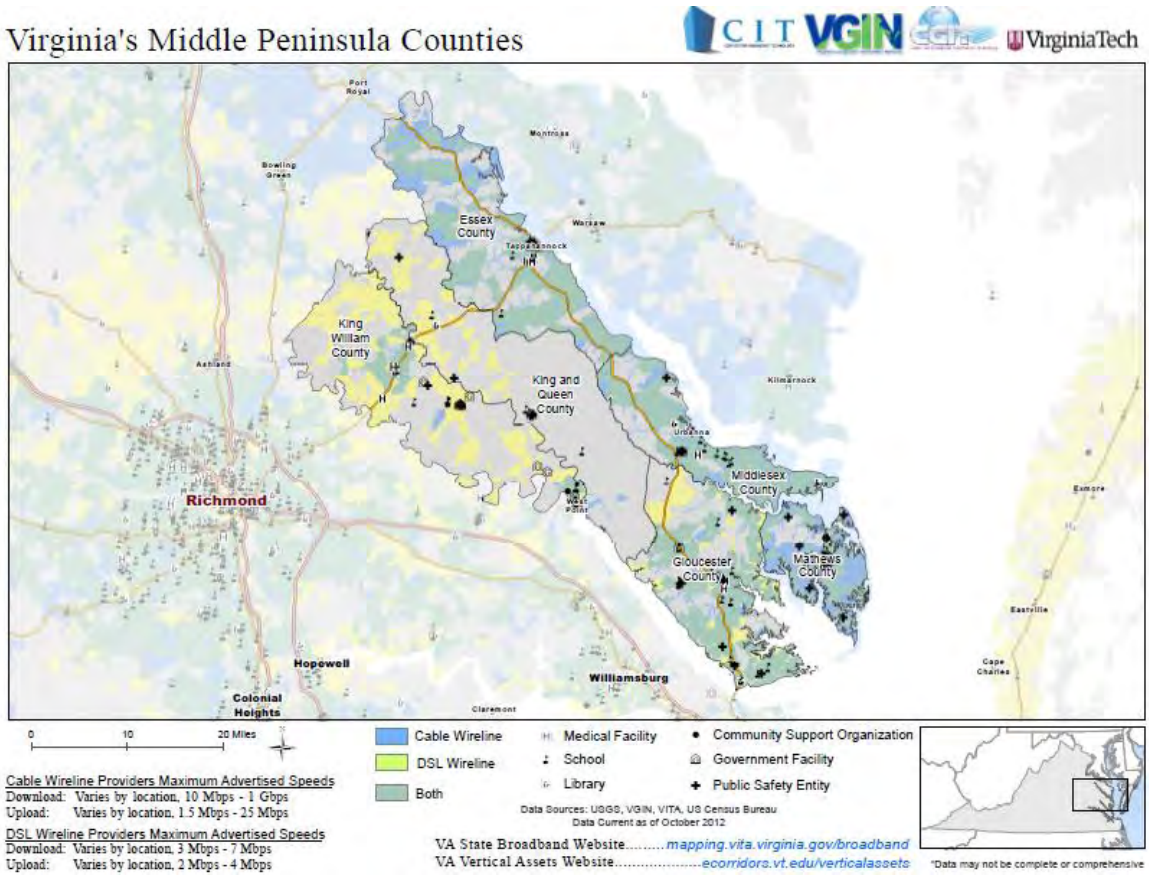

Figure 2 Geographic Location of Community Anchor Institutions (CAIs)

CAI Future Plans

It is important to consider the strategic technology plans of all the CAIs as these plans will stipulate the future broadband requirements. How are the schools, libraries, local governments, first responders and medical facilities going to leverage Internet applications and technology in the next three to five years? This information is vital to planning any future broadband networks as well as vital to the ability to demonstrate future demand for any Internet service providers.

Libraries provide necessary access to citizens such as jobs databases and job search, access to homework resources, access and information for e-government services, for completing government forms, and software and other resource to assist patrons with creation of resumes and employment materials.

Asset Inventory

Vertical Assets

The Middle Peninsula area has a total of 297 vertical assets included in the Commonwealth's Vertical Asset Inventory. This data does not currently include the new towers in King and Queen County as those towers may not yet be registered with the FCC or there may be a lag in our data extract from FCC registrations. The total assets break out as follows by type:

TYPE OF VERTICAL ASSET	NUMBER
Private: Business	160
Private: Individual	5
Private: Institutional/nonprofit	14
Pubic: Local	74
Pubic: State	29
Unknown in source data	15
	297

The number of local and state-owned assets represents almost 35% of the total -- these assets may be leveraged for broadband deployment. The remaining assets – privately owned – could possibly be leveraged depending on the structure owner. These structures are truly assets to the region and should be considered in any broadband deployment plan. Each potential asset will need to be evaluated to determine if there is available space to accommodate new equipment. This evaluation is typically determined by the structure owner conducting a structure load analysis that is often funded by the organization wanting to place the equipment on the tower. The location of many of these publicly owned assets are shown in the map below. A full inventory of vertical assets is provided electronically to the Middle Peninsula Planning District Commission and is always available through the Commonwealth's Vertical Asset Inventory tool (online at http://www.vait.gis.bev.vt.edu/index.php).

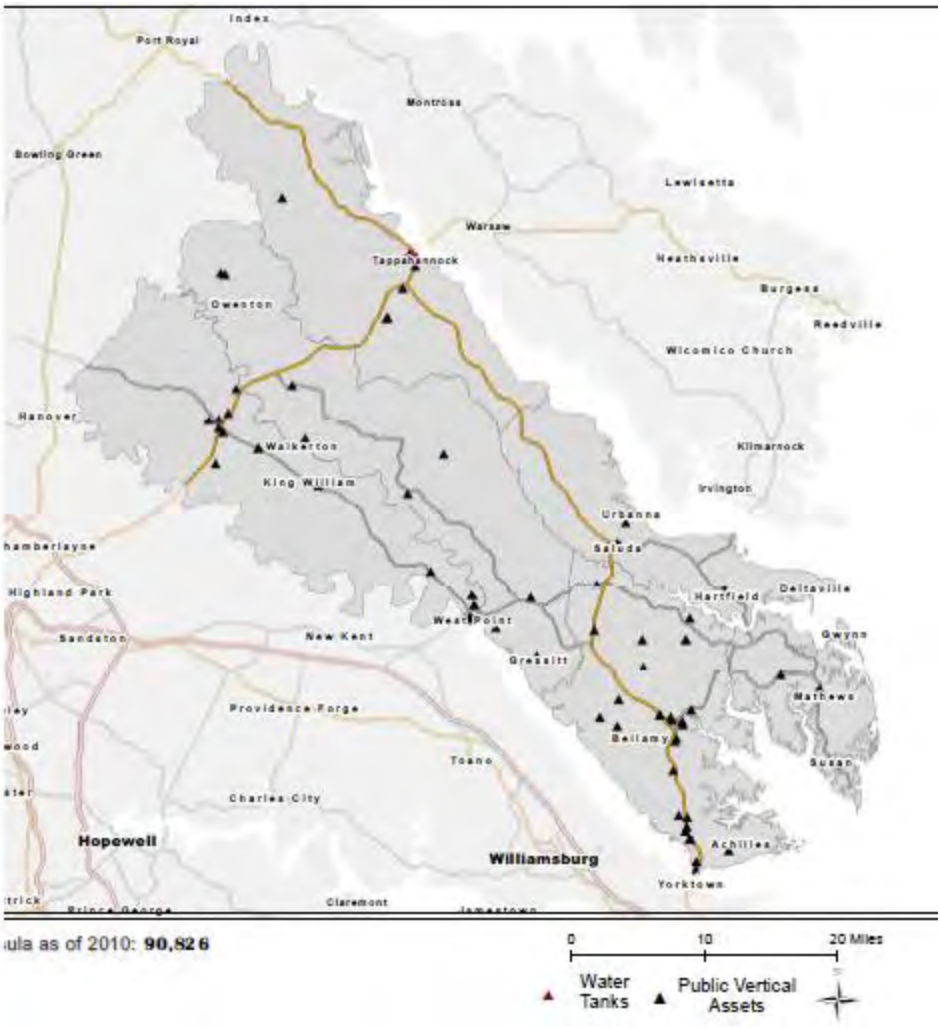

Figure 3 Vertical Assets

Cable Franchise Agreements

There is a mix of cable providers throughout the Middle Peninsula and it appears, based on research, that all the counties have a cable franchise agreement with a provider. Cable providers are held to the build-out requirements as stated in the franchise agreements and rarely are these requirements changed unless renegotiated at franchise renewal time. Occasionally when a franchise is being transferred to another company the locality can negotiate a few additional builds based on demand.

Cable providers have made huge strides in build-outs in the past few years to expand broadband services. Often the challenge is the cost of extending the cable plant to neighborhoods as there can be miles of few or no homes to reach a neighborhood in rural areas. Some localities are finding that neighborhoods are able to negotiate builds beyond the franchise requirements once they demonstrate a sufficient number of customers willing to subscribe to the provider's service and agree to some cost sharing on the extension of the

cable plant to the neighborhood. This practice is similar to the "fiber-hoods" in Google Kansas fiber deployment, where enough citizens in a neighborhood must commit to subscribe before Google will extend fiber into the neighborhood.

Points of Presence (POPs) Serving Middle Peninsula

One component integral to delivering broadband is Internet Point-of-Presence (PoP) which is the access point to the Internet. These are physical locations that house servers, routers, ATM switches and other equipment. They may be housed in a telecommunications provider's facility that an Internet service provider (ISP) leases or they may be a co-location facility that several providers share. Typically ISPs rely upon multiple PoPs for redundancy – ensuring their ability to provide service even if one network goes down.

There are few PoPs in the Middle Peninsula area. Nearby Mechanicsville, for instance, has multiple primary providers available to ensure redundancy. There are Internet feeds to a few towers in neighboring Northern Neck that are serving Northern Neck Wireless. Another impact of having fewer providers is the cost of service where it is available. ISPs such as Northern Neck Wireless have to pay more for the Internet feed than providers in more urban areas due to less competition and the cost of fiber deployment to rural areas.

Existing Broadband Services

Types of Broadband Technologies

There are several types of technologies used today to deliver broadband services. The technologies vary in speed and costs. Keep in mind the following table of broadband speed tiers is provided by the FCC. The FCC currently classifies true broadband speed of at least 4Mbps download and 1Mbps upload.

FCC Speed Tier Upload/Download Speeds Broadband		
	From	To
1st Generation	200 Kbps	768 Kbps
Tier 1 Broadband	768 Kbps	1.5 Mbps
Tier 2 Broadband	1.5 Mbps	3 Mbps
Tier 3 Broadband	3 Mbps	6 Mbps
Tier 4 Broadband	6 Mbps	10 Mbps
Tier 5 Broadband	10 Mbps	25 Mbps
Tier 6 Broadband	25 Mbps	100 Mbps

FCC Speed Tier Upload/Download Speeds Broadband		
	From	To
Tier 7 Broadband	Greater than 100 Mbps	

The available technologies today include:

- Fiber Optic – providing the fastest and most scalable service (Tier 7)
- mobile wireless (cellular) – available via smart phones or in the home but typically has a cap on monthly data usage (Tier 2 and some Tier 3)
- Digital Subscriber Lines (DSL) – service from the local telco provider with limited speeds and limited scalability (Tier 3)
- Cable TV – providing cable modem for Internet Access at satisfactory speeds but not as scalable and some including a cap on monthly data usage (Tiers 3 and 4)
- Fixed Wireless – providing speeds equivalent and now often exceeding that of cable or DSL at competitive prices, less costly and faster to deploy than wired services and have the ability to transmit radio signals 35+ miles (Tiers 3, 4 and 5 depending on the equipment and distance)

These technologies vary in cost with fiber connectivity to the premise being the most costly in rural areas. The cost of deploying fiber includes many parameters in addition to distance such as frost index, wetlands percentage, soil texture and road intersections to cross. Developing a model to calculate cost dependent on area features and population density becomes very complex. The FCC provided some estimates but providers found these numbers to vary from their construction experience. One individual, Larry Thompson Vantage Point Solutions' CEO, began building a formula to calculate fiber build costs in rural areas in 2010. Mr. Thompson used his engineering skills and his firm's construction cost data to build a formula which he hopes to refine to provide a more useful model. The formula:

Cost per household = $3,072

+ $13,365 * (adjusted road miles/households)
- 0.8867 * households + $25.04 * frost index
+ $17,700 * wetlands percentage
+ $1,376 * soils texture
+ $165.40 * road intersection frequency

As complex as the formula appears, one can quickly discern there are many factors that affect the cost of fiber deployment and for rural areas, especially those involving wetlands, it is too costly.

TECHNOLOGIES CURRENTLY AVAILABLE IN THE AREA

The Middle Peninsula is not unlike other un-/under-served areas in that there are several providers in the area but their service areas are limited. The following information has been collected from Virginia's broadband map. In 2009 Virginia became one of the first states to map broadband availability and the only one to do it at no cost to the taxpayer. In 2010 all states began broadband mapping due to the national broadband mapping initiative, however due to early and continued success Virginia consistently collects more and better data than any other state. We have non-disclosure agreements with all providers ensuring that we protect their market service area details and hence cannot show specific provider coverage areas in the map. The Virginia broadband map does show coverage by type of technology such as mobile wireless, cable, fiber, etc. Although we make every attempt to ensure the accuracy of the map data we are dependent on the data from the providers and they are only required to report at the census block level which can cause some under-served areas to present as served.

The following chart lists the various Internet providers serving areas throughout the Middle Peninsula, the offered package speeds and associated costs. Not all of these providers are available in all areas of the peninsula – please refer to the following coverage maps to view the locations of the types of coverage that are available. This table does provide a view of the types and costs of Internet service that some residents have access and are for comparison only.

Current Residential Internet Options in Middle Peninsula						
Provider	**Technology**	**Package**	**Download Speed**	**Upload Speed**	**Monthly Data Usage Limit (GB)**	**Monthly Cost**
Comcast	Cable	Xfinity	3Mpbs - 105Mbps	.8 Mbps – 10Mbps	250	$40-130
Verizon	DSL	High Speed Internet	.5 Mbps – 15 Mbps	768 Kbps	?	$20-30
WildBlue	Satellite	Exede12	12 Mbps	3 Mbps	7.5 – 25	$50-130
T-Mobile, AT&T Wireless, Verizon Wireless, Sprint, nTelos	Cellular (3G & 4G)	Wireless Mobile Broadband	1.4 Mbps – 24 Mbps	0.5 Mbps – 5 Mbps	2 – 12	$35 – 80
MetroCast	Cable	High Speed Basic/ Internet/ Ultra	256 kbps – 25Mbps	128kbps – 1Mbps	100/250/ 350	$25 – 70
Cox Communications	Cable	Essential/Preferred/Premier/Ultimate	1 Mbps – 100 Mbps	384Kbps – 20 Mbps	50 – 400	$40 - 100
Northern Neck Wireless	Fixed Wireless	Basic/Business/Advantage/Dedicated Wireless	1.5 Mbps – 15 Mbps	768kbps – 15Mbps	none	$40 – 150
KQVA.Net	Fixed	Basic Best Effort/	512 kbps	128 kbps	None	$30 - 90

Current Residential Internet Options in Middle Peninsula						
Provider	**Technology**	**Package**	**Download Speed**	**Upload Speed**	**Monthly Data Usage Limit (GB)**	**Monthly Cost**
	Wireless	Standard/Enhanced/ Premium/ Supreme	– 6 Mbps	– 6 Mbps		

Satellite Coverage

The Virginia broadband map includes satellite coverage and as expected this coverage is everywhere. Satellite service is improving with some new technology that will provide faster speeds however there is still a latency issue due to the distance the data must travel. This service is also severely affected by weather conditions (rain, snow and ice as well as 'sun spots'). The latency affects the ability to support virtual private network (VPN) connections typically required for teleworking and other critical applications such as video conferencing.

