

Goochland High Speed Internet Committee

Goochland, Virginia



**Findings and Recommendations
(October 2012)**

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Executive Summary

The Goochland County Board of Supervisors (BoS) established The Goochland High Speed Internet Committee (GHSIC) at its April 17th 2012 meeting. The Committee was charged with identifying opportunities to facilitate County-wide availability of high speed Internet service.

This effort supports two of the Board of Supervisors strategic priorities:

- ❖ Excellent Quality of Life
- ❖ Strong and Diverse Economy

According to Federal Communications Commission (FCC) Chairman Julius Genachowski “High speed Internet is the central platform of the 21st century for economic development and job creation, similar to what telephones were in the 20th century, but with even greater opportunity.” Understanding this and having heard from Goochland County citizens about limited availability of economical high speed internet service in the County, the BoS appointed the GHSIC and charged the group explore opportunities to improve service on a county-wide basis.

For Goochland there is not one simple solution to provide County citizens and businesses with high speed Internet service. State and Federal laws constrain the County’s ability to operate broadband systems, the current providers of broadband in the County have financial constraints which limit their ability to serve less densely populated areas, and the County has geographical and topographical conditions which create barriers to providing services in certain areas. However there are opportunities. The County has current providers of service, available towers and available fiber optic networks which can be leveraged to provide service.

All this said the committee recommends the following:

In the immediate term, The County should continue efforts with the existing providers (Comcast, Verizon primarily) to accelerate and expand their services within Goochland. In the

intermediate term, the Committee recommends that the BoS explore the opportunity to establish an economical fiber based Point of Presence (POP), which would enable other third party companies to provide both middle and last mile solutions to customers.

Other recommendations include:

1) Implementation of short and long term solutions should be made through a multifaceted approach with methodologies and a timeline

A variety of methods must be applied. These may include:

- Offering space on vertical and other assets
- Continue to consider future technologies when replacing older vertical assets
- Establishing fiber connection points
- Working with existing providers and Citizens to enhance their installation base
- Using lessons learned from past experiences and successful expansion as a template for continued expansion

2) Develop a high speed Internet information clearinghouse and distribution facilitator

There are a number of means to which Goochland County Citizens can acquire high speed Internet services. Unfortunately the dissemination of information has in some cases been a limit to access. By providing a central location for Citizens to access information, additional connections can be made.

3) As part of the economic development package for businesses and developers, provide assistance working with high speed Internet service providers.

4) Review, analyze, and propose changes to the Code of Virginia that the Board of Supervisors can recommend to our Delegates and Senator

There are a number of rules and regulations that limit what action the County and other entities can perform to increase high speed Internet service to Citizens and businesses. A number of the limitations are potentially dated and some appear to be conflicting.

5) **Explore producing a request for information (RFI) followed by request for proposal (RFP) to learn what opportunities by existing high speed Internet service providers and other providers not currently in the Goochland County market could provide.**

6) **Review of County ordinances, policies, and procedures to make high speed Internet deployment a goal and a priority.**

This may be accomplished during planning and preconstruction meetings to recommend early contact between developers/providers to facilitate planning/deployment of services.

7) **Complete a comprehensive survey of the high speed Internet assets in the County**

It is believed that there is a large amount of installed fiber lines in the County. These resources need to be identified and potentially exploited as practical. The Committee made a first attempt, but believes there is more available than it was able to discover.

Committee Charge

Statement of Charge

The Goochland County Board of Supervisors (BoS) established The Goochland High Speed Internet Committee (GHSIC) at its April 17th 2012 meeting. The Committee was charged with identifying opportunities to facilitate County-wide availability of high speed Internet service.

This effort supports two of the Board of Supervisors strategic priorities:

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Mission/Vision of the GHSIC

To promote high speed Internet availability at a reasonable cost to all Goochland County residents and businesses.

High Speed Internet

High Speed Internet services, also called broadband, are services that provide data transfer rates considerably higher than that possible using a dial-up modem. The FCC defined broadband access as "Internet access that is always on and faster than the traditional dial-up access". The FCC currently sets 768KBps (kilobytes per second) as the minimum speed for the service to be considered "high speed". However, speeds between 2MBps (megabytes per second) and 4MBps were identified by the committee as those that can be truly considered broadband access. The term broadband was originally a reference to multi-frequency communication but over the years it has become a marketing term that telephone, cable, and other companies use to label their more expensive, higher data rate products (reference

Wikipedia). The terms Broadband and high speed Internet are used interchangeably in this document.

Importance of High Speed Internet

High speed Internet allows citizens and businesses more efficient access to basic services such as education, healthcare, public safety, and government services. It allows citizens to participate in online learning and distance education, and also enables small and home-based businesses to thrive via e-commerce. It can save companies and organizations money by allowing employees to work from home (telework), provide voice service and video services over the same broadband facility (Voice Over Internet Protocol – VOIP, and streaming video conferencing). It can help connect patients in remote areas to healthcare services (telemedicine). High speed Internet allows our schoolchildren to complete class assignments, and to receive those assignments when unable to attend class.

The National Broadband Plan (<http://www.broadband.gov/plan/>) states that no matter where one lives or how much money one makes, every American, every school, every library, every business, every health care institution and every public safety facility needs to have access to affordable broadband services. Broadband has become the foundation of the American economy and the platform required for innovation and opportunity. It is a tool every child needs if they are to learn and compete in the global economy. Access to affordable broadband is required to ensure that businesses, large and small, are created or move here, and choose to stay in Goochland.

Broadband allows regions and communities to compete globally, attracting new investments and jobs, with next-generation communications infrastructure. American communities without broadband will be left out of the digital revolution. Local economic development plans and federal programs must take this into account when assessing the economic prospects of a community.

If we want to encourage economic development within Goochland; if we are to improve our children's educational opportunities, then we must continue to pursue the growth of high

speed Internet services and providers in the County. Our success in this endeavor may determine whether our County remains vital and prosperous.

Regulated and non-regulated services

Regulated and Unregulated Utilities and Services- What is the difference?

A regulated public utility is one that offers service that is considered a basic necessity. The regulating authority has methods and levels of rate control, consumer protection and fairness, and monitoring/oversight. Regulation is/ can be provided at the federal, state, and local levels of government. An example of a regulated public utility, overseen by the State of Virginia, is Dominion Virginia Power. Examples of regulated services at the federal level include Verizon land lines, Verizon phone lines, Comcast, cable service, radio stations, and satellite communications. “The Federal Communications Commission (FCC) is an independent United States government agency. The FCC was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. The FCC's jurisdiction covers the 50 states, the District of Columbia, and U.S. possessions.” (<http://transition.fcc.gov/aboutus.html>). The first and last overhaul of the Communications Act of 1934 was the Telecommunications Act of 1996. The primary intent of this overhaul was to create additional competition in the market and encourage new providers to provide services. Between 1996 and now, some 16 years later, there have been significant and profound changes in the use of home phones, cellular phones, Internet services, and the method of delivery.

While cable companies and phone companies offer regulated services such as telephone service, no local, State, or Federal government can dictate to these companies where they offer their non-regulated broadband or wireless services. These companies deploy these services based on market conditions governed by their respective business plans. Like many other industries, technology has outpaced the legal/regulatory governance. Given the rapid changes in communications, perhaps changes are required to further encourage the market to provide broadband services in areas where present return on investment calculations/business models discourage it.

It is clear by today's standards that broadband service is a necessity. It clearly should fit into the government's category of regulated services but by law, Internet service is not currently treated in that way.

Best Practices

Best practices are concepts, techniques, methods, and processes that have been proven to consistently produce the most favorable outcomes. While efforts to deploy large-scale, public, rural and semi-rural broadband implementations and studies are relatively young (less than 15 years old), there are publicly available sources of information.

The Committee reviewed broadband implementations,(failed and successful) studies, and presentations from Roanoke, VA; Franklin County, VA; Burlington, VT; Martin County, FL; Bristol, VA; and Emporia, VA, to name a few. Members also studied aggregated information referencing areas in the State of Virginia from the Mid-Atlantic Broadband Co-operative (MBC), the (Virginia) Center for Innovative Technology (CIT), and the Virginia Information Technologies Agency (VITA).

The recurring concepts in both studies and implementation are listed below.

Study Best Practices

- Identify whether or not you are a broadband-friendly zone (permitting, land use, comprehensive plan)
- Identify existing, pending, and potential services
- Identify existing and pending vertical assets
- Identify existing broadband fiber lines, (used and unused)
- Identify redundancy and backhaul points
- Identify private and public collaborators
- Identify community interest and advocates
- Identify cost barriers (why it doesn't exist today)

- Identify current grant and co-funding opportunities

Implementation Best Practices

- Address your broadband-friendly zone issues before commencing
- Address backhaul
- Harness private collaborators, public collaborators, and community advocates
- Mitigate cost barriers creatively (vertical assets, co-funding, short-term sponsoring)
- Aggregate and address needs in a phased and economical format
- Continue growth and change, but scale network growth and change carefully
- Plan for growth
- Utilize local and government resources as anchor tenants
- Be bold and innovative. Continually seek grants and co-funded opportunities for innovative implementations.

