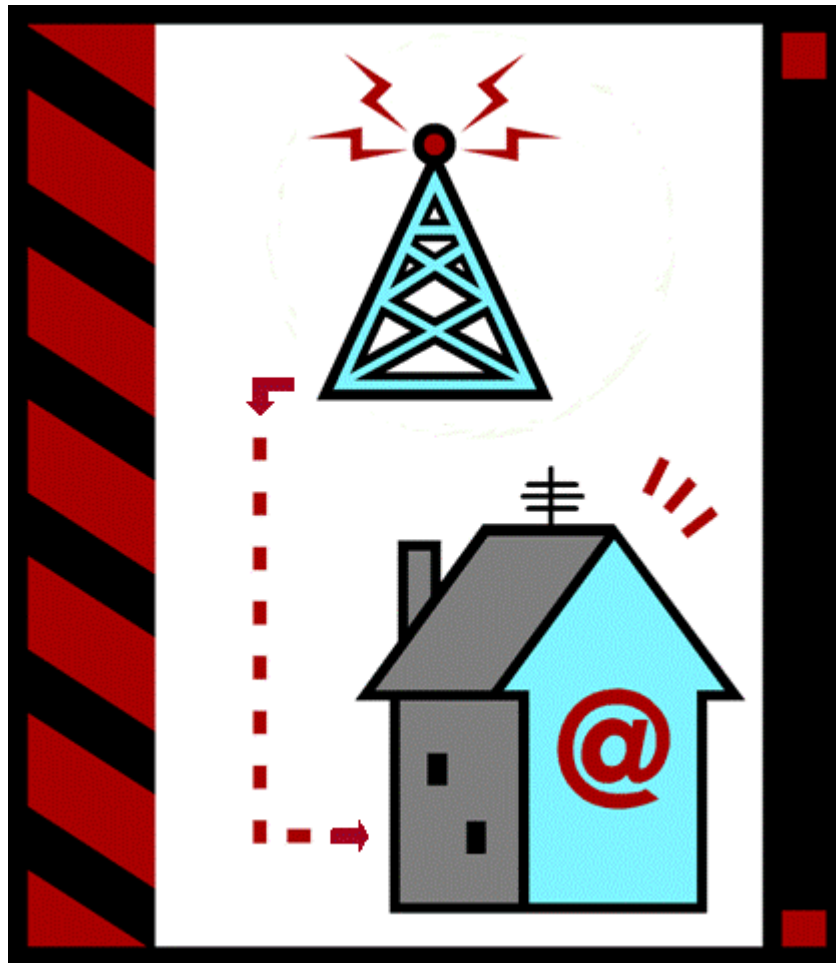


Brookneal 501 Corridor Wireless Broadband Internet System



Fiscal Year 2008 Priority & Initiative: Evaluate the Brookneal 501 Corridor Wireless Broadband Internet system's effectiveness and the potential to expand Wireless Broadband into the underserved areas of Campbell County.

II. Table of Contents

	Page
I. Cover Page	1
II. Table of Contents	2
III. Background	3-5
IV. Brookneal Wireless System Description/Evaluation	6
V. Expansion Capabilities/Competition Evaluation	7
VI. Conclusion	8
VII. Recommendation	9
VIII. Definitions	9-12
IX. Appendices	
a. Appendix 1 – Elert & Associates Scope of Work	13
b. Appendix 2 – Elert & Associates Executive Summary	14-15
c. Appendix 3 – Region 2000 Broadband Infrastructure Study	16-18
d. Appendix 4 – CEDS 2007 Update Projects/Programs and Priorities	19
X. Bibliography	20

III. Background

In May of 2001, the Campbell County Department of Community & Economic Development initiated a grant application to the Virginia Tobacco Indemnification and Community Revitalization Commission to explore Brookneal/Campbell County Broadband Internet access. This project was limited in scope to the Town of Brookneal and the U.S. Route 501 development corridor that was identified as 501 north from Brookneal to the Georgia Pacific facility, approximately a 5 mile span. The project was the result of complaints from area businesses regarding not having adequate availability to Broadband access. The lack of Broadband access put local businesses at a competitive disadvantage in the marketplace. The project's scope was to contract for professional services to identify needs and opportunities in economic development, to identify engineering requirements to connect to a fiber optic backbone and provide point of presence, to identify service providers, and to establish service in the area. The study was meant to essentially answer three questions, which were:

- Does the Brookneal area have adequate Broadband Internet access?
- If not, is there a need for additional Broadband Internet access in the Brookneal area?
- If there is a need for more Broadband Internet access in the Brookneal area, how can this need be met?

In Fiscal Year 2005, the Campbell County Economic Development Department and Information Technology Department adopted as a future Priority and Initiative the following: **Evaluate the Brookneal 501 Corridor Wireless Broadband Internet system's effectiveness and the potential to expand Wireless Broadband into the underserved areas of Campbell County.** In Fiscal Year 2008, this advanced to a Priority 1 in the Priority & Initiative process. The goal of this Priority and Initiative was to evaluate the effectiveness of the Brookneal Wireless Broadband system and the potential to expand the system to other areas of Campbell County.

