

Existing Conditions Report: Broadband and Telecommunications



Washington County, NY

OCTOBER, 2015

Acknowledgements

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Produced by the Washington County Planning and Economic Development Department



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Introduction

Today, broadband is an increasingly vital component of our lives. Communications access and access to internet are critical tools for providing global access to information, business services, health services, education, public safety, and telecommuting options. Likened to the need for rural electrification in the 1930's, broadband is increasingly seen as an essential, not a luxury.

However, due to relatively low population density, topographical barriers, and geographical distances, as is the case in many rural areas access to broadband service is limited throughout Washington county as the costs to overcome these barriers is high.

Nor is the problem solved by the proliferation of the now multi-functional cell phones as adequate service to these devices is also limited throughout the county.

In an effort to better understand the extent of the problem, the County surveyed all residents and businesses to identify levels of satisfaction, and commissioned a cell propagation study to determine exact levels of cell phone coverage on major roads across the county. The results of this data are presented in this report as part of an ongoing effort to secure better access to broadband for all.

County Overview

Washington County is located within the Capital Region of New York State. In addition to Washington County, this area includes Albany, Saratoga, Greene, Columbia, Warren, Rensselaer, and Schenectady Counties. The 831 Square mile County is home to approximately 63,216 people distributed between seventeen (17) Towns and nine (9) Villages. The county is primarily rural/agricultural with low population density and business scattered throughout. There are no cities within the county, the highest population densities are found in the Villages of Hudson Falls, Fort Edward, and Fort Ann.

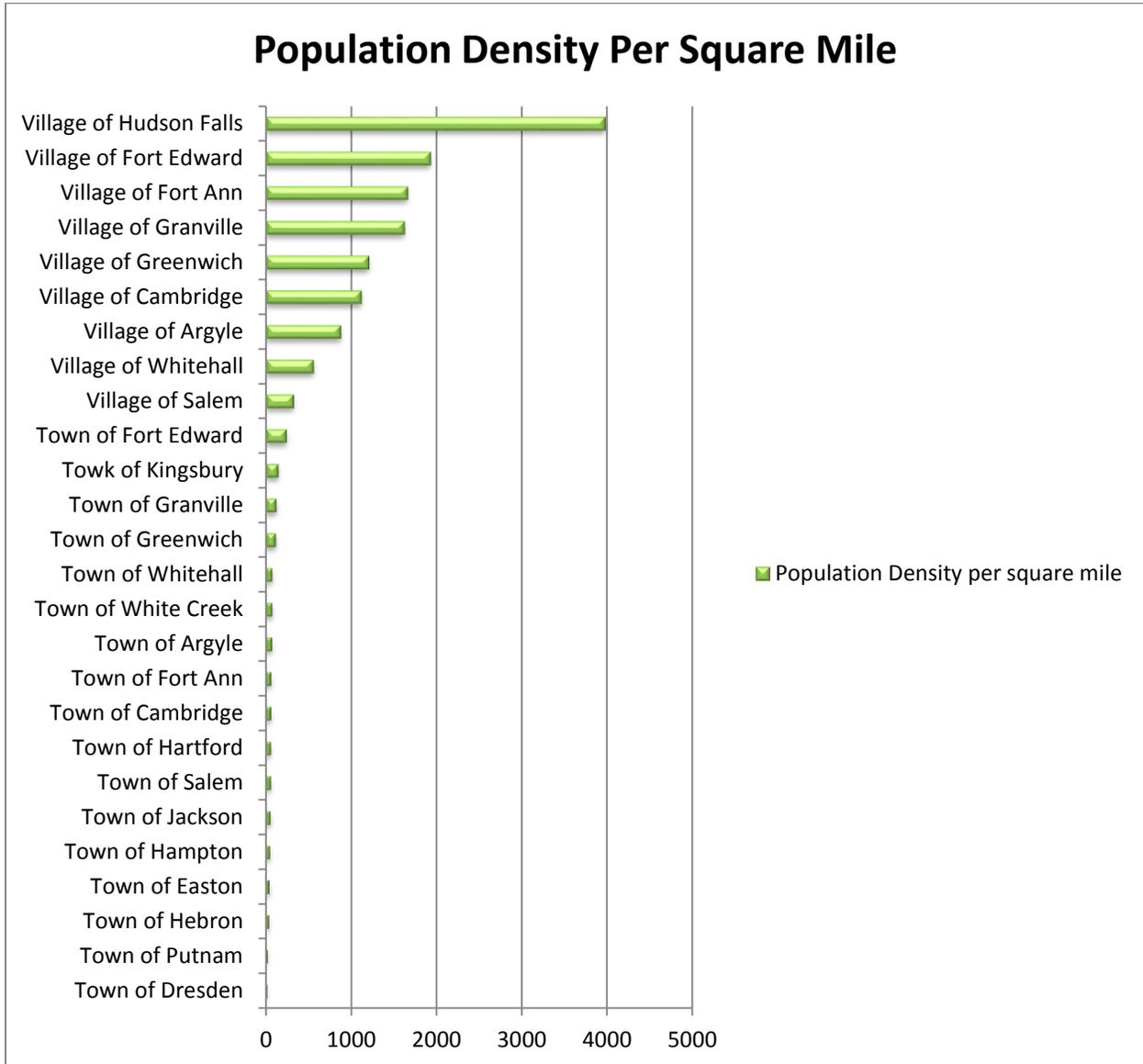
Demographic Profile

Washington County is part of the Glens Falls Metropolitan Statistical Area 50 miles north of Albany. It is adjacent to Saratoga and Warren Counties and forms part of the eastern border of New York State. According to the US Census, Washington County's population reached 63,216 in 2010, a 3.56% increase from the previous census in 2000. The Village of Hudson Falls is the most densely populated community within the County by a wide margin, followed by the



Villages of Fort Edward and Fort Ann. The majority of communities however, boast fewer than 500 people per square mile as can be seen in the chart in Figure 1 below.

Figure 1: Population Density



Source: Census 2010

Over the past decade, Washington County saw a significant increase in overall age of its population. The Median age increased from 37.5 in 2000 to 41.2 in 2010, a 9.8% increase. The increase in median age is mostly due to a loss of population in the 20-34 and 0-4 age cohorts, as well as a 20% jump in the number of persons between ages 45 and 54.

Between 2000 and 2010 there was a moderate increase in the number of occupied housing units growing from 22,458 units in 2000 to 24,142 units in 2010, a 7.5% increase, while the

number of total existing units increased as well, from 26,794 units in 2000 to 28,844 units in 2010, a 7.65% increase. However, vacant housing also increased from 4,336 units in 2000 to 4,702 units in 2010, an 8.4% increase. It is noteworthy that while 16.3% of the County's homes are vacant, 61.2% of these vacant units are seasonal homes.

An analysis of educational attainment within Washington County shows mixed results: Over 42% of the population over the age of 25 has graduated high school, compared to 27.8% and 28.6% for New York State and the entire nation, respectively. However, only 16.8% have a bachelor's degree or higher, compared to 27.4% across the entire state and 24.4% for the nation as a whole.

According to 2009-2013 American Community Survey data Washington County's median household income (\$52,361) is just below the state's (\$55,603) as well as the national median household income (\$53,046).

Over 5% of the county workforce works at home, and self-employment levels in the county are significantly higher than the state average with 9.1% of the workforce classified as self-employed; a rate that has remained stable over the past decade. The majority of our business base is comprised of small businesses, with less than a dozen employers with more than a hundred employees.

Characteristics of the County

Washington County's diverse geography and immaculate rural landscapes provide the canvas for our vibrant communities. However, as can be seen from the demographic data above, our communities are stable with high homeownership rates, but we are rapidly aging, lack higher education, and while our income levels are catching up to those at the State, we still lag behind. We exhibit an appetite for entrepreneurialism; an excellent lifestyle choice in a county lacking infrastructure necessary to serve large industry.

In order for our communities to thrive, tools are needed to support and expand our business climate, maintain safe communities, support the flourishing arts and cultural resources, increase access to excellent schools, and provide ease of access to farm fresh foods and shopping experiences in our historic villages. In today's complex world, the tools available to make us thrive are driven by connectivity and broadband.

Broadband: A Critical Infrastructure Component

By definition, telecommunications include telephone, cable television, and a variety of types of internet service. These services play a vital role in communications, public health, and education, as well as quality of life through fostering connectivity. Furthermore, retention, expansion, and attraction of businesses to the region are dependent on up to date infrastructure and technologies for economic growth and development.

While Washington County has the strategic advantage of being located within the Capital Region, and within easy reach of major markets, telecommunications infrastructure will need to be enhanced and made available throughout the entire county; in both rural and urban areas, as new technologies continue to enter the market. The infrastructure needs that this analysis covers includes: Internet services, Broadband, FiOS, and cell service throughout the area.

NYS Broadband Initiatives

According to data compiled by the NYS Broadband Office, the eight capital region counties have significant issues with broadband access where over half of the population did not have access to broadband at download speeds of 25 Megabits per second (Mbps) as of July 2014.

To address the lack of broadband access, Governor Andrew M. Cuomo launched #Broadband4All, a campaign to rally support for his New NY Broadband Program proposal. According to the NYS Broadband Program Office, the New NY Broadband Program is a \$1 billion program that leverages both public and private resources to ensure every New Yorker has access to high-speed Internet by 2018. The goal of this program is to provide broadband speed up to 100 Mbps in most developed places with 25 Mbps to New York's most remote communities. According to the NYS Broadband Program Office; 70% of upstate New Yorkers cannot access broadband at 100 Mbps, including thirty-two counties with no access at all to broadband at that speed.

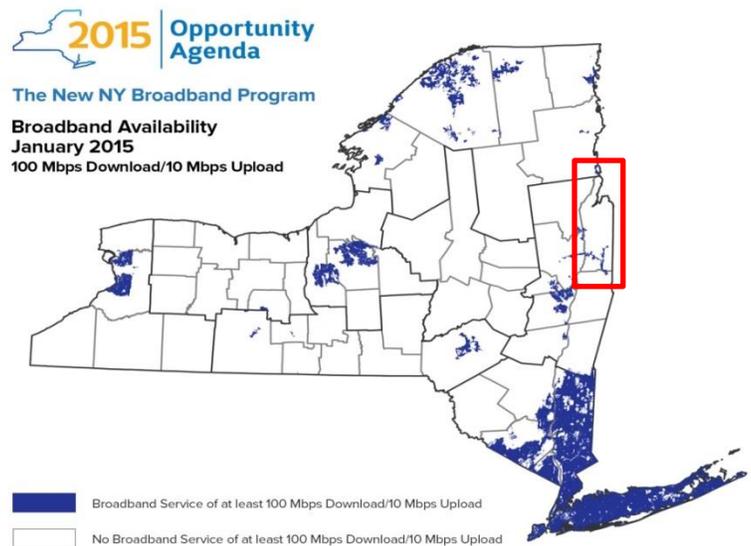


Figure 2. Broadband Availability Map

Source: NYS Broadband Office

Telecommunications Availability Issues

According to the NYS Broadband Program Office and the Broadband Availability Map, shown in Figure 2 above, Washington County has some very limited access in the southern portion of the county to speeds of at least 100Mbps. With assistance from Connect NY funding, coverage has improved over the past 2-3 years with the deployment of additional infrastructure; however, significant public concern continues to be expressed regarding inadequate or no coverage.

Indications are that broadband service in the majority of the county is spotty with several areas lacking any coverage. The more developed portions of the region appear to be adequately served by *current* standards. However, if a standard of 25 Mbps service in rural areas is applied, the vast majority of the county is unserved. Mobile wireless and cellular is also found primarily in the developed areas and along well traveled traffic corridors with spotty or no coverage in many areas. The eastern portions of the region as well as large portions of the north have large areas of inadequate service or no service at all.

The widespread lack of service creates several issues. Public safety, education, and business needs that rely on internet and cell service are of serious concern in regards to connectivity. Additionally, with the increasing use of on-line health care, shopping for supplies, and increased telecommuting we exhibit an ever increasing dependence on both broadband and cell coverage in our daily home and work lives. The critical first step to achieving acceptable service levels is to more concretely identify levels of existing coverage and community satisfaction.