Research

Research and Investigations

A critical component of GHSIC work was to compile a comprehensive listing of the current options for broadband service and where those services can be found in Goochland County. The Committee began with a list of known providers reported in the 2008 Broadband Deployment Options Report. There are essentially 5 types of service available in Goochland County: Leased lines (T-1 – OC circuits), Digital Subscriber Line (DSL), cable, satellite, and cellular (3G/ 4GLTE).

Leased Lines

These services are offered through Verizon, Level 3, or other similar carriers, and while available to the consumer, businesses are the principal subscribers to these offerings due to the high monthly costs. These services offer from 1.5 Mbps (megabits per sec) and up (depending on the circuit) and offer flexible provisioning (symmetrical or asymmetrical), depending on the terminating equipment. Although this technology is considered widely-available, cost is a function of existing services in the area, distance from central equipment, and required bandwidth.

DSL

Digital Subscriber Line (DSL) is a broadband service designed to provide high-speed Internet over traditional telephone lines. It is provided by Verizon within Goochland County. DSL is typically provided in asymmetrical form (more speed or transfer rate downstream and less upstream), with upstream speeds as slow as 128 Kbps and downstream speeds as fast as 3 Mbps. The highest service level most commonly found during our research of DSL availability in the County is 1.5 Mbps downstream and 768 Kbps upstream. DSL can also be provided in a symmetrical form.

To deploy DSL service, Verizon utilizes its traditional copper telephone lines from the central office into the home. There is a device within the central office called a Digital Subscriber Line Access Multiplexer (DSLAM) that communicates with the DSL modem at the customer's location in order to provide the high-speed Internet connection. The DSLAM is in turn connected to the Internet server.¹

It is important to note that the potential expansion of this technology is not likely. Not only is this technology reliant on antiquated technology, given newer options, Verizon made it clear during presentations that it is more focused on its wireless 4GLTE services.

Cable Modem Service

Comcast is the sole provider of cable services in the County. It provides services under its existing County cable franchise. To deploy cable modem service, Comcast utilizes a HFC (Hybrid Fiber Coaxial) network. A HFC network is characterized by fiber from the nearest head end or hub to neighborhood nodes that serve a given number of homes (typically an average of about 500) with coaxial cable. The system then employs Cable Modem Termination System (CMTS) gear in the headend (a headend is similar to the phone company's central office – see glossary) or hub which communicates with the individual cable modems or routers in subscribers' homes. The CMTS also communicates with Comcast's main server which is connected to the Internet. This provides the high-speed Internet connection from Comcast to the home.¹

Satellite

Two providers have been identified as providing broadband service via satellite in Goochland County: HughesNet and Exede/WildBlue. Satellite Internet service employs a small satellite dish on a residence, which communicates with an orbiting geostationary satellite 22,300 miles above Earth's equator, to transmit and receive data. The orbiting satellite transmits (and receives) its information to a location on Earth called the Network Operations Center (NOC). A server in the NOC is connected to the Internet (or private network), so all communication made

from a satellite dish connection to the Internet must flow through a NOC.² Given that signals bounce from a subscriber's dish to an orbiting satellite and back to the NOC, which takes time, satellite services have problems with latency. They are also severely affected by atmospheric conditions (heavy rain and snow) which interfere with the signals.

Cellular 3G/4GLTE

Cellular telephone providers have been providing broadband services over their cellular networks using a variety of 3G (Third Generation) and now 4G LTE (Fourth Generation, Long Term Evolution) technologies. Verizon is the primary provider of the 4G LTE technology present in the County. This technology is designed to increase the capacity and speed of wireless networks using new digital signal processing techniques and modulations. This service can be used in a fixed location or as a mobile service. Just like cellular voice services, cellular coverage and signal strength greatly affect the ability to utilize broadband service over the cellular network. The stronger the signal strength, the higher the transfer rate of data.

Below is a comprehensive view of the technologies, providers and packages that can be contracted in Goochland County. The availability of these services is not guaranteed for all areas of the County.

Figure A - Technologies/providers/services available in Goochland County

Current Residential Internet Options in Goochland County, Virginia								
Providers	Technology	Package	Advertised Speeds (Mb/s)		Monthly Limit (GB)	Monthly Cost	Latency Issues ⁽¹⁾	Coverage
Comcast	Cable	xfinity Business Class	3 - 105	0.8 - 10	250	\$40 - \$130	No	Limited ⁽²⁾ .
Verizon	DSL	High Speed Internet	1 - 7	?	?	\$25 - \$35	No	Very limited ⁽³⁾ .
Verizon Wireless	Cellular (4G LTE)	HomeFusion	5 - 12	4 - 10	10 - 30	\$60-\$120	No	4G LTE coverage area ⁽⁴⁾ .
Exede	Satellite	Exede12	12	3	7.5 - 25	\$50-\$130 ⁽⁵⁾	Yes	All of County ⁽⁶⁾
HughesNet	Satellite	Basic, Power 150, Power 200	1 - 2	0.2 - 0.3	Daily ⁽⁸⁾	\$60 - \$110	Yes	All of County ⁽⁶⁾
Century Link	DSL	High Speed Internet DSL	1.5 - 10	0.9	150 - 250	\$50 - \$79	No	No intentional coverage within County at this time.
Verizon Wireless, ATT, Sprint, nTelos	Cellular (3G & 4G)	Wireless Mobile Broadband	1.4 - 24	0.5 - 5	3 - 12	\$35 - \$80	No	Varies ⁽⁷⁾

⁽¹⁾ Latency is a signal delay that can cause issues with VLAN, voice, and gaming applications.

⁽²⁾ Coverage is generally provided per the terms of the Goochland County-Comcast Franchise Agreement dated

⁽³⁾ Must be near one of the 3 Verizon Central Offices which support DSL. No plans to expand coverage. Speed

⁽⁴⁾ Service requires external antenna. Plans are in place to replace all existing 3G with 4G by 2013. Short

⁽⁵⁾ Equipment rental is additional \$10/month or one-time payment of \$220.

⁽⁶⁾ Requires external dish antenna facing toward southern sky.

⁽⁷⁾ See Providers' websites. Generally regarded as a mobile solution. May require additional equipment for

⁽⁸⁾ 250 Mb - 450 Mb daily limit. Hughesnet allows twice daily limit to accumulate. Free download period

Goochland County is not responsible for the accuracy of this information, which is subject to change. Always research plans prior to making a commitment, including Terms and Conditions. Additional providers and plan options may be available. Most plans are subject to duration commitment with early termination penalty. Additional Federal, State, and other charges may apply. Installation and equipment fees typically apply. Advertised speeds are typically maximums and will vary. Charges for going over monthly limit may be significant.

Potential Services

The committee also explored a number of other technologies that potentially could be deployed in Goochland County to assist in the effort of providing broader coverage. “Dark Fiber” (un-used fiber which companies lease/sell to others), Broadband over power lines (BPL), WiMax, and Fiber To The Home (FTTH) technologies were discussed and explored for satisfying the needs in un-served or underserved areas of the County. Unfortunately there are no commercial applications of these services available in the County.