Cable Coverage

Comcast is the primary cable provider however MetroCast is serving areas of Mathews County, Middlesex County and Essex County. As mentioned earlier we now have MetroCast data included in the Virginia Broadband Map with the April data submission.

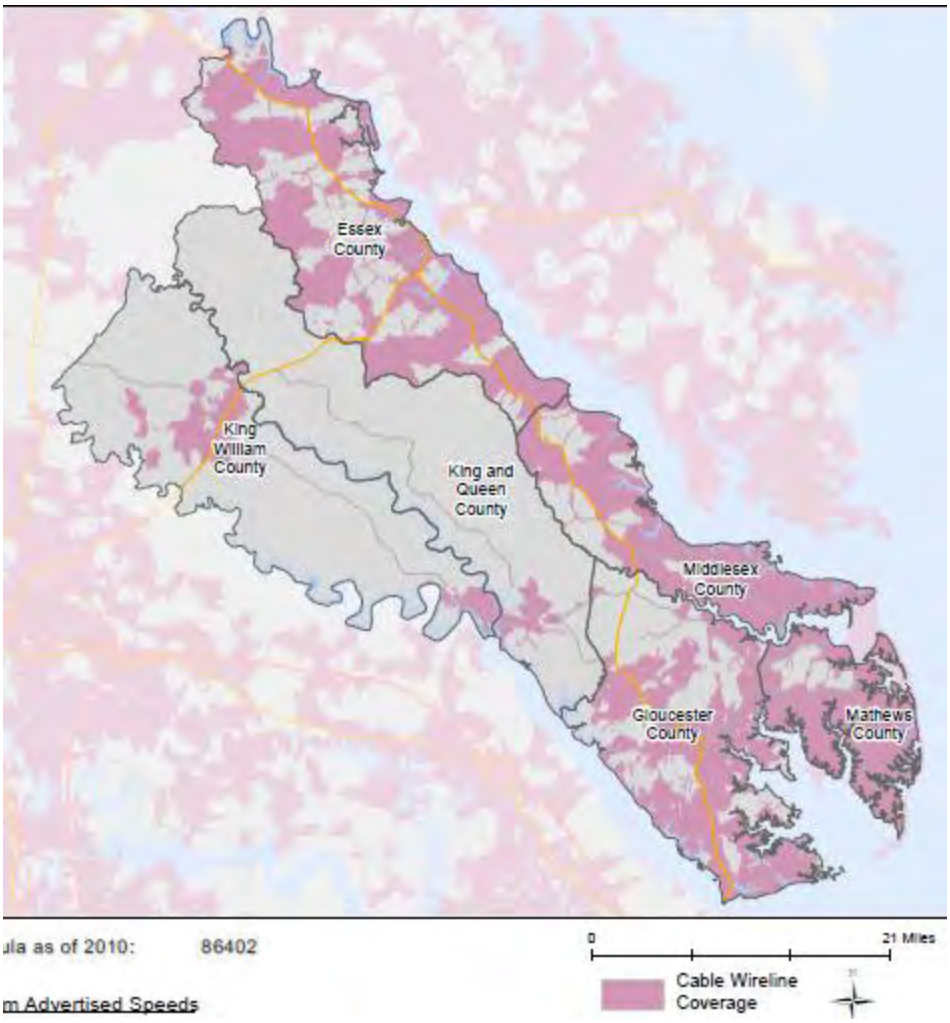

Figure 4 Cable Coverage Areas

Digital Subscriber Line (DSL) Coverage

DSL is delivered over traditional copper telephone lines and is typically limited to facilities within 3 miles of a telco Central Office (CO). There are several COs in the Middle Peninsula including Saluda, Mathews, King William, Tappahannock, Gloucester and King and Queen.

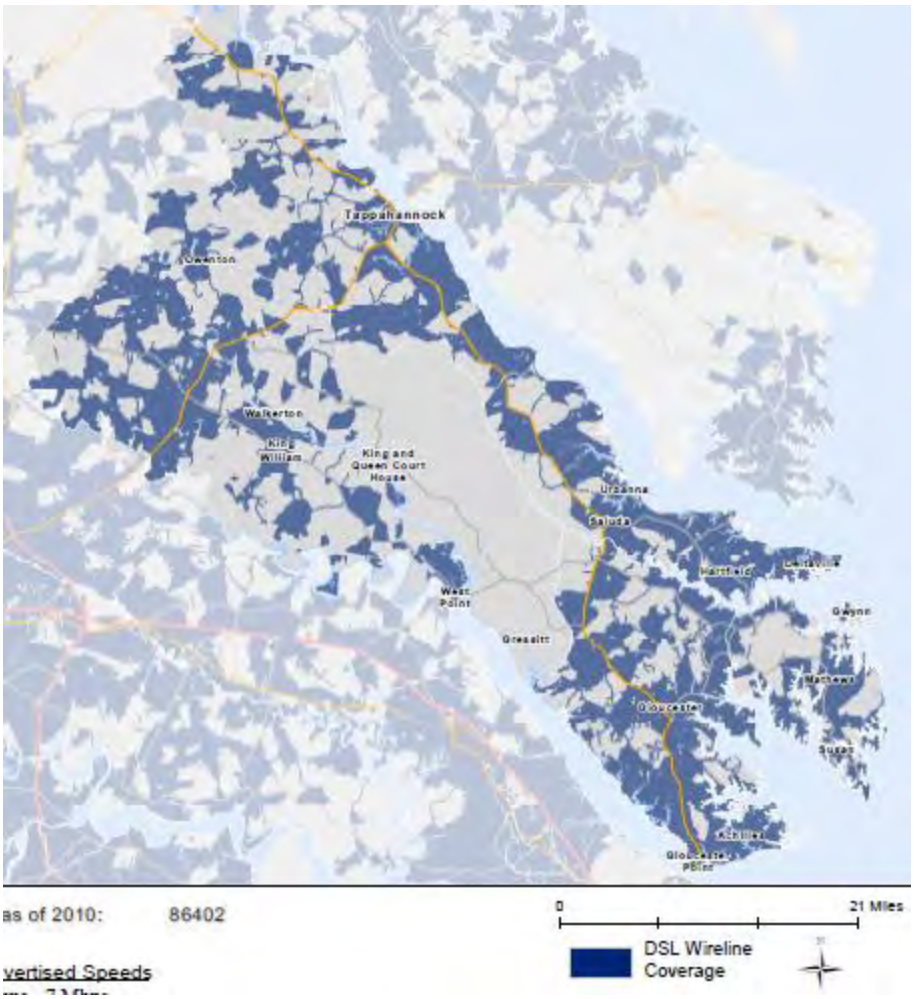

Figure 5 DSL Coverage Areas

Fiber Optic Coverage

The Virginia broadband map does not show any presence of fiber in the Middle Peninsula area. However, it is important to note that the map does not include any 'dark' or fiber not currently serving end subscribers. Remember that providers only need report service areas and type of service. Therefore, if any organization has dark fiber or fiber used only for transport that do not report it for mapping purposes.

Broadband services, no matter the type that delivers to the premise or customer facility, are dependent on a 'head end' or main location fiber connection. Typically these head end facilities for Internet service providers are served by multiple primary Internet providers (such as Windstream, Level 3, AT&T, etc.) to accomplish redundancy. These primary providers are interfaced in locations referred to as "point of presence" or POPs. The demarcation points were originally where long distance telephone carriers could terminate

their services and provide connections to local telephone companies. Today these POPs are access points to the Internet and are physical locations that house servers, routers and switches and can be in facilities owned by telecommunication providers or Internet service providers.

In assessing an area to determine broadband options we must also evaluate the location of POPs to understand the challenges in bringing Internet service into an area. In the Middle Peninsula, the serving POPs for all providers are located in Richmond. This does provide some challenges for providers extending their services as well as for any potential new providers to the area.

Fixed Wireless Broadband Technology

Fixed wireless technology consists of transmitters typically mounted on towers that send radio signals to receiver antennas mounted on buildings/houses. These radio signals can travel up to 25-30 miles for large 'backhaul' or transport equipment and 15-20 miles to receivers. This type of wireless technology has required line-of-sight to the transmitter, however, new WiMax technology now has the ability to shoot through and around the more frequent challenge of tree canopy. Equipment manufacturers are beginning to provide technology that will utilize the television "white space" recently made available with the move to all digital television broadcasting. This new "white space" frequency has the ability to push through obstacles currently impeding current technologies and frequencies such as tree foliage. Fixed wireless technology is the most economical and easily deployed last mile solution and is well suited for rural, challenging terrain and where there is little to no funding available for fiber deployment.

There is limited fixed wireless coverage in the peninsula – originating in the Northern Neck and now in King and Queen County. At this time Northern Neck Wireless is the only fixed wireless provider contributing their data for mapping. We are aware of other wireless providers – Middle Peninsula WiFi and VA Broadband – in the area and are working to obtain their data. We have been advised both providers have limited coverage at this time. We have not yet pursued King and Queen County and Gamewood to participate in our mapping but hope to include their service coverage area in the future.

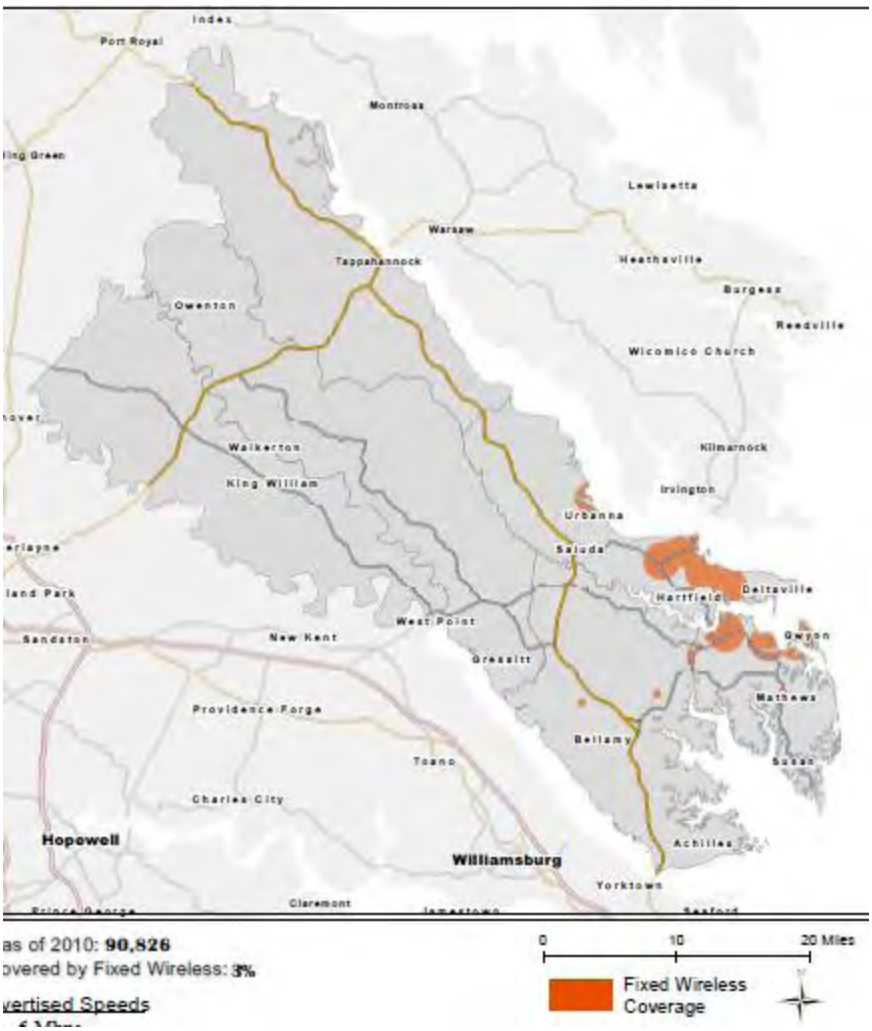

Figure 6 Fixed Wireless Coverage

Business Case Analysis

The greatest challenge to any broadband deployment initiative is funding – grants, private investment, local general fund tax dollars or other sources. This section is all about thinking creatively on how to leverage the assets, reduce costs, reallocate current spend and make deployments easier.

Middle Peninsula Coverage Assessment

In comparing the combination of DSL and cable coverage areas and census population density it is clear there are gaps, the larger ones noted in the map below by red circles. The wireless network deployed recently by King and Queen will certainly fill most of the gaps in that county. There are a significant number of areas that are not served. One exception may be Mathews as estimates appear to show MetroCast is covering most if not all of that county. It is important to note there are a number of vertical assets throughout the Middle Peninsula either within the noted gaps or certainly in very close proximity. These vertical assets are denoted in the map below by the black triangles. These vertical assets could be leveraged with wireless technology to expand broadband options to these unserved areas.

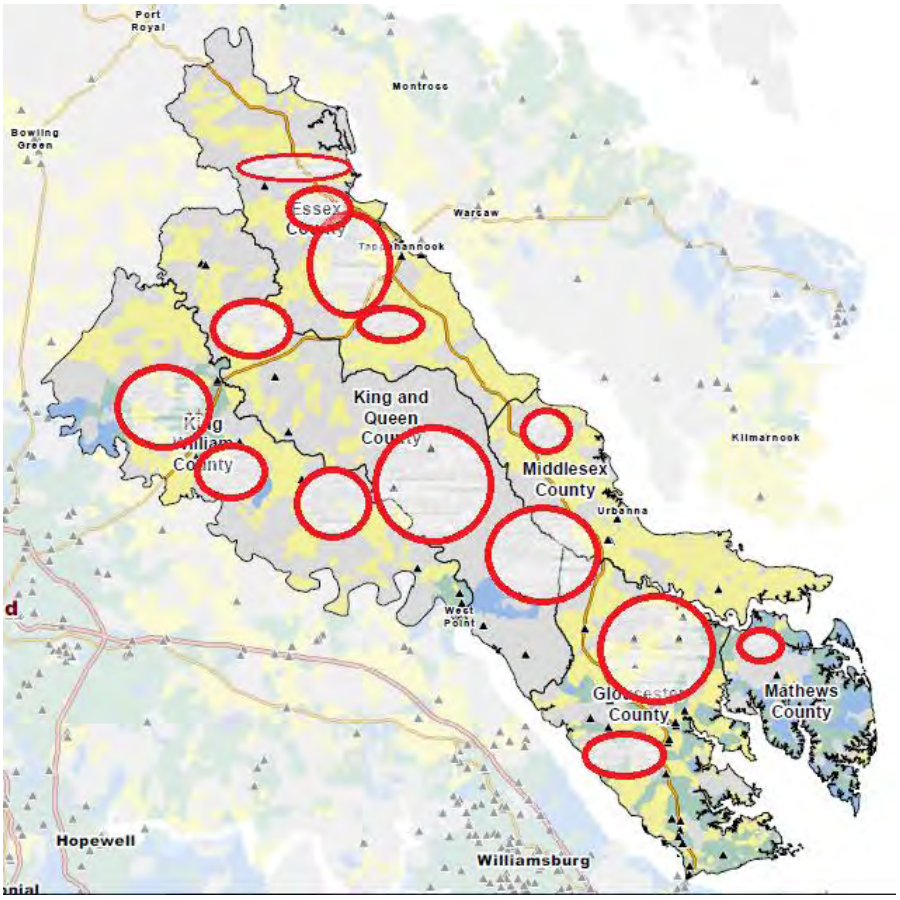

Figure 6 Middle Peninsula Broadband Coverage Gaps

Reallocate Existing Telecom Spend

Any broadband initiative should include an audit of current telecom expenditures as some of these expenditures will be reduced with the broadband expansion and that money could be reallocated to buy-down the cost of the deployment or required infrastructure. For instance, the region could consider paying for Internet services in advance to a partner provider to ease the capital investment of the provider, accelerating deployment. Additionally, a partner provider could assist in recommending alternate, Internet-based, solutions to further reduce the region's telecom expense.

