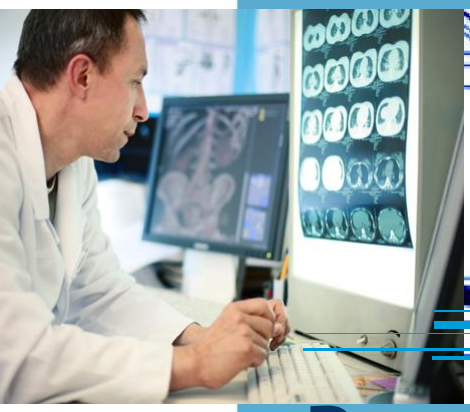
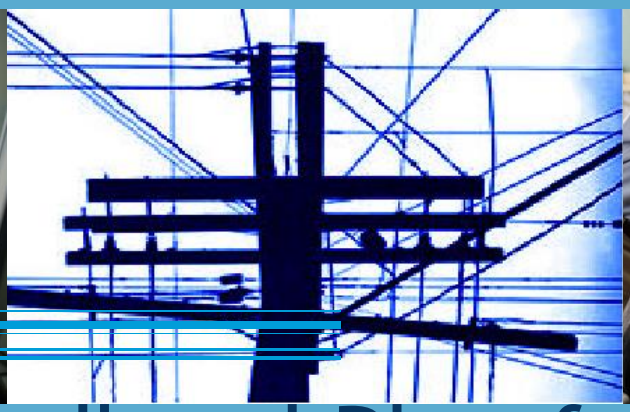
NEW HAMPSHIRE broadband MAPPING & PLANNING PROGRAM


Broadband Plan for the Nashua Region

Prepared by the Nashua Regional Planning Commission

NRPC

Adopted December 17, 2014

University of New Hampshire Cooperative Extension

University of New Hampshire

NH GRANIT

NTIA

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B. Executive Summary

Affordable broadband service has become a key amenity in the 21st Century, just as telephone service was a standard service in the 20th Century. Broadband connectivity and efficient internet speeds are becoming a fundamental need in the workplace, home, and key anchor institutions. High available speeds are sometimes the deciding factor in the purchase of land, space for a business, or a new school or municipal building. As a whole the region is generally well-served, with some pockets of underserved and unserved areas in the western and more rural parts of the region. This plan outlines the efforts of the Nashua Regional Planning Commission (NRPC), University of NH Cooperative Extension (UNHCE), NH Department of Resources and Economic Development (DRED), NH Office of Energy and Planning (OEP), and nine other regional planning commissions (RPCs) in the state to identify barriers and designate strategies to overcome these barriers and improve broadband connectivity.

In the greater Nashua Region's communities, the vision for broadband is to provide reliable, affordable, high speed internet access with low latency (the amount of time it takes for data to get from one point to another) to all thirteen member communities. The focus is providing wireless service to the rural communities in the western part of the region, and continuing to improve the technologies available in areas that are currently served. The purpose of this plan is to identify issues in the region and provide analysis of survey results, identify goals, and include strategies to help communities achieve these goals.

One main issue members of the Nashua Region face in improving broadband service is the lack of funding to create middle and last mile infrastructure (see page 10 for definitions and discussion). This was seen as a prevalent issue among those small pockets of unserved and underserved communities. Results of a UNH survey showed that 96% of respondents in the Nashua Region have broadband access at home, which indicates a lack of underserved areas throughout the region. However, this percentage may be not accurately reflect local pockets of underserved areas in the western part of the region, as the survey represents the region as a whole. Additionally, the maps present an overly optimistic depiction of broadband service because they are based on aggregate data that is summarized at the census block level. They show an area as "served" if service is delivered to any part of the census block. Although these underserved areas are few, there must be strategies put in place to connect them to the rest of our generally well served region. Geographical barriers are another issue in connecting the Nashua Region. The topography of the landscape in some of the more rural areas is a challenging environment for infrastructure development. In the region Digital Subscriber Line (DSL) and cable are the most popular services followed by wireless and fiber

optic. A general consensus across sectors in the region, on whether their broadband connectivity suits their current needs, is that current service was sufficient but there is room for improvement. However, when asked if current service levels would suit their future needs most indicated that they would not.

The following strategies are suggested so that the improvements made in the future will allow broadband access in the region to suit the needs of our residents now and in the future. The strategies that were chosen by the Broadband Stakeholder Group (BSG) as the highest priority for the region include: working with municipalities to provide assistance to administrators and selectmen in negotiating cable franchise agreements; encouraging broadband innovation and inclusion in town master plans; enforcement of pole attachments to be included in local zoning ordinance updates; and coordination among sectors and with providers to develop service maps with full disclosure of service line locations. These strategies are a result of barriers identified by NRPC. Strategies are also based on findings from surveys given to Nashua Region communities by UNHCE. They are intended to guide communities in their efforts to expand broadband service where it is not available, and improve upon service that is available to make it sustainable for future advancement in technologies.

C. Introduction

1. Project Background

The Broadband Plan for the Nashua Region was developed in conjunction with the New Hampshire Broadband Mapping and Planning Program (NHBMPP), the Broadband Stakeholder Group (BSG), and the University of NH Cooperative Extension (UNHCE). Funding was provided by a grant from the American Recovery and Reinvestment Act (ARRA), as well as support from the National Telecommunications and Information Administration (NTIA). Over the course of three years, beginning in 2011 the Nashua Regional Planning Commission (NRPC) has attended quarterly meetings with the nine other planning commissions (RPC's) in the state to collaborate on this plan. The plan is a product of this collaboration and input.

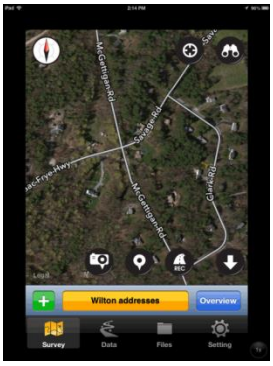
The NHBMPP is a comprehensive, multi-year initiative that began in 2010 with the goal of understanding where broadband is currently available in New Hampshire, how it can be made more widely available in the future, and how to encourage increased levels of broadband adoption and usage. NHBMPP is part of a national effort to expand broadband access and adoption.

The NHBMPP is managed by the Geographically Referenced Analysis and Information Transfer (GRANIT) system within the Earth Systems Research Center at the University of New Hampshire (UNH), and is a collaboration of multiple partners including: the NH Office of Energy and Planning (OEP), NH Department of Resources and Economic Development (DRED), UNHCE, UNH Information Technology (UNHIT), and the state's nine RPCs.

2. Purpose & Objectives/Overview of Planning Process

The NHBMPP is comprised of several components, including a broadband availability inventory and mapping effort as well as a suite of planning and technical assistance initiatives. Following are brief descriptions of these components as well as an overview of the broadband planning initiative.

i. Mapping



In 2010, UNH GRANIT, the RPC's, and other partners began an inventory and mapping effort aimed at better understanding the current availability of broadband throughout the state through several projects and activities. The data was obtained by collecting data semi-annually from the public and commercial entities that provide broadband services in New Hampshire on the location, type and speed of broadband technology available. Refining the information collected on broadband availability initiated a series of verification efforts, including map verification with community collaborators, online speed tests and user surveys, a statewide cell

phone reception study, and other related activities. In addition, data was verified by surveying and mapping broadband availability at community anchor institutions (CAIs) such as schools, libraries, hospitals, public safety facilities, and municipal buildings. The first public master address file of households located in rural census blocks was developed as well as efforts in collecting and hosting a statewide inventory of cable franchise agreements. This information will be shared with the NTIA and the Federal Communications Commission (FCC) on a semi-annual basis for inclusion in the National Broadband Map.

ii. Technical Assistance and Training

UNHCE took the lead on developing and administering technical assistance and training opportunities to help businesses, local governments, organizations and individuals better understand the importance of and applications for broadband in today's world. The Cooperative Extension assessed the broadband training and technical needs of stakeholder groups including educational institutions, small business, municipalities, healthcare providers and other organizations. This was done to determine topics on which stakeholders would like to receive training, as well as applications that would be of use to them. Developing tools and learning modules on topics related to broadband utilization and adoption such as "Leveraging Broadband to Promote Economic Development," "Putting your Business on the Digital Map," and "Three Free Ways to Promote Your City/Town/School via the Web" were the themes of workshops and training sessions. This was all part of the technical assistance offered to broadband stakeholder groups to support increased broadband adoption and use.

iii. Capacity Building

A third component of the NHBMPP was capacity building. This focused on the development of tools and resources necessary to implement broadband projects within communities and regions across the state. The Director of Broadband Technology, DRED, and project staff from UNHCE and UNHIT, worked together to enhance broadband capacity in five ways. The first was to encourage collaboration establishing best practices in policy management, financial resources, and advocacy for business and residential broadband. Second was tracking and reviewing legislation related to broadband and telecommunications. The third strategy was to work with the NTIA, to analyze and assess the state's broadband infrastructure and promote access to affordable and reliable advanced telecommunications services. Researching successful community broadband solutions and funding options, including and aggregating them into a toolkit on broadband solutions and funding for NH was the fourth strategy. Finally, the fifth strategy was to establish a Resource Team, who will work with regional planning commissions and BSGs to identify communities prepared to initiate their broadband plans and provide assistance with community broadband decision making.

iv. Planning

In 2010, NHBMPP partners engaged in a five-year effort aimed at incorporating the information and momentum gained during the mapping activities to better understand current broadband availability in New Hampshire and plan for increased broadband adoption and utilization through outreach, community engagement, and surveying activities.

As part of an effort to gain a better understanding of broadband at the regional level, each planning commission developed a broadband stakeholder group, comprised of individuals representing a wide range of sectors. The stakeholder group which met quarterly has played a vital role in assisting regional planning commissions in assessing the need for improved broadband capability, availability, and affordability. The stakeholder groups helped the planning commissions develop a list of broadband needs and barriers to broadband adoption and utilization. They also assisted with developing goals, objectives, and strategies to overcome barriers in each region.

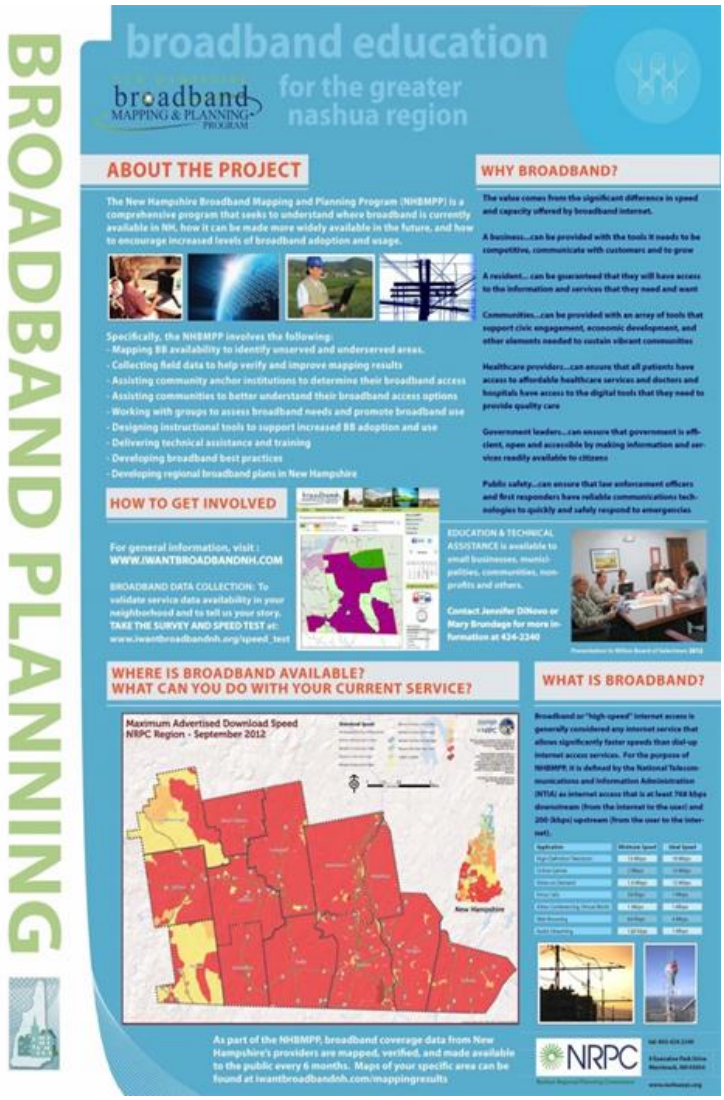
A major undertaking of the broadband planning component was a sector-based analysis. This activity involved developing and facilitating focus group meetings, structured interviews, and other methods to identify broadband needs and challenges specific to various sectors, including healthcare, education, local government, economic development, and public safety. Each regional planning commission held focus groups or conducted interviews with representatives from these sectors to better understand the importance of broadband accessibility to each sector.

Additionally, each regional planning commission held public forums throughout the course of the project. These forums were an opportunity to share information regarding ongoing broadband efforts in the region, progress of the NHBMPP, and to receive feedback from community members regarding broadband availability.

Sector Based Analysis Education

Information gathered from the activities described above led to the development of nine regional broadband plans in NH. Each regional planning commission reviewed and analyzed data collected through the mapping efforts, outreach activities, sector-based analysis, as well as public forums to develop comprehensive documents that highlight the current landscape of broadband availability in the state and identify ways to increase broadband adoption and utilization.

The regional broadband plans serve as guidance documents for communities, policy makers, businesses, institutions, and residents to better understand the availability, need for, and utility of broadband presently and into the future. All nine plans are to be compiled into a statewide broadband planning document by OEP.



D. Understanding Broadband

1. Broadband Explained

Broadband, also called 'high-speed internet,' is the umbrella term referring to internet access that is always on and is faster than dial-up internet access. NTIA defines broadband as, "advanced communications systems capable of providing high-speed transmission of services such as data, voice, video, complex graphics, and other data-rich information over the internet and other networks."[1] As our technology capabilities are continually changing, it is important to define what broadband is so that stakeholders can determine where broadband is currently available, and how it can be made more widely available to their community members.

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 per second, 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, so should the different types of broadband effecting resulting speeds and functions while using the internet.

Although NTIA defines broadband at 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 from anywhere in the country. At 10

[1] "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).

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.[2] 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.

NHBMPP developed a matrix to assist stakeholders in understanding the many levels of broadband available in the state of New Hampshire today, and the typical functions a user might be able to perform within a range of download and upload speed tiers. Using these tiers, the NHBMPP has established broadband availability categories ("un-served," "underserved," and "served") to describe access to broadband service. The table on the next page is a condensed version of the NHBMPP matrix.

[2] "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).

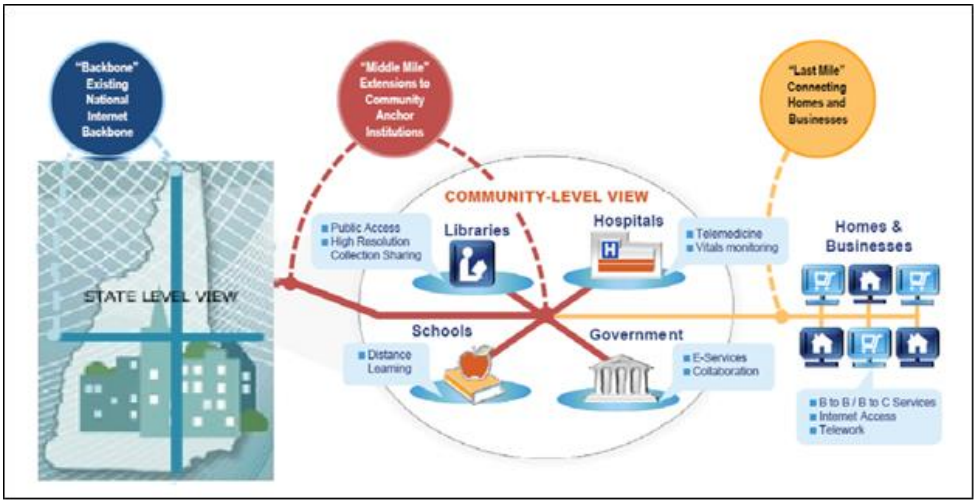
Figure 1 Broadband Service and Functionality

Tiers of Service	Download Speed	Upload Speed	Typical Functions / Use (functions additive to level above)
un-served	< 768 Kbps	< 200 Kbps	• Email (client/served-based)
underserved	768 Kbps to < 1.5 Mbps	200 Kbps to < 768 Kbps	• 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	• 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	• 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	• 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	• HD quality, large frame videoconferencing • Remote synchronous education, professional development facilitated simultaneously at multiple locations • Tele-health applications possible
	25+ Mbps	10+ Mbps	• 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

Broadband infrastructure consists of the 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, town offices, hospitals, schools, emergency services, 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.[3]

Figure 2 Backbone to last mile infrastructure



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

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, WiMax), Wi-Fi, satellite, and wireless internet service providers (WISP).[4] 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.

[3] 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).

[4] "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).

Image courtesy bandwidthplace.com

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, preventing shared 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.[5] 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.[6] Building out the fiber network is currently the most effective means to provide the highest capacity broadband internet; it is also the most costly.

Wireless broadband is available through many technologies, including mobile wireless (3G, 4G, LTE), Wi-Fi, satellite, and 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, or cell phones, etc).

