CCG CONSULTING INC

Southern Maryland Broadband Study

Study Areas:

- Calvert
- Charles
- St. Mary's

Major Issues:

- Availability
- Service
- Price

Objective: To Study the Availability of Broadband in Southern Maryland and to Propose Solutions for Areas without Broadband.

September 1, 2005

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Overview of the Project

The Tri-County Council, representing Charles County, St. Mary's County and Calvert County engaged CCG Consulting, Inc. (CCG) to study issues associated with broadband availability within the three counties. In its Request for Proposal and subsequent discussions, the Counties summarized the primary goals of the project as follows:

1. Identify the needs for broadband for the various segments of the Counties including large and small businesses, government, education, and residence / SOHO.
2. Identify the extent and the cause of broadband service deficiency today in the counties by the various market segments.
3. Analyze the existing network infrastructure in the Counties that could be used to deliver broadband.
4. Analyze the issues with delivering broadband with the incumbent providers – Verizon, Comcast and GMP.
5. Identify the most promising technologies that could be used today and in the future to deliver broadband to the Counties.
6. Look at specific network designs that could be used to bring broadband the unserved / underserved parts of these counties.
7. Develop a financial feasibility report which explores the potential for a commercially viable solution for bringing broadband to the unserved / underserved parts of the Counties.
8. Recommend specific solutions that will make broadband available to unserved / underserved parts of the Counties.
9. Discuss the proper role of government in solving the digital divide issues associated with broadband.
10. Make specific recommendations on other broadband related topics.
11. Provide timelines, task lists and analysis that would assist the Counties in implementing the proposed solutions.

To meet these objectives we took the following steps:

- We conducted interviews with key players in the three counties. We attended various meetings in the Counties where we met with key players and discussed the issues. We also received voluntary surveys completed by those who represented various key segments of the Counties.

- We developed maps showing the current coverage of DSL and cable modem within the Counties. The broadband coverage maps were then sent to Verizon, Comcast and GMP for verification.

- We interviewed Verizon, Comcast and GMP concerning their network, their current broadband products, plans for future expansion and other broadband issues.

- We conducted generic market research on the location and density of businesses and residences in the three Counties.

- We identified the technologies available today that support broadband and discussed the applicability of these technologies for the region.

- We identified, to the extent possible, the existing broadband infrastructure in the Counties.

- We performed a high-level engineering design of a wireless system that could deliver broadband to the unserved / underserved parts of the Counties. We explored both a basic design and a more robust network design.

- We interviewed the experts in the industry to determine the amount of bandwidth that is needed today and what might be needed in the future.

- We developed several versions of financial business plans to determine if there is a viable economic model that would work for bringing broadband to the unserved / underserved portions of the Counties.

- We reviewed possible solutions for solving the broadband gap in the Counties. We explored the right role for government to play and determined a number of possible ways to find a solution for the digital divide issue.

- We proposed an implementation plan that would lay forth a specific plan for implementing the proposed best solution.

Executive Summary of the Results of the Study

CCG Consulting, Inc. submits this Report on our findings and recommendations concerning the current and future state of broadband in Southern Maryland. Through an RFP issued by the Tri-County Council the Counties launched an initiative to study the issues and possible solutions concerning the availability of broadband The Counties recognized that many residences and businesses in the area are without broadband today. The Counties realized that it must promptly educate itself about broadband issues, ascertain the current and future broadband needs of the area, and develop policies to ensure that the broadband needs of the Counties will be met.

To assist it in this effort, the Counties engaged CCG Consulting, Inc. to undertake a broadband study. CCG gathered an enormous amount of relevant information through surveys; focus groups; individual and small-group interviews with stakeholders of all kinds; meetings with industry representatives and state officials; and extensive document and literature reviews. CCG also undertook a financial analysis to determine if broadband could reasonably be brought to the unserved and underserved portions of the Counties.

FINDINGS

Based on the information we gathered and our experience with broadband issues across the United States, we report the following findings:

- There is a significant portion of each County where there is no DSL or cable modem coverage. This shortfall is shown by maps in Section I. The coverage areas on these maps have been verified by Comcast, GMP and Verizon.
- There is a broadband shortfall in the Counties in that a significant number of homes and businesses don't have broadband options today. We estimate the homes and businesses without broadband as follows:

	Total Businesses	Unserved / Underserved	Percent of Market
Calvert County	2,623	250	10%
Charles County	4,539	1,750	39%
St. Mary's County	3,388	1,000	30%
Total	10,550	3,000	28%

	Total Households	Unserved / Underserved	Percent of Market
Calvert County	25,447	1,400	6%
Charles County	41,668	9,000	22%
St. Mary's County	30,642	4,000	13%
Total	97,757	14,400	15%

- There are several technologies that could be used to satisfy the broadband shortfall. The technology that best fits the terrain, population density and other characteristics

of these counties is Wi-Fi wireless. We looked at the economics of providing Wi-Fi to unserved and underserved homes and businesses and we found that such a business could be profitable and sustainable.

- The broadband products available to most business customers today will not be adequate in the near future. One problem is upload speeds. Both DSL and cable modem upload speeds are slow and are a hindrance to a business that relies on using data. Second, today's download speeds of 1 Mbps to 3 Mbps are going to be inadequate in the near future for many businesses. We think this means that broadband will continue to be an issue and that within a few years we will be looking at today's broadband products as obsolete. The demand for broadband will continue to grow and technologies that can't grow to satisfy the demand will be as obsolete in a few years as dial-up Internet is obsolete today.
- While there are existing private networks that include fiber, there is no existing fiber network that can address the overall bandwidth shortfall needs of the Counties.
- We could find no sound economic model for bringing broadband to just unserved / underserved businesses. Serving business was the genesis of this project, but our research shows us that a broadband solution must serve residential customers as well as business customers to be economically viable.

RECOMMENDATIONS

Some of the challenges facing the Counties require immediate attention. Other challenges would benefit from the development of more facts and a thorough, open debate of the options. All of the major decisions will involve difficult trade-offs. How should the Counties proceed to deal with the results of this report? Following is a summary of our recommendations. More detailed analysis of the recommendations is included in Section V.

First, we suggest that the Counties fund a "broadband czar", that is, create a position that would be responsible for bringing better broadband to the Counties and for closing the digital divide. Our experience is that a funded focused effort is required to solve these types of problems. Such a position need not necessarily be a new or a full-time position. There are many different agencies where such a position might reside. For example, funding could be increased to the Tri-County Council or some other such group somewhere within the Tri-County. What is important is that solving the digital divide will need a champion – some person or agency that can work toward finding solutions across the region.

Second, we recommend that the Counties actively promote getting broadband to the unserved / underserved areas. We think this will require a two-prong approach. The first priority would be to get commitment from existing providers to expand broadband coverage. Even with such a commitment there is going to remain substantial unserved / underserved areas of the Counties. We recommend that the Counties promote the creation of a broadband Cooperative to serve areas where nobody else will serve. We show in this study that such a business can be economically viable.

Third, we recommend that the Counties actively support the expansion of fiber into the area. There is substantial fiber today in the three counties, but none of it is readily available for solving the general lack of broadband. There are a number of possible ways to promote fiber expansion and these will be discussed in more detail in the study.

Fourth, we recommend that the Counties heavily rely on the concept of partnering and facility-swapping to promote broadband expansion in the Counties. Almost all successful broadband entrepreneurs and network providers today rely on the idea of sharing construction costs and operational responsibilities for networks.

Fifth, we recommend that the Counties formally lobby Comcast in order to get them to modify their installation charges for businesses. Currently if a business is more than 125 feet from an existing Comcast service tap (and most businesses are further away than that), then Comcast wants to charge the full cost of construction up-front before selling cable modem service. We don't think Comcast will waive the fees, but it seems reasonable to ask them to spread the fees over time. If Comcast won't make this change it should be included in any future franchise agreement renewal.

Sixth, Charles and St. Mary's County should negotiate to change their next franchise agreement so that CATV must be constructed when there are 15 or more homes per street mile. The requirement in Calvert County today is 15 homes per street mile but is 20 in the other two Counties. Over time this would bring cable TV, and more importantly cable modem service to many areas that aren't served today.

Seventh, we think the Counties ought to petition Verizon to have the Counties considered for Verizon's Fiber-to-the-home FIOS systems. Verizon is building state-of-the-art networks throughout its operating footprint.

Eighth, high tech economic development today requires diversity in addition to broadband. Businesses that use large amounts of broadband want to be on networks that are diversely routed locally so that problems or cable cuts on one part of the network do not shut them down. The Counties need to promote diverse fiber routing to all business parks and any other locations that are key for economic development.

I. Needs Assessment

The Tri-County Council, representing Charles County, St. Mary's County and Calvert County engaged CCG Consulting, Inc. (CCG) to study issues associated with broadband availability within the three counties. In its Request for Proposal and subsequent discussions, the Counties summarized the primary needs assessment objectives as follows:

1. Identify the needs for broadband for the various segments of the Counties including large and small businesses, government, education, and residence / SOHO.

This task was accomplished by CCG using the following tools:

- Public Input Groups
- Interviews with select regional leaders
- Interviews with stakeholders.
- Voluntary surveys

2. Identify the Extent and the Cause of Service Deficiency. This includes looking at technological constraints, restraints due to the incumbent providers in the counties, financial constraints and regulatory constraints.

This task was accomplished by:

- Developing coverage maps for current DSL and cable modem availability. These maps were then sent to the incumbent providers for verification.
- Interviews with the Verizon, Comcast and GMP, the three major incumbent providers of broadband in the Counties.
- Generic market research showing the location of businesses and residences in the Counties.

A. Surveys and Interviews

Joe Sudo of CCG conducted formal interviews with approximately 50 businesses in Southern Maryland. Additionally, CCG attended numerous meetings in each County where we met with various trade, industry and civic groups to discuss broadband issues. In total we talked to hundreds of business owners or broadband decision makers in businesses about broadband. We interviewed businesses of all sizes ranging from consultants who work at home up to the largest businesses in the Counties.

We concentrated on businesses since that was our instruction for the project. We also received feedback in regard to residential service during the interviews and meetings. From a residential prospective most complained that the lack of residential broadband in many areas did not allow Southern Maryland residents to work at home.

The results of the surveys conducted are not scientific in that they don't represent a statistically valid sample of all businesses in the Counties. However, our goal was not to create a scientific poll for the Counties, but rather to discover the various issues that businesses face in obtaining and paying for broadband. The businesses participating in the surveys were largely volunteers. We called on some businesses, mainly by referral from others who had participated in this study. However, the Tri-County Council and various groups within each County arranged private business participation in surveys and interviews.

Our goal was not to conduct formal business interviews, but to generate discussion on the general experiences with broadband or the lack thereof in Southern Maryland. In doing so Southern Maryland businesses addressed questions in the following areas:

- About the overall experience and satisfaction with existing broadband providers.
- Detailed broadband services that they buy today, what would they buy today if there were no broadband barriers, and what they might want to buy in the future.
- Prices and affordability.
- The availability to businesses every service that they want and need today.
- Addressed the awareness of competition in broadband today and if they knew how to look for broadband alternatives.
- Service issues.
- Businesses shared their feelings on the government's role in providing broadband, and if so, what sort of role.

Following is a summary of the most commonly found responses and issues uncovered as a result of the business surveys and interviews:

- **Geography matters**. Location in these counties has a big bearing on the availability of broadband options. Some businesses have multiple options while others have none. This issue will be examined in much greater detail later in this section.

- **Service problems**. There were many different service problems ranging from bad installation experiences, unknowledgeable customer service, slow data speed and outages, and repair issues.

  CCG has conducted broadband studies of this type all over the country. Other studies have included random samples of surveys while others were conducted exactly like this study by interviewing volunteer companies. With that said, we saw more service complaints in Southern Maryland than we have seen elsewhere. We believe this has to do mainly with the rural nature of Southern Maryland. Because Southern Maryland is a bit off the beaten path for most of the service providers, services offered need to compete with the neighboring

metropolitan areas. Following below are some quotes from business interviews concerning service issues.

- **High prices**. Prices are perceived as being too high. Many businesses complained that prices in Southern Maryland are significantly higher than prices in the Washington, DC metropolitan area.

- **Comcast Installation Policy**. The Comcast installation policy was seen as a significant barrier by many companies. As a result the Comcast cable modem solution was found to be uneconomical for most small and medium sized businesses. Comcast essentially charges full construction costs to add a business customer to its network. Businesses installation quotes ranged from $450 to $30,000 in order to obtain service from Comcast.

- **Role of Government**. There was very little demand for having government get into the broadband business. However, there seemed to be a consensus to have the government help to find solutions for the various perceived problems.

- **Diverse Network Routing**. In Calvert County a number of businesses reported that there was a single point of failure in the Verizon network at the North Beach Central Office. Several years ago, a fire at the North Beach Central office prevented anyone in Calvert County from calling outside of the county. Verizon reports that since the fire they have now provided diversity and that Calvert County is no longer isolated. Diversity was also raised as an issue at the Patuxent Business Park. Businesses said they did not want to locate there since lack of diversity means they could lose voice and data service.

- **Voice Calling Scope.** While our intention was not to talk about telephone service we did receive a sufficient amount of feedback about calling scopes – that is, where people can call for free (local call) vs. charge-per-minute calls outside of the local calling scope (toll call). There was a widespread feeling that at a minimum each County ought to have free calling inside the County.

- **Comcast Data-Only rates**. Businesses complained about the higher prices that businesses have to pay to Comcast if they but data without cable TV.

Following are some representative quotes from the formal interviews. These statements represent about 25% of the businesses interviewed in the Counties. Instead of a list of specific quotes from the group meetings, we have made notes of issues raised.

Service Issues

Service comments ranged from those who felt they had good service to those who had problems and complaints. Here is a sample of service comments roughly grouped by topic.

Happy with Service

"Verizon has been 80% positive. My clients and I all use Verizon DSL."

"We have not experienced any problems."

"Have everything that we want and need but are concerned about the future. Would like fiber into the hospital."

"We have experienced few voice or data service problems and all were resolved in a reasonable period of time."

"My experience with Verizon has been satisfactory. Aside from the occasional down time (high speed internet) which are infrequent and short, I have had no problem with both voice and data services."

"Verizon DSL- no complaints. Comcast cable modem- no complaints."

"QoS is respectable with satellite. Any problems (only one major thus far) have been handled promptly."

"Verizon frequently calls when the frame is down (even before we know it's down)."

Comcast Experience

"Comcast service was great when it was first installed; however, once more subscribers were added to the system, the speeds became slower and has become less reliable."

"When Comcast network was down the service rep told her to "go read a book"."

"Customer service does not acknowledge the cable is "out" until multiple subscribers complain."

"Have "real time cameras" on the production floor that need to be seen from home. Comcast has been attempting to turn up the service for the past six weeks."

"Comcast cable modem has been fairly reliable for home users. DSL is a little less reliable, but that may be because of installations. The Comcast service contract does not guarantee VPN connectivity."

"There is no difference in service between business class and residential class except the price is double for business class. Although the Comcast download speed is fast, you're at the mercy of the upload speed when connected to a VPN."

"Comcast was the first provider of broadband services in Solomons and have had Comcast cable modem for two years. Service has been very dependable. Comcast's download speed is above average and good upload speed. Can see cable modem speed slow from 4:00PM to 7:00 PM. Installation of the Comcast cable modem was very difficult."

Verizon Experience

"Verizon for data services has not been good. We now use Choice Networks as our agent for Verizon since we had so much trouble with Verizon due to lack of customer service, etc."

"Use dial-up through Verizon- very slow. Need DSL."

"Verizon Tech support was terrible and difficult to deal with. We switched to KE & Associates."

"Verizon installation of the frame relay circuits was a nightmare. Took Verizon 8-10 hours to complete the installation. In the past in the event that a frame relay circuit went down, a "page" message was sent to the sheriff's office. As of two years ago, Verizon now has a four hour window in which to begin testing the frame relay trouble."

"Verizon DSL changes are nearly impossible (5 phone calls in 5 weeks). Wanted to go from a "dynamic" to a "static" IP address."

"DSL being ready after Service Ready Date is 50/50. Comcast static IP is not static."

"DSL performance substandard at times, customer service substandard, responsiveness nonexistent."

"Initially subscribed to Verizon DSL in Lexington Park; however, when Verizon came out to install, Verizon cancelled the order (building wiring wasn't good enough). Then subscribed to GMP cable modem (no problems).

Comcast router has to be restarted on occasion (rates 8 out of 10). Verizon DSL is slower than cable modem."

"Verizon DSL. In the past they have not been very helpful. Long time for initial installation. Customer services is difficult."

"Verizon and Comcast have been difficult to deal with both at the home office location and in subdivisions containing new home construction. Verizon sales department will typically ship out a DSL modem even though the location is not capable of such service."

"Phone - Verizon phone is very difficult to set up service; slow and confusing process. Data is not available in our area. Had to go with satellite."

"Verizon DSL is not available in my area. The Cable TV provider has been unsatisfactory due to technical issues and expense. In addition, the Fire Station at Golden Beach has been unable to get the county rip and run printers connected since this area is services by Comcast and the county has a contract with GMP."

GMP Experience

"The upgrade of the GMP plant has provided new opportunities. Experience with GMP has been very good; however, sometimes you can't get in touch with people by phone."

"I used GMP cable in an apartment I rented temporarily. GMP data service was not reliable and had left me with many nights (and some days) of "down time". The customer service was inadequate and the people in charge were not knowledgeable."

"GMP was able to provide multiple IP addresses and a faster connection than Verizon; however, there were Email connectivity issues with GMP. Because of the Email issues, we switched to Verizon DSL in November 2004."

"GMP Cable provided HORRIBLE service. Only worked for approximately 5 minutes per day. Called repeatedly for service help, and was told over and over "we will get to you in 30 days." Problems were never resolved and I eventually cancelled by cable modem service. DSL is not available in my area, and AOL service is so slow that I cannot effectively work from my home office and download/upload files to my corporate office in Denver. Technology limitations have severely impacted my ability to consult with clients and/or potential clients in this Southern Maryland region. The technology limitations in this area are also impacting my decision about whether or not to remain here as a resident, on a long-term basis."

Satellite Experience

"From a home business perspective, I am located in a slice of Calvert County that cannot obtain DSL data services from Verizon. My residence is too far from the public road and I do not live in a residential cluster; therefore neither the previous nor the present (Comcast) cable systems were willing to install basic video cable or enhanced data cable. I could do so if willing to pay for the installation of my own local loop, approximately $2600. I also have Starband satellite that on good days delivers about 500kb downlink and a miserable 14-21kb uplink. For uploading large files, and during outages or equipment problems, I often switch to a backup dial-up connection. Repair support is nonexistent in this area, and I have had to resort to buying parts over eBay from third parties to provide my own repairs. The local voice lines (410-535, and 301-494) give at best 26.4kb connectivity, and usually less. Verizon considers this "acceptable" and has no public plans for providing anything better."

Price Issues

"The T1 services are too expensive by today's standards. The cost for business for T1/DSL is exorbitant."

"Services are negotiable- they don't start at affordable."

"Verizon was very expensive for the Internet service provided."

"Verizon can get you a T1 anywhere, but at a high price. Issue of price due to crossing LATA boundaries between St. Mary's County and Calvert County."

"Comcast has not been competitive due to initial installation cost"

"Basically all telecommunications are available; however, they are not competitively priced as compared to the D.C./Metro market."

"In Calvert County - Local loop Charges for T1 lines are outrageous - nearly $800 for just the local loop in many places. T1s are reliable but very expensive. Typically the T1 charges elsewhere in the Counties include $400-$500 for bandwidth and $600-$700 for the local loop charge. Sprintlink charges $1100/month for an Internet T1 in Prince Frederick and $600/month in Upper Marlboro."

> "We pay $800 extra per month (for broadband) as compared to those who receive cable modem and DSL service. Comcast offered to bring in cable modem service for $30,000."

B. Mapping Broadband Availability

One of the major tasks included in this study was to map broadband availability. The two primary broadband products included in the broadband maps were cable modems and DSL. Satellite is available nearly everywhere (assuming you can point a dish at the right part of the sky). T1 service from Verizon is available almost everywhere; however, DSL and cable modem service was more economically feasible to small and medium sized businesses. DSL and cable modem is also the primary service available to residences and businesses working out of homes or home offices.

We approached the mapping in several stages. First, we mapped the location of existing businesses in the Counties by obtaining business addresses from white page listings. This method of locating businesses is not 100% accurate (since some businesses don't appear in the white pages or are very new). However, we believe this method gives us the general location of businesses and we believe our results are about 95% accurate in identifying businesses (except many small SOHO businesses).

DSL Mapping

Next we attempted to map DSL and cable modem coverage. We will discuss DSL technology in more detail later in this paper. However, for mapping purposes it is important to understand that DSL service availability depends on where Verizon deploys a DSL transmitter device referred to as a DSLAM. In Southern Maryland Verizon has DSL service installed in every central office. Central offices are the traditional buildings where Verizon has equipment used to deliver voice services to customers. Each central office is a local hub from which Verizon runs copper wires and fiber to customers in the immediate area. CCG has databases that detail the location of every Verizon central office.

Verizon is also able to install DSL in remote locations outside of the central offices. These remote locations are known by a number of the names within the telephone industry such as remote huts, SLCs (subscriber line cabinets), remote switches, remote terminals, etc. These remote locations vary in size depending on how many customers they serve and the specific technology and age of the remote device. Some remote locations are buildings, others are huts and others are simply small cabinets.

Nobody outside of Verizon knows the addresses of the remote locations and many of them are well hidden in the field in order to deter vandalism. We knew that Verizon had installed some DSL in the Counties at these remote locations. We utilized several tools that allowed us to find these pockets of DSL coverage. First, we were able to use a Verizon on-line tool that automatically qualifies a customer for DSL;

however, we know from real life experience that this tool is not always accurate. For example, this tool confirms that DSL is available at our CCG office in Riverdale, Maryland, and yet DSL service is not actually available. However, we have found that this tool is fairly accurate in areas where Verizon confirms that DSL is NOT available. We began our search for DSL remote huts by typing in various street addresses into the Verizon DSL on-line qualifying tool. In this way we were able to plot points on the map where Verizon seems to be offering DSL.

Finally we narrowed the size and locations of the DSL coverage areas by calling homes and businesses and inquired whether they had DSL or if they knew if it is available.

After all of this effort we have produced maps for each of the three counties that display DSL coverage. Because DSL is subject to distance limitations, you will note on the maps that DSL coverage is shown as circles. DSL can reasonably be served up to around 18,000 feet from a central office switch or a remote location in the most favorable conditions. But poor copper wiring in most areas realistically makes this limit closer to 10,000 to 12,000 feet. This distance limitation is further shortened in reality, since it is measured in cable feet rather than "as the crow flies" in a straight line. The copper wiring coming out of a central office often wanders up and down streets and rarely runs in a straight line to reach areas away from the switch. Realistically, in many areas, this 10,000 to 12,000 foot distance limitation creates a potential delivery circle of only about a mile-and-one-half around the switch. In our mapping we used 15,000 foot circles around each DSL transmitter to represent the DSL coverage. It is important to understand that the circles are only an approximation of DSL coverage. There are areas within those circles that can't get DSL and some customers just outside the circles that can.

We forwarded our DSL maps to Verizon for verification. Verizon responded to our mapping and said that we had mapped DSL accurately.

It is important to note that DSL is not necessarily available to every home and business inside of these coverage circles. There are various reasons why DSL might not work at a given location. First, the quality of the wire might prevent DSL from working. Some copper is old, weathered and in poor condition, and DSL will often not work sufficiently on degraded copper. DSL also works better on larger rather than smaller copper wires. Verizon deploys many different sizes of copper wires throughout the service territory, and those areas served with smaller diameter wires will have smaller DSL coverage. Because DSL is strictly a pure copper technology, DSL cannot be served to any customer that has fiber optic cable between the DSLAM and the customer, even if it were just one foot of fiber. Verizon does not have much fiber optic cable in Southern Maryland, but it does exist and there are probably a few customers who can't get DSL because of the existence of fiber. Finally, some customers can't get DSL because the wiring inside their homes or businesses is inadequate. Verizon owns the wiring that gets to the home or business, but customers

own the wiring inside the buildings, or inside of campuses for larger businesses. We know of many cases where bad inside wiring will prevent DSL availability.

Cable Modem Coverage.

Cable modem coverage is more difficult to define than DSL since it is not limited by distance in the convenient circles. Generally both Comcast and GMP offer cable modems to residences everywhere that they offer cable TV service. Our goal in mapping cable modems thus became the task of mapping cable service.

Cable companies request and are granted franchises for serve very specific geographic areas. We began our mapping by analyzing the franchise service territories of GMP and Comcast. However, there are two major exceptions where cable modem service is not available inside of the franchise area.

First, both Comcast and GMP have household density franchise requirements that determine where they must build to offer cable TV. These requirements are not the same in all three Counties. For example, the Calvert County franchise agreement requires that cable be built where there are 15 houses per street mile. In St Mary's and Charles County the requirement is 20 homes per street mile. It is optional for the cable companies to build if there are fewer houses than these requirements. In our experience the cable companies have some latitude in how to apply these requirements. For example, if a new subdivision was built with a cluster of 20 homes within a mile, but was also fed by a 1 mile entrance road (two miles of total roads), then the cable companies might insist that the density would need to be 40 houses per two miles and might refuse to build to the cluster.

We believe the lower density requirement in Calvert County is one of the reasons why there is better cable coverage in the County. There are parts of Calvert County that are as sparsely populated as the other two Counties, yet there is far better cable coverage in Calvert County.

Second, the cable TV providers have no requirement to build to businesses. Traditionally, cable TV networks bypassed businesses. Businesses were never seen as good cable TV customers and the cable providers generally bypassed businesses when they originally built their coaxial cable networks. Now that cable companies can also offer voice and data services they are more willing to add business customers to their cable network.

However, as described in the survey issues, adding a business onto the cable network is not without a cost. Comcast has a policy of charging a business the full price required to add them to the existing cable network. Businesses installation quotes ranged from $450 to $30,000 in order to obtain service from Comcast.

In summary, there are many residences and businesses inside the cable TV franchise areas that don't have cable modem availability.

Once we created the cable franchise coverage maps we forwarded them to GMP and Comcast for verification. St. Mary's County actually has a GMP coverage map on their website, which represents the recent network upgrade/buildout. Comcast reviewed our maps and provided us with cable modem coverage maps of their own.

The coverage maps follow which include 15 maps, five for each County. The first map for each County shows the distribution of businesses within the County. The second map displays cable modem coverage. The third map illustrates DSL coverage. The fourth map overlays both DSL and cable modem coverage. The final maps overlays everything – businesses, DSL coverage and cable modem coverage.

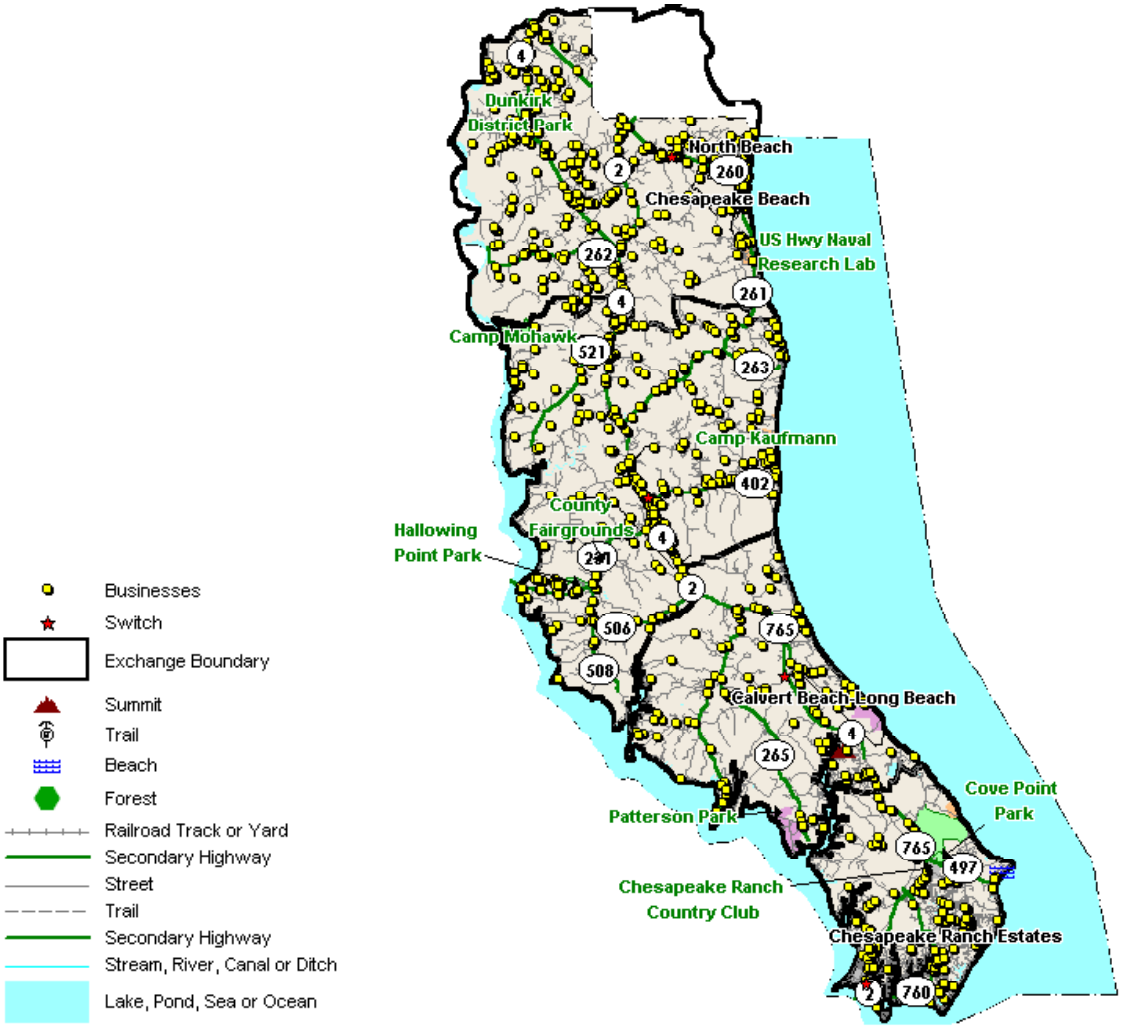
The maps are as follows:

Map 1 – Calvert County Businesses
Map 2 – Calvert County Cable Modem Coverage
Map 3 – Calvert County DSL Coverage
Map 4 – Calvert County Cable Modem & DSL Coverage
Map 5 – Calvert County Businesses and Broadband Coverage
Map 6 – Charles County Businesses
Map 7 – Charles County Cable Modem Coverage
Map 8 – Charles County DSL Coverage
Map 9 – Charles County Cable Modem & DSL Coverage
Map 10 – Charles County Businesses and Broadband Coverage
Map 11 – St. Mary's County Businesses
Map 12 – St. Mary's County Cable Modem Coverage
Map 13 – St. Mary's County DSL Coverage
Map 14 – St. Mary's County Cable Modem & DSL Coverage
Map 15 – St. Mary's County Businesses and Broadband Coverage