Telephony Costs – PBX Extensions via OPX Lines

The Internet is quickly becoming an important communication channel for citizens and businesses. Voice-over-IP is readily available to everyone that has a broadband connection and this technology can reduce telecom expenditures for citizens and businesses. Video conferencing is also readily available as an accepted Internet application. The following table lists the current municipal telecom expenditures reported for this study and these should be considered as expenditures that could be reduced and funds allocated to these expenses could be diverted to fund broadband connections.

Locality	Annual Telephone Service Costs	OPX Lines in Use?
Middlesex County	$3,763	No
Town of Urbanna	$5,650	No
Gloucester County (including Schools)	$294,736	No (fiber between buildings; wireless point-to-point & gigabit between schools via Verizon
Mathews County	<not reported>	
King and Queen County	<not reported>	
King William County	<not reported>	
Essex County	<not reported>	
Town of Tappahannock	<not reported>	

Reducing Cost of Deployment

Leveraging Existing Vertical Assets

Wireless broadband technologies can leverage many types of structures to mount transmitters including towers, water tanks, silos and building roof tops. It is most cost effective to consider all existing structures when designing a broadband network. The following table identifies a county by type of existing structures by locality.

Locality	Existing Vertical Assets
Middlesex County	5 cell towers and 1 water tower
Town of Urbanna	1 100' water tower
Gloucester County	15 cell towers, 8 radio towers, 2 water towers
Town of West Point	3 towers
Mathews County	<not reported>
King and Queen County	<not reported>
King William County	<not reported>
Essex County	<not reported>
Town of Tappahannock	<not reported>

In reviewing the existing Vertical Asset Inventory, there are 21 publicly (locally) owned vertical assets that are located in key areas adjacent to or in close proximity to the unserved areas of the region.

The towers that are supporting the King and Queen wireless network can most definitely address many of the un-/under-served areas of the region. King and Queen's Newtown tower is perfect for addressing the unserved area west of Tappahannock and the northern unserved area of King William county; their South Tower can serve the area west of Urbanna; their Canterbury Tower can serve a portion of King William as well as the unserved area just south of Tappahannock. Their Courthouse tower may be able to serve another unserved area in King William county and the small unserved area in the northern portion of Middlesex county.

The following table lists those key assets that should be included in any broadband deployment plan. Included in the third column is a recommended Phase (1-4) as prioritized by census tract and the actual census tract number of that location.

Latitude	Longitude	Structure Type	Phase – Census Tract	Structure Height	Structure Address	Structure City	Structure Owner Name
37.358599	-76.5272	TANK	P1 – 1002	55	.7 Mi W Of White Marsh Va	Gloucester	Gloucester, County of
37.391799	-76.5238	TOWER	P1 – 1002	91.4	6584 Beehive Drive	Gloucester	York, County of
37.409399	-76.6022		P4 - 1001	21	Int Of Rt 606 And Rt 615	Sassafras	Gloucester, County of
37.414199	-76.5264		P1 - 1002	15	Int Main St And Walker St	Gloucester	Gloucester, County of
37.417699	-76.5286	TOWER	P1 - 1002	57.9	Justice Drive	Gloucester	York, County of
37.419699	-76.6258	TOWER	P4 - 1001	57.9	4 Mi Nw Of Int Rt 17 Byp And Rt 17	Gloucester	York, County of
37.436399	-76.33	TOWER	P4 - 9514	128	2 Km S Int 611 & 621	Mathews	Mathews, County of
37.607499	-76.5947		P4 – 9510	55	Int St Rt 33 & 17	Saluda	Middlesex, County of
37.523599	-76.498		P1 – 1002	12	Rt 606 One Mi N	Harcum	Gloucester, County of
37.502199	-76.5644	TOWER	P4 – 1001	61	1.2 Mi Nw Of Pinero Va	Gloucester	Gloucester, County of
37.740299	-77.1297		P1 - 9501	0	Int Sr 662 And 30	King William	King William, County of
37.745299	-77.1356	TOWER	P1 – 9501	15.2	11962 King William Road	King William	King William, County of
37.754399	-77.1494	B	P1 - 9501	15.2	91 Carlton Court	Aylett	King William, County of
37.891699	-76.8772	TOWER	P1 - 9507	85	0.5 Mi From Int Of Rt 360 & 17	Tappahannock	Essex, County of
37.669699	-76.8783	TOWER	P2 - 9504	61	Int Rts 14 & 655 100 Yds S On 655 Cthse	King And Queen	King and Queen, County of
37.681099	-77.0008	TOWER	P3 - 9502	27.4	King William Courthouse	King William	King William, County of
37.731399	-77.0172	TOWER	P2 - 9504	30	Int Rts 1203 & 629 Nw Cor Walkerton Vfd	Walkerton	King and Queen, County of
37.761899	-77.1222	B	P1 - 9501	15.2	1999 Kennington Parkway	Aylett	King William, County of

Local Government Owned Land

Local government-owned land can easily be leveraged for future infrastructure build-outs including towers, poles, huts, etc. The following localities have indicated some local government land may be available:

- **Middlesex County**- Minimal available space but Middlesex has several landings and various parcels of properties that may be of use.
- **Town of Urbanna -** limited space is available by the Town's water tower, Taber Park and behind the Town office on Cross St.
- **Gloucester County** - the county has 84 vacant parcels and the schools have 10 vacant parcels.
- **Town of West Point** - has some parcels in the industrial park

How to Fund Broadband Expansion

How to Buy-Down The Cost

Existing Telecom Expenditures

Voice-over-IP is one of the greatest cost-saving applications enabled by broadband connectivity. The current telecom expenses gathered for this study was incomplete; however, the data submitted indicates there is more than $305,000 spent annually by the region for telecom services. There is a tremendous opportunity for significant cost savings with the expansion of broadband services. This potential grows exponentially if citizens' and businesses' telecom services are considered as part of this expansion.

Current Internet Service Costs

The Middle Peninsula local government facilities need to combine their total current Internet service costs and consider that expenditure could be diverted to a partner to facilitate broadband deployment or expansion. Typically the peninsula organizations are buying Internet service from different providers. If they aggregate this service it will maximize their buying power. This aggregated demand can offer sustainability to any provider while ideally lowering everyone's cost for Internet service. The following table does not represent a full inventory of Internet expenses in the region, only those reported for this particular study. This information should be completed prior to any broadband initiative.

Locality	Current Annual Internet Service Cost
Gloucester County	$ 55,896
Gloucester County Schools	$340,800
Town of Urbanna	$ 2,000
Middlesex County	$ 17,500
Town of West Point	$ 4,788
King William County	<not reported>
Mathews County	<not reported>
King and Queen County	<not reported>
Essex County	<not reported>
Town of Tappahannock	<not reported>
Total Reported	**$420,984**

Public Safety Communications Projects

Consider broadband infrastructure needs whenever planning public safety radio upgrades. Include space to accommodate at least 4 providers in addition to the locality's equipment when planning any new towers. Electronic or network equipment cabinets at tower sites should be large enough to accommodate providers' equipment in addition to the locality's radio equipment. Plan the tower site security to allow for providers to have access to maintain their equipment.

The following localities have indicated they have plans to upgrade their public radio systems:

- **Middlesex County** -- radio upgrades are planned for their emergency services / e991/ dispatch. Just completed vesta pallas upgrade to the phones.
- **Town of West Point** – a new radio system and HRSD is discussing erecting a tower at their site in the industrial park.

Leverage Federal Funds

e-Rate Funding for Schools

- The federal E-rate program provides subsidies to schools and libraries, including funds to upgrade services under certain circumstances.
- The specific resources funded through these programs are restricted to be used only by qualified schools, libraries and research institutions, but in many cases those specific resources can be purchased from or be made part of a larger project.
    - This service can be aggregated as part of total demand for the region and provide maximum buying power when negotiating with providers.

Federal Economic Development Administration

- The EDA will partially fund public works projects used for economic development purposes.
- Broadband projects are theoretically eligible for this funding, and it is ideally suited to funding lateral extensions to under and unserved commercial and industrial areas.
- More specifics about this grant opportunity can be found at the Grants.gov website (http://www.grants.gov/search/search.do;jsessionid=knDpQzXGJ6gWnzy1h6Tn3D1fjKBNK9Fw40vlTDxWx3xrJGpLpCN4!-861966415?oppId=208353&mode=VIEW)

Federal and State Agencies for Telemedicine

- Federal and State agencies provide funding for broadband resources that support telemedicine programs.

- Typically, telemedicine programs buy services from existing providers rather than constructing facilities, and can potentially be anchor tenants of new broadband projects.
- The possibility of tapping into these funds should be considered whenever a health care provider can be served by proposed lateral or other network extensions.
- The Telemedicine.com site keeps current all related grant information (http://www.telemedicine.com/grants.html).

Evaluate Grant Opportunities

Virginia Department of Housing and Community Development (VDHCD)

http://www.dhcd.virginia.gov/index.php/business-va-assistance/telecommunications.html

Rural Broadband Planning Initiative

- Funding feasibility studies of best last-mile solutions for rural areas
- Can cover:
    - assist in promoting awareness of potential eligible activities and gauging stakeholder interest;
    - creating a management team of potential user groups to oversee the creation of a telecommunications plan;
    - conduct surveying efforts to document the eligibility of future telecommunication planning and implementation efforts for DHCD funding;
    - conduct informational and training programs; and
    - identify and procure professional assistance as necessary.
- Develop Community Telecommunications Plans
    - needs assessments and asset inventory;
    - analysis of current and future business and professional uses and applications;
    - assessment of community computer literacy and identification of technology education needs;
    - determination of need for, and nature of, broadband infrastructure;
    - network organization and operation;
    - funding strategies; and
    - the marketing of a network
    - address needs and opportunities for residential users to have universal access at high speed with competitive prices.
        - Universal access should not be the primary focus of the planning process.
    - there should be an emphasis placed on collaborations with private-sector providers, to maximize the provision and affordability of services to the community at large.
- Eligibility:

    - any public entity (such as units of local government, planning district commissions), non-profit organization, authority or cooperative which has the support, direct involvement, and endorsement from the participating local government, and will agree to undertake a comprehensive community telecommunications planning effort is eligible to apply.
- Funding Amount:
    - up to $25,000 per project is available for Telecommunications Planning Grants. DHCD's experience is that the maximum available amount for telecommunications planning grants is not sufficient to complete the activities required to create a community telecommunications study. Applicants are expected to show additional funding is available and committed prior to receiving a planning grant offer.

VDHCD Telecommunications Projects

- Telecommunications efforts, which may include
    - implementation (e.g., installation of a fiber network) or
    - system development and support (e.g., community business training and education), may be eligible for assistance.
- All projects must demonstrate activities that are outcome-focused and demonstrate a direct relationship between intended project efforts and measurable, tangible improvements to the health of the community being served.
- All projects must demonstrate that they meet a National Objective and demonstrate a direct relationship between intended project efforts and measurable, tangible improvements to the health of the community being served.
    - National objectives include
        - benefiting low- and moderate-income persons,
        - preventing or eliminating blight, or
        - meeting other community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community, and other financial resources are not available to meet such needs.
- Please note that CDBG funds can only be used for open-access networks that allow for competition among different service providers.
- All projects funded must first submit a community telecommunications plan for approval by DHCD.
- Only implementation projects which target "last mile" installation of broadband applications will be considered for funding. (e.g., no long-haul backbone systems will be installed)
- Eligibility:
    - applicant eligibility depends on the scope and location of the proposed project. Only units of local government in non-entitlement localities are the only eligible recipients of VCDBG funding. Virginia ARC eligible applicants include localities, planning district commissions, educational institutions, health organization, nonprofit organizations and others.
- Funding Amount:

- up to $200,000 per project is available for telecommunications
- applicants for telecommunications implementation projects under the Local Innovation Fund must provide match with local funds in an amount equal to 50% of the CDBG request up to a maximum of $100,000.

Appalachian Regional Commission (ARC)

http://www.arc.gov/funding/ARCGrantsandContracts.asp

Telecommunications Initiative

- Appropriate for initiatives that seek to stimulate economic growth and improve the standard of living in the region through technology-related avenues
- Broaden the availability of advanced telecommunications services by promoting increased infrastructure investments from both private sector and government sources.
- Ensure that the region is supporting today's workforce as well as developing the workforce of tomorrow by integrating technology into K-12 and continuing education programs plus expanding community awareness and training programs
- Improve the competitiveness of businesses in the region by increasing the adoption of e-commerce practices.
- Proposals will be accepted for the following project types:
  - planning
  - system Development and Technical Support
  - implementation
- There must be a Community Telecommunications Plan in place for the locality / region that will be served by the proposed project. This Community Telecommunications Plan must indicate that the locality has seriously considered its need and demand for the proposed project.
- ARC targets special assistance to economically distressed counties in the Appalachian Region, allowing up to 80 percent participation in grants in distressed areas
- **NOTE:** the 2013 list of Distressed Counties that would be eligible do not include any counties in Virginia.

USDA Rural Utilities Service (RUS)

http://www.rurdev.usda.gov/RD_Grants.html

Community Connect Grant

- Traditionally this program has provided grants for small scale broadband network projects that also include two public computer terminals and wireless computer connectivity in communities that cannot get broadband today.