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

[6] "*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).

Wireless Internet Service Providers (WISP) 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 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 an area such as a neighborhood, shopping mall, or campground.[7] 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 re-transmits the signal to a network operation center that is connected to the internet. Satellite-based internet connections can be interrupted by objects and weather, and broadband upload speeds are typically slower than wired or other wireless networks.[8] While wireless broadband can offer mobility and access for rural locations, wireless connections are unlikely to overtake the wired network which is known 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,[9] and help bridge the gaps in broadband infrastructure.

2. Why Broadband is Important

Broadband is in 2014 what telephone service was in the 1930's - a necessity. As a predominantly rural state, the availability of high-speed internet in New Hampshire is one of the most significant factors that will impact the ability of communities to achieve economic growth and maintain quality of life. In a relatively short period of time, fast and reliable broadband has become essential for economic and community development and is critical infrastructure for public safety, education, health care, business and government operations.[10]

There is no doubt that we live in an information rich 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

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

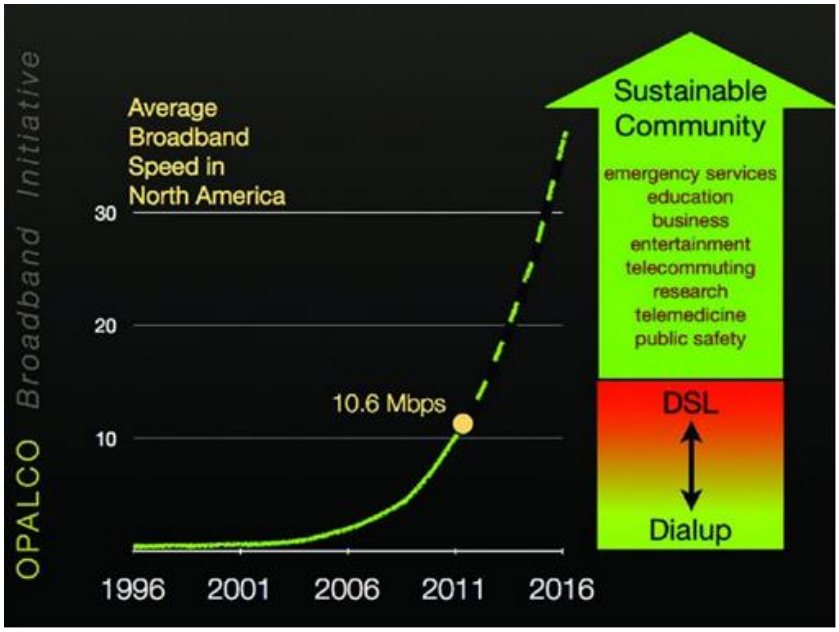
[8] Shuffstall, Bill, Monica Babine, and Andy Lewis, "Connecting Communities," *The National e-Commerce Extension Initiative*, http://www.connectingcommunities.info/. (accessed July 2013).

[9] "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).

[10] "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).

different forms.[11] In 2010, it was estimated that there were almost 200 million Americans with access to broadband at home, up from 8 million in 2000.[12] 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, the effects of which are depicted in the following figure.

Figure 3 Broadband Speed Needed for Sustainable Communities



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

[11] David Salway, "Why is Increasing Broadband Adoption so Important to Society?," *About.com Guide*, http://broadband.about.com/od/barrierstoadoption/a/Why-Is-Increasing-Broadband-Adoption-So-Important-To-Society.htm. (accessed July 2013).

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

i. Education

Broadband is an important tool to enhance access to and improve the quality of education at all levels in New Hampshire and beyond. Broadband-enabled teaching and learning has the potential to extend beyond the limits of the classroom, provide more customized learning opportunities, and increase the efficiency of school systems.[13] 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 may be unable to keep up with educational trends and potentially, be less prepared than their peers in better served areas. The State Educational Technology Directors Association recommends that K-12 schools have access to broadband speeds of 100 megabits by the year 2014 and 1 gigabyte per second by 2017.[14] 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.[15] This need for improved broadband connections in schools will only increase over time; especially, as educators transition to web-based content and resources and more states require online assessments and testing.

Broadband access improves the overall quality of education.

In rural parts of New Hampshire, access to broadband is very limited. In the Nashua Region, the towns of Lyndeborough, Mason and Wilton face the greatest difficulties.

[13] 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).

[14] 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).

[15] 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).

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.[16] 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.[17] Providing access to learning opportunities that address these skills can help empower students to actively engage in an increasingly technology-driven and digital culture.

ii. Health

With increasing and changing health needs ranging from rising health care costs, to managing chronic illnesses, to 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 outcomes while also controlling costs and extending the reach of health care providers.[18] 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.

Electronic medical records systems enable providers to collaborate in 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 patients and 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.[19] 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.

"Network connectivity is a foundation for many services that healthcare wants to deliver in the near future."

-Robert Brentrup
IT Manager
Dartmouth Hitchcock Medical Center

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

[17] 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).

[18] Federal Communications Commission, *Connecting America: The National Broadband Plan*, 2010, http://www.broadband.gov/plan/11-education/#_edn16. (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).

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, patient and professional health related education, public health, and health administration.[20] New Hampshire, with rural geography, scarcity of local specialty medical services, and high percentage of elderly residents, can benefit from telehealth systems.[21] Broadband internet is necessary to continue supporting current and emerging telehealth applications for patients, providers, hospitals, and health care businesses.

iii. Community Support and 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 and technology should augment New Hampshire's tradition of accessibility to the public process. But citizens have come to desire, and sometimes expect, a certain level of online interactivity with government and community support organizations. Most towns in New Hampshire currently host websites providing 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.

"During periods of high [library] use, patrons have real difficulty accessing our wireless service."

-Nancy Vigezzi
Head of Technical Services
Merrimack Public Library
Merrimack, N.H.

[20] 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

[21] 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

Equal in value to the administrative 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. While new applications allowing for improved public sector interaction and transparency will continually surface, their reliance on perpetually maintained broadband infrastructure will remain a constant.

iv. Public Safety

New Hampshire is a predominantly rural state, where firefighters, law enforcement and emergency medical personnel cover wide geographic areas. These public safety officials are often required to quickly make potentially life-saving decisions in the field, despite the challenges of rugged terrain and natural and man-made disasters. 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.

"We lose streaming ability due to poor weather, and slow connections make online training very difficult."

-Rainsford Deware III
Officer in Charge
Lyndeborough Police
Lyndeborough, N.H.

v. Economic Development and Business

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.[22] Broadband and economic development are intertwined and as we progress into the future, both are needed for each to be successful. 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. All of which are key elements for a successful economic development strategy.

[22] 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% between 2008 and 2018 or at a rate of 2.5% faster than the average for other occupations and industries.[23] 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% of New Hampshire households and businesses had access to broadband and, nationally in 2012, 66% of adults have broadband at home, which is up from 3% in 2000[24], a staggering increase. 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 small businesses in their state generate $1.9 billion in online sales, and those businesses with a broadband connection have revenues that are $200,000 higher annually than those which do not.[25]

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, 68% of businesses surveyed boosted the speed of their access to knowledge, 54% saw reduced communications costs and 52% saw increased marketing effectiveness.[26] The use of broadband by small businesses has proven to be an efficient and cost-effective tool. Statistics have shown that small businesses have consistently been the foundation for job and wealth creation in the US economy. The use of broadband has truly served to bolster this trend into the 21st century.

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

[24] The Pew internet and American Life Project, Sept. 2012, available at http://www.pewinternet.org/.

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

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

E. Regional Broadband Overview

1. Introduction

Dependable high speed broadband access has become an increasingly vital part of our communities in the region. The benefits of having broadband for rural economic development, small business growth, local government, increased educational services, and emergency services are just a few examples of how broadband improves the quality of life for our residents and visitors. High speed broadband access can be hindered by low population densities and geographical barriers, such as topography and infrastructure costs. Internet service providers are reluctant to extend the necessary middle and last mile broadband infrastructure to homes and businesses in remote locations due to the extremely high costs. While the urban and suburban areas of our region have sufficient coverage of broadband, our more rural areas have fallen behind in receiving service. Even within our more populated areas, there are still pockets of unserved or underserved areas. Looking ahead, the existing broadband infrastructure must be continually upgraded to meet the needs for increased bandwidth as websites become increasingly more complex.

i. Regional Vision

It is our regional vision that all of the communities in the Nashua Region, including those in the rural western part of the region, are served by reliable, affordable, high speed broadband internet access, and that the economy remains competitive through technology advances.

ii. History of Broadband Planning in the Region

Broadband access and infrastructure has improved tremendously throughout the past decade, and having access has become a necessity much like phone service. The demand for access to broadband in both the office and home continues to increase throughout the region. In a recent survey conducted by the UNH survey center, 96% of respondents stated they currently have access to broadband at home, making the Nashua Region generally well served. There are a few small pockets of underserved and unserved areas in the western part of the region. These communities are challenged by lack of sufficient funding to create middle and last mile infrastructure, and geographic barriers such as hilly and rough terrain.

Broadband Stakeholder Group (BSG)

NRPC formed a BSG at the beginning of this project to oversee the plan's formation and assist in identifying regional needs and barriers as well as goals, objectives, and strategies for overcoming barriers. The group first met in September of 2011, to review the NHBMPP project trajectory as well as their roles and responsibilities. This group met continually over the span of two years. The BSG provided input on the plan throughout its drafting process.

Outreach and Education

Outreach and education for this project was accomplished via presentations, educational materials, and surveys. NRPC developed educational materials that were specific to the Nashua Region and outlined the goals of the project and how to get involved. This information was distributed to the BSG as well as members of the community to encourage participation in the plan's development. NRPC held seven public forums from August of 2012 through January of 2013 with the following groups and events: the Milford Rotary Club; Mason Planning Board; Amherst Board of Selectman; Wilton Board of Selectman; Hollis Planning Board; Mont Vernon Planning Board; and the Souhegan Valley Chamber of Commerce Technology Fair.

This outreach and public engagement was vital to the development of the plan and helped members of the community learn how to get involved and advocate for better broadband access. These public forums generated many positive results. After the Mason Planning Board public forum, members expressed interest in updating their telecommunications regulations. Residents in Amherst expressed interest in a project to help expand service to a new neighborhood that is currently underserved. Hollis Planning Board members provided helpful input on barriers to broadband including funding resources, precision of data, and competing carrier information. Each forum reached out to different sectors of the community which allowed NRPC to incorporate diverse perspectives into the plan. An online survey was also created and sent to our BSG asking them to rank the goals, objectives, and strategies for the project in terms of high and low priority, and length of time they believe it would take to accomplish. This feedback was used to prioritize our objectives and strategies for the region, to best support the vision stated above.

Outreach and Interviews in Wilton, Mason, and Milford

"If you go one mile to the south, east, or west, you can get [cable broadband service]. But not us, we're boxed in."

-RaDan Rau
Business owner
Mason, N.H.

In order to gain a greater understanding of barriers to accessing broadband in the region, NRPC staff representatives visited a number of businesses in communities most limited by broadband access issues, including those in the towns of Wilton, Mason and the western part of Milford. Staff distributed brochures highlighting broadband challenges and opportunities in the region as well as internet links where businesses could take a speed test and complete a survey documenting issues that were encountered with broadband service. In many cases, business representatives were willing to take the survey and run the speed test in person. This allowed businesses to highlight many issues in greater depth than they may have been able to via an internet or telephone survey.

While every business owner interviewed agreed that faster broadband speeds would be helpful, there was some disagreement regarding whether existing broadband service was adequate to meet current business needs. Several businesses in Downtown Wilton agreed that poor broadband service significantly stymied business functions. Downtown Wilton is the historic center of business activity in the community, and a number of small businesses maintain locations there. Business owners noted that a lack of broadband access would limit business growth in the area.

Wilton businesses located away from the downtown, including representatives from local shops located along the Route 101 corridor, indicated that current broadband service was sufficient to meet their needs. An auto body owner said that he did not do significant broadband work as part of his role in the business, but noted that none of his staff, who use broadband services regularly, had indicated any issues to him.

A business owner in Mason, the most rural of the communities in the Nashua Region, noted the most frustration with broadband access. Another Mason business owner noted that the business was located in a part of town that was "a black hole" for broadband access. If the business were located only a short distance in any direction, it would enjoy access to faster internet services, the owner indicated. Because the owners do extensive internet marketing, as well as other core business functions over the phone and internet, this presented a major

obstacle for business growth. The owner noted that while the location was successful and enjoyed very steady business, broadband issues have been so challenging that the business was considering relocating.

2. Regional Overview

i. Geography and Physical Landscape

The Nashua Region covers a substantial area of southern New Hampshire, and includes the City of Nashua and the 12 surrounding towns of Amherst, Brookline, Hollis, Hudson, Litchfield, Lyndeborough, Mason, Merrimack, Milford, Mont Vernon, Pelham and Wilton. The NRPC's expanse is typically characterized as a small urban center (Nashua) bordered by suburban communities of varying degrees of density. From moderately mixed-use communities such as Hudson and Milford to traditionally single family residential communities typical of Hollis and Brookline, the region is comprised of a diverse and multi-faceted landscape. From the spruce fir forests adorning the highest hills in Lyndeborough, to the urban landscape of Nashua, the colonial villages of Hollis and Amherst, and the prime farmland along the Merrimack River in Litchfield, the natural setting of the Nashua Region is widely varied. The region is located in the Merrimack River Valley. The river runs from north to south through the region and its major tributaries in the region include the Nashua River, the Souhegan River, Salmon Brook and Pennichuck Brook.

Agriculture in Litchfield

ii. Population Characteristics

According to historical population data, the Nashua Metropolitan Area experienced rapid growth in population and housing in the last four decades of the 20th century while the first decade of the 21st century saw a decline in those growth rates. The region's population grew over 57% between 1960 and 1970, but only 4.5% between 2000 and 2010. And while growth rates have been steadily decreasing for both Hillsborough County and the state, the 2010 Census showed the first decade in nearly 100 years where the region's percent growth was lower than either Hillsborough County's or the State of New Hampshire's. A review of Census data going back to 1900 showed that the period between 2000 and 2010 was the only decade where the City of Nashua, the region's largest community, lost population; the City's population decreased by 111 between 2000 and 2010 after increases of nearly 7,000 between 1990 and 2000 and nearly 11,800 between 1980 and 1990. Other notable population changes between the 2000 and 2010 Censuses show that Brookline grew by only 19.4% after having a 73.5% increase in population between 1990 and 2000 (the largest of

any community; over 500 people). Mason grew by 20.5% (235 people) after a decrease of 5.4% (65 people) between 1990 and 2000. Wilton's population decreased by 66 people (-1.8%) after increasing by 621 people (19.9%) between 1990 and 2000.

Table 1 Historical Population Growth 1960-2010

Area	Population				Percent Change			Annual % Growth			
	1980	1990	2000	2010	1980 - 1990	1990 - 2000	2000 - 2010	1980 - 1990	1990 - 2000	2000 - 2010	1960 - 2010
NRPC Region	138,881	172,690	196,935	205,765	24.3%	14.0%	4.5%	2.2%	1.3%	0.4%	2.35%
Hillsborough County	276,608	336,073	380,841	400,721	21.5%	13.3%	5.2%	2.0%	1.3%	0.5%	1.63%
Statewide	920,475	1,109,252	1,235,786	1,316,470	20.5%	11.4%	6.5%	1.9%	1.1%	0.6%	1.56%

Source: http://www.nh.gov/oep/data-center/historical-census.htm

iii. Socioeconomic Conditions

According to the 2010 Census, median household income for Hillsborough County is $66,609. Connecting low cost broadband infrastructure in the region will help the low income residents gain access to the broadband network, which can potentially benefit them as well as the community in many ways such as pursuing an online education, gaining resources to find job opportunities, and learning new technological skills that will make them desirable to employers. Should the broadband infrastructure improve in New Hampshire, there will be ample potential to create job opportunities for those currently unemployed or underemployed.