Map-1

Calvert County

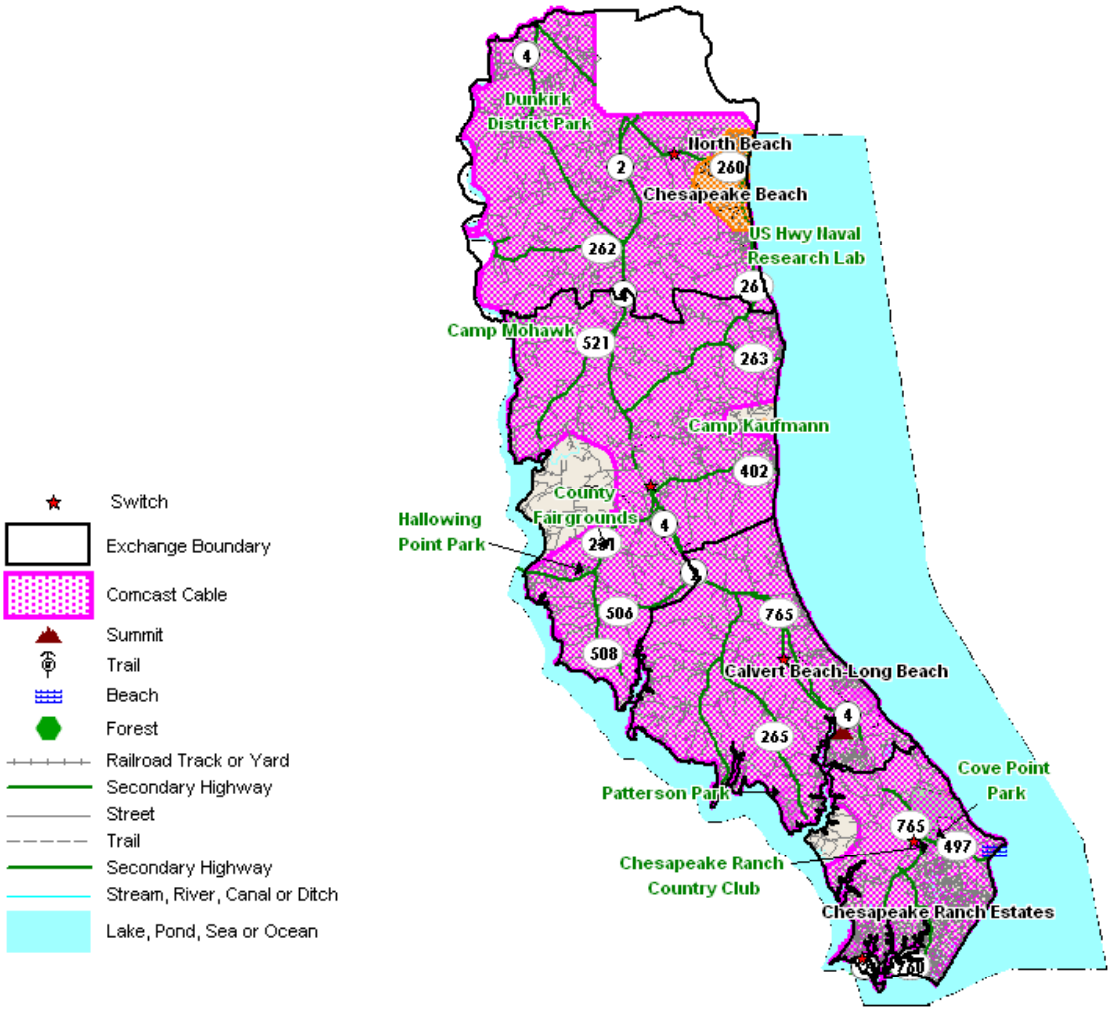
Local Businesses



Map-2

Calvert County

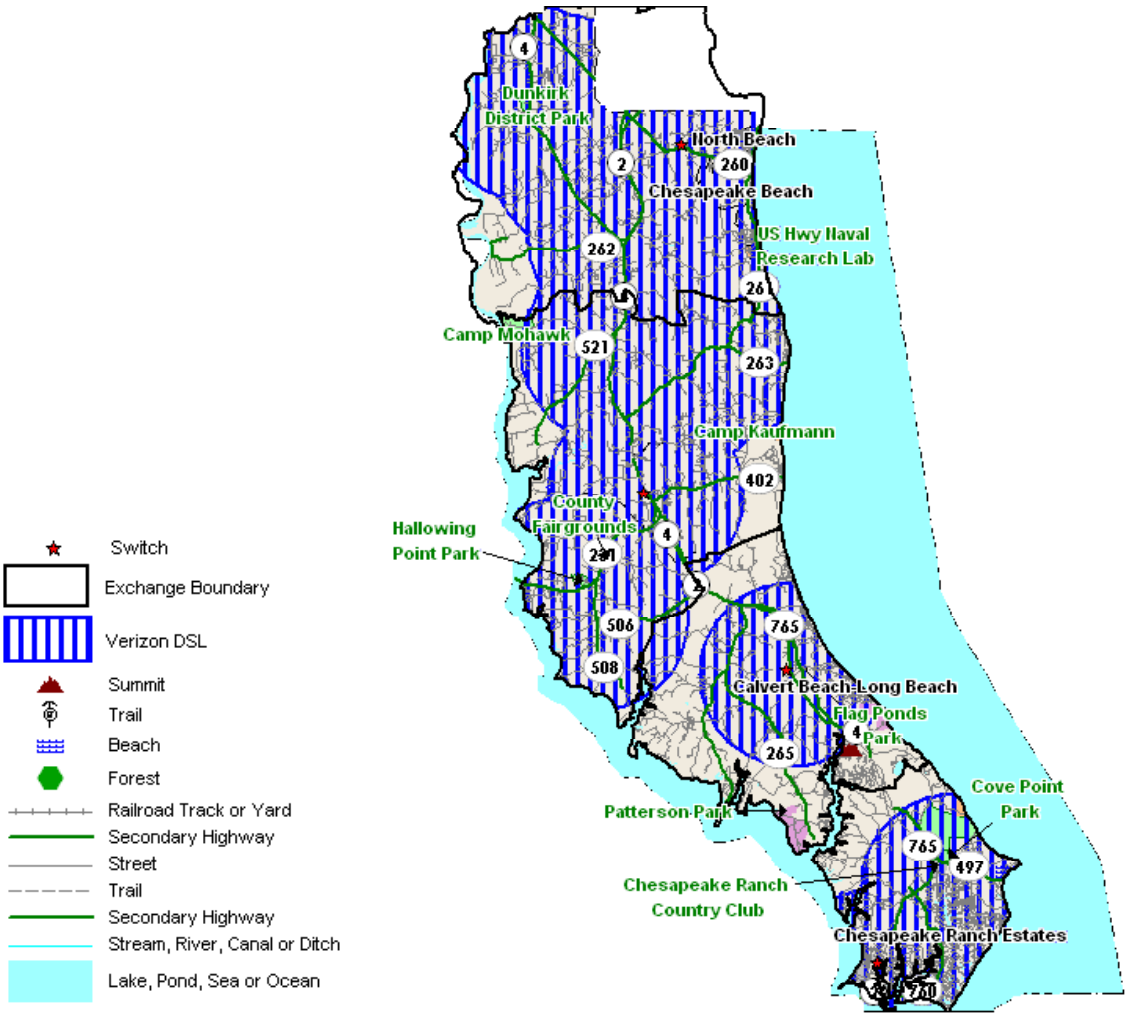
Cable Modem Availability



Map-3

Calvert County

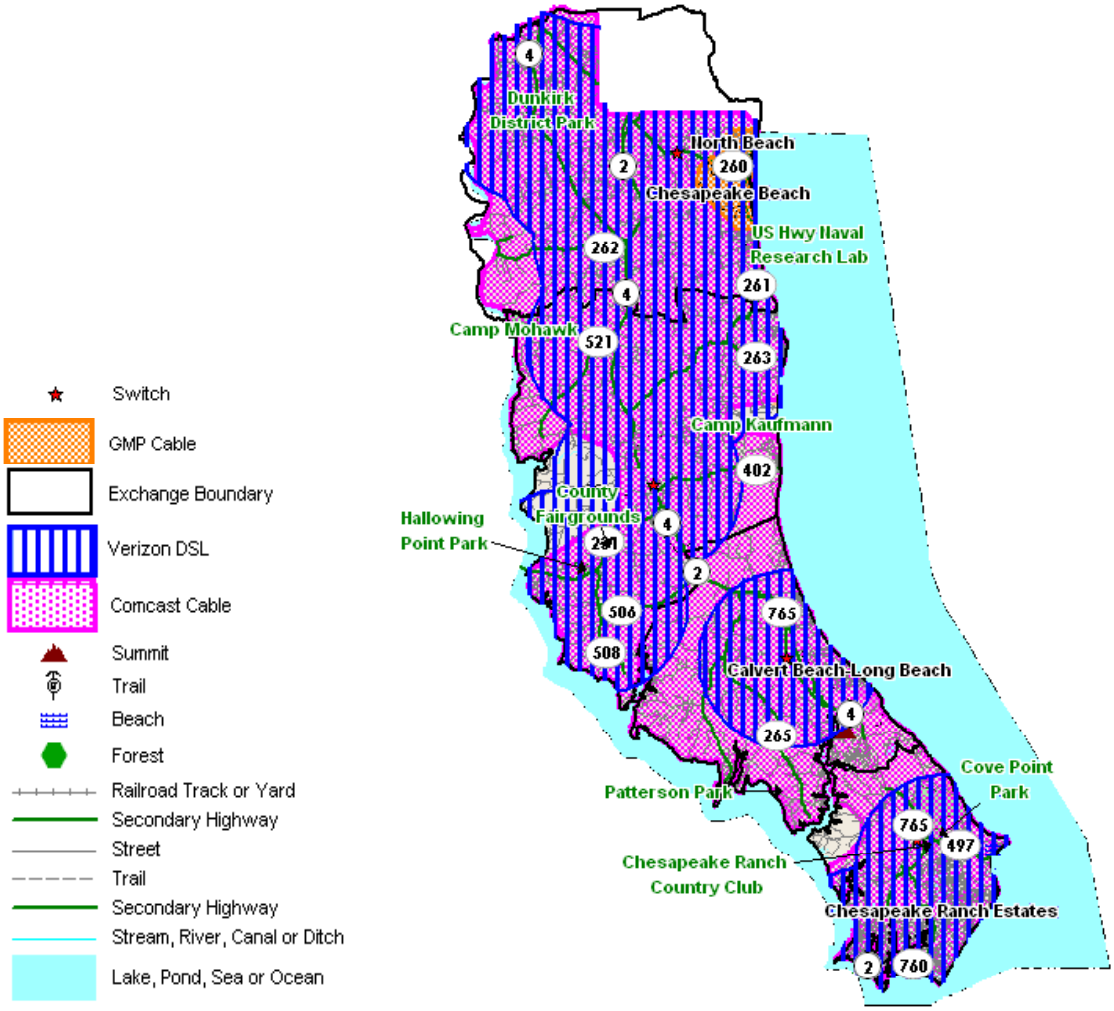
DSL Availability



Map-4

Calvert County

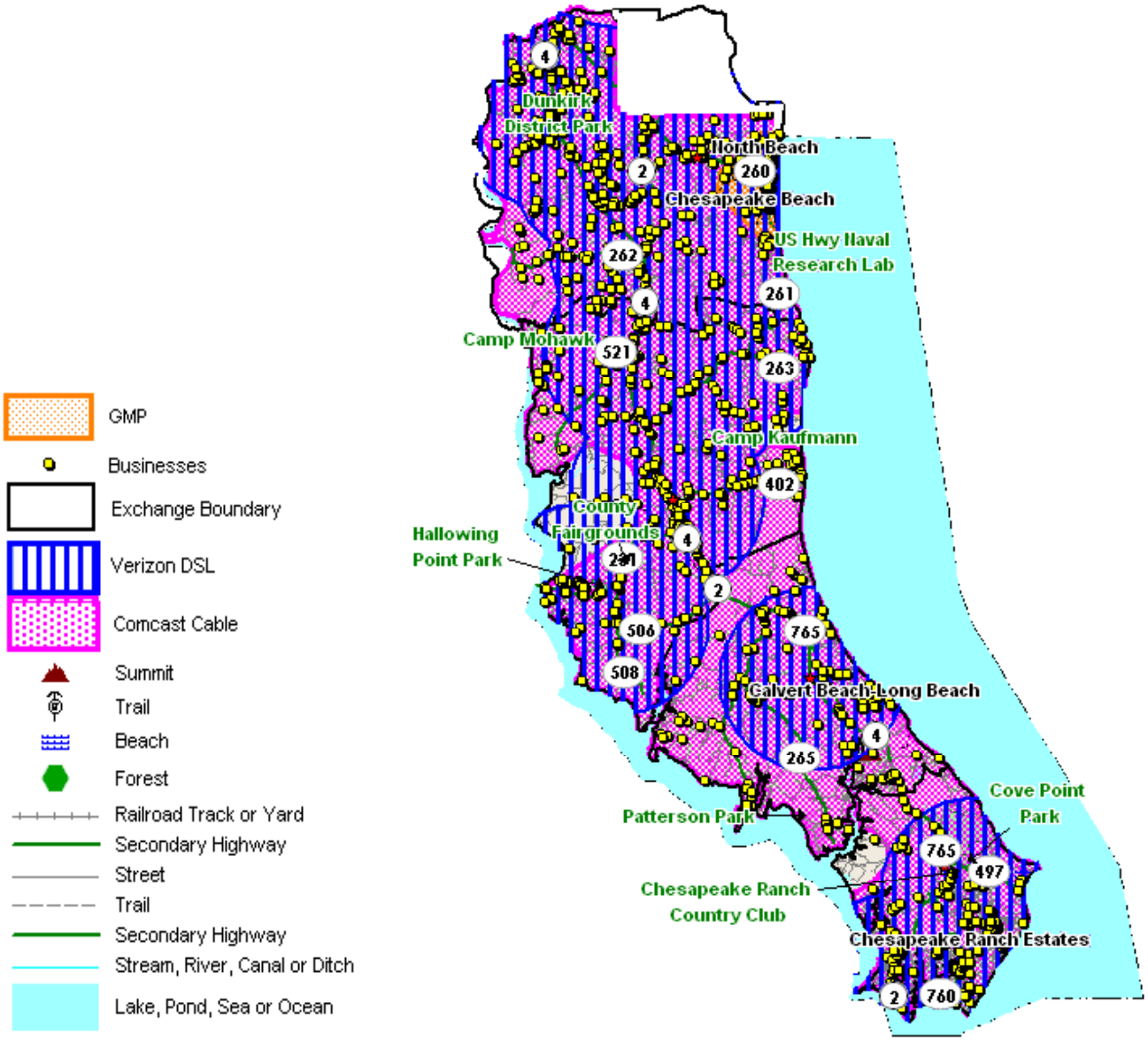
Cable Modem & DSL Availability



Map-5

Calvert County Local Businesses

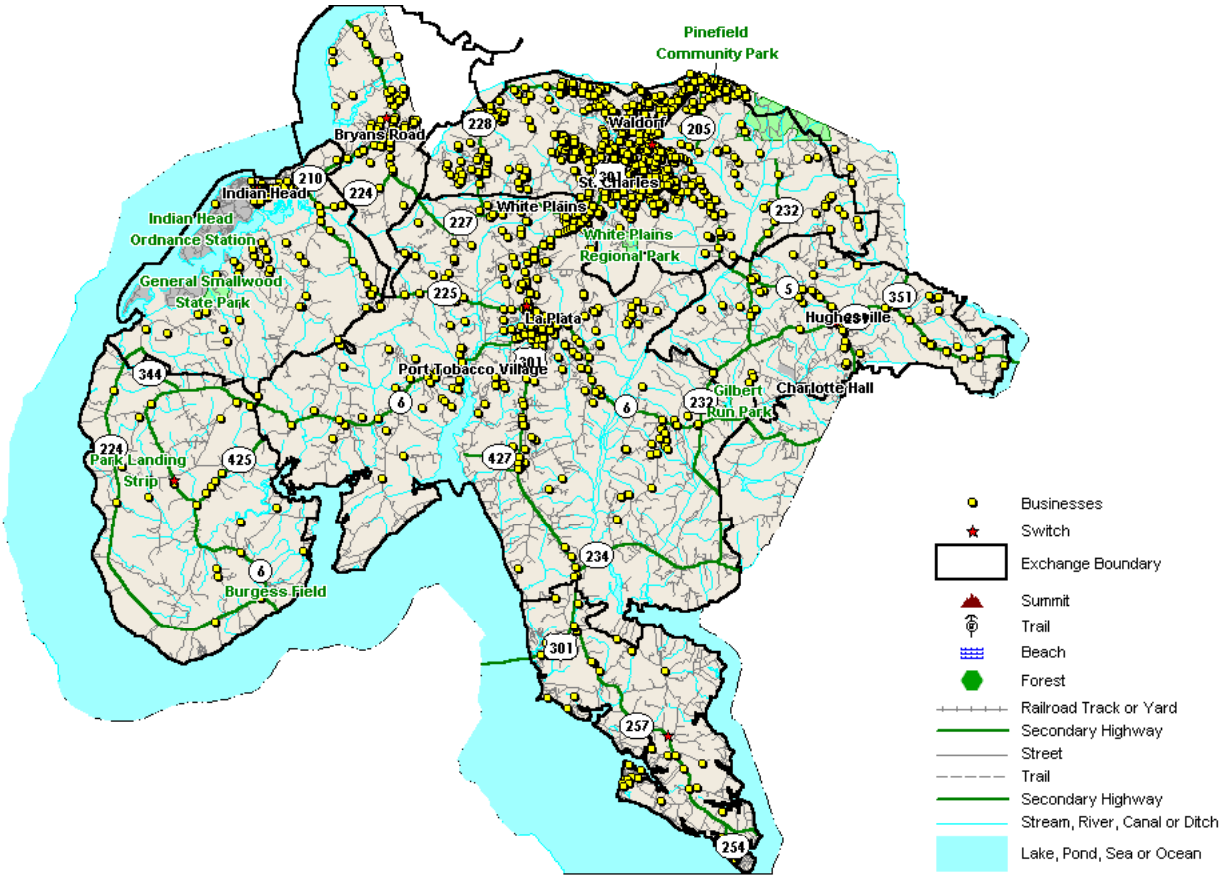
Cable Modem & DSL Availability



Map-6

Charles County

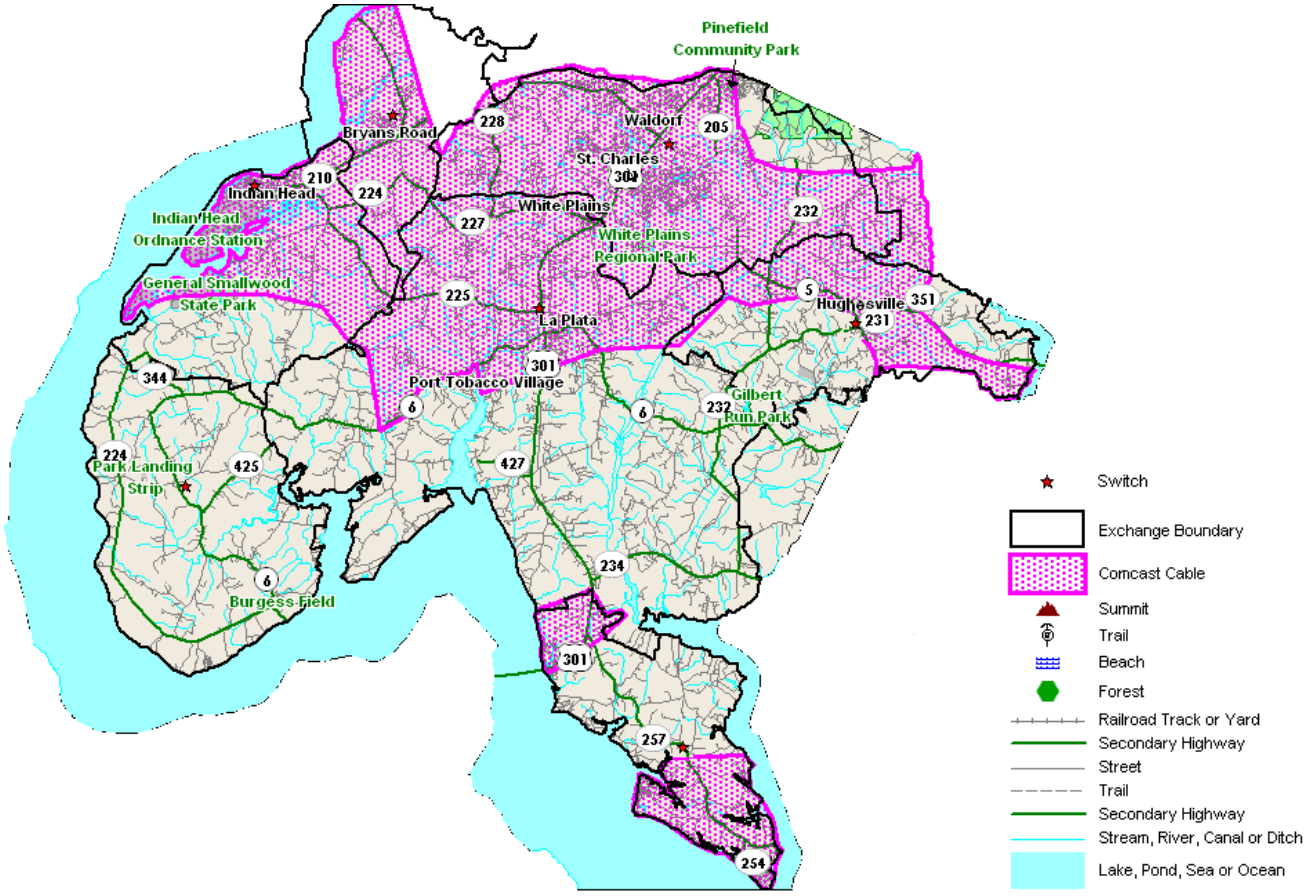
Local Businesses



Map-7

Charles County

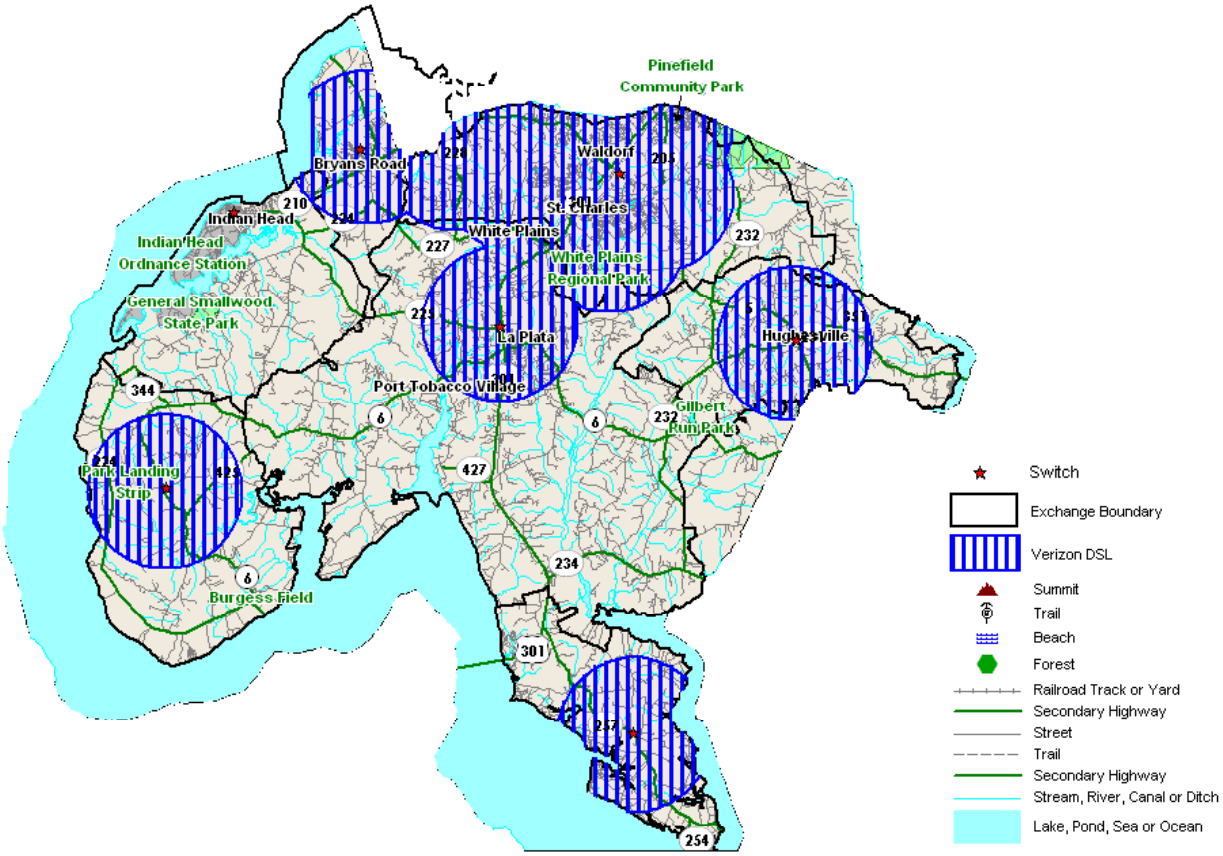
Cable Modem Availability



Map-8

Charles County

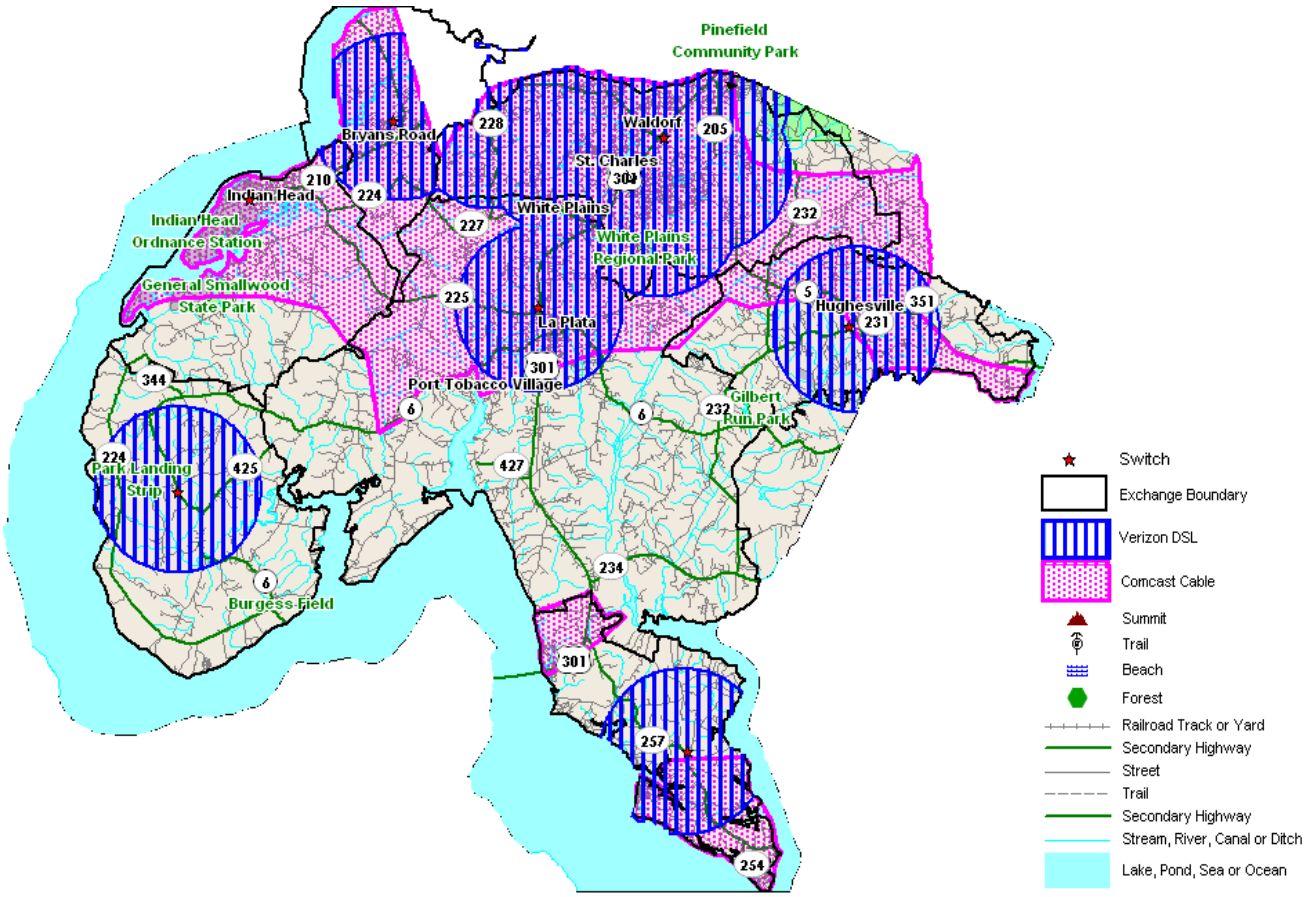
DSL Availability



Map-9

Charles County

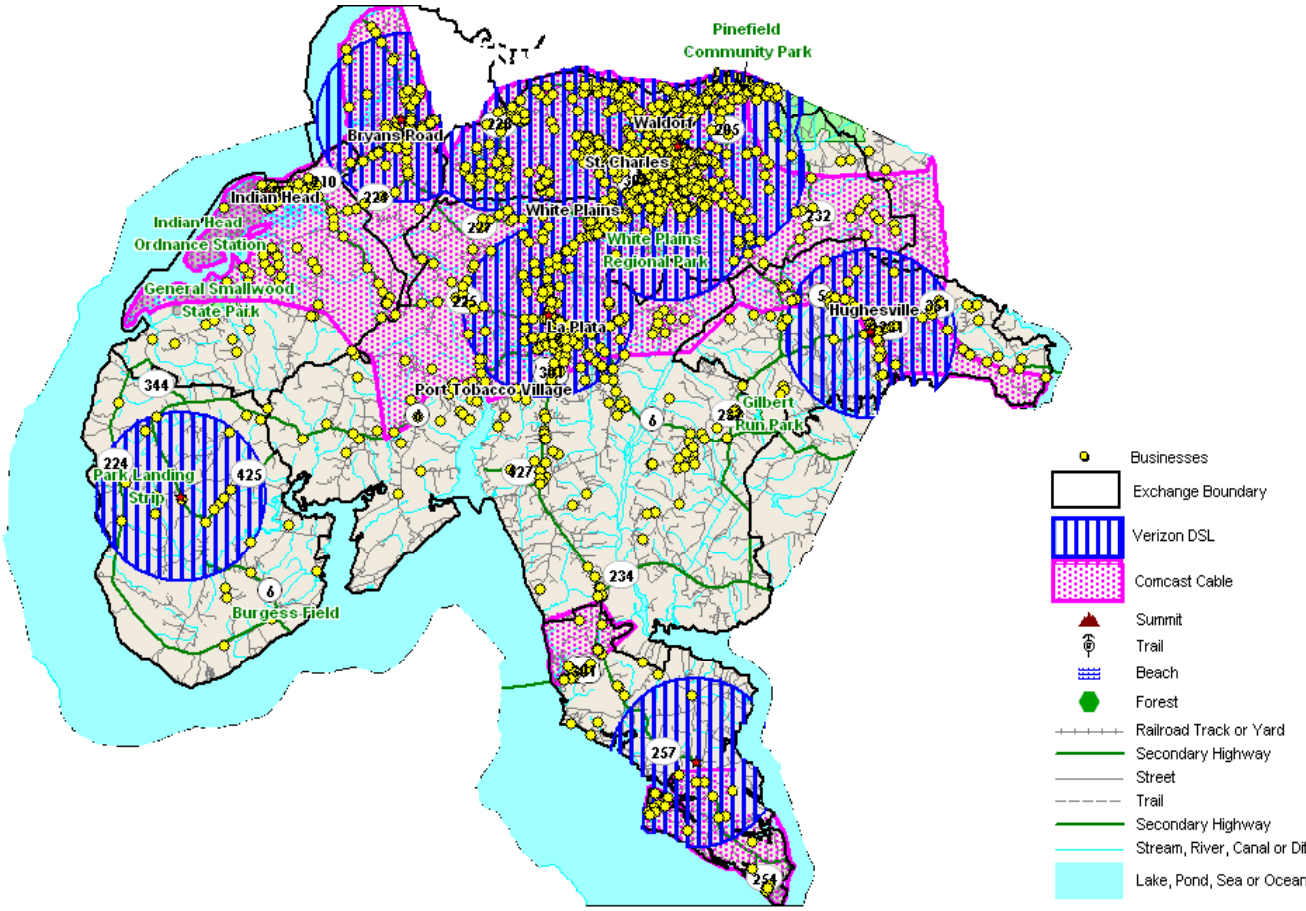
Cable Modem & DSL Availability



Map-10

Charles County Local Businesses

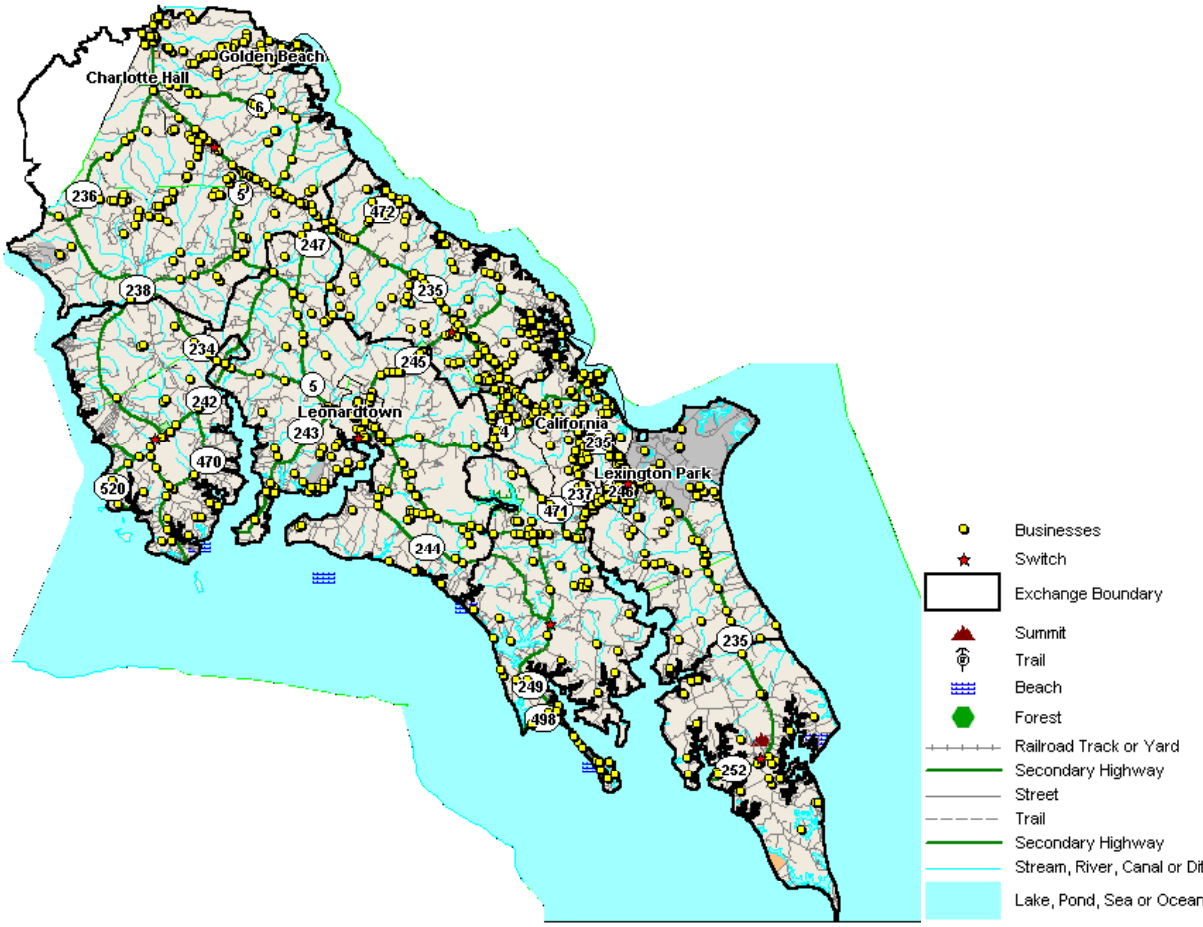
Cable Modem & DSL Availability



Map-11

St. Mary's County

Local Businesses

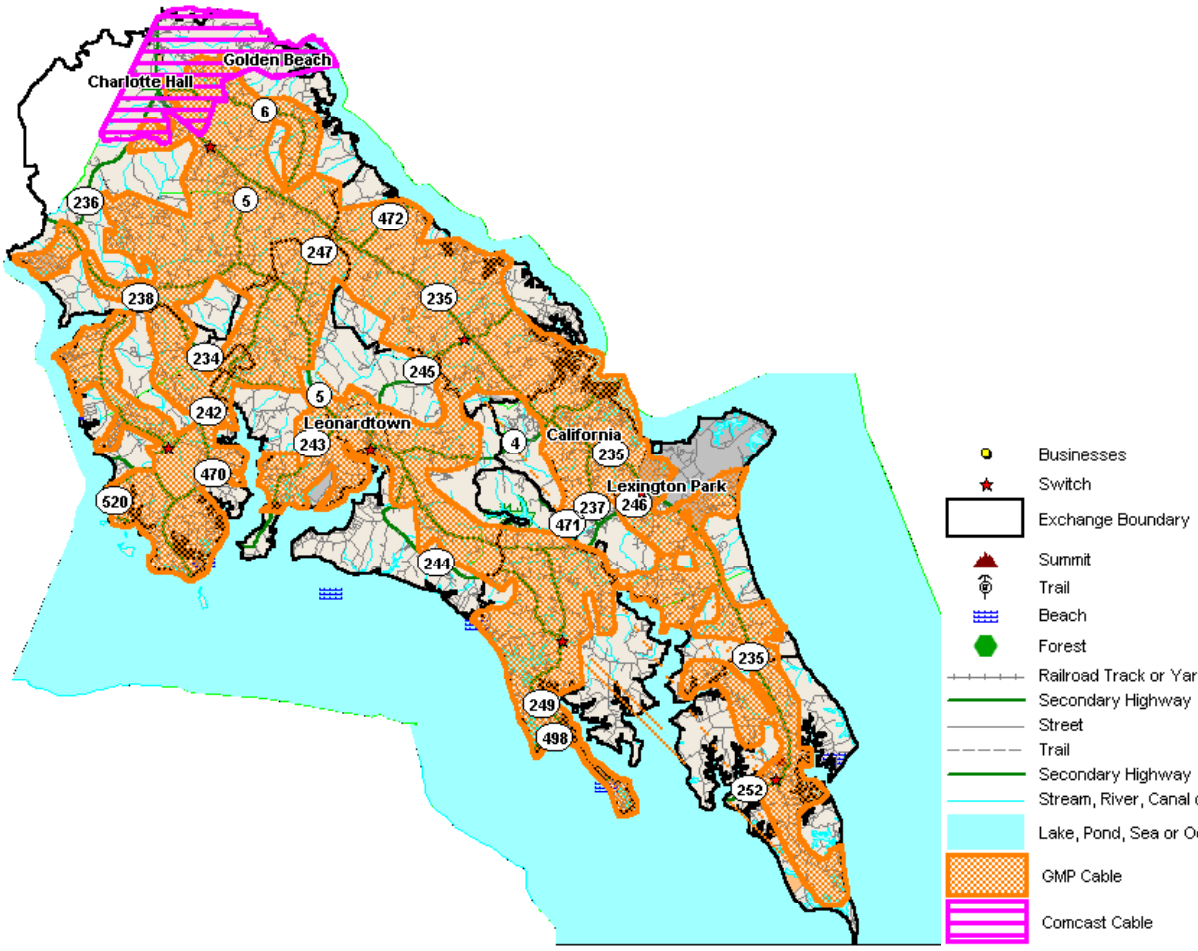


Map-12

St. Mary's County

Cable Modem

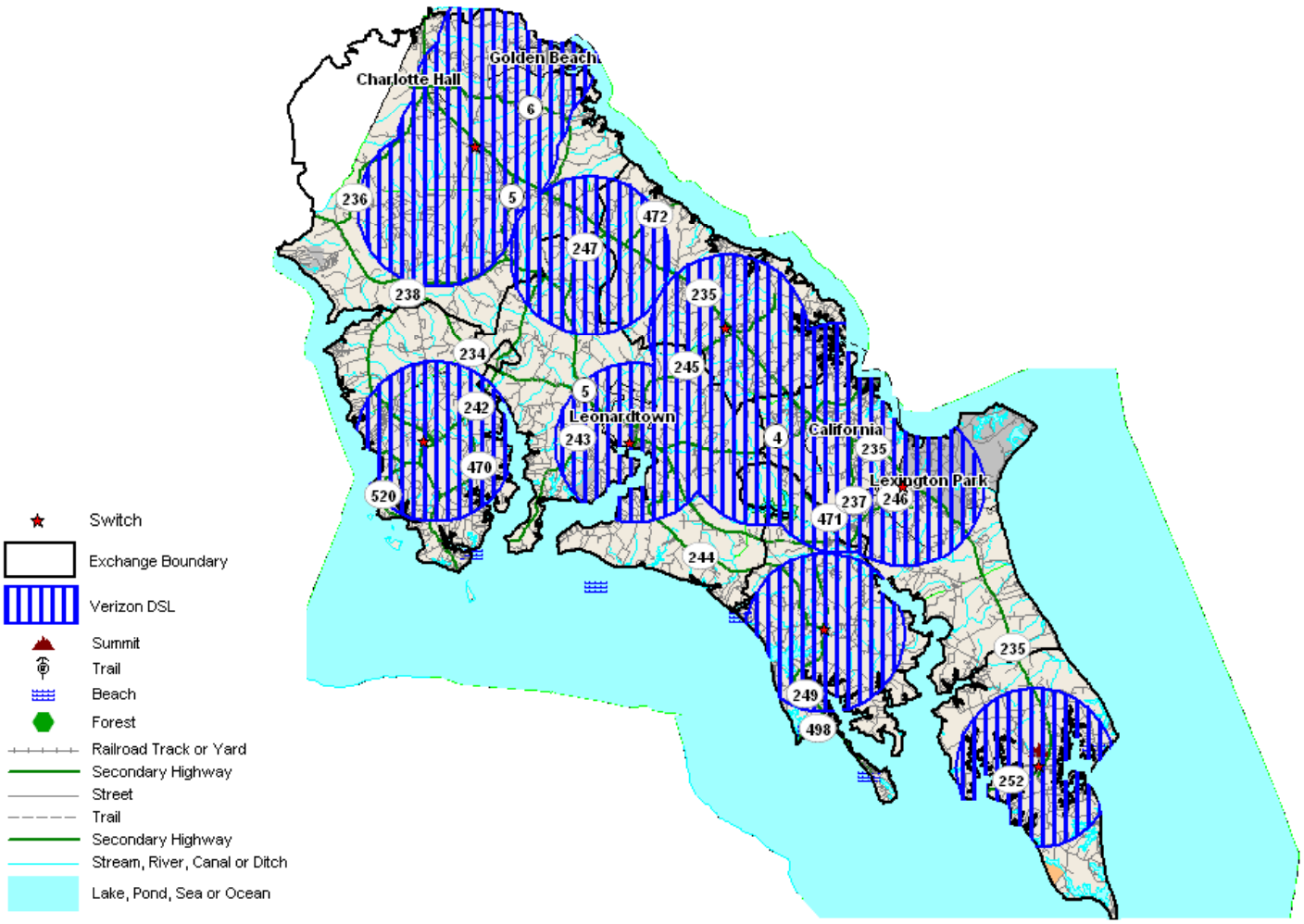
Availability



Map-13

St. Mary's County

DSL Availability

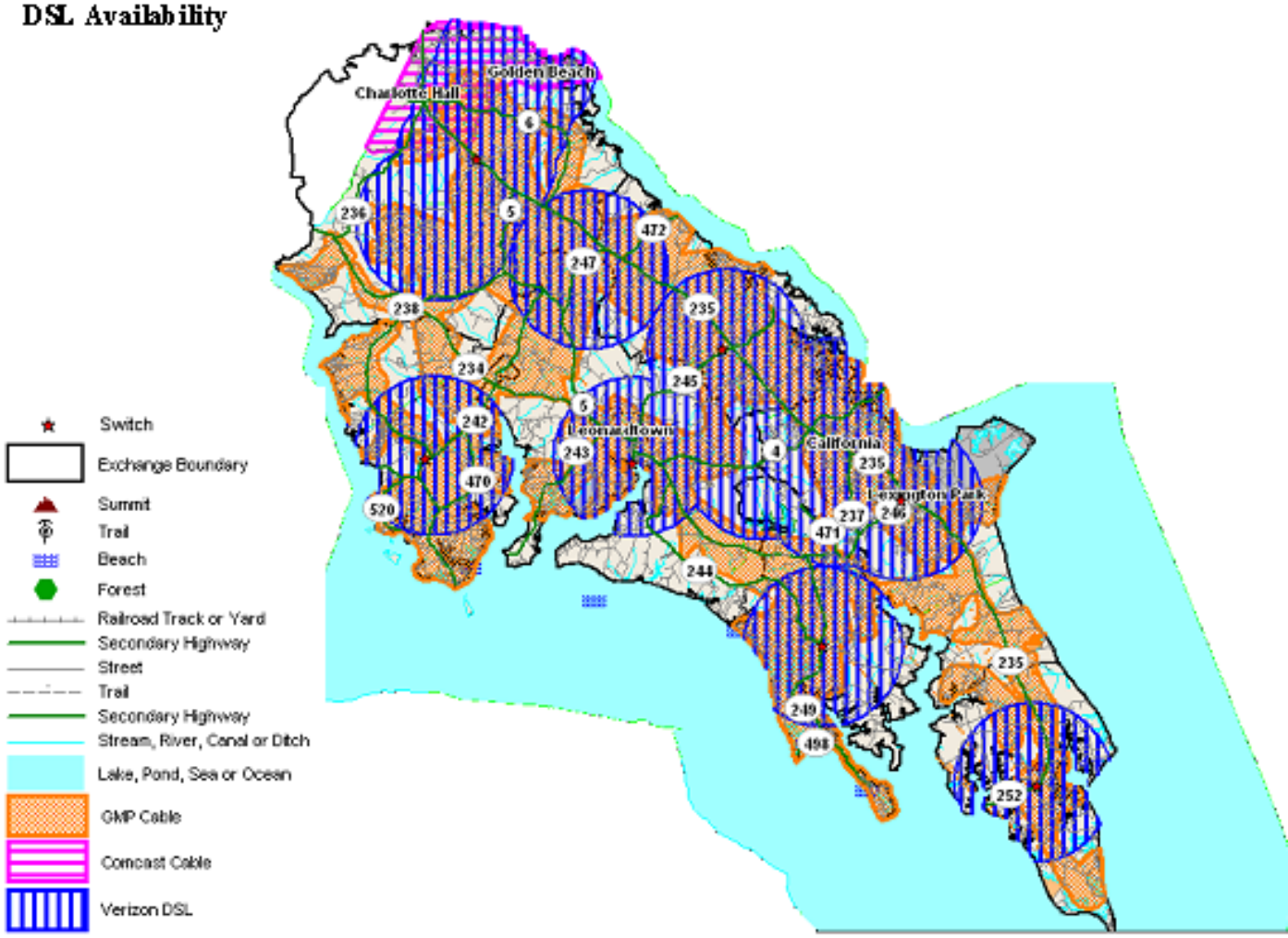


Map-14

St. Mary's County

Cable Modem &

DSL Availability



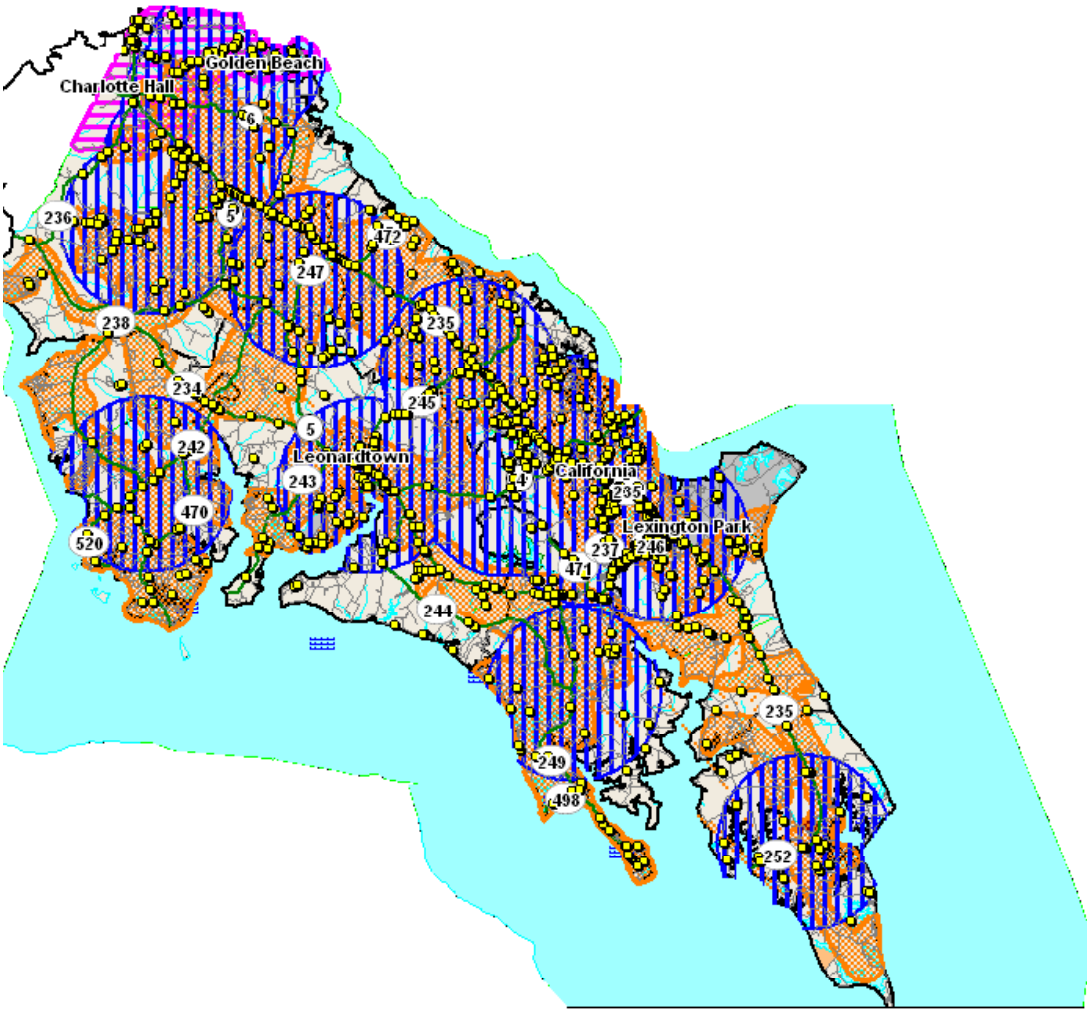
Map-15

St. Mary's County

Local Businesses

Cable Modem &

DSL Availability



Once we prepared the coverage maps we were then able to utilize the maps to estimate the number of residences and businesses in each County that were not covered by DSL or cable modem service. **These estimates only count those households and businesses that are outside of the coverage areas of the two services (DSL and cable modem) – and do not count households who reside inside the coverage areas and for some reason cannot get DSL or cable modem service.**

Unserved / Underserved Businesses

We were able to count businesses by use of our mapping program. Since we had plotted businesses by street address using White Page listings, we were then able to use our mapping program to count those businesses that were within and outside of the DSL and cable modem coverage area.

