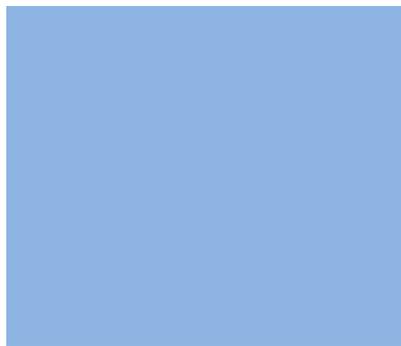
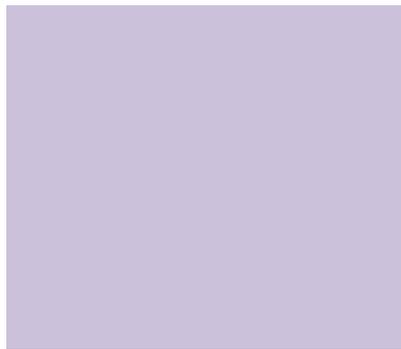


Investing in Broadband

For Windham's Economic Growth



Investing in Broadband For Windham's Economic Growth

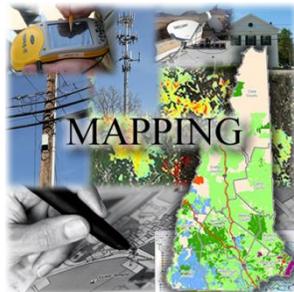
Town of Windham, NH

February 2015

An Economic Development Plan Prepared by the Windham Broadband Advisory Group
& the Southern New Hampshire Planning Commission



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Acronyms

| | |
|--------|--|
| ACS | American Community Survey |
| BPL | Broadband over Power Line |
| BTOP | Broadband Technology Opportunities Program |
| CAI | Community Anchor Institutions |
| DSL | Digital Subscriber Line |
| FCC | Federal Communications Commission |
| Gbps | Gigabit per second |
| GRANIT | Geographically Referenced Analysis and Information Transfer System |
| GSF | Granite State Future |
| HD | High Definition (Video) |
| ISP | Internet Service Provider |
| IT | Information Technology |
| Kbps | Kilobit per second |
| Mbps | Megabit per second |
| NHBMPP | New Hampshire Broadband Mapping and Planning Project |
| NH OEP | New Hampshire Office of Energy and Planning |
| NISP | Neighborhood Internet Service Provider |
| NNHN | Network New Hampshire Now |
| NTIA | National Telecommunications and Information Administration |
| PC | Personal Computer |
| SAU | School Administrative Unit |
| SNHPC | Southern New Hampshire Planning Commission |
| TIF | Tax Increment Financing |

| | |
|-------|------------------------------------|
| UNH | University of New Hampshire |
| VPN | Virtual Private Network |
| Wi-Fi | Wireless Fidelity |
| WISP | Wireless Internet Service Provider |

Executive Summary

The Southern New Hampshire Planning Commission (SNHPC) is utilizing available funding, which was obtained through the NH Broadband Mapping and Planning Program (NHBMPP), through the end of December 2014 to assist the Town of Windham in developing a broadband plan for the town.

The NHBMPP is managed by the University of New Hampshire and is funded by the American Recovery and Reinvestment Act, through the National Telecommunications and Information Administration (NTIA). The NHBMPP has two main components: Broadband Availability, Inventory and Mapping; and Broadband Planning and Technical Assistance. The goal of the NHBMPP is to understand where broadband is currently available in New Hampshire, how it can be made more widely available in the future, and how increased levels of broadband adoption and usage can be encouraged throughout the state. The program advocates expanding broadband infrastructure to support economic development, energy efficiency, healthcare, and improved educational opportunities.

A Broadband Advisory Group was organized and came together to work with the SNHPC to facilitate and guide the development of this plan. Most of the information about the town's broadband services and infrastructure is provided from the NHBMPP, the Town of Windham's 2005 Master Plan, and local broadband surveys and other Town Officials.

The primary focus of the plan is to provide the Town of Windham with guidelines and recommendations for enhancing local broadband infrastructure development and investment within the community. This includes raising awareness of the importance of broadband as an economic development necessity and identifying areas where enhanced broadband infrastructure, access and connectivity can be improved.

The specific goals of the plan are to: (1) provide a brief overview of broadband technology, (2) identify strengths and weaknesses that exist in the Town of Windham's broadband coverage, (3) identify barriers to access for coverage expansion, and (4) make recommendations for what improvements can be made to increase high speed broadband access throughout the community.

Introduction

According to Carol Miller, Director of Broadband Technology at the Department of Resources and Economic Development, New Hampshire has some of the best broadband networks in the U.S., but there are still gaps in rural areas of the state and high-speed broadband services are not equally available across the state and within the state's municipalities. Roughly 9% of the state's population lives in areas with reported gaps according to the New Hampshire Broadband Planning and Mapping Program.¹

In the latest report on the use of Computers and the Internet issued by the US Census in November 2014, NH is ranked 2nd in the nation at 93.2% of households owning a computer and 1st in New England. New Hampshire is also ranked 1st in the nation at 85.7% of households that use high-speed Internet (as defined as 40Mb down by 1Mb up).

According to Akamai's most current June 2014 report, New Hampshire placed 3rd in the nation for increased high speed broadband over 15Mbps to 26% of households, 53% of NH households over 10Mbps; and 84% of NH households with speed of over 4Mbps.²

Over the last 5 years, NH has benefited from over \$600 million of federal and private investment for communications infrastructure improvements with new fiber, telecom and cable broadband expansion, and mobile cellular deployment and upgrades.

Similar to the above statewide statistics, broadband availability and coverage within the Town of Windham, NH is fairly comprehensive and equally available across the town. What Windham would like to see enhanced is speed and resiliency, as noted by many of the survey returns and findings.

In September 2014, an ad-hoc Broadband Advisory Group to help facilitate and guide the development of this plan. Between October 2014 and February 2015, a total of four meetings were held and the following topics were discussed:

1. Who are the current broadband service providers in Windham?
2. Are current broadband services in Windham adequate and reliable?
3. What are the major broadband issues and needs facing Windham?
4. Can current broadband services and speeds be improved and enhanced?
5. How does the business community view their broadband needs in Windham?
6. How does broadband services in Windham compare to other towns in the region/state?
7. Is there a need for more cell towers in Windham in the future?

¹ <http://nheconomy.com/business-services/broadband-telecommunications/default.aspx> (accessed March 6, 2014). It is important to note that these penetration rates are determined at a census block level and then averaged at a statewide level so the exact penetration rate varies considerably by geography (at the census block level) throughout the state. According to the Director of Broadband Technologies with the NH Division of Economic Development, these penetration rates do not mean that every household in the state has broadband.

² Akamai is a leading cloud-based platform that also develops quarterly "State of the Internet" reports based on the data it gathers from servers across the globe; see <http://www.akamai.com/stateoftheinternet/> (accessed September 16, 2013). Akamai's ratings reflect data measured at the edge of all the networks and these averages can fluctuate quarterly when a new report is issued. The rates are also indicative of the competition among states to utilize new network infrastructure and enhanced speed offerings.

8. Is there adequate broadband, wireless communication and Wifi for town and public buildings?
9. Are there any streets, subdivisions, neighborhoods currently underserved?
10. What are the major elements of the town's cable franchise agreement?
11. Is the franchise agreement up to date and adequate?
12. How do the town's telecommunications regulations stack up to current state statutes?
13. What can Windham do to accommodate and bring about enhanced broadband services in the future?

Many of the answers to these questions are provided by the maps and information contained in this plan. Where information is lacking, it is recommended that the Town of Windham staff and relevant boards and committees dedicate the necessary time and energy to better understand the issue and develop effective strategies and actions.

Understanding Broadband

Background

Reliable high speed broadband access is an increasingly important asset for communities. The benefits of having reliable and high speed broadband internet services is critical for economic development, small business growth, emergency services, and can result in increased property values and improved quality of life. The proliferation and expansion of broadband access today is often paralleled with the great public infrastructure projects of the Twentieth Century – namely the expansion of the electricity network and the creation of the interstate highway system. Today, high speed broadband access creates economic development opportunities, increases the potential of business and industry, provides greater educational opportunities to both adults and children, improves the ability and efficiency of emergency responders and government officials to effectively do their jobs and improve the lives of all citizens.

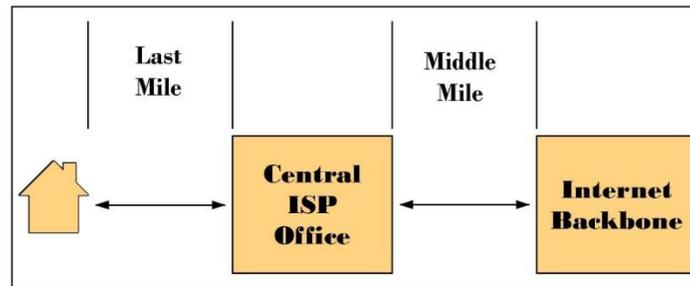
However, high speed broadband access is often hindered by factors, such as low population densities, and geographical barriers, like topography and infrastructure costs. It often does not make financial sense for internet service providers to extend the necessary “last mile” broadband infrastructure to homes and businesses in remote locations where there will likely be no profit. As a result, rural residents and businesses must often deal with spotty or non-existent broadband coverage. Approximately 19 million Americans—6 percent of the population—still lack access to fixed broadband service at threshold speeds. In rural areas, nearly one-fourth of the population —14.5 million people—lack access to this service. Even in areas where broadband is available, approximately 100 million Americans still do not subscribe.³ See Figure 1 for a diagram of Broadband Infrastructure.

One of the most important tools in broadband planning is the National Broadband Map. This map was created by the National Telecommunications and Information Administration, the Federal Communications Commission (FCC) and all States of the United States. It is an online tool that provides semi-annual information on the availability, technology, speed, and location of broadband Internet access at the census block level. In looking at the National Broadband Map for Rockingham County, the county has a total population of 295,074 and of that, a total population of 15,944 is without broadband access. With a population density (population per square mile) of 425 and a per capita income of \$35,889, the

³ [“Eighth Broadband Progress Report,”](#) Federal Communications Commission, August 2012.

percentage of housing units in Rockingham County with access to broadband with fiber is 0% and cable is 78%. (National Broadband Map Data, Eight Broadband Progress Report, Federal Communications Commission, June 2011.)

Figure 1: Diagram of Broadband Infrastructure



Source: SNHPC 2012

Broadband Speed

Broadband is defined in terms of how fast the user's computer can download and upload information from the internet. Download speed is the rate that a computer receives data from the internet while upload speed is the rate a computer can send data. The speed at which information can be transmitted depends on bandwidth. Bandwidth is the transmission capacity of an electronic pathway. That capacity can be described in terms of how much data, measured in bits, can be transmitted per second, and is reported in kilobits (Kbps), megabits (Mbps), and gigabits (Gbps). NTIA defines broadband as providing a minimum speed of 768 Kbps download and 200 Kbps upload. Most broadband technologies have different downloading and uploading speeds, with upload speed typically being more limited. As technology and applications continually change, there are many different types of broadband services, as well as resulting speeds and functions while using the internet.

Although NTIA defines broadband at a 768 Kbps minimum download threshold, download speeds up to 3 Mbps have limited functionality. At up to 3 Mbps, internet users are able to use web-based email, send and receive small to medium-sized documents, and browse the web. However, operating multiple functions may cause potential slowness, making it difficult to conduct necessary business and education operations. Today, in order to use many internet applications successfully, a minimum download speed of 3 Mbps is required. From 3 Mbps to 6 Mbps download speed, and 1.5 Mbps to 3 Mbps upload speed, users can send and receive photos and word documents through email, conduct multiple functions simultaneously, and access small window videoconferencing, such as Skype.

At 6 Mbps to 10 Mbps download and 3 Mbps to 6 Mbps upload, users can send and receive large documents and files, such as small videos, and can access their company's network while traveling or working from home with a speed of operation that is similar to being in the office. Also, higher quality videoconferencing can be conducted, allowing businesses to communicate with clients, partners, and employees. At 10 Mbps to 25 Mbps download and 6 to 10 Mbps upload, telemedicine and telehealth applications are possible and remote education, professional development, and workshops can occur in high definition (HD) quality. At 25+ Mbps download and 10+ Mbps upload, real time HD medical imaging

and consultation can occur.⁴ As internet technology and applications continuously emerge and evolve, it takes much more than the minimum broadband threshold to operate successful businesses, and provide relevant education and quality medical care.

The New Hampshire Broadband Mapping and Planning Program developed a matrix to assist stakeholders in understanding the many levels of broadband available in the state of New Hampshire today, as well as the typical functions a user might be able to perform within a range of download and upload speed tiers. Using these tiers, the NHBMP has established three broadband availability categories (“un-served,” “underserved,” and “served”) to describe access to broadband service. Figure 2 is a condensed version of the NHBMP matrix.