- Must provide 2 years free service to all Community Anchor Institutions
- Provide a community center with at least two PC connects and free wireless for all for 2 years
- Urban area not next to a city with populations > 50,000
- Eligibility:
    - any organization or state/local government
    - city, town or incorporated area with population <= 20,000
- If any resident or business within a community is served by wireless, DSL or cable modem the entire community will be considered ineligible. Satellite and cellular Internet access is excluded in this service determination.
- Funding Amount:
    - $50,000 to $1,000,000
    - must provide 15% match
- NOFA usually issued in January with a 90-day window to apply.
- PROPOSED CHANGES:
    - funding recipients would be able to use their 15% matching funds toward the operating costs of broadband projects – something they can't do today—
    - and would be able to use grant funds for larger geographic areas rather than for a single community.
    - in addition, the application process would be streamlined and funding applications would be prioritized based on a variety of factors including:
        - service provided to communities in persistent poverty counties
        - service provided to communities in out-migration communities
        - the rurality of the proposed funded service area
        - the speed of service provided by the project
        - service to substantially underserved trust areas
        - services provided to persons with disabilities
        - any other socio-economic factors that may be described in the notice of funding availability to differentiate and rank applications

Distance Learning and Telemedicine Program (DLT)

- Objective to connect education and healthcare facilities for distance learning and telemedicine
- Uses the same "rurality" definition as the Community Connect program
- Does not fund transmission facilities but does fund the following:
    - computer hardware and software
    - audio and video equipment
    - interactive video equipment
    - computer network components
    - instructional programming
    - providing technical assistance and instruction
- Funding Amounts
    - $50,000 and up
    - requires a match of 15% for 100% grant

NOTE: In October of 2012, Bay Rivers Telehealth Alliance announced a grant award of nearly $250,000 for the establishment of new telehealth sites throughout the Middle Peninsula, Northern Neck and Eastern Shore areas to obtain support from medical specialists located in Hampton and Richmond. This grant will help the alliance expand the network infrastructure; links to distant clinicians; professional development for healthcare providers, etc.

Innovative Funding Models

http://www.cjspeaks.com/msp/snapshot-5-21.pdf

Promissory Notes

- Twenty-three Vermont towns created ECFiber, an LLC nonprofit corporation. ECFiber offers tax-exempt 15-year $2,500 promissory notes that effectively earn 6 percent interest. Fifty thousand people in these towns collected over $900,000 in 2011 to begin an initial build out covering 26 miles. Several additional fundraising efforts generated hundreds of thousands of dollars to continue the build out.

Investments (pre-paid)

- The Utah Telecommunication Open Infrastructure Agency (UTOPIA) is a consortium of 16 Utah cities. Community residents became "investors" in the network by paying upfront for its build out. UTOPIA CEO Todd Marriott said that "if residents were interested we'd bill them one fee of $3,000/home to connect to the network. We offered financing if they agreed to have a lien put on their houses. Over 31 percent of residents subscribed, with 25 percent of these households paying the $3,000 up front."

Donations

- The Steuben County [IN] Community Foundation created a supporting organization called iMAN that raised $2.7 million through mostly local donations to build a dark fiber network infrastructure. iMAN sells the dark fiber to businesses that in turn contract with ISPs to turn on the fiber and sell Internet services. Sixty-five percent of activation fees go to the Foundation whose Board of Directors fund local economic development projects.

Crowd-funding

- Crowd-funding has been used in the private sector to gather people with a common interest to pool their resources – typically money – to fund an event or service and typically leverage social media (Facebook, etc.) to build the momentum.
- A technology company in Kansas City – Neighbor.ly – is working with some local governments to use crowd-funding to solicit support (money) from residents to fund and promote services they want. Kansas City is using this service to expand the number of neighborhoods eligible for the Google fiber network and another effort to raise money (over $400,000) to establish a downtown bicycle-sharing program.

Loan Opportunities

USDA Rural Utilities Service (RUS)

http://www.rurdev.usda.gov/RD_Loans.html

Farm Bill Broadband Loan Program

http://www.rurdev.usda.gov/utp_farmbill.html

- The program funds the costs of construction, improvement, and acquisition of facilities and equipment to provide broadband service to eligible rural areas on a technology-neutral basis.
- Direct loans are in the form of a cost-of-money loan, a 4-percent loan, or a combination of the two.
- Broadband loans provide funding for:
    - the construction, improvement, and acquisition of all facilities required to provide service at the broadband lending speed to rural areas, including facilities required for providing other services over the same facilities;
    - the cost of leasing facilities required to provide service at the broadband lending speed if such lease qualifies as a capital lease under GAAP (Generally Accepted Accounting Principles);
    - an acquisition, under certain circumstances and with restrictions (see the interim rule for more details).
- Eligibility:
    - rural area means any area, as confirmed by the latest decennial census by the U.S. Census Bureau, which is not located within: (a) A city, town, or incorporated area that has a population of more than 20,000 people; or (b) An urbanized area contiguous and adjacent to a city or town with a population of more than 50,000 people. An urbanized area means a densely populated territory as defined in the latest decennial census.
    - to be eligible for a broadband loan, an applicant may be either a nonprofit or for-profit organization, and must take one of the following forms: (1) Corporation; (2) Limited liability company (LLC); (3) Cooperative or mutual

organization; (4) Federally recognized Indian tribe or tribal organization; or (5) State or local government, including any agency, subdivision, or one of their units.

- a service area may be eligible for a broadband loan if all of the following are true: (1) The service area is completely contained within a rural area; (2) At least 25 percent of the households in the service area are underserved households; (3) No part of the service area has three or more incumbent service providers; (4) No part of the funded service area overlaps with the service area of current RUS borrowers and grantees; (5) No part of the funded service area is included in a pending application before RUS seeking funding to provide broadband service.

Virginia Resources Authority

http://www.vra.state.va.us/projectfinancing.shtml

Loan Programs

- The Virginia Resources Authority provides innovative, cost-effective and sustainable financial solutions to build vibrant and healthy Virginia communities. Created by the General Assembly in 1984.
- Will finance broadband infrastructure and equipment (wired and wireless).
- VRA makes loans to counties, cities, towns, and authorities in several loan programs with the advantage of below market rates or credit enhancement.
- VRA conducts a thorough credit review of each project and borrower in its loan programs and provides post closing monitoring of every loan.

Recommendations

Facilitate Citizens Locating Providers

Many localities that are working to bring broadband to their constituents are finding that many times citizens just do not know the providers that are available. It is recommended that the planning district website and all localities' websites in the area (counties and towns) include a list of Internet service providers in the area with contact information. This will make it easier for citizens or businesses moving to the area to contact existing providers and evaluate broadband options. It is also recommended that each website include a link to the Virginia broadband map as it supports the ability to search for providers based on an address (http://mapping.vita.virginia.gov/broadband/).

Ensure a Broadband "Friendly" Zone

It is important that all local building and zoning ordinances facilitate broadband deployment and not inhibit construction or expansion. One of the first lessons Google learned from its fiber project in Kansas was that government needs to start waiving regulations, fees and bureaucracy if it wants private companies to build broadband networks. Every locality is encouraged to expedite the permitting process for telecommunications deployment and reduce costs of that deployment wherever possible. Providers consider all costs associated with infrastructure builds when planning deployments and expansions – localities need to help make these builds cost effective to encourage expansions. Localities should include broadband infrastructure into all of their plan reviews just as they do for other utilities.

Every attempt was made to review all county and town ordinances in regards to the following recommendations; however as that is an arduous process it is recommended that the local planning and building staff consider these recommendations for their locality. Following are just a few of the steps that localities are encouraged to take to ensure their communities are prepared to support broadband telecommunications deployment today and in the future.

Telecommunications Wiring

Local ordinances should include updated guidelines for telecommunications wiring in all buildings and homes for CAT5/6 wired directly to the central circuit using "home run wiring" or "star topology", not branched or daisy chained. All use of CAT3 and non-twisted pair wiring should be discontinued.

Each point where the wiring is chained opens up the possibility of interference, power influence, and improper wiring termination. For FTTH and even DSL in conjunction with

IPTV, it is extremely important to have home runs. POTS (plain old telephone) service only takes two wires (1 Pair). 100Mbps Ethernet takes 4 wires (2 pairs); 1,000Mbps takes 8 wires (4 pairs). A CAT5/6 wire is twisted pair and has 4 (twisted pairs). The reason for the twist is to reduce "cross talk" between pairs, especially if they are used for separate services (for example: you can use 2 pairs for 100Mbps Ethernet and 1 pair for phone service).

Renovations of older structures should include provisioning non-metallic conduit, to allow telecommunications services to enter the building, feeding into centralized "communications rooms". The non-metallic conduit should be equipped with radius elbows that won't kink the telecommunication cables. The conduit should be adequately spaced from electrical wiring. Conduit and electrical wiring should never cross paths, if possible. Renovation blueprints and other documentation should always include telecommunication conduit routes.

Wiring Policies Findings

No reference to type of wiring to be used in buildings or homes was found in any of the county or town local ordinances. All local code should be modified to specify telecommunications wiring as indicated in the recommendation above.

Grounding Codes

All localities should ensure that grounding codes are up-to-date and adhere to the residential and commercial codes. Common grounding in buildings is critical to equipment protection and aids in limiting power surges, lightning damage and power influence. Improper building grounding can impact the delivery of broadband services to an entire neighborhood, not just the improperly grounded building.

AEP has recently updated their policies and will no longer allow other utilities to attach a grounding clamp to the meter base. There is a grounding/bonding bus bar that is being placed on some newer houses. The grounding/bonding bus bar is attached to a ground wire that goes back to the panel box and has a series of set screws for other utilities to attach under.

Grounding Policies Finding

No reference to grounding codes to be used for buildings or homes was found in any of the county or town local ordinances. All local code should be modified to specify ground wiring as indicated in the recommendation above.

Permitting Policies

All permitting policies should be reviewed and modified to facilitate broadband deployment and expansion. Permitting requirements vary by locality and some require weekly or daily permits instead of an overall project permit. This type of granular permitting creates delays which equates to additional expense and budgeting issues, and administrative overhead for

both the service provider and locality staff. Some localities depend on permits for tracking where work is being conducted. Some service providers recommend requiring maps and weekly updates (not permits) to indicate where infrastructure work is being done and when. Localities should expedite the permitting process as it relates to telecommunications construction such as towers, huts, etc. and control fees where possible.

Permitting Policies Findings

No indication that the Middle Peninsula localities require daily/weekly permits for projects. There appeared to be no specific consideration for telecommunications projects or exceptions for towers, huts, etc. All local code should be modified to expedite the permitting and review process for broadband deployment and infrastructure projects.

Utility Zoning for Telecommunications

Very few Virginia localities have setup utility zoning. Normally, the lots that telecommunications huts or co-location buildings are built on do not need to be as large as a residential or commercial lot. The facilities need enough land to have a grounding field, for earth grounding electronic equipment, and room for backup power such as a generator which may require fuel storage tank when natural gas is not available at the site. Excessive zoning requirements like setbacks and green spaces can inhibit a provider's ability to purchase or use a site; it should be possible for these sites to have small footprints.

Utility Zoning Findings

No indication was found that the Middle Peninsula localities have implemented utility zoning. There appeared to be no specific consideration for telecommunications projects or exceptions for towers, huts, etc. as related to setbacks and lot size. All local code should be modified to include utility zoning to ease the construction of telecommunications equipment.

"Dig Once" Policy

Considered by many to be the easiest and most effective policy change to help expedite and reduce the cost of future broadband deployment. "Dig once" policies are designed to reduce the number and scale of repeated excavations for the installation and maintenance of broadband facilities in rights of way.

The largest expense of building out broadband infrastructure is the construction phase. "Greenfield utility deployments" (development of utilities like telecommunications, water, electric, etc., before buildings, roads and sidewalks are paved) are always less expensive than deploying to an area that is already developed.

A few ways localities can facilitate broadband deployment though "dig once" policies:

- Require developers to have large utility easements that allow for placement of all utilities, including telecommunications infrastructure or conduit, underground before roads or paved and sidewalks are poured.
    - this can be taken a step further by defining standards for where each type of utility is placed in the utility easement in order to minimize utilities crossing each other and the need for "pot holing" to locate other utilities.
- Localities can partner with developers to plan the installation of open-access conduit systems (including service access pedestals and/or hand holds) throughout any new development at the time other underground utilities are installed, ensuring the conduit system is brought to the main development entrance where telecommunication providers can access the conduit for service delivery.
- When a locality plans to renovate, repair or build new streets, sidewalks, parking lots etc., open access conduit could be installed when the ground is open. During the planning stage, all service providers should be notified of the opportunity to utilize the conduit or to coordinate with the locality for new infrastructure installation. If open access conduit is installed, it could be leased to service providers thus paying for itself over a period of time. It can also be used to manage tight right-of-way areas.
- The open access conduit system would need to strategically place adequate hand holds and/or pedestals for service providers to use and to house splice cases.

"Dig Once" Policy Findings

Although there was some reference to conduit for broadband support in a few comprehensive plans, there was no specific indication that the Middle Peninsula localities have implemented a "dig once" policy. All local ordinances should be modified to include a "dig once" policy and reference an open access conduit system. Ideally there should be an open access conduit system plan for each locality.

We recommend that all localities encourage fiber deployment in duct or conduit installation rather than direct burying of fiber. All localities should offer joint trenching with local government conduit or duct installed alongside private duct so that the localities begin to deploy a duct system that can be leased out to generate revenue and as a way to preserve right-of-way for future use.

Partner With Incumbent Providers

It is important that local government leaders meet with the incumbent providers – cable and telephone companies – to share the above recommended policy changes. The incumbent providers should be made aware that local governments are going to make policy changes to improve infrastructure construction and make broadband deployment easier and less costly. This should encourage further build-outs throughout the region. Discussions with the existing providers may uncover additional barriers to broadband deployment that should be included in these policy changes.

Share the identification of the broadband service coverage gaps identified in this report with the providers to discuss un-/under-served areas near their coverage. Discuss what it would take to expand their coverage and bandwidth for the future.

It would be beneficial to discuss with these providers what skills they see lacking in community workforce. Local governments, through their workforce development resources, design programs to address these skill deficiencies, meeting the needs of the local providers and promoting job growth.

Fixed Wireless Technology

As mentioned earlier, fiber is the ideal technology for delivering broadband services. However, the cost to deploy that technology is very high and may not be feasible for years and may have to be deployed in phases over many years. The study performed in 2008 by Icon Broadband Technologies presents a solid recommendation for a middle-mile fiber solution and that recommendation should be considered whenever future funding is available for the area to deploy fiber.

This recommendation is to pursue a fixed wireless solution that can deliver broadband service to CAIs, businesses and citizens. Certainly some facilities may require connectivity greater than can be provided by today's fixed wireless technology but the majority can easily be serviced by this technology. Fixed wireless technology is easily deployed and portable so it can be re-deployed to other unserved areas as wireline providers expand their services. This is a solution for today and tomorrow as it can augment wired and cellular networks and future fiber deployments.

Fixed Wireless Technology Facts

Fixed wireless is the most cost effective technology to deliver broadband to residences and businesses – especially in rural and low-population density areas. This technology leverages radio frequencies – licensed or unlicensed – to transmit signals between towers and to businesses and residences. These networks are referred to as point-to-multipoint as one transmitter can transmit to many customer sites. Fixed wireless technology can deliver high throughput over reliable and scalable networks. Providers have a "head end" location that supplies their wireless network with multiple fiber Internet services providers for redundancy. This fiber-fed Internet service is then distributed across the wireless technology and can span 25-30 miles for backhaul and up to 15-20 miles for customer sites.