In 2001 the Virginia Tobacco Indemnification and Community Revitalization Commission awarded a grant in the amount of \$50,000 for the Brookneal/Campbell County Wireless Broadband Internet/Access project. The project totaled the \$50,000 awarded by the Tobacco Commission.

The Board of Supervisors for Campbell County authorized the release of an RFP for Telecommunication Consulting Services to identify the requirements and funding needed to identify needs and opportunities in economic development, to identify engineering requirements to connect to a fiber optic backbone and provide point of presence, to identify service providers, and to establish service in the area. The Request for Proposal was properly advertised, proposals were received, and Elert & Associates of Stillwater, Minnesota, was awarded the contract.

Elert & Associates signed an Agreement with Campbell County for the completion of this project in July 2002. The first step in E&A's process for completing the delineated Scope of Work for the project (Appendix – 1) was to create and perform a survey and conduct interviews. The survey was created in conjunction with Campbell County staff and hosted a set of questions to be asked of Brookneal business representatives. A planning session and face-to-face

interviews were arranged and conducted. In attendance were business people, Town of Brookneal and Campbell County officials, and school district personnel. E&A briefed those present on wireless technology and its capabilities. The survey was used in the face-to-face interviews and was mailed to other businesses as a written questionnaire.

E&A next gathered provider information from current and potential providers of wireless Broadband Internet. This information included the level of existing services and the providers' plans for expanding services. Following this step, E&A performed a topographical review of the area. The topographical review included:

- Examining existing tower locations
- Examining distances and potential barriers to Broadband Internet wireless communications
- Touring the area with Mike Davidson, Director of Economic Development, to see potential customers and their buildings, potential base station locations for a central provider, and possible wireless paths to service providers from within and outside Brookneal
- Obtaining latitude, longitude, and ground elevation information for the potential base station locations

Finally, E&A performed an analysis of the information gathered and created a report on the results of its study (Elert & Associates, 7-8).

Elert & Associates reported its Findings, Analysis, and Recommendations in its Executive Summary (Appendix 2).

As an overview of its Executive Summary, E&A found that the current providers, Sprint (now Embarq) and Adelphia (now Comcast) either were not providing services or had no plans for expanding existing Broadband Internet services in Brookneal, though the majority of the Brookneal businesses expressed wanting greater bandwidth (speed) and being willing to pay slightly more than they currently paid for dial-up services. Since Sprint, the telecommunications provider, and Adelphia, the cable TV service provider, were not providing access to meet the needs of the consumer and neither planned on expanding services, the most economical system type to install was identified as wireless Broadband. However, the typical cost for wireless Broadband Internet service was much higher than the customers were currently paying or were willing to pay in the future as identified by the survey questionnaire. In addition, bringing Broadband to the area was estimated to cost roughly \$100,000 for the installation of the antenna tower and the backbone equipment. Plus there were other related costs that would be rolled into monthly user fees.

E&A found that from a technical standpoint, installation of a wireless Broadband Internet service would be very feasible. There were at least four wireless providers interested in bringing Broadband to Brookneal, though the providers wanted an assurance of customers. There appeared to be concern that there was not a large enough volume of end users to make a traditional business plan/model work or be economically successful.

As a result, E&A recommended a public/private partnership to install wireless Broadband Internet in the area. E&A suggested gaining financial support for a system through grants or local funding and recommended working with the Town of Brookneal to use its downtown water tower for an antenna attachment, at no cost to the potential providers. Among its other recommendations were getting proposals from potential providers, promoting Broadband to the customer base, possibly easing current regulations and/or ordinances for potential providers, and, finally, evaluating the progress made after one year's effort (Elert & Associates, 4-5).

Upon the recommendation of the Elert & Associates study, in 2002 Campbell County applied for and was awarded a grant from the Tobacco Commission for the installation of a wireless Broadband Internet system. One stipulation of the Tobacco Commission's approval was for a not-for-profit organization to own the system for a period of time. The Industrial Development Authority of Campbell County agreed to serve in this capacity. The IDA contracted with Pure Internet, Inc. to be the Wireless Internet Service Provider (WISP) and install the system. Pure Internet currently provides internet service to approximately 12 customers in Brookneal.

As a result of the study and the IDA's installation of its Broadband Internet system, Applewood Communications (formerly ezTel Network Services, LLC) and Embarq (formerly Sprint) saw the demand for High-speed and Broadband access in Brookneal. Applewood Communications installed its own wireless Broadband Internet system, which now serves approximately 25 customers, and Embarq brought more DSL service into the area.

In 2004 the Region 2000 Economic Development Partnership conducted a Broadband Internet Study. Region 2000 determined in its Broadband Internet Study that "the availability of Broadband technologies is critical to the regional economy. Broadband is an *accelerator* of economic development. It has a pervasive impact that comes from both direct and indirect sources" (Region 2000, iiix). Appendix 3 is a copy of the Executive Summary for this study.

The Campbell County Comprehensive Economic Development Strategy 2007 Update, created and presented by Campbell County staff and the CEDS Committee (comprised of the Economic Development Commission and appointed Committee members) and adopted by the Campbell County Board of Supervisors, places a great deal of emphasis on the importance of Broadband connectivity.