Figure 2: Tiers of Broadband Service

| Tiers of Service | Download Speed | Upload Speed | Typical Functions / Use <i>(functions additive to level above)</i> |
|------------------|------------------------|------------------------|--|
| un-served | < 768 Kbps | < 200 Kbps | <ul style="list-style-type: none"> • Email (client/server-based) |
| underserved | 768 Kbps to < 1.5 Mbps | 200 Kbps to < 768 Kbps | <ul style="list-style-type: none"> • Web-based email • Limited web browsing • Send/receive small documents not concerned with speed of download/upload • Single user internet device |
| | 1.5 Mbps to < 3 Mbps | 768 Kbps to <1.5 Mbps | <ul style="list-style-type: none"> • Medium social media use • Send/Receive medium-size documents/files • Limited streaming content, buffering a concern • 1-3 simultaneous internet devices possible |
| served | 3 Mbps to <6 Mbps | 1.5 Mbps to <3 Mbps | <ul style="list-style-type: none"> • Send/Receive medium to large-size documents or files • Streaming content, downloading High Definition (HD) content, speed a concern • Low quality, small window videoconferencing |
| | 6 Mbps to <10 Mbps | 3 Mbps to 6 Mbps | <ul style="list-style-type: none"> • Send/Receive large documents or files (small videos) • Streaming HD • Virtual Private Network (VPN) access for remote work at speed critical to job function • Multi-player online gaming |
| | 10 Mbps to <25 Mbps | 6 Mbps to <10 Mbps | <ul style="list-style-type: none"> • HD quality, large frame videoconferencing • Remote synchronous education, professional development facilitated simultaneously at multiple locations • Tele-health applications possible |
| | 25+ Mbps | 10+ Mbps | <ul style="list-style-type: none"> • Send/Receive medium to large databases • Real-time HD medical imaging and consultation, remote patient monitoring |

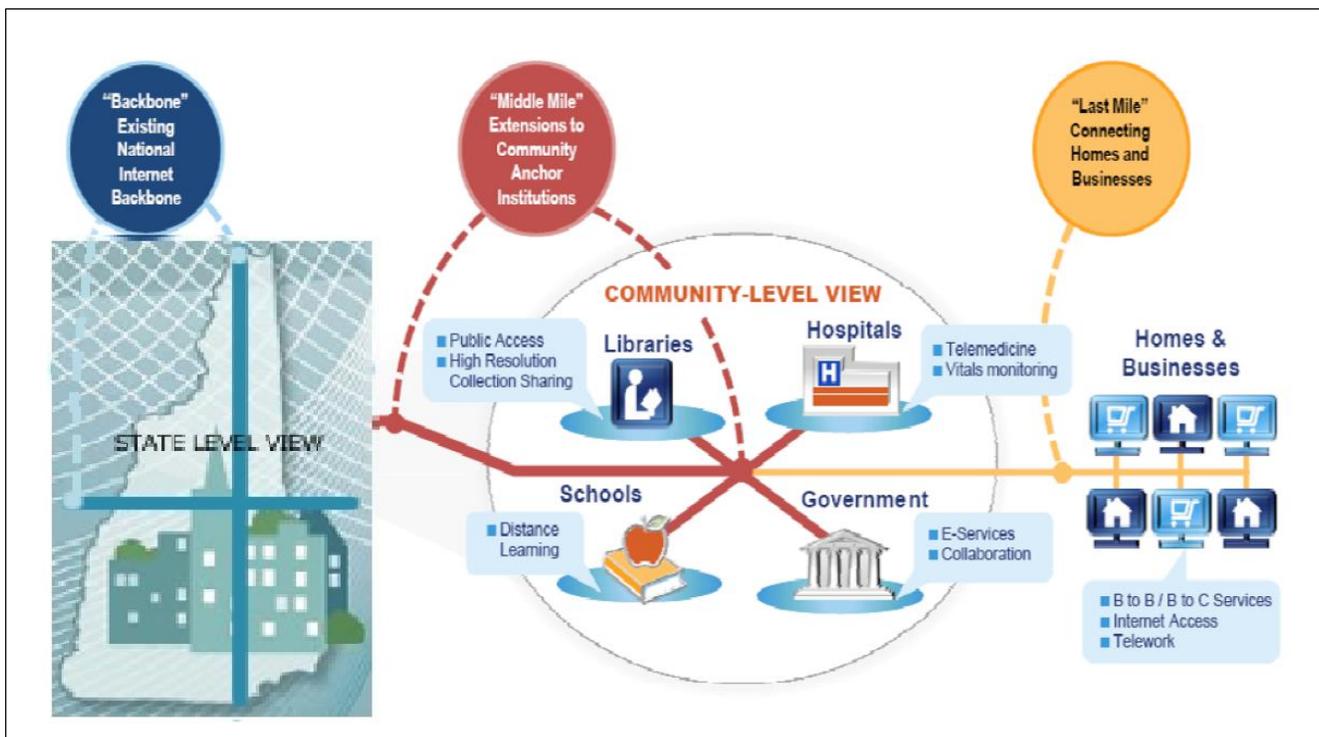
Source: New Hampshire Broadband Mapping and Planning Program <http://www.iwantbroadbandnh.org>

⁴ “Broadband: As defined by the NH Broadband Mapping and Planning Program,” *New Hampshire Broadband Mapping and Planning Program*, February 15, 2012, <http://iwantbroadbandnh.com/planning-and-assistance>. (accessed July 17, 2013).

Broadband Network

Establishing a broadband connection requires investment in a physical network that facilitates the transfer of information. Broadband infrastructure consists of an internet “backbone,” which is hosted by large commercial, government, academic, and other high-capacity network centers. The “middle mile” refers to the segment linking a network operator’s core network to the local network plant. In order to transport the internet to homes and businesses, known as the “last mile,” it can be most cost-effective to increase the reach of the “middle mile” through community anchor institutions. Community anchor institutions are typically municipal libraries and town offices, hospitals, schools, emergency services and public safety operations, and large businesses that have the means and capacity to access broadband-based services. The majority of home and small business users rely on the last mile hosts, Internet service providers (ISPs), to obtain broadband services.⁵ Figure 3 shows these network connections.

Figure 3: Broadband Network Connections



Source: <http://www.whitehouse.gov/sites/default/files/20091217-recovery-act-investments-broadband.pdf>

⁵ State of New Hampshire, Department of Resources and Economic Development and The Telecommunications Advisory Board, State of New Hampshire Broadband Action Plan: Appendix A, 2008, <http://www.nheconomy.com/uploads/Broadband-Action-Plan-Appendices.pdf>. (accessed July 17, 2013).

Broadband Technology

There are many different broadband delivery technologies. These technologies can be separated into two major categories of wired and wireless broadband. Wired technologies include Digital Subscriber Lines (DSL), Cable Modem, Fiber Optics, Leased Lines (T1), and Broadband over Powerline (BPL). Wireless technologies include mobile wireless (3G, 4G, LTE, and WiMax), Wi-Fi, satellite, and Wireless Internet Service Providers (WISP).⁶ Wired broadband technologies bring a wire connection to the home or business. Often, a Wi-Fi router is used by the subscriber to share the internet connection wirelessly among different devices within the home, such as a laptop computer or tablet.

Digital Subscriber Lines (DSL) and Cable Modem are wired technologies commonly used by residential and small businesses. DSL uses copper phone lines to deliver direct, one-on-one connections to the internet, allowing users to not have to share bandwidth with neighbors. Users must be located within 18,000 feet (3.4 miles) of a phone company's central office, which means service is often unavailable in rural areas.⁷ The most common DSL connections are asymmetric, with networks offering more bandwidth and faster speeds for download compared to upload, since residential users predominately are downloading more information from the internet than uploading. Symmetric types of DSL provide equal bandwidth for uploading and downloading speeds, which is sometimes marketed as "Business DSL" as companies often have greater needs for uploading, or transmitting data.

Cable Modem, which is typically faster than a common asymmetric DSL connection, uses the cable network to deliver broadband to users. Cable networks are a shared connection, so speeds can slow during peak usage times due to congestion when people in the same neighborhood are online. Fiber optic systems use lasers across very thin strands of glass creating reliable, resilient technology that has an extremely high capacity for speeds and data transmission. There is a high cost associated with laying out the fiber network but once in place, the system can be easily upgraded and maintained, with lower operating costs than DSL, cable, or wireless networks.⁸ Building out the fiber network is currently the most effective means to provide the highest capacity broadband internet.

Wireless broadband is available through many technologies, including mobile wireless (3G, 4G, and LTE), Wi-Fi, satellite, and Wireless Internet Service Providers (WISP). Unlike wired technologies, which bring wires directly to a location, wireless technologies use radio frequencies through transmitters and receivers to deliver broadband. Wireless broadband can be categorized as wireless networks or satellite. Cell phones, and other mobile devices, use mobile wireless licensed technologies such as 3G, 4G, LTE, WiMax, and other networks. Wi-Fi or 'hotspots' are designed to broadcast the internet for several hundred feet. They are used by public and private networks, including businesses for their employees or retailers for their customers, who connect to the internet using built-in Wi-Fi cards in their mobile devices (e.g. laptops, tablets, cell phones, etc.).

Wireless Internet Service Providers are designed to cover large areas using point-to-multipoint networks to broadcast wireless data up to 20 miles. A signal is broadcast from a base station and is received by a

⁶ "Wireless Internet 101," *Institute for Local Self-Reliance*, <http://www.ilsr.org/content-types/fact-sheets-resource-archive/?contenttype=fact-sheets-resource-archive&initiative=broadband>. (accessed June 2013).

⁷ Shuffstall, Bill, Monica Babine, and Andy Lewis, "Connecting Communities," *The National e-Commerce Extension Initiative*, <http://www.connectingcommunities.info/>. (accessed July 2013).

⁸ "Broadband 101," *Institute for Self-Reliance*, <http://www.ilsr.org/content-types/fact-sheets-resource-archive/?contenttype=fact-sheets-resource-archive&initiative=broadband>. (accessed on July 17, 2013).

fixed wireless antenna mounted on a customer's premises. A combination of a Wi-Fi Hotspot and a WISP can enable a Neighborhood Internet Service Provider (NISP) or a Wi-Fi Hotzone. A Wi-Fi Hotzone can cover a set geographic area such as a neighborhood, shopping mall, or campground.⁹ WISP networks can provide "last mile" solutions and broadband availability to rural areas where it is often cost-prohibitive to build wired networks.

Satellite internet users send and receive information via small dishes installed on the premises to a satellite in space, which retransmits the signal to a network operation center that is connected to the internet. Satellite-based internet connection can be interrupted by objects and weather, and upload speeds are typically slower than wired or other wireless networks.¹⁰

While wireless broadband can offer mobility and access for rural locations, wireless connections are unlikely to overtake the wired network, which is likely to maintain higher speeds and lower costs, especially when compared to a ubiquitous fiber network. Wireless and wired broadband networks can be thought to complement each other to create available broadband internet connections.¹¹

Federal Telecommunications Act of 1996

The Federal Telecommunications Act of 1996, enacted by the Federal Communications Commission (FCC), is the comprehensive federal law that governs the telecommunications industry. Section 704 of the Act specifically outlines the land use and zoning roles local governments can play regarding telecommunications and wireless infrastructure. It grants local governments zoning authority for the most part, stating "Nothing in this Act shall limit or affect the authority of a State or local government or instrumentality thereof over decisions regarding the placement, construction, and modification of personal wireless service facilities." There are several exceptions and/or limitations to this statement outlined in Section 704, which include:

- Land use development standards may not unreasonably discriminate among wireless service providers and may not prohibit the deployment of personal wireless services.
- Local governments must act upon applications for new wireless infrastructure within a reasonable period of time after the request is filed according to the nature and scope of the request.
- Land use policies may be adopted to promote the location of telecommunications facilities in certain designated areas. The Act also encourages the use of third party professional review of site applications.
- Local governments cannot deny an application for a new wireless facility or the expansion of an existing facility on the basis of the environmental effects of radio frequency emissions, provided such facilities comply with the FCC's emissions regulations.

⁹ Shuffstall, Bill, Monica Babine, and Andy Lewis, "Connecting Communities," *The National e-Commerce Extension Initiative*, <http://www.connectingcommunities.info/>. (accessed July 2013).

¹⁰ Shuffstall, Bill, Monica Babine, and Andy Lewis, "Connecting Communities," *The National e-Commerce Extension Initiative*, <http://www.connectingcommunities.info/>. (accessed July 2013).

¹¹ "Wireless Internet 101," *Institute for Local Self-Reliance*, <http://www.ilsr.org/content-types/fact-sheets-resource-archive/?contenttype=fact-sheets-resource-archive&initiative=broadband>. (accessed June 2013).

Section 704 also states:

“Any person adversely affected by any final action or failure to act by a State or local government or any instrumentality thereof that is inconsistent with this subparagraph may, within 30 days after such action or failure to act, commence an action in any court of competent jurisdiction.”

Additionally, Section 707 of the Act requires states to keep up to date with the latest advanced technology available and to help foster its expansion. This applies especially to broadband service, which was not widely available in 1996 when the Act was initially released. The Section states:

The Commission and each State commission with regulatory jurisdiction over telecommunications services shall encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans (including, in particular, elementary and secondary schools and classrooms) by utilizing, in a manner consistent with the public interest, convenience, and necessity, price cap regulation, regulatory forbearance, measures that promote competition in the local telecommunications market, or other regulating methods that remove barriers to infrastructure investment.¹²

Why is Broadband Important?

As a predominantly rural state, the availability of high-speed internet is one of the most significant factors impacting the ability of communities to achieve economic growth and maintain a certain quality of life. In a relatively short period of time, fast and reliable broadband has become essential for economic and community development and it is critical infrastructure for public safety, education, health care, business and government operations.¹³ This is shown in Figure 4.