Telecommunications Study

In order to identify at risk and unserved areas in Washington County, this analysis was prepared to determine the availability of telecommunications; more specifically, the availability of cell phone coverage and broadband services. The result will help determine unserved and underserved areas in the county and develop a strategy to bring service to all areas. Without adequate coverage we cannot increase business development, foster entrepreneurship, and support business growth.



Regional Broadband plan

The Adirondack Gateway Council, a coalition of local governments, municipal planning agencies and economic development groups in Warren, Washington and northern Saratoga counties has partnered with ECC Technologies, a Technology and Communications Consulting firm to prepare a regional broadband plan. The plan will focus on developing strategies to increase broadband infrastructure throughout the region. In July of 2015, the Adirondack Gateway Council Broadband Inventory Study was completed. This document mapped existing physical

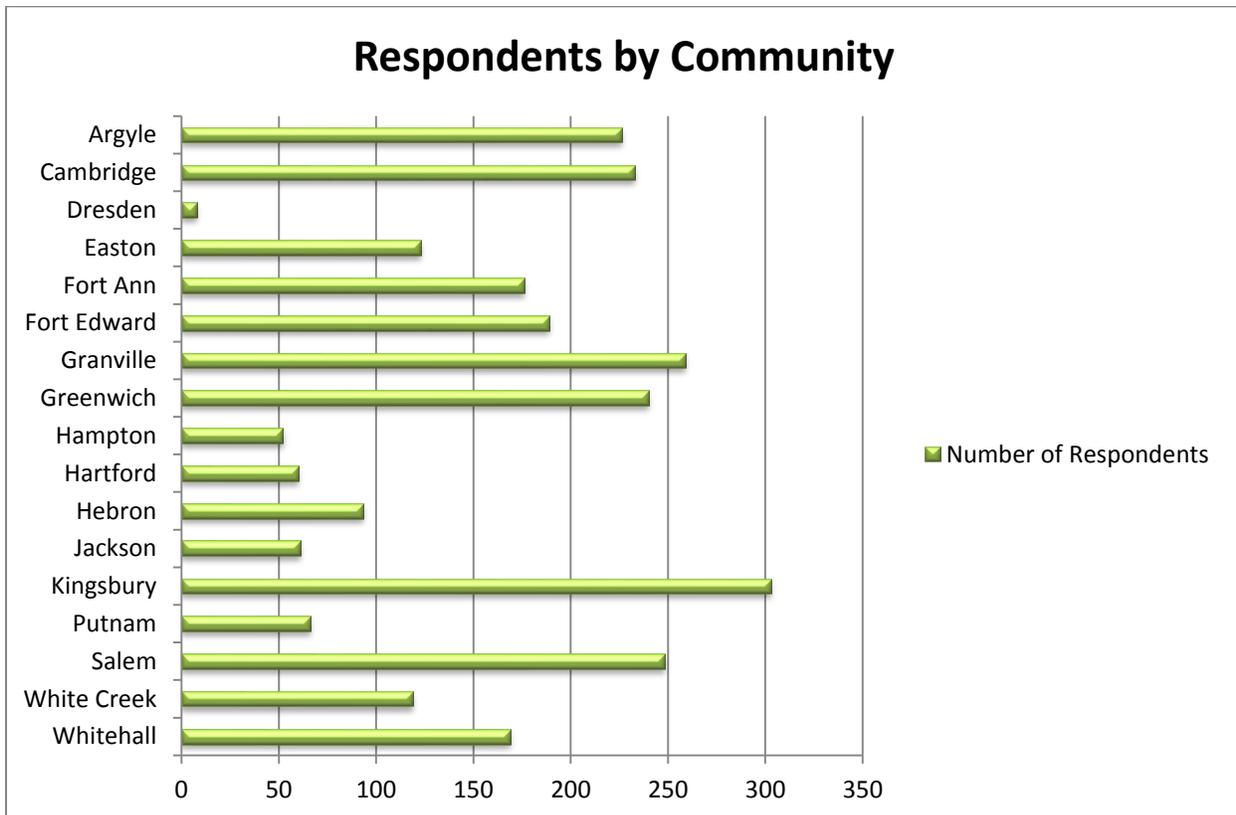
and technological infrastructures of all known carriers in the region. However, although this information is a critical tool in planning for future infrastructure, it documents infrastructure; not levels of penetration/areas of coverage. Data from this report will supplement that effort.

Countywide Broadband Survey

Approximately 29,400 surveys were sent out throughout the County. These surveys were sent to every mailing address in Washington County to pinpoint where the County's underserved as well as unserved areas are located. This survey was conducted by the Washington County Planning and Economic Development Department over the span of 2 months. The response rate to this survey was excellent, with 10% of residents and businesses participating in the survey. Following are the analytical findings from the Washington County broadband survey conducted by The Economic Development and Planning Departments in June and July of 2015.

In total, 2,856 community members, businesses, and households responded to the Washington County Broadband Survey, although many did not answer all questions. Communities represented by respondents are shown in Figure 3 below. The highest response rates were generated from the Towns of Kingsbury, Granville, and Salem, respectively.

Figure 3: Respondents by Community



Source: Washington County Planning Department

Figure 4: Internet Service

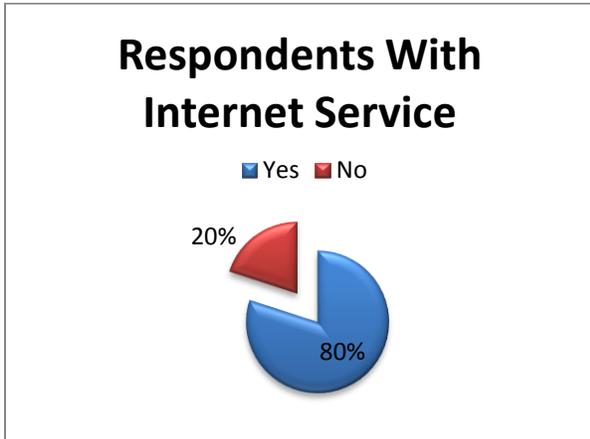
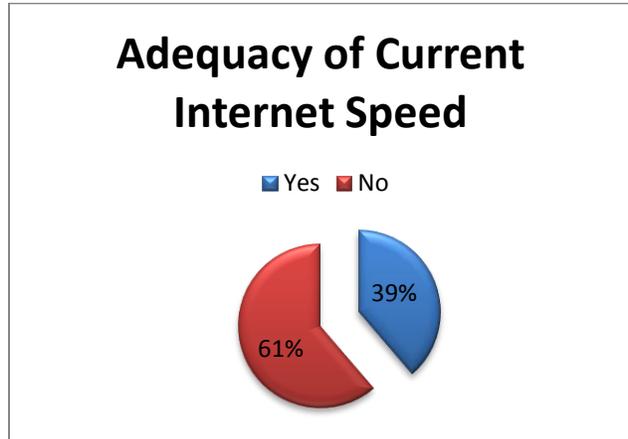


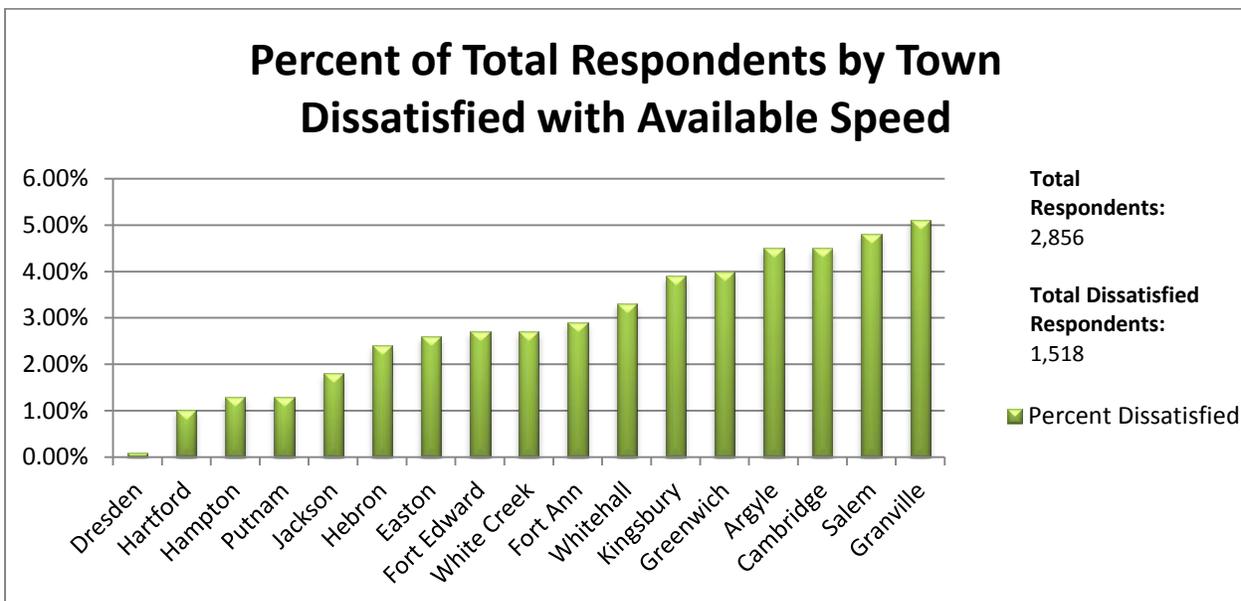
Figure 5: Speed Adequacy



Source: Washington County Planning Department

Respondents were initially asked if they *currently* have internet service. As shown in Figure 4 above, of the 2,856 respondents 80% indicated that they do currently have some type of internet service and 20% (571) have no service. When asked if the speed of their service was adequate for their needs over **61%** of the respondents indicated that the current internet speeds available are **NOT** adequate for their needs indicated in Figure 5 above. A further breakdown of responses shown by community in Figure 6 below indicates that the highest numbers of respondents dissatisfied with speed availability are in the Towns of Granville and Salem. Interestingly, although Greenwich had more total respondents than Argyle, a higher percentage of respondents in Argyle were dissatisfied with service speeds than in Greenwich.

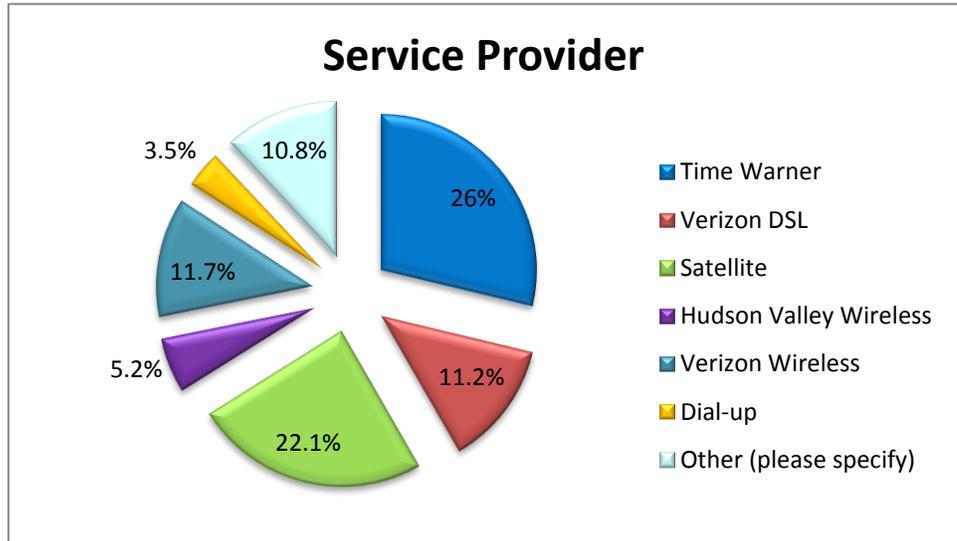
Figure 6: Total Respondents by Town Indicating Inadequate Speed



Source: Washington County Planning Department

In order to determine utilization rates of various available service providers, respondents were asked to indicate the name of their provider. From this, we can conclude that there are six primary internet service providers in the county with Time Warner Cable providing service to 26% of the respondents, followed by users of Satellite services at 22.1%. Verizon Wireless and Verizon DSL are the next most prevalent service providers. Close to 11% of the survey respondents utilize other provider options. The most frequently named providers listed as “other” were cell service hotspot providers such as AT&T and Sprint, as well as Bounce Linx.