The CEDS 2007 Update states in its Executive Summary, "Campbell County recognizes Broadband Internet connectivity to be one of the basic infrastructure needs for all business, equally important as water, sewer, roads, and electricity" (Campbell County, Virginia, Department of Economic Development, ES-2). The CEDS Committee identified Last Mile Broadband Internet Access as one of its current top five priorities (Campbell County, Virginia, Department of Economic Development, 2-1).

IV. Brookneal Wireless System Description/Evaluation

Campbell County received a grant in the amount of \$50,000 from the Virginia Tobacco Commission for the installation of a wireless Broadband Internet system in Brookneal. The IDA agreed to be the owner of the system and entered into an approved contract with Wireless Internet Service Provider (WISP) Pure Internet, Inc.

According to the “Payment Schedule and Milestones” from the Contractual Services Agreement, Pure Internet contracted to design, procure, and install “a 900 MGH non-line of sight system consisting of, but not limited to, antenna, routers, servers, and additional necessary equipment to provide for an operational Wireless Broadband Internet Access system.” For five (5) years Pure Internet will warrant the equipment, parts, and labor and will provide primary network maintenance. It will also provide problem resolution.

All High-speed or Broadband systems still need an ISP for wireless coverage. The current wireless signal is broadcast in 360 degrees from atop of the Main Street water tank. The elevation of the Main Street Water tank is 570 feet above sea level, at a height of 90 feet. The higher you can locate the antenna the greater the range and quality of coverage you can provide. A cell tower is the ideal location to affix a wireless antenna due to the heights at which they are built. Most co-location fees for a cell tower are in the \$1,000 or greater per month range. A system needs a large subscriber base to be able to afford that kind of monthly fixed fee. Once broadcast from the antenna, the signal is received by a small antenna inside of the business or residential building. The antenna is connected to the computer and provides for the two-way transport of the signal from the computer to the water tank main antenna via a wireless signal. There lies the potential for ground and topography interference. Wireless systems do not have the ability to penetrate all low topographic depressions and may pass overtop of them without providing a signal. The broadcast signal does not have the ability to penetrate large solid obstructions. Under perfect conditions, the maximum limit of broadcast is a 5 mile radius from the broadcast antenna. A three mile radius is more effectively served by a single antenna site.

The Pure Internet Broadband Internet system works effectively to meet the needs of its customers, though some areas of Brookneal cannot access the system due to topography and signal interference. Some of the signal interference has been caused by competing wireless systems. The system proves to be reliable, with little down time.

Pure Internet has not gained the clientele anticipated due to unexpected competition. Once ISP's such as Applewood Communications and Embarq saw the demand for Broadband services, they began providing High-speed internet services and were able to do so at a lesser cost to the consumer than Pure Internet initially charged. This result, however, is still in line with the intent of the Tobacco Commission grant, which was to bring more Broadband connectivity to the Brookneal area. Presently the customers of the two Brookneal wireless Broadband systems are paying the lowest monthly fees of any location in Virginia.

V. Expansion Capabilities/Competition Evaluation

Brookneal

- Hunter Road Water Tower: This would be a better strategic location for the system since it is a taller tank, but there is no electrical service to this tower and no equipment shack in which to store the equipment. The County looked at servicing the tower with solar panels and a tank closet, but this is not feasible due to the size of the battery pack necessary to insure reliability.
- Cell Towers: There are two cell towers in Brookneal. Both require a monthly payment of \$1,000 to hang equipment on their structures. There are not enough customers to make a business plan work with that added expense while still keeping the service reasonably priced.
- Mid-Atlantic Broadband Cooperative is exploring the option of building a tower in Brookneal. If it does that, Campbell County might be able to take its Broadband Internet system to a higher elevation, which would expand its coverage area.

Naruna

- Cell Tower: It is too expensive to hang off the cell tower.
- William Campbell High School: Campbell County looked at the water tank at William Campbell High School and held conversations with the school officials, offering WCHS free connections in exchange for the ability to hang off of the water tank. The school system was exploring creating its own private wireless system and would not entertain the proposal. There are no other suitable existing structures to hang off.

Gladys

- Cell Tower: It is too expensive to hang off the cell tower.
- Kedron Baptist Church: Campbell County unofficially explored the option of utilizing the church steeple to hang the antenna. Campbell County talked with a member of the church's Deacon Board, but the project did not materialize.
- Emergency Services site and Private site: Campbell County looked at a co-location option on a site controlled by the Emergency Services organizations. It also looked at a co-location option on a site owned by a private business owner in Gladys. The County would have constructed a tower on either of their sites. Neither site was at the optimal elevation, which would have limited the coverage area and, therefore, the customer base.
- Sprint/Embarq: Sprint/Embarq announced its intention to roll out more DSL service at a cheaper rate. It could not, however, make a business case for the expansion costs.

Halifax County

- Perth power substation: The opportunities to hang off of structures near the Perth power substation did not materialize.

Red House

- Red House: Campbell County explored the potential to co-locate on an MCI tower near Red House. MCI sold the tower, and the new owner was not interested in pursuing the proposal.

VI. Conclusion

Based upon the research conducted, Campbell County presents the following conclusions regarding the Brookneal 501 Wireless Broadband system.