Communities today face many challenges: a competitive global marketplace; an aging population; the need for a better-educated and better-prepared workforce; and, access to health care. These issues are magnified in rural areas, as the distance between households and services makes it difficult to access certain resources and opportunities. Reliable and cost-effective broadband can help community leaders find innovative solutions to these challenges.

There is no doubt that we live in an information society, and broadband connects us to opportunities and services. Whether this is training for a new skill, a new language, or completing an online course, broadband facilitates the access of information in many different forms.¹⁴

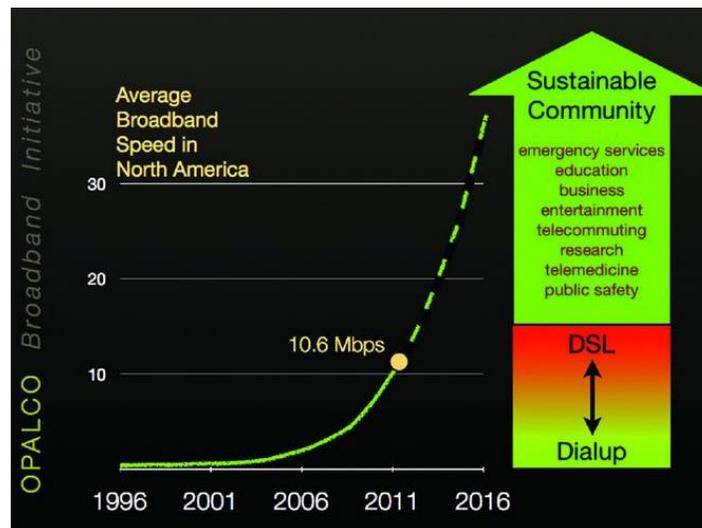
¹² All the information contained in this section is provided from the Federal Communications Commission’s 1996 Telecommunications Act, <http://www.fcc.gov/Reports/tcom1996.pdf>

¹³ “Building Community Capacity through Broadband (BCCB) Initiative,” *University of Wisconsin Extension*, November 2010, http://www.uwex.edu/broadband/documents/BCCBUWEXFAQ_rev_11_18_10withmap.pdf. (accessed June 2013).

¹⁴ David Salway, “Why is Increasing Broadband Adoption so Important to Society?,” *About.com Guide*, <http://broadband.about.com/od/barrierstoadooption/a/Why-Is-Increasing-Broadband-Adoption-So-Important-To-Society.htm>. (accessed July 2013).

In 2010, it was estimated that there were almost 200 million Americans with access to broadband at home, up from 8 million in 2000.¹⁵ While this is an impressive increase, there are still many Americans with insufficient access to broadband services. In New Hampshire, access varies from good coverage and availability in denser areas of the state to areas of un-served and under-served communities in the northern, western and eastern parts of the state. This variability can lead to disparities in economic opportunity, education, community vitality, public health and safety, and quality of life.

Figure 4: Projected Broadband Speed in North America



Source: <http://www.opalco.com/broadband/do-we-really-need-faster-internet-service-2013-05-01/>

For Education

Broadband is an important tool that enhances access to and improves the quality of education at all levels, in New Hampshire and across the country. Broadband-enabled teaching and learning has the potential to extend learning beyond the limits of the classroom, provide more customized learning opportunities, and increase the efficiency of school systems.¹⁶ The availability of a wide range of internet based resources, such as distance learning programs, online learning modules, and digital textbooks allows students to engage in multimedia lessons, take virtual trips, and communicate with classrooms in other parts of the world. These tools offer educators a platform to share curricula and provide adult learners easy access to professional development or educational opportunities online.

However, as teaching and broadband technology become increasingly intertwined, students lacking access to adequate broadband, both in school and at home, will be unable to keep up with educational trends and potentially, be less prepared than their peers in more 'connected' areas. The State Educational

¹⁵ Federal Communications Commission, *Connecting America: The National Broadband Plan*, 2010, http://www.broadband.gov/plan/11-education/#_edn16. (accessed July 17, 2013).

¹⁶ Federal Communications Commission, *Connecting America: The National Broadband Plan*, 2010, http://www.broadband.gov/plan/11-education/#_edn16. (accessed July 17, 2013); United National Educational, Scientific, and Cultural Organization, Technology, *Broadband and Education: Advancing the education for all agenda*, Jan. 2013, <http://unesdoc.unesco.org/images/0021/002196/219687e.pdf>. (accessed July 17, 2013).

Technology Directors Association recommends that K-12 schools have access to broadband speeds of 100 megabits per second for every 1,000 students and staff by the year 2014 and 1 gigabyte per second by 2017.¹⁷ Although most schools provide some level of internet access, too often the speeds of these connections fall short of what is considered appropriate or necessary.¹⁸ This need for improved broadband connections in schools will only increase over time, especially as educator's transition to web-based content and resources and more states require online assessments and testing.

Not only does the availability of reliable broadband technology offer advances in education, it is imperative to the economic welfare and long-term success of our state and nation.¹⁹ Participation and competition in the global economy is increasingly dependent on twenty-first century skills, including the ability to effectively use technology and navigate the digital world.²⁰ Providing access to learning opportunities that address these skills can help empower students to actively engage in an increasingly technology-driven and digital culture.

According to Adam Steel, Business Manager with the Windham School District, Windham Schools currently have in place a scalable 300mb/s connection to the Internet and fiber connections between all locations. All the schools also provide access, after school, throughout each building for WiFi use. Over the next three years, the School District is looking to increase the bandwidth between the school building locations to 10GB Fiber and expand the school's network footprint allowing for the extension of services beyond just the core buildings. This includes utilizing current infrastructure, as well as building out several other key areas. This would allow students to have greater access to technology and resources beyond the standard school day. The goal is to foster the notion of a truly Digital Learning Commons and allow easier access to resources both Flipped and Virtual Classrooms.

For Health Care

With increasing and changing health needs, ranging from rising health care costs, managing chronic illnesses, meeting the needs of an aging population, and a shortage of specialists in rural locations, broadband internet plays an important role in how these issues are addressed. Many emerging technologies and approaches to health care are dependent on broadband connections to improve health care outcomes, while also controlling costs and extending the reach of health care providers.²¹ Individual patients, providers, and the overall public health of a community benefit from more efficient, innovative, and informed health care systems as new technologies are adopted.

Telehealth, the broader term incorporating telemedicine, is the transfer of electronic medical data (images, sounds, live video and patient records) from one location to another. It includes the use of electronic information and telecommunications technologies to support long distance clinical care,

¹⁷ C. Fox, J. Walters, G. Fletcher and D. Levin, "The Broadband Imperative: Recommendations to Address K-12 Education Infrastructure Needs," *State Education Directors Technology Association*, 2012, <http://www.setda.org/web/guest/broadbandimperative>. (accessed July 17, 2013).

¹⁸ C. Fox, J. Walters, G. Fletcher and D. Levin, "The Broadband Imperative: Recommendations to Address K-12 Education Infrastructure Needs," *State Education Directors Technology Association*, 2012, <http://www.setda.org/web/guest/broadbandimperative>. (accessed July 17, 2013).

¹⁹ Federal Communications Commission, *Connecting America: The National Broadband Plan*, 2010, http://www.broadband.gov/plan/11-education/#_edn16. (accessed July 17, 2013).

²⁰ Charles M. Davidson and Michael J. Santorelli, *The Impact of Broadband on Education*, A Report to the U.S. Chamber of Commerce, Dec. 2010, http://www.uschamber.com/sites/default/files/about/US_Chamber_Paper_on_Broadband_and_Education.pdf. (accessed July 2013).

²¹ Federal Communications Commission, *Connecting America: The National Broadband Plan*, 2010, http://www.broadband.gov/plan/11-education/#_edn16. (accessed July 17, 2013).

patient and professional health-related education, public health, and health administration.²² New Hampshire, with a rural geography, scarcity of local specialty medical services, and a high percentage of elderly residents, can benefit from telehealth systems.²³ Broadband internet is necessary to continue supporting current and emerging telehealth applications for patients, providers, hospitals, and health care businesses.

Electronic medical records systems enable providers to collaborate on patient care by accessing treatment information from different locations. Patients can have better access to their medical records and information in an effort to better engage them and their families in managing their health. Video conferencing allows physicians to conduct video consultation and monitor treatment of patients remotely. It also increases the reach of specialized physicians and research.²⁴ Broadband internet connection plays an essential role in the ability to incorporate the latest health technologies that benefit patients, health providers, and health industry businesses.

For Community Support/Government

From providing a displaced community member with food and shelter to organizing community initiatives, local governments and community support organizations in New Hampshire deliver a wide variety of valuable services to their constituents. Demands for services are constantly increasing, yet organizational budgets rarely follow that same trend. Broadband connectivity provides the capacity to more efficiently and cost-effectively deliver services, while opening up possibilities for new services and facilitating more robust public participation.

Undoubtedly, certain matters will always be best handled through face-to-face contact but technology can augment New Hampshire's tradition of accessibility to the public process. Citizens have come to ask for, and sometimes expect, a certain level of online interactivity with government and community support organizations. Most towns in New Hampshire currently host websites, which provide immediate, remote access to public notices, event calendars, applications, forms, ordinances and regulations. While constituents benefit from easy access to the information they need, governments and community support organizations save time, money and resources when routine requests are handled online.

Equal in value to the administrative and E-governance efficiencies associated with broadband technology are the accessibility opportunities broadband creates. Online meetings, surveys, blogs and other modules offer new ways for a larger percentage of the population to watch and participate in community decision-making processes. Similarly, technologies utilized by community support organizations now enable them to administer one-on-one services without travelling great distances.

²² Louis Kazal Jr. and Anne Conner, "Planning and Implementing a Statewide Telehealth Program in New Hampshire", 2005, <http://www.endowmentforhealth.org/uploads/documents/resource-center/Planning%20and%20Implementing%20a%20Statewide%20Telehealth%20Program%20in%20NH.pdf>

²³ Louis Kazal Jr. and Anne Conner, "Planning and Implementing a Statewide Telehealth Program in New Hampshire", 2005, <http://www.endowmentforhealth.org/uploads/documents/resource-center/Planning%20and%20Implementing%20a%20Statewide%20Telehealth%20Program%20in%20NH.pdf>

²⁴ Federal Communications Commission, *Connecting America: The National Broadband Plan*, 2010, http://www.broadband.gov/plan/11-education/#_edn16. (accessed July 17, 2013).

For Public Safety

New Hampshire is a predominantly rural state, where firefighters, law enforcement and emergency medical personnel cover wide geographic areas. Public safety personnel need the ability to quickly communicate with each other, access online resources (via a PC or mobile device), connect to networks, and quickly transfer important video and data files during emergencies. Broadband access, through a combination of wired and wireless technologies, can enhance public safety by enabling first responders to make informed decisions and allowing them to communicate with one another effectively, usually resulting in reduced loss of life and property. Having a reliable and seamless communication network is also important for the public in times of emergencies in order to communicate with first responders.

Chief Lewis, with the Windham Police Department, provided the following statement for use in this plan:

“Also with limited budgets and minimal public sector growth most agencies do not have the ability to add additional staff. Hence technology, primarily in the area of broadband communications, is critical. Speed and thoroughness of information allows authorities to quickly obtain and evaluate information and act sooner, which in many cases can help avert a more significant incident requiring additional manpower and resources.”

In addition, Chief Lewis has identified the following areas of concern with cellular signals, as well as radio, within the Town of Windham:

| | |
|--------------------------------------|---------------------------|
| Shelley Road | Wilson Road |
| North Lowell Road | Castle Hill Road |
| Field Road | Rowe Road |
| Deer Leap | Ryan Farm Road at the end |
| Heritage Hill Road | Londonderry Road |
| Country Club Road | Glance Road |
| Parts of Searles Road | Marblehead Road |
| Mammoth Road at the Pelham town line | |

For Economic & Business Development

The total economic impact of broadband in New Hampshire was estimated at \$634 million in 2010 and in 2011, 11,000 net new jobs were created as a result of expanded broadband.²⁵ The use of broadband for economic development improves the ability to retain and recruit businesses, increases business profitability, attracts highly skilled workers, improves the efficiency of municipal services, enhances access to healthcare, and contributes to stronger educational attainment. There are all are key ingredients to a successful economic development strategy.

²⁵ R. Crandall and H. Singer. “The Economic Impact of Broadband Investment.” *National Cable and Telecommunications Association*, 2010.

Jobs depending on broadband and information and communications technology will grow by 25 percent between 2008 and 2018 or at a rate of 2.5 percent faster than the average for other occupations and industries.²⁶ To say that broadband technology has not changed the way we do business is to deny the tremendous impact that computers have had on our lives worldwide. In 2011, 73 percent of New Hampshire households and businesses had access to broadband and, nationally in 2012, 66 percent of adults have broadband at home, which is up from 3 percent in 2000.²⁷

Investment in broadband is showing benefits for small businesses and local economies, as well. A Connect Iowa study of the state's small businesses found that Iowa small businesses generate \$1.9 billion in online sales and that small businesses with a broadband connection have revenues that are \$200,000 higher annually than those which do not.²⁸

Broadband and broadband-dependent applications allow small businesses to increase efficiency, improve market access, reduce costs and increase the speed of both transactions and interactions. By using Web-based technology tools, naturally 68 percent of businesses surveyed boosted the speed of their access to knowledge, 54 percent saw reduced communications costs and 52 percent saw increased marketing effectiveness.²⁹ The use of broadband by small businesses has proven to be an efficient and cost effective tool. Business statistics have shown that small businesses have consistently been the backbone for job and wealth creation in the US economy. The use of broadband has truly served to enrich that position into the 21st century.