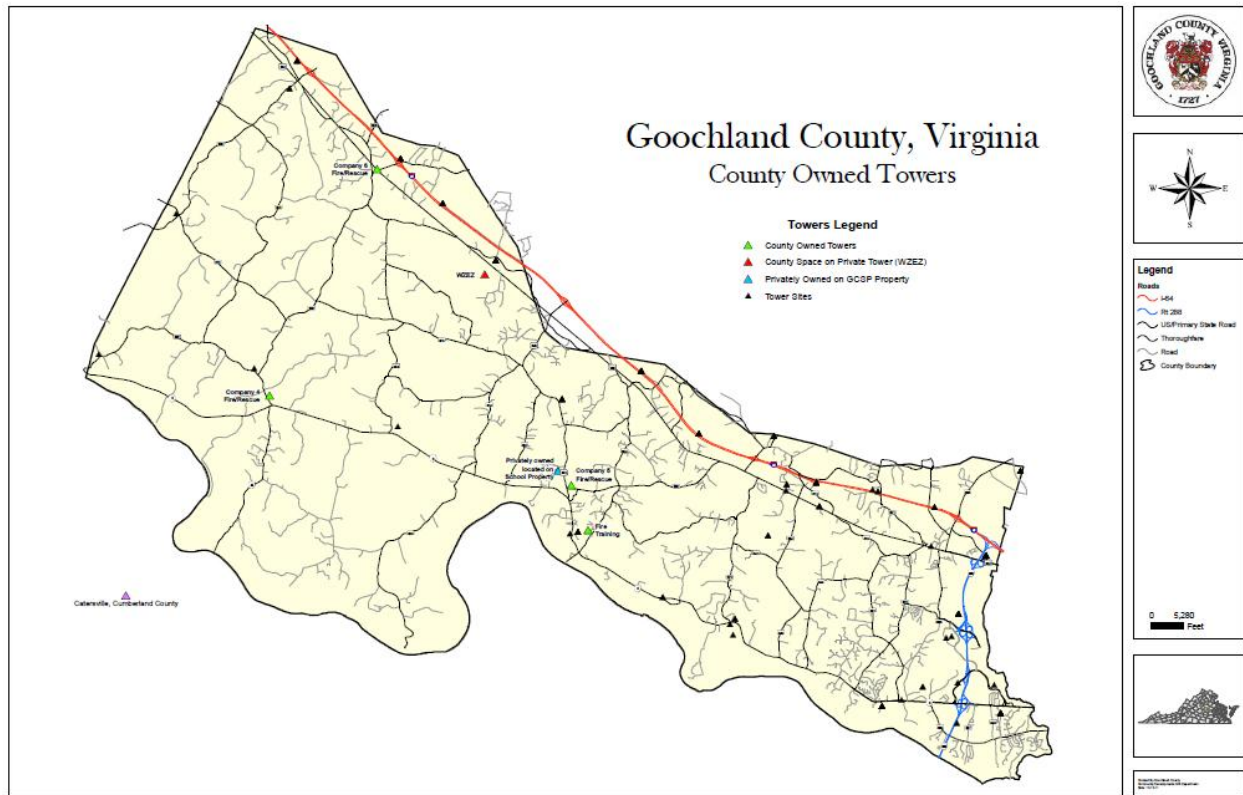
As part of the research and investigation, the Committee met with representatives from Verizon, Verizon Wireless, Comcast, and Centurylink to discuss the future plans and current broadband service offerings each company provides in Goochland County. Given the current market conditions, each company had limitations, primarily capital constraints. Although access to capital could, in each case, lead to expansion of service, none of these companies pursued available rural grants.

The GHSIC did determine that Comcast may expand the existing cable service within a subdivision, but those seeking service should anticipate additional expense in order to offset costs. Those successful in this endeavor, have joined together to negotiate a single payment for a common deployment of service.

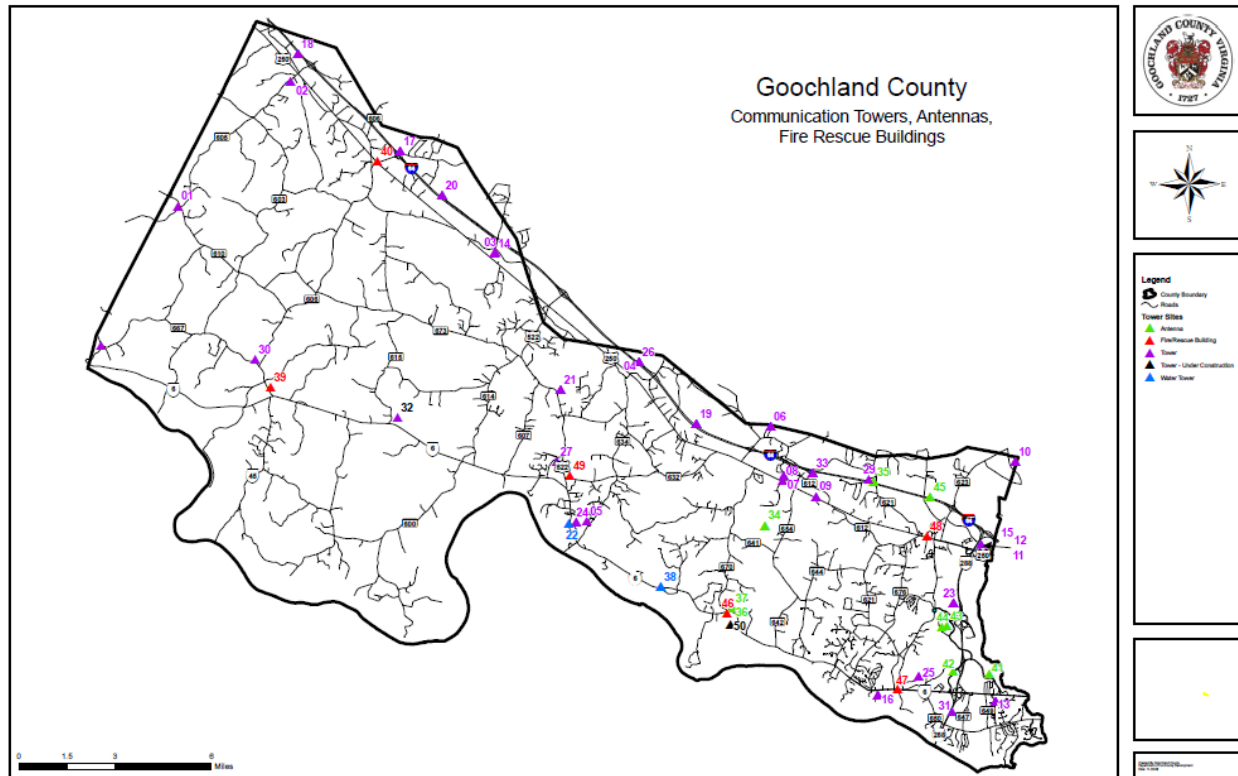
Current and Pending Vertical Assets

The Committee also reviewed the vertical assets (towers) in use and available to the County. Vertical assets offer an opportunity to encourage wireless broadband options. There are a number of cellular towers found within the County, and the County is also constructing two additional telecommunications towers as part of the County’s Emergency Communications Radio Project.

County Owned Towers



County Communication Towers, Antennas, Fire Rescue Buildings



Estimated Cost of Full Fiber Broadband Rollout

If money was no object, what broadband facilities would exist in Goochland?

Residents would want fiber to the home (FTTH), known locally as Verizon FIOS, a hybrid fiber coaxial network (HFC) such as one deployed locally by Comcast, and at least a more widely available 4GLTE service like Verizon. These networks would allow voice, data, and video services limited only by the cost of the terminal equipment or available technology. However, economic realities have prevented construction of these networks in sparsely populated, rural communities such as Goochland. The Committee's research included several examples of communities in southwestern Virginia (Danville, Va.), who have brought broadband service to their communities. However, unlike Goochland, much of the money spent in those localities came from Tobacco Settlement funds, and not the localities' tax revenues. In other instances, such as Bristol's Opti-Net deployment, construction of fiber infrastructure was part of the electric cooperative's plan create "smart grid" technology and the broadband services provided an additional method to use the capital. While it is difficult to estimate the costs to deploy a fiber network, an HFC network, or an improved 4G wireless network, to service all of Goochland, without engineering studies, there are cost ranges based on assumptions from other studies and deployments.

While FTTH infrastructure would certainly benefit Goochland County residents, it is the most expensive to develop. Currently, the average cost per household, if a significant amount of existing backbone fiber is already in place, approaches \$850 per home. If the backbone infrastructure also needs to be developed, the cost approaches \$1,450 per home. Since the average population density in Goochland is lower than the average density for FTTH builds (including areas currently being built by companies such as Verizon), the numbers above would likely climb significantly for a Goochland FTTH build-out, to closer to \$2,260 per household. Therefore, implementing a FTTH system throughout Goochland County would equate to a total of approximately \$14,250,000 to build (construction estimate taken from CBG Communications, Inc Final Report dated June 2008).

The Tobacco Settlement funds also created the Mid Atlantic Broadband Co-operative (MBC). This organization has provided cost effective fiber solutions to entrepreneurs south of the James River. By providing an economical Point of Presence, other third party companies; for example Kinextel; are then able to provide both middle and last mile solutions to customers. MBC recently extended their network to Powhatan County, with a significant fiber cable along Rt.60. This proximity to Goochland enabled MBC to provide the following: *“the construction requirements to extend fiber to Goochland from Powhatan ... The estimated cost of constructing 10 miles of fiber including a crossing of the James River and the railroad north of the river is \$500,000. The cost of an equipment shelter outfitted with electronics and a backup generator is \$250,000 bringing the total project cost to \$750,000.”*

A recent study from Roanoke, Virginia estimated the cost to construct a 43 mile fiber back bone at just over 7.9 million dollars. These costs did not include costs for customer equipment or facilities to connect customers to the fiber backbone. Actual costs for deployment of a fiber backbone in Goochland requires a plan of design, a system roll-out, and an engineering study, however, if one assumes that Goochland's costs are similar to Roanoke's cost, the backbone fiber alone could cost upwards of 8 million dollars.