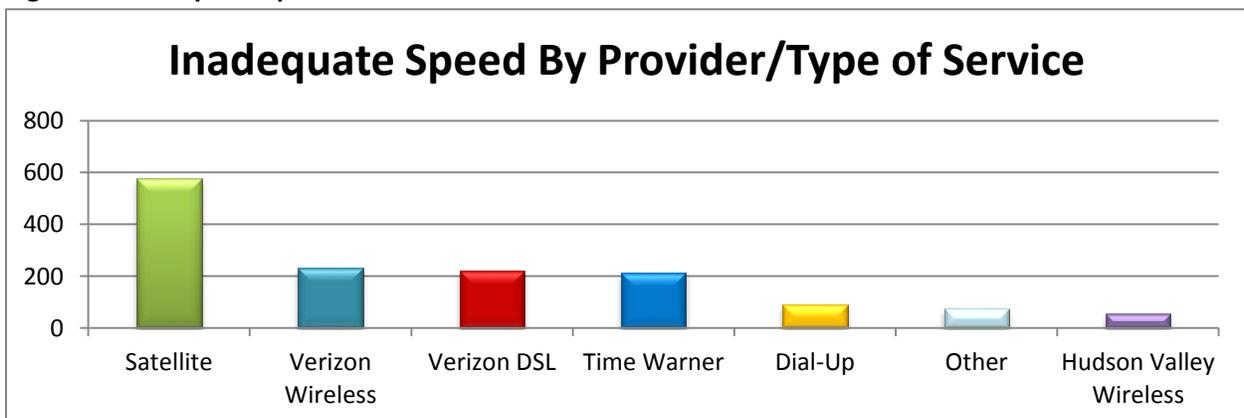
Figure 7: Providers Utilized in the County



Source: Washington County Planning Department

As would be expected, when types of service are analyzed, the highest levels of dissatisfaction with available speed occur with users of satellite services as shown in Figure 8 below. Note that dissatisfaction with Verizon Wireless may be partially attributable to inadequate cell coverage in the county as explored later in this document. Additionally, only a very small number (74) of respondents use dial-up, but almost all dial up and satellite users indicated dissatisfaction.

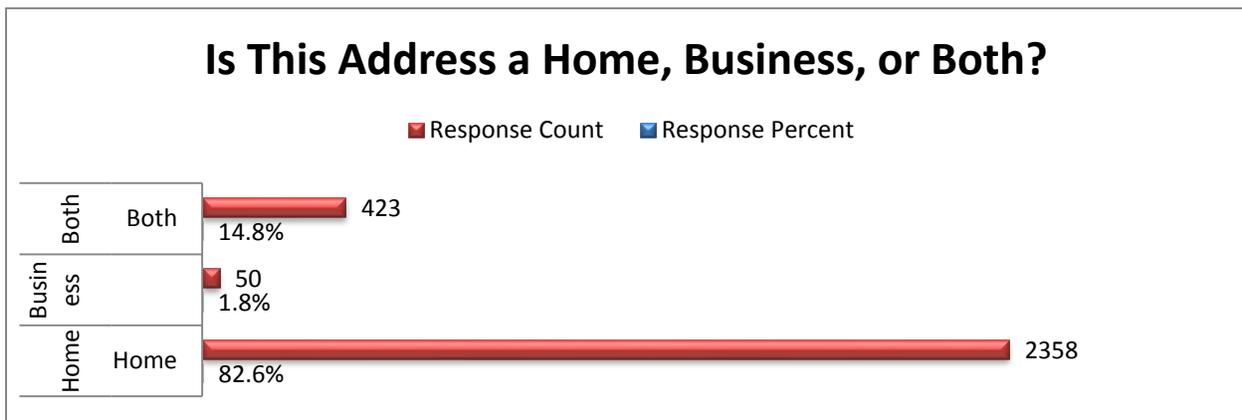
Figure 8: Inadequate Speed



Source: Washington County Planning Department

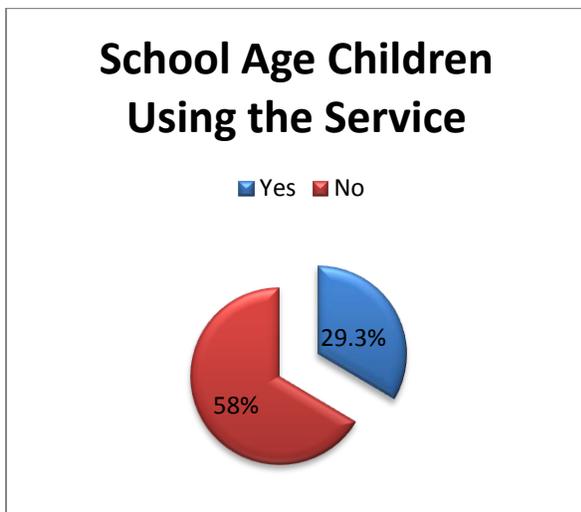
It should be noted that the vast majority of respondents to the survey were residential rather than commercial. Of the 2,856 survey respondents 82.6% were residential, 1.8% were commercial, and 14.8% were homeowners with businesses as indicated in Figure 9 below. It is revealing that such a high number of home based businesses responded. With the lack of infrastructure sufficiently adequate to support extensive commercial development the County economic growth will be closely aligned with small business and home based business development. These types of businesses will benefit significantly from improved access to broadband.

Figures 9: Address Type



Source: Washington County Planning Department

Figure 10 School Age Children Using the Service

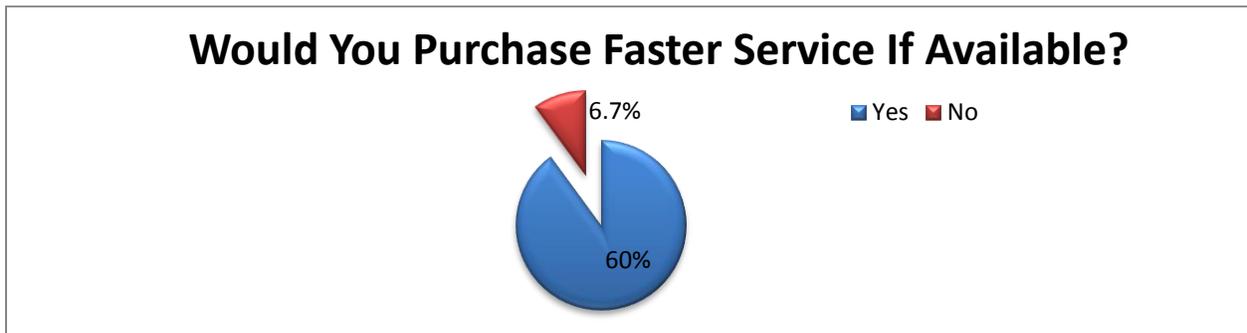


Source: Washington County Planning Department

It can be seen in Figure 10 to the left, that of the total number of survey respondents answering the question, approximately a third, or 29.3% have school age children using internet services.

In Figure 11 below, respondents were asked if they would purchase faster service if it was available in their location. A total of 60% of the respondents answering this question indicated that they would be willing to invest in faster service speeds. 939 survey respondents (close to a third) did not answer the question.

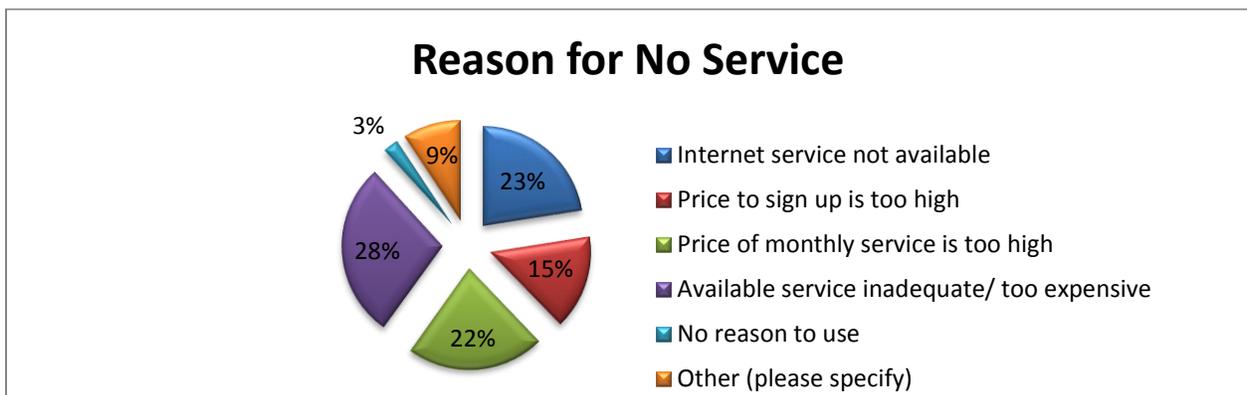
Figure 11: Would Purchase Faster Service



Source: Washington County Planning Department

As earlier demonstrated in Figure 4, a total of 20 % (550) respondents currently do not have any internet service. An evaluation of the reasons for lack of service is shown in Figure 12 below; 28% of the respondents indicated that the primary reason for lack of service is that the services provided are too expensive and/or inadequate. The second largest reason (23%) is that there are no available internet services.

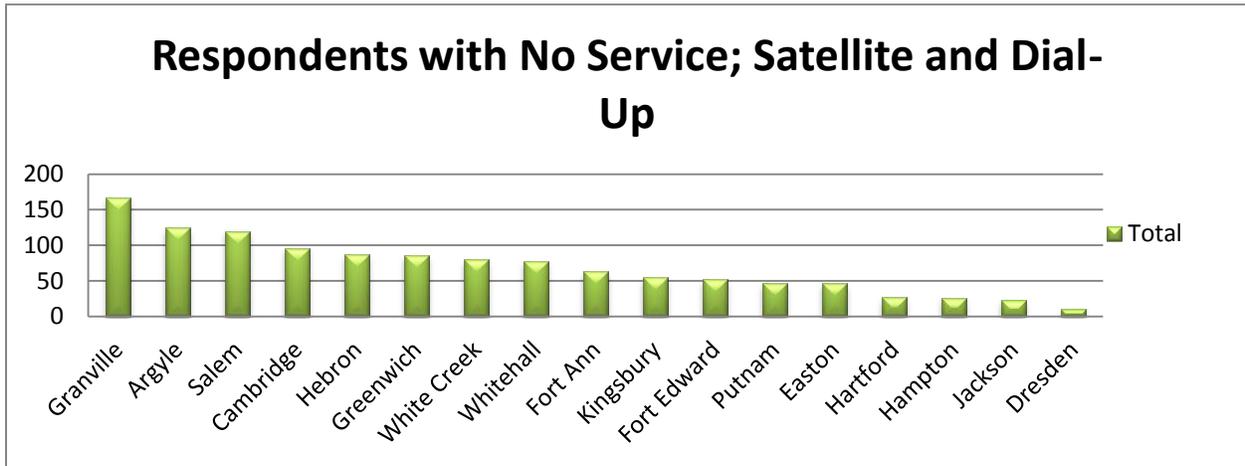
Figure 12: Reasons Respondents Do Not Have Service



Source: Washington County Planning Department

Examining the locations of respondents lacking service it is important to note that by all current standards, dial-up and satellite are not considered broadband. Therefore, by adding respondents utilizing dial up and satellite services, to respondents indicating they have no service we begin to pinpoint the most unserved areas within the county. We see, in Figure 13, that the top three communities indicated as lacking any service availability based upon survey responses are Granville, Argyle, and Salem. Overall, factoring in dial-up and satellite as “no” service, 42% of the 2837 respondents to the survey currently have **no access at all** to broadband by today’s standards.