This technology is not affected by weather but does depend on line-of-sight (LOS) or near-line-of-sight (nLOS) to a transmitter. Tree canopy and hills can disrupt signal, however, the technology is advancing rapidly and there are some WiMax version that have proven very good at transmitting through tree canopy. Some wireless Internet services providers (WISPs) are now using utility poles to mount equipment and 'hop' into neighborhoods that do not have LOS to existing towers. Equipment does require some electric power but there have been successful implementations utilizing solar in some of the more remote tower locations.

Recent technology advances have moved to software upgrades which allow providers to push out new features without having to physically touch the equipment.

Fixed wireless technology is delivering broadband service to millions of customers around the world in many different environments. The technology has exceptionally low outage rates and has advanced quickly over the last several years. The fixed wireless equipment can be co-located on towers with all other types of equipment without interference which allows areas to leverage existing vertical assets. This technology can provide tiered service models allowing customers to choose the bandwidth speeds they need between 1Mbps to 55Mbps and possibly beyond. It has very low latency that is consistently 5-7 milliseconds which is lower and more predictable than some other technologies.

There are no trenches to dig and no copper or fiber to lay making deployment easy and affordable. The technology has been proven for over 10 years all over the world and the latest technology easily supports triple-play (voice, video and data).

A Public-Private Partnership

A public-private partnership with an Internet service provider can limit the region's financial exposure while expanding broadband options and potentially increasing job growth. As outlined in the appendix, Franklin County has proven to be a very sustainable model and realized growth during an extremely tough economy. Franklin County local government benefited in many ways from this partnership over the past eight years including improved communications, lowered telecommunications costs and several temporary communications support during different initiatives.

In Franklin County the local government contributed some general fund investment early in the partnership – funding equipment and infrastructure such as towers. As the network grew and the private partner's business expanded, the county had little need to invest more money. The Virginia legislation that supports the formation of a wireless broadband authority positions local authorities to be able to assist a private partner with obtaining a low cost loan. A low cost loan could assist the private partner during the initial network build as most wireless providers have a one to two year return on investment and that initial capital outlay can be difficult. However, it is advised that this should only be considered if the private partner qualifies for a loan on their own.

Development of a marketing and communication plan can help generate both public support for the partnership and increased subscriptions – "take rates". Higher take rates play an important role in generating initial cash flow for the private provider and ensuring financially sustainable broadband service.

There are some different models on how to construct the public-private partnership. Franklin County's model was based on providing the partner with access to all county-owned vertical assets at no monetary cost to the provider but an exchange of services to the county. This greatly limited the financial risk to the county while lowering the deployment costs for the provider. There was the potential risk to county services and the broadband network if

the private partner failed at business management or decided to close the business. However, since the county primarily invested in infrastructure such as towers, those investments would continue to be beneficial for years to come. The King and Queen County model and one formed years ago in King George County, is founded on the county covering the costs of the equipment and upstream Internet service while the private partner invests time and resources to design, build, operate and maintain the network. This latter model could potentially put the county at risk should something happen in the partnership and the private partner ends the relationship. The county would then own all the equipment but potentially not have the expertise or resources to maintain the operations. As mentioned earlier, fixed wireless technology is advancing rapidly and hence can become obsolete and outdated in three to five years.

It is critical to the partnership no matter which model is formed, to have a detailed agreement for the operation and maintenance of the service and supporting infrastructure. The partnership plan must lay out any ongoing responsibilities for all members within the partnership. There needs to be a responsibility to keep the network equipment up to date and regularly upgrade and expand the network.

As the nation has observed the Google fiber project in Kansas we have learned that equipment subsidies coupled with term contracts offer benefits to the consumers. Local governments or the regional authority could attempt to leverage the DHCD CDBG grant to fund the customer premise equipment costs for low-income eligible citizens to offset the full cost of deployment. Local government could then establish an assistance program for qualified (low-income, unemployed, etc.) residents to help mitigate the one time install fee, underwrite some amount of the monthly pricing package or offer discounts. This assistance improves community life and speeds broadband adoption. The assistance program could be done as a pilot program and should require the recipients to commit to a minimum contracted period of service with penalties assessed for early termination to recover the costs.

Leverage Existing Vertical Assets

The previous study conducted by Icon Broadband Technologies prioritized the census tracts based on community anchor institutions and population density. It does appear that some of these priorities should be adjusted as current coverage data indicates expansion of service in some areas since 2008. Areas that we believe should be lower priority include southern point of Middlesex County (tract 9512) and southern portion of Mathews County (tract 9514) as these appear to now be served by multiple providers. Another factor in an adjustment to the prioritization is King and Queen County's wireless initiative. A view of the census tracts for the region for reference follows.

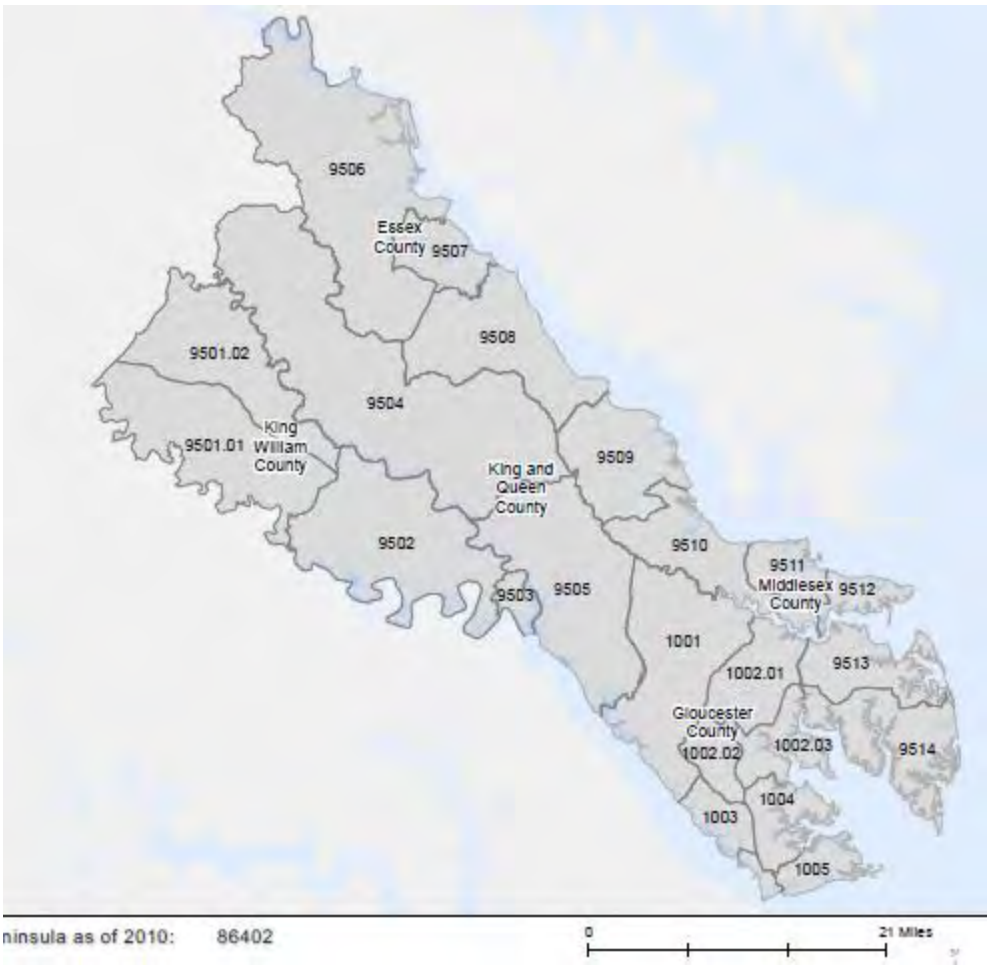

Figure 7 Middle Peninsula Census Tracts

The modified suggested prioritization is as follows:

	County	Census Tract
Phase I	King William	9501
	Essex	9507
	Gloucester	1002
Phase II	Essex	9506
	King & Queen	9504
	Gloucester	1002
	King William	9503
Phase III	Essex	9508
	King and Queen	9506
	King William	9502
	Middlesex	9509
	Mathews	9513

This prioritization is considered in regards to listing the vertical assets in this particular order. However, the chosen private partner may need to build-out differently

depending on where their head-end service is located. The prioritization should certainly be included in an RFP/RFI to assist the provider in planning the build.

New Communications Towers

There is a need for additional towers specifically in the following two areas. One would be in King William County in the northern portion of the 9502 census tract area. Areas noted in red in the map view below represent areas that are affected by state and federal regulations. These areas could be pursued for new vertical assets; however the existing Federal and State policies would make that construction complex and potentially more costly. The areas highlighted include wetlands, floodplains and historical areas (red circles).

- Wetlands require a permit from the U.S. Army Corps of Engineers allowing the construction of the proposed antenna structure and a copy of that permit must be filed with the FCC.
- Floodplain areas required a relevant map from the Federal Emergency Management Agency showing the location of the proposed antenna structure. Additionally, a copy of the building permit from the local jurisdiction where the proposed structure will be located must show that the structure will be at least one foot above the floodplain.
- If the proposed location is within a Nationally Registered of Historic Place, that requires structures are not in violation of the National Historic Preservation Act.

It is recommended that suitable locations within the census tract are explored for a new tower.

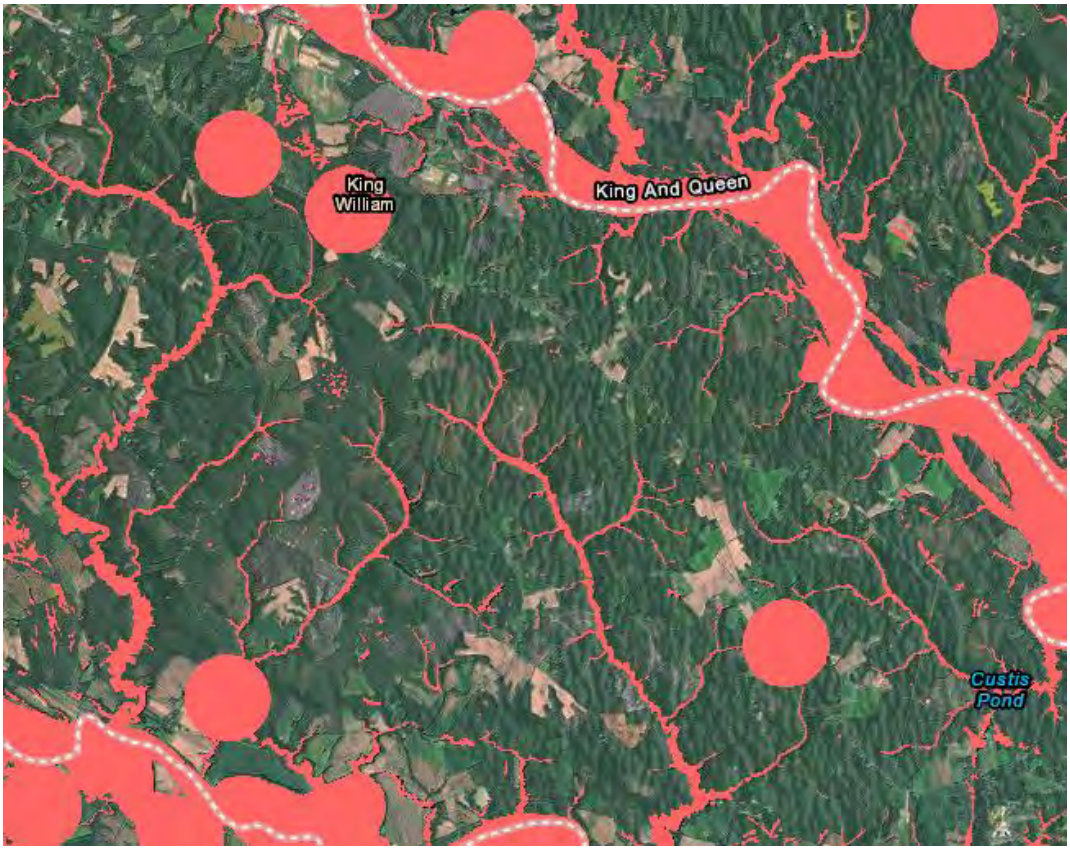

Figure 8 King William Census Tract 9502 – Unsuitable areas for tower are denoted in red

It would also be very beneficial for an additional tower in the northern area of Essex County – in the 9506 census tract. However, as depicted in the map below, there are few areas that are suitable for tower construction. It is recommended that Essex County explore these areas to locate a new tower when funding becomes available.

Figure 9 Essex County Census Tract 9506 -- Unsuitable Tower Locations are depicted in red

ISSUE AN RFP/RFI FOR A PRIVATE PARTNER

It is recommended the authority issue a Request for Proposals or Request for Information to locate a private wireless Internet provider partner. The request should include many of the details in this report including key vertical assets, aggregated demand, and prioritization of census tracts.

Additionally the request should stipulate the following terms to be met by the provider:

- Customer Service
  - no phone tree – there should be a person to answer the phone.
  - no voice mail – there should be a person to leave a message.
  - measurements of customer service and business metrics -- tracking results through reporting to the Authority at least twice per year – such as number of calls for tech support, total customers, and average wait time.
  - they should have a customer service strategy – steps or staff to go through so everyone is consistent in delivery of customer service.
- Network Build Best Practices
  - build a modular network as this will allow for upgrades without rebuilding the entire network
  - network should not be based on wi-fi technology as there are too many problems with that technology

- document the network strengths, weaknesses, opportunities and threats (SWOT) and document contingency plans
- ensure full redundancy, as much as possible considering the limitations on upstream fiber providers in the area.

CIT Broadband will be happy to assist with the development of an RFP/RFI and would assist with the review of the proposals or documents.

Broadband Adoption and Awareness

Providing all citizens and business with affordable broadband is a necessity and the goal of many communities and governments. In addition to providing broadband options, we must also ensure that citizens and businesses are aware of and prepared to leverage the many benefits that having broadband affords them. These benefits include the following:

- Financial savings
  - Lower costs by telecommuting, engage in commerce and online savings, and manage personal and business finances through online applications and services.
- Increased Productivity
  - Businesses expanding their use of broadband can increase their competitiveness in their market – increasing economic growth
- Educational benefits
  - Distance education opens doors to many that cannot afford to move to a university or have needs to stay at home to assist family members.
- Voice communication
  - Broadband provides the opportunity to leverage the Internet for voice communications and reduce telecom expenditures for both citizens and businesses. Online meetings provide ability to share documents and applications and eliminate costly travel for many meetings.
- Community Participation
  - Broadband provides social avenues that allow citizens to be more active in their society through engaging government services and community organizations to name just a few. Citizens can be more engaged and informed in government affairs.
- Improved Healthcare Access
  - Broadband supports telehealth which is important to providing improved healthcare in rural areas. The Veterans Administration has expanded home monitoring systems and has documented the improved health and savings from these systems. Electronic health records and health information exchange between doctors and health systems offers improved diagnosis and healthcare and are dependent on broadband connectivity.
- Improved Public Safety

- Law enforcement and public safety first responders are better positioned to protect and serve communities when they have fast and reliable access to information and communications through broadband connections.