Comcast utilizes a HFC (Hybrid Fiber Coaxial) network. A HFC network is characterized by fiber from the nearest headend or hub, to neighborhood nodes that serve a given number of homes (typically an average of about 500) with coaxial cable. The system then employs Cable Modem Termination System (CMTS) gear in the headend or hub, communicates with the individual cable modems or routers in subscribers' homes. The CMTS also communicates with Comcast's main server, which is connected to the Internet. This provides the high-speed Internet connection from Comcast to the home.

HFC construction costs will vary depending on whether the plant constructed is aerial (built on power or telephone poles), versus an underground plant. For projection purposes we have utilized aerial construction costs of \$20,000 per mile of construction and \$40,000 per mile of new underground plant. Based on an average cost of \$30,000 per mile for new plant that would be needed to serve all households in the County, the cost for such cable system expansion

(and therefore broadband cable modem service expansion) could exceed \$7,000,000.¹ Again these costs are plant construction, and do not take into account other headend/subscriber equipment required to provide services (construction estimate taken from CBG Communications, Inc Final Report dated June 2008 so the number may be considerably higher).

While not the first choice for home/business service, if fiber or cable options are available, Verizon has announced that 4GLTE service will be available in Goochland by year end 2013. This service will provide considerable increases of speed and bandwidth to homes and businesses not served by Comcast, and towers can be erected more cheaply than constructing fiber/cable. CBG Communications, Inc., in the 2008 study for the County, determined that the following would be required to offer broadband over cellular services:

- Approximately 7 additional towers or other structures of sufficient height;
- Backhaul communications (either wireless or landline);and
- Power to be provisioned to each of the aforementioned sites.

At a projected cost of \$200,000 for each tower and subsequent antenna placement it could conceivably be as much as \$1,400,000 to provide the towers necessary to fill in all of the cellular service gaps to serve the entire County. Other operating/deployment costs such as legal/zoning costs, providing power, and sufficient backhaul connectivity to serve the customers subscribed to each tower, will add to the overall project costs.

The largest challenge to providing ubiquitous service in Goochland is money. Where can the County access capital - Does it come from private investment, increased taxes, access to Universal Service Funds, grants, or from other sources?

¹ Note that all the costs projected herein are based on current industry averages for the technologies and systems discussed. They are subject to change based on evolution of the technologies, as well as changes in the marketplace concerning equipment availability, shifting costs and other pertinent factors. Actual costs would be determined at the time of system walkout and design, based on these factors.

Formulation of Basis for Short Term Solutions

The goal is to create a scalable, reliable network to support high quality communications in Goochland. In the short term we can accomplish this goal, but not in the same manner everywhere in Goochland. The solution depends on the availability/proximity of existing services. It is necessary for the Board of Supervisors to facilitate continued research and recommendations for how to promote County-wide high speed Internet. The Administration staff or other Board of Supervisors designee(s), identified could serve as point of contact for residents, businesses or providers regarding high speed Internet service in the County. This designee(s) could provide suggestions back to the Board on further steps to be taken to promote high speed Internet. In addition, this individual, or group of people, may work with Comcast to assist neighborhoods in extending cable services by providing “templates” from other neighborhoods which have successfully negotiated for service. The designee(s) may serve as a collector of data and disseminator of findings to all County agencies and residents. They should have the experience and knowledge to weigh and recommend fiscally responsible options.

This same designee should work with Verizon to facilitate/accelerate the roll-out of 4GLTE services to better fill-in gaps in coverage. Where can they deploy the quickest and serve the most people? Does Verizon need capital for equipment, assistance with leases or support for additional tower placement? The designee could identify areas in the County where a service similar to what Telepage offered in its markets in southern Virginia and northwestern North Carolina could be deployed.

The Committee created a map that shows the “gaps” in service. The next step is to explore what additional enticement is needed to attract private business to those areas. These enticements could include use of Government owned land/rights-of-way, access to tower space, and short-term monetary assistance. Franklin County, Virginia invested \$83,000.00 to assist a private company’s initial deployment. The County buildings were used as anchor users, with freedom to serve all adjacent residents and businesses. There may be opportunities to leverage money from County operations, such as savings in telephony services used to connect the

various schools and public facilities, via targeted deployments of point-to-point or point-to-multipoint systems, which would also serve residents.

Formulation of Basis for Long Term Solutions

While we do not know what future technology's capabilities will be, we do know that Moore's Law indicates that processing speed and therefore hunger for increased bandwidth will increase exponentially over time. When the dial-up modem (2400 baud) became commonplace for surfing the Internet (remember America Online), it might have been used with a 6 MHz, 80286 processor, with up to 2MB of RAM, and a 720kB floppy disc could hold both applications and data. Today, these specifications have increased one thousand-fold (just in a smart phone), with most in higher-density communities realizing Internet speeds that are 1,000 times faster. However, after more than a quarter century, here in Goochland, the dial-up modem is still the only non-satellite Internet option for many. Without scalability, whether that means improved wireless networks, or constructing fiber optic cables closer to homes and businesses, Goochland will continue to play "catch-up" in the broadband world.

The short term efforts will help to establish/build a greater broadband customer base in the County. However without access to sources of funding, there will still be areas, for reason of demographics, population density, or geography that will not have service unless significant money is spent. The larger customer base may make the County more attractive to competitive services, which will help in the long run. The BoS should explore what legislative changes are required to access USF dollars. Is it possible to isolate County demographics of the more "rural" areas, which will create a more powerful case for State/Federal broadband funding which currently is lost when the "non-rural" areas of the County are blended together? What additional sources of funds can be used to encourage increased network deployment?

Any prospect for true county wide high speed broadband network depends on the availability of an economical and business viable fiber Point of Presence in the middle of the county that can be utilized by third party entrepreneurs to provide middle mile and end mile solutions to our citizens. Evidence that any such service would be provided by existing providers is slim, and County Government in partnership with private enterprise, together with any State/Federal grants/funding, is going to be required to enable this to succeed. With such a Point of Presence, the wide arrange of possible service solutions is made possible to our county.

Conclusions and Recommendations

Overview

The Goochland County Board of Supervisors charged the GHSIC with the following tasks:

- Assess needs in the current environment;
- Solicit input from Citizens and organizations;
- Collect information and benchmark with other localities on high speed Internet efforts;
- Evaluate possible options for Goochland to pursue;
- Hold community meetings to discuss options;
- Develop proposal(s) and present recommendations to the Board of Supervisors

Since its first meeting, the GHSIC has assessed the needs of the Goochland County Citizens and businesses. This has been accomplished by encouraging and listening to our Citizens, businesses, and organizations and by applying the GHSIC member expertise and experience to the current environment in the County.

The GHSIC solicited input from Goochland County citizens and organizations through multiple means. All of the GHSIC meetings have been held as open forums, public comment periods have been provided, meetings have been recorded, and several meetings have been streamed on the Internet. This has allowed Citizens and representatives from organizations to observe, review and participate in the meetings. The GHSIC has also sponsored public meetings within the community that are briefly discussed below.

The GHSIC has benchmarked and collected data from other localities. The GHSIC have reviewed information from a variety of cities, counties, and states including:

- Bristol, Virginia
- Franklin County, Virginia
- Goochland County previous studies and information

- Howard County, Maryland(One Maryland Inter-County Broadband Network)
- Louisa County, Virginia
- Martin County, Florida
- Roanoke Valley, Virginia

The GHSIC collected and cataloged this information for use by the committee and for future use by citizens, organizations, and other interested parties. In addition to the collection of documentation and files, the GHSIC has also engaged representatives from:

- Bristol Virginia Utilities
- Center for Innovation Technology
- Century Link
- Comcast Business Services
- Comcast Cable
- PCL Solutions, Inc.
- Telpage Broadband
- Verizon
- Virginia Polytechnic Institute
- VITA

As part of its continuing deliberations, the GHSIC has considered and evaluated potential broadband implementation options in the County. This process has included observing the current digital transmission infrastructure in the County, current and future predicted state of the art technologies, and other deployments in similar localities. The recommendations enumerated below.

In addition to meetings conducted at Goochland County Administration Building, the committee conducted two community “Town Hall” meetings to hear from citizens and organizations. The first meeting was conducted at Byrd Elementary School in District 1, and the

second was conducted at the Company 3 Centerville Fire and Rescue Station in District 4.

The Goochland County Board of Supervisors charged the GHSIC with the tasks to “develop proposal(s) and present recommendations to the Board of Supervisors.” The purpose of this section of the report is to provide the GHSIC’s conclusions and proposed recommendations to the Board of Supervisors for consideration.

What this report is not

This report does not attempt to justify or provide the reasons for why high speed Internet service is desirable. The GHSIC initiated its activities with the assumption that justification for the concept is not required and that high speed Internet service throughout Goochland County for its Citizens is a desirable goal.