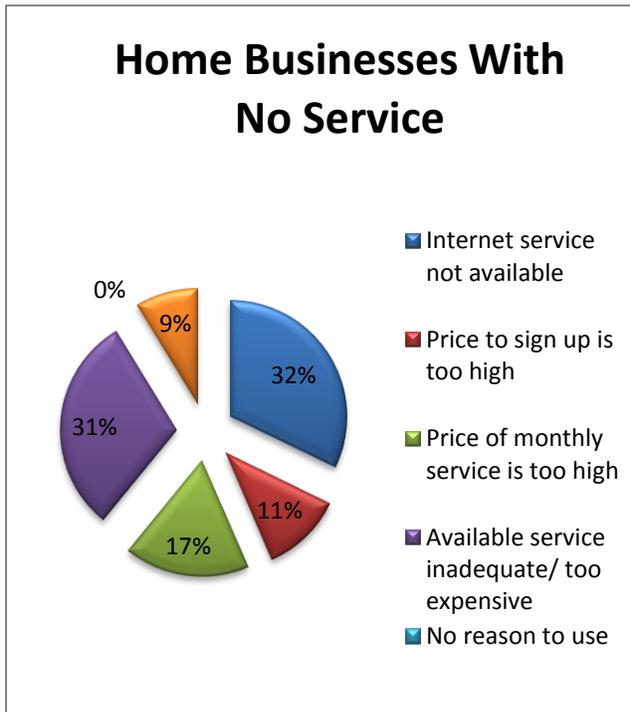
Figure 13: No Broadband Access by Town



Source: Washington County Planning Department

It is also interesting to compare the reasons for no service by type of respondent. Figure 14 below shows that out of the 423 respondents with home businesses, 63% have no internet service primarily because services are unavailable, inadequate or expensive. Figure 15 demonstrates that 57% of the 50 commercial businesses who responded to the survey indicated that the primary reason they do not have internet was the lack of availability. In figure 16 residents exhibit more of a concern with pricing.

Figure 14: Home Businesses



Source: Washington County Planning Department

Figure 15: Commercial Businesses

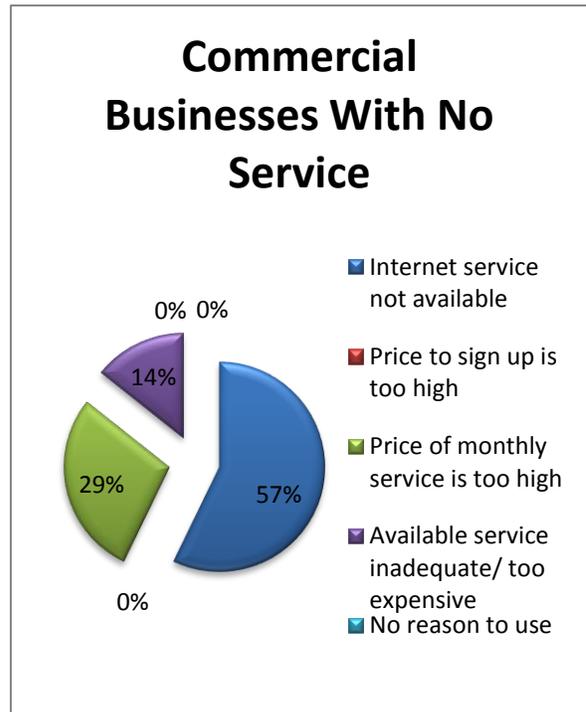
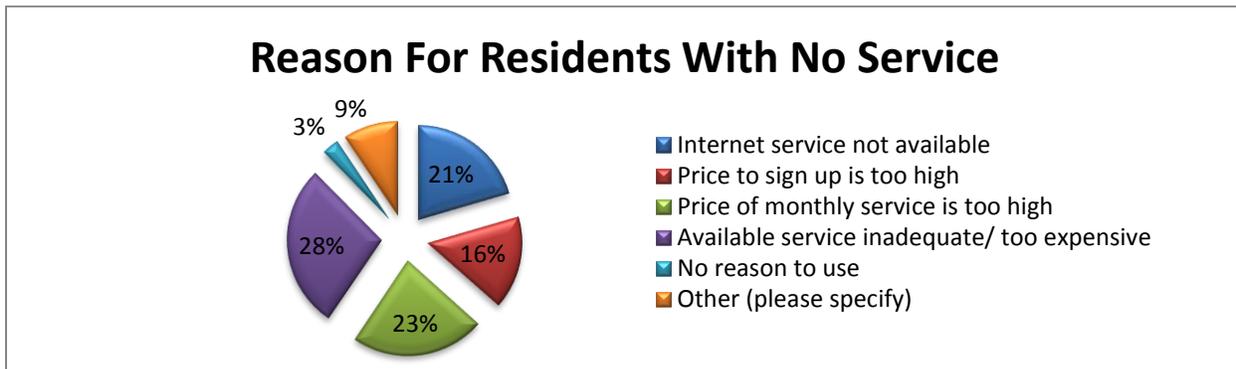
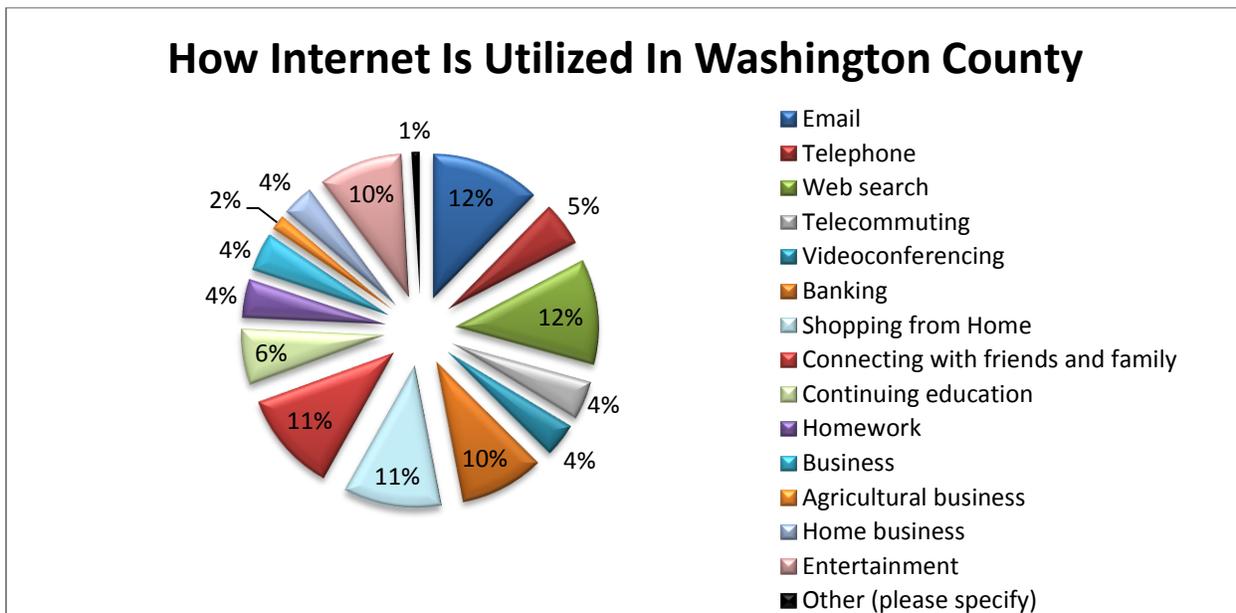


Figure 16: Reason for Residents with No Service



Source: Washington County Planning Department

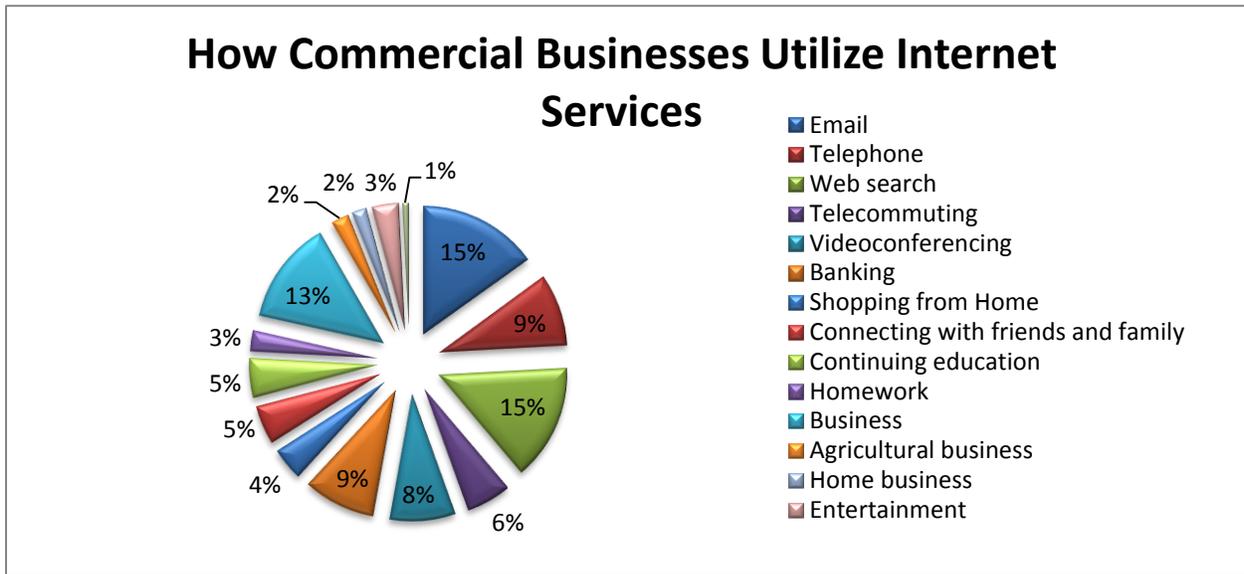
Figure 17: How Internet is Utilized in Washington County



Source: Washington County Planning Department

Overall, respondents indicated that internet in Washington County is utilized for many tasks. From the 2,285 respondents with service it is indicated that the main usage for internet is for e-mail (12%), web search (12%), connecting with friends and family (11%), and shopping from home (11%). An evaluation of respondents broken down by commercial business, home business and residents demonstrates that Commercial Businesses in the county have many needs for internet that may not necessarily correspond with the needs of homeowners. The main internet usage in commercial businesses (Figure 18) is for e-mail (15%), web-search (15%), videoconferences (13%), banking (9%), and telephone uses (9%).

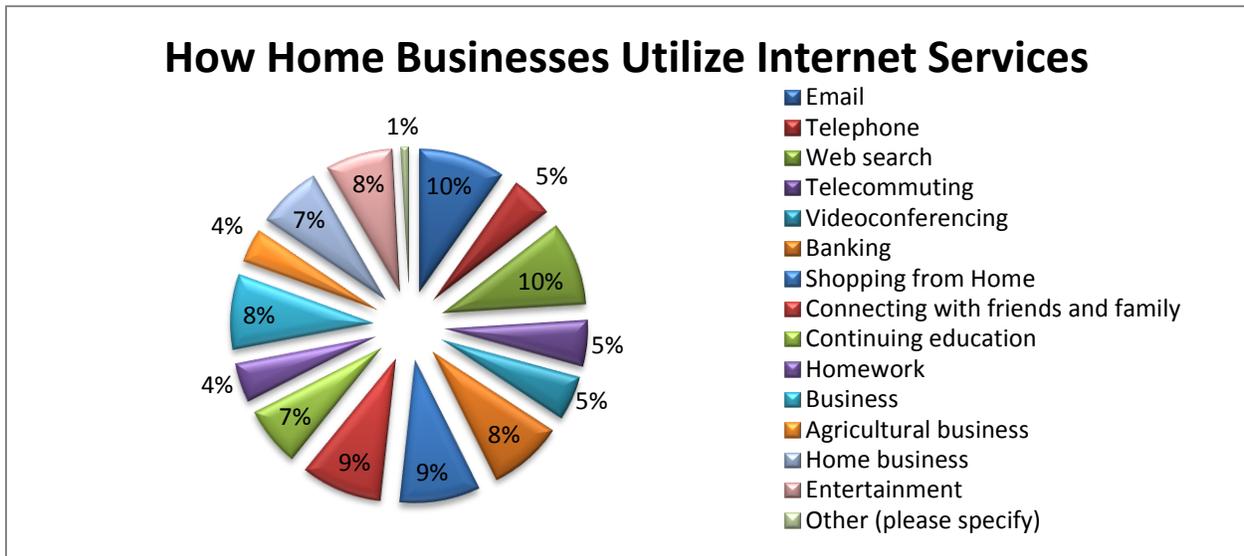
Figure 18: Commercial Business Utilization of Internet Services