The existing system is operating effectively and efficiently. The existing customer base for Broadband in this service area includes small business, in home business, and private users. Presently there are 12 business customers utilizing the IDA-owned system. There are other enhanced means of Broadband connectivity as a direct result of this system being put into operation. Presently the system provides 90 % coverage in a three (3) mile radius around the broadcast antenna. The areas not covered are due to topography and solid obstructions blocking the signal.

The area encompassed by the system's territory is sparsely populated. This presents a challenge to normal business plans. There are not enough potential users to justify return on investment for a private enterprise due to the large expenditures required for the infrastructure. If bank financing is necessary for the project, the business plan will not justify enough revenue to allow a financial institution to loan funds for such uses.

There are limited potentials to co-locate on existing communications (cell) towers, and the normal fees to co-locate on such towers are cost prohibitive based upon the potential customer base. Antennas need to be at least in the 100 to 120 foot height range to service a three (3) to five (5) mile radius. The cost to develop and construct a tower site in the range of 120 feet costs approximately \$50,000 for a monopole structure and more for a lattice tower. Monopole structures are not conducive to co-locating other users' antennas. Because of the limited number of potential customers and the monthly fees to recover the capital investment expenditures for construction of these tower structures, the costs are prohibitive in a normal business plan.

Once the initial research was completed that established the need for more service, several other providers changed their position and entered the market to provide High-speed connectivity. While this has expanded the opportunity for Broadband access in the Brookneal community, it has also impacted the ability to expand the existing IDA-owned wireless system. Presently there is an additional wireless provider that is serving approximately 25 customers, and Embarq has expanded its DSL service. Economic Development is unable to confirm the number of new users of DSL, as Embarq will not release those numbers. Typical Wireless Broadband monthly user fees average \$45.00 per month. The competition in the area between the two existing wireless systems has driven down the monthly fee to \$29.95 per month. Typical DSL for private subscribers runs around \$35.00 per month. The competitive pricing of Broadband connectivity has limited the potential to recover capital investment expenditures and eliminated the generation of revenue to fund expansions of the system.

VII. Recommendation

Campbell County staff recommends that the greatest opportunity to expand the existing system lies with a Mid-Atlantic Broadband Cooperative expansion. If Mid-Atlantic Broadband installs a tower in the Brookneal area and Campbell County co-locates its system to that tower, the County will be able to take its Broadband Internet system to a higher elevation, and thus reach a larger service area.

The County staff also recommends that the County conduct a more thorough study of the entire county to find a regional solution. The Departments of Economic Development and Information Technology adopted the following Priority and Initiative: **FY09 P7I- [Economic Development] Work with Information Technology to complete a Broadband assessment to include the research obtained during the evaluation of the Brookneal 501 Corridor Wireless Broadband Internet system. The assessment will provide the breadth and depth of Broadband service in the County, the providers involved, and the prices and service packages available.**

VIII. Definitions

- **ADSL (Asymmetrical Digital Subscriber Line):** Term for a higher-bandwidth link to the business or home over twisted pair wiring already going to the location. The word asymmetric refers to the fact that this technology offers greater bandwidth from provider to user (downstream) and a smaller amount in the reverse direction (upstream). See also DSL. (Region 2000, 54).
- **Antenna** An antenna is a transducer designed to transmit or receive electromagnetic waves. In other words, antennas convert electromagnetic waves into electrical currents and vice versa. Antennas are used in systems such as radio and television broadcasting, point-to-point radio communication, wireless LAN, radar, and space exploration. Antennas usually work in air or outer space, but can also be operated under water or even through soil and rock at certain frequencies for short distances. Physically, an antenna is an arrangement of conductors that generate a radiating electromagnetic field in response to an applied alternating voltage and the associated alternating electric current, or can be placed in an electromagnetic field so that the field will induce an alternating current in the antenna and a voltage between its terminals. Some antenna devices (parabolic antenna, Horn Antenna) just adapt the free space to another type of antenna (“Antenna”, 2008).
- **Bandwidth:** The amount of data that can be carried by a circuit between two points of a network. Bandwidth is typically measured in Hertz (cycles per second) or kilobits per second or Megabits per second (shortened to Kbps and Mbps). The top speed of today’s modems operates at 56 Kbps. One strand of fiber optics can carry 20,000,000,000 (20 Gigabits) or more (via wave division multiplexing). That 20 Gbps fiber optic strand can interconnect 357,000 telephone calls or carry 222 television channels. As examples of bandwidth, the following chart compares analog to digital bandwidth:

<u>Device</u>	<u>Analog</u>	<u>Digital</u>
Telephone	300-3,000 Hertz	56,000 Bits/Second
Television (broadcast)	30-3,500,000 Hertz	90,000,000 Bits/Second
Compressed Video	30-3,500,000 Hertz	56,000-1,544,000 Bits/Second

(Elert & Associates, 69)