Secondly, this report is not comprehensive. The BoS provided a limited time period for the GHSIC to carry out its directives, however, much work was accomplished by volunteer members. The volume of studies and other information regarding provision of high speed Internet within localities is overwhelming. In addition, the layman’s review and analysis of the Code of Virginia and other laws is by no means complete.. An inclusive review may generate proposed law and regulation changes to the Code of Virginia, and also proposals for federal law and regulation modifications which may be discussed with our elected officials.

Finally this report is a set of recommendations of initial steps for BoS consideration , it does not contain a magic solution to provide all the County’s Citizens high speed Internet service. It also does not recommend the gross expenditure of Citizens’ monies, the creation of a County operated utility or district, or the County takeover or new development of any systems.

Constraints

The GHSIC has learned that a simple solution does not exist to provide our County’s citizens and businesses with high speed Internet service. The County has legal limits, specified by the Code of Virginia, federal law and regulation, as to what it can and cannot do. A discussion of these legal and regulatory constraints is contained in Appendix A+X.

At this time, high speed Internet connectivity is available to almost every corner of the

County by one or more means, however cost is the fundamental constraint.

In addition to the legal constraints, the County's population distribution and small number of businesses limits ground-based cable, wire, or fiber infrastructure deployment. The County's low density population especially in the center to western areas excludes the opportunity for an Internet provider to achieve an acceptable return on investment.

The current County digital infrastructure also provides several constraints. Verizon provides POTS service to most of the County citizens, business, and organizations and the company does not plan improvements within that system. During the GHSIC meetings with Verizon, their representatives clearly stated their plans include the greater reliance on wireless phone and data communications. They also stated that they have no plans to deploy their FIOS product into Goochland, nor do they plan any further deployment of their DSL². In addition to Verizon, the installed Comcast Cable system provides limitations. Comcast Cable's existence in the Goochland County market means that it is unlikely that any competitor will enter the market. It is unlikely in the near term that Comcast will expand its services beyond the existing node locations. Future CATV service expansion will depend on Comcast's current business plans and return on capital unless arrangements are made.

Wireless deployments also have constraints. In general, the County's topography enables good wireless tower broadcast signal coverage. However, in areas, particularly the western part of the County, there are a limited number of towers which creates gaps in service. Like the wireline services, these areas' low population density do not provide adequate return for companies to expand.

While there are numerous cases of experiments conducted in the counties, cities, districts, and states throughout our nation (some successful some not), the Committee focused on a few. The Committee determined that there are characteristics to successful deployments:

1. Funding (many cases had Tobacco Settlement funding or State/Federal funding)

² Verizon DSL is available in specific areas of the County including the Court House area within a 2 line mile of the switching center.

2. Existing public enterprises which could be leveraged to provide broadband.
3. Public assets such as buildings, towers and resources which could be used to reduce initial capital expenses.
4. Existing fiber resources beyond those of the local exchange carrier (LEC).
5. No legal constraints (the State laws have changed which prevents similar deployments in Bristol)

Opportunities

The County has wireless Internet coverage and the service is improving both in coverage area and bandwidth. (the only exception are parts of western Goochland) However its continued enhancement should be encouraged. Verizon Wireless is the County's most aggressive wireless Internet provider and they are currently upgrading their 3G network to 4G LTE network and stated their project completion date for the County is 2013. This will enable faster data transfer rates throughout the County. Currently the Verizon 4G LTE is deployed along most of the I-64 and the 228 corridors, the eastern part of the County, the Crozier area, and in the Court House area. Its continued enhancement should be encouraged by employing several methods discussed in the following recommendations.

The County's topography and vegetation also allows a competitive satellite Internet solution for most residents. Although this solution may have limits, a number of providers provide service within the County.

The Comcast Corporation Xfinity® (residential) and Business Class systems exist in portions of the County serviced by two main nodes; the eastern node and the Sandy Hook node. The company offers phone, security (currently residential only), CATV, and high speed Internet service to County residents and businesses. Residents and businesses within the service areas have a variety of product offerings that include advertised high speed Internet service speeds of 100 Mbs download and 10 Mbs upload and like the wireless service, continued expansion of the Comcast Cable network should be encouraged.

The County contains a large installed underground fiber resource. This includes backbone,

backhaul, subnetwork, and dark fiber deployments by:

- Level 3 Communications
- Verizon
- AT&T
- Comcast
- Unknown

These high speed Internet paths are believed to run throughout the entire County. As an example, a number of OC-192 fiber channels (9.953 Gbs) are available in the Goochland Court House area but the extent and type of their topology is unknown. In addition, there are two very high speed Level 3 Communications fiber lines in the County one of which runs the entire length of Route 6 and the other runs several miles west of and parallel with Route 288 along Route 623. This resource needs to be exploited by determining assets, contacting providers, analyzing implementation methods.

Conclusion

Recommendations for Action

The GHSIC provides the following recommendations to the Goochland County Board of Supervisors for consideration:

Recommendation 1

Implementation of short and long term solutions should be made through a multifaceted approach with methodologies and a timeline

Because one simple solution does not exist, a variety of methods must be applied. This may include:

- Offering space on vertical and other assets
- Continue to consider future technologies when replacing older vertical assets
- Establishing fiber connection points
- Working with existing providers and Citizens to enhance their installation base
- Using lessons learned from past experiences and successful expansion as a template for continued expansion

The existing high speed Internet providers should be consulted to ensure the continued expansion of offerings. Future deployments need to be considered and applied to ensure that the County is not left behind with the state of art or within the business and political structures. Methodologies need to be delineated and timeline developed to support these efforts.

Recommendation 2

Develop a high speed Internet information clearinghouse and distribution facilitator

There are a number of means to which Goochland County Citizens can acquire high speed Internet services. Unfortunately the dissemination of information has in some cases been a limit to access. By providing a central location for Citizens to access information, additional connections can be made. It would not replace or provide service that would compete with the

current providers. This information should include the pros and cons and means to install:

- Comcast Cable
- Fiber
- POTS modem and DSL
- Satellite systems
- Wireless systems
- New service providers

This central high speed Internet point of contact could provide case studies and private sector contact information. As an example, the expansion of the Comcast system has been driven by Citizens in local communities and businesses. The methods used including correspondence, surveys, and agreements could be posted for other communities and businesses to use as templates to work with Comcast for continued expansion.

Recommendation 3

As part of the economic development package for businesses and developers, provide assistance working with high speed Internet service providers.

This will help to ensure that new subdivisions, businesses, and other locations install connections that can be used to provide residents, customers, and other parties service from the existing installed base of resources. Although it may be improper to mandate that developers include high speed Internet connections as part of a new community or business, County staff should suggest that the service be made available. In addition, the County staff should provide contact information for obtainable high speed Internet providers in the area to all developers at initial contact.

Recommendation 4

Review, analyze, and propose changes to the Code of Virginia that the Board of Supervisors can recommend to our Delegates and Senator

As discussed in the constraints above and in Appendix A+X, there are a number of rules and regulations that limit what action the County and other entities can perform to increase high speed Internet service to Citizens and businesses. A number of the limitations are potentially

dated and some appear to be conflicting. As an example of dated law, there are at least 80 references to “telegraph” when discussing telecommunications. The Code doesn’t appear to understand that high speed Internet services can provide telephony, video, security, gaming, and other functions.

As an example of potentially conflicting and dated law, § 56-265.4:4.D states:

Any county, city, or town that has obtained a certificate pursuant to this section may construct, own, maintain, and operate a fiber optic or communications infrastructure to provide consumers with Internet services, data transmission services, and any other communications service that its infrastructure is capable of delivering; provided, however, nothing in this subsection shall authorize the provision of cable television services or other multi-channel video programming service. Furthermore, nothing in this subsection shall alter the authority of the Commission.

This section appears to suggest that CATV or other multi-channel video programming services cannot be provided with a service that may include Internet services. This appears to conflict with other parts of the code (§ 58.1-602, see “Video Programming”) and conflicts with how video is currently provided through the Internet in general. The Internet is the largest single means of accessing video information and will continue to grow with the proliferation of portable devices, new video sources, and the introduction of UHDTV.

However most restricting are the laws that limit how local governments can work within the high speed Internet deployment. In particular, § 15.2-2108.6, § 56-265.4:456-484.7:1, and § 56-484.7:1 limit as to what functions the County may do. A detailed review of these limitations should be conducted and alternative language or general recommendations should be provided to our Commonwealth legislators.

Recommendation 5

Explore producing a request for information (RFI) followed by request for proposal (RFP) to learn what opportunities by existing high speed Internet service providers and other providers not currently in the Goochland County market could provide.