Source: Washington County Planning Department

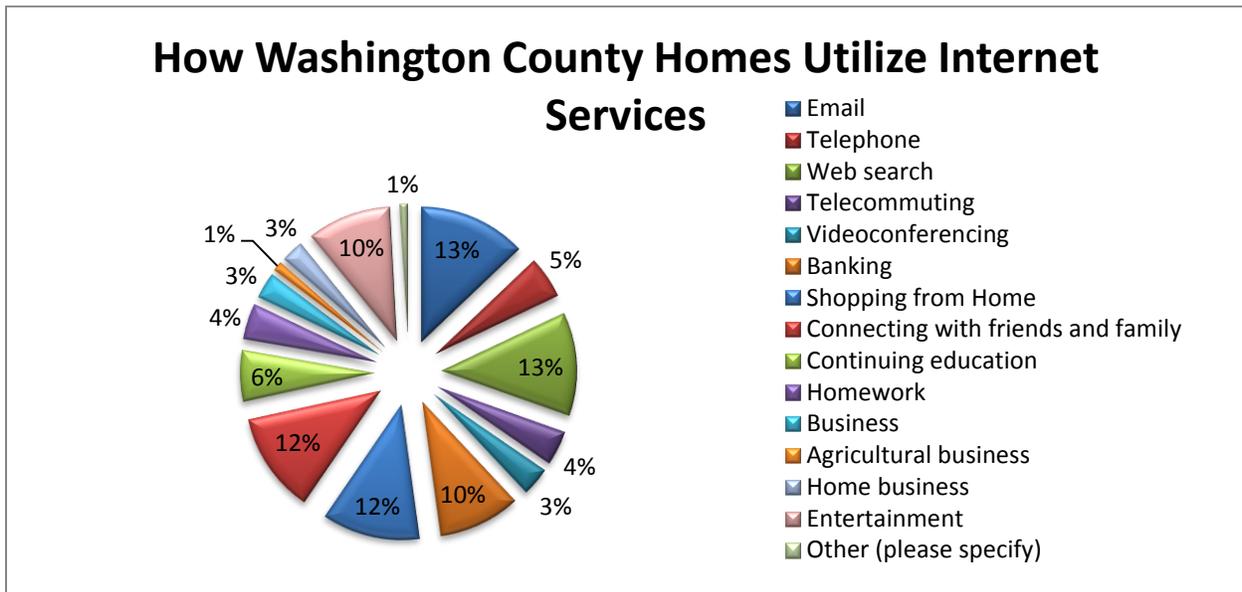
Figure 19 shows responses from home businesses indicate that internet being used by home businesses is mainly for e-mail (10%), web-search (10%), shopping from home (9%), connecting with friends and family (9%). According to Figure 20, Residents in Washington County indicated that e-mail (13%), shopping from home (12%), connecting with friends and family (12%), and web search were the main usages for internet (13%).

Figure 19: How Home Businesses Utilize Internet Services



Source: Washington County Planning Department

Figure 20: How Washington County Homes Utilize Internet Services



Source: Washington County Planning Department

When asked if lack of or inadequate internet service had an impact on the ability to sell products or serve their customers, both commercial and home businesses indicated a significant issue. Figure 21 below shows that 45% of the businesses that responded to this survey believe that their businesses are impacted by the lack of adequate service. Even more significant is the fact that 68% of home businesses that responded to the survey indicated that their businesses are being impacted because of the lack of adequate services as seen in Figure 22 below.

Figure 21: Commercial Businesses Impacted

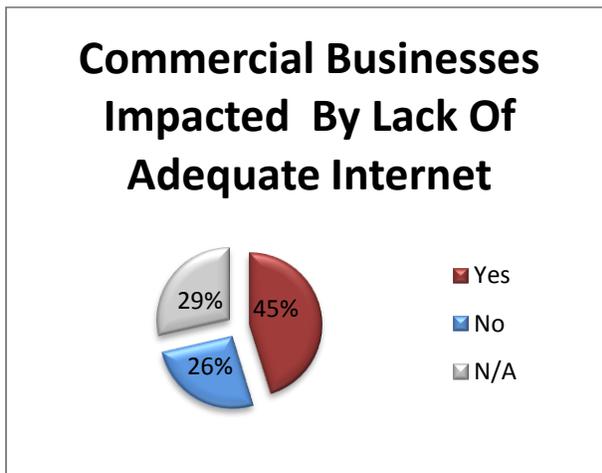
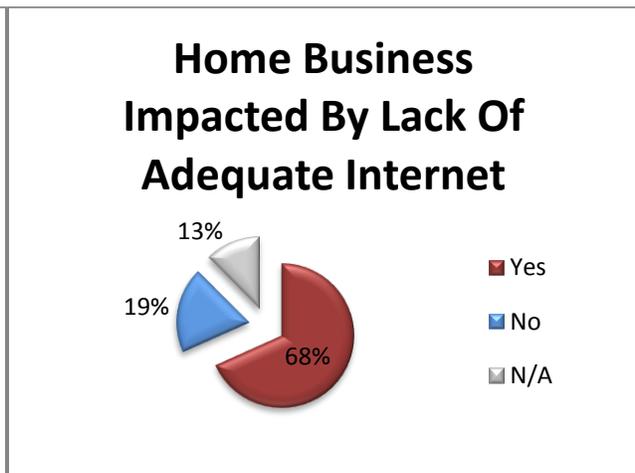


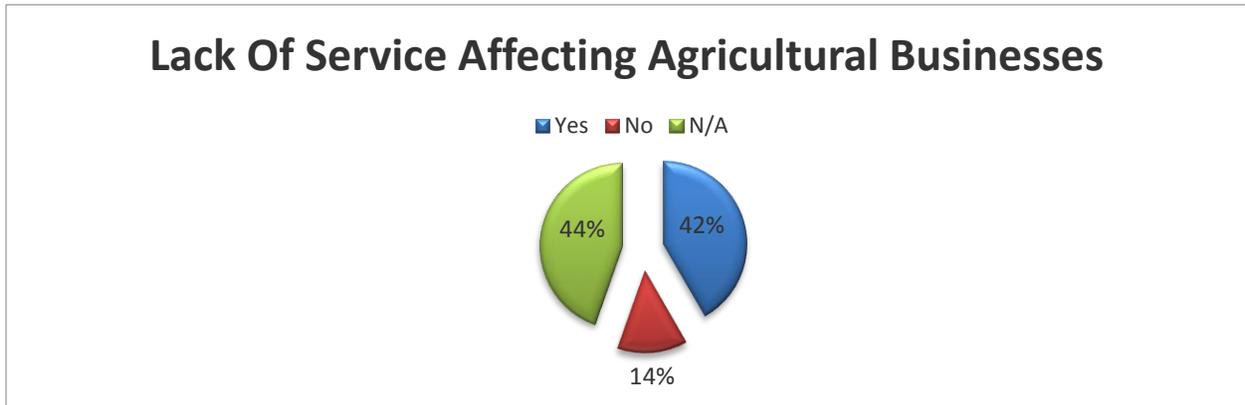
Figure 22: Home Businesses Impacted



Source: Washington County Planning Department

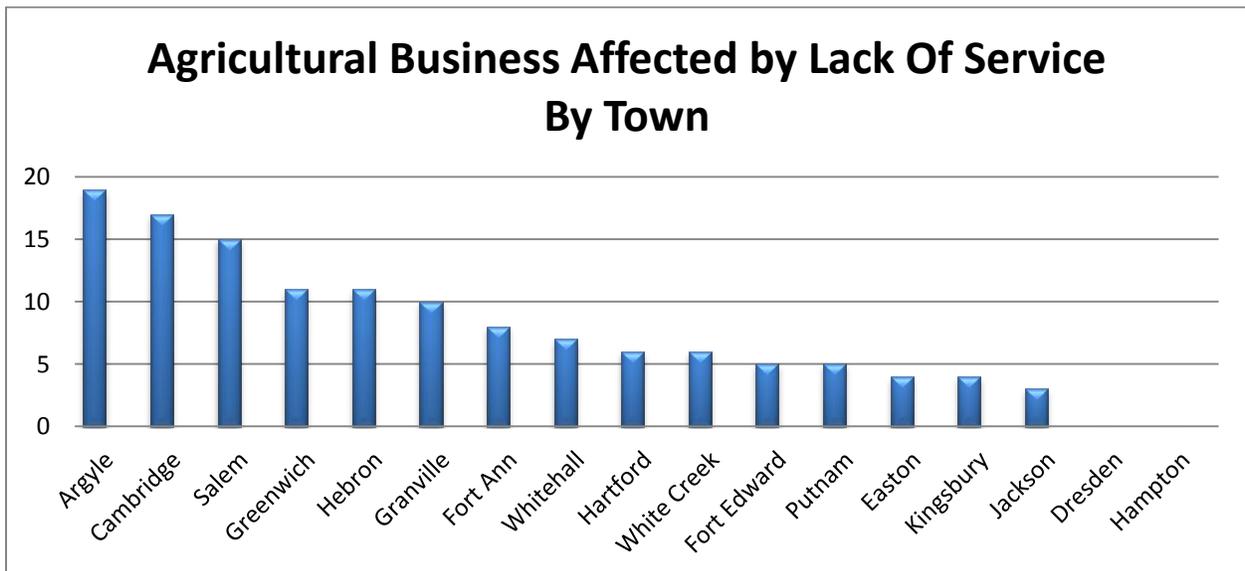
Given the typical remote location/isolation of many agricultural businesses, we evaluated the number of agricultural businesses answering the survey who indicated that their business is being impacted by the lack of broadband service. In Figure 23 below, it can be seen that of the 314 respondents indicating they use the service for an agriculture related businesses 42% said that their business is affected by lack of broadband. Of these respondents, Figure 24 below breaks down these respondents by town, and shows that the towns of Argyle, Cambridge, and Salem had the highest number of respondents with agriculture businesses adversely impacted by lack of broadband.

Figure 23: Agricultural Business Affected By Lack Of Service



Source: Washington County Planning Department

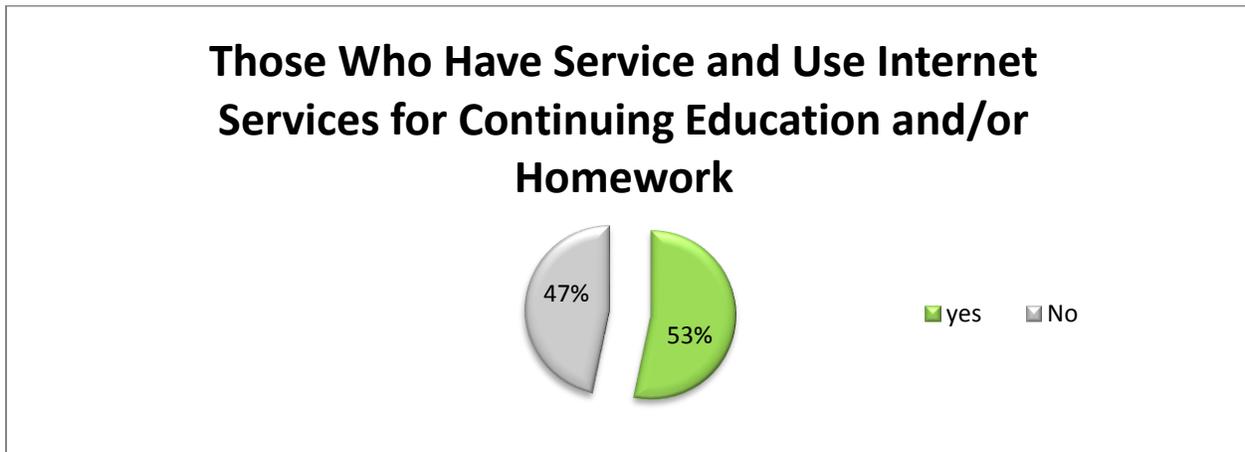
Figure 24: Agricultural Business Affected By Lack Of Service By Town



Source: Washington County Planning Department

Finally, utilization of the internet to participate in online coursework and homework has become increasingly important to support delivery of educational services. In order to measure the impact of broadband on our schools, we illustrate below that of the 2,285 respondents indicating that they do have internet service, 1,218 or 53% responded that they currently do use the services for continuing education and/or homework.

