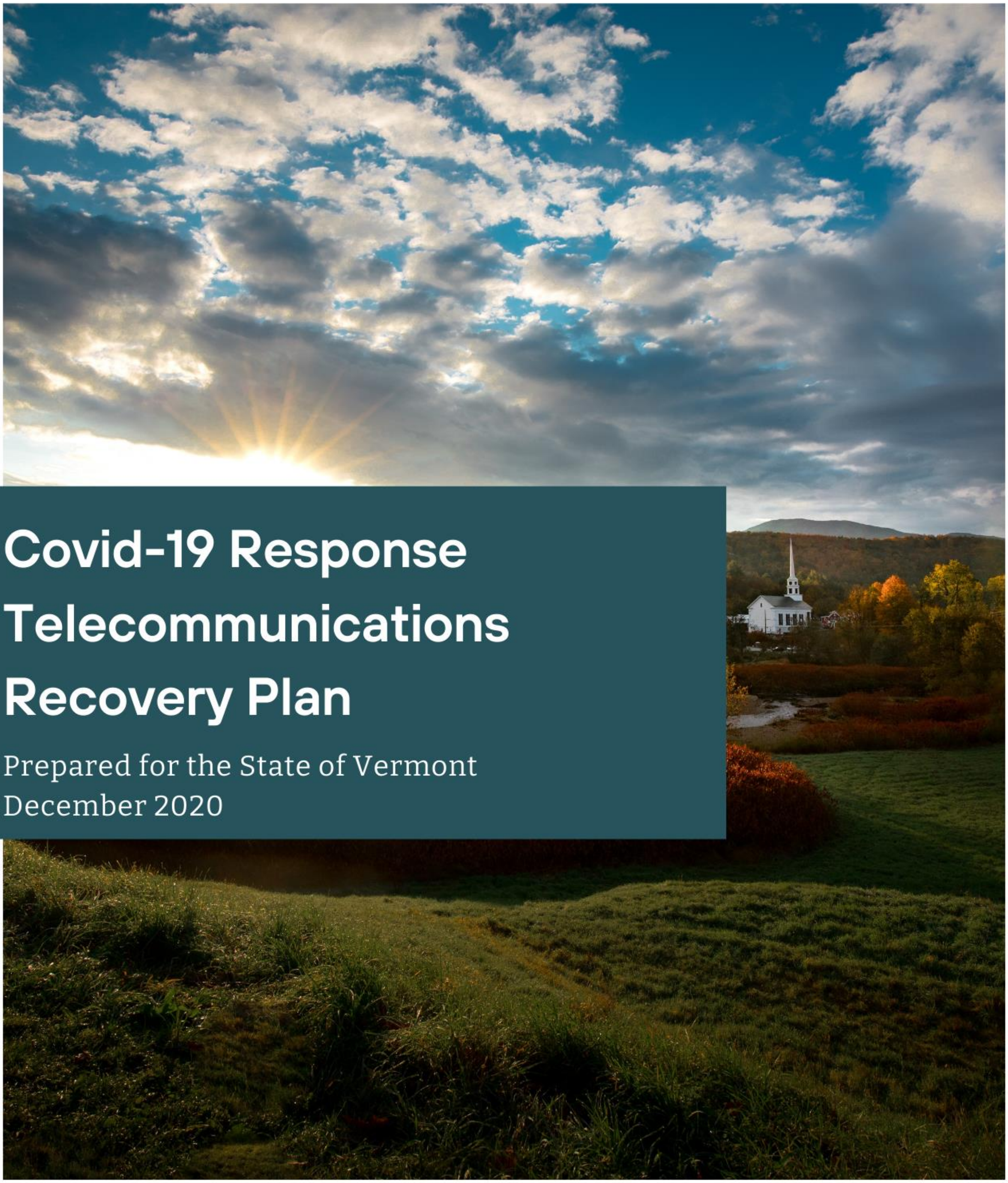

Covid-19 Response Telecommunications Recovery Plan

Prepared for the State of Vermont
December 2020

ctc technology & energy
engineering & business consulting

Rural Innovation Strategies

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1 Executive Summary

Covid-19 has laid bare the challenges of lack of universal broadband in Vermont. In the midst of a pandemic, inequities in the availability and affordability of broadband create further inequities in areas such as education, telehealth, and the ability to work from home.

To understand and address those challenges on an emergency basis, this Covid-19 Emergency Telecommunication Plan (Report) was commissioned by the Vermont Department of Public Service in October 2020. The Report is intended to meet the requirements of Section 15 of H.966, an act relating to Covid-19 funding and assistance for broadband connectivity, housing, and economic relief, and 30 V.S.A. § 202d. The Report was funded by Vermont's federal CARES Act funds to provide research and recommendations regarding how to address, in the near term, the immediate connectivity crisis created by Covid-19.[1] The Report was prepared in October and November 2020 by a project team led by CTC Technology & Energy and Rural Innovation Strategies, Inc.

1.1 The Scope of This Report

The research undertaken for this Report illuminates and illustrates the short-term connectivity challenges that require immediate effort to repair the harm done to Vermonters during the pandemic. Despite the best efforts of stakeholders, many students are not receiving school instruction, workers are not able to work remotely from home, patients who want telehealth services are struggling to connect, and doctors participating in prudent quarantine practices are unable to engage with hospitals and patients. Even citizens hoping to stay connected to their municipal government's activities are struggling to attend public meetings. With surging cases and cold weather approaching, these challenges are likely only to further exacerbate inequitable access to education, work, healthcare, and the democratic process.

The research for this Report also reinforces the importance of accelerating progress toward the State's 100/100 Mbps broadband goal. For example, surveys conducted as part of this effort found that, even among Vermonters who do have access to broadband, satisfaction with current internet service has decreased during the pandemic; approximately one-third of respondents to an online survey express dissatisfaction with connection speed and reliability during the pandemic.

[1] H.966, https://legislature.vermont.gov/Documents/2020/Docs/BILLS/H-0966/H-0966%20As%20Passed%20by%20Both%20House%20and%20Senate%20Unofficial.p

At the same time, given the immediacy and urgency of this effort, it's important to note what this Report was not intended to accomplish: It does not represent a long-term strategy to meet the State of Vermont's important residential 100/100 Mbps goal.

The consulting team heard from many stakeholders who hoped this Report would offer the Vermont broadband "Marshall Plan" to accelerate the State's path to 100/100 Mbps service by 2024. However, given the scope established for this effort and the source of funding for the work, this Report is focused on short-term efforts, not long-term strategy. Indeed, given the short time horizon for executing any strategy recommended by this Report, it does not incorporate recommendations regarding medium- or long-term strategies or technologies, such as construction of fiber-to-the-premises or use of neutral host infrastructure, however important those strategies are likely to be for Vermont's long-term broadband future.

Stated simply: *This Report should be understood as a complement rather than an alternative to long-term planning* that would address the State's broader internet goals. We strongly recommend that Vermont continue with that longer-term planning once the immediate emergency has been addressed.

In light of the scope of this Report, this analysis follows three key principles:

1. **Addressing Immediate Needs:** Recommendations in this plan are intended to address immediate, urgent needs during the pandemic.

2. **Achieving Long-Term Goals:** Recommendations in this plan should not make achieving the State's long-term goals (universal 100/100 service before 2024) more difficult.

3. **Accelerating Long-Term Goals:** Wherever possible, recommendations for short-term connectivity strategies in this plan should be constructed to accelerate the State's path toward long-term goals.

The Report builds on the State's considerable efforts and achievements to date. The Vermont Department of Public Service has developed more granular and up-to-date data on broadband availability than perhaps any other State. The electric utilities in the State share crucial data regarding utility poles and fiber assets. During the pandemic, Public, Education and Governmental Television (PEG TV) stations and libraries have taken on new and critical roles, disseminating information such as educational content, Covid-19 safety guidelines, and municipal events to the public quickly and efficiently. The State also moved very quickly to deploy centrally located public hotspots and invested in programs to identify people with distinct needs and bring Vermonters online quickly.

1.2 Summary of Tasks

Over the course of October and early November 2020, the project team conducted quantitative and qualitative research to understand the use of telecommunications services during the Covid-19 pandemic and the gaps that still exist in Vermont.[2] At the same time, attorneys from Keller & Heckman, a national firm, and Montroll, Backus & Oettinger, a Vermont-based firm, provided regulatory and legal consultation regarding these issues.

Specifically, the project team undertook the following activities:

1. **Assessed the current state of commercial and residential telecommunications infrastructure and services and surveyed Vermont residents and businesses:**[3] The effort was intended to understand how Vermont's telecommunications infrastructure has performed during the pandemic to lay the groundwork for near-term changes that should be considered in light of the emergency. The team undertook multiple surveys of Vermont residents and businesses, in cooperation and consultation with the Agency of Commerce and Community Development (ACCD), and the relevant departments of State government, to determine what telecommunications services are needed during the pandemic with respect to the education, healthcare, public safety, and workforce training sectors. Specifically, the team conducted online surveys of Vermont residents and businesses and a telephone survey of unserved residences.[4]

2. **Evaluated State-owned and managed telecommunications systems and related infrastructure:**[5] In this task, the project team analyzed public sector telecommunications systems and related infrastructure and evaluated the need to provide the best available and affordable technology for use by State and local government, public safety, educational institutions, community media, nonprofit organizations performing governmental functions, and other community anchor institutions. In particular, we analyzed how publicly-owned infrastructure has performed during the pandemic and

[2] The Report is based on data developed in October and November 2020, and there exist some pending processes that may impact the recommendations made here. For example, the status of federal Coronavirus financial support is unclear, and there exists potential for additional funding should another federal stimulus be made available or should the deadline for spending the current CRF money be extended. In addition, the ongoing Rural Digital Opportunity Fund (RDOF) reverse auction and VTel's pending USDA Reconnect grant application could impact connectivity in Vermont in the coming year or two.

[3] This effort is responsive to Tasks 1 and 2 of the scope of work assigned by the Vermont Department of Public Service.

[4] The project team's initial plan was to conduct a statistically valid mail survey of thousands of Vermont households, but the urgent and accelerated nature of the engagement made infeasible a methodology that would require several months of effort. The phone survey is focused only on Vermont residents thought to have little to no broadband connection, to correct for the obvious limitations of a residential survey conducted online.

[5] This effort is responsive to Task 3 of the scope of work.

what needs have come to light as a result of this emergency. To this end, the team conducted more than 50 interviews of Communications Union Districts (CUDs), ISPs, health care providers, electric utilities, superintendents, librarians, community media experts, public safety entities, anchor institutions, and local government leaders.

3. **Assessed status, coverage, and capacity of telecommunications networks and services:**[6] The project team assessed the status, coverage, and capacity of telecommunications networks and services available throughout Vermont in light of how the pandemic has affected the capacity of current networks, with particular focus on telehealth and distance learning requirements. To this end, the team conducted dozens of interviews and surveys of health care professionals and school superintendents, among other critical stakeholders. In addition, robust geospatial and mapping analysis was performed to understand the options for reaching as many Vermonters as possible in response to the pandemic. The team utilized data including, but not limited to, Vermont's data on served and unserved premises, cable and fiber systems, 248a permit applications, NRB data, various cellular service data from drive tests, and data from the census.

4. **Assessed opportunities for shared infrastructure:**[7] The project team completed an assessment of opportunities for shared infrastructure, open access, and neutral host wireless facilities to guide deployment of new technology that can assist the State in responding to, and recovering from, the pandemic. We concluded that strategies related to neutral host infrastructure are long-term in nature and advise against policy changes in the short-term to deal with the pandemic; we recommend instead that these long-term strategies be considered in the context of a long-term, comprehensive broadband plan.

5. **Analyzed PEG TV responses to the pandemic:**[8] PEG access media organizations were assessed with particular attention to changes brought on by the pandemic and how PEG Access has been leveraged to address the crisis in the context of the State's overall communications needs. To this end, we interviewed key PEG stakeholders and experts.

6. **Analyzed strategies to use public ownership and control of rights-of-way to expand broadband and increase network resiliency during the pandemic:**[9] The project team was tasked to develop short-term measures that the State can undertake to leverage its ownership and management of the public rights-of-way to create opportunities for accelerating the buildout of fiber-optic broadband and for increasing network resiliency

[6] This effort is responsive to Task 4 of the scope of work.
[7] This effort is responsive to Task 5 of the scope of work.
[8] This effort is responsive to Task 6 of the scope of work.
[9] This effort is responsive to Task 7 of the scope of work.

capacity. We concluded that strategies related to ownership and management of rights-of-way are long-term in nature and advise against policy changes in the short-term to deal with the pandemic; we recommend instead that these long-term strategies be considered in the context of a long-term, comprehensive broadband plan.

7. **Assessed emergency communications initiatives and requirements:**[10] Public safety specialists on the project team analyzed federal initiatives and requirements, including the Department of Commerce FirstNet initiative and the Department of Homeland Security Statewide Communication Interoperability Plan, and how these activities can best be integrated with strategies to advance the State's short-term responses to the pandemic. The analysis includes an assessment of how these systems have performed during the pandemic and what is needed to respond to the crisis. As part of this analysis, the project team interviewed key stakeholders within Vermont and drew on best practices nationally.

8. **Analyzed regulatory and legal barriers facing State action:**[11] As of the date the first draft of this Report is delivered to the State, the project team is still preparing a discussion of relevant federal and State laws and regulations affecting State action in the telecommunications area, including relevant preemption issues raised by any proposed policy initiatives.

9. **Developed recommendations designed to advance State telecommunication policies and goals:**[12] The recommendations are intended, per the scope of this effort established by the State of Vermont, to address short-term needs and to ensure that short-term strategies for addressing the pandemic not interfere with longer-term efforts to address larger broadband needs as defined by 30 V.S.A. § 202c.

1.3 Summary of Findings

Based on the Tasks described above, this Report finds the following:

- Institutional and governmental telecommunications systems have been resilient during the pandemic, and emergency plans and adaptations have successfully minimized gaps in operations of government services. Most commercial business locations are generally served by adequate broadband.

[10] This effort is responsive to Task 8 of the scope of work.

[11] This effort is responsive to Task 9 of the scope of work.

[12] This effort is responsive to Task 10 of the scope of work.

- Broadband use has increased dramatically since the start of the pandemic, as would be expected. For example, respondents to an online poll report increased use of the internet for telemedicine (an increase from 19 percent to 75 percent) and for civic engagement (an increase from 33 percent to 74 percent). Additionally, 62 percent of respondents use the internet for teleworking on a daily basis, compared with 21 percent of respondents before the pandemic.

- There exist considerable challenges with respect to insufficient residential telecommunications infrastructure. Many Vermonters are struggling with connectivity for remote work, online education, and telehealth (including doctors in quarantine who cannot connect to hospitals and patients from home with video conferencing). For example, four in 10 respondents to a residential survey reported that they have experienced connectivity issues during telehealth appointments. Overall, satisfaction with internet service aspects has decreased during the pandemic, particularly for speed and reliability of service. More than one-half of respondents are not at all satisfied (approximately one-third) or are only slightly satisfied (approximately one-fifth) with connection speed and reliability during the pandemic.

- Low-income Vermonters in particular are facing challenges accessing broadband and getting assistance. For example, a survey of families connected to the internet suggests that more low-income respondents to the survey who currently have service had applications to ISP low-income programs denied than those who were able to enroll.

- Small businesses, remote workers, parents, patients, and civically engaged Vermonters are learning digital skills quickly, but are still struggling to understand how to use connectivity tools during the pandemic.

- Many municipalities have struggled to engage citizens and elected officials via online tools, and few have made plans for larger engagement challenges like Town Meeting Day. In some cases, PEG TV is filling the gap. Sixteen percent of all respondents to a survey report viewing PEG TV content during the Covid-19 pandemic. Among those who viewed PEG programming, the most commonly accessed content was broadcasts of municipal functions, cited by 72 percent of respondents. One-half of PEG viewers accessed information about Covid-19.

1.4 Summary of Recommendations

Given that, for the most part, the immediate challenge for connectivity during the pandemic appears to be on the residential rather than business or institutional fronts, this Report focuses its recommendations on the needs of the following categories of Vermonters:

1. **Served but low-income**: This category is of those Vermonters who have available broadband service of 25/3 or more, but may not be able to afford service

2. **Unserved but able to pay**: This category is of those Vermonters without access to broadband—who could and would pay for service, if the infrastructure was made available

3. **Unserved *and* low-income**: Vermonters without access to broadband who also need assistance paying for monthly service

Addressing the needs of these Vermonters requires work and programming in three categories that are responsive to the needs: First, we recommend infrastructure deployments to enable short-term solutions to address the needs of the unserved. Second, we recommend service subsidies for low-income Vermonters who may struggle to afford broadband service in the current economic crisis. Finally, we recommend execution capacity to reach everyone across the State. The recommendations are based on the assumption that the State can mobilize staff/contract resources to act quickly, and assumes the State will utilize Covid-19 emergency funding sources for implementation wherever possible, whether those are CRF funds or future emergency stimulus.

1.4.1 Recommendation: Provide a Broadband Service Subsidy to Low-Income Vermonters During the Pandemic

The Vermont Department of Public Service has already developed a successful effort to reimburse broadband costs to families that are adversely impacted by the pandemic's economic crisis. We recommend the State complement that effort, and expand it, by also focusing resources on providing free broadband to low-income families that may not already have service to their homes because of the barrier of cost.

Specifically, the State could purchase services in bulk from providers that currently serve communities throughout Vermont, then provide codes for qualified residents to redeem for free service from any participating provider—thus completely eliminating cost as a barrier to adoption.

This approach would enable the State to use its large-scale purchasing power to realize efficiencies and ensure competitive pricing—reducing its costs both in total and on a per-subscriber basis. This is especially true to the extent that the State can leverage carriers' underutilized low-cost programs such as Comcast internet Essentials and Spectrum Internet Assist. The State could use a quick-turnaround procurement process to engage internet service providers willing to offer low pricing, flexibility, and high-quality customer service.

Given the reality of service availability in Vermont, the program would offer codes for service over fixed networks wherever possible and mobile hotspots everywhere else.

To maximize participation and the overall impact of this approach, the State would need to make the process as simple as possible for residents and would need to commit to providing support and guidance to families as they navigate the program. Ideally, eligible residents would receive communications through multiple channels—both analog and digital—that clearly describe the program's benefits, include a personalized code, and provide instructions for subscribing to service from the participating provider of their choice.

For purpose of equity and ease of program deployment, eligibility should be based on income level and should build on existing mechanisms like a Vermonter's eligibility for Medicaid or the National School Lunch Program. This will require collaboration and data sharing by public school systems or other institutions.

Assuming an average cost per household of $350 for 12 months, representing service, equipment, and installation, and approximately 20,000 eligible households, we estimate the potential cost of a program like this could be $7 million in the first year.

1.4.2 Recommendation: Fund Modest Infrastructure Enhancements Where Feasible in the Short-Run and in Areas Where These Investments Will Not Compromise Long-Term Efforts

After consideration of the Emergency Connectivity Initiative, 61,187 homes, or approximately 20 percent of Vermont households, are not served by wireline service that meets the federal definition of broadband (25 Mbps download and 3 Mbps upload) and thus face difficulty working remotely, learning remotely, or obtaining telemedicine services over broadband.

This Report considers possible approaches for addressing these broadband gaps. While the optimal long-term approach is to connect unserved premises with fiber or other high-speed wireline services, we recommend an emergency approach that accomplishes the following:

1. **Use of Mobile**. Leverages the commercial mobile broadband networks that serve most of Vermont, including areas unserved by wired 25/3 broadband services. Households without fixed broadband service can use a mobile hotspot device to access service. We have identified 44,850 households (73 percent of the 60,511 unserved households) in this category through use of State drive test data, State tower data, and AT&T data regarding planned 2020 FirstNet expansion.

2. **Line Extensions.** Pays to extend cable or fiber service to small unserved pockets within or adjacent to otherwise-served areas. These can be built quickly and will be difficult to serve by a new fiber provider such as a Community Utility District. We identified 1,701 homes

in this category using a mapping algorithm that identifies small unserved areas in mostly-served towns—and we estimate this will cost $4.5 million.

3. **Rooftop Boosters.** Identifies where the use of rooftop booster antennas could help households with marginal mobile broadband service attain service at acceptable speeds and provide equipment and installation services, along with the hotspot device. We identify 3,780 additional households in this category by selecting areas with lower signal level thresholds for mobile broadband, but at levels that can be boosted to provide acceptable service.

Many public comments on the draft plan asked why the project team did not recommend new fixed wireless deployments as an emergency response strategy. There are two primary reasons: One, State financial support for the expansion of permanent infrastructure that is not cable or fiber, does not contribute to the long-term goal of 100/100 service, and indeed may impede that goal. Two, between permitting (which takes several months in Vermont), interference testing, manufacturing lead time, and installation work, the deployment of new wireless radios would not be able to happen on a timeline compatible with the emergency scope of our work.

1.4.3 Recommendation: Develop a Broadband Corps

To support Vermonters in their adoption and use of broadband, we recommend development of a Broadband Corps. The Corps would be a statewide team dedicated to supporting CUDs and mobilizing the people power necessary to confirm mobile hotspot options, assist with nontechnical installations, and provide technical support for low income and technology-challenged Vermonters. The Corps would launch before December 30 and would continue over the next 8 to 10 months, transitioning to longer-term data collection (such as pole assessments) in the late spring once emergency connections are completed.

Consistently, during the research for this Report, stakeholders demonstrated need for more hands-on resources to assist with the technical issues that inevitably arise as more Vermonters move online. A Broadband Corps could address these gaps through organizing volunteers through the CUDs and providing direct service to Vermonters to make sure as many as possible are connected quickly.

We recommend the creation of a Broadband Corps in order to: (1) Assist with infrastructure and service deployment; (2) Perform outreach, and direct technical support to Vermonters becoming familiar with their broadband connections and devices; and (3) Provide high touch support to ensure low-income Vermonters take advantage of broadband support programs. If the Corps is successful in connecting Vermonters rapidly, we recommend in the spring that Corps members spend available time on pole surveys of towns on behalf of CUDs and thereby advance their work toward deploying fiber.

As an illustration of what is possible, this Report describes a Broadband Corps structure that combines regionally assigned Corps members with a statewide installation team. Corps members could be assigned to Regional Planning Commission regions and could work closely with RPCs and/or CUDs if desired, with centralized, statewide management. We recommend at least 22 regional corps members (two for each RPC region), and at least 20 statewide Corps members.

While a Corps could be put together quickly to get started as early as December, it is likely such a team would be focused on executing for a six-month period, for a budget of approximately $1.3 million, including staffing and equipment.

2 Survey of Vermont Residences and Businesses

The project team—in consultation with key State stakeholders—conducted an online business survey, an online residential survey, and a phone-based residential survey.

The online residential survey illuminated important aspects of changing customer behavior due to the pandemic in terms of use of the internet and demand for access—and, importantly, a severe lack of usage of low-cost broadband programs available to low-income residents.

2.1 Online Residential Survey Methodology

The online residential survey ultimately secured more than 4,000 responses from Vermonters, 3,046 were deemed "valid" by the statistician analyzing the data. The survey was promoted through organic and paid promotions, including a press release from Vermont's Department of Public Service (PSD); requests made to town administrators, librarians, State legislators and other stakeholders to post the survey on town listservs; social media promotion from a range of entities; paid Front Porch Forum advertisements; outreach via Communications Union Districts (CUD), and more.

The survey responses (presented in full in Appendix A) were weighted based on the age of the respondent and region. Since older persons are more likely to respond to surveys than younger persons, the age-weighting corrects for the potential bias based on the age of the respondent. In this manner, the results more closely reflect the opinions of each county's adult population. The figures below summarize the sample distribution by county and by age.

Figure 1: Online Residential Survey Response Distribution by County

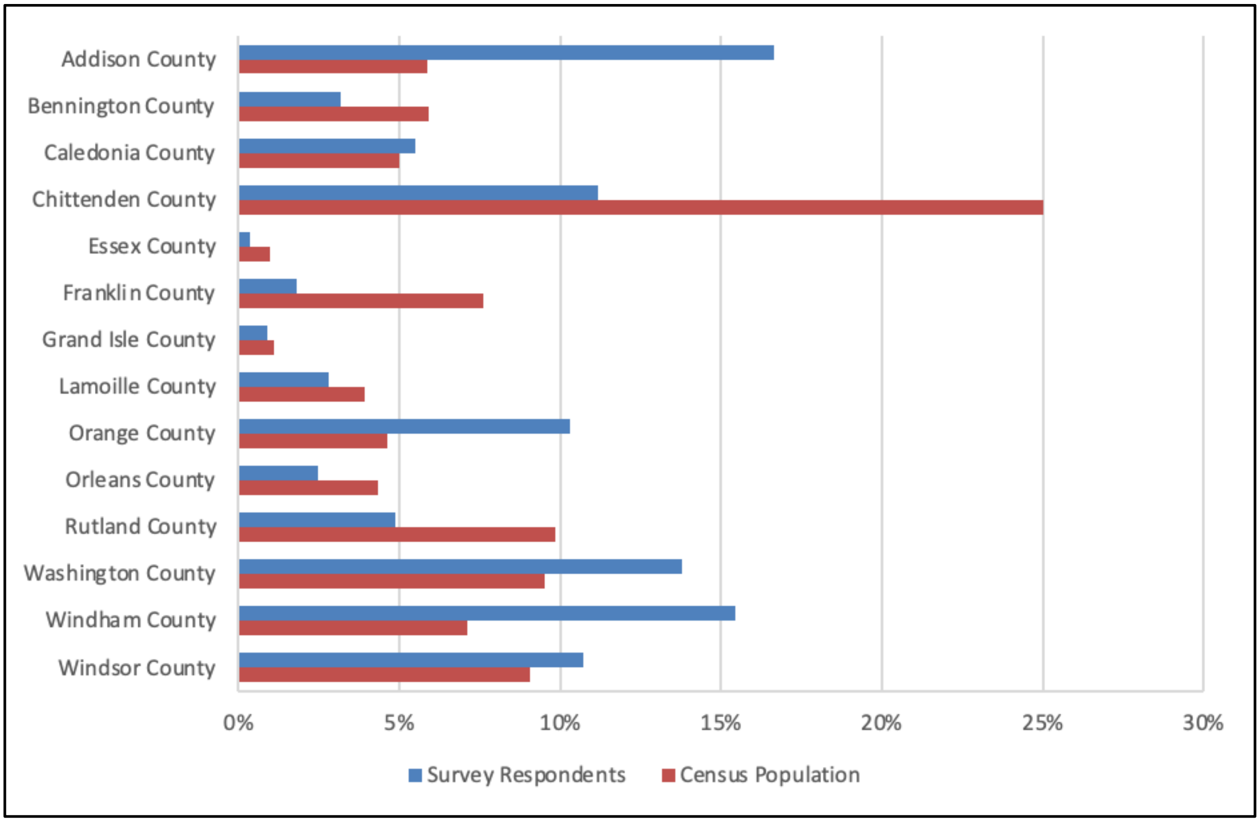
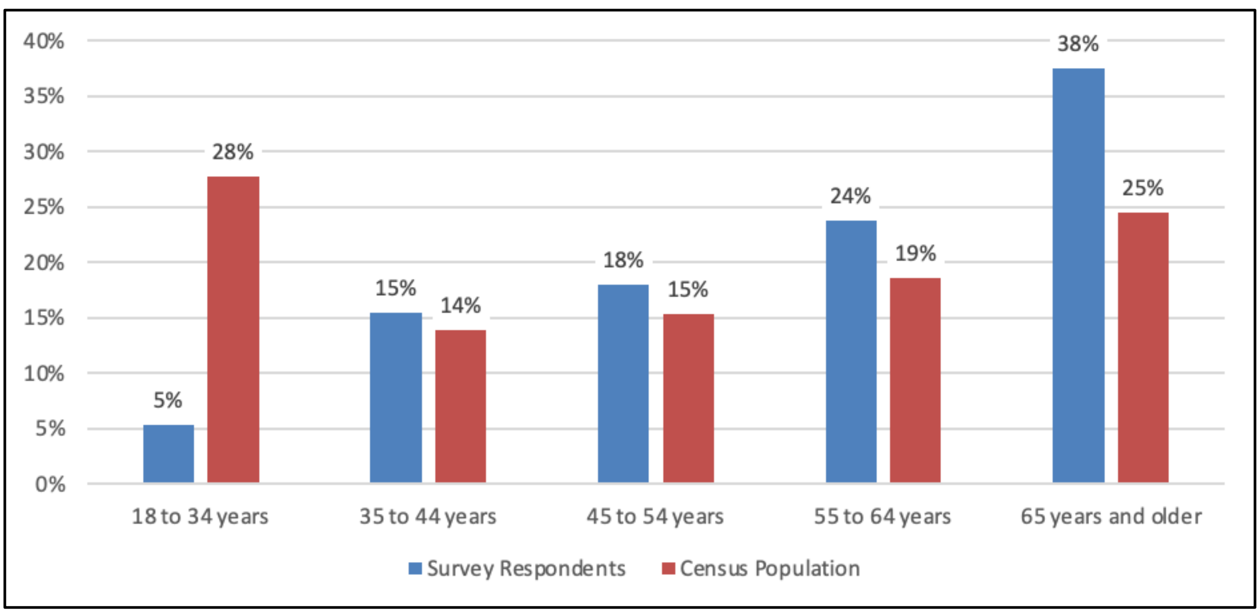


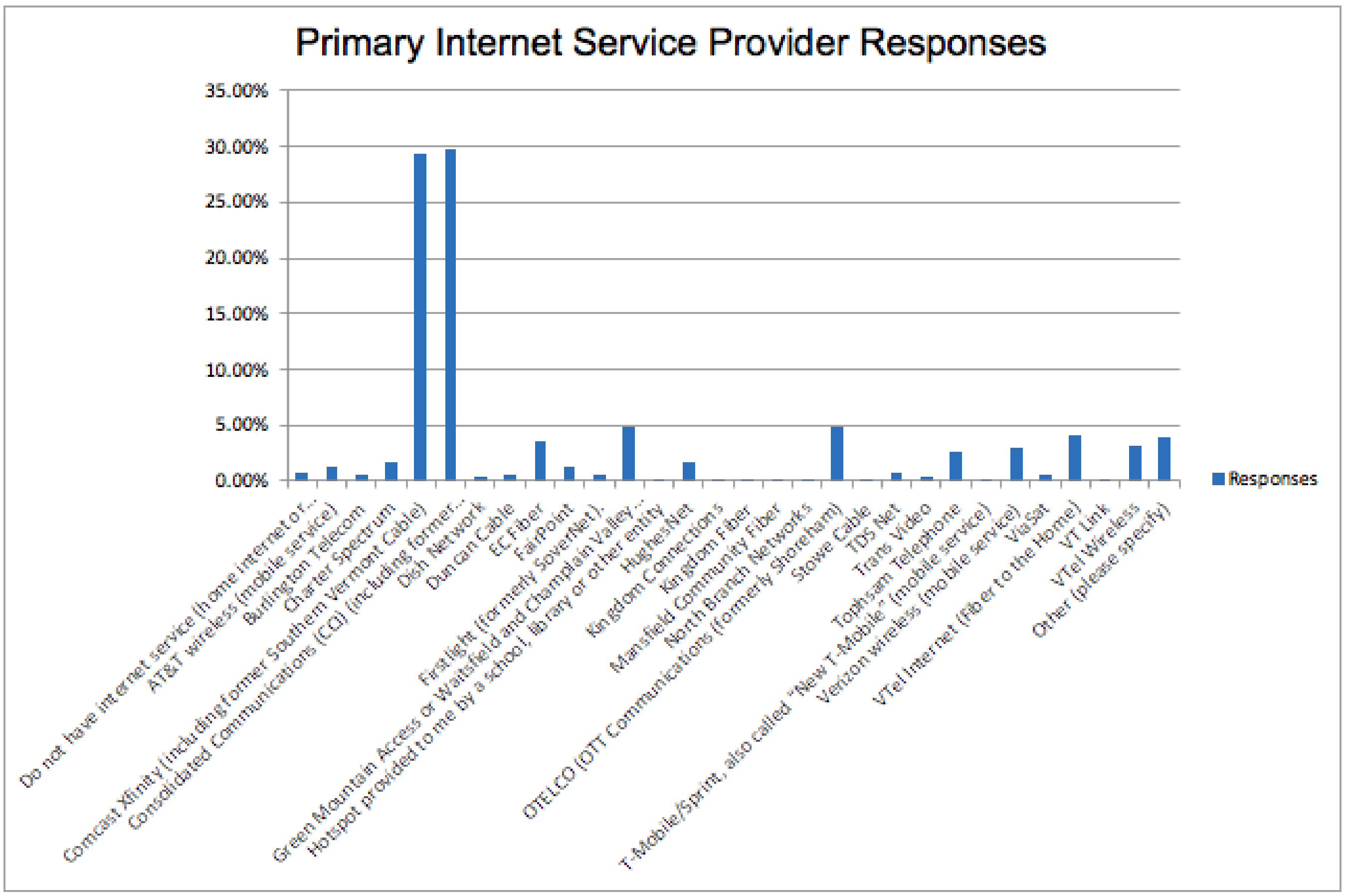
Figure 2: Online Residential Survey Response Distribution by Age



Most respondents (96 percent) reported having internet access, including 79 percent who have both home internet service and a cellular/mobile telephone service with internet (smartphone). The high saturation of internet access would be expected in an online survey.

Comcast Xfinity and Consolidated Communications (CCI) are the leading internet service providers (ISP) used according to our surveys responses. Three in 10 respondents subscribe to Comcast Xfinity, and three in 10 subscribe to CCI. Other ISPs comprise much smaller shares of the market statewide but may represent larger shares in some individual counties. Further detail on companies used by respondents are provided in the body of the report. The figure below shows the sample size distribution by primary internet service provider.

Figure 3: Internet Service Providers Used by Online Survey Respondents



2.2 Key Online Residential Survey Findings

2.2.1 Broadband Access Gaps

The online residential survey found very few gaps in acquisition of residential internet access services. This was to be expected from a survey conducted online. However, the survey illuminated important aspects of changing customer behavior due to the pandemic in terms of use of the internet and access points to the internet, and importantly, a severe lack of usage of low-cost broadband programs available to low-income residents. The following are key findings:

- **5 percent of all respondents and 9 percent of low-income households (earning less than $25,000 per year) only use a smartphone for home internet access.** This may limit their ability to fully utilize online services at home.

- **Residents may be significantly underutilizing existing broadband subsidy programs.** Only one percent of all Comcast subscribers, and 10 percent of low-income subscribers, participate in the Comcast Internet Essentials program. Another 59 percent of low-income subscribers were unaware of the program, and 15 percent attempted to enroll but were declined.

- **Most (99 percent) respondents access the internet from any location, including a range of locations outside the home.** However, use of the internet outside of the home has declined significantly during the Covid-19 pandemic.

- **Most respondents are unaware of the State's emphasis on Communications Union Districts.** Three in 10 respondents said they are aware of CUDs as a way to improve broadband access in unserved areas, while 59 percent are unaware and 11 percent are unsure.

- **Public Wi-Fi access may not be adequate.** Nearly one-half of respondents (45 percent) are aware of public Wi-Fi hotspot locations near their home, but just eight percent said that hotspot access is adequate in the area. Another 43 percent were unsure.

- **Most respondents use search engines to learn about availability of internet service.** Two-thirds named search engines as the leading source of information to learn about available service options, and seven in 10 named search engines as the top source for learning how to use the internet more effectively.

2.2.2 Covid-19 Impacts on Broadband Use

Respondents reported increased use of and demand for broadband services during the Covid-19 pandemic. They are utilizing the internet more at home and less often outside the home, as may be expected, and they are engaged in more online activities for work, school, and entertainment. The following are key findings:

- **Daily use of home internet services at various times has increased during the pandemic**. Prior to the Covid-19 pandemic, just over one-half of respondents made daily use of the internet mid-morning or early afternoon, compared with approximately nine in 10 respondents during the pandemic. Four in 10 households have at least three members online during peak usage times during the Covid-19 pandemic.

- **Use of internet services outside of the home has declined significantly during the Covid-19 pandemic.** Use of the internet in key areas decreased significantly when comparing figures pre-Covid and during-Covid, including in work settings (79 percent vs. 56 percent), private businesses (65 percent vs. 27 percent), schools or colleges (38 percent vs. 20 percent), and public buildings (37 percent vs. 18 percent).

- **Engagement in online activities has increased significantly during the Covid-19 pandemic.** Use of the internet for telemedicine or medical appointments (19 percent vs. 75 percent) and for civic engagement (33 percent vs. 74 percent) increased substantially from pre-pandemic to during-pandemic, although some of the use is at a monthly or less than monthly basis. Additionally, 62 percent of respondents use the internet for teleworking on a daily basis, compared with 21 percent of respondents before the pandemic.

- **Satisfaction with internet service aspects has decreased during the pandemic, particularly for speed and reliability of service.** More than one-half of respondents are not at all satisfied (approximately one-third) or are only slightly satisfied (approximately one-fifth) with connection speed and reliability during the pandemic.

- **Many respondents have experienced some challenge with accessing telehealth or an online medical appointment during the pandemic.** Specifically, four in 10 respondents experienced an issue (e.g. having to switch from video to audio only), while three in 10 have not had a medical appointment and another three in 10 did not respond or had no issue.

- **Most households with children have internet access, but it may not be sufficient for some families.** Most respondents disagreed that their children have to do homework or distance learn at various locations outside the home (although 13 percent agreed or strongly agreed that their children cannot complete their homework or cannot distance learn because they do not have access to the internet at home.) However, four in 10 respondents strongly disagreed that their home internet connection is adequate for their or their children's needs for doing homework or attending classes online.

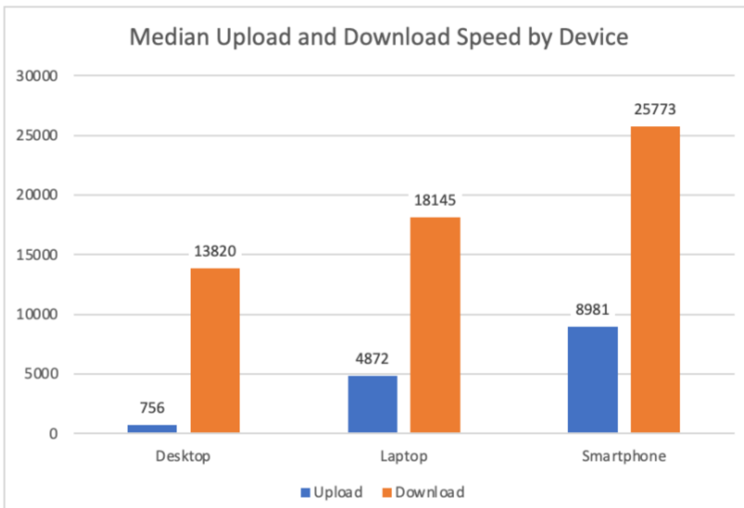
Sixteen percent of all respondents consumed public, educational, or governmental (PEG) TV content during the Covid-19 pandemic. Among those who viewed PEG programming, the most commonly accessed content was broadcasts of municipal functions, cited by 72 percent of respondents. One-half of PEG viewers accessed information about Covid-19.

2.3 Online Speed Survey Findings

In addition to the online residential survey, respondents were asked to submit the results of an online internet speed test. Though only a small portion of online survey respondents completed the speed survey (377), some findings are worth noting.

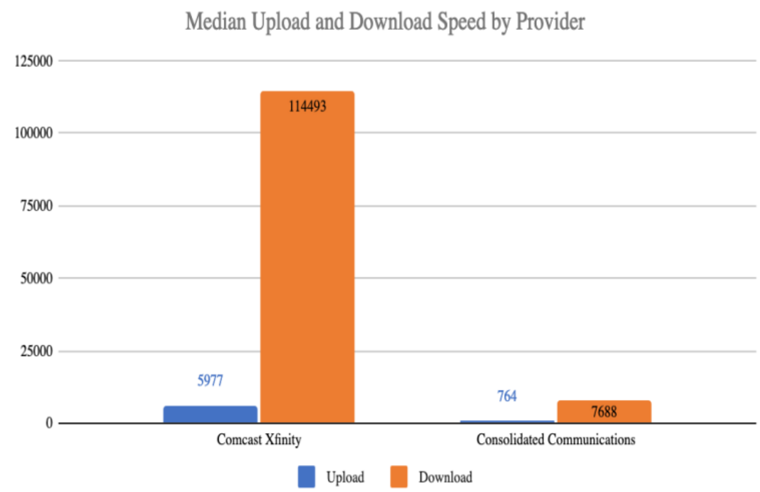
- The fastest average upload and download speeds were recorded on mobile devices. Laptops recorded the mid-range averages, and desktops recorded the slowest speeds. While there is not enough data to differentiate by intersecting elements like service provider, this does indicate that mobile may be providing good service to a portion of Vermonters already, validating that a mobile hot spot program could be used to help Vermonters during the pandemic.

Figure 4: Speed Test Results – Median Upload and Download Speeds



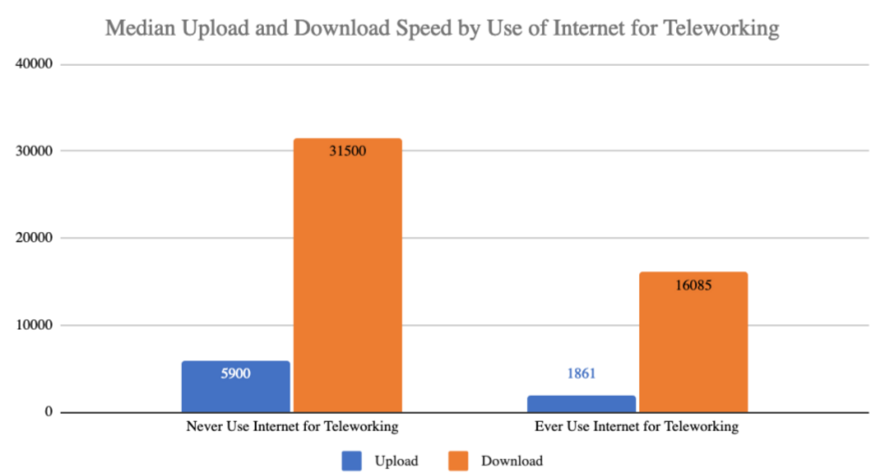
- Comcast and Consolidated Communications were the two most common providers amongst online survey respondents. Amongst those who recorded their speed survey results, Comcast subscribers achieved an average 114 Mbps download and 6 Mbps up; CCI subscribers achieved 7.6 Mbps down and 0.7 Mbps up.

Figure 5: Speed Test Results – Median Upload and Download Speeds by Provider



- There was a slight inverse correlation between internet speeds and participation in teleworking or telemedicine; this suggests unsurprisingly that during the pandemic, teleworking or using telemedicine is often not a choice, and that if you need to engage in those activities, you must do so regardless of the quality of your internet.

Figure 6: Speed Test Results – Median Upload and Download Speeds for Teleworkers



2.4 Phone-Based Residential Survey Methodology

A phone-based residential survey was conducted by Goodwin Simon Strategic Research (GSSR) to capture responses of residents identified as having slow internet connections. GSSR matched 20,000 addresses with slower than 25/3 Mbps to telephone numbers, and secured completed surveys from a random sampling of 411 respondents. Additional results from this survey can be found in Appendix C.

2.5 Key Phone-Based Residential Survey Findings

The telephone survey confirmed and augmented our understanding of many of the trends seen in the online survey. Unsurprisingly, residents say that having faster internet service would improve their ability to engage in activities, including teleworking, using videoconferencing to communicate with friends and family, and to do schoolwork and engage in remote learning. In general, younger, more educated, and wealthier Vermonters are less satisfied with their current internet, and willing to pay more for increased service. Importantly, this survey also found that the majority of people with slower internet still used the internet every day, even for activities like telehealth, remote school, and remote work.

The following are key findings relating to identifying broadband access gaps and the Covid-19 impact on broadband:

2.5.1 Broadband Access Gaps

- Satisfaction with internet connectivity differs based on location type. Vermont residents expressed more satisfaction with their internet at work (76 percent), inside of coffeeshops and other private businesses (74 percent), and inside of schools, colleges/universities (71 percent) than other locations where they spend time.

- There are regional contrasts when it comes to respondents' internet use at home. Vermont residents living in the Northwest region (91 percent) are significantly more likely to report daily internet use than those in the Central region (82 percent). Those living in the Northeast region (8 percent) are significantly more likely than those living in the Northwest region (1 percent) to report they never use the internet at home.

- The vast majority of residents are interested in switching to faster internet if the cost was comparable to what they currently pay. 82 percent of survey respondents stated that they would likely sign up for faster internet if the cost was the same or if the cost were subsidized by the state of Vermont (76 percent). Notably, nearly half (42 percent) would be likely to sign up for faster internet even if the cost was higher than what they currently pay.

- Residents identified that faster internet would improve their engagement with telework and online school. Sixty-nine percent of Vermont residents say that faster internet service would improve their ability to engage in remote learning and doing homework. Seven out of 10 residents (71 percent) say that having faster internet service would increase their ability to telework either a great deal or fair amount.

- 12 percent of respondents had better internet than the PSD data indicated. This deviation indicates that some respondents had better internet deployed to their house between 2019 when the PSD data was assembled, and today. It also indicates an amount of error in the data; however it should be stated that the project team considers this error rate to be low and quality of the PSD's data exceedingly high, considering the dataset in question and difficulty of obtaining accurate address-level broadband data.

2.5.2 Covid-19 Impacts on Broadband Use

- The telephone survey findings suggest that broadband service is highly correlated with being able to adequately engage in large number of important activities during the pandemic. Two thirds (67 percent) of those with broadband strongly agree that their home internet has been adequate for accessing information related to the pandemic, compared to barely half (51 percent) among residents with non-broadband providers. In addition, relatively few residents overall say their home internet has been adequate for attending school online, but the proportion strongly agreeing with that statement is far higher among those with broadband providers (33 percent) than those without (19 percent).

- Nearly six out of ten respondents say their home internet has been adequate for using the internet to work from home. Women were less likely than men to say their home internet is adequate for working from home. Additionally, respondents with broadband service at home (45 percent strongly agree and 34 percent somewhat agree) are significantly more likely to say their home internet is sufficient for working from home than those without broadband service (22 percent strongly agree and 33 percent somewhat agree). Satisfaction decreases in households with more than one person using the internet simultaneously.

- Residents connect to the internet outside of their home on a daily basis. 38 percent of residents use the internet at work, 9 percent at the home of a family member or friend, 7 percent inside a school, college or university, or at other locations on a daily basis. 85 percent of Vermont residents say they have been using the internet at home every day since the pandemic began.

- Despite internet access difficulties, the survey reported an increased usage of telehealth. Seventeen percent of residents used the internet very or somewhat often to speak to a healthcare provider prior to the pandemic, but those engaged in telehealth surged to 37 percent during the pandemic. Increases in telehealth usage was particularly pronounced among younger residents. 17 percent of residents ages 18 to 39 used telehealth before COVID, which increased to 48 percent reporting telehealth usage during the pandemic.

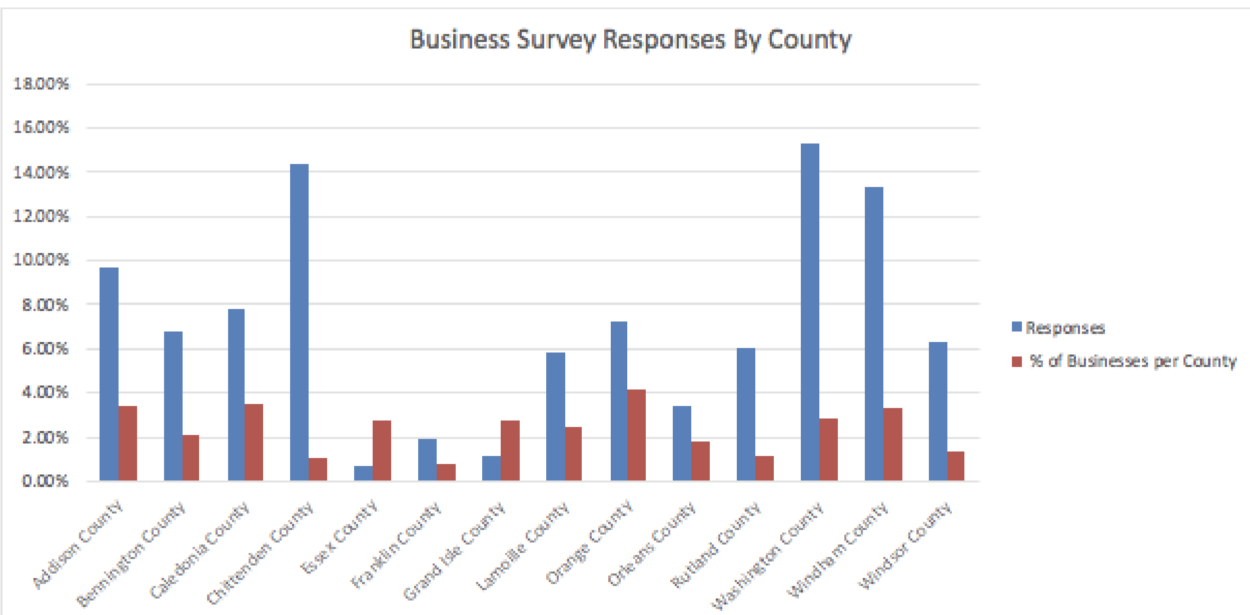
2.6 Business Survey Methodology

The online business survey was promoted through organic and paid promotions, including a press release from the PSD, requests made from town administrators and managers, social media promotion from a range of entities, paid Vermont Business Magazine advertisements, outreach via Regional Planning Commissions and Regional Development Corporations, and other efforts.

The survey received responses from 422 respondents. The survey results are presented in full in Appendix B.

More than two-thirds (70 percent) of respondents owned a business that employed one to four employees; more than 84 percent of the respondents stated they only operated out of one location.

Figure 7: Business Survey Responses by County



2.7 Key Business Survey Findings

Key findings are here presented thematically in two subsections: broadband internet usage and Covid-19 impacts on broadband use.

2.7.1 Broadband Internet Usage

The survey found that communication services are widely used and that there are very few gaps in acquisition of business internet. The following are key findings:

- **Almost all businesses have internet access.** Leading types of primary internet service include cable modem (35 percent), DSL (27 percent), and fiber (15 percent). One-half (50 percent) of businesses do not have a backup or secondary internet connection, and 32 percent have a cellular/mobile connection as their backup or secondary internet connection.

- **The most utilized connectivity services were internet and telephone.** Most (99 percent) reported having internet access at their primary business location, while 75 percent have telephone service, 61 percent have cellular data service, and 54 percent have videoconferencing service.

- **Almost all (99 percent) businesses have personal computers.** Specifically, 65 percent of businesses have one to four computers, 21 percent have five to nine computers, and 13 percent have ten or more computers.

- **Price may be a barrier to purchasing carrier-grade internet service.** Nearly two-thirds of respondents (65 percent) are extremely willing to purchase 1 Gbps internet for $75 per month, but willingness drops considerably at higher price points. Just eight percent of businesses would be extremely willing to pay $250 per month for very fast internet service, but 22 percent would be extremely willing to purchase carrier-grade Ethernet transport and internet access service at this price point. Businesses would be not at all likely to slightly likely to pay more than $250 per month for carrier-grade service.

2.7.2 Covid-19 Impacts on Broadband Use

Businesses are relying more on remote work during the pandemic and at the same time are reporting some inadequacies in their broadband internet service, particularly with speed and reliability of service. The following are key findings:

- **Businesses report their internet service being slower during the pandemic**. Before the Covid-19 pandemic, more than four in 10 respondents (42 percent) thought their internet connection speed was fast enough for their needs, dropping to 35 percent during the Covid-19 pandemic. Only 15 percent thought their internet connection speed was very slow and would like to be connected at much higher speeds before the pandemic, while during the pandemic this number increased to 26 percent.

- **Satisfaction with internet connection speed and reliability has dropped somewhat during the pandemic.** Nearly one-half of businesses (47 percent) were very or extremely satisfied with their internet's speed of connection prior to the pandemic, dropping to 38 percent during the pandemic. Similarly, 47 percent of businesses were very or extremely satisfied with their internet's reliability of connection, dropping to 35 percent during the pandemic.

- **Businesses are making more use of online platforms to sell goods or services or to engage in online marketing and promotions during the pandemic.** The percentage of businesses that exclusively use online platforms to sell goods or services or to engage in online marketing and promotions has increased from six percent before the Covid-19 pandemic to 15 percent during the pandemic.

- **The percent of time that employees work remotely has increased during the pandemic.** Specifically, one-third of employees now telework 75-100 percent of the time, compared with 11 percent of employees before the pandemic.

- **The percentage of employees working remotely is expected to increase after the Covid-19 pandemic.** More than four in 10 (42 percent) businesses said they did not have a work remote option prior to the pandemic, while 29 percent said they do not plan to have one after the pandemic and seven percent are undecided. One-fifth of business plan to have a fully remote work option for some or all employees after the pandemic, compared with 13 percent during the pandemic.

- **Many businesses said that most or all of their employees (75-100 percent) experienced issues due to inadequate broadband service during the pandemic**. For example, one-third of businesses said that all or most of their employees experienced delays in uploading or downloading content. More than one-half of businesses said inadequate broadband service is a very significant or extremely significant issue.

- **Many businesses plan to take some action in the next 12 months related to broadband internet service and computers.** Most businesses expect to obtain higher-quality broadband service (57 percent) and to enhance an existing website or online sales effort (56 percent) in the next 12 months. Fewer respondents expect to take other actions; however, 15 percent plan to help employees obtain internet access at home and 11 percent plan to move to an area with better broadband service.

3 Pre-Covid Use and Expected Future Requirements for Telecommunications Services in Vermont

In every major use category we analyzed—including telehealth, telework, remote learning, and civic participation—we found that Covid-19 led to an increased demand for and reliance on telecommunications services in the State. Looking ahead, we anticipate those trendlines to continue; while remote learning and telework levels, in particular, will likely decline in a post-Covid-19 world, our analysis indicates broadband requirements in Vermont will be higher after the pandemic than they were before.

3.1 Healthcare and Telehealth in Vermont

Telehealth usage has dramatically increased in the State of Vermont due to the Covid-19 pandemic, and with that, more Vermonters are reporting challenges with connectivity related to healthcare appointments. According to our online residential survey, 75 percent of respondents have used telehealth services during the pandemic, and four in 10 experienced technical difficulties or challenges related to connectivity.

The growth in telehealth usage is a direct result of the pandemic and the desire to avoid in-person hospital visits; however, it could not have happened were it not for a range of State and federal regulatory waivers and changes, including the waiver of platforms from being HIPAA compliant;[13] the expansion of telehealth by the U.S. Centers for Medicare & Medicaid Services (CMS) through section 1135 waivers that allow a range of medical visits to be reimbursed by Medicare;[14] and the temporary allowance of audio-only telehealth appointments to be reimbursed by Medicaid at the State level.[15,16]

Though it is unclear whether these regulatory changes will be made permanent (thus enabling continued heightened use of telehealth) or allowed to expire, the use of telehealth has provided a range of benefits, including the reduction of travel burdens and miles driven, the elimination of wait times (especially in indoor, shared spaces), and a reduction in missed appointments, especially for certain specialties.

3.1.1 Telehealth Appointment Trends

UVM Health Network saw eConsult appointments increase from an average of 300 appointments weekly to an average of 3,400 appointments as a result of the pandemic. UVM Health Network

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13 https://www.hhs.gov/about/news/2020/03/17/ocr-announces-notification-of-enforcement-discretion-for-telehealth-remote-communications-during-the-covid-19.html

14 https://www.cms.gov/newsroom/fact-sheets/medicare-telemedicine-health-care-provider-fact-sheet

15 https://dvha.vermont.gov/sites/dvha/files/documents/News/DVHA%20Telemedicine%20%26%20Emergency%20Telephonic%20Coverage_Dental%20Providers%2004.10.2020.pdf

16 https://dfr.vermont.gov/sites/finreg/files/doc_library/dfr-memo-covid19-telehealth-guidance.pdf

reached a peak in April, estimating around 7,000 eConsults in a single week. Pre-pandemic, their annual goal had been to conduct 3,000 eConsults within the year.

Community-based Federally Qualified Health Centers (FQHC) serve about a third of the Vermont population and saw a spike in telehealth visits in April. As patients have been able to return for in-person care, the number of telehealth appointments has declined to about 10 percent of weekly appointments. However, the percentage of telehealth delivered as video visits as compared to telephone visits has increased—implying that more residents are relying on their home broadband connections or smartphones for telehealth.

Dartmouth-Hitchcock Medical Center reported that pre-Covid, offices were delivering about 10 outpatient video visits per day, split about 50/50 between patients at home and patients at another clinical facility closer to their home. In mid-April, DHMC hit a high of 2,600 telehealth appointments per day, including both video and telephone appointments.

After an initial spike in telehealth usage in March and April, healthcare providers saw a slow decline of telehealth appointments, especially as patients returned to in-office appointments for in-person needs like flu shots, immunizations, and testing that was delayed from earlier in the year. Nationally, the trend is similar, with telemedicine visits averaging around 6 percent of the total weekly visits.[17] However, rising case numbers in Vermont may cause telehealth usage to rise again—as residents who have sufficient telecommunications connectivity request telehealth visits, and as healthcare providers require virtual appointments whenever feasible as a way to limit exposure.

As telehealth appointments have increased in the last six months, providers have seen significant variability in telehealth usage by specialty. Nationally, behavioral health telehealth usage remains high as the pandemic continues, whereas surgical specialties have little to no usage of telemedicine. Additionally, telehealth has been adopted more widely in specific areas of care management, particularly in chronic care management and mental health services. OneCare Vermont reported that in a survey it conducted, Vermont healthcare providers responded that the top four telehealth services they plan to continue post-pandemic are chronic management, mental health services, medication management, and non-urgent acute visits.

Though advocates do not anticipate telehealth increasing the number of patients that can be served in a given amount of time because practices' implementation is still at the stage where it

[17] "The percentage of all visits via telemedicine visits is slowly declining from its April peak. But it continues to be well above the pre pandemic baseline of very few telemedicine visits." Ateev Mehrotra et al., ((Commonwealth Fund, Oct. 2020)

is taking providers as long or longer to see each patient with the new workflows, practices are seeing a reduction of the number of no-shows, particularly in mental health.

Lastly, it is important to note that FQHCs found that there is not a correlation between telehealth usage with a patient's broadband coverage or type (though clearly a patient requires reliable and sufficient broadband access to be able to consider a telehealth visit). Telehealth usage is influenced by many factors related to the provider, including:

- Practice culture – incorporating telehealth workflows requires investment in new trainings
- Grants and funding – practices that have received funding for telehealth equipment are more likely to see higher usage of telehealth appointments
- Buildings and facilities – providers that have access to buildings large enough to continue seeing patients in person while taking Covid-19 precautions may be less reliant on telehealth options
- Reimbursement – practices are reluctant to use telehealth until long-term reimbursement decisions are made

3.1.2 Barriers to More Effective Telehealth Engagement

Though audio-only telehealth visits are widely used, lack of broadband access is cited as a major barrier to effective telehealth appointments in the State. According to a OneCare Vermont survey, over 75 percent of providers reported insufficient broadband access as a barrier for patients to participate in telehealth services. Providers routinely experience appointments where they are required to switch to audio-only to complete providing care. Though audio-only appointments may make telehealth services available to more people, some providers, like DHMC, believe that video-enabled telehealth appointments provide for better outcomes.

UVM Health Network provided mobile hotspots to senior living centers to allow for telehealth appointments where broadband connectivity was unable to meet remote care needs. By providing mobile hotspots to boost connectivity, UVM also eliminated unnecessary exposure for both patients and providers. Another pilot to provide short-term connectivity for telehealth needs was facilitated by the Vermont Legislature through the Department of Health for the Covid-Response Telehealth Connectivity Program. The program was administered by the Vermont Program for Quality in Health Care, Inc. and ran a pilot to provide 1000 tablets and 350 Wi-Fi boosters for patients prioritizing high risks and medically underserved areas across the State. The pilot was not able to meet the demand of all requested devices due to financial constraints and a limited timeline. Further, VPQHC identified some applicants as ineligible for the pilot because of the practices' limited access to broadband infrastructure.

In addition to a lack of broadband access, technical support and digital literacy were also a large barrier to effective telehealth. In March 2020, OneCare Vermont and Vermont Medical Society each completed a survey of Vermont providers to assess the transition to telehealth where both surveys received responses indicating that appointments take longer due to technical issues from patient/provider knowledge and broadband issues.[18] 55.7 percent of providers who took their survey state "Lack of staff time/ability to coach patients" as a barrier for providing telehealth service.[19] Nearly half of the respondents in the OneCare Vermont survey stated that they had appointed a dedicated employee in their office to educate and assist patients in telemedicine. Relatedly, we heard from several interviewees that clinical teams are spending too much time on technical issues with the patients, shortening appointment time for health related discussion and limiting the amount of patients providers are able to serve.

In some cases, Covid-19 has also created the need for practices to bring on additional staff. For example, UVM Health Network increased staff who participated in telehealth delivery from 50 providers to 1,600 since March. This increase in staffing clearly indicates the impact of the pandemic on demand for telehealth, and implies a likely future baseline of telehealth demand that exceeds the pre-Covid levels.

A lack of widespread residential broadband also impacts medical staff and healthcare providers. A key concern of providers in the State is that when providers are exposed or test positive for Covid-19, they are required to quarantine for 10 days, which can leave offices short-staffed. The potential for a Covid surge in the winter has heightened the fear that hospital resiliency is thus limited to some degree by lack of universal residential broadband access. By the same token, if hospitals themselves do not have systems in place to perform telehealth appointments, they are at a disadvantage during the pandemic, and potentially afterwards as telehealth takes on new prominence in our healthcare system.

The field of telehealth is evolving quickly. Data and metrics about effectiveness are still being studied, and the techniques needed to make appointments as efficient as possible are still being developed. Given the short transition timeline due to the urgency of the pandemic, telehealth services have worked considerably well for Vermonters who have strong-enough broadband service to access it and available devices to use. The health, safety, and environmental benefits to the State have been demonstrated, and more Vermonters are using telehealth than ever before—but, the benefits of telehealth (now and in the future) can only truly be captured by a connected, digitally trained population.

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[18] Vermont Medical Society Survey. OneCare Vermont Survey summary, March 2020

[19] OneCare Vermont survey summary, 325 responses, over 55% from the Burlington Health Service Area, March 2020.