The purpose of the RFI(s) is to learn about and to alert the market of the County’s interest. The purpose of the RFP(s) is to actually solicit the high speed Internet service providers to match market provided solutions with the desires of the County. The GHSIC believes that there

opportunities for this strategy. There are a number of ways RFIs and RFPs could be employed. As one example, research could be conducted with regards to the existing WZEZ tower. Could providers use existing space, what backhaul facilities serve the site and could the tower's height allow service in less populated areas. This information along with the specific functional requests could be delineated in an RFI with other attributes and terms and conditions. Once completed and reviewed, the RFI could distributed to the extremely large number of potential providers to learn what type of systems and services that they may be interest in providing. The responses to the RFI could be analyzed and an RFP generated based on the responses and sent to the interested parties.

Because Comcast serves portions of Goochland County, RFIs and RFPs and/or queries could be made to learn methods and costs to extending services to Citizens and businesses. This could involve RFPs to light businesses and business parks to the benefit of Citizens in the extension pathway.

Recommendation 6

Revision of County ordinances, policies, and procedures to make high speed Internet deployment a goal and simpler

A County goal should be established to assist in the expansion in the availability and cost of high speed Internet service to its Citizens. The goal's content should be developed and discussed with all County staff.

Ordinances, policies and procedures should be reviewed, modified and/or developed to ensure that the County buries or enables a private entity through competitive bid to bury wire and/or fiber at any major project that requires the burial in or movement of earth. All applicable ordinances should be reviewed to ensure that they do not limit or restrict and enhance high speed Internet deployment and utilization. County staff should be informed that any project whether under County or private sector direction is aware of the need to increase high speed Internet to the Citizens. In all cases, the project manager should be made aware of this suggestion.

County staff should also be directed to take a proactive role in the support of this goal including working with providers, developers, and project managers to access in whatever manner possible to acquire the goal.

Recommendation 7

Complete a comprehensive survey of the high speed Internet assets in the County

It is believed that there is a large amount of installed fiber lines in the County. These resources need to be identified and potentially exploited as practical. In addition to providing further high speed Internet deployment, this will also assist with the marketing to businesses by the County. As an example, GHSIC research has shown that there is a very high speed fiber-based Internet ring around the West Creek Business Park and it appears one resident of the park is using it. This is a very valuable in-ground functioning asset that is necessary for certain types of desirable business centers including data centers. We have also learned of high speed fiber-based Internet availability in the Court House area. Other installed fiber assets need to be identified to promote expansion in all areas of the County.

In addition, all locations in the County with limited or no wireless service need to be identified so that resolutions can be applied. Exploration of the Virginia Polytechnic Institute vertical assets inventory program could assist with identifying these areas. Once these specific areas are identified, location precise solutions could be applied through the RFI and RF processes or through direct discussion with private sector providers.

Closing Thoughts

All seven (7) of the recommendations made by this committee were chosen because we believe that they will entice private communication firms to deliver high quality Internet service to our citizens at competitive prices. Although some of the recommendations will require County resources for coordination and information sharing, we have deliberately chosen to endorse ideas for your consideration that do not require massive amounts of public money.

From a technology perspective, a range of infrastructure-oriented options do exist that the Board of Supervisors might also consider. However, the committee felt that it was best to position these infrastructure projects as pathways best implemented by private corporations in partnership with the County, potentially using a variety of available grants. Among the infrastructure projects that could be undertaken, the least costly of them that we evaluated concerns the establishment of one or more fiber optic Points of Presence (POP) in Goochland County from which private communications companies could gain less expensive access to the

information superhighway.

We alluded to such an existing project in a neighboring county in the section entitled "Estimated Cost of Full Fiber Broadband Rollout" earlier in this document. Powhatan County has two POPs which can connect so-called "middle mile" providers to a high speed fiber backbone. These POPs help those moving Internet traffic do it at lower cost by avoiding the so-called Local Exchange Carrier (LEC) connection fees which typically make the use of regulated carrier networks by third parties much more expensive. The existence of those POPs allow entrepreneurial companies to enter Powhatan County and build "last mile" networks using a variety of innovative technologies that serve their citizens high quality Internet service, typically at very competitive prices.

Goochland County's effectiveness in pursuing each of the recommendations that we made in the last section would be greatly amplified if we had high-speed, low cost on ramps to the Internet like those found in Powhatan County. We encourage the Goochland County Board of Supervisors to consider making a capital investment toward that goal. As you examine each of the seven (7) recommendations we made, think about how each of them would be performed if high-speed, low-cost POPs existed for entrepreneurs to leverage. By enabling those private companies to move traffic on and off the information superhighway at lower cost, the Board would enable a whole host of creative solutions and useful experiments both from staff members and from the wide range of business people eager to serve the citizens, residents and business owners of our beloved Goochland County.

Appendices

Board of Supervisor's Resolution to create GHSIC

ESTABLISHMENT OF THE GOOCHLAND HIGH SPEED INTERNET COMMITTEE (taken directly from Goochland County Board of Supervisor's Meeting Minutes, April 17, 2012 Meeting)

Mr. Alvarez stated the Board of Supervisors, during their March 6, 2012 meeting, announced the formation of the Goochland High Speed Internet Committee. The purpose for establishing the committee is to identify opportunities to facilitate countywide availability of high speed Internet service. Mr. Alvarez stated the proposed mission/vision is to promote high speed Internet availability to all Goochland County residents and businesses at a reasonable cost.

The ***Scope of the Project*** will be:

- Assess needs in the current environment
- Solicit input from citizens and organizations
- Collect information and benchmark with other localities on high speed Internet efforts
- Evaluate possible options for Goochland to pursue
- Hold community meetings to discuss options
- Develop proposal(s) and present recommendations to the Board of Supervisors

Mr. Alvarez stated the committee will be active for no more than 6 months. Along with periodic reports to the Board of Supervisors, it will present its final findings and recommendations to the Board at their October 2012 meeting. Mr. Alvarez reviewed the composition of the Committee which will include the following appointments:

Committee Members

Manuel Alvarez Jr. - Board of Supervisor, Kevin Hazzard – School Board member, the following citizens with expertise – appointed at large by the Board of Supervisors, county staff and School IT Staff.

Citizens

- Elizabeth Nelson-Lyda
- Ben Slone
- David Gerace
- Marshall Bowden
- James Dearden
- Richard Lewis
- Matt Brewer
- John Meyers
- James Maitland*

*late addition to the committee

County Staff

- Qiana Foote – Interim Director, Information Systems Technology
- Paul Drumwright – Senior Management & Projects Analyst School IT Staff
- Peter Martin – Coordinator of Technical Services

It was noted these meetings would be open to the public, in compliance with the Freedom of Information Act. On motion of Ms. Lascolette, seconded by Mr. Minnick, the Board approved establishment of the Goochland High Speed Internet Committee, along with its mission/vision, scope, time frame and appointment of members.

Mr. Alvarez asked if the committee wants to change its mission/vision do we have to come back to the Board for approval. County Attorney Sales stated it would depend upon how much of a change you are contemplating. Just tweaking the mission statement of the committee

he does not think it would require Board approval unless the Board wanted it, if there was a sea change in the scope of the Committee then I think you would want to come back to the Board to bless it. Mr. Alvarez stated it is his intention to get everyone together then set meeting dates through October. Meetings would be held at the County Administration Building and would be streamed through the Internet. Mr. Peterson asked if there is any intention to expend any funds. Mr. Alvarez stated no, none at all; it is really for figuring out what we have today, where we might want to go in the future, what opportunities we have for the county, look at the options, noting everything would have to be approved by the Board of Supervisors.

Ayes: Alvarez, Creasey, Lascolette, Minnick, Peterson.

Nays: None.

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Glossary

Term	Definition
<i>1xRTT</i>	Cellular communications <i>protocol</i> predating 3G; 144kbs of <i>bandwidth</i> . Still in use in some Goochland cellular towers.
<i>3G</i>	Cellular communications <i>protocol</i> , 3rd Generation - a.k.a. <i>wireless broadband</i> ; Generally <i>bandwidth</i> up to 1.4Mbps.
<i>4G</i>	The 4th generation of mobile broadband. This standard, itself, is much faster than actual obtainable speeds, and is limited by the providers' and users' equipment. The 4G standard is closely related to the WiMAX standard of telecommunications.
<i>4G LTE</i>	Long Term Evolution (LTE) standard of 4G wireless broadband. Current typical speeds are between 5 and 12 Mbps. LTE is a GSM-based technology (the bulk of the world has used the GSM cellular standard, while many US carriers, such as Sprint and Verizon, used CDMA). Adoption of this version of 4G is becoming globally accepted, and may lead to the first global mobile telecommunications standard.
<i>backbone</i>	A high-speed connection that forms a major pathway within a network. See also <i>backhaul</i> .
<i>backhaul</i>	This is the "first-mile", high-bandwidth connection, typically over fiber, which transports data from a network back to a major service providers' core network, or data center.
<i>bandwidth</i>	How much data that can be sent through a connection. Usually measured in bits-per-second (bps), or less commonly, "baud".
<i>bit</i>	A single digital number, either a 1 or 0. The smallest unit of data is a bit (b).
<i>BoS</i>	Goochland County Board of Supervisors.
<i>bps</i>	Bits-Per-Second. A unit of measurement for how fast data is moved through a connection (<i>bandwidth</i>). A "56k" dialup modem can move data at up to 57,000 bits per second. A 1.4Mbps wireless modem can move up to 1,400,000 bits in one second.
<i>broadband</i>	See <i>high speed Internet</i> .
<i>browser</i>	An end-user software (application) that is used to access various kinds of Internet resources.
<i>byte</i>	A set of <i>bits</i> representing a single character of data. File sizes are typically given in bytes (B). In bandwidth measurement, there are 8 bits in a byte. Therefore, it takes approximately 8 seconds to transfer a 1 MB file on a 1Mbps connection. Modern computers store data in higher numbers of bits in each byte, depending on the operating system (32-bit, 64-bit), in order to access large files, which is transparent to the user.