The result of the calculation shows the following businesses have no cable modem or DSL availability *simply because they are located outside of the coverage areas for these services.* These are what we define as unserved businesses.

	Total Businesses	Without DSL	Without DSL and Cable Modem
Calvert County	2,623	140	1
Charles County	4,539	679	202
St. Mary's County	3,388	364	32

As described elsewhere in this paper, we know that there are a significant number of businesses that face large construction charges in order to obtain Comcast cable modem service. For the most part Comcast has not traditionally wired its network to reach businesses, and they have a policy today of passing onto the customer full construction costs for any business that is more than 125 feet away from an existing Comcast service tap. Most businesses are not that close to a service tap; therefore, most are faced with high "up front" fees in order to gain access to the Comcast cable modem network. These are what we define as underserved businesses.

It is nearly impossible to know how many businesses can't afford to get connected to Comcast. We have many anecdotal stories about this issue and we know there are a significant number of small and medium businesses that won't pay the high Comcast construction quotes. In our business plan our estimates included the number of businesses who might be interested in wireless service, if it was available. The estimates used for that study include:

	Total Businesses	Unserved / Underserved Customer	Percent of Market
Calvert County	2,623	250	10%
Charles County	4,539	1,750	39%
St. Mary's County	3,388	1,000	30%
Total	10,550	3,000	28%

Unserved Residential Customers

For purposes of creating a business plan we also calculated the number of unserved residential customers. These are customers that do not have cable modem or DSL service available. We know that a handful of these customers subscribe to satellite service, but the problems with satellite service and its cost discourage the use of satellite data for the typical homeowner.

In order to calculate the number and location of residential customers we plotted household density by using information available from the 2000 US Census. By utilizing data available from the 2000 Census at www.census.gov we were able to map household density by census block (a census block is the smallest grouping of households tracked by the Census). Although there is no set size for a census block, a typical census block size is around 800 households. For the purposes of this study we utilized MapInfo as our mapping tool. Once we plotted the census blocks, MapInfo was able to count the number of households that fall inside or outside of the DSL and cable modem coverage areas. The density maps of the three Counties are shown below.

By overlaying the cable modem and DSL coverage maps with the density maps we were able to estimate the number of households who have no broadband coverage today. The results are as follows:

	Total Residences	Without DSL and Cable Modem
Calvert County	25,447	724
Charles County	41,668	5,368
St. Mary's County	30,642	2,228

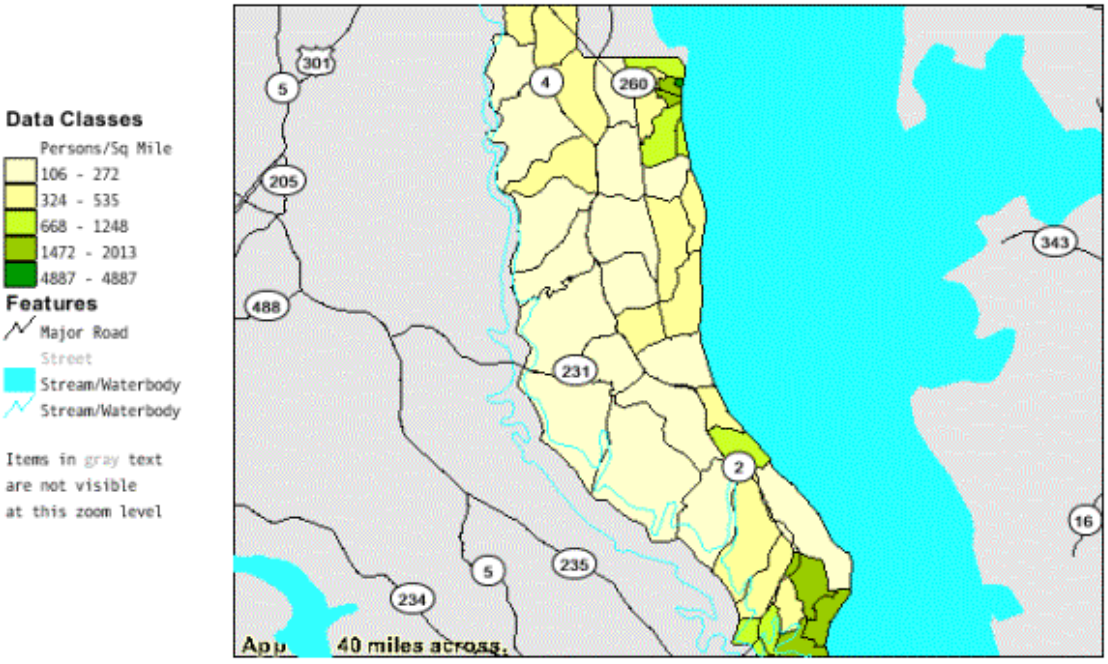
We recognize that Southern Maryland counties are high-growth areas and that there are now more households in the unserved areas than were shown in the 2000 Census data. As described elsewhere in this paper, we also note that there are a significant number of residences that may face large construction fees to get connected to cable modem service. The franchise agreements in the Counties require the cable providers to build network when homes reach a certain density. The requirement is 15 homes per street mile in Calvert County and 20 homes per street mile in St. Mary's and Charles Counties. We know that there are many neighborhoods within the franchise service areas that don't have cable service today because they fall below these density requirements.

The budget for this project was not great enough to allow us to really determine the number of residences that don't have cable service. (That would be a very expensive task). We have many anecdotal stories about customers who can't get cable TV service and we know there are a significant number of households within the franchise areas who don't have cable. Such households are in areas where the household density is below the franchise build requirement. In our business plan we estimated the number of residences who might be

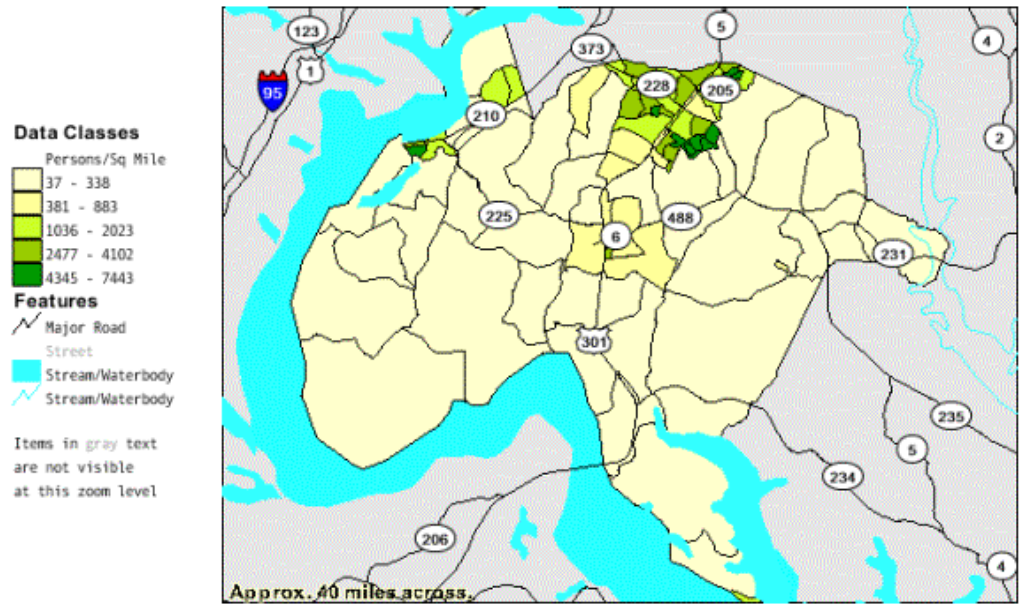
interested in wireless service, if it was available. The estimates we used for that study are as follows:

	Total Households	Unserved Underserved Customer	Percent of Market
Calvert County	25,447	1,400	6%
Charles County	41,668	9,000	22%
St. Mary's County	30,642	4,000	13%
Total	97,757	14,400	15%

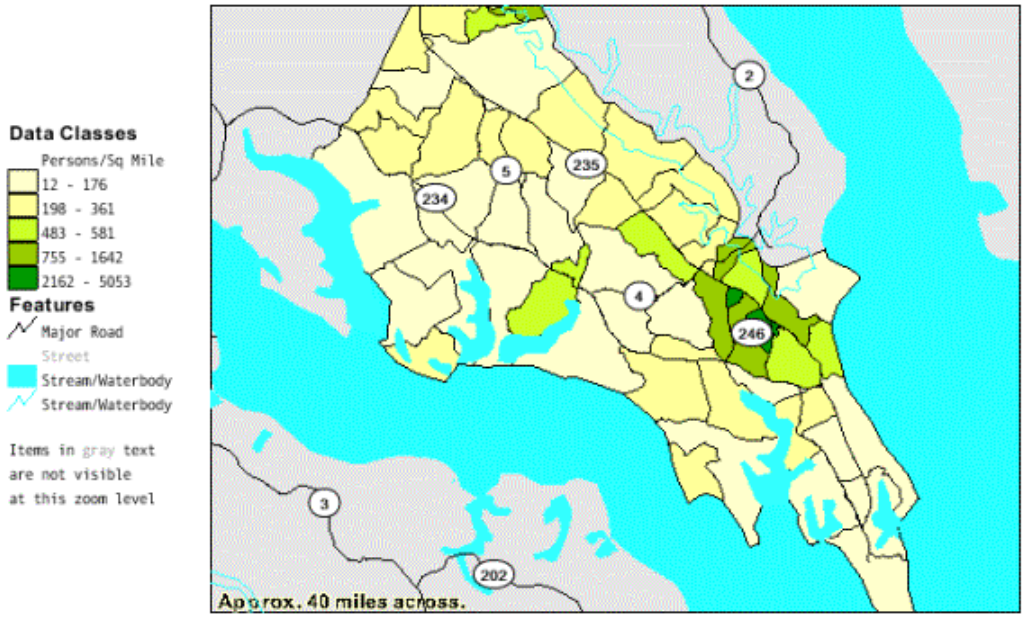
Calvert County Population Density Map



Charles County Population Density Map



St Mary's County County Population Density Map



C. Interviews with Incumbent Providers

Included in this project were interviews with Verizon, Comcast, GMP and various other smaller providers who sell broadband today in Southern Maryland. Following are the results of these interviews:

Comcast Interview

Our interview was with:

Sean M. Looney
Director, Government Affairs
Comcast Cable
27 Francis Street
Annapolis, MD 21401
P: (410) 280-0600
F: (410) 280-0601

We spoke with Sean about Comcast's broadband products and how Comcast views Southern Maryland. Sean did not have instant answers to every question, but he allowed us to follow-up with a list of written questions. Sean did follow-up by answering all of our questions.

We also provided our cable modem coverage maps to Comcast. Comcast then returned our maps showing what they believed to be areas with Comcast cable modem coverage.

The discussion with Comcast included the following:

- Comcast stated that Southern Maryland has a slightly higher cable modem penetration rate than the Comcast national average, which is 16.5%. This percentage represents the percentage of households that subscribe to cable modem to that of the number of households that have Comcast cable running by their house. This percentage does not include houses where Comcast has not built their network. Note that the nationwide residential high-speed Internet penetration is reported widely in the press to be around 45% for all service providers combined.

- Sean verified that Comcast has a nationwide policy whereby businesses or residences who are not on the network today, and who don't meet franchise buildout requirements, must pay the full construction cost of gaining access to the network. Comcast charges businesses a standard installation fee of $250 if the business is located within 125 feet of an existing Comcast service tap. If a business is more than 125 feet from a service tap then full construction charges apply.

- Comcast reports than in January 2005 that cable modems for all residential customers were upgraded from a maximum of 3 Mbps to 4 Mbps.

- Comcast described all of the features available with both residential and commercial cable modem service. Those descriptions are included in the next section below.

- We asked Comcast about the price difference of buying cable modem as part of a package compared to buying it a la carte. Comcast's response:

  > "On the residential side the a la carte price for modem service is $57.95 per month. If bundled with our cable television service the monthly charge is $42.95 per month. In any case customers can lease a modem from Comcast at an additional $3.00 per month. Customers can also purchase a modem from us or at any local, retail outlet.
  >
  > At this time all commercial/business services are a la carte. The cable (programming) business is complex, with many limits/restrictions placed on the commercial/business customer. There are also copyright issues based on whether or not the general public can view the service… the size of the business, how many TV's, etc., which makes bundling difficult. Because of this, the commercial cable and the commercial Internet services are currently managed by two separate Comcast entities."

- We questioned Comcast about requirements for wiring of schools, government buildings, etc. Comcast's response:

  > This varies depending on the individual Local Franchise Area requirements. Also, Comcast's Education Initiatives provides for wiring any public/private school for video services and offers a Computer Lab environment level of high-speed data service to any K-12 public/private school in Comcast's footprint.
  >
  > Charles County has the most comprehensive I-Net requirement in the Comcast footprint. This includes a fiber network connecting most public schools, county government buildings, Fire, Police, EMS, and libraries. There are a couple sites that are fiber-only as they were not in our coaxial footprint.
  >
  > Calvert County requires that we wire county government buildings, public schools, Fire, Police, EMS, and libraries with video service only. There are 10 sites in the county that receive a level of high-speed data services.

> We serve only a small portion of St. Mary's County. There is one public school that Comcast will connect to the I-NET being constructed by the primary cable provider for St. Mary's county.

Verizon Interview

Our interview was with:

Jason Groves
Assistant Vice President External Affairs – South
12 West Street
Annapolis, MD 21401

and Saran Baker – Sales

We spoke with Jason about Verizon's broadband products and how Verizon views Southern Maryland. Verizon responded to CCG by describing their broadband products and pricing and by verifying our DSL maps.

The discussion with Verizon included the following:

- DSL is available in most Southern Maryland central offices. The offices without DSL are the most rural exchanges (meaning customers live far away from the Verizon central office).

- Verizon DSL penetration rate is around 10% of the available households. This rate is extremely low for Verizon compared to the rest of Maryland and also compared to Verizon's national averages.

- Verizon (or Jason) believes that Southern Maryland customers are not buying Verizon DSL because they do not value the service. Jason stated that culturally Southern Maryland is not ready for Verizon DSL. He believes this was due to the percentage of farm families and long-distance commuters compared to places like Prince Georges County.

- Jason says Verizon makes the decision to invest in and install DSL as a pure business decision based upon the expected number of customers who will buy. The current low DSL penetration rates are not driving Verizon to expand DSL coverage.

- Geographic coverage is not as great in southern St. Mary's County due to the Naval Base. Employees of the Naval Base who require a high-speed connection at home typically purchase the service through a Naval contract.

- Geographically only about half of Calvert County central offices have access to DSL. Verizon claims this is because of the rural nature of the area.

- All of the central offices in Charles County have DSL.

- As of the time of the interview Verizon stated that they will not sell DSL to a customer who uses some other carrier for local dial tone. This is true even if the other carrier is reselling Verizon facilities. However, on May 29, 2005 Verizon announced they would sell "naked" DSL, meaning that customers will be able to buy DSL without buying Verizon dial-tone.

- The cost of an Internet T1 in Maryland varies according to the mileage from the customer's location to the Verizon Internet POP (currently in Arlington, VA). Verizon stated that its tariffed T1 rates are roughly $800 in Southern Maryland. Although $800 is higher than places close to Arlington he mentioned that this rate is comparable to places like Laurel. (Note that the $800 price does not include the Internet connectivity.)

- Verizon's Enhanced Flexgrow Fractional T1 service allows business customers to mix and match voice and data over 24 clear channels. This service originates out of the Waldorf central office. The Flexgrow price ranges are from $400-$600 per month depending on the number of lines and the speed of access to the internet. Full T-1 services w/o discount are running about $824.00 per month.

- Verizon was not familiar with Commissioner Mattingly's (St. Mary's) belief that there is a special Verizon plan in St. Mary's County which extends DSL beyond 18,000 feet.

GMP Interview

Our interview was with:

Hans Welch, General Manager
Dave Dexter, Internet Engineer
44150 Airport View Drive
Hollywood, MD 20636

We spoke with GMP about broadband products and how GMP views Southern Maryland. GMP responded to our interview questions and also our follow-up written questions.

We also forwarded our cabled modem coverage maps to GMP for review and verification. They would not directly verify the maps, but they referred us to the buildout/coverage maps found on the St. Mary's County website.

The discussion with GMP included the following:

- Nearly 5 years ago GMP deployed one of the earliest "first generation" cable modem services in the country.

- The current rebuild of the GMP system is now complete. GMP completed the rebuild in two years in what was originally estimated to take four years. Southern St. Mary's County was the last to be completed. The upgrade included an increase in frequency from 450 MHz to 870MHz.

- Harron Entertainment Company acquired GMP in late 2004. This was a "change of control" brought on by new investors rather than a true system sale.

- In December 2004 GMP increased its cable modem speed from 768k to 1.5 Mb. GMP will again increase its cable modem speed to 3 Mb sometime in the near future.

- GMP does not cover the Golden Beach and Charlotte Hall portions of St. Mary's County; Comcast provides service in these areas.

- As part of the upgrade GMP added Comedy Central, C-Span2, TV Land, EWTN, Animal Planet, Women's Entertainment, E! Entertainment, Travel Channel, Court TV, G4Tech TV, Bloomberg TV Fox Movie Channel, Univision, Sci-Fi Channel, Outdoor Channel, and National Geographic.

- GMP will be adding video-on-demand and VoIP telephony services in the near future.

- Cable modem service is available everywhere in which the build-out has occurred. For more details see:
  http://www.co.saint-marys.md.us/cable/ and
  http://arcims.co.saint-marys.md.us/website/cablemap/viewer.htm

D. Products and Prices of Broadband Available Today in the Southern Maryland

In this section we review broadband prices available to customers today in Southern Maryland.

Verizon

Verizon Residential DSL

Plan	Monthly Price	Commitment	Equipment
One-Year Commitment Plan	$29.95	One Year	Modem and wireless router included
Month-to-Month	$37.95	None	Modem

As can be seen, Verizon Residential DSL does not quote a speed of service. As discussed in the technical section of this paper, DSL speeds vary according to the distance from the central office, the size of the wire and the condition of the copper. Thus customers will get differing DSL speeds depending upon exactly where they live. Further, DSL speeds, like all broadband products, could be limited in speeds during the busiest peak network hours due to allocating bandwidth between multiple users.

Verizon Residential DSL includes:

- 9 email accounts
- 10 MB of web storage space
- Dynamic IP address

Verizon Business DSL

Maximum Connection Speeds (downstream/upstream)	BASIC Up to 3M/768K	FULL FEATURED Up to 3M/768K	FULL FEATURED Up to 7.1M/768K
Dynamic IP	$39.95	$59.95	$204.95
Static IP (see below for more info)	Not Available	$79.95	$234.95
How Your Business Uses the Internet			
- Research, surfing and e-mail	x	x	x
- Receive / send large text, graphic and photo files	x	x	x
- Audio / video streaming	x	x	x
- Remote users access your network	x	x	x
- Connect multiple users to one DSL line	x	x	x
- Video-conferencing	x	x	x
- Remote dial-up access for use when traveling		x	x
- Maintain a Web site		x	x

- Conduct e-commerce (with static IP)			x
Remote Dial-Up Access	Optional	Unlimited	Unlimited
	$8.95 for 50 hrs.		
Personal Web Space	Not Available	20M	20M
e-Mail Accounts	10 .net	10 .net Or	10 .net Or
		3 domain name	3 domain name

(One-year contract required. Not all packages are available in all locations. Check availability for your phone number above.)

Verizon T1 Products

For decades the standard Verizon data product has been a T1. A T1 is a 2-way circuit that can be installed to almost any customer in Southern Maryland. A T1 delivers 1.544 Mbps both in the upstream direction and in the downstream direction.

T1s are relatively expensive for Internet access. T1 pricing for Internet access comes in three components, a termination charge, mileage and an Internet port charge. Verizon's rates for T1 service are tariffed, meaning the rates are on file at the Maryland Public Service Commission. Tariffed rates don't generally vary for small customers who buy only a few T1s; typically the tariffed rates will apply. Verizon will offer discounts for both length of term and for quantity purchases.

The T1 rates from the tariff are as follows:

	Month to month		3 Year	
Channel Termination	**Monthly**	**NRC**	**Monthly**	**NRC**
1.544 Mbps	$225.00	$610.56	$210.94	$610.56
Channel Mileage	**Fixed**	**Per Mile**	**Fixed**	**Per Mile**
1.544 Mbps	$50.00	$30.00	$46.88	$28.13

In addition to these rates is an Internet Port charge. This rate is not tariffed, but various businesses in Southern Maryland have stated that they are paying roughly $400 - $500 per month for the bandwidth.

The biggest problem with Verizon T1s for Internet access is that the nearest Internet POP is in Arlington, Virginia. This means that customers must buy a T1 from their location in Southern Maryland to Arlington.

The Verizon T1 pricing can be broken down as follows: If one were to buy an Internet T1 in Leonardtown, the T1 price would include:

$ 610.56 Nonrecurring charge (One-time fee)

$ 225.00	Channel Termination
$ 50.00	Channel Mileage Termination
$ 600.00	Mileage to Arlington
$ 400.00	Bandwidth Internet Port
$1,275.00	**Total Monthly T1 charge**

Businesses in Southern Maryland stated that Internet T1s cost from $900 to $1,200 per month, depending on the location within the Tri-County region.

Note that other companies also sell T1s. For example, most of the long distance companies like AT&T, MCI, Sprint, and Qwest sell T1s in Southern Maryland. The rates from these companies are generally a bit lower than Verizon's rates (but not significantly less). These companies own no facilities to the customers in Southern Maryland; therefore, they buy Verizon facilities through a bulk discount. In the end, any T1 delivered in Southern Maryland is delivered over Verizon's facilities.

Flexgrow

Verizon has a new product offering that allows customers to mix voice and data on a T1. This product is sold under the brand name "Flexgrow". A T1 can be subdivided into 24 channels of 64 Kbps each. With Flexgrow each of these channels can be assigned to either voice or data – and a customer is not required to buy all of the channels. Thus, if a business today already has 7 voice lines, then they could convert to Flexgrow and use seven channels of the T1 for voice and they could use any or all of the remaining 17 channels for data. This allows a customer to get just the right amount of bandwidth. Thus, a customer could buy 4 data channels (264 Kbps), eight channels (512 Kbps) or any amount up to the maximum of the T1.

Flexgrow is complicated to price, because by definition it includes two different types of service (voice and data) from up to two different service providers. The basic T1 for a Flexgrow service costs $190 per month. Customers will continue to pay the same amount as they do today for voice services depending on the type of voice line. For data a customer can either obtain data services from Verizon Online (Verizon's Internet Service) or else subscribe to data services from any other ISP who is equipped to sell data at the Verizon central office. Thus, in order to calculate the full price quote for Flexgrow a customer will need to price the Flexgrow T1, the voice lines, and the Internet data separately.

The advantage of Flexgrow seems to be is that a customer can buy a partial T1 – something that is otherwise a challenge. This is a relatively new product and we would recommend to those businesses that can't afford a full T1 to consider this product as a cheaper alternative.

Comcast

Comcast Residential Cable Modem

Comcast Speed Options	Comcast Customers Monthly Fee	Non-Comcast Customers Monthly Fee
Up to 3Mbps/256Kbps	$42.95	$57.95
Up to 4Mbps/384Kbps	$52.95	$67.95
Installation Options	**Comcast Customers One-Time Fee**	**Non-Comcast Customers One-Time Fee**
1 Computer	$29.95	$29.95
2-5 Computers (price per PC)	$29.99	$29.99
Self Install (1) Computer	$ 9.95	n/a
Connection Options	**Comcast Customers Monthly Fee**	**Non-Comcast Customers Monthly Fee**
Lease modem (1) computer	$3.00	$3.00
Purchase modem (1) computer	$50.00	$139.00
Lease Gateway to connect up to (5) computers	$5.00	$5.00
Purchase Gateway to connect up to (5) computers	$179.99	$199.00

Note that Comcast's pricing differs for customers who subscribe to other cable services versus those customers who don't.

Comcast Business Cable Modem

Comcast Workplace - Standard	Comcast Workplace - Enhanced
Package Features:	**Package Features:**
Up to 5.0 Mbps downstream	Up to 7 Mbps downstream
Up to 512 Kbps upstream	Up to 768 Kbps upstream
7 comcast.net e-mail addresses	20 Business Class e-mail addresses (or 7 comcast.net e-mail addresses)
1 dynamic IP address	1 dynamic IP address

Firewall to help protect your network	Firewall to help protect your network
Local area network ready	Local area network ready
Domain name service	Domain name service
Priority Business Class support	Priority Business Class support
Optional Features:	**Optional Features:**
1 or 5 Static IP addresses	1 statically assigned IP address
Equipment:	**Equipment:**
Comcast managed IP gateway (Firewall/Router) or Modem included	Comcast managed IP gateway (Firewall/Router) included.
IP gateway required with static IP	
Price:	**Price:**
Installation: $250.00	Installation: $250.00
Monthly Service Charge: $95.00. Equipment included.	Standard Monthly Service Charge: $200.00 Promotional Price: $160.00 1 year contract required.
Requires a one year contract	Optional Statically assigned IP address: $30.00 month
1 Static IP address: $30.00 month	
5 Static IP addresses: $60.00 month	

GMP

GMP Residential Cable Modem

St. Mary's County MD - GMPexpress

Service	Speed	Price
Residential Silver	1.5meg Down / 256k Up	$29.95
Residential Gold	3meg Down / 384k Up	$39.95
Residential Gamers	3meg Down / 512k Up	$69.95

Chesapeake/North Beach Calvert County MD - Westernshore.net

Service	Speed	Price
Residential Basic	1.5meg Down / 256k Up	$39.95
Residential Silver	2.0meg Down / 256k Up	$69.95

Installation - $10.00. Often have marketing programs for free installation.

There is a $10.00 Internet access fee for customers who subscribe to modem service only (without any cable services)

Residential Service includes one dynamic IP address.

GMP Business Cable Modem

St. Mary's County MD - GMPexpress

Service	Speed	Price
Commercial Basic	3.5meg Down / 1meg Up	$89.95
Commercial Silver	5.0meg Down / 1meg Up	$129.95

Chesapeake/North Beach Calvert County MD - Westernshore.net

Service	Speed	Price
Commercial Basic	2.5meg Down / 512k Up	$89.95

Installation - $10.00. Often have marketing programs for free installation.

There is a $10.00 Internet access fee for customers who subscribe to modem service only (without any cable services)

One static IP is included with the commercial cable modem service. Additional Static IP's are available for commercial customers are $14.95 each per month.

Starband (Satellite)

Residential 360 Service

Monthly Fee	$49.99 to $99.99
Equipment	$99.99 to $599.99
Location	Home Only

Download Speed	Up to 500 Kbps
Upload Speed	Up to 50 Kbps
Support VPN	No
Static IP	No
Internet Sharing	No
Email Accounts	10 with 10 MB storage each

Residential 481 Service

Monthly Fee	$69.99 to $89.99
Equipment	$499.99 to $799.99
Location	Home Only
Download Speed	Up to 500 Kbps
Upload Speed	Up to 100 Kbps
Support VPN	No
Static IP	Yes, for $4.99 / Month
Internet Sharing	No
Email Accounts	10 with 10 MB storage each

Telecommuter Service

Monthly Fee	$109.99 to $119.99
Equipment	$499.99 to $799.99
Location	Home Only
Download Speed	Up to 750 Kbps
Upload Speed	Up to 128 Kbps
Support VPN	Yes
Static IP	Yes, for $4.99 / Month
Internet Sharing	No
Email Accounts	10 included. 500 MB in primary, 15 MB in rest

Small Office Service

Monthly Fee	$139.99 to $149.99
Equipment	$599.99 to $899.99
Location	Home or Office
Download Speed	Up to 1 Mbps
Upload Speed	Up to 256 Kbps
Support VPN	Yes
Static IP	1 Included. Additional 3 for $19.99 / Month
Internet Sharing	Yes
Email Accounts	15 included. 500 MB in primary, 100 MB in rest

There are several drawbacks to satellite broadband. Compared to other broadband options it's expensive for the bandwidth received. The start-up equipment costs are very high. Of the biggest concern is data upload speeds. Customers in Southern Maryland report actual speeds as low as 14 Kbps, much slower than dialup and therefore not a business solution. According to feedback we received from satellite broadband customers, there are no satellite service firms in Southern Maryland, so customers are on their own for repairs and service.

Southern Maryland Wireless

Southern Maryland Wireless offers wireless Internet access in central St. Mary's County and lower Calvert County.

Residential Fixed Wireless Service	Monthly Fee
512Kbps	$45
1.0Mbps	$75
1.5Mbps	$149
Commercial Fixed Wireless Service	**Monthly Fee**
512Kbps	$299
1.0Mbps	$399
1.5Mbps	$649
Installation Charges	
Fixed Wireless Installation Charge	$200
	Monthly Fee
1.54Mbps point to point T1 (port)	$549
Commercial Wired Services	
Loop charges in the local	$200-$300
Fractional point to point T1's (port)	**Monthly Fee**
512Kbps	$299
1.0Mbps	$399
Other Services	
Roaming Wireless (PDA's only)	**Monthly Fee**
100Kbps	$15
By the Day 512K Wireless	
$5/day - 3 day minimum - for transients, boaters, etc - must use own equipment (laptop) - must be billed to a credit card	

E. General Business Market Data

The following table illustrates the SIC Code (Standard Industry Classification) as utilized by the Census and the IRS to track businesses. We believe this breakdown, by County, was useful in order to understand the types of businesses that are located in the Tri-County area. Note that SIC codes are self-assigned by each business and are not always accurate. We also well aware that there are many small SOHO businesses that fall under the radar and therefore, are not represented in Census data found below. Again, our number of businesses was based upon a database that started with white page listings, so any business not found in the white pages would be missing from this data collection.

		Charles County	Calvert County	St. Mary's County
Division A: Agriculture, Forestry and Fishing				
SIC CODES	**CATEGORY**			
0111-98 - 0191-98	Agriculture Production-Crops	4	2	4
0211-01 - 0291-04	Agriculture Production-Livestock	2	0	0
0711-01 - 0783-98	Agriculture Services	45	36	54
0811-01 - 0851-08	Forestry	0	0	3
0912-01 - 0971-06	Fishing Hunting & Trapping	1	0	1
	Subtotals	**52**	**38**	**62**
Division B: Mining				
SIC CODES	**CATEGORY**			
1411-01 - 1499-98	Mining & Quarry - Nonmetallic Minerals	2	0	0
	Subtotals	**2**	**0**	**0**
Division C: Construction				
SIC CODES	**CATEGORY**			
1521-01 - 1542-29	Building Construction-Gen Contractors	141	168	142
1611-01 - 1629-31	Heavy Construction Except Building	20	16	27
1711-01 - 1799-87	Construction-Spcl Trade Contractors	279	182	231
	Subtotals	**440**	**366**	**400**
Division D: Manufacturing				
SIC CODES	**CATEGORY**			
2011 - 2099-17	Food and Kindred Products-Mfrs	1	3	1
2311 - 2399-11	Apparel & Other Finished Products-Mfrs	1	5	0
2411 - 2499-19	Lumber & Wood Prods Exc Furn-Mfrs	6	3	4
2511 - 2599-03	Furniture & Fixture-Mfrs	1	5	1
2611 - 2679-10	Paper & Allied Products-Mfrs	0	2	0
2711 - 2796-12	Printing Publishing & Allied Industries	39	22	15
2812 - 2899-24	Newspaper and Book Printers	3	0	1
2911 - 2999-01	Petroleum Refining & Related Inds-Mfrs	2	1	0
3011 - 3089-21	Rubber & Miscellaneous Plastics-Mfrs	0	3	1
3211 - 3299-08	Stone Clay Glass & Concrete Mfrs	4	4	4
3312 - 3399-04	Primary Metal Industries-Mfrs	0	0	1
3411 - 3499-20	Fabricated Metal Products-Mfrs	10	7	1
3511 - 3599-16	Industrial & Comm Machinery-Mfrs	12	7	5
3612 - 3699-11	Electronic & Other Electrical Equip-Mfr	0	1	6
3711 - 3799-13	Transportation Equipment-Mfrs	2	4	5

		Charles County	Calvert County	St. Mary's County
3812 - 3873-06	Measuring & Analyzing-Mfrs	2	1	5
3911 - 3999-72	Misc-Manufacturing Inds-Mfrs	17	11	7
	Subtotals	**100**	**79**	**57**
Division E: Transportation, Communications, Electric, Gas & Sanitary Services				
SIC CODES	**CATEGORY**			
4111-01 - 4173-98	Local/Suburban Transit & Hwy Pssnger	21	12	14
4212-01 - 4231-01	Motor Freight Trans/Warehouse	39	15	36
4311-01	United States Postal Service	21	14	29
4412-98 - 4499-13	Water Transportation	9	33	24
4512-01 - 4581-14	Transportation By Air	5	1	4
4724-01 - 4789-08	Transportation Services	12	14	6
4812-01 - 4899-03	Freight Brokers	26	7	19
4911-01 - 4971-02	Voice and Data Communication Services	26	17	5
	Subtotals	**159**	**113**	**137**
Division F: Wholesale Trade				
SIC CODES	**CATEGORY**			
5012-01 - 5099-98	Wholesale Trade-Durable Goods	146	65	69
5111-01 - 5199-98	Wholesale Trade-Nondurable Goods	46	28	26
5211-01 - 5271-05	Building Material & Hardware	72	49	45
5311-01 - 5399-05	General Merchandise Stores	31	8	19
5411-01 - 5499-36	Food Stores	107	36	67
5511-01 - 5599-18	Auto Dealers & Service Stations	119	58	74
5611-01 - 5699-98	Apparel and Accessory Stores	65	16	22
Division F: Wholesale Trade Cont:				
SIC CODES	**CATEGORY**			
5712-01 - 5736-14	Home Furniture & Furnishing Stores	138	47	90
5812-01 - 5813-08	Eating & Drinking Places	188	109	140
5912-01 - 5999-98	Miscellaneous Retail	291	147	171
	Subtotals	**1,203**	**563**	**723**
Division H: Finance, Insurance and Real Estate				
SIC CODES	**CATEGORY**			
6011-01 - 6099-16	Depository Institutions	45	15	32
6111-01 - 6163-02	Nondepository Institutions	48	21	18
6211-01 - 6289-05	Security & Commodity Brokers	10	6	8
6311-01 - 6399-03	Insurance Carriers	6	8	5
6411-01 - 6411-98	Insurance Agents-Brokers & Service	101	41	57

		Charles County	Calvert County	St. Mary's County
6512-01 - 6553-98	Real Estate	123	137	123
6712-01 - 6799-98	Holding & Other Investment Offices	3	0	1
	Subtotals	**336**	**228**	**244**
Division I: Services				
SIC CODES	**CATEGORY**			
7011-01 - 7041-98	Hotels Rooming Houses & Camps	26	19	18
7211-01 - 7299-95	Personal Services	196	111	118
7311-01 - 7389-98	Businesses Services	176	145	160
7513-01 - 7549-25	Auto Repair Services & Parking	145	66	88
7622-01 - 7699-98	Miscellaneous Repair Services	67	57	53
7812-01 - 7841-98	Motion Pictures	26	20	22
7911-01 - 7999-98	Amusement & Recreation Services	86	67	69
8011-01 - 8099-55	Health Services	475	265	316
8111-01 - 8111-98	Legal Services	124	47	74
8211-01 - 8299-75	Educational Services	78	50	92
8322-01 - 8399-98	Social Services	122	71	84
8412-01 - 8422-07	Museums Art Galleries & Gardens	5	2	7
8611-01 - 8699-20	Membership Organizations	204	109	146
8711-01 - 8748-98	Engineering & Accounting & Mgmt Svcs	125	83	167
8999-01 - 8999-52	Miscellaneous Services NEC	2	5	2
9111-01 - 9199-06	Executive Legislative & General Govt	34	58	34
9211-01 - 9229-06	Justice-Public Order & Safety	26	19	17
9311-01 - 9311-05	Public Finance & Taxation Policy	3	3	4
9411-01 - 9451-04	Administration-Human Resources Progs	4	6	5
9511-01 - 9532-04	Admin-Environmental Quality Progs	5	6	6
9611-01 - 9661-04	Administration of Economic Programs	5	6	3
9711-01 - 9721-04	National Security & Internatl Affairs	8	5	10
9999	Nonclassifiable Establishments	305	16	270
	Subtotals	**2,247**	**1,236**	**1,765**
	Grand Total	**4,539**	**2,623**	**3,388**

II. Industry Analysis

As our research has disclosed, the biggest communications concern for businesses and residents of Southern Maryland is the availability and affordability of broadband capabilities and services. Focusing on this issue, we will begin by presenting an overview of the communications industry as it has evolved over the last decade. We will also discuss the current service providers in Southern Maryland. We will also discuss the key issues surrounding the current broadband products used in Southern Maryland – digital subscriber line (DSL), cable modems, terrestrial wireless, satellite broadband, and the potential for fiber-to-the-home/business. We will also critique each of the service providers in Southern Maryland. Finally, we will review the general industry issues concerning broadband.

A. Overview of the Communications Industry

For many decades, the communications industry operated in four essentially separate spheres – wireline telecommunications services, cable television, information services, and wireless services. Wireline telecommunications services consisted largely of local and long distance telephone and data communications services, all involving the transmission of information without change in the form or substance of the user's information. For example, a telephone company carried a customer's telephone calls, faxes or data without altering it in any way. Cable services consisted primarily of one-way transmission of cable television signals, with minimal return communications for channel-selection purposes. Information services included substantial amounts of content or involved manipulation of the user's information in some way during transmission or storage. For example, a provider of "information service," such as AOL, offered its customers access to the provider's or third-party content and subjected the user's emails and other communications to protocol changes during transmission and storage. Wireless services included public and private radio communications and, in recent decades, portable telephone, paging and data services.

Not only did providers of communications services treat these four spheres as separate for operational purposes, but federal and state laws did so as well. As a result, telecommunications, cable, information and wireless providers were – and in many respects still are – subject to completely separate regulatory regimes, each with its own unique concepts, definitions and rules.

Another important feature of the communications industry is that monopolists historically dominated local telecommunications and cable markets. In the telecommunications area, federal and state laws officially sanctioned, encouraged and protected local monopolies beginning with the enactment of the Communications Act of 1934. The rationale behind these laws was that local telephone service is a "natural monopoly" – i.e., only a single firm with guaranteed profits can afford the huge capital investments and operating costs necessary to provide ubiquitous service. In the cable area, federal, state and local laws have sought to encourage competition, particularly through the pro-competitive measures enacted as part of

the 1992 amendments to Title VI of the Communications Act of 1934 (the "Cable Act"). These laws, however, have not had the desired level of success.

During the last decade, the communications industry has changed dramatically as a result of numerous interrelated technological, legal, financial, marketing, and other developments. We summarize some of the major developments in this section and elaborate on them where appropriate elsewhere in this Report.