Communities must provide educational resources to citizens and businesses to ensure they realize all the benefits of broadband and not just deliver broadband options. There are several online options providing digital literacy training and many community educational organizations – community colleges and workforce development centers – positioned to provide public courses.

The Middle Peninsula should provide the following resources and local programs to community organizations to ensure all are aware of the programs that are available. Consider that average "take rates" – the percentage of citizens that actually purchases broadband services when they are available – are about 60-65%. This indicates there are many citizens and businesses that have an option for broadband but may not see the need for that connectivity. This is where community outreach for awareness and education could impact citizens that do have broadband options. Once they are aware of the benefits, they could leverage the service to improve quality of life through expanded education, job opportunities and healthcare.

It is important for the region to especially target the small businesses to ensure they are leveraging broadband to improve and grow their business. CIT's Virginia e-commerce assessment results show that small businesses are impacted the greatest by leveraging the Internet and this can directly result in job growth in the region. It is recommended the region share the following resources and any local programs with the chambers and any other local business organizations.

Following is a list of current online resources to provide training for citizens and businesses:

- Start-Up Savings
  - created by the Internet Innovation Alliance (IIA) and the Small Business and Entrepreneurship Council (SBE Council) to show businesses how broadband can lower costs and barriers to business startup.
  - http://internetinnovation.org/small-biz/
- Microsoft's Online Digital Literacy training
  - Microsoft has created an extensive curriculum for all skill levels for free. This online training is focused on Microsoft products but does include the very PC and online basics. It does not require that you own the Microsoft products but there is a requirement that it is accessed by a Windows PC using Microsoft's Internet Explorer browser. The curriculum includes assessments to ensure participants are mastering the lessons.
  - http://www.microsoft.com/about/corporatecitizenship/citizenship/giving/programs/up/digitalliteracy/default.mspx
- DigitalLiteracy.Gov
  - a portal created by the Obama Administration to provide a plethora of online resources delivering digital literacy training and services.
  - http://www.digitalliteracy.gov/
- Digital Literacy Portal

- a web portal created through a collaborative project run by Link Americas Foundation (LAF) and Kempster Group promoting Information and Communication Technologies and Digital Literacy training. The portal provides many resources available for training including materials.
- http://www.ictliteracy.info/ICT-Training.htm

APPENDICES

VIRGINIA MODELS DETAILS

UTILITY OWNED FIBER

Bristol Virginia Utilities (BVU)

Bristol Virginia Utilities is a national model and the first city in the nation to build a fiber-to-the-home (FTTH) network. BVU began planning their fiber network in the late 1990s followed by deployment of fiber-to-the-premise (FTTP) in 2001 reaching 6,000 customers in just the first two years. The initial customers were municipal buildings, their own electrical substations and schools. BVU was the first municipal utility in the nation to build a fiber network delivering 'triple-play' – phone, Internet and cable TV. BVU transitioned over the years from being owned by the city to being owned by an authority (2010) and are continuing expansion including smart-grid technology through some BTOP and Tobacco Commission funding. It is important to note that BVU's initial goals were -- as with most municipal fiber networks – to lower telecommunications services prices.

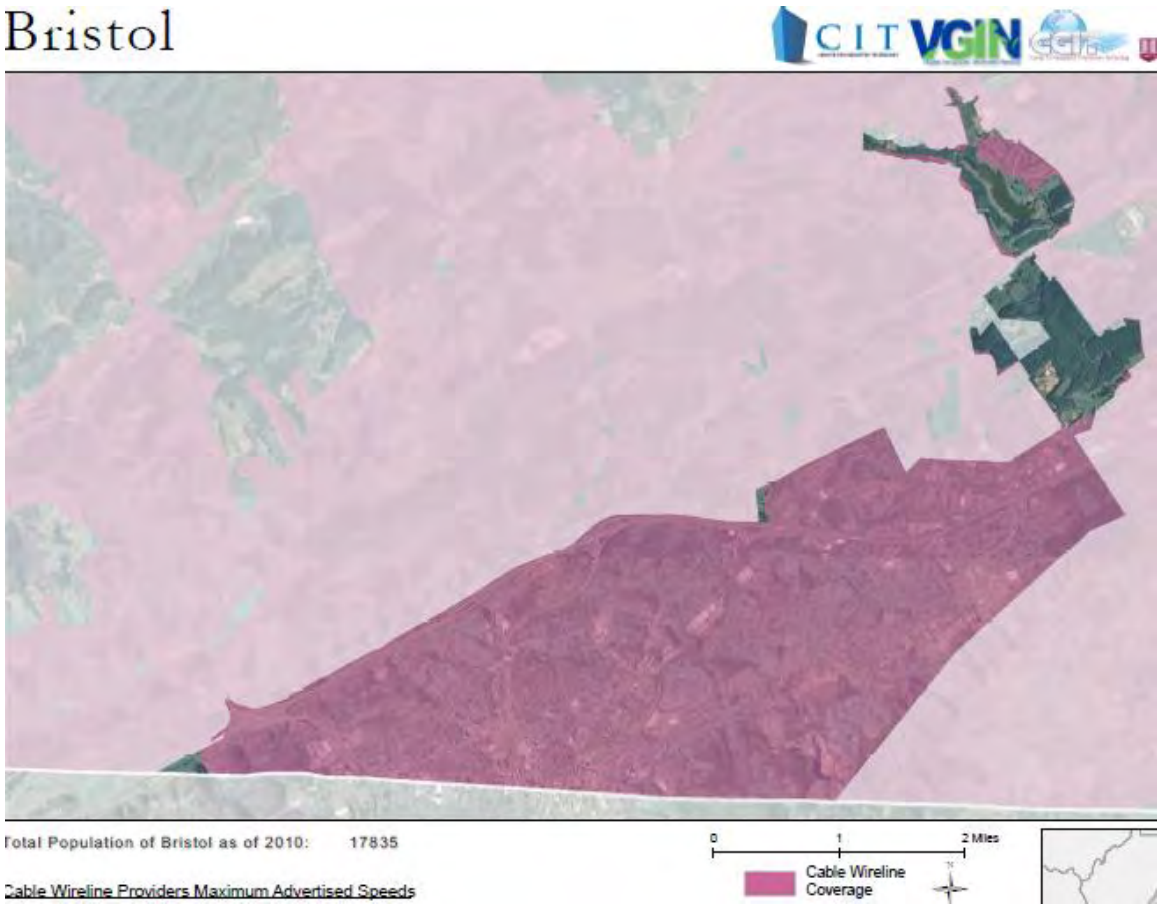

Figure 10 Bristol VA Cable Coverage

Danville's nDanville Network

In 2004 Danville Utilities began building fiber to connect approximately 120 local government and the public school system buildings. Since inception they have expanded to connect approximately 100 businesses and then in 2011 began a residential connection pilot. This network is an open-access network allowing private sector providers to sell services to the connected businesses and citizens – the city does not sell services except to providers to use the network. For comparison, below are maps of the nDanville fiber network and cable and DSL coverage from the Virginia Broadband map. As expected, Danville has very good cable coverage.

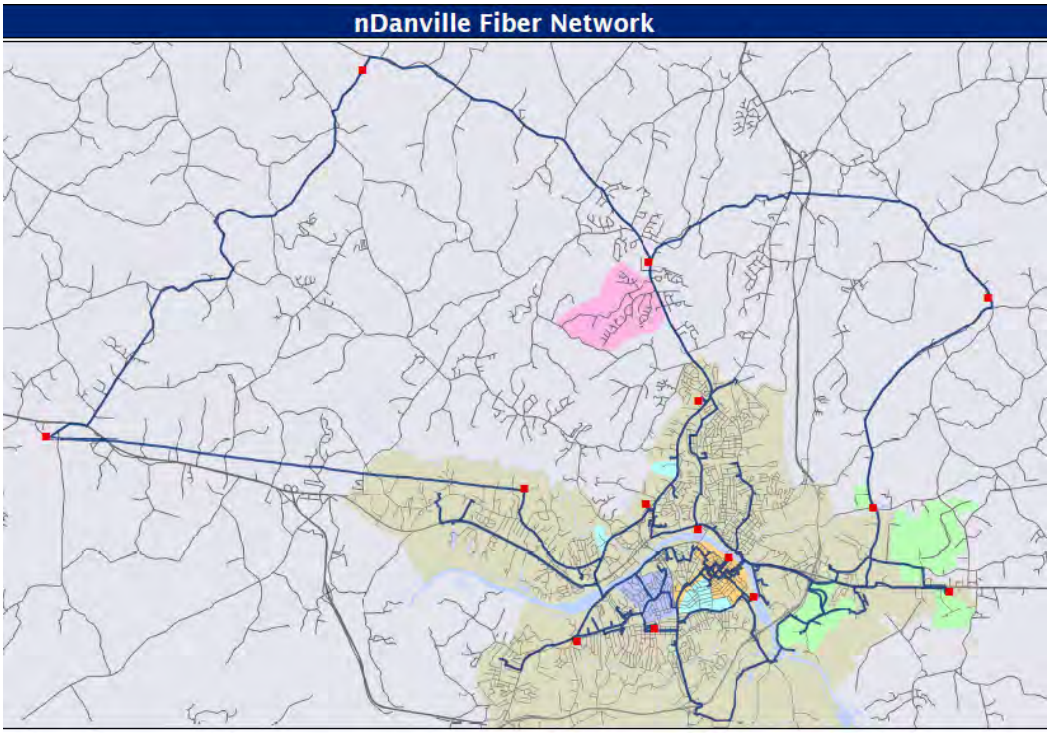

Figure 11 nDanville Fiber Network Map

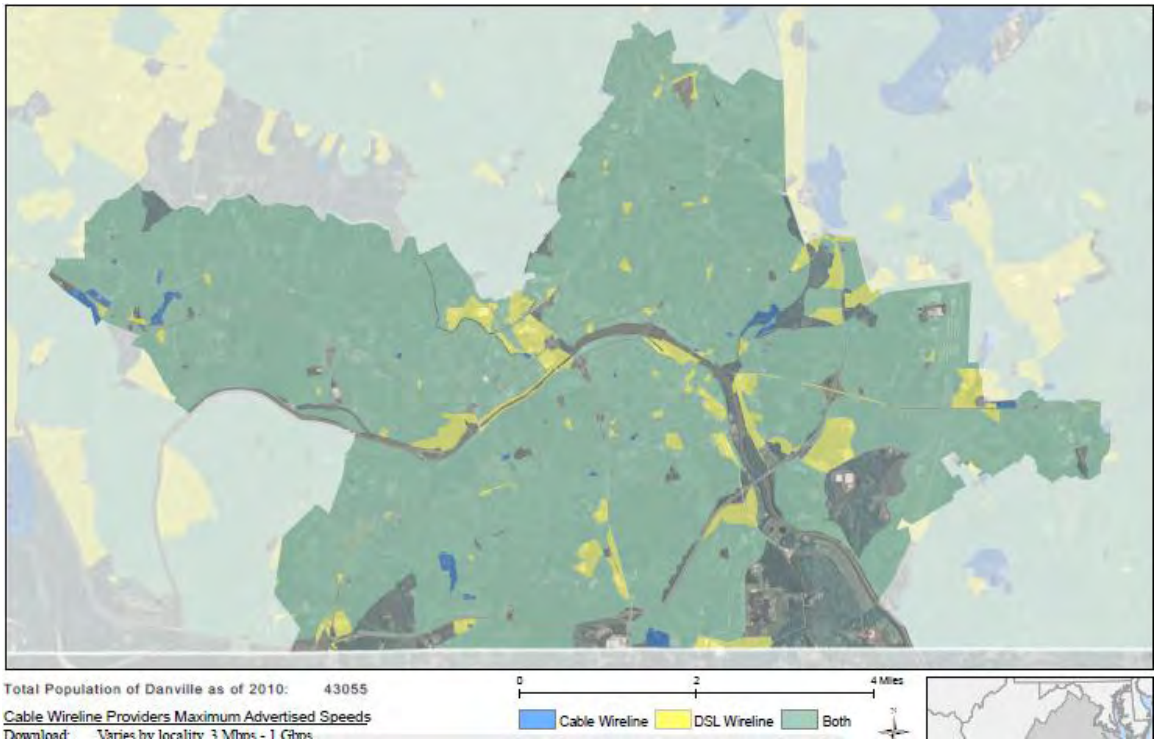

Figure 12 Danville City DSL and Cable Coverage

Rural Telecom Digital Subscriber Line (DSL)

Citizens Telephone Cooperative

Citizens is based in Floyd and began in the early 1940s as a telephone coop. They have continued to expand through the years offering, in addition to telephone service, VoIP, IPTV video, DSL and FTTP serving 7 counties in southwest Virginia. Additionally, Citizens operates a 248 mile regional open access fiber network in 6 counties – serving 8 industrial parks. In 2010 Citizens received a BTOP award to extend the open access fiber network an additional 186 miles through 7 counties connecting industrial parks and community anchor institutions (CAIs). Notice in the map below that Floyd is very well covered with DSL service which is very rare for a rural county.

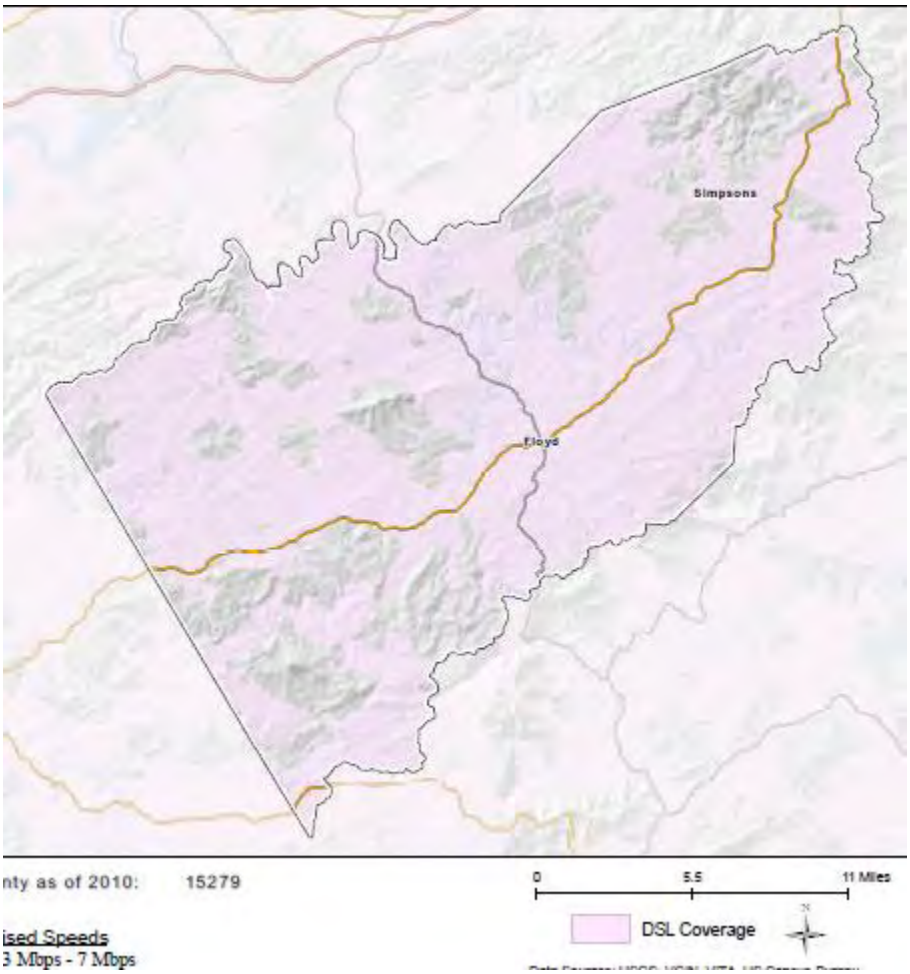

Figure 13 Floyd County DSL Coverage

Highland County

Highland Telephone Cooperative began in 1905 as a mutual telephone company and then became a cooperative corporation incorporated in 1980. This project was preceded and ultimately helped by leverage from Distance Learning Labs that were installed in Highland and Bath Counties through funding from Regional Competitive and RUS grants. Highland county is a beautiful and very mountainous terrain area which provides many challenges to deployment.