- **Base Station:** The central radio transmitter/receiver that maintains communications with mobile radiotelephones within a given range (typically a cell site). See also Cell, Cell Site (Elert & Associates, 69).
- **Broadband Internet:** Internet data service that provides data rates faster than 200Kb/s. (approx 10 times faster than dial-up) High Speed Broadband is service with data rates faster than 1.5Mb/s. (Region 2000, 54).
- **BPL – Broadband over Power Line:** Internet data service transmitted over standard power lines to the home. Uses a modem that implements protocols based on the Homeplug standard. Commercial services claim to provide a minimum of 256Kb/s service (Region 2000, 54).
- **Cable modem:** A device used to provide data services over a cable TV (CATV) network. Typical offerings are from 1 Mbps to 3 Mbps bandwidth, with 40 Mbps as the upper limit. Users in a given locality share the available bandwidth, so when many local users are connected simultaneously, they will experience slower network performance (Elert & Associates, 70).
- **Cell:** The basic geographic unit of a wireless system. Also, the basis for the generic industry term “cellular.” A city or county is divided into smaller “cells,” each of which is equipped with a low-powered radio transmitter/receiver. The cells can vary in size depending upon terrain, capacity demands, etc. See also Base Station, Cell Site (Elert & Associates, 70).
- **Cell Site:** The location at which communications equipment is located for each cell. A cell site includes antennas, a support structure for those antennas, and communications equipment to connect the site to the rest of the wireless system. This equipment is normally housed in a small shelter at the base of the site. Although many antennas are placed on towers, where existing structure provide for a site that is higher than its surroundings, antennas will be placed on them. For example, antennas have been placed on water towers, grain silos, and building rooftops. See also Base Station, Cell (Elert & Associates, 70).
- **Co-Location:** The siting of two or more separate companies’ (or departments’) equipment in or on the same structure. See also Cell Site (Elert & Associates, 71).
- **Dial-Up (or dial-up):** The technique used to initiate a communications session over a common carrier switched transmission line. More commonly, the use of a standard telephone to create a telephone or data call (Elert & Associates, 72).
- **DSL:** Digital Subscriber Line. A service providing data connectivity (to the Internet or private networks) over ordinary copper telephone lines. DSL circuits are switched, not shared as cable modems, but bandwidth can vary greatly, based on both distance and the quality of the circuit. There is typically a distance limitation of approximately 12,000 to 18,000 feet from the nearest main facility (telephone company central office or equivalent). See ADSL and HDSL (Elert & Associates, 72).

- **Fractional T-1:** One or more channels of a T-1 service. A complete T-1 carrier contains 24 channels, each of which provides 64 Kbps. Most phone companies, however, also sell fractional T-1 lines, which provide less bandwidth but are also less expensive. Typically, fractional T-1 lines are sold in increments of 56 Kbps (the extra 8 Kbps per channel is used for data management) (Region 2000, 58).
- **Frequency:** A measure of energy, as one or more waves per second, in an electrical or light wave information signal. A signal's frequency is stated in either cycles-per-second or Hertz (Hz). See also Hertz (Elert & Associates, 74)
- **Frequency Re-Use:** The ability to use the same frequencies repeatedly within a single system, made possible by the basic design approach for wireless. Since each cell is designed to use radio frequencies only within its boundaries, the same frequencies can be re-used in other cells not far away with little potential for interference. The concept is akin to an FM radio station in Chicago using the same frequency as one in Denver without interference. The re-use of frequencies is what allows a wireless system to handle a huge number of calls with a limited number of channels. (Elert & Associates, 74).
- **GHz (Gigahertz):** One thousand million Hz. A measure of radio frequency. Personal Communications Services operate in the 1.9 GHz band of the electromagnetic spectrum. See also Hertz, KHz, and MHz (Elert & Associates, 74).
- **Hertz:** A measurement of electromagnetic energy, equivalent to one "wave" or cycle per second. See also KHz, MHz, and GHz (Elert & Associates, 75).
- **Interference:** In physics, **interference** is the addition (superposition) of two or more waves that result in a new wave pattern. As most commonly used, the term **interference** usually refers to the interaction of waves which are correlated or coherent with each other, either because they come from the same source or because they have the same or nearly the same frequency. Two non-monochromatic waves are only fully coherent with each other if they both have exactly the same range of wavelengths and the same phase differences at each of the constituent wavelengths. The total phase difference is derived from the sum of both the path difference and the initial phase difference (if the waves are generated from 2 or more different sources). It can then be concluded whether the waves reaching a point are *in phase* (constructive interference) or *out of phase* (destructive interference) ("Interference", 2008).
- **ISP:** Internet Service Provider (Elert & Associates, 77).
- **KHz (Kilohertz – Thousands of Hertz):** See also Hertz, MHz, and GHz (Elert & Associates, 77).
- **"Last-mile" (sometimes referred to as "first mile"):** This term is used to describe the final connection to a building as opposed to the high capacity circuits extending across a city or county. This connection is often the bottleneck that prevents high-speed network connectivity, due to lack of high capacity cabling options (Elert & Associates, 77).
- **Lattice Tower:** A lattice tower is a freestanding steel framework tower. It is used as a pylon especially for voltages above 100 kilovolts, as a radio tower (a self-radiating tower or as a carrier for aerials) or as an observation tower ("Lattice tower", 2008).
- **Line-of-Sight Transmission:** Transmission limited to straight lines. Examples are microwave and laser. Most wireless wide area network transports require a line of sight from the sending location to the receiver (Elert & Associates, 78).