In the landmark Telecommunications Act of 1996, Congress sought to eliminate, once and for all, the monopoly-oriented approach to providing telecommunications services. Instead, Congress sought to stimulate robust competition in all communications markets by imposing various market-opening requirements on incumbent monopolists and by offering potential new providers numerous incentives to compete with the incumbents.

For example, the Act required incumbent local exchange carriers (ILECs), such as Verizon, to (1) interconnect their networks and facilities with those of new providers; (2) allow new providers to collocate their equipment in the ILEC's central offices; (3) make ILEC network elements available to new providers on an unbundled basis; (4) afford new providers fair, reasonable and non-discriminatory access to ILEC poles, ducts, conduits and rights of way; and (5) make any services that ILECs sold at retail available to new providers at wholesale prices, to facilitate resale by the new providers. During the congressional debates that preceded the Act, the ILECs agreed to these requirements (and many others) because the Act also gave them what they wanted – elimination or simplification of many regulatory requirements, the ability to enter into the long distance business under certain conditions, the ability to provide cable service free of existing cross-ownership bans, and the ability to enter into the lucrative equipment business.

Dramatic technological changes have also occurred over the last decade, particularly in fiber optics, data storage and digital information processing and transmission. The new technologies have not only greatly increased the speed and lowered the costs of transmitting and storing large amounts of information, but by reducing communications of all kinds to binary digits of 1 and 0, they have also blurred the technological distinctions among telecommunications services, cable services and information services. Thus, telephone companies, cable operators and information service providers are increasingly able to offer each other's traditional products. At the same time, wireless providers can readily provide voice some data services, and satellite providers can readily provide cable television and some data services. Today Voice Over IP (VoIP) technology is allowing companies to provide services over high-speed connections provided by others.

A significant effect of this convergence of service technologies, coupled with diminished legal barriers to entry, is that the potential market has greatly expanded for each historical category of provider. For example, a cable operator that previously sold only cable television service to a household for, say, $50 a month, can now realistically hope to sell the household a bundle of cable television, local and long distance telephone service and high-speed Internet access for a total of $120 a month or more.

During the last five years demand for the Internet has grown at an explosive rate, offering companies and individuals vast new opportunities to search for, gather, and trade large amounts of information. This development has profound implications for economic development, educational and occupational opportunity, and quality of life. As a result, demand for high-speed connectivity has increased dramatically and will continue to do so for the foreseeable future. Nationwide the penetration rate for high-speed Internet services is now greater than 45% of households.

In the mid-to-late 1990s, the financial community believed that the future of communications was very bright, and it invested billions in the communications industry. Dozens of new competitive local exchange carriers (CLECs) emerged with plans to compete with incumbent telecommunications providers for the most lucrative business and residential customers. A number of "broadband overbuilders" also appeared, each intending to build state-of-the-art communications networks that would enable them to compete simultaneously with providers of voice, video, data, security, and other communications services. In the meanwhile, the major cable and telecommunications firms voraciously acquired new companies and existing competitors, justifying their actions in part as necessary to deploy advanced communications services as rapidly as possible to all Americans.

A few years ago the global economy turned steeply downward and a major shakeout occurred in the communications industry. As a result, many CLECs and broadband overbuilders have cut back on their operations or gone out of business altogether. The large long distance carriers have gone out of business or are being absorbed into other companies. Even the major incumbents have significantly reduced their expansion plans and reneged on their promises to deploy advanced communications services rapidly to all Americans. Outside of the major population centers, with little if any competition in sight, the incumbent providers have grown increasingly unresponsive to local concerns. In areas like Southern Maryland, small-to-medium businesses and residents have been unable to obtain services comparable to those available to their urban counterparts. This phenomenon has come to be known as the "Digital Divide."

A number of progressive local governments have overcome or mitigated the "Digital Divide" in their communities by providing broadband services themselves or by forming strategic partnerships with the private sector to facilitate the provision of such services.

B. Issues with Broadband Technologies

Across the United States, small-to-mid-sized businesses and residents in communities outside the major population centers – including Southern Maryland – are clambering for prompt and affordable access to high speed Internet access but are unable to obtain it. In many cases, their frustrations are heightened by misleading or downright dishonest promises that such services will be available "in the near future." In Section III of this paper we will look at each

of the existing broadband technologies in more detail, In this section we will look at the pros and cons of each broadband technology as it applies to business and residential customers.[1]

1. DSL

DSL is a technology that allows the delivery of data at high speed over existing copper telephone wires. It is a proven technology that has been in use for approximately six years. Where available, DSL is typically offered in a number of different bandwidths, which allows users to select the bandwidth that it needs and can afford. DSL service generally uses only a portion of a copper line's capacity and thus permits users to make telephone calls at the same time that they are working on the Internet. DSL is also "always on," so users can send and obtain information even when they are not physically present before their computers, nor do they need to obtain a new line or connection each time they initiate or receive a communications.

There are a number of different types of DSL in use or under development. These are often referred to as the various "flavors" of DSL. They are typically marketed under the acronyms ADSL, SDSL, HDSL, VDSL, IDSL and G-Lite. These are described in more detail in the Section III.

Deploying DSL is capital intensive for the service provider. The DSL network begins at a telephone company central office with a transmission device referred to as a DSL Access Multiplexer ("DSLAM"). A DSLAM is, in essence, a small data switch that can support multiple DSL users. Each customer must also have appropriate hardware to receive DSL. Most brands of DSL use a DSL modem at the customer location that is referred to as an IAD (Integrated Access Device). DSL also requires that the relevant copper be stripped of all signals other than the DSL signal. In the telephone industry, this is referred to as "deloading the line." The copper in the telephone system often was built using a system of power boosters and signal repeaters that allow the normal telephone signal to be carried with greater strength and for greater distances. In order to deploy DSL, such repeaters and boosters must be physically disconnected from the copper pair, and this usually requires a field crew with bucket trucks to trace the pair and to physically strip the copper pair.

The hardware cost of deploying DSL varies widely by brand purchased and by the specific flavor of DSL being deployed. G-Lite can now be purchased for as little as $300 per customer for both ends of the hardware. Some of the variations of ADSL and VDSL can cost as much $1,000 per customer. In any case, the telephone company must make a significant investment to deploy DSL. In addition, most flavors of DSL require customers to buy Ethernet modems for their computers – something most computers are now equipped with.

[1] The term "broadband" has no universally-accepted meaning. The FCC defines it as bandwidth capacity that will support both uploads and downloads at a speed of at least 200 Kbps. We believe that this definition is highly restrictive and obsolete, but it is not necessary for our purposes to define a specific higher capacity.

DSL is not readily available everywhere for a number of reasons. First, DSL is subject to distance limitations. DSL can reasonably be served up to 18,000 feet from a central office switch in the most favorable conditions, but poor copper wiring in most exchanges realistically makes this limit closer to 10,000 to 12,000 feet, depending on the brand of equipment. This distance limitation is further shortened in reality, since it is measured in cable feet rather than "as the crow flies" in a straight line. The copper wiring coming out of a central office often wanders up and down streets and rarely runs in a straight line to reach areas away from the switch. Realistically, in many exchanges, this 10,000 to 12,000 foot distance limitation creates a potential delivery circle of only about a mile-and-one-half around the switch.

There are two solutions to DSL's distance limitations. First, as newer generations of DSLAMs are developed to deliver higher bandwidths, the DSL delivery range will increase. DSL bandwidth delivery over copper is not linear, meaning that the amount of bandwidth that can be delivered drops off quickly with distance from the transmission point. Where a 1-Meg modem today might fall off to a 128k signal at 10,000 feet, a future 5-Meg modem might be able to deliver 1 Meg at that same distance. Thus, over time, the distance issue might be overcome to some degree through improved technology.

The second solution to DSL distance limitations results from what are referred to as "remote" or "mini" DSLAMs. This technology allows DSLAMs, or central DSL hubs, to be moved into more remote locations in the network – e.g., to the cable junction in front of a housing development or a business park. From this remote DSL origination point, the DSL signal could still be delivered for the same distance, but this distance is now measured from the new field-installed hardware and not from the central office. Such technology should mean that DSL can be made available to most customers, but as will be described elsewhere in this paper, Verizon is not deploying DSLAMs in all of its remote terminal locations in Southern Maryland.

The second problem with DSL delivery is the existing copper network. Copper plant was not originally built with DSL in mind, and there are many places in current networks where DSL will not work, regardless of the distance from the central office. In some cases, the copper is too small in gauge or thickness, since the thicker the copper the better that DSL will work. In other cases, there are signal leaks into the system or there are other reasons why some copper pairs will not readily accept DSL signals. There is very little that can be done to fix stray "noise" problems, other than to replace the portions of the network that have such problems. Replacement is an expensive solution that often means re-wiring an entire neighborhood.

Third, DSL is a copper-only technology. This means that if any path to a customer includes even one foot of non-copper cable, such as fiber, then DSL will not function. For many years, Verizon and other telephone companies have been building new feeder cables using fiber. Feeder cables are large capacity cables that carry signals from the central office to large neighborhood clusters of homes and businesses. Fiber is cheaper and more reliable for this use, and almost all new subdivisions and business parks built in the last ten years are fed with fiber feeder cables. Additionally, phone companies have been replacing older copper feeder cables with fiber cables as they do routine upgrades. This has led to the strange phenomenon

that the newer the neighborhood, the less likely that DSL will be available. Older neighborhoods that are built throughout with copper may be good candidates for DSL, whereas in newer areas with fiber feeds, DSL will not work at all. This phenomenon is not favorable to rapidly growing communities in which a large percentage of homes and businesses have been built in the last ten years.

Another issue affecting the availability of DSL is the phone company's decision of where and when to deploy it. This is matter of setting corporate-wide priorities. As large as they are, Verizon has not made it a corporate priority to fully deploy DSL to all of its operating territory. Often, they have chosen to roll out DSL only in areas in which doing so is necessary to meet competition by cable modems. Verizon admits they look at expected profitability, by neighborhood in determining where to out DSL. DSL to some degree is now viewed by Verizon as an interim technology that will eventually be replaced by fiber-to-the-home, as I will describe elsewhere in this paper. DSL has been around long enough that one can assume that if DSL is not available in an area today that it may not be available for many years to come. Verizon admitted to CCG during the interview process that they had no current plans for expanding the DSL footprint in Southern Maryland.

2. Cable Modem

The most popular source of high speed Internet access today is cable modem service. At the end of 2004 there were approximately 20 million cable modem subscribers, whereas telephone companies provided DSL to approximately 16.5 million customers.

Cable systems were originally designed to deliver through sealed coaxial cable lines the same radio-frequency signals that residents with good reception could obtain from television broadcast towers over the air. Over the years, cable operators have upgraded their networks to Hybrid Fiber Coaxial (HFC) systems by replacing some of their coaxial cables and associated facilities with fiber optic lines and electronics. They have also increased the bandwidth capacities of their systems from 330-450 MHz to 750-860 MHz (or more), adopted digital compression technologies, and added infrastructure to support Internet networking. As a result, a growing number of cable systems have the capacity to provide hundreds of television and music channels as well as high-speed Internet access. Many cable systems are now also providing or experimenting with telephone service.

Cable systems that provide cable modem service generally use one cable television channel (6MHz) for downstream signals and another channel for upstream signals. At the cable company headend, a cable modem termination system (CMTS) uses these channels to create a virtual local area network with cable modems attached to computers at subscriber residences. Depending on the transmission technology used, cable operators can theoretically send up to 36 Mbps per channel down stream from the cable headend, and users can send up to 10 Mbps per channel upstream. This upstream and downstream bandwidth must, however, be shared by all active users connected to a network segment called a "node." The level of usage at a node at any point in time can have a significant effect on the performance that individual users experience, as downstream speeds can drop from 1.5 Kbps to 500 Kbps or less as the number of simultaneous users increases. Upstream capacity is even more limited,

as cable operators typically do not allocate as many channels for upstream use as they do for downstream use. In fact, some cable providers limit users to upstream speeds of 128 Kbps.

If congestion occurs because of high usage, cable operators can add additional channels or run fiber-optic lines deeper into neighborhoods, reducing the number of users per node. Years ago, cable systems often served up to 2,000 – 5,000 homes per node. That number has decreased significantly, with new systems generally designed to serve 125-150 homes per node. However, systems like Comcast in Southern Maryland still have relatively large nodes with around 500 customers per node.

Currently, cable modem service is not a viable option for many, if not most, businesses. For one thing, cable service is not generally available in commercial areas. This is in large part a historical phenomenon – cable operators typically did not build their systems out to commercial areas because few, if any, businesses subscribed to cable television service. Most cable companies would now be willing to extend their systems to commercial establishments if they could solve an even more significant problem – cable systems do not currently have the bandwidth or the expertise to support widespread business usage of their systems. For example, businesses typically cannot obtain web hosting services from cable companies. This may change over time, but it is not likely to change in the near future. We described this issue in more detail in Section 1.

Cable systems are capable of delivering significant amounts of bandwidth to customers. However, what we see in the marketplace is that cable providers seem to have the goal of just staying ahead of DSL in capability. Most cable providers are very leery about dedicating too many channels for data service unless they have to – they would rather keep the channels for TV programming. Cable providers are wresting today with the desire to carry High Definition TV channels (HDTV) since these channels require much more bandwidth than traditional channels.

The cable TV providers have all banded together nationwide and created a firm that they all use to do research and product development – called Cable Labs. Cable labs develops the specifications for cable modems and all of the cable providers have agreed to only use products that are Cable Labs compliant. Through this process the cable providers have been able to really get low prices for such things as cable modems and settop boxes.

Cable providers are not going to introduce products to their network that do not use Cable Labs standards and approved equipment. Thus, if some cable provider wanted to offer a 50 Mbps cable modem product they would be unable to find equipment. The industry sticks together and they will advance as a group.

With that said, competition will drive Cable Labs and the providers to develop faster cable modem products. For example, Verizon is currently offering a 15 Mbps product on its FIOS Fiber-to-the-Home network for residential customers. Comcast has announced that it is going to also offer a 15 MBPS cable modem (but only in those areas that are competing with Verizon's FIOS service. In general, cable companies could offer larger amounts of bandwidth, but economics, tight bandwidth for HDTV and a commitment to Cable Labs

means we won't see great breakthroughs in cable modem speeds unless the market demands it (and Cable Labs provides it).

3. Wireless Broadband

Wireless broadband holds a lot of promise as a technology that can bring broadband services to rural areas like Southern Maryland. The FCC has allocated a number of licensed and unlicensed spectrums that can be used to deliver wireless service to customers. The wireless technologies will be discussed in more detail in Section III,

In the unlicensed spectrum arena, meaning that anybody is free to use the spectrum, there are two major bandwidths that are being used for customer broadband. The first is 802.11 spectrum, generally referred to as Wi-Fi that uses the 2.4 GHz and 5 GHz spectrums.

There are a number of problems with deploying Wi-Fi broadband to large numbers of customers. First, Wi-Fi requires a line-of-sight delivery if it will be used to deliver significant bandwidth. This means that customers who are surrounded by trees of who live in valleys may be hard to reach with wireless signal. Wireless delivery also suffers from what is called rain fade, meaning that the signal gets degraded during bad weather or high humidity. Probably the most significant long term problem with Wi-Fi is that it uses an unlicensed spectrum. Since anybody can deploy devices using this spectrum, all experts agree that the free spectrum will get extremely busy and may eventually become nearly unusable for high-speed data. This problem has been seen before. All early cordless phones used a free spectrum at 900 MHz. I am sure that every user of a cordless phone remembers that this spectrum eventually became so polluted that it became nearly impossible to make a call on a cordless phone without getting cross-talk or major interference. I can also remember stories of people with 900 MHz garage door openers that would open when people talked on their phones. Any free spectrum will eventually get saturated and the problems due to saturation will increase over time. One would think that unlicensed spectrum will be used less heavily in rural areas than in urban areas, so the spectrum may last for more years in the rural areas.

Another problem with any wireless technology that delivers point-to-point broadband is that there are only a limited number of customers who can be served from one given antenna site. The Federal Communications Division (FCC) is the entity that defines spectrum in the US. The FCC has had a long term polity of trying to make the available bandwidth in the country stretch as far as possible to meet the demands of a diverse set of wireless users. This policy has led the FCC to divvy bandwidth up in the US over relatively narrow channels. For example, in most of the spectrum used to deliver broadband the channel size is 6 MHz. This means that a transmitter at one location can only allocate up to 6 MHz of bandwidth for all users that can be reached from that site. Our US channel sizes are much smaller than the channels being allocated today in laces like Korea and Japan. This means a wireless product in Japan will accommodate more customers with more bandwidth than will the same service in the US.

With all of those problems listed, wireless is still the one best solution today to bring broadband to unserved areas. The problem with serving rural areas is referred to in the

industry as the last mile problem. The last mile refers to getting a signal from some central location to customers over the last few miles of terrain. In rural areas today the only existing network is generally the telephone system, and occasionally the cable network. However, when customers live outside the DSL service circle and streets aren't wired for cable service there is no real broadband alternative. Wireless technology can leap over this last mile and bring broadband where none is otherwise available.

The other wireless option is to use licensed spectrum. The FCC has been auctioning spectrum to service providers over the last decade. A winner of a spectrum auction wins the right to be the sole user of the given spectrum within a given geographic footprint. There have been a number of wireless spectrums auctioned that could be used to deliver wireless broadband – LMDS, MMDS and PCS – and these are described in more detail in Section III. However, there have been problems that have hindered the practical use of these spectrums in the US. First, many of the companies that own the spectrum went bust during the telecom meltdown. A bigger issue is the availability of affordable and reliable equipment for these spectrums. After each of the spectrum auctions there were a number of license holders who wished to deploy wireless broadband. However, at the time the technology was not up to speed and the early companies that tried the technology available at the time all failed, often to technological problems with the equipment. This scared off other companies from trying wireless broadband and the industry ended up in a catch-22 situation. Spectrum owners couldn't buy equipment because no good reliable equipment was available, and no manufacturers were willing to devote research and development on equipment unless they had license holders willing to commit to buying equipment. This paralyzed the industry and there are very few deployments of broadband in these spectrums today, many years after the spectrum was first auctioned.

4. Satellite Broadband

In 2000, two companies – Direct TV and EchoStar's DISH Network – began to offer high-speed Internet access through satellites. An examination of the available satellite services available today suggests that satellite broadband is not a viable option for businesses and is unlikely to succeed for residential users except where there are no other choices available.

Direct TV, a division of Hughes, had an offering called Direct TV-DSL. However, after a few years of selling this service Hughes pulled out of the business abruptly, stranding several hundred thousand customers nationwide. The problem that Hughes saw was that they could never offer decent upload speeds and they required customers to have a dial-up connection for uploading. Hughes also looked at the financial situation and figured they would never be profitable for the product line.

DISH TV, whose broadband product is referred to as Starband, is aimed today mainly at rural residential markets. Starband has a business offering, but it I weak compared to other alternatives.

The trade association for the satellite industry recently filed a paper with the National Telecommunications and Information Administration claiming that new and better satellite

broadband technologies are in store in the future. The main thrust of its paper, however, is that the federal government should bestow various benefits on the satellite industry because these technologies will be very expensive at the user level.

In short, we are not optimistic about the satellite industry's ability in the near term to offer an attractive alternative to other broadband services, where they are available. Under any circumstances, we question the value of satellite broadband services for businesses.

There are newer satellite technologies now hitting the market. One equipment provider, in particular – iDirect – offers pure native Ethernet over satellite. However, iDirect only sells equipment and each user of their service must find their own solution for getting hooked up with a satellite provider. This means that only government agencies and large corporations are really using satellite data in its newest and better forms.

Satellite data will never be cost competitive with terrestrial data sources, except for those customers that have no alternatives. We have heard reports of satellite T1s available for around $900 per month. However, it is not easy for the normal business to actually get connected at this price – there is no resale industry pushing these products to customers and customers have to do a tremendous amount of work to get a satellite connection at a decent price.

5. Fiber to the Home/Business

An interesting new technology is fiber to the home/business (FTTH/B), which can be used to deliver voice, data and video services. As with an HFC buildout, a provider must completely overbuild the area to be served. Unlike an HFC system, however, an FTTH/B system is essentially future-proof, as there is no practical upper limit on the amount of bandwidth that it can deliver to each customer. Since there is little risk of obsolescence, financial analyses can use longer pay-back periods to calculate the viability of these projects.

There are several vendors now building CPE for fiber to the home, the leading ones being World Wide Packets, Optical Solutions, Wave 7 and Alcatel. This business is capital intensive, but the costs are dropping rapidly. There are a handful of communities who have deployed FTTH to every home and business - Grant County, Washington; Bristol, Virginia; Kutztown, Pennsylvania, Dalton, Georgia and Jackson, Tennessee. Interest in FTTH/B appears to be especially great abroad.

Of most importance to Southern Maryland is the fact that Verizon is now deploying FTTH technology. Press reports differ in quantities, but Verizon is reporting that it will have built FTTH to pass somewhere between 2 million and 3 million households by the end of 2005.

Verizon markets its FTTH product under the brand name FIOS. Verizon is taking full advantage of the technology and is supplying some of the highest speed and most affordable bandwidth in the nation over the FIOS systems. Verizon's current FIOS data products and prices are:

Up to 5 Mbps Download / 2 Mbps Upload	$ 39.95
Up to 15 Mbps Download / 2 Mbps Upload	$ 49.95
Up to 30 Mbps Download / 5 Mbps Upload	$199.95

Installation - Free

Verizon is building FIOS in some communities nearby to Southern Maryland. For example, they are building some portions of Anne Arundel County near Annapolis, some parts of Howard County. They have deployments in several communities in Northern Virginia. From what we can see, Verizon seems to be building FIOS first to communities that are the fastest growing, densely populated and wealthiest neighborhoods. Verizon does not announce where it is building FIOS until near to the construction dates, so we don't know where they might be going next.

6. Broadband Over PCS (3G)

The mobile wireless providers like Verizon Wireless, Sprint and Cingular have been advertising "broadband" access through cell phones. For example, if one looks at the Verizon Wireless website one will see promises of up to 700 kbps available to cell phones and laptop computers across a wide footprint.

The technology used to provide Ethernet over wireless is referred to as 3G (third generation) equipment. Verizon Wireless was the first company to provide this product and they deployed in the DC metropolitan area and San Diego in 2000.

The technological challenge for 3G is that any bandwidth used for data traffic reduces the amount of bandwidth available for cellular voice calls. Thus, if many wireless subscribers are trying to use a specific cell tower, the voice traffic suffers. The only solution to this problem is to move towers closer together so that there are enough towers for both voice and data.

This phenomenon means that 3G can only practically deliver significant bandwidth in downtown areas where antennas are close together. Today you can spot cellular antennas on almost any tall building downtown. In areas where there are not a lot of towers, which is the vast majority of the cellular footprint, the wireless providers choke down the 3G bandwidth available to customers. Thus, while downtown sites may get 200 kbps to 400 kbps, suburban sites rarely get more than 100 kbps. Rural sites in the wireless network often gets speeds even slower than dial-up.

We would be surprised if anywhere other than Waldorf would have any 3G speeds greater than 100 kbps. Since the cell sites in these counties are widely separated, 3G speeds in the county will be slow, by definition. It is very unlikely that cell sites in the counties will be moved significantly closer (which would require hundreds if not a thousand new cellular towers), and so 3G is unlikely to ever provide a significant amount of bandwidth in these counties.

Finally, 3G has been designed as a tool for mobile business people, like salespeople. The service is not cheap. Until recently the month cost has been around $80 per month but is trending now closer to $60 per month. This is quite costly for dialup internet access and will only remain attractive to people who work in the field and not to homes and businesses.

C. The Existing Broadband Providers in Southern Maryland

Verizon

Verizon is, and will continue to be for the foreseeable future, the dominant provider of telecommunications services in Southern Maryland. Verizon Communications, Inc. (NYSE:VZ) is one of the world's largest providers of communications services. Verizon companies are the largest providers of wireline and wireless communications in the United States, with 136.6 million access line equivalents and 33.3 million Verizon Wireless customers. Verizon is the third-largest long-distance carrier for U.S. consumers, with 13.2 million long-distance lines, and the company is also the largest directory publisher in the world, as measured by directory titles and circulation. With approximately $67 billion in annual revenues and 227,000 employees, Verizon's global presence extends to the Americas, Europe, Asia and the Pacific. For more information on Verizon see www.verizon.com.

Verizon is the current incumbent telephone provider for the entire Metropolitan Washington region. Verizon serves all of Washington, D.C., practically all of Maryland, and most of the densely populated areas of Virginia. The company has undergone a number of dramatic changes in the last 25 years. Before 1984, it was part of AT&T and was known locally as the Bell Atlantic Telephone Company. In 1984, as part of the divestiture of AT&T, Bell Atlantic was spun off as a stand-alone company. In 1997, Bell Atlantic merged with NYNEX (originally New York New England Telephone), and the surviving company continued with the Bell Atlantic name. In 1999, Bell Atlantic merged with GTE, the largest non-RBOC telephone company. Subsequently, the merged firm changed is name to Verizon.

As the incumbent provider, Verizon is treated as the “provider of last resort.” This means that Verizon is required to serve all residential and business customers for basic local services, and it must provide facilities to all customers. The rules that govern the way that Verizon serves customers in Southern Maryland are embodied in their “General Customer Services Tariff “ that is approved by the Maryland Public Service Commission. This tariff contains all of the products and prices, along with the terms and conditions under which Verizon will sell them to customers. The tariff sets forth rules for such customer service procedures as the manner and amount of customer deposits, the rules by which Verizon will disconnect service for nonpayment, and the rules by which they will reconnect service. This tariff can be found online at:

http://www.bellatlantic.com/tariffs_info/intra/efftar/md/html/alpha.htm/

Verizon sells data products using two different companies. The local telephone company sells the physical line that goes to customers. This is generally referred to as the loop. The

local telephone company also sells larger data circuits like T1s. However, a T1 bought from the telephone company does not include Internet access. Customers can use T1s to connect different locations within their company (point-to-point circuits). To connect to the Internet through Verizon a customer must by service from Verizon Online. Thus, a data T1 from Verizon includes a local loop from the telephone company and Internet access from Verizon Online.

Comcast

Comcast is the largest cable TV provider in the US with 21.5 million cable customers and 7 Million high-speed Internet customers at the end of 2004. Comcast's primary business, generating 95% of its revenues, is the development, management and operation of broadband cable networks. Comcast is introducing telephone products and says that all metropolitan systems will have a competitive telephone product by the end of 2006. We don't know if Southern Maryland is included in this rollout.

Comcast also owns programming and they have investments in E! Entertainment Network, the Style Channel, the Golf Channel, Outdoor Life Network, G4, International Channel Networks, TV One and regional sports networks like Comcast SportsNet in the DC area.

Comcast has revenues of $20.3 Billion in 2004. They have cash reserves of about $2 Billion. Comcast is heavily leveraged and has about $35 Billion in debt that comes from paying for acquisitions and for upgrades to its systems over the last five years. The latest Comcast annual statement can be found at: http://ccbn.mobular.net/ccbn/7/981/1039/

Comcast has grown large by acquisitions. The last big acquisition was adding AT&T cable properties (formerly TCI) in 2002. Comcast is currently attempting to buy the cable customers of Adelphia. However, there is a federal cap imposed by the FCC that limits any cable provider from having more than 30% of the total US market. Comcast is just below that cap and it is proposing to sell other properties in order to complete the Adelphia merger.

Comcast has been very aggressive in rolling out high-speed Internet. Since the company is forbidden to grow any more by acquisition it must its efforts on increasing revenues per customer. Comcast revenues grew over 10% from 2003 to 2004 with virtually the same number of cable customers, so Comcast is achieving more revenue by selling products like telephone and cable modems (and from increasing cable rates).

GMP

GMP Communications offers cable and Internet service in towns in Maryland, Virginia and Pennsylvania. Harron Entertainment Company acquired GMP in late 2004. GMP claims the acquisition is really a "change of control" brought on by new investors rather than an actual change in company ownership.

The entire GMP system in Southern Maryland recently underwent a major upgrade. The rebuild is now complete. GMP completed the rebuild in two years in what was originally

estimated to take four years. Southern St. Mary's County was the last part of the network to be completed. As part of the upgrade GMP added Comedy Central, C-Span2, TV Land, EWTN, Animal Planet, Women's Entertainment, E! Entertainment, Travel Channel, Court TV, G4Tech TV, Bloomberg TV Fox Movie Channel, Univision, Sci-Fi Channel, Outdoor Channel, and National Geographic. They will also be adding VoIP and video on demand in the near future.

Of more importance is the fact that the upgrade allowed GMP to increase bandwidth and increase stability of the Internet product. GMP admits that the old network had massive reliability problems and customers experienced frequent outages. GMP has increased speeds to 1.5 Mbps and is now rolling out a 3 Mbps product. The old GMP Internet utilized relatively old technology that was leftover from GMP's initial data deployment. GMP was one of the first cable companies nationwide to deploy high-speed Internet, but like many early adapters the technology used quickly became obsolete.

GMP reports that the network is now stable and is working great. GMP believes that network reliability problems are a thing of the past.

Southern Maryland Wireless

Spectrum Sciences Internet, Inc. ("Spectrum Sciences") was founded as an ISP in 1996. They offer broadband fixed wireless service under the name "Southern Maryland Wireless" which covers the middle St. Mary's and lower Calvert County. See the link below for a map that details the coverage:

http://www.somdwireless.com/coverage.htm

Spectrum Sciences originally focused on serving businesses until residential customers began to inquire about the service. The makeup of the current customer base includes 80% business, 20% residential and includes several hundred customers today. Temporary service to visiting boaters has also become a popular service.

Qwest ran fiber into Spectrum Sciences location in California. The Qwest fiber provides a direct link to Qwest's POP in DC (essentially establishing a Qwest POP in California).

The company got started in the wireless business when they replaced a Verizon T1 private line with a wireless T1 private line to a business ¼ miles away. Spectrum Sciences also provides Internet locally via traditional "wired" point-to-point T1's and Frame Relay through Verizon.

Southern Maryland Wireless has presence on a number of towers including: Lexington Park, Solomons, Leonardtown, and at the intersection of Chancellor's Run Road and Route 235. The wireless customers are served via 802.11b. Backhaul is routed via the 2.4 Ghz band. They plan to soon expand service offering through the use of 802.16 Wi-Max, given the technologies greater range.

III. Technical Issues

In this section we will examine the technical issues surrounding broadband. The questions we will explore are: How much bandwidth is enough? What constitutes good broadband today and in the future? In this section we will review the various broadband technologies deployed in the Counties today and we will also look at what these technologies may be capable of in the future.

A. How Much Broadband is Enough?

How much bandwidth does America realistically need to satisfy current and predictable future needs? We will look at current bandwidth products available in Southern Maryland today in more detail below, but today's broadband products for the residential marketplace generally deliver speeds of 1 – 3 Mbps. Of course as we saw earlier in this study, many households in these counties only have access to dial-up which can achieve 56 Kbps at best (and far less in many cases).

It is also important when looking at bandwidth to consider upload and download speeds. Today's broadband products generally have far greater download speeds than upload speeds. As an example, while a cable modem may deliver 2-3 Mbps download speeds it is probably limited to 364k upload. Businesses desire much greater upload speeds than most of today's broadband products can deliver. As residential customers regularly begin using broadband to both send and receive files, they will also demand much faster upload speeds. Where the residential broadband products of today are most inadequate is when they are used for working at home.

While many households are satisfied with today's download speeds, we are beginning to see sophisticated users demand more bandwidth. In the near future experts all agree that households are going to demand far faster speeds than are currently being delivered. We have already seen the rapid evolution from early dial-up access to 56 Kbps dial-up to cable modems and DSL. There is no reason to believe that we have reached the end game in terms of the need for faster broadband. Consumers are finding more and more uses for broadband. Users are routinely swapping pictures, video files, and other large files. Gamers are using the Internet for live play across the street and around the world. We are on the cusp of having the Internet becoming the prime mechanism for delivering videos to households. For example, it was recently announced that TIVO is negotiating with Yahoo and Google to bring TV to the Internet. Streaming video is expected to become the prime deliver method for getting movies to the house and TIVO and NetFlix recently announced a deal to deliver movies via the Internet rather than through the mail with DVDs. Of even more interest is where technology is going. Several manufacturers are working on 3-D video technology that will enhance the gaming and movie experience (and require gigantic data files).

In its most recent report to Congress on the status of deployment of advanced telecommunications networks, the FCC stated:

> Providers assert that within the next several years, consumers can expect connections providing symmetrical service at 10 to 20 Mbps. Within five to ten years, these connection speeds should increase to 100 Mbps, and some providers predict that premium services may provide consumers with 1 gigabit per second (Gbps) access within a decade. Even higher-speed connections may be deployed to businesses, with some providers predicting the availability of 10 Gbps business services.

Other industry experts have also predicted that, within the next few years, homes will need vastly more bandwidth capacity than is currently available. For example, a recent study by Jupiter Research concluded that, by 2009, average households will need 57-72 Mb/s of bandwidth and that "tech savvy" households will consume nearly 100 Mb/s. A significant amount of this bandwidth will support in-home wireless applications, as well as high definition television and other bandwidth-rich applications.

Similarly, another recent study by Technology Futures, Inc., which was funded and supported by the RBOCs, concluded that:

> In the 2006 timeframe, a shift to much higher data rates in the range of 24 Mb/s to 100 Mb/s is likely to begin. So far, only a few places have access at these rates, notably Japan. Leading broadband countries are a full generation ahead of North America. Japan and Korea are already rolling out the subsequent generation of services operating at 20 Mb/s and above, and have plans to complete the transition by 2010."

B. Why Broadband is Important

We could write an entire paper describing why broadband is important to Southern Maryland. There are many clear advantages of having broadband everywhere. Some of the most important advantages of broadband:

- We are now competing in a worldwide economy. It is important for businesses in the US to have broadband to compete with businesses around the world. See the next section below to see how poorly the U.S. is faring in broadband connectivity.

- The average business now requires broadband just to function normally. I will use our own firm, CCG Consulting as an example. As a consulting firm we conduct a lot of research and we buy and subscribe to a number of basic research tools and databases. For many years these tools and databases were

delivered to us on CDs and we had a big library of diskettes we used for basic research. In the last few years every one of our vendors has changed delivery to be on-line and none of them even offer CDs as an alternative any longer. If we could not get on line our business would be crippled severely. This same sort of shift is happening everywhere. Many vendors now expect customers to reach them online. Businesses also rely more and more on email that often includes large attachments. For most businesses broadband is now a necessity and not an option.

- Lack of broadband in Southern Maryland will stop businesses from locating there. We know that one of the biggest economic pushes for the Counties is to grow jobs at home so that workers don't have to commute to the DC metro for work. Companies now put broadband high on their list when looking at relocating. Lack of broadband, or expensive broadband is a major drawback for the Counties.

- Companies without broadband may even decide to move elsewhere. As hard as it is to attract new businesses to an area, it is even more important to keep existing ones. The economic development folks in these counties tell us that businesses have been lost over the broadband issue.

- Most new jobs are now created by small businesses, and a large number of small businesses now start in the home. There is a significant number of households in the County without broadband, and residences of these neighborhoods are hampered from starting their own business. As bad as it is to not have broadband, many residences complain that dial-up speeds are far slower than 56 Kbps due to copper wiring problems.

- Many companies now routinely expect employees to be able to work from home from time to time. Employees are expected to read emails and download files from corporate LANs regardless of where they are at. Lack of broadband at home is a major disadvantage to information age workers.

- Lack of broadband means loss of educational opportunities. Many companies offer training online – and training generally requires broadband. Probably even more important is that kids without broadband are missing out on the information age. During this study there was an article in the Washington Post that told of households that needed to ferry kids to libraries just to get routine homework done. Our kids need broadband if they are to learn how to navigate in the modern world.

C. Broadband Around the World

For the best part of a century the U.S. has been a major technological leader in the world. We have enjoyed a technical advantage in a large number of fields due to our political system, our infrastructure and our educational system.

However, as is witnessed by the large number of jobs being outsourced from the U.S. to the rest of the world, our advantages are disappearing. Broadband is the infrastructure of the 21st century. In the last century one of our major assets as a nation was in interstate highway system. While it seems trite to mention the information highway, broadband really is the new equivalent of the interstates. Nations that have broadband have the economic advantage today.

Over the last four years, the United States has dropped from 4th to 16th place in the world in broadband penetration, as measured by the International Telecommunications Union, and to 12th place among a smaller group of nations ranked by the Organization for Economic Cooperation and Development. If the United States is to regain and retain its competitive position in the world economy, it must develop better ways to keep within haling distance of the world's leading countries in per capita broadband penetration, access to high-bandwidth broadband, and cost per unit of bandwidth. A quick glance at the countries with better broadband than the US tells where our jobs are headed - India, South Korea, China, Singapore, Ireland etc..

In 2002, the United States Department of Commerce published an extensive report on the multiple benefits that ubiquitous access to affordable, high-bandwidth broadband would produce for America.[2] The report noted that "the current generation of broadband technologies (cable and DSL) may prove *woefully insufficient* to carry many of the advanced applications driving future demand. *Today's broadband will be tomorrow's traffic jam, and the need for speed will persist as new applications and services gobble up existing bandwidth*."[3] The report then went on to encourage governments at all levels to act aggressively to stimulate broadband demand.

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2 U.S. Dep't of Commerce, *Understanding Broadband Demand: A Review of Critical Issues* (September 23, 2002), http://www.technology.gov/reports/TechPolicy/Broadband_020921.pdf.

3 *Id*. at 6 (emphasis added).

D. Broadband Technologies in Use Today

1. Fiber Technologies

The Technology. Fiber optic communications is different from any other data transmission method, in that it does not use electricity through a conductor to transmit information. Instead of electrical signals, modulated light is used to transmit data over long distances through an insulated glass fiber. Fiber optics is currently the most efficient long distance communications method because it provides much faster data transfer speeds when compared to traditional interconnection media such as copper wire. Fiber is clearly the best technology available today for transmitting data.

Following is a description of the fiber optic products that are available today:

SONET Point-to-Point and Ring Fiber. The traditional use for fiber has been in point-to-point applications using the SONET (Synchronous Optical Network) technology. Since fiber can be built in long runs and since the signal can be sent for a long distance without a repeater, fiber has become the preferred technology for sending signals for long distances. Sprint was the first company to complete a coast-to-coast fiber network, but today almost all telephone and cable TV long haul is done using fiber.

Ethernet Point-to-Point and Ring Fiber. Newer fiber electronics is based upon delivering native Ethernet. In this system bandwidth is not delivered in multiples of a T1 as listed above. Rather the entire fiber is one continuous data stream. With Ethernet technology there is more intelligence built into data routing. With SONET technology each piece of data is assigned to a specific T1 equivalent time slot. However, with Ethernet each piece of data has routing information built into the packet and thus all bits of data can use any part of the data pipe. Ethernet routing is what allows the Internet to work – packets of data contain the needed routing information regardless of what network they are carried on.

Ethernet routing is far more efficient and lower in cost than SONET based routing. With SONET, a T1 channel is dedicated to each transmission path, even if there is nothing being used on a given T1 at a given moment. With Ethernet all data bits are free to grab the first available space, and thus an Ethernet pipe can carry much more data than a T1-based path.

Another advantage of Ethernet systems over SONET is the relatively cheapness of the electronics needed to interpret the signals. SONET equipment must be able to segregate signals into the equivalent T1s while Ethernet equipment needs merely understand and route the data. Ethernet routing has greatly reduced the cost of fiber optics terminal equipment and Ethernet routing is quickly becoming the standard form of data transmission.

Fiber-to-the-Home (FTTH).

We are now seeing commercial deployments of Fiber-to-the-Home (FTTH) technology. This technology deploys relatively cheap lasers that allow the deliver of significant bandwidth to multiple locations.

Verizon is deploying FTTH technology under the brand name of FIOS. Verizon is aggressively deploying the technology. In 2005 they are deploying at least ten "test" communities around the country with FTTH. Press releases from Verizon are making many differing claims, but it seems that by the end of next year they plan on deploying fiber to pass somewhere between 2 million and 3 million homes.

There are a number of different brands of FTTH equipment and several different protocols being used to deliver FTTH. Early FTTH systems have used BPON (Broadband Passive Optical Network) technology. This technology uses a form of signaling called ATM, which is based upon the T1 architecture mentioned above. With a BPON system there are separate parts of the customer bandwidth assigned for voice, Cable TV and data.

BPON is being supplanted by EPON (Ethernet Passive Optical Network) and GPON (Gigabit Passive Optical Network) technologies. These technologies use native Ethernet for the customer delivery path, meaning that the bandwidth to the customer can be used more efficiently. Again, when we try to compare an ATM system to an Ethernet system it becomes difficult to compare the amount of bandwidth on the system. If a BPON and an EPON system were to carry the same amount of total bandwidth, the EPON system would actually deliver much more practical bandwidth. At full capacity the EPON system could use every available bit of capacity while the BPON system would devote a lot of transmission time to sending empty data paths.