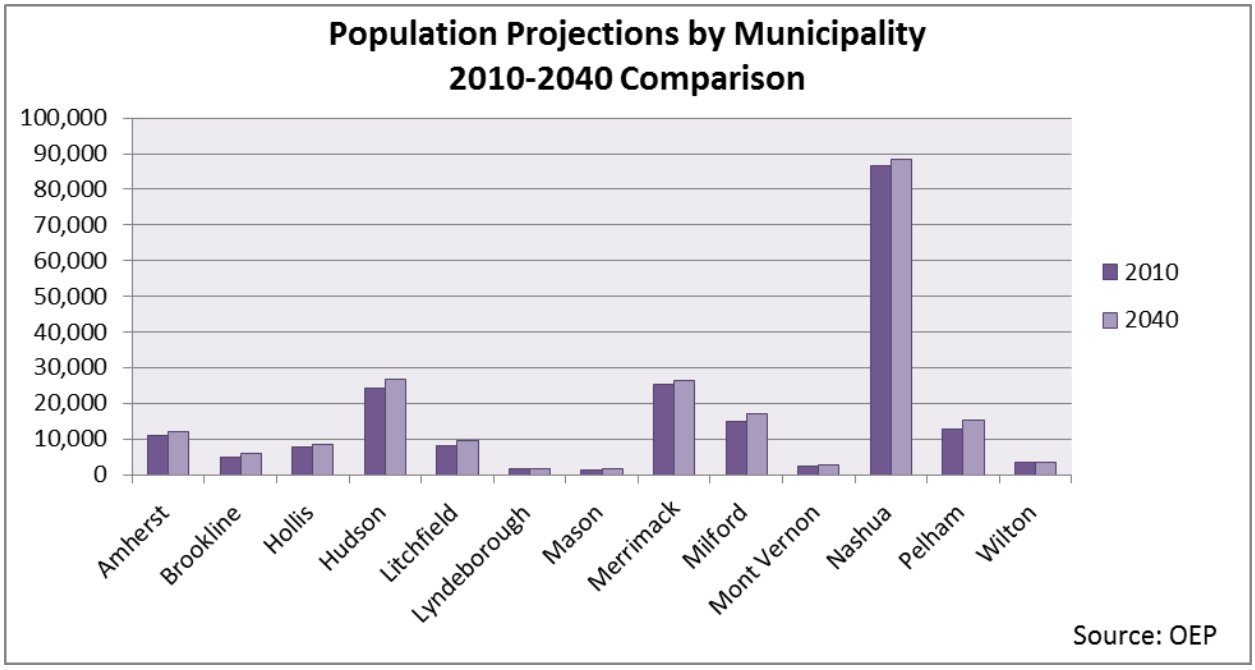
Commuting Patterns

Based on US Census data, approximately two thirds of the region or 67% works either in the community they live in, or close by within Hillsborough County. Much like the last two decades, about one quarter of the population or 26% work outside New Hampshire. Generally, commuters in the region travel around thirty minutes or less to their place of employment. In the Nashua Region commute times are slightly higher than Hillsborough County and state averages, which could be caused by the larger number of people commuting to the Boston Metropolitan Region. In the past two decades commute times have increased by 3.5 minutes which is consistent with county and statewide trends. Only ten percent of commuters in the region require over an hour of travel time to get to work, and eight percent of commuters either work at home (5%) or travel less than five minutes to work each day (3%). Of all the commuters on the road daily, 8% carpool, while over 80% of drivers commute alone. This statistic is slightly higher compared to the national average of

76% of commuters driving alone. Public transportation is the least frequently used method of transportation; only 1.1% of the population in the Nashua Region uses it to get to work.

iv. Anticipated Demographics and Trends

Figure 4 Projected Population



The above table presents population projections by municipality for the period 2010 through 2040. The projections are done in five-year intervals, and are consistent with the county population projections in the report titled: State of New Hampshire, Regional Planning Commissions, Office of Energy and Planning - County Population Projections, 2013 By Age and Sex.

3. Regional Broadband Availability

i. Results of Broadband Mapping

During May and July of 2013, The University of New Hampshire Survey Center conducted a survey for New Hampshire's nine RPCs as part of the Granite State Future and New Hampshire Broadband Mapping and Planning initiatives. Results of this survey helped to inform the maps that follow and aid in explaining their importance. The maps shown paint a picture of the broadband infrastructure in the region. They display such topics as level and type of service as well as community anchor institutions that are served by broadband in the region. Table 2, shown below, illustrates types of tasks that can be done at different speeds which coincide directly with Maps 3 and 4, which show the majority of our region as not only served but having access to high speed broadband service.

Table 2 Broadband Speeds Available and Applications Supported

Level of Speed	Applications
High	• Sending and receiving large files • Sending and receiving small to medium sized databases • Large frame videoconferencing • Multiple bridged sites and users • Telehealth and Telemedicine • High-speed end-to-end network business applications • Telemetry • internet 2 applications
Moderate	• Medium to high social media use • Sending and receiving medium to large documents • Streaming standard definition content when buffering is not problematic • Downloading high definition content when slow download speeds are available • 3-5 simultaneously connected devices • VPN where speed is not critical to job function • Simultaneous functions such as web browsing, streaming video, and music downloading • Low quality, small window videoconferencing (Skype) • Cloud based computing and data storage

The survey showed that 96% of respondents have internet access at their home. With so much of the region having access to overall service, demand for increased broadband quality and extension of service areas is relatively low. Ninety percent of those served consider the access they have now adequate for their uses, and 83% of residents said that they would not be willing to pay more money to have faster internet speeds. Anticipated demographic changes may impact demand for future services. Survey results showed that those who are 70 years of age or older are less likely to have internet access at home. This was also true for individuals with a high school education or less as well as households earning less than $20,000 per year. According to the survey and the maps below (produced by the NHBMPP) our region is generally well served for broadband intensive uses such as; sending and receiving large files, telehealth and telemedicine, large frame videoconferencing, and high-speed end-to-end network business applications. Overall survey results showed that only 5% of residents claim to not have service in the entire region. The Nashua Region has the most need for improved broadband service in the communities of Mason and Lyndeborough.

Map 1: Broadband Level of Service for Basic Applications

Level of service indicates the degree or quality of service as defined by a range of download and upload speeds (see figure 1 on page 9). Map 1 shows broadband level of service as a basic application. Tasks such as email and surfing the web can be performed with these speeds. The Nashua Region is generally well served, with some pockets of underserved and unserved areas. These tend to be in the more rural areas of the region such as Lyndeborough and Mason and to a lesser extent in Wilton and Mont Vernon. In the map, depicted by dark green, are the census blocks that are served by at least one service provider. Limited competition between service providers can lead to higher broadband costs for the customer.

Map 2: Broadband Level of Service for Intensive Applications

The second map depicts level of service for intensive applications. This indicates the degree to which service supports bandwidth-intensive applications such as streaming HD content, connecting five or more internet devices, and video conferencing. The Nashua Region is mostly covered in terms of service that offers bandwidth usable for intensive applications, but there are still some rural areas in the western part of the region, primarily in Lyndeborough and Mason, that are underserved or have reported service gaps. Speed tests have been done in the region to make sure that consumers are getting the speed advertised, and additional information about broadband service indicates that contrary to advertised reported speeds, there are areas where service is lacking. These coverage "gap" areas are particularly important when they occur in commercial areas of our region, where it could potentially impact business competitiveness.

Maps 3 & 4: Broadband Availability for Uses That Require High and Moderate Speeds

Maps 3 and 4 depict broadband availability by use. Availability indicates the presence or absence of service as defined by the download and upload speeds required for both high and moderate speed internet access. Table 2 below shows more detailed information on the types of applications supported for each speed.

According to these standards Map 4 shows that there is availability for broadband service for applications that require moderate speed access across most of the region, except in Lyndeborough and Mason, where large areas of no service still exist. Map 3 shows how this area of non-service expands into portions of Brookline and Hollis at high speed levels of access. If speeds do not increase to a bandwidth offering at least moderate speeds there could be potential negative impacts on business competitiveness and the expansion of remote patient monitoring into residential areas.

Map 5: Broadband Availability at Community Anchor Institutions

The current broadband availability at Community Anchor Institutions can be seen in Map 5. This map indicates the presence or absence of broadband service at K-12 schools, colleges and universities, libraries, medical/healthcare sites, public safety locations, community government sites, and other non-government buildings. Community anchor institutions sometimes serve as the only point of internet access for residents. In the context of this

map, availability is defined by a minimum of 768 Kbps downstream and 200 Kbps upstream. In other words, sites that are coded as available could be considered underserved according to previous definitions. Throughout the Nashua Region, most community anchor institutions have broadband service.

Map 6: Fastest Available Broadband Technology

The fastest available broadband technology in our region is illustrated in Map 6 for each census block, which can be defined as the technology that delivers the fastest advertised download speed. For the majority of our region, cable providers are offering the fastest service. There are two pockets of fiber service that are not reflected in the maps. The first is the Technology Park in south Nashua and the other is Fidelity Investments located in Merrimack. Another recent change that is not reflected in the map is the availability of fiber to most residents in the Town of Hollis. In some of the more rural western areas of our region DSL is either equal to or faster than cable, or cable is unavailable. For significant western portions of our region, mobile wireless (e.g. cellular) service is the fastest technology available.

Map 7: Degree of Competition for Broadband Availability

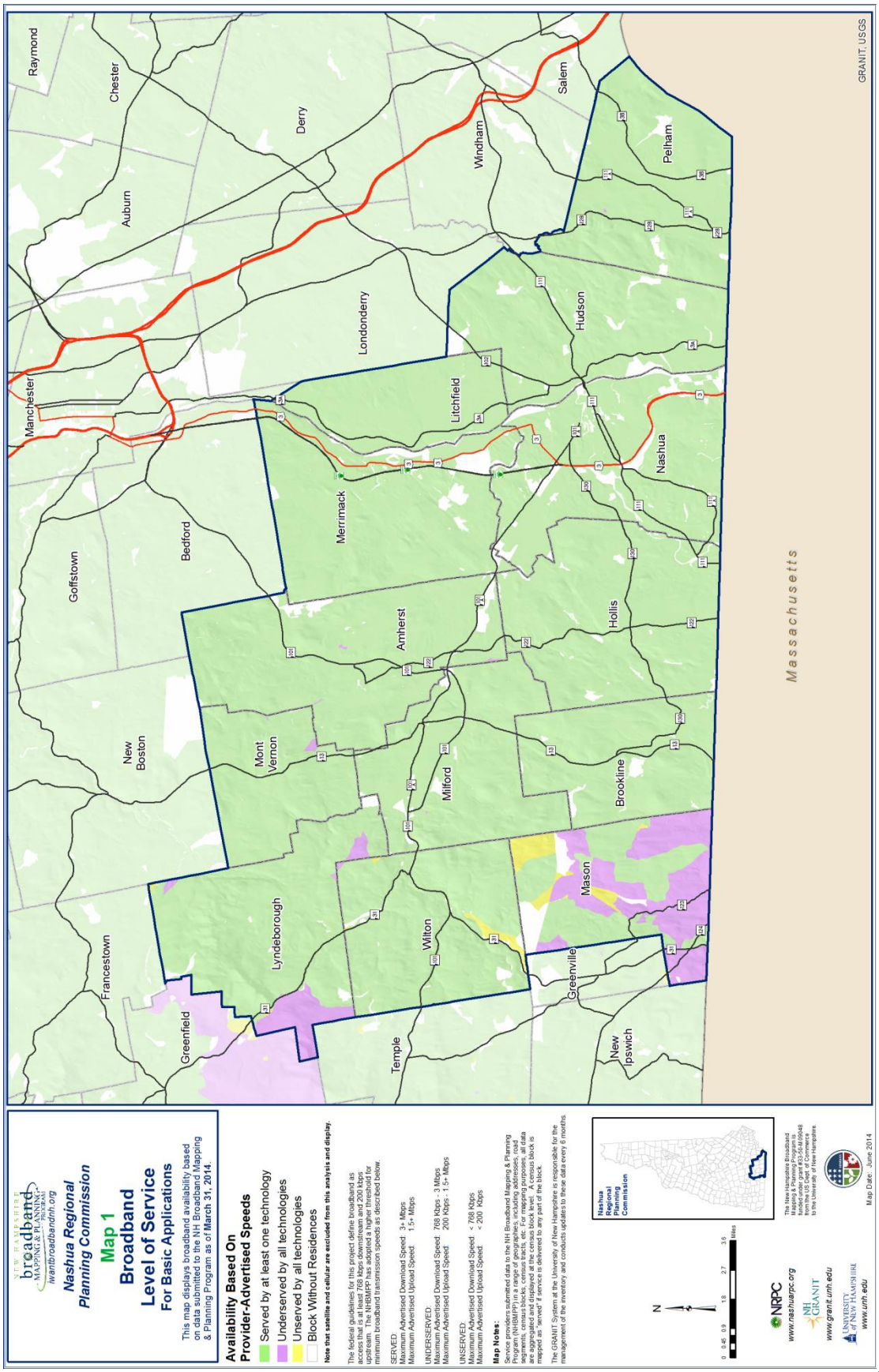
Map 7 quantifies the number of service providers for any one census block in the region. This map excludes satellite, but includes all other types of service including cable, DSL, terrestrial fixed wireless, cellular internet, T1, and fiber. Broadband providers are represented if they provide access at a minimum of 768 Kbps downstream and 200 Kbps upstream. For our region, there are no census blocks that are not part of at least one provider's service territory for some of the more rural areas in our region; however, in those areas the only service available is cellular internet. For any particular census block, the number of broadband service providers in the Nashua Region ranges from 1 to 12. Competition is strongest in the more densely populated areas of our region including greater Nashua, Hudson, Merrimack, and to a lesser degree in Litchfield and Milford. Broadband providers are included without consideration of the relative affordability of the service they offer. Competition for broadband service providers in our region is sometimes challenged by the cost that it takes to extend a network into a rural area. There are areas where residents do not have a choice in service provider and must pay that provider's price to obtain broadband access.

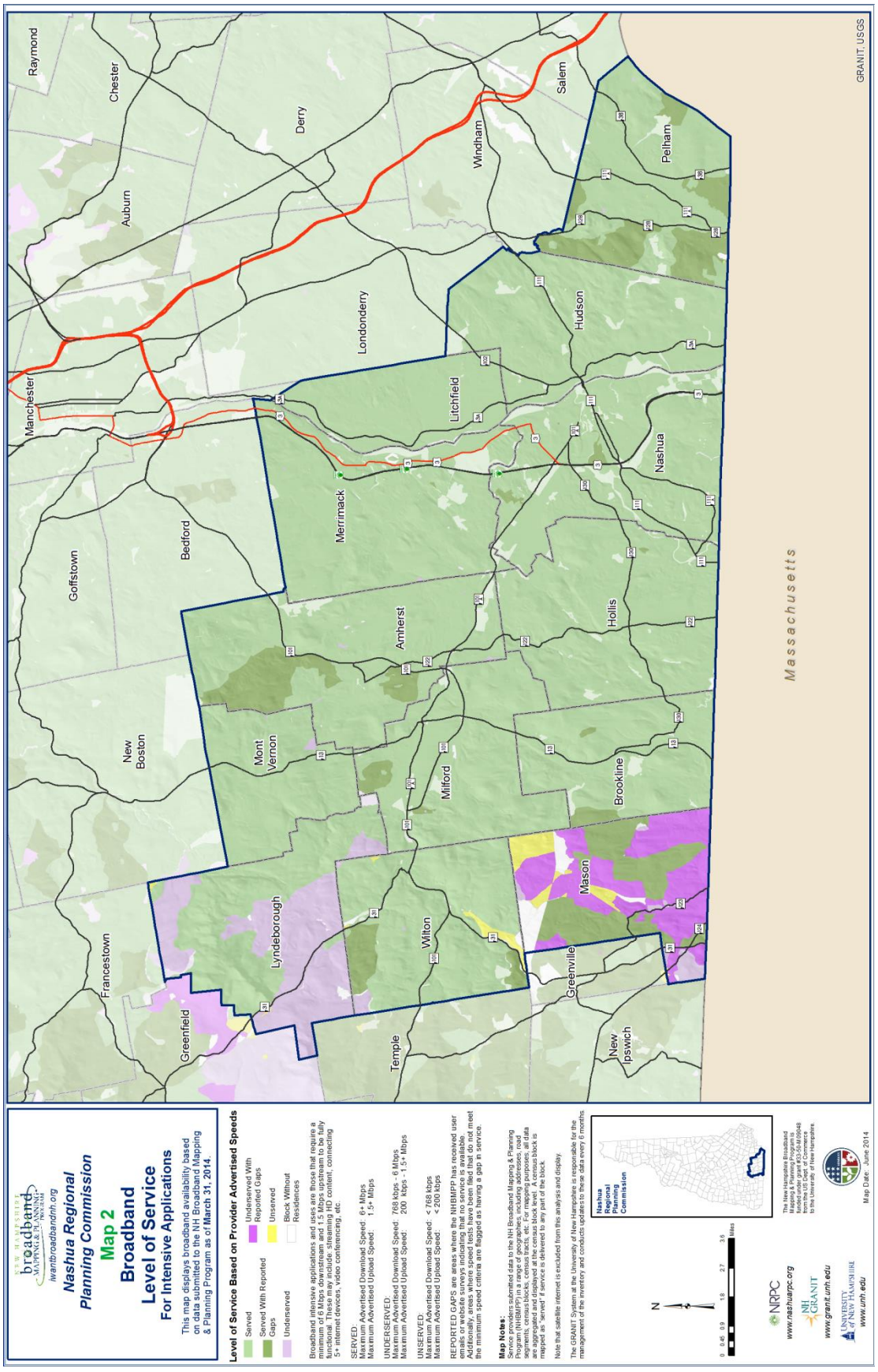
Map 8: Broadband Availability by Maximum Download Speed