- **MHz (Megahertz):** Millions of Hertz. See also Hertz, KHz, and GHz (Elert & Associates, 79).
- **Monopole Antenna:** A monopole antenna is a type of radio antenna formed by replacing one half of a dipole antenna with a ground plane at right-angles to the remaining half. If the ground plane is large enough, the monopole behaves exactly like a dipole, as if its reflection in the ground plane formed the missing half of the dipole (“Monopole antenna”, 2008).
- **Router:** A device that performs routing functions – possibly altering physical data link and network layer protocols – within a network or between dissimilar networks (Elert & Associates, 83).
- **T-1:** A label describing a transmission speed of 1.544 Mbps, or the equivalent of 24 analog lines. Also known as DS1 (Region 2000, 58).
- **T-3:** A label describing a transmission speed of approximately 45 Mbps (44.735Mbps). Also known as DS3 for Digital Signal 3 speed. Equivalent to 28 T1’s (Region 2000, 58).
- **Transmission:** The transfer of information from one point to another using one of many physical methods and one of many media (Elert & Associates, 85).
- **Wireless:** Describing radio-based systems that allow transmission of telephone and/or data signals through the air without a physical connection, such as a metal wire or fiber optic cable (Elert & Associates, 87).
- **WISP (Wireless Internet Service Provider):** Internet service providers with networks built around wireless networking. The technology used ranges from commonplace Wi-Fi mesh networking or proprietary equipment designed to operate over open 900MHz and 2.4GHz bands or licensed frequencies in the UHF or MMDS bands (“Wireless Internet service provider”, 2008).
- **900 MHz:** 900 millions of Hertz. See also Hertz, KHz, and GHz.

Appendix 1 – Elert & Associates Scope of Work

Elert & Associates was selected through the County’s RFP process. The scope of work was noted as “to identify needs and opportunities in economic development, to identify engineering requirements to connect to the existing fiber optic backbone and provide point of presence, to identify service provider(s), and to identify investment needed to establish service in the area.”

As per the RFP, the primary task was to “perform a comprehensive evaluation and prepare a report to include, but not limited to, the following:

- A. Survey and catalogue existing business and industry (located within the identified corridor) needs for wireless broadband Internet access.
- B. Survey and catalogue existing applicable infrastructure to identify and determine what additional infrastructure will be necessary to implement wireless broadband access.
- C. Define the area that can be served.
- D. Prepare a detailed outline of the necessary infrastructure needed to complete the project.
- E. Coordinate with the Tobacco Indemnification & Community Revitalization Commission E-58 Project to insure compatibility.
- F. Prepare a cost estimate to implement the proposal.
- G. Prepare an implementation schedule for proposal.”

Appendix 2 - Elert & Associates Executive Summary

This document is both about “Attending to the Present” and “Concentrating on the Future.”

In the present, the Brookneal areas of Campbell County is suffering through our tough economic times with an added burden – very little availability or choice for Internet connectivity. As we all know, in today’s marketplace every advantage your competitor has is one more hurdle to overcome.

In the future, attracting additional business and residents is essential to the Brookneal area. As workers are more willing to commute further, Brookneal has the potential to become a bedroom community, as well as to add service businesses to cater to those new residents. But potential residents want similar amenities in their new community to those they could have if they lived closer to work. Among these amenities in today’s world is broadband Internet access.

Summary of Findings

- Investigation into the existing and future broadband offerings of the incumbent providers, Sprint and Adelphia, found none now and little hope for future broadband services for Brookneal, though Sprint does have plans to add DSL service in the Rustburg and Gladys areas.
- The majority of the twenty-four businesses who participated in this study desire greater bandwidth (speed) to the Internet than is now available to them. Most currently have only dial-up services at 26.6 Kbps.
- Dial-up Internet Brookneal area subscribers now pay between \$15 and \$25 per month. Most businesses surveyed are willing to increase their monthly payments for Internet service by up to 10%, i.e., up to \$27/month. However, broadband wireless services typically cost \$50 to \$70 per month per connection.
- Estimated “getting started” capital expenditure costs for a wireless broadband system for the study area would be roughly \$100,000 for the “base station” equipment and installation.
- Depending on the user’s location, a tower or mast may be needed at that site. This is usually paid for by the subscriber, either up front or through an increase to the monthly bill. Other than towers/masts, the installation charge for per user generally costs \$100-\$200.
- Ongoing or operational costs would include any necessary tower attachment fees, plus costs for Internet access, for support, and for back office systems. These costs would be passed along to users as part of their monthly fees.

Analysis

Technically, construction of a wireless broadband access system that could serve the Brookneal area is very feasible. Please see “Findings and Conceptual Design for Brookneal” and “Recommendations for System Design” for more information.

E&A found at least four wireless providers who expressed interest in a project in the Brookneal area. However, there is no longer a “built it and they will come” attitude among providers. From a business plan perspective, potential wireless providers today are seeking a guaranteed

customer base and/or funding participation from local agencies in order to ensure that they can be profitable and continue to offer services.