FTTH systems can also gain some efficiency because of the use of the PON architecture. With a PON layout, one transmitting laser at the headend can talk to as many as 32 customer lasers. Again, since lasers are the most expensive components of a fiber system, this efficiency holds down the cost of FTTH.

Some brands of FTTH use Active Optical Component (AON) as opposed to passive optical components in the fiber distribution facilities. AONs use powered components to light and distribute the fiber and bandwidth to the customer's homes. An AON, as opposed to a PON, uses two distinct lasers to feed each home (one in the electronics and one at the home). With PON one base laser is shared up to 32 homes, thus reducing cost, the number of lasers and powered components in the field.

FTTH can be deployed as a pure digital bandwidth system (an all data system), or it can be deployed as a combination digital bandwidth system and an RF broadcast system. The RF broadcast system component allows the network provider to deliver robust video, exactly like the CATV companies, but completely over fiber. Thus a FTTH network offers a flexible network that can deliver Cable TV for residential

customers and tremendous amounts of data for business customers. FTTH currently outperforms copper and coaxial systems and is expected to do so far into the future.

Bandwidth. The theoretically maximum bandwidth available on fiber is astronomical in the mega terabit range. In practical terms the amount of bandwidth that can be delivered over fiber depends on the lasers being used. Generally the higher the bandwidth the more expensive the laser.

SONET lasers are designed to deliver bandwidth in multiples of a T1. A T1 is a data path of 1.544 Mbps in both directions. Following are the amounts of bandwidth that can be transmitted over a single fiber pair using the proper SONET electronics.

T1	1.544 Mbps		
DS3	45 Mbps	28 T1s	28 T1s
OC3	155 Mbps	3 DS3s	84 T1s
OC12	622 Mbps	4 OC3s	336 T1s
OC48	2,488 Mbps	4 OC12s	1,344 T1s
OC192	9,953 Mbps	4 OC48s	5,376 T1s
DWDM	159,248 Mbps	16 OC192s	86,016 T1s

While no fiber is designed to deliver only a T1 or a DS3, there are standard lasers and electronics available that can deliver the other listed bandwidths today. As the chart shows, one fiber pair using DWDM can deliver the equivalent of 86,016 T1s over one pair of fiber.

There are also several standard Ethernet lasers that can be purchased today:

10-Base T	10 Mbps
100 Base T	100 Mbps
Gig Ethernet	1,000 Mbps
10 GIG	10,000 Mbps

In comparing these bandwidths to SONET bandwidths, once would think that a 10-Base T system would be the equivalent of roughly 6.5 T1s. However, since Ethernet is so much more efficient than SONET, in practical terms a 10-Base T system is equivalent to something closer to 20 T1s.

FTTH technology today can deliver as much as 2 Gbps with generally one Gig reserved for Cable TV and telephone and the other reserved for data. In the future as EPON technology is introduced the entire bandwidth will be available to deliver any service.

2. Copper

The Technology. Verizon historically has deployed copper technology. With copper technology each customer is served either by copper entirely between the customer and the telephone company office, or by some combination of copper and fiber. In all cases the speeds that can be delivered to customers is limited by the copper portion of the network. Except where they are building FIOS (Fiber-to-the-Home) Verizon uses fiber for only the largest business customers. Very few customers in these Counties are served entirely by fiber today.

Verizon has deployed a technology called DSL (Digital Subscriber Line) to achieve greater bandwidth out of copper. DSL works by utilizing a different portion of the copper than is used to make normal telephone calls.

There are a number of different types of DSL in use. These are often referred to as the various "flavors" of DSL. They are typically marketed under the acronyms ADSL, ADSL2+, SDSL, HDSL, VDSL, IDSL and G-Lite. The following is a brief description of each of these types of DSL.

ADSL stands for Asynchronous DSL, which means that the upstream and downstream delivery speeds are not necessarily the same. Most Internet users are more interested in downstream speeds than upload speeds. The ability of a bandwidth provider to offer smaller upstream capabilities allows them to conserve bandwidth and serve more customers on the same Internet backbone. Upstream speed is very important, however, for businesses, telecommuters and others that must send sizable data files, graphics, video clips and other band-rich files.

ADSL2+ is a third generation ADSL that delivers bandwidth up to 24 Mbps out to about 6,000 feet and 10 Mbps out to 10,000 feet. Twinned pairs using two ADSL2+ modems may deliver up to 20 Mbps out to 10,000 feet. This is the new technology expected to be widely used by BellSouth as they roll out cable TV.

SDSL stands for Synchronous DSL and was one of the earliest versions of DSL. SDSL delivers identical upstream and downstream speeds to a customer. SDSL is designed to deliver 2 Mbps bi-directional data speeds out to 12,000 feet.

HDSL stands for High Bit Rate DSL, a version that mimics the delivery of a T1. This is a useful product, in that many customers have hardware, such as Private Branch Exchanges ("PBXs") that have been designed to handle only a T1 level input, being equal to 1.544 Mbps in both the upstream and downstream direction. HDSL allows for the delivery of a T1 to such users over one copper pair rather than with the traditional two copper pairs. Telephone companies routinely deploy HDSL as a functional replacement for

older T1 technology. When a customer buys a T1 from BellSouth they are likely to actually be served with HDSL rather than with traditional T1 technology.

VDSL stands for Video DSL and represents technology that seeks to deliver several channels of video over copper. This version of DSL needs a large downstream bandwidth, as video signals require at least 3 Mbps of throughput for standard TV quality signals and up 118 Mbps for HDTV digital signals. VDSL is a problem in the field in that the bandwidth drops off quickly with distance and most VDSL can only support high bandwidth for around 6,000 feet.

IDSL stands for ISDN DSL and is the one version of DSL that is not limited to the 18,000 feet distance limitation. With IDSL, a provider can deliver a limited bandwidth, capped at 128k in one direction for up to 30,000 feet from the switch. This allows the delivery of speeds higher than dial-up, but much lower than the other types of DSL. Per the FCC, 128k bandwidth is not considered as high-speed.

G-Lite is a variation of DSL that has been designed for residential use. This form of DSL differs from the other types, in that it is designed to layer on top of the current telephone signal on copper. With G-Lite, customers can keep their telephone service on a current copper pair, without change, and the G-Lite operates on the bandwidth in the copper pair that is not used by the voice signal. All other types of DSL use the entire bandwidth on a copper pair and electronically mix the voice and the data together. This is the predominant technology being used to deliver DSL to homes.

Bandwidth. A bare copper wire is limited, without enhancement to delivering 64 Kbps of information for voice. However, when delivering data some of this path must be used for signal overheads, and a bare copper wire is limited to delivering 56 Kbps of data. This is the fastest speed that can be achieved by dial-up Internet service.

In order to achieve higher data speeds over copper BellSouth uses one of two technologies. First, they can deliver a T1 to customers if they use two copper pairs. A T1 is 1.544 Mbps, or 24 times faster than dial-up Internet. A T1 is also a synchronous 2-way data path meaning that it can download and upload data at the same 1.544 Mbps speed. The problem with T1 service is generally an issue of cost. T1s require a fairly expensive piece of equipment at the end to receive the signal. T1s also require two copper pairs (or paying for two lines). T1s can generally be delivered to almost any customer in the Counties. However, a T1 connected to the Internet can cost anywhere from $900 to $1,200 dollars in various parts of the Tri-County.

The second bandwidth product is DSL. Various DSL products offer different bandwidths. Following are some examples of the bandwidth available through each type of DSL:

ADSL	Up to 2 Mbps downstream, small upstream
ADSL2	Up to 12 Mbps downstream, small upstream
Paired ADSL2+	Up to 24 Mbps downstream, small upstream
SDSL	Synchronous 2 Mbps
HDSL	Synchronous 1.544 Mbps (Same as a T1)
VDSL	12 Mbps for 3,000 feet. 6 Mbps to 6,000 feet.
IDSL	Synchronous 128k
G-Lite	2 Mbps downstream, small upstream

Problems and Issues with Copper. There are a number of problems with copper facilities that create problems for customers:

- Some of the copper in the market is old. Older copper develops problems. Water can leak into the sheath. The copper wiring can degrade from age and weather. Generally older copper can't transmit as much data as newer copper.
- Different sizes of copper wires. Many residential neighborhoods were built with relatively thin copper wires. The thinner the wire the less data that can be carried. A DSL signal will travel farther over a 22-gauge copper wire than it will over a 24-guage copper wire (22-gauge being larger).
- Electrical Interference. Copper wire is subject to interference from electrical signals of all sorts, and this interference can cause problems with the signal.
- Repeaters. Copper is only capable of delivering a signal up to a few miles without the need for signal repeaters. Repeaters are electronic devices installed on the telephone lines that repeat and boost the signal. The repeaters generally interfere with DSL signals, and this is one of the factors that limit how far DSL can travel. In order to get DSL to work a technician must climb poles and disconnect the repeaters for a DSL pair – a costly process.
- Inherent DSL distance limitations. DSL signals degrade with distance. Today, from a practical basis, Verizon can't offer DSL for any customer more than 18,000 feet from the DSL transmitter. This distance represents physical feet of copper, not distance as the crow flies. Thus, customers within roughly a 3-mile circle around any Verizon central office might be able to get DSL (depending on the other problems listed). Customers outside of these circles generally cannot get DSL. Another distance-related issue with DSL is that customers close to a BellSouth central office get more bandwidth than a customer who is further away. A customer who lives 1 mile from a central office can get much better DSL bandwidth than a customer living 3 miles away.
- Different download and upload speeds. DSL is almost always configured to have a much higher download sped than an upload speed. Lower upload speeds limit the value of DSL for business customers. Uploading files will become a bottleneck for anybody trying to work at home or in an office with these limitations. The upload speeds are often drastically lower than the download speeds and it is not unusual to see a 2 Mbps download speed paired with a 256 Kbps upload speed (one tenth of the speed of the download).

3. Hybrid Fiber Coaxial Systems (HFC).

The Technology. Comcast and GMP deploy HFC coaxial cable technology in the Tri-County area. HFC networks are bi-directional RF distribution systems capable of transmitting from 550 to 1,000 MHz of bandwidth. This network, deployed by most cable operators and some telephone companies is an evolution of the traditional cable distribution networks, thereby inheriting the term "Hybrid".

HFC networks consist of single mode fiber strands starting at the Cable TV headend, the system that receives and encodes the television signals, to multiple nodes and hubs. Optical-to-electrical conversion is performed at the nodes to place the RF signal onto a coaxial before it reaches the subscribers tap. HFC networks are a shared bandwidth system where the actual physical circuit is common to many customers.

Bandwidth. Coaxial cable systems can deliver much more bandwidth than copper systems. This is mainly due to the much larger size of the wire being used.

The amount of total bandwidth available in any HFC system is dependent upon the electronics of the system. Generally only a discrete amount of bandwidth is carved out of an HFC system for data deliver, with the remaining bandwidth used for cable TV channels. Today cable modem systems typically deliver up to 3 Mbps for data. Some metropolitan systems have been upgraded to deliver as much as 6 Mbps. Cable operators typically do not advertise upload speeds, but in most systems upload speeds are often a tenth of the download speeds.

However, one has to always be cautious when looking at data speeds on HFC systems since data is shared among many households. When the cable company advertises a speed of 3 Mbps, this represents the ***maximum*** speed that a customer can receive. The maximum speed generally can only be obtained at off-peak hours, like the middle of the night. During the day and evening when there are many customers sharing the network the speeds often get much slower. There are many reports nationwide of cable modem systems that slow down to dial-up speeds during peak evening usage.

Problems and Issues with Coaxial Cable. There are a number of problems with HFC systems as follows:

- Age of the wire. Just as with the telephone system, old degraded wiring will degrade the signal.
- Interference. Coaxial systems are extremely susceptible to interference from electrical sources. Interference can be seen on the TV signal as snow or noise. Coaxial connections are susceptible to interference at each place where there is a physical connection. In many houses there are many connections and thus many opportunities for the introduction of noise. A coaxial system with one or more open ports acts as a large antenna that can introduce interference into entire system.

- Shared nature of the System. HFC systems architecture is by nodes, meaning some fixed number of households in a neighborhood share the same local network. This means that that all customers in a node share the bandwidth for the node. Customers also share in noise and interference problems, and a problem with one customer usually affects other customers in the node. Shared bandwidth means that the amount of data available over a cable modem will vary according to how many customers in a node are using the data system. It is not untypical for a cable modem system to bog down at peak hours as many customers are trying to use the shared bandwidth.

4. Unlicensed Wireless (Wi-Fi)

The Technology. Wi-Fi is short for ***wi****reless* ***fi****delity* and is meant to be used generically when referring of any type of 802.11 network**,** whether 802.11b, 802.11a, dual-band, etc. Any products tested and approved as "Wi-Fi Certified" (a registered trademark) by the Wi-Fi Alliance are certified as interoperable with each other, even if they are from different manufacturers. A user with a "Wi-Fi Certified" product can use any brand of access point with any other brand of client hardware that also is certified. Typically, however, any Wi-Fi product using the same radio frequency (for example, 2.4GHz for 802.11b or 11g, 5GHz for 802.11a) will work with any other, even if not "Wi-Fi Certified."

Wi-Fi is sold in the marketplace in several applications. Bluetooth is a Wi-Fi application that is meant for very short connections. Generally Bluetooth is used to connect devices together within a network, within the same building or room. Bluetooth is used for such devices as wireless keyboards and smart appliances. Bluetooth speeds are relatively slow at around 720 Kbps.

More common is wireless networking. With 802.11b Wi-Fi can deliver up to 11 Mbps for distances up to 300 feet. With 802.11g Wi-Fi can deliver up to 54 Mbps up to 150 feet. Both of these applications are used to create wireless LANs inside businesses and residences.

Another use of Wi-Fi is for public hotspots. This is the application being developed in Philadelphia. Wi-Fi can be used to send relatively low bandwidth, under 1 Mbps, and often less, to laptops and handheld devices within a relatively short distance, usually less than half a mile from the transmitter.

The final technology using Wi-Fi is deployment of networks. The Wi-Fi spectrum can be used to connect a central transmitter to multiple locations. There are three general network architectures that can be deployed with Wi-Fi today:

- Point-to-Point Connections. A point-to-point connection can be used to connect only two locations. This is a very expensive way to provide Internet connections and this technology is generally used more as part of a network as an alternative to fiber.

- Point-to-Multipoint systems. This technology allows one transmitter, generally mounted on a tall antenna, to deliver bandwidth to many locations. The limiting factor with point-to-multipoint systems is that the receiver must be within the line of sight of the transmitter. In areas like Southern Maryland this kind of system has problems with trees and foliage.
- Mesh Network. This newest Wi-Fi technology is a point-to-multipoint technology with a twist. Each receiver at a customer location can be used in a mesh network to retransmit data to other customers. This solves the line of sight problem in that a customer does not need to see the base station transmitter as long as they can see one of more other customers on the network. However, mesh networks can't retransmit data forever and in the perfect network no customer would be more than 3 hops away from the base station transmitter.

Bandwidth. The amount of bandwidth that can be delivered using Wi-Fi depends on the specific vendor and depends on the network configuration. One a point-to-point basis (between only two points) Wi-Fi can deliver up to 20 Mbps. In a point-to-multipoint system there is generally a shared 7 MPBS that can be divided up among the customers hanging from a given antenna (or sector of an antenna). Wi-Fi networks are generally shared bandwidth meaning that all of the customers within a given access point share whatever data is available.

In this paper we will be examining in more detail Wi-Fi technology as a possible solution for providing broadband to the unserved customers in the Tri-County area.

5. Licensed Wireless Spectrum

There are three primary spectrums in use to deliver wireless broadband over licensed spectrum - Local Multipoint Distribution Service (LMDS), Multichannel Multipoint Distribution Service (MMDS) and wireless loops using Personal Communications Service (PCS). Each has certain advantages and disadvantages.

LMDS

LMDS is a broadband wireless point-to-multipoint system operating between 27.5 GHz to 31.3 GHz that can be used to provide digital two-way voice, data, Internet, and video services. With current equipment, this is primarily a delivery mechanism for large business customers because of the relatively high price of customer premises equipment (CPE) associated with the bandwidth.

The LMDS spectrum is robust because of the 1150 MHz of bandwidth available with an A license. There is also an LMDS B spectrum license for every US market with 150 MHz of bandwidth. The spectrum is interesting in that it can be used for both a point-to-point delivery signal like traditional microwave systems and can also be used on a point-to-multipoint basis to serve large numbers of customers from one central

transmitter. With the high bandwidth available, a provider can provide a DS3 of data to a customer through the air.

On the negative side there are several transmission characteristics that limit the use of LMDS. The most significant of these is the practical delivery distance of the signal, and the distance decreases with greater bandwidth and also decreases due to humidity and bad weather. In dry parts of the country, such as the desert west, LMDS can deliver bandwidth for 3-4 miles from a central transmitter. In humid, rainy places like Florida, the maximum distance could be as short as 1.5 miles. LMDS also has limitations due to foliage and obstructions, and a clear delivery path must be available for its use.

The FCC auctioned this spectrum more than six years ago, but there are only a handful of systems that are operational today. In classic chicken-egg fashion, the CPE is expensive because there have not been many installations, and there have not been many installations because the CPE is expensive. Small investors own most LMDS licenses and there are no large nationwide providers pushing the development of equipment to utilize this spectrum. Winstar was the major operator in the 39 MHz spectrum, and it is now bankrupt and out of business.

MMDS

Another useful spectrum for data delivery is MMDS. This frequency, from 2.15 GHz to 2.68 GHz, was auctioned years ago and was originally intended for use in delivering wireless Cable TV. This did not materialize because the equipment took many years to be developed, and more importantly because the cable TV industry evolved. MMDS systems can deliver approximately 30 channels of cable TV, which is no longer economically viable for cable TV in most markets.

In 1999 the FCC changed the rules for the spectrum by allowing it to be used for 2-way communications, thus opening it up for data and voice providers. Compared to LMDS, MMDS offers a solution for small and medium customers. With current CPE, it can deliver several megabytes of data along with voice lines on one small antenna. There are a few manufacturers of CPE that can currently deliver a customer antenna for under $1,500. At this price, this is a good solution for small business customers and maybe also for very high-end residential customers.

At one point there were high hopes for this spectrum. Licenses covering about 2/3 of the US population have been purchased by Sprint and MCI, and both companies announced aggressive plans to roll out MMDS beginning in early 2001. Both companies stopped the rollout in 2001 and there has been very little activity since then with this spectrum.

Wireless Using PCS Spectrum

Another wireless data technology is wireless using the PCS spectrum. The PCS spectrum is most normally used for roaming wireless telephone, and the nationwide providers in these spectrums are Sprint Spectrum and AT&T Wireless. However, a few small providers are using this spectrum for the delivery of a wireless local loop to rival landline phones. This is referred to as "fixed wireless," meaning that the receiving sets are fixed in place rather than mobile. The largest provider of fixed wireless loops is Western Wireless. This technology is used much more extensively in the rest of the world, and the largest single use is in Japan and sold under the name Handiphone.

The second use for PCS data is Internet for cell phones and PDAs (handheld computers). A new technology called 3G (for third generation) is increasing the bandwidth available to cell phones through PCS. Data through cell phones is never expected to offer more than a few Mbps, and for most users the routine bandwidth available will be far less than that. However, cell phones should be able to send and receive simple emails, provide basic web browsing and other data related functions.

6. Broadband over Powerline (BPL)

Broadband over Powerline (BPL) technology is a method of transmitting data over electric lines. BPL is currently widely deployed in Europe. However, the electric systems in the U.S. use different protocols and standards that require different equipment than that which is used in Europe.

BPL is being considered as a direct competitor to DSL; however, early versions of BPL are having trouble delivering more than 1 Mbps. Expectations are that BPL will be improved and within a few years be capable of delivering as much as 10 Mbps.

The big promise for BPL is as a tool to deliver bandwidth to those customers without other data alternatives. Cable modems and DSL are primarily deployed in urban and suburban areas and there are many rural areas without any high bandwidth options. BPL has some distance limitations, but it can deliver a data signal much further than DSL. Electric companies, particularly rural electric companies are considering BPL. It will require some reengineering of existing powerlines, but overall BPL systems require modest investments per customer, since the electric companies already own all of the lines and the right-of-ways to customers.

We will discuss BPL in more detail below, in the section containing potential solutions.

7. Satellite Data

There is a general opinion among wireline carriers that satellite broadband as an access technology is inferior to other sources of Ethernet. The perception is that satellite broadband has serious latency problems (time delays) and jitter issues which make it inadequate to support advanced applications, particularly VoIP. There is also a general perception that satellite Ethernet is costly to establish and that it is rarely price competitive with other sources of Ethernet, except in very remote locations.

To some degree these observations still apply to much of the satellite industry. This industry has been historically focused on serving only very large backbone transport for carriers in very remote locations or the video broadcast industry where more than of 70% of their revenue is still derived and an annual basis. The major vendors of satellite data have been very slow to react to the general explosion of Ethernet in the world and they have not seized upon more mainstream opportunities in the landline world. To some degree we can compare the large satellite data providers to the large telephone companies – they are large incumbents who are satisfied with their market niche and not particularly open to change. Their behavior is geared towards selling wholesale transponder space as opposed to delivering value-added network services.

The satellite industry has historically been controlled by a handful of very large providers who both own and operate satellites or who have contracted for much of the usage on satellites. Companies like Hughes and Spacenet have created very stable businesses by selling large data pipes to remote locations. The customers for such data tend to be governments and large businesses that have large data needs in remote locations. These data connections have always been expensive compared to normal terrestrial data prices, but the remoteness of the sites has given the satellite providers a virtual monopoly of service. The hardware for satellite data delivery has historically been very expensive and most satellite data users typically purchased large amounts of bandwidth at a given site.

Residential and Small Business Data over Satellite

In recent years a number of companies have started selling satellite data to the residential market. These connections generally offer less speed at a greater price than cable modem and DSL connections. However, the fact that satellite data is available almost everywhere means that remote customers often find satellite as their only alternative.

The standard and technology used today for residential data delivery from satellites is DVB (Digital Video Broadcast). DVB was designed to deliver one-way downstream MPEG video signal and the application of this standard to data has been an afterthought. However, DVB is the standard of choice in the marketplace for data delivery since it is a simple standard that can be supported with low cost and easily available chip sets.

A new standard has also been developed for upstream satellite data – DVB-RCS (Return Channel via Satellite). This standard allows for two-way data services. Early satellite data products required a dial-up connection for outbound data, which basically defeated the whole purpose of having a high-speed connection.

Problems with Satellite Data

Satellite systems have some inherent issues that make it hard to design competitive data products. Some of these problems include:

- *Propagation delay*. Satellites have an inherent 280 msec propagation delay due to the location of geo stationary orbit of satellites.
- *Jitter*. Jitter quantifies the effect of network delay of packets arriving at the receiver in any Ethernet system. Jitter is calculated by measuring the inter-arrival time of successive packets. Advanced data services need low jitter.
- *Packet loss*. Packet loss causes degradation of any real time service. Packet loss is measured using BER (Bit Error Rate) – and advanced services needs a low BER.
- *QOS and traffic prioritization*. Packet switched networks are subject to congestion since data traffic is typically "bursty". Congested networks wreak havoc for real-time services.
- *Compression techniques and standards*. The standard encoding scheme used with most satellite data uses very inefficient overheads and headers and wastes valuable data space.

At least one company so far has come up with a solution to all of the problems caused with data delivery using satellite. iDirect Technologies of Reston, Virginia has developed hardware and software that allows for the delivery of traditional Ethernet over satellite. In many cases iDirect equipped satellite data can rival the performance of terrestrial data. For example, iDirect is widely deployed today in Iraq where nearly every military installation is utilizing this hardware to connect to the Internet and to VoIP.

However, the biggest issue with satellite data is always going to be cost. Today an Internet T1 over satellite costs at least $900 per month and that price is not likely to drop in the near future. Satellite is becoming a viable competitor in rural locations, but it is never likely to compete directly with any urban or suburban network. At this point there are no major companies out promoting satellite data and in addition, it is very hard for the average customer to implement a satellite solution.

E. The Future Technologies

What is the likely migration for each of the existing technologies in the future? Also, are there any new technologies on the horizon that might bring broadband affordably to consumers?

Future of DSL

DSL speeds are expected to increase over time with new innovations. In the labs there have been DSL technologies tested with speeds up to 50 Mbps. However, the high bandwidth DSL variants tend to have characteristics that drastically shorten the bandwidth with distance. Distances for very-high-speed DSL is 1,000 feet or less and is expected to be useful in conjunction with Fiber-To-The-Curb (FTTC) deployments. A FTTC system would still require fiber traversing every street, but would replace fiber drops with copper drops and DSL. FTTH costs more than a FTTC system today, but can deliver tremendously more bandwidth.

Realistically, in the next ten years we might see some commercial DSL circuits capable of delivering as much as 20 Mbps. With the concept of delivering paired DSL circuits using two lines, the future DSL might be cable of delivering as much as 40 Mbps out to about 6,000 to 8,000 feet,

Development labs are working toward DSL that might be able to generate as much as 100 Mbps. However, in real life all of the problems with copper would drastically lower the bandwidth that can be delivered. However, one would think that in looking out over a 30-year window that DSL with speeds of 50 Mbps might be possible. Thus, 25 years from now DSL might grow to deliver 1/10 as much bandwidth as FTTH can deliver today.

Future of Cable Modems

Cable operators always need to balance the need for TV channels with the demand for data speeds. Today most cable providers are much more concerned about how to fit HDTV (High Definition TV) onto their system than they are about increasing cable modem speeds. The industry expectation is that cable providers will use any future increases in overall system bandwidth, or from increased CATV compression improvements to offer more channels rather than drastically increase data speeds.

As an industry we expect cable providers to deliver just enough data to stay ahead of the telephone companies and DSL, their predominant competitor. Thus, today, cable modems can deliver speeds a slightly faster than DSL (at least theoretically when the system isn't busy).

There are already cable modems tested in the lab that can deliver as much as 50 Mbps. However, cable providers are going to stick to products that can be mass-produced and sold in the mass market. Today cable modems are inexpensive since so

many are produced. Cable providers are always going to be leery about increasing speeds since this will require all new hardware. Cable providers also will want to support only a few different modems in a given system, and the reluctance to swap modems will hold down innovation. Cable providers will upgrade modems only when competition forces them to do so.

Thus, the long term expectations for cable systems is that they will always offer products that are a little better than DSL, but not drastically better. The merger mania in both the telecom field and the cable TV field means that future competition is going to be mostly between a few big cable providers and a few big telephone companies. Cable companies have an inherent advantage in the battle since they already have full deployment of CATV programming and an advantage with cable modems compared to DSL.

Wi-Max Wireless.

The next generation of unlicensed spectrum technology is referred to as Wi-Max. Originally promised for 2005, it now looks like true first generation units will hit the streets closer to 2006. One would not expect a mature product until 2008, at the earliest.

The first generation of Wi-Max is being touted as having as much as 70 Mbps of shared bandwidth available to users. However, realistically we don't expect to see systems delivering that much bandwidth to customers for quite some time. Wi-Max has some of the same limitations as a cable modem system. The users on any Wi-Max antenna are sharing the bandwidth. The biggest challenge that a Wi-Max provider will have is getting the bandwidth to the transmitter. A fiber network is needed behind a Wi-Max system to feed the needed bandwidth to each antenna. A Wi-Max antenna needs as much as two DS3s of base broadband in order to serve customers. In most markets, getting that much bandwidth delivered to multiple antennas is going to be very challenging, and costly. In most markets the only provider of this much bandwidth is the telephone company, and telephone company bandwidth is still very expensive. Additionally, the telephone companies are generally not equipped to deliver native Ethernet.

In real life the marketplace expects that Wi-Max systems will be designed to act like super DSL lines. They may deliver customer speeds a few Mbps faster than DSL, but not drastically more and will still have distance limitations of delivering the high speeds required to support video or other bandwidth intensive services more than one or two miles.

Wi-Max systems will suffer from the same problems that plague Wi-Fi systems. To some degree Wi-Max will require line of sight, meaning that hills, trees and neighboring buildings will be a problem. Wi-Max will also suffer fade during rainstorms. Access to spectrum will remain an issue for a point to multi-point Wi-Max system. There is a limited amount of spectrum available and the most easily

accessible spectrum is free and shared by anyone who wants to use it. Many markets will have tremendous interference in the free spectrum space. As with all wireless solutions, the industry expects to see the distances between the antenna sites and the customers reduced before it becomes a mass market solution. (But shorter distance implies antennae fed by fiber).

The real issue with Wi-Max will be the ability of the providers to supply the antenna sites with bandwidth. Wi-Max is not going to bring big bandwidth to customers in markets where wholesale bandwidth is already difficult to obtain – the Wi-Max provider will suffer from the same problem as large business customers. Wallstreet believes that Wi-Max providers will be niche providers. In many cities the 3-mile limitation on DSL delivery means that many customers have no alternative to cable modems. Wi-Max may fill these geographic niches. Wi-Max also holds a lot of promise as a technology to serve small rural towns (assuming they can get the bandwidth at a reasonable price).

Gigabit Wireless

There are wireless technologies on the drawing board that may be able to deliver as much as a Gigabit of data (1,000 Mbps) over very short distances. For example, this spectrum could deliver bandwidth from a pole in front of your house to your computer and TV.

This type of bandwidth will only make sense when coupled with a fiber system. If the transmitters and receivers of this technology were made at a low enough cost, such a wireless technology could replace the drop to the house and act just like having a fiber to your house. Such a system would enable a customer to serve multiple TVs and computers and move them around at will without reliance on wires. However, only a fiber system can deliver enough bandwidth to make such a system work, so only FTTH or FTTC systems could support this breakthrough.

Comparing Future Technologies

The following table shows our best estimate at the commercially available bandwidth that is available today and in the future with the primary commercial technologies. It is clear that fiber is today, and will remain for the foreseeable future as the most robust technology.

Data Download Delivery Speeds

	Today	10-years	25-years
FTTH	1,000 Mbps	5,000 Mbps	10,000 Mbps
DSL	Up to 3 Mbps	Up to 24 Mbps	Up to 100 Mbps

Cable modem	Up to 6 Mbps	Up to 50 mbps	Up to 200 mbps
Wi-Max	N/A	70 Mbps	200 Mbps
BPL	3 Mbps	10 Mbps	30 Mbps

F. Infrastructure Analysis

One of our tasks in this project was to inventory as much as we could on the existing infrastructure in Southern Maryland. A necessary component of the infrastructure that we researched was that it could be used to support broadband. Such infrastructure consists of two primary types of assets: fiber optic cable and towers for wireless deployment.

Fiber Optics

Many companies own at least some fiber in Southern Maryland. This includes Verizon, Comcast, GMP, SMECO, and long distance companies like Qwest and AT&T. Additionally, there is some fiber owned by the US Government to serve areas of the military and other government installations in the area. There is also fiber owned by Network Maryland.

None of the fiber owners would give us permission to include details of their fiber networks in our study. In most cases they were unwilling to share any information on current fiber infrastructure. In a few cases they had security concerns about revealing details of their network to the outside world.

These networks for the most part seem to be built for each company's own purposes and the networks are largely not coordinated or interconnected.

Network Maryland

Network Maryland was funded by the state to bring affordable and high quality internet access to the state and other government entities in Maryland. SwGI is a Network Maryland service that provides a centralized resource for State entities to communicate with other State governmental entities and data centers. SwGI allows State agencies to create and share resources like FMIS, WebFleet Master, DNS, MVA applications and email relay services.

Network Maryland provides communication between the Internet and its Internet Service customers. Network Maryland's Internet Service is analogous to the routed services provided by a traditional Internet Service Provider (ISP). Network Maryland will provide the routed infrastructure over which its Internet Service customers will communicate to the World Wide Web community.

Network Maryland is located in all 4 Local Access Transport Areas (LATAs). A LATA is a continuous geographic calling area established by a Federal Court with the divestiture of AT&T. Network Maryland's InterLATA transport service is analogous to the services provided by a long distance phone carrier. The InterLATA transport service is designed to facilitate private WAN networks across a common infrastructure. Network Maryland serves to provide a transport (Layer 2 of the OSI Reference Model) medium over which its customers can engineer their required network services. Even though the Network Maryland CORE uses ATM technology, the network can interface with users by Ethernet, Frame-Relay and limited DS-1.

The Route 301 Governor Nice Bridge, which traverses the Potomac, will soon be lit on the Network Maryland fiber optic network. Network Maryland has plans to meet with St. Mary's College to discuss placing fiber directly into the campus. If the fiber is constructed to St. Mary's College, then arrangements will be made to drop off Network Maryland fiber at the College of Southern Maryland's Leonardtown and Lexington Park locations. A Network Maryland microwave link from LaPlata to Prince Frederick would be used to link to the Calvert County campus.

Network Maryland is a resource for government agencies throughout the state. However, network Maryland does not allow commercial uses of the network and it can't be used to supply bandwidth to businesses.

Wireless Antennas

Another key infrastructure asset in Southern Maryland is wireless antennas. Every wireless provider that uses a licensed spectrum (such as cellular and PCS) must register the location of their transmitters with the FCC. Thus, the FCC has a great inventory of existing tower locations.

Most companies that erected wireless towers make extra revenue by leasing tower space out to other wireless providers. It is not mandatory that tower owners share space, but it's almost universal that extra space is leased to others. In fact, the majority of towers in the U.S. are owned by investment firms that own towers but do not offer wireless service.

The Counties take some role in tower ownership. Charles County has made its facilities available to wireless providers. Charles County leases 6 water towers and seven antennas through American Tower Corporation (ATC). ATC is the largest antenna manager in the country. Calvert County owns the land under most towers but does not own the towers. St Mary's County does not own towers or land at towers.

Following, by County, is a map of the towers that are registered with the FCC. In this study we will be considering the possible use of unlicensed spectrum to provide broadband for unserved areas of the Counties. These FCC tower sites tend to be fairly

tall formal towers, and these are the type of towers we would be interested in for the backhaul wireless network.

In addition, SMECO owns some towers for its own use that are not registered with the FCC. SMECO gave us permission to show the towers on these maps and said that any spare space on these towers would be available for an initiative that would bring more broadband to the Counties.

In our engineering study these major tower sites are the places we would consider using as the major hub locations. However, when we begin serving neighborhoods we are able to use much shorter structures (including structures that aren't really towers like building roofs, signs and tall poles). A study was conducted in Calvert County entitled "Site Survey for County Communications System - Calvert County" by Business Information Group, studied all of the structures that might be used to provide wireless coverage into neighborhoods. In this study, Business Information Group canvassed local neighborhoods to identify potential tower sites that could be used for a wireless deployment. The towers identified in the Calvert County study are the identical types of towers we would need in to serve neighborhoods in our proposed technical solution.

Other Networks

When looking at all infrastructure in Southern Maryland one must also consider the various government networks when looking at potential long-term solutions for bandwidth and network. There currently is no coordinated effort to construct, maintain, operate or otherwise coordinate these networks.

The government networks are constructed and cobbled together in all sorts of manners. These networks are comprised of fiber routes, some wireless microwave routes, many leased circuits and some infrastructure provided by the incumbents as part of CATV intranet agreements. We imagine there are legal or other restrictions that might make it difficult to use some of these networks for commercial purposes, just like the restriction on Network Maryland. However, these networks ought to be inventoried and any legal restrictions identified if the Counties decide to push for greater connectivity in the region.

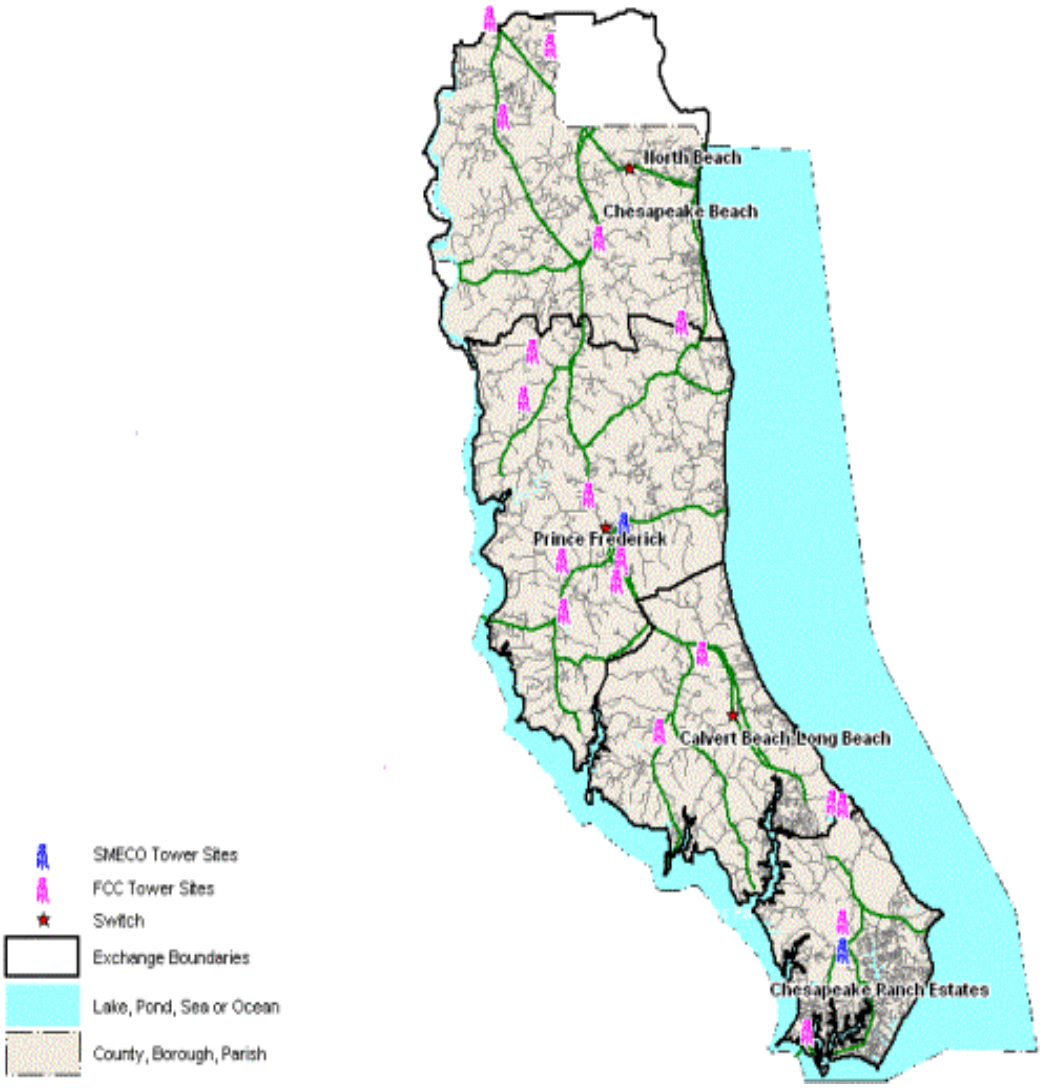
In the end, network is network, and to the extent that any of these existing networks today, or such networks constructed in the future might provide links that would be useful to a greater Southern Maryland network, then all these networks ought to be considered as part of the long term solution. Legal and other restrictions can eventually be overcome as long as the issues have been identified.

It will require some effort to identify the specific assets on each network and to then remain coordinated to keep such an inventory up-do-date. This possibly might be a task assigned to the broadband czar we have recommended.