3.2 Telework

The shift to telework is one of the most pronounced impacts of the pandemic, and will have a lasting impact on how large segments of the population work even after the recovery. Reliable and sufficient broadband access has been critical to Vermonters' ability to telework during the pandemic and will continue to be required post-Covid for those whose jobs can be performed remotely.

LinkedIn members shifted from self reporting 10 percent worked remotely in February of 2020 to 60 percent working remotely in May.[20] Many large companies (e.g., Zillow, Twitter) have declared that distributed work will be made permanent and the applications market has exploded with tools to facilitate distributed collaboration.

However, the ability to move one's job online is not universal. Most jobs in tourism, manufacturing, agriculture, and construction need to be done in person. As in most rural parts of the country, Vermont's employment mix makes it particularly susceptible to the impacts of pandemic-related shutdowns. Vermont's unemployment soared in the spring of 2020 (though there has been a rebound over the past six months).

Part of the reason the unemployment rate is not currently higher is that Vermont appears to have also benefited from the move to remote work, with evidence of an influx of people seeking refuge from cities (on a temporary or part-time basis) who brought their jobs with them. This trend is dependent on the availability of residential broadband services. The Agency of Commerce and Community Development cited research from UVM that anticipates that of the new arrivals in Vermont, many of whom are currently working remotely, one-third will stay permanently (and will presumably continue to require broadband service), one-third will leave after the pandemic is over, and another third are undecided.[21]

Vermonters also saw a significant shift to online work. Our online survey showed that 62 percent of respondents use the internet for teleworking on a daily basis, compared with 21 percent of respondents stating they teleworked on a daily basis before the pandemic. This shows a huge spike in demand for broadband as a result of Covid—a spike that will continue to the extent that residents continue to telework post-Covid. Respondents to the business survey also saw significant shifts in their employees working from home and the phone survey found that a large number of people who are not deemed served are attempting to work from home with deeply inadequate connection speeds or needing to find publicly available connectivity.

[20] Interview with Allen Blue, co-founder of LinkedIn.

[21] Interview, Ken Jones, Agency of Commerce and Community Development, conducted October 16, 2020.

Figure 8: How Often Used the Internet for Various Activities Before Covid-19 Pandemic

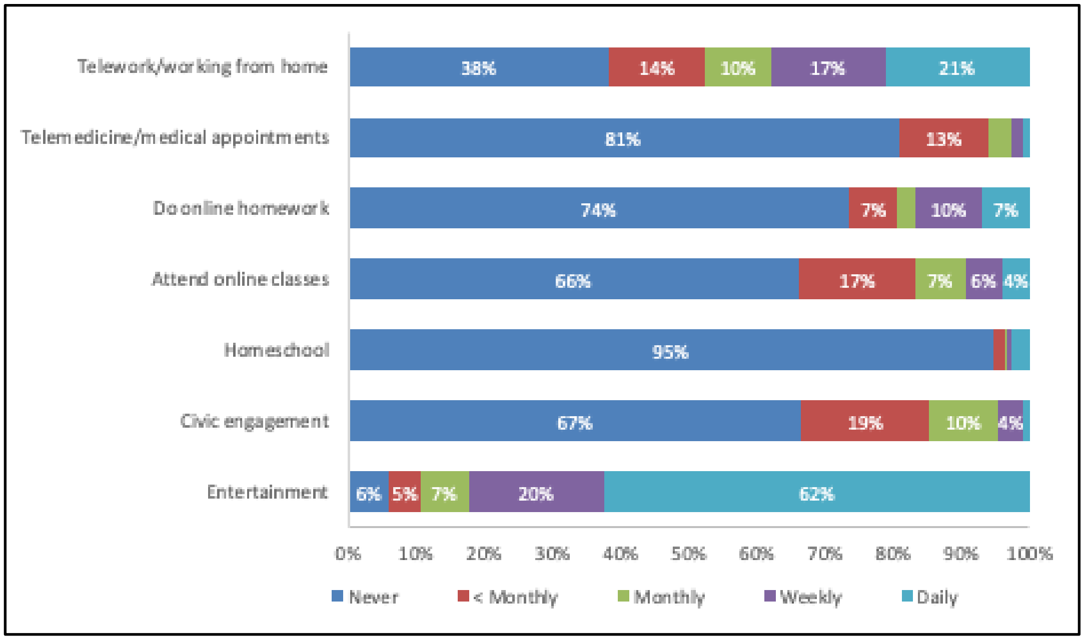
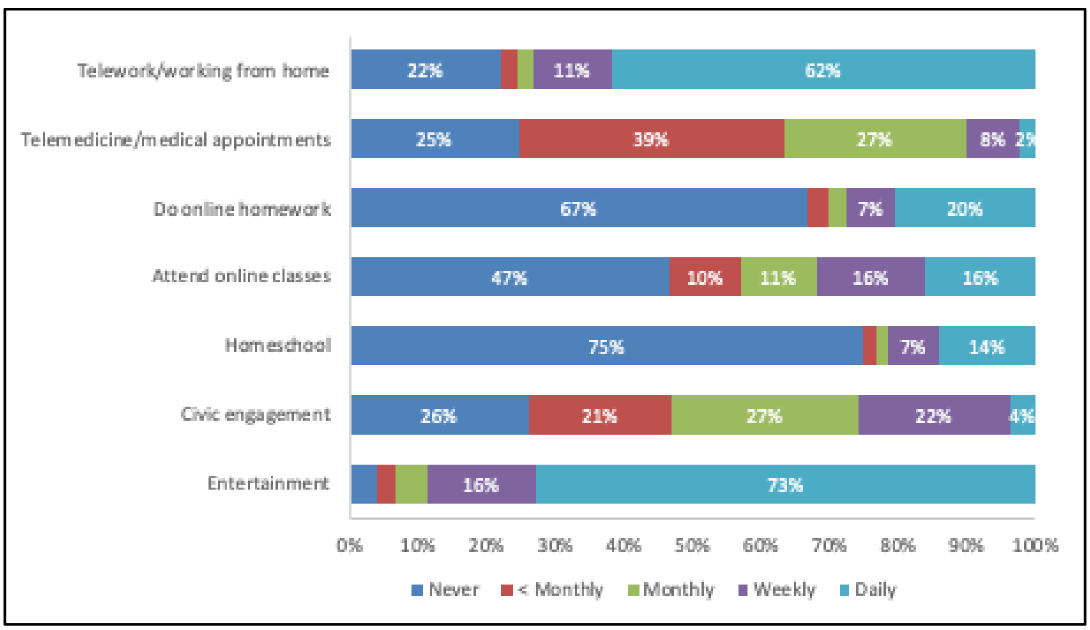


Figure 9: How Often Used the Internet for Various Activities During Covid-19 Pandemic



Understandably, this movement to remote work has put unprecedented value on access to residential broadband—and on the quality of that service. The online residential survey results suggest deepening dissatisfaction with broadband speeds as more people attempt to work from home. Not only does this reinforce the need for remote workers who are struggling to have passable connectivity as soon as possible, it reinforces the need for Vermont to move to a 100/100 statewide solution.

Vermonters have responded to the remote work mandates as directed by the governor—and employers have been working hard to develop new mechanisms for continuing operations in a remote work environment. Clearly these efforts have been thwarted by inadequate residential broadband speeds in some areas, even from those who are considered served. The move to remote work has the opportunity to benefit Vermont as more people from out of state seek a rural lifestyle and Vermont's other benefits, yet regions with poor broadband connectivity will be left out of this potential migration.

3.3 Remote Learning

Clearly, connectivity challenges are continuing to present challenges for educators despite best efforts to adjust to the realities of the pandemic. Disadvantaged students whose parents are less likely to be able to afford broadband connections and those without broadband infrastructure are now at an even greater risk of falling behind. Some school districts have clearly made attempts at accommodating many of their students, but unlike other states, Vermont has not taken a comprehensive statewide approach to address the problem.

Superintendents who responded to a survey (described in detail below) overwhelmingly expressed that expanded residential high-speed internet is needed to facilitate online learning. As one superintendent explained, "Connectivity is the biggest challenge for us as a district; we are one to one with devices, but connectivity is the challenge."

Because of the pandemic, children across the State spent the fall 2020 semester—and most of the earlier spring semester, after about mid-March—in a learning environment unlike any other. The operations of Vermont schools are decided on a school-by-school basis, and the majority have taken "hybrid" approaches with some in-person teaching and some remote learning, to minimize the Covid-19 transmission risks to children, teachers, and families. This environment is challenging, and though schools and teachers are adapting curricula and teaching strategies to provide the best learning environment they can, many students are struggling with remote learning due to inadequate residential broadband internet, especially because online learning often uses broadband-intensive applications like Zoom.

When interviewed, representatives of the Vermont Agency of Education (AOE) emphasized that it is clear that many families are struggling with broadband, but it is not always apparent whether the underlying issue is affordability or access to infrastructure. Nearly every town has some areas that are served and some unserved with broadband, and there are low-income families in all Vermont communities.

The AOE also reported that the shift to online learning has caused a large increase in workload for school district employees. Technology directors are spending time helping students navigate computer and other technical issues, teachers are having to create multiple lesson plans to be taught online and in-person, and administrators have been preparing for a potential “second wave” that would force schools to operate entirely online. The AOE also reported that the Vermont Virtual Learning Cooperative, which allows students to take online classes from other schools, now supports a record 11,000 students—all of whom depend on broadband connections.[22]

Though some ISPs with close relationships to the community—like Waitsfield Champlain Valley Telecom—have worked with schools to connect all students who need broadband, other school districts have been cautious about any sharing of student data, and the AOE has echoed concerns surrounding privacy of student data given the quick transition to online learning. An additional privacy concern is that public Wi-Fi networks, by their nature, are less secure; a number of students without broadband at home are using these networks to access classes and homework.

The project team sent a survey to 52 superintendents whose email addresses were available online to determine how school districts are adjusting to the Covid-19 pandemic and what gaps still remain; 32 superintendents from 11 counties completed the survey, representing over half of superintendents (there are 54 supervisory unions in the State). Complete results are presented in Appendix D.

Importantly, it was clear that schools were working hard to ensure students had access to broadband by expanding Wi-Fi coverage in school parking lots, distributing laptops and hotspots, and working with the Department of Public Service to identify households that cannot access broadband infrastructure. Among the survey findings are the following:

- 94 percent of superintendents said their school districts surveyed their students to determine which students have access to broadband at home.
- 78 percent of superintendents said their school district assisted the State of Vermont in identifying households with K-12 students without access to broadband for the Emergency Connectivity Initiative and Get Vermonters Connected Now Initiative; the remaining superintendents were “not sure” if their district participated.
- Access to internet-connected devices is less of a concern than broadband access; 94 percent of school districts are providing equipment, such as Chromebooks to students;

[22] https://www.vtvlc.org/

the remaining superintendents were "not sure" if their school district provided equipment.

- It is less common for schools to provide students equipment to connect to the internet, such as portable Wi-Fi hotspots, with 53 percent of superintendents reporting their district did so. Portable hotspots rely on cellular service, which is poor in much of the State.

- 75 percent of superintendents said their district added equipment to strengthen Wi-Fi signal in school parking lots.

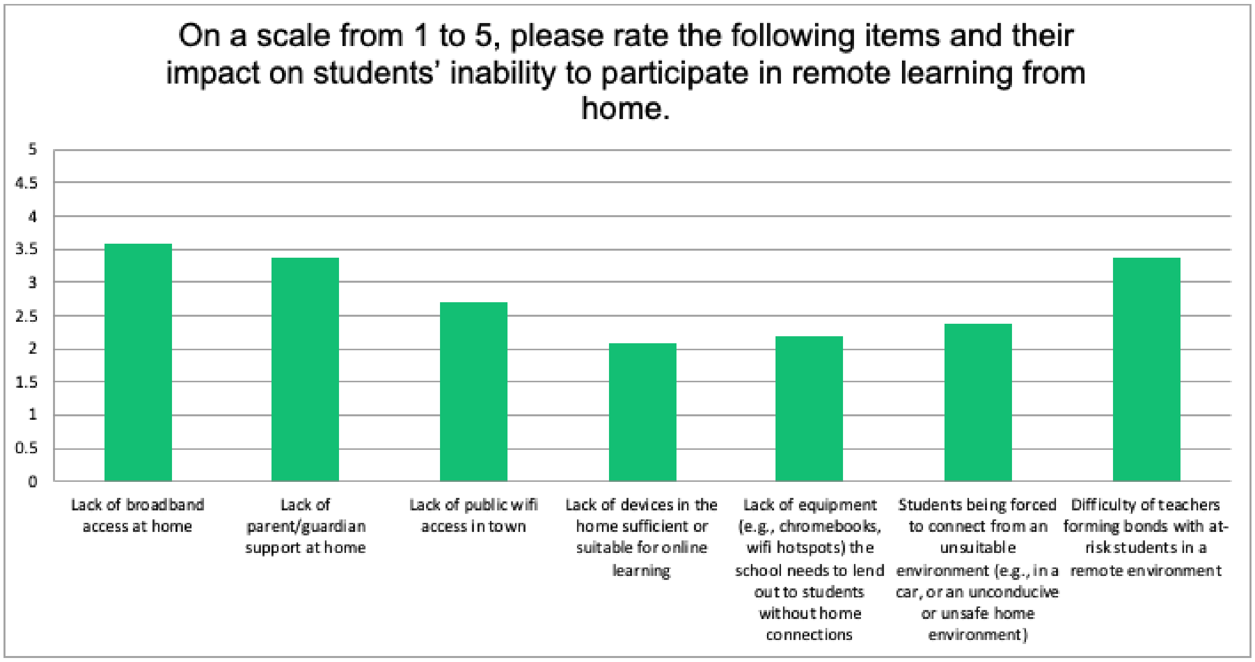
- 50 percent of superintendents said that their district either participated in a subsidy program or promoted a program with an Internet Service Provider to bring low-cost internet to low-income families.

That being said, connectivity issues were far from solved by what schools were able to do, and lack of broadband access among some students had a major impact on school operations throughout the year:

- 71 percent of superintendents said broadband access for students and teachers was a "very important" factor when making plans for this school year.

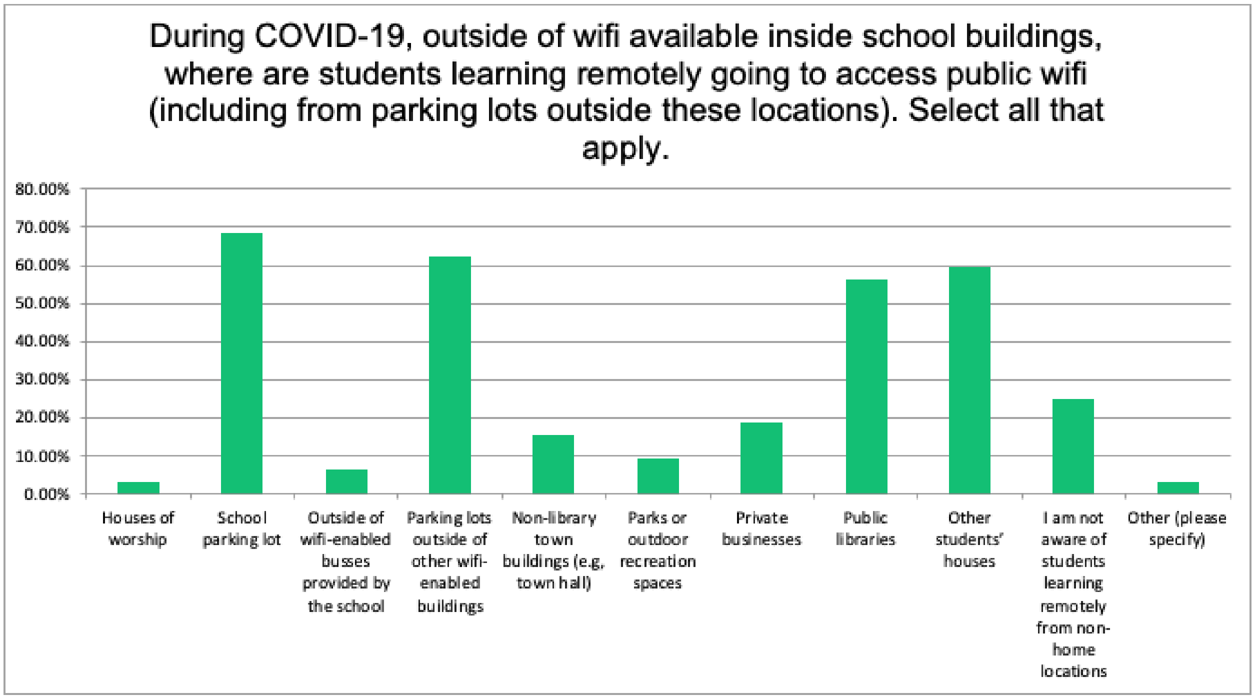
- The biggest barriers to online learning were a lack of broadband access at home, a lack of parent/guardian support at home, and difficulty of teachers forming bonds with at-risk students in a remote environment.

Figure 10: Importance of Broadband for Remote Learning



- 56 percent of superintendents said 75 percent of students or fewer had access to broadband at home
- 75 percent of superintendents said students were completing online work at locations other than home. In particular, students were connecting to the internet in school parking lots, other parking lots with Wi-Fi access, and at other students' homes.

Figure 11: Public Wi-Fi Has Been Critical for Remote Learning During Covid-19



- Teachers also struggle with access to adequate broadband: 81 percent of superintendents said teachers had difficulties with low video quality due to poor internet connections and 68 percent said that teachers had difficulty accessing online tools due to a lack of broadband.

- Absenteeism is a concern for many schools; 44 percent of superintendents said absenteeism for online students had slightly or significantly increased compared to a normal semester. 40 percent said absenteeism stayed about the same, and 16 percent said it decreased.

- Teachers are using applications that require faster upload and download speeds. Before the Covid-19 pandemic, the use of video conferencing software was not widespread: No superintendents reported that 75 percent or more teachers were using video conferencing software (Zoom, Microsoft Teams, etc.) for teaching. In stark contrast, during the Covid-19 pandemic, 84 percent of superintendents reported 75 percent of teachers or more using video conferencing software.

- 75 percent of superintendents reported increased challenges addressing health and mental health needs of students. Of superintendents who answered yes, 75 percent said lack of sufficient broadband has exacerbated difficulties addressing health issues.

- Superintendents are reasonably confident that they could pivot to online-only learning. On a scale of 1 – 5, where 5 is extremely confident, 71 percent of superintendents rated their readiness to pivot as a 4 or 5.

- Superintendents noted some groups are particularly at risk of falling behind: rural students, students of color, students at risk of dropping out of school, students living in poverty, students who need access to reduced-price lunches, students with disabilities, young children, students without adult support at home, English language learners, and students without internet access.

Inadequate cellular service is also an issue, as mobile hotspots rely on cellular service; one superintendent reported that families in remote areas “can all reach enough Wi-Fi to operate a cell phone, [but] they do not all have sufficient connection to run Zoom for multiple hours a day.” Sentiments like this reinforce the need for something more than just mobile hotspots—like signal-boosting equipment—for students with poor cell service.

3.4 Civic Participation

During the Covid-19 pandemic, access to broadband internet has become necessary for Vermonters to fully engage with local governance, and equally so for local leaders to engage with constituents as selectboard, school board, and other public meetings transitioned to being held online. Telecommunications services—for both residents and their local leaders—has been essential during the pandemic.

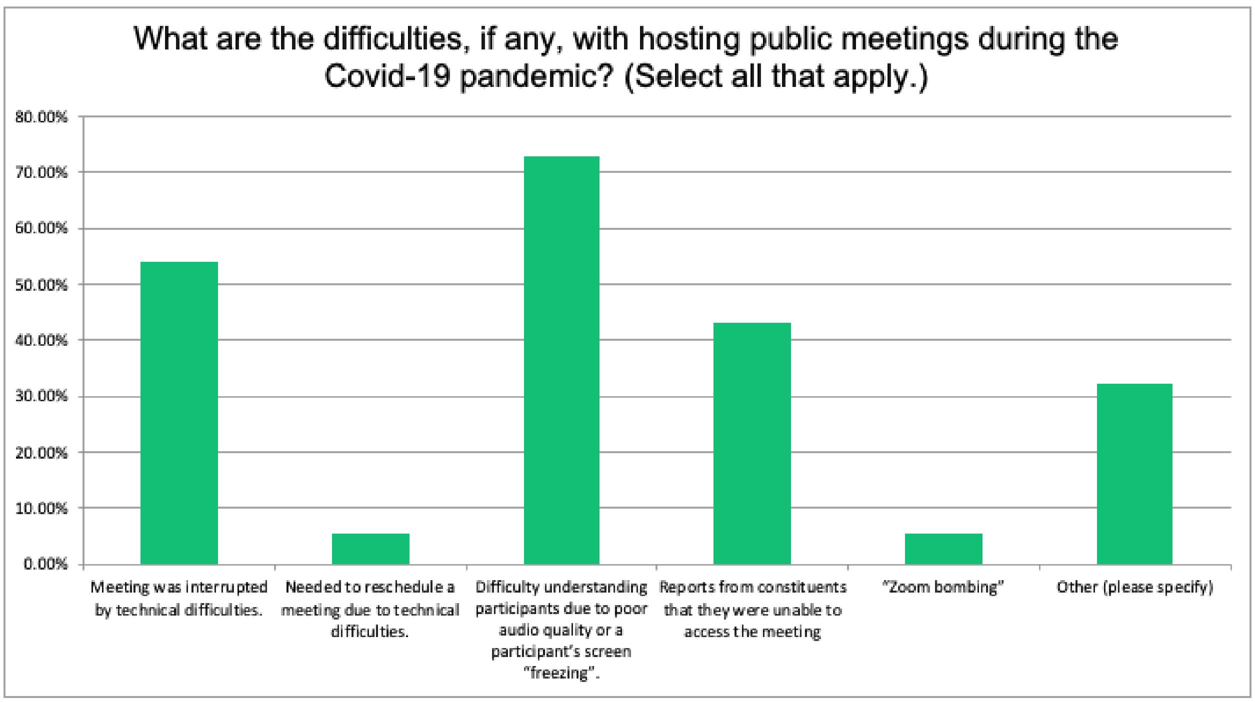
The project team sent a town administrator survey to 205 town managers, mayors, administrators, selectboard chairs, and other local officials across the State; email addresses were provided by the Vermont League of City and Towns. A total of 41 municipal leaders located in 13 counties completed the survey. (As of the writing of this report, the project team has decided to keep the survey open to gather additional responses; the Vermont League of Cities and Towns has also sent a second email asking local leaders to complete the survey. Results to date are presented in Appendix F.)

Vermont is a very civically engaged state, and widespread participatory democracy has served the State well for years, ensuring good faith and cooperative and collaborative governance of our cities, towns, and state. Indeed, broadband availability during the pandemic seems to have enabled even more civic participation than before. Whereas 33 percent of survey respondents reported participating in civic engagement at least monthly before the pandemic, over 50 percent report participating now. With the fast approach of Town Meeting Day next year, it is important to note that just as a lack of connection is a barrier to equity for schoolchildren participating in distance learning, it also can present an equity issue for Vermonters participating in local government.

The survey's initial findings include the following:

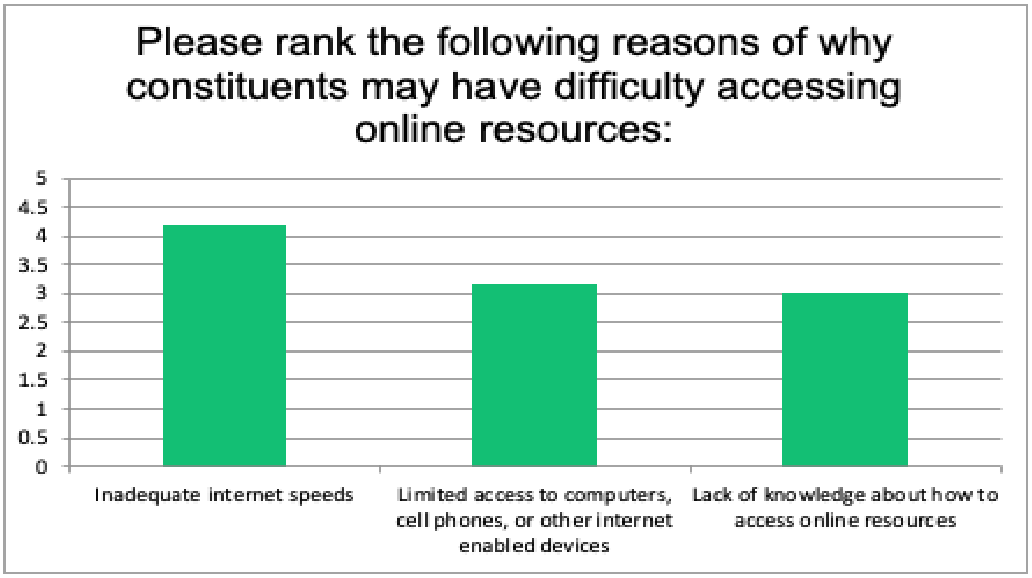
- While no towns utilized video conferencing software for public meetings before the pandemic, 84 percent of towns are doing so during the pandemic. The percentage of towns utilizing telephone conferencing for public meetings increased from 20 percent to 73 percent.
- 36 percent of towns have held in-person meetings during the pandemic.
- Both before and during the pandemic, 34 percent of towns broadcast public meetings on Public, Educational and Government Access Television.
- Hosting public meetings online was challenging, with 73 percent of respondents reporting difficulty understanding participants due to poor audio quality or a participant's screen "freezing." 43 percent reported that some constituents have had trouble accessing online meetings.

Figure 12: Challenges with Hosting Virtual Public Meetings



- 27 percent of respondents reported that attendance at public meetings increased during the Covid-19 pandemic, 15 percent reported decreased attendance, and the remaining respondents said attendance stayed about the same.
- Inadequate internet speeds was listed as the biggest reason constituents were not able to access online resources.

Figure 13: Importance of Broadband for Accessing Resources



- 37 percent of respondents said their towns have started planning for an online town meeting this spring. When asked to rate their confidence in hosting an online spring meeting on a scale of 1 to 5, where 5 is "extremely confident," only 15 percent of respondents rated themselves a 4 or a 5.
- To ensure residents can participate in public meetings, the vast majority of respondents stated that increased high-speed internet access would be most helpful. Other respondents also asked the State to provide guidance as to what the best practices would be for online municipal meetings, and how-to videos and technical assistance were also requested.

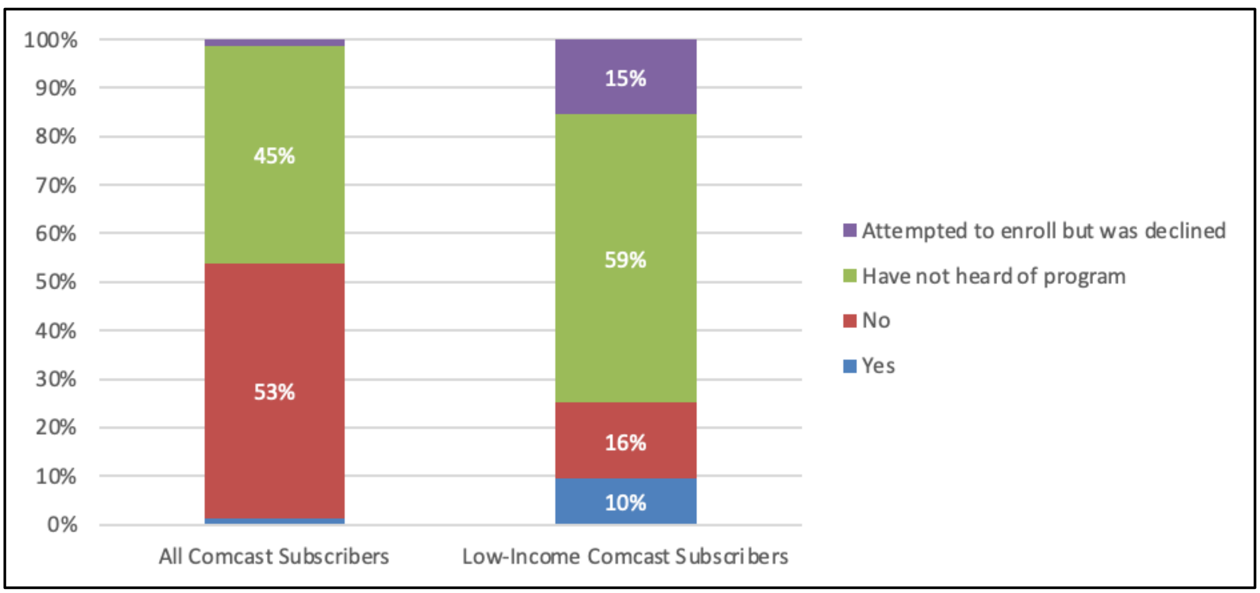
4 Status, Coverage, and Capacity of Telecommunications Networks and Services

4.1 Status Reported by Residents

Online residential survey respondents were only moderately satisfied with aspects of their internet service prior to the Covid-19 pandemic, and satisfaction has dropped somewhat during the pandemic. Specifically, more than one-half of respondents are not at all satisfied or only slightly satisfied with their connection speeds and service reliability during the pandemic. Just 29 percent are very or extremely satisfied with these service aspects, compared with four in 10 before the pandemic. Respondents are also less satisfied with price compared with other service aspects (which is typical in satisfaction surveys).

Although most ISPs are offering low-cost services for low-income residents, the survey found there is a major gap in participation between those who are eligible and those who actually use the services. Comcast's Internet Essentials, for example, was used by only 2 percent of Comcast customers in Vermont who took our online survey, and used by only 10 percent of the low-income Comcast customers. More low-income Comcast customers were declined access to this program than are currently enrolled; a full 15 percent of low-income Comcast customers who tried to sign up for Internet Essentials were declined.

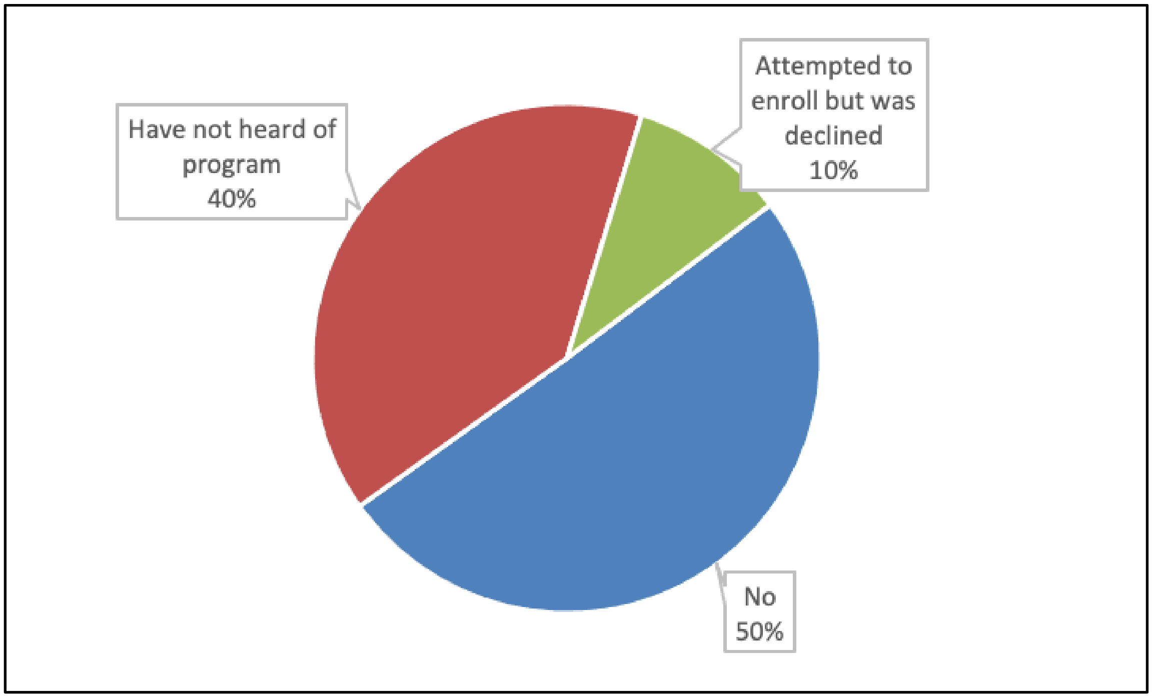
Figure 14: Vermonters' Use of Comcast's Low-Cost Internet Essentials Service



The online survey suggests that usage of Charter Spectrum's program is even lower. Compared to Comcast, Charter Spectrum's program is barely promoted and difficult to find on their website;

likely impacting usage and familiarity with the program. The following chart shows online survey responses from low-income Charter Spectrum customers, when asked if they enroll in Spectrum Internet Assist.

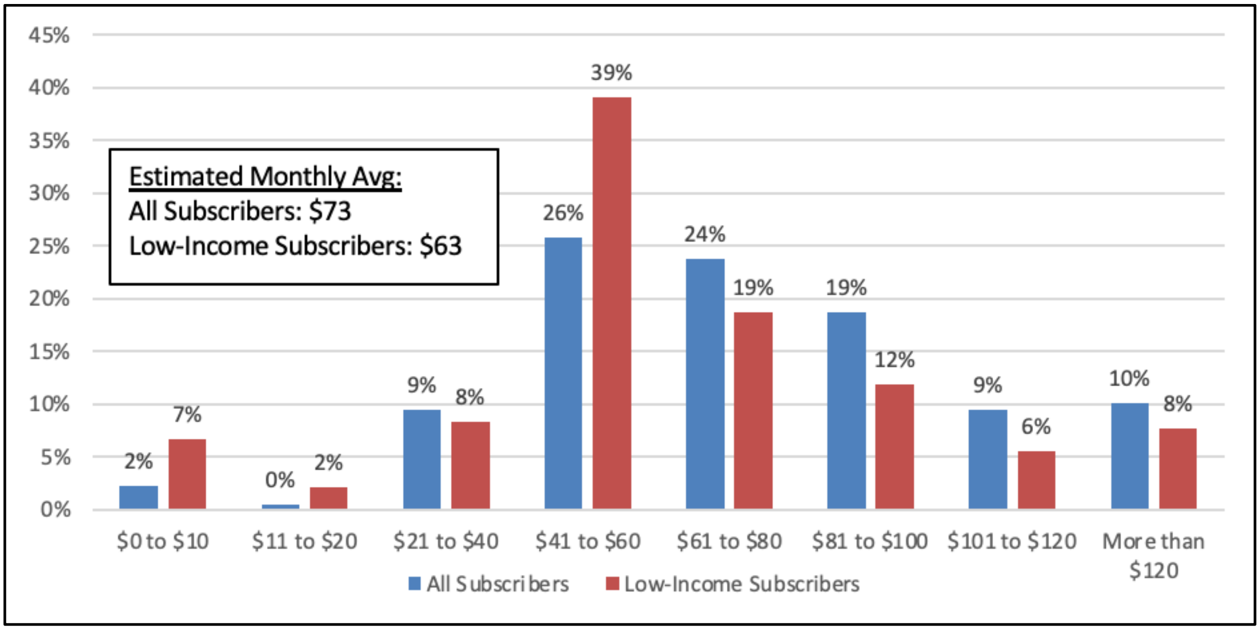
Figure 15: Vermonter's Use of Charter Spectrum's Low-Cost Service



Charter Spectrum also reported that their Stay Connected program, which allows schools to bulk-purchase internet access for educators and students' homes, was not utilized in the State.

Survey responses indicate that low-income internet subscribers are paying only $10 less per month, on average, than non-low-income subscribers.

Figure 16: Monthly Fees for Low-Income Subscribers Compared to All Subscribers



These survey results also clearly indicate a lack of usage of existing low-income programs. Providers' prices for service in Vermont, as well as a comparison to prices in other states, are in Appendix G.

4.1.1 Overview of Service Based on State Broadband Mapping and Testing

The State Department of Public Service has compiled a rich set of data providing the level of wired broadband service available at each address in the State, as well as wireless service areas based on drive tests on major State roads. The map and the accompanying drive tests and resources are among the most comprehensive sets of information compiled by any state and provide a starting point to assessing and addressing the State's broadband challenges. Unlike databases produced by the Federal Communications Commission and others that work on the Census Block level, and erroneously describe entire areas as "served," when only one or a few addresses are claimed to be served by a service provider, the State's data and accompanying materials provide the wired broadband service at each address from the State's E-911 database. The data fit the existing service into categories of 100/100 Mbps service, 25/3 Mbps service, 10/1 Mbps, 4/1 Mbps and underserved. The broadband map also provides the opportunity to comment on the service at each address, to correct information and to provide more background about other aspects of the broadband service or needs at the address.

Because the wireless drive test data was taken in 2018 and was measured only on major roads, the information from those tests is more impressionistic. Yet it is still a useful complement to the wired data and, accompanied by further information from subsequent drive tests in various parts of the State as well as further analysis based on tower locations, provides a starting point for understanding both wired and wireless coverage.

Based on the State's data, approximately 70,000 premises, or about 20 percent of the total, do not receive at least 25 Mbps download and 3 Mbps upload speeds—the current definition of broadband by the FCC.

Households and businesses not receiving 25/3 service will likely have challenges with stable and consistent access to the following applications, especially when a home's broadband connection is used by more than one person at a time:

- Interactive video as part of Zoom, Teams, or other tools commonly used for distance learning
- Access to data resources such as maps and stored videos (YouTube, etc.)
- Access to resources in a work or learning environment based in the cloud
- Sharing and backup of files in a storage and application environment such as Google Docs, Dropbox or OneDrive
- Medical appointments including video, medical charts, and rudimentary testing

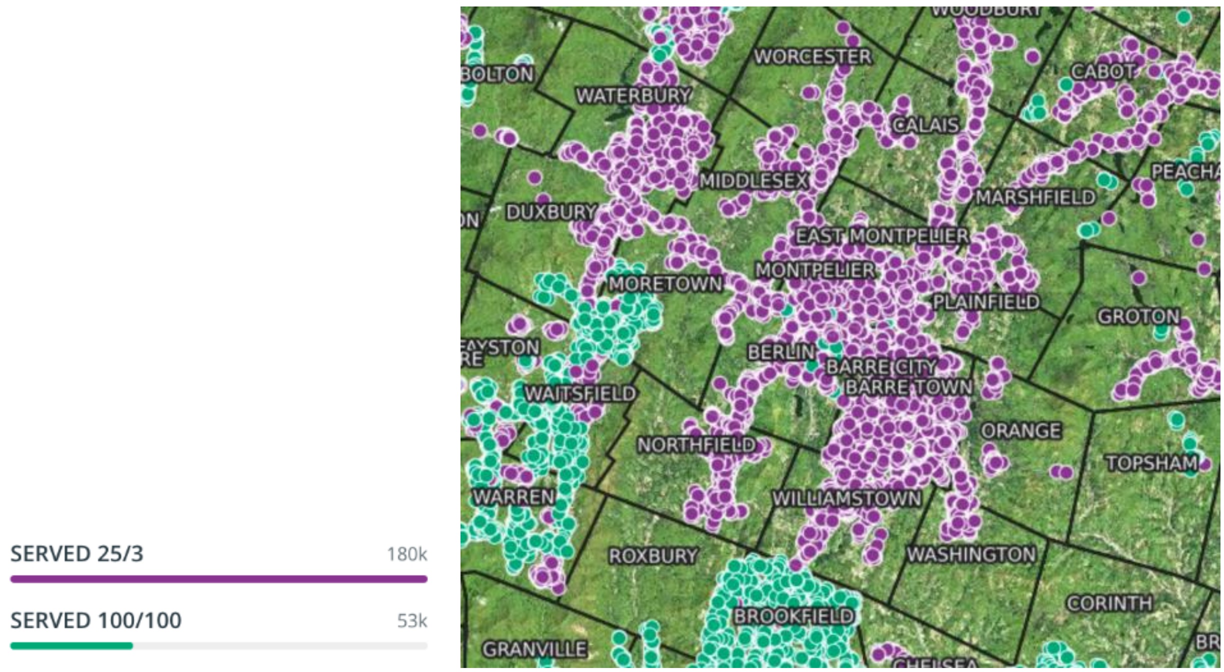
Moreover, households and businesses who have bandwidth-limited or metered services (e.g. "up to 20 GB per month"), even if their service is adequate for these applications, will need to be extremely sparing in their use, needing to ration bandwidth between work needs, classroom learning by children, and entertainment. Even wireless and satellite services which claim to be unlimited often have fine print terms enabling the provider to "deprioritize" users who hit their bandwidth caps, resulting in inability to effectively use video resources until the following month billing period, and/or may pay significant overage charges.

Since the State's broadband data were compiled in 2019, there have been expansions of service by some providers (e.g., ECFiber, Waitsfield Champlain Valley Telecom, and others) and the funding of deployment to approximately 8,700 addresses via the Emergency Connectivity Initiative. Though we do not have data on where providers have built in planned expansions, we have subtracted the premises served by the Emergency Connectivity Initiative to identify 62,000 premises without access to wireline broadband over 25/3 to be at immediate connectivity risk during the pandemic, and we identify strategies targeted at these homes and businesses.

The 62,000 premises that do not receive 25/3 are distributed throughout the State, which poses significant and varied challenges for both short-term and long-term connectivity goals. However, there are some clear trends. Those served by 25/3 or 100/100 tend to be in the cities and towns.

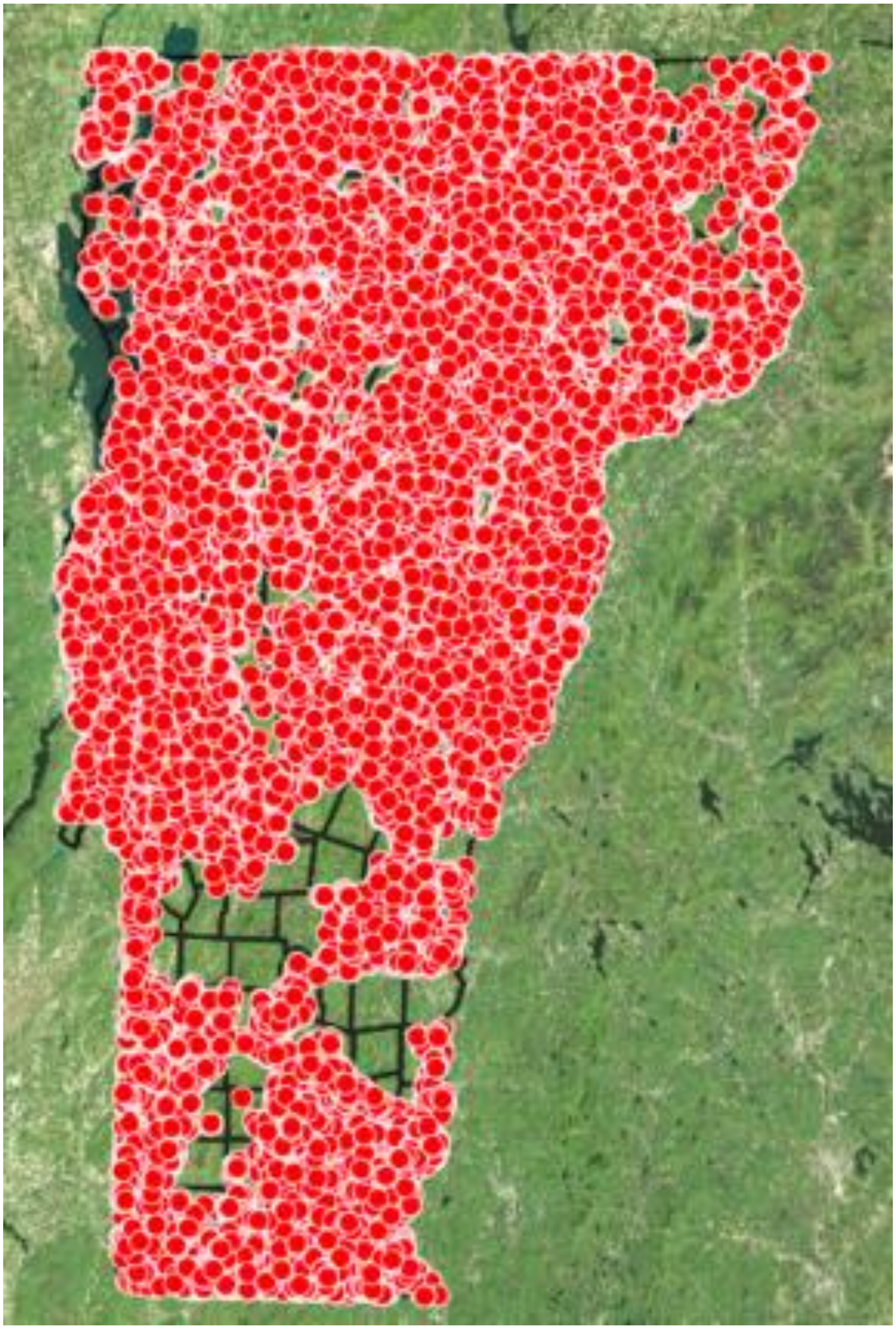
Those without the service are often in a perimeter area around a town or in an outlying area. The following figure provides a typical example.

Figure 17: Sample Coverage Map



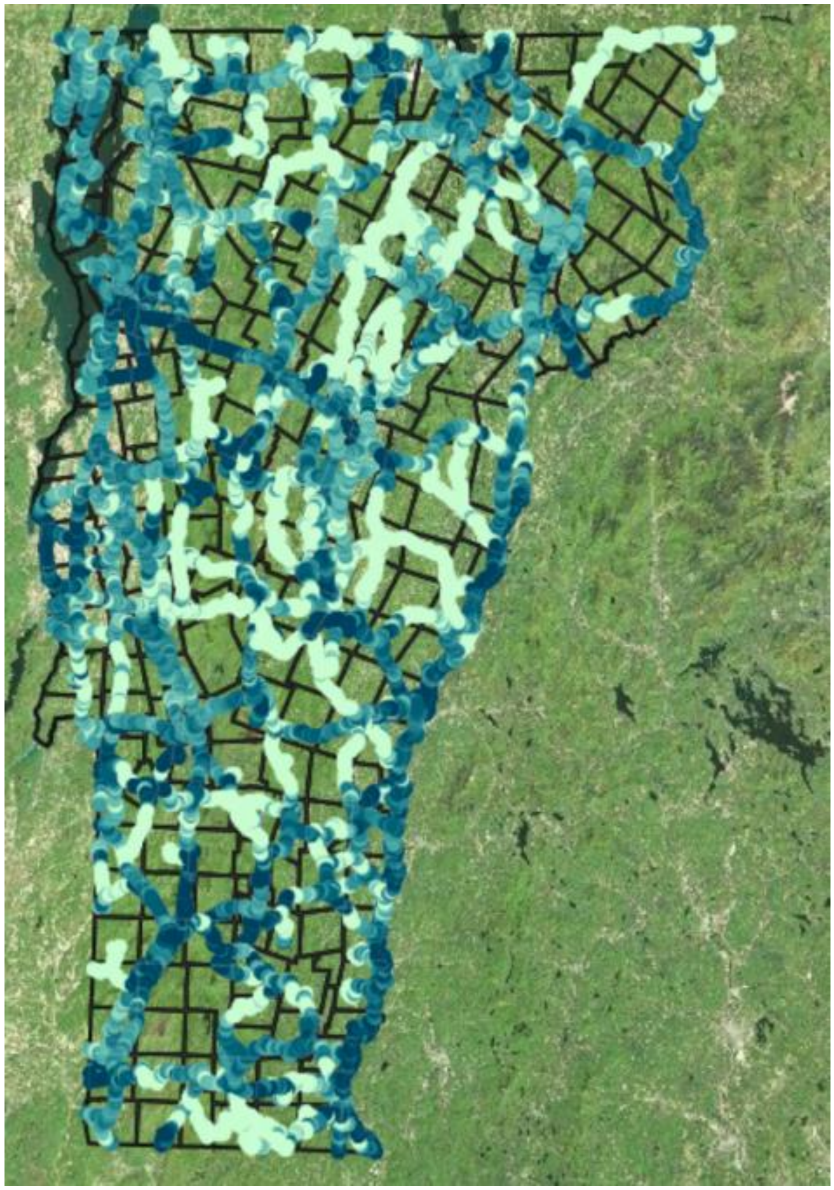
Because most of the 25/3 service is provided by cable broadband companies (Comcast, Charter) the distribution is mostly historical, due to the fact that cable operators were only required to build to areas up to a particular density in their franchise agreements. The following is a map of unserved premises in Vermont. This data was collected by the State in 2019 and is current as of that date, however, premises funded by the Emergency Connectivity Initiative have been removed.

Figure 18: Unserved Premises (State Data)



Vermont's mobile broadband coverage is strongly influenced by the topography and geography of the State; due to the hills, mountains, and trees, almost no town is completely covered by service, though very few towns are also wholly unserved. The following is a map of drive-test data performed on major roads in 2018, with additional data collected by volunteers in 2020.

Figure 19: Drive Test Routes



In addition to the drive-test data, we have mapped locations of cell provider antenna sites in Vermont used by one or more providers. The infrastructure ranges from latticed towers to monopoles or "stealth trees" to radios on siloes, steeples, or water towers. Naturally, the height of the infrastructure and surrounding topography will dictate how far service reaches; however due to time constraints, we have estimated that good service can be provided to premises up to three miles away from the radios. This is a crude estimate that is an average; with good height and lines of sight, service could potentially extend for five or more miles. Installed low and in a valley or obstructed by trees, service might be limited to a mile.

Even advanced RF propagation estimates may not be able to predict how strong a signal is at a particular premises. Any first responder who knows the back roads of the State would tell you that propagation maps published by providers themselves largely overstate the range of their signal.

However, our high-level analysis based on the drive test maps and the tower sites, indicates that there may sufficient coverage over many parts not served by 25/3 with wired services, to provide broadband using mobile service to many underserved Vermonters—and that because provide them with mobile service does not require new construction or new towers, they can receive service in time to address their needs during the pandemic.

An even larger number of the remaining unserved and underserved premises in the State could be served if the signal were augmented by a rooftop signal booster. We note again the difficulty in precisely predicting the signal levels and capacity of wireless networks, and emphasize that it will need to examine individual cases more closely, which may be the responsibility of the proposed Broadband Corps discussed in more detail below.

4.1.2 Status Reported by Providers

In interviews, internet service providers across the State reported increases in bandwidth usage over the course of the epidemic, with a larger increase in upstream utilization. For example, Waitsfield and Champlain Valley Telecom reported a 30 percent increase in bandwidth usage; AT&T reported that core network traffic increased 22 percent and that video conferencing increased 400 percent. ISPs also reported changes in peak utilization times: Peak internet usage used to be around 8pm; providers are finding now that peak usage occurs throughout the day as well as in the evening, as people are working and learning from home.

Internet service providers reported that their networks were able to handle increased utilization, although in practice, certain types of networks become much more constrained with more usage. In particular, wireless technology and DSL based technology, have greater capacity constraints and are more likely to provide slow performance with many users on the network. In contrast to wireless and DSL, operators of fiber networks and cable networks reported no bandwidth constraints during the pandemic, despite increased bandwidth needs.[23]

Wireless providers face similar constraints due to limitations of their technology and the spectrum. VTel reports that they manage capacity by limiting service to customers with adequate

[23] Sutich, John, and Matthews, Alicia, "Comcast Covid Response Interview," October 22, 2020; Gruendling, Kurt, "Waitsfield Champlain Valley Telecom Covid Response Interview," October 30, 2020.

line of sight from the antenna to their home or business. They report that they do not like to hook up customers on their wireless 4G LTE network unless they are confident the customer can get at least 10 Mbps download, because customer satisfaction drops significantly at lower speeds.

Several internet service providers interviewed said they saw an increase in requests for customer installations, and in some cases did not have enough technicians to meet the demand; for example, ECFiber, FirstLight, and Waitsfield and Champlain Valley Telecom all expressed the need for more trained technicians.

Prices for service in Vermont range by provider, but are not out of step with service costs in other areas (see Appendix G for comparison to other states). Providers have also launched a range of programs to assist Vermonters who may be struggling financially due to the Covid-19 pandemic, many focused on ensuring children in school have access to the internet. The Department of Public Service has aggregated a list of ISP programs on their website:[24]

- CenturyLink, Comcast, Consolidated Communications, FirstLight, Sprint, AT&T, Burlington Telecom/Schurz Communications, TDS Telecom, US Cellular, Verizon, Waitsfield and Champlain Valley Telecom signed the FCC Keep America Connected Pledge,[25] which was in effect through June 30th

- AT&T, Burlington Telecom, Charter, Comcast, Franklin Telephone, Stowe, T-Mobile, VTel, and Waitsfield and Champlain Valley Telecom, opened up public Wi-Fi hotspots.

- Comcast, Charter, and others introduced programs to assist customers with overdue bills.

- Waitsfield Champlain Telecom and Burlington Telecom have not been disconnecting customers during the Covid-19 pandemic, and ECFiber has announced they are not disconnecting any customers until further notice. Duncan Cable has extended all disconnections for non-pay from the normal 30 days past due to 60.

- Charter and Comcast have existing low-cost options for qualifying low-income customers. Comcast has given 60 days free to new Internet Essentials customers. Comcast expressed that while about 14-15,000 Vermonters are currently enrolled in Internet Essentials, there

[24] https://publicservice.vermont.gov/content/new-connectivity-resources-support-you-during-covid-19-state-emergency-vermont

[25] The pledge is “to not terminate internet/data service to any residential or small business customers because of their inability to pay their bills due to the disruptions caused by the coronavirus pandemic; waive any late fees that any residential or small business customers incur because of their economic circumstances related to the coronavirus pandemic; and open its Wi-Fi hotspots to any American who needs them.”

are many eligible Vermonters who have not enrolled. Charter offers Spectrum Internet Assist as an option for low income customers.

- Burlington Telecom, Charter, Consolidated Communications, ECFiber, Otelco, TDS, Waitsfield and Champlain Telecom have introduced programs to connect K-12 students. These programs vary, but the most common program is providing 60 days of free service.
    - Some programs are for low-income students, while others are designed for all students.
    - Some have been funded by private philanthropists, and some by providers themselves.
- Charter instituted a program that provided one month of free service for new small business customers.
- Comcast and CenturyLink suspended data caps; AT&T suspended data caps for fixed internet service. T-Mobile and Sprint gave their customers 60 days of unlimited data, and Verizon added 15GB of free data for residential and small business customers free of charge. Charter continues to impose no data caps or hidden fees.

Our study did not determine whether the quality of infrastructure provided to low-income Vermonters is significantly worse than that available to wealthier Vermonters. It has been documented in other states that some providers charge similar amounts in wealthier and lower-income areas, but only upgrade infrastructure in higher income areas. This investigation was not able to be done within the confines of this work; however, it is important to understand whether low-income Vermonters are paying similar rates for similar quality infrastructure, or if they are more likely to have only less capable infrastructure available to them.

4.2 State-Owned and Operated Systems

Operators of State telecommunications systems report their networks have functioned well during the Covid-19 pandemic, and alterations to operations or resiliency measures put in place have not impacted delivery of services.

Many State agencies successfully changed telecommunications protocols or operational protocols due to the pandemic—increasing the IT and network load to State agencies. The Agency of Natural Resources switched to a contact-free payment system as a Covid-19 safety precaution, which requires an internet connection to use. The Agency of Natural Resources now allows game harvest reporting online. During the height of the pandemic, when thousands of Vermonters were filing new unemployment claims, and the department successfully replaced their aging Unemployment Insurance system.

The Agency of Digital Services reported that the State moved to the cloud-based Microsoft Office 365 system before the start of the pandemic, which eased the challenge in migrating State employees to remote work. ADS has also helped State agencies transition to remote work by purchasing preconfigured laptops and facilitating the participation in Consolidated Communications' Enterprise@Home program, which allows business customers to extend their LAN to their worker's remote sites, and which was used here to extend the State's enterprise network to state-employees' homes.[26] Because most remote work is now done on employee's home networks the State's WAN network has experienced lower traffic during the Covid-19 pandemic. However, this has put the strain on the connection to employee home networks, and many State employees working from home struggle with the same residential connectivity challenges as other employers in the State.

In interviews, employees at a range of State agencies reported that co-workers were struggling with reliable broadband at home. For example, one State employee reported that a co-worker had trouble using CAD software at home, as CAD requires significant bandwidth. It is common for employees with poorer home connectivity to need to come into the office more often to do work, use office equipment, or communicate.

Some State telecommunication systems need upgrades or expanded capacity, although many of these needs predate the pandemic. First, the Agency of Transportation and Agency of Natural Resources have buildings in remote locations, which still struggle with connectivity. Cellular service is also an issue at many of these locations. In addition, libraries on the FiberConnect network are responsible for maintaining the network electronics on location. Because of the age of the network but the need to use compatible systems, libraries buy electronics that are eight or nine years old, and report that it is becoming difficult to find equipment of that age. Upgrading the network to use newer equipment will cost about $250,000 but will be key to ensuring resiliency.

In addition to the needs of State employees, as government services are increasingly offered online, many State agencies are most concerned about making sure that constituents who are not connected to the internet are not left out. Thirty-five percent of town managers, town administrators, and selectboard chairs surveyed said that their constituents were having trouble accessing State and federal resources, such as Unemployment Insurance applications and DMV services.

[26] https://www.consolidated.com/about-us/news/article-detail/id/750/consolidated-communications-enterprisehome-connects-remote-home-office-locations-with-reliable-secure-technology

Workforce development and training and other programming, offered by agencies like the Department of Labor and Department of Libraries, has also shifted online. The Department of Labor noted the need to make training materials compatible with smartphones, as some people they worked with had access to a smartphone but not a computer.

In addition, the Unemployment Insurance system is operated online, with reminders to file claims and other information sent by email. As backup, there is an automated phone system that the Department of Labor uses to reach people without emails though. In general, most people filing for unemployment had access to a computer and the internet, and the Department of Labor addressed connectivity on a case-by-case basis (for example, filing by fax or in person).

Based on our discussions with agencies, the State has been able to serve its internal needs adequately. For example, the 911 system upgrade this year is slated to save the State $1 million over the course of the next five years, and ADS's migration of many government services to the cloud is a desirable approach, as it will allow for more resiliency, security, alignment with industry standards, and—in the pandemic—help State workers to more easily access work when outside of the States' LAN. The State should keep in mind that the suite of technology solutions employed across agencies may become more complicated and network-intensive as functions migrate to the cloud, and maintaining secure and resilient connections that employees can access from residences is extremely important, as is maintaining top-tier cybersecurity protocols.

Though 40 libraries are on the FiberConnect network, some libraries are being served by fiber networks outside of the State's FiberConnect system. Some schools, by the same token, have fiber access through the e-rate program, and some do not. These unserved institutions, as well as many unserved Agency of Transportation and Agency of Natural Resources sites, will potentially only be served when the State achieves its goal of 100/100 Mbps service across the State. By supporting the Communication Union Districts and their deployment, the State will also quickly be able to bring sufficiently fast and reliable service to these unserved institutions, whose subscription to services as anchor customers can potentially provide modest revenue to the emerging networks.

We recommend that connectivity on a building-by-building basis be expanded upon in the 10-year plan.

4.3 Opportunities for Shared Infrastructure, Open Access, and Neutral Host Wireless

The project team completed an assessment of opportunities for shared infrastructure, open access, and neutral host wireless facilities to guide deployment of new technology that can assist the State in responding to, and recovering from, the pandemic. We concluded that strategies related to neutral host infrastructure are long-term in nature and advise against policy changes in the short-term to deal with the pandemic; we recommend instead that these long-term strategies be considered in the context of a long-term, comprehensive broadband plan. At the same time, we offer these high-level observations.

4.3.1 Shared Infrastructure

One opportunity to increase the options for broadband to underserved and unserved Vermonters in time to assist during the pandemic is to continue and expand the placement of wireless broadband in and around government and community anchor locations. All stakeholders with infrastructure of this nature—from librarians to the Agency of Transportation, Agency of Natural Resources, and others—expressed interest in making their facilities available if needed. Should the pandemic worsen in winter months, we recommend that entities with fiber or cable connections to large buildings consider if there is a safe way to allow individuals to work and learn inside, physically distanced, to alleviate the number of people currently connecting from parking lots. This could be considered for underused town halls, heated Agency of Transportation garages, or other similar buildings.

Because of the needed Covid-19 precautions, however, this must be done with great caution; and to not burden existing employees, the operation of facilities like this could be done by the proposed Broadband Corps, who could be responsible for opening and closing facilities, monitoring usage, setting up Covid-19 barriers, and sanitizing surfaces.

4.3.2 Open Access and Neutral Host Wireless

Open access networking is a model where the physical infrastructure is built and operated for the benefit of multiple service providers who can access the network on a non-discriminatory basis and provide competitive services. A neutral host model is where the entity that builds and operates the open access physical network is it itself not a service provider.

For purposes of long-term planning, with the understanding that neutral host infrastructure will not materially impact immediate pandemic-era needs, we recommend the State examine the suitability of both approaches for areas which are unserved or underserved by wireless providers. These are potential models in particular for areas where the cost to build and operate is sufficiently high that an individual wireless provider will not take the risk to build, or where construction is particularly challenging. One example is the US-6 corridor in the Colorado Front Range, where CDOT planned and built a DAS with Crown Castle acting as a neutral host provider

Further, as CUDs around the State launch plans for new fiber networks, many have been asking if they can build “open-access” networks that a range of providers can use, to encourage competition and hopefully drive down prices. Utopia Networks, in Utah, has been cited as a potential model.

Advocates of open-access fiber seek to provide the best quality and most affordable service to people passed by the network by having competing service providers on a single fiber network. The main challenges with building and operating an open-access model in areas as rural as Vermont are in attracting partners to fund and build the network, and in finding service providers interested in setting up operations if they had only a portion of an already limited number of customers.

With regards to neutral-host wireless facilities, an illustrative experiment in Vermont was the small cell deployment done by CoverageCo to fix cell service gaps in 2016 and 2017. The project did not ultimately succeed for three primary reasons:

1. The first radios deployed were along driving corridors, and usage was 5x less than anticipated due to Vermonters talking less while driving than the national average, and a moratorium on talking while driving enacted shortly after deployment.

2. Many initial radios were deployed using DSL as backhaul, which proved to be unreliable and insufficient, leading to poor customer experiences.

3. Refusal by a telephone company to allow its subscribers to roam on the network decreased usage.

The problems listed above resulted in the majority of deployments losing money every month; clearly, an unsustainable operation.

The company pivoted their deployment strategy to focus on locations with cable or fiber backhaul, and in locations where the radios could serve residential clusters. This strategy relied on field organizing to find households, businesses, churches, and other entities willing to place a receiver on their structures; however, many were happy to do so to bring service to their neighborhood. Highly reliable and functional sites were put up, for example, at Coburn's General Store in Strafford, Kedron Valley Inn in South Woodstock, and on the steeple of the Hartland UU Church. These sites became profitable; however, CoverageCo was not able to pivot fast enough to install enough profitable sites to overcome the number of sites losing money month to month.