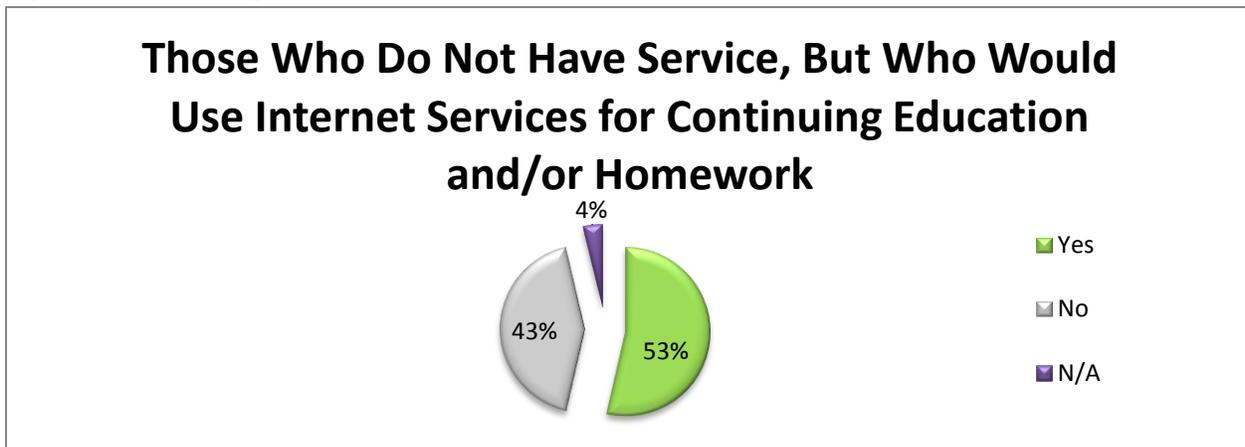
Figure 25: Continuing Education/ Homework With Service



Source: Washington County Planning Department

In total, 571 respondents to the survey indicated that they do not have internet services. Note that this analysis does not factor in dial-up and satellite users. Of the 571 respondents with no access to service, 306 of these respondents (53%) indicated that they would use the services for continuing education and/or homework if service was available. It can be anticipated that with increased ability to deliver training and education services over the internet a wider array of education and training options will become increasingly available to students, businesses, farms, and residents alike.

Figure 26: Continuing Education/ Homework Without Service



Source: Washington County Planning Department

Cell Propagation Study

As the Broadband survey was being conducted, a base-line drive test to determine existing cell service coverage with the major carriers in the area was conducted in June of 2015. This testing was performed for the Verizon and AT&T Long Term Evolution (LTE) networks for determining the actual coverage footprint and to determine suitability for use as a Data Network. LTE is a standard for wireless communication of high-speed data for cell phones and other devices.

Metrics were collected for the following technology types:

- LTE Carrier (Verizon), AWS Channel 2100, 2350, and 700 Channel 5230
RSRP, CINR
- LTE Carrier (AT&T), AWS Channel 2000 and 700 Channel 5110
RSRP, CINR



In cellular networks, when a mobile phone moves from cell to cell and performs cell selection/reselection and handover, it measures the signal strength/quality of the neighbor cells. In the LTE network, Reference Signal Received Power (RSRP) is the average power of the reference signals spread over the full bandwidth. Carrier to interference plus noise ratio (CINR) is another signal quality measurement that takes signal interference into consideration.

The following maps summarize the service levels available from the two major carriers in the area, AT&T and Verizon as of the date of this report. While some service is available in some areas from other providers such as Sprint it was anticipated that coverage from these providers would not surpass AT&T or Verizon. A full copy of the report may be found in Appendix 2.

Map A on page 20 represents cell coverage across major roads throughout the northern portion of the county for AT&T. The map is an aggregation of signal power for AT&T classified as “Good”, and “Very Good” possible on all major county roads and “Weak” or “No” service. **Map B**, page 21 represents the same for the southern portion of the county.

Map C on page 22 represents cell coverage across major roads throughout the northern portion of the county for Verizon. The map is an aggregation of signal power for Verizon classified as “Good”, and “Very Good” possible on all major county roads. **Map D**, page 23 represents the same for the southern portion of the county

Overall, in the northern portion of the county, Fort Ann, Kingsbury, Hartford, and a portion of Putnam and Fort Ann are fairly well served by AT&T available service. However, the towns of Dresden, Whitehall, Hampton, and Granville have very poor access to AT&T service.

With the exceptions of the southern portion of Whitehall, and some portions of Fort Ann and Dresden, the communities in the northern part of the county have reasonable access to Verizon services.

In the southern part of the county Easton, and Fort Edward and portions of Greenwich have reasonable access to AT&T services, Cambridge, White Creek, Argyle and Greenwich have spotty coverage, while Hebron, Salem, Jackson and White Creek have only limited access to AT&T.

Verizon service is available throughout most of the southern portion of the county, with the exception of Hebron and portions of White Creek and Argyle.

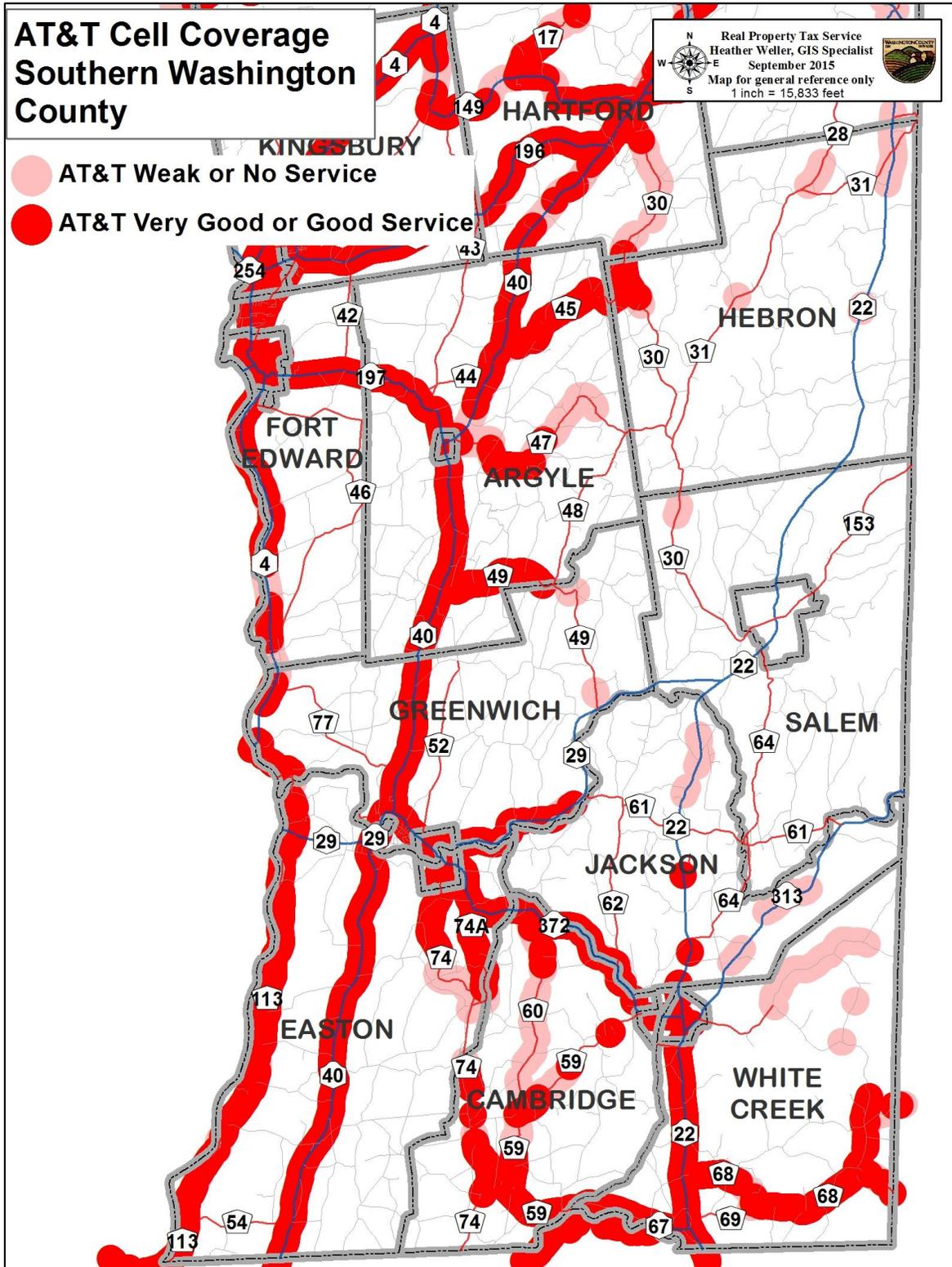
Summary

Although we cannot draw absolute conclusions from answers provided by ten percent of the households and businesses in the county, we can identify problems and surmise issues and trends. Based on responses, there are a significant number (42%) of residents and business with no service forced to rely on dial up, or satellite; this effectively constitutes no access to broadband. For those with some level of service, satisfaction with these services is extremely poor for most (61%). Overall, factoring in those with no access to service combined with those dissatisfied with current services we can conclude that the vast majority of the county is underserved or unserved by **current** broadband standards. With the proposed new standards the majority of the county will be unserved unless there are upgrades to existing broadband infrastructure and widespread deployment of additional infrastructure. As explored next, when combined with countywide access to adequate cell phone service, the picture begins to look even grimmer.

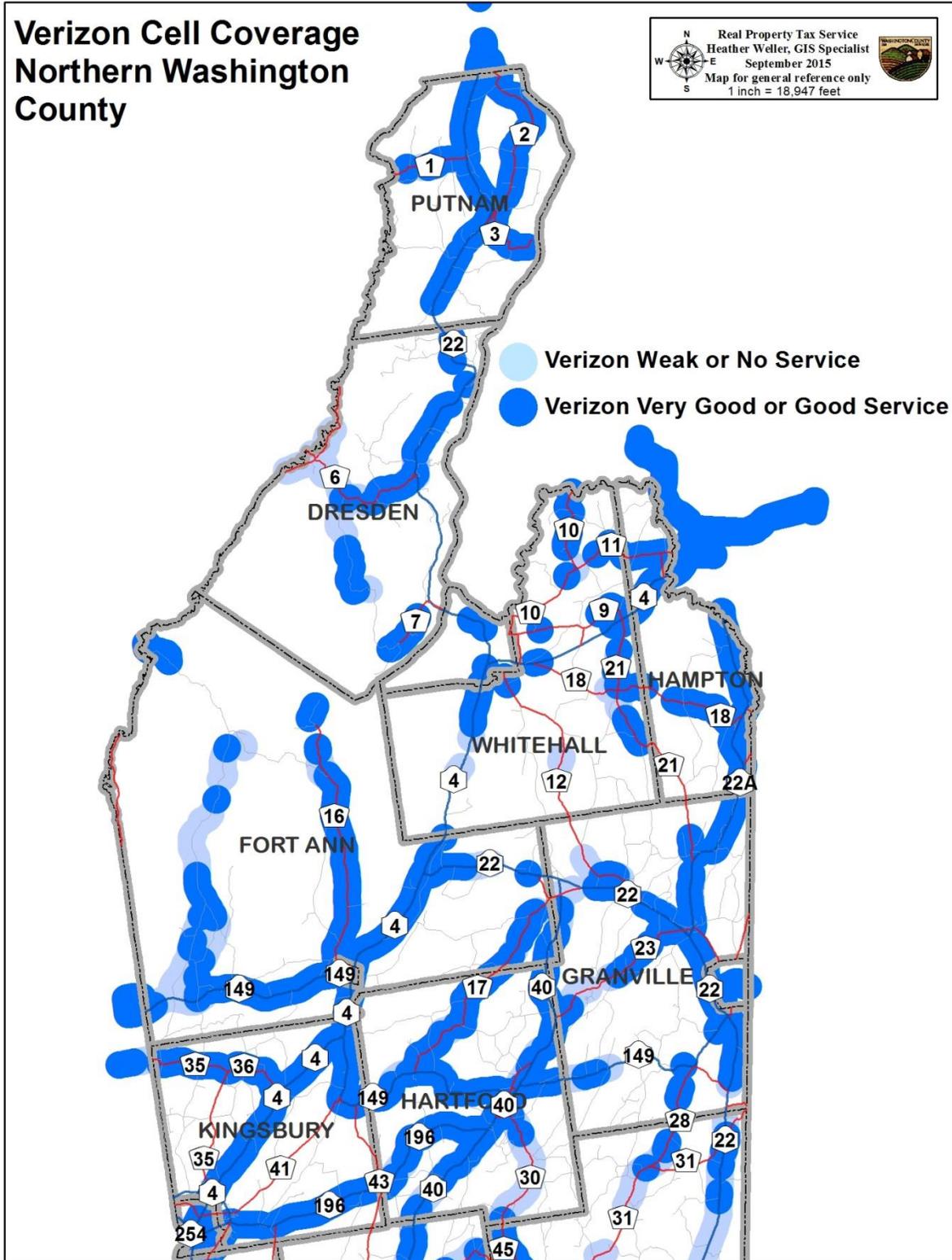
When evaluating overall connectivity incorporating coverage from broadband infrastructure and cell phone coverage we can define some of the highest-need areas in the county. The communities of Hebron, Dresden and Whitehall appear to have the most limited cell service availability based on coverage along major roads. However, line of sight to a cell tower is critical for good coverage and the scope of work for this study did not include all roads in the county; therefore coverage along a major road does not necessarily imply coverage along a nearby road. This will result in “spotty” service in many communities due to the topography throughout the county.