Term	Definition
<i>CATV</i>	Cable television.
<i>cellular</i>	A mobile telecommunications system that uses a number of short-range radio stations to cover the served area. The signal is automatically switched from one station (tower) to another as the user's location changes. In rural communities, cellular technology is often applied to household (fixed location) Internet service.
<i>cloud</i>	Cloud computing is the use of the remote shared resources over the Intranet, typically using a standard web browser. The "cloud" may refer to off-site storage accessible from many machines and locations, and may also include shared applications. There is a growing trend in the IT industry for expensive and powerful processors, databases, and software licenses to be remoted and shared by users. This concept is similar to the earlier days of mainframes and terminals, but with the Internet as the network connection. A high speed Internet connection is typically vital to proper performance. Netflix, Google Docs, and Dropbox are just a few examples of clouds. Note that a cloud shaped symbol is often used to denote the Internet as a connection means.
<i>COAX</i>	An old, but very elegant design of 2-conductor cable whereby a woven shield conductor isolates (shields) an inner conductor from outside interference. Although designed initially for low frequency signals, this cable continues to push higher and higher bandwidths. Used by cable companies, such as Comcast, as a <i>middle-mile</i> and <i>last-mile</i> solution.
<i>co-location (cellular)</i>	The installation of more than one providers' cellular equipment on a tower. It is common for towers to be owned by a third party, who is not a provider, and leased to one or many service providers.
<i>DHCP</i>	Dynamic Host Configuration Protocol (DHCP) is a protocol by which a machine can obtain an IP address from a server or router. Many <i>ISP's</i> provide a different <i>IP address</i> each time a customer connects.
<i>DSL</i>	Digital Subscriber Line. A method for moving data over standard (copper) phone lines. A DSL connection is much faster than a telephone (dial-up) connection. Standard voice telephone service can be shared with DSL with the use of filters, used to remove the higher frequency data for conventional telephones and fax machines connected to the same phone wiring. The distance from the user to the Central Office providing the service reduces the available bandwidth. For this reason, DSL is typically limited to 3 miles of total cable length.
<i>EDA</i>	Economic Development Authority.
<i>Ethernet</i>	The most common <i>protocol</i> for networking computers in a <i>LAN</i> .

Term	Definition
<i>FCC</i>	The Federal Communications Commission. An independent agency of the United States government, the FCC regulates wired and wireless communications, with goals directed toward public safety, economic well-being, truth in advertising, and accessibility. For example, the FCC protects your right to install an antenna on your roof to access wireless telecommunications, but does not regulate the price or existence of such services.
<i>fiber</i>	Fiber optic cable. An optical, non-conductive cable, using light produced by Light Emitting Diodes (multi-mode fiber) or lasers (single-mode fiber), to transmit data, often for long distances, over a thin glass strand. Verizon FiOS, run to the home, is only one example, and very different from that used as a backhaul by service providers. Typically, two strands of fiber are required for each data connection (transmit and receive). Unused fibers are often referred to as being "dark".
<i>FIOS</i>	Verizon FiOS is a bundled Internet access, telephone, and television service which operates over a fiber-optic communications network.
<i>FTTH</i>	Fiber to the home. A term for any broadband network architecture using optical fiber to replace all or part of the usual metal local loop to residences.
<i>FTTP</i>	Fiber to the premises.
<i>fire wall</i>	A software and/or hardware that separates a PC, or network, into two parts (often <i>virtual</i> parts). The pre-fire wall side typically has no private data to be exploited, while the post-fire wall side employs protected access to help keep data safe from <i>hackers</i> .
<i>Gbps</i>	Gigabits-per-second or 1,000 Mbs. A high rate of speed, common for LAN traffic, but typically reserved for major <i>backhauls</i> in WANs.
<i>Geek</i>	Slang for one who, due to an odd or non-mainstream aptitude in an overly-technical, narrow-band of subject matter, was targeted to serve on the Goochland High Speed Internet Committee.
<i>GHSIC</i>	Goochland High Speed Internet Committee.
<i>Gigabyte (GB)</i>	1,000 Megabytes or 1,000,000 kilobytes or 1,000,000,000 bytes. (Note that as binary measurements typically are very large numbers formed in powers of 2, technically there are 1024 MB in a GB, but only real a real <i>Geek</i> worries about this.)
<i>hacker</i>	An unscrupulous person intent on gaining access to a private network for malicious purpose.

Term	Definition
<i>high speed Internet</i>	A term that is generally used to describe Internet service that is significantly faster than dial-up access using a 56k modem. This term is also referred to as <i>broadband</i> Internet. The actual <i>bandwidth</i> threshold defining such service is in contention. High speed Internet, in varying degrees of bandwidth, may be provided alone, or in conjunction with cable television on coaxial cable, wirelessly using cellular technologies, DSL over phone lines, dedicated fiber to the home, carried over various radio technologies, and via satellite.
<i>HTML</i>	HyperText Markup Language. The coding language used in web <i>browsers</i> .
<i>internet</i>	2 or more networks connected together.
<i>Internet</i>	The vast collection of interconnected networks, using <i>TCP/IP</i> protocols, forming a global WAN. The Internet is largely unsecured, but moves so much data, in so many potential pathways, that it is difficult for to consistently monitor any one user's traffic from one location.
<i>Intranet</i>	A collection of files and directories, located within a private <i>LAN</i> , accessed using the same kinds of software as the public Intranet, but only for internal use.
<i>IP address</i>	A 4-part number, separated by dots, providing a unique address for network access (example: 192.168.1.124). Note that computers within a LAN typically are unique only to that LAN, while Internet-accessible servers must be globally unique. Due to a limited combinations of numbers in this system (version 4), a second system (version 6) using 6 groups of numbers, is gradually being adopted. A static IP address is one that never changes, while a dynamic address (see <i>DHCP</i>) is assigned by the server upon connection. Some <i>ISPs</i> can provide a static IP address for a fee. Many servers also use Domain Names that are easier to remember, but work similarly.
<i>ISDN</i>	A largely-outdated data connection using telephone lines, providing up to 128kbs of bandwidth. During voice conversations, the speed is reduced by one half.
<i>ISP</i>	Internet Service Provider. This is the company who provides an Internet connection to a customer; Verizon, Comcast, etc.
<i>IT</i>	Information Technology. Very general term referring to anything related to the field, including everything from computer hardware to network management. Most large companies have IT departments.
<i>jitter</i>	The undesired deviation from the predicted signal transmission time.
<i>kbps</i>	1000 bits per second.
<i>kilobyte</i>	1000 bytes (kB).

Term	Definition
<i>LAN</i>	Local Area Network. This is the private network confined to a limited area, typically within the same building, floor of a building, dwelling, etc. It can be wired, wireless, or both.
<i>last-mile</i>	The technology used to deliver Internet from a network hub to the end-user (customer).
<i>latency</i>	A measure of the time delay experienced in a connection, between when a signal is sent and received.
<i>Linux</i>	A series of widely-used, Open Source (free) and low-cost <i>operating systems</i> , based on the system kernel first released by Linus Torvalds in 1991. Complete operating systems, including desktop interfaces, are released as "distributions", such as "Ubuntu" and "Mint". These can be a no-cost alternative to Microsoft Windows or Apple, often run on older, less-powerful computers, and are generally limited to the growing number of Open Source software applications specifically written for it. Due to its worldwide popularity, today's most popular browser applications are also released in Linux versions.
<i>MBC</i>	Mid-Atlantic Broadband Cooperative is a not-for-profit entity, based in South Boston, VA, created to build a cost-effective, carrier-class infrastructure to expand high-speed Internet services into Southside Virginia. MBC currently operates a 700-mile active network of fiber optic cable, spanning from Atlanta, Georgia to Washington DC, and is a wholesaler of broadband services. This network has a 100 Gbps capability, capable of OC-768 bandwidth. Much of the benefit of MBC fiber in rural communities has been from <i>last-mile</i> projects driven by Tobacco funding, and has excluded Goochland County. The nearest branch of MBC fiber is in Powhatan, VA.
<i>Mbs</i>	1,000,000 bits per second or 1,000 kbs.
<i>Megabyte (MB)</i>	1,000 kb or 1,000,000 bytes.
<i>middle-mile</i>	The technology used to deliver Internet from the <i>backhaul</i> to the <i>last-mile</i> . This is often a local service provider's network.
<i>modem</i>	MOdulator/DEModulator. A device that interconnects the <i>ISP's middle-mile network</i> to the customer's computer or <i>LAN</i> . Modems may be rented from the <i>ISP</i> or owned by the customer. Some modems may also act as <i>routers</i> .
<i>network</i>	The connection of multiple computers together to share resources.
<i>node</i>	A single point or computer on a <i>network</i> .