The gap between what potential users say they are willing to pay monthly and the likely real costs could be a barrier to entry to potential Wireless Internet Service Providers.

From an economic development perspective, the lack of broadband service is a sore spot for the Brookneal area.

Recommendations

With start up costs approximating \$100,000, the implementation of a broadband wireless system is very justifiable for this area. We recommend the following steps to move forward:

1. Gain support and funding for potential subsidization of initial capital expenditures to implement a wireless base station facility, whether through local funding or grants.
2. Seek approval from the Town of Brookneal to offer antenna attachment to its downtown water tower at no cost to potential providers.
3. Seek service provision, first by providing potential providers with this study and asking them to submit proposals. If that option doesn't elicit the type of responses the County seeks, then develop and release a Request for Proposal for a wireless system.
4. Promote the benefits of fast Internet access to businesses and residents, with the understanding that fees are somewhat higher, but justifiable due to time savings and added abilities.
5. Review local regulations and/or ordinances with the goal of easing entry for potential providers.
6. Review and evaluate progress after a year's effort, then determine whether additional effort and/or funding are necessary to move ahead.

Appendix 3 - Region 2000 Broadband Infrastructure Study



Region 2000 Broadband Infrastructure Study

Region 2000 Broadband Infrastructure Study

Executive Summary

There is a growing realization that the availability of broadband technologies is critical to the regional economy. Broadband is an *accelerator* of economic development. It has a pervasive impact that comes from both direct and indirect sources.

At the request of the Region 2000 Economic Development Partnership, the Region 2000 Technology Council undertook this study of the Broadband Internet infrastructure in the Region 2000 area.

The study was undertaken to gain a better understanding of the Internet infrastructure in the region as well as the demand side of Internet usage in business, industry and government. The study did not specifically address residential use or deployment of Broadband Internet capability; however, the coverage information applies to residential use as well. The mapping gives a quite complete description of the availability of Internet services regardless of use by businesses or households.

Findings

- Confirmation of the perception that there is a great disparity in high-speed access to the Internet between rural and populated areas of the region. The “digital divide” in the region has more to do with the population density rather than socio-economic divisions. High speed Internet service still costs substantially higher than cut-rate dial up services and this will likely create somewhat of a divide based on socioeconomic differences.
- From some of the town meetings and surveys it appears that many businesses do not know about the availability of high speed internet in the area or have an idea of the impact it could have on their business. Once they switch to a high-speed service they wonder why they did not do it earlier. Part of the business survey that was conducted attempts to understand how local businesses are using the Internet.
- Businesses in the Lynchburg area have many options for high-speed access to the Internet and appear to be adopting the technology. Businesses in Lynchburg indicated a higher usage of DSL than Dial-up for Internet access. Areas outside of the core Lynchburg area and especially in rural areas were found to have no or limited access to broadband capability and limited Internet connectivity by dial-up.
- At least 3 independent options for high-speed Internet access via fiber are available in Lynchburg and into businesses and parks along Route 29 and Route 460 corridors. Availability is highly dependent on demand and willingness to pay for the bandwidth.
- There is an issue with a lack of competition for last mile connectivity for T1, fractional T1's, leased lines, and DSL. Nearly all of the last mile connectivity comes through the local ILEC and the Wire Centers they control. Although backbone connectivity may



Region 2000 Broadband Infrastructure Study

come from other third parties; most companies will still have to go through either Verizon or Sprint (in Altavista & Brookneal) to get connected.

- Most of the local governments have plans to use the Internet to provide better access to government services, forms, and information. However some applications like GIS and access to large documents require the constituents to have broadband Internet service to access or make use of these services.
- The eCorridors project is being implemented in Southside VA to bring gigabit Ethernet capability to communities in the area. Three out of four Region 2000 counties (Campbell, Bedford and Appomattox) were included in the design for a fiber backbone for the area. Discussions were held and ongoing with the Virginia Tech eCorridors team about having them do a similar design for Amherst County so that the complete Region 2000 area would be covered if an effort to execute this plan were made.
- Nearly all of the cable service in the region has or will soon be converted to 2-way Hybrid Fiber-Coax (HFC) systems allowing high-speed Internet access. The only exception is around the Smith Mountain Lake area.
- This effort already has positive impact on the region. The airport now has free wireless Internet access courtesy of Nesbe Cable as a result of this study. Other areas around the region will soon follow. A new project to inform people and promote wireless hot spots in key areas around the region will soon be launched by the R2KTC as a spin-off of this study.
- The state mandate that Standards of Learning tests (SOL's) will all become computer-based could be a growing issue. School systems will have to have the internal and external network capacity to download SOL tests from administration computers, and relay information back to them. Schools which only have a T1 connection back to the administration HQ will find it increasingly difficult since this connection is used both for the school systems intranet as well as school internet traffic. Performance issues may become a major problem. School systems will have to take this into account in their planning and budgets.

Recommendations

- Promote the awareness of broadband connectivity in the area. This can be done by promoting broadband connectivity on the Region 2000 and R2KTC websites and having R2KTC members speak to the topic at Chamber of Commerce meetings and other business gatherings in the region. Many companies apparently still spend hours waiting for documents and e-mail to download over the phone line. This effort should also benefit the IT service companies in the region that can help small businesses set up their systems for high speed internet. The Regional Commission or other regional authority should undertake a series of Public Service Announcements (PSA's) to raise the level of broadband awareness in the region. For example, a PSA could show local businesses how they can improve their operations, and in some cases lower communication and labor costs, by using broadband Internet services.