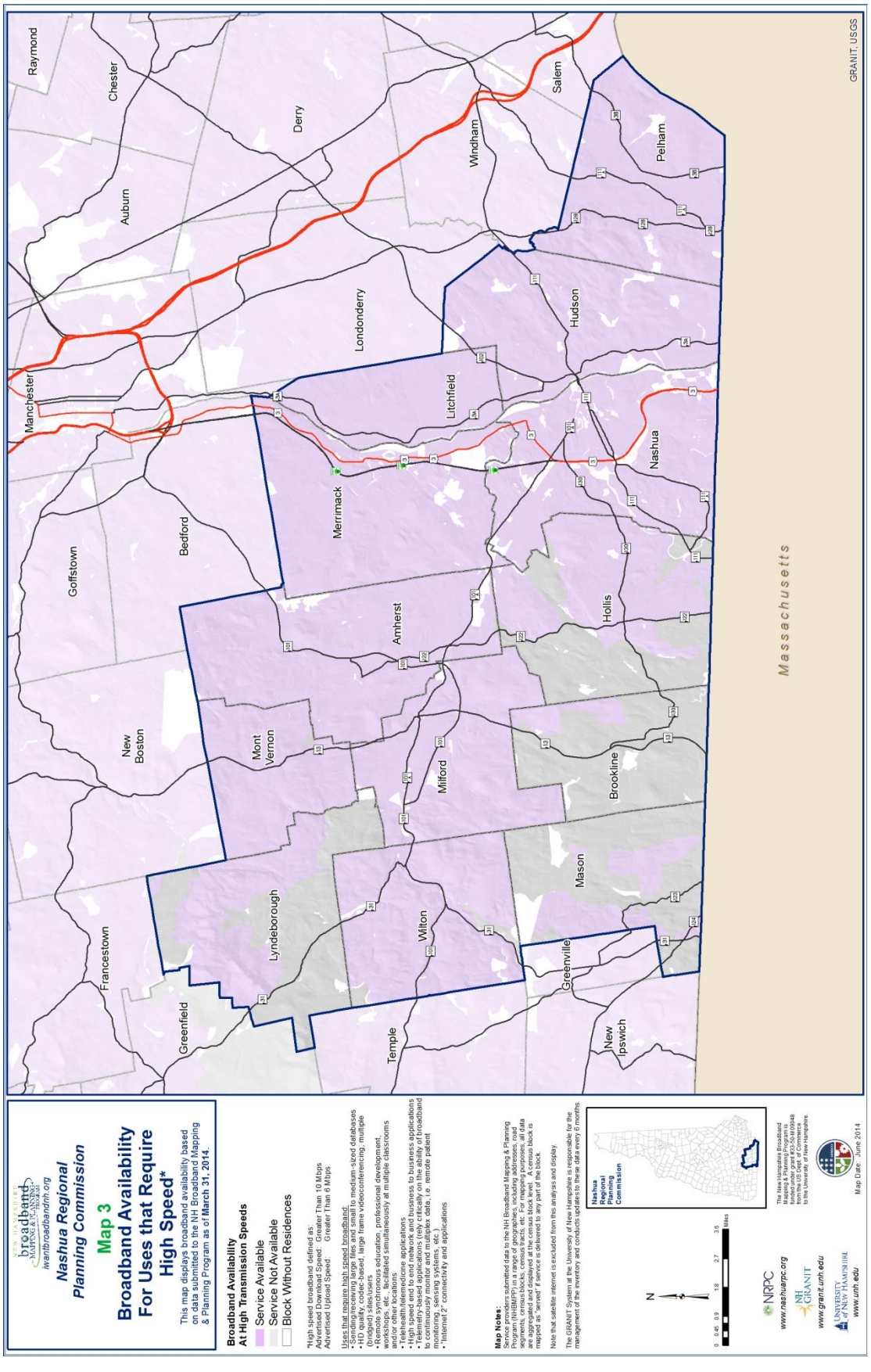
According to the data represented in Map 8, our region is well-served for the most part. All census blocks in our region have some type of service defined by download speeds of 6Mbps or greater including cellular service. The majority of the region's census blocks are served by maximum advertised download speeds greater than or equal to 100 Mbps and less than 1 Gbps.

Maps 9 and 10:
Wireline versus Wireless Service Availability and Satellite Broadband Service

Wireline, wireless, and satellite service are all traditional internet services such as cable and DSL. Satellite service is another form of wireless broadband but a user must have a dish, a special satellite internet modem, and conditions providing a clear line of sight to the provider satellite. This can sometimes be compromised in the event of extreme weather. Wireless service includes mobile (cellular) wireless and terrestrial fixed wireless whereby a stationary user can access a wireless broadcast from a fixed point transmitter. In rural areas where wired infrastructure is not yet available, fixed-wireless broadband has become a viable option for internet access. As shown by Maps 9 and 10 the entire region is served by wireless service, and satellite service can also be obtained in all census blocks. There are isolated pockets throughout the region where wireless is in fact the only service available.


NEW HAMPSHIRE broadband MAPPING & PLANNING PROGRAM
iwantbroadbandnh.org
Nashua Regional Planning Commission
Map 1
Broadband Level of Service
For Basic Applications
This map displays broadband availability based on data submitted to the NH Broadband Mapping & Planning Program as of March 31, 2014.
Availability Based On Provider-Advertised Speeds
Served by at least one technology
Underserved by all technologies
Unserved by all technologies
Block Without Residences
Note that satellite and cellular are excluded from this analysis and display.
The federal guidelines for this project define broadband as access that is at least 768 kbps downstream and 200 kbps upstream. The NHBMPP has adopted a higher threshold for minimum broadband transmission speeds as described below.
SERVED:
Maximum Advertised Download Speed: 3+ Mbps
Maximum Advertised Upload Speed: 1.5+ Mbps
UNDERSERVED:
Maximum Advertised Download Speed: 768 Kbps - 3 Mbps
Maximum Advertised Upload Speed: 200 Kbps - 1.5+ Mbps
UNSERVED:
Maximum Advertised Download Speed: < 768 Kbps
Maximum Advertised Upload Speed: < 200 Kbps
Map Notes:
Service providers submitted data to the NH Broadband Mapping & Planning Program (NHBMPP) at various geographic levels including wire segments, census blocks, census tracts, etc. For mapping purposes, all data are 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.
The GRANIT System at the University of New Hampshire is responsible for the management of the inventory and conducts updates to these data every 6 months.
Nashua Regional Planning Commission
N
0 0.45 0.9 1.8 2.7 3.6 Miles
NRPC
www.nashuarpc.org
NH GRANIT
www.granit.unh.edu
UNIVERSITY of NEW HAMPSHIRE
www.unh.edu
The New Hampshire Broadband Mapping & Planning Program is funded under grant #33-10-A19048 from the US Dept. of Commerce to the University of New Hampshire.
Map Date: June 2014
GRANIT, USGS
Massachusetts
Raymond
Chester
Auburn
Derry
Salem
Windham
Pelham
Londonderry
Hudson
Manchester
Litchfield
Merrimack
Nashua
Goffstown
Bedford
Amherst
Hollis
New Boston
Mont Vernon
Milford
Brookline
Lyndeborough
Wilton
Mason
Francestown
Greenville
Greenfield
Temple
New Ipswich