Term	Definition
<i>non-regulated service</i>	The provision of goods or services that is largely not regulated by the government. Although the local franchising authority may regulate some aspects of telecommunications companies, all but telephone is considered non-regulated in Virginia. In general, such privately-owned companies use their own business models to determine fee structure, service offerings, service areas, and how to invest their money. While our County Franchise Agreements and State laws may dictate minimum population densities requiring services for some providers, such companies are under no obligation to exceed these very basic requirements.
<i>OC-1</i>	Optical Carrier. A transmission protocol with bandwidth of 51.84 Mbps. This is the base unit, and can be obtained at multiples of this speed.
<i>OC-768</i>	Optical Carrier with a bandwidth of 51.84x768 Mbps or 39.813 Gbps (usable bandwidth is this minus network management overhead).
<i>operating system</i>	An Operating System (OS) is the software that manages the applications, services, and hardware on a computer. Examples include Windows 7, OS X Lion (Apple), Ubuntu 12.04 (<i>Linux</i>), and Android 4.1 Jelly Bean (Google) - all of which employ the same <i>TCP/IP</i> standard to communicate on the Internet. However, software applications residing on a computer must be written for the specific OS which is running to function properly.
<i>ping</i>	A test to see if a server is running.
<i>POP</i>	Point of Presence (also Post Office Protocol). A term that refers to availability of an ISP or network in a region. (The second definition is a popular protocol that an email client software uses to interface with a mail server.)
<i>POTS</i>	Plain old telephone service.
<i>protocol</i>	A set of rules used for two devices or systems to communicate electronically.
<i>public utility</i>	An organization that provides a service, and/or maintains infrastructure for a service, to serve a community. Such organizations are subject to varying degrees of public control and regulation. Regulation may occur when the government believes that the operator would behave in a way that is contrary to the community's best interest, but would not weaken or stagnate that market.

Term	Definition
<i>quality of service</i>	Quality of Service (QoS) refers to several related aspects of telephony and networking in the transport of information. Criteria that may be applicable to the application includes: bandwidth, latency, jitter, availability, bit error probability, and dropped packets. Quality of service directly relates to user satisfaction, and the importance of each of the individual criteria will vary by application.
<i>regulated service</i>	The provision of goods or services that is regulated by a government-appointed body. The regulation may cover the terms and conditions of service, including the price allowed to be charge, and/or to whom they are distributed. Often, this is the result of a effort to control a monopoly, as in the case of telephone, water, gas, and electricity.
<i>router</i>	A special-purpose mini-computer that manages the connections between 2 networks, and commonly in a small-scale <i>LAN</i> , may also <i>network</i> together local computers.
<i>satellite</i>	A transceiver which has been placed in orbit. The most common satellites providing Internet service are geostationary (fixed position relative to a point on the surface of the Earth). Such satellites must necessarily be located in the Clarke Belt, 22,236 miles above sea level, and directly above the equator. Because of this distance, signals will experience <i>latency</i> greater than 1/2 second for a round trip, and then again for a response. Low and medium-Earth orbit satellites orbit much closer, with far less latency, but require many units to cover a region as they continuously move relative to a any given point. O3b Networks is a medium-Earth orbit (1,243 miles above sea level) collection of satellites currently used as a <i>backhaul</i> for WANs. These satellites, similar to GPS satellites, orbit the earth every 12 hours.
<i>server</i>	A specialized computer, or software, that provides services to "client" software residing on network. A server may provide Internet access, applications, centralized data storage, and more to networked computers..
<i>skype</i>	Skype is a proprietary VoIP and video conferencing service and software recently purchased by Microsoft. Direct communication between devices is free after any ISP charges. A telephone number can be obtained for a monthly fee.
<i>T-1</i>	A leased-line connection capable of providing data at a bandwidth of 1.544 Mbps.
<i>T-3</i>	A leased-line connection capable of providing data at a bandwidth of 44.736 bps or the equivalent of 29 T-1's.

Term	Definition
<i>TCP/IP</i>	Transmission Control Protocol/Internet Protocol. This is the basic protocol that the Internet uses to move information. All major operating systems use TCP/IP to communicate over the Internet, allowing Windows, Apple, Linux, Android, etc. machines to seamlessly access and share the same web pages, mail servers, <i>clouds</i> , and other services.
<i>terabyte</i>	1,000 GB or 1,000,000 MB.
<i>URL</i>	Uniform Resource Locator. This is simply the web address for a specific webpage on the Internet. It is entered into a web browser and must be exact to make contact.
<i>vertical asset</i>	A sufficiently tall or strategically significant raised location, potentially useful for installing wireless networking equipment for use in a <i>middle-mile</i> or <i>last-mile</i> capacity.
<i>VITA</i>	Virginia Information Technologies Agency. See http://www.vita.virginia.gov/
<i>VoIP</i>	Voice over Internet Protocol. This technology allows humans to talk over the Internet, similar to the use of copper telephone lines. Costs can be significantly lower than conventional voice service, and may use IP addressable phones, or adapters and conventional telephones. VoIP requires approximately 64kbs, with low <i>latency</i> and <i>jitter</i> , for toll-quality telephony. Although VoIP will not continuously transmit this much data, it is important that this portion of the total available bandwidth be dedicated to telephony when voice calls are being made.
<i>VPN</i>	Virtual Private Network. A technology for using the <i>Internet</i> to connect computers to a remote private <i>network</i> , such as an Employer's business. This can allow employees to work from home, access their files, printers, etc., while maintaining security. Access may be as a remote user on the network, or remote emulation of the employee's actual computer within the business. This technology is complicated by <i>latency</i> and <i>jitter</i> within the Internet connection. Security is typically accomplished using tunneling protocols with encryption and password protection. At today's gas prices, for some individuals, this capability can more than pay for the cost of Internet service.
<i>WAN</i>	Wide Area Network. The connection two or more <i>LANs</i> together to cover a larger geographical area, typically leaving the confines of a building. Interconnection may comprise leased lines (<i>T-1</i> , etc.), microwave transceivers, dedicated fiber, radio, cellular (<i>4G</i> , etc.), or <i>satellite</i> , and may consist of distributed connections to the <i>Internet</i> . Large <i>LANs</i> may utilize <i>backbones</i> to interconnect sub-networks, and <i>backhauls</i> to connect sub-networks to the Internet. The largest WAN in existence is the Internet, itself.

Term	Definition
<i>WiFi</i>	A wireless LAN, connected using radio signals to transmit over a small area, known as a "hot-spot". Connection to the network may be open or secure, requiring password access. Routers having Wi-Fi capability are known as "wireless routers".
<i>WiMAX</i>	A wireless networking technology, similar to Wi-Fi, but with the ability to communicate over greater distances and higher speeds. 4G is a type of WiMAX using cellular frequency bands.

FAQ

Q.	Will Comcast come to my neighborhood in the near future?
A.	Comcast has already expanded its infrastructure to cover the existing areas which currently meet its business model. They are receptive to covering additional areas where communities will provide the up-front investment required to bring a rural area into its minimum required return on investment strategy.
Q.	Can someone force a provider to serve my area?
A.	No. There are no Internet services that are currently regulated in such a way that service are can be mandated beyond current State and Local Government Franchise Agreements.
Q.	Should Goochland County become an Internet Service Provider?
A.	There is no easy answer to this dynamic and complex question. Building, maintaining, and upgrading a public service is a large undertaking, and could discourage other providers from serving Goochland County. There are varying levels of involvement that a community can take to create an attractive environment for providers.
Q.	How can I determine what Internet services are available to me?
A.	Currently, there is no single entity charged with assisting residents with finding available providers. However, each ISP currently operating within Goochland County has some type of coverage map on their website.
Q.	I don't have Internet service. Where can I go to get on line?
A.	The Goochland County Public Library has both computers and Internet service available for public use.
Q.	Is federal or state money available to bring Internet service to the County?
A.	Most grants which are available for direct assistance to the County in acquiring rural Internet, require less than 20,000 residents in a community. Goochland County, as a whole, is slightly over this limit. None of the Internet Service Providers, who are current serving Goochland County, pursued grants that could be used to benefit us indirectly.