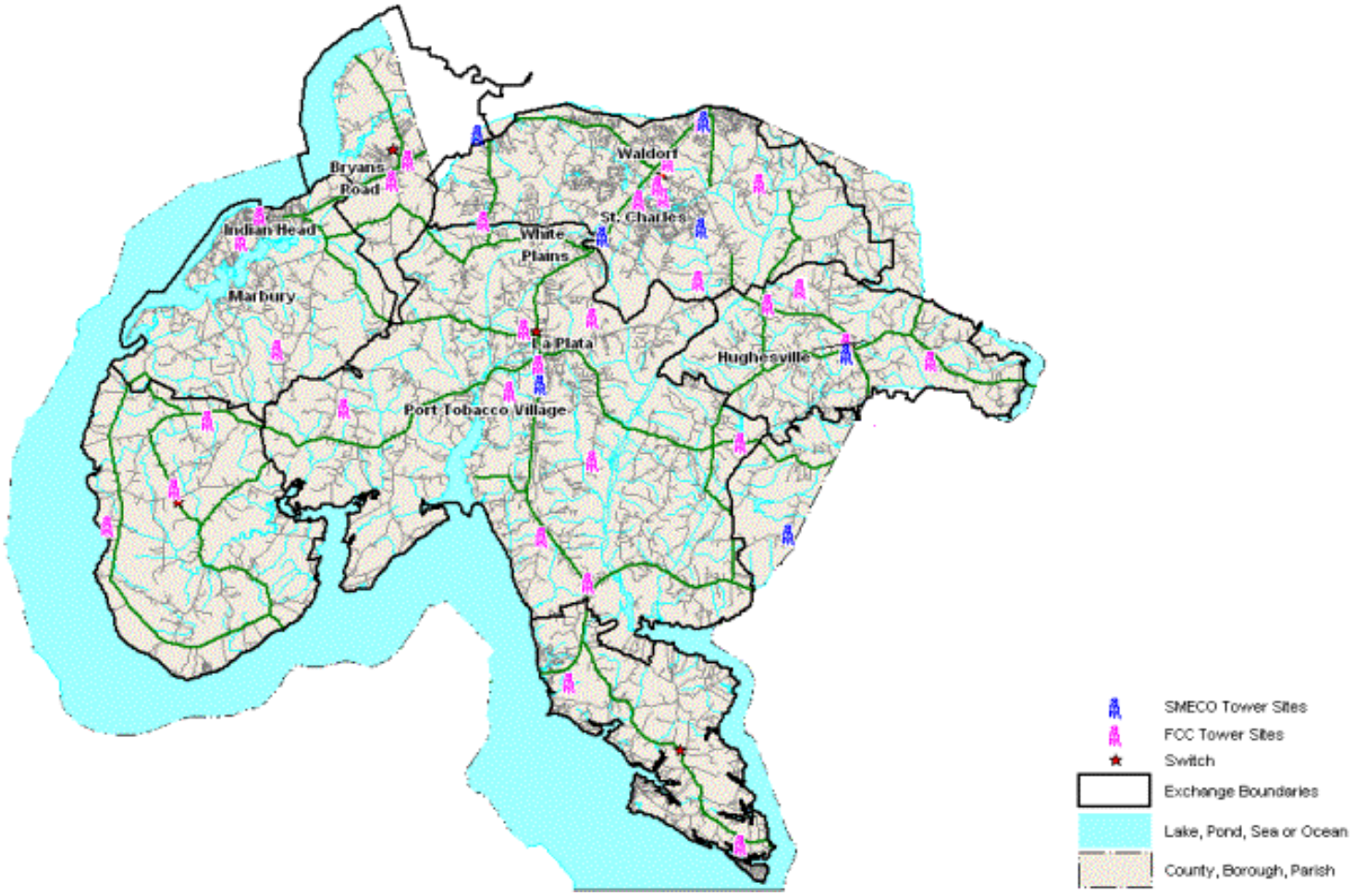
Following is an example of some of the existing networks that may have resources that might contribute to a larger network effort. There are additional government networks in addition to these examples.

- The libraries in the counties are connected through the Sailor network. This network supplies high-speed Internet access and intranet services among the various libraries.
- The College of Southern Maryland maintains an extensive network to bring Internet and other access to its campus and associated entities.
- St. Mary's and Charles Counties each have an extensive intranet that is supplied as provision of the CATV franchise agreement. These networks provide fiber and bandwidth connectivity between government locations within these counties.
- The federal government has provided connectivity around the various military and government locations to connect to businesses or other institutions associated that work with them.

Calvert County Tower Site Map



Charles County Tower Site Map



St. Mary's County Tower Site Map

G. High Level Technical Design – Possible Solutions for Broadband

In this section we explore possible solutions that could be used to deploy broadband to the unserved and underserved areas of the Tri-Counties. Our goal was to find a technical solution that would work today and that would be flexible enough still work in the future. Any recommended solution must also have an economically sound basis for deployment. In Section IV below we look at the economics using several business plans.

We began our design by using our research that mapped and identified the unserved and underserved customers in the Counties. This research showed several things:

- Calvert County has most extensive coverage of DSL and cable modem.
- The southern half of Charles County has almost no broadband coverage by either cable modem or DSL.
- There are scattered pockets throughout St. Mary's County that have no DSL or cable modem coverage.
- Regardless of the maps, we know of many customers within the "covered" areas of the maps that don't have or feel they can't afford the current broadband options.
    - We interviewed many businesses that can't afford the high construction costs from Comcast.
    - We know that cable is often not wired to streets and neighborhoods that have less than 20 homes per street mile in Charles and St. Mary's County and fewer than 15 homes per street mile in Calvert County..
- There are significant numbers of homes and businesses that can't get or can't afford to get connected to the current broadband options. Our estimates of unserved and underserved customers are as follows:

	Total Businesses	Unserved / Underserved Customer	Percent of Market
Calvert County	2,623	250	10%
Charles County	4,539	1,750	39%
St. Mary's County	3,388	1,000	30%
Total	10,550	3,000	28%

	Total Households	Unserved / Underserved Customer	Percent of Market
Calvert County	25,447	1,400	6%
Charles County	41,668	9,000	22%
St. Mary's County	30,642	4,000	13%
Total	97,757	14,400	15%

The results of this research indicate that any broadband solution must be able to cover most of the geographic area of all three counties. However, any solution must first serve the rural portions of St. Mary's and Charles Counties, where the majority of the unserved and underserved customers are located.

Possible Technical Solutions

There were three possible technical solutions that met our requirements: Broadband over Powerline (BPL), Unlicensed Wireless using Wi-Fi and Unlicensed Wireless using Wi-Max. Our study showed that Wi-Fi offers the best possible immediate solution to supplying broadband for the unserved / underserved areas of the Counties. However, we believe that BPL and Wi-Max Wireless show a lot of future potential. The best possible business plan would consider a migration path to a future technology. Following are the results of our technical analysis of each possible solution.

Broadband Over Powerline (BPL)

There are a number of issues with the current generation of BPL equipment that is available in the U.S. As a result of these problems we are leery about recommending BPL for immediate deployment:

- The FCC today officially considers BPL as an experimental technology. As a result, one must request an experimental waiver from the FCC in order to deploy BPL. While a request for a waiver is a technicality and trial licenses are routinely granted, this experimental status means that there are not many deployments of BPL. The FCC experimental status is required because BPL is known to interfere with other radio frequencies. The largest amount of interference is with ham radio frequencies, and since ham operators take an important role in emergencies, the FCC is still considering how to deal with the issue. This particular FCC seems to be very pro-business and the experts all believe that BPL will get certified as an acceptable technology even with the interference issues. But until the FCC formally blesses it there is some risk of deploying BPL.
- BPL today does not deliver very much bandwidth even though it is intended as a competitor to DSL and cable modems. In the trials conducted by a number of municipal electric companies the actual speed achieved by current BPL deployments is less than 1 Mbps. There is promise that future generations of equipment will deliver faster speeds (we know of lab trials of 5 Mbps speeds), and eventually the technology is thought to be capable of delivering 10 Mbps.
- BPL is currently a first generation design, meaning that the equipment currently available is being deployed in a "beta test" mode. This means the field trials real goal is to identify and clean up problems not found in the lab. At CCG we have grown extremely leery of deploying any technology that is not in the second or third generation of field deployment. We have almost 350 clients who deploy networks, and we can't think of one example where a company that deployed first generation equipment was happy with the results from a financial perspective.

- First generation equipment tends to cost too much. Prices don't ever become reasonable until equipment is mass-produced.
- In far too many cases we have seen some of the manufacturers of first generation equipment eventually decide to abandon a particular business line. It is generally a financial disaster when one's vendor of choice leaves the business.
- In general there is a "fork-lift" upgrade needed to go from first generation equipment to third generation equipment, and this is expected with BPL. A "fork-lift" upgrade implies that an upgrade will require almost complete replacement of the original equipment. Such upgrades are very expensive and generally those who invested in first generation equipment find it uneconomical to replace this equipment only a few years after deployment. We have a perfect real life example. GMP was one of the earliest cable companies to deploy cable modems. We're sure that their early customers were eager to get off of dial-up and go to something faster. However, as GMP deployed the first-generation cable modem network they experienced a wide array of problems. The network grew to become largely unreliable and there were frequent outages. Finally, after suffering through the first generation equipment for five years GMP was able to upgrade to newer equipment and today they have a robust and smoothly operating cable modem system. Had GMP waited before deploying first generation cable modem equipment they would have avoided many of the problems they have had over the years.

In summary, we don't believe that BPL is ready for a large-scale commercial deployment at this stage of the product life. Assuming that all goes as the BPL industry plans – meaning the equipment improves and enough consumers accept BPL as a broadband solution – then BPL could become a mainstream technology within two to three years. We cannot recommend taking a chance on deploying BPL at the current level of technology.

Unlicensed Wireless

We considered unlicensed spectrum using both Wi-Fi and Wi-Max technologies. Wi-Max is the promised next generation equipment that utilizes unlicensed spectrum. Although Wi-Max has been heavily hyped there is no Wi-Max equipment available today. Just as we warned with BPL, we cannot recommend deployment of first generation Wi-Max technology as the primary technology. Like every other first generation roll-out, there will be problems.

If Wi-Fi is being considered, it is critical to confirm that the equipment vendor chosen has a clear migration path planned that would allow the Wi-Fi equipment to be eventually upgraded to Wi-Max capabilities, without a forklift upgrade. Most Wi-Fi manufacturers talk about having forward looking equipment; however, not all of them have a migration path in mind. Note that many Wi-Fi vendors are now referring to their equipment as *pre-Wi-Max*. This tends to imply to the marketplace that this equipment, while not Wi-Max, is offering at least some of the Wi-Max performance. We are skeptical of these "fine print" claims.

In looking at Wi-Fi we set forth the following design goals:

- Must be modular
- Must be scalable
- Must have as much redundancy as possible
- Must accommodate future population growth
- Must allow for upgrades to future technology
- Must work today without fiber but have the capability to interface with fiber if it became available in Southern Maryland.

In designing the wireless network we examined the population in southern Maryland according to the population densities as defined by the Bureau of the Census[4]. Using the Census definitions we have categorized the population density in the Counties into three types:

- Urban/suburban –Having over 1,000 people and/or 400 households per square mile.
- Middle America – Between 500-1000 people/200-400 households per square mile.
- Rural – Between 0-500 people/0-200 households per square mile.

The type of service of the network also plays an important role in the design because different communities around the U.S. have deployed wireless networks for different purposes. There are four common uses for a broadband wireless network:

- Government use only – A closed network may cover sections of a city, the entire city, or the county, but it can only be used and accessed by local government agencies.
- Hotspot/Downtown – This network is deployed in high-traffic areas including downtown, public parks, tourist destinations, etc. Access may be provided for free or for a fee depending on the business model chosen.
- Citywide – This network attempts to cover the entire city. Like existing cellular networks, citywide wireless broadband networks will have spots where service is not available.
- Countywide – This network attempts to cover the entire county. Countywide networks can present unique political challenges since it will be necessary to build consensus among many different government agencies.

For the purpose of this paper we have defined the scope of the wireless broadband network as countywide.

Network Architecture

There are four possible major network architectures that can be used for the deployment of unlicensed wireless networks, as follows.

[4] U.S. Census Bureau. 9 September 2004 (http://www.census.gov/geo/www/ua/ua_2k.html).

Point-to-Point. The point-to-point (PTP) wireless network is the simplest of all four network architecture; it connects one single point to another single point. The advantages of the PTP architecture include much higher speeds that can be delivered between the two points. There are several disadvantages to a PTP network. First, this is quite costly since there must be a 2-way radio at both locations. Next, this type of network is difficult to migrate to other types of architecture. Requirements such as antenna selection, LOS determination, site surveys, hardware costs, facility costs, installation, testing and support all plays important roles in the PTP network architecture. A PTP network architecture is most appropriate choice when trying to bring a large amount of bandwidth to a small number of locations. Such a network will not bring a broadband solution to the unserved homes and businesses in Southern Maryland.

Point-to-Multipoint. The Point-to-Multipoint (PMP) wireless network can be the most economical way to provide connectivity from a single hub site to multiple end user locations. The wireless equipment at the hub is referred to as the access point. The equipment at each end user location is generally referred to as the customer premise equipment (CPE) or client equipment. The advantages of the PMP network architecture are that such a network is affordable, scalable and open for upgrades to new technology. There are also some disadvantages. The primary disadvantage is that a PMP network requires line-of-sight between the transmitter and the customer. This means that trees, buildings and hills can interfere with coverage. A second disadvantage (and maybe also advantage) is the shared nature of the bandwidth. The bandwidth is shared between all customers from a given access point. This means as the number of customers increases the bandwidth to each customer will decrease. Sufficient bandwidth from this type of network assumes that sufficient and affordable bandwidth can be sullied to the antenna transmitter site – something that is currently a problem in Southern Maryland. A third problem with a PMP network is the availability of antennas. Most antennas today are built for cellular traffic, meaning that the towers sites are not chosen with line-of-sight considerations (cellular spectrum can pass easily through trees and bounce over hills somewhat). The Point-to-Multipoint network architecture is most appropriate when many users are located in the same general area and when there is clear and open terrain.

Cellular Architecture. When point-to-multipoint networks are linked to the same backbone network, the result is a cellular network. The advantages of the cellular architecture include the expansion of coverage area, increases in network capacity, redundant end user coverage and roaming. The single biggest disadvantage of the cellular network is interference. Cellular network architecture is the most appropriate when more end users exist than a single point-to-multipoint network can cover or when end users are located in different geographical areas.

Mesh Architecture. The Mesh architecture is a multipoint-to-multipoint (MMP) architecture with at least one Internet connectivity point. In a mesh network each network node can connect to any other network that is within range. The biggest advantage of a mesh network is that it largely solves the line-of-sight issue since

customers most likely will be able to achieve line-of-sight to at least one other customer. Another advantage is that the equipment is extremely flexible - each node performs two key functions: routing/repeating and termination[5]. The disadvantages of the mesh architecture are that nodes must be within close proximity and have adequate line-of-sight to the customer. The best use of a mesh networks is when there are scattered pockets of customers.

We took the following steps in evaluating possible network architectures:

1. Analyzed maps to understand the unserved areas
2. Inventoried the available antennas in the Counties
3. Identified customer density and proximity to transmitter sites
4. Evaluated the point-to-point architecture
5. Evaluated point-to-multipoint architecture
6. Evaluated cellular architecture
7. Evaluated mesh architecture
8. Equipment selection process

A well planned broadband wireless network is primarily dependent on line-of-sight (LOS) paths and must be cognizant of interference issues. In a poorly designed wireless network there can be interference between transmitters, thus wasting valuable bandwidth. The best network for an area as diverse as Southern Maryland might include areas that benefit by each of the four architectures described above. The terrain and the obstructions are different in each county and thus there might be a different local solution in different parts of each County. Any final wireless network would be planned and constructed with LOS paths that will fit around and over the obstructions in the area. In this study we were funded just to determine high-level design. If a network were to be deployed, local engineering which identify local terrain issues would still be required. However, we believe our overall design should accommodate most scenarios in each of the Counties.

Overview of the equipment selection process

The preliminary network design and proposed architecture layout has been proposed given the following general assumptions:

1. Utilize licensed free radio spectrum
2. Use readily and widely available components and equipment
3. Provide clear line-of-sight under different conditions
4. Avoids interference between transmitters
5. Use any available source of Internet connectivity
6. Has a maximum over-subscription rate of 50:1 (number customers that share the same bandwidth)
7. Data speeds can be increased if more Internet backbone bandwidth is available. We chose the following initial data delivery speeds as the minimal deployment
    a. Maximum downlink in 1Mbps
    b. Minimum uplink is 128Kbps

[5] Data packets can travel through several intermediate wireless nodes to reach the desired end user node. If one or more nodes are down, the data packet is rerouted through other intermediate nodes.

c. Maximum uplink is 384Kbps

Equipment Selection

After the identifying the requirements for the wireless network, we reviewed fifteen vendors of wireless equipment. We then narrowed the list to three vendors that could supply the type of customer network suited best to Southern Maryland. Finally, we chose one primary vendor, Motorola. Motorola's Canopy Series mesh architecture seemed to best fit the geography and business plan that would best serve Southern Maryland. We also selected Terabeam Wireless to provide the point-to-point radios needed for wireless backhaul between major antenna sites.

What was most attractive about the Motorola Canopy product is that it can accommodate all types of network deployments. The base radios used for the Canopy product are very flexible. Each radio is really six different transmitters that can be utilized in different ways. Each of the sectors can be used for Point-to-Point service, Point-to-Multipoint service or as part of a mesh network. For example, two of the Canopy's six radios could be used for backhaul to other major transmitters.

Since the Motorola radios are limited in backhaul to 10 Mbps we decided to use more robust radios for backhaul. There are several of brands that are adequate for this purpose and any radio that can deliver 25 Mbps or better Point-to-Point would be adequate for network backhaul in Southern Maryland.

Both of the equipment vendors selected for this project support industry standards and are known to be generally interoperable.

Version 1- Wireless Backhaul Network

We have proposed two different network architectures. In the first version, which we will refer to as the "Wireless Backhaul" option, we have created the simplest and quickest network that could be used to begin the delivery of wireless broadband. Under this scenario we selected one antenna site near Waldorf as the primary base station for the Counties. This site was selected since we believe Waldorf is where the lowest priced Internet backbone circuits can be purchased. In total we designed six major transmitters, two in each County. In the Wireless Backhaul option, the only Internet connection is at this main hub located in Waldorf. Additional backhaul throughout the Tri-County region would require wireless Point-to-Point links. These PTP links could be provisioned using unlicensed radios; however, there are fairly inexpensive radios using licensed microwave spectrum that could also be used. The licensing process for PTP licensed connections has been streamlined at the FCC; it is now fast and inexpensive. In the end we selected Terabeam Wireless as the vendor for the PTP radios, using the unlicensed spectrum. However, there are other vendors that also provide cost effective PTP service.

We have not specifically selected the six specific towers that would be utilized. However, as evidenced by maps of the available towers included below, we are certain that we could find two suitable towers in each County that would be within line of sight of each other.

This network is designed as a ring for redundancy purposes (the Internet backhaul is actually sent in both directions around the ring). Thus, if one antenna site went down, the other five would keep functioning. If one of the wireless links goes out of service, all six sites could still function at a slightly reduced capacity.

This option would supply a minimal amount of bandwidth and could support a mixture of products ranging from 256 Kbps to 1 Meg download and 256 Kbps upload. This is a "bare bones" minimal network. We completed our first business plan based upon this option since we were anxious to see if the minimal network could succeed on an economic basis. More details of the economics are included in the next section of the report.

Probably one of the most attractive aspects of Wi-Fi network is the bandwidth scalability. The more bandwidth that is poured into the transmitters, the more output that can be achieved by customers. For example, the minimal scenario looks at supplying just one DS3 of Internet backbone to the Waldorf primary hub. However, we could also bring multiple DS3s to that location and have a more robust network with higher bandwidth available to customers.

It is always a challenge in defining how much bandwidth customers can achieve on a wireless network. With the Motorola Canopy and other wireless products we can cap the maximum amount of bandwidth that any given customer can receive. For example, if a customer signs up for a 512 Kbps product, we can be certain that the customer will never receive more than 512Kbps. However, it is far more difficult to engineer the minimum amount of bandwidth the customer will receive. Wireless networks are similar to cable modem networks in this respect in that the bandwidth is shared in a given node between all of the customers on that node. Thus, at peak times the amount of bandwidth available for any customer will decrease as more and more customers use the system. Therefore the engineering goal is to engineer for peak times if we are to offer a quality product. One of the best ways to ensure quality is not to overload the antennas with customers. For example, if we assigned 600 customers per base antenna rather than 400, then performance would suffer during peak hours.

Engineering for peak times is done with an engineering process known as over-subscription. Over-subscription is a measure of the number of users that can be expected to "share" the same amount of bandwidth at the same time. In real life customers are not using bandwidth all of the time. They periodically upload or download files, but most of the time customers are not using much bandwidth even though they are on the Internet. Enough study has been done on Internet customer behavior so that service providers are able to use general engineering rules of thumb in designing Ethernet shared networks. We would recommend a network where the over-subscription rate is no greater than 50:1. This means that if we provision 1 Mbs of Internet backbone, we could sell a 1 Mbps service to 50 customers and all 50 should still be able to enjoy good quality of service. With this many users they will occasionally bump into each other downloading files, but for the most part any given user

will have the full use of the 1 Mbps backhaul when they choose to access a file. Remember that at any given time a significant number of these users won't even be logged onto the Internet.

A 50:1 over-subscription ratio would make this network as good as most quality networks. There are many service providers including cable companies that over-subscribe customers as much as 100:1 or even 200:1. High over-subscription rates mean degraded service during peak hours. There are anecdotal stories of cable modem networks that slow down to dial-up speeds at 7:00 in the evening.

While we designed a "minimum" scenario for this network, we would hope that any network built for Southern Maryland could be more robust. One way to do this would be by adding more Internet bandwidth at the primary hub in Waldorf. However, a better solution would be to bring Internet backbone directly to the main transmitters (closer to the customers).

Version 2- Local Network

In our business plan we considered a second network architecture, which we will refer to as the "Local Network" option. In this scenario we constructed almost the same network, but rather than bringing the Internet backbone into Waldorf we brought Internet backhaul into one antenna site in each County. We also doubled the number of towers and thus have the presence of a local ring of four antenna sites within each County. In addition the Counties are still linked to each other in a ring configuration so that there is overall redundancy.

In this second scenario we still propose to use PTP radios to compose the rings; however, the rings would only be needed when one of the sites went out of service. The PTP connections would not be used for primary backhaul between Counties, except during emergencies.

The main benefit of the Local Network option is that we are bringing more bandwidth to the network. This option would allow for two improvements over the minimal network designed in the first scenario. We could either add more customers or we could provide more bandwidth for each customer. We believe the ideal solution is to both add more customers and provide more bandwidth for each customer.

In our minimal scenario we designed a network that could support roughly 2,400 customers. With a DS3 of bandwidth this gives each customer roughly 900 Kbps of bandwidth as product with a 50:1 concentration. Divided into upload and download, this would equate to roughly 256 Kbps upload and 650 Kbps download. In the more robust second scenario we supply 3 DS3s for bandwidth and provision about 4,800 customers. This scenario supplies about 1.5 Mbps on average to customers, much better than in the first scenario.

When we discuss "average bandwidth" we are not accounting for the fact that some customers will be able to get more bandwidth than others. This will be covered in more detail in the business plan section, but note that each of our business plans assume we will sell a low, a medium and a high speed product to customers. The levels of these speeds will be

determined by the amount of Internet backbone and by the number of customers we have sharing the network. In the Local Network option, the fastest broadband product could be roughly 3 Mbps – faster than DSL and very comparable to cable modem.

If this business plan were to be immediately implemented, we would recommend one additional step in the process. We believe it is important for anyone deploying a network to understand that the equipment really works and to research all about the bugs and nuances of operating a network. We recommend to our clients that they obtain this information in one of two possible ways. First, they can visit someone who has built a similar network with similar equipment. Unfortunately, too many equipment salesmen will make promises for equipment that is very different than what is actually available. Vendors are very willing to make referrals to other clients if their equipment is working well in the field. (Conversely, a vendor who won't give referrals ought to be avoided like the plague). Another way to test equipment is to set up field trials, deploying different brands in different parts of the network. Generally field trials work best for somebody that already has a large established network and would not be recommended for someone who is considering building their first network. In Southern Maryland we would highly recommend that whoever builds the network first visit other working networks.

Modular Architecture

We have assumed a 'modular' deployment strategy that minimize the capital expenditures and maximize the return on investment. By modular, we mean that a bare network can be constructed before we have even signed up our first customers. Fortunately with a Wi-Fi network, most of the cost is associated with the antennae at customer locations, and thus most capital is spent as we sign up customers. We have selected vendors that can provide off the shelf gears in 2.4GHz ISM band and 5GHz ISM and 5GHz U-NII (Unlicensed National Information Infrastructure).

By modular we also mean that this network can be expanded in the future to meet growth. With the architecture we have chosen we could integrate other major transmitters into the system at one of the many major antennas found throughout the region. Such new nodes could be incorporated into the ring architecture for redundancy and emergency backup. Each new node could also be supplied independently with new Internet backbone or could draw Internet backbone from an existing site.

One of the major costs of operating the proposed wireless network is the cost of the Internet Backbone. Many businesses in Southern Maryland complained to us about the cost of Internet connectivity. Internet backbone is expensive in Southern Maryland because the Internet Pops are located near Washington DC. Southern Maryland is at a geographic and economical disadvantage in that only a handful of providers like Verizon can supply access to the Internet. It's obvious that the region is bandwidth starved and we recommend this network with the hope that eventually the Internet backbone can be provided by a new fiber network provider. We will be discussing the overall bandwidth requirements of the Counties and the possibility of new networks elsewhere in this report.

Vendor Selection

Following is a list of the vendors we considered for the project:

Point-to-Point and Point-to-Multipoint
- Proxim (Tsunami Multipoint, Quickbridge and Lynx)
- Tranzeo (TR6000 and other TR products)
- Trango (M2400 Series and other products)

Point-to-Point
- Terabeam Wireless
- Alvarion (BreezeACCESS Series)
- Smartbridges (Nexus Series)
- Harris (uses licensed spectrum)

Mesh
- Motorola (Canopy Series)
- Tropos Networks (5210 Series)
- Belair (200 and 100)
- Firetide (HotPoint)
- Mesh Dynamics

Other
- Colubris (InReach Series)
- Lynksys/Cisco
- DLink

The technology that we chose that best fits Southern Maryland was Motorola and the Canopy series of equipment. There were a number of aspects of the Canopy product that best fit Southern Maryland:

- The architecture is basically designed to support a mesh network. However, the radios are very flexible and they can also be used to support Point-to-Point backhaul and Point-to-Multipoint customer deployment. This flexibility was perhaps one of the best features of Motorola. This flexibility best fits the rural nature of Southern Maryland. With the Canopy product customers could be served directly from the main antenna in their region or they could be part of a mesh network.
- The Motorola product has a built-in customer platform that makes it easy to set and manage bandwidth for customers remotely.
- The system is quick and easy to deploy and install.
- The radios can operate in the 2.4, 5.4 and 5.7 GHz bands.
- There are some proprietary protocols in the management system, but overall these radios operate to basic industry Wi-Fi standards.
- Motorola is a large and stable manufacturer who should be around in the future to support the product.

Here are more detailed specifications for Motorola:

Motorola – 2.4GHz Canopy Access Point

- Bandwidth – 10 Mbps, 7 Mbps throughput
- Typical LOS – 5 miles (8 km)
- Frequency Band – ISM 2400-2483.5 MHz
- Channel – 3 non-overlapping channels
- Modulation – Frequency Shift Keying (FSK)
- Encryption – DES capable
- Latency – 5 to 7 msec
- Antenna Gain – 8 dB
- Power – Equivalent isotropic Radiated Power (EIRP) 10mW to 2.0W

Motorola – 2.4GHz Canopy Subscriber Module

- Bandwidth – 3 to 4 Mbps
- Typical LOS – 5 miles (8 km)
- Frequency Band – ISM 2400-2483.5 MHz
- Channel – 3 non-overlapping channels
- Modulation – Frequency Shift Keying (FSK)
- Encryption – DES capable
- Latency – 15 msec
- Antenna Gain – 8 dB
- Power – Equivalent isotropic Radiated Power (EIRP) 10mW to 2.0W

Motorola – 5.7GHz Canopy Access Point

- Bandwidth – 10 Mbps, 7 Mbps throughput
- Typical LOS – 2 miles (3.2 km)
- Frequency Band – ISM 5725-5850 MHz
- Channel – 6 non-overlapping channels
- Modulation – Frequency Shift Keying (FSK)
- Encryption – DES capable
- Latency – 5 to 7 msec
- Antenna Gain – 7 dB
- Power – Equivalent isotropic Radiated Power (EIRP) 1.0W

Motorola – 5.74GHz Canopy Subscriber Module

- Bandwidth – 3 to 4 Mbps
- Typical LOS – 2 miles (3.2 km)
- Frequency Band – ISM 5725-5850 MHz
- Channel – 6 non-overlapping channels
- Modulation – Frequency Shift Keying (FSK)
- Encryption – DES capable
- Latency – 15 msec
- Antenna Gain – 7 dB

- Power – Equivalent isotropic Radiated Power (EIRP) 1.0W

Motorola – 5.7GHz Canopy Advantage Subscriber Module

- Bandwidth – 14 Mbps up to 1 mile
- Typical LOS – 5 miles (8 km)
- Frequency Band – ISM 2400-2483.5 MHz
- Channel – 6 non-overlapping channels
- Modulation – Frequency Shift Keying (FSK)
- Encryption – DES capable
- Latency – 15 msec
- Antenna Gain – 8 dB
- Power – Equivalent isotropic Radiated Power (EIRP) 10mW to 2.0W

The other two brands of radios that we considered strongly included Trango Broadband and Tropos Networks. If this network was to be built we would recommend an RFP be sent to these three manufacturers.

Trango Broadband

Trango Broadband Wireless, a division of Trango Systems, Inc., is a technology leader specializing in the development and manufacturing of broadband wireless access solutions used globally by service providers, municipalities and small business. Trango Broadband products provide a wireless alternative to wired Internet access solutions such as DSL and cable modems. Ideal for numerous applications and settings, including various sized businesses, campuses, and residences, Trango Broadband Wireless extends the "last mile," offering a multitude of solutions addressing the demand for high-speed IP-based data services for the middle and rural market. While Trango Broadband offers similar features to the Canopy, the carrier class outdoor fixed wireless products could be provisioned for businesses and residential end users demanding value added services and minimal service Level agreement (SLA). The distinguishing feature of the Trango Broadband system is the bandwidth controller allowing for the customization of the Committed Information Rate (CIR) and Maximum Information Rate (MIR) settings per subscriber unit.

Here are the specifications foe Trango radios:

Trango Broadband M2400S Series – 2.4GHz Access Point

- Bandwidth – 5 Mbps throughput
- Typical LOS – 15 miles (w/10 dB fade margin)
- Frequency Band – ISM 2400-2483 MHz
- Channel – 8 non-overlapping channels
- Modulation – Direct Sequence Spread Spectrum (DSSS)
- Encryption – Trango proprietary authentication based on MAC address and alphanumeric ID; over the air data scrambling
- Latency – Not Available

- Antenna Gain – 13 dBi
- Power – Equivalent isotropic Radiated Power (EIRP) 10mW to 2.0W

Trango Broadband M2400S Series – 2.4GHz Subscriber Unit

- Bandwidth – 5 Mbps throughput
- Typical LOS – 15 miles (w/10 dB fade margin)
- Frequency Band – ISM 2400-2483 MHz
- Channel – 8 non-overlapping channels
- Modulation – Direct Sequence Spread Spectrum (DSSS)
- Encryption – Trango proprietary authentication based on MAC address and alphanumeric ID; over the air data scrambling
- Latency – Not Available
- Antenna Gain – 15 dBi
- Power – 10.0W

Trango Broadband Access5830 – 5.8GHz/5.3GHz Access Point

- Bandwidth – 10 Mbps throughput
- Typical LOS – 4 miles to 10 miles (depending on antenna)
- Frequency Band – ISM 5725-5850 MHz; U-NII 5250-5350 MHz
- Channel – 8 non-overlapping channels
- Modulation – Direct Sequence Spread Spectrum (DSSS)
- Encryption – Trango proprietary authentication based on MAC address and alphanumeric ID; over the air data scrambling
- Latency – Not Available
- Antenna Gain – 13 dBi
- Power – 13.4W

Trango Broadband TrangoFox Series – 5.8GHz/5.3GHz Subscriber Unit

- Bandwidth – 10 Mbps throughput
- Typical LOS
    - FOX5800 – 4 to 10 miles
    - FOX5300 – 2 miles
- Frequency Band
    - FOX5800 ISM 5725-5850 MHz
    - FOX5300 U-NII 5250-5350 MHz
- Channel
    - FOX5800 6 non-overlapping channels
    - FOX5300 5 non-overlapping channels
- Modulation – DSSS
- Encryption – Trango proprietary authentication based on MAC address and alphanumeric ID; over the air data scrambling
- Latency – Not Available
- Antenna Gain – 15 dBi

Trango Broadband Atlas Series – 5.8GHz Wireless Ethernet Bridge

- Bandwidth – 6 Mbps (5 Mbps throughput); 54 Mbps (45 Mbps throughput)
- Typical LOS – 6 to 20 miles
- Frequency Band – ISM 5725-5850 MHz
- Channel – 23 non-overlapping channels
- Modulation – OFDM
- Encryption – Trango proprietary authentication based on MAC address and alphanumeric ID; over the air data scrambling; two level password control
- Latency – less than 5msec
- Antenna Gain – 23 dBi

Tropos Networks

Tropos Networks, Inc. is a leading supplier of systems used to build metro-scale Wi-Fi networks. Tropos' products enable network operators, service providers and government departments to provide ubiquitous, metro-scale, broadband, wireless data coverage for users in any locale. Tropos' solution creates a truly wireless network, free from the requirement of per node wired connectivity associated with Wi-Fi hot spot deployments using access points. Tropos' products enable larger coverage areas, decreased installation costs and decreased operational costs. Formerly FHP Wireless, Inc., Tropos is headquartered in San Mateo, California.

Other current Wi-Fi solutions require a wired backhaul, such as a T-1 line at each access point. With the Tropos mesh system, Wi-Fi cells require limited wired connectivity because they communicate wirelessly with each other while providing Wi-Fi coverage for end users. This allows us to quickly build a scalable, metro-wide, non-line-of-sight network that can easily be expanded by just adding Wi-Fi cells.

While we believe that Tropos mesh technology will be the future of wireless networking. The 'shared bandwidth' aspect of 802.11 b/g and limitation of the single point of failure (limited wired connectivity) limit equipment from Tropos Networks to dense urban/suburban deployment. However, Tropos equipment is not quite a flexible as Motorola in areas of lower population density.

Specifications for the Tropos radios:

Tropos Networks 5210 Outdoor MetroMesh Router – 2.4GHz Outdoor Router

- Bandwidth – 802.11b/g (up to 54 Mbps shared bandwidth)
- Typical LOS – 300 ft
- Frequency Band – 802.11 b/g
- Modulation
    - 802.11b DSSS
    - 802.11g OFDM
- Encryption – Wi-Fi based encryption scheme

- Latency – Not Available
- Antenna Gain – 7.4 dBi
- Power – 1W

Terabeam Wireless

We selected Terabeam Wireless as the provider of the wireless backhaul between transmitters. Terabeam Wireless is the business name of YDI Wireless, Inc. Terabeam Wireless is a world leader in providing extended range, license-free wireless data equipment and is a leading designer of turnkey long distance wireless systems ranging from 9600 bps to 1.44 Gbps for applications such as wireless Internet, wireless video, wireless LANs, wireless WANs, wireless MANs, and wireless virtual private networks.

The Terabeam wireless Terabridge is a PTP, high capacity, all outdoor radio optimized for backhaul of Ethernet or traditional telecommunication voice and data networks. For heavily congested areas and/or high bandwidth backhaul over short distances, Terabeam provides a high bandwidth carrier grade solution in the licensed free spectrum for you backbone network. We would highly recommend a 24GHz licensed free solution in heavily congested urban areas and 5.3GHz/5.7GHz for all other areas.

Specifications of the Terabeam Wireless radios:

Terabeam TeraBridge 5345/5845 – PTP Radio

- Bandwidth – 45 Mbps, Full Duplex; 90 Mbps aggregate
- Typical LOS – 4 miles to 40 miles
- Frequency Band
    - 5.3 GHz U-NII full duplex radio for short and medium links
    - 5.7GHz ISM full duplex radio for links up to 40 miles
- Modulation – 16 QAM
- Latency – very low
- Antenna Gain
    - Flat Panel – 23 dBi
    - Parabolic – 22 dBi to 34.6
- Power – up to 2.0W

Terabeam TeraBridge 2445 – PTP Radio

- Bandwidth – 45 Mbps, Full Duplex; 90 Mbps aggregate
- Typical LOS – 1.7 miles to 3.9 miles
- Frequency Band – 24.05 GHz to 24.25 GHz full duplex radio for short and medium links
- Modulation – 16 QAM
- Latency – very low
- Antenna Gain
    - 12 inch Parabolic – 34.5 dBi

- Power – up to 2.0W
- VOIP carrier grade – 99.999% up to 1 mile; 99.99% up to 1.5 miles; 99.97% up to 4.3 miles

Summary

Although a large number of Internet users in Southern Maryland have access to broadband, a disturbing number of customers have no broadband alternatives (28% of businesses and 15% of residences). We have offered a wireless network using unlicensed 2.4GHz and 5.8GHz technology as the best solution for providing bandwidth to these unserved / underserved customers.

We also considered Broadband over Powerline, but reject it for now as not quite ready for prime time. We also considered Wi-Max Wireless, but again this technology is not yet available from vendors. At CCG we are huge believers in building networks using only proven technologies. We have yet to see one of our clients happy as a guinea pig for early technology rollouts, before the bugs are worked out of a new technology.

In the next section of the paper we will look at the economics of this wireless solution. From an engineering perspective we needed to design a network that could serve customers in low density areas spread over a large geographic footprint. We designed a network that is modular, can grow to support more customers, is easily upgraded in the future, and that has some routing redundancy.

Most of the Wireless providers today have deployed networks in denser, more urban areas. We ended up rejecting some vendors because their equipment was aimed at higher density areas and was not suited to Southern Maryland.

With emerging (pre) Wi-Max technology still a year away, the Motorola and/or Trango Broadband solutions can provide fixed broadband wireless coverage over distances of up to 5 miles, thereby establishing a business case for wireless in rural cities.

All vendors were selected based on off the shelf availability of the equipment, high performance and high availability as well as ease of installation, ease of management, and low cost of ownership and deployment.

IV. Business Plan Analysis

In this section we look at whether there are any financially viable models for bringing broadband to the unserved and underserved areas of Southern Maryland. The unserved areas can be defined in three groups – those areas where there is no DSL and that are outside the CATV franchise areas, areas where there is no DSL and where the household density is below the CATV franchise build requirement, and businesses that can be anywhere but which cannot afford the current broadband alternatives.

A. Business Plan Key Assumptions

In order to explore the economics of offering broadband in Southern Maryland, CCG Consulting, Inc. (CCG) undertook two business plan studies that contemplated all aspects of potential profitability. A summary of the results of these business plans is included below in Section B.

The business plan assumptions used in the forecast include our best estimate of the operating characteristics for such a business. As a firm we consult to over 350 other communications entities that operate voice, broadband or cable TV businesses. We also work with our clients to provide profitability maximization and we are experienced in how businesses really operate under all sorts of conditions. We represent that these financial results are characteristic of similar operations elsewhere and we believe these results can be achieved in Southern Maryland.

As described briefly in the last section of this report, we selected Wi-Fi wireless as the best technology choice to supply broadband to Southern Maryland. We have created two business plans scenarios:

> Version One – Wireless Backhaul Network. This network consists of network where all backhaul and customer connections are made wirelessly. This network does not require fiber, but instead will rely on establishing a primary hub in the location in Southern Maryland where we can get the lowest cost Internet connection. This would probably be somewhere in the Waldorf area. With one Internet DS3 Internet connection this network could support roughly 2,400 customers with an average bandwidth of 500 Kbps. This is clearly a minimal network, but we wanted to see if the simplest network could pay for itself.
>
> Version 2 – Local Network. Version 2 represents a more robust network. This network will have a separate Internet feed locally in each County. There would be a network hub for each County. The network would still have wireless connections to create a ring for the whole network. These wireless connections would provide backup should any local hub or Internet connection have problems. With one DS3 at each of the three primary hubs this network could support 4,800 customers with average bandwidth of 1.5 Mbps.

Version 1 – Wireless Backhaul Network

In this section we will discuss the key assumptions and inputs to our financial model.

We began by determining the people that would be required to operate a small broadband company. The key position in this company will be the General Manager. The General Manager must be experienced with broadband and have experience managing people. In a small company of this size this person makes all of the important decisions. This individual must also possess good number, written and oral communications skills. Because of the relatively small size of the company, the General Manager positions will be a working position. The General Manager will be in charge of day-to-day operations of all aspects of running the company. We assumed a starting salary for the General Manager at $80,000.

In order to effectively cover a three county footprint, we slated six Field Technicians. These technicians would be responsible to install, maintain and trouble shoot the wireless network. They would be responsible for customer installation paperwork and the maintenance of assigned truck, tools, and equipment. The starting salary for Field Technicians is $40,000

A company this size will also need three Help Desk Representatives. These employees will help customers to get connected to the Internet and will answer technical questions from customers. Since most Internet inquiries are often about customer's computers, they also will help customers generally with computer issues. They must be able to help customers make the Internet and their computers work. The starting salary for Help Desk Reps is $30,000.