The NH Economic and Labor Market Bureau anticipates that by expanding broadband access and capacity, additional businesses within the major industry sectors of Good-Producing Industries and Service-Producing Industries will likely grow or relocate to the SNHPC Region, thereby generating higher wage jobs. Generally, most all industry sectors today depend on broadband access for information and business purposes. Increased economic benefits could also be realized through free Wi-Fi access throughout the region. This region wide goal to expand broadband access and capacity would also benefit the Town of Windham.

High-speed internet has also sparked a revolution in telecommuting and home-based businesses by allowing employees to access files and servers off-site to work and allowing new businesses to start-off slowly with minimal overhead. By increasing the popularity and rate of telecommuting, businesses and workplaces can help to decrease traffic congestion and greenhouse gas emissions and improve quality of life. The rise in home-based businesses help foster the entrepreneurial spirit and keep the economy moving forward. Coordinated efforts such as this plan to increase broadband capacity and access can help in achieving these goals.

The Census Bureau term "work at home" does not distinguish between those who have a home-based business and those telecommuting; however, these numbers are the most accurate portrayal of workers telecommuting. A large percentage of Windham residents also work at home (8.2 percent), as reported by the 2007-2011 ACS 5-year estimate.

²⁶ Federal Communications Commission, *Connecting America: The National Broadband Plan*, 2010, http://www.broadband.gov/plan/11-education/#_edn16. (accessed July 17, 2013).

²⁷ The Pew Internet and American Life Project, Sept. 2012, available at <http://www.pewinternet.org/>.

²⁸ Anna Read and Damon Poter, "Building High-Speed Communities," *APA Planning Magazine*, March 2013.

²⁹ Federal Communications Commission, *Connecting America: The National Broadband Plan*, 2010, http://www.broadband.gov/plan/11-education/#_edn16. (accessed July 17, 2013).

Summary

This business attraction model must also include broadband improvements as an essential component of the town's economic development vision. In addition, it must view broadband in a larger lens particularly in retaining a younger, well educated population and workforce. In short, the key to expanding and improving broadband access and connectivity in Windham must come from the businesses, neighborhoods and residents which demand greater access and higher speeds. The Town of Windham has many characteristics that encourage economic development, as well as positive indicators of economic growth for the future. The success of Windham's economic future is dependent on stable, state of the art and equitable broadband access and service. Windham's many desirable attributes, its skilled workforce, and improvements in broadband infrastructure, access, connectivity and resiliency will help to sustain this performance in the future.

Broadband Implementation: Challenges & Opportunities

There are many political/regulatory, economic, social, and technological barriers related to broadband development, investment and implementation. These barriers are at all levels – national, state, and in Windham, which are notes as follows.

Political/Regulatory Barriers

Regulatory Concerns - Cable/Internet providers do not fall under the purview of the NH Public Utilities Commission and broadband providers prefer not to be regulated as a utility by the Public Utilities Commission. While cable TV access franchises are subject to negotiated agreements with individual municipalities, the broadband/Internet component of the service is not part of formal franchise service negotiations.

Deployment Difficulties – Many consider deployment to certain rural remote areas to be cost-prohibitive. Securing pole attachment rights is costly and sometimes abetted by competitive conflicts.

Economic Barriers

Inadequate Access for Commercial Applications - The level of service required by technologically demanding business in the foreseeable future could potentially outstrip the planned build-out of broadband services.

Economic Constraints – The capital investment required to provide broadband service in areas with low population densities may not be economically feasible for the private sector because the return on investment is too low. In these cases, public funding will likely be needed. Additionally, some providers appear to be focusing on expansion of metered wireless broadband services rather than wired broadband, indicating it may be the more lucrative investment. Alternative economic models (e.g. municipal or neighborhood association financing) to provide last mile connections exist but some existing providers discourage this approach.

Social Barriers

Complacency – Many residents and businesses feel that the region is adequately served and prepared for the future. There has been a lack of concern about broadband access among the general resident population. The perception is that, by and large, broadband access and speed are adequate.

Age – Some of those within the aging population have not adopted the changes that the Internet has brought to society over the past 20 years. As government, healthcare and businesses shift to the use of Internet applications, those without sufficient Internet access or knowledge will be left behind.

See Appendix D for the results of the Granite State Future Survey.

Technological Barriers

Infrastructure Information - In order to understand future network expansion, the large commercial broadband users need to understand the existing broadband infrastructure, and its ability to meet future needs. There is a desire to have better information relating to the location of broadband backbone infrastructure, as well as existing and potential bottlenecks. This information is available from public providers but is considered proprietary by the private providers and unavailable to planning agencies or users. If there were regulation of the industry, or if service level agreements became part of commercial delivery business models, the information might be available and service might be provided.

Regional/Local Community Opportunities

The following list identifies a number of potential opportunities for improving broadband investment and implementation within communities:

Public/Private Partnerships – Prepare a guidance document to help communities and neighborhoods understand the potential to partner with service providers to extend lines into underserved areas of the community. A revolving loan grant program may support such an initiative.

Service Expansion Grants: Explore grant opportunities to extend service/capabilities in underserved neighborhood/communities.

Regional collaboration: Bundle a larger numbers of users to leverage increased investment and responsiveness from existing service providers to enhance their offerings.

Publish Accurate Service Maps: Precise service maps may show providers the potential savings by displaying accurate service regions (less wasted advertising to areas with no infrastructure), provide customers with information on the extent (or lack of) service. Internet capacity is increasingly a feature that impacts property values and choice.

Community Master Plans: Develop a broadband-specific chapter for local and regional master plans to help with understanding of zoning for broadband infrastructure and awareness of broadband as critical infrastructure for economic development and quality of life. This will help to maintain consistency and to share innovative ideas.

Legal reform: Identify regulatory issues, such as pole attachment, fixed wireless antenna placement and shared radio frequency rights, then work to resolve those issues within communities where possible.

Local Technical Assistance: Develop a regional informational package for municipalities to help local decisions makers better understand how to foster broadband improvements through franchise agreement and other means.

Broadband Technological Opportunities Program (BTOP): Ensure there is the availability to expand or that there is adequate coverage of business-quality broadband infrastructure, including regional access to fiber capacity implemented through the NH BTOP and others.

The Demand for Broadband in Windham

Windham's Economic Development Self-Assessment

In August 2014, Northeastern University, Dukakis Center for Urban and Regional Policy facilitated the implementation of an Economic Development Self-Assessment Tool for the Town of Windham. Information technology and broadband and was included in the assessment. The following results³⁰ were identified:

- Windham's infrastructure-water supply, electric power, cellular, and fiber-optic/cable/DSL- were noted as providing unreliable service and as such, were identified as the most serious weakness in Windham.
- Specifically regarding telecommunications, landlines have capacity for current needs only and cellular service is unreliable. Broadband service (i.e., fiber optic, cable, and DSL) also have unreliable service. Windham may also want to initiate conversations with telecommunications and broadband providers on opportunities for enhancing infrastructure and service.
- In terms of data/telecommunications – cellular, fiber optic, cable, DSL-the assessment determined that existing services in Windham are unreliable.

Specifically with regard to broadband, the report recommended that the Town of Windham initiate discussions with broadband providers to upgrade and expand their infrastructure and services in Windham. Also to engage regional, state, and federal resources that support bringing broadband services to rural areas.

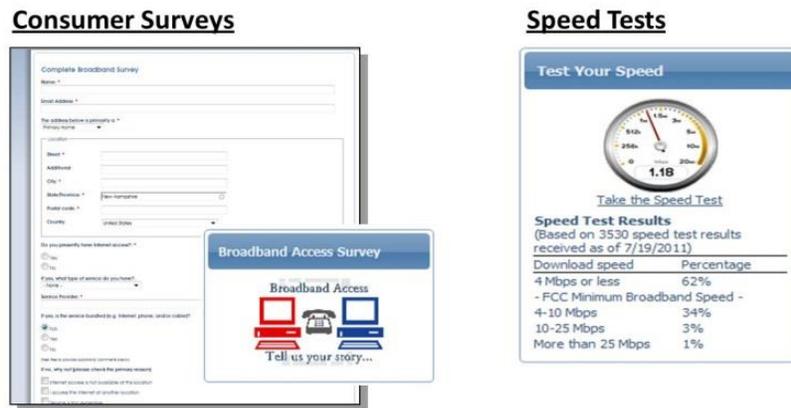
UNH Speed Test Survey Results

In order to supplement public outreach efforts verifying local broadband service, as well as advertised speeds by Internet Service Providers (ISPs), the University of New Hampshire developed a speed test and a short survey for residents across the state to share. When participants selected the speed test application at www.iwantbroadbandnh.org, both download and upload speeds were measured at the reported location of the user. Table 4 displays the total number of speed test and survey participants by municipality in the SNHPC Region, as of September 2013. The most speed tests completed were in the City of Manchester and the towns of Derry, Goffstown and Bedford.

³⁰ These results were based on a survey filled out by the Windham Economic Development Committee and public comments received at an October 2, 2014 public meeting.

As of September 2013 only 7 speed tests have been submitted by residents and businesses in the Town of Windham to this site. Based upon this information, the Broadband Advisory Committee recommended that a survey be conducted among Windham’s businesses to assess not only speeds, but reliability of service and other needs.

Figure 5: Speed Test Instruments



www.iwantbroadbandnh.org

Source: www.iwantbroadbandnh.org

How Reliable and Fast is Windham’s Broadband (Email Survey)

As part of this plan, the Windham Community Development Director and the Southern New Hampshire Planning Commission (SNHPC) conducted a short broadband survey to assess what various improvements to broadband could be made to expand business and promote economic development within the Town of Windham. The survey was distributed by email by the Windham Community Development Department on November 3, 2014 and December 1, 2014 among 520 businesses and non-profits throughout the community. A total of 16 responses were received. The questionnaire consisted of four questions regarding broadband services, speeds and backup connections to help assess the needs of the local business community. See Appendix C for the full survey results.

Survey Results

The survey results obtained from the first question – “do you have adequate broadband service” - is clear that the majority of business respondents felt they have adequate high speed broadband access/service, however many of the respondents noted that they would like to have faster speeds and bandwidth to perform more functions. Among many of these respondents, obtaining faster speeds and bandwidth is also a cost and affordability issue.

With regard to the second question – “do you need faster speeds” – there was no clear majority and the responses were almost equally split between 6 that would like faster speeds and 7 responses that they do not. Several responses indicating that they would like faster speeds noted that they are paying to have fiber installed to their place of business to increase speeds and bandwidth.

In terms of the third question – “do you have or need a “back up” internet connection during power outages” – again there was no clear majority as 6 businesses indicated that they would like a backup generator or internet connection – especially if data is stored online, while 7 businesses indicated that they already have it or do not need it based on current work activities.

Responses received to the fourth question – “what were your results with regard to the speed test” – are as follows: Generally these test results are varied due to differences in services; connections; availability of fiber or not; and activity at the time of the test. However, the results clearly fall within the range of broadband service, which is considered to be “served”, as per the broadband tier definitions provided in Figure 1.

Download – from 5 to upwards 95 Mps with lowest at 4.69 Mps

Upload – from 5 to upwards 61 Mps with lowest at .04-.08 Mps

With regard to the final question – “other comments” – some of the comments provided noted that it would be effective to have more “fiber” at a lower cost to promote business growth; the town needs another alternative to Comcast; and any improvements must include network engineering and customer service.

Broadband Availability in Windham

Broadband History – Windham 2005 Master Plan

The Town of Windham’s existing 2005 Master Plan provides an overview of the development of broadband and various communication systems within the town. The Plan goes on to explain that as a result of greatly expanded Internet use and the proliferation of business conducted from homes, there is an increasing demand for new lines and bandwidth within the town.

The plan also points out that older neighborhoods and businesses are primarily served by above ground utilities and that new commercial or residential subdivisions are served by underground utilities. The master plan also states that Internet access is becoming increasingly important to Windham residents. In the 2000 Master Plan Survey, over 60% of the households surveyed have Internet access. Telecommuting is a reality for a number of residents, as are home-based businesses. These trends are expected to continue.

“Telecommuting is a reality for a number of residents, as are home-based businesses. These trends are expected to continue.”
(2005 Windham Master Plan, p.88)

The master plan also notes that Verizon has upgraded all links and hub points to optical fiber. Telephone usage (particularly wireless) is increasing significantly today as many households now have multiple lines for voice, fax, and Internet access.

Under the Utilities Chapter in the town's master plan it notes that the topography of Windham, with many hills and valleys, has made wireless communication difficult. However, police and fire communications use a "voter system" to provide enhanced coverage with portable, mobile and two-way radios. The primary transmitter/receiver is located on a private tower on Jenny's Hill, with secondary antennas at Golden Brook School, Windham High School and on an industrial building just over the town line in Pelham. The Town is connected to the internet in several different ways, primarily using 2 Fairpoint FAST connections for the majority of our access, with several additional Comcast Connections to the Cable Studio, Nesmith Library, Transfer Station and Highway Department. Each connection beyond the 2 FAST connections is a unique case, the Library and the Cable Studio access is provided at a reduced cost.