Nashua Regional Planning Commission
Map 2
Broadband Level of Service
For Intensive Applications
This map displays broadband availability based on data submitted to the NH Broadband Mapping & Planning Program as of March 31, 2014.
Level of Service Based on Provider Advertised Speeds
Served
Served With Reported Gaps
Underserved
Underserved With Reported Gaps
Unserved
Block Without Residences
Broadband intensive applications and uses are those that require a minimum of 6 Mbps downstream and 1.5 Mbps upstream to be fully functional. These may include: streaming HD content; connecting 5+ internet devices; video conferencing; etc.
SERVED:
Maximum Advertised Download Speed: 6+ Mbps
Maximum Advertised Upload Speed: 1.5+ Mbps
UNDERSERVED:
Maximum Advertised Download Speed: 768 Kbps - 6 Mbps
Maximum Advertised Upload Speed: 200 Kbps - 1.5+ Mbps
UNSERVED:
Maximum Advertised Download Speed: < 768 Kbps
Maximum Advertised Upload Speed: < 200 Kbps
REPORTED GAPS are areas where the NHBMPP has received user emails or website surveys indicating that no service is available. Additionally, areas where speed tests have been filed that do not meet the minimum speed criteria are flagged as having a gap in service.
Map Notes:
Service providers submitted data to the NH Broadband Mapping & Planning Program (NHBMPP) in a range of geographies, including addresses, road segments, census blocks, census tracts, etc. For mapping purposes, all data are represented at the census block level. Any census block is mapped as 'served' if service is delivered to any part of the block.
Note that satellite internet is excluded from this analysis and display.
The GRANIT System at the University of New Hampshire is responsible for the management of the inventory and conducts updates to these data every 6 months.
Nashua Regional Planning Commission
N
0 0.45 0.9 1.8 2.7 3.6 Miles
NRPC
www.nashuarpc.org
NH GRANIT
www.granit.unh.edu
UNIVERSITY of NEW HAMPSHIRE
www.unh.edu
The New Hampshire Broadband Mapping & Planning Program is funded through a grant awarded from the US Dept. of Commerce to the University of New Hampshire.
Map Date: June 2014
GRANIT, USGS
Massachusetts
Raymond
Chester
Auburn
Derry
Salem
Windham
Pelham
Manchester
Londonderry
Litchfield
Hudson
Merrimack
Nashua
Bedford
Goffstown
Amherst
Hollis
New Boston
Mont Vernon
Milford
Brookline
Lyndeborough
Wilton
Mason
Francestown
Greenville
Temple
New Ipswich
Greenfield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Map 3
Broadband Availability For Uses that Require High Speed*
This map displays broadband availability based on data submitted to the NH Broadband Mapping & Planning Program as of March 31, 2014.
Broadband Availability At High Transmission Speeds
Service Available
Service Not Available
Block Without Residences
*High speed broadband defined as:
Advertised Download Speed: Greater Than 10 Mbps
Advertised Upload Speed: Greater Than 6 Mbps
Uses that require high speed broadband:
• Sending/receiving large files and small to medium-sized databases
• HD quality, codec-based, large frame videoconferencing, multiple (bridged) sites/users
• Advanced online learning, education, professional development, workshops, etc., facilitated simultaneously at multiple classrooms and/or other locations
• Telehealth/telemedicine applications
• High speed transactional applications by business to business applications
• Internet-based applications (many critically on the ability of broadband to continuously monitor and multiplex data, i.e. remote patient monitoring, sensing systems, etc.)
• "Internet 2" connectivity and applications
Map Notes:
Service providers submitted data to the NH Broadband Mapping & Planning Program (NHBMPP) in a range of geographies, including addresses, road segments, census blocks, census tracts, etc. For mapping purposes, all data are processed and displayed at the census block level. A census block is mapped as 'served' if service is delivered to any part of the block.
Note that satellite internet is excluded from this analysis and display.
The GRANIT System at the University of New Hampshire is responsible for the management of the inventory and conducts updates to these data every 6 months.
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Map Date: June 2014
GRANIT, USGS
Massachusetts
Raymond
Chester
Auburn
Derry
Salem
Windham
Pelham
Manchester
Londonderry
Litchfield
Hudson
Merrimack
Nashua
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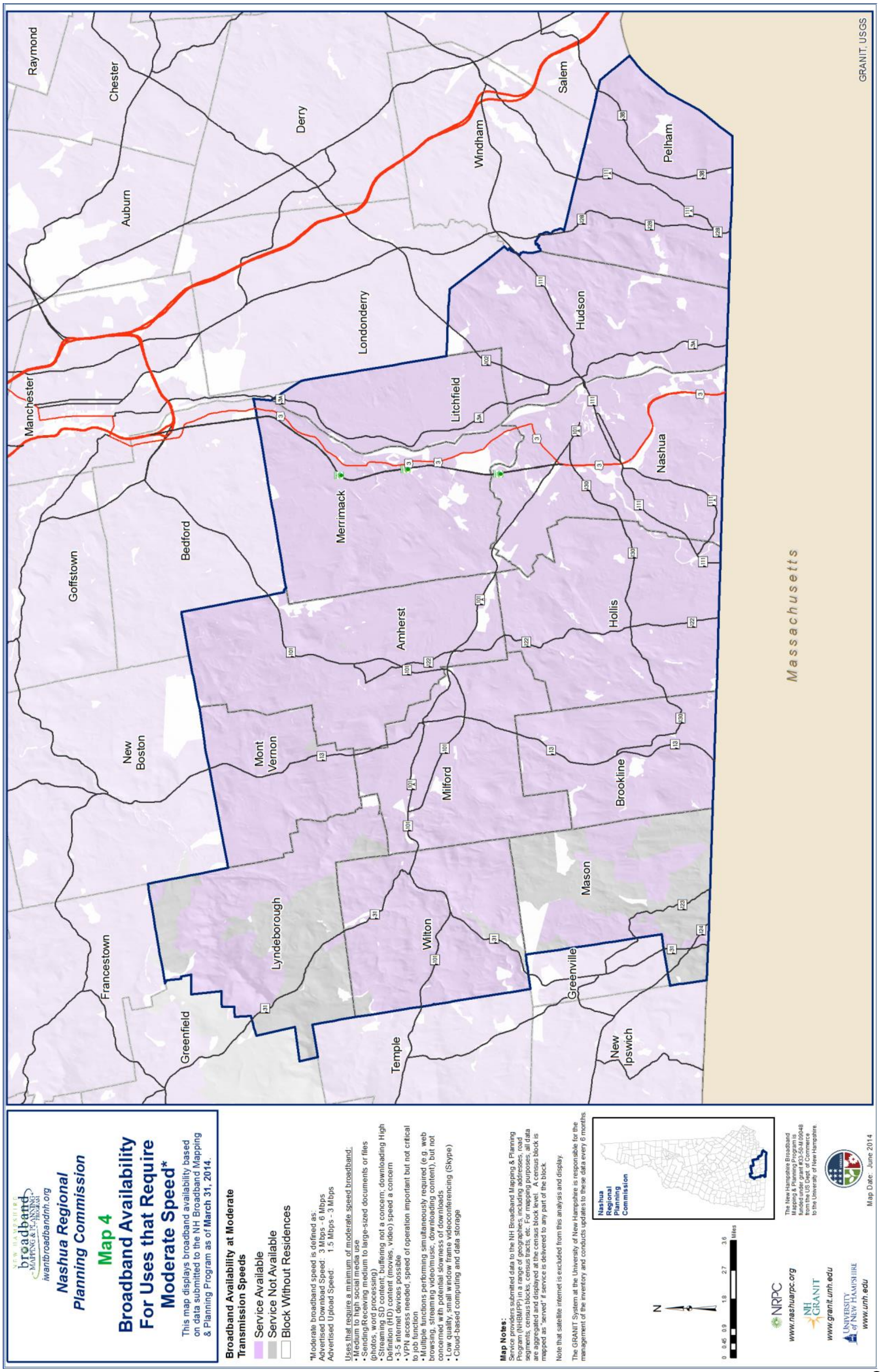
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Map 4
Broadband Availability For Uses that Require Moderate Speed*
This map displays broadband availability based on data submitted to the NH Broadband Mapping & Planning Program as of March 31, 2014.
Broadband Availability at Moderate Transmission Speeds
Service Available
Service Not Available
Block Without Residences
*Moderate broadband speed is defined as:
Advertised Download Speed: 3 Mbps - 6 Mbps
Advertised Upload Speed: 1.5 Mbps - 3 Mbps
Uses that require a minimum of moderate speed broadband:
• Medium to high social media use
• Sending/Receiving medium to large-sized documents or files (photos, word processing)
• Streaming SD content; buffering not a concern; downloading High Definition (HD) content (movies, video) speed a concern
• 3-5 internet devices possible
• VPN access needed, speed of operation 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)
• Cloud-based computing and data storage
Map Notes:
Service providers submitted data to the NH Broadband Mapping & Planning Program (NHBMPP) in a range of geographies, including addresses, road segments, census blocks, census tracts, etc. For mapping purposes, all data are 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.
Note that satellite internet is excluded from this analysis and display.
The GRANIT System at the University of New Hampshire is responsible for the management of the inventory and conducts updates to these data every 6 months.
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Manchester
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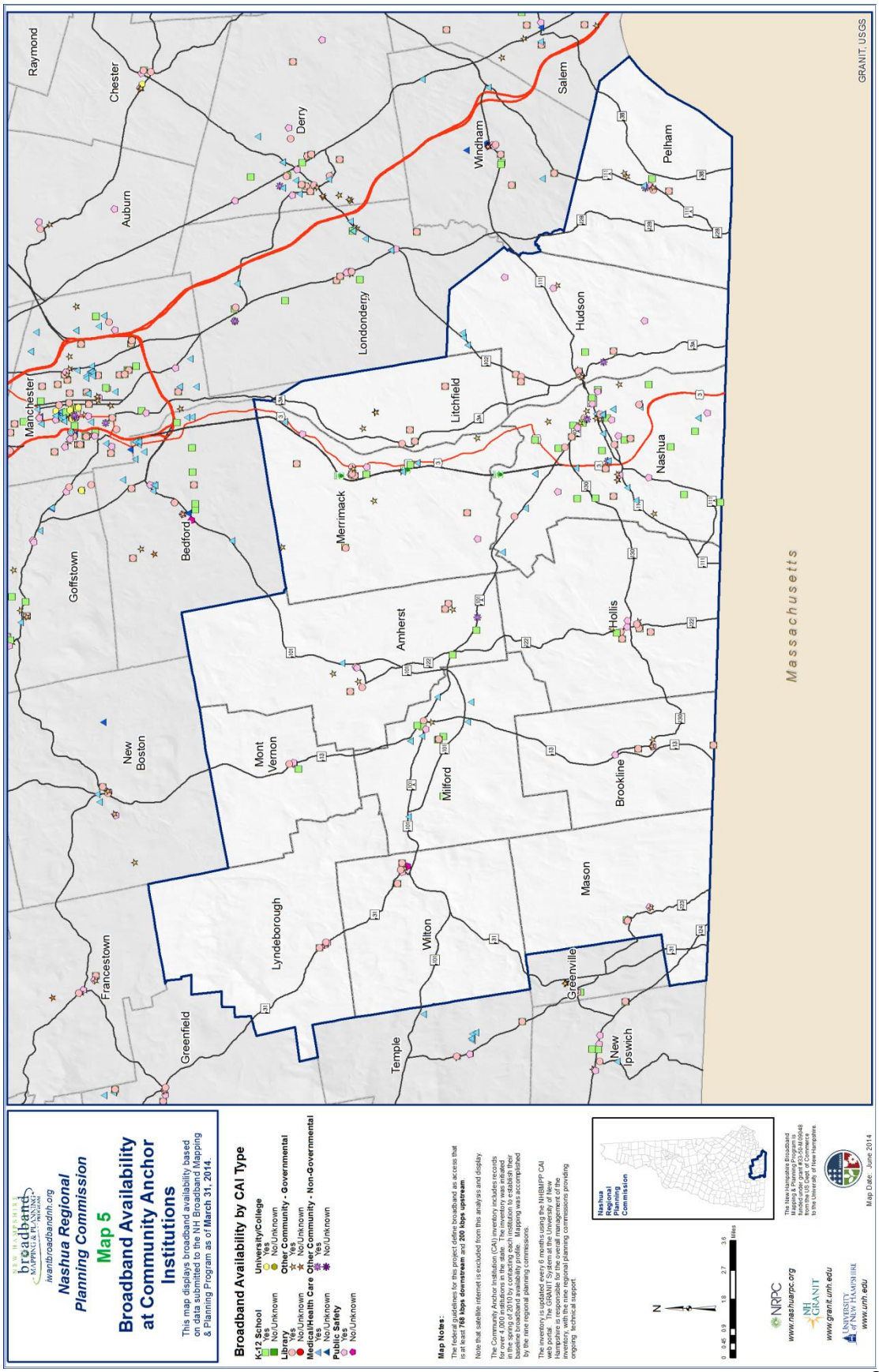
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Map 5
Broadband Availability at Community Anchor Institutions
This map displays broadband availability based on data submitted to the NH Broadband Mapping & Planning Program as of March 31, 2014.
Broadband Availability by CAI Type
K-12 School
Yes
No/Unknown
Library
Yes
No/Unknown
University/College
Yes
No/Unknown
Other Community - Governmental
Yes
No/Unknown
Medical/Health Care
Yes
No/Unknown
Other Community - Non-Governmental
Yes
No/Unknown
Public Safety
Yes
No/Unknown
Map Notes:
The federal guidelines for this project define broadband as access that is at least 768 kbps downstream and 200 kbps upstream.
Note that satellite internet is excluded from this analysis and display.
The Community Anchor Institution (CAI) inventory includes records for over 4,000 institutions in the state. The inventory was initiated in the spring of 2010 by contacting each institution to establish their broadband availability and speed. Mapping was accomplished by the nine regional planning commissions.
The inventory is updated every 6 months using the NHBMPP CAI verification survey. The Granit GIS Center at the University of New Hampshire is responsible for the overall management of the inventory, with the nine regional planning commissions providing ongoing technical support.
Nashua Regional Planning Commission
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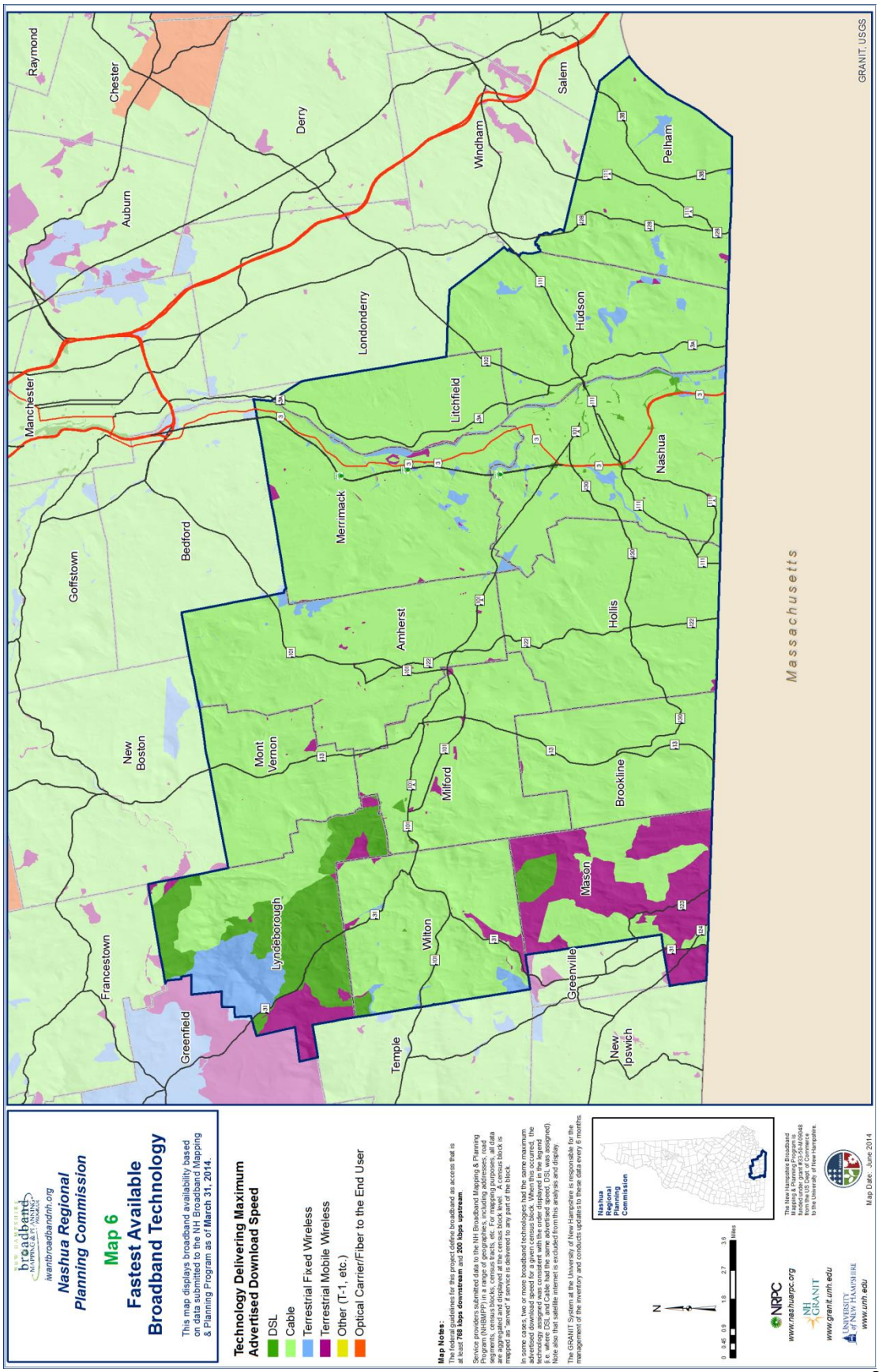
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Map 6
Fastest Available Broadband Technology
This map displays broadband availability based on data submitted to the NH Broadband Mapping & Planning Program as of March 31, 2014.
Technology Delivering Maximum Advertised Download Speed
DSL
Cable
Terrestrial Fixed Wireless
Terrestrial Mobile Wireless
Other (T-1, etc.)
Optical Carrier/Fiber to the End User
Map Notes:
The federal guidelines for the project define broadband as access that is at least 768 kbps downstream and 200 kbps upstream.
Service providers submitted data to the NH Broadband Mapping & Planning Program showing areas where they provide service, and at what speeds. Census blocks, census tracts, etc. For mapping purposes, all data are 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.
In some cases, two or more broadband technologies had the same maximum advertised download speed for a given census block. When this occurred, the technology providing the most reliable service at the advertised speed (i.e. where DSL and Cable had the same advertised speed, DSL was assigned). Note also that satellite internet is excluded from this analysis and display.
The GRANIT System at the University of New Hampshire is responsible for the management of the inventory and conducts updates to these data every 6 months.
Nashua Regional Planning Commission
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Map Date: June 2014
Raymond
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Merrimack
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New Boston
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Temple
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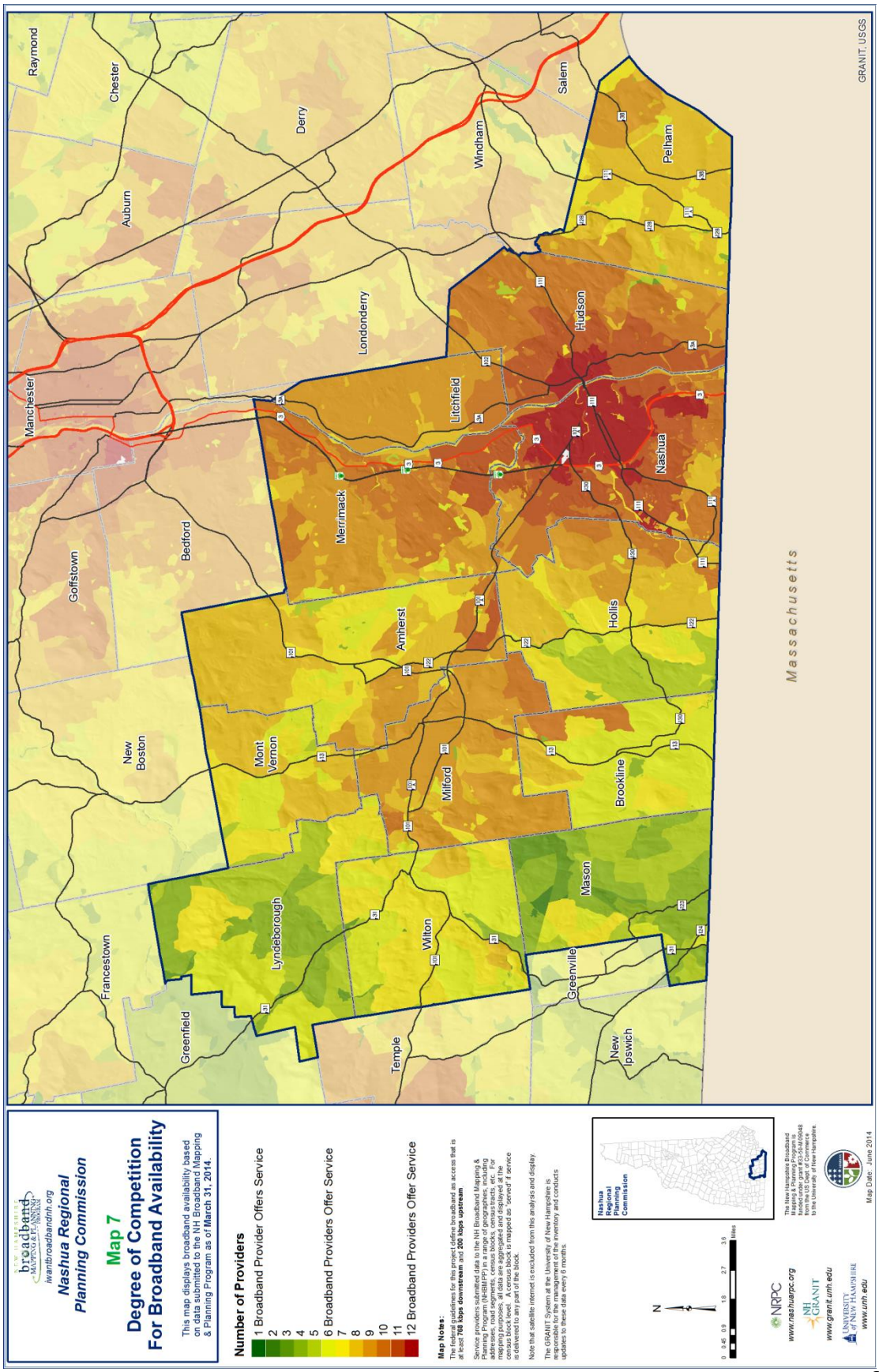
Greenfield
Massachusetts
GRANIT, USGS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New Ipswich
Massachusetts
GRANIT, USGS
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Map 7
Degree of Competition For Broadband Availability
This map displays broadband availability based on data submitted to the NH Broadband Mapping & Planning Program as of March 31, 2014.
Number of Providers
1 Broadband Provider Offers Service
2
3
4
5
6 Broadband Providers Offer Service
7
8
9
10
11
12 Broadband Providers Offer Service
Map Notes:
The federal guidelines for this project define broadband as access that is at least 768 kbps downstream and 200 kbps upstream.
Service providers submitted data to the NH Broadband Mapping & Planning Program showing where they have the ability to serve addresses, rural segments, census blocks, or geographic areas. For mapping purposes, all data are 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.
Note that satellite internet is excluded from this analysis and display.
The GRANIT System at the University of New Hampshire is responsible for the management of the inventory and conducts updates to these data every 6 months.
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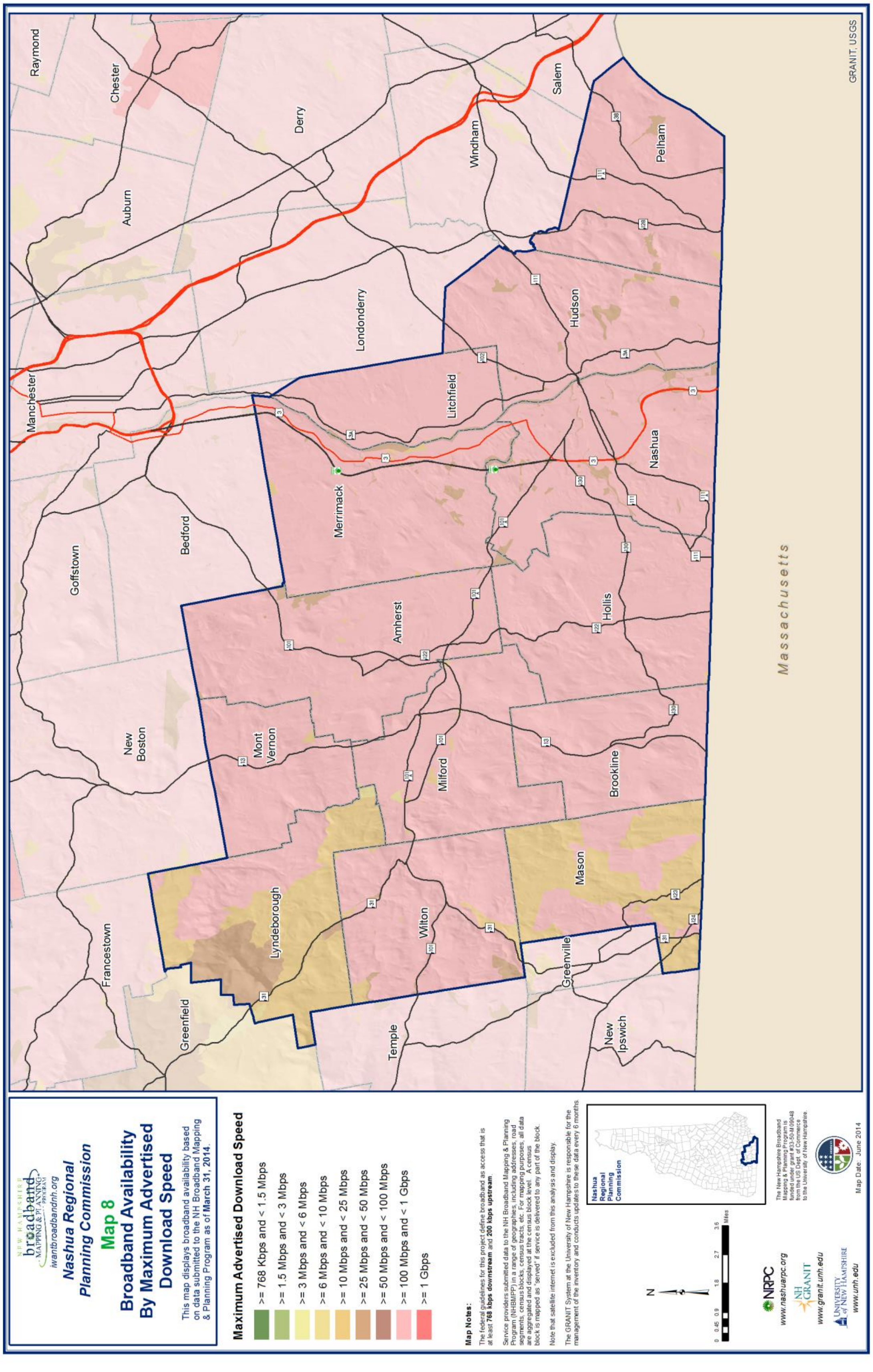
Map Date: June 2014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Map 8
Broadband Availability By Maximum Advertised Download Speed
This map displays broadband availability based on data submitted to the NH Broadband Mapping & Planning Program as of March 31, 2014.
Maximum Advertised Download Speed
>= 768 Kbps and < 1.5 Mbps
>= 1.5 Mbps and < 3 Mbps
>= 3 Mbps and < 6 Mbps
>= 6 Mbps and < 10 Mbps
>= 10 Mbps and < 25 Mbps
>= 25 Mbps and < 50 Mbps
>= 50 Mbps and < 100 Mbps
>= 100 Mbps and < 1 Gbps
>= 1 Gbps
Map Notes:
The federal guidelines for this project define broadband as access that is at least 768 kbps downstream and 200 kbps upstream.
Service providers submitted data to the NH Broadband Mapping & Planning Program (NHBMPP) in a range of geographies, including addresses, road segments, census blocks, census tracts, etc. For mapping purposes, all data are 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.
Note that satellite internet is excluded from this analysis and display.
The GRANIT System at the University of New Hampshire is responsible for the management of the inventory and conducts updates to these data every 6 months.
N
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Map Date: June 2014
Manchester
Raymond
Goffstown
Francestown
New Boston
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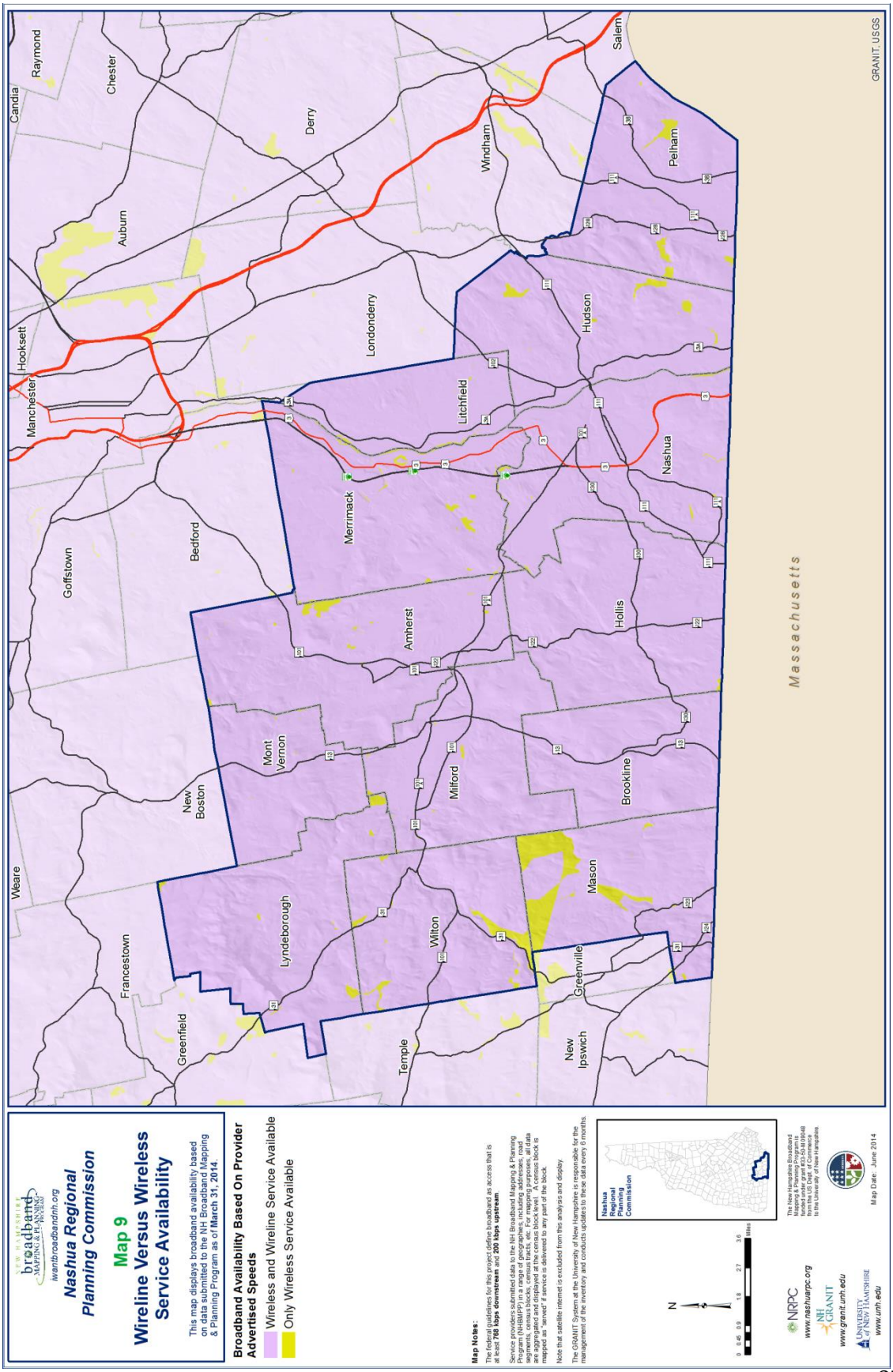
Nashua Regional Planning Commission
Map 9
Wireline Versus Wireless Service Availability
This map displays broadband availability based on data submitted to the NH Broadband Mapping & Planning Program as of March 31, 2014.
Broadband Availability Based On Provider Advertised Speeds
Wireless and Wireline Service Available
Only Wireless Service Available
Map Notes:
Map Date: June 2014
Massachusetts
Nashua
Hudson
Litchfield
Merrimack
Londonderry
Derry
Windham
Pelham
Salem
Hollis
Brookline
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Greenville
New Ipswich
Milford
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New Boston
Bedford
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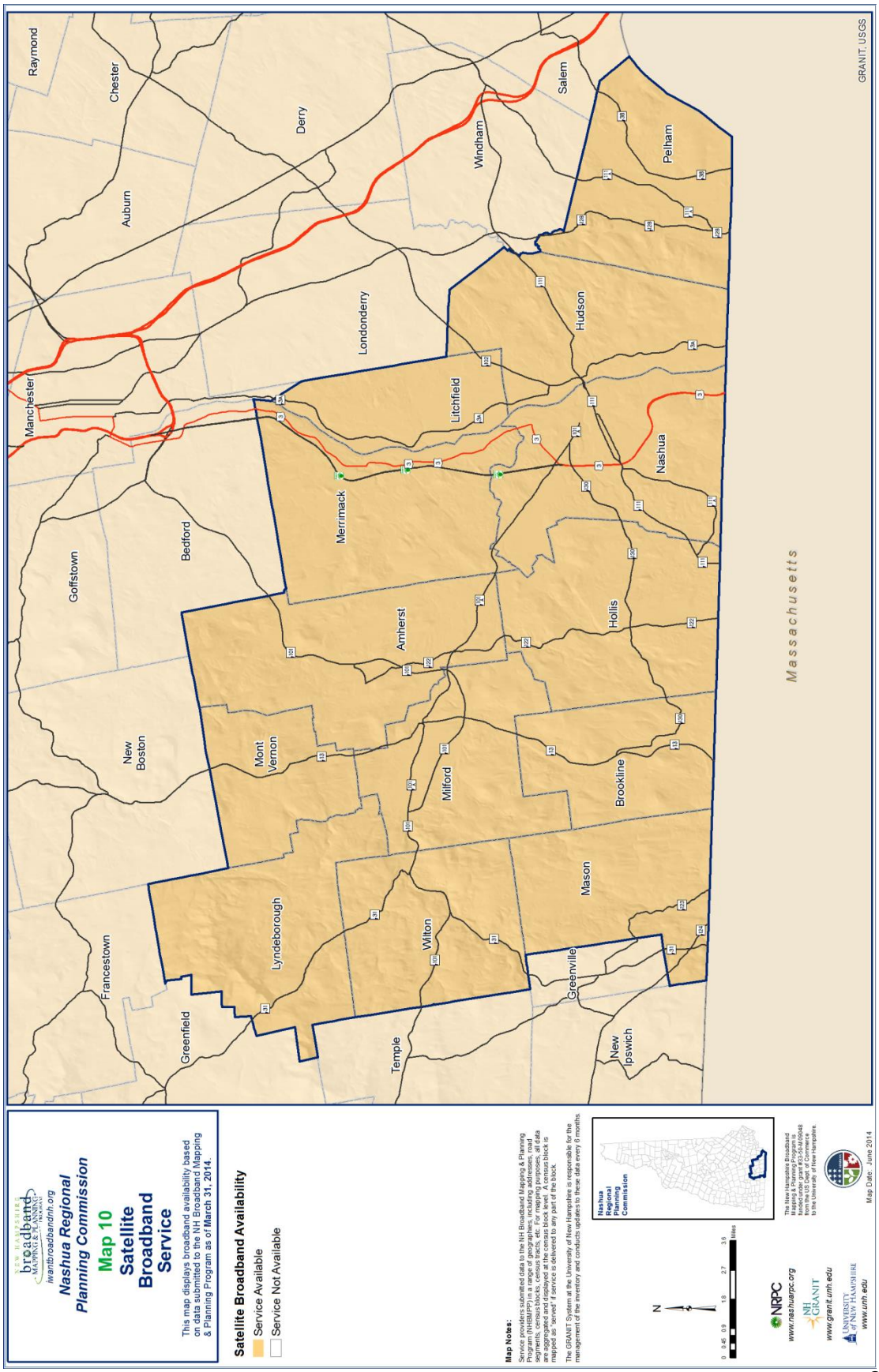
Raymond
Candia
Hooksett
Manchester
Weare
Lyndeborough
Wilton
Temple
Greenfield
Francestown
GRANIT_USGS