We have also proposed to hire two Customers Service Representatives. They will be responsible for taking orders for new business and for answering customers questions about billing and service issues. Customer Service Reps will need a basic working knowledge of the company's technology and will serve as back-up to the Help Desk. The starting salary will be $30,000 per year.

We have also assumed a full time Sales Coordinator for the new company. This person will be in charge of sales and marketing efforts. The Sales Coordinator will be responsible to developing product promotions to enhance sales. The starting salary for Sales Coordinator is $40,000.

We have assumed an annual increase in salary for all positions of 3% a year and benefits to be 20% of annual salary.

Training will be the building block for the new broadband company. Because of the technical nature of the work, almost all functions must begin with some formal training, accompanied by on-the-job training. The model assumes annual training of $1,000 for each customer service representative and $5,000 annually for Installers and Help Desk Representatives.

We have assumed that the company will lease office space in the Tri-County area. We based the rent upon existing rental rates in the area. To house this many people and the Internet headend we have assumed a monthly lease of $4,000 including floor space and basic utilities.

We estimated general insurance at $7,000 per year. We have estimated $25,000 for desks, chairs and other office furniture. We have also assumed a computer for each employee at $1,500 per employee.

The new company will market broadband services to customers who have historically had no access to high speed Internet. For purposes of the feasibility study we have assumed three speeds and have labeled them low, medium and high. The actual speed of each product is not specified on our study. In the Version 1 study the average customer gets 500 Kbps. This means we could probably have a 256 Kbps product, a 500 Kbps product and a 1 Mbps product. In Version 2 the average bandwidth per customer is increased to 1.5 Mbps and the three products would be correspondingly faster. The low speed product is $45.00 per month, the medium speed is $75.00 per month and the highest speed is $150.00 per month. We have not specified different prices for residences and business. Some providers make this sort of price differentiation, and if this was done the residential prices would be lower than the business rates.

Residential and business sales are would be achieved with an aggressive marketing and advertising campaign. However, we assume that if this venture was backed by the Counties that there would be a lot of free advertising as the Counties got the word out that there was a new broadband option. In addition to the sales coordinator position we have assumed $112,000 for sales and marketing for the first year of operations, $93,000 the second year and an annual budget of $75,000 for the remaining years. Sales would be achieved through direct mailings, newspaper, and radio advertising.

We have assumed an ongoing monthly cost for billing at $.50 per customer per month. We assume most customers will pay using a credit card while some will want traditional bills. We assumed a 3% fee for all credit card purchases. The model assumes a $50,000 initial purchase of billing software.

The new company will need to purchase vehicles for each field technician. We have estimated a cost of $20,000 per vehicle. Each vehicle will require, fuel, maintenance and insurance and we estimated this annual cost at $4,200 per vehicle per year. These estimates are based upon today’s average rates for gas and insurance and routine maintenance.

In order to provide bandwidth, the company must operate and maintain dedicated connectivity to the Internet. The company will get Internet access using a dedicated DS3. The estimated cost of an Internet DS3 in Southern Maryland today is $9,000 per month.

We also estimated start-up and administrative expenses in the model. These expenses include outside legal council, accounting and auditing, copies, supplies and other miscellaneous expenses. New businesses also require many one-time start-up costs. This would include legal advice that we estimated at $20,000. We have also assumed additional start-up costs of $50,000 that will be used to pay for such things as licenses, permits and professional services. There are other startup costs like office supplies, business cards and letterhead. As the business matures, we have an annual budget of $5,000 for legal, $17,000 for accounting

and $10,000 for copies and supplies. In addition to these expenses we have assumed $30,000 for annual miscellaneous expenses.

We have assumed the business will incur two primary taxes. First, we have assumed that the business would have to pay state and federal income tax when they are profitable. We have assumed a corporate effective rate of 33%. However, if the business decides to operate as a cooperative they may be able to avoid income taxes. Business that own assets like a wireless network also have to pay property taxes. We assumed a property tax rate at 3% of equipment values.

We assumed that the new company would be financed through a combination of debt and equity. We don't believe this company can be started without contributing at least some capital. The model shows a 20% equity contribution and 80% financed at 6.5% for seven years. We have assumed that the loan would be interest and principle free for the first year, thus requiring eight total years to repay. This sort of construction loan is typical for start-up businesses that require significant assets. Actual financial terms would need to be negotiated with a bank, but these terms are typical of what we see for other small firms today. The Wireless Backhaul Network model requires a loan of $2,040,000 and an equity infusion of $510,000.

We assumed that the Wireless Backhaul Network could support 2,400 broadband Internet customers. For model purposes we assumed 1,985 residential customers and 415 business customers. This works out to equal 13.5% of the unserved houses and businesses in the Tri-County area. Since we will be selling in areas of the counties where there are no other Internet options, we assume there is a lot of pent-up demand for services.

The rate of new customer installations will be limited by the number of employees who can install new customers. We have six installers in our financial plan and we assume that each one can hook up two new customers per day. At that rate it would take ten months to connect 2,400 customers.

Version 2 – Local Network

Version 2 is the "Local Wireless Network" which is a more robust network made up of multiple local rings. The majority of the assumptions are the same for both versions. The primary difference is the robustness and capacity of the network. In this model we have doubled the number of primary tower locations. We also bring one Internet hub and Internet feed into each County. The network is more robust locally, and still has redundant wireless backhaul should any tower experience problems.

We have added one additional Help Desk Representative and one full time Network Technician. The Network Technician is responsible for servicing and maintaining the broadband network. The Network Tech will evaluate sales forecast to plan and site network equipment to meet customer demands. The Network Tech also plans for and assists in the implementation and coordination of network maintenance and restoration activities.

In Version 2 we have increased the advertising budget to $167,000 for the first year of operations, $133,000 for the second year with an annual budget of $75,000 for the remaining years.

This more robust network will require three dedicated DS3s for Internet access. The estimated cost of one DS3 is $9,000 per month.

We assumed that the Local Wireless Network could support 4,800 broadband Internet customers. For the model purposes we assumed this would be 3,062 residential customers and 768 business customers. This works out to equal 26% of the unserved houses and businesses in the Tri-County area. We believe this to be a conservative business goal when one considers that the nationwide residential penetration rate for broadband is now above 40% and growing rapidly. One problem (albeit a good one) that this sort of business might face would be a higher demand than predicted by our study from households with no other broadband options. With the six installers in our business plan it will take twenty months to connect to 4,800 customers.

B. Business Plan Results

In this section we look at the results of the two versions of the wireless business plan. In this sort of business there are many ways to measure success. The first key to success of any business is operating profitability. Companies measure operating efficiency by looking at EBITDA (Earnings before Interest, Taxes, depreciation and Amortization). A positive EBITDA means that a company is generating enough revenue to cover its operating expenses. Both scenarios will generate positive EBITDA in the second year of operations. That early success depends on one major fact – that there is pent-up demand for broadband services in areas that have no broadband today. It is our expectation that if this sort of business was started, with County backing, that customers would show up in droves to be able to finally get broadband.

Another way to measure financial success is by looking at Net Income. Net Income is total revenues minus total expenses. Net Income is more important to mature companies than it is to start-up companies. By definition, almost every start-up company will have Net Income losses for a few years. This particular business plan happens to be capital intensive – it requires a significant amount of assets in the form of radios and antennas. One generally expects capital intensive firms to have negative net income in the early start-up years because of significant depreciation expense. Depreciation is an expense that is recognized to show the use of the assets over time. Depreciation tends to be highest in the early years, and thus has a significant affect on start-up profitability. Even so, Version 1 has a positive net income in the second year while Version 2 has a positive Net income in the third year.

A third way to look at a business is to look at the ability to generate cash. A business that can generate cash is able to self-fund future growth and can afford to replace its assets over time. The very conservative Version 1 generates only $1M in cash over ten years and is not very

successful by this measure. The more realistic Version 2 generates $6.4 million in cash over ten years.

A final way to judge a new investment is to look at the Internal Rate of return (IRR). IRR is a way to measure the return on the investment made in a company. In these models we have assumed that any banks are going to want to see 20% equity from the founders in order to start this business. This 20% cash infusion is the only investment made in the company and the remaining funding is assumed to come from bank loans. The returns on the initial equity investments are fantastic in these models. In the conservative Version 1 the 10-year IRR is 44%. In the second version the 10-year IRR is 72%. Generally banks would expect IRRs of at least 30% to 40% for new ventures.

Thus, under any of these typical financial measures these wireless business plans have the potential to be successful. Version 1 is a lot riskier than Version 2, which indicates that we should plan for a more robust network.

Following are ten-year financial statements for both versions of the business plan. Included are an Income Statement, a Statement of Cash Flows, and a Balance Sheet for each version of the business plan.

Some highlights of each plan:

Version 1 – Wireless Backhaul Network

This is our conservative business plan in that that network will support only minimal customers and can offer relatively slow internet speeds. This business plan just barely works over the ten years. We are certain that that customers will want more bandwidth than this model offers, but average speeds of half a meg are far better than dial-up for customers with no alternatives.

Some key financial results of this business plan:

- Positive EBITDA in Year 2
- Positive Net Income in Year 2
- 10-year IRR of 44%
- $1.7M of Equipment – around $700 per customer
- Generates $1M in cash over ten years.

Version 2 – Local Wireless Network

We believe this version is a more realistic look for the potential for this business. This version constructs a network that can support 26% of the unserved homes and businesses in the County. This version generates enough cash to be self-funded to grow and serve even more customers. The network is modular and can be grown to almost any size needed. The Internet speeds offered in this version are comparable, and maybe even a little superior to

competitive products. While the network can support an average customer bandwidth usage of around 1.5 Mbps, this means that high-end customers will be able to get a product of roughly 3 Mbps.

Some key financial results of this business plan:

- Positive EBITDA in Year 2
- Positive Net Income in Year 3
- 10-year IRR of 72%
- $3.3M of Equipment – around $700 per customer
- Generates $6.4M in cash over ten years.

Income Statement, Cash Flow Statement and Balance Sheet

Version 1 – All Wireless Model

Income Statement

	Year 1	Year 2	Year 3	Year 4	Year 5
Operating Revenue					
Residential Low	96,795	600,255	640,440	640,440	640,440
Residential Medium	94,125	583,650	622,800	622,800	622,800
Residential High	27,000	166,800	178,200	178,200	178,200
Business Low	8,370	52,470	57,240	57,240	57,240
Business Medium	30,600	192,150	209,700	209,700	209,700
Business High	22,200	139,800	153,000	153,000	153,000
Installation Revenues	72,000	51,800	6,550	6,850	7,200
Total Revenues	351,090	1,786,925	1,867,930	1,868,230	1,868,580
Less Bad Debt:	7,022	35,740	37,359	37,365	37,372
Net Revenues	344,068	1,751,185	1,830,571	1,830,865	1,831,208
Operating Expenses					
Vehicle Expense	20,706	26,496	27,244	28,061	28,903
Tools & Equipment	4,814	6,048	6,121	6,182	6,244
Rent and Maintenance	121,000	157,440	158,923	160,451	162,024
Computer	3,762	5,304	5,517	5,682	5,853
Network Maintenance	329,583	469,875	482,621	495,750	509,272
Internet Transport	72,000	108,000	108,000	108,000	108,000
Advertising & Marketing	112,500	93,750	75,000	75,000	75,000
Sales Expense	41,670	51,504	53,045	54,636	56,275
Customer Service	50,000	75,000	79,568	81,955	84,414
Billing	10,537	65,500	70,247	70,247	70,247
Executive Expenses	100,000	103,000	106,090	109,273	112,551
General Accounting	12,000	17,364	17,981	18,625	19,294
Start-up Costs	50,000	0	0	0	0
Legal Expense	20,000	7,000	5,000	5,250	5,513
Other Gen & Admin	32,666	42,360	43,230	43,892	44,586
Property Tax	0	33,460	38,583	29,079	19,918
Total Operating Expenses	981,238	1,262,101	1,277,169	1,292,083	1,308,094
EBITDA	(637,170)	489,084	553,402	538,782	523,114
Cumulative EBITDA	(637,170)	(148,086)	405,315	944,098	1,467,212
Depreciation	94,177	301,627	316,780	316,780	316,780
Interest Expense	0	125,594	109,662	92,660	74,520
Net Income Before Taxes	(731,347)	61,863	126,960	129,342	131,814
Income Taxes	0	0	0	0	0
Net Income	(731,347)	61,863	126,960	129,342	131,814
Cumulative Net Income	(731,347)	(669,484)	(542,525)	(413,182)	(281,368)

Version 1 – All Wireless Model

Income Statement

	Year 6	Year 7	Year 8	Year 9	Year 10
Operating Revenue					
Residential Low	640,440	640,440	640,440	640,440	640,440
Residential Medium	622,800	622,800	622,800	622,800	622,800
Residential High	178,200	178,200	178,200	178,200	178,200
Business Low	57,240	57,240	57,240	57,240	57,240
Business Medium	209,700	209,700	209,700	209,700	209,700
Business High	153,000	153,000	153,000	153,000	153,000
Installation Revenues	7,600	8,000	8,400	8,900	9,300
Total Revenues	1,868,980	1,869,380	1,869,780	1,870,280	1,870,680
Less Bad Debt:	37,380	37,388	37,396	37,406	37,414
Net Revenues	1,831,600	1,831,992	1,832,384	1,832,874	1,833,266
Operating Expenses					
Vehicle Expense	29,770	30,663	31,583	32,531	33,507
Tools & Equipment	6,306	6,369	6,433	6,497	6,562
Rent and Maintenance	163,645	165,315	167,034	168,805	170,629
Computer	6,028	6,209	6,395	6,459	6,524
Network Maintenance	523,201	537,547	552,323	567,543	583,219
Internet Transport	108,000	108,000	108,000	108,000	108,000
Advertising & Marketing	75,000	75,000	75,000	75,000	75,000
Sales Expense	57,964	59,703	61,494	63,339	65,239
Customer Service	86,945	89,554	92,240	95,008	97,858
Billing	70,247	70,247	70,247	70,247	70,247
Executive Expenses	115,927	119,405	122,987	126,677	130,477
General Accounting	19,989	20,710	21,459	22,237	23,045
Start-up Costs	0	0	0	0	0
Legal Expense	5,788	6,078	6,381	6,700	7,036
Other Gen & Admin	45,315	46,081	46,885	47,729	48,616
Property Tax	10,532	4,998	9,110	7,898	10,964
Total Operating Expenses	1,324,658	1,345,879	1,377,573	1,404,670	1,436,922
EBITDA	506,942	486,113	454,811	428,204	396,344
Cumulative EBITDA	1,974,153	2,460,267	2,915,078	3,343,282	3,739,626
Depreciation	315,847	(125,466)	44,300	51,720	58,400
Interest Expense	55,163	34,514	12,481	0	0
Net Income Before Taxes	135,931	577,065	398,030	376,484	337,944
Income Taxes	0	142,437	131,350	124,240	111,522
Net Income	135,931	434,628	266,680	252,244	226,423
Cumulative Net Income	(145,437)	289,191	555,872	808,116	1,034,538

Version 1 – All Wireless Model

Cash Flow Statement

	Year 1	Year 2	Year 3	Year 4	Year 5
Cash Flow From Operations					
Net Income	(731,347)	61,863	126,960	129,342	131,814
Plus Depreciation and Amortization	94,177	301,627	316,780	316,780	316,780
Less Increase in Accounts Receivable	(80,144)	(72,251)	(153)	(25)	(29)
Plus Increase in Accounts Payable	106,325	(5,687)	5,792	1,243	1,334
Net Cash Provided by Operations:	(610,989)	285,551	449,380	447,340	449,900
Use of Cash from Investing Activities					
Equipment	(1,209,500)	(472,400)	0	(11,400)	(3,900)
Total use of Cash from Investing	(1,209,500)	(472,400)	0	(11,400)	(3,900)
Cash Flows From Financing Activities					
Loans	1,620,000	420,000	0	0	0
Principle Repayment	0	(237,920)	(253,852)	(270,854)	(288,994)
Owners' Contribution	405,000	105,000	0	0	0
Total Cash Flows from Financing Activities	2,025,000	287,080	(253,852)	(270,854)	(288,994)
Net Increase (Decrease) in Cash	204,511	100,231	195,527	165,086	157,005
Cash, beginning of period	0	204,511	304,743	500,270	665,356
Cash, end of period	204,511	304,743	500,270	665,356	822,362

Version 1 – All Wireless Model

Cash Flow Statement

	Year 6	Year 7	Year 8	Year 9	Year 10
Cash Flow From Operations					
Net Income	135,931	434,628	266,680	252,244	226,423
Plus Depreciation and Amortization	315,847	(125,466)	44,300	51,720	58,400
Less Increase in Accounts Receivable	(33)	(33)	(33)	(41)	(33)
Plus Increase in Accounts Payable	1,380	1,768	2,641	2,258	2,688
Net Cash Provided by Operations:	453,126	310,898	313,589	306,181	287,478
Use of Cash from Investing Activities					
Equipment	(131,400)	(11,600)	(3,900)	(153,900)	(16,400)
Total use of Cash from Investing	(131,400)	(11,600)	(3,900)	(153,900)	(16,400)
Cash Flows From Financing Activities					
Loans	0	0	0	0	0
Principle Repayment	(308,351)	(329,000)	(351,028)	0	0
Owners' Contribution	0	0	0	0	0
Total Cash Flows from Financing Activities	(308,351)	(329,000)	(351,028)	0	0
Net Increase (Decrease) in Cash	13,375	(29,702)	(41,339)	152,281	271,078
Cash, beginning of period	822,362	835,737	806,035	764,696	916,977
Cash, end of period	835,737	806,035	764,696	916,977	1,188,055

Version 1 – All Wireless Model

Balance Sheet

	Year 1	Year 2	Year 3	Year 4	Year 5
Assets					
Cash	204,511	304,743	500,270	665,356	822,362
Accounts Receivable	80,144	152,395	152,548	152,572	152,601
Vehicles	120,000	120,000	120,000	120,000	120,000
Tools and Work Equipment	50,000	50,000	50,000	50,000	50,000
Furniture	25,000	27,000	27,000	27,000	27,000
Computers and Software	69,500	69,500	69,500	69,500	69,500
Internet Equipment	75,000	75,000	75,000	75,000	75,000
Wireless Equipment - Radios	150,000	150,000	150,000	150,000	150,000
Wireless Equipment - CPE	720,000	1,190,400	1,190,400	1,190,400	1,190,400
Less Accumulated Depreciation	(94,177)	(395,804)	(712,584)	(1,017,964)	(1,330,844)
Total Assets	1,399,978	1,743,234	1,622,134	1,481,865	1,326,019
Liabilities					
Long Term Debt	1,620,000	1,802,080	1,548,228	1,277,373	988,379
Accounts Payable	106,325	100,638	106,431	107,674	109,008
Total Liabilities	1,726,325	1,902,718	1,654,658	1,385,047	1,097,387
Owners' Equity					
Paid-in Capital	405,000	510,000	510,000	510,000	510,000
Retained Earnings	(731,347)	(669,484)	(542,525)	(413,182)	(281,368)
Total Owners' Equity	(326,347)	(159,484)	(32,525)	96,818	228,632

Income Statement, Cash Flow Statement and Balance Sheet

Version 2 – Local Wireless Network

Income Statement

	Year 1	Year 2	Year 3	Year 4	Year 5
Operating Revenue					
Residential Low	96,795	762,435	1,221,480	1,315,980	1,315,980
Residential Medium	94,125	741,450	1,188,000	1,279,800	1,279,800
Residential High	27,000	212,400	340,200	365,400	365,400
Business Low	8,370	66,555	99,900	99,900	99,900
Business Medium	30,600	243,825	365,400	365,400	365,400
Business High	22,200	177,300	266,400	266,400	266,400
Installation Revenues	72,000	144,000	42,150	13,600	14,300
Total Revenues	351,090	2,347,965	3,523,530	3,706,480	3,707,180
Less Bad Debt:	7,022	46,961	70,471	74,130	74,144
Net Revenues	344,068	2,301,004	3,453,059	3,632,350	3,633,036
Operating Expenses					
Vehicle Expense	20,706	26,496	27,244	28,061	28,903
Tools & Equipment	4,814	6,048	6,121	6,182	6,244
Rent and Maintenance	141,500	265,440	266,923	268,451	270,024
Computer	4,455	5,916	6,365	6,556	6,753
Network Maintenance	424,583	567,500	605,342	621,852	638,858
Internet Transport	216,000	351,000	324,000	324,000	324,000
Advertising & Marketing	167,500	133,500	75,000	75,000	75,000
Sales Expense	45,837	51,504	53,045	54,636	56,275
Customer Service	56,250	75,000	79,568	81,955	84,414
Billing	12,697	87,517	132,766	140,000	140,021
Executive Expenses	100,000	103,000	106,090	109,273	112,551
General Accounting	12,000	17,364	17,981	18,625	19,294
Start-up Costs	50,000	0	0	0	0
Legal Expense	20,000	7,000	5,000	5,250	5,513
Other Gen & Admin	40,583	42,360	43,230	43,892	44,586
Property Tax	0	37,455	69,118	67,196	48,338
Total Operating Expenses	1,316,925	1,777,100	1,817,792	1,850,929	1,860,774
EBITDA	(972,857)	523,904	1,635,267	1,781,421	1,772,262
Cumulative EBITDA	(972,857)	(448,953)	1,186,313	2,967,734	4,739,996
Depreciation	97,502	384,281	640,288	640,288	640,288
Interest Expense	0	203,168	177,393	149,891	120,548
Net Income Before Taxes	(1,070,359)	(63,546)	817,586	991,242	1,011,427
Income Taxes	0	0	0	222,724	333,771
Net Income	(1,070,359)	(63,546)	817,586	768,518	677,656
Cumulative Net Income	(1,070,359)	(1,133,905)	(316,319)	452,199	1,129,854

Version 2 – Local Wireless Network

Income Statement

	Year 6	Year 7	Year 8	Year 9	Year 10
Operating Revenue					
Residential Low	1,315,980	1,315,980	1,315,980	1,315,980	1,315,980
Residential Medium	1,279,800	1,279,800	1,279,800	1,279,800	1,279,800
Residential High	365,400	365,400	365,400	365,400	365,400
Business Low	99,900	99,900	99,900	99,900	99,900
Business Medium	365,400	365,400	365,400	365,400	365,400
Business High	266,400	266,400	266,400	266,400	266,400
Installation Revenues	15,050	15,850	16,700	17,550	18,500
Total Revenues	3,707,930	3,708,730	3,709,580	3,710,430	3,711,380
Less Bad Debt:	74,159	74,175	74,192	74,209	74,228
Net Revenues	3,633,771	3,634,555	3,635,388	3,636,221	3,637,152
Operating Expenses					
Vehicle Expense	29,770	30,663	31,583	32,531	33,507
Tools & Equipment	6,306	6,369	6,433	6,497	6,562
Rent and Maintenance	271,645	273,315	275,034	276,805	278,629
Computer	6,956	7,164	7,379	7,453	7,528
Network Maintenance	656,373	674,415	692,997	712,137	731,851
Internet Transport	324,000	324,000	324,000	324,000	324,000
Advertising & Marketing	75,000	75,000	75,000	75,000	75,000
Sales Expense	57,964	59,703	61,494	63,339	65,239
Customer Service	86,945	89,554	92,240	95,008	97,858
Billing	140,044	140,068	140,093	140,119	140,147
Executive Expenses	115,927	119,405	122,987	126,677	130,477
General Accounting	19,989	20,710	21,459	22,237	23,045
Start-up Costs	0	0	0	0	0
Legal Expense	5,788	6,078	6,381	6,700	7,036
Other Gen & Admin	45,315	46,081	46,885	47,729	48,616
Property Tax	29,256	14,015	5,041	3,262	10,237
Total Operating Expenses	1,871,279	1,886,539	1,909,008	1,939,494	1,979,731
EBITDA	1,762,492	1,748,016	1,726,380	1,696,727	1,657,421
Cumulative EBITDA	6,502,488	8,250,504	9,976,884	11,673,611	13,331,033
Depreciation	641,038	311,313	63,800	72,010	72,000
Interest Expense	89,239	55,834	20,191	0	0
Net Income Before Taxes	1,032,215	1,380,869	1,642,389	1,624,717	1,585,421
Income Taxes	340,631	455,687	541,989	536,157	523,189
Net Income	691,584	925,182	1,100,401	1,088,560	1,062,232
Cumulative Net Income	1,821,438	2,746,621	3,847,022	4,935,582	5,997,814

Version 2 – Local Wireless Network

Cash Flow Statement

	Year 1	Year 2	Year 3	Year 4	Year 5
Cash Flow From Operations					
Net Income	(1,070,359)	(63,546)	817,586	768,518	677,656
Plus Depreciation and Amortization	97,502	384,281	640,288	640,288	640,288
Less Increase in Accounts Receivable	(80,144)	(176,885)	(30,726)	(14,941)	(57)
Plus Increase in Accounts Payable	142,614	3,305	5,564	2,761	820
Net Cash Provided by Operations:	(910,387)	147,155	1,432,712	1,396,626	1,318,707
Use of Cash from Investing Activities					
Equipment	(1,346,000)	(1,439,700)	(576,240)	(11,700)	(4,200)
Total use of Cash from Investing	(1,346,000)	(1,439,700)	(576,240)	(11,700)	(4,200)
Cash Flows From Financing Activities					
Loans	2,000,000	1,300,000	0	0	0
Principle Repayment	0	(384,869)	(410,645)	(438,146)	(467,490)
Owners' Contribution	500,000	325,000	0	0	0
Total Cash Flows from Financing Activities	2,500,000	1,240,131	(410,645)	(438,146)	(467,490)
Net Increase (Decrease) in Cash	243,613	(52,414)	445,827	946,780	847,017
Cash, beginning of period	0	243,613	191,199	637,026	1,583,805
Cash, end of period	243,613	191,199	637,026	1,583,805	2,430,822

Version 2 – Local Wireless Network

Cash Flow Statement

	Year 6	Year 7	Year 8	Year 9	Year 10
Cash Flow From Operations					
Net Income	691,584	925,182	1,100,401	1,088,560	1,062,232
Plus Depreciation and Amortization	641,038	311,313	63,800	72,010	72,000
Less Increase in Accounts Receivable	(61)	(65)	(69)	(69)	(78)
Plus Increase in Accounts Payable	875	1,272	1,872	2,541	3,353
Net Cash Provided by Operations:	1,333,436	1,237,702	1,166,004	1,163,042	1,137,508
Use of Cash from Investing Activities					
Equipment	(133,000)	(12,200)	(4,500)	(304,500)	(17,000)
Total use of Cash from Investing	(133,000)	(12,200)	(4,500)	(304,500)	(17,000)
Cash Flows From Financing Activities					
Loans	0	0	0	0	0
Principle Repayment	(498,799)	(532,204)	(567,847)	0	0
Owners' Contribution	0	0	0	0	0
Total Cash Flows from Financing Activities	(498,799)	(532,204)	(567,847)	0	0
Net Increase (Decrease) in Cash	701,638	693,297	593,657	858,542	1,120,508
Cash, beginning of period	2,430,822	3,132,460	3,825,757	4,419,415	5,277,956
Cash, end of period	3,132,460	3,825,757	4,419,415	5,277,956	6,398,464

Version 2 – Local Wireless Network

Balance Sheet

	Year 1	Year 2	Year 3	Year 4	Year 5
Assets					
Cash	243,613	191,199	637,026	1,583,805	2,430,822
Accounts Receivable	80,144	257,029	287,755	302,696	302,753
Vehicles	120,000	120,000	120,000	120,000	120,000
Tools and Work Equipment	50,000	50,000	50,000	50,000	50,000
Furniture	35,000	37,000	37,000	37,000	37,000
Computers and Software	71,000	72,500	72,500	72,500	72,500
Internet Equipment	75,000	75,000	75,000	75,000	75,000
Wireless Equipment - Radios	275,000	300,000	300,000	300,000	300,000
Wireless Equipment - CPE	720,000	2,131,200	2,707,440	2,707,440	2,707,440
Less Accumulated Depreciation	(97,502)	(481,783)	(1,122,071)	(1,750,659)	(2,386,747)
Total Assets	1,572,255	2,752,145	3,164,650	3,497,782	3,708,768
Liabilities					
Long Term Debt	2,000,000	2,915,131	2,504,486	2,066,339	1,598,849
Accounts Payable	142,614	145,919	151,483	154,244	155,064
Total Liabilities	2,142,614	3,061,050	2,655,968	2,220,583	1,753,914
Owners' Equity					
Paid-in Capital	500,000	825,000	825,000	825,000	825,000
Retained Earnings	(1,070,359)	(1,133,905)	(316,319)	452,199	1,129,854
Total Owners' Equity	(570,359)	(308,905)	508,681	1,277,199	1,954,854

Version 2 – Local Wireless Network

Balance Sheet

	Year 6	Year 7	Year 8	Year 9	Year 10
Assets					
Cash	3,132,460	3,825,757	4,419,415	5,277,956	6,398,464
Accounts Receivable	302,814	302,880	302,949	303,018	303,096
Vehicles	120,000	120,000	120,000	120,000	120,000
Tools and Work Equipment	50,000	50,000	50,000	50,000	50,000
Furniture	42,000	42,000	42,000	42,000	47,000
Computers and Software	72,500	72,500	72,500	72,500	72,500
Internet Equipment	75,000	75,000	75,000	75,000	75,000
Wireless Equipment - Radios	300,000	300,000	300,000	300,000	300,000
Wireless Equipment - CPE	2,707,440	2,707,440	2,707,440	2,707,440	2,707,440
Less Accumulated Depreciation	(2,899,785)	(3,198,898)	(3,258,198)	(3,025,708)	(3,085,708)
Total Assets	3,902,429	4,296,679	4,831,106	5,922,207	6,987,792
Liabilities					
Long Term Debt	1,100,051	567,847	(0)	(0)	(0)
Accounts Payable	155,940	157,212	159,084	161,624	164,978
Total Liabilities	1,255,991	725,058	159,084	161,624	164,978
Owners' Equity					
Paid-in Capital	825,000	825,000	825,000	825,000	825,000
Retained Earnings	1,821,438	2,746,621	3,847,022	4,935,582	5,997,814
Total Owners' Equity	2,646,438	3,571,621	4,672,022	5,760,582	6,822,814

V. Solutions and Recommendations

The three Counties undertook this project because there was a general perception that there is a broadband gap in Southern Maryland. This study was undertaken to determine if the digital divide gap could be quantified and if there are ways the Counties could help to close the digital divide. In this section we will suggest solutions.

At the outset, we realize that we have presented the Counties with an enormous amount of information, and much of this information is changing rapidly. Some of the challenges facing the Counties require immediate attention. Other challenges would benefit from the development of more facts and a thorough, open debate of the options. All of the major decisions will involve difficult trade-offs. How should the Counties proceed to deal with the results of this report? Following is a summary of our recommendations. Following this summary we will look at each recommendation in more detail.

First, we suggest that the Counties develop some sort of a broadband czar, that is, create a position that would be responsible for bringing better broadband to the Counties and for closing the digital divide. Without such a position there is a fear that the other solutions proposed by this paper will not be implemented. Such a position need not necessarily be a new position. There are many different agencies where such a position might reside. For example, funding could be increased to the Tri-County Council or some other such group somewhere within the Tri-County. What is important is that solving the digital divide will need a champion – somebody who can work toward finding solutions across the region.

Second, we recommend that the Counties actively promote getting broadband to the unserved / underserved areas. We think this will require a two-prong approach. The first step would be to get commitment from existing providers to expand or establish the broadband business. Even with such a commitment there is going to remain substantial unserved / underserved areas of the Counties. We are recommending that the Counties promote the creation of a Cooperative to serve areas where nobody else will serve. We show in this study that such a business can be economically viable.

Third, we recommend that the Counties actively support the expansion of fiber into the area. There is fiber today in the three counties, but none of it is readily available for solving the general lack of broadband. There are a number of possible ways to promote fiber expansion and these will be discussed in more detail below.

Fourth, we recommend that the Counties heavily rely on the concept of partnering and facility-swapping to promote broadband expansion in the Counties. Almost all successful broadband entrepreneurs today rely on the idea of sharing building costs and operational responsibilities for networks.

Fifth, we recommend that the Counties formally lobby Comcast in order to get them to modify their installation cost requirements for businesses. Currently if a business is more than 125 feet from an existing Comcast service tap (and most businesses are further away

than that), then Comcast wants to charge them the full cost of constructing to meet them up-front before giving them cable modem service. Comcast will probably not agree to drop the requirement, but it's reasonable for Comcast to agree to spread the costs over time and thus make it easier for a business to get connected.

Sixth, Charles and St. Mary's Counties should consider changing their next franchise agreement so that CATV must be constructed when there are 15 or more homes per street mile. Today the requirement for 15 homes per street mile is used in Calvert county. However, the franchise agreements for Calvert and St. Mary's Counties call for 20 homes per street mile. Changing the threshold would bring cable modem service to many areas that aren't served today.

Seventh, we think the Counties ought to petition Verizon to have the Counties considered as places where Verizon would agree to build their Fiber-to-the-home FIOS systems.

Eighth, high tech economic development today requires diversity in addition to broadband. Businesses that use large amounts of broadband want to be on networks that are diversely routed so that problems in one part of the network do not shut them down. The Counties need to promote diverse fiber routing to all business parks and any other locations that are key for economic development.

Recommendation 1 – The Need for a Broadband Czar

Our first recommendation is that the counties together fund one person or organization to be in charge of implementing the broadband recommendations from this report, but more importantly to be tasked with making sure the Counties become current and stay current in broadband deployment for citizens and businesses. An example of another jurisdiction nearby who recently created a broadband czar is Loudon County, Virginia. Loudon County shares many characteristics with these three Counties – rural in nature, mostly a commuter population and with high growth.

We don't have any specific preference for how the counties should go about funding or creating this position – what is important is that somebody takes ownership of broadband issues. What we have seen with other government entities is that solutions can't be achieved unless somebody is tasked with making them happen. Some of the recommendations we have made in this report will require a sustained and focused effort to succeed.

If we were dealing with just one jurisdiction then we would have an easier time making a more specific recommendation. We would have been able to pinpoint where such a position ought to reside if we were working with just one County. However, with three Counties involved there is probably no one best place to place this position.

We think the Counties were correct in working together to get this study done. As it turns out, the Counties have a lot of similar problems and each County has a significant number of

residences and businesses that can't get broadband today. All three Counties are dealing with similar infrastructure, a similar lack of fiber, and with similar current service providers.

It certainly would be most economical for the Counties to fund this function together (as opposed to creating a separate position in each County).

One possible place to put this function might be in a place like the Tri-County Council. While the recommendation is to create a "czar", what we really mean is to assign the responsibilities to solve broadband issues to one person, one agency or one group. Thus, this function could be assigned to the Tri-County Council or some other organization that works for all three Counties.

We note that the person or group in charge of this effort must have some technical background. While this doesn't necessarily require an engineer it requires somebody who is familiar with broadband and fiber issues from a technical perspective. Since this is a position that functions with multiple counties, the position also would require somebody who is a consensus builder.

Such a function needs to be permanently funded. We don't have an easy estimate of the required level of funding. We would suggest the Counties choose the person, agency or group first and to ask them to then come back to the County governments with a funding request.

I hope this paper creates a sense of urgency for the Counties. There are currently a large bloc of homes and businesses without broadband and without County intervention this digital divide will become permanent. This means there will be neighborhoods that will be permanent broadband "have-nots".

It is CCG's opinion that neighborhoods without broadband will be disadvantaged over time. Today there is over a 40% nationwide household broadband penetration and this will soon be over 50%. We believe that when the majority of households have broadband that broadband will become an expected "utility". Kids living in houses without broadband are going to be disadvantaged compared to their neighbors (as was described in the Washington Post article that discussed this project). One would expect over time that homes without broadband will become undesirable for buyers who expect broadband.

Household broadband is still a relatively new product, having been around for only a few years. There are no academic studies that compare the difference between areas with and without broadband, but in a few years such studies will certainly be undertaken. We know that other parts of the country without broadband are very concerned about this issue. This is a huge issue in the rural West today since there are still entire counties without broadband. The people in these areas have all concluded that they must get broadband or else be left behind. We think this phenomenon will play out on a smaller scale and that neighborhoods without broadband will loss attractiveness over time compared to nearby neighborhoods with broadband.

In the end, if the Counties don't take the initiative to solve the broadband problems, these problems will not get fixed. The incumbent providers have already made all of the network broadband investments in these Counties that they are likely to make. There may be some alternatives arise, such as wireless providers who will serve some of the unserved areas, but most homes and businesses without broadband today are not likely to get broadband without County intervention.

Recommendation 2 – Bring Broadband to Unserved Homes and Businesses

Probably our most significant recommendation is that the Counties take an active role in bringing broadband to the unserved / underserved homes and businesses in the Counties.

We were tasked with several responsibilities in undertaking this part of our study. First, we were to look at existing technologies to determine the best fit for bringing broadband to the Counties. Second we were tasked to see if there was any economic justification for bringing broadband – in other words, could a broadband venture be financially successful and viable, Finally, we were tasked with determining the best business structure for a broadband business – government owned, commercially owned, joint venture, cooperative, etc.

In looking at technologies, we determined that the best technology today and into the unforeseeable future is a wireless broadband network. We considered Broadband over Powerline along with technologies such as Fiber to the Home and determined that wireless technology could best satisfy the diverse and scattered geographic footprint of unserved and underserved customers.

We created a business plan that looked at the economics of providing a wireless broadband network. We found that a wireless business can be a commercial success.

Finally we looked at the best business structure for such a business and determined that a cooperative best fit the needs of these counties.

If the Counties are going to take a hand in developing broadband, there are a number of options of how to get this accomplished:

- Try to get the incumbents to bring broadband to every home and business.
- Try to get private firms to deploy the needed broadband.
- Create a public / private partnership to bring broadband.
- Encourage the creation of a broadband cooperative to bring broadband.
- The Counties get into the broadband business themselves.

We think the best solution is to take a two prong approach. The first step would be to strongly encourage existing providers or other new firms to expand the broadband footprint in the Counties. For example, SMECO might be encouraged to deploy BPL (in a few years when it's a mature technology). The existing wireless providers might be encouraged to expand and the Counties might even give them help in raising expansion capital. New

providers might be encouraged to come into the area. Almost everybody we talked to during this process thought that a commercial solution for the Counties would be the best solution.

However, after considering the dispersed footprint of the many homes and businesses without broadband, it is our opinion that commercial providers will never be talked into serving all of these areas. Thus, unless some provider steps forward to serve everybody, then we also need to consider having the government promote or provide a solution.

We think the only economically viable way to serve the unserved / underserved areas is to encourage a Broadband Cooperative for Southern Maryland. This Cooperative would be formed with the concept of bringing broadband to all underserved areas of Southern Maryland. A Cooperative is attractive since it requires minimal government intervention or assistance. We see the government's role as seeding the funding to get the Coop started. If the Cooperative were to charge perspective members a start-up fee, the effort should quickly become self-funded. In our opinion the customers without broadband today are going to be without alternatives for many years to come. Since a Cooperative tends to emphasize what is best for its members, we think a Cooperative will bring the best in quality and service to the unserved parts of the Counties.

However, a cooperative is not the only possible way to solve the problem. Following is analysis of each option:

Encourage the Incumbent Providers to Bring Broadband to Everybody

The Counties could lobby Verizon, Comcast and GMP to bring broadband to every home and business in Southern Maryland.

However, this option looks to have little chance of success. The cable companies are already operating under franchise agreements that lay forth the areas they must serve. It is very unlikely that you will ever get them to agree to serve the least densely populated portions of Southern Maryland. Recommendation 5 suggests that we push the cable companies to do a little better than today, but this would still not bring a ubiquitous solution. Remember that we are estimating that there are 3,000 businesses and 14,400 residences without broadband today, and we believe those number are growing because of the pace of new construction in the Counties.

Verizon has technical limitations with DSL. Even were Verizon to deploy DSL in every central office and in every likely remote field cabinet, there would still be significant portions of Southern Maryland that could not get DSL. DSL has distance limitations and customer must be within a few miles of one of the DSL transmitters (DSLAMs). Even when customers are close enough to get DSL there are often problems with the quality of Verizon's wires, the customer's wires or some other part of the network.

This particular option has almost zero chance of bringing broadband to all of the homes and businesses that don't have it today. Of the incumbents we believe the best chance of getting any expanded coverage would be with GMP.

Encourage Private Firms to Deploy the Needed Broadband

This option has more chance of success and we recommend it as a very important step in solving the broadband shortage. Today there are two small firms already deploying wireless broadband in Southern Maryland. Neither of these firms has a very big footprint and both seem to have a relatively small number of customers. However, it might be possible to encourage these firms or similar commercial firms to serve some or all of the underserved areas of the Counties.