When comparing this information to communities represented as unserved by broadband it is clear that there are many areas across the county that overlap both poor cell coverage, and poor broadband service; effectively resulting in no connectivity at all.

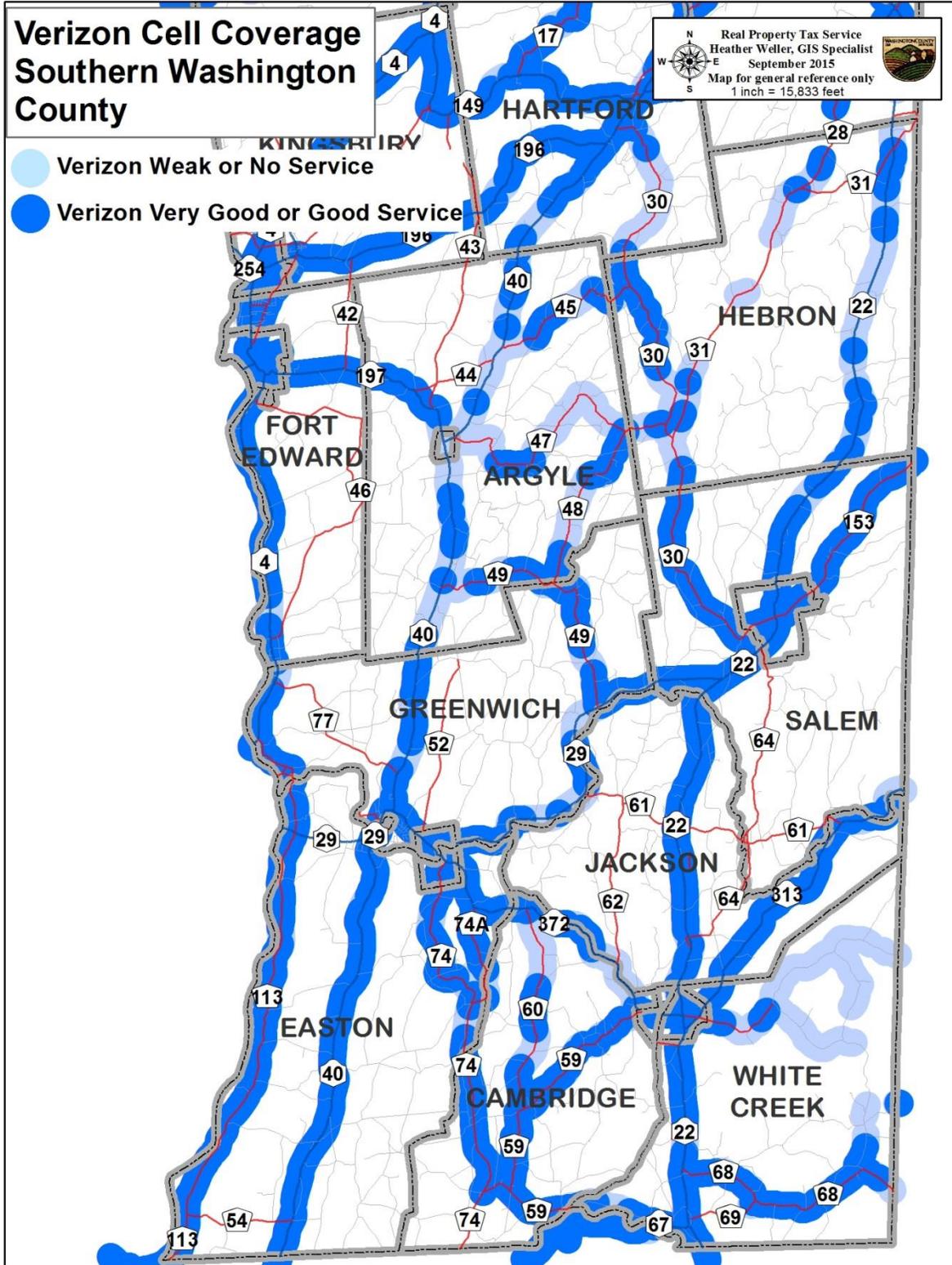
Map B



Map C



Map D



Appendices

*****ECRWSEDDM****
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Washington County Broadband Survey



**Survey Deadline is
July 17th, 2015**

Are you connected?

Help us get quality internet service to all areas of Washington County!

Improved and expanded broadband internet connectivity can help influence the future quality of life, economic development and educational opportunities for everyone in Washington County!

By completing the short survey on the back of this flyer you can assist with the county wide effort to try and ensure broadband for all.

This survey is available online at <https://www.surveymonkey.com/s/washcony>. If you do not have internet, you can call into our automated survey at +1 206-455-6240 and enter the code 472923 and then #. Then you will be prompted for your responses. You can also mail responses to: Washington County Planning Department, 383 Broadway Fort Edward, New York 12828; or drop it off at your local town hall!

Washington County Broadband Questionnaire (1/household)

1. Street Address: _____ Town: _____
(Please, no post office box numbers.)
2. Is this address a: A. Home ___ B. Business ___ C. Both ___
3. Do you currently have Internet service? (If No, please skip to question 8)
 A. Yes ___ B. No ___
4. If yes who is your provider? (Choose all that apply)

A. Time Warner	_____	E. Verizon Wireless	_____
B. Verizon DSL	_____	F. Dial-up	_____
C. Hudson Valley Wireless	_____	G. Other	_____
D. Satellite(Wildblue, Hughesnet)	_____		
5. If yes, is your internet speed adequate for your current needs?
 A. Yes ___ B. No ___
6. If not adequate, would you purchase faster service if it was available?
 A. Yes ___ B. No ___
7. Are school age children using the service?
 A. Yes ___ B. No ___
8. If you are a business, is lack of or inadequate, service impacting your ability to sell products or serve your customers?
 A. Yes ___ B. No ___ C. N/A ___
9. If you don't have Internet service, please indicate the reason (Select all that apply):

A. Internet service not available	_____	E. No reason to use	_____
B. Price to sign up is too high	_____	F. Other	_____
C. Price of monthly service is too high	_____		
D. Available service inadequate / too expensive	_____		
10. If you have internet service or were able to get it at your location, what would you use it for? (Choose all that apply)

A. Email	_____	H. Connecting with friends and Family	_____
B. Telephone	_____	I. Continuing Education	_____
C. Web Search	_____	J. Homework	_____
D. Telecommuting	_____	K. Business	_____
E. Videoconferencing	_____	L. Agricultural Business	_____
F. Banking	_____	M. Home Business	_____
G. Shopping from home	_____	N. Entertainment (TV, Music, etc.,)	_____
		O. Other	_____

This survey is available online at <https://www.surveymonkey.com/s/washcony>. If you do not have internet, you can call into our automated survey at +1 206-455-6240 and enter the code 472923 and then #. Then you will be prompted for your responses. You can also mail responses to: Washington County Planning Department, 383 Broadway Fort Edward, New York 12828; or drop it off at your local town hall!



Monday, June 22, 2015

INTRODUCTION

GIANT SOLUTIONS is pleased to provide drive test data to Laura Oswald at Washington County and the Adirondack Gateway Council for Baseline Drive Test services. The testing covered the Verizon and AT&T LTE network. The attached drive map shows the scope of testing.

SERVICES PROVIDED

Baseline Drive Test Service:

The following metrics were collected for each technology type:

- LTE Carrier (Verizon), AWS Channel 2100, 2350, and 700 Channel 5230
RSRP, CINR
- LTE Carrier (AT&T), AWS Channel 2000 and 700 Channel 5110
RSRP, CINR

Deliverables

The metrics for each recorded channel represent aggregations into 4 service levels indicating very good, good, weak, and no service. The range of each service level is shown below for both RSRP (reference signal receive power) and CINR (carrier to interference and noise ratio).

	Very Good	Good	Weak	No Service
RSRP(dBm)	>-85	-85<x<-98	-98<x<-115	x<-115
CINR(dB)	>20	20<x<10	10<x<0	x<0

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Monday, June 22, 2015

Drive Map:



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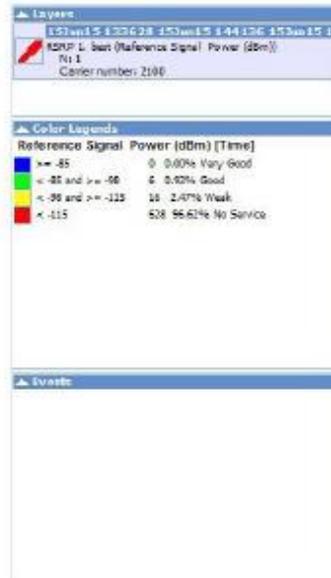
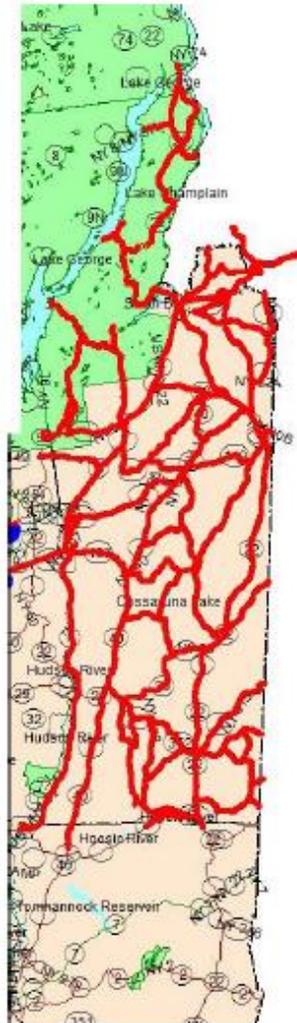
Page 2