NEW HAMPSHIRE broadband MAPPING & PLANNING PROGRAM
livanbroadbandnh.org
Nashua Regional Planning Commission
Map 10
Satellite Broadband Service
This map displays broadband availability based on data submitted to the NH Broadband Mapping & Planning Program as of March 31, 2014.
Satellite Broadband Availability
Service Available
Service Not Available
Map Notes:
Service providers submitted data to the NH Broadband Mapping & Planning Program (NHBMPP) in a range of geographies, including addresses, road segments, census blocks and coverage areas. For reporting purposes, all data are 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.
The GRANIT System at the University of New Hampshire is responsible for the management of the inventory and conducts updates to these data every 6 months.
Nashua Regional Planning Commission
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Map Date: June 2014
GRANIT, USGS
Massachusetts
Raymond
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Derry
Auburn
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Amherst
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New Boston
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Greenville
Francestown
Temple
New Ipswich
Greenfield

Mapping Verification Results

In addition to the UNH Survey and the NHBMPP mapping project, the nine RPCs were also responsible for conducting a Mapping Verification Project. The data used for the above maps were collected at the census block level. If one house on a single street was listed as having service the entire block would be coded as having service. This caused concern with the BSGs as well as residents of the communities who were shown as having service when they did not, and was certainly a limiting factor in our research efforts. In an effort to improve data accuracy, the Mapping Verification Project was initiated. The process began with each community receiving a printed map to note discrepancies in service. Maps were given to community officials who were identified as having the most accurate knowledge of broadband service in the region.

This was a voluntary process and towns were not required to indicate changes to their maps. Eleven out of the thirteen communities participated in this project. Changes were only made in four towns. The central and eastern communities were largely unchanged, while some changes were needed in the western part of the region. In Mason, it was shown that DSL was available on five roads that were not previously reported to have service. It was also shown that cable was not available on all but three town roads. In the town of Hudson, cable service had to be added to all of Pasture Drive and all areas of Benson Park. Pelham's map reported DSL service to be removed from portions of 14 roads. The last town that needed amendments to their map was Amherst, where reported cable service was removed from segments of two roads. NRPC's GIS staff tracked all comments on the maps that were noted by each town that participated, and sent back both the updated maps and a tracking spreadsheet to the project team at UNH. All census blocks crossed by a changed road segment will be updated to reflect either confirmed service or a reported gap in service.

4. Demand for Broadband

i. Survey and Public Forum Results

NRPC conducted a series of presentations on broadband planning, throughout the region, between August 2012 and January 2013. These presentations gave an overview of broadband technology, the economic impact of broadband, and the NHBMPP. Maps were also distributed at these meetings that showed the broadband coverage in the community and highest advertised download speed. NRPC staff solicited feedback on broadband coverage and encouraged people to take the speed test and survey done by the UNHCE.

A major concern expressed at these meetings was the issue of who will pay for new technology and improved coverage. Along with this concern was discussion of non-compete agreements between different carriers which limits consumer choice. Another concern voiced was the accuracy and precision of the data presented.

ii. Sector-based Data and Analysis

The purpose of the sector analysis is to better understand the existing and future broadband needs, uses, and applications specific to each of the following six sectors; health, economic development, education, public safety, residential and government. This data was used to identify existing and potential barriers to meeting these needs, and to discuss planned and proposed strategies for overcoming these barriers.

The NRPC conducted the sector analysis by using the Survey Monkey on-line survey tool and also by conferring with stakeholders in the sectors with a specific set of questions. Regional stakeholders and organizations were identified by CAIs and through recommendations from the BSG. The survey was conducted from October 2012 to February 2013.

Ten out of the thirteen communities in the region were represented in at least one sector. The types of businesses and organizations represented included retail, technology services, grade schools, colleges, hospitals, health clinics, physician practices, libraries, local government offices, police, and ambulance services. The number of employees per organization ranged widely with most employing between 20-49 people. All the economic development respondents had a small staff of 1 to 4 people while a couple of organizations in both the education and health sector had employees numbering over 500. While a few organizations had either a part or full-time person employed for managing IT, most organizations used a consulting service. DSL or cable were the most popular service, followed by wireless and fiber optic. Upload and download speeds also varied widely across all sectors. The economic development sector had some of the slowest speeds which are most likely due to their location.

The general consensus across the sectors on whether their broadband connectivity suits their current needs was that it was sufficient but there is room for improvement. However, when asked if their connectivity would suit their future needs, most indicated that it would not. The biggest barriers indicated were cost and lack of choice.

The most frequently noted broadband needs were for web-based email, web browsing, working multiple functions simultaneously (e.g. web browsing, streaming video/music, downloading content), operating multiple devices simultaneously, social media use and streaming content. Overall needs regarding broadband in our region included having the ability to conduct research wherever you go. This would eliminate the need for travelling to a location with free Wi-Fi for people who cannot afford to have it in their homes. A second overarching need, stretching across all sectors, is data management. The third identified overall need is professional development and training which would lead the way to an innovative marketplace and help ensure future employees are educated in the newest technologies. Having this level of education available to all students and professionals will increase the competitive market and help create a drive for new innovation. In addition, each sector indicated which functions for using the internet and/or computer software are the most important to their sector.

The top technology related challenges faced by all the sectors were lack of resources to get the best technology, keeping up with technology, rapidly changing technology and inadequate internet speed. When asked what it would take for their organization to address these challenges, budget was the most common response followed by more resources and training for staff. When asked about how they would characterize the state of broadband deployment in this region most felt that it is growing but still lacking in many areas. They also indicated that service was unreliable and there was no obvious pattern about which areas were covered. The comments were consistent across all sectors.

Health

The health sector will be one of the most important beneficiaries of broadband service. High speed internet will create a portal for sharing of important medical records in a timely fashion that was conceptual just a few years ago. The electronic sharing of medical information is referred to as telehealth and telemedicine. These terms describe a method of communication that will connect doctors and patients not only around the country but internationally in the future. This will enable medical records to be shared much more efficiently and doctors may be able to videoconference with their patients using broadband access. Patients would be able to have access to more options when choosing a doctor that meets their specialized needs. Video conferencing is a task that the health sector could utilize if increased broadband access were

available. Engaging in multiple tasks at once, using electronic data transfer to share medical documents via the web, and video conferencing could modernize visits to the doctor's office. Social media and webpage design would be two other things the health sector indicated it would improve if connectivity barriers are overcome.

Challenges noted include issues with access, connectivity, and budgets. Network connectivity is a foundation for many services health care wants to deliver and use in the near future. Currently, the health care sector is using Carrier Ethernet Services to interconnect remote locations within the organization and over the internet to other health care partners. Without a stable interconnected network hospitals do not have a fast enough way to connect with local emergency responders.

Economic Development

Cloud computing is a way to keep files connected on multiple devices. The cloud enables a user to work on a document on a laptop and then edit that same document on a tablet simply by saving it in the cloud. Cloud computing will allow business owners to run their business no matter where they are. They could create a presentation on a train going across the country and have it available on their computer once they reach their destination.