In addition, the town has installed a Private Branch Exchange (PBX) system for the Police Department, Town Hall, Fire Department, Armstrong Building, and Community/Development Department. The system is connected underground by fiber optic cable to provide for expanded communications requirements. This single system allows for efficiency in communication and cost by using shared outgoing lines. It is also not subject to interference from electrical storms. The master plan also points out that there was a remaining copper line connection that was scheduled to be replaced by the end of 2004.

The combination of these private and public communication systems, including from Internet services to public access television, provides the core of a strong communication system in Windham. The master plan also notes that although there are some upgrades that would enhance the internal town department communication, the town has in place staff and infrastructure to provide quality communication services. The master plan also recommends that the town continue to upgrade the overall communication system as newer technologies come into the market place.

The master plan also notes that the Information Technology (IT) Department has begun a limited wireless technology system in the Town Hall and plans to continue to expand this technology to other town buildings within its annual budget requirements as computer and communication equipment is upgraded. This technology will allow high speed communication without the requirement for hardware retrofitting of town buildings and facilities, which may be problematic in some instances.

Wireless Communications Towers

The Town of Windham currently has three cell towers (see following map).

One tower is located on Jenny's Hill east of Interstate 93, off Governor Dinsmore Road, and is owned by Motorola. This tower has cellular, paging, TV relay link and business repeater antennas. Sprint, AT&T, Cell One, and the Town of Windham all lease space on the tower located on Jenny's Hill.

Another tower is located in the area between Route 111 and Hardwood Road and consists of a monopole designed as a pine tree (see photo).

The third tower is located at the intersection of Rt 111 and Rt 128 and is known locally as the Waterhouse Cell Tower.

Tower Disguised as a Tree



Source: NH OEP

With the widespread adoption of cell phones, research in recent years has identified a growing trend among households cancelling their landline phone service to rely solely on their mobile phone.³¹ In June 2010, the National Center for Health Statistics reported more than one-in-four (26.6 percent) households did not have a landline phone and only had a wireless phone. According to an article in USA Today, researchers identified both renters and low-income households are more likely to be wireless-only homes. Charles Govin, of Forrester Research, states that young people growing up with cell phones see no need investing in a landline.³² An established mobile phone number remains with the owner over the years, saving someone from changing their contact information any time they were to move to a new location. Carrying a cell phone on-hand provides the added benefit of flexibility and increased availability. The increasing reliance on cell phones as the primary means of communication have caused wireless communication towers to be considered vital infrastructure for residents of any community.

Telecommunications Regulations

Wireless communications are served by cell towers, which are located in almost every municipality of the state. Concentration of cell towers is generally higher along major interstates and state highways, although the past few years have witnessed increasing service even in rural areas. The construction of new towers is a highly regulated issue for planning and zoning boards who mitigate between the increasing need for wireless services and the aesthetic preservation of the town.

All cell towers are subject to setback, design, and zoning regulations. It is a generally accepted practice that municipalities adopt strict regulations that force competing companies to cooperate on the use of

³¹ Snider, Mike. "More people ditching home phone for mobile," USA Today, April 21, 2011.

(<http://usatoday30.usatoday.com/tech/news/2011-04-20-cellphone-study.htm>) Accessed March 4, 2014.

³² *ibid.*

existing telecommunications infrastructure and transmission structures in order to minimize impact to the town and increase the efficiency of communications systems.

Currently, communications towers or Personal Wire Service Facility (PWSF) as provided for under NH RSA 12-K:2 are restricted in Section 701.3 of the Windham Zoning Regulations to specific commercial and industrial properties within the town.

In comparing the Town of Windham's PWSF regulations in the Zoning Ordinance and Site Plan Regulations to the telecommunication planning statutes provided for under RSA 12-K:1, there are several areas where improvements can be made as identified below.

1. The town's zoning regulations should recognize that the visual effects of tall antenna mounts or towers may go well beyond the physical borders between municipalities. Thus, Windham's regulations could be amended to require that all affected parties have the opportunity to be heard as part of the review process.
2. Windham's zoning regulations could also encourage carriers wishing to build PWSFs in the town to consider commercially available alternative PWSFs to tall cellular towers, which may, include the use of the following:
 - Lower antenna mounts which do not protrude as far above the surrounding tree canopies;
 - Disguised PWSFs such as flagpoles, artificial tree poles, light poles, and traffic lights, which blend in with their surroundings;
 - Camouflaged PWSFs mounted on existing structures and buildings;
 - Custom designed PWSFs to minimize the visual impact of a PWSF on its surroundings;
 - Other available technology.
3. In addition, a requirement for a PWSF map could be added to Windham's zoning regulations. A PWSF map is necessary to allow for orderly and efficient deployment of wireless communication services and to ensure that the public has adequate information with which to consider appropriate siting and options to mitigate the visual effects of PWSFs.
4. The guidelines and suggestions in the NH Office of Energy and Planning model ordinance for PWSFs, as well as other community's ordinances, should also be reviewed and considered by the Windham Planning Board.
5. While the need for another cell tower in Windham may not be a high priority or needed in the future, the town should be prepared as wireless and broadband technology is changing rapidly. A simple amendment to Windham's PWSF zoning ordinance to include broadband is also presented in the Recommendations section of this plan.
6. While new cell towers require significant site engineering and access considerations, thus triggering site plan approval; co-locating onto existing towers generally should not require site plan approval unless there are significant changes to the site, access and security, and site aesthetics. The Planning Board could consider adding co-locating to existing PWSF facilities as a Conditional Use under the town's PWSF zoning ordinance and as an "exempted use" or use requiring minor site plan review under the Board's site plan regulations. In this fashion, the public health and welfare of the town can be protected at the same time the town is promoting the co-

location of these facilities and uses on existing structures; thus, enhancing wireless communications within the town.

7. In addition, as wireless technology improves and changes, the Windham Planning Board may also want to explore developing or adding additional provisions in the town's zoning ordinance to address and promote the development of Fixed Wireless Transmitter Antenna Array within the community. This technology could help improve cellular coverage within the community particularly within the dead zones and hot spots identified by the Windham Police Chief.

Current Broadband Providers

There are, in general, a large number of broadband providers currently operating within the SNHPC Region. This is an indicator that there is healthy competition, which contributes to lower prices and potentially more coverage and higher speeds as providers try to attract customers with better services.

Communities along the fringes of the region, generally have the least (two to seven) broadband providers. Many of the communities located immediately along and/or within the I-93 corridor are found to have the highest number of broadband providers. The I-93 corridor is also where the majority of the region's population can be found.

The 13 ISPs currently (September 2013) operating within the Town of Windham include:

| | |
|--------------------------------|----------------------|
| AT&T Mobility, LLC | Clear |
| Clearwire | Comcast |
| FairPoint Communications, Inc. | G4 Communications |
| Granite State Telephone | MegaPath Corporation |
| Spectra Access | Sprint |
| T-Mobile | US Cellular |
| Verizon Wireless | |

Broadband Maps for Windham

Results of Broadband Mapping

This section of the plan provides a summary of the results of the broadband mapping and data collection prepared for the SNHPC Region under the New Hampshire Broadband Mapping and Planning Program (NHBMPP). These maps provide information about existing broadband availability, technology, download speeds, and service levels for the Town of Windham. The maps are based upon the availability of the data submitted to the NHBMPP by existing service providers as of September 2014. For the purposes of this plan, a total of eight broadband maps have been prepared for the Town of Windham. These maps are described below and include the following:

1. Broadband Availability for Uses that Require High Speed
2. Broadband Availability for Uses that Require Moderate Speed
3. Broadband Availability at Community Anchor Institutions
4. Level of Service for Broadband Intensive Applications and Uses
5. Broadband Technology By Maximum Advertised Download Speed
6. Satellite Broadband Service

7. Broadband Availability With Maximum Advertised Download Speed
8. Wireline Versus Terrestrial Wireless Service Availability

Map #1: Broadband Availability for Uses that Require High Speed

This map shows that high speed is defined as advertised download speed greater than 10 Mbps and advertised upload speed greater than 6 Mbps. Uses that require a high speed broadband connection include: sending/receiving large files and small to medium sized databases; HD quality, codec based, large frame videoconferencing; multiple (bridged) sites/users; remote synchronous education, professional development, workshops, etc., facilitated simultaneously at multiple classrooms and/or other locations; telehealth/telemedicine applications; high speed end to end network and business to business applications; telemetry-based applications (rely critically on the ability of broadband to continuously monitor and multiplex data, i.e. remote patient monitoring, sensing systems, etc.); and “Internet2” connectivity and applications.

As shown by this map, the majority of the Town of Windham is able to use applications that require moderate speed broadband which is also the same providing the ability to use applications that require high speed broadband. This map shows that the Town of Windham’s broadband availability for uses requiring high speeds is an advantage, both technologically and economically, compared other towns in the region. Residents’ living in areas where broadband is capable of handling high speeds have access to download speeds greater than 10 Mbps and upload speeds greater than 6 Mbps. At these speeds, users are able to view high-definition videos, send and receive large file sizes, handle large databases and telemedicine applications. Many of the areas depicted with “no available service” are generally unpopulated areas.

Map #2: Broadband Availability for Uses that Require Moderate Speed

This map explains that moderate speed is defined as advertised download speed 3 to 6 Mbps and advertised upload speed of 1.5 to 3 Mbps. Uses that require a minimum of moderate speed broadband include: medium to high social media use; sending and receiving medium to large-scale documents or files (photos, word processing); streaming standard-definition (SD) content; buffering not a concern; downloading high-definition (HD) content (movies, video) speed a concern); 3-5 connected internet devices possible; VPN access is needed, speed of operation is important but not critical to job function; multiple functions performing simultaneously required (e.g. web browsing, streaming video/music, downloading content), but not concerned with potential slowness of downloads; low quality, small window frame videoconferencing (Skype); and cloud-based computing and data storage.

Map #3: Broadband Availability at Community Anchor Institutions

This map identifies those community anchor institutions (e.g. K-12 schools; libraries; medical/health care; public safety; university/college; and other governmental and non-governmental community institutions) where broadband is currently available or not available or not known to be available in Windham. Broadband availability at these institutions is absolutely necessary, for educating students using the latest technology and at medical and public safety facilities in accessing high-speed broadband for important public safety reasons and emergencies.

The data collected on community anchor institutions for this map was obtained by contacting each institution to establish their baseline broadband availability profile. This inventory is updated by the GRANIT System at University of New Hampshire and all the regional planning commissions in the state

every six months utilizing the NHBMP Community Anchor Institution web portal. All municipalities, public safety officials and health organizations, and facilities within the SNHPC Region are encouraged to inspect and to go to the NHBMP Community Anchor Institution web portal (<http://iwantbroadbandnh.org/get-involved>) to identify/verify the Community Anchor Institutions designated as not having or unknown to be connected to broadband. Through the broadband mapping and data collection prepared for the SNHPC Region, it will be an important goal and action step of this plan to ensure the Town of Windham and any isolated unserved areas as well as all the CAIs within the town be adequately identified and provided with the necessary infrastructure to obtain access and connectivity to reliable and high-speed broadband within the immediate future.

There are currently a total of 23 relevant Community Anchor Institutions Identified in the Town of Windham as reported on the www.iwantbroadbandnh.org.

| | |
|--|-----------------------|
| Windham Fire Department | 3 Fellows Road |
| Windham Police Department | 4 Fellows Road |
| Nesmith Library | 8 Fellows Road |
| Windham Town Hall | 3 North Lowell Road |
| Windham Highway Department | 2 Ledge Road |
| Windham Seniors Center | 2 North Lowell Road |
| | |
| Warde Health Center | 21 Searles Road |
| Pine Hill Estate Ltd | 35 North Lowell Road |
| Windham Terrace | 3 Church Road |
| Elliot Family Medicine at Windham | 5 Industrial Drive |
| Elliot Peak Internal Medicine at Windham | 127 Rockingham Road |
| Grace House of Windham | 23 Mammoth Road |
| ConvenientMD Urgent Care | 125 Indian Rock Road |
| Labcorp – Windham PC | 49 Range Road |
| | |
| Windham Center School | 2 Lowell Road |
| Windham Center School Library | 2 Lowell Road |
| Golden Book Elementary School | 112B Lowell Road |
| Golden Brook Elementary School Library | 112B Lowell Road |
| Windham Middle School | 112A Lowell Road |
| Windham Middle School Library | 112A Lowell Road |
| Windham High School | 64 London Bridge Road |
| Windham High School Library | 64 London Bridge Road |
| SAU 95 – SAU #95 Office | 19 Haverhill Road |

Map #4: Level of Service for Broadband Intensive Applications and Uses Map

This map clearly identifies that the Town of Windham is considered to be served for broadband intensive applications and uses. There are also several isolated areas located within Windham which are currently identified as served with reported gaps in service. There are no identified unserved or underserved areas with reported gaps within the town.

Map #5: Broadband Technology by Maximum Download Speed Map

This map displays the range of download speeds reported by the broadband service providers, by type of technology, within Windham. As currently reported, cable is the technology of choice in providing the highest maximum advertised internet services and download speeds within the Town of Windham. This map also provides a more detailed portrayal of the technologies that are included in each census block. These include DSL, Cable, Optical Carrier/Fiber to the end user. The map is based upon the broadband information submitted by the service providers to the NHBMP as of September 30, 2014. For mapping purposes, this data was aggregated and displayed at the census block level. A census block is mapped as "served" if service is delivered to any part of the block. Further data collection is needed to refine the service area to a smaller scale.