4.4 Short-Term Strategies to Leverage Ownership of Rights-of-Way

The State's ownership and management of rights-of-way does have an impact on broadband deployment; however, the project team did not find and service providers did not report major impediments to broadband deployment regarding the use of rights-of-way. As was concluded in a previous study, opening up State rights-of-way by itself is not by itself going to catalyze significant broadband deployment. Right-of-way concerns were not expressed by ISPs, CUDs, or other stakeholders in the State as being significant roadblocks.

Across Vermont, town owned roads and state-owned roads have different Right of Way permitting requirements, which adds complexity, time, and cost to deployments; however, any recommendations for changes to this system must be given careful consideration and are beyond the scope of this plan, especially considering the time needed to design and adopt changes.

The project team recommends two models be investigated in the next 10-year plan; the "Utah model" and the "New York City" model.

In the former, the State built and traded communications conduit, fiber, and communications circuits statewide. The state built an initial allotment of 600 fiber-miles as part of an initial infrastructure deployment centered around intelligent transportation systems on UDOT corridors. The state publicized its existing routes and a wish list of future routes for future needs. It established a master lease agreement with each entity seeking to build in UDOT right of way and engaged in mile-for-mile trades of its excess infrastructure to expand its own use to new areas built by other providers, as well as making it possible for new providers to get a head start in their builds using the excess UDOT infrastructure in already-constructed routes. Trades are not required, however, and providers may also simply pay a fee for access to UDOT rights-of-way.

New York City has identified three different zones, A, B, and C, based on broadband need. Fees for Right of Way access—in the case of New York, rent for access to City streetlights for small wireless facilities, can operate on a sliding scale. The fee is 3.5 times higher per month to operate a small cell in Midtown Manhattan than in an area with less service.

Lastly, though the Agency of Transportation does not have "dig once" provisions, V.S.A §§ 8090—93 requires power companies to notify telecom providers of their intent to reconstruct lines and other plant should the telecom providers want to lay conduit during the construction project, which achieves the effect of a dig once provision in most instances The establishment of an expanded dig once provisions should be considered in the next 10-year plan.

While these are not concerns raised by providers, we note that with the vast majority of deployments being aerial, pole space will likely become scarce, with providers needing to choose between expensive pole replacement and make ready, and underground construction. Considering the high cost of underground construction in rocky soils, it will make sense for the State and municipalities to make potential excavators and broadband deployers aware of road expansion and improvement projects whenever possible, and to notify excavators who may want to take the opportunity to build—especially in expensive routes in urban areas, rocky soils and alongside limited access roads.

4.5 Emergency Communications Initiatives and Requirements

Through interviews with a range of emergency personnel and State emergency management leadership, and review of the 2020 Statewide Communications Interoperability Plan (SCIP), the project team found that though emergency services were forced to react, adapt, and in some cases make contingency plans due to the pandemic, emergency communications and operations in Vermont have not been adversely impacted by the pandemic.

The e911 Board has six Public Safety Answering Points (PSAPs), which provides redundancy to the system. All six have continued to operate during the pandemic, and the e911 Board also created a back-up PSAP location in case one needed to be closed down due to a Covid-19 outbreak; the e911 Board plans to keep the back-up location after pandemic has subsided for additional redundancy. While the 911 system is operating well, there are ongoing concerns regarding customer education with regards to 911 communication, and interoperability with certain calling and texting mechanisms. For example, not all messaging apps and/or over-the-top Wi-Fi calling apps work with the State's 911 system.

Further, the State delayed the transition to a next generation 911 system by several months due to travel restrictions and other Covid-related challenges; however, they had a fully functioning system in place they could continue to rely on, and when the transition ultimately happened in October, it went smoothly.

The primary concerns of the e911 Board include spotty cell coverage in the State—a problem that clearly pre-dated the pandemic—and concerns regarding customer education. For example, not all text messaging apps work with the State's text to 911 system, and it is incumbent upon all involved parties (not the least of which the apps themselves) to communicate their constraints to the public.

Land Mobile Radio (LMR) is the primary means of communication for first responders in Vermont; this system is resilient and robust in all parts of the State.[27] The LMR system has continued to function well during the Covid-19 pandemic.

The Vermont Communications System (VCOMM) is an alternate interoperable radio system that operates on the Very High Frequency (VHF) and Ultra High Frequency (UHF) bandwidths.[28] This system provides frequencies that can be used across service areas, regions and states; first responders that receive grant money through the Department of Homeland Security are required to put VHF and UHF channels on their radios, which ensures interoperability across state lines.

[27] https://rts.vermont.gov/interoperability-planning

[28] https://rts.vermont.gov/interoperability-planning

Vermont's Statewide Communication Interoperability Plan (SCIP) includes plans to promote the VCOMM system. There were no reported issues with the VCOMM system during the pandemic.

Cellular broadband is also often used by first responders when available. Verizon is the cellular provider with the most coverage in the State, followed by AT&T, though coverage by the latter is increasing due to FirstNet deployments and roaming agreements AT&T has recently enacted with VTel. Still, locations with unreliable cell service remain a public safety concern for first responders, Agency of Transportation employees in the field, and drivers on Vermont's roads; however, first responders know their communities well and have always accounted for known gaps in service and planned ahead accordingly.

The FirstNet network, currently being deployed, should improve cellular coverage for all Vermonters, but will prioritize traffic from first responders. FirstNet originated as the National Public Safety Broadband Network created in response to the 9/11 Report's call for nationwide public safety communications interoperability and was assigned spectrum for broadband wireless communications for first responders. FirstNet issued a national request for proposals and selected AT&T to build and operate the network.

AT&T has use of the FirstNet public safety spectrum nationwide and is required to increase its coverage according to FirstNet specifications. As a result, AT&T is expanding its service nationally and in Vermont, using the FirstNet spectrum and its other spectrum. AT&T may use the spectrum to serve its customers, but must provide priority and, if necessary, preemption to support first responders in an emergency.

The project team interviewed AT&T to understand their deployment in Vermont. AT&T has committed to deploying 36 FirstNet sites in Vermont by the end of the first quarter of 2022 (including six sites to be built for FirstNet by Great North Woods Wireless (GNWW)). So far, AT&T has deployed radios at 4 new sites in Vermont, as well as upgrades to 2 existing sites. By the end of the year, AT&T projects they will deploy 8 additional sites and upgrade one more site, bringing AT&T's total number of FirstNet sites in the State to 15.

FirstNet deployment has not been proceeding as quickly as some had hoped, although AT&T is still within the timeline allotted for deployment and will accelerate deployments in the next 2 years to meet their deadline. One challenge identified is that many FirstNet deployments are in areas where there is no cellular coverage; deploying in these areas requires extending utilities backhaul to a new cell tower, which takes more time and planning. AT&T said that in these situations, delays are increased by the fact that ISPs providing backhaul often do not want to begin planning backhaul deployment until the cell tower is "room ready," which can add another six months to the deployment process. Permitting for new towers can also be a challenge; additionally, AT&T cited deployment in certain areas such as the Green Mountain National Forest or the State-owned Green Mountain Reservoir. However, this tension is to be expected in a state with robust environmental concern and attention paid to environmental impacts, and the project team does not feel that assessing permitting processes was appropriate to do on an extremely accelerated project timeline.

The decision to enroll in FirstNet will remain the jurisdiction of local public safety departments, as they understand their own territory best, however there are cost, redundancy, and interoperability benefits to the prioritization of a single system. AT&T allows first responders to try out FirstNet enabled devices to determine if there is service free of charge, which will allow public safety departments to make an informed decision.

The nature of Vermont's geography means that the FirstNet network will likely still have gaps after being fully deployed. The State has hired a company to verify FirstNet's claimed coverage, and the State should ensure that the next 10-year plan includes an assessment of how the State can fill remaining gaps in service.

The State should expect everything that supports public safety communication ecosystems will expand, become more complicated, and more dependent on broadband. For example, an application that allows 911 callers to send photos of an injury to a 911 dispatcher, or even video call a 911 dispatcher, would have the potential to improve public safety — but only where adequate coverage is available. While the appetite for adopting cutting edge applications varies by agency and department, these applications will not even be possible without better cellular coverage. With the State's recent migration to a new, improved e911 call system, the State has remained up to date and even ahead of the majority of other states in terms of sophistication of its system.

It will also be necessary to bridge the LMR system with new cellular-based communications. The Vermont State police are starting to implement "Project 25" design standards, which will bridge legacy LMR radios and digital radios that use 4G LTE; under P25, first responders can download an application that allows them to use their cell phone like two-way radio. While the State police force is starting to implement this system, municipalities have not yet done so. Because the State police work closely with local police departments, state police will wait until all or a majority of local departments are on board to begin using the P25 system. This is a prudent approach.

Vermont's Statewide Communication Interoperability Plan (SCIP) provides a future vision which includes the FirstNet mobile broadband network assuming a more critical role in emergency communications. The need to migrate public safety to broadband and FirstNet in particular means that public safety is now tethered to mobile broadband coverage and capacity. Underserved areas for broadband are also underserved from the point of view of public safety communications, even if the traditional land-mobile radios systems serve the area—because LMR is no longer the sole infrastructure needed for emergency response.

Accelerating AT&T expansion will thus have the dual purpose of furthering broadband for the public as needed for Covid and providing the emergency communications that responders need in the same area

One notable success described in the SCIP that has paid dividends during the pandemic is that Vermont is significantly ahead of most states in implementation of next-generation NG-911 statewide. Among other many other functional benefits, this means that the State has interconnected PSAPs that can handle each other's calls and thus manage surges in needs due to Covid, the system creates more options for the State to have PSAPs handling each other's loads if staff are reduced due to Covid, or locations need to be closed or scaled back due to infection or needs for distancing, and that the State having a GIS based database of all homes and businesses in VT that can be used for 9-1-1 and also leveraged for broadband planning.

Noting the priority in the SCIP for FirstNet rollout, there should be increased emphasis on addressing any issues that may be delaying the FirstNet rollout. One step could be to address the claim by AT&T that fiber providers will not begin planning and design of backhaul until site is complete—and address any technical and business issues with the fiber providers that are creating the delay.

5 Local Institution Pandemic Responses

The project team would like to recognize the efforts many local institutions have done in response to the pandemic and resulting telecommunications challenges. Not only have their responses to date helped alleviate the challenges of the pandemic for many people; their willingness to continue to work hard and collaborate to drive toward a solution will be key to successfully implementing a state-wide, comprehensive emergency response plan.

5.1 Municipalities

The project team is hoping to augment the town administrator survey results below with more responses before publishing the final draft. However, based on initial responses, it is clear that towns are doing what they can to assist with connectivity issues. We found that

- Of surveyed town managers, town administrators, and select board chairs, 73 percent said their town is using public Wi-Fi hotspots to connect residents,
- 13 percent of respondents said their town was either participating in or promoting a program with an ISP to bring low-cost internet to low-income constituents (e.g., Comcast's Internet Essentials)
- 10 percent of respondents said their town was providing opportunities for residents to improve their digital literacy and technical skills
- Towns expanded public Wi-Fi access: Before the Covid-19 pandemic, across the towns represented by respondents, constituents could connect to public Wi-Fi at 46 town buildings or parks; during the Covid-19 pandemic, that number increased to 57 locations (including parking lots).
- 15 percent of respondents said their town added equipment to strengthen Wi-Fi signal in parking lots.
- That being said, many town buildings and parks do not have public Wi-Fi availability: Between all respondents, there were about 200 town owned or leased buildings and 120 parks of at least one acre.
- Across the survey respondents, there were at least 25 town buildings with a fiber connection that do not currently offer public Wi-Fi.

The Public Service Department, in collaboration with town administrators and municipalities, is continuing to deploy free Wi-Fi locations, which are crucial to providing options for low-income and underserved residents alike.

5.2 Public, Educational and Government Access Television

The Covid-19 pandemic has increased the difficulty of delivering PEG services, while also increasing the importance and urgency of those services.

PEG stations have been tasked with providing crucial communications resources for Vermonters, including information on the pandemic, support for remote education, access to governmental affairs, and connections with other community events. Overall, viewership has been steady or increasing, and in many cases, the Vermont community's engagement with PEG resources has increased significantly, with many stations reporting spikes in Facebook views, YouTube views, and Google website traffic during the pandemic months. For example, GNAT saw a 71.6 percent year-over-year increase in Facebook video views from the July-to-September in 2019 to the July-to-September period in 2020.

BCTV saw a 197 percent increase in YouTube subscribers added in January-March 2020 compared to January-March 2019; and CAT-TV saw a 75 percent increase in quarterly web traffic from April-June 2020 compared to April-June 2019.

At the same time, PEG stations have seen a five-year downward trend in revenues in part due to decreases in cable franchise fees and declining cable subscribership, which peaked in 2017.[29] They also face greater pressure on their existing technical capacities, as the growth in demand for coverage of an increasingly wide array of events is stretching staff thin. Stations report spending increased time on digital management and training of local community members on digital technology. They also have had to adapt to health protocols in the actual filming and production of events.

Importantly, PEG stations have responded to the Covid-19 pandemic by providing critical content to meet community needs. PEG stations have provided:

- Ongoing emergency management updates, including access to government press conferences, related to the Covid-19 pandemic.

- Production and technical support to stream and archive public meetings and events. This involves working with community members and institutions to facilitate best use of virtual meeting tools.

[29] Wassenaar, Mike, and Davitian, Lauren-Glenn, "Quick question on public comment on VT Plan," December 15, 2020, email.

- Delivery of education programs for students and adults, including live-streamed distance learning opportunities, graduations and school ceremonies, and school sports coverage.

- Election coverage, including candidate forums, information on absentee ballot casting, and town meeting feeds.

- Production of community-meeting events and open forums, including anti-racism demonstrations, theater performances, and local fundraising events.

PEG stations reported responding to the effects of the pandemic by continuing to expand their virtual offerings and design hybrid public meetings and events. They are working to increase security, success, and transparency of these events, as the pandemic continues to change the way that video production can operate, and to change the way that video consumption is done.

Lastly, as they continue to respond to this increased demand and shifting environment, PEG stations are concerned with the barrier of inadequate broadband speeds, which many member stations have already documented as impeding the ability to broadcast certain local events, including those in public buildings.

5.3 Regional Development Corporations

Regional Development Corporations are running a technical assistance program to help businesses during the Covid-19 pandemic; 40 to 60 percent of the funded projects are “internet based,” such as helping businesses build e-commerce capabilities. Moving to e-commerce has become a necessity for businesses; even main street stores have discovered that they need an e-commerce platform; businesses also need assistance in social media and building an online brand. As a whole, this is a healthy evolution for businesses to make; however, doing so during a pandemic when traditional revenue sources are constrained is not ideal. What is clear is that the businesses that survive will likely make digital elements a long-term part of their operations. An increase in digital literacy across the State, and residential broadband, will allow the employees and employers of newly digital businesses better ability to continue operations and grow.

The RDCs are providing valuable technical assistance to many businesses in Vermont, but they need additional resources in order to meet all the needs of Vermont businesses. RDCs have not been able to keep up with the demand for this program; they are currently assisting a cohort of 300 businesses, with 80 to 100 more businesses on waiting lists; the RDCs stopped advertising their program when they realized they would not be able to serve all the businesses that had signed up, so the true demand for this program is likely even higher.

Furthermore, while the current program will help businesses set up e-commerce programs, the RDC does not have capacity to then support businesses in maintaining those platforms, and importantly, the RDCs have not had the funding to provide technical assistance regarding cybersecurity, which will become increasingly important as more functions migrate online.

Finally, as many other stakeholders have reported, digital literacy is a big issue, and businesses could benefit from additional assistance training their employees on how to use video conferencing, online platforms, and digital work technologies.

5.4 Libraries

Vermont's libraries are working hard to support residents during the Covid-19 pandemic with online resources and programming, laptop and tablet lending programs, and access to Wi-Fi where possible. The project team surveyed librarians in a survey distributed by the Vermont Department of Libraries; 81 librarians representing libraries in all 14 counties completed the survey. Complete results are presented in Appendix E. Findings include:

- 50 percent of libraries are open for patrons, 30 percent are appointment-only, and about 20 percent are closed.
- 66 percent of libraries are providing programming for the general public, both online and in person. Programming includes virtual book clubs, support for remote learners, virtual or outdoor storytime, take-home craft kits, and digital literacy training.
- 67 percent of librarians reported their library increased access to electronic materials, 87 percent are offering online or by-telephone reference services, and 97 percent have implemented minimal-contact pickup
- 80 of the 82 libraries surveyed are allowing patrons to connect to their library's Wi-Fi in the parking lot.
- Most librarians say 5 to 10 people use their Wi-Fi in the parking lot on a given day, but some librarians reported 30, 50 and 65 patrons using the parking lot Wi-Fi.
- 24 percent of librarians say they have added equipment to strengthen the Wi-Fi signal, 38 percent have added tents or seating outside, and 8 percent are allowing patrons to use library computers outside.
- Before the Covid-19 pandemic, only 8.6 percent of librarians say their library lets patrons check out laptops or tablets; during the pandemic, 25 percent of libraries offer this service.

- 70 percent of librarians say their library has never run out of laptops to lend; only 4 libraries reported a lack of laptops weekly or daily
- During the Covid-19 pandemic, two libraries are lending out MiFi portable hotspots
- Libraries have published "how to" videos, resources, and have hosted workshops to help Vermonter's access online resources. Several libraries are also offering IT support over the phone.
- Libraries have partnered with local schools as well as recreation centers, food banks, and other local organizations.

5.5 Communications Union Districts

In addition to their work planning fiber-to-the-premises networks, CUDs and their all-volunteer boards have taken on an active role in responding to the Covid-19 pandemic.

Although expansion of a competitor's service in their territories encroaches into CUDs ultimate business plans, CUDs recognized the need for short-term connectivity and have worked to connect their constituents in whatever way possible. Several pursued plans for temporary wireless networks as long as possible, until it was evident the time constraints of the CARES act funding became too restrictive to meet.

At least one CUD worked to aggregate neighbors to apply for line extension grants under LECAP, although one CUD chair we interviewed expressed their efforts had largely not been rewarded, as few constituents ultimately received LECAP grants.

The CUDs also had an important role to play in the Emergency Connectivity Initiative and Get Vermonters Connected Now Initiative (GVCNI). CUDs assisted the Department of Public Service in collecting priority locations for the Emergency Connectivity Initiative and GVCNI. Additionally, CUDs have interpreted their ability to participate in the approval of Emergency Connectivity Initiative grant recipients as a mandate to thoroughly vet grant applicants. While CUDs the project team interviewed ultimately accepted most applications, the CUDs spent significant time researching applicant entities. In some cases, the CUDs balanced the need to bring short-term relief to disconnected constituents with information on the providers, their service levels, and reputations.

Ensuring CUD buy-in to further short-term emergency planning is essential to maintain a clear, efficient path toward universal 100/100 service in Vermont. The pandemic has made CUDs realize the importance of broadband, and providing service to low-income and struggling Vermonters, like never before, and the work they have done during the pandemic to continue on the path to fiber networks, while also exploring short-term options, has only increased their sophistication and understanding of the challenges that lie ahead.

6 Evaluation of State's Responses to Expand Broadband

In response to the Covid-19 pandemic, Vermont's Department of Public Service (PSD) quickly launched several programs to support Vermonters' telecommunications needs—working to connect Vermonters as fast as possible and assist those struggling financially. In general, programs were beneficial and accomplished their stated goals—though, as with most programs executed so quickly, they would have been even more effective if PSD had additional resources and time.

6.1 Line Extension Customer Assistance Program

The Line Extension Customer Assistance Program (LECAP) awarded $3,000 grants to subsidize the customer contribution, or contribution-in-aid-of-construction (CIAC), of a line extension.[30] Up to $500 of that amount may be applied to subsidize the cost of a customer drop beyond 300 feet. The consumer is responsible for any costs exceeding $3,000.

LECAP is a unique program, as it is driven by the consumer rather than ISPs. In the project team's experience, most line extension programs rely on the ISP applying for funding for specific projects, meaning line extension funding is driven by where ISPs desire to expand. In contrast, consumers apply for LECAP grants, meaning funding is allocated based on consumer demand.

That being said, the LECAP model does put some burden on consumers, as they must apply with their ISP for a LECAP grant. Additionally, because a single line extension to serve multiple premises would decrease the cost for each individual applicant, residents would benefit from coordinating with their neighbors—which could be challenging.

Under Vermont Public Utility Commission Rule 8.313(B), cable companies must extend service to customers within their franchise territory, but the cost of construction is split between the customer and the cable company, with the cable company paying a larger share in more densely populated areas. The CIAC is shared between all residents who commit to subscribing to cable television. The PSD provides an online calculator (https://jscalc.io/calc/Z9n1nal1nku3VNP4) to estimate the CIAC per subscriber. The calculator estimates that the cost per subscriber for a 1-mile line extension, with a construction cost of $30,000 is:

- $0 with 16 subscribers
- $625 with 12 subscribers
- $1,875 with 8 subscribers
- $3,125 with 6 subscribers
- $5,625 with 4 subscribers
- $13,125 with 2 subscribers

[30] https://publicservice.vermont.gov/content/vermont-covid-19-line-extension-customer-assistance-program

LECAP is available to Vermonters who can demonstrate a Covid-19 related need, such as remote learning, telehealth, or telework, lack 25/3 broadband internet service, and are near an existing cable video provider or other ISP. If a service provider did not project that they could complete a requested line extension by the end of the year, the consumer making the request would not be eligible for a LECAP grant.

Consumers had to apply for a line extension with the service provider *and* apply for the LECAP grant from the PSD. Applications were due September 15.

Some ISPs, consumers, and community institutions express frustration with LECAP. For example, the NEK CUD partnered with school districts to hold an educational seminar explaining how their constituents could apply for LECAP, and also attempted to help organize neighbors to apply together, but ultimately felt that these efforts were in vain as few constituents were connected through the program. The roll-out of the program may have also created high expectations among consumers, some of whom were eventually told they were not eligible or their line extension would cost significantly more than $3,000. ISPs felt they had to manage consumer expectations; for example, Comcast expressed that it wished there was better communication about who was eligible and how they could apply.

Overall, LECAP is a successful program, well designed and implemented quickly. The Department of Public Service stood up an innovative program driven by consumer demands in an incredibly short timeframe. Particularly impressive is how customer demand drove deployments, to ensure that line extensions were targeted to people who were going to use them.

6.2 Emergency Connectivity Initiative and Get Vermonters Connected Now Initiative

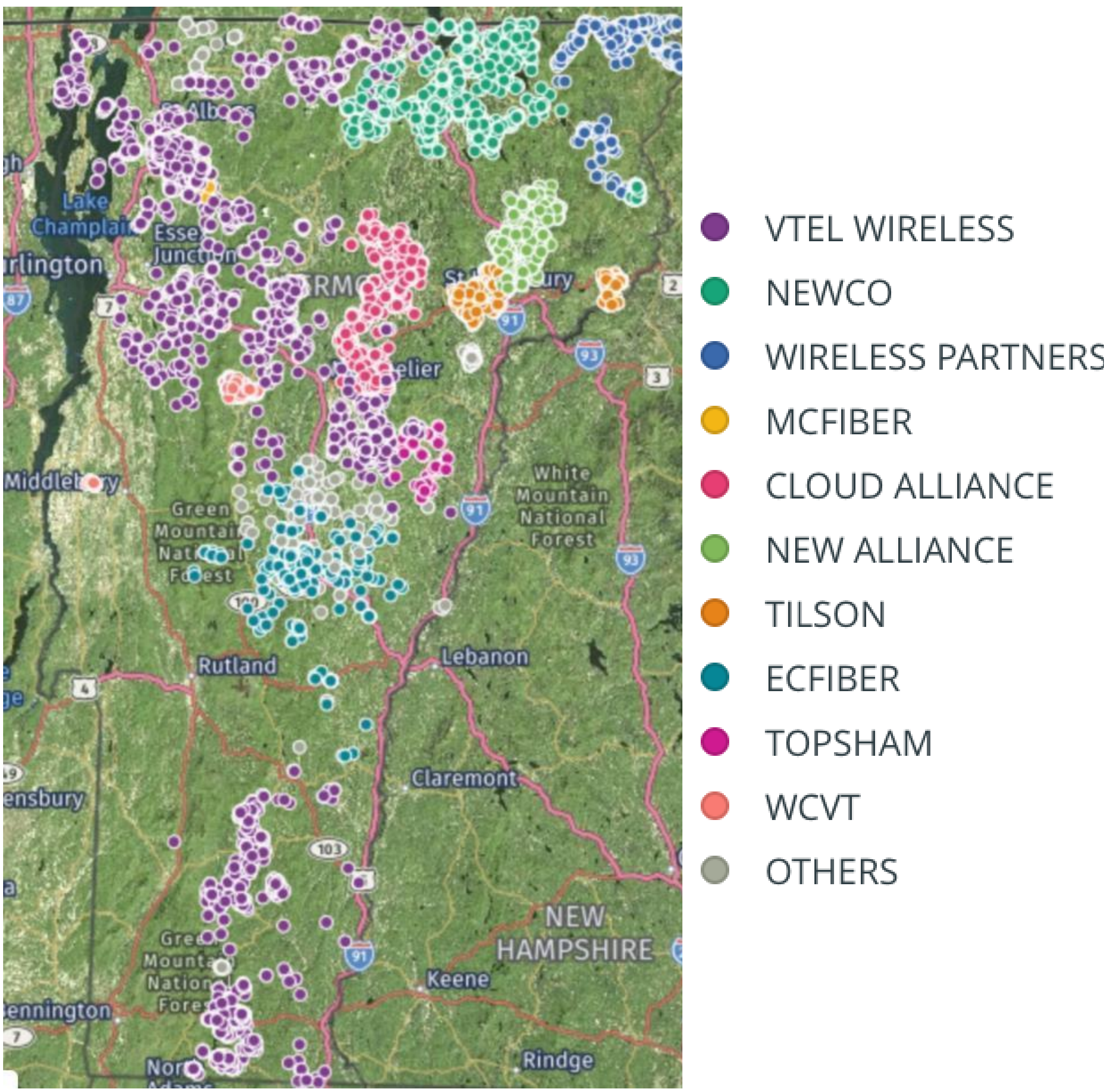
The Emergency Connectivity Initiative and Get Vermonters Connected Now Initiative (GVCNI) awarded $12 million in three rounds to fund broadband deployment to locations without access to the internet with speeds of at least 25/3 Mbps. This program prioritizes "underserved locations with K-12 students, teleworkers, and those with identified telehealth needs," as well as locations lacking 4/1 service. While the Connectivity Initiative is an existing program in Vermont, typically funded through the Vermont Universal Service Fund, the most recent awards were funded through the Coronavirus Relief Fund. This round of funding was made up of two programs: the GVCNI, which was created by H. 966 and funds fiber-to-the-premises customer installations and service drops, especially when underground conduit or lengthy drops have made deployment cost prohibitive, and the Emergency Connectivity Initiative, which funds broadband deployment delivering speeds of at least 25/3 Mbps.

The PSD administered these two programs together, using one RFP and one list of priority and eligible locations. Providers must provide at least 500 MB of un-throttled service. Wireless and

DSL providers must conduct a speed test at funded locations demonstrating that their service provides internet at speeds of 25/3, and providers will forfeit funding for any locations that do not meet this requirement; if 15 percent or more locations cannot provide 25/3 service, the provider will forfeit the entire grant. All funded projects must be completed by the end of the year.

The Emergency Connectivity Initiative and GVCNI have funded deployments that will connect 9,771 locations: about 2,200 with fiber to the home, 271 with cable, and about 7,300 with wireless.

Figure 20: Emergency Connectivity Initiative and GVCNI-Funded Deployments



Collecting data to determine locations with remote learning, telework and telehealth needs was challenging. The Department of Public Service relied on school districts, CUDs, town governments, and other community institutions, many of which worked diligently to help their constituents connected. The data used to inform the program's priority locations did vary by region. For example, not all school districts provided data on which students had connectivity needs because of privacy concerns. Healthcare providers similarly had to be cautious of privacy laws.

In addition to assisting the Department of Public Service in identifying priority locations, CUDs also had the right to object to any Emergency Connectivity Initiative and GVCNI grants within their footprints. Many ISPs did not appreciate this aspect of the initiative. The project team also interviewed several CUDs, and found that while they recognized that grants might hurt their future business case, CUDs understood the importance of improved connectivity in the short term and approved most projects, especially projects that did not offer wired services. The CUDs the project team interviewed only rejected funding for projects that the CUDs felt would not appropriately serve their community, or would be clearly detrimental to reaching the long-term goal of 100/100 service.

The Emergency Connectivity Initiative and GVCNI will connect nearly 10,000 previously unserved premises by the end of the year for a price of $1,200 per premises. Importantly, if CUDs are going to continue to play a role in shaping the connectivity landscape of their regions, the State and CUDs should collaboratively provide guidance, with public input from that region, as to what infrastructure and deployments should be prioritized. For example, cable line extensions in unserved pockets within already cabled towns are less likely to affect CUD plans, and yet are equally as helpful at connecting difficult-to-serve areas.

Lastly, additional assessment of the effectiveness of this program should be undertaken after speed tests confirm that promised speeds have been delivered.

6.3 Public Wi-Fi Hotspot Programs

The Department of Public Service took several steps to expand access to public Wi-Fi hotspots at buildings like schools, libraries, town offices, and more, which allow residents to park nearby and access free Wi-Fi. These hotspots are an important resource Vermonters without access to broadband infrastructure and Vermonters who cannot afford a broadband subscription.

First, the Department of Public Service identified existing public Wi-Fi hotspots through an email survey of schools, libraries, and town offices in March 2020; the Department of Public Service then published an online interactive map of existing public Wi-Fi.

In April, Governor Phil Scott announced a new program, where RTO Wireless installed 35 new commercial-grade outdoor Wireless Access Points, which were funded by Microsoft. Seeing the success of these hotspots, and with a waitlist of 30 sites, the Department of Public Service approved emergency funding for 65 additional hotspots; in October, the PSD approved funding for a third round of 50 RTO hotspots. The PSD has prioritized funding hotspots in locations without adequate broadband infrastructure or cell service. While there are many public Wi-Fi hotspots, public Wi-Fi access may not be adequate: only 8 percent of respondents to the online residential survey said public Wi-Fi was adequate, while another 43 percent were unsure, which may be indicative of more promotion and publicization of their locations and availability. Further, counties with the highest awareness of public Wi-Fi hotspots—like Caledonia and Orleans—were also the most likely to say that their availability and access was inadequate.

The Department of Public Service effectively leveraged existing public Wi-Fi, philanthropic dollars and emergency funding to help Vermonters connect to public Wi-Fi hotspots. There is no doubt that these are critical to allowing people easy access to Wi-Fi. These hotspots will continue to be important, as an estimated 4,000 premises will still be unserved after implementing the proposed infrastructure investments. As is described below in the recommendations section, Public Wi-Fi hotspots also provide great central, non-home locations where "Broadband Corps" members can show people how to use internet tools.

Despite the need to provide public Wi-Fi hotspots, the State of Vermont should still work to ensure as many Vermonters can connect to the internet from home as soon as possible. Completing work or school from a car can be difficult, especially during the winter, and attending a telehealth appointment in a parking lot is not ideal due to privacy and network security concerns.

6.4 Programs for Vermonters Struggling Financially

The Department of Public Service also started programs to assist Vermonters who are struggling financially due to the Covid-19 pandemic. First, the Vermont Covid-19 Arrearage Assistance Program provides eligible Vermont households and businesses with a grant to pay for past-due balances for regulated utility bills; this program covers electric, landline telephone, Vermont Gas and private water companies, but not broadband internet.

The Department of Public Service also hosted a page on its website of all the programs ISPs have created to support Vermonters during this time.

Finally, the Department of Public Service created the Temporary Broadband Subsidy (TBS), which provides eligible households with a credit of up to $40 to assist with broadband internet costs; payments can be applied retroactively to March 1. While the TBS is a generous program, its reach was unfortunately limited, perhaps by the effort required to receive the subsidy. The Department of Public Service estimates that about 2,000 Vermonters took advantage of the program, while the program had funding to assist up to 8,600 Vermonters.

The Temporary Broadband Subsidy could be improved by reducing friction for end-users (i.e., making the program easier to take advantage of), encouraging wider promotion via community institutions, and potentially promotion in coordination with other programs targeted to similar users.

7 Broadband Technology Sufficiency Standards in a Pandemic

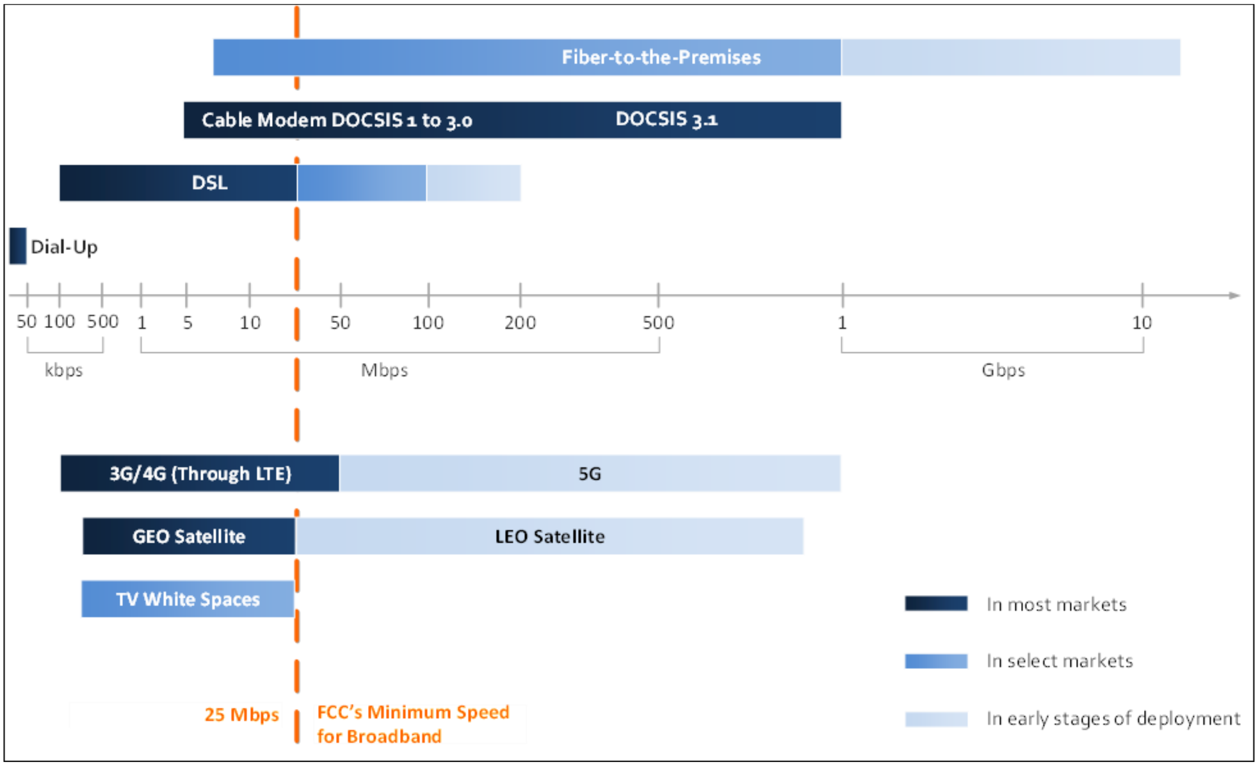
To meet the challenge of connecting thousands of new users to broadband in a short period of time, it will be important to understand the strengths and weaknesses of each technology to determine the best type of technology in a situation. It is also important to understand which types of technologies can support very heavy use (that is, those that are most scalable).

Where wireline networks are available, their technical characteristics mean that they will be able to support significant numbers of new connected households. This is especially true of fiber optic, cable broadband, and high-speed DSL connections (rated at 25/3 Mbps). The majority of students in Vermont are in homes passed by a high-speed wireline technology, though many are not.

Where wireline networks are not available, adding many new users all at once could tax the wireless networks. This is the case for both fixed wireless service and mobile broadband (4G) service. Wireless providers can provide maps and estimates of signal quality, which can provide an estimate. However, even with this type of estimate, there will need to be flexibility in the program to change to a different technology (satellite or wireline) if the broadband service at a given location cannot perform adequately. Ideally, the broadband provider should also be responsive and potentially modify its network—in areas with many students having poor signal, the provider may be able to improve the situation with a deployable Cell on Wheels (CoW) antenna. Providers may also offer outdoor antennas to boost the signal.

Where no other option is available, satellite technology can connect students who cannot be effectively connected with a wireline or mobile broadband connection. A satellite internet connection is far better than none at all but will be less robust than terrestrial networks for two-way video use in distance learning.

Figure 21: Internet Speed by Delivery Type



In a pandemic environment, a scenario in which two students are attending school classes using Zoom and two adults are using their broadband connections to attend occasional meetings, send e-mail, and do research, the combined required bandwidth could easily exceed the Federal Communications Commission's 25/3 Mbps minimum.[31] A 25/3 Mbps connection might be workable if internet usage were mainly in the form of internet browsing, email, and even streaming movies (i.e., primarily downloads). But essential applications in the context of a pandemic, video conferencing and tele-medicine, demand high bandwidth in the upload direction as well. For example, while there is no specific set minimum for healthcare broadband speeds, many telehealth programs require a minimum of 1.5 Mbps for both upload and download speeds to successfully display audio and video data.

In this scenario, even the FCC's next tier of service (50/5) would strain to supply the needed bandwidth.[32]

[31] Federal Communications Commission, "Broadband Speed Guide," https://www.fcc.gov/consumers/guides/broadband-speed-guide?contrast=

[32] A rule by the Federal Communications Commission regarding the Rural Digital Opportunity Fund and Connect America Fund, https://www.federalregister.gov/documents/2020/03/10/2020-03135/rural-digital-opportunity-fund-connect-america-fund

Peak Bandwidth Utilization for a Family of Four

	PEAK BANDWIDTH UTILIZATION TYPICAL FAMILY OF FOUR (DAYTIME)	DOWNLOAD / UPLOAD
x1	Tele-Work /Tele-Health Video Conferencing	1.5 Mbps / 1.5 Mbps
x2	Tele-Learning Remote Classroom	3.0 Mbps / 3.0 Mbps
x1	Streaming Music / Video	2.0 Mbps / 0.1 Mbps
x10	Home Security (Ring, etc.) and other household smart devices (Alexa, Cortona, etc.)	0.3 Mbps / 2.0 Mbps
	TOTAL BANDWIDTH USE (rounded)	7 Mbps / 7 Mbps

	PEAK BANDWIDTH UTILIZATION TYPICAL FAMILY OF FOUR (EVENING)	DOWNLOAD / UPLOAD
x1	Online Video Gaming	2.0 Mbps / 1.0 Mbps
x2	Streaming Video Applications (Netflix, Prime, etc.)	10 Mbps / 0.2 Mbps
x3	Surfing Internet	3 Mbps / 1.0 Mbps
x10	Home Security (Ring, etc.) and other household smart devices (Alexa, Cortona, etc.)	0.3 Mbps / 2.0 Mbps
	TOTAL BANDWIDTH USE (rounded)	15 Mbps / 4 Mbps

In another example, in which a Vermonter works from home during the pandemic, an internet connection would need to support process financial transactions through e-commerce applications, occasional video meetings with customers, the transfer of files via online cloud storage providers, and sending e-mail. During peak times, other family members may be using the internet to stream videos, attend tele-health appointments, or send e-mail as well. This scenario would require at least 20 Mbps downstream and 17 Mbps upstream.

Figure 22: Peak Bandwidth Utilization for a Home Business and Large Family

	PEAK BANDWIDTH UTILIZATION HOME BUISNESS (DAYTIME)	DOWNLOAD / UPLOAD
x1	Home Business Operations	10.0 Mbps / 10.0 Mbps
x1	Tele-Work / Tele-Health Video Conferencing	1.5 Mbps / 1.5 Mbps
x1	Streaming Video Applications (Netflix, Prime, etc.)	5.0 Mbps / 0.2 Mbps
x2	Tele-Learning Remote Classroom	3.0 Mbps / 3.0 Mbps
x10	Home Security (Ring, etc.) and other household smart devices (Alexa, Cortona, etc.)	0.3 Mbps / 2.0 Mbps
	TOTAL BANDWIDTH USE (rounded)	20 Mbps / 17 Mbps

	PEAK BANDWIDTH UTILIZATION MULTI-GENERATIONAL FAMILY OF ELEVEN (EVENING)	DOWNLOAD / UPLOAD
x2	Online Video Gaming	4.0 Mbps / 2.0 Mbps
x3	Streaming Video Applications (Netflix, Prime, etc.)	15.0 Mbps / 0.3 Mbps
x3	Surfing Internet	3.0 Mbps / 1.0 Mbps
x1	Video Chat (Zoom, etc.)	1.5 Mbps / 1.5 Mbps
x10	Home Security (Ring, etc.) and other household smart devices (Alexa, Cortona, etc.)	0.3 Mbps / 2.0 Mbps
	TOTAL BANDWIDTH USE (rounded)	24 Mbps / 7 Mbps

The following is a more detailed summary of the four most critical types of internet broadband and a summary of advantages and disadvantages and the key factors for each.

1) High-speed wireline technology (fiber optic and cable)

a. Advantages

i. High top speed—able to simultaneously connect many individuals in a household to video services and two-way distance learning.

ii. Scalability—underlying network can simultaneously connect all homes in a service area without losing speed or reliability.

b. Disadvantages

i. Not present in all areas, especially outside of metropolitan areas and towns.

ii. If a student is not in a connected home, requires an installer to come to the house to install, or may require a change of equipment.

2) Lower-speed wireline technology (telephone lines, DSL)

a. Advantages

i. May have high speed, depending on age and maintenance of system—if so it can connect many individuals in a household to video services and two-way distance learning.

ii. Might be scalable, depending on age and maintenance of system; underlying network might be able to connect all homes in a service area.

iii. Serves many parts of the State outside of towns and metropolitan areas.

b. Disadvantages

i. Older, less well-maintained systems might not be able to support distance learning.

ii. If customer is not already connected, requires an installer to come to the house to install, or may require a change of equipment.

3) Wireless

a. Advantages

i. Available within range of wireless towers across State.

ii. May be able to support distance learning, depending on location of antennas and student, the type of technology (mobile must be 4G or better), the connection to the tower (fiber), and the level of congestion.

iii. Scalability—depending on service area, available spectrum, type of technology and number of users, a tower may be able to connect dozens of students to distance learning.

iv. Ease of installation—mobile providers can provide a device to a student that works "out-of-the-box" and doesn't require an installer to come to the house.

b. Disadvantages

i. Not all parts of State have wireless coverage, particularly indoors, in rural areas, in treed or hilly areas, or away from main roads and towns.

ii. Not always scalable—sharp increases in use (like adding thousands of distance learners) may use up all the bandwidth, especially in rural areas where towers already tend to have slower connections.

iii. Difficult to predict where and when speed and service exist—while providers know where towers are and how they are connected, the actual service depends on dozens of factors that vary from place to place and change unpredictably (terrain, indoor/outdoors, number of users, material in a building)—this is why wireless providers tend not to advertise or promise speeds.

iv. Service runs significantly slower in "upstream" direction from student to network—because of the technical challenge of wireless, it is harder to get speed in the upstream direction than with wired technologies, which can result in poor quality of signal from the student to the network, and fuzzy or broken images and poor sound quality.

v. Fixed wireless providers typically need to perform installation at the home.

4) Satellite

a. Advantages

i. Available anywhere there is an unobstructed view from the house to the south and an antenna can be mounted on the roof or the house.

ii. Can provide high speed for distance learning in downstream signal (network to student).

iii. Scalability—depending on service area, congestion on network and number of users, a satellite may be able to connect thousands of students to distance learning.

b. Disadvantages

i. Signal has to travel a long distance through space, so there is a significant delay, making distance learning and videoconferencing confusing and difficult at times.

ii. Upstream (student to network) connection is limited, it is harder to get speed in the upstream direction than with wired technologies, which can result in poor quality of signal from the student to the network, and fuzzy or broken images and poor sound quality.

iii. Very large numbers of distance learners may use up the capacity in an area.

iv. Typically requires professional installation.

8 Strategic Recommendations

The Covid-19 pandemic has laid bare the challenges faced by Vermonters who do not have quality, residential broadband internet. This analysis, narrowly defined, focuses on creating actionable steps to ensure significantly increased broadband access during the pandemic. While many of these recommendations may not contribute to long-term solutions, they can deliver broadband swiftly to those who need it most as an immediate solution in the pandemic.

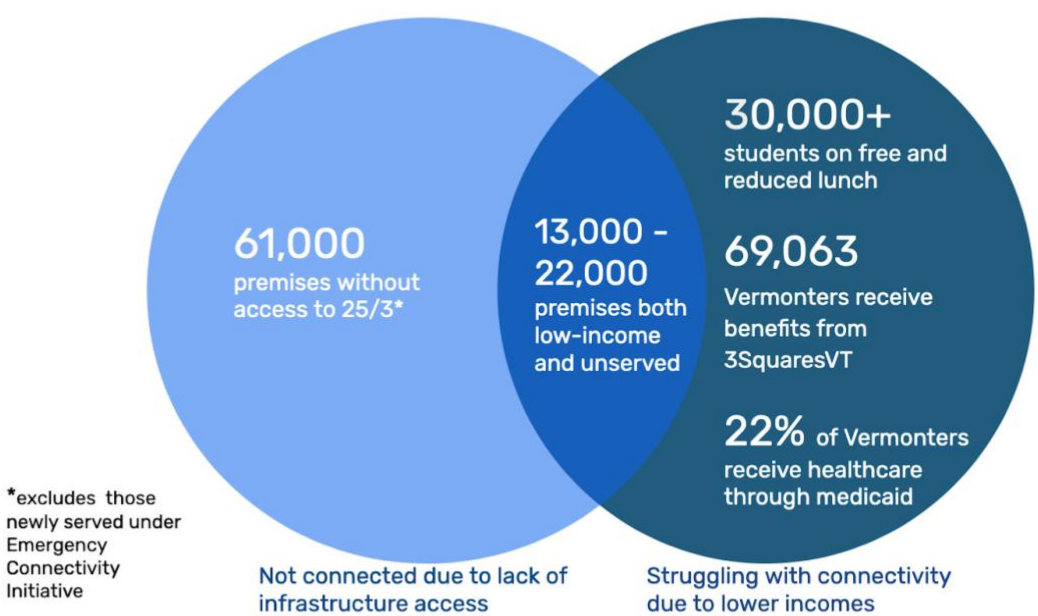
As discussed, Vermonters without home broadband internet fall into three categories:

- Low-income Vermonters who are potentially served with available infrastructure for 25/3 broadband, but unable to afford it
- Unserved Vermonters without access to broadband who could and would pay for service, if the infrastructure was made available
- Unserved, low-income Vermonters without access to broadband who also need assistance paying for monthly service

These three categories are addressed in our recommendations, where we provide estimated numbers of people in each group and the likely costs needed to provide a solution to them.

Below are an approximate number of Vermonters who fit into each category outlined above. The State may wish to use other thresholds to determine eligibility.

Figure 23: Numbers of Unserved Vermonters



These numbers are meant to provide benchmarks to lawmakers and stakeholders in understanding the scope of the challenges. It should be noted that the data used has two main sources of variability. First, the data on which premises are served vs unserved is largely from 2019, and though we have removed premises served by the Emergency Connectivity Initiative, many ISPs reported doing some additional deployment this year.

Second, tracking accurate data on who is low-income during a pandemic when spikes in cases continue to affect businesses, employment, and income levels. The State should choose an income threshold they feel is clear and appropriate, so eligibility is easily understood.

To estimate the number of people each of our strategic recommendations can reach and estimate costs to do so, we used various forms of geospatial analysis, cost estimates based on what the project team has seen in other states, and data from state and federal sources. To the extent we can, we will refine our estimations if updated data becomes available to us, for the final report.

8.1 Recommendation for Broadband Subsidy Plan

We recommend that the State of Vermont bulk purchase internet service to connect low-income households, prioritizing households with K-12 students so that they can participate in distance learning for the coming year, on the assumption that the pandemic may last that long. Given available funding, it would be ideal to extend the program to other low-income households for purposes of telehealth service, post-secondary education, employment searches, job training, civic engagement, and reducing social isolation.

The following offers a recommended strategy to implement such a program, with the following key priorities in mind:

1. Service must be able to support meaningful remote work and learning activities
2. Quality service must be equally accessible to all eligible students
3. The plan should be efficient, non-burdensome, and capable of enabling service to eligible households as soon as possible

Because the quality of service and the timeline on which it must be delivered is paramount, our recommendations seek to leverage existing mechanisms whenever possible, and to allocate responsibilities among entities in a manner that maximizes strengths to ensure effective and efficient program implementation.

While there will be challenges inherent in this program related to the unequal distribution of broadband infrastructure across Vermont, it's important to note that the State of Vermont has been working to address the rural digital divide for a number of years and that Vermont currently manages a successful, well-regarded broadband subsidy program for households adversely impacted by the pandemic. The rural digital divide is a problem in every state, without exception, and it reflects challenges that are not within Vermont's control. Some of these challenges will present themselves in execution of this strategy, but the State deserves credit for having narrowed that gap substantially through Vermont's broadband efforts in recent years.

This recommendation is based on best practices in jurisdictions around the country.

8.1.1 Current State of Home Broadband Affordability

While Vermont-specific data about home broadband adoption based on income is not available, national data consistently shows that adoption is drastically lower in low-income households than in households with higher income. Data from the Pew Research Center shows that in 2019, 92 percent of Americans with an annual income of $75,000 or more had home broadband, while only 56 percent of those with an annual income of less than $30,000 had home broadband.[33] Cost of service is the primary reason for choosing not to subscribe.[34]

The fact that high cost so often keeps broadband service out of reach even when it is physically available is critical, because it means that the need for assistance extends throughout the entire State of Vermont (and, indeed, the entirety of the United States), as opposed to solely in rural communities.

At the current time, there does not exist reliable data regarding which low-income Vermont households are not connected to broadband. In the absence of such data, we recommend development of a program that would apply broadly based on income level rather than based on current levels of connectivity.

8.1.2 Technology Assessment and Recommended Service Requirements

Bringing service to hundreds of thousands of Vermont homes on an expedited basis is a significant logistical and technical challenge. Given that the need is urgent and immediate, it will not be feasible to significantly expand core networks.

For example, it will not be possible for wireline providers to construct any significant amount of new cables on utility poles or place cable underground in rights-of-way. Wireline providers will either serve customers who already have connections, or who are already passed by a cable on the street. Wireless providers—mobile as well as fixed—will not be able to construct new towers or new antennas, nor place new fiber optic cables to those towers. Wireless providers will only be able to provide new user devices (such as Wi-Fi hotspots) and perform smaller-scale upgrades,

[33] https://www.pewresearch.org/internet/fact-sheet/internet-broadband/

[34] https://www.pewresearch.org/internet/2015/12/21/3-barriers-to-broadband-adoption-cost-is-now-a-substantial-challenge-for-many-non-users/

such as changing the speeds or configurations of equipment using software or placing temporary antennas.

As a result, to meet the State's goals, it will be necessary to make the best use of existing resources. Rather than prioritizing new construction and engineering, service providers will need to dedicate staff to acquire, configure, and ship equipment. They will need to enter new customers into their billing and support systems and provide customer support. They will need to install service at customer homes. In addition, in order to alleviate strains on existing networks that will result from the sudden addition of a large number of new customers, including a broad array of locally available providers is preferable to contracting with only a few large providers.

8.1.2.1 Recommended Performance Characteristics for Services

Based on discussions with educators in the State, this report recommends technical specifications for service that can support meaningful distance learning, telehealth, and job retraining (Table 1). These specifications can be provided by different types of service providers, and, given the scale of the challenge, will require the full participation of multiple service providers to fulfill across the State.

Table 1: Technical Specifications

Capacity	25/3 Mbps or capable of operating at least two simultaneous Zoom or Google Classroom sessions
Latency	< 150 ms for terrestrial networks
Data caps and restrictions	No limitations on time of day. Data unlimited, with at least 25 GB data per month at full speed
Wi-Fi	Capable of supporting at least five simultaneously connected devices
Equipment	Must include necessary equipment to enable service, including Wi-Fi distribution within the home
Installation	All necessary installation at the home to be included, or capability to work out-of-the-box with written instructions. If devices work out-of-the-box, delivery to be provided at home
Customer service	Available 8 am to 5 pm seven days a week
Coverage Data	Respondent to provide map indicating ZIP codes (or census blocks) where service is available and where there may be limitations (e.g., chance of lower speed, or poor performance indoors)

8.1.2.2 Particular Challenges in the Unserved Parts of the State

The challenge remains that broadband infrastructure is distributed unevenly throughout the State—a pattern that is consistent with that of the rest of the country. There has been an exemplary ongoing effort on the part of Vermont to incentivize construction of new infrastructure, and while progress is being made, gaps still remain.

To address the challenges with connectivity, this program will need to maximize use of existing networks across all platforms. The scale of the effort to connect all eligible schoolchildren to home broadband far out-scales the capacity of any single network, both in terms of footprint and capacity. To that end, the success of this program depends on the strategic maximization of all available broadband networks, utilizing a layered approach.

Because wireline networks often have more capacity than their wireless and cellular counterparts, wireline broadband connections should be prioritized wherever they are available. In areas where wireline broadband is not available, mobile cellular service can be used where the signal is strong enough. Finally, satellite service can be used to fill in remaining gaps where neither wireline nor cellular 25/3 Mbps service is possible.

8.1.3 Potential Program Scale and Budget

The likely budget for the full program is summarized below and is based on a number of assumptions regarding the potential cost per household for service over 12 months, bundled with the necessary equipment and installation to make service possible.

8.1.3.1 Program Eligibility and Budget Considerations

We recommend that the State leverage existing eligibility parameters for the National School Lunch Program, which offers free and reduced-price school meals to low-income students, to determine initial eligibility for this program.[35] In creating parallel eligibility, the State would be able to significantly reduce the complexity of implementing a new program, resulting in fast execution and efficient distribution of resources to families identified as being in need.

Based on data provided by the Vermont Department of Education, we understand that approximately 32,000 students in Vermont schools are eligible for the National School Lunch Program. Based on average household sizes, this equates to approximately 20,000 eligible households. Should the State choose to expand eligibility, additional households could be added, including those eligible for Medicaid (enabling telehealth services) and unemployment insurance payments (enabling online job searches and worker retraining). This analysis assumes eligibility of 20,000 households, but the numbers can be increased in a linear fashion if eligibility is expanded.

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[35] Based on eligibility parameters for free and reduced-cost school meals, the following students would be eligible: (1) Those in households with incomes at or below 185 percent of the federal poverty level; and (2) those in households participating in the Supplemental Nutrition Assistance Program and Temporary Assistance for Needy Families, as well as foster youth, migrant, homeless, or runaway youth, and Head Start participants.

In brief, we estimate that approximately $7 million could be used for a one-year term, based on average costs per household of $350 and assuming utilization by 20,000 low-income Vermont households.[36] The potential budget is thus based on an estimated cost per household of $350 for 12 months of service, including installation and equipment, as follows:

Fixed service: $150 for service $200 for home equipment and installation
Mobile service: $250 for service $100 for mobile hotspot device

Given the uncertainties regarding how many eligible households might participate in the program, it is prudent to develop a contingency plan for surplus funds. A determination of whether to repurpose unused funds could be made after several months of program execution. If the data show that fewer households than expected utilize the benefit, the surplus funds can be repurposed to support other low-income users, including low-income post-secondary students and telehealth users.

Lastly, the State should include people experiencing homelessness in its efforts to connect low-income Vermonters. The State has supported Vermonters experiencing homelessness during the pandemic by subsidizing hotel and motel rooms around the State; by subsidizing their stay, the State should be, in effect, subsidizing an internet connection as well. The State should require that proprietors provide these Vermonters with a Wi-Fi connection just as they would provide access to any other customer. (If the motel or hotel does not have adequate Wi-Fi, the mobile hot spot program described in Section 8.2 should be used.)

8.1.4 Recommended Process

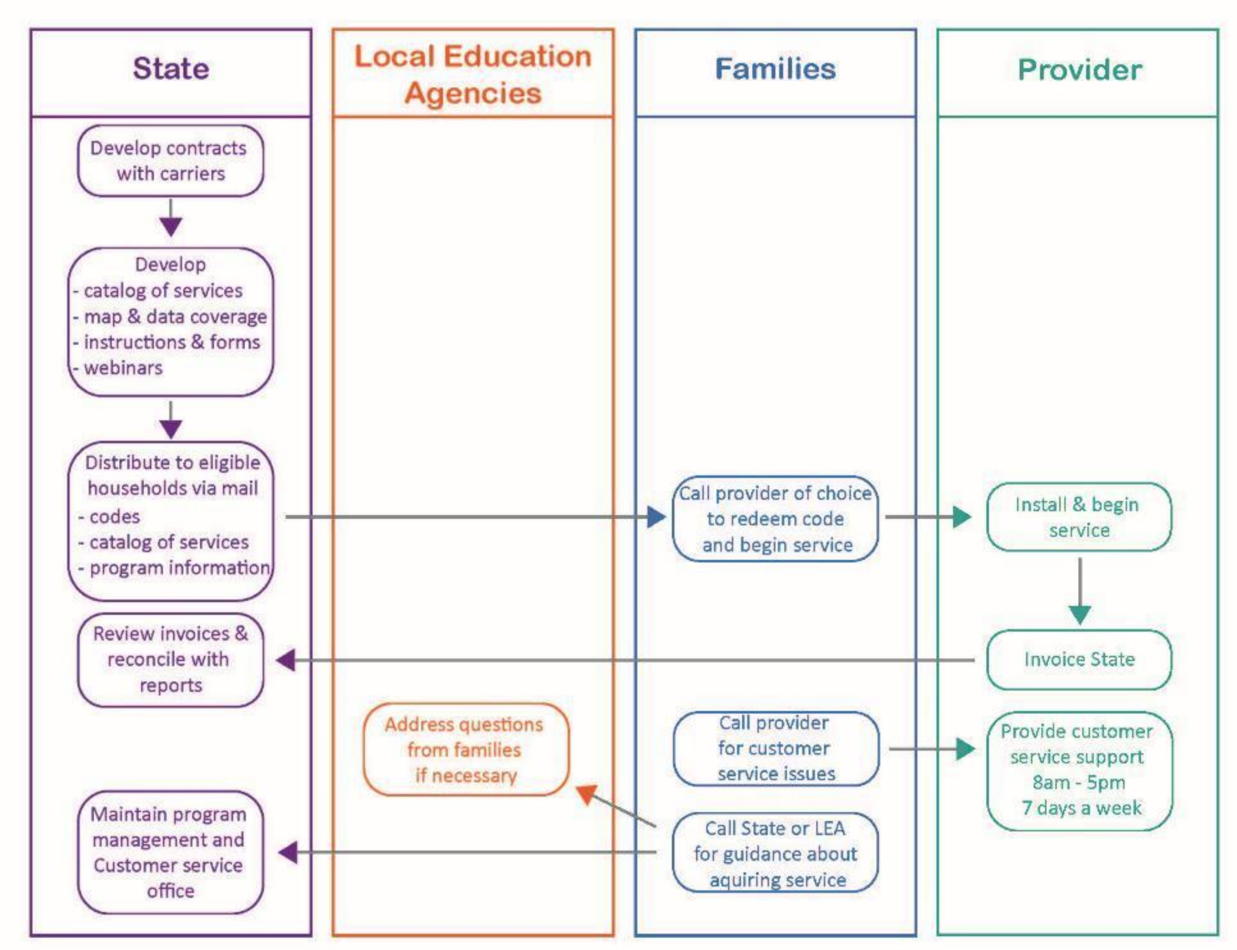
This report recommends the following process to quickly and efficiently procure bulk internet service to provide eligible students home broadband connectivity. The recommendations seek to leverage existing mechanisms whenever possible, and to allocate responsibilities among

[36] The great uncertainty in the projected budget concerns the level of participation by eligible households. There is no precedent for this program, which makes challenging projections regarding how many households will choose to take advantage of the program. As a result, there is a certain level of uncertainty about how much funding will be utilized.

entities in a manner that maximizes strengths to ensure effective and efficient program implementation.

Given the urgency of this effort, it will be critical to keep the process as simple and efficient as possible and to allocate roles and responsibility efficiently, without duplication of effort or need for extensive preparation time. The process recommended below seeks to create that level of efficiency. The following graphic illustrates the process recommended, which is described in greater detail below.

Figure 24: Recommended Program Structure



8.1.4.1 Procurement Mechanism

We recommend that the State utilize existing contracts with providers wherever possible and also issue a simple solicitation document, appropriate to State procurement rules, that seeks to identify additional providers that are able to meet requirements related to broadband service, customer service, equipment and installation, and reporting.

This proposed process seeks to leverage existing State contracts wherever possible and utilizes an emergency declaration in order to rapidly procure new services that meet the RFP requirements.

Due to the scale of this effort, a multi-provider solution is necessary in order to reach all eligible students and to avoid overloading any one network to the point of severe service degradation. The recommended procurement structure is intended to capture all respondents that would be capable of providing services that meet the technical specifications outlined in Table 1, above.

8.1.4.1.1 Procurement Structure

Based on best practices, the following components should be included in a comprehensive yet efficient procurement:

1. **Geographic coverage.** Respondents should be asked to provide a map of the State of Vermont indicating ZIP codes or census blocks where service is available that meets the capacity and data requirements outlined in the item below. The map should indicate where there may be service limitations, such as a chance of lower speeds or poor performance indoors.

2. **Service requirements.** Respondents should be asked to indicate their ability to meet the following requirements.

   a) **Minimum required capacity**. Eligible service will perform indoors *at minimum* speeds of 25 Mbps download and 3 Mbps upload, with no limitations on speed dependent on the time of day. Terrestrial networks will have latency less than 150 ms.

   b) **Minimum required data.** Eligible service will provide unlimited data, with a minimum of 50 GB of data available at an unthrottled capacity, per household served per month. There will be no limits on data use dependent on time of day.

   c) **Equipment and installation requirements.** Respondents must provide the equipment necessary to enable in-building Wi-Fi within the home, including but not limited to modems, routers, or hotspot devices. Such equipment must be capable of connecting at least five devices simultaneously through Wi-Fi.