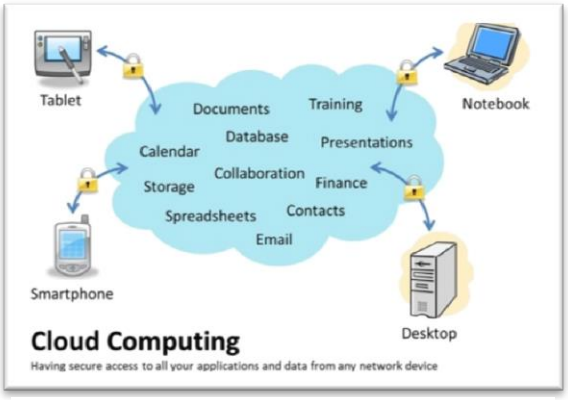


Photo Source: TechyGadget.com

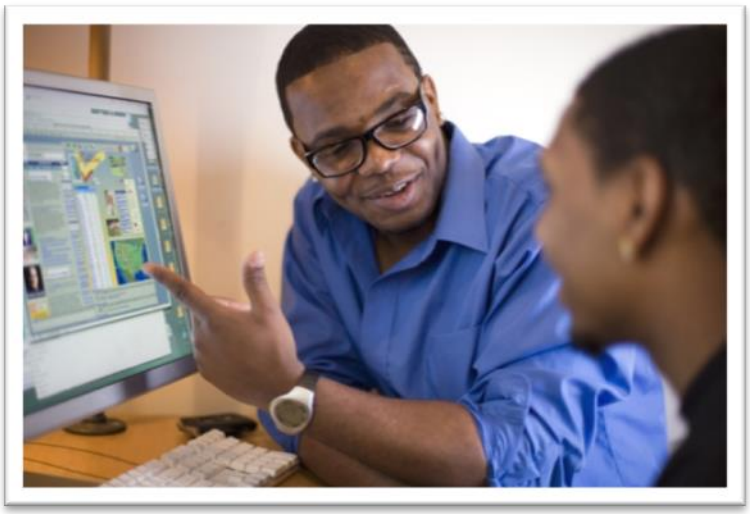
This will open doors for productivity that will give the market a new competitive edge. Selling your product online is another benefit of broadband for businesses. Having your product available both in store and online will double your inventory without the added office space. Selling products via the internet makes for a limitless customer base, and is an attractive and convenient way for them to shop from home. With this comes the ability to track shipments and let customers know exactly where their package is, and when it will be delivered to their door, creating a convenience that is unmet by more conventional shopping methods. With broadband access comes teleworking; a new and innovative way to work from home. Having the ability to work from home will allow new mothers to stay longer with their infants, and also save money on daycare options. Teleworking can also connect people on opposite sides of the country, essentially giving them the best of both worlds. A resident in one state could have a job in a completely different part of the country, and be in constant contact with his or her employers.

When asked what they would use increased broadband services for, the economic development sector showed interest in online ordering. Being able to sell more products faster, and giving customers the ability to track their order as it is shipped to them is a convenient way to boost their revenue. Having this kind of tracking ability also made them feel more comfortable when dealing with suppliers. Another attractive feature of having

increased broadband access would be for businesses to create websites and social media sites. This is essentially free advertisement, and connects businesses to millions of people nationwide. Interest was also expressed in instant file transfers and services. Businesses would be able to have presentations via video conferencing from anywhere in the country. Immediately after or before video conferences files could be transferred and signed, and deals could be made in hours instead of days.

Education

Every library, in every school, cannot have every book, or can they? With broadband this dream could become a reality. Students could potentially have access to any book they want to read and teachers can share books and other resources with each other via the web. Teachers can also share lesson plans and ideas instantly creating an online community that will connect educators across the nation, and the world. Students could video-chat with pen pals in China, and actually see them. Parent-teacher communication would be instantaneous as well, making it more manageable to deal with each individual child and ensure each student's specific needs are met. Classroom curricula would be accessible online so a student that is out for an extended period of time would be able to continue their schoolwork while absent. Student progress can be monitored so that parents, teachers, and students are always able to find out where improvements are needed, or where hard work is paying off. Online courses and learning tools allow students of all ages and learning types to take classes online where and when it is most convenient for them. Self-conducted learning is a new development made available with broadband access. Conducting research will be easier than ever, and researchers will be able to find and share new developments in any field. Research and file storage and management will be convenient and organized, and data input will be faster than ever.



Online training and interactive learning for students is one benefit of broadband access in schools. Teachers would be able to attend online workshops and access a variety of lesson plans and other resources. Offering students the chance to gain a greater skill set is a benefit that will allow students graduating from high school to increase their technological skills. Having broadband access will also provide students with fast and reliable ways to conduct research. With access to broadband available in all schools, students will have the ability to create online digital portfolios that can be home to all of their work throughout their years in school. They could then select the work that they would like to submit to colleges, potential

employers, or community stakeholders. It also allows them to always have access to past work that they may need to reference in the future or track their progress.

To eliminate some of these challenges the education sector has been working with E-Rate for technology upgrades. Steps have been taken to make a shift from the Comcast cable async network to the Fairpoint 20 mb EDIA sync network. Some remaining challenges include the rising price and upload to the cloud, and the need for more bandwidth and wireless access points.

Public Safety

High speed file download will enable first responders to access patients' medical history on a tablet in the ambulance. This will open doors for emergency medicine and create a way for EMTs to consult each individual's medical records before treating them in a life threatening situation. Remote access to databases such as building department databases, criminal history, medical records, and more will also benefit police and fire when entering situations that threaten their own lives. A person's criminal history would be available for a police officer in the safety of their car before approaching any dangerous suspects. Fire fighters will know if a building's infrastructure is going to threaten their rescuers or the people trapped inside before entering the building. Digital mapping and location services would fill the gaps in helping to locate missing persons before it is too late. Remote surveillance and monitoring will allow officers and security guards to review camera footage instantly to assist in crime solving processes. Workforce collaboration will be an attainable goal with the help of broadband, and connect all sectors of our emergency response network.

Being able to train officers remotely would be highly beneficial to the public safety sector. If access to broadband was readily available to them, officers and other public safety officials said that they would utilize a remote training system. On-scene field telemetry to hospitals would allow first responders to alert the emergency room of in-coming patients. This would also be beneficial in the event of a mass emergency so that the hospital can be as prepared as possible when the patients arrive. Some challenges for public safety officials begin with the need for higher-speed bandwidth that is affordable.

Local Government

Streamlining administrative functions would enable the government to provide some self service options to dealing with simple government services. This combined with electronic data exchange would expand the online governmental access to communicating with your state, local, and federal governments all at once. Social media allows for discussions and collaboration to happen over the internet sparking new ideas and initiatives. Interactive technology paired with each city or town's website would allow citizens to participate without even leaving home. Having this channel will create an open line of communication between citizens and their local decision makers, enabling them to have a voice in their community.

Video training for staff and increased resident access are two key benefits of broadband service to communities. Streaming video using Voice over Internet Protocol (VoIP) would mean that any device; phone, tablet, or computer, would be able to call another device over the internet without a provider as long as it is based on a Session Initiation Protocol (SIP) program. Broadband access would allow for faster transfer of data across a private government cloud. Comcast has recently increased speeds and for a small monthly fee and is able to offer speed and Static IPs.

F. Challenges to Regional Broadband Implementation and Improvement

Barriers to implementing broadband infrastructure in the Greater Nashua Region can be categorized into the following four groups: administrative, service, financial, and data and mapping. Administrative issues include the unique relationship between Incumbent Local Exchange Carriers and Competitive Local Exchange Carriers and co-location issues. Service does not always exist in the area advertised as being "served" by the service provider. High latency in certain areas is causing a high time delay experienced by a system. Funding to expand service is limited to preventing improved service to more rural areas. Finally, there is a distinct lack of information on existing service areas and types. Overall the region was identified as well served based on results from the UNH Survey Center. The participants claiming they do not have good service indicated that they either do not want to pay, cannot afford to pay, or have no interest in better broadband service. In order to improve broadband service in the region, each of these four barriers will need to be addressed.

1. Administrative Barriers

Barriers faced at the administration level include geographic franchising boundaries, as well as obtaining permission to co-locate wires on existing poles. Incumbent Local Exchange Carriers (ILEC's) are required to permit access to existing lines. The competition between ILEC's and Competitive Local Exchange Carriers (CLEC's) in this region is certainly a barrier. Bigger companies have shown no interest in competing with smaller companies to service more rural parts of the region. According to the Telecommunications Act of 1996 ILEC's must only share their equipment with CLEC's if there is absolutely no viable way to compete. Because of this and the transfer that many ILEC's are making from copper to fiber cables CLEC's are in danger of becoming obsolete. If our local exchange carriers make a full transition, they are no longer obligated to share equipment; the 1996 Act only requires them to do so for copper lines.

2. Service Barriers

Some towns in our region are currently underserved by their service provider, which is an ongoing conflict between residents who want service but cannot afford the initial cost of infrastructure redevelopment, and carriers who might be reluctant to invest the money to extend lines to the more rural areas of the state. Some residents have also noted that they do not wish to see lines brought to their communities and have no need for broadband. According to our surveyed individuals, service providers need to focus on latency instead of bandwidth. Satellite service is available across the entire region, but has a high latency which makes it an undesirable service compared to some of the ILEC's such as Comcast and Fairpoint which run on cables attached to poles. More accurate data is needed to assess the current state of served, underserved, and unserved areas, as well as which areas are

interested in better service and those who do not feel they need any change from their current providers, if they have any at all.

By improving quality of existing data, faster speeds and more reliable technology will result. Improving the existing infrastructure will be a helpful way to bridge the gap from DSL and copper lines to newer technology running through fiber. By connecting all infrastructure in the region and state more communities will be able to at least have the option of service without paying higher amounts to get lines laid down to their individual residencies. With more lines and different services available, companies would be able to expand their service areas and residents would have more options for service providers. This could facilitate a competitive marketplace that would in turn spark competitive pricing. Of the people surveyed in our region, most who had an issue with service said that there was not enough choice in providers. The more people are involved in the improvement of broadband availability, the lower the cost of extending networks will be.

3. Financial Barriers

Funding sources to extend broadband service to more rural parts of the region are currently very limited. The cost is often too high for towns or individual residences to pay the initial cost of service extension to a particular street or area of a town. Conversely, the same situation exists for providers who cannot justify the cost of extending service to a limited number of residences or small businesses, as it would take years to see a return on their investment. This financial burden also affects well served areas as they face the need for constant service upgrades to meet the ever increasing demand for bandwidth as more and more services move to the internet.

If future funding sources are identified local committees, individual communities or the region would have the opportunity to implement one or more of the recommended action items identified in this plan.

4. Data and Mapping Barriers

The telecommunications utility industry is regulated at the federal level, and currently there is no federal regulatory mandate that broadband service providers share their proprietary data with outside planning organizations or local governments. One of the most significant challenges in developing this plan was obtaining current broadband service data to easily determine which locations in the region have access to specific broadband service types. As a region we need the capability to accurately map, at the household or street level, existing broadband service in the region by provider and service type such as cable, DSL, fiber and satellite. These data would assist the region in developing a comprehensive plan for service expansion to underserved areas and facilitate economic development by providing vital information for prospective businesses considering relocating to the region.

The NRPC will work to promote wireless service and continue to form better relationships with service providers in the region, attempting to bridge the gap between consumer and provider. In creating these relationships we will focus on getting providers to publish

mapping information showing service areas so that we may paint an accurate picture of our region's needs and goals. This will also help to provide a framework and action plan for improvement. The BSG has identified the need to obtain more accurate service area data as their number one priority.

Opportunities

Opportunities exist in the relationship between stakeholders, providers, planners, and other public and private partnerships. In order to successfully extend broadband service, all of the above need to create good working relationships with each other as well as their community members. Customers need to encourage companies to provide faster technology and voice their concerns directly to their service provider to create awareness of their need for faster and more efficient service.

Customers should also be vocal about extending service and expanding to new areas. By becoming more active in this process consumers will promote the idea that broadband service is a basic utility. Technologies are only going to advance further and it is important to stay up to date to ensure all members of the community have equal access to education, jobs, and all other technological resources.

G. Findings and Recommendations

1. Evaluation and Prioritization of Needs, Challenges and Opportunities

Economic

High initial costs to enter new markets make return on investment (ROI's) difficult to ensure without certain customer density and/or loyalty. Rural locations are most typically affected and are recommended as a high priority in the region. High operational costs associated with utility pole and conduit rental fees from incumbent power and telephone providers is an issue that prevents smaller companies from renting lines. If this service was more affordable there would be more private companies attaching to these poles creating increased competition. ILEC's are focused on maximizing use of older infrastructure, e.g. copper and coax wires, and need to focus more on future technologies like fiber to help create a more cohesive network and ensure adequate service measures. Lack of coordinated statewide effort for grant opportunities and funding is a challenge that can be met with a more vocalized population advocating for better broadband service.

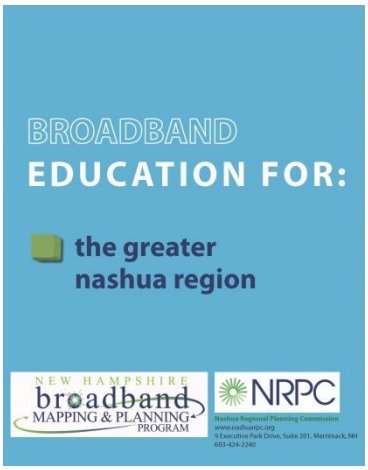
Administrative and Regulatory

On the regulatory front, there is a need to encourage the development and incorporation of telecommunications chapters in Master Plan updates. As technology becomes a staple in our way of life Master Plans should reflect it as such. Planning a broadband infrastructure system deserves attention just as planning for future land use and transportation do. Connecting common ideas and goals for future advancement of broadband at the local, regional, and state level will help keep communities synced. Antiquated zoning ordinances and land use regulations could be hindering broadband expansion by restricting companies from laying down new lines. Many regulatory barriers exist at the state level, and improvements will require cooperation from state departments, planning commissions, service providers and community members.

Service

Lack of cooperation among service providers to collaborate on developing service maps is a challenge currently faced by planners. The need for service providers to disclose the location of backbone, long-haul, and final-mile fiber assets, especially in the Nashua Region is

imperative to achieving this project's goals. Limited service offerings (e.g. dark or lit fiber) in urban areas could hinder business development. This is particularly an issue in Nashua where quality of service is significantly better just over the state border into Massachusetts.



Education

Lack of a coordinated effort on educating the general public on the benefits of broadband services is indeed a challenge, but it is also an excellent opportunity. The development of this Broadband Plan will help inform the statewide project as well as provide residents with information on the benefits of advanced technology. Lack of educational materials for Planning Boards and Boards of Selectmen on broadband options has been a limiting factor in promoting the broadband plan. The more education and outreach we can conduct, the better our chances are for guiding the region into a technologic future that best suits everyone's needs.

2. Goals, Objectives, and Strategies

i. Goal 1:

Focus on providing wireless service to our rural communities in the western part of the region.

OBJECTIVE 1:

Expand the broadband network to the areas in our region considered underserved and unserved.

- ☐ **Strategy 1:** Apply for grant opportunities to fund this initiative.
- ☐ **Strategy 2:** Collaborate with providers to make fair deals with homeowners to pay a portion of the start-up cost to extend service to places that are unserved.
- ☐ **Strategy 3:** Coordinate with providers to develop a service map and aim for disclosure of service line locations.

OBJECTIVE 2:

Amend municipal regulations and policies to support changing technologies.

- ☐ **Strategy 1:** Update local zoning ordinances and land use regulations to address current telecommunications information.
- ☐ **Strategy 2:** Encourage the development and incorporation of telecommunications chapters in Town Master Plan updates.
- ☐ **Strategy 3:** Continue to identify regulatory barriers to address.

OBJECTIVE 3:

Continue to monitor and update broadband maps of service and availability.

- ☐ **Strategy 1**: Work with DRED and the UNH Cooperative Extension to create an office for broadband.
- ☐ **Strategy 2:** Coordinate with providers to develop a service map and aim for disclosure of service line locations.
- ☐ **Strategy 3:** Pursue wireless projects to rural areas. Understand the NHBMPP coverage maps and work with municipalities and providers to encourage expansion, and support wireless projects that expand public safety.

OBJECTIVE 4:

Educate residents, businesses, and community stakeholders on how broadband is useful to them.

- ☐ **Strategy 1:** Assist municipalities in developing and maintaining broadband master plans.
- ☐ **Strategy 2:** Supporting business development by providing detailed broadband availability information to the regions business centers.
- ☐ **Strategy 3:** Pursue broadband funding sources including federal, state, local, and public/private partnerships.
- ☐ **Strategy 4:** Work with the NH Municipal Association to promote or sponsor education, training, and other opportunities around broadband capacity building for municipalities.

OBJECTIVE 5:

Provide information to offer affordable internet services and access to computers for underrepresented populations such as veterans, home-based business owners, and others with limited or no service.

- ☐ **Strategy 1:** Mirror a program like the Comcast Internet Essentials Program, which can be found at http://www.internetessentials.com/, which offers reduced rates and purchase prices of computers for families that qualify for free and reduced lunches.
- ☐ **Strategy 2:** Expand use of and access to existing programs offered by service providers to increase access to computers to youth and underrepresented populations.

ii. Goal 2:

Continue to promote economic development by continuing to enhance the technologies that are available in areas currently served.

OBJECTIVE 1:

Provide wireless coverage with low latency and better service.

- ☐ **Strategy 1:** Update local zoning ordinances and land use regulations to address current telecommunications information.

- ☐ **Strategy 2:** Improve existing service in the urban areas to encourage and promote business development.
- ☐ **Strategy 3:** Encourage the development and incorporation of telecommunications chapters in town master plan updates.

OBJECTIVE 2:

Work with local economic development committees and chambers of commerce to promote the importance of broadband technology.

- ☐ **Strategy 1:** Attend local chamber meetings.
- ☐ **Strategy 2:** Attend local economic development meetings.
- ☐ **Strategy 3:** Coordinate regional training opportunities.
- ☐ **Strategy 4:** Develop and distribute educational materials for broadband technology.
- ☐ **Strategy 5:** Expand existing and develop new free, public Wi-Fi networks.
- ☐ **Strategy 6:** Facilitate conversations with industry experts, local communities, and sector stakeholders around the development of public Wi-Fi networks.
- ☐ **Strategy 7:** Explore potential market and economic barriers to full utilization of existing or developing fiber infrastructure.