Map #6: Satellite Broadband Service Map

This map clearly identifies that complete satellite broadband service available in Windham. Reliability of these services is weather and technology dependent.

Map #7: Broadband Availability with Maximum Advertised Download Speed Map

This map displays the availability of broadband based on internet service providers' advertised speeds. Again, this map identifies that the Town of Windham is considered to be served by broadband. To be considered "served," users must have the ability to download at a speed of 3+ Mbps and upload to the internet at a speed of 1.5+ Mbps.

Map #8: Wireless versus Terrestrial Wireless Service Availability Map

This map confirms that 100% percent of the Town of Windham has both wireless and terrestrial wireless broadband service available.

Overall Map Summary

The Map showing "Level of Service for Broadband Intensive Applications" and "Uses and Broadband Technology with Maximum Advertised Download Speeds" are best maps displaying the maximum advertised download speed by available broadband technology, such as DSL, cable, fixed wireless, mobile wireless, fiber and other technologies available in Windham. The data portrayed by these maps also closely matched the results contained in the Granite State Futures Broadband Telephone Survey. As shown by this data, the vast majority of the Town of Windham is covered by cable and this specific broadband technology currently offers customers fast download and upload speeds available.

These maps also identify several areas which are unserved with broadband – particularly along Routes 111 and 28, although these areas are currently undeveloped. Coverage throughout Windham is also provided by terrestrial mobile wireless and terrestrial fixed wireless services.

Optical fiber, the broadband technology capable of the fastest speeds, is currently limited to paying customers in Windham (primarily commercial) through a few Internet Service Provider (ISP) who are willing to make the significant investment and commitment necessary in installing fiber to the home or business. Ultimately, everyone within the Town of Windham could benefit from improved broadband connectivity and improved Internet service if there was more competition among other ISPs in offering fiber to their customers. This should be identified as an important and future long term goal of this plan.

The Town of Windham also has universal broadband service availability through satellite, wireline and terrestrial wireless services. However, despite the availability of these modes of broadband, very few residents/businesses in the Town of Windham responded that they are utilizing these broadband services.

A significant area of focus for broadband investment should be within the town's Professional, Business and Technology District, Limited Industrial District, the Village Center District, the Business Commercial A and B Districts, and the Gateway Commercial District. Business growth and development and broadband investment is critical within these areas of Windham.

Broadband Goals and Recommendations

The Town of Windham has in place cable broadband services covering the majority of the community. There is also terrestrial fixed and mobile wireless services provided throughout the town. There are no major issues with respect to having access to sufficient broadband download or upload speeds in Windham, however, many businesses and home based businesses in Windham would like faster broadband services and to be assured that these services are available at reasonable rates. While this is not a major disadvantage within the community and the community's future economic growth and development, it could become an issue, if high speed access and necessary infrastructure is not available for the needs for future users.

During development of the Regional Broadband Plan by the Town of Windham Broadband Advisory Group, a number of broadband goals and recommendations for the Town of Windham were identified and discussed.

The Town of Windham's overall Broadband Goal is to improve the availability and capacity of Broadband within the community, in order to bolster and enhance economic development and quality of life. Some other goals that are complimentary are listed below.

Broadband Goals:

- 1) Broadband service should meet the needs of current and future users in non-residential areas of the town.
- 2) Broadband is part of the community's infrastructure, much like roads and stormwater facilities, and should be considered as such when developing regulations and prioritizing investment decisions.
- 3) The Town of Windham should do all it can to promote and facilitate state/private broadband programs and initiatives to expand these broadband technologies within the community
- 4) All public safety-related services and departments should be served by dependable broadband.
- 5) Access to and the reliability of broadband service in the event of power loss is desirable.

Recommendations:

- 1) Work with Comcast, FairPoint and other ISPs to determine existing infrastructure needs, future fiber plans, and what broadband services can be easily improved within the community.
- 2) Ensure that existing and new broadband infrastructure is resilient and redundant so that there are adequate opportunities for connection when power supply is down due to storms.
- 3) Research the ability to invest in broadband infrastructure, as necessary, through use of bonds, impact fees, TIF Districts, right-of-way fees, and economic development grants.
- 4) Install fiber connectivity between the municipal buildings to increase broadband speed & service.
- 5) Revisit the feasibility of extending fiber from the High School to the Library.
- 6) Research possible locations for the implementation municipal public wifi, such as all Town-owned buildings and recreation facilities
- 7) Conduct a study comparing Windham's broadband services and infrastructure to Nashua, Salem, Londonderry and Derry for economic development and marketing purposes.
- 8) Add to the information included in economic development material (web site and printed information) that includes broadband provider contacts.
- 9) Expand and develop opportunities for education around broadband use to the business community.
- 10) Include broadband components in the town's 2015 Master Plan in the Economic Development and Community Facilities Chapters.
- 11) Include broadband in hazard mitigation and recovery planning as part of the Town's local emergency management and response plans.
- 12) Include the availability of broadband as a component on the Towns property assessment records
- 13) Require conduit to be installed as part of and in anticipation of new business development to facilitate broadband infrastructure expansion within the community.
- 14) Adopt Shadow duct regulations requiring broadband utilities to be constructed and/or repaired and buried only during scheduled street reconstruction or resurfacing.
- 15) Amend the Zoning Ordinance
 - Adopt "A Municipal Fixed Wireless Broadband Facility Ordinance" to more readily allow fixed wireless broadband facilities (which include towers, relay sites and antenna array) to be placed within the community.
 - Amend the definition of Personal Wireless Service Facility (PWSF) to better position the Town of Windham in preparing and planning for enhanced broadband development within the community. The following language should be added to the end of the existing definition: "including high speed (broadband) internet or any other communications through the sending and/or receiving of electromagnetic waves of any frequency and bandwidth."

Appendix A - Glossary of Terms

Bandwidth – The transmission capacity of an electronic pathway such as a communications line, computer bus or computer channel. In a digital line, it is measured in bits per second or bytes per second (see Mbps). In an analog channel or in a digital channel that is wrapped in a carrier frequency, bandwidth is the difference between the highest and lowest frequencies and is measured in Hertz (KHz, MHz, GHz).

Broadband – (1) High-speed transmission. The term commonly refers to Internet access via cable and DSL, which is as much as 400 times faster than analog dial-up. The term has always referred to a higher-speed connection, but the speed threshold varies with the times. Widely employed in companies, the 1.5 Mbps T1 line was often considered the starting point for broadband speeds, while the FCC defines broadband as a minimum upload speed of 200 Kbps.

The T1 line is no longer the coveted connection for Web surfing. Home users with cable modems experience download speeds up to four times that of T1 and more (see cable modem). For example, in 2007, Comcast offered home users a premium service of 1 Mbps upload and 16 Mbps download. Fiber-based offerings from telephone companies are even greater.

After the turn of the century, South Korea leapfrogged the U.S. in Internet access, offering DSL up to 50 Mbps and calling their 1.5 Mbps service "light." See broadband router, wireless broadband, T1, cable modem and DSL.

(2) Transmitting data by modulating a carrier wave in order to differentiate it from other signals in the air or in a single line. For example, frequency division multiplexing (FDM) is used to carry hundreds of channels of analog and digital TV in a single coaxial cable. In this context, broadband is used in contrast with "baseband," which is data that has not been modulated or multiplexed. In most cases, the term "broadband" is used for high-speed transmission as in definition #1 above.

Cable modem – A modem used to connect a computer to a cable TV service that provides Internet access. Cable modems can dramatically increase the bandwidth between the user's computer and the Internet service provider. Download speeds have reached 6 Mbps and beyond, but the connection is asynchronous. In order to prevent users with lower-cost cable access from hosting high-traffic Web servers, the upload speed is considerably slower, from 10 to 20 times slower. Cable operators also routinely change IP addresses assigned to users to prevent Web hosting.

Channel – The physical connecting medium in a network, which could be twisted wire pairs, coaxial cable or optical fiber between clients, servers and other devices.

DSL (Digital Subscriber Line) – A technology that dramatically increases the digital capacity of ordinary telephone lines (the local loops) into the home or office. DSL speeds are based on the distance between the customer and Telco central office. There are two main categories. Asymmetric DSL (ADSL) is for

Internet access, where fast downstream is required, but slow upstream is acceptable. Symmetric DSL (SDSL, HDSL, etc.) is designed for connections that require high speed in both directions.

FCC (Federal Communications Commission) – An independent United States government agency, directly responsible to Congress. The FCC was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. The FCC's jurisdiction covers the 50 states, the District of Columbia, and U.S. possessions. (<http://www.fcc.gov/aboutus.html>)

Fiber-optic – Refers to systems that use optical fibers. Fiber-optic communications networks have transformed the world. Barely starting in the late 1960s but gaining serious momentum in the 1980s, the phone companies began to replace their copper long distance trunks with fiber cable. Eventually, all transmission systems and networks are expected to become fiber based, even to the home. In time, the electronic circuits in computers may be partially or fully replaced with circuits of light, in which case fiber pathways would be used throughout the system.

Fixed Wireless – Refers to point-to-point transmission through the air between stationary devices. Fixed wireless is typically used for "last mile" connectivity to buildings.

FTP (File Transfer Protocol) – A protocol used to transfer files over a TCP/IP network (Internet, UNIX, etc.). For example, after developing the HTML pages for a Web site on a local machine, they are typically uploaded to the Web server using FTP.

FTP includes functions to log onto the network, list directories and copy files. It can also convert between the ASCII and EBCDIC character codes. FTP operations can be performed by typing commands at a command prompt or via an FTP utility running under a graphical interface such as Windows. FTP transfers can also be initiated from within a Web browser by entering the URL preceded with ftp://.

Internet2 – The second generation of the Internet, developed by a consortium of more than 200 universities, private companies and the U.S. government. It was not developed for commercial use or to replace the Internet, but is the reincarnation of it, intended primarily for research. Whereas the Internet was first designed to exchange text, Internet2 is designed for full-motion video and 3D animations. Originally namedUCAID (University Corporation for Advanced Internet Development), Internet2 spawned the high-speed Abilene backbone.

Kbps – One thousand bits per second. Kbps is used as a rating of relatively slow transmission speed compared to the common Mbps or Gbps ratings.

Last Mile – The connection between the customer and the Telephone Company, Cable Company or ISP. The last mile has traditionally used copper-based telephone wire or coaxial cable, but wireless technologies offer alternative options in some locations. Also called "first mile."

Mbps – Mbps means megabits per second and is used for transmission speeds in a network or in internal circuits.

Mobile Wireless – Refers to transmission through the air from a base station to a moving device such as a cell phone.

Cellular vs. Wi-Fi – Cellular carriers offer optional, digital data services for Web browsing, e-mail and other text and data applications. The data service is separate from the carrier's voice plans, often costing considerably more than a basic voice subscription. The cell phones must support the data service, which is also available for laptops and other portable devices with the installation of the appropriate modem.

Wi-Fi networks are available to the public in many cities and municipal areas. Individual venues such as airports and coffee shops also provide service. Typically fee based by the hour or day, some municipalities provide free service.

Location is the key issue in real estate and also the primary concern with wireless systems. For travelers who need ubiquitous connectivity, there are many gaps (white spaces) in Wi-Fi coverage. Although cellular data rates (EDGE, EV-DO, HSPA, etc.) are typically slower than Wi-Fi, cellular carriers offer the most inclusive coverage when traveling, very often equivalent to using a cell phone for voice.

Network – A system that transmits any combination of voice, video and/or data between users. The network includes the network operating system in the client and server machines, the cables connecting them and all supporting hardware in between, such as bridges, routers and switches. In wireless systems, antennas and towers are also part of the network.

Redundancy – Having a secondary peripheral, computer system or network device that takes over when the primary unit fails.

Remote access – The ability to log on to a computer or network within an organization from an external location. Remote access is typically accomplished by directly dialing up analog or ISDN modems or via a connection to the Internet.

Router – A network device that forwards packets from one network to another. Based on internal routing tables, routers read each incoming packet and decide how to forward it. The destination address in the packets determines which interface on the router outgoing packets are directed to. In large-scale enterprise routers, the current traffic load, congestion, line costs and other factors determine which outgoing line to forward to.

Satellite Broadband – Just as satellites orbiting the earth provide necessary links for telephone and television service, they can also provide links for broadband. Satellite broadband is another form of wireless broadband, also useful for serving remote or sparsely populated areas.

Downstream and upstream speeds for satellite broadband depend on several factors, including the provider and service package purchased, the consumer's line of sight to the orbiting satellite, and the weather. Typically a consumer can expect to receive (download) at a speed of about 500 Kbps and send (upload) at a speed of about 80 Kbps. These speeds may be slower than DSL and cable modem, but

download speed is about 10 times faster than download speed with dial-up Internet access. Service can be disrupted in extreme weather conditions. (<http://www.fcc.gov/cgb/broadband.html>)

Server – A computer system in a network that is shared by multiple users. Servers come in all sizes from x86-based PCs to IBM mainframes. A server may have a keyboard, monitor and mouse directly attached, or one keyboard, monitor and mouse may connect to any number of servers via a switch. In large companies, servers often reside in racks in the datacenter, and all access is via their network connections.