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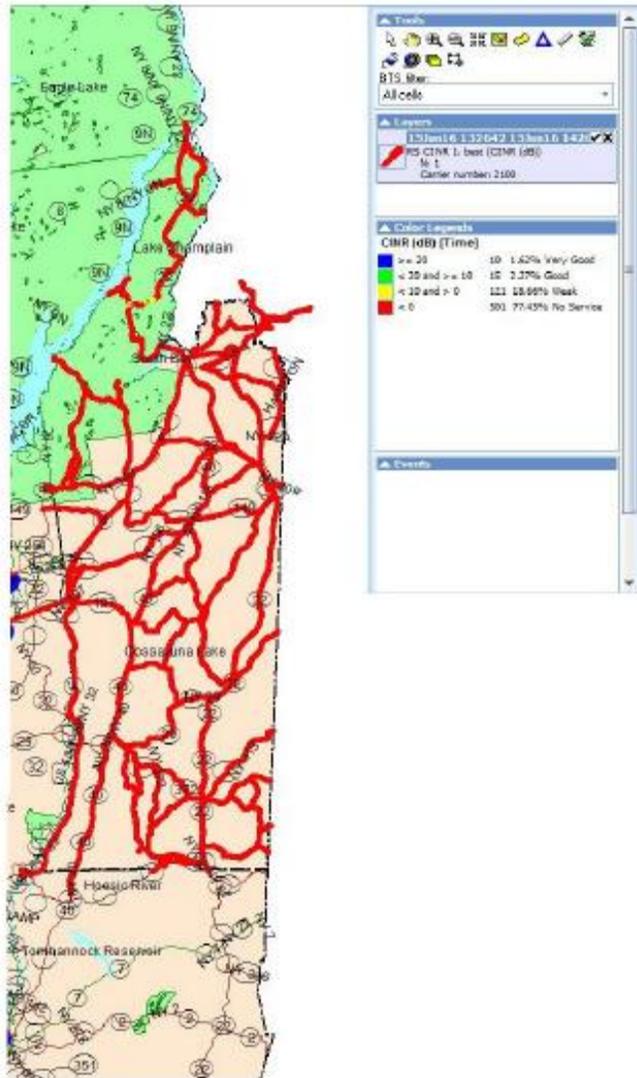
Verizon LTE Results:

1. Channel 2100 (Band 4 AWS, 2125 MHz)



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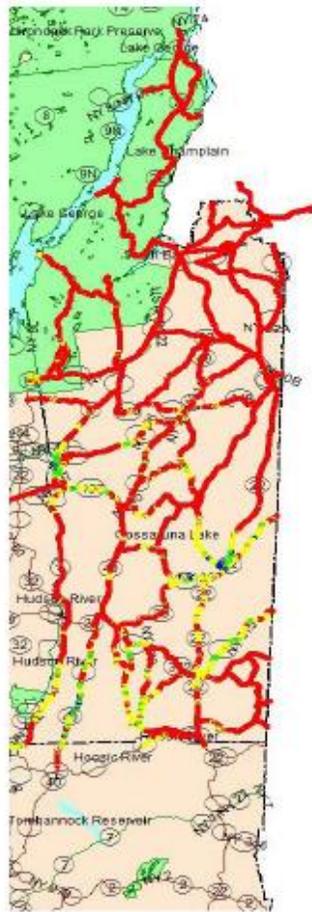
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2. Channel 2350 (Band 4 AWS, 2150 MHz)

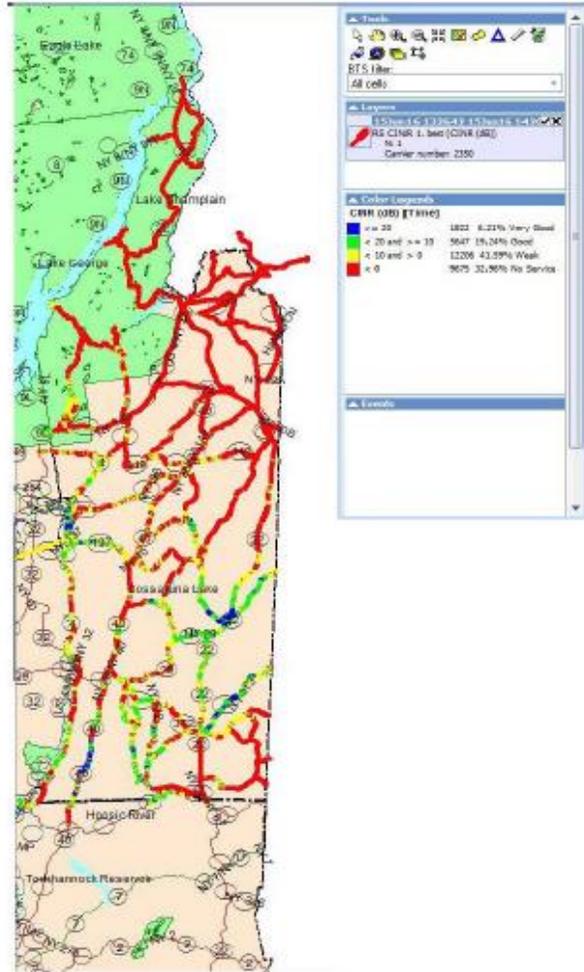


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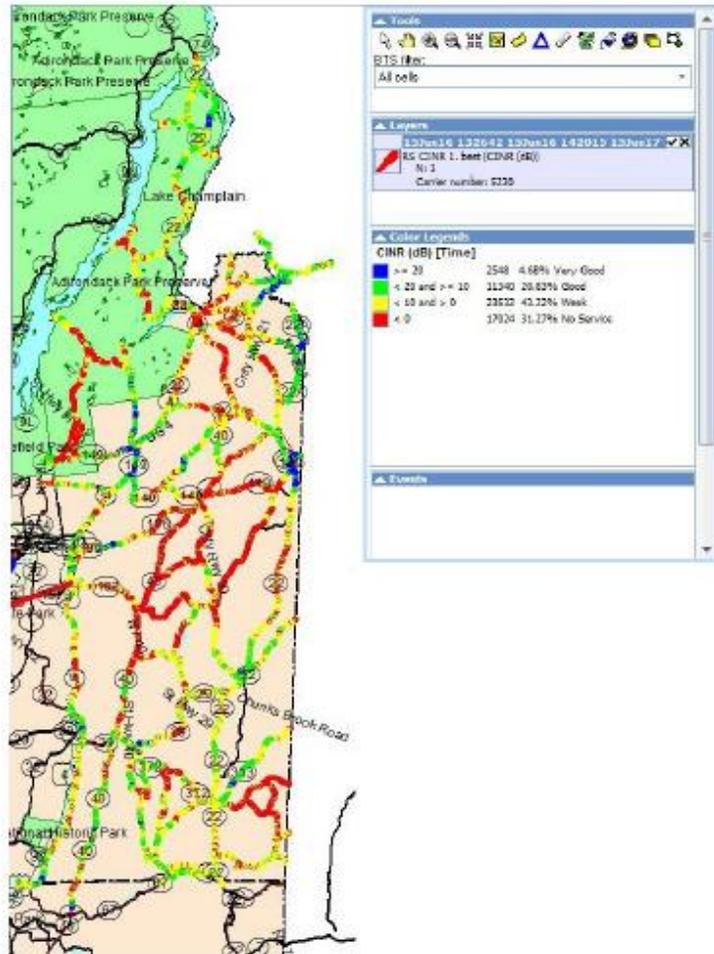


Monday, June 22, 2015



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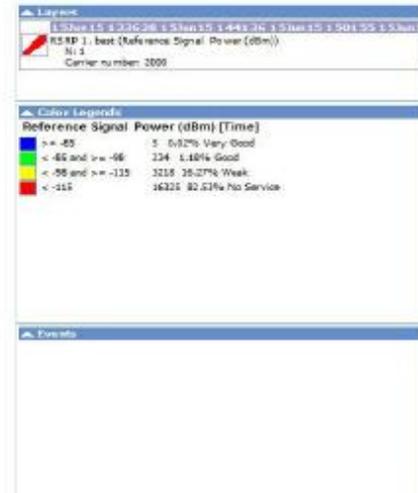
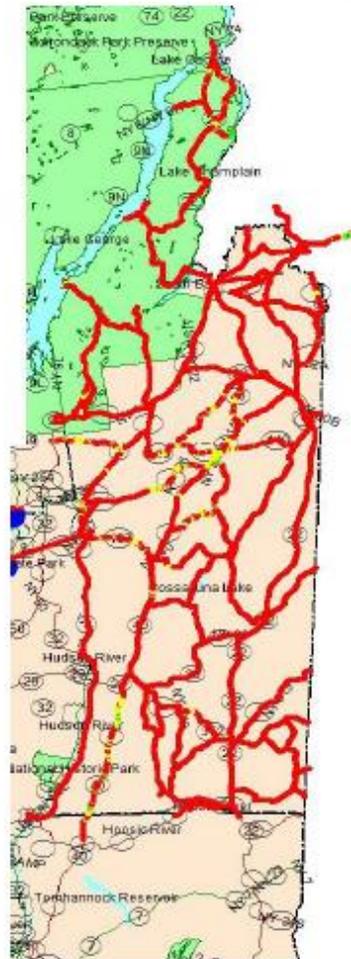




Monday, June 22, 2015

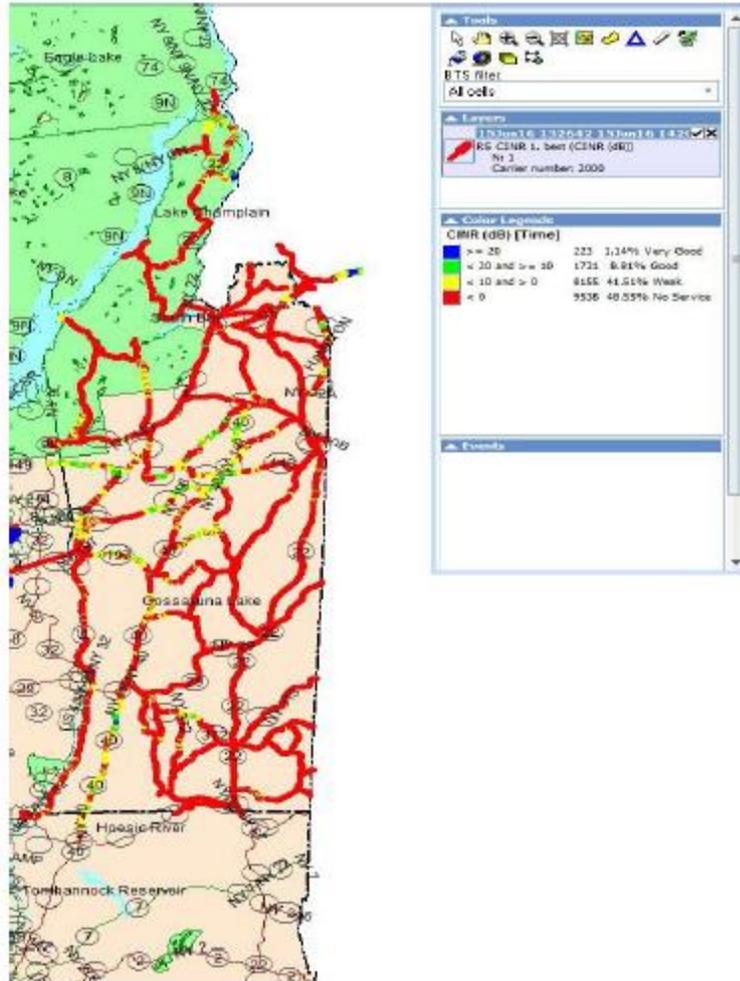
AT&T LTE Results:

1. Channel 2000 (Band 4 AWS, 2115 MHz)



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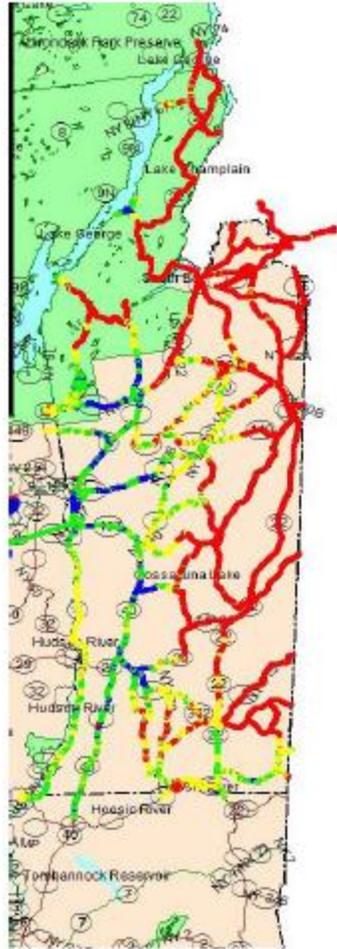
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Monday, June 22, 2015

2. Channel 5110 (Band 12, 739 MHz)



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