Respondents must be able to provide installation services as necessary and when customer self-installation is not possible. Any necessary in-home installations must follow appropriate social distancing guidelines and use of masks or other personal protective equipment (PPE), as determined appropriate by the State. If devices are to work directly out of the box, they should be delivered to the home and with included instructions.

d) **Customer service obligations.** Respondents must indicate their ability to make customer service available between 8am and 5pm Central time, seven days a week, for the extent of the service period.

3. **Timeline.** Respondents must indicate their ability to offer service beginning as soon as possible and continuing for one year.

4. **Proposed pricing.** Respondents should indicate proposed pricing for such services, on a per-household basis, for service, equipment, and installation (if any) for one year.

5. **Reporting requirements.** Reporting requirements will be included as deemed necessary by the State.

6. **Invoice format.** A standardized invoice format will be developed and included in the RFP so that submissions by providers are consistent and aligned with State requirements.

8.1.5 Service Enrollment and Installation

Based on best practices in other states, we recommend that the State directly mail each eligible household a package that contains the following:

- **A code that is unique to that household** and can be used to redeem service directly with a participating service provider
- Information about the program, including a phone number for the customer service office within the State, and a step-by-step explanation of how the code can be used to redeem service
- District-specific information about participating providers and a phone number to contact each provider for service enrollment

Families may then choose the service they wish to receive and use their unique code to enroll directly with the service provider.

8.1.5.1 Invoicing and Payment

We recommend that participating service providers be required to track and collocate households served at least once per month, and submit to the State a single monthly invoice based on the number of service connections made that month, as well as a list of the individual voucher codes that have been used to redeem service.

Service providers would invoice the State directly and submit one invoice on a monthly basis based on the number of connections set up during the preceding month. This strategy vastly simplifies the invoicing process for both the provider and the State, enabling a streamlined transaction and efficient compensation.

8.1.5.2 Program Support and Service Validation

CTC recommends that the State create a small office in order to provide program support and service validation to ensure the integrity of the program. The office's responsibilities would include:

- Develop and distribute promotional and informational materials to families and school districts, including:
    - Catalog of services
    - Explanatory information regarding each provider and their service offering
    - Map of provider coverage areas
    - Explanatory information regarding accessing and using vouchers, including how to sign up for service with providers
    - Instructions for accessing customer service
    - Draft materials for communications with families
- Develop and maintain a dedicated website with all written and webinar materials, to be updated frequently
- Develop and deliver a series of webinars to communicate this information to the school districts

- Provide customer service support to eligible families as they navigate the program. We recommend that a customer service telephone line be made available and staffed between 8 am to 5 pm from project initiation. Customer service representatives should be able to answer questions from families and intervene with providers in the event of customer challenges (such as service not working or significant delays associated with installation). Escalation to technical support, made available during the same hours, should also be available

- Review invoices from service providers and reconcile with reports of participating households
- Conduct random quality control and spot checks of service to ensure service level requirements are being met

8.1.6 Timeline for Implementation

Assuming a fast procurement, we believe the following timeline is feasible:

Figure 25: Potential Timeline for Implementation

Milestone	Month 1	Month 2	Month 3	Month 4	Month 5	Month 5
State launches program & develops procurement						
State develops program materials & webinars						
State finalizes contracts with providers						
State distributes materials to families & school districts						
Families contact providers for service						
State maintains program management & customer service office to support families & districts						
Providers deliver service						

In addition, in the event that the federal government extends the timeline for use of CARES Act funds, the period for delivery of service could be extended by the State through the end of the school year.

8.2 Improving Broadband Access for Unserved Vermonters

In many areas of the State, Vermonters cannot access broadband internet at any price due to a lack of infrastructure. These places are often rural, low-density areas where it is not profitable for private Internet Service Providers to extend service.

The State of Vermont has long recognized the need for more robust broadband infrastructure and has set a statutory goal of serving every E911 address with 100/100 Mbps service by 2024. The State has taken many steps to improve broadband access over the last decade, including creating the Vermont Universal Service Fund, allowing the creation of Communication Union Districts (CUDs), and using loans from the Vermont Economic Development Authority to facilitate broadband expansion.

Still, many gaps remain, and the Covid-19 pandemic has introduced new challenges to those without access to broadband. According to Public Service Department data, there are 60,511 premises in Vermont without access to broadband infrastructure that could deliver speeds of at least 25/3 Mbps, excluding those that will soon receive service under the Emergency Connectivity Initiative and GVCNI. (For the purposes of this report, locations that will soon be served by the Emergency Connectivity Initiative and GVCNI are considered served.)

8.2.1 Types of Unserved Premises

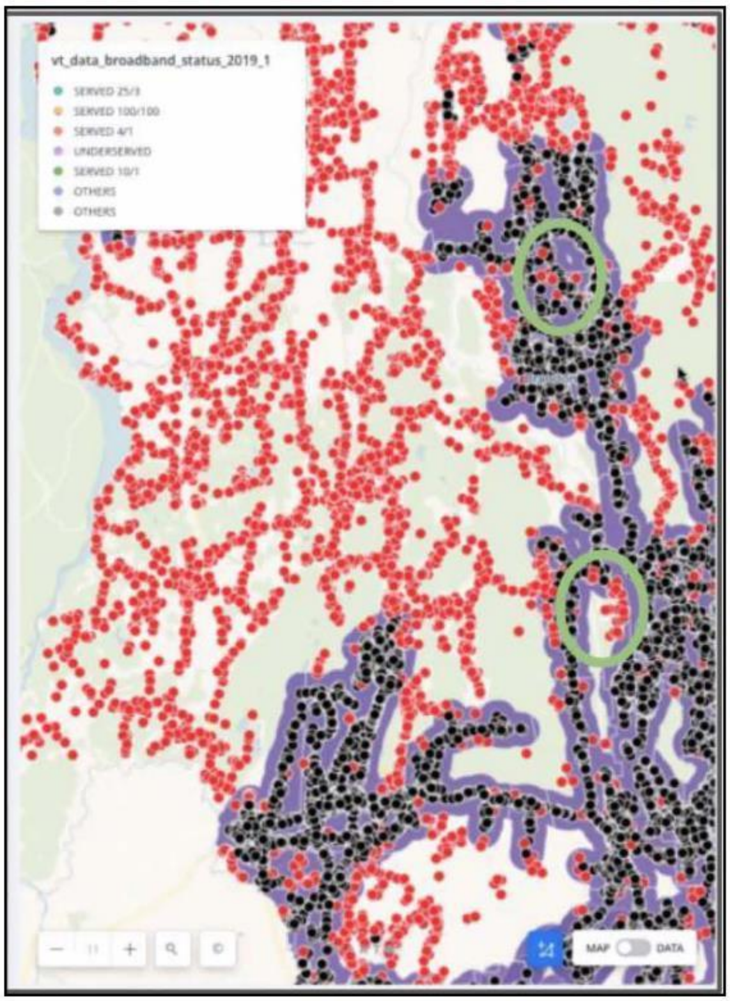
We have identified three primary "categories" of unserved premises. We note that the category numbers do not indicate prioritization or emphasis in terms of the State's approach to filling its broadband gaps; the numbers are merely a convenient way to refer to the categories. All three of these categories of unserved premises are prevalent and distributed throughout the State.

- **Category 1: Large, contiguous unserved areas where there is no wired provider available for miles.** These areas are typically rural and have a low density of premises per mile. CUDs in particular are eager to serve these areas as it is significantly cheaper for a new provider to build out in areas with no existing cable or fiber presence, and being the only provider offering 25/3 much less 100/100 in those areas provides for healthy penetration rates. However, these areas cannot be connected with wired service quickly enough to address the Covid-19 pandemic, as the infrastructure does not exist in close proximity; however, wireless infrastructure, including 4G LTE service, does reach the majority of these locations.

- **Category 2: Discrete clusters of unserved addresses in an otherwise largely served area.** These can also be referred to as "pockets" or "islands" of unserved houses. The isolated unserved premises are typically on roads that are particularly long relative to the number of potential broadband customers on the road; in other words, they have a lower density of potential customers than the surrounding areas. The incumbent ISP has not built infrastructure on those roads because their potential return on investment is not great enough to prompt an investment in reaching the potential customers who live there. Given the low density of houses, too, a cable provider is not obligated to build infrastructure on those roads under the terms of their cable franchise agreements with the local jurisdiction.

  For the residents on roads like these, which exist in locations in many parts of the State, this situation is particularly challenging; the cost of an ISP's line extension down their road—which the residents would be required to pay in order to get service from those companies—can be high. Furthermore, these locations are unlikely to be served by a CUD or another competitor in the near future because of similar investment costs and lack of return needed to keep CUDs sustainable. Reaching these locations would require overbuilding significant amounts of cable or fiber, which increases construction costs, and due to the low-density in these areas, means expected revenue is low. Based on our analysis, an estimated 16,000 unserved premises are within a half-mile on either side of existing cable or fiber infrastructure, and 27,000 unserved premises are within a mile of existing infrastructure. (Note, this calculation includes premises with lengthy drops, mentioned below.)

Figure 26: Unserved Premises Close to Existing Infrastructure



However, we advise that the Public Service Department identify the pockets to be prioritized by line extensions, rather than large, contiguous sections that extend out into category 1 areas. The map (above) of portions of the western side of the State illustrates the difference between Category 1 unserved contiguous areas, and Category 2: unserved pockets. The Purple "buffer" demonstrates a half-mile distance from existing cable and fiber plant (Category 1); green circles identify unserved pockets surrounded by, and a short distance away from, existing wired service (Category 2).

- **Category 3: Premises with long driveways or requiring underground conduit.** Here, homeowners struggle to get service, despite the presence of broadband infrastructure passing the entrance to their driveway, due to being set so far back from the road that the ISP has no obligation to build the service drop from the road to the user's premises at no cost to the customer. This generally refers to locations where the home or business is more than 300 feet away from the road—that distance being the typical limit for cable franchisees' obligations to install a service drop at no cost to the customer.

  Additionally, ISPs may charge customers for installations that must be connected via underground conduit; manufactured housing parks in particular often must be connected by underground conduit. Although these homes are effectively unserved because many homeowners find the drop construction cost unaffordable, the homes do not always fit into the category of unserved for purposes of federal or Emergency Connectivity Initiative funding. The State has taken some actions to solve this problem, though: GVCNI funds fiber-to-the-premises customer drops and installations, and up to $500 of a LECAP grant can be applied to the cost of customer drops beyond 300 feet.

8.2.2 Strategic Recommendations for Connecting Unserved Premises

This strategic plan is designed to quickly and efficiently bring internet service capable of performing work from home, telehealth, and remote learning tasks, to unconnected Vermonters in the pandemic, without harming the State's progress toward a long-term 100/100 solution. Therefore, recommendations focus on leveraging existing infrastructure whenever possible.

For unserved areas, we are using the following "triage" of service mechanisms. The fastest, most economical solutions are tried first; more challenging, slower, and/or more expensive solutions are implemented in areas where the optimal solutions are not viable. The triage is as follows:

1. Cellular service has expanded in the State, due to AT&T's FirstNet deployments, and roaming agreements between carriers and VTel. Where good cell service is available, **provide mobile hotspots to low-income families**.

2. **Fund Line Extensions in a targeted way to reach "pockets" of unserved premises surrounded by existing wired service.** Mobile hotspots can be provided to low-income residents in these locations to bridge the gap until line extensions are built.

3. **Provide signal boosting equipment** to premises with poor cell signal via rooftop antennas.

This triage also enables the State to serve the low-income households that are also unserved with the subsidy program outlined in recommendation #1—because a mobile broadband solution is very likely to be technically attainable for low income households, whether or not they are passed by 25/3 wireline service

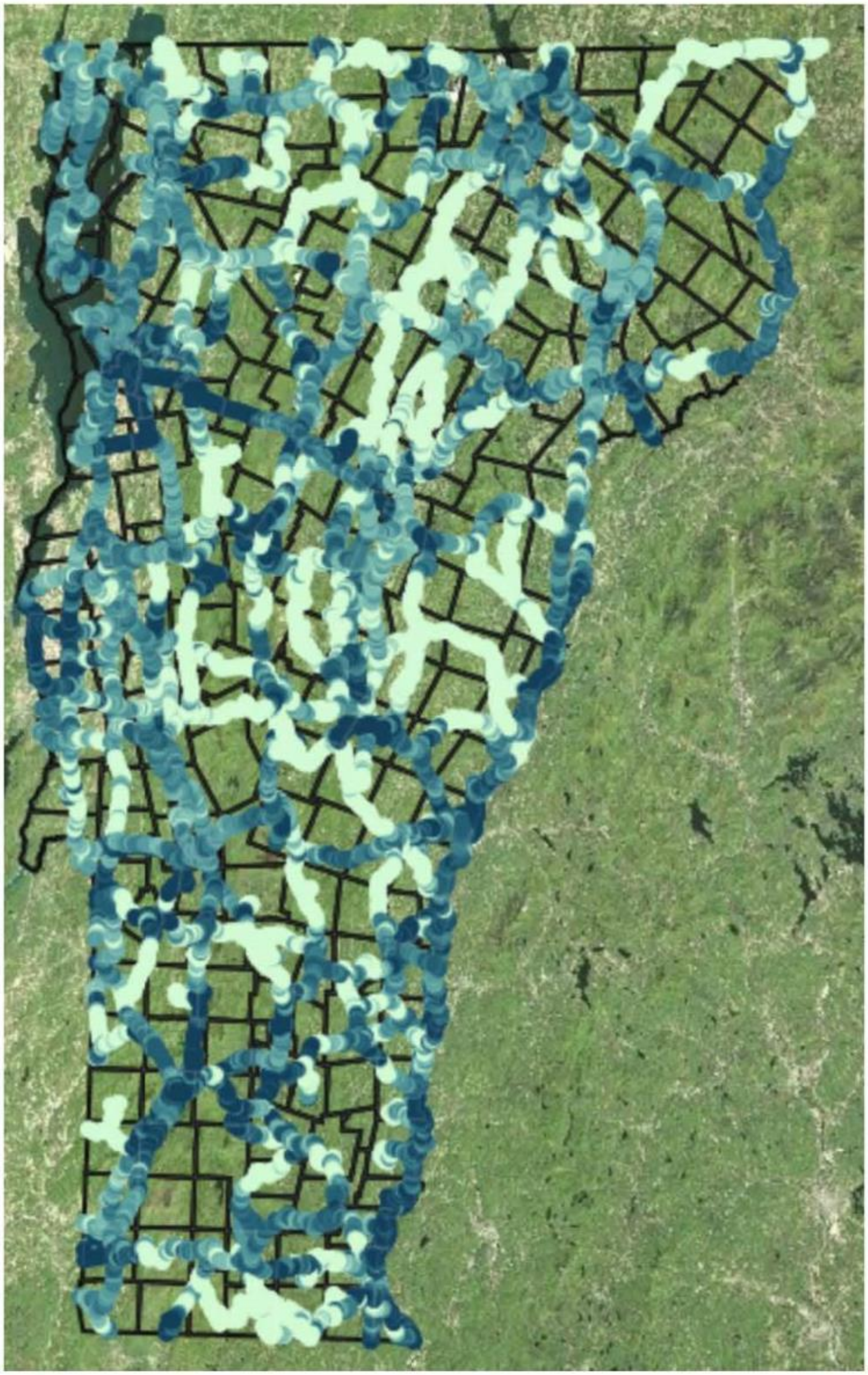
Lastly, this section will also discuss considerations around other technology solutions that were vetted and deprioritized.

8.2.2.1 Cellular Service Expanded by Hotspots

As noted, there are approximately 61,000 unserved premises according to the Department of Public Service, after Emergency Connectivity Initiative grants were awarded. These premises are distributed throughout the entire state.

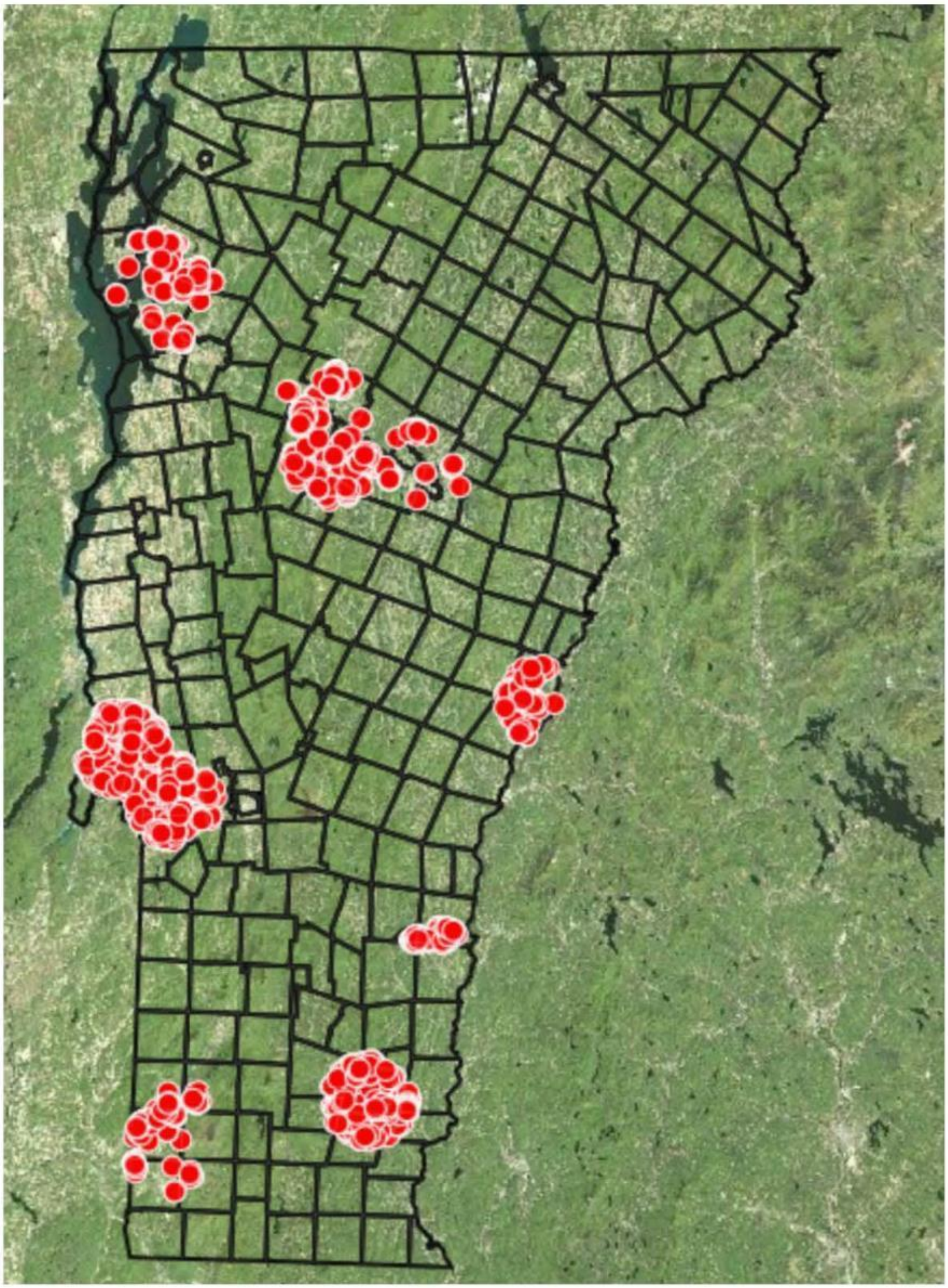
Using cellular coverage data compiled by 2018 drive tests on major roads, 2020 volunteer drive-tests, 248a tower applications that list at least one mobile data provider, and a list of AT&T's FirstNet deployments projected through the end of 2020, we identify areas where we estimate there will be acceptable mobile broadband service. With the drive test results, we identify areas that had a minimum download speed of 10 Mbps or higher in 2018 and any point within a half-mile as likely mobile broadband service areas; 21,700 premises can be reached according to drive-tests.

Figure 27: Drive Test Routes



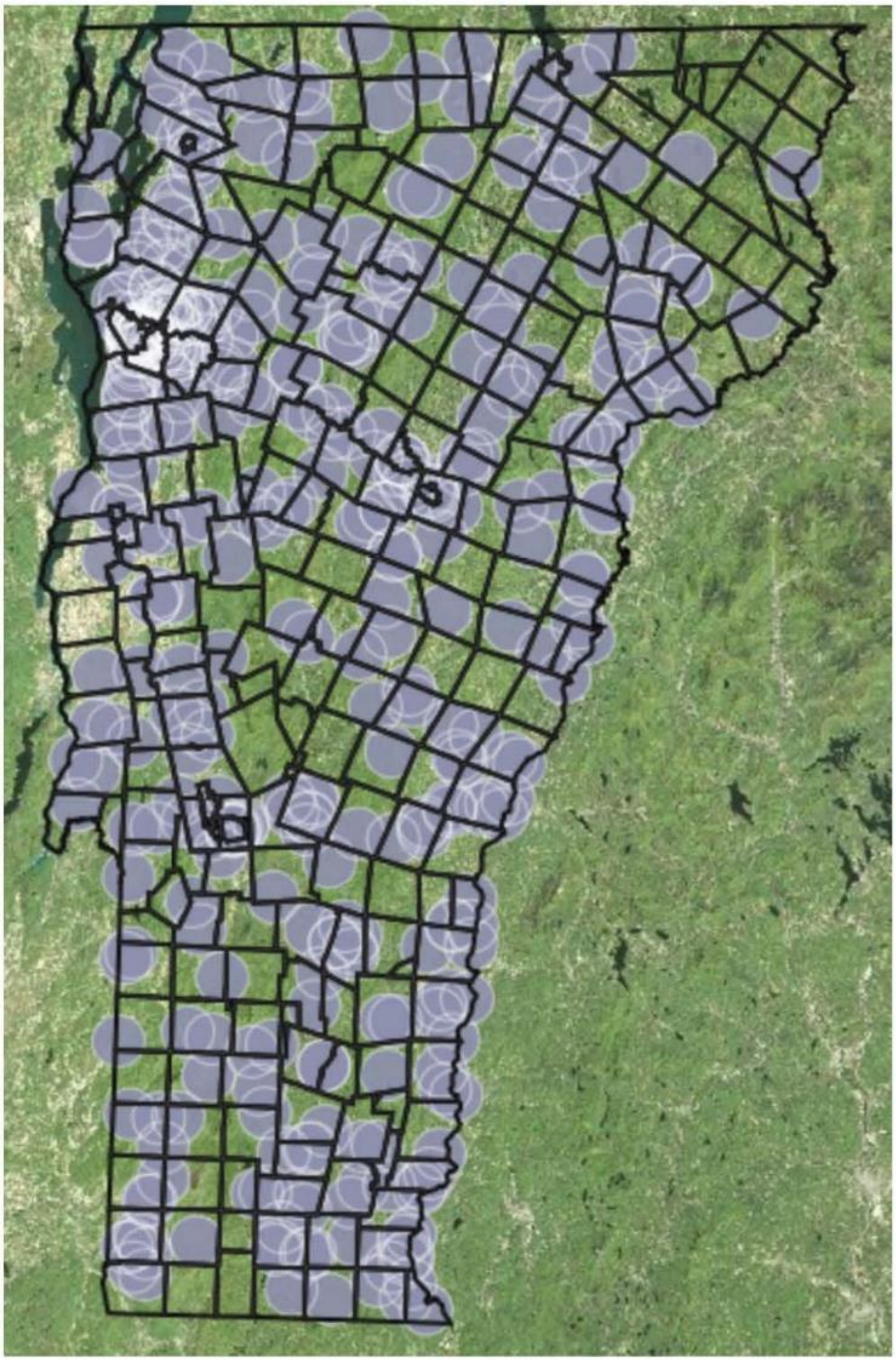
An additional 2,800 premises can be reached via AT&T FirstNet deployments that are required to be completed in 2020.

Figure 28: Premises That Can Be Reached by AT&T FirstNet



Lastly, adding in an analysis of 248a tower permit data outside the other mobile broadband service areas, we believe an additional 20,300 premises not captured in the drive-test data or by new AT&T deployments, that are within 3 miles of the additional towers, can be served by cellular data.

Figure 29: 248a Installations With at Least One Cellular Data Provider



In addition, recent roaming agreements between VTel and cell carriers, and the fact that not all roads were surveyed likely make this number significantly higher.

Using the threshold of 22 percent of Vermonters as qualifying as low income, we project that 9,850 of these households may qualify for the recommended subsidy program, and should the State anticipate subsidizing mobile hotspots for all of these low-income premises for 1 year, the cost would be approximately $2.4 million.

8.2.2.2 Targeted Cable and Fiber Line Extensions

Many Vermonters live in proximity to areas served by cable networks but their homes are not passed by cable service. These pockets of unserved locations are unlikely to be served by entities other than the providers that are already close by, as that would require costly and extensive construction by the new provider solely to reach them.

An estimated 16,000 unserved premises are within a half a mile of a cable or fiber line, and 27,000 unserved premises are within a mile buffer, although some of these premises are located on the outskirts of existing wired infrastructure (Category 1) and are therefore not considered in an "unserved island" (Category 2). Using geospatial analysis techniques, the project team identified 39 towns where at least 85 percent of the existing road miles are already served by cable or fiber according to PSD data; these towns are most likely to have islands of unserved premises. We then performed some visual verification of maps of those towns to confirm unserved premises were indeed in pockets, and removed towns from the list without substantial pockets or towns known to be in the process of being built, resulting in a list of the top 31 towns where we believe line extensions could be prioritized. In these towns, there are 1,397 premises in islands within 0.5 miles of existing cable or fiber, 1,651 premises within 1 mile of cable or fiber, and 1,701 total unserved premises. There are approximately 148 road miles without infrastructure, not including interstates and two-lane highways. Assuming the cost of cable and fiber deployment remains at $30,000 per mile (the number the State of Vermont has used as a benchmark for cable line extensions), the project team estimates that building out the unserved areas in the 31 towns would cost $4.5 million. This results in a cost per premises of around $2,650.

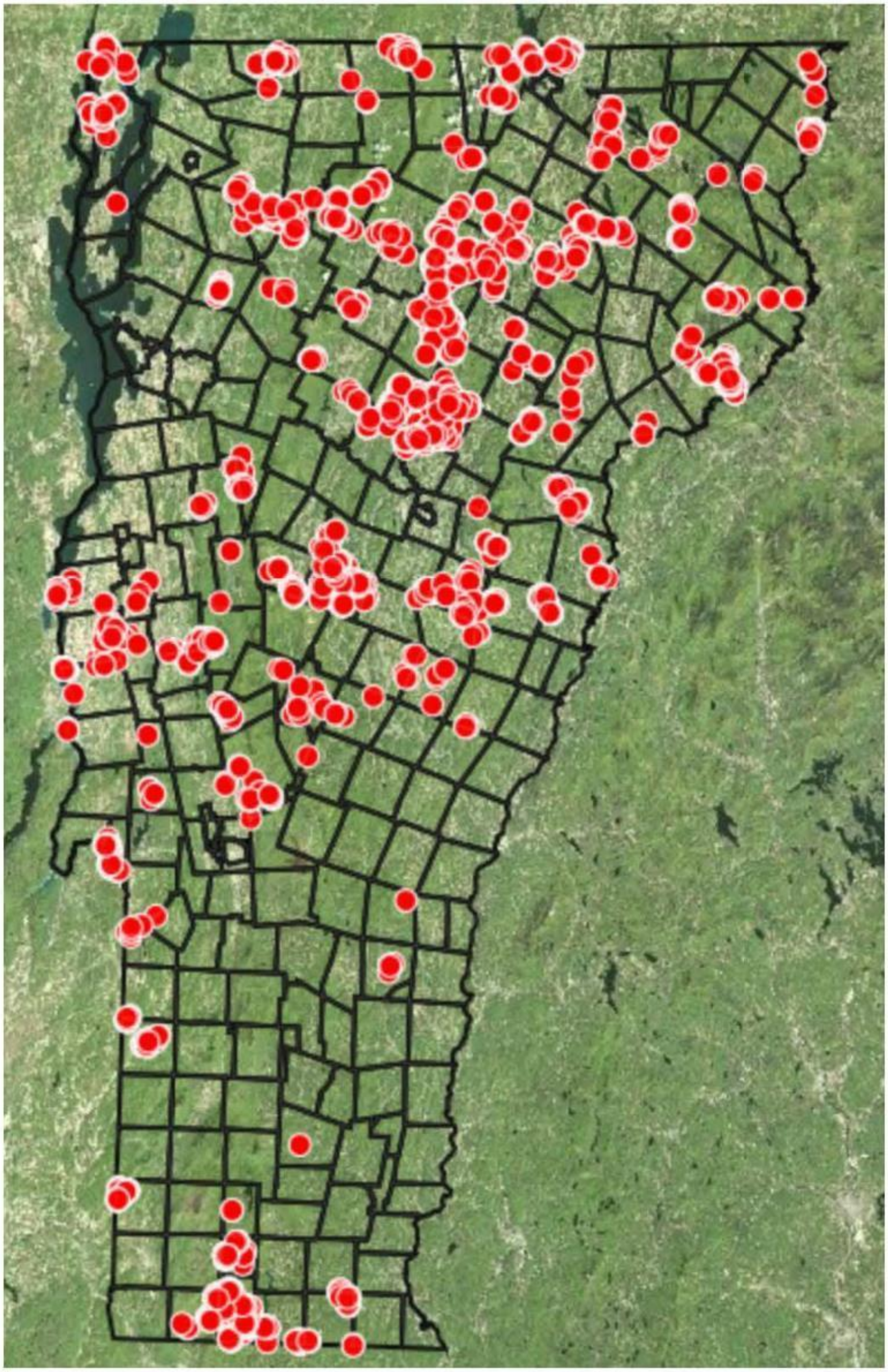
It is important to note that during the performance period of this project, Consolidated Communications, Inc. (CCI) won many FCC Rural Digital Opportunity Fund (RDOF) locations around the state and announced its intentions to build fiber to 200,000 premises, a substantial number of which are likely to be in already-cabled towns. Though ideally the State could anticipate where CCI was going to build and when so as to not fund a line extension in a location about to be built using private funds, the State will not likely be able to predict or know where CCI intends to build (outside of its RDOF blocks), and so should proceed with line extensions until it knows with certainty when and where CCI will build.

An explanation of our methodology and details on each of these towns are in Appendix H. Because these deployments are extending existing infrastructure, the project team believes that with sufficient resources and cooperation by the cable and fiber providers, this deployment could be completed by the end of the year and if possible, funded using CARES Act dollars.

8.2.2.3 Cellular Service Signal Boosters

Some Vermonters have weak cellular service and would not be able to get consistent broadband but would be able to get significantly better service by installing cell service repeaters, also known as signal boosters, typically on a premise's roof. Installing signal boosters will allow a greater number of Vermonters to receive adequate internet speeds on existing cellular networks. Using data from The Department of Public Service's drive test (expanding to areas with any measured speed, and any area within one-half mile of those areas), we estimate that about 3,700 additional unserved locations likely have weak cell service and could benefit from repeaters. (If VTel receives ReConnect funding and expands its network as discussed below, a further 3,500 locations would receive enough signal to likely benefit from repeaters.)

Figure 30: Premises Where Cell Boosters Could Benefit Connectivity



The project team recommends the State of Vermont notify residents who may benefit from signal boosters and provide a list of options. The project team recommends that the State bulk purchase signal boosters for an estimated 820 low-income households that would benefit; another 775 low-income households would likely benefit from a cell service repeater if VTel expands its network. The State should also consider the bulk purchase of signal boosters for additional Vermonters who are not below the low-income threshold, which would allow them to access better service without needing to pay as much for the installation of new equipment.

As described below, the proposed Broadband Corps could install these signal boosters for Vermonters. Corps members will receive a simple training on installation, as well as Covid-19 safety precautions.

Cell signal boosters typically cost about $400, with installation costs of about $350. Assuming the Broadband Corps is able to complete installations and the State can negotiate a lower price when purchasing in bulk, the project team estimates that the State of Vermont can install signal boosters for 1,575 low-income households for about $535,000.

8.2.2.4 Potential New Wireless Deployments

VTel has applied for ReConnect funding from the USDA to extend its wireless network. While this application is still pending, VTel has already begun to expand its network with new wireless deployments, like their recent deployment in Whitingham. Our estimates indicate that VTel's proposed network expansion will cover about 2,500 that are currently without access to mobile data service; and would not be well covered by the mechanisms described above. In addition, another 3,500 premises could be served be VTel's proposed network with the installation of cellular signal boosters. It is not known whether VTel would build part or all of the proposed networks should USDA funding not be available.

We do not recommend at this point that Vermont step in to subsidize VTel's proposed deployment should the USDA decline to fund it. First, this wireless infrastructure would not provide speeds of 100/100, and therefore does not advance the State's long-term goals. Second, funding this project may keep many parts of the State of Vermont ineligible for future USDA ReConnect funding for a longer period of time, which would inhibit the State's ability to meet its long-term goals. Because the State has set 100/100 as a goal, any investment in long-term, permanent investment should be directed toward meeting that goal.

8.2.2.5 Wireless from Other Non-Residential Fiber

We evaluated whether it was possible to expand broadband access by deploying wireless equipment on buildings or other vertical assets where there is existing non-residential fiber; for example, a wireless provider could attach equipment to a building connected by FirstLight or a fiber splice located outside a VELCO substation on VELCO's fiber network. However, the project team does not recommend that the State of Vermont fund the deployment of this type of wireless network at this time.

Nearly all locations within a 0.5 mile radius of a building served by FirstLight or a VELCO substation could be more rapidly served by mobile data (including those households that could benefit from signal boosters) or line extensions. Identifying and deploying small-scale wireless solutions would require time from PSD employees or employees from other agencies that could best be used implementing other programs.

Individuals across the State have been working on these types of hyper local solutions — from Addison County to the Northeast Kingdom. Individuals with experience could be supported by the CUDs may be able to set up and manage these micro-networks. These deployments are not to be discouraged; however, if is not in the State’s best interest to fund them to address an immediate Covid-19 emergency.

8.3 Using Broadband Corps to Mobilize Solutions

Consistent through interviews and survey feedback, stakeholders have illustrated a need for more hands-on resources to assist with the technical issues that inevitably arise as the State moves online. Schools tech directors that were busy serving an in-person school enterprise now need to also assist educators, students and parents for both online and in person instruction. Healthcare providers report that appointments take longer due to technology barriers and state that they often are using appointment time to walk patients through use of their online systems. And the rapid distribution of wireless devices and boosters to connect many unserved locations will require relatively low skill but intensive work on the ground.

8.3.1 Overview of Broadband Corps Tasks

A quickly organized Broadband Corps could address these gaps through organizing volunteers through the CUDs and providing direct service to Vermonters to make sure as many as possible are connected quickly and able to use this new connectivity.

We recommend the creation of a Broadband Corps to perform the following tasks:

1) **Assist with infrastructure and service deployment**. Corps members will assist Vermonters to measure what type of hot spot would work best, and whether a signal booster is needed. Corps members would also be responsible for installations, updating coverage maps, and other duties related to infrastructure deployment. Installation of signal boosters are very simple efforts that require few specialized skills and could be ideal for volunteer efforts.

2) **Perform outreach, and direct technical support to Vermonters becoming familiar with their broadband connections and devices.** Corps members will work with schools,

libraries, town administrators, CUDs, to increase effective utilization of devices and online tools. Structured as a digital literacy help desk that used telephone service to engage participants, Corps members would deliver support to those unfamiliar with core video conferencing tools, as well as specific applications related to remote education and telehealth.

3) **Provide "high touch" support to ensure low-income Vermonters take advantage of broadband support programs.** Enrollment in programs for low-income Vermonters – from State subsidies to ISP specific programs – is very low. In collaboration with regional organizations who work with low income populations, Broadband Corps members can undertake proactive outreach to eligible Vermonters and provide phone based support to ensure applications get processed and submitted.

If the Corps is successful in connecting Vermonters rapidly, we recommend in the Spring that Corps members spend available time on pole surveys of towns on behalf of CUDs and thereby advance their work toward deploying fiber.

8.3.2 Possible Broadband Corps Structure and Scale

We have created a sample Broadband Corps structure that combines regionally assigned Corps members with a statewide installation team. Corps members could be assigned to Regional Planning Commission regions, and could work closely with RPCs and/or CUDs if desired, with statewide management based in a central location. We recommend at least 22 regional corps members (two for each RPC region), and at least 20 statewide corps members.

Regional corps members would be focused on evaluating the viability of hotspot or booster for unserved households. Statewide corps members would comprise the trained installation teams. Though this may seem like extra driving for the central corps members, central storage of equipment provides great efficiencies, and this is how installation teams in the renewable energy space and other similar ventures operate.

A recommended management structure for the Broadband Corps would include a statewide director, two to three regional managers, one data manager, and one operations manager. The initiative could be assigned to a nonprofit with experience in this arena or potentially managed under the SerVermont office with the understanding that traditionally the Vermont National Service Commission has been largely focused on distributing AmeriCorps resources, not managing direct service activities. Though this structure would also work well as an AmeriCorps program with the benefits that kind of structure provides (e.g., insurance, recruiting support, education awards), incorporating it into this national structure would likely delay the project by many months or longer. There would remain opportunities to leverage other national service programs like the National Community Conservation Corps (NCCC), which has the ability to quickly deploy teams of trained AmeriCorps members to a state for six-week labor-intensive projects like this one, although preparations would need to be made to maximize the value of this deployment. Once this program is underway, SerVermont could evaluate whether the initiative could be transitioned to a statewide AmeriCorps program.

While a Corps could be put together quickly to get started as early as December, it is likely such a team would be focused on executing for a six-month period. Below is a draft budget for a six month effort:

Table 2: Sample Broadband Corps Budget

Personnel	Cost	Number	Total
Regional Corps Member	$18,000.00	22	$396,000
Statewide Corps Member	$18,000.00	20	$360,000
Full Team Director	$50,000.00	1	$50,000
Regional Director	$40,000.00	3	$120,000
Data Manager	$40,000.00	1	$40,000
Operations Manager	$40,000.00	1	$40,000
Fringe	15%		$150,900
Total Personnel Cost	$1,156,900		
Work Equipment	**Cost**	**Number**	**Total**
Monthly Truck Lease	$500	10	$50,000
Gas, oil, tires, maintenance	$500	10	$50,000
Construction equipment	~$350	10	$3,500
Pole Collection software	$50	10	$5,000
Total Equipment Cost			$108,500

Note: This is a sample budget to provide scale to this proposal. Room for contingencies should be built into this budget, as well as administration costs and overhead for the managing entity, and estimates should be further vetted for equipment and personnel costs.

9 Legal Analysis

This legal analysis was prepared by Andrew Montroll, of Montroll, Backus & Oettinger P.C., based in Burlington, Vermont; and Jim Baller and Casey Lide, of Keller and Heckman LLP, based in Washington, D.C.

9.1 Introduction

This section explores the regulatory and legal landscape facing Vermont as it seeks to ensure that broadband connectivity is accessible in every corner of the State.

Required to focus on near-term emergency measures, the Report did not examine in detail other options that the State might have to meet its broadband goals. As the Report also makes clear, however, these emergency measures are intended to complement the other options that the State may consider in the future. Accordingly, the legal analysis begins in Section 9.2 below by addressing the relatively few legal issues that these near-term emergency initiatives may pose. As the State considers them, however, it should be mindful of the legal issues that may lie ahead. To help the State do so, Section 9.3 outlines the federal and State legal framework underlying the key communications services and networks, and Section 9.4 discusses legal issues that may be particularly germane to the State's other options.[37]

9.2 The Report's Strategic Recommendations

In general, the Report's three main near-term recommendations contemplate activities that do not present legal issues that are particularly unusual for the State, or that involve arcane concepts under federal and State communications law and regulation. Taking each of the Report's three main recommendations in turn:

(1) Broadband service subsidy to low-income Vermonters

The Report recommends that the State build upon the Vermont Department of Public Service's effort to reimburse broadband costs of families affected by the pandemic and establish a subsidy program addressing barriers to adoption relating to affordability. As stated in Section 1.4.1:

> We recommend that the State complement that effort, and expand it, by also focusing resources on providing free broadband to low-income families that may not already have service to their homes because of the barrier of cost.

[37] The field of communications law is extraordinarily complicated and rapidly evolving. Outcomes will often depend on the particular facts involved. The discussion in this Section 9 is not intended, and should not be interpreted, as legal advice. It is presented for general informational purposes only.

> Specifically, the State could purchase services in bulk from providers that currently serve communities throughout Vermont, then provide codes for qualified residents to redeem for free service from any participating provider—thus completely eliminating cost as a barrier to adoption.

The two main elements of this proposed initiative present certain legal issues. First, the State would need to "purchase services in bulk" from providers. This will require contract negotiations with service providers and other processes consistent with the State's procurement regulations. We assume that the State is well-versed in its procurement requirements and practices, and we offer no further comment on those issues.

Second, the recommendation calls for the State to qualify certain residents as "low income," and suggests that eligibility determinations "should build on existing mechanisms like Vermonters' eligibility for Medicaid or the National School Lunch Program." It goes on to note "[t]his will require collaboration and data sharing by public school systems or other institutions."[38] Apart from the issue of establishing standards for qualification in fact (on which we do not comment), the State's use of such information to qualify low-income households raises sensitive privacy-related questions relating to (1) how the State obtains the information (assuming the State does so at all), and (2) how the State maintains it.

Again, we assume that the State has substantial experience with Medicaid and the National School Lunch Program, including their privacy-related requirements, and with handling tax, health, and other confidential data under various other programs. If the State seeks to obtain and use such information directly, it will need to identify and navigate any relevant constraints. There may also be other approaches that might work for the State, including third-party verifier programs of the kind that exist under the FCC's Lifeline program. If the State is interested in these alternatives, it should examine them in detail.

However the State obtains information concerning low-income households in Vermont, the State should ensure that the information is protected against disclosure in a manner comparable to other confidential or sensitive information maintained by the State. The State should also consider whether and how to ensure that the program's service providers are also protecting the

[38] Section 1.4.1.

confidential data to which they have access, and it should include appropriate confidentiality provisions in program-related agreements with service providers.

(2) Funding modest infrastructure enhancements.

The Report proposes a near-term recommendation relating to the availability of broadband. It provides in Section 1.4.2: "While the optimal long-term approach is to connect unserved premises with fiber or other high-speed wireline services, we recommend an emergency approach" involving: (1) use of mobile hotspot devices, (2) paying for extensions of cable or fiber service in targeted, unserved pockets, and (3) the use of rooftop antennas to boost marginal mobile broadband service.

In general, these recommended initiatives do not present substantial legal issues for the State. The deployment of additional mobile devices and of rooftop boosters primarily involves obtaining the devices and obtaining permission to mount them on rooftops. These are essentially routine procurement and contract issues. State financial support of line extensions could become somewhat complicated, as it raises potentially significant (but not intractable) questions regarding the qualification of eligible areas and households, and the selection of service providers that may receive or benefit from such funds. The State should also ensure that service providers do not impose unreasonable rates, terms, and conditions on households connected under the program – such as requiring the purchase of cable television service in addition to broadband Internet access service.

(3) Developing a Broadband Corps

The Report's third major strategic recommendation, in Section 1.4.3, calls for the development of a "Broadband Corps," described as "a statewide team dedicated to supporting CUDs and mobilizing the people power necessary to confirm mobile hotspot options, assist with nontechnical installations, and provide technical support for low income and technology challenged Vermonters." While the establishment of such a program would involve staffing and equipment procurement matters, it does not appear to present any significant legal issues.

9.3 Legal and Regulatory Framework for Particular Communications Services and Networks

As the discussion to this point indicates, the Report's three main recommendations do not present significant legal issues. As noted above, the State is likely to encounter more significant legal and regulatory issues as it considers its other strategic objectives related to broadband, and it should be aware of such issues as it establishes its short-term emergency programs. To help the State do this, we begin below by providing an overview of the federal and State legal and regulatory framework for the major types of communications services and networks. Then, in Section 9.4, we turn to some key legal issues that the State's long-term options may pose.

9.3.1 Telecommunications Service

Federal law. While many may think of "telecommunications service" as simple telephone service, that term has a much broader meaning as a legal and regulatory matter. In fact, when Congress enacted the Telecommunications Act of 1996 (amending the Communications Act of 1934) to break down monopolies and enhance competition in all communications markets, it used the term "telecommunications service" throughout the Act, allocating various obligations and incentives among incumbent and potential competitive providers to encourage them to act in ways that would advance the pro-competitive goals of the Act.[39]

The term "telecommunications service" covers a broad range of activities. As a carrier moves from providing relatively simple services to providing more complex and extensive services, it will encounter increasingly heavy regulatory obligations and burdens. At the same time, as a provider's income from telecommunications services increases, it will have to shoulder an increasing share of the nation's burden to support universal service.

At the simplest level, all providers of "telecommunications service" are subject to various general duties. They must meet all relevant common carrier requirements of Title II of the Communications Act (which the FCC has relaxed to some extent). They must protect consumer privacy in the manner specified by Section 222. They must comply with the provisions of Section 251(a) that require them to interconnect directly or indirectly with the facilities and equipment of other telecommunications carriers and to refrain from installing network features, facilities or capabilities that may adversely affect disabled persons. They must also file reports and make contributions to the federal universal service program, as required by Section 254 of the Act.

If a provider elects to become a "local exchange carrier" (LEC)—a provider of local telephone service and/or access to long distance service—it will also have to meet the additional interconnection obligations of Section 251(b). These include allowing competing telecommunications carriers to resell the utility's telecommunications services; providing other

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39 In 47 U.S.C. § 153(46), "telecommunications service" is defined as "the offering of telecommunications for a fee directly to the public, or to such classes of users as to be effectively available to the public, regardless of the facilities used." The embedded term "telecommunications" is defined in 47 U.S.C. § 153(43) as "the transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent or received." A "telecommunications carrier" is defined in 47 U.S.C. § 153(44) as "any provider of telecommunications services." Section 153(44) goes on to say that such a carrier "shall be treated as a common carrier under this Act only to the extent that it is engaged in providing telecommunications services."

telecommunications carriers number portability, if technically feasible, in accordance with the FCC's requirements; affording them dialing parity; permitting them to make attachments to poles, ducts, conduits and rights of way at rates, and on terms and conditions, that are consistent with Section 224; and establishing reciprocal compensation arrangements for the transport and termination of telecommunications.

Section 251(c) imposes even greater regulatory duties on "incumbent" local exchange carriers (ILECs), which were the dominant local telephone providers in their service areas on the date of enactment of the Telecommunications Act.[40] The duties of ILECs originally included providing requesting telecommunications carriers interconnection and physical or virtual collocation; offering non-discriminatory access to unbundled network elements (UNEs); making any telecommunications services that the ILEC offers at retail available to competing telecommunications carriers on a wholesale basis for resale; providing physical or virtual collocation on just, reasonable and non-discriminatory terms and conditions; to support competitors' interconnection and access to UNE's; giving advance public notice of important changes to their networks; and negotiating in good faith to fulfill these obligations. However, over the last two decades, the FCC has eliminated or substantially reduced these requirements.

As indicated, the Act also provides numerous incentives to encourage persons to provide "telecommunications service." For example, new providers of such services are the beneficiaries of the pole attachment requirements of Section 224 and of the interconnection requirements of Section 251. Section 253 protects them from state and local barriers to entry, and Section 254 offers them subsidies for providing services covered by the federal universal service program.

Vermont law. The federal Telecommunications Act of 1996 allows Vermont to regulate telecommunications within the state as long as such regulations are not inconsistent with federal law.[41] Accordingly, the Vermont Legislature has granted broad authority to the Vermont Public Utility Commission (PUC) to oversee and regulate any "person or company offering telecommunications services to the public on a common carrier basis."[42] The Legislature likewise has broadly defined "telecommunications services" that are subject to PUC jurisdiction as:

> [T]he transmission of any interactive two-way electromagnetic communications, including voice, image, data, and information. Transmission of electromagnetic communications includes the use of any media such as wires, cables, television

40 The FCC can also treat a new entrant as an ILEC, but only if the FCC declares, by rule, that the entrant has acquired or displaced an existing ILEC and that treating the entrant as an ILEC is in the public interest.

41 *In re Verizon New England*, 173 Vt. 327, 332, 795 A.2d 1196, 1200-01 (2002).

42 30 V.S.A. § 203(5).

> cables, microwaves, radio waves, light waves, or any combination of those or similar media.
>
> Telecommunications service does not include value-added nonvoice services in which computer processing applications are used to act on the form, content, code, and protocol of the information to be transmitted unless those services are provided under tariff approved by the Public Utility Commission.[43]

The PUC uses a number of tools to regulate telecommunications services. First and foremost, Sections 102 and 231 of Title 30 of Vermont Statutes require that the PUC issue a Certificate of Public Good (CPG) to a company before it can offer telecommunications services to the public in Vermont. One of the primary purposes of this requirement is "to protect consumers against incompetent or dishonest businesses."[44] Likewise, the PUC has the authority to require telecommunications companies to issue tariffs for their services, which are subject to PUC approval.

While the PUC historically engaged in heavy regulatory oversight of telecommunications companies, it has taken a lighter approach, particularly for non-dominant or competitive telecommunications carriers, since the 1996 Act.[45] For example, under PUC rules, only dominant local exchange carriers are subject to corporate organization and financial reviews by the PUC, and non-dominant or competitive carriers are no longer required to file tariffs.[46]

Likewise, the process for non-dominant/competitive telecommunications companies to apply for a CPG from the PUC has been greatly simplified. To that end, the PUC has created a streamlined registration form that requires only basic information about the company and the services to be provided, along with a commitment from the company to comply with and follow all of the applicable rules and regulations regarding the provision of telecommunication services in Vermont.

9.3.2 Cable TV Service

Federal law. While telecommunications service is regulated through a mix of state regulation and federal regulation under Title II of the Communications Act, cable TV service has since 1984

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43 30 V.S.A. § 203(5).

44 *Investigation into New England Telephone and Telegraph Company's tariff filings re: Open Network Architecture*, Docket 5713, Order of 2/4/99 at 59.

45 *See* 30 V.S.A. § 227c.

46 PUC Rule 7.500.

been regulated primarily through a franchising process at the local level (or in some places, such as Vermont, at the state level). The Cable Communications Policy Act of 1984, codified at 47 U.S.C. § 521 *et seq*., ("Cable Act") requires cable operators[47] to obtain a cable franchise from a state or local franchising authority.[48] The Cable Act permits franchising authorities to impose various requirements as a condition of receiving a franchise, and imposes certain statutory limitations.[49] A franchising authority cannot "unreasonably refuse" to grant a franchise to a cable operator, for example, and franchises cannot be exclusive.[50] A franchising authority is permitted to require payment of a franchise fee, but the fee cannot exceed 5 percent of the cable operator's gross annual revenues from the provision of cable service.[51] The Cable Act also requires cable operators to support local public, educational and government access (PEG) facilities and programming, and prescribes certain customer service obligations.

In an order issued in 2007, the FCC found that local franchising authorities often imposed buildout, PEG, institutional network, non-cable, and other requirements that were overly burdensome to new market entrants.[52] Since then, the FCC has repeatedly acted to restrict local franchising authority discretion on various fronts. For example, local franchising authorities must now make a final decision on franchise applications within particular time frames, and they cannot refuse to grant a franchise based on issues relating to non-cable facilities or services (such as Internet access).[53] Any cable-related, in-kind payments required by a franchising authority are to be counted toward the 5 percent franchise fee cap, including certain specific franchise terms such a requirement to provide free or discounted cable service to public buildings, or to construct

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47 Under federal law, a "cable operator" is an entity that provides "cable service" using a "cable system" that it owns or controls. Each term is defined at 47 U.S.C. § 153.

48 47 U.S.C. § 541.

49 47 U.S.C. § 541(a)-(b).

50 47 U.S.C. § 541(a)(1).

51 47 U.S.C. § 542.

52 *In the Matter of Implementation of Section 621(a)(1) of the Cable Communications Policy Act of 1984 as amended by the Cable Television Consumer Protection and Competition Act of 1992*, FCC 06-180, 2007 FCC LEXIS 1867 (rel. March 5, 2007).

53 *In the Matter of Implementation of Section 621(A)(1) of the Cable Communications Policy Act of 1984,* MB 05-311, Report and Order and Further Notice of Proposed Rulemaking, FCC 06-180, released March 5, 2007 ("*First Order*"); *Alliance for Community Media v. FCC,* 529 F.3d 763 (6th Cir. 2008).

I-Nets.[54] In addition, while a franchising authority may require a franchisee to contribute toward PEG capital costs – which do not count toward the 5 percent franchise fee cap – the FCC has tended to view this exception more restrictively (although the issue remains in flux).[55]

With regard to "mixed-use networks" – cable systems that also provide Internet access or other non-cable services –the FCC has maintained that franchising authorities may not, through their authority under the Cable Act, regulate *non*-cable services that a cable operator may provide over a cable network, such as broadband Internet access service:

> 1. 121. We clarify that [local franchising authorities] LFAs' jurisdiction applies only to the provision of cable services over cable systems. … an LFA has no authority to insist on an entity obtaining a separate cable franchise in order to upgrade non-cable facilities. For example, assuming an entity (*e.g.*, a LEC) already possesses authority to access the public rights-of-way, an LFA may not require the LEC to obtain a franchise solely for the purpose of upgrading its network. So long as there is a non-cable purpose associated with the network upgrade, the LEC is not required to obtain a franchise until and unless it proposes to offer cable services. For example, if a LEC deploys fiber optic cable that can be used for cable and non-cable services, this deployment alone does not trigger the obligation to obtain a cable franchise. … 122. We further clarify that an LFA may not use its video franchising authority to attempt to regulate a LEC's entire network beyond the provision of cable services.[56]

The precise boundaries of this principle have been the subject of multiple orders and litigation since 2007. Most recently, the FCC sought to clarify that any state or local cable franchising regulation – and also generally applicable regulations and ordinances – that regulate non-cable services provided by cable operators (whether incumbent or a new entrant) would be preempted.[57]

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54 *Implementation of Section 621(a)(1) of the Cable Communications Policy Act of 1984*, MB Docket No. 05-311, FCC 19-80, 2019 WL 3605129 ("*Third Order*") (adopted Aug. 1, 2019).

55 *Third Order*; *City of Eugene v. FCC,* No. 19-72219 (9th Cir. Aug. 30, 2019); *City of Eugene v. FCC,* No. 19-4161 (6th Cir.).

56 *First Order,* at para. 121; *see Montgomery County v. FCC,* 863 F.3d 485 (6th Cir. 2017).

57 *Third Order,* paras. 81-82.

Vermont law. As with traditional telecommunications services, cable TV is also regulated in Vermont.[58] As set out in the federal Cable Act, the primary scheme for regulating cable TV on the state or local level is through the franchising authority. In Vermont, the Legislature designated the Public Utility Commission to be the statewide franchising authority "empowered to grant, renew, and revoke certificates of public good for all cable television systems and shall have all other authority to regulate cable television systems."[59]

Unlike the light touch that the State has adopted for the provision of competitive telecommunications services, the state statutes along with PUC rules continue to impose heavy regulatory oversight over cable TV providers and services in Vermont. For example, before being granted a CPG to own and operate a cable TV system in Vermont, the cable operator must establish that they meet ten different criteria set out in state statute,[60] along with nine different criteria, known as the EMCO criteria, set out in the PUC rules.[61]

Likewise, while CPGs for competitive telecommunications services are granted on a statewide basis, cable TV CPGs by state statute can only grant a company the authority to build and operate the cable TV system to serve customers only within specified geographic boundaries.[62]

9.3.3 Broadband Internet Access Service

Federal law. In contrast to the relatively well-established regulatory regimes governing telecommunications and cable TV service networks, the advent of broadband Internet access service has created regulatory challenges on many fronts.

In 2002, the FCC found that "cable modem service" – the cable industry's primary vehicle for providing broadband Internet access – was offered to consumers as a combination of two

58 A "cable television system" is defined in Vermont by state statute as "facilities by which television signals are received at a central location and for consideration are transmitted to customers or subscribers by means of cables of wires." 30 V.S.A. § 501(2).

59 30 V.S.A. § 502(b).

60 *See* 30 V.S.A. § 504. The criteria set out in section 504 requires that the Cable TV operator show for example, that they will have sufficient staff to provide adequate and prompt service, that they will provide a reasonably broad range of public, educational and governmental programing, and that the provider will have adequate signal quality, among other criteria.

61 *See* PUC Rule 8.000. The criteria set out in Rule 8.000 requires that the Cable TV operator, for example, show that they have financial soundness and stability, provide an eleven-year pro-forma balance sheet and income statement, demonstrate that they are committed to a construction and in-service schedule, and show that they will have a logical fit with neighboring cable TV systems, among other criteria.

62 30 V.S.A. § 540(d).

inextricably intertwined services: "information services" (which are largely unregulated) and "telecommunications" as defined in the Communications Act (see above). The FCC found that, when offered as a single service, the transmission component loses its identity, and the combination becomes an unregulated "information service." In a 2005 case commonly known as *Brand X*, the Supreme Court upheld the FCC's 2002 decision, stressing that the FCC's decision applied only to services in which "information services" and "telecommunications" are inseparably bound together.[63]

The *Brand X* analysis remained the critical factor in determining whether an offering was a "telecommunications service" or an "information service" until the FCC's 2015 *Open Internet Order*, which reclassified broadband Internet access service as a Title II "telecommunications service."[64] With that authority, the FCC issued several so-called "network neutrality" rules, including prohibitions on blocking or throttling of information destined for the Internet, a ban on paid prioritization, and extensive transparency requirements. To avoid subjecting Internet Service Providers (ISPs) to burdensome common carrier regulation, the FCC exercised its forbearance authority under 47 U.S.C. § 160(a) to exempt ISPs from most Title II requirements. This had several potentially significant implications, including giving ISPs the federal pole attachment and other benefits that telecommunications carriers enjoy without subjecting ISPs to most of the burdens of that classification.

In December 2017, in its *Restoring Internet Freedom Order*, the FCC reinstated its classification of broadband Internet access service as an "information service" and found that the FCC did not have authority in 2015 to issue its network neutrality rules.[65] The FCC also found that network neutrality rules were harmful as a factual matter and that states – including Vermont – were preempted from enacting or enforcing them.

On appeal, the United States Court of Appeals for the DC Circuit upheld the *Restoring Internet Freedom Order* in most respects and took issue with the Order only on a few discrete issues.[66] One is of potential significance here: the court ruled that the FCC cannot maintain that it lacks authority over broadband Internet access service and, at the same time, insist that it has

63 *Nat'l Cable & Telecom. Ass'n v. Brand X Internet Services*, 545 U.S. 967 (2005) ("*Brand X*").

64 *In the Matter of Protecting and Promoting the Open Internet,* GN Docket No. 14-28, Declaratory Ruling and Order, FCC 15-24, released March 12, 2015 ("*Open Internet Order*").

65 *In the Matter of Restoring Internet Freedom,* WC Docket No. 17-108, Declaratory Ruling, Report and Order, FCC 17-166, released January 4, 2018 ("*Restoring Internet Freedom Order*").

66 *Mozilla Corp. v. FCC*, 940 F.3d 1 (D.C. Cir. 2019).

authority to preempt states from filling the FCC's acknowledged gap in its authority. We discuss this further in the following section on Vermont law.

Vermont law. This distinction between "information services" and "telecommunications services" has been playing out in Vermont as well. Unlike telecommunications service providers or cable TV operators, both of which are regulated by the PUC and are statutorily required to obtain CPGs to operate in Vermont, broadband Internet service providers are subject to only limited regulation in Vermont and are not required to obtain CPGs in order to build or operate their systems.

Although it may be simpler to provide broadband Internet access service in the absence of state regulation, many of the regulations in fact bestow benefits and rights on holders of a CPG. For example, a CPG was historically required before an entity was permitted to attach its cables to existing utility poles or to use the public right of way for its equipment. Such regulations would prevent a broadband service provider who is not required to have a CPG from being able to install their wires or cables on poles or within the public right of way. However, the Legislature and the PUC have created exceptions for broadband service providers. For example, the PUC rules allow a broadband service provider that does not hold a CPG to attach to poles, provided that it agrees to be bound by the PUC pole attachment rules.[67]

Additionally, if a broadband Internet access provider also seeks to offer telecommunications services and/or cable TV services, it must thereby comply with the regulatory requirements of those services. As such, even though broadband Internet access service may only be subject to limited regulatory oversight in Vermont, any provider that offers a broader array of services such as telephone or cable TV services may nonetheless find itself subject to more intensive statutory and regulatory schemes, and CPG requirements, as a result of providing these other services.

In 2018, the Vermont Legislature also addressed the issue of net neutrality and found that "Without net neutrality, [Internet service providers] will have the power to decide which websites you can access and at what speed each will load. In other words, they'll be able to decide which companies succeed online, which voices are heard—and which are silenced.'"[68] The Legislature further concluded that "The State has a compelling interest in promoting Internet consumer protection and net neutrality standards."[69]

67 PUC Rule 3.702.

68 See Sec. 1 (7) S.289 (January 3, 2018) (quoting Tim Berners-Lee, founder of the World Wide Web, December 13, 2017).

69 See Sec. 1 (21) S.289 (January 3, 2018).

Through the legislation enacted in 2018, the State established a variety of net neutrality standards.[70] The primary way in which the State sought to enforce these standards to promote net neutrality in Vermont is through its contracting powers. Specifically, any Internet access service provider that seeks to provide broadband internet services to State agencies must certify that it is in compliance with the State's net neutrality standards.[71]

No party to the *Mozilla* net neutrality case petitioned the Supreme Court for certiorari, so the portion of the D.C. Circuit's decision dealing with state network neutrality laws became final. At that point, attention shifted to California, where the U.S. Department of Justice and several other parties were challenging California's network neutrality law. The Attorney General of Vermont has agreed to stay enforcement of Vermont's network neutrality law and litigation concerning that law until the California litigation is resolved.[72]

9.3.4 Mobile Wireless Service (CMRS)

Federal law. Providers of cellular telephone service – officially known as "cellular commercial mobile radio service" (CMRS) [73] – are largely regulated at the federal level under Title III of the Communications Act of 1934 (as amended).[74] Providers of CMRS, such as AT&T, Verizon and T-Mobile, rely upon spectrum rights licensed and administered by the FCC. The FCC is also exclusively responsible for radiofrequency (RF) emission standards and notices about them, and it will preempt any attempt by a state or local government to do more than require wireless companies to demonstrate that their facilities comply with FCC standards. In addition, the Act preempts state and local governments from regulating "the entry of or the rates charged by

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70 3. V.S.A. § 348(b)(1).