Symmetrical – For the purposes of broadband technologies, it means that the download speed and upload speed are the same.

T1 – A 1.544 Mbps point-to-point dedicated, digital circuit provided by the telephone companies. The monthly cost is typically based on distance. T1 lines are widely used for private networks as well as interconnections between an organization's PBX or LAN and the Telco. The first T1 line was tariffed by AT&T in January 1983. However, starting in the early 1960s, T1 was deployed in intercity trunks by AT&T to improve signal quality and make more efficient use of the network.

TCP/IP (Transmission Control Protocol/Internet Protocol) – A communications protocol developed under contract from the U.S. Department of Defense to interconnect dissimilar systems. Invented by Vinton Cerf and Bob Kahn, this de facto UNIX standard is the protocol of the Internet and the global standard for communications.

Telecommuting – Working at home and communicating with the office by phone, fax and computer. In the U.S., at the beginning of the 21st century, more than 30 million Americans were telecommuting at least one day a week. Also called "teleworking."

Telehealth – Telehealth and telemedicine are sometimes used interchangeably, however, telehealth is generally considered to be a broader and provider neutral term that encompasses various applications where technology and medicine are being utilized to provide better patient care.

Telemedicine – Using a videoconferencing link to a large medical center in order that rural health care facilities can perform diagnosis and treatment. A specialist can monitor the patient remotely taking cues from the general practitioner or nurse who is actually examining the patient. Also referred to as "long distance" medicine.

USAC (Universal Service Administrative Company) – An independent, not-for-profit corporation designated as the administrator of the federal Universal Service Fund by the Federal Communications Commission (FCC). USAC administers Universal Service Fund (USF) programs for high cost companies serving rural areas, low-income consumers, rural health care providers, and schools and libraries. The Universal Service Fund helps provide communities across the country with affordable telecommunications services. (<http://www.usac.org/about/usac/>)

USF (Universal Service Fund) – The goals of the Universal Service, as mandated by the Telecommunications Act of 1996, are:

- ◆ To promote the availability of quality services at just, reasonable, and affordable rates
- ◆ To increase access to advanced telecommunications services throughout the Nation
- ◆ To advance the ability of such services to all consumers, including those in low income, rural, insular, and high cost areas at rates that are reasonably comparable to those charged in urban areas

The Universal Service Fund (USF) was created by the Federal Communications Commission in 1997 to meet these goals. In addition, the 1996 Act states that all providers of telecommunications services should contribute to federal universal service in some equitable and nondiscriminatory manner; there should be specific, predictable, and sufficient Federal and State mechanisms to preserve and advance universal service; all schools, classrooms, health care providers, and libraries should, generally, have access to advanced telecommunications services; and finally, that the Federal-State Joint Board and the FCC should determine those other principles that, consistent with the 1996 Act, are necessary to protect the public interest. (<http://www.usac.org/about/universal-service/purpose-of-fund/>)

Video Conferencing – A real time video session between two or more users or between two or more locations. Although the first videoconferencing was done with traditional analog TV and satellites, in-house room systems became popular in the early 1980s after Compression Labs pioneered digitized video systems that were highly compressed. While videoconferencing may comprise any number of end points communicating, the term "video chat" typically means between two end points only.

VoIP (Voice Over IP) – A telephone service that uses the Internet as a global telephone network. Many companies, including Vonage, 8x8 and AT&T (CallVantage), typically offer calling within the country for a fixed fee and a low per-minute charge for international. Broadband Internet access (cable or DSL) is required, and regular house phones plug into an analog telephone adapter (ATA) provided by the company or purchased from a third party.

VPN (Virtual Private Network) – A private network that is configured within a public network (a carrier's network or the Internet) in order to take advantage of the economies of scale and management facilities of large networks. VPNs are widely used by enterprises to create wide area networks (WANs) that span large geographic areas, to provide site-to-site connections to branch offices and to allow mobile users to dial up their company LANs.

WAN (Wide Area Network) – A long-distance communications network that covers a wide geographic area, such as a state or country. The telephone companies and cellular carriers deploy WANs to service large regional areas or the entire nation. Large enterprises have their own private WANs to link remote offices, or they use the Internet for connectivity. Of course, the Internet is the worlds largest WAN.

Wi-Fi (Wireless-Fidelity) – Network devices comply with the IEEE 802.11 wireless Ethernet standards. In the early 2000s, Wi-Fi/802.11 became widely used (initially 802.11b, then 802.11g), and within a short

time, all laptops and other handheld devices came with Wi-Fi built in. Earlier laptops can be Wi-Fi enabled by plugging in a Wi-Fi adapter via the USB port or PC Card.

WiMAX (World Interoperability for Microwave Access, Inc.) – An organization founded in 2001 that promotes the IEEE 802.16 wireless broadband standard and provides certification for devices for compliant devices. WiMAX is designed to extend local Wi-Fi networks across greater distances such as a campus, as well as to provide last mile connectivity to an ISP or other carrier many miles away. In addition, Mobile WiMAX offers a voice and higher-speed data alternative to the cellular networks. (www.wimaxforum.org)

Appendix B - NH Broadband Programs

New Hampshire Broadband Mapping and Planning Program

The State of New Hampshire is currently working on the New Hampshire Broadband Mapping and Planning Program (NHBMP), a coordinated, multi-agency initiative funded by the American Recovery and Reinvestment Act through the National Telecommunications and Information Administration (NTIA). It is part of a national effort to expand high-speed internet access and adoption through improved data collection and broadband planning. The University of New Hampshire's GRANIT program was granted \$1.7 million to manage the program which will inventory and map current and planned broadband coverage available to the state's businesses, educators, and citizens. The project is comprised of two components: a five-year broadband availability inventory and mapping effort, and a four-year planning initiative.

The inventory, now in its fifth year, uses service-area landline and wireless data collected from the 60-plus public and commercial entities that currently provide broadband services in the state.³³ This data shows service availability, type, and technology and will help to identify areas of the state that are unserved or underserved by the current broadband infrastructure. Concurrently rural addresses are being collected through the program to develop a database containing a mapped point feature and associated street addresses for every residential address in the rural Census blocks in the State of New Hampshire. Rural Census blocks are defined as having an area of at least 2 square miles. 2010 Census figures for the entire state of New Hampshire identify a total of 39,991 households within those rural blocks. Lastly, data is also being collected on broadband availability at individual community anchor institutions such as schools, libraries, medical/healthcare locations, public safety offices, and state, county, and municipal buildings.

The planning component of the NHBMP will incorporate the information collected and the momentum generated by the mapping activities into regional broadband plans throughout New Hampshire. The development of these regional plans will be coordinated by the state's nine regional planning commissions. The plans will involve establishing regional broadband stakeholder groups to identify barriers to broadband deployment, promote collaboration with service providers, and facilitate information sharing regarding the use of and demand for broadband services. Additional support for the program will be provided by a variety of state agencies, including the Division of Economic Development, the Office of Energy and Planning, and the Public Utilities Commission.³⁴

To learn more about this program see: <http://www.iwantbroadbandnh.org/>.

Network NH Now (NNHN)

NNHN is a sister program of the NHBMP designed to provide broadband connectivity that is symmetrical and capable of delivering current and next generation services that are comparable to the rest of the country. The end result will enable many social service, non-profit and commercial organizations to receive reliable service without having to pay for expensive copper-based connections. This will assist New Hampshire's competitiveness to attract potential businesses and investment.

³³ For a full list refer to: New Hampshire Broadband Mapping and Planning Program, <http://iwantbroadbandnh.com/where-is-broadband>. February, 2012.

³⁴ NH Business Resource Center, <http://blog.nheconomy.com/?tag=new-hampshire-broadband-mapping-program>

As the construction contractor for Network NH Now (NNHN), Waveguide technicians are installing more than 750 miles of optical fiber along roadways throughout the state. When complete, this network will provide a high-capacity communications backbone that will allow local providers to bring high-quality voice, video and data services to all 10 counties in the state.

As a public-private partnership, the NNHN project is made possible thanks to federal economic stimulus funds, as well as private contributions. Much like the Eisenhower Interstate Highway System of the 1950s did for the nation's transportation infrastructure; Network New Hampshire Now (www.networknhnow.org) will bring a comprehensive and forward-thinking broadband highway to communities all across New Hampshire, fostering economic growth, job creation, improved communication, and affordable high-speed internet access. **Error! Reference source not found.** 6 shows the current NNHN three statewide projects: Middle-Mile Fiber; FastRoads; NH DOT connections; and Microwave improvements.

To learn more about this program see: <http://www.networknhnow.org/>

NH FastRoads

The NH FastRoads program intends to build an open access middle mile and last mile network that aggregates demand for an entire region in New Hampshire, including community anchor institutions, large and small businesses, government offices and agencies, and residents. The routes built provide middle mile and last mile projects that will provide fiber connections to businesses and residents in the project area, where many residents are still limited to dial up Internet access.

To learn more about this program see: <http://www.newhampshirefastroads.net/>

Appendix C - Windham Broadband Survey

Survey Respondents

Matt Mock

Medicus Health Care Solutions, LLC

Marry Ann Pfeiffer

108 Degrees, LLC

John Connors

The Troupe

Deborah Vandeberghe

Private Island Cakes

Trent Sanders

36Creative

Thomas Case

Resident

**Garage Storage Cabinets of Northern
New England**

Spencer Hehje

Kevin Verratti

Windham School District

Al Getler

Ellie Wheels Media Inc.

Alexandra Van De Water

The Dubai Group, Inc.

Daniel Koravos

DK Engineering Associates, Inc.

Scott Baetz

AdminInternet

David Sullivan

Windham Town Administrator

Michelle McManus

Benchmark-Office Systems

Meghan Lemke

Quarry Brook Outdoor Learning Center

Gerry Lewis

Windham Police Department

Survey Responses

Question #1: Do you have adequate high speed broadband service?

| | <u>YES</u> | <u>NO</u> |
|---|---|---|
| Medicus Health Care Solutions, LLC | | No, the speed does not allow us to take advantage of heavy cloud usage or remote office connectivity. |
| 108 Degrees, LLC | I would prefer if it were faster, however I already pay Comcast several limbs per month so I can't really afford a higher cost service. | |
| The Troupe | Yes | |
| Private Island Cakes | The broadband speed I have is adequate for this business but faster connection speeds would certainly be welcome. | |
| 36Creative | Average, we could always use more. | |
| Garage Storage Cabinets | Yes | |
| Windham School District | At this time yes, our solution is scalable to meet our needs should we require faster speed. | |
| Ellie on Wheels Media Inc. | Adequate is the best way to describe it. | |
| The Dubai Group, Inc. | We currently do have adequate high speed broadband service for our needs. | |
| Windham Police Department | Yes, but efficiency and effectiveness of the customer system impacts our service. | |
| DK Engineering Associates, Inc. | Yes | |
| AdminInternet | Yes, we most certainly do. We subscribe to Comcast, we have the option of increasing our overall bandwidth for | |

additional funds. The standard rate, and supplemental rates are both appropriate for our needs and essentially the industry standard, so we have more than adequate speed.

Quarry Brook Yes

Question #2: Do you need faster speeds?

YES

NO

Medicus Health Care Solutions, LLC We are currently having our provider Windstream install fiber to accomplish as we do need faster download and upload speeds.

108 Degrees, LLC Yes

The Troupe No

Private Island Cakes I don't need faster speed but it would definitely help make me more efficient.

36Creative Yes

Garage Storage Cabinets No

Windham School District Not at this time.

Ellie on Wheels Media Inc. Yes for website design and uploads.

The Dubai Group, Inc. We currently do not need faster speeds for our business type. We mostly send emails so it is not critical to have the fastest broadband. If we became a huge company that relied on VOIP phones, frequent video conference calls between multiple offices, or if all our data was stored 100% in the cloud we would need faster speeds.

Windham Police Department Yes.

DK Engineering Associates, Inc.

No.

AdminInternet

Want versus need would be the key phrase here. We need no additional speed, would we enjoy it, sure. Speed is NOT a hold back for us.

Quarry Brook

As of now the speed works well For us.

Question #3: Do you have or need a “back up” internet connection during power outages?

YES

NO

**Medicus Health
Care Solutions, LLC**

Yes, we must have redundant connectivity at all times.

108 Degrees, LLC

We have a generator so we don't usually lose internet during power outages... however when the internet goes down, we are without phone or internet service, so it is pretty devastating.

The Troupe

No

Private Island Cakes

I would definitely benefit from a backup internet connection when the power goes out. As it stands, I usually end up at the library as soon as they are up but that's not ideal working conditions. Having an internet connection is vital for me to be able to work when it's down, I don't get paid.

36Creative

Would be amazing.

Garage Storage Cabinets

No

Windham School District We have several backups to our connection, one via coax and being wireless hotspots.

Ellie on Wheels Media Inc. That would be wonderful.

The Dubay Group, Inc. Currently we do not need a “back up” internet connection because most of our data is local on our machines. If we made the switch to a cloud based data storage system we would need a “back up” internet connection. Data storage is rapidly moving online to non-local “cloud” storage systems and not being able to have access to it would shut down the business until the internet came back online.

Windham Police Department Need back-up/redundancy (off site).

DK Engineering Associates, Inc. No

AdminInternet We do not run that type of business our servers are located in several locations throughout the U.S, so we are not too concerned if we lose service here due to power issues.