OBJECTIVE 3:

Encourage policies that bring competitive innovative service providers to the region by eliminating barriers to market entry.

- ☐ **Strategy 1:** Enforce states pole attachment regulation and enforcement.
- ☐ **Strategy 2:** Encourage high conduit lease fees and land use right-of-way laws.
- ☐ **Strategy 3:** Work with municipalities and provide assistance to administrators and selectmen negotiating cable franchise agreements.
- ☐ **Strategy 4:** Define adequate broadband and wireless data speeds and getting data caps removed.
- ☐ **Strategy 5:** Encourage broadband innovation: e.g. fiber to the home projects, high-capacity broadband for business and schools.
- ☐ **Strategy 6:** Explore opportunities for promoting a multi-technology approach to expanding broadband availability.
- ☐ **Strategy 7:** Compare feasibility and cost effectiveness of solutions promoting fiber to the end user with other fixed wireless or wireline services.

Priority Rating	Phase *	Strategy	Level of Action*	Relevant Sectors*						Potential Partners	Notes*
				Economic	Education	Government	Health	Public Safety	Residential		
High	Short	**G.2.Obj.1.S.1.** Update local zoning ordinances and land use regulations to address current telecommunications information.	● Local ○ Region			●				-Planning Board -RPC	
	Mid	**G.1.Obj.1.S.1.** Apply for grant opportunities to fund this initiative.	● Local ○ Region ○ State	●	●	●	●	●	●	-Residents -ISP's -Private Organizations and Businesses	
	Mid	**G.1.Obj.1.S.3.** Coordinate with providers to develop a service map and aim for disclosure of service line locations.	○ Region ● State	●		●			●	-Realtors -ISP's -UNH	
	Mid	**G.1.Obj.2.S.1.** Update the local zoning ordinances and land use regulations to address current telecommunications information.	● Local ○ Region			●				-Planning Board -RPC	
	Mid	**G.1.Obj.2.S.2.** Encourage the development and incorporation of telecommunications chapters in Town Master Plan updates.	● Local ○ Region			●				-Planning Board -RPC	
	Mid	**G.1.Obj.2.S.3.** Continue to identify regulatory barriers to address.	● Local ○ Region			●				-Planning Board -RPC	
	Long	**G.2.Obj.3.S.1.** Enforce NH pole attachment regulation and enforcement.	● State			●				-PSNH -PUC -ISP's	
	Long	**G.2.Obj.3.S.3.** Work with municipalities and provide assistance to administrators and selectman negotiating cable franchise agreements.	○ Local ● State			●				-UNH -Municipalities	
	Long	**G.2.Obj.3.S.4.** Define adequate broadband and wireless data speeds and getting data caps removed.	● State ○ Nation	●	●	●	●	●	●	-UNH -Municipalities	
	Long	**G.2.Obj.3.S.5.** Encourage broadband innovation: e.g. fiber to the home projects, high-capacity broadband for business and schools.	● Local ○ State	●	●	●	●	●	●	-UNH	

Priority Rating	Phase *	Strategy	Level of Action*	Relevant Sectors*						Potential Partners	Notes*
				Economic	Education	Government	Health	Public Safety	Residential		
Medium	Short	**G.2.Obj.1.S.2.** Improve existing service in the urban areas to encourage and promote business development.	● Local ○ Region ○ State	●						-Chambers -ISP's -EDC's -RPC's -Local Businesses	
	Mid	**G.1.Obj.1.S.2.** Collaborate with providers to make fair deals with homeowners to pay a portion of the start-up cost to extend service to places that are unserved.	○ Local ○ State						●	-ISP's -Private Businesses and Residences	
	Mid	**G.1.Obj.3.S.1.** Work with DRED and UNH Cooperative extension to create a broadband committee.	● Local ○ Region ○ State	●	●	●	●	●	●	-Municipalities -RPC's -UNH -DRED	
	Mid	**G.1.Obj.3.S.2.** Coordinate with providers to develop a service map and aim for full disclosure of service line locations.	○ Region ● State	●		●			●	-Realtors -ISP's -UNH	
	Mid	**G.2.Obj.2.S.4.** Develop and distribute educational materials for broadband technology.	● Local ● Region ● State	●	●	●	●	●	●	-Municipalities -RPC's -UNHCE	
	Long	**G.1.Obj.4.S.1.** Assist municipalities in developing and maintaining broadband master plans.	● Local ○ Region			●				-Planning Boards -RPC's	
	Long	**G.1.Obj.4.S.2.** Supporting business development by providing detailed broadband availability information to the regions business centers, and chambers of commerce.	○ Region ● State	●						-Chambers of Commerce -RDC's -UNH	
	Long	**G.1.Obj.4.S.3.** Pursue broadband funding sources including Federal, State, Local, and public/private partnerships.	● Local ● Region ● State ● Nation	●	●	●	●	●	●	-RPC's -UNH -Municipalities -Federal Government	
	Long	**G.2.Obj.3.S.2.** Encourage high conduit lease fees and land use right-of-way laws.	● State			●				-UNH -ISP's	

Priority Rating	Phase *	Strategy	Level of Action*	Relevant Sectors*						Potential Partners	Notes*
				Economic	Education	Government	Health	Public Safety	Residential		
Lower	Short	**G.2.Obj.1.S.3.** Encourage the development and incorporation of telecommunications chapters in town master plan updates.	● Local ○ Region			●				-Planning Boards -RPC's	
	Mid	**G.2.Obj.2.S.1.** Attend local chamber meetings.	● Local ○ Region	●						-EDC's -Chambers of Commerce -RPC's	
	Mid	**G.2.Obj.2.S.2.** Attend local economic development meetings.	● Local	●						-EDC's -Chambers of Commerce -RPC's	
	Mid	**G.2.Obj.2.S.3.** Coordinate regional training opportunities.	○ Local ● Region ○ State	●	●	●	●	●	●	-EDC's -Chambers of Commerce -RPC's -Municipalities -UNH	

*** Matrix Key**

Phase

Short = < 1 yrs.

Med = 2-4 yrs.

Long = >4 yrs.

Ongoing

Level of Action

● Primary level of action

○ Secondary level of action

Relevant Sectors

● Primary Sector Affected

○ Secondary Sector(s) Affected

Notes:

This field can contain information on potential funding sources, fiscal impact (cost neutral, minimal investment, significant investment), and other relevant factors.

Acronym Guide:

ISP-internet Service Provider
RPC-Regional Planning Commission
EDC-Economic Development Committees
PSNH-Public Service of New Hampshire
UNHCE-University of New Hampshire Cooperative Extension
RDC-Regional Development Council
DRED-Department of Resources and Economic Development

H. Appendices

1. Sample Town Master Plan Broadband Chapter Outline
2. Glossary of Terms

1. Sample Town Master Plan Broadband Chapter Outline

1) First Steps

a) Form a Broadband Stakeholder Group

b) Connect with local Service Providers

i) Contact information for New Hampshire Public Utilities Commission: http://www.naruc.org/commissions/default.cfm?s=nh

ii) The NHPUC Website: http://www.puc.nh.gov/ this website includes list of workshops, agendas, meeting minutes, pole attachment regulations.

iii) UNHCE: Mapping and technical assistance provided here http://www.iwantbroadbandnh.org/.

c) Public outreach and education

i) Create an online survey using www.surveymonkey.com to engage local community members in the decision making process.

ii) Hold public meetings to address key broadband issues and developments.

2) Introduction

a) Background

i) General overview of broadband

ii) Vision Statement

iii) Goals of chapter (sample goals are listed below and are meant only for reference)

(1) Expand broadband networks to underserved and unserved areas of the town

(2) Work with cable companies to map out existing infrastructure and where it can be improved

(3) Create a Broadband Committee to oversee task and issues relating to broadband

(4) Improve existing networks and maintain high levels of service

(5) Provide free Wi-Fi access to downtown areas

**Note:* *Objectives and Strategies for these and more goal examples can be found in the Recommendations section below*

3) What is Broadband?

a) Brief explanation of what broadband "is"

i) Upload and download speeds

ii) Who uses it

iii) Tasks that can be done at different speeds

4) Broadband Infrastructure

a) General breakdown of how infrastructure works

i) Middle mile, last mile, and backbone

b) Explanation of carrier competition

i) Different kinds of service offered

(1) Cable

(2) Wireless

(3) Wi-Fi

(4) DSL

(5) Cellular

c) Cost per unit

5) New Hampshire Broadband Mapping and Planning Program

**Note:* *Background information on NHBMPP can be found at http://www.iwantbroadbandnh.org/about-nhbmpp*

a) Who they are and brief overview of project
b) How they can help towns

6) Federal Telecommunications Act of 1996

**Note:* *Explanation of this Act can be found at: http://transition.fcc.gov/telecom.html*

a) Background
b) Limitations
   i) Intro
   ii) Federally regulated, not by PUC
c) Requirements

7) Broadband related technology land use regulations

a) Cell tower/antenna regulations
b) Local ordinances and regulations for broadband

8) Existing conditions and trends in the community

a) Vision Statement
b) Needs and Barriers to Broadband
   i) Sample questions posed to sector organizations:
      (1) Which of the following best describes how your organization receives technical support?
         (a) Full-time person(s) (e.g. Technology Director)
         (b) Part-time person(s)
         (c) Consulting services
         (d) None
      (2) What is your organization's source of internet connection?
      (3) What is your organization's current upload speed?
      (4) What is your organization's current download speed?
         (a) Broadband speeds can be tested here: http://iwantbroadbandnh.org/speed_test
      (5) Is your current level of broadband connectivity sufficient for the current needs of your organization?
      (6) What types of broadband functions does your organization need to function effectively?
         (a) Social media use
         (b) Cloud-based computing
         (c) High speed end to end network and business to business applications
         (d) Video-conferencing
         (e) Teleworking (use of broadband to work away from the office)
      (7) Is your current level of broadband connectivity sufficient for your future needs? If not, what barriers prevent your organization from acquiring faster broadband speeds?
      (8) What technology related challenges does your organization currently face?

(9) Please identify any other barriers you can think of.

c) Opportunities and possible solutions.

d) Once barriers are identified create a survey where your BSG can prioritize them based on length of time to completion, and low to high priority. This could also include a list of key participants that would be essential in carrying out the strategies to fix these barriers.

e) Overview of wireline service
   i) DSL
   ii) Cable
   iii) Providers in the area
   iv) Quality of service
      (1) Maps depicting different types of service

f) Overview of wireless service
   i) Cellular service
   ii) 3G and 4G
   iii) Providers in the area
   iv) Quality of service
      (1) Maps depicting different types of service

g) Map and explanation of service at Community Anchor Institutions

**Map for the region can be found on page 34 of the Broadband Plan for the Nashua Region*

   i) Hospitals
   ii) Schools
   iii) Libraries
   iv) Municipal buildings

9) Recommendations for the Future

a) What can the town do?
   i) Learn how to best negotiate Cable Franchise Agreements (CFAs)
      (1) Develop guidance for communities that shares resources and information for navigating the CFA process.
      (2) Establish resources for RPC's and others with information to better understand the components and legalities of and process for negotiating CFAs.
      (3) Explore development of training program and capacity building opportunities around education and guidance on CFA negotiation (Towns can use UNHCE, NH Municipal Lawyers Association, NH Municipal Association, and the help of Citizen Planners for this task).
      (4) Update existing web resources on topic to contain most current information.
      (5) Investigate potential strategies to encourage and enable inclusion of access to internet service in CFAs.
      (6) Establish model CFA for communities to use in negotiating or renewing CFAs.

b) What can the BSG do?
   i) Promotion
      (1) Promote the development of municipal telecommunications or broadband committees.
      (2) Explore possible funding opportunities for sustaining staff support to regional broadband stakeholder groups past December 2014.

(3) Support continuation of the NH Broadband Mapping and Planning Program efforts to collect, analyze, and map broadband information from providers and community anchor institutions across the state.
(4) Support initiatives to address regulatory and or policy barriers to broadband expansion.
(5) Encourage legislators to support legislative amendments seeking to enhance municipalities' ability to bond for broadband infrastructure.
(6) Conduct an impact study or audit of local land use regulations to identify barriers to broadband development.

(Example: http://www.broadbanduk.org/2013/11/15/uk-broadband-impact-study-published/)

ii) Education and Outreach
(1) Develop a how-to guide for municipalities to form broadband committees.
(2) Develop resource materials to assist work of local broadband committees
(3) Develop guidance materials and training programs for towns on creating and adopting broadband components to municipal master plans such as broadband chapters.
(4) Develop a model broadband chapter to be included in a master plan for use by communities.
(5) Form a Telecommunications Advisory Committee to assist the Planning Board with the development of broadband master plan chapters.

c) Who can they look to for help?
i) UNHCE
(1) Develop a clearinghouse of public information (web-based), reference materials, and meeting minutes for business owners, legislators, and the general public to stay informed on regional and local efforts around planning for broadband which would include links to resources within and outside the region.
ii) DRED
(1) Encourage providers to make available information on the location of fiber network infrastructure.
(2) Explore innovative methods for acquiring information on the location of broadband; link broadband availability to property assessment at the local level.
(3) Revisit requirements of service providers to share information with the NH Office of Energy and Planning in NH RSA 12-K, Deployment of Personal Wireless Service facilities.
iii) Local Institutions
(1) Expand and develop opportunities for education around broadband use.
(2) Look to community education institutions like colleges to offer workshops and training sessions.
(3) Look to existing training programs that involve parents and teens in shared learning experiences as models.

2. Glossary of Terms

Broadband Terminology[27]

Backbone or Transport Layer - A backbone network or network backbone is a part of computer network infrastructure that interconnects various pieces of network, providing a path for the exchange of information between different LANs or sub-networks. A backbone can tie together diverse networks in the same building, in different buildings in a campus environment, or over wide areas. Normally, the backbone's capacity is greater than the networks connected to it.

Backbone networks should not be confused with the Internet backbone. The Internet backbone refers to the principal data routes between large, strategically interconnected networks and core routers in the Internet. These data routes are hosted by commercial, government, academic and other high-capacity network centers, the Internet exchange points and network access points that interchange Internet traffic between the countries, continents and across the oceans of the world. Internet service providers (often Tier 1 networks) participate in Internet backbone exchange traffic by privately negotiated interconnection agreements, primarily governed by the principle of settlement-free peering.

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 Mb/sec). 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 - 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. The FCC defines broadband as 4 Mbps download speed and 1 Mbps upload speed. Whereas, the NTIA defines broadband as 768 Kbps download speed and 200 Kbps upload speed.

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.

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.

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.

[27] Source: State of New Hampshire Broadband Action Plan, June 30, 2008, Appendix A - Glossary of Terms http://www.nheconomy.com/uploads/Broadband-Action-Plan-Appendices.pdf)

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.

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 Internet service provider. 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" or “fiber to the home.”

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

Middle Mile[28]- In the broadband Internet industry, the "middle mile" is the segment of a telecommunications network linking a network operator's core network to the local network plant, typically situated in the incumbent telephone company's central office that provides access to the local loop, or in the case of cable television operators, the local cable modem termination system. This includes both the backhaul network to the nearest aggregation point, and any other parts of the network needed to connect the aggregation point to the nearest point of presence on the operator's core network.

Middle-mile provision is a major issue in reducing the price of broadband Internet provision by non-incumbent operators. Internet bandwidth is relatively inexpensive to purchase in bulk at the major Internet peering points, and access to end-customer ports in the incumbent operator's local distribution plant (typically where local loop unbundling is mandated by a telecom regulator are also relatively inexpensive relative to typical broadband subscription costs.

However, middle-mile access, where bought from the incumbent operator, is often much more expensive than either, and typically forms the major expensive of non-incumbent broadband ISPs. The alternative, building out their own fiber networks, is capital-intensive, and thus unavailable to most new operators. For this reason, many proposals for government broadband stimulus initiatives are directed at building out the middle mile. Two examples are the Network New Hampshire Now and Maine Fiber Company in the Northeast US, both funded largely by the National Broadband Plan (United States) to connect all community anchor institutions.

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 (see hotspot). Typically fee based by the hour or day, some municipalities provide free service (see Muni Wi-Fi).

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.

[28] Source: http://en.wikipedia.org/wiki/Middle_mile

Satellite Broadband[29] - Just as satellites orbiting the earth provide necessary links for telephone and television service, they can also provide links for broadband services. Satellite broadband is another form of wireless broadband and is particularly 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. Satellite service can be disrupted in extreme weather conditions. Typically a consumer can expect to receive (download) at a speed of about 1 Mbps and send (upload) at a speed of about 200 kbps. These speeds may be slower than DSL and cable modem, but the download speed is still much faster than the download speed with dial-up Internet access. New facilities, scheduled for deployment in 2012, are expected to support consumer broadband services for several million customers at speeds up to 12 Mbps for downloads and 3 Mbps for uploads.

Obtaining satellite broadband can be more costly or more involved than obtaining DSL or cable modem. A user must have:

- a two or three foot dish or base station - the most costly item;
- a satellite Internet modem; and
- a clear line of sight to the provider's satellite.

To find out if satellite broadband is available to your home, contact broadband satellite companies or your state's public service commission.

[29] Source: http://www.fcc.gov/guides/getting-broadband