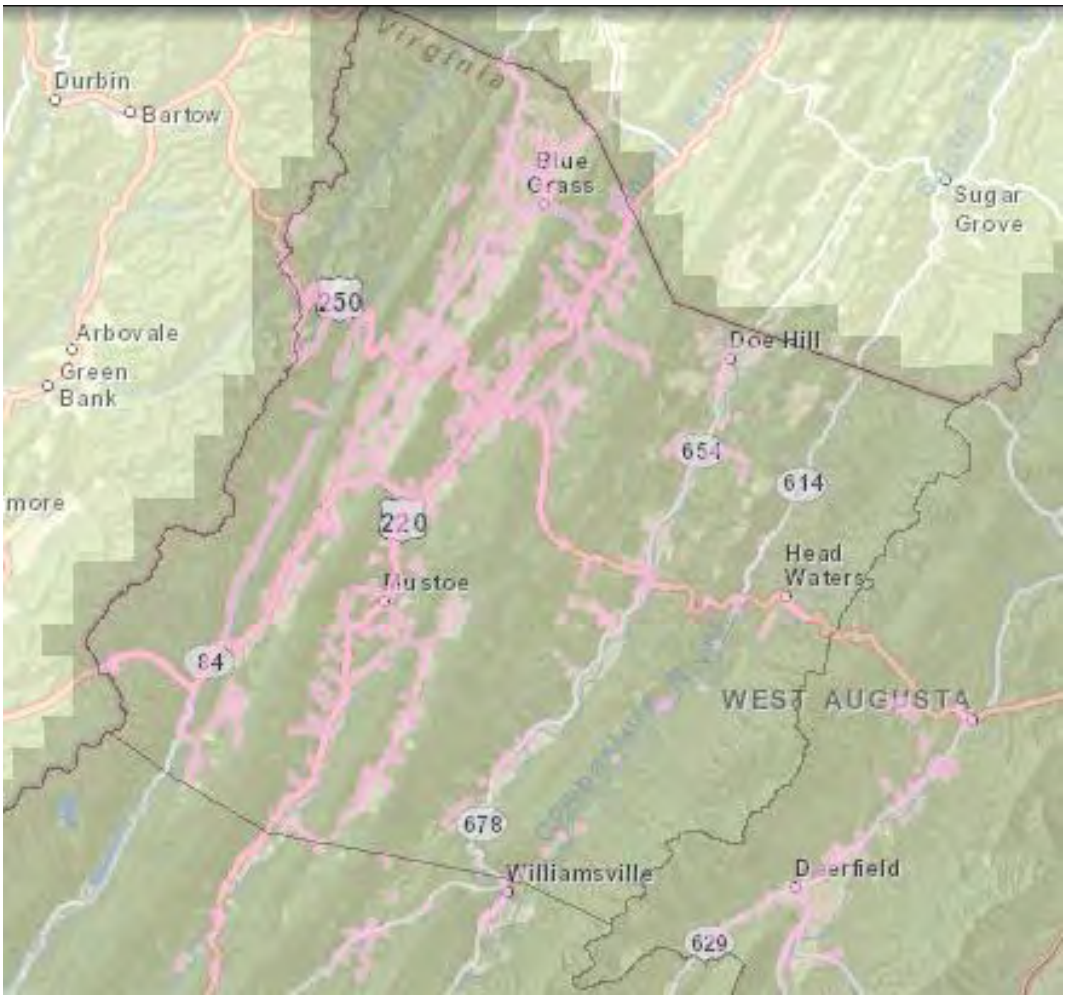

Figure 14 Highland County DSL Coverage

Public-Private Partnerships

Franklin County

Franklin County is 721 square miles in the foothills of the Blue Ridge mountains – too large and challenging terrain to attempt fiber builds to serve the entire county. The size and terrain challenges make it difficult for private providers – local telco and cable – to make the business case to extend their fiber builds.

Franklin County formed a public-private partnership with a wireless Internet service provider (WISP) in 2005. That partnership was based on the county providing access to all county-owned vertical assets (towers, water tanks, building rooftops, etc.) in exchange for Internet service. The county invested very little from general county funds (approximately $36000 initially) in addition to $50,000 of a Homeland Security Grant to connect all 16 fire and rescue stations. The invested money was used to cover new tower infrastructure upgrades, some receiver equipment and pre-pay for services from one commercial tower. This partnership arrangement allowed the WISP low-cost entry to build a fully redundant and robust wireless network throughout the county serving the local government, citizens and businesses. The WISP has continued expanding the network over the years and upgrading equipment as wireless technology advanced – serving hundreds of businesses and thousands of residences. The local government built a wide-area-network (WAN) over the wireless broadband network easing support and management of technology through all government agencies. The government was able to reduce telecom expenditures 36% over two years by deploying a voice-over-IP solution to all government facilities because of this wireless network.

The following coverage map was recently produced by the WISP providing the Virginia State Broadband Initiative team with tower locations and equipment specifications which were used to model the wireless signals. This current process does not include tree canopy or building obstacles but our state broadband initiative is working to include this data in future models to continually improve the accuracy of mapping wireless coverage. The map below is somewhat overstated in coverage but only in regards to those types of obstacles in particular locations.

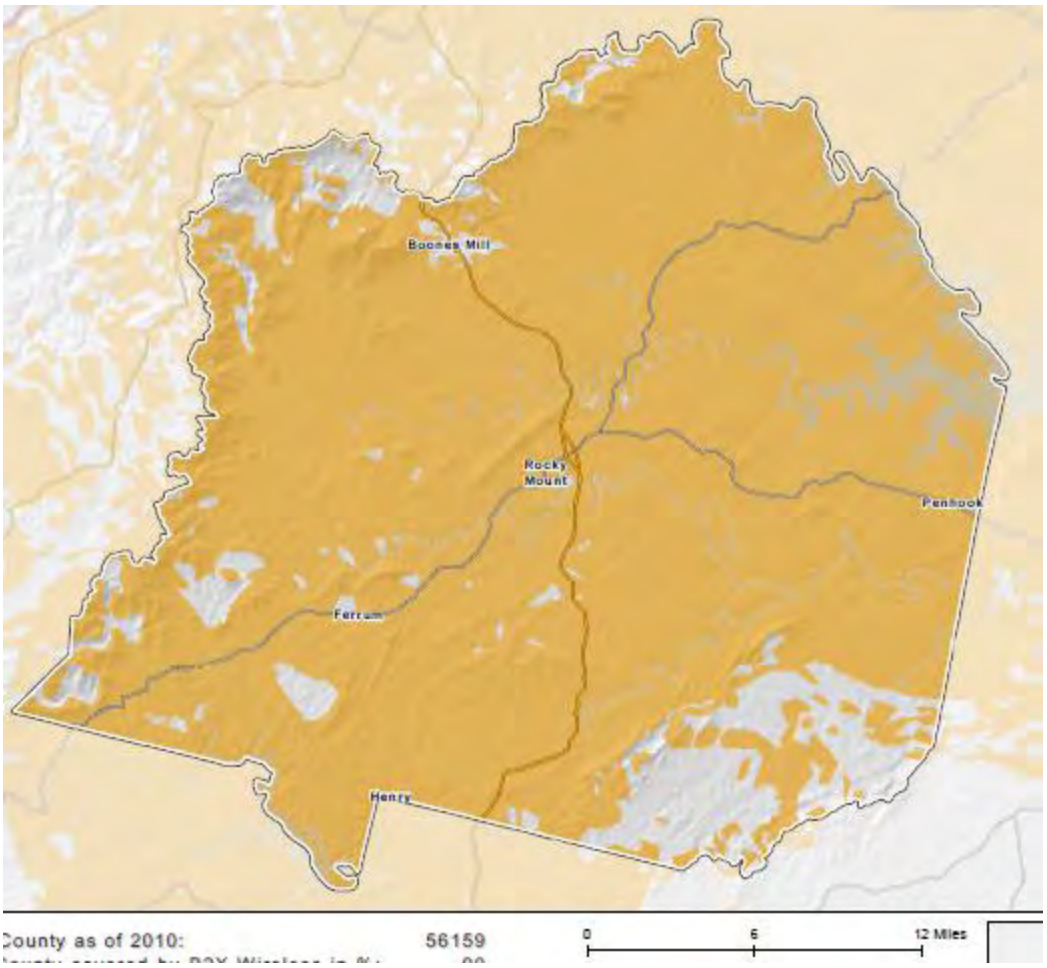

Figure 15 Estimated Fixed Wireless Coverage in Franklin Count VA

AUTHORITY OR CO-OP OWNED OPEN ACCESS FIBER NETWORK

Eastern Shore Broadband Authority

Northhampton and Accomack counties formed the authority in 2008 and began construction of an open-access fiber backbone connecting community anchor institutions. Funding was through DHCD, EDA and congressional earmark in addition to county contributions. Few details will be repeated here since this authority is a close neighbor of the Middle Peninsula. The Virginia broadband map shows provider service coverage areas and as such, does not map open access fiber backbone. The Virginia broadband map view does show the eastern shore having good DSL coverage and a bit of cable coverage on Chincoteague.

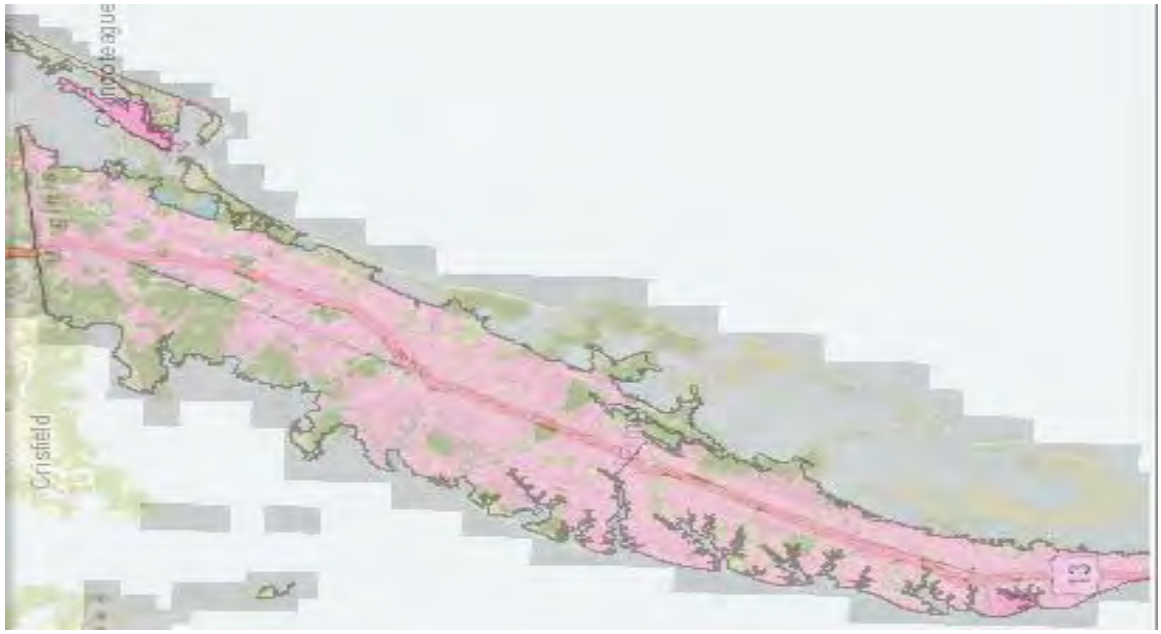

Figure 16 Eastern Shore DSL Coverage

Lenowisco

The LENOWISCO Planning District Commission partnered with private firm Sunset Digital in 2001 to deploy a fiber network throughout the counties of Lee, Scott and Wise and including the city of Norton. Funding was received primarily from the Tobacco Commission and by the end of 2009 they had deployed over 350 miles of fiber connecting over 800 FTTP subscribers. The planning district commission owns the network while Sunset Digital designed, built and operates the open access network in addition to providing Internet service.

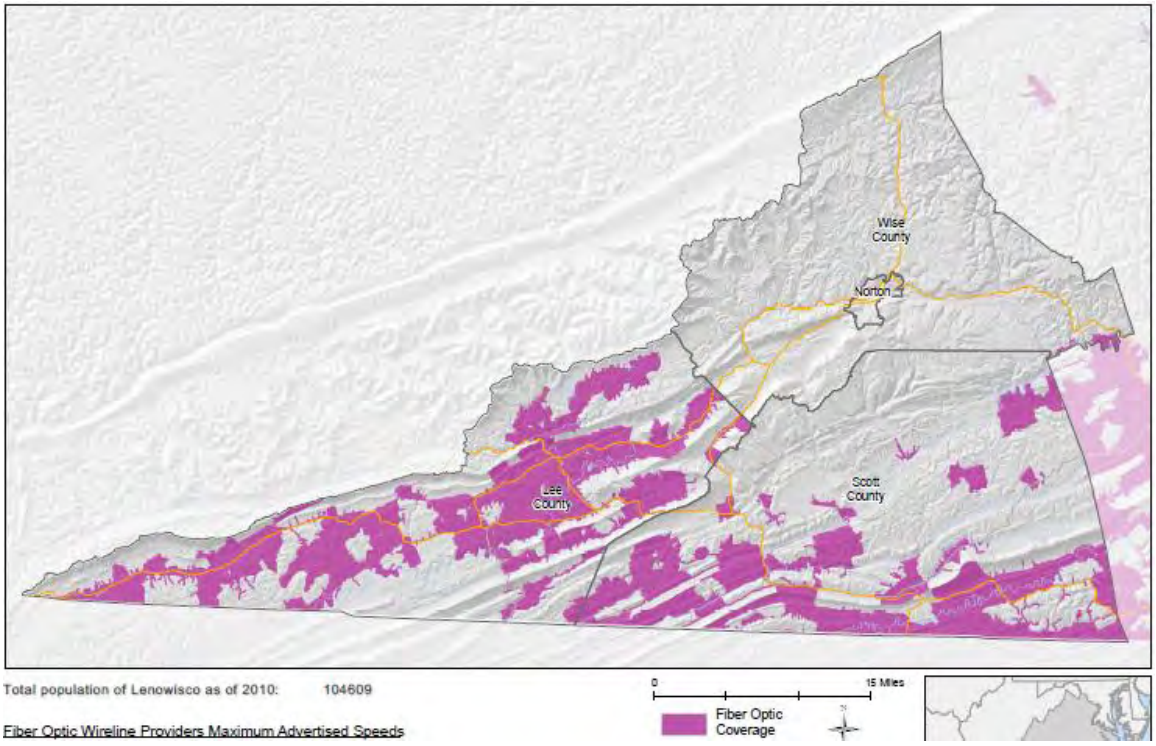

Figure 17 LENOWISCO Fiber Coverage

Authority Owned and Operated Wireless

Dickenson County Wireless Integrated Network (DCWIN)

In 2001 Dickenson County's IT Department was evaluating options to connect the 911 facility and the courthouse. They found wireless to be the most cost effective solution and then began a discussion with the county Board of Supervisors about providing broadband via wireless technology. In 2002 they began serving the county agencies, 911 and the schools and then in 2004 the citizens and businesses. They constructed several towers to support the wireless network and formed a Wireless Authority to manage and operate the network. They are currently serving 300 customers in addition to the 911 center, schools and local government facilities. Unfortunately DCWIN has not yet contributed service data to the Virginia broadband mapping initiative and hence, their fixed wireless coverage area is not depicted on our broadband map.