Quarry Brook It would be good to have but not necessary.

Question #4: What were the results of the speed test?

| | <u>Download</u> | <u>Upload</u> |
|---|-----------------|---------------|
| Medicus Health Care Solutions, LLC | 5 mb | 5 mb |
| 108 Degrees, LLC | 15.31 mbps | 12 mbps |
| The Troupe | 38 mbps | 12 mbps |

| | | |
|-----------------------------------|------------|--------------|
| Private Island Cakes | 5 mbps | 5 mbps |
| 36Creative | 21536 kbps | 8878 kbps |
| Thomas Case | 94.92 mps | 12.14 mps |
| Garage Storage Cabinets | 20 Mps | 13.8 Mps |
| Windham School District | 13 mbs | 61 mbs |
| Ellie on Wheels Media Inc. | 15.40 Mbps | 8.08 Mbps |
| The Dubay Group, Inc. | 31.22 Mbps | 11.17 Mbps |
| Windham Police Department | 5.38 Mbps | 10.84 Mbps |
| DK Engineering Associates, Inc. | 6479 kbps | 3954 kbps |
| AdminInternet | 35 Mps | 8.91 Mps |
| Windham Town Administrator | 5.50 Mps | 11.08 Mps |
| Benchmark-Office Systems | 4.69 Mbps | .04-.08 Mbps |
| Quarry Brook | 10.60 Mbps | 8.24 Mbps |

Question #5: Other comments-

Comments

| | |
|---|---|
| Medicus Health Care Solutions, LLC | Having more fiber in the area would allow more providers at a lower cost for business class circuits. |
| The Troupe | Regarding providers, I found that FairPoint is just trying to compete whereas Comcast has been more aggressive to get the business and has provided more bandwidth options. |
| 36Creative | We have very unique needs as the internet is basically the backbone of our company. |
| Garage Storage Cabinets | Provider: FairPoint Fios! |
| Windham School District | All buildings in the SAU are connected via fiber to the SAU and receive internet service from the central office. |
| Ellie on Wheels Media Inc. | Not that I have had issues with them, but it would be nice to have a Comcast alternative. |
| Windham Police Department | Any improvement(s) to broadband service need to include quality network engineering of the customers system; otherwise, such improvement(s) serve no purpose. |
| AdminInternet | Internet speed is not a business barrier for our business at this time |

Appendix D - Granite State Futures Telephone Survey Results

During May-July 2013, the University of New Hampshire Survey Center conducted a statewide and regional telephone survey for each of New Hampshire’s nine Regional Planning Commissions, as part of the *Granite State Future* and *New Hampshire Broadband Mapping and Planning* initiatives. The results from this survey were used to inform the broadband plans developed in each of NH’s nine planning regions.

A total of 2,935 New Hampshire adults were contacted by telephone by UNH staffers between May 9 and July 21, 2013 in conducting the survey. The overall response rate was 33 percent and the margin of sampling error for the survey was +/- 2.2 percent.³⁵

Survey Results

Many of the survey responses obtained within the SNHPC Region closely mirror statewide responses; however, a select few are noted for their difference. Of prime importance, 93 percent of the region’s residents report having access to the internet at home (See Table 5). Overall, the UNH Survey Center found statewide those who are 70 or older, those unemployed and looking for work, those with a high school education or less, and households earning less than \$20,000 are less likely to have internet access at home. Results for the City of Manchester may differ from the region as a whole, considering the city’s socio-economic characteristics, such as median household income and unemployment rates discussed earlier.

Table 5: Internet Access at Home

Do you have access to the internet at home?

| Respondents | Yes | No | Don’t know | Number responding |
|---------------------|------------|-----------|------------|-------------------|
| Statewide | 91% | 9% | 0% | 2925 |
| SNHPC Region | 93% | 7% | 0% | 591 |

Source: Granite State Future 2013 Statewide Survey

Table 8 reveals there are several reasons why 7 percent of the region’s residents do not have internet access at home, many of which are related to social preferences. 29 percent of respondents claimed they don’t need the internet and 10 percent said they don’t know how to use it. These answers may be related to differences between generations. Of those who don’t have internet access at home, 13 percent do not have a computer that can adequately handle internet connections, while 17 percent reported internet service is too expensive. Identifying and implementing strategies addressing the affordability of broadband will help decrease the number of people unable to access internet at home.

The majority of residents within the SNHPC Region utilize cable-based broadband internet (79 percent) while DSL generates the second most common type of internet connection (See Table 9). Compared to statewide types of internet connections, residents in the Southern New Hampshire Region use cable internet more. 4 percent of respondents in the region report using fixed wireless, while only 3 percent have a fiber-based connection at home.

³⁵ “NH Regional Planning Commissions: A Granite State Future, 2013 Statewide Survey.” The Survey Center, UNH. September 2013.

Table 10 explores why residents use their current internet providers. The two most common responses are that it was the only provider and “other” (31 percent). About 24 percent stated that they were happy with their current service provider.

Of those respondents who knew what their monthly internet bill was, the most common price range indicated is \$50-\$99 (29 percent), followed by monthly internet bills exceeding \$100 (28 percent) (See Table 11). A \$20-\$49 monthly internet bill is also fairly common, with 21 percent of respondents paying this amount. These prices are not clear if they include bundled services, which account for 79 percent of residents paying for internet services (See Table 12). The Survey Center found that statewide, households earning less than \$20,000 are less likely to pay for bundled internet service (see Tables 12-17).

Additionally, The Survey Center found those who are 70 or older, retired people, those with a high school education or less and households with an income of less than \$20,000 are less likely to shop online. Millennials are found to be more likely to watch videos online, while conversely, those who are 60 or older are less likely to watch online videos.

With 93 percent of the region’s residents having access to broadband at home, 94 percent report being pleased with their internet connection at home for their uses (See Table 18). This response rate signifies that the popularly-utilized cable internet connection serves the region’s population well.

A strong majority of residents (87 percent) are uninterested in paying more per month for a faster internet connection (See Table 19). With such an overwhelming majority of respondents stating their connection is adequate, paying more for a faster connection will not yield significant benefits.

Of particular importance to local elected officials, residents were asked if they would support their municipality funding the expansion of broadband access to existing and potential development. 56 percent of respondents oppose a municipality using any funds for broadband (See Table 20). Of the 40 percent who favored the use of municipal funds for broadband, 22 percent stated they would accept higher taxes for the service, while 18 percent would prefer a different funding mechanism used other than taxes.

Table 8: Reasons for not having Internet

Which of the following is the most important reason why you don't have internet access at home?

| Respondents | It is not available where I live | I have access at another place such as my job | It is too expensive | I don't know how to use it | I don't need it | I don't have an adequate computer | Some other reason | Don't know | Number responding |
|---------------------|----------------------------------|---|---------------------|----------------------------|-----------------|-----------------------------------|-------------------|------------|-------------------|
| Statewide | 5% | 9% | 20% | 8% | 26% | 9% | 21% | 2% | 262 |
| SNHPC Region | 0% | 5% | 17% | 10% | 29% | 13% | 27% | 0% | 43 |

Source: Granite State Future 2013 Statewide Survey

Table 9 Types of Internet Connections

What type of connection do you have to the internet at home?

| Respondents | Dial-up | DSL | Cable | Fixed wireless | Cellular | Satellite | Fiber | Other | Don't know | Number responding |
|---------------------|-----------|-----------|------------|----------------|-----------|-----------|-----------|-----------|------------|-------------------|
| Statewide | 1% | 16% | 68% | 5% | 2% | 2% | 2% | 1% | 3% | 2646 |
| SNHPC Region | 1% | 9% | 79% | 4% | 1% | 0% | 3% | 2% | 1% | 547 |

Source: Granite State Future 2013 Statewide Survey

Table 10: Why Dial-up/Satellite?

If you are on dial-up or satellite, why?

| Respondents | Only available option | Too costly to change | Too much effort to change | Learning curve is too steep | I don't know what other options are available | Other | Don't know | Number responding |
|---------------------|-----------------------|----------------------|---------------------------|-----------------------------|---|------------|------------|-------------------|
| Statewide | 26% | 9% | 2% | 2% | 2% | 10% | 49% | 158 |
| SNHPC Region | 0% | 11% | 0% | 0% | 0% | 17% | 72% | 9 |

Source: Granite State Future 2013 Statewide Survey

Table 11: Current Provider Choice

Why are you using your current provider?

| Respondents | I'm happy with my current provider | Only option available | Too costly to change | Too much effort to change | Learning curve is too steep | I don't know what other options are available | Other | Don't know | Number responding |
|---------------------|------------------------------------|-----------------------|----------------------|---------------------------|-----------------------------|---|------------|------------|-------------------|
| Statewide | 22% | 39% | 5% | 3% | 0% | 2% | 23% | 6% | 2631 |
| SNHPC Region | 24% | 31% | 3% | 4% | 0% | 1% | 31% | 6% | 545 |

Source: Granite State Future 2013 Statewide Survey

Table 12: Monthly Internet Bill Prices

What is your monthly internet bill?

| Respondents | Less than \$20 | \$20-49 | \$50-99 | \$100 or more | Don't know | Number responding |
|---------------------|----------------|------------|------------|---------------|------------|-------------------|
| Statewide | 3% | 25% | 29% | 24% | 19% | 2590 |
| SNHPC Region | 1% | 21% | 31% | 28% | 19% | 537 |

Source: Granite State Future 2013 Statewide Survey

Table 13: Bundled Services

Do you pay for a bundled service (internet, TV, phone)?

| Respondents | Yes | No | Don't know | Number responding |
|---------------------|------------|------------|------------|-------------------|
| Statewide | 76% | 22% | 2% | 2624 |
| SNHPC Region | 79% | 20% | 2% | 545 |

Source: Granite State Future 2013 Statewide Survey

Table 14: Email

Do you use the internet to check your email at home?

If Yes: Is the speed of your internet connection too slow, or is the speed of your internet connection adequate for this?

| Respondents | Do not check email at home | Do, but connection is slow | Do, and connection speed is adequate | Don't know | Number responding |
|---------------------|----------------------------|----------------------------|--------------------------------------|------------|-------------------|
| Statewide | 4% | 5% | 90% | 1% | 2622 |
| SNHPC Region | 4% | 3% | 93% | 0% | 542 |

Source: Granite State Future 2013 Statewide Survey

Table 15: Shopping Online

Do you use the internet to shop online at home?

If Yes: Is the speed of your internet connection too slow, or is the speed of your internet connection adequate for this?

| Respondents | Do not shop online at home | Do, but connection speed is slow | Do, and connection speed is adequate | Don't know | Number responding |
|---------------------|----------------------------|----------------------------------|--------------------------------------|------------|-------------------|
| Statewide | 19% | 5% | 75% | 0% | 2622 |
| SNHPC Region | 18% | 5% | 77% | 0% | 541 |

Source: Granite State Future 2013 Statewide Survey

Table 16: Online Videos

Do you use the internet to watch online video, such as YouTube or Netflix at home?

If Yes: Is the speed of your internet connection too slow, or is the speed of your internet connection adequate for this?

| Respondents | Do not watch online video at home | Do, but connection speed is slow | Do, and connection speed is adequate | Don't know | Number responding |
|---------------------|-----------------------------------|----------------------------------|--------------------------------------|------------|-------------------|
| Statewide | 37% | 10% | 53% | 1% | 2622 |
| SNHPC Region | 32% | 8% | 60% | 0% | 542 |

Source: Granite State Future 2013 Statewide Survey

Table 17: VPN

Do you use the internet to connect to other computers using VPN (Virtual Private Network) at home?

| Respondents | Do not connect to other computers at home | Do, but connection speed is slow | Do, and connection speed is adequate | Don't know | Number responding |
|---------------------|---|----------------------------------|--------------------------------------|------------|-------------------|
| Statewide | 66% | 4% | 27% | 2% | 2612 |
| SNHPC Region | 60% | 7% | 32% | 1% | 542 |

Source: Granite State Future 2013 Statewide Survey

Table 18: Adequate Internet Connection?

Overall, do you consider your internet connection at home to be adequate for your uses?

| Respondents | Yes | No | Don't know | Number responding |
|---------------------|------------|-----------|------------|-------------------|
| Statewide | 92% | 7% | 1% | 2630 |
| SNHPC Region | 94% | 5% | 1% | 544 |

Source: Granite State Future 2013 Statewide Survey

Table 19: Paying for Faster Internet Speeds

How much more (if any) would you be willing to pay for faster internet speeds?

| Respondents | Nothing | 25% more per month | 50% more per month | Don't know | Number responding |
|---------------------|------------|--------------------|--------------------|------------|-------------------|
| Statewide | 85% | 11% | 2% | 3% | 2622 |
| SNHPC Region | 87% | 9% | 1% | 3% | 543 |

Source: Granite State Future 2013 Statewide Survey

Table 20: Using Municipal funds for Broadband Access

Do you favor or oppose using municipal funds to provide broadband access to existing and potential development?

If Favor: Would you be willing to pay higher fees or taxes to pay for it?

| Respondents | Favor higher taxes | Favor no taxes | Oppose | Don't know | Number responding |
|---------------------|--------------------|----------------|------------|------------|-------------------|
| Statewide | 26% | 16% | 51% | 6% | 2910 |
| SNHPC Region | 22% | 18% | 56% | 4% | 589 |

Source: Granite State Future 2013 Statewide Survey