Region 2000 Broadband Infrastructure Study

- Promote an effort to get Region 2000 more involved with the projects such as the Mid-Atlantic Broadband Cooperative that are working to bring the next level of internet connectivity to the region. Actively engage the political representation in the area to help make this happen.
- Initiate an effort to provide adequate and equal Internet access to all schools and libraries within Region 2000. We should look at a way to provide high speed (10MB or better) connections to all schools and libraries in the region.
- Investigate ways to aggregate demand in the region and provide bandwidth at a cost that can make it commercially viable to offer high bandwidth connection to small and medium size businesses in underserved areas. This could be done in partnership with regional carriers capable of supplying Tier 1 connectivity and then selling the bandwidth to providers in rural areas at a reduced rate so that they can make a business case to provide service in the rural areas. It appears that wireless or Internet over power line will be the best choice to reach rural areas of Region 2000.
- Put in place an effort to maintain a GIS database of regional Internet connectivity and get regular updates from area providers on expansions of existing service or new service that is offered. Collection of this information could be mandated if necessary as well as paid for by changes to the permit or franchise regulations.
- Information on the regions right-of-ways should be collected as well to facilitate the introduction of new providers to the area.

Appendix 4 - CEDS 2007 Update Projects/Programs and Priorities

Section 2. CEDS Projects and Programs

Exhibit 2.1 CEDS Projects/ Programs and Priorities

Projects/ Programs	Ranking (1-20)		Type of project	Potential Costs	Project Length
	Rank	Average			
Workforce Training	1	4.36	operational		Short term
Seneca Commerce Park	2	4.64	capital	\$1,500,000.00	Short term
Sewer Extension: Route 29 South	3	5.00	capital	\$10,000,000.00	Long term
Business Recruitment and Promotion	4	6.00	operational		Short term
Last Mile Broadband Access	5	7.36	capital	\$3,000,000.00	Long term
Dearing Ford (Communications)	6	8.00	capital	\$100,000.00	Short term
Airport Industrial Park	7	9.45	capital	\$6,000,000.00	Long term
Long-Term Planning	8	10.82	operational		Long term
Brookneal 501 Waterline Extension	9	11.09	capital	\$150,000.00	Short term
Small and Minority Business Development	10	11.27	operational		Short term
Transportation	11	11.36	capital		Short term
Downtown Revitalization	12	11.73	capital	\$0.00	Long term
Brookneal Industrial Park Improvements	13	12.45	capital	\$1,000,000.00	Long term
HUB Zone Designation	14	13.80	operational		Short term
Entrepreneurial Development Program	15	14.36	operational		Short term
Agricultural Land Planning Initiative	16	14.60	operational		Short term
Tourism and Project Development	17	14.60	operational		Short term
Seneca Park - Flex Space Building	18	14.64	capital	\$3,000,000.00	Short term
Marketing for Agriculture	19	18.20	operational		Long term
Farm Partnership Program: Alliances	20	19.33	operational		Long term

Source: 2007 Campbell County

2.1 Project Funding and Completion

The CEDS Committee ranked each project according to its importance to Campbell County and according to how the Committee feels each project should be prioritized. However, due to limited funding and the time required to complete certain projects, it may be necessary for the county to complete projects out of order from their ranking.

X. Bibliography

“Antenna.” Wikipedia.org. 23 June 2008. Wikimedia Foundation, Inc. 25 June 2008

<<http://en.wikipedia.org/wiki/Antenna>>.

Elert & Associates. “Campbell County, Virginia: Wireless Broadband Internet Access Telecommunications Study.” Stillwater, MN: Elert & Associates, 2002.

Campbell County Industrial Development Authority & PURE INTERNET inc.

Contractual Services Agreement. Campbell County: Commonwealth of Virginia, 2003. 1.

Campbell County, Virginia, Department of Economic Development. Comprehensive Economic Development Strategy 2007 Update. Campbell County: Commonwealth of Virginia, 2007.

“Interference.” Wikipedia.org. 7 June 2008. Wikimedia Foundation, Inc. 25 June 2008

<<http://en.wikipedia.org/wiki/Interference>>.

“Lattice tower.” Wikipedia.org. 4 June 2008. Wikimedia Foundation, Inc. 25 June 2008 <

http://en.wikipedia.org/wiki/Lattice_tower>.

“Monopole antenna.” Wikipedia.org. 28 April 2008. Wikimedia Foundation, Inc. 25 June

2008 <http://en.wikipedia.org/wiki/Monopole_antenna>.

Region 2000. Region 2000 Technology Council. Region 2000 Broadband Infrastructure Study. Region 2000, 2004. iiiiv-x, 54-59.

“Wireless Internet service provider.” Wikipedia.org. 19 June 2008. Wikimedia

Foundation, Inc. 25 June 2008 <http://en.wikipedia.org/wiki/Wireless_Internet_Service_Provider>.