Figure 18 Dickenson County DSL and Fiber coverage

Existing Vertical Asset Inventory

The full listing of existing vertical assets that have been registered with the FCC and water tanks insured by VML have been provided to the Middle Peninsula Planning District Commission in a separate document as it is a large listing.

Community Anchor Institutions

Facility Name	Address	City	Facility Type
Rappahannock Community College	12745 College Dr	Saluda	Community College
Deltaville Branch Library	35 Lovers Lane	Deltaville	Library
Gloucester County Library	6920 Main St	Gloucester	Library
Goucester Library Branch	1720 George Washington Memorial Highway	Gloucester	Library
Upper King William Branch Library	694-J Sharon Rd	King William	Library
Mathews County Public Library	251 Main St	Mathews	Library

Facility Name	Address	City	Facility Type
King and Queen Branch Library	450 Newtown Rd	Saint Stephens Church	Library
Essex Public Library	117 N Church Lane	Tappahannock	Library
Urbanna Branch Library	150 Grace Street	Urbanna	Library
West Point Branch Library	721 Main Street	West Point	Library
Aylett Family Medical Ctr	7864 Richmond Tappahannock Hwy	Aylett	Medical or Healthcare Provider
Central Virginia Health Svc	11814 King William Rd	Aylett	Medical or Healthcare Provider
King William Pharmacy	7890 Richmond Tappahannock Hwy	Aylett	Medical or Healthcare Provider
St Davids Free Health Clinic	11241 W River Rd	Aylett	Medical or Healthcare Provider
Courthouse Pediatrics	7363 Walker Ave # 1	Gloucester	Medical or Healthcare Provider
Family Health Care LTD	8025 Belroi Rd	Gloucester	Medical or Healthcare Provider
Gloucester House Personal Care Home	7657 Meredith Dr	Gloucester	Medical or Healthcare Provider
Gloucester Mathews Free Clinic	7314 Main St	Gloucester	Medical or Healthcare Provider
MPNN Counseling Ctr	9228 George Washington Meml	Gloucester	Medical or Healthcare Provider
Riverside Care Nursing & Convalescent	7385 Walker Ave	Gloucester	Medical or Healthcare Provider
Riverside Walter Reed Hospital	7519 Hospital Dr	Gloucester	Medical or Healthcare Provider
Ruszkowski, Ronald Jose MD	6876 Main St	Gloucester	Medical or Healthcare Provider
Virginia Oncology Assoc	6870 Main St	Gloucester	Medical or Healthcare Provider
Professional Vision Care	44 Cricket Hill Rd	Hudgins	Medical or Healthcare Provider
Rivers Health Care Resources	112 Commerce Park Dr	Manquin	Medical or Healthcare Provider
Rivers Healthcare	112 Commerce Park Dr	Manquin	Medical or Healthcare Provider
Mathews Medical Ctr	10976 Buckley Hall Rd	Mathews	Medical or Healthcare Provider
Riverside Care Residences	603 Main St	Mathews	Medical or Healthcare Provider
Town Center Physicians	10980 Buckley Hall Rd	Mathews	Medical or Healthcare Provider

Facility Name	Address	City	Facility Type
Three Rivers Health District Hdqtrs.	2780 General Puller Hwy	Saluda	Medical or Healthcare Provider
Bon Secours Tappahannock Pri	721 Charlotte St	Tappahannock	Medical or Healthcare Provider
Brock, Lee R MD	200 Hospital Rd # A	Tappahannock	Medical or Healthcare Provider
Dominion Women's Health	1822 Tappahannock Blvd	Tappahannock	Medical or Healthcare Provider
Essex County Health Dept	423 N Church Ln	Tappahannock	Medical or Healthcare Provider
Family Eye Care	1660 Tappahannock Blvd # B	Tappahannock	Medical or Healthcare Provider
Gilchrist Eye Care Ctr	402 Airport Rd	Tappahannock	Medical or Healthcare Provider
National Nurses Svc-Home Health	1413 Teakwood Dr	Tappahannock	Medical or Healthcare Provider
Tappahannock Dialysis Ctr	1922 Tappahannock Blvd	Tappahannock	Medical or Healthcare Provider
Tappahanock Free Clinic	317 Duke St	Tappahannock	Medical or Healthcare Provider
Sexual Assualt Crisis Ctr	6732 Main St	Gloucester	Other Community Support Organization
YMCA	101 Main St	Mathews	Other Community Support Organization
YMCA Greater West Point	3135 King William Ave	West Point	Other Community Support Organization
Gloucester Building Dept.	6582 Main St	Gloucester	Other Government Facility
Gloucester Clean Community	6361 Main St	Gloucester	Other Government Facility
Gloucester Cnty Mosquito Cntrl	7385 Justice Dr	Gloucester	Other Government Facility
Gloucester County Administration	6467 Main St	Gloucester	Other Government Facility
Gloucester County Assessor/Taxation/Revenue	6489 Main St	Gloucester	Other Government Facility
Gloucester County Historical	6539 Main St	Gloucester	Other Government Facility
Gloucester County Offices	6511 Main St	Gloucester	Other Government Facility
Gloucester County Visitor Ctr	6509 Main St	Gloucester	Other Government Facility
Gloucester Courthouse	7400 Justice Dr	Gloucester	Other Government Facility

Facility Name	Address	City	Facility Type
Harvey Morgan Legislative Ofc	6549 Main St	Gloucester	Other Government Facility
Petsworth Coordinator	10658 George Washington Mem Hy	Gloucester	Other Government Facility
King William Co-Op Extension Svc	175 Courthouse Ln	King William	Other Government Facility
King William County Administration	180 Horse Landing Road	King William	Other Government Facility
King William Courthouse	351 Court House Ln	King William	Other Government Facility
King William Health Dept	172 Courthouse Ln	King William	Other Government Facility
King William Juvenile Court Svc Unit	41 Horse Landing Rd	King William	Other Government Facility
King William Transportation Dept	119 Roane Oak Rd	King William	Other Government Facility
Co-Op Extension Svc	10494 Buckley Hall Rd # B	Mathews	Other Government Facility
Mathews Co. Animal Warden	Po Box 839	Mathews	Other Government Facility
Mathews County Administration	10644 Buckley Hall Rd	Mathews	Other Government Facility
Mathews County Building Offcl	17 Court St	Mathews	Other Government Facility
Mathews County Courthouse	10604 Buckley Hall Rd	Mathews	Other Government Facility
Mathews County Treatment Plant	89 Brickbat St	Mathews	Other Government Facility
Middle Peninsula Planning District Commission	125 Bowden St	Saluda	Other Government Facility
Commonwealth Attorney	309 Prince St	Tappahannock	Other Government Facility
Essex County Administration	319 Prince St	Tappahannock	Other Government Facility
Essex County Building Inspctn	202 S Church Ln	Tappahannock	Other Government Facility
Essex County Revenue Comm	317 Prince St	Tappahannock	Other Government Facility
Essex Town Office	915 Church Ln	Tappahannock	Other Government Facility
Essex Treasurer's Office	321 Prince St	Tappahannock	Other Government Facility
US Marine Corps Recruiting	406 Marsh St	Tappahannock	Other Government Facility

Facility Name	Address	City	Facility Type
Hampton Roads Sanitation District	600 23rd St	West Point	Other Government Facility
King William Dept. of Info Tech	32303 King William Rd	West Point	Other Government Facility
National Guard	2406 King William Rd	West Point	Other Government Facility
King William Volunteer Fire	7936 Richmond Tappahannock Hwy	Aylett	Public Safety Entity
Mathews Fire Dept	by Lat/Long	Cobbs Creek	Public Safety Entity
Gloucester Cnty Emergency Svc	6504 Main St	Gloucester	Public Safety Entity
Gloucester Co 911, GIS & Technology	6382 Main St	Gloucester	Public Safety Entity
Gloucester Fire & Rescue Station	6595 Main St	Gloucester	Public Safety Entity
King William County Sheriff	351 Courthouse Ln	King William	Public Safety Entity
Mattaponi Vol Rescue Squad	15867 King William Rd	King William	Public Safety Entity
Mathews Co. Transportation Dept	15934 John Clayton Mem Hwy	Mathews	Public Safety Entity
Mathews Fire Dept - Station 1	43 Brickbat Rd	Mathews	Public Safety Entity
Mathews Sheriff's Office	10622 Buckley Hall Rd	Mathews	Public Safety Entity
Essex County Emergency Svc	309 Cross St	Tappahannock	Public Safety Entity
Tappahannock Fire House	620 Airport Rd	Tappahannock	Public Safety Entity
Tappahannock Police Dept	315 Duke St	Tappahannock	Public Safety Entity
King William Sheriff Office	351 Courthouse Ln	King William	Public Safety Entity
Middlesex County Sheriff Office	75 Oakes Landing Rd	Saluda	Public Safety Entity
Middle Peninsula Regional Security Ctr	170 Oakes Landing Rd	Saluda	Public Safety Entity
West Point Police Dept	433 12th street	West Point	Public Safety Entity
King and Queen County Sheriff	242 Allens Circle, Suite A	King and Queen Court house	Public Safety Entity
Upper King and Queen Vol. Fire Dept	155 Indian Neck Rd	Newtown	Public Safety Entity
Mattaponi Vol Rescue Squad	6089 Canterbury Rd	Walkerton	Public Safety Entity
Central King & Queen Vol Fire Dept	37.67124,-76.875042	King and Queen Court house	Public Safety Entity
West Point Fire & Rescue Squad	421 7th st	West Point	Public Safety Entity
Middlesex Volunteer Fire Dept	Virginia St	Urbanna	Public Safety Entity
Tappahannock Rescue Squad	303 Duke St	Tappahannock	Public Safety Entity
Upper Middlesex Vol Fire Dept	4583 Waterview Rd	Waterview	Public Safety Entity

Facility Name	Address	City	Facility Type
Mathews Vol Fire - Station 5	6802 New Point Comfort Hwy	Susan	Public Safety Entity
Mathews Vol Fire - Station 2		Bohannon	Public Safety Entity
Mathews Vol Fire - Station 3	2137 Old Ferry Rd	Hudgins	Public Safety Entity
Mathews Vol Fire - Station 4		Cobbs Creek	Public Safety Entity
Mathews Vol Rescue Squad	94 Cricket Hill Rd	Hudgins	Public Safety Entity
Bethel Elementary School	2991 Hickory Fork Rd	Gloucester	School (K-12)
Botetourt Elementary School	6361 Main St	Gloucester	School (k-12)
Gloucester County Public School Board	6489 Main St	Gloucester	School (k-12)
Gloucester High	6680 Short Lane	Gloucester	School (K-12)
Peasley Middle	2885 Hickory Ford Rd	Gloucester	School (K-12)
Petsworth Elementary School	10658 George Washngton Mem Hwy	Gloucester	School (k-12)
Thomas C Walker Elementary	6099 T C Walker Rd	Gloucester	School (K-12)
Abingdon Elementary	7087 Powhatan Drive	Hayes	School (K-12)
Achilles Elementary	9306 Guinea Rd	Hayes	School (K-12)
Central High	17024 The Trail	King and Queen Court House	School (K-12)
Acquinton Elementary School	18550 King William Rd	King William	School (k-12)
Cool Spring Primary School	7301 Acquinton Church Rd	King William	School (K-12)
Hamilton-Holmes Middle School	18444 King William Rd	King William	School (k-12)
King William High School	80 Cavalier Dr	King William	School (k-12)
King William School Board Ofc	18548 King William Rd	King William	School (k-12)
Middlesex Elementary	823 Philpot Rd	Locust Hill	School (K-12)
St Clare Walker Middle School	6814 General Puller Hwy	Locust Hill	School (K-12)
Lee-Jackson Elementary School	347 Church St	Mathews	School (k-12)
Mathews County School Board	63 Church St	Mathews	School (k-12)
Mathews High School	9889 Buckley Hall Rd	Mathews	School (k-12)
Thomas Hunter Middle School	387 Church St	Mathews	School (k-12)
King & Queen Elementary	24667 The Trail	Mattaponi	School (K-12)
Lawson-Marriott Elementary	1599 Newtown rd	Saint Stephens Church	School (K-12)
Chesapeake Bay Governors Schl	12745 College Dr	Saluda	School (k-12)
Middlesex High	454 General Puller Hwy	Saluda	School (K-12)

Facility Name	Address	City	Facility Type
Essex County School Board Garage	713 Marsh St	Tappahannock	School (k-12)
Essex High School	833 High School Circle	Tappahannock	School (K-12)
Essex Intermediate School	912 Intermediate School Circle	Tappahannock	School (K-12)
Tappahannock Elementary	205 Elementary School Circle	Tappahannock	School (K-12)
West Point School Board	1626 Main St	West Point	School (k-12)
Christchurch School	49 Seahorse Lane	ChristChurch	School Private
Gloucester Montessori School	8381 George Washington Mem Hwy	Gloucester	School Private
Majesty Christian Academy	10487 Harcum Road	Gloucester	School Private
Newington Courthouse Preschool	6169 Main St	Gloucester	School Private
Ware Academy	7936 John Clayton Memorial Hwy	Gloucester	School Private
Dominion School of Hair Design	1755 Geo Washington Mem Hwy	Gloucester Point	School Private
Bay School Of The Arts	279 Main St	Mathews	School Private
Aylett Country Day School	Millers Tavern	Millers Tavern	School Private
Mt Landing Children's Ctr	1413 Teakwood Dr	Tappahannock	School Private
Saint Margaret's School	444 Water Lane	Tappahannock	School Private
Tappahannock Junior Academy	PO Box 790	Tappahannock	School Private
West Point Elementary	1060 Thompson Ave	West Point	School (K-12)
West Point High School	2700 Mattaponi Ave	West Point	School (K-12)
West Point Middle School	1040 Thompson Ave	West Point	School (K-12)

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