71 *See, e.g.* 3 V.S.A. § 349 (contracts with the executive branch); 2 V.S.A. § 754 (contacts with the legislative branch); 4 V.S.A. § 27a (contracts with the judicial branch).

72 Gary Arlen, "Back to Court in California," *Multichannel News* (August 7, 2020), https://www.nexttv.com/news/doj-associations-seek-net-neutrality-injunction-in-california; Julia Arciga, "Vt. Agrees to Halt Enforcement of Net Neutrality Law," *Law360* (September 25, 2020), https://www.law360.com/articles/1313606/vt-agrees-to-halt-enforcement-of-state-net-neutrality-law

73 "Commercial mobile radio service" is a mobile service that is provided for profit, is interconnected with the public-switched telephone network (i.e., users can make and receive phone calls), is available to the public. *See* 47 CFR § 20.3.

74 47 U.S.C. § 301 *et seq.*

any commercial mobile service or any private mobile service, except that this paragraph shall not prohibit a State from regulating the other terms and conditions of commercial mobile services."[75]

The Act treats CMRS providers as common carriers and subjects them to a variety of service-related requirements and consumer protection obligations, including, for example, E-911 service requirements.[76] FCC regulations also require CMRS providers to permit resale of services and to permit manual and automatic roaming "on commercially reasonable terms and conditions."

Given that federal law specifically addresses carriers' obligations relating to "roaming," an attempt by the State to impose additional roaming requirements would probably be preempted.

Within the scope of their limited authority over CMRS providers, states may require them to contribute to state-managed universal service programs. State or local governments generally may also assess sales tax on wireless service receipts (as they may with telecommunications services generally).[77]

Vermont law. In Vermont, CMRS providers are subject to the jurisdiction of the PUC, from which they must obtain a CPG before providing cellular services in the state.[78] Recognizing that federal law substantially limits the State's authority over cell services, the PUC has adopted a simple CPG registration process that imposes minimal requirements on the CMRS providers. Likewise, CMRS providers need not file tariffs for their services, but they must file up-to-date contract forms to keep the PUC informed of the company's terms and conditions of services.

9.3.5 Wireless Infrastructure Siting

As discussed above, state and local governments have little regulatory authority over the provision of wireless services. They still have significant influence over the wireless industry's access to public rights of way (PROW) and public facilities within the PROW. Through the zoning process, they can also influence the siting of towers and other wireless support structures on private property. In recent years, however, the FCC has been working hard to diminish that influence.

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75 47 U.S.C. § 332(c)(3).

76 *See* 47 U.S.C. § 332(c); 47 CFR Part 20.

77 47 U.S.C. § 332(c)(3).

78 30 V.S.A. § 102 and 231.

Federal law: 47 U.S.C. §§ 332(c)(7) and 253. State and local authority over wireless siting decisions is directly addressed in Section 332 of the Telecommunications Act of 1996 and more generally in Section 253.

Section 332(c)(7)(A) begins by reaffirming and preserving local authority over the siting of wireless infrastructure:

> Except as provided in this paragraph, nothing in this chapter shall limit or affect the authority of a State or local government or instrumentality thereof over decisions regarding the placement, construction, and modification of personal wireless service facilities.[79]

Section 332 then proceeds to establish several fundamental limits on such authority:

> The regulation of the placement, construction, and modification of personal wireless service facilities by any State or local government or instrumentality thereof— (I) *shall not unreasonably discriminate* among providers of functionally equivalent services; and (II) *shall not prohibit or have the effect of prohibiting* the provision of personal wireless services.[80]

Two points are worth noting with respect to this subsection. First, subclause (I) does not prohibit *any* discrimination whatsoever, but only "unreasonable" discrimination among providers of functionally equivalent services. Second, subclause (II) effectively mirrors the more general barrier-to-entry language applicable to telecommunications market entrants set forth in Section 253(a) of the Telecommunications Act. As under Section 253(a), courts and the FCC have interpreted Section 332(c)(7)(B) to prohibit any legal requirement that "materially inhibits" the provision of wireless services. Under that standard, a state or local requirement can be found unlawful even if it does not explicitly or effectively preclude a provider from providing service altogether. For example, as applied to small wireless facilities supporting 5G technology, which, according to the FCC and the Ninth Circuit, requires more rapid, widespread deployment of more facilities than previous generations of wireless technology, "even fees that might seem small in

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79 47 U.S.C. § 332(c)(7)(A).

80 47 U.S.C. § 332(c)(7)(B) (emphasis added). *See In the Matter of Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment,* Declaratory Ruling and Third Report and Order, WT Docket No. 17-79, WC Docket No. 17-84, FCC-18-133, released September 27, 2018 ("*Small Cell Order*").

isolation have material and prohibitive effects on deployment, particularly when considered in the aggregate given the nature and volume of anticipated Small Wireless Facility deployment."[81]

Another provision of Section 332 limits the time period within which state and local governments must act on wireless siting applications:

> A State or local government or instrumentality thereof shall act on any request for authorization to place, construct, or modify personal wireless service facilities *within a reasonable period of time* after the request is duly filed with such government or instrumentality, taking into account the nature and scope of such request.[82]

FCC regulations have further refined this obligation. In 2009, the Commission opted to employ "shot clocks" "to define a presumptive 'reasonable period of time' beyond which state or local inaction on wireless infrastructure siting applications would constitute a 'failure to act' within the meaning of Section 332."[83] The Commission adopted "a 90-day clock for reviewing collocation applications and a 150-day clock for reviewing siting applications other than collocations."[84] The shot clocks would begin to run when an application is first submitted, and can be paused—not reset—if the government entity notifies the applicant within 30 days that the application is incomplete.

Finally, as noted above, state and local governments have no authority to regulate RF emissions or notices about them, and this limitation extends to wireless facility siting decisions as well: state and local governments may not regulate or deny an application for "the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the [FCC's] regulations governing such emissions."[85]

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[81] *City of Portland v. FCC*, 969 F.3d 1020, 1035 (9th Cir. 2020), quoting *Small Cell Order*, ⍰ 53.

[82] 47 U.S.C. § 332(c)(7)(B)(ii)(emphasis added).

[83] *Petition for Declaratory Ruling to Clarify Provisions of Section 332(c)(7) to Ensure Timely Siting Review,* Declaratory Ruling, 24 FCC Rcd 13994 (2009), *aff'd, City of Arlington v. FCC,* 668 F.3d 229, (5th Cir. 2012), *aff'd,* 133 S. Ct. 1863, 569 U.S. 290 (2013).

[84] *Id.,* at para. 100. In 2009, the term "collocation" meant an installation on a structure that already had a wireless facility attached to it. In its 2018 *Third Report and Order* focusing on small cell facilities, the FCC revised the definition of "collocation" to mean an attachment to any preexisting structure, regardless of whether it includes a preexisting wireless facility.

[85] 47 U.S.C. § 332(c)(7)(B)(iv).

It is worth emphasizing at this point that, despite the attention in recent years concerning small cell wireless facilities (on which we now focus in greater detail), Section 332(c)(7) applies more broadly, encompassing *any* wireless facility used for the provision of personal wireless services.[86]

FCC Small Cell Order. Beginning in about 2015, the FCC began to take note of the wireless industry's burgeoning demand for relatively small wireless support facilities, primarily in cities. This "densification" of wireless equipment coincided with the development of certain types of advanced wireless technology, characterized by high bandwidth over relatively small distances. As a result, providers have increasingly sought to install small wireless facilities around and within cities, close to their users, and only a few hundred feet apart, as opposed to much longer-range traditional wireless facilities mounted high up on existing tower structures.

According to the wireless industry and the FCC, local governments have been impeding the deployment of small cell facilities by dragging their feet in processing applications, imposing high costs for attachment and franchise rights, and erecting various other obstacles. In 2018, the FCC issued a declaratory ruling and order to address such issues ("*Small Cell Order")*.[87]

The *Small Cell Order* prescribed a number of new rules applicable to state and local treatment of "small wireless facilities," against the backdrop of statutory requirements set forth in Sections 332(c)(7) and 253:

- Adopted a specific definition of the term "small wireless facilities."[88]

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86 "[T]he term 'personal wireless services' means commercial mobile services, unlicensed wireless services, and common carrier wireless exchange access services; (ii) the term 'personal wireless service facilities' means facilities for the provision of personal wireless services; and (iii) the term 'unlicensed wireless service' means the offering of telecommunications services using duly authorized devices which do not require individual licenses," 47 U.S.C. § 332(c)(7)(C). It is not clear that a Wi-Fi device would be subject to Section 332(c)(7).

87 *In the Matter of Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment,* Declaratory Ruling and Third Report and Order, WT Docket No. 17-79, WC Docket No. 17-84, FCC-18-133, released September 27, 2018 ("*Third Report and Order*").

88 A "small wireless facility" must meet the following definition:

(1) "The structure on which antenna facilities are mounted
  (i) is 50 feet or less in height including antennae, or
  (ii) is no more than 10 percent taller than other adjacent structures, or
  (iii) is not extended to a height of more than 50 feet or by more than 10 percent above its preexisting height as a result of the collocation of new antenna facilities, whichever is greater; and

- Adopted a broad interpretation of "effective prohibition" under Sections 253 and 332(c)(7).[89]
- Rejected, for preemption purposes, any distinction between government entities acting in a "regulatory" capacity as opposed to a "proprietary" capacity, when providing access to the PROW or authorizing attachments to government-owned property.[90]
- Determined that state and local fees and charges – including all PROW access fees and attachment fees – must be limited to a "reasonable approximation" of the government entity's "objectively reasonable costs."[91]
- Suggested that "in-kind" compensation arrangements that do not "meaningfully advance any recognized public-interest objective" would not be permitted.[92]
- Held that aesthetic determinations must be reasonable, non-discriminatory, and published in advance.[93]

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(1) Each antenna associated with the deployment (excluding the associated equipment) is no more than three cubic feet in volume; and

(2) All antenna equipment associated with the facility (excluding antennas) is cumulatively no more than 28 cubic feet in volume; and

(3) The facility does not require antenna registration under part 17 of this chapter; and

(4) The facility is not located on Tribal lands, as defined under 36 CFR 800.16(x); and

(5) The facility does not result in human exposure to radiofrequency radiation in excess of the applicable safety standards specified in Rule 1.1307(b)."

89 *Small Cell Order,* at para. 16.

90 *Id.,* at n.253.

91 *Id.,* at para. 50. The *Small Cell Order* specified certain amounts that would be "presumptively reasonable": $500 for a single up-front application that includes up to five SWFs, with an additional $100 for each Small Wireless Facility beyond five, or $1,000 for a new pole to support a SWF; and $270 per SWF, per year, for all recurring fees (including "any possible ROW access fee or fee for attachment to municipally-owned structures in the ROW"). Again, a government entity may exceed these charges if it can demonstrate that such amounts are a reasonable approximation of its actual costs.

92 *Id.,* at n.252.

93 *Id.*

In addition, the *Small Cell Order* adopted new, shortened deadlines – popularly known as "shot clocks" – for approval of applications for permits to site small wireless facilities: requests to site small wireless facilities on preexisting structures ("collocation") must be acted upon within 60 days, and requests that involve construction of new structures must be processed within 90 days. Note that a violation of these time periods does not result in a "deemed granted" remedy, rather, the time limits operate as a "presumption of reasonableness," with a violation enabling a wireless provider to seek redress in court under Section 332(c)(7)(B).

City of Portland v. FCC. Not surprisingly, the new rules adopted in the *Small Cell Order* were challenged by local government entities and others. Ultimately, the case came before the Court of Appeals for the Ninth Circuit, which issued an opinion in *City of Portland v. FCC* in August 2020.[94]

In short, *City of Portland* was a significant victory for the FCC and the wireless industry. With two exceptions related to aesthetics, it upheld virtually all of the FCC's rules set forth in the *Small Cell Order.*[95] The two exceptions, as summarized by the court, were the following:

> In sum, the requirement that aesthetic regulations be "no more burdensome" than those imposed on other technologies is not consistent with the more lenient statutory standard that regulations not "unreasonably discriminate." The requirement that local aesthetic regulations be "objective" is neither adequately defined nor its purpose adequately explained. On its face, it preempts too broadly. We therefore hold those provisions of Paragraph 86 of the Small Cell Order must be vacated.[96]

Vermont law. In general, land use in Vermont is regulated on the local and regional level.[97] However, the Legislature has specifically limited the ability of municipalities to regulate the citing

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94 *City of Portland v. FCC,* 969 F.3d 1020 (9th Cir. 2020).

95 *City of Portland* also considered two other FCC orders issued in 2018 not discussed here, relating to moratoria and "one touch make-ready" rules. *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Inv.*, 33 FCC Rcd. 7705, 7775–91 (2018)("*Moratoria Order*"); *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Inv*., 33 FCC Rcd. 7705, 7705–91 (2018) ("One Touch Make-Ready Order").

96 *City of Portland*, at 1042-43.

97 24 V.S.A. ch. 117. *See also* Act 250.

of cell towers and related facilities, and it has generally exempted wireless facility providers from the municipal zoning process.[98]

Instead, through 30 V.S.A. § 248a, the Legislature has conferred regulatory authority over the siting, construction, and operation of wireless communications facilities upon the Public Utility Commission, and the PUC primarily exercises this authority through the CPG process under Section 248a.

There are three categories of Section 248a projects: *de minimis* modifications to existing structures or facilities; smaller projects of limited size and scope; and larger projects. A *de minimis* modification project is defined in Section 248a as the addition, modification or replacement of telecommunications equipment, antennas, or ancillary improvements on existing facilities, or the reconstruction of existing facilities and support structures, provided there are only minor changes in the overall dimensions of the facility and/or structure.

Projects of limited size and scope include new facilities that do not exceed 140 feet in height, or the modification of an existing facility that would result in a total height of less than 200 feet, would not increase the width of the support structures by more than 20 feet, and for either new or modified facilities, would not disturb more than 10,000 square feet of earth.

Larger projects, which are the most heavily regulated under Section 248a, are new facilities and structures, or modifications that exceed either *de minimis* modifications or projects of limited size and scope.

Section 248a also imposes certain land use restrictions on the siting of cell towers. For example, proposed facilities should not have "an undue adverse effect on aesthetics, historic sites, air and water purity, and the public health and safety."[99] Moreover, while cell towers are generally exempt from local regulations, the PUC is required to give "substantial deference" to town and regional land use plans as well as local zoning when deciding whether to grant a CPG for the project.[100]

For most projects, prior to submitting an application to the PUC, applicants are also required under Section 248a to provide 60-day advance notice to the legislative bodies and municipal and regional planning commissions in the communities where the project will be located, certain

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98 30 V.S.A. § 4412(8)

99 30 V.S.A. § 248a(c)(1).

100 30 V.S.A. § 248a(c)(2); 24 V.S.A. § 4412(8)(C).

state agencies, and adjoining landowners. This advance notice provides these parties with the opportunity to learn about the project before the application has been submitted to the PUC and provides them with an opportunity to file comments regarding the project to the PUC for consideration in the application process.

9.4 Legal Issues and Recommendations Relating to Vermont's Potential Other Broadband Strategies

In the previous section, we described the basic legal and regulatory foundations underlying the provision of various communications services and networks as a general matter. In this section, we focus on targeted issues that are particularly germane to Vermont's future broadband initiatives, again describing each in terms of federal law and Vermont law.

9.4.1 Right of Way Access and Compensation

Overview. Prompt and efficient access to the public right-of-way (PROW) is fundamentally important for the development of new broadband infrastructure. At the same time, local governments and state agencies must manage the PROW in a responsible and non-discriminatory fashion and ensure that users of the PROW provide appropriate compensation in exchange for such use. Navigating these competing objectives can present a significant challenge for state and local governments.

The underlying regulatory environment relating to PROW use by communications companies is complicated and, in some ways, counterintuitive. For historical and other reasons, the applicable regulations may differ significantly depending on a service provider's home industry. For example, a provider of "cable service" operates under a different set of rights and obligations concerning PROW access than does a provider of "telecommunications service" or a provider of broadband Internet access service.

As to wireless facilities, the recent development of "small cell" wireless equipment has led service providers to employ structures within the PROW – such as electric utility poles, street lights, and traffic signals – as potential antenna sites. Wireless companies are seeking to rapidly deploy facilities in much greater numbers, creating tension and conflict with local authorities who seek to manage the PROW responsibly to preserve and protect public safety, aesthetics, and property values and to obtain fair and reasonable compensation for various uses of the PROW. Over the past several years, regulatory developments have tended to favor the wireless companies at the expense of local PROW authority.

Federal law. Administration of the PROW historically has been a matter of local, and sometimes state, authority. For the installation of communications facilities in the PROW, federal law now plays an increasingly significant role, depending on the nature of the service in question.

Telecommunications service. For PROW access issues in general, Section 253 of the Telecommunications Act of 1996, 47 U.S.C. § 253, establishes the outer boundaries for local regulation of PROW access.[101] Section 253(a) bars state or local governments from adopting a statute, regulation, or other legal requirement that "may prohibit or have the effect of prohibiting the ability of any entity to provide interstate or intrastate telecommunications service." The FCC and courts tend to interpret this provision broadly in favor of telecommunications service providers, finding that a "prohibition" exists under 253(a) if the requirement "materially inhibits" the ability of a company to provide telecommunications service.[102] Section 253(c) amounts to an exception to the general prohibition in Section 253(a), preserving state and local authority "to manage their public rights-of-way" and to "require fair and reasonable compensation from telecommunications providers, on a competitively neutral and non-discriminatory basis, if the compensation required is publicly disclosed by such government."[103]

While Section 253 establishes the broad parameters of permissible PROW regulation, the nuts and bolts of PROW regulation as to telecommunications service is generally left to local governments, under authority granted by state statutes or constitutions. In fact, there is significant variation among the states in their approach to PROW use by telecommunications carriers, and in particular whether a "telecommunications franchise" is permitted or required.[104]

Cable service. As previously explained in detail, the federal Cable Act requires cable operators to obtain a cable franchise in order to use the PROW. Historically, such franchises were granted and administered by local (municipal or county) governments. Since the mid-2000s, however, many states have adopted a form of state-level franchising, enabling providers to more easily obtain cable franchise rights in markets across an entire state, as opposed to negotiating

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101 47 U.S.C. § 253. *See In the Matter of Missouri Network Alliance, LLC Petition for Preemption and Declaratory Ruling,* WC Docket No. 20-46, Declaratory Ruling, released November 9, 2020.

102 *City of Portland*, 969 F.3d at 1035; *California Payphone Association Petition for Preemption of Ordinance No. 576 NS of the City of Huntington Park, California Pursuant to Section 253(d) of the Communications Act of 1934*, CCB Pol 96-26, Memorandum Opinion and Order, 12 FCC Rcd 14191, 14206, para. 31 (1997) (*California Payphone*).

103 47 U.S.C. § 253(c).

104 Some states confer upon state-certified telecommunications carriers a right to occupy the PROW (i.e., no separate franchise is required), subject to applicable local construction / encroachment permits. In other states, localities may require a local telecommunications franchise.

franchises with each individual locality. That is the case in Vermont, where the state Public Utilities Commission serves as the "local franchising authority" for purposes of the Cable Act.

Internet access service. How state and local PROW access and compensation requirements should be applied to Internet access service, if at all, has been the subject of significant regulatory activity and litigation over the past 20 years.[105] As explained in detail above, Internet access service is largely unregulated, and unlike cable service or telecommunications service, it is not subject to a regulatory scheme that authorizes PROW access, subject to specified terms and conditions. As a result, Internet service providers and state or local franchising authorities have often had to look to whether the provider can also qualify as a telecommunications service provider (under federal Title II and/or state utilities regulation) or as a cable system operator (under the federal Cable Act and local franchising authority).

Wireless facilities in PROW. As mentioned, federal law, particularly as the FCC and the Ninth Circuit has interpreted it, confers significant rights on the wireless industry when it comes to siting small wireless facilities in the PROW. For more on this topic, please refer to our prior discussion of wireless infrastructure siting.

Vermont law. In Vermont, "Lines of telegraph, telephone, and electric wires [including for cable TV systems], as well as two-way wireless telecommunications facilities and broadband facilities" may be constructed upon or under a town or state highway so long as it does not interfere with the travel, use or maintenance of the highway.[106] Permits are required before the public right of way along can be used in this way.[107]

Further, permits for use of the state highway right-of-way can be conditioned on the payment of a transportation impact fee.[108] All such impact fees must be spent on specified capital transportation projects.[109] There does not appear to be any provision that would allow the impact fees paid with respect to use of the public highway right-of-way to be used for telecommunications-related projects.

105 See, e.g., discussion of the battle over Net Neutrality, above at Section 9.3.3.

106 30 V.S.A. § 2502.

107 30 V.S.A. § 2502; 19 V.S.A. § 1111.

108 19 V.S.A. § 1111(a)

109 10 V.S.A. § 6109.

However, the Vermont Supreme Court has noted that section 2502 "does not explicitly prohibit municipalities from charging utilities a fee for placing facilities aboveground."[110] Accordingly, it is somewhat of an open question as to just what fees may be assessed and how those fees may be spent.

Companies subject to the jurisdiction of the PUC may also erect and maintain lines and facilities along the sides of railroad tracks, subject to paying reasonable compensation to the railroad.[111] Companies that are not subject to PUC jurisdiction are also granted similar rights to erect and maintain wireless telecommunications and broadband facilities within the railroad right of ways.[112]

It should be noted that lines that are installed along the highway right of way can be required to be altered or removed as needed.[113]

9.4.2 Pole Attachments

Overview. The ability of a communications network provider to attach its facilities to poles within a reasonable timeframe on reasonable terms and conditions is crucial to the prompt and efficient deployment of communications infrastructure and services. Complications relating to pole attachments can introduce significant delays and additional costs for new deployments.

Federal law. Federal statutory law relating to pole attachments was established in the Pole Attachment Act of 1978, codified at 47 U.S.C. § 224. Importantly, under federal law the term "pole" is defined to mean not just a conventional above-ground utility pole, but also a "duct, conduit or right-of-way owned or controlled by a utility."[114]

Note also that Section 224 applies only to a "utility," defined to mean "any person who is a local exchange carrier or an electric, gas, water, steam, or other public utility, and who owns or controls poles, ducts, conduits, or rights-of-way used, in whole or in part, for any wire communications."[115] The definition goes on exclude from the definition of "utility" (and thus

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110 *City of Burlington v. Fairpoint Communications, Inc.*, 2009 VT 59 at ¶ 13 (2009).

111 30 V.S.A. § 2513.

112 30 V.S.A. § 2513(b).

113 30 V.S.A. § 2522.

114 47 U.S.C. § 224(a).

115 *Id.*

from Section 224 altogether) “any railroad, any person who is cooperatively organized, or any person owned by the Federal Government or any State.” “State,” in turn, is defined to include “any political subdivision, agency, or instrumentality thereof.”[116] Thus Section 224 does not apply to municipally owned utilities, nor to pole owners that are electric cooperatives.

Section 224 empowers the FCC to regulate rates for pole attachments, and to otherwise ensure that rates, terms, and conditions are “just and reasonable.”[117]

In general, federal pole attachment regulations relating to communications infrastructure assume that the attaching entity is a provider of “telecommunications service” or “cable service.” When the attachment does not clearly involve the provision of telecommunications or cable service (as in the case of a broadband-only service provider, or for the attachment of unactivated or “dark” fiber), questions may emerge concerning the scope of attachment rights and pole owner obligations.

As previously discussed in Section 9.3.3, the D.C. Circuit in the *Mozilla* case upheld most of the FCC’s *Restoring Internet Freedom Order* but remanded certain discrete issues to the FCC. One of these issues was whether treating broadband Internet access as an “information service” would adversely affect broadband deployment by depriving broadband-only service providers of federal pole attachment rights. On October 29, 2020, the FCC issued an *Order on Remand* that provided a negative answer to that question.[118] Among other things, the FCC found:

> 73. We find that the vast majority of subscribers are served by ISPs that provide either cable or telecommunications services over their networks and therefore remain able to take advantage of the rights guaranteed by section 224 after the reclassification of broadband Internet access service as an information service. The record overwhelmingly confirms our conclusion.[119]

If the FCC’s factual findings are correct and representative of Vermont, then the broadband-only provider issue would be of little consequence as matter of federal law. In any event, Section 224 also contains a provision that enables states to voluntarily opt out of federal pole attachment regulation by certifying their own regulatory authority over rates, terms, and conditions and by

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116 *Id.*

117 47 U.S.C. § 224(b).

118 *In the Matter of Restoring Internet Freedom Bridging the Digital Divide For Low-Income Consumers Lifeline and Link Up Reform and Modernization, Order on Remand*, FCC 20-151, 2020 WL 6391155 (F.C.C.).

119 *Id*., at 73 (footnote omitted).

adopting regulatory mechanisms to implement this election. Through this "reverse preemption," a state's own pole attachment regulatory and enforcement scheme controls, not Section 224, the FCC's pole attachment regulations, or the FCC's interpretations of them.[120]

The State of Vermont is a state that has opted to reverse preempt and adopt its own pole attachment regulatory scheme. As discussed below, the Legislature has rendered the broadband-only issue moot in Vermont by expressly giving broadband-only Internet Service Providers pole attachment rights.

Vermont law. In Vermont, entities under the jurisdiction of the Vermont PUC that own utility poles are generally required to provide pole attachment rights to other entities under the jurisdiction of the Vermont PUC.[121] The Vermont Legislature likewise tasked the PUC to develop and implement pole attachment rules, which are found in PUC Rule 3.700.

As discussed above, the PUC has limited jurisdiction over companies that provide only broadband services. Even so, the Vermont Legislature has specifically extended pole attachment rights to broadband service providers.[122] The PUC Pole Attachment Rules require that broadband service providers that wish to attach to poles agree that they "will abide by the terms and conditions of this Rule and any applicable pole attachment tariffs."[123]

In some instances, individuals or entities may seek to install dark fiber intended for future use, on an open access basis, without knowing how the fiber will ultimately be used. While the Pole Attachment Rules make clear that fiber optic cables installed by broadband Internet access service providers have pole attachment rights, it is less clear that a provider of dark fiber that does not itself provide telecommunications, cable, or broadband Internet service also falls within such rules. As the State further develops its long-term strategies, it is likely to find that this set of issues requires further exploration.

Under the PUC Pole Attachment Rules, companies seeking to attach their facilities to the poles must pay for the cost of the make ready along with a rental fee. The goal of these fees is to

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120120 Attaching entities who would benefit more from an FCC interpretation than the State's interpretation may argue that the FCC interpretation, while not binding, should be treated as a benchmark of what is fair and reasonable.

121 See, for example, 30 V.S.A. § 8091 that requires gas and electric companies make their plant and equipment, including poles, available for use by communications service providers.

122 30 V.S.A. § 209(i)(1).

123 PUC Rule 3.702(C).

ensure that an entity that attaches to poles should pay the fair cost of the usage of the pole. Pole owners must file pole-attachment tariffs with the PUC that include the rates, terms, and conditions governing the attachment to the poles and the rights of ways.

Although the rules typically require the attaching entity to pay the attachment costs, these costs can be significant for a new broadband service provider such as a newly formed CUD that may have only limited funding in its first few years. The question then becomes whether an electric utility that owns the poles can voluntarily assume all or a portion of the make-ready costs and/or the pole rental rates of the attaching entity during its early years of startup and operation. Under the current rules, electric utilities may not subsidize the pole attachment costs of another entity, but with the PUC's approval, [124] they can enter into contracts concerning the cost, maintenance, and use of poles outside of the terms of the pole-attachment tariffs.[125] Accordingly, under existing Vermont law, it may be possible for an electric utility to accept in-kind payment (e.g., *n* strands of fiber) or other forms of compensation in lieu of charging the tariffed make-ready or pole rental fees. For the future, the State should consider the pros and cons of clarifying and expanding these options.

9.4.3 Open Access Networks

Overview. Section 4.3 of this Report suggests that the State consider supporting "open access" and "neutral host" networks as part of a comprehensive broadband plan. Consistent with that advice, this section analyzes the key legal issues that these strategies may pose.

In the communications field, the term "open access" can have many meanings, but it most often refers to a business model under which a wireline network is built and operated for the benefit of multiple service providers, which can each access the network on a non-discriminatory basis and provide competitive services. [126, 127] The term "neutral host" is most often used to describe

[124] PUC Rule 3.704(A).

[125] PUC Rule 3.704.

[126] More precisely, "[a]n open-access network refers to a horizontally layered network architecture in telecommunications, and the business model that separates the physical access to the network from the delivery of services. … In an [open access network], the owner or manager of the network does not supply services for the network; these services must be supplied by separate retail service providers." Wikipedia, "Open-access network," last mod. August 17, 2020, https://en.wikipedia.org/wiki/Open-access_network (accessed November 9, 2020).

[127] "Open access" should not be confused with "open Internet," the umbrella term used by the FCC to describe a set of principles also known as "network neutrality." Network neutrality refers to an obligation of retail

a wireless network that an entity builds and operates to provide non-discriminatory access and support to wireless service providers. The operator of the physical network is itself not necessarily (although could be) a service provider.

Open access and neutral host models will not always be feasible. But proponents believe that, when and where viable, they can simultaneously provide multiple benefits to multiple stakeholders. This may include accelerating buildouts and decreasing time to market for service providers: spurring and supporting robust competition among providers, thereby enhancing consumer choice; increasing facility-owner revenues while decreasing service-provider costs; increasing the efficiency of maintenance; making it easier for facility owners to obtain financing, by reducing their dependence on the success of a small number of service providers; and decreasing the number and intensity of disputes with neighbors by minimizing duplication of support structures. In the case of public networks in particular, open access networks may be able to serve well in circumstances where exclusive arrangements between a government-owned network and a private service provider may not be legally permissible or advisable.[128]

After the State gets beyond the COVID emergency and turns to its additional broadband options, it is likely to find that there are several potentially viable public, private, or mixed models for broadband development and that the feasibility of any particular model in a given case will depend on the circumstances involved. Given the sheer number of possibilities, we cannot here anticipate and analyze all of the potential legal issues that might be involved. We will therefore concentrate on the key legal issues that the State may need to address in deciding whether to support open access and neutral host models.

The State could support open access and neutral hosting in several ways: (1) it can try to use its regulatory powers to compel networks to open up; (2) it can seek to provide open access network or neutral hosting itself, using the fiber and other assets that it owns or controls; (3) it can make the fibers and other assets the State owns or controls available to other entities that agree to provide open access or neutral hosting; (4) it can offer grants, loans, or other subsidies to public or private entities that agree to provide open access or neutral hosting; or (5) it can combine elements of these options. We now turn to the legal issues that these approaches may implicate.

service providers to enable users to access Internet services and information provided by other entities on a neutral, nondiscriminatory basis.

128 See, e.g., Jordan Arnold and Jonathan Sallet, "If We Build It, Will They Come? Lessons From Open-Access, Middle-Mile Networks," Benton Institute For Broadband and Society (December 2020), https://www.benton.org/sites/default/files/OAMM_networks,pdf

For convenience, in the remainder of this discussion we refer to open access and neutral host networks collectively as "open access" networks.

Federal law. Federal statutes and regulations do not directly address open access networks as they are described above, but various aspects of federal law may come into play as Vermont, or a unit of local government, considers supporting such networks.

First, the Fifth Amendment of the U.S. Constitution prohibits the federal government from taking a person's property without just compensation, and the Fourteenth Amendment prohibits state governments from doing so. For example, in *Gulf Power v. Federal Communications Commission*, 187 F.3d 1324 (11th Cir.1999), the Eleventh Circuit held the FCC's regulations authorizing cable companies to make attachments to privately-owned utility poles were lawful because they also provided for just compensation. Similarly, in *Loretto v. Teleprompter Manhattan CATV Corp*., 458 U.S. 419 (1982), the Supreme Court applied the same rationale in upholding a New York statute that required landlords to permit cable companies to install facilities on their property without paying more than the amount determined by a state commission to be reasonable. To be sure, the law in this area is complicated and highly nuanced, but the underlying principle appears to be well established – i.e., a regulation that provides for open access must also provide for just compensation to the owner of the property thus opened. Moreover, even if the state does provide for just compensation, its methodology for determining just compensation may well face protracted legal challenges.

Second, while the State of Vermont may not be constrained by constitutional takings law from compelling open access to existing networks, provided that it provides for suitable compensation and judicial review, adversely affected parties would undoubtedly argue that federal law also explicitly or implicitly preempts the State from doing so. We are not aware of any case that has addressed this precise issue, and it is uncertain how any future case would turn out. One thing is certain, however: such a State requirement would be vigorously challenged, and it might take many years for the courts to reach a final decision.

Third, even if the State believes that it has sufficient authority to require open access, it should carefully consider the pros and cons of doing so. If the State's main goal is to spur deployment of *new* broadband networks, requiring owners of *existing* networks to open them up may not achieve that goal and, indeed, may discourage investment in future networks. This is a complicated matter that requires careful study.

In this regard, the FCC's experience with unbundled network elements (UNEs) may be instructive. In the Telecommunications Act of 1996, Congress found that the telecommunications industry was highly concentrated and anticompetitive. Congress sought to remedy this situation by, among other things, requiring incumbent local exchange carriers (ILECs) to provide competitors unbundled access to portions of their ILEC networks at wholesale rates.[129] In 2003, the FCC exempted network elements supporting Fiber-to-the-Home from its UNE rules, finding this necessary to remove disincentives to the deployment of advanced telecommunications facilities in the mass market.[130] For the same reason, the FCC soon afterward also exempted network elements supporting Fiber-to-the Curb deployments.[131] Over time, as "intermodal competition" has increased, the FCC has essentially dismantled the UNE process altogether – at least in urban areas.[132]

To be sure, one can question whether the FCC made the right decisions for the right reasons in addressing UNEs, and some of the FCC's conclusions may not necessarily apply to Vermont today. But the extensive factual and policy questions that the FCC asked are well worth studying.

Further complicating matters is the fact that the FCC's authority with respect to broadband Internet access service – which is fundamental to the open access approach – has waxed and waned over the past ten years. As discussed above, the current FCC maintains that Internet access service is an "information service" over which the FCC does not exert regulatory jurisdiction.[133] That could well change when under the Biden Administration or as a result of Congressional action.

In short, reliance upon governmental fiat to bring open access networks into existence carries with it a substantial risk of protracted litigation based on federal law (and possibly state law, as described below), with the outcome uncertain at best.

But while an open access *mandate* by the State may be problematic, the State could conceivably take steps to *encourage* open access networks by other, less coercive means. For example, the State may be able to provide open access to some of the fiber optic cables and related assets that it owns or controls in various locations across to Vermont. Or it may be able to make such

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129 *See* 47 U.S.C. § 251(c)(3).

130 *In the Matter of Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers*, ¶ 278, 18 FCC Rcd. 16978, 2003 WL 22175730 (rel. September 17, 2003).

131 *In the Matter of Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers*, ¶ 2, 19 FCC Rcd. 20293, 2004 WL 2347593 (rel. October 18, 2004).

132 *See In the Matter of Modernizing Unbundling and Resale Requirements in an Era of Next-Generation Networks and Services,* WC Docket No. 19-308, Report and Order, FCC 20-152, released October 28, 2020.

133 *In the Matter of Restoring Internet Freedom,* WC Docket No. 17-108, Declaratory Ruling, Report and Order, FCC 17-166, released January 4, 2018

assets available to entities that will, in turn, make them available to third parties on an open access basis. The State could also explore whether it makes sense as a policy matter to tie State broadband grants or financing to the open access model – i.e., in exchange for State funding, providers would agree to operate on an open-access basis.

While federal law may have little to say about how the State uses fiber and other assets that it has funded exclusively itself, the State must be attentive to conditions that apply to assets that it has acquired in whole or in part with federal funds. For example, subject to the conditions and procedures set forth in 23 C.F.R. § 710.403, a state can give other entities access to currently unused assets that the state acquired for transportation purposes in whole or in part with funds from the Federal Highway Administration (FHWA). The state must ordinarily charge fair market value for such access, and it must use the proceeds for transportation purposes. These requirements do not apply, however, if the state can demonstrate to the FHWA's satisfaction that "an exception is in the overall public interest based on social, environmental, or economic benefits, or is for a nonproprietary governmental use."[134]

In short, before making the fiber and other assets that it owns or controls available to other parties, the State of Vermont must ensure that doing so is consistent with federal law or other terms and conditions that apply to them.[135]

Vermont law. Vermont has a "takings clause" similar to the one in the U.S. Constitution. That is, Chapter I, Article 2, of the Vermont Constitution prohibits the government from condemning private property without adequate compensation.[136] As a result, the arguments under federal law both for and against mandated open access discussed above could also be made under Vermont law. In short, Vermont can arguably require open access, as long as it provides for suitable compensation, but whether it should do so is a question requiring careful study.

Opponents of an open access mandate may also argue that the State lacks authority to regulate Internet access networks, and thus has no authority to impose an open access requirement. Here as well there are arguments and passionately-held views on both sides of the issue. So, as stated

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134 23 C.F.R. § 710.403(d) and (e).

135 Restrictions may also appear in bond instruments, franchises, pole attachment agreements, and many other kinds of contracts.

136 "That private property ought to be subservient to public uses when necessity requires it, nevertheless, whenever any person's property is taken for the use of the public, the owner ought to receive an equivalent in money." Vermont Constitution, Ch. 1, art. 2.

above, an effort by the State to mandate open access could well result in years of time-consuming, burdensome, and costly litigation.

Rather than rely upon its regulatory authority, the State may be able to use fiber optic cable networks that it owns or controls in various locations across Vermont to advance open access. Doing so through non-regulatory means can be of great assistance as the State seeks to make broadband Internet services available to every resident in Vermont. While a government entity cannot take control or ownership of privately-owned fiber optic cable, or individual strands within a company's fiber optic cable, without providing for fair compensation in exchange, the State nonetheless has a variety of opportunities to control fiber optic networks in Vermont.

For one thing, the State itself has deployed networks of its own fiber optic cables for its own purposes and has the right to construct further State-owned networks. To the extent that these State-owned fiber networks have excess capacity, the State can make them available to broadband providers.

The State also leases or licenses fiber optic strands in cables that have been deployed by third parties, which again it can make available for use by other broadband providers.

The State has potential opportunities to acquire further rights to fiber optic cables in Vermont. In addition to simply paying for such rights, the State can exchange rights to use State owned/controlled fiber for the right to use third-party fiber. Likewise, when the State provides grants or financing to construct fiber optic cables, it can seek to reserve for itself the right to use some of the fiber strands in such network.

Finally, as noted above, the Vermont Constitution contains certain eminent domain rights.[137] To that end, Vermont, like most other states, permits the use of eminent domain *on behalf of* a telecommunications utility (and other public utilities) to obtain access to necessary rights-of-way.[138] Entities that have received a CPG from the PUC, and that demonstrate the necessity of the condemnation, may exert a right of eminent domain as to the property of another private entity. The valuation of eminent domain by public utilities is established by the PUC.[139]

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137 Vermont Constitution Ch. I, art. 2 ("That private property ought to be subservient to public uses when necessity requires it, nevertheless, whenever any person's property is taken for the use of the public, the owner ought to receive an equivalent in money.").

138 *See, e.g.,* 30 V.S.A. § 110.

139 30 V.S.A. § 112(4).

Eminent domain, however, may be of limited use. While state law may permit the use of eminent domain on behalf of a telecommunications utility, we are unaware of any instance in which a government entity has condemned private telecommunications facilities for the purpose of putting such facilities to its own use, or for government-directed economic development initiatives. Indeed, Vermont law specifically prohibits a "governmental or private entity" from taking private property through the use of eminent domain "if the taking is primarily for purposes of economic development."[140]

9.4.4 Municipal Broadband

Overview. Over the past two decades, municipalities and municipally-owned utilities across the country have developed state-of-the-art communications networks to serve their citizens. In general, these efforts are undertaken by necessity, as smaller cities and towns find themselves inadequately served by traditional private sector communications providers. About 20 states have some form of legislative limitation on municipal communications networks, typically adopted at the behest of large incumbent communications service providers. (Vermont is not one of them, as discussed below.)

While "municipal broadband" is often portrayed as a taxpayer-funded service offered directly by a municipal government, in recent years the trend in "community broadband" has been toward the development of partnerships between local governments and private-sector service providers, with many successful examples to be found across the country.

Federal law. While federal law encourages local governments to provide communications services of all kinds, it does not affirmatively empower them to do so. For such authority, local governments must look to state and local law. Moreover, such authority must exist for each activity in question.[141]

With respect to telecommunications services, Section 253(a) of the federal Telecommunications Act of 1996, 47 U.S. § 253(a), states:

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140 12 V.S.A. § 1040. Note, however, that Section 1040 does not affect "the authority of an entity authorized by law to use eminent domain for the following purposes: …public utilities, including entities engaged in the generation, transmission, or distribution of electric, gas, sewer and sewage treatment, or communication services." *Id.*

141 For example, in *City of Bristol, VA v. Earley*, 145 F.Supp.2d 741, 745 (W.D. Va. 2001), the court held that the City has authority to provide telecommunications services, and in *Marcus Cable Associates, L.L.C. v. City of Bristol*, 237 F.Supp.2d 675, 678-79 (W.D.VA 2002), the same court held that the City does not have authority to provide cable television service. According to the court, the critical difference was that Virginia's statute authorizing localities to establish "public utilities" applied to telecommunications services but not to cable television.

> No state or local statute or regulation or other state or local legal requirement may prohibit or have the effect of prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service.

Despite the broad sweep of this language, the courts have held that Section 253(a) does not affirmatively authorize municipalities to provide telecommunications services – and does not even bar states from prohibiting municipal provision of such services. *Nixon v. Missouri Municipal League,* 541 U.S. 125 (2004).[142]

Similarly, while prior administrations have encouraged local governments to participate in the rapid deployment of broadband communications services and capabilities, Congress has not yet explicitly empowered municipalities to provide such services.[143]

In 2015, the FCC adopted an *Order*[144] preempting the state barriers to public broadband initiatives in North Carolina and Tennessee. The FCC relied on Section 706 of the Telecommunications Act of 1996, which requires the FCC to ensure that broadband is being deployed on a reasonable and timely basis to all Americans.[145] Under Section 706(b) if the FCC determines that advanced communications capabilities are not being deployed to all Americans in a reasonable and timely manner, the FCC must "take immediate action to accelerate deployment…by removing barriers to infrastructure investment and by promoting competition." In August 2016, the United States Court of Appeals for the Sixth Circuit the FCC's preemption decision, finding that Section 706 does not contain a sufficiently clear statement of Congressional intent to authorize the FCC to preempt state barriers to public broadband initiatives.[146]

142 Indeed, in a case that preceded the Nixon decision the Texas barrier to municipal entry was upheld in *City of Abilene v. FCC*, 164 F.3d 49, 53 n.7 (D.C. Cir. 1999).

143 In nearly every session of Congress, one or more bills are introduced to remove state barriers to public broadband initiatives. This year HR 2, the Moving Forward Act, was such a bill.

144 *Memorandum Opinion and Order, in the Matter of Petitions for Preemption by the City of Wilson, North Carolina and the Electric Power Board of Chattanooga, Tennessee*, .

145 47 U.S.C. 1302(b).

146 *State of Tennessee v. Federal Communications Commission*, 832 F.3d 597 (6th Cir. 2016).

Vermont law. Municipalities in Vermont are specifically authorized by the Legislature to acquire and build communications plants and facilities and to provide communications services.[147] Municipalities that provide such communications services enjoy broad rights.

A municipality that provides communications services may do so both within and outside of its municipal boundaries. The municipality also has the right of eminent domain to acquire buildings, land, and rights-of-ways as may be necessary or convenient to the operation of the communications plant, and it may use any public highway as may be necessary for its pole and wires.

However, a municipality that provides communications services must still comply with the PUC rules and regulations. For example, the municipality must obtain a CPG from the PUC before it can provide telecommunications or cable TV services, but no CPG is needed if the municipality provides only broadband services. In order to protect other communications providers, the CPGs must be nonexclusive, and they cannot contain terms or conditions more favorable than those imposed on existing CPG holders that are authorized to serve the municipality.

The most stringent set of conditions placed on municipalities that desire to provide communications services concerns the financing of the plant and operations:

- A municipality's operation of any communications plant must be supported solely by the revenues derived from the operation of the plant, except for the portion that is used by the municipality for its own municipal purposes.
- Any financing that the municipality using must be paid from the net revenues derived from the operation of the communications plant.
- The municipality is strictly prohibited from passing any financial losses from its communications operations onto the municipality's taxpayers.

In 2015, the Legislature expanded the rights of municipalities by allowing two or more of them to form a communications union district (CUD).[148] A district formed under that legislation continues to be a body politic much like the underlying municipalities, all for the purpose of providing communications services. The rules and regulations for CUDs are similar to those for municipalities that go it alone. And like municipal communications services, no losses by the CUD can be borne by the taxpayers of the member municipalities.

[147] 24 V.S.A. ch. 54.

[148] 30 V.S.A. ch. 82.

As discussed in the Report, many municipalities in Vermont have already joined together to create CUDs in various regions of the State. The Report further acknowledges the important role that CUDs play in bringing broadband services into their communities.

The financial restrictions imposed on municipalities and CUDs under these statutes may, however, impose roadblocks or cause delays in their ability to bring communications services to their residents, business, schools, hospitals and others. The State has periodically revisited the question of whether these financial restrictions should be maintained, and in December of 2019, decided to take a "wait and see" approach to any such decision to relax these restrictions.[149] However, given the significant role that the State is asking municipalities and CUDs to play in expanding broadband internet services in their own communities, particularly in response to need highlighted by COVID-19, it may be prudent for the Legislature to explore again whether it is appropriate to loosen the financial restrictions on municipalities and CUDs, thereby allowing them greater financial flexibility to help bring broadband to their towns. That is particularly so given that private entities are aggressively seeking taxpayer subsidies themselves. Public support should go to whichever entities, public or private, can deliver the best value to the public.

9.4.5 Electric Co-Op Cross Subsidization of Communications Services

Overview. Nearly a hundred years ago, many rural homes throughout the country, including those in rural homes in Vermont, were without electric service. President Roosevelt and Congress answered the call in the mid-1930s through the enactment of the Rural Electrification Act of 1936, with the goal of bringing electricity to unserved rural communities and farms. The Act provided for the creation of the Rural Electrification Administration (REA), which quickly learned that the best vehicle for making rural electrification a reality in the hardest to serve areas was through member-owned electric cooperatives. To that end, in 1937, the REA drafted a model law that states could adopt, called the Electric Cooperative Corporation Act, to enable the formation and operation of not-for-profit, consumer-owned electric cooperatives.[150]

This led to the creation of electric coops in Vermont. For example, according to its history posted on its website, "Vermont Electric Coop (VEC) was established in 1938 by farmers in the town of

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149 *See* Report to the Vermont Legislature Act No. 79, Section 14: A Report on the Use of General Obligation Bonds for Improvements to Municipal Telecommunications Plants, Submitted by Susanne Young, Secretary of Administration, December 1, 2019.

150 NRECA – America's Electric Cooperatives, *History, The Electric Cooperative Story*, www.electric.coop/our-organization/history.

Eden with the goal of bringing electricity to rural Vermonters who had been bypassed by investor-owned utilities."

Today, the question is, what role can electric cooperatives play in helping to bring broadband services to Vermont's rural communities?

Vermont law. Electric cooperatives are established in Vermont by state statute.[151] Although the primary mission of electric coops, as the name and history imply, is to provide electric services to its members, the enabling legislation also grants electric coops with the power to provide telecommunications, cable television and internet services to its members.[152] Moreover, electric coops are authorized by statute to "work cooperatively with governmental entities or private sector institutions, or a combination of both, for purposes of economic or community development, to benefit cooperative members in their communities."

Accordingly, electric coops in Vermont have the authority to assist and/or engage in the provision of communications services, include broadband internet services to its members. Beyond simple authority, coops also likely have a significant interest in being able to help their members obtain broadband services because the electric service ratepayers, members and owners of the coop are all one and the same.

At the same time, however, just as municipalities and CUDs that seek to provide broadband services to their residents are currently limited as to sources of funds that they can use to provide communications services, so too are coops. More specially, electric coops in Vermont are prohibited from using revenues from the provision of electric services to help fund the communications services: "the electric revenues received from regulated activities of a cooperative shall not subsidize any nonelectric activities of the cooperative.'[153]

Given that coops are already providing electric services in some of Vermont's most rural and hard to reach communities, and given the importance and necessity of bringing broadband to these very same residents, it may be prudent for the Legislature to explore whether it is appropriate to loosen the financial restrictions on electric coops thereby allowing them greater financial flexibility to help bring broadband to their member/owners.

151 30 V.S.A. ch. 81.

152 30 V.S.A. § 3001a.

153 30 V.S.A. § 3047.

Appendix A: Residential Survey Results

1. Executive Summary

As part of its efforts to perform a comprehensive evaluation of broadband gaps during the Covid-19 pandemic, the State of Vermont commissioned an online survey of households. The survey was intended to gather basic data about the types of services to which residents subscribe and their use of these services (including subsidized programs such as Comcast Internet Essentials). Moreover, the survey was designed to provide insights about how the pandemic has impacted residents' use of the internet at various times and locations inside and outside the home and whether internet service is sufficient to meet the needs of households across the State.

Almost all respondents have access to the internet, which is to be expected of online survey participants. At the same time, households' internet service may be inadequate to meet their needs during the pandemic. Usage in the home at various times and for various activities has increased significantly during the pandemic, at the same time that satisfaction with connection speed and reliability has decreased. Many respondents disagreed that their home internet connection is adequate to meet their needs, particularly for attending online classes and doing homework. Additionally, very few respondents (8 percent) feel that public Wi-Fi access in their area is adequate.

This appendix documents the survey process, discusses methodologies, and presents results intended to assist the State in developing strategies to close the identified gaps.

9.4 Key Findings

Key findings are here presented thematically in two subsections: broadband access gaps and Covid-19 impacts on broadband use. These and other findings are presented in greater detail in the body of the report.

Broadband Access Gaps

The survey found very few gaps in acquisition of residential internet access services, but also that relatively few residents are taking advantage of available subsidized programs. The following are key findings:

- **Most residents do have home internet access.** Most (96 percent) reported having internet access, including 79 percent who have both home internet service and a cellular/mobile telephone service with internet (smartphone). The high saturation of internet access would be expected in an online survey.

- **Five percent of all respondents and nine percent of low-income households (earning less than $25,000 per year) only use a smartphone for home internet access.** This may limit their ability to fully utilize online services at home.

- **Comcast Xfinity and Consolidated Communications (CCI) are the leading internet service providers used.** Three in 10 respondents subscribe to Comcast Xfinity, and three in 10 subscribe to CCI. Other ISPs comprise much smaller shares of the market statewide but may represent larger shares in some individual counties. Further detail on companies used by respondents are provided in the body of the report.

- **Residents may be significantly underutilizing existing broadband subsidy programs.** Only one percent of all Comcast subscribers, and 10 percent of low-income subscribers, participate in the Comcast Internet Essentials program. Another 59 percent of low-income subscribers were unaware of the program, and 15 percent attempted to enroll but were declined.

- **Most (99 percent) respondents access the internet from any location, including a range of locations outside the home.** However, use of the internet outside of the home has declined significantly during the Covid-19 pandemic.

- **Most respondents are unaware of the State's emphasis on Communication Union Districts.** Three in 10 respondents said they are aware of CUDs as a way to improve broadband access in unserved areas, while 59 percent are unaware and 11 percent are unsure.

- **Public Wi-Fi access may not be adequate.** Nearly one-half of respondents (45 percent) are aware of public Wi-Fi hotspot locations near their home, but just eight percent said that hotspot access is adequate in the area. Another 43 percent were unsure.

- **Most respondents use search engines to learn about availability of internet service.** Two-thirds named search engines as the leading source of information to learn about available service options, and seven in 10 named search engines as the top source for learning how to use the internet more effectively.

Covid-19 Impacts on Broadband Use

Respondents reported increased use of and demand for broadband services during the Covid-19 pandemic. They are utilizing the internet more at home and less often outside the home, as may be expected, and they are engaged in more online activities for work, school, and entertainment. The following are key findings:

- **Daily use of home internet services at various times has increased during the pandemic**. Prior to the Covid-19 pandemic, just over one-half of respondents made daily use of the internet mid-morning or early afternoon, compared with approximately nine in 10 respondents during the pandemic. Four in 10 households have at least three members online during peak usage times during the Covid-19 pandemic.

- **Use of internet services outside of the home has declined significantly during the Covid-19 pandemic.** Use of the internet in key areas decreased significantly when comparing figures pre-Covid and during-Covid, including in work settings (79 percent vs. 56 percent), private businesses (65 percent vs. 27 percent), schools or colleges (38 percent vs. 20 percent), and public buildings (37 percent vs. 18 percent).

- **Engagement in online activities has increased significantly during the Covid-19 pandemic.** Use of the internet for telemedicine or medical appointments (19 percent vs. 75 percent) and for civic engagement (33 percent vs. 74 percent) increased substantially from pre-pandemic to during-pandemic, although some of the use is at a monthly or less than monthly basis. Additionally, 62 percent of respondents use the internet for teleworking on a daily basis, compared with 21 percent of respondents before the pandemic.

- **Satisfaction with internet service aspects has decreased during the pandemic, particularly for speed and reliability of service.** More than one-half of respondents are not at all satisfied (approximately one-third) or are only slightly satisfied (approximately one-fifth) with connection speed and reliability during the pandemic.

- **Many respondents have experienced some challenge with accessing telehealth or an online medical appointment during the pandemic.** Specifically, four in 10 respondents experienced an issue (e.g. having to switch from video to audio only), while three in 10 have not had a medical appointment and another three in 10 did not respond or had no issue.

- **Most households with children have internet access, but it may not be sufficient for some families.** Most respondents disagreed that their children have to do homework or distance learn at various locations outside the home (although 13 percent agreed or strongly agreed that their children cannot complete their homework or cannot distance learn because they do not have access to the internet at home.) However, four in 10 respondents strongly disagreed that their home internet connection is adequate for their or their children's needs for doing homework or attending classes online.

- **Sixteen percent of all respondents consumed public, educational, or governmental (PEG) TV content during the Covid-19 pandemic.** Among those who viewed PEG programming, the most commonly accessed content was broadcasts of municipal functions, cited by 72 percent of respondents. One-half of PEG viewers accessed information about Covid-19.

9.5 Survey Process and Data Analysis

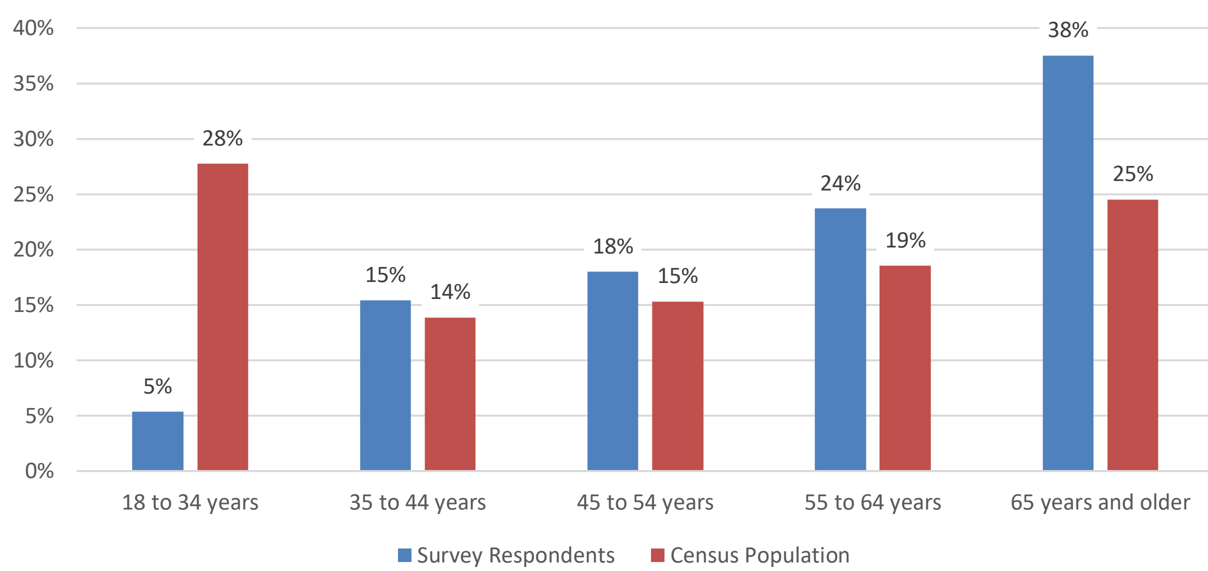
CTC, in close coordination with the State of Vermont, managed the survey project, including development of the questionnaire, programming and hosting the online survey, survey data analysis, and reporting of results. CTC developed the draft survey instrument and the State provided revisions and approved the final questionnaire. A total of 3,046 useable surveys were completed by the date of analysis.

The survey responses were entered into SPSS[154] software and the entries were coded and labeled. SPSS databases were formatted, cleaned, and verified prior to the data analysis. The survey data was evaluated using techniques in SPSS including frequency tables, cross-tabulations, and means functions. Statistically significant differences between subgroups of response categories are highlighted and discussed where relevant.

The survey responses were weighted based on the age of the respondent and region. Since older persons are more likely to respond to surveys than younger persons, the age-weighting corrects for the potential bias based on the age of the respondent. In this manner, the results more closely reflect the opinions of the County's adult population.

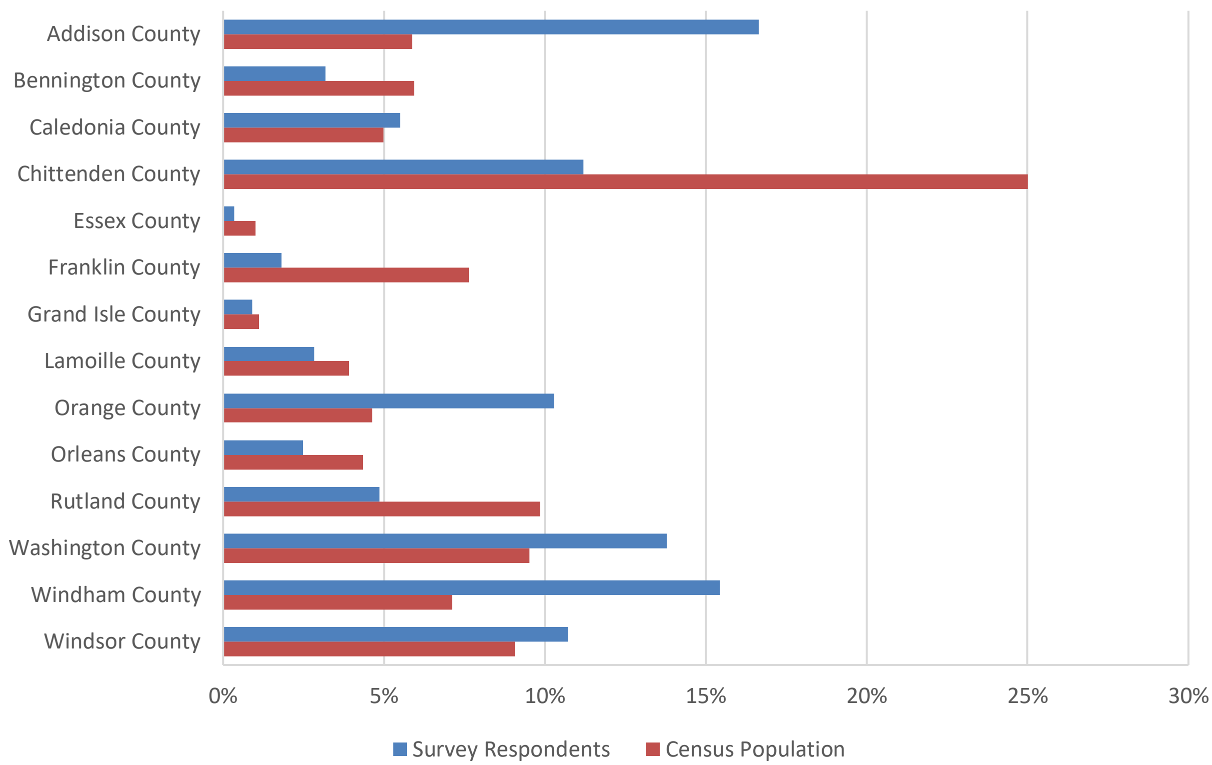
The following figures summarize the sample and population distributions by region and age.

Figure 31: Age of Respondents and Adult Population



[154] Statistical Package for the Social Sciences (http://www-01.ibm.com/software/analytics/spss/)

Figure 32: County of Respondents and Population



The following sections summarize the survey findings.

9.6 Survey Results

The results presented in this report are based on analysis of information provided by 3,046 State of Vermont residents. Unless otherwise indicated, the percentages reported are based on the "valid" responses from those who provided a definite answer and do not reflect individuals who said "don't know" or otherwise did not supply an answer because the question did not apply to them. Key statistically significant results ($p \leq 0.05$) are noted where appropriate.

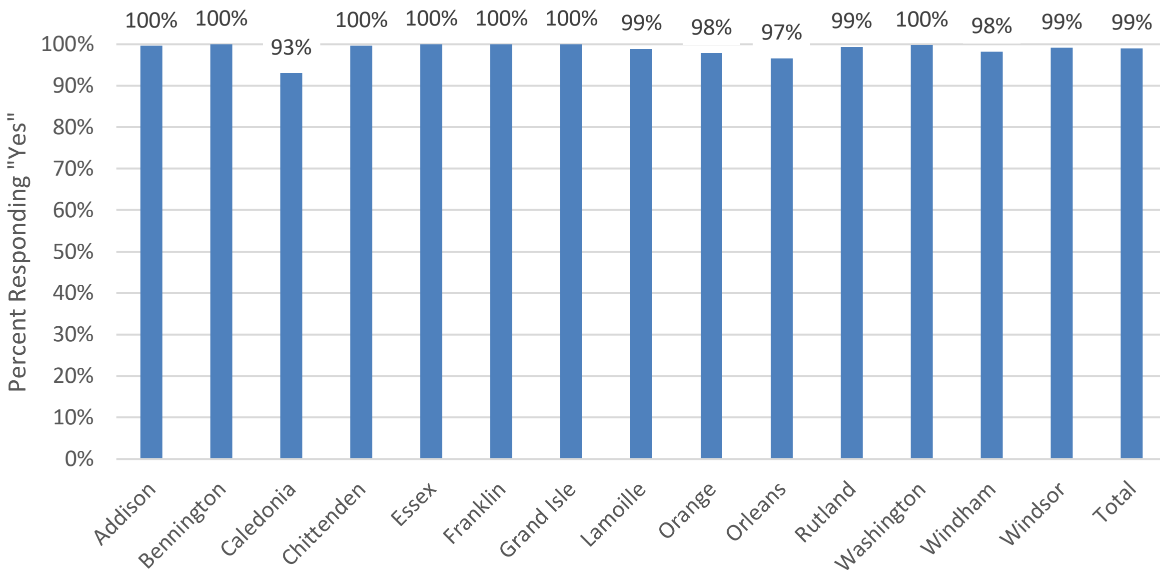
Internet Connection and Use

Respondents were asked about their use of the internet, including home internet connection types and providers, internet costs and enrollment in programs for low-income subscribers, and Wi-Fi availability. This information provides valuable insight into residents' need for various internet and related communications services.

Internet Usage

Almost all (99 percent) respondents make some use of the internet, on any device from any location, as shown in the following figure. Usage is high across all demographic groups, including low-income households (99 percent).

Figure 33: Internet Usage by County



Agreement with reasons for not accessing the internet are highlighted in the following figures. Availability of internet service is the leading barrier to internet access, with 17 of 27 (64 percent) of those who do not access the internet strongly agreeing that internet is not available. The next tier of factors include the ability to get internet at another location and service is too expensive.

Figure 34: Reasons for Not Using the Internet (Mean Ratings)

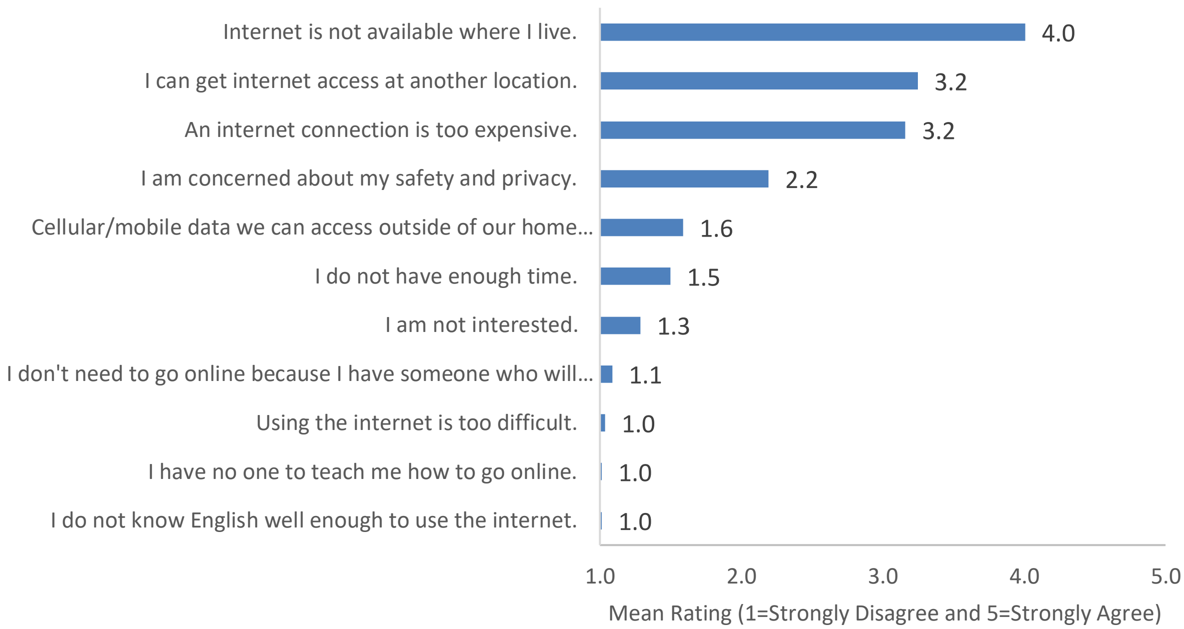
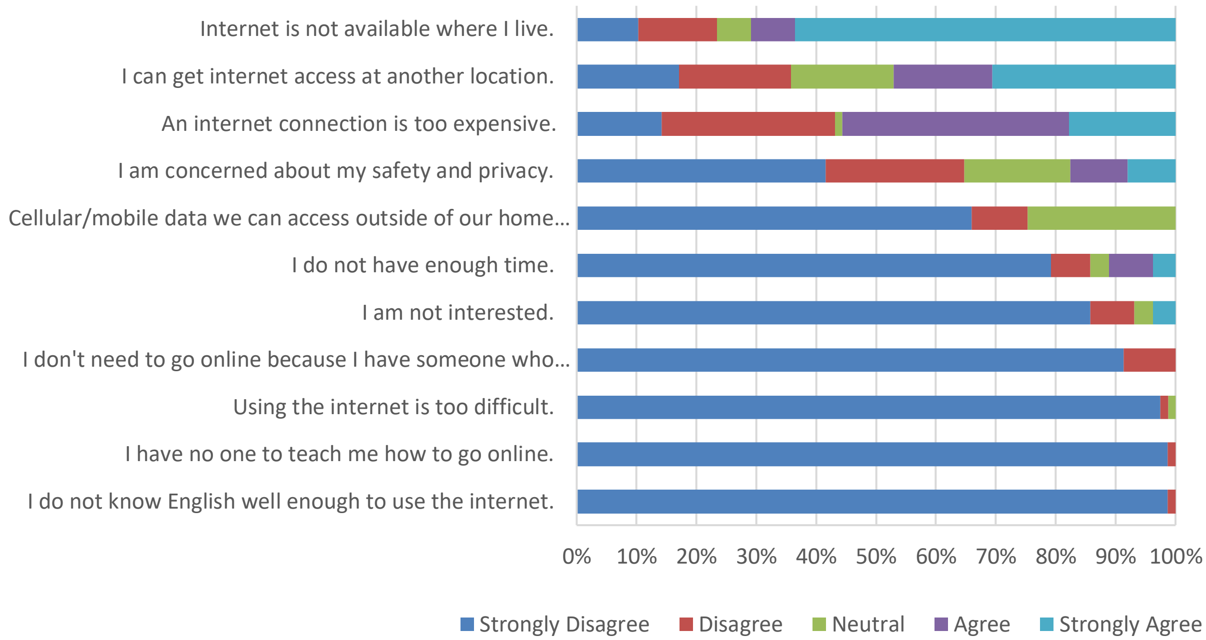


Figure 35: Reasons for Not Using the Internet



Communications Services

Saturation of communications services currently purchased for the household is illustrated in the following figures. Overall, 96 percent of respondents indicated having some internet access—either a home connection or via smartphone. Specifically, 91 percent have internet service in the home and 83 percent have cellular/mobile telephone service with internet. Fewer households have landline telephone service, cable/satellite television service, cellular/mobile telephone service without internet, and free Wi-Fi service.

Figure 36: Communication Services Purchased

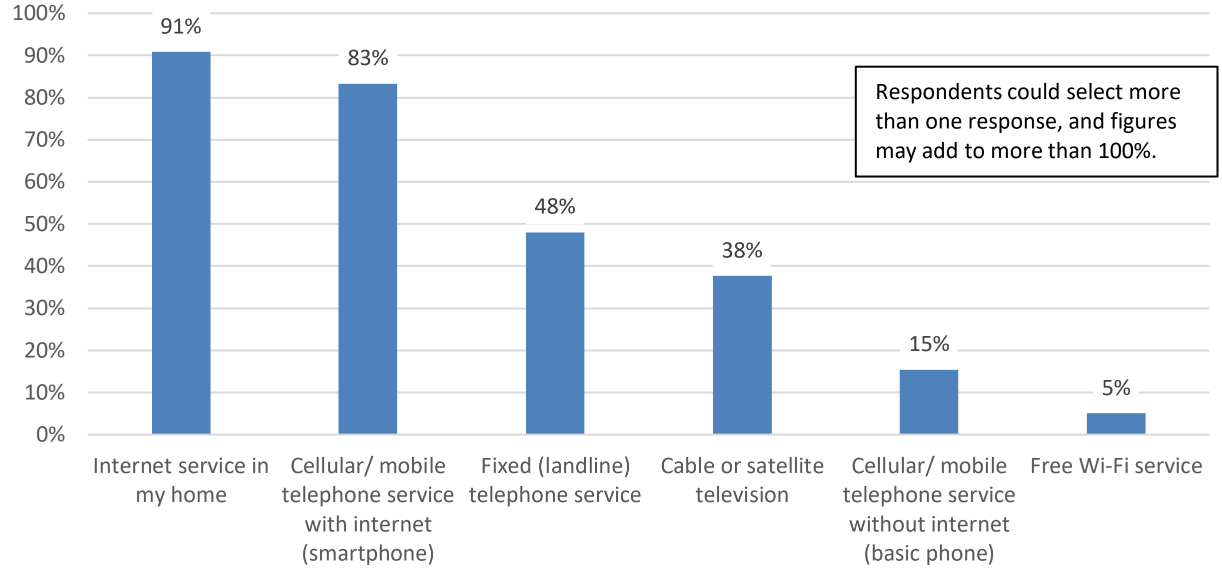
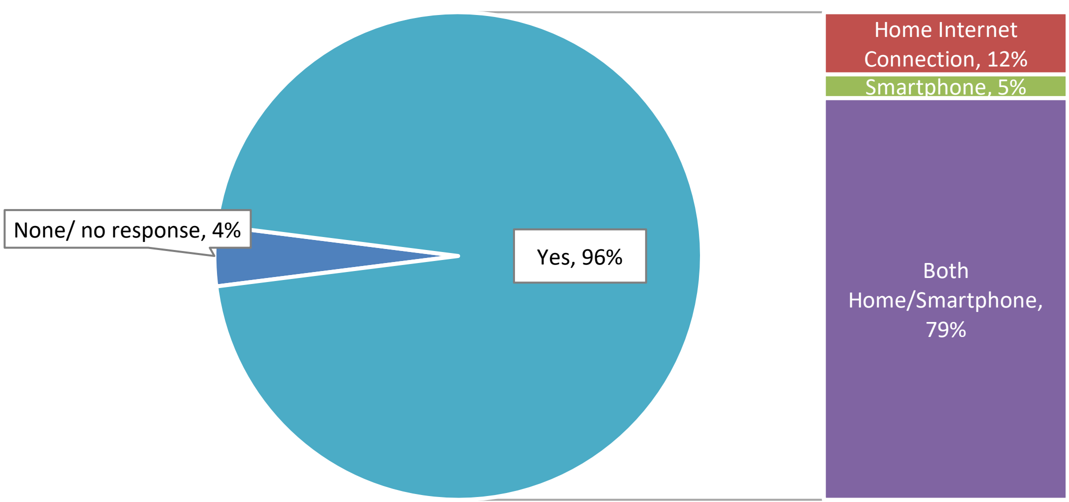


Figure 37: Internet Services Purchased



As discussed previously, most respondents have some internet access, including 79 percent who have both home internet service and a cellular/mobile telephone service with internet (smartphone). Total internet access is high across all demographic groups, as shown in the following table. Older respondents and those in lower income households are more likely to have a home internet connection only, and they are less likely to have both a home internet connection and a smartphone.

Table 2: Internet Access by Key Demographics

TOTAL	**4%**	**12%**	**5%**	**79%**	**96%**	***3046***
County						
Addison County	0%	8%	3%	89%	**100%**	*151*
Bennington County	0%	9%	3%	88%	**100%**	*151*
Caledonia County	4%	7%	17%	72%	**96%**	*127*
Chittenden County	1%	6%	2%	91%	**99%**	*636*
Essex County	7%	13%	6%	74%	**93%**	*25*
Franklin County	0%	19%	5%	76%	**100%**	*193*
Grand Isle County	0%	5%	0%	95%	**100%**	*28*
Lamoille County	2%	19%	5%	74%	**98%**	*99*
Orange County	1%	24%	7%	68%	**99%**	*120*
Orleans County	3%	19%	0%	78%	**97%**	*110*
Rutland County	2%	11%	4%	83%	**98%**	*250*
Washington County	1%	17%	4%	79%	**99%**	*243*
Windham County	2%	13%	6%	78%	**98%**	*181*
Respondent Age						
18 to 34 years	1%	8%	4%	88%	**99%**	*702*
35 to 44 years	0%	7%	3%	90%	**100%**	*356*
45 to 54 years	1%	7%	5%	88%	**99%**	*390*
55 to 64 years	1%	14%	6%	79%	**99%**	*474*
65 years and older	2%	21%	5%	72%	**98%**	*639*
Education						
HS education or less	2%	14%	6%	77%	**98%**	*304*
Two-year/technical degree	1%	15%	10%	73%	**99%**	*286*
Four-year college degree	1%	11%	3%	85%	**99%**	*998*
Grad, prof, doctorate	1%	11%	3%	84%	**99%**	*975*

Income						
Less than $25,000	1%	22%	9%	68%	**99%**	*140*
$25,000 to $49,999	2%	15%	8%	75%	**98%**	*351*
$50,000 to $74,999	1%	8%	6%	85%	**99%**	*423*
$75,000 to $99,999	2%	10%	3%	85%	**98%**	*424*
$100,000 to $149,999	1%	14%	3%	83%	**99%**	*485*
$150,000 to $199,999	1%	6%	2%	91%	**99%**	*165*
$200,000 or more	0%	7%	3%	89%	**100%**	*130*
Race/Ethnicity						
Other race/ethnicity	0%	11%	6%	83%	**100%**	*88*
White/European American	1%	11%	4%	83%	**99%**	*2171*
Gender Identity						
Woman	2%	12%	5%	82%	**98%**	*1463*
Man	0%	11%	3%	86%	**100%**	*909*

Internet Service Provider

As illustrated in the following figure, Comcast Xfinity and Consolidated Communications are the leading ISPs overall in the Vermont market area. This varies significantly by county of residence, with saturation of Comcast Xfinity customers highest in Chittenden County and saturation of CCI customers highest in Lamoille and Franklin Counties (see the figure below).

Figure 38: Primary Internet Service Provider

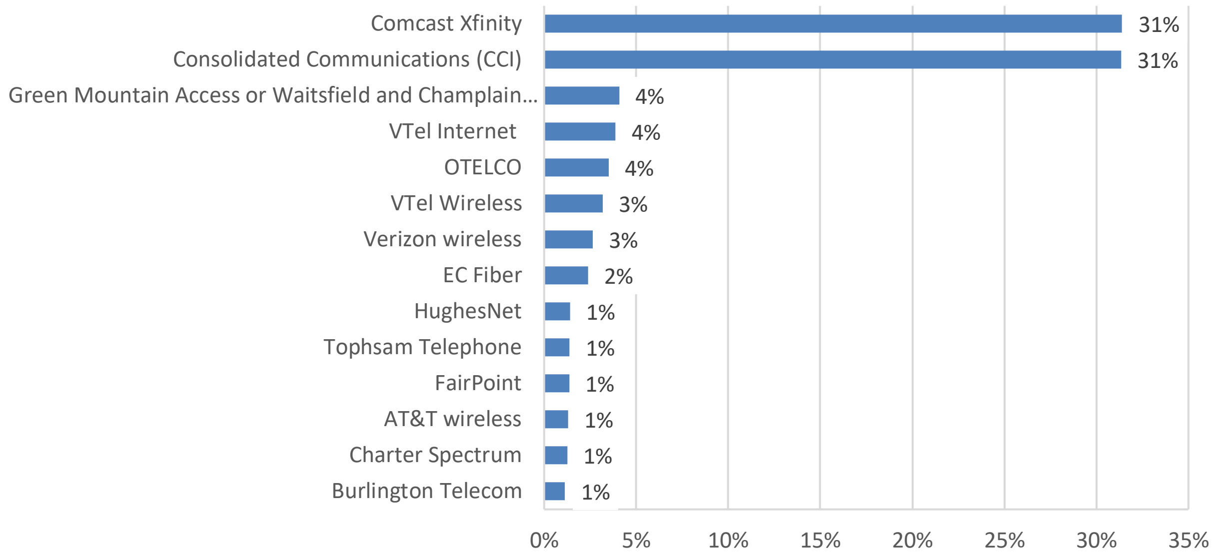
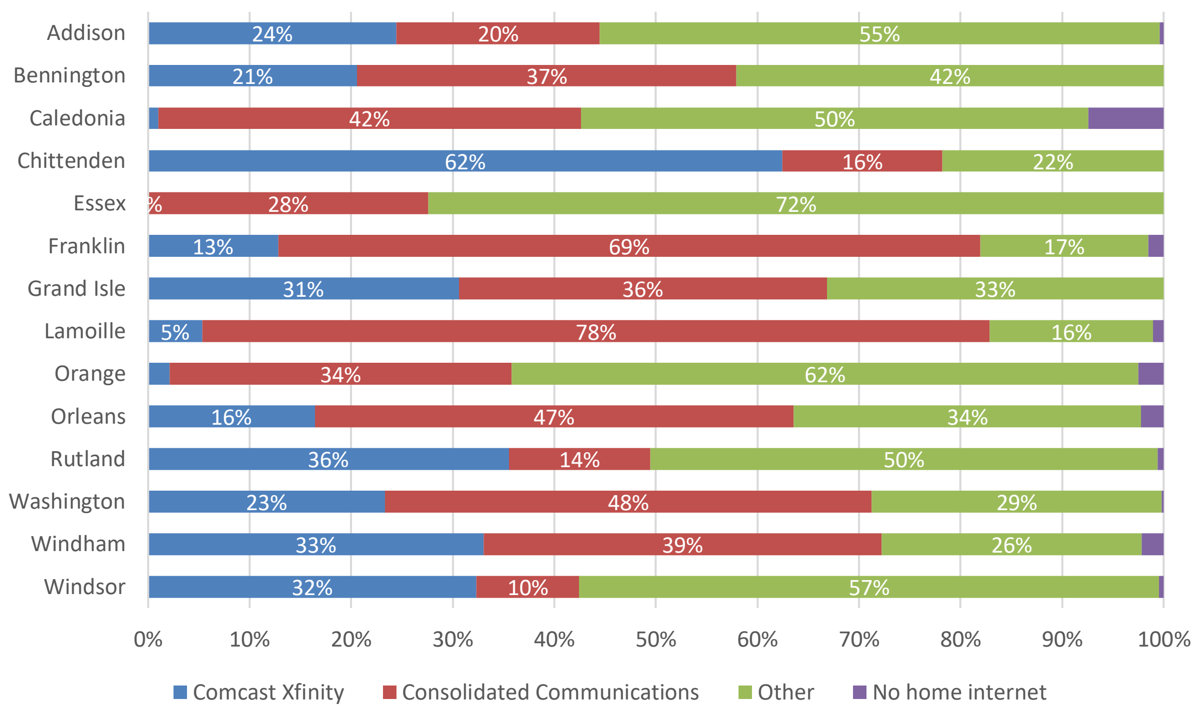


Figure 39: Primary Internet Service Provider by County

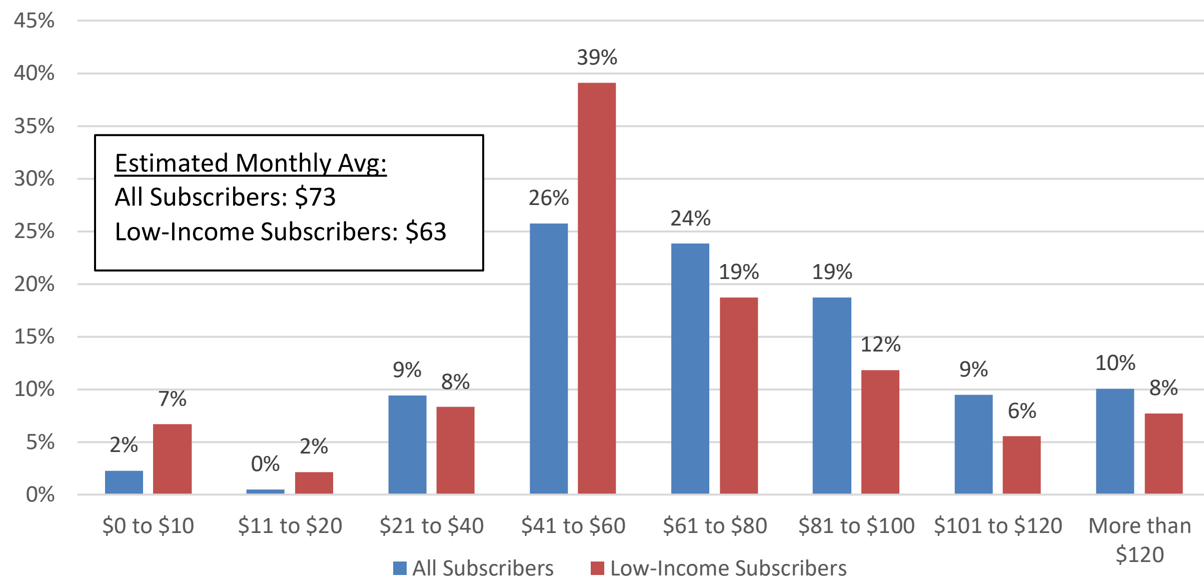


Internet Service Cost and Programs for Low-Income Subscribers

The estimated monthly average cost for internet service is $73, as shown in the figure below. One-fifth of respondents pay over $100 per month. Low-income subscribers (earning less than

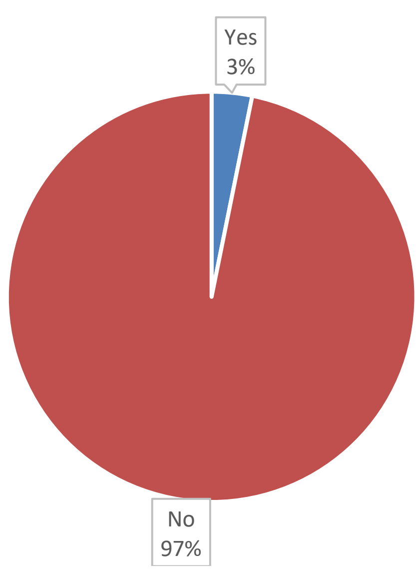
$25,000 per year) pay a slightly lower monthly fee for internet service (not controlling for type of service).

Figure 40: Monthly Price for Internet Service



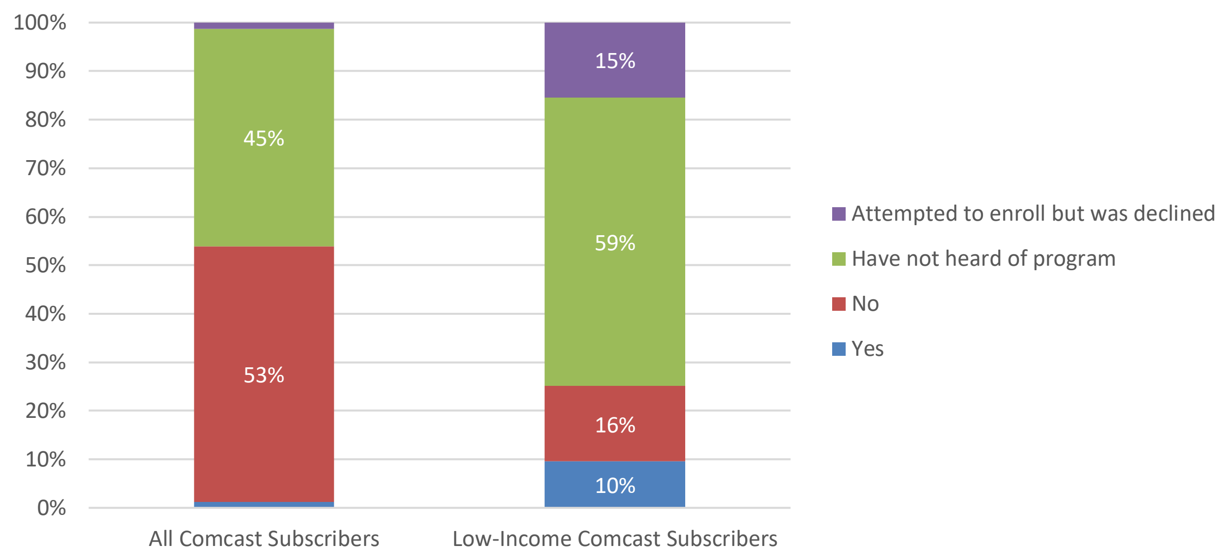
Three percent of all internet subscribers (and 10 percent of low-income subscribers) have missed an internet service payment but found their service remained connected due to the State's or the provider's policy on halting disconnections during the Covid-19 pandemic (see the figure below).

Figure 41: Missed Payments But Service Remained Connected



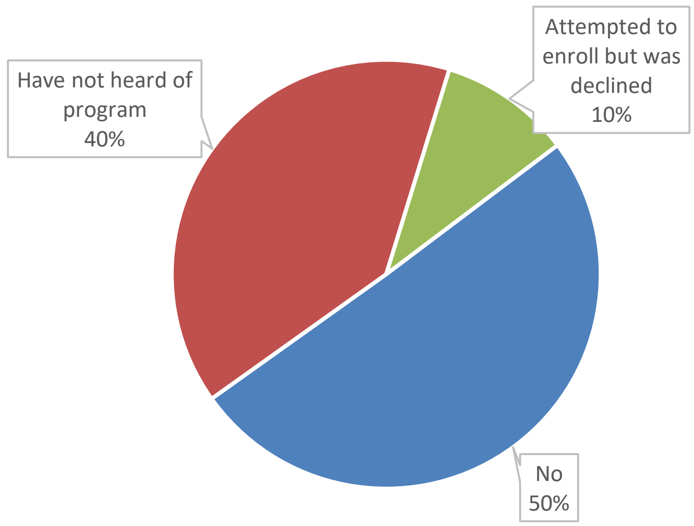
As illustrated in the figure below, just one percent of all Comcast customers, and 10 percent of low-income customers, are enrolled in the ISP's Internet Essentials program for low-income households. Another 15 percent of Comcast customers earning under $25,000 per year said they attempted to enroll but were declined. Keep in mind that figures among low-income households are based on a relatively small number of respondents.

Figure 42: Participate in Comcast's Internet Essentials Program



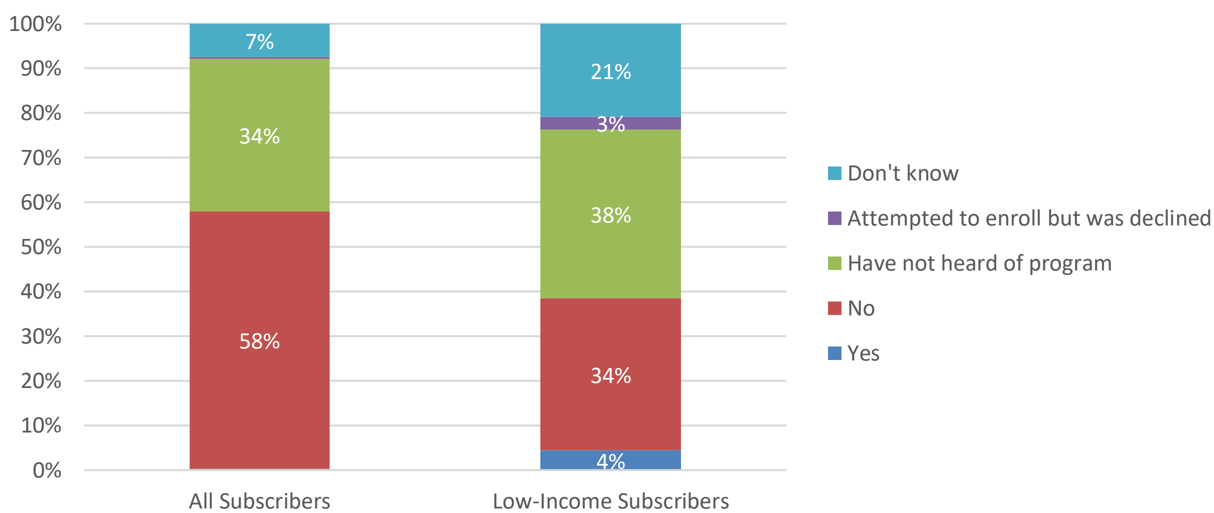
No Spectrum customers are enrolled in the ISP's Internet Assist program for low-income subscribers, while four in 10 said they have not heard of the program (see the figure below). Seven of 10 low-income customers said they have not heard of the program.

Figure 43: Participate in Spectrum's Internet Assist Program



Just 4 percent of low-income subscribers (earning under $25,000 per year) receive the $9.25 subsidy under the FCC's Lifeline program, and 21 percent are unsure if they receive the subsidy. Most households are not receiving the subsidy (see the figure below).

Figure 44: Receive $9.25 Subsidy Under FCC's Lifeline Program



Internet Service and Wi-Fi Availability

Nearly two-thirds (65 percent) of respondents use a search engine to find out more about internet service options, and seven in 10 use a search engine to learn how to use the internet more effectively. Other sources used include friends/family members and broadband providers.

Just two percent of respondents use CUDs to learn about internet service options (see the figures below).

Figure 45: Sources Used to Learn About Internet Service Options

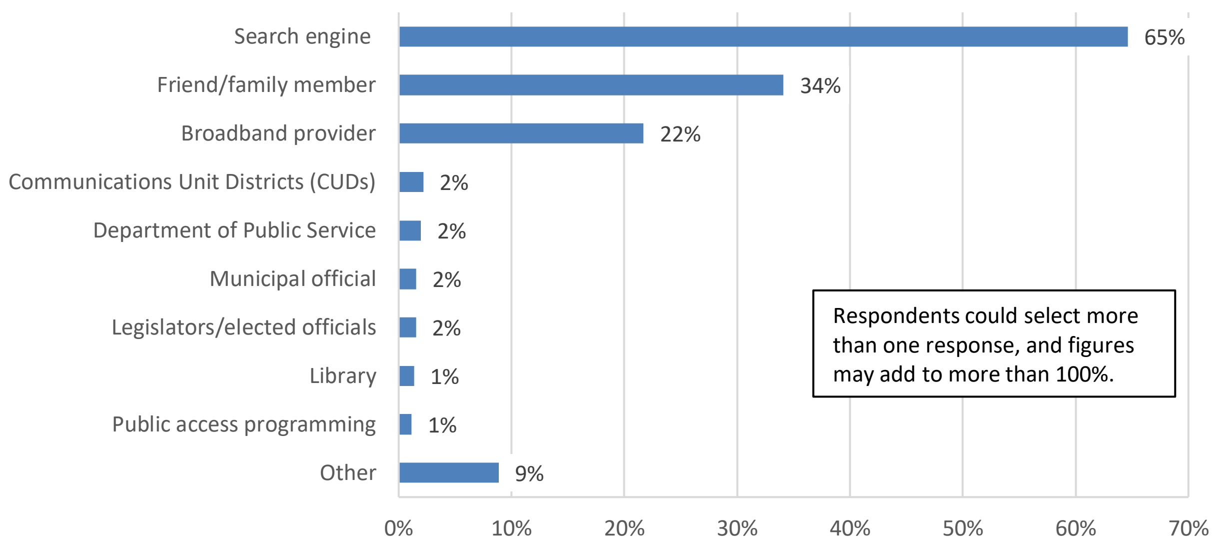
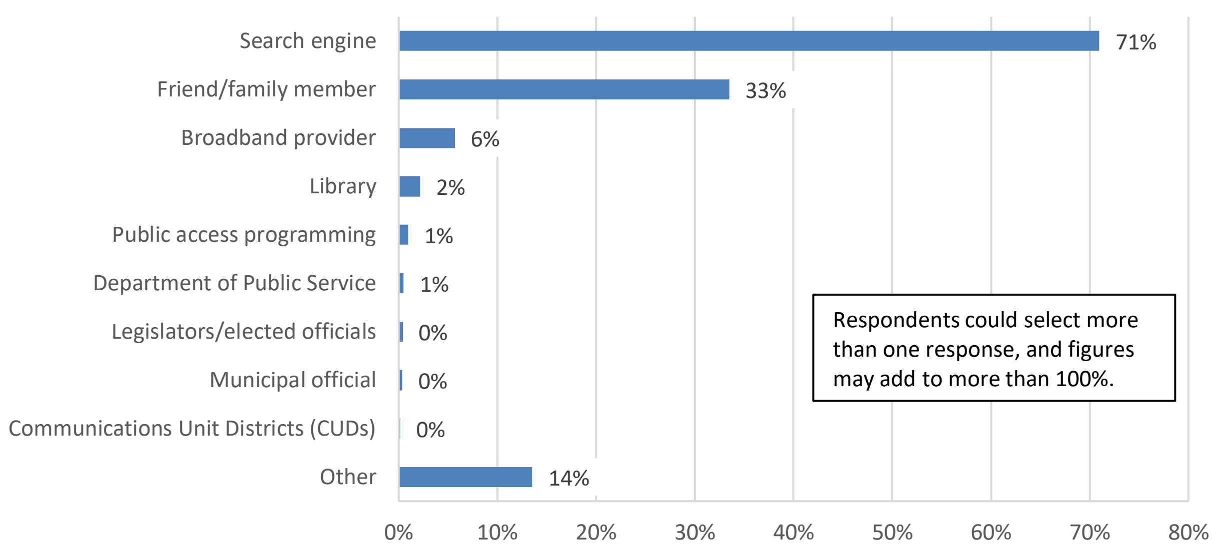


Figure 46: Sources Used to Learn How to Use the Internet More Effectively



Search engine is the top source used across age groups; however, the proportion of respondents using it declines as age increases (see the figures below). Nearly nine in 10 respondents ages 18 to 34 years old use a search engine to learn about internet service options, compared with 50 percent of those ages 65 years and older. Conversely, younger adults are less likely than older adults to contact their broadband provider for information.

Figure 47: Top Sources Used to Learn About Internet Service Options by Respondent Age

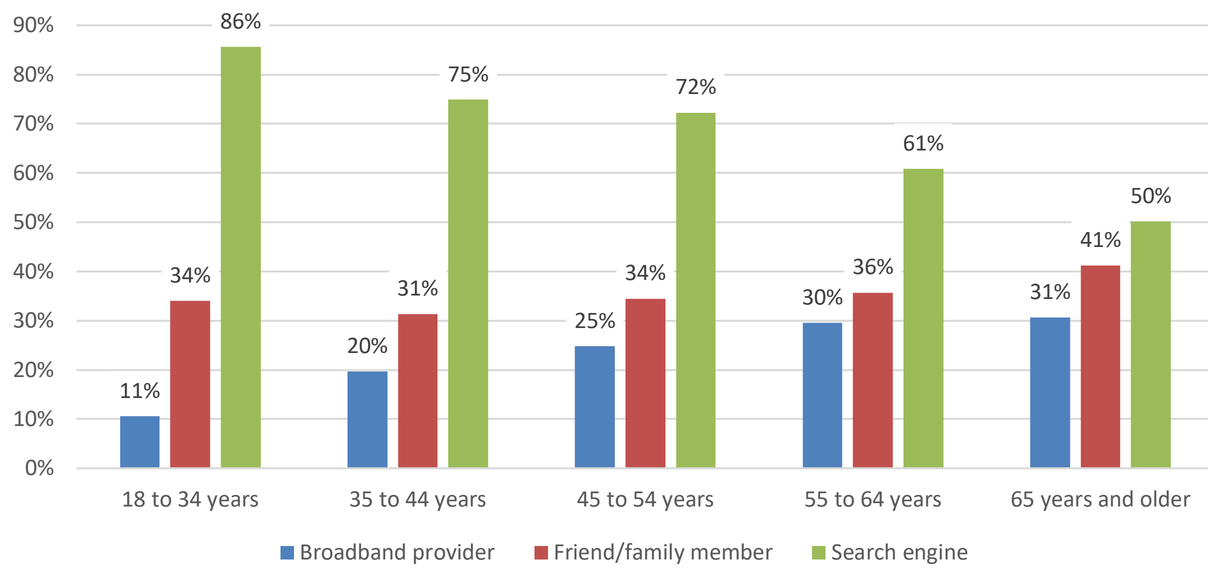
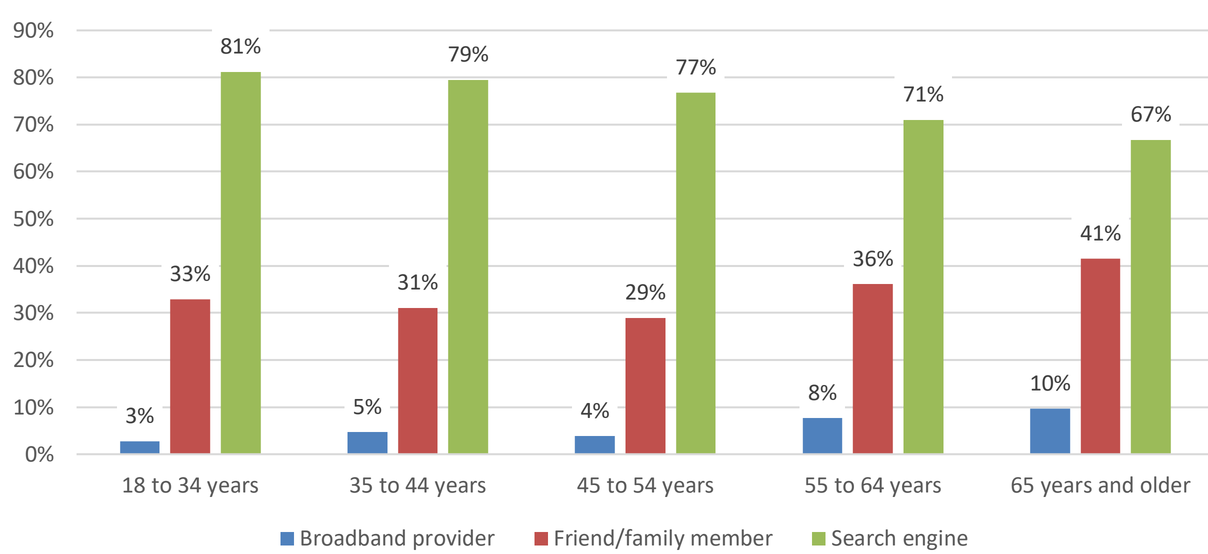
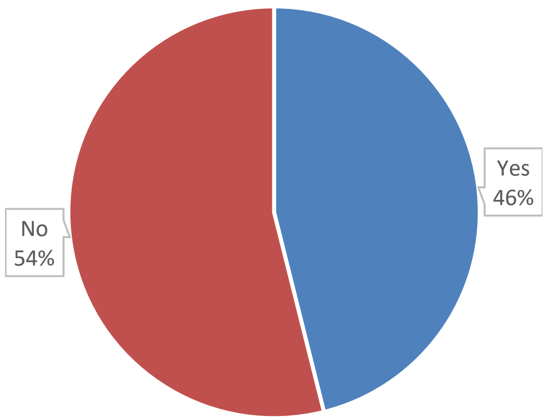
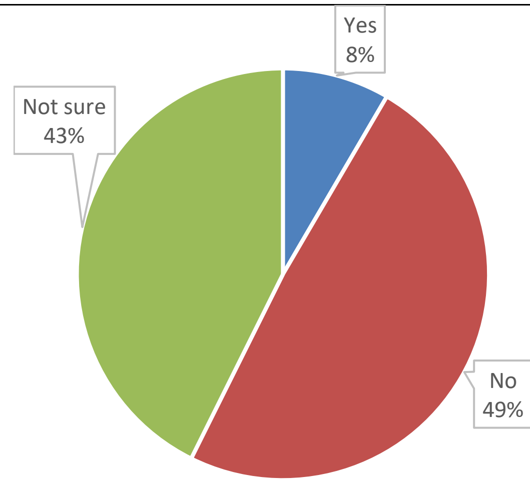


Figure 48: Top Sources Used to Learn How to Use the Internet More Effectively by Respondent Age



Respondents were also asked if they are aware of public Wi-Fi hotspot locations near their home and if they believe public Wi-Fi hotspot access is adequate in their area. Nearly one-half of respondents (45 percent) are aware of public Wi-Fi hotspot locations near their home, but just eight percent said that hotspot access is adequate in the area, as shown in the figures below. Another 43 percent were unsure.

Aware of Public Wi-Fi Hotspot Locations Near Home	**Public Wi-Fi Hotspot Access Is Adequate in Area**
	

Awareness of public Wi-Fi hotspot locations varies significantly by county of residence. Specifically, awareness is highest among Caledonia County and Orleans County residents, although just a small percentage of residents said that access is adequate (see Figure 49 and Figure 50).

Figure 49: Aware of Public Wi-Fi Hotspot Locations Near Home by County

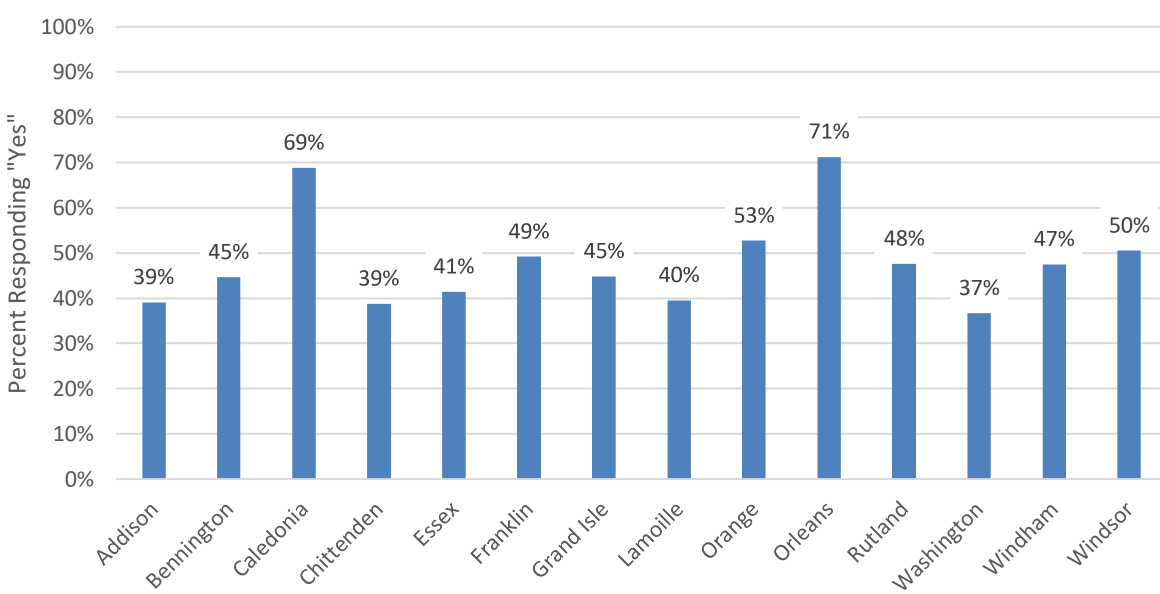
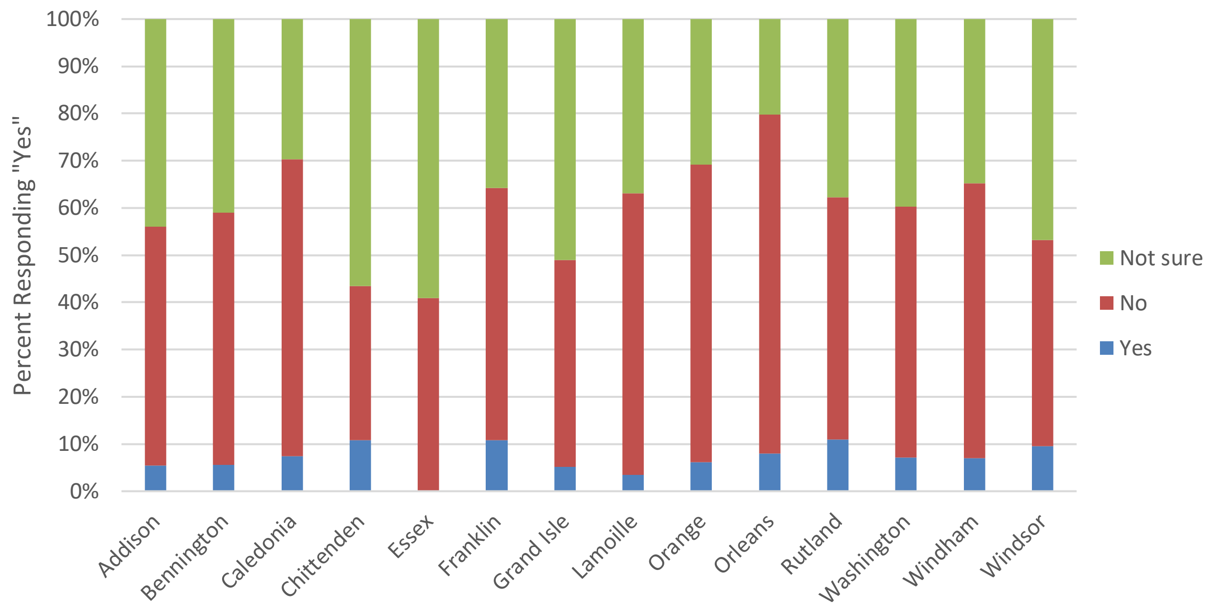


Figure 50: Public Wi-Fi Hotspot Access Is Adequate by County



Overall, three in 10 respondents were aware of the State's emphasis on Communication Union Districts as a way to improve broadband access to unserved areas around the State. Another 59 percent of respondents were unaware, and 11 percent were unsure. As illustrated in Figure 51, awareness was highest among Bennington County, Caledonia County, and Orleans County residents. Also, awareness is correlated with respondent age, with just 23 percent of respondents under age 45 aware of CUDs compared with 37 percent of those ages 65 and older (see Figure 52).

Figure 51: Aware of State's Emphasis on Communication Union Districts by County

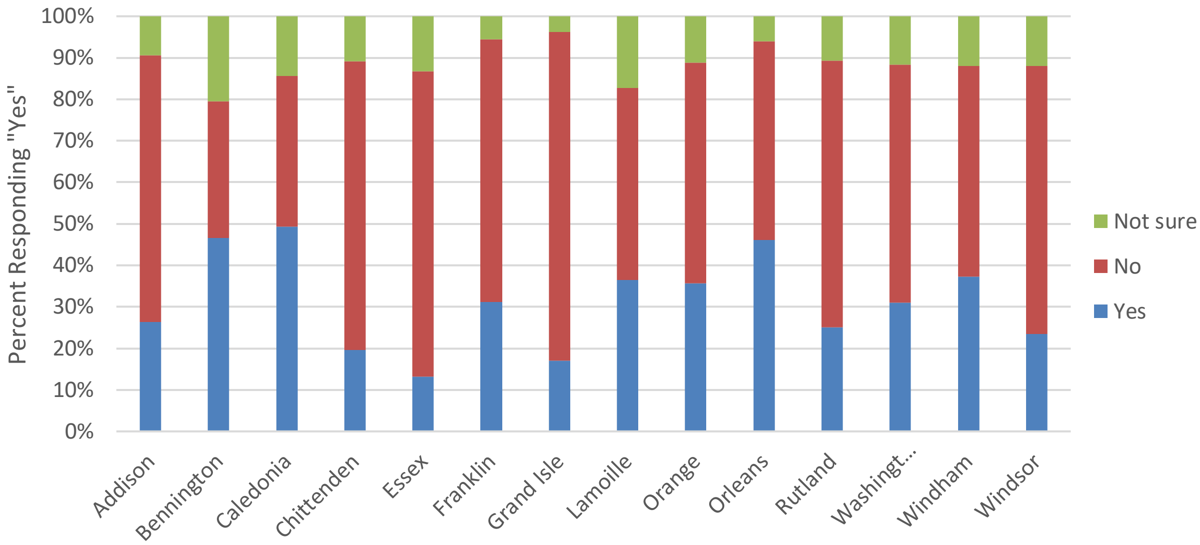
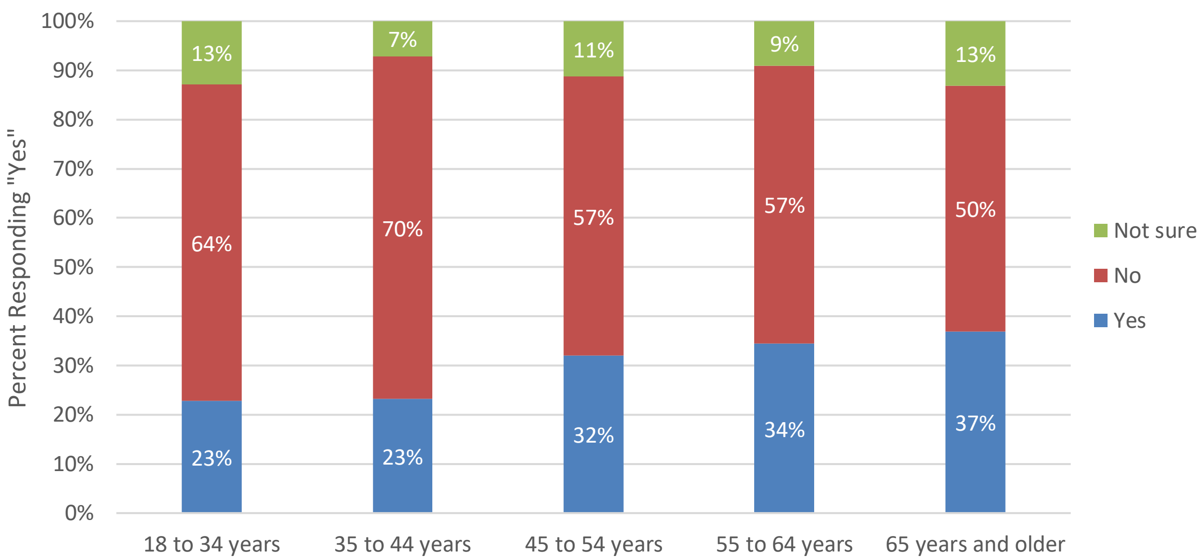


Figure 52: Aware of State's Emphasis on Communication Union Districts by Respondent Age



Covid-19 Impacts on Home Broadband

Respondents were asked a series of questions on how their broadband use has changed during the Covid-19 pandemic, including impacts on time and location of internet use, engagement in various internet activities, satisfaction with internet service, distance learning, and consumption of PEG programming. This information provides valuable insight into demand for broadband service during the pandemic.

Internet Use at Various Times

Respondents were asked to indicate how often they use the internet at various times before and during the Covid-19 pandemic. As shown in Figure 53, daily use of internet services at various times has increased during the pandemic. Most respondents are making use of the internet throughout the day, whereas prior to the pandemic usage was lower during daytime hours and peaked in the evening.

Figure 53: Daily Use of the Internet at Various Times Before and During Covid-19 Pandemic

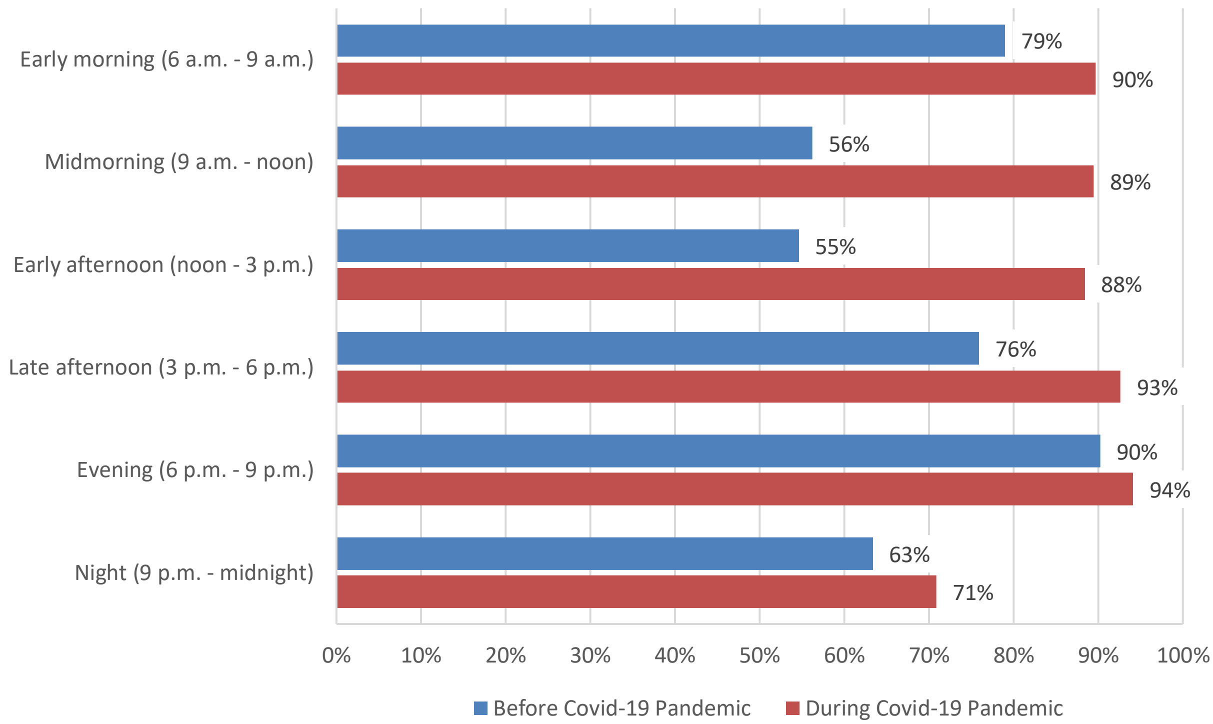


Figure 54 and Figure 55 show detailed usage of the internet at various times, before and during the pandemic. Most respondents made/make daily use of the internet in the evening, before and during the pandemic. Prior to the Covid-19 pandemic, just over one-half of respondents made daily use of the internet mid-morning or early afternoon, compared with approximately nine in 10 respondents during the pandemic.

Figure 54: How Often Use the Internet at Various Times Before Covid-19 Pandemic

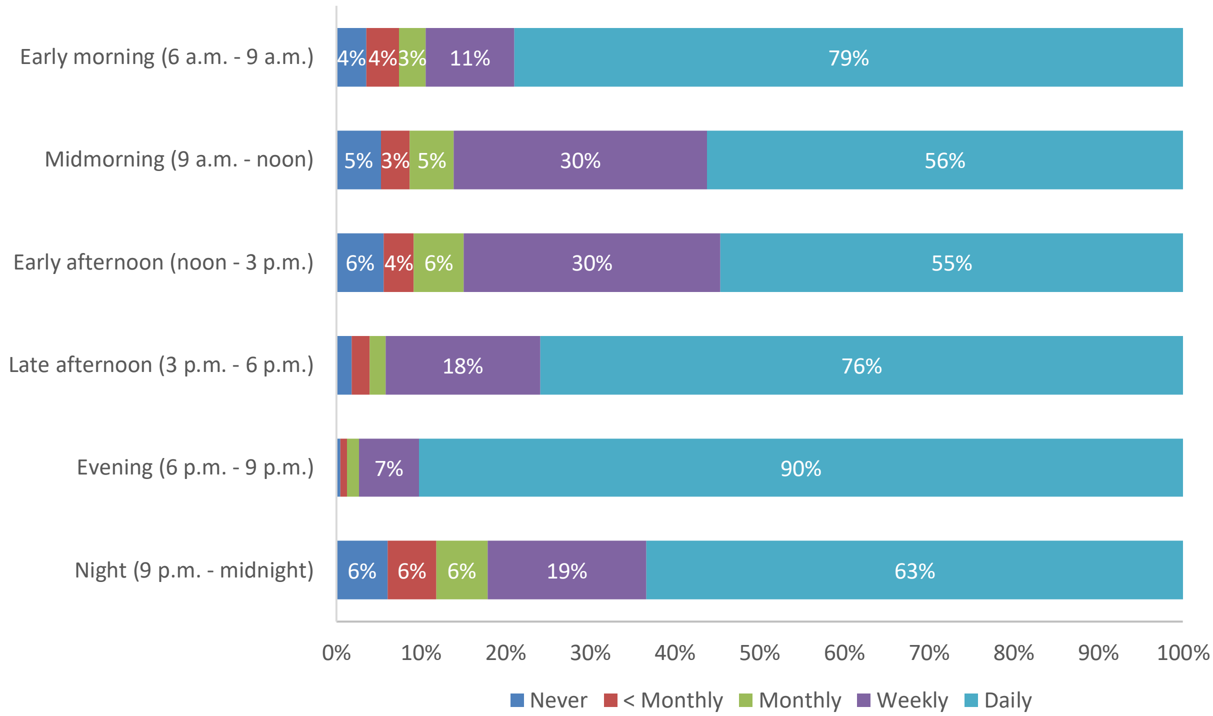
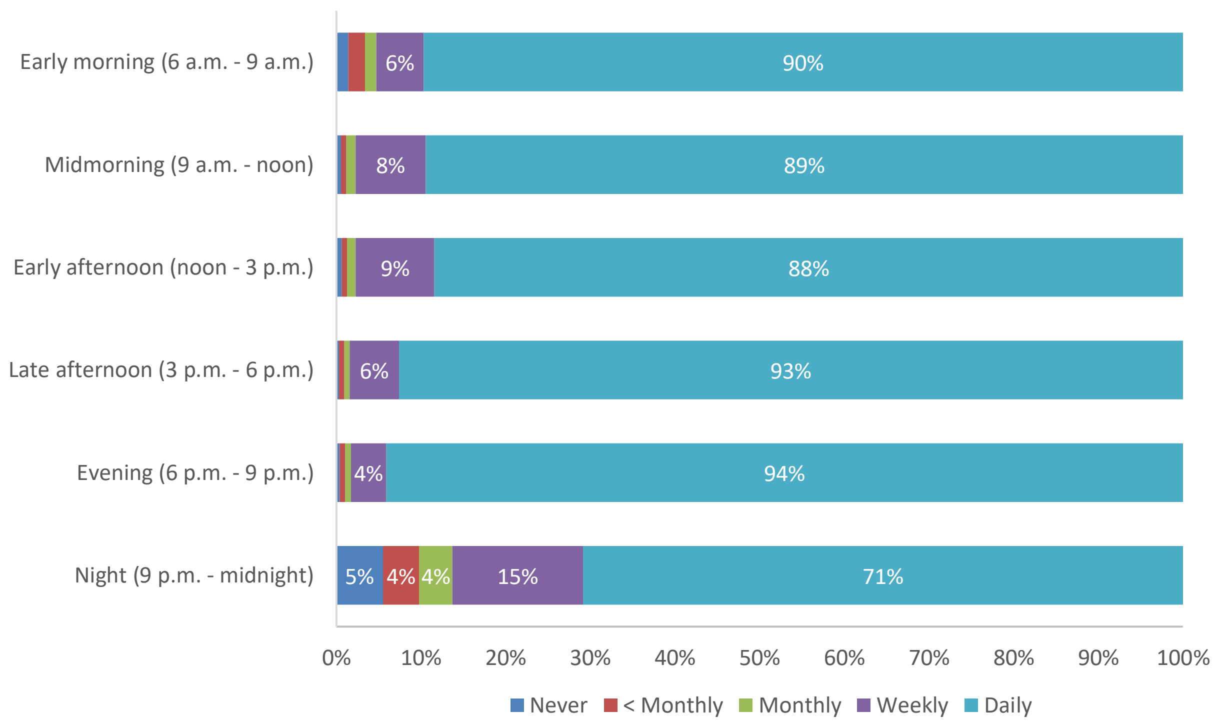


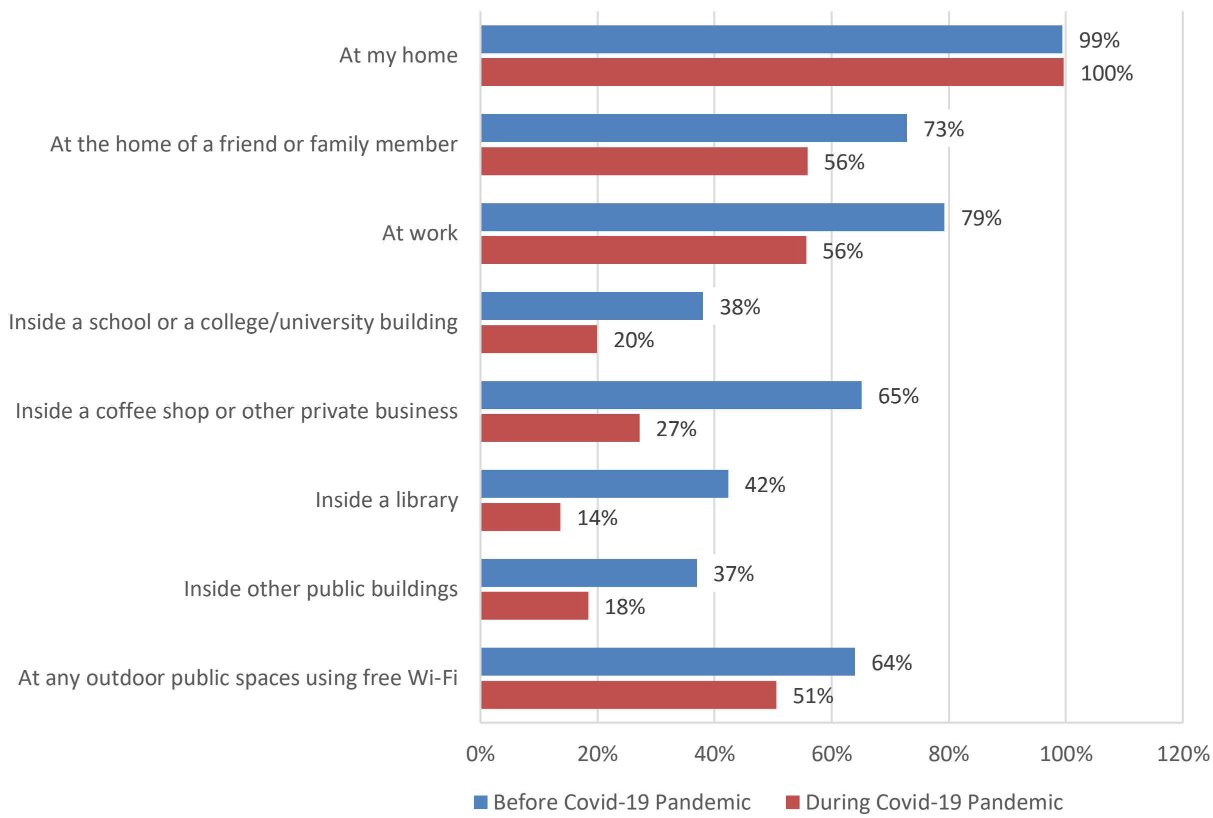
Figure 55: How Often Use the Internet at Various Times During Covid-19 Pandemic



Internet Use by Location

Respondents were also asked to indicate how often they use the internet in various locations before and during the Covid-19 pandemic. As shown in Figure 56, use of internet services outside of the home has declined significantly during the pandemic, which makes sense as many public areas and work settings have not been accessible.

Figure 56: Ever Use the Internet in Various Locations Before and During Covid-19 Pandemic



Significantly, use of the internet declined in work settings (79 percent vs. 56 percent) and private businesses (65 percent vs. 27 percent) when comparing pre-Covid and during-Covid figures. Use of the internet at schools or colleges declined from 38 percent of respondents pre-Covid to 20 percent currently. Use in libraries (42 percent vs. 14 percent), public buildings (37 percent vs. 18 percent), and outdoor public spaces (64 percent vs. 51 percent) also declined. Use of the internet at the home of a friend or family member declined from 73 percent of respondents pre-pandemic to 56 percent of respondents during the pandemic. Usage inside the home remained flat.

Figure 57 and Figure 58 show detailed usage of the internet at various locations, before and during the pandemic.

Figure 57: How Often Use the Internet in Various Locations Before Covid-19 Pandemic

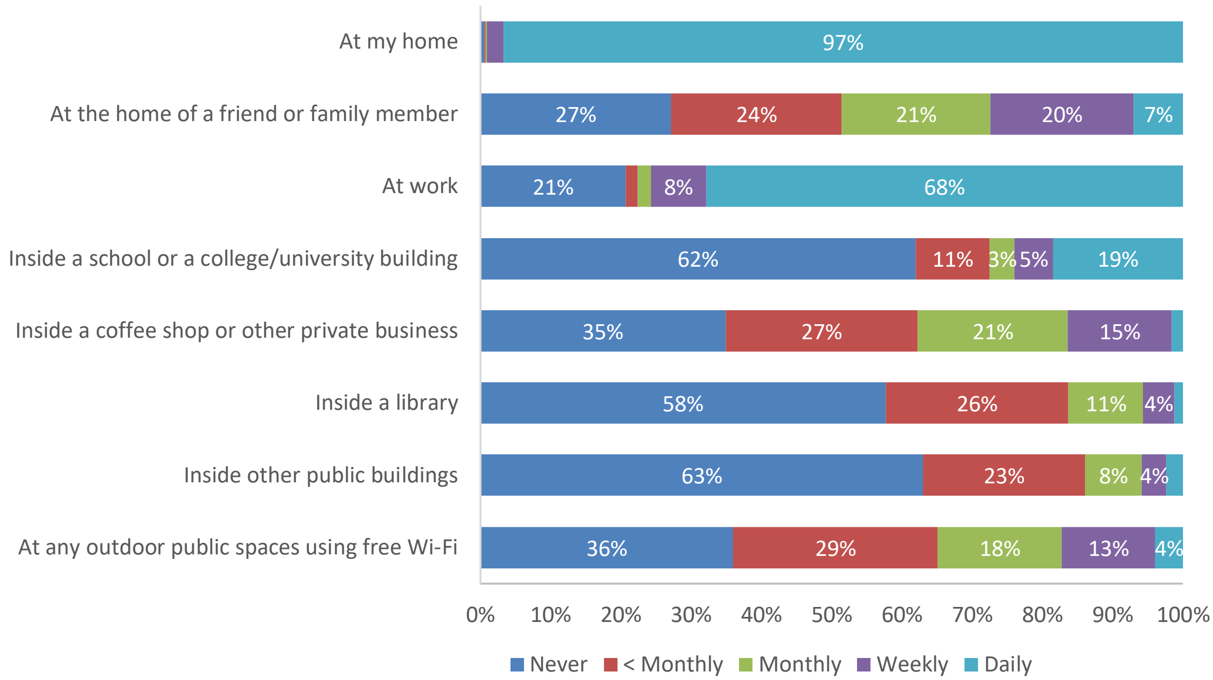
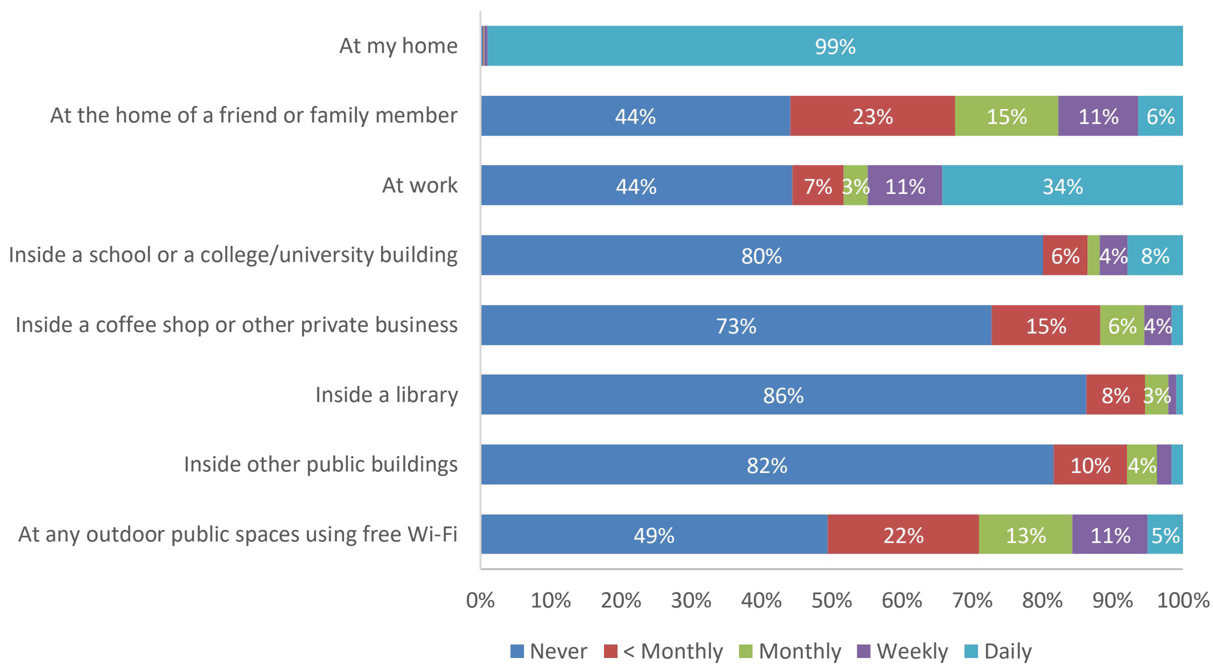


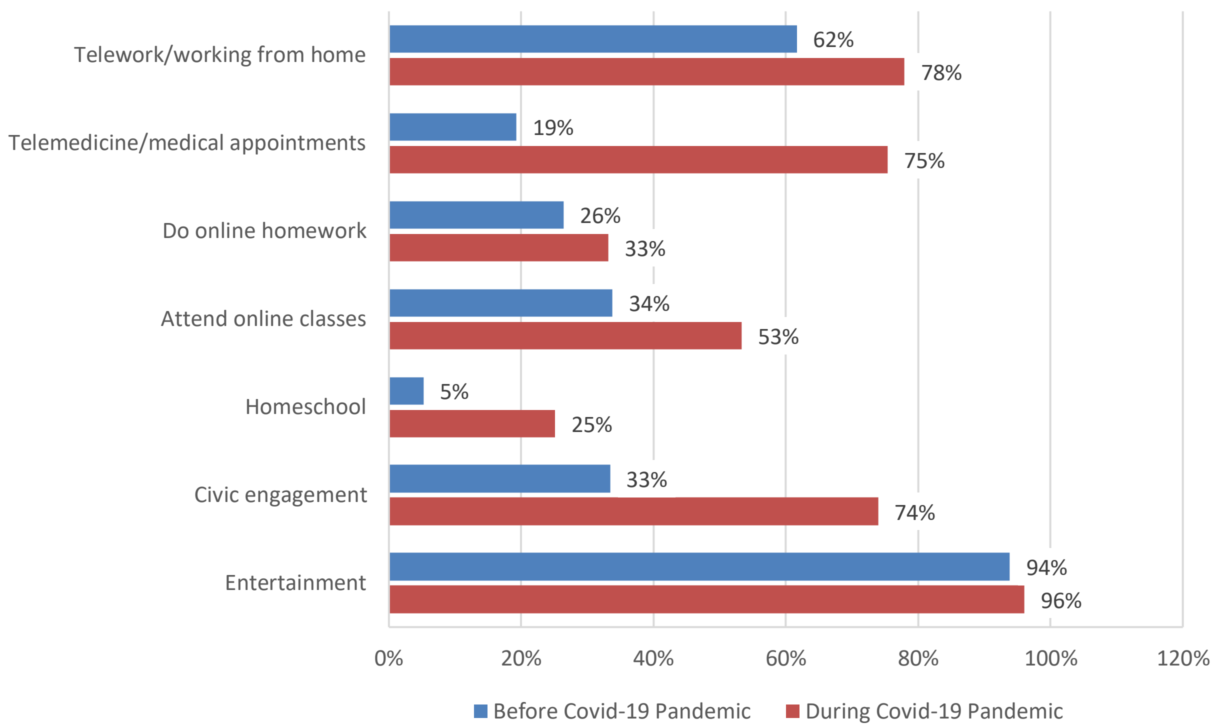
Figure 58: How Often Use the Internet in Various Locations During Covid-19 Pandemic



Engaged in Internet Activities

Respondents were asked about how they engaged in various internet activities before and during the Covid-19 pandemic. As shown in Figure 59, engagement in online activities has increased significantly during the Covid-19 pandemic, with the exception of using the internet for entertainment which already had a very high usage rate.

Figure 59: Ever Used the Internet for Various Activities Before and During Covid-19 Pandemic



Three-fourths of respondents have used the internet for telemedicine or medical appointments during the Covid-19 pandemic (most on a monthly or less than monthly basis), compared with just 19 percent before the pandemic. Use of the internet has also increased substantially for civic engagement, going from 33 percent of respondents pre-pandemic to 74 percent of respondents during the pandemic. Specifically, weekly use of the internet for civil engagement jumped from four percent to 22 percent of respondents during the pandemic. Additionally, 62 percent of respondents use the internet for teleworking on a daily basis, compared with 21 percent of respondents before the pandemic.

Figure 60 and Figure 61 show detailed usage of the internet for various activities, before and during the pandemic.

Figure 60: How Often Used the Internet for Various Activities Before Covid-19 Pandemic

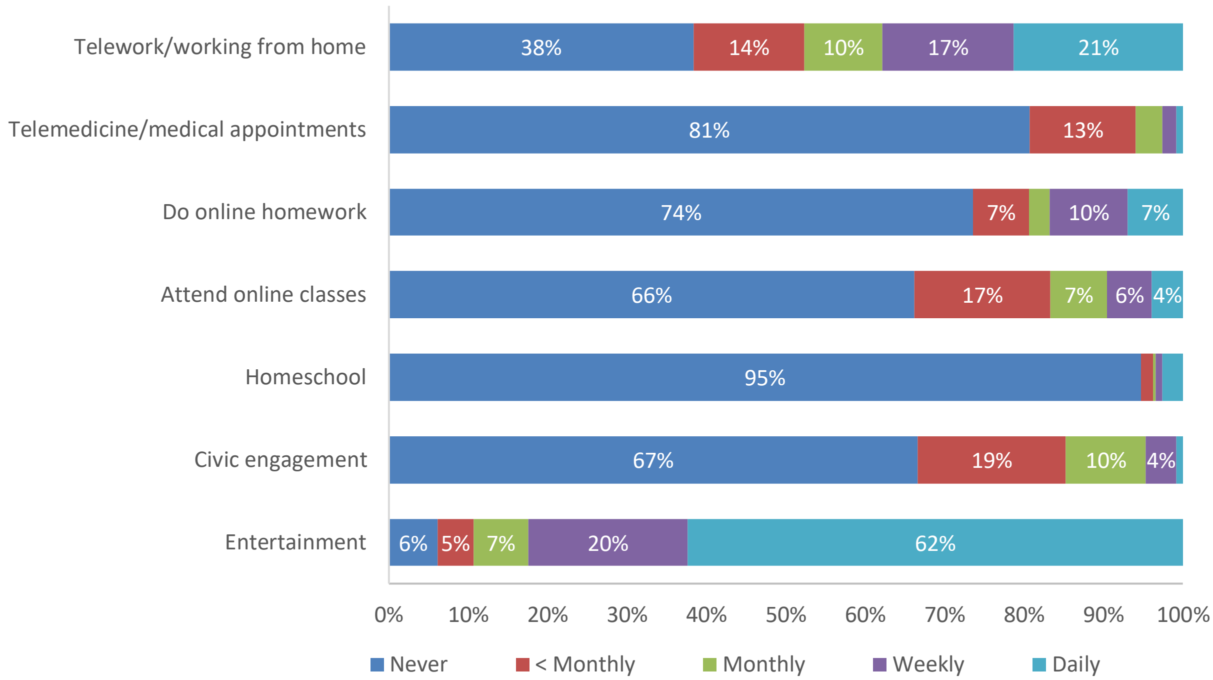
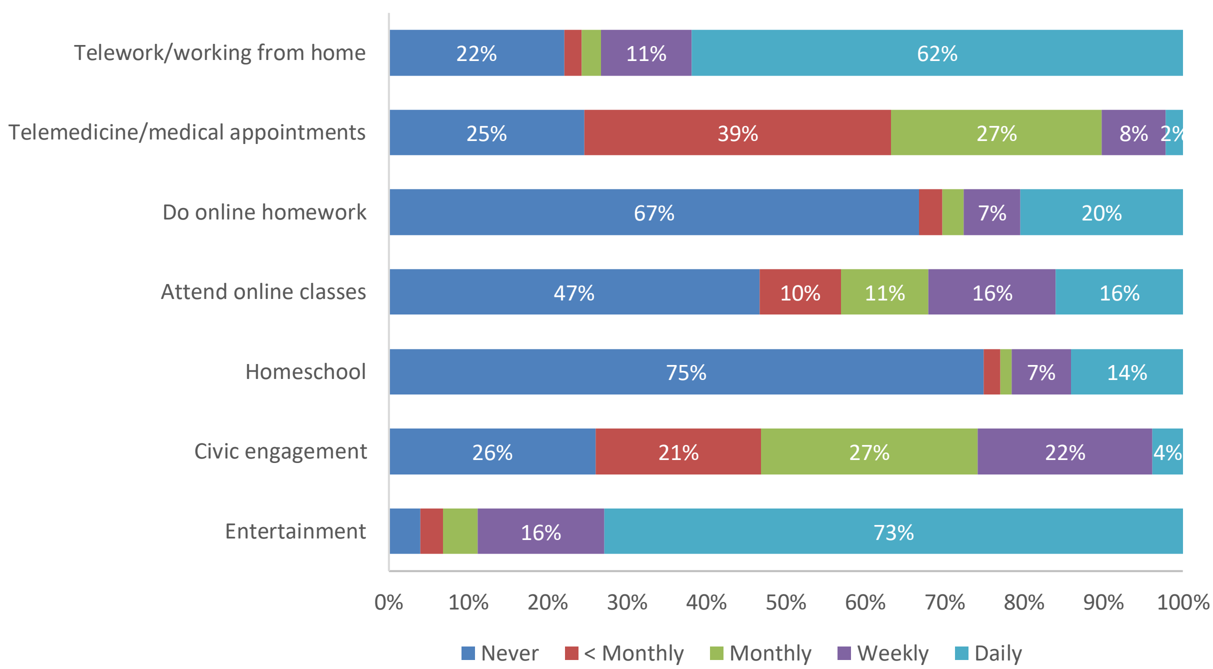


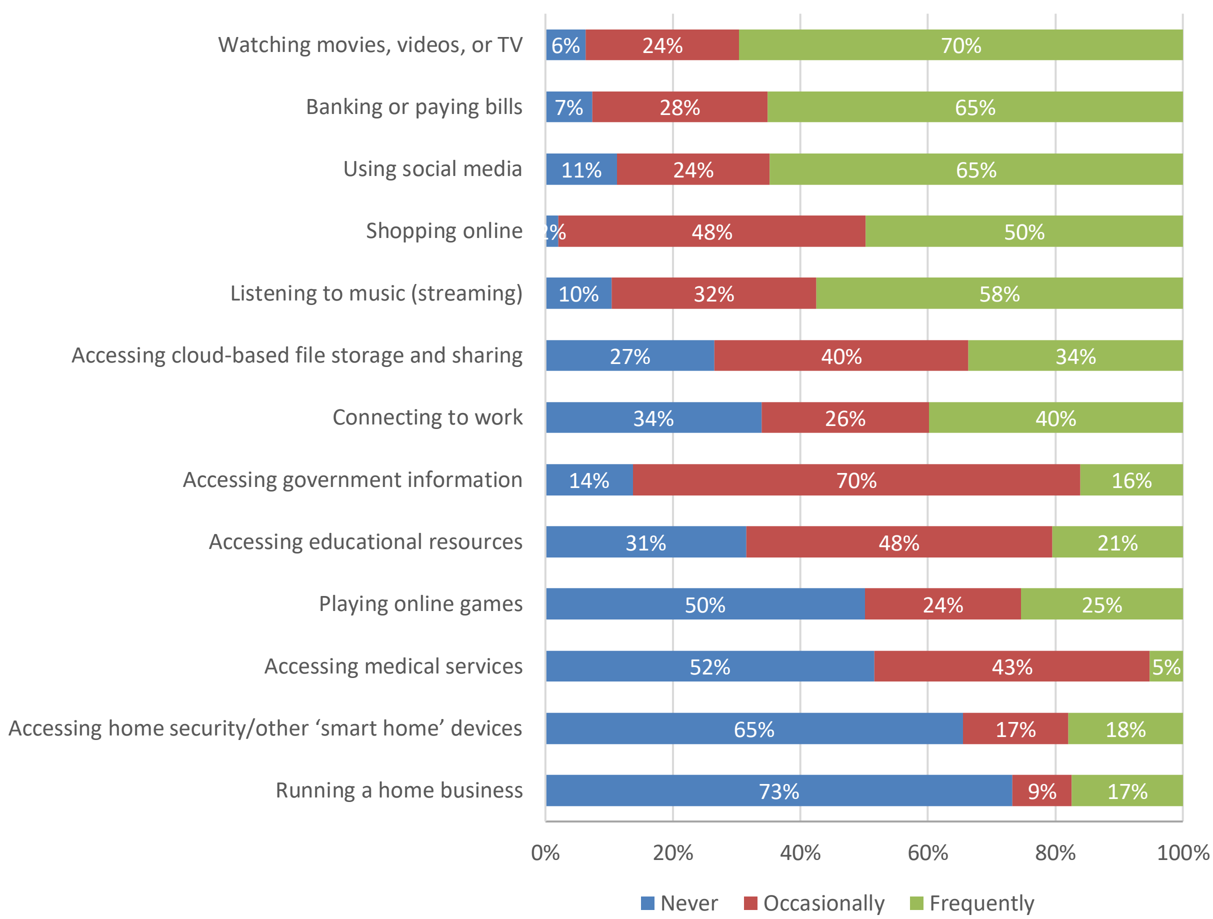
Figure 61: How Often Used the Internet for Various Activities During Covid-19 Pandemic



Respondents were also asked if they never, occasionally, or frequently engage in other internet activities. Among those items listed, the internet was most frequently used before the Covid-19 pandemic for watching movies, videos, or TV, followed by banking or paying bills, using social media, shopping online, and streaming music (see Figure 62). A home internet connection was less frequently used for other activities.

Some respondents used a home internet connection to access other key information and services. Seven in 10 respondents accessed government information occasionally, and 43 percent accessed medical services occasionally. Another 48 percent accessed educational resources occasionally, and 21 percent accessed them frequently, while another 31 percent never used it for this purpose. Four in 10 respondents frequently used the internet to connect to work, and 26 percent occasionally used the internet for this purpose. Another 26 percent of respondents occasionally or frequently used the internet to run a home business.

Figure 62: Internet Use for Various Activities Before the Covid-19 Pandemic



Among the items listed, the most frequently conducted internet activities during the pandemic remain watching videos, banking or paying bills, shopping online, using social media, and listening to music, although frequency of use has increased somewhat (see Figure 63). During the pandemic, two-thirds of respondents frequently use the internet to connect to work, up from 40 percent before the pandemic. Many respondents frequently use the internet for accessing government information (38 percent), accessing educational resources (40 percent), accessing medical services (20 percent), and running a home business (21 percent).

Figure 63: Internet Use for Various Activities During the Covid-19 Pandemic

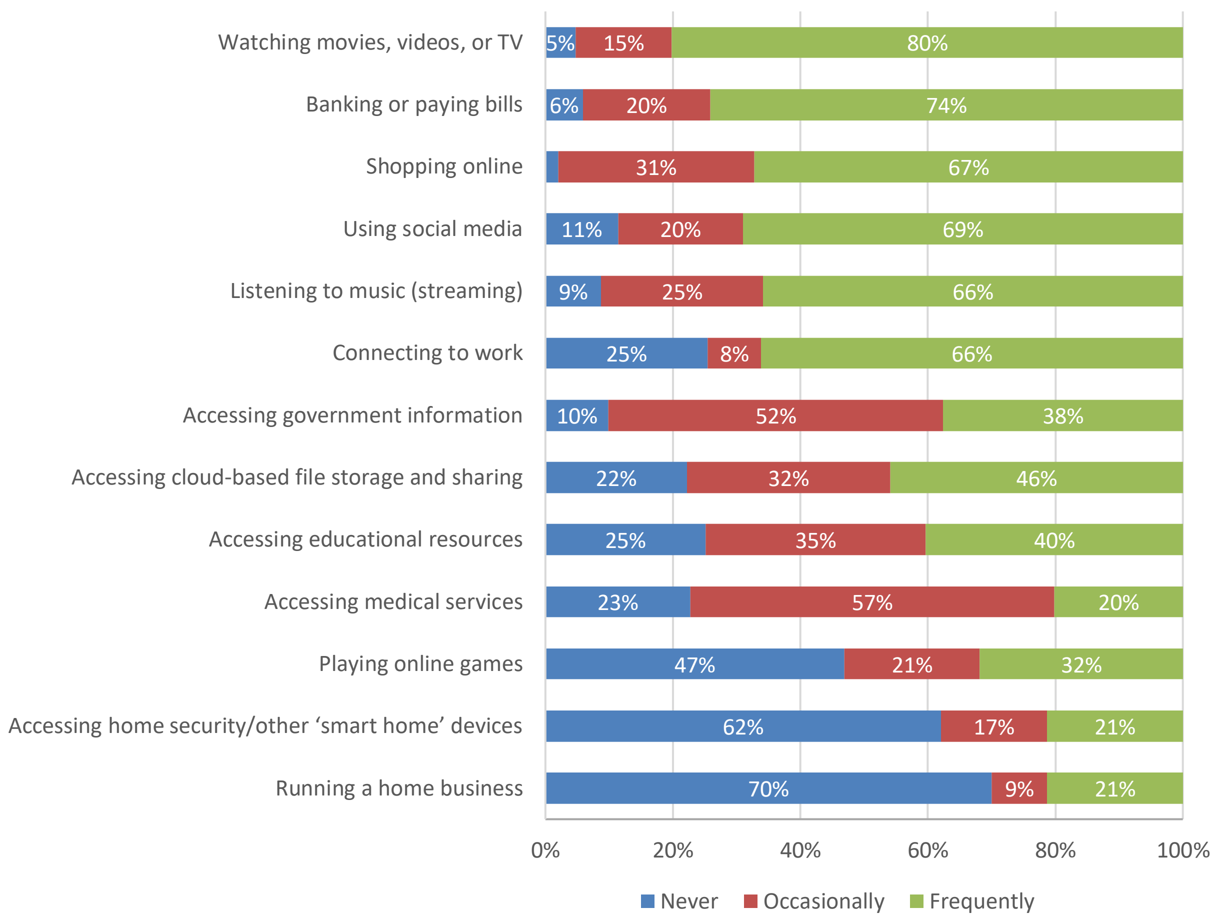
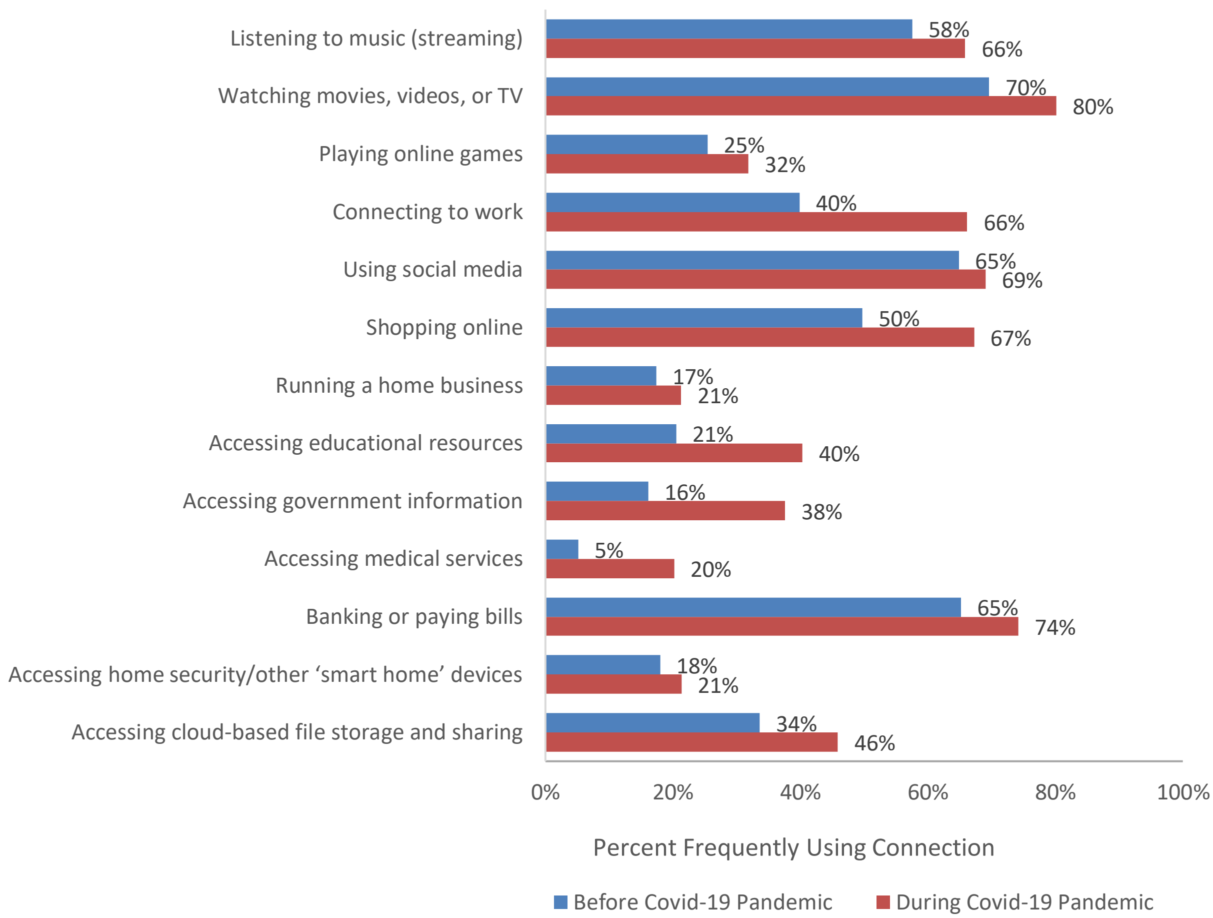


Figure 64 compares the percentage of respondents who frequently used their connection for various activities before and during the Covid-19 pandemic. Across many categories, usage is higher during the pandemic as many respondents shifted from occasional use to frequent use of the internet.

Specifically, respondents are much more likely to frequently use the internet during the pandemic than before the pandemic for: connecting to work, shopping online, accessing educational resources, accessing government information, and accessing medical services.

Figure 64: Frequently Used the Internet for Various Activities Before and During Covid-19 Pandemic



Internet Uses by Respondent Age

Younger respondents were more likely than older respondent to use the internet for key activities before and during the pandemic, in particular streaming music, watching videos, using social media, and banking or paying bills. Respondents under age 65 saw larger increases in frequency of use during the pandemic for some key activities, such as connecting to work and accessing educational resources and government information, compared with those ages 65 and older.

Table 3: Frequently Used Internet Activities Before Covid-19 Pandemic by Respondent Age

	18-34 years	35-44 years	45-54 years	55-64 years	65 + years
Listening to music (streaming)	77%	71%	66%	47%	32%
Watching movies, videos, or TV	85%	82%	76%	61%	51%
Playing online games	28%	23%	27%	26%	23%
Connecting to work	31%	52%	53%	49%	28%
Using social media	75%	72%	67%	62%	50%
Shopping online	49%	60%	54%	49%	43%
Running a home business	11%	21%	22%	23%	16%
Accessing educational resources	24%	23%	21%	20%	15%
Accessing government information	14%	16%	17%	18%	16%
Accessing medical services	4%	4%	3%	5%	8%
Banking or paying bills	69%	74%	72%	57%	59%
Accessing home security/other 'smart home' devices	24%	23%	19%	16%	10%
Accessing cloud-based file storage and sharing	39%	44%	36%	30%	24%

Table 4: Frequently Used Internet Activities During Covid-19 Pandemic by Respondent Age

	18-34 years	35-44 years	45-54 years	55-64 years	65 + years
Listening to music (streaming)	82%	81%	77%	58%	40%
Watching movies, videos, or TV	94%	91%	87%	75%	62%
Playing online games	36%	32%	37%	31%	25%
Connecting to work	76%	89%	83%	68%	32%
Using social media	78%	79%	76%	65%	52%
Shopping online	66%	80%	74%	68%	58%
Running a home business	15%	29%	27%	27%	17%
Accessing educational resources	44%	58%	54%	35%	22%
Accessing government information	42%	39%	45%	37%	28%
Accessing medical services	22%	24%	22%	18%	17%
Banking or paying bills	78%	80%	81%	71%	65%
Accessing home security/other 'smart home' devices	25%	29%	25%	21%	12%
Accessing cloud-based file storage and sharing	56%	59%	53%	43%	29%

Internet Uses by Household Income

Lower income respondents were less likely than higher income households to engage in some key activities particularly connecting to work and online shopping. Respondents earning over $25,000 per year connect to work more frequently during the Covid-19 pandemic compared with before the pandemic. Those in low income households did not show an increase in usage for work purposes; 29 percent of low-income households frequently used the internet to connect to work before the pandemic, and 30 percent frequently use it to connect to work during the pandemic.

Table 5: Frequently Used Internet Activities Before Covid-19 Pandemic by Household Income

	<$25k	$25-49k	$50-74k	$75-99k	$100k +
Listening to music (streaming)	53%	58%	56%	61%	62%
Watching movies, videos, or TV	69%	59%	73%	71%	73%
Playing online games	37%	30%	25%	28%	20%
Connecting to work	29%	24%	33%	42%	49%
Using social media	68%	64%	72%	66%	66%
Shopping online	36%	41%	52%	55%	53%
Running a home business	17%	16%	16%	18%	16%
Accessing educational resources	31%	18%	22%	23%	19%
Accessing government information	18%	12%	20%	20%	13%
Accessing medical services	6%	4%	3%	11%	3%
Banking or paying bills	63%	60%	59%	62%	75%
Accessing home security/other 'smart home' devices	11%	9%	15%	21%	23%
Accessing cloud-based file storage and sharing	19%	27%	30%	29%	45%

Table 6: Frequently Used Internet Activities During Covid-19 Pandemic by Household Income

	<$25k	$25-49k	$50-74k	$75-99k	$100k +
Listening to music (streaming)	65%	68%	63%	66%	71%
Watching movies, videos, or TV	78%	74%	81%	81%	85%
Playing online games	37%	38%	35%	33%	27%
Connecting to work	30%	50%	62%	66%	85%
Using social media	63%	72%	76%	66%	70%
Shopping online	48%	62%	67%	69%	72%
Running a home business	15%	24%	20%	22%	19%
Accessing educational resources	46%	38%	40%	42%	41%
Accessing government information	40%	38%	36%	42%	39%
Accessing medical services	26%	23%	19%	27%	17%
Banking or paying bills	71%	74%	71%	68%	81%
Accessing home security/other 'smart home' devices	14%	14%	16%	24%	26%
Accessing cloud-based file storage and sharing	31%	38%	44%	40%	60%

Satisfaction with Internet Service

Respondents were asked to evaluate their satisfaction, before and during the Covid-19 pandemic, with various internet service aspects. Average rating scores are highlighted in Figure 65, while Figure 66 shows detailed responses.

Figure 65: Satisfaction with Internet Service Aspects (Mean Ratings)

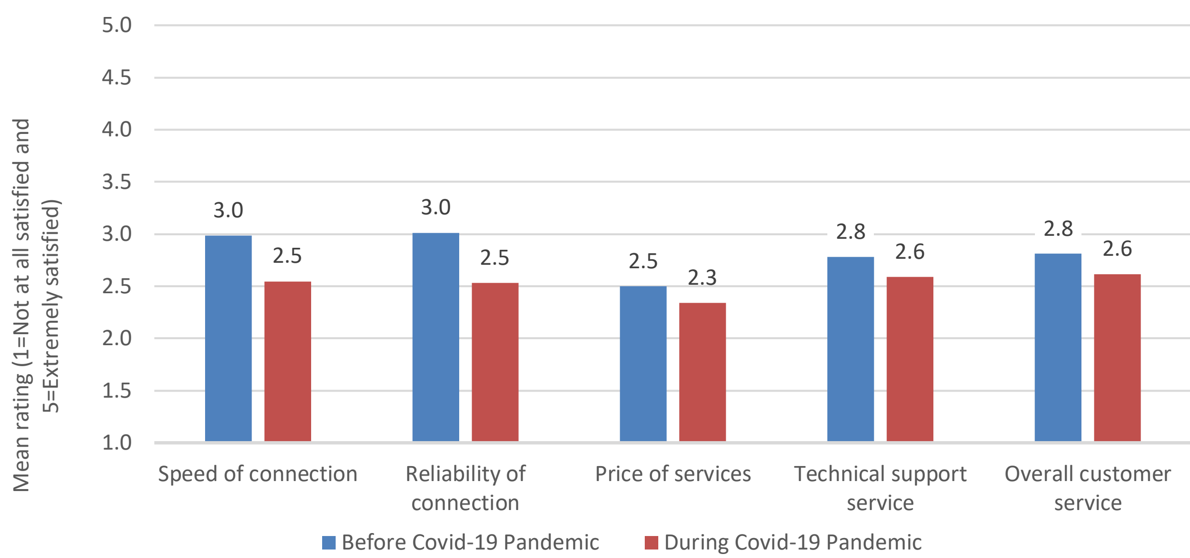
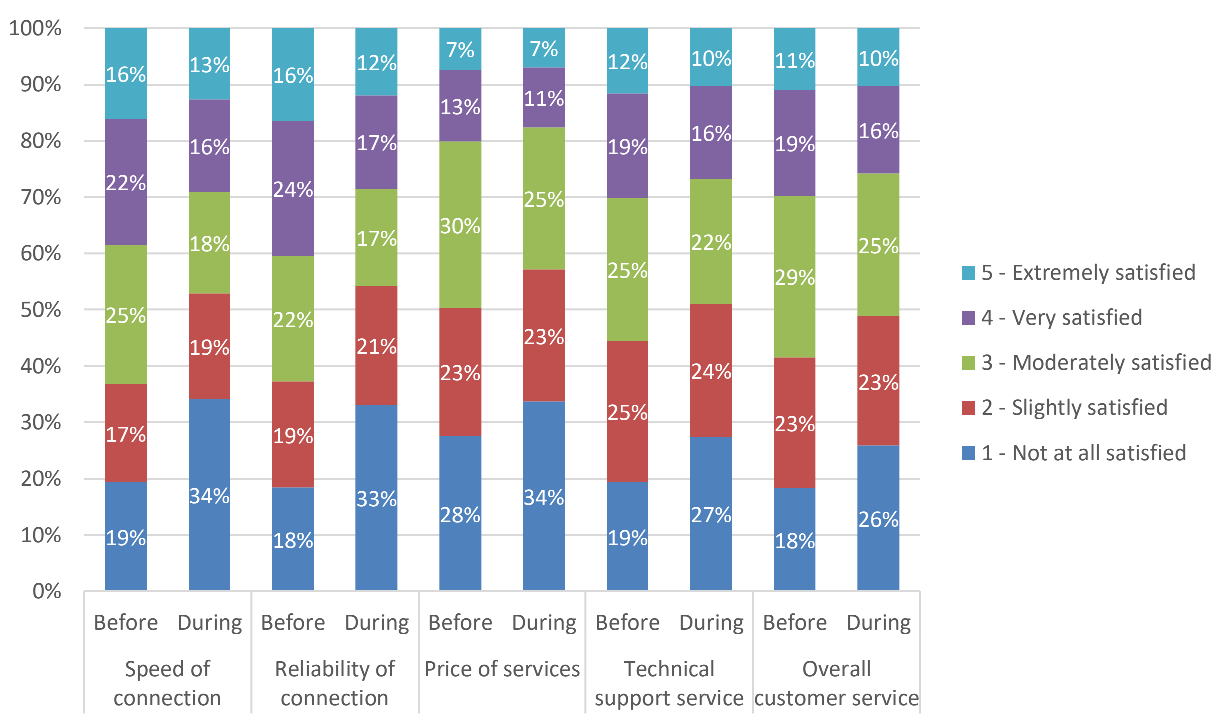


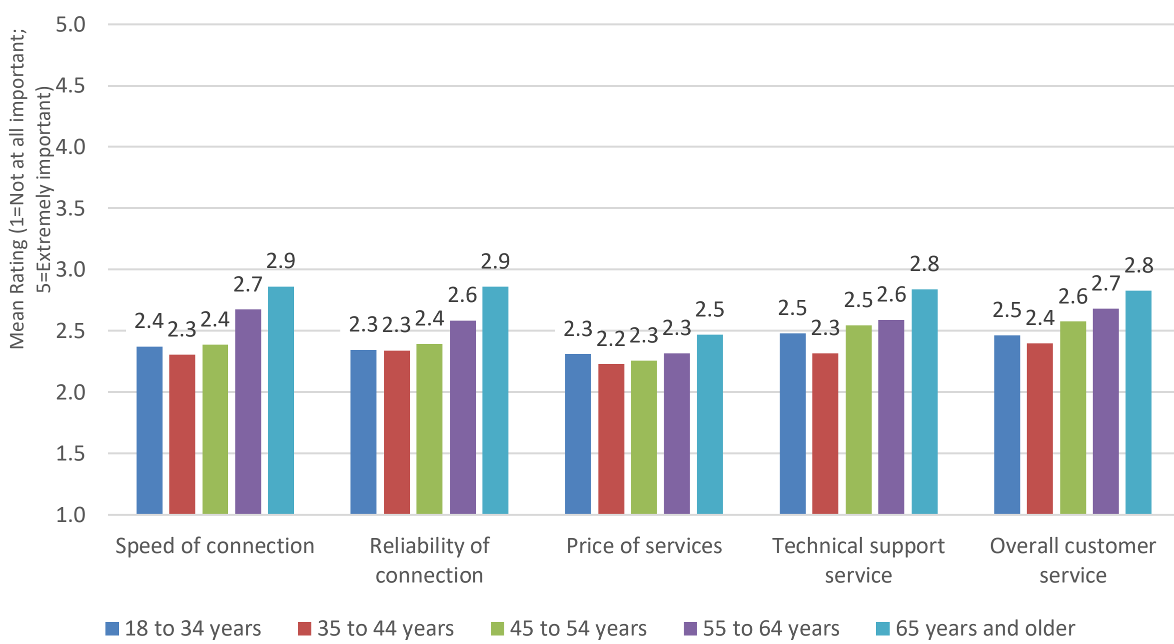
Figure 66: Satisfaction with Internet Service Aspects



Overall, respondents were only moderately satisfied with aspects of their internet service prior to the Covid-19 pandemic, and satisfaction has dropped somewhat during the pandemic. Specifically, more than one-half of respondents are not at all satisfied or only slightly satisfied with connection speed and reliability during the pandemic. Just 29 percent are very or extremely satisfied with these service aspects, compared with four in 10 before the pandemic. Respondents are less satisfied with price compared with other service aspects, which is typical in satisfaction surveys.

Both prior to and during the Covid-19 pandemic, respondents ages 65 and older expressed a higher level of satisfaction with internet service aspects compared with younger respondents (see Figure 67).

Figure 67: Satisfaction with Internet Service Aspects During Covid-19 Pandemic by Respondent Age



Adequacy of Primary Home Broadband Connection

Respondents were asked to evaluate the adequacy of their home internet connection during the Covid-19 pandemic. Average rating scores are highlighted in Figure 68, while Figure 69 shows detailed responses.

Overall, respondents were neutral on whether their home internet connection is adequate for their needs for having online medical appointments. More than one-half of respondents disagreed or strongly disagreed that their internet service is adequate for working from home. More than four in 10 respondents strongly disagreed that their home internet connection is adequate for their or their children's need for doing homework or attending classes online; six in 10 respondents disagreed or strongly disagreed.

Figure 68: Agreement with Statements About Adequacy of Primary Home Broadband Connection During Covid-19 Pandemic (Mean Ratings)

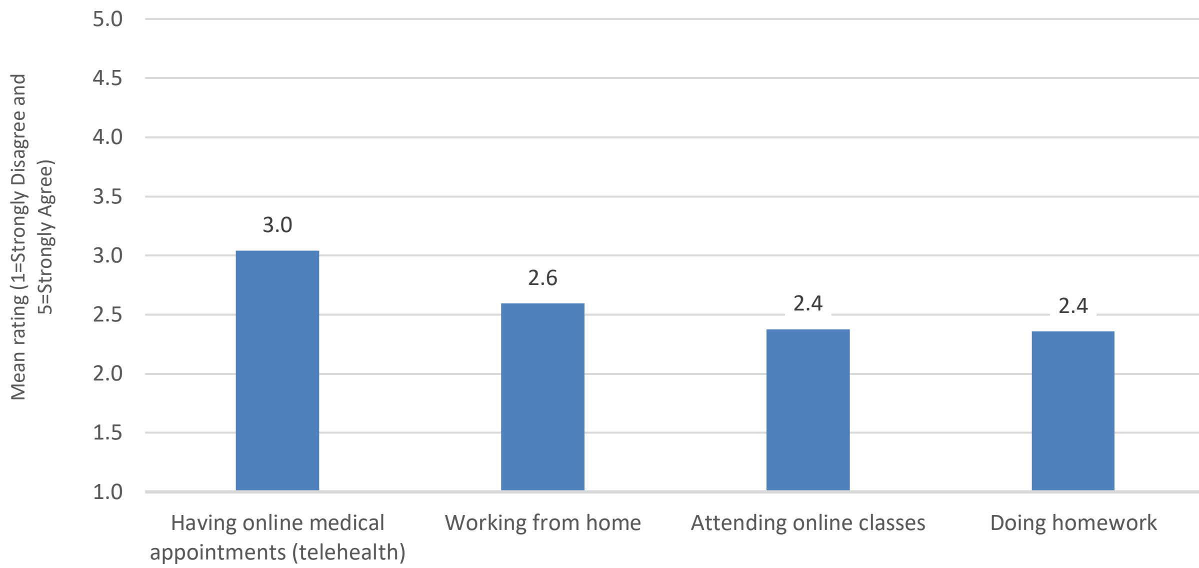
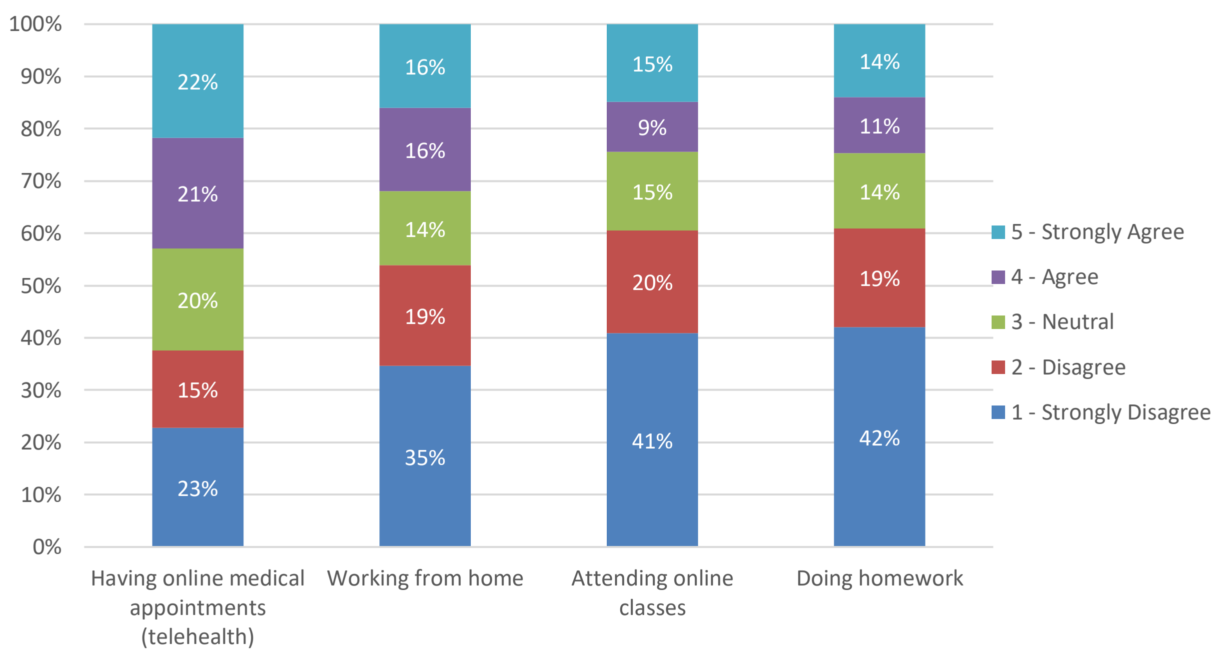
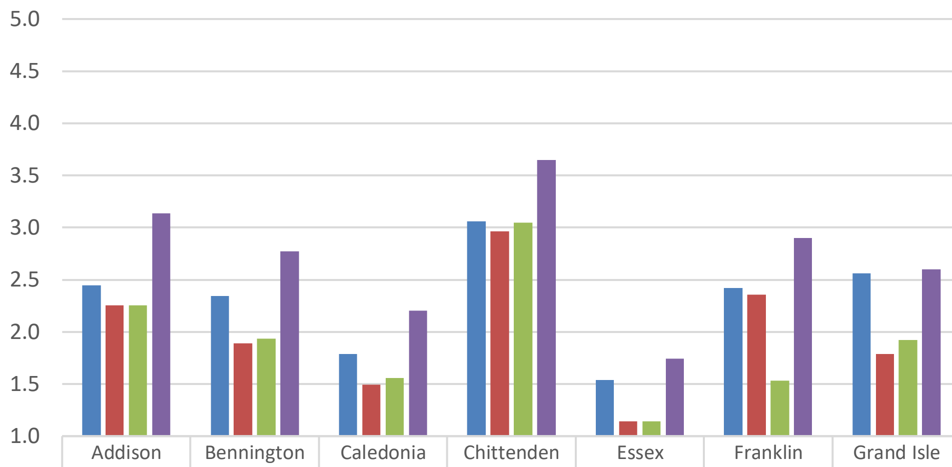


Figure 69: Agreement with Statements About Adequacy of Primary Home Broadband Connection During Covid-19 Pandemic



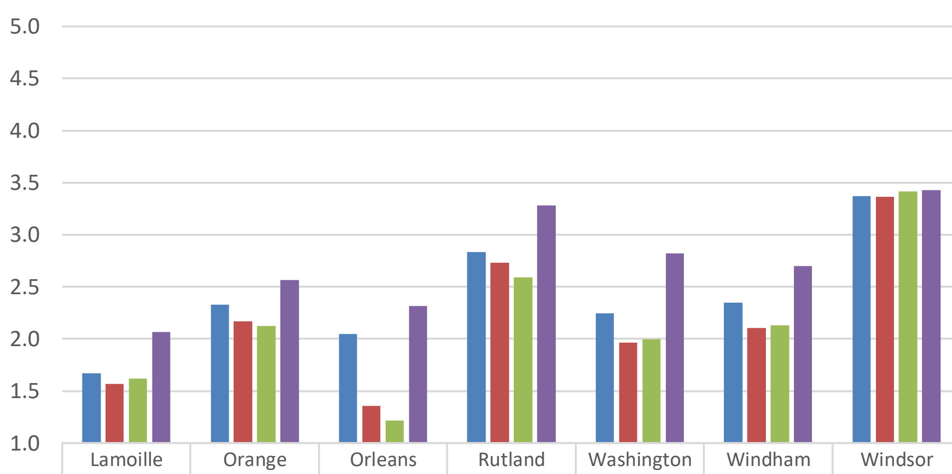
Chittenden, Rutland, and Windsor County residents expressed a higher level of agreement with adequacy of their home internet connection, compared with residents of other counties (see Figure 70 and Figure 71).

Figure 70: Agreement with Statements About Adequacy of Primary Home Broadband Connection During Covid-19 Pandemic by County (Part A)



	Addison	Bennington	Caledonia	Chittenden	Essex	Franklin	Grand Isle
Working from home	2.4	2.3	1.8	3.1	1.5	2.4	2.6
Attending online classes	2.3	1.9	1.5	3.0	1.1	2.4	1.8
Doing homework	2.3	1.9	1.6	3.0	1.1	1.5	1.9
Having online medical appts	3.1	2.8	2.2	3.6	1.7	2.9	2.6

Figure 71: Agreement with Statements About Adequacy of Primary Home Broadband Connection During Covid-19 Pandemic by County (Part B)



	Lamoille	Orange	Orleans	Rutland	Washington	Windham	Windsor
Working from home	1.7	2.3	2.0	2.8	2.2	2.4	3.4
Attending online classes	1.6	2.2	1.4	2.7	2.0	2.1	3.4
Doing homework	1.6	2.1	1.2	2.6	2.0	2.1	3.4
Having online medical appts	2.1	2.6	2.3	3.3	2.8	2.7	3.4

Cell Phone Bill

Overall, 22 percent of respondents said their cell phone bill increased during the pandemic due to increased data usage, while 71 percent said it has not increased (see Figure 72). Another seven percent of respondents said they do not have a cell phone plan; this saturation is higher for lower-income households earning under $50,000 per year (15 percent).

Figure 72: Cell Phone Bill Increased During Pandemic Due to Increased Data Usage

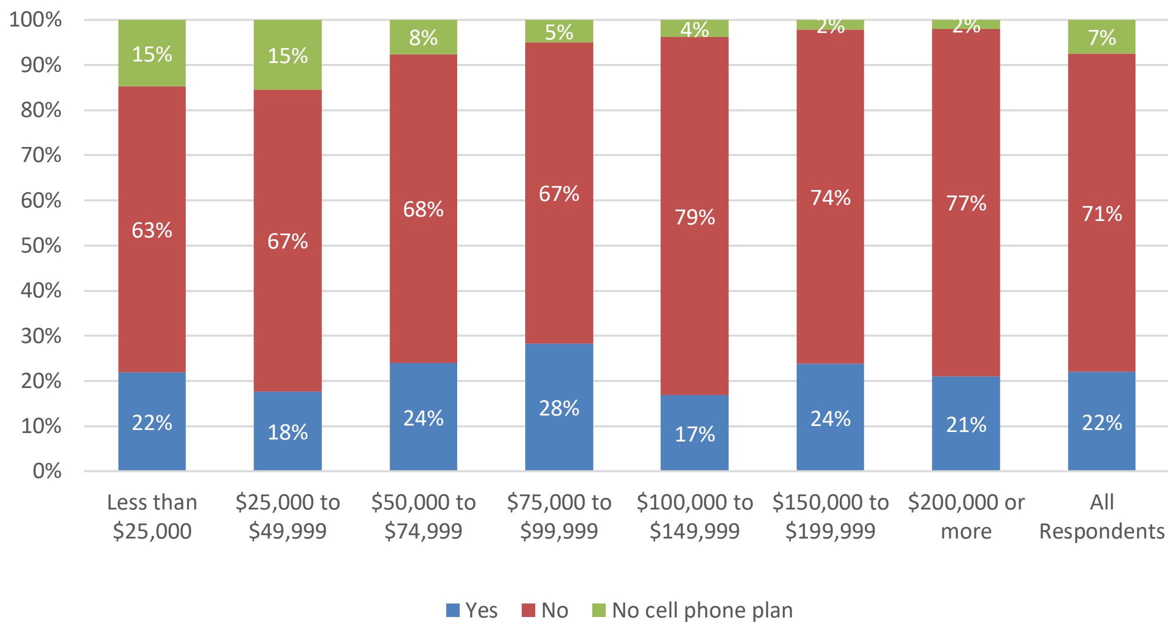
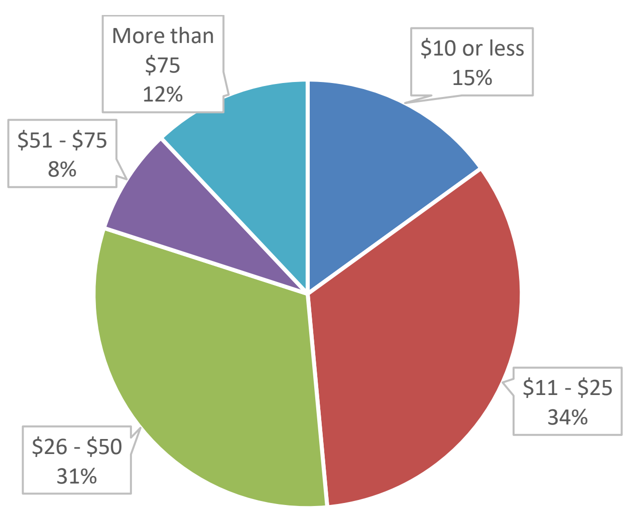


Figure 73: How Much Monthly Cell Phone Bill Increased During Covid-19 Pandemic



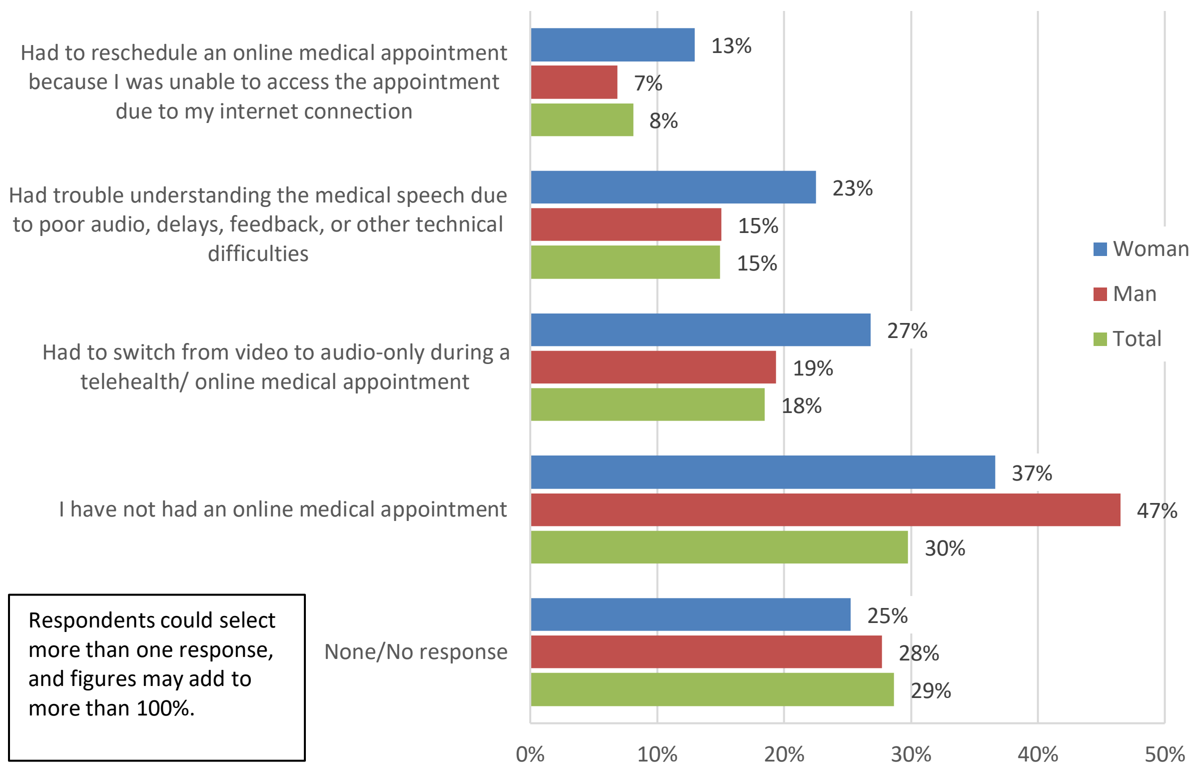
Those whose monthly cell phone bill increased during the pandemic saw significant changes in the amount they pay. As illustrated in Figure 73, one-fifth of those whose monthly cell phone bill increased during the pandemic saw an increase of over $50. One-third saw an increase of $11 to $25, and three in 10 saw an increase of $26 to $50. Another 15 percent had their monthly bill increase by $10 or less.

Challenges Accessing Online Medical Appointments

Four in 10 respondents experienced some challenge while accessing telehealth or an online medical appointment, including having to switch from video to audio only (18 percent), having trouble understanding speech due to technical issues (15 percent), and having to reschedule because they were unable to access an appointment due to internet connection issues (8 percent). Three in 10 respondents have not had an online medical appointment, and another three in 10 did not respond or had no issue (see Figure 74).

Women are more likely than men to have experienced challenges while accessing telehealth or an online medical appointment, but men were more likely to have not had an online medical appointment.

Figure 74: Challenges Experienced While Accessing Online Medical Appointments



Number of Household Members Online During Peak Usage Times

Four in 10 households have at least three members online during peak usage times during the Covid-19 pandemic, and another 43 percent have two members online (see Figure 75). Respondents ages 35 to 54 years have the most members online during peak usage, with six in 10 reporting they have three or more members online at the same time. Respondents ages 65 and older have fewer members online during peak usage; however, the majority have at least two members using the internet.

Figure 75: Number of Households Members Online During Peak Usage Times

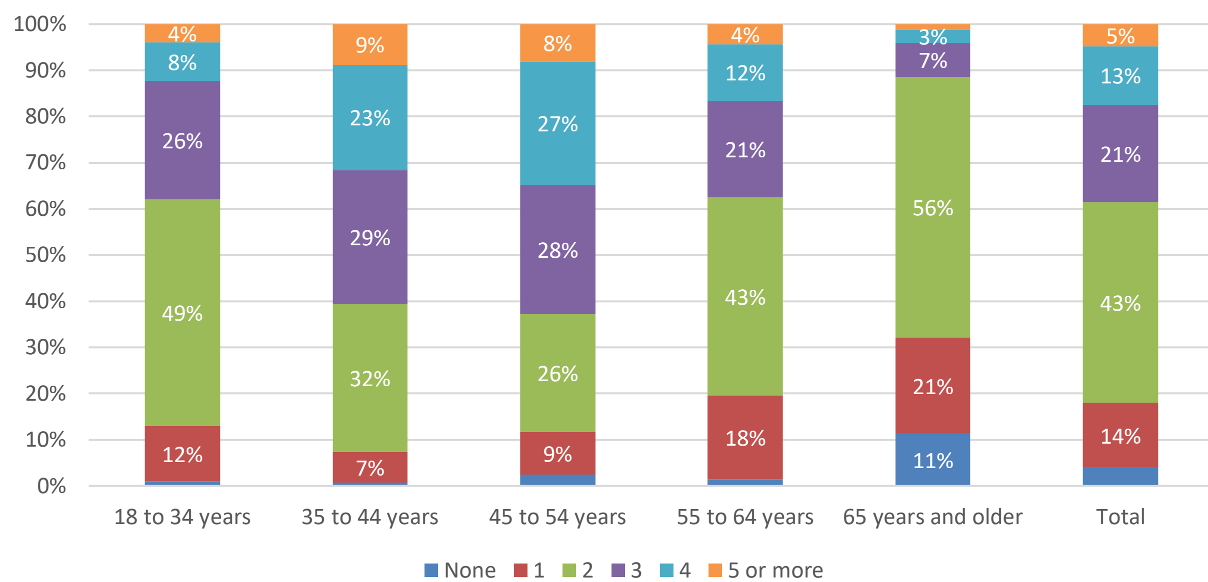
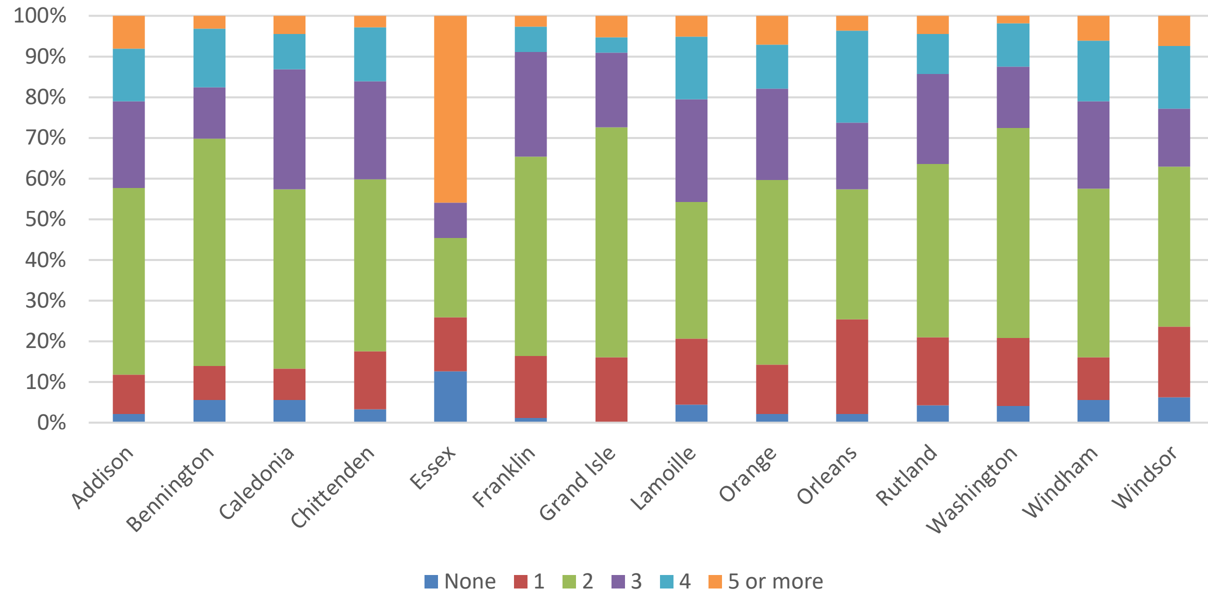


Figure 76: Number of Households Members Online During Peak Usage Times by County



As illustrated in Figure 76, the majority of all counties have at least two household members using the internet during peak usage times, and a sizeable percentage have three or more members online at the same time. Although Essex County households appear to have more members online during peak usage times, this is based on a small number of responses (weighted count of 25).

Technology for Children and Students

Four in 10 respondents have a child or student in the household across a range of education levels, including seven percent in preschool, 15 percent in primary school, and 10 percent in secondary school (see Figure 77). Respondents ages 35 to 54 are more likely than others to have a child or student in the household (see Figure 78).

Figure 77: Education Level of Children or Students in the Household

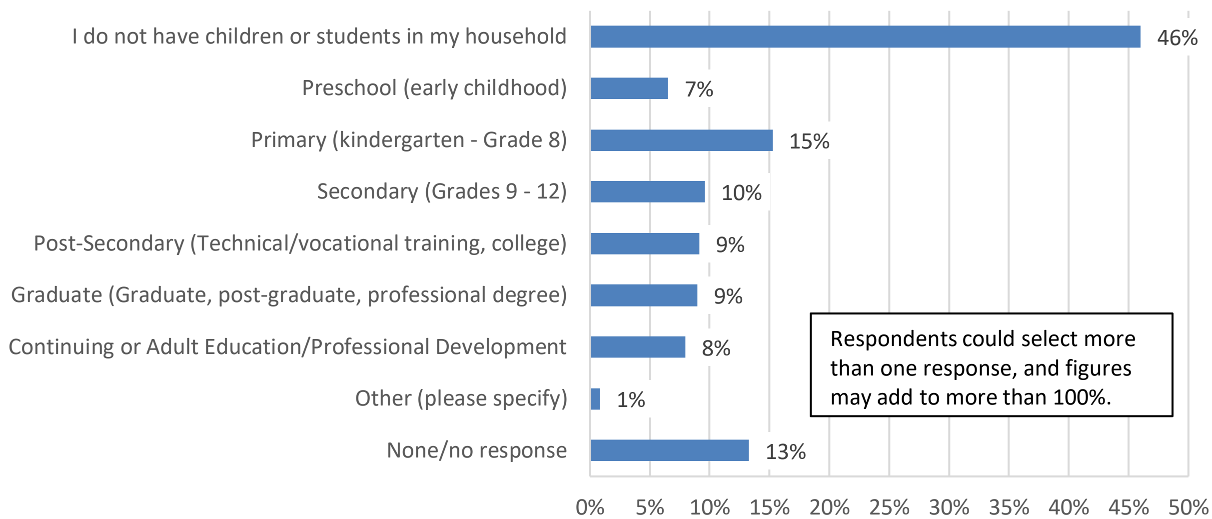
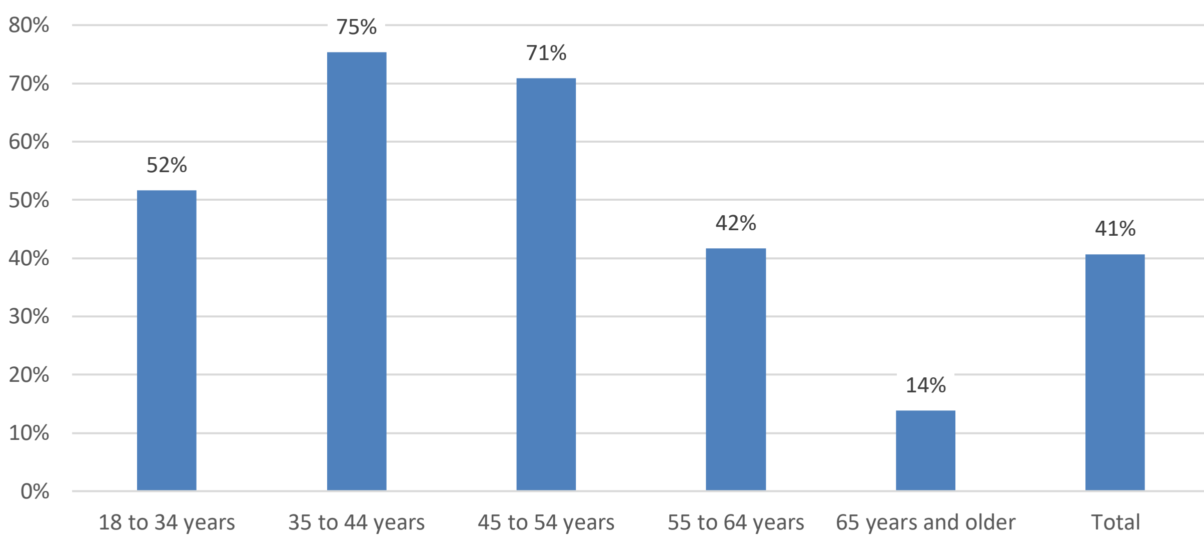


Figure 78: Education Level of Children or Students in the Household by Respondent Age



Respondents who have a child or student in the household were asked their level of agreement with statements about how their child is able to distance learn or do homework. Average rating scores are highlighted in Figure 79, while Figure 80 shows detailed responses.

A majority of respondents indicated that the children in their care have sufficient internet access. Most respondents strongly disagreed with the various statements, particularly that children do not have access to a computer or device to complete distance learning and/or homework (85 percent), that children have to distance learn or do homework using free internet services provided by restaurants, town government, or other entities (76 percent), and that students have to distance learn or do home at the home of family or friends in order to have access to the internet (11 percent).

Still, accessibility may be an issue for a small segment of households. Particularly, 13 percent agreed or strongly agreed that their children cannot complete their homework because they do not have access to the internet at home, and 13 percent agreed or strongly agreed that their children cannot distance learn because they do not have access to the internet at home. Furthermore, the percentage of children who access the internet at a public or school library has decreased somewhat during the pandemic.

Figure 79: Agreement with Statements About Children's Use of Technology During the Covid-19 Pandemic (Mean Ratings)

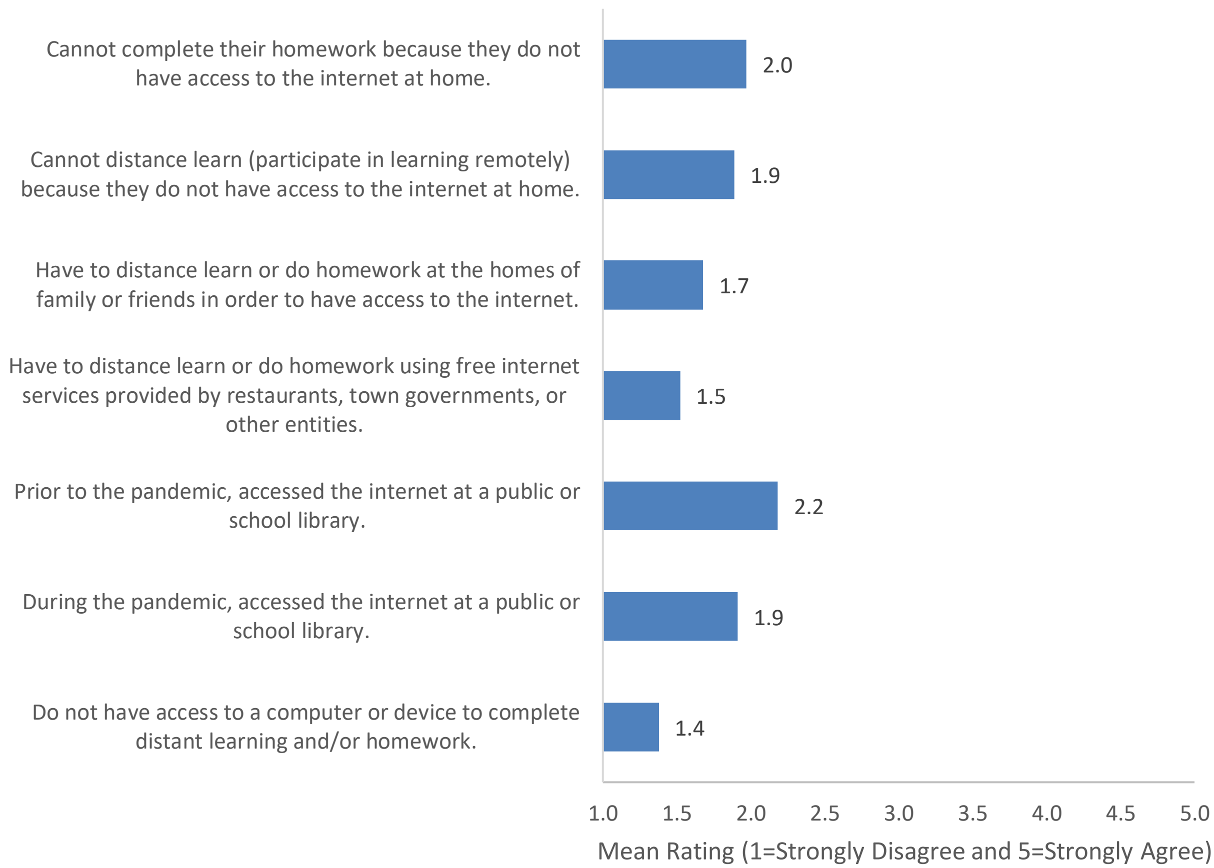
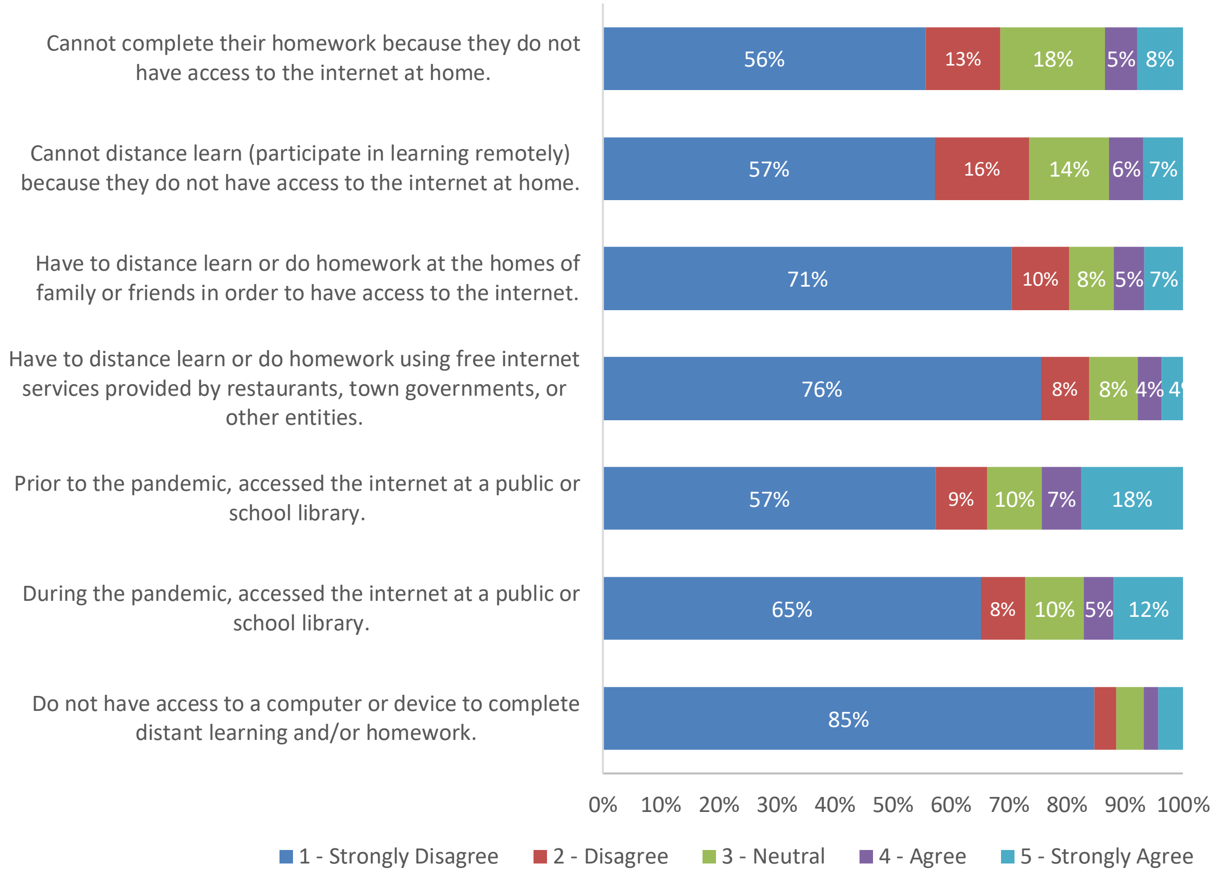


Figure 80: Agreement with Statements About Children's Use of Technology During the Covid-19 Pandemic



Caledonia County residents were more likely than residents of other counties to agree that their children cannot complete homework or distance learn because they do not have access to the internet at home (see Figure 81 and Figure 82).

Additionally, respondents earning under $25,000 per year were more likely than those with a higher household income to agree that their children cannot complete homework or distance learn because they do not have access to the internet at home, although this is based on a small number of responses (weighted count of 22; see Figure 83 and Figure 84).

Figure 81: Agreement That Children Cannot Complete Their Homework Because They Do Not Have Access to the Internet at Home by County (Mean Ratings)

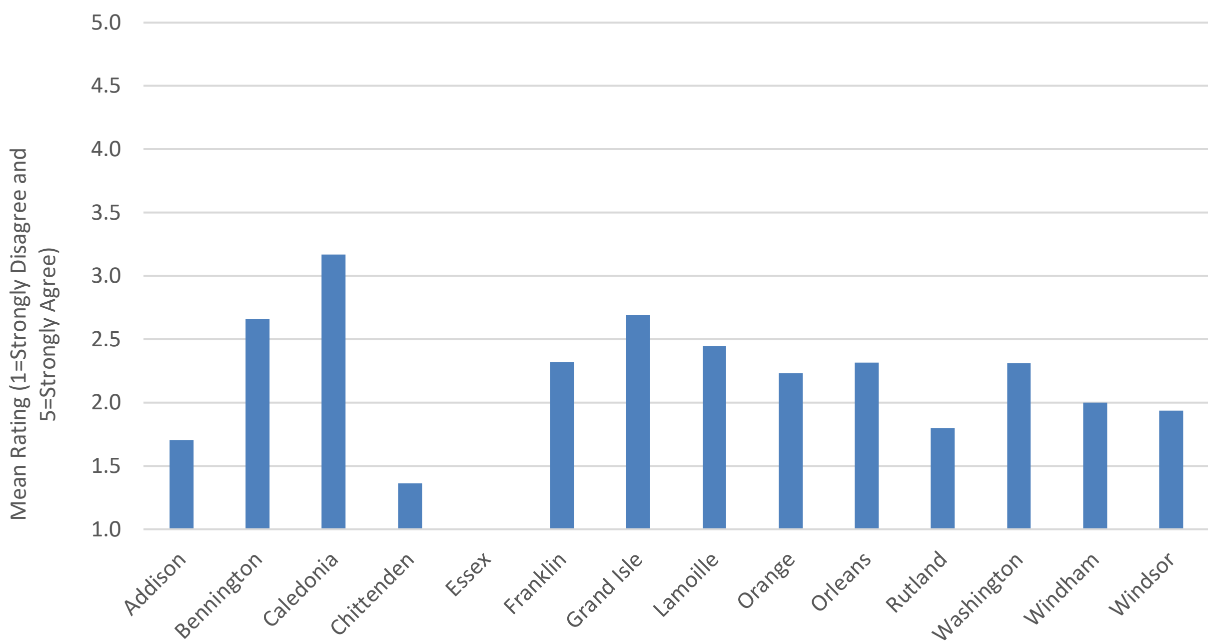


Figure 82: Agreement That Children Cannot Distance Learn Because They Do Not Have Access to the Internet at Home by County (Mean Ratings)

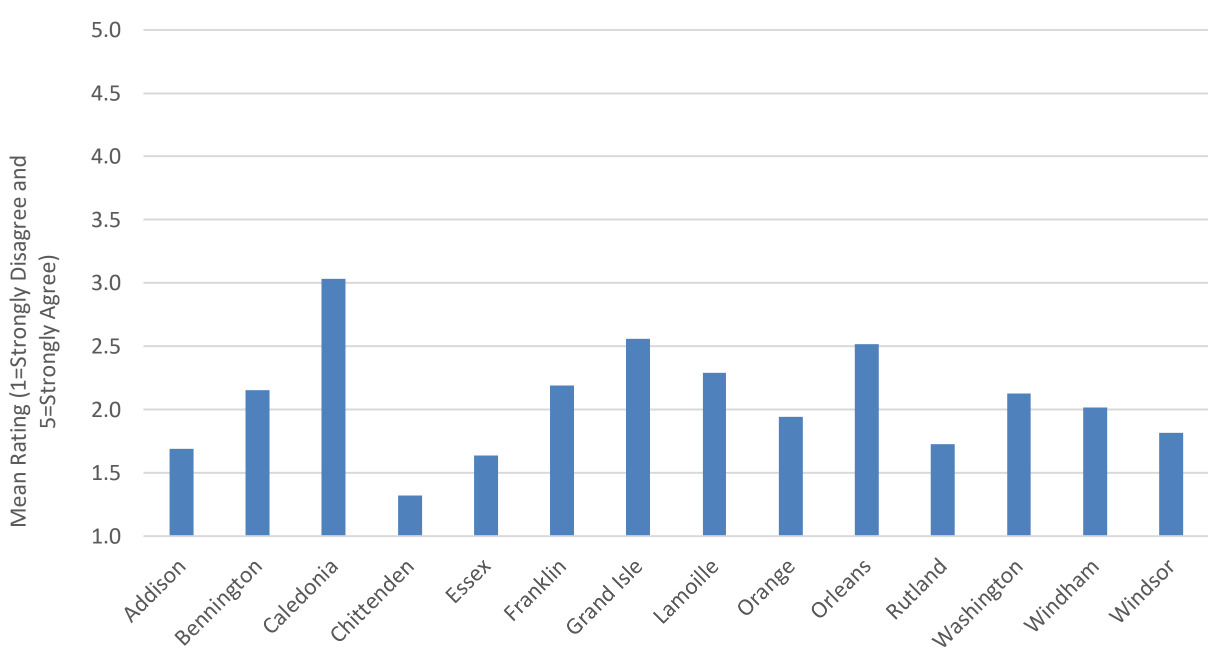
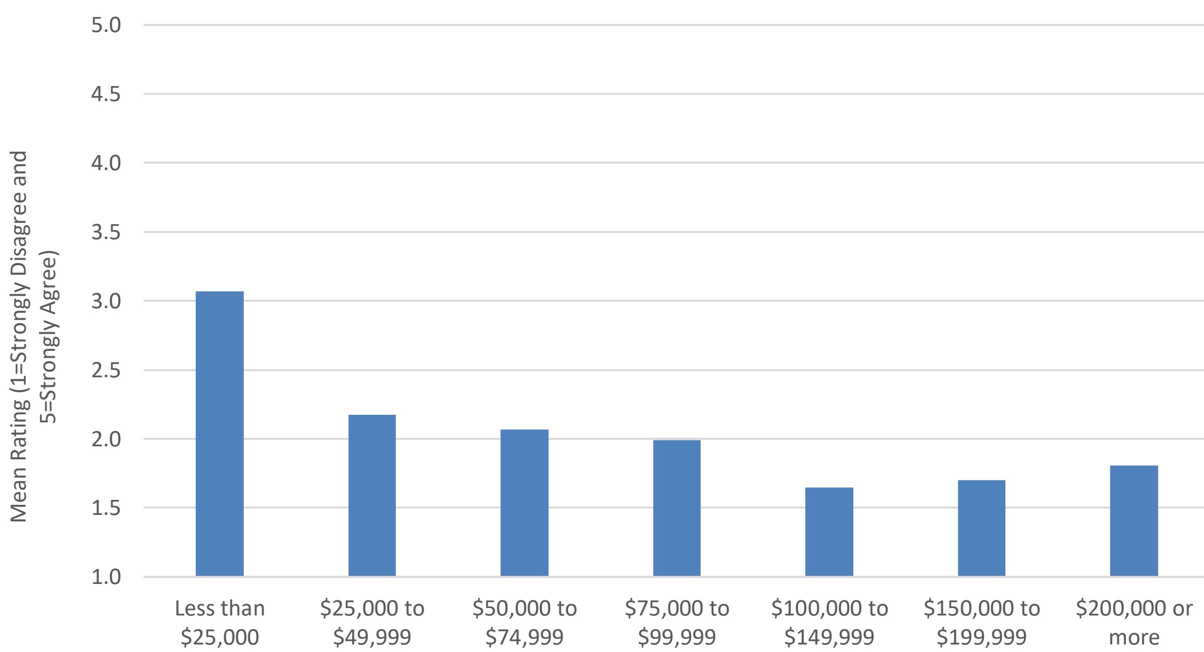


Figure 83: Agreement That Children Cannot Complete Their Homework Because They Do Not Have Access to the Internet at Home by Household Income (Mean Ratings)

Figure 84: Agreement That Children Cannot Distance Learn Because They Do Not Have Access to the Internet at Home by County (Mean Ratings)



PEG TV Content

Sixteen percent of all respondents consumed public, educational, or governmental (PEG) TV content during the Covid-19 pandemic. Respondents ages 18 to 34 years (21 percent) were more likely than older respondents to consume PEG content (see Figure 85). Also, men were more likely than women to have watched PEG programming (23 percent vs. 13 percent). As illustrated in Figure 86, PEG viewership was highest in Franklin County.

Figure 85: Consumed Public, Educational, Governmental (PEG) TV Content During the Covid-19 Pandemic

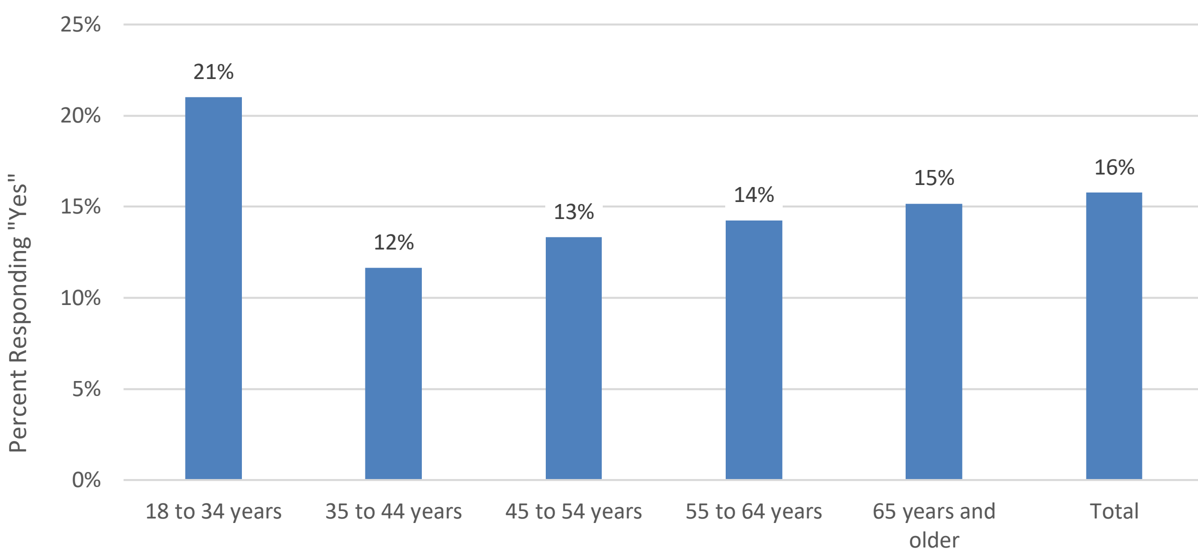
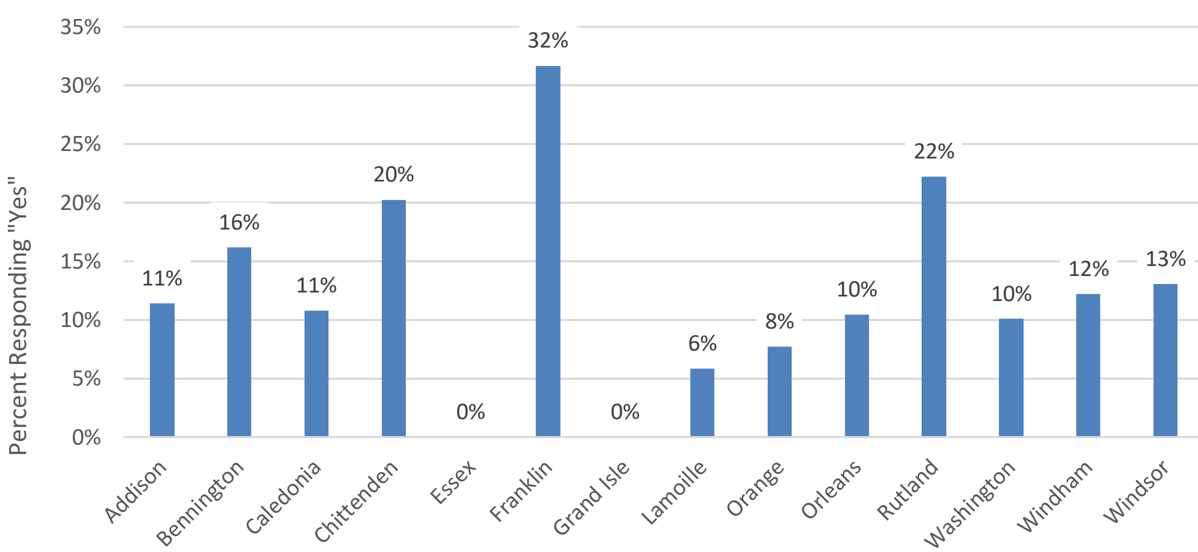
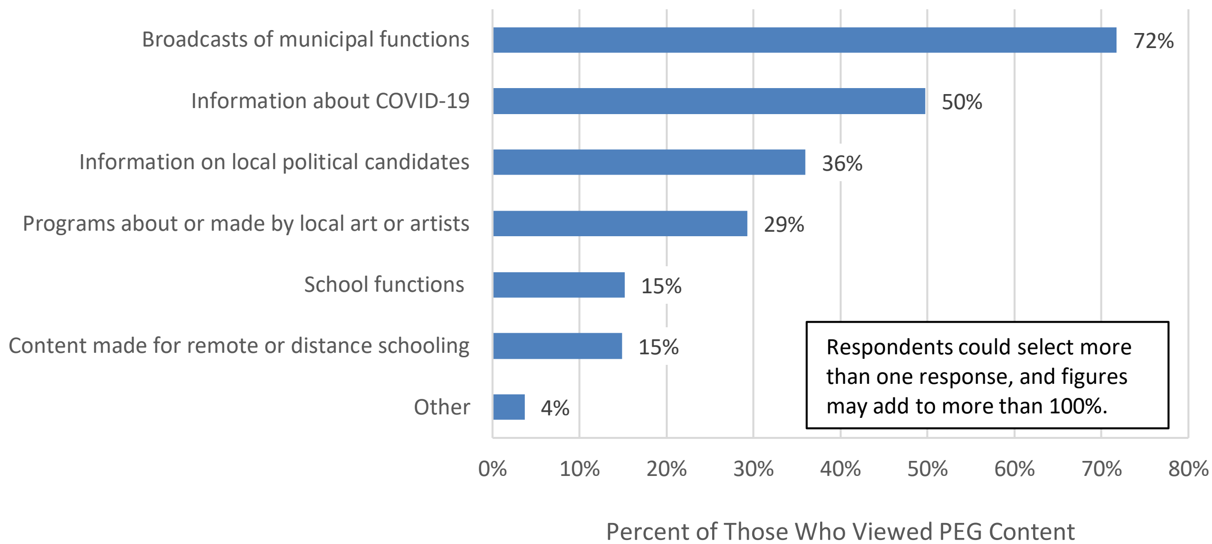


Figure 86: Consumed Public, Educational, Governmental (PEG) TV Content During the Covid-19 Pandemic by County



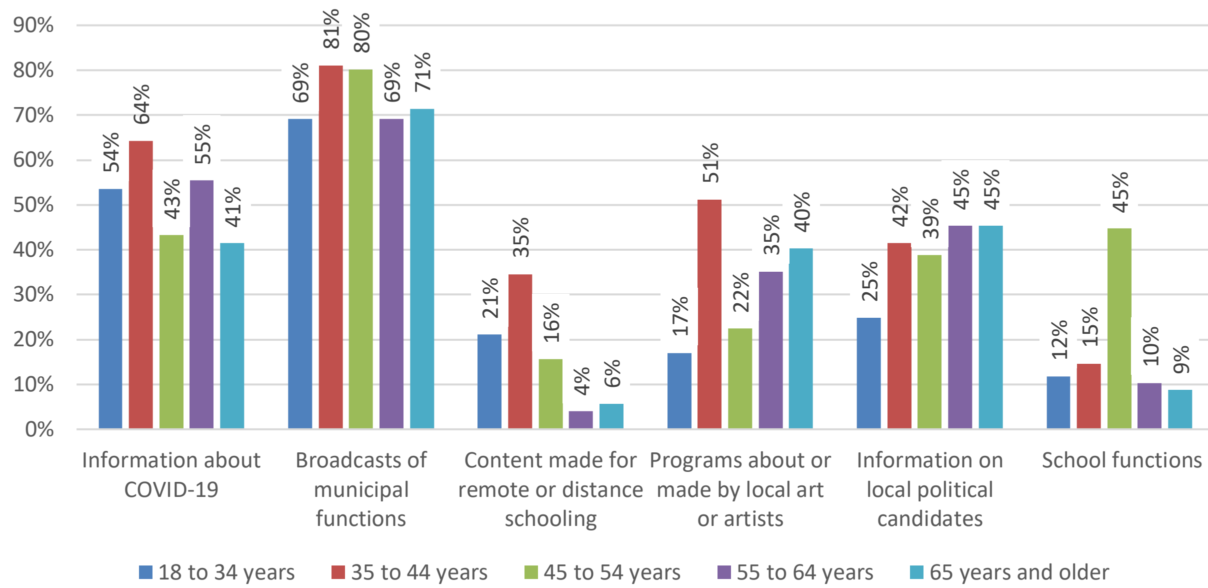
Among those who viewed PEG programming, the most commonly accessed content was broadcasts of municipal functions, cited by 72 percent of respondents. One-half of PEG viewers accessed information about Covid-19 (see Figure 87).

Figure 87: PEG Content Accessed During Covid-19 Pandemic



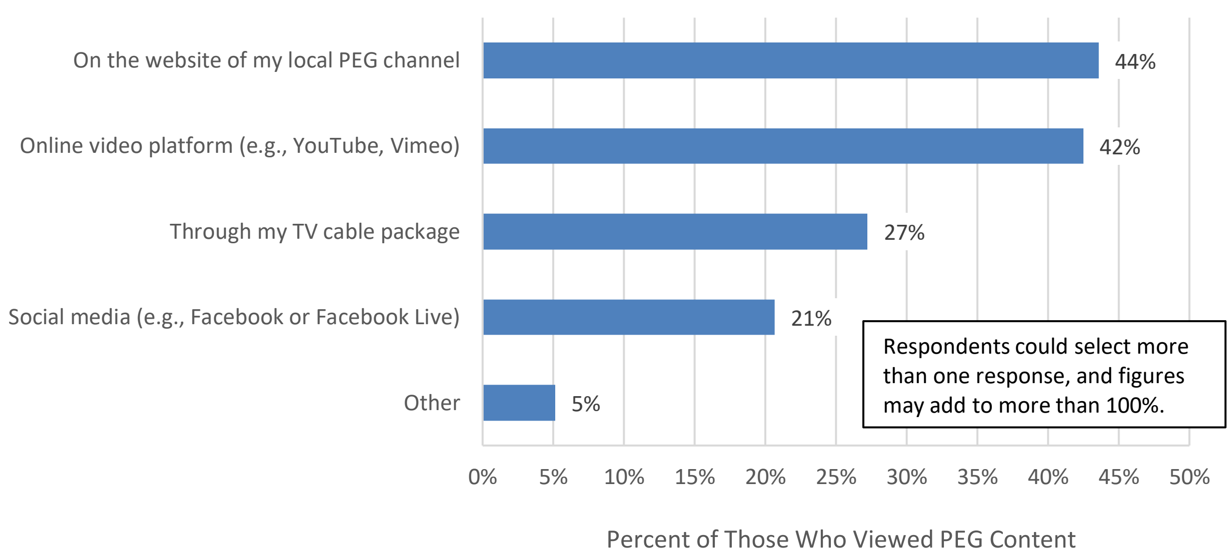
Respondents under age 35 were somewhat less likely than older respondents to view some types of content, such as program about/by local artists and information on local political candidates. PEG viewers ages 45 to 54 were much more likely than older and younger viewers to access content about school functions (see Figure 88).

Figure 88: PEG Content Accessed During Covid-19 Pandemic by Respondent Age



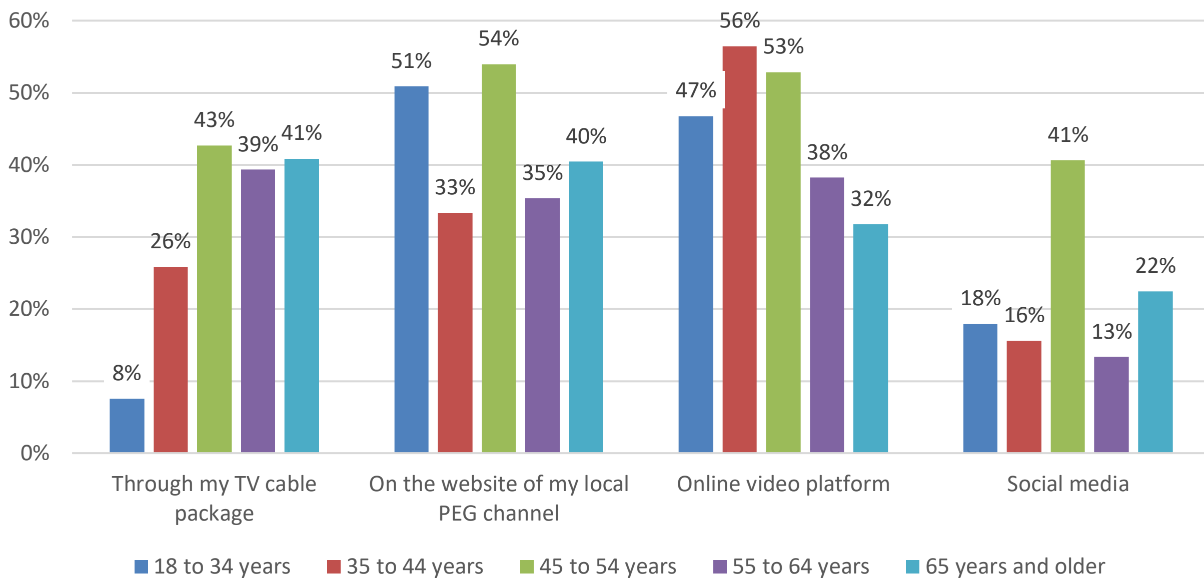
The most widely used media for watching PEG TV content include the website of the local PEG channel (44 percent) and online video platforms (42 percent). Fewer viewers said they watched through their TV cable package (27 percent) or via social media (21 percent), as shown in Figure 89.

Figure 89: Medium Used to Watch PEG TV Content



Respondents under age 35 were less likely than older respondents to watch PEG TV Content through a TV cable package, as illustrated in Figure 90. Viewership through an online video platform was lower for those ages 55+ compared with younger respondents, and viewership through social media was highest among respondents ages 45 to 54 years.

Figure 90: Medium Used to Watch PEG TV Content by Respondent Age



Respondent Information

Basic demographic information was gathered from survey respondents and is summarized in this section. Several comparisons of respondent demographic information and other survey questions were provided previously in this report.

As indicated previously regarding age-weighting, disproportionate shares of survey respondents were in the older age cohorts relative to the State's adult population as a whole (see Figure 91). Similarly, the data were weighted to account for differences in response by County. The weighted survey results presented in this report are adjusted to account for these differences and to provide results that are more representative of the State's population, as discussed previously.

Figure 91: Age of Respondents and State of Vermont Adult Population

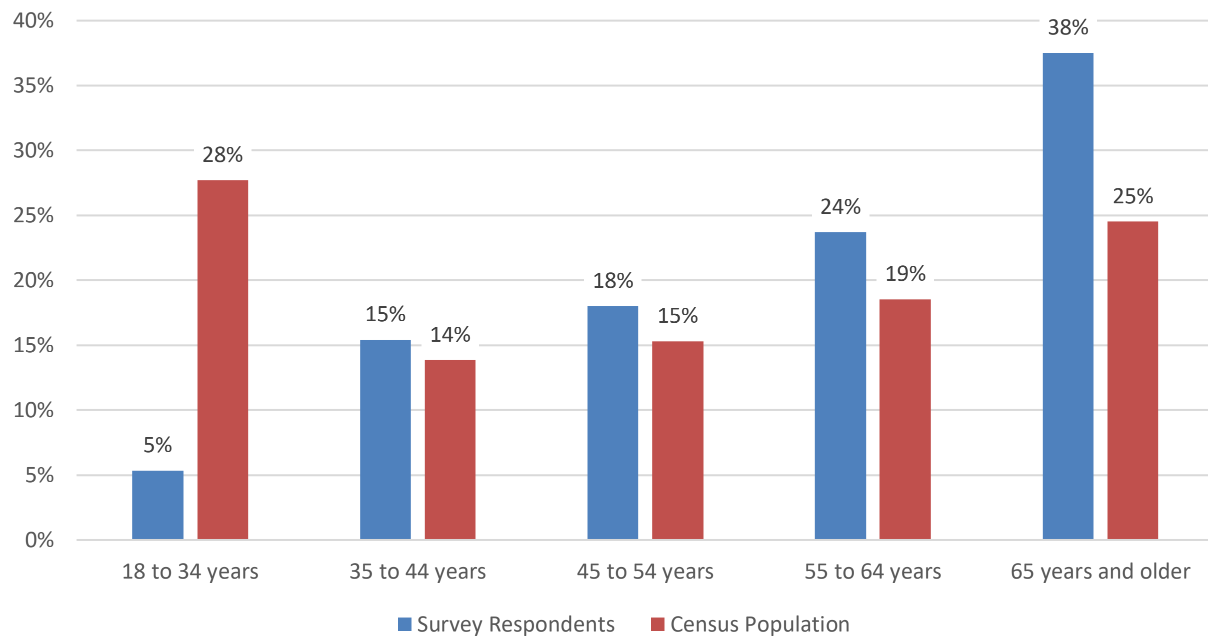
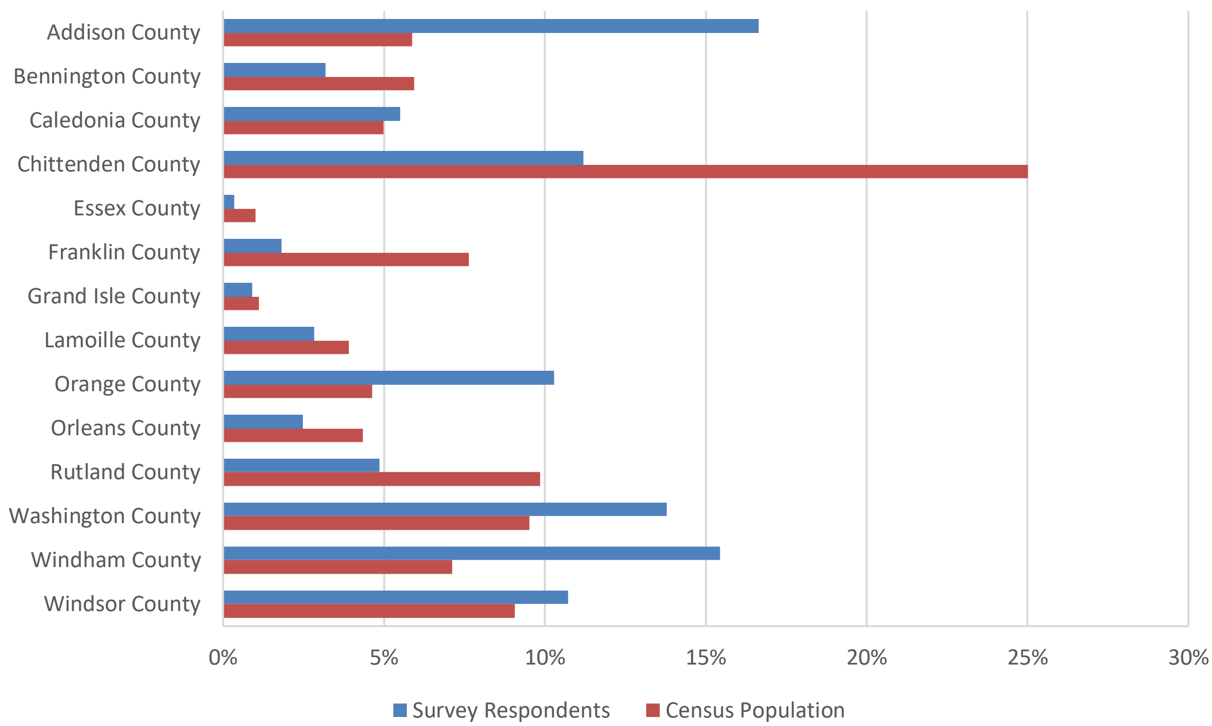
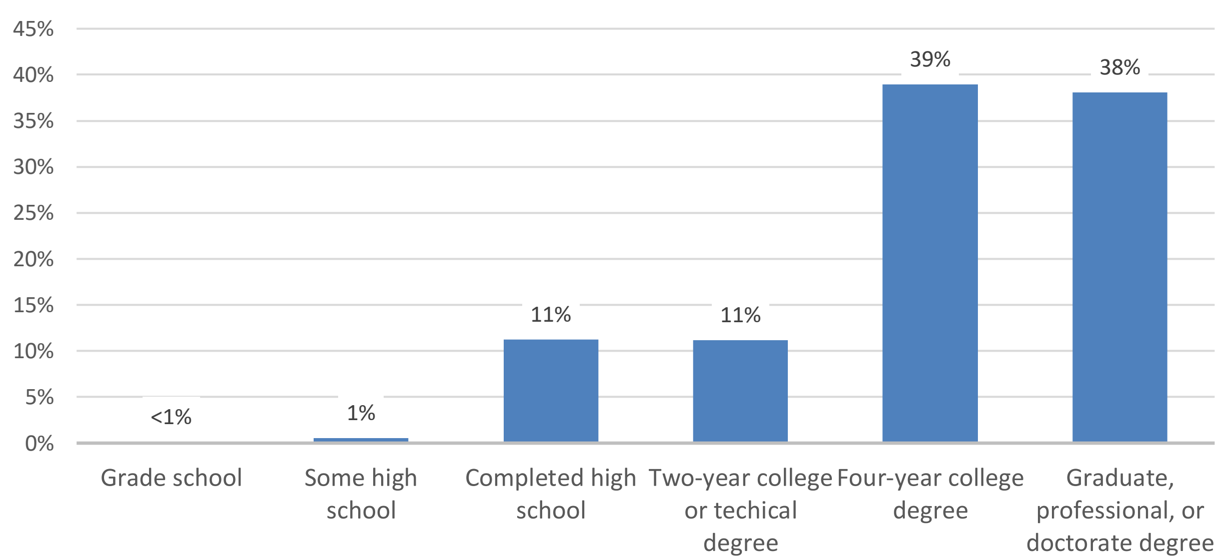


Figure 92: County of Residence



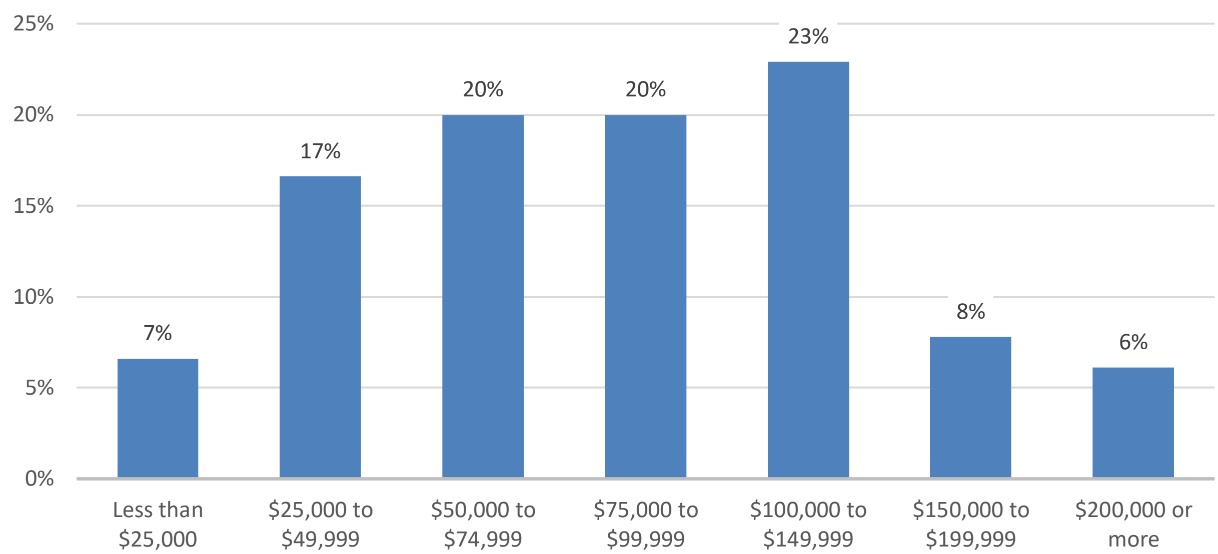
The respondents' highest level of education attained is summarized in Figure 93. Most respondents have a four-year college degree (39 percent) or a graduate, professional, or doctorate degree (38 percent).

Figure 93: Education of Respondent



One-fourth of respondents earn less than $50,000 per year, including seven percent who earn under $25,000. Four in 10 earn $50,000 but less than $100,000, while 37 percent earn $100,000 or more per year (see Figure 94).

Figure 94: Annual Household Income



As illustrated in Figure 95 and Figure 96, the majority of respondents are White/European American and identify most strongly with that race/ethnicity.

Figure 95: Race/Ethnicity

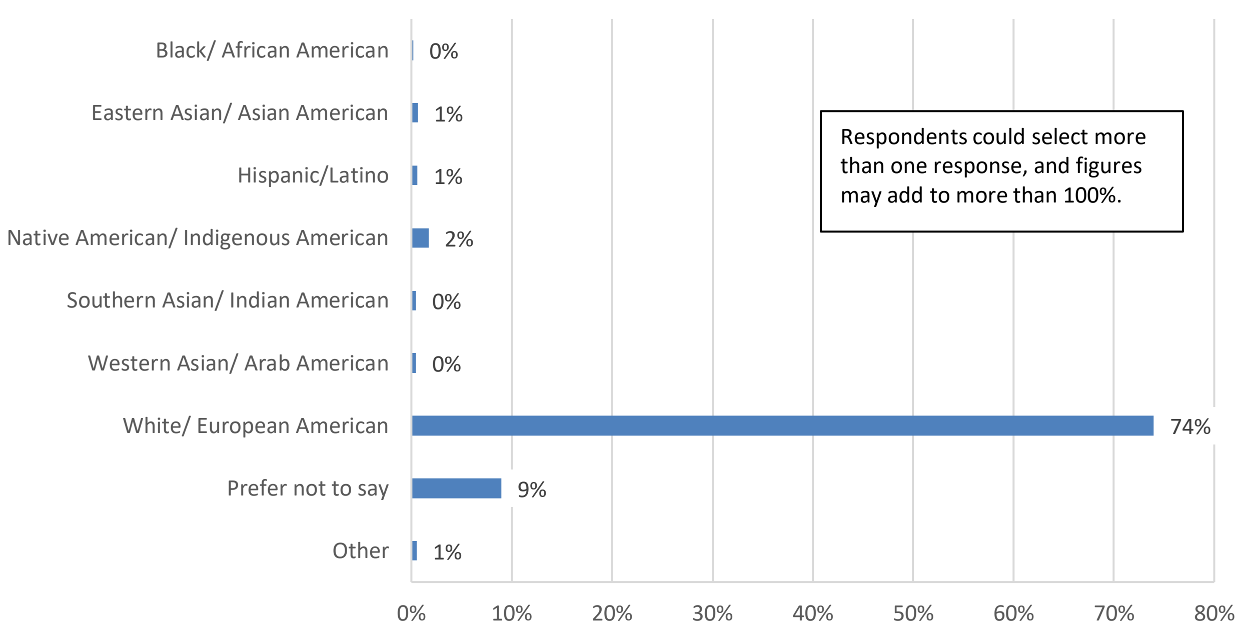
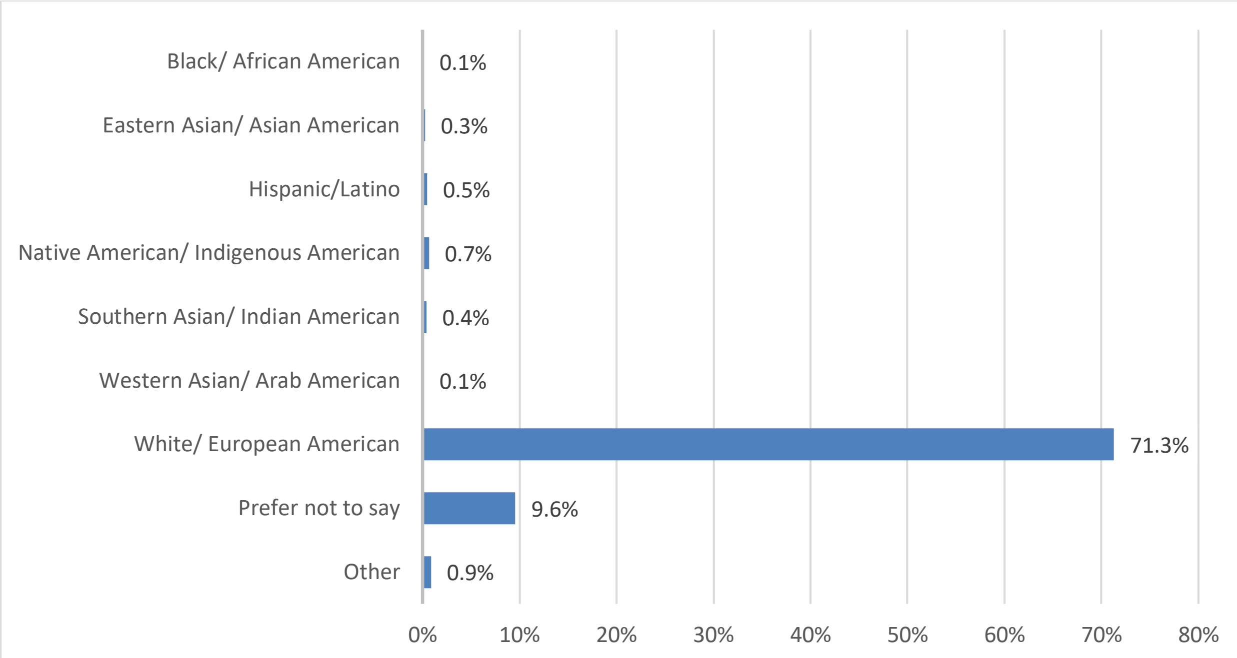
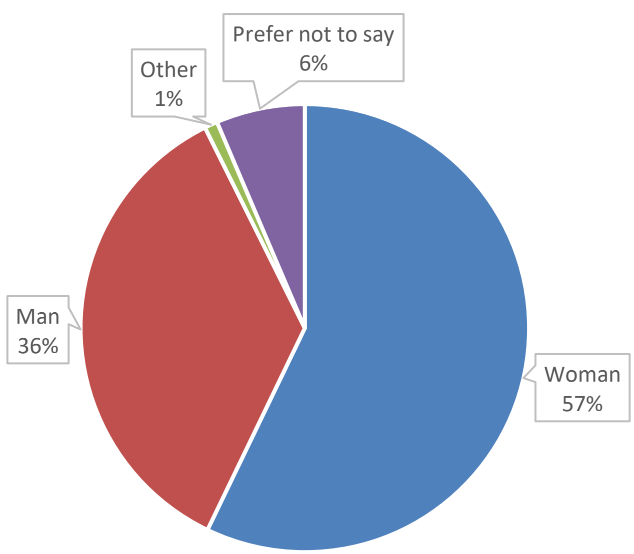


Figure 96: Race/Ethnicity Most Strongly Identify With



More than one-half of respondents (57 percent) identify as female, and 36 percent identify as male (see Figure 97).

Figure 97: Gender Identity



Appendix B: Business Survey Results

1. Executive Summary

As part of its efforts to perform a comprehensive evaluation of broadband gaps during the Covid-19 pandemic, the State of Vermont commissioned an online survey of businesses. The survey was intended to gather basic data about the types of communication services that businesses use and their willingness to purchase high-speed internet. Moreover, the survey was designed to provide insights about how the pandemic has impacted businesses' and employees' use of the internet and whether internet service is sufficient to meet the needs of businesses across the state.

Almost all businesses have access to the internet, which is to be expected of online survey participants. At the same time, businesses' internet service may be inadequate to meet their needs during the pandemic. As more employees are working remotely, some businesses are reporting internet issues faced by employees such as delays in uploading or downloading content and inability to use interactive video conferencing due to insufficient internet bandwidth. Reported internet speeds have declined, and satisfaction with internet reliability and speed has decreased during the pandemic.

This report documents the survey process, discusses methodologies, and presents results intended to assist the State in developing strategies to close the identified gaps.

9.7 Key Findings

Key findings are here presented thematically in two subsections: broadband internet usage and Covid-19 impacts on broadband use. These and other findings are presented in greater detail in the body of the report.

Broadband Internet Usage

The survey found that communication services are widely used and that there are very few gaps in acquisition of business internet. The following are key findings:

- **Almost all businesses have internet access.** Leading types of primary internet service include cable modem (35 percent), DSL (27 percent), and fiber (15 percent). One-half (50 percent) of businesses do not have a backup or secondary internet connection, and 32 percent have a cellular/mobile connection as their backup or secondary internet connection.

- **The most utilized connectivity services were internet and telephone.** Most (99 percent) reported having internet access at their primary business location, while 75 percent have telephone service, 61 percent have cellular data service, and 54 percent have videoconferencing service.

- **Almost all (99** percent**) businesses have personal computers.** Specifically, 65 percent of businesses have 1-4 computers, 21 percent have five to nine computers, and 13 percent have ten or more computers.

- **Price may be a barrier to purchasing carrier-grade internet service.** Nearly two-thirds of respondents (65 percent) are extremely willing to purchase 1 Gbps internet for $75 per month, but willingness drops considerably at higher price points. Just eight percent of businesses would be extremely willing to pay $250 per month for very fast internet service, but 22 percent would be extremely willing to purchase carrier-grade Ethernet transport and internet access service at this price point. Businesses would be not at all likely to slightly likely to pay more than $250 per month for carrier-grade service.

Covid-19 Impacts on Broadband Use

Businesses are relying more on remote work during the pandemic and at the same time are reporting some inadequacies in their broadband internet service, particularly with speed and reliability of service. The following are key findings:

- **Businesses report their internet service being slower during the pandemic**. Before the Covid-19 pandemic, more than four in 10 respondents (42 percent) thought their internet connection speed was fast enough for their needs, dropping to 35 percent during the Covid-19 pandemic. Only 15 percent thought their internet connection speed was very slow and would like to be connected at much higher speeds before the pandemic, while during the pandemic this number increased to 26 percent.

- **Satisfaction with internet connection speed and reliability has dropped somewhat during the pandemic.** Nearly one-half of businesses (47 percent) were very or extremely satisfied with their internet's speed of connection prior to the pandemic, dropping to 38 percent during the pandemic. Similarly, 47 percent of businesses were very or extremely satisfied with their internet's reliability of connection, dropping to 35 percent during the pandemic.

- **Businesses are making more use of online platforms to sell goods or services or to engage in online marketing and promotions during the pandemic.** The percentage of businesses that exclusively use online platforms to sell goods or services or to engage in online marketing and promotions has increased from six percent before the Covid-19 pandemic to 15 percent during the pandemic.

- **The percent of time that employees work remotely has increased during the pandemic.** Specifically, one-third of employees now telework 75-100 percent of the time, compared with 11 percent of employees before the pandemic.

- **The percentage of employees working remotely is expected to increase after the Covid-19 pandemic.** More than four in 10 (42 percent) businesses said they did not have a work remote option prior to the pandemic, while 29 percent said they do not plan to have one after the pandemic and seven percent are undecided. One-fifth of business plan to have a fully remote work option for some or all employees after the pandemic, compared with 13 percent during the pandemic.

- **Many businesses said that most or all of their employees (75 – 100 percent) experienced issues due to inadequate broadband service during the pandemic**. For example, one-third of businesses said that all or most of their employees experienced delays in uploading or downloading content. More than one-half of businesses said inadequate broadband service is a very significant or extremely significant issue.

- **Many businesses plan to take some action in the next 12 months related to broadband internet service and computers.** Most businesses expect to obtain higher-quality broadband service (57 percent) and to enhance an existing website or online sales effort (56 percent) in the next 12 months. Fewer respondents expect to take other actions; however, 15 percent plan to help employees obtain internet access at home and 11 percent plan to move to an area with better broadband service.

9.8 Survey Process and Data Analysis

CTC, in close coordination with the State of Vermont, managed the survey project, including development of the questionnaire, programming and hosting the online survey, survey data analysis, and reporting of results. CTC developed the draft survey instrument and the State provided revisions and approved the final questionnaire. A total of 422 completed surveys were received by the date of analysis.

The survey responses were exported into SPSS[155] software and the entries were coded and labeled. SPSS databases were formatted, cleaned, and verified prior to the data analysis. Address information was merged with the survey results using the unique identifiers included in each survey invitation. The survey data was evaluated using techniques in SPSS including frequency tables and means functions.

The following sections summarize the survey findings.

[155] Statistical Package for the Social Sciences (http://www-01.ibm.com/software/analytics/spss/)

9.9 Survey Results

The results presented in this report are based on analysis of information provided by 422 businesses in the State of Vermont. Unless otherwise indicated, the percentages reported are based on the "valid" responses from those who provided a definite answer and do not reflect individuals who said "don't know" or otherwise did not supply an answer because the question did not apply to them. Key differences by business types are noted where appropriate.

Business Information and Services Used

Basic information was gathered from survey respondents to profile businesses in the survey. The following charts in this section highlight characteristics of businesses in the survey sample, services used, and willingness to purchase internet services (see Figure 98 through Figure 112).

Eighty-four percent of businesses are the sole location, and seven in 10 businesses have fewer than five full-time employees. Six in 10 businesses own their office location, and one-fourth share their space with other, unrelated businesses. Three-fourths of respondents completed the survey from their typical place of business.

All Vermont counties are represented in the sample, including 15 percent of businesses with a main office location in Washington County, 14 percent in Chittenden County, 13 percent in Windham County, and 10 percent in Addison County.

Thirteen percent of businesses spend less than $1,000 per year on their telecommunications expenses, while 39 percent spend $1,000 to $2,499 per year and 21 percent spend $2,500 to $4,999 per year. Another 16 percent of respondent spend $5,000 or more per year on telecommunications expenses.

Almost all (99 percent) businesses have personal computers. Specifically, 65 percent of businesses have 1-4 computers, 21 percent have five to nine computers, and 13 percent have ten or more computers.

The most utilized connectivity services at the businesses' primary business location were internet (99 percent) and telephone (75 percent). Six in 10 use cellular data, 54 percent use video conferencing, and four percent wrote-in other connectivity services.

Almost all (99 percent) businesses reported having internet service. Over one-third (35 percent) of businesses use a cable modem as their primary internet connection, 27 percent use DSL primarily, and 15 percent have fiber service as their primary internet connection. One-half (50 percent) of businesses do not have a backup or secondary internet connection, and 32 percent have a cellular wireless connection as their backup or secondary internet service.

One in 10 businesses pay less than $50 per month for internet service at their primary location, while 31 percent pay $50 to $99, 22 percent pay $100 to $149, 23 percent pay $250 to $299, and 15 percent pay $300 or more per month for internet service.

Figure 98: Number of Employees in Vermont

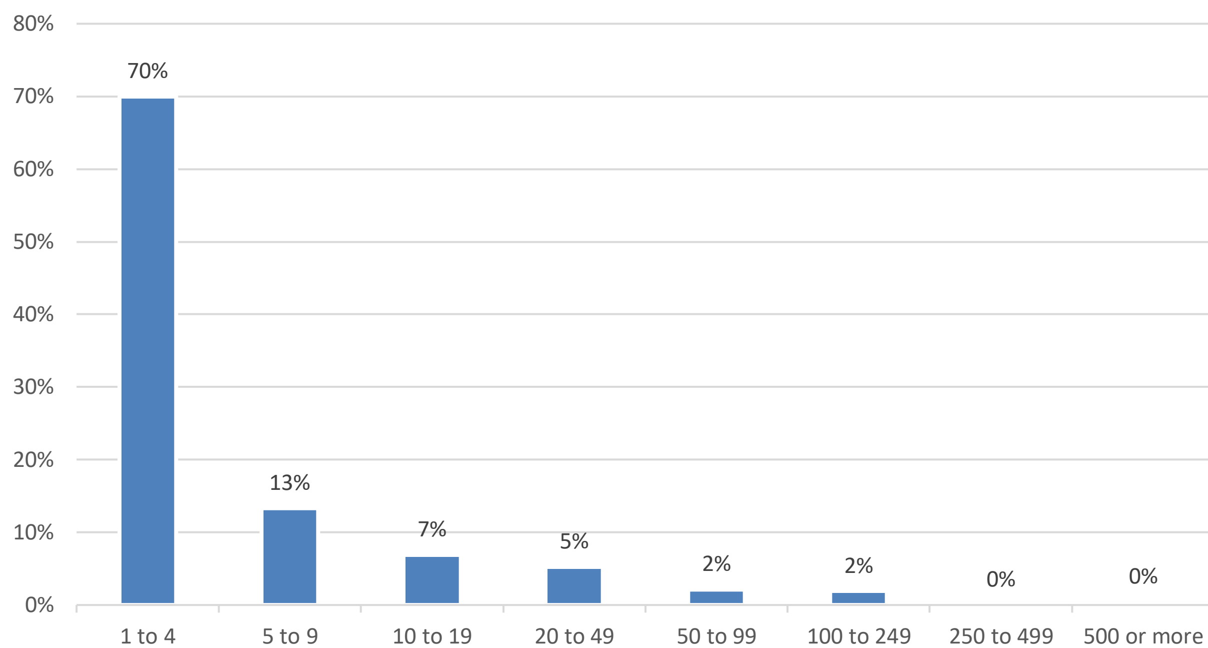