However, in our experience, government will have had a difficult time getting private firms to serve the entire footprint. There are a number of issues that might arise in trying to find a purely commercial solution to the problems:

- Businesses tend to cherry-pick. This means they tend to go after only the most lucrative customers. Thus, it might be hard to talk any business or combination of businesses into serving all of the unserved areas. Our business plan shows that if a company were to try to serve every unserved customer that a good business case can be made. However, if a company were to serve only the most densely populated areas they probably can make even more money than is shown by our business plan.
- Small private firms probably can't raise the needed capital. We have prepared two business plans. The smallest and most conservative plan requires a business to raise $2.5 Million in loans and equity. The larger more robust business plan, the version that really solves the broadband shortage, requires a total of $4.1 Million in total funding. Most small firms can't raise that much capital.
- There is no guarantee that a small firm will succeed. Even if the Counties could talk a firm into tackling the broadband shortfall, there is no guarantee that the business would complete the business plan, that the provider would remain solvent or that the provider would even remain in Southern Maryland. In our experience the sorts of firms that supply wireless broadband today tend to be small regional Internet Service Providers that have added broadband to an existing business. These sorts of providers are infamous for selling, merging and changing business plans. A permanent solution is needed in order for Southern Maryland to permanently solve the digital divide, and there is no guarantee that a commercial solution involving small providers will be permanent.

There are a few larger companies that could be of assistance in tackling this solution. For example, SMECO has regulatory barriers which prevent it from directly rolling out wireless. However, a regional broadband cooperative could play the middleman which could allow SMECO's fiber, towers, and other future wireless assets to be used in conjunction with or as a precursor for eventually rolling out BPL. This could

alleviate the regulatory barriers for SMECO's participation. The Counties might also be able to tempt some other larger company into trying this, although the list of potential candidates is small and quickly shrinking. With telephone companies gobbling up MCI and AT&T there are fewer and fewer larger companies who might consider coming to Southern Maryland with broadband.

We note that an additional commercial wireless provider might be coming to Southern Maryland. Bay Broadband is a company that supplies wireless broadband on the eastern shore of Maryland, and they have posted a legal notice in the newspapers recently showing they applied for a loan from the Rural Utility Service, a branch of the Department of Agriculture. The RUS supplies low-cost loans to promote broadband in rural and underserved areas. There is no guarantee that Bay Broadband will actually get such a loan, and there is no guarantee that they will serve all of today's unserved areas. We note that on the eastern shore that Bay Broad offers a relatively low speed product in most areas of around 250k, which, while better than dial-up is not really broadband in today's environment.

If the Counties want to pursue promoting private investment there are two ideas worth considering. First, you could issue and RFP to see if any companies might be interested in serving all three Counties. We don't think you will get any takers, but you really never know until you try. Second, the Counties could decide to assist a private provider with some sort of incentives. Worchester County Maryland recently made a $500,000 investment in broadband to kick off a solution for the County. The Counties could kick in some of the start-up money, guarantee loans or give some sort of tax abatement to entice a private company to make the needed investments and to serve the entire region.

Partner with a Private Firm

Another idea is to partner with a commercial firm to bring broadband to the unserved areas. This idea is similar to the last idea, but here the Counties would take a more formal role. There are a number of ways the Counties could partner with a private provider. However, there are generally a number of legal complications that make such partnerships quite tricky to implement. If this idea were to get serious consideration I would recommend you start the process by talking to a good municipal attorney who would understand the legal barriers in Maryland to creating a partnership with a government entity.

A partnership could be defined in a number of different ways. There really is no limit on how a County and a private provider could work together to bring broadband. Some partnering ideas include:

- Counties provide some of the funding in the form of a loan. The Counties might take no active role in running the business and the Counties roll would be to stay involved until the loan is repaid to the Counties. Involvement could take many forms from a Board seat to a true ownership share. Probably in the

ideal situation the Counties would bow out after the business was a success and the loans were repaid.

- Counties and the partners have an equal say in running the business. There could be different proportions of ownership based upon level of investment. In such a situation the government is really getting into the business and is acting like a partner in any business. The best example I know of this type of partnership is a broadband fiber network operated by the City of Memphis, Tennessee and a private partner.
- County could solicit a partner for technical assistance in the start-up years. In such a case the partner would eventually expect to be liquidated with the government taking over the business. Of course, this could also work in reverse with the government bowing out after a successful business was up and operating.

There is no real limit on the possible permutations such a partnership could take. There are a lot of considerations in finding a partner. At CCG we always say that making a partnership work is even more difficult than a marriage (and we all know the marriage divorce rate). It is very important that you know, trust and like your partner. If not, only bad things will happen. It is essential that both parties understand all of the obligations. There should be firm unambiguous rules for: governance, capital contributions, capital calls, profit distribution (or reinvestment), and for day-to-day decision making. It's also important to find a partner with staying power. This is very hard to do in the communications space. Both small and large firms seem to come and go these days. The firm you partner with today might get into financial difficulties, might merge or be bought by somebody else, or might just have a change of philosophy. In the end we believe public / private partnerships are very difficult to do well. Governments and for-profit firms have such different motives and different outlooks and make very unlikely partners.

Encourage the Creation of a Broadband Cooperative

The option that we think works best for Southern Maryland is for the Counties to promote the creation of a broadband cooperative. A broadband cooperative would be a business that is owned by the customers that use it. Everybody in the region is already well aware of the benefits of a cooperative because of SMECO.

There are many benefits of a cooperative in this situation.

- Only residences and businesses without broadband alternatives would be motivated to join initially. This means the folks who most need a solution can band together to solve their own problem. Of course, over time, if the Cooperative was successful many other customers in Southern Maryland might ask to join.
- A Cooperative generally watches out for its members above other considerations. Cooperatives are essentially non-profit companies. They may generate and retain cash for future expansion, but in the long run profits are used to benefit owner / members.

- A Cooperative would be highly motivated to stay current with technology. As newer and better technology is available over the years the Cooperative is likely to work hard to bring the best possible broadband to customers. This is a very different philosophy than what we see with the incumbent providers who seem to think that what they offer is good enough.
- A Cooperative might be exempt from many taxes, and thus might make even more profit than is shown in our business plans. A Cooperative would be likely to use some of the profits to lower prices.
- Up-front membership fees are a convenient and easy way to raise seed capital for a Cooperative. For example, if each new member were required to make a $200 contribution as an entrance fee into the Coop, then there might be as much as $500,000 to $900,000 raised in seed capital. With that kind of equity it should be relatively easy to borrow the remaining funds. Customers are generally okay with contributing to a Cooperative since there is the promise that excess profits will be returned to members in the future. A Cooperative could even promise to pay back the start-up fees after some period of time.

A Cooperative solves the broadband problem without an excess of government intervention. However, we believe it is necessary for the Counties to help get a Cooperative get started. For example, the Counties might make a one-time grant to fund one person to get the Coop started. However, after the startup period the Counties should have no additional role or obligations.

Get into the Broadband Business Yourself

There are 98 other government entities that have already gotten into the wireless broadband business. These governments mostly use the wireless networks just for themselves, but very often they also sell broadband to businesses, and sometimes to residences. Following is the list of the governments that we know about that are already deploying wireless. There are dozens more in the process of rolling out wireless, with the largest being Philadelphia.

Governments in the Wireless Business

Nantucket, Massachusetts
Malden, Massachusetts
Island Pond, Vermont
Montpelier, Vermont
Croton on Hudson, New York
Jamestown, New York
Brockton, New York
York County, Pennsylvania
Allegheny County, Maryland
Ocean City, Maryland
Shenandoah, Virginia
Dickinson County, Virginia

Culpepper, Virginia
Arlington, Virginia
Alexandria, Virginia
Blacksburg, Virginia
Greensboro, North Carolina
Winston Salem, North Carolina
Charleston, South Carolina
Clemson, South Carolina
Hilton Head, South Carolina
Myrtle Beach, South Carolina
Surfside Beach, South Carolina
Adel, Georgia
Athens, Georgia
Quitman, Georgia
St. Cloud, Florida
Cocoa Beach, Florida
North Miami Beach, Florida
Jacksonville, Florida
Manalapan, Florida
Daytona, Florida
Gulf Breeze, Florida
Panama City, Florida
Dayton, Ohio
Akron, Ohio
Cincinnati, Ohio
Lexington, Kentucky
Owensboro, Kentucky
Franklin, Tennessee
Jackson, Tennessee
Scottsburg, Indiana
Marion, Indiana
Grand Haven, Michigan
Muskegan, Michigan
Marquette, Michigan
Gladstone, Michigan
DuPage, Illinois
Sun Prairie, Wisconsin
Waupaca, Wisconsin
Shawano, Wisconsin
Jackson, Wisconsin
Vivian, Louisiana
Baton Rouge, Louisiana
Washington, Louisiana
New Orleans, Louisiana
Lewis and Clark County, Missouri
Springfield, Missouri

Des Moines, Iowa
Chaska, Minnesota
Buffalo, Minnesota
Moorehead, Minnesota
Grand Marais, Minnesota
Linden, Texas
Granbury, Texas
Garland, Texas
Corpus Christi, Texas
Addison, Texas
Frisco, Texas
Austin, Texas
Oklahoma City, Oklahoma
Lincoln, Nebraska
Rio Rancho, New Mexico
Las Vegas, Nevada
Boulder City, Nevada
Cerritos, California
Long Beach, California
Lompoc, California
Hermosa Beach, California
Fullerton, California
Culver City, California
Encinitas, California
Los Angeles, California
San Diego County, California
San Mateo, California
Pleasanton, California
Milpitas, California
Livermore, California
Medford, Oregon
Ashland, Oregon
Pasco, Washington
Stevenson, Washington
Benton County, Washington
Spokane, Washington
Vancouver, Washington
Kennewick, Washington
Umatilla, Washington
Morrow County, Washington

There are a number of considerations for a government to consider before getting into the wireless business. These include:

- Legal Restrictions. Many states have laws that create barriers for governments to enter into a commercial business. A list that is kept current of

these barriers can be found at a website maintained by the Baller Herbst Law Group - http://www.baller.com/barriers.html. This list does not show any restrictions for municipal broadband in Maryland. While many states have specific restrictions against municipalities getting into the telephony or Cable TV business, there are few specific barriers today to broadband. However, as this site demonstrates, there is a broad movement by the large incumbent cable TV and telephone companies to stop municipalities from getting into any businesses. So while there seems to be no restriction in Maryland today, one might expect a legislative initiative by Verizon and Comcast should they perceive that Maryland cities were competing against them. To get a detailed analysis of legal restrictions in Maryland we would recommend contacting a lawyer like Jim Baller to do the legal research.

- Already in Some Line of Business. We find that the majority of communities that have gotten into the broadband business already run some other type of business such as water, wastewater, electric or some other municipal type business. Operating a business is not necessarily a natural thing for any government. We find that governments that already operate an existing business are far more comfortable with the idea of opening a new one.
- Community Support. A government must have community support before deciding to get into any business line. In conducting our interviews of businesses we got a number of businesses telling us that they didn't think government belonged in the broadband business. Of course, our surveys were not done scientifically, nor did we solicit many responses from residences, so what we found in conducting this study may or may not represent the wider community. If the Counties are going to consider getting into the broadband business, the first step taken should be to conduct a formal survey of community support for the project.
- Regulatory Barriers. In some states there are regulatory barriers that either restrict or in some other way define the rules for a municipality operating a communications business. Generally there are no regulatory restrictions on operating a broadband business, but this is still something that would require checking specifically for Maryland.
- Can Separate Business From Politics. Communities that run successful businesses are able to separate politics from business decisions. As an example, it would be politically easy to lower rates for a business line in order to get voter support, but this might not be the best decision to make for the business. Many governments handle this issue by creating a quasi-corporation separate from the rest of the government for running utilities and other businesses.
- Need a Clear Line of Responsibility and Accountability. A big issue that always arises when a government opens a business is how to make certain that the business will function properly from a management perspective. People that work in government are not automatically going to make good businessmen. It is essential that any business run by a government have a clear and sensible chain of command and decision making. The government

needs to know when it should monitor, when it should meddle and when it should leave the business alone. These are not always easy rules to define.

- Must be Prepared to Suffer Start-up Losses. Almost any new business is going to lose money, at least in the first few years. Any government entering a new business needs to be prepared to handle the political pressure that comes from operating a business that is losing money.
- Must Have a Sound Business Plan. Any new business needs a well designed business plan. Any ongoing business needs a formal capital and expense budget.
- Must have a Plan for Financing. The magnitude of the broadband business as outlined by these business plans would indicate that bond or some other typical government financing method would be needed to start a venture. Bonds are not always needed. For instance we know a few Cities who have gotten into the broadband business by using excess funds – but this is rare these days.
- Must Have the Political Will. Unless the Community is overwhelmingly in favor of starting a business, a government must be prepared for political resistance.
- Must Be Prepared to Fight with the Incumbent Providers. This is an interesting dilemma. Almost every government that has gotten into the broadband business has first requested that the services be provided by the incumbent cable TV and telephone companies. Normally the government only decides to get into business after these firms refuse to bring the needed solutions. However, when a government then decides to do things for themselves we have repeatedly seen the incumbents battle intensely to keep the government out of a competing business.

If a government is willing to consider all of those factors, then getting into the broadband business directly might have some appeal. I don't see this as the best option for Southern Maryland. As much difficulty as a single government might have in starting a broadband business, trying to do so across three different County governments seems to be too complicated. A business can't be run well by committee and without a firm chain of command it would be difficult to make the needed business decisions when multiple governments are involved.

Recommendation 3 – Actively promote fiber expansion into the Counties

Regardless of whether the Counties decide to somehow promote broadband for unserved customers, the Counties need to take a leadership role in getting more fiber built in the Counties. Today there are fiber networks that benefit individual companies like Comcast or Verizon, but there is no fiber that is more broadly benefiting the region. In the long run having more fiber will mean better broadband, both for the governments and for residences and businesses. More fiber will also allow the Counties to promote economic development in the Counties as a way to grow the tax base and keep commuters home.

There are at least three possible avenues for the Counties to pursue to promote more fiber:

- Network Maryland. Network Maryland is currently considering extending their fiber network to the 301 bridge with a presence in St. Mary's College. Unfortunately Network Maryland fiber can benefit the Counties, but it can't be used to benefit a commercial venture. Thus, having this network can help the universities and government agencies, but not much of anything else.
- Mid-Atlantic Broadband Cooperative. There is discussion with this group to build fiber through Southern Maryland. This is the same group that is bringing fiber to the Eastern Shore. There is apparently some state funding available for the project.
- SMECO. SMECO has informally offered to lease fiber to a "County-sponsored" regional business that was solving broadband shortfalls. Currently SMECO has bits and pieces of fiber in each County. However, they have plans to create several major rings in the near future. To the extent there is a suitable arrangement that creates no regulatory issues SMECO believes a financial agreement for leasing fiber assets could be worked out. This might ultimately be the best way to get bandwidth to where it's needed in Southern Maryland. SMECO also says it is willing to consider trading or swapping its fiber assets for bandwidth elsewhere in the region and this may create a non-monetary arrangement of mutual benefit.

The benefits of expanding fiber are obvious. Broadband backbone is expensive for customers in the region today. An internet DS3 in Southern Maryland costs $9,000 and upwards per month, significantly higher than in the Washington DC metropolitan area. Fiber will allow bandwidth to be brought to where it is needed. Broadband might be used to feed this wireless network. Broadband might be used at all key economic development sites like the Patuxent Business. Broadband fiber can offer a long-term alternative to the Counties who today rely on cable company INETs. More usable fiber in the Counties will mean lower broadband prices, mean more alternatives for customers, and allow the Counties to entice businesses to locate in the Counties.

In recommendation 1 we promoted having a broadband czar, and getting more fiber would be one of the tasks assigned to such an individual or group.

Recommendation 4 – Rely on partnerships and Swapping

We recommend that the Counties heavily rely on the concept of partnering and facility-swapping to promote broadband expansion in the Counties. Almost all successful broadband entrepreneurs today rely on the idea of sharing building costs and operational responsibilities for networks.

This concept would be most useful in the area of expanding fiber in Southern Maryland. It is unlikely that the governments in Southern Maryland could raise all of the funds necessary to get fiber built to all of the needed places, per recommendation 3 above. However, if Southern Maryland has a broadband czar promoting the expansion of fiber, this person can work to find creative ways to get fiber to where it's needed.

Today commercial firms widely accept the idea of partnering on fiber construction. Thus, when a fiber route is desired, the best economic way to get fiber built is to find somebody who wants the same or a similar route. Sharing can be done in a number of ways. More than one party can share the cost of construction. Alternatively, one party can build the fiber along with a long term lease from the second party to offset the cost of construction. Companies also widely share in the operating and maintenance costs on fiber routes. Years ago many companies wanted to have 100% control over their networks while today most companies see the economic sense in sharing costs.

Another common practice in network expansion today is swapping. Swapping is where use of a network in one place is swapped for use of a network elsewhere. One of CCG's clients pioneered this concept. Our client was DeltaCom. a long distance company in the South. DeltaCom acquired a large fiber route from Dallas to Atlanta back before there were many other fiber routes. Since there were many other network providers who wanted this route in order to complete larger networks, DeltaCom was able to extensively swap usage on this route for fiber elsewhere. Sometimes they swapped fiber pairs, meaning they gave up a pair on their route for a pair elsewhere. Other times they swapped bandwidth. In the end DeltaCom ended up with a fiber route that went to almost every major Southern City –and they did this without building any additional fiber.

One of the most important jobs of the broadband czar would be to constantly make sure all of the parties in Southern Maryland communicate with each other. It's impossible to partner and be cooperative on networks when parties don't share their plans with others. The broadband czars main role in might be as a facilitator between the many diverse parties in Southern Maryland.

Recommendation 5 – Change Comcast Business Installation Fees

Comcast charges an installation fee if a business customer is more than 125 feet from an existing Comcast power tap. There are quotes from businesses we interviewed of construction quotes from $450 to $30,000.

Comcast has this policy nationwide and I don't think Comcast can be talked out of charging for installation. However, the Counties ought to make an effort to get Comcast to agree to spread payments over time instead of requiring the payments be made up-front. In the end, spreading the payments would get Comcast the same revenue as today. However, spreading the payments would be a lot easier on customers and would get broadband to more businesses. Comcast certainly could require a term contract from a customer so that they were assured of getting repayment.

The Counties ought to first just ask Comcast to make this policy change. If that doesn't work, this ought to be considered as an issue to negotiate during any franchise renewal.

Recommendation 6 – Change Franchise Agreements to Bring Broadband to More Neighborhoods

Today there are different requirements for cable deployment in the Counties. Calvert County requires the cable company to construct cable when there are 15 or more homes per street mile. In the other two Counties this requirement is 20 homes per street mile. There are many neighborhoods in Southern Maryland with a home density lower than these thresholds, and this requirement is the major reason why there are large areas with no broadband coverage.

Our suggestion is that in the next round of cable franchise negotiations that Charles and St. Mary's Counties strive to get this standard lowered, maybe to the same 15 homes per street mile threshold as Calvert County. This would bring cable modem to a number of additional neighborhoods.

In considering this change, the Counties might want to first ask the cable operators to quantify how many houses this would impact. We assume is that the cable companies know household densities since they are applying these thresholds today.

This change will not be without cost to these providers and the Counties may need to barter other provisions in the franchise negotiations.

We did a quick survey of other towns and we found that CATV buildout requirements range in other jurisdictions from 15 homes per street mile to 25 homes per street mile. The Counties might want to talk to a law firm that specializes in cable franchise negotiations. Such a firm probably would have a good grasp on this issue in different parts of the country.

In any case expect the cable companies to fight hard against this request. The desire to take on this battle probably ought to be linked to the choices the Counties make concerning recommendation 2. If some sort of broadband business is going to be started to serve the unserved areas, then this recommendation becomes less important.

Recommendation 7 – Petition Verizon to bring FIOS Fiber-to-the-Home

Verizon is currently deploying a fiber-to-the-home network in many parts of its operating area. Verizon is selling this service under the name FIOS. Press reports differ, but Verizon is reported to be aiming to pass 1 million to 2 million homes with fiber by the end of 2005.

The FIOS system uses state-of-the-art fiber technology and Verizon is delivering tremendous amounts of bandwidth to homes and businesses. They have residential bandwidth products today on FIOS ranging from 5 Mbps to 30 Mbps. This is a broadband network designed to satisfy the need for broadband for the next 50 years.

At this point Verizon seems to be building FIOS to high growth and upscale communities. In this region there are FIOS builds proceeding in parts of Howard and Anne Arundel Counties. There are several FIOS builds in northern Virginia.

The Counties ought to present a request to Verizon to bring FIOS to Southern Maryland.

Currently Verizon seems to be building FIOS to neighborhoods and not to complete towns or Counties. This concerns a lot of people since to some degree Verizon is creating yet another class of have-nots. There will be customers with FIOS, customers with DSL and cable modem, and customers with no broadband all residing in somewhat close proximity to each other. However, I am sure the Counties would rather be dealing with the issue of having some customers with a lot of broadband rather than having nobody with a lot of broadband.

Recommendation 8 - Get Fiber Diversity at the Patuxent Business Park

Currently the Patuxent Business Park does not have diverse routing for telecommunications and data. This means that any company that depends on a reliable network will not locate there.

The Counties need to seek a redundant route for the Business Park. There are two ways to get diversity. First, the Counties could push Verizon to create diversity. Second, the Counties could deal with this themselves. A diverse route could be built by the Counties, or else built as part of a project to bring more fiber to Southern Maryland (Recommendation 3).

VI. Implementing the Solutions

In this section we discuss how a broadband solution could be implemented. At CCG we have assisted many companies get started with new businesses and this is probably our core competency.

The approach we take to launching a new business is to first create a task list. This lists all of the major tasks required to complete the business launch. Below is a task list for a wireless launch in Southern Maryland. We have chosen to create a task list for the Cooperative Option, but the task list for other implementation options would be similar.

At CCG we are big believers in the Gantt chart process. A Gantt chart takes the task list and assigns responsibility for each task and then sets each task on a time line. It is nearly impossible to create a live Gantt chart until all of the responsible people are involved in the process. In place of a "live" Gantt chart here we are listing the primary tasks and putting the major tasks on a time line. In any project the actual time needed for implementation is based upon the quantity, talent, and other obligation of the people involved in implementing the project. We are going to propose a generic time line below. This time line is going to assume that all of the people working on this project were dedicated to it full time and not distracted by other responsibilities.

A. The Task List

Following is a detailed task list for the launch of a wireless broadband provider in Southern Maryland. While this task list includes roughly 250 tasks, it is still a high-level list. Generally during the implementation process some tasks get fleshed out in more detail as the task is tackled. For example, where we have a task that says "install the radios", during actual implementation this task might get replaced by half a dozen more specific sub-tasks.

Following is the task list. Following this list will be a description of the major tasks to be completed as well as a discussion of the resources and issues associated with each major task.

Task List For A Wireless Broadband Network

Political Decision
- Three Councils Choose to Support Cooperative
  - Choose Specific Method of Support
  - Determine Funding
  - Approve Funding
  - Assign Responsibility for Starting Cooperative

Create the Cooperative
- Determine Entity Name
- Establish Business Entity
- Obtain Business License
- Create Bylaws
- File Articles of Incorporation

- File For Tax Status with IRS

Obtain Financing

- Seed Capital from Counties?
- Fees from Coop Members?
- Finalize Financial Business Plan
- Obtain Approval of Business Plan
- Convey Business Plan to all Parties
- Create Budget
- Obtain Budget Approval
- Determine Loan Requirements
- Create Loan Package for Banks
- Negotiate Bank Loan
- Finalize Bank Loan
- Obtain Funding

Organizational Readiness

- Design Logo
- Order Envelopes and Letterhead
- Identify Points of Responsibility
- Determine Regular Meeting Schedule
- Get General Liability Insurance
- Establish Bank Accounts
- Choose Lawyer
- Establish Governance Issues

Employee Readiness

- Hire General Manager
- Write Job Descriptions for Other Positions
- Establish Benefits
- Create Job Ads
- Interview Employees
- Hire Employees
- Establish Payroll Process
- Determine Employee Policies

Internet Backbone

- RFP to Various Backbone Providers
- Receive Bids / Contract Proposals
- Identify Negotiations Manager
- Choose Primary Vendor
- Red Line Vendor Agreement
- Return Red Line to Vendor for Acceptance
- Receive Executable Copy Back
- Sign Agreement and Return to Vendor
- Receive Vendor Account Manager
- Establish Master Service Agreement (if applicable)
- Determine Deposit Requirements
- Arrange for Letter of Credit or Deposit

Network Readiness

- Determine Interconnection Point(s) for Internet Backbone
- Create Network Schematics
- Create Final Network Plan
- Choose Radio Vendor

- Create RFP for Equipment
- Send RFP to Vendor List
- Review RFP Responses
- Choose Vendor
- Negotiate Price / Terms

Choose Primary Antenna Sites
- Identify Preferred Sites
- Identify Site Owners
- Supply Antenna Profile
- Request Prices
- Negotiate Contract
- Finalize Contract

Determine Neighborhood Antenna Sites
- Identify Preferred Sites
- Identify Site Owners
- Negotiate Price / Terms
- Negotiate Contract
- Finalize Contract

Network Engineering
- Line of Site Study between Major Sites
- Determine Power Requirements
- Determine Equipment Space Requirements
- Determine Neighborhood Antenna Sites
- Calculate Available Customer Bandwidth

Purchase Radio Equipment
- Determine Final Equipment Needs
- Receive Cost Proposal
- Accept Cost Proposal
- Order Equipment
- Determine Warehouse / Storage Needs
- Receive Equipment
- Determine Inventory Procedures

Install Radios
- Site Readiness
- Prepare Racks / Enclosures for Equipment
- Obtain Power
- Install Equipment
- Test Radios

Engineer the neighborhoods
- Determine Customer Locations
- Determine Best Local Antenna Sites
- Test for Line of Sight

Customer CPE Readiness
- Determine Tools Required
- Determine Best process
- Train Installers on Installation

Server Readiness

Order Server and Modems and Antennas
Building Ready (Including Power & Grounding)
Install Server and Modems

- Connect to Internet Backbone
- Test Server
- Set Up Email Server
- Set Up DNS Server
- Establish Process for Creating and Assigning IP Addresses
- Test Internet Connection

Purchase Other Assets

- Purchase Vehicles
  - Determine Best Vehicle
  - Obtain Bids
  - Purchase Vehicles
  - Get Tags
  - Get Insurance
  - Equip Trucks for Tool Requirements
- Purchase Tools
- Purchase Computers / Printers
- Purchase Furniture
- Purchase / Lease Copier
- Purchase / Lease Postage Meter

Establish Office Space

- Find Convenient Office Space
- Negotiate a Lease
- Create Signage
- Prepare Equipment Space
  - Wiring Requirements
  - Power Requirements

Customer Billing Readiness

- Solicit Bids on Billing Software
- Review Proposal from Vendors
- Approve Proposal from Vendor/Sign Contract
- Establish Implementation Schedule
- Bill Format
  - Design Bill Format and Bundling
  - Program for Bill Format and Bundling
- Determine Customer Rates
- Establish Rate Tables
- Choose Billing Cycles
- Develop Accounting Interface
- Ensure Proper Taxes to Bill
- Establish Process to Remit Taxes
- Develop Methods to Ensure Cash Integrity
- Establish Internal Interfaces
- Establish Credit Card Accounts
- Test Credit Card Billing
- Test Billing
- Determine Reporting Requirements
- Request Report Specifications
- Receive Report Requirements
- Develop Reports

Customer Provisioning Readiness

- Establish Implementation Schedule
- Establish Pre-Order Process
- Establish Order Process
- Test Order Process

Accounting Readiness

- Determine Tax Exempt Status
- Provide Tax Exempt Paperwork to Underlying Vendors
- Establish Chart of Accounts
- Revenue Accounting
- Define Managements Report Requirements
- Create Management Reports
- Choose Accountant
- Choose Auditor

Customer Service Readiness

- Establish Feeds
- Customer Service Solution Implementation
  - Establish Implementation Schedule
- Establish Procedures
  - Pre-Order Activities
    - Coordinate with Sales
    - Establish Hand Off Process
    - Determine Work Flow
    - Document Work Flow
    - Test Internal Process
  - Order Activities
    - Determine Work Flow
    - Document Work Flow
    - Test Internal Process
  - Trouble/Maintenance Activities
    - Determine Work Flow
    - Document Work Flow
    - Test Internal Process
  - Installation and Repair Activities
    - Determine Work Flow
      - Establish Toll Free Number
      - Trouble Call Handling
      - After Hours Service
    - Document Work Flow
    - Test Internal Process
  - Credit and Collections Activities
    - Determine Work Flow
      - Fraud
      - Drop Box Locations
    - Document Work Flow
    - Test Internal Process
  - Determine Customer Policies
    - Deposits
    - Credit Checks
    - Delinquent Customer Handling
    - Disconnection Policies

- Partial Payment Policies
- Reconnection Policies
- Forms
  - Create Service Order Forms
  - Establish Inventory of Forms

Marketing Readiness

- Define Competitors
- Define Target Market
  - Conduct Market Research Survey
- Define Product Line
  - Data
  - Other Media
- Establish Product Pricing
- Design Marketing Plan
  - Brochures
  - Other Media
  - Customer Welcome Package
  - Product & Services User Guide
- Establish Sales Plan
  - Find Friendly Customers for Beta Test
  - Create Sales Evaluation Process
  - Create Compensation Plan
  - Create Commission Plan
  - Program for Commission Plan
  - Sales Training
- Determine Need for Customer Contacts
  - Create Customer Contract

Quality Assurance Program

- Design QA Program
- Implement QA Program
- Design "Win Back" Program

B. The Major Tasks

Note that these task descriptions are written as if choosing the Cooperative is the plan of choice. Should one of the other alternatives be chosen the tasks would be almost the same except for tasks specifically associated with the Cooperative.

Political Decision

This is probably the most impossible task to predict, as far as a time line. This set of tasks includes getting buy-off from the three County Councils to support a broadband solution. Every solution is going to require some funding, even if the decision is made to try to find commercial providers to bring the needed broadband. In this specific scenario – creating a Cooperative, the Counties will probably need to fund a person or a group to at least get the ball rolling. Once the Cooperative is able to begin soliciting contributions from potential customers they should become self-sufficient and self-funded.

Create the Cooperative

Starting a Cooperative is more complicated than starting a normal corporation. In Maryland we have hand-carried through a normal C Corporation in one day. However, with a Cooperative there are also steps to take at the IRS to get tax-free status. We have never created a Cooperative, but we understand the process requires several months. The company would want to find a lawyer with experience in starting a Cooperative.

Obtain Financing

Once the Cooperative is created one of the first major tasks would be to line-up financing. It is our expectation that a business of this sort will require both equity and debt financing. In our business plan we have assumed that banks would want to see 20% equity (contributed start-up capital), but the amount required might be lower or higher than that.

In order to get bank financing the first required step would be to get a completed business plan. In this report we have developed a high level business plan and this would need to be fined tune to fit the specific final plan. A package would be developed for banks that would include financial projections and a written report describing the planned business.

It would be normal to try several banks for such a project. In our experience the best place to get this kind of money is with local banks. We have seen that the smaller regional banks have lost a lot of car loan and mortgage loan business in recent years due to the growth of credit unions. Such banks are generally very receptive to quality business loans. It would not be unusual if a local bank were to spread this loan among several local banks so that no one of them carried the full loan.

It is also possible to get some financing from other sources. For example, the Rural Utility Service (RUS), a branch of the Department of Agriculture is making subsidized loans to promote rural broadband. These loans are typically at lower interest rates and are designed to promote companies that will bring wireless to rural areas. There may be other types of grants and start-up money available from state sources.

Organizational Readiness

These are basic tasks that are associated with starting any new business. Included are such tasks as designing letterheads, choosing a lawyer and accountant, establishing a bank account and getting general liability insurance.

Employee Readiness

This set of task deals with finding and hiring the required employees. A new company needs to establish employee policies like vacations and sick leave, establish benefits, and establish payroll procedures.

Internet Backbone

One of the keys to having a successful wireless network is to find the most affordable, yet reliable Internet backbone bandwidth. These steps find, negotiate and purchase the bandwidth. There are a limited number of bandwidth providers in Southern Maryland and initially this bandwidth is going to have to come from Verizon or one of the long distance providers like Sprint or AT&T.

Network Readiness

Network Readiness is one of the major tasks. This involves the design, purchase, installation and testing of the new wireless network. There are a number of important tasks within this larger task:

Engineer the system. Determine the exact network. This study has given some suggestions on how to construct such a network. However, an engineer would need to look at our assumptions such as available equipment, available tower sites, desired bandwidth, etc. Assuming that it would be another year or more until this was re-engineered, there might be consideration given to the next generation of wireless equipment. Engineering also includes such things as determining the profile of the antennae, determining power requirements, and determining space requirements.

Choose the Radio Vendor. There is a generic process used to choose technical network equipment. Generally one first writes an RFP (Request for Proposal). This RFP would include detailed technical specifications for what you want to achieve. The RFP is sent to potential vendors and they are asked to respond if they can meet the technical specifications and they are asked to supply pricing. Prices are purely negotiable in this industry and we would want to try to get lower prices. Contracts with vendors generally also cover such things as spare parts, ongoing maintenance and technical support.

Determine Neighborhood Antenna Sites. The locations of the major primary antenna sites are determined as part of network engineering. Neighborhood antenna in this sort of mesh network can be placed at existing antenna sites but could also be placed on buildings, tall signs, or poles. Calvert County has a study that looks at potential antenna sites in the County. This study was done by Business Information Group of York and in the study they identified these secondary possible locations for local wireless antennas. This is the same sort of study that should be done for the whole Tri-County area. However, rather than pay a consultant for such a report, the new company might assign this as a task for the first few technical employees.

Purchasing Equipment. These tasks involve the actual purchase of the equipment. Part of this process will include developing procedures for receiving and inventory receiving and management.

Installing Equipment. There are a few options for installing equipment. First, employees can be trained to install the equipment. Installation can also be purchased as a service from the vendor. Finally, there may be a local or regional firm that specializes in installing equipment on antennas.

Testing the Network. The final step in creating the network is to test the new network thoroughly. Generally the process is to create a test plan. This is a list of different tasks and performance standards that are expected from the network. Then a procedure would be developed for testing each of these items.

Server Readiness

The business is in the broadband business and in essence they are going to be an Internet Service Provider (ISP). As such the business will need to be prepared to do all of the normal tasks associated with being an ISP. For example, the business should have an email server so that customer can route receive email through this network. The company should be able to assign IP addresses to customers. Finally, the company needs to be able to maintain a high quality Internet connection.

Purchase Other Assets.

There are other assets to purchase such as vehicles, computers, furniture, and office equipment like copiers and printers.

Establish Office Space

Like any new business, the company will need to find office space. They will need to define the space requirements, including any special needs associated with housing Internet servers. The company will need to search for space and negotiate a lease.

Customer Billing Readiness

The company must be prepared to bill customers. The first step in this process will be to find and purchase a billing / OSS platform. This is a computer system that allows the company to log in customer orders and that maintains the basic facts about the customer and the products purchased. Since this business has a pretty limited business line they should be able to use standard billing software used by many small businesses.

We assume that this business will want to bill as many customers as possible using credit cards. This saves on time, postage and envelopes. There are specific steps that must be taken in order to be able to receive credit card payments. Most businesses like this allow customers to choose between credit card and traditional billing, so the business also needs to be prepared to open envelopes and process checks.

The customer billing process needs to establish procedures and policies. For example, what happens when a customer doesn't pay the bill? How long before service is disconnected? How do we deal with our antenna at the customer site when they are disconnected? What do we do if a customer makes a partial payment?

The company also needs to design a bill that is clear to customers. The bills need to include all applicable taxes.

The billing system needs to somehow be linked to the accounting system so that revenues and customer receivables can get into the ledger. In the simplest solution the company can book manual accounting entries to recognize revenues. However, most companies today try to maintain automated billing and payment accounting so they can track cash flow.

Finally, the company needs to develop management reports that show the number of customers, the status of receivables, and other statistics related to customers and sales.

Customer Provisioning Readiness

The provisioning process is the steps that are required from the time that a customer signs up for our service until that customer receives his first bill. The company should have a clear and documented procedure for each step of this process. For example, how do we schedule the installation? How do we notify the installers of the work to be done? How do we accurately get the customer information into the billing system? There may be as many as a few dozen steps required to proceed from an order through a successful customer installation. At CCG we recommend that the process is fully documented so that orders can proceed even if we have employee turnover.

Accounting Readiness

Accounting Readiness is the steps needed to deal with the financial aspects of the company. This proposed company is too small to require a full time accountant. We would recommend that a company of this size outsource the process of keeping the books. However, the company is still involved in the financial process from collecting funds to purchasing materials and supplies. We note that many companies give little attention to accounting when they first start, only to find themselves unable to understand cash flows a year after they go into business. Getting accounting right is essential to successfully operating this type of business.

Customer Service Readiness

The customer service process is the process that takes orders from customers, takes trouble calls from customers, and that responds to customer inquiries. In this company we recommend two types of customer service employees. The business needs help desk technicians to answer technical questions about the wireless network, about the Internet and about computers. The business also requires a few customer service representatives who take orders and deal with billing and other financial issues. A company this small would cross-train between these two positions so that any customer service person can respond to the typical basic questions that customers have.

Customer service readiness involves establishing processes and procedures for dealing with customers. For example, there should be a standard process for walking a customer through the process of getting new service. There should be a clear set of procedures for dealing with customer problems. This would include having an escalation process so that important problems, such as network outages, get quickly conveyed to the right people within the company.

Sales and Marketing.

The sales and marketing process is how we inform potential customers about of existence and about our products. Interestingly enough, we find that when broadband comes to an unserved area that the best sales are done by word of mouth. It is likely that this company would get bombarded by inquiries from customers who want service.

There are a number of different ways that sales could be done in this company. One model that works really well is to do very specific targeted marketing, street by street. As the network is deployed to a new neighborhood we might want to knock on doors or leave door hangers announcing that broadband is coming to the neighborhood. This sort of sales approach allows for a concentrated installation process since we can concentrate sales and installations on a few neighborhoods at a time.

However, all of the more routine marketing techniques from billboards to newspaper ads should also be considered.

Quality Assurance Program

Finally, we always recommend a quality assurance program. This how a company knows how good they are doing. It is extremely important for the company and for employees to have specific goals. For example, the company should strive for a standard installation interval from the time a customer places an order – and then track how it performs compared to this ideal standard. A company can’t have real

quality service unless they take the time to truthfully measure how they are performing.

C. Time Line

In this section we will look at a basic time line to predict how long it might take to launch this sort of business. Obviously this can take longer, but with the right leader this could also happen much faster than predicted.

Political Decision

This is the hardest item to predict. In this case the recommendation is to get all three Counties to endorse the idea of a Broadband Cooperative and then fund at least one person or a group to get the Cooperative process started. This process could take anywhere from a quarter to a year.

Create the Cooperative

Forming the Cooperative is generally a task that will be handed by a lawyer. This process takes up to three months, but can be done while other tasks are proceeding.

Obtain Financing

Obtaining financing is a two-stage process. The most time consuming process is to solicit the required capital needed to get the Cooperative going. We know many Cooperatives have started by soliciting a start-up fee from prospective members. It might take six months to make the pitch and solicit fees from enough perspective members. The best pat of this process is that signing up members is the sales process and eliminates a lot of initial marketing costs.

Once the Cooperative equity has been collected the remaining funds must be borrowed. The normal bank loan process is two to three months. Borrowing from the RUS might take as long as nine months.

Employee Readiness

Hiring employees would require a month or two.

Network Readiness

Designing the network would require a month. Finding tower sites would require several months. During this time the equipment can be negotiated and purchased. Including installation and testing, the entire network process should not require more than six months.

Server Readiness

Done during the network readiness time line.

Purchase Other Assets.

Done during the network readiness time line.

Establish Office Space

Done during the network readiness time line.

Customer Billing Readiness

Done during the network readiness time line.

Customer Provisioning Readiness

Done during the network readiness time line.

Accounting Readiness

Done during the network readiness time line.

Customer Service Readiness

Done during the network readiness time line.

Summary of Time Line

Following are the critical path steps – those steps that determine how long it will take to start and open the business. All of the other tasks would be accomplished at the same time that these tasks are being accomplished.

Political Decision	-	3 - 12 months
Obtain Financing	-	6 - 9 months
Hire Employees	-	2 months
Buy and Install Network	-	6 months
Total time	-	17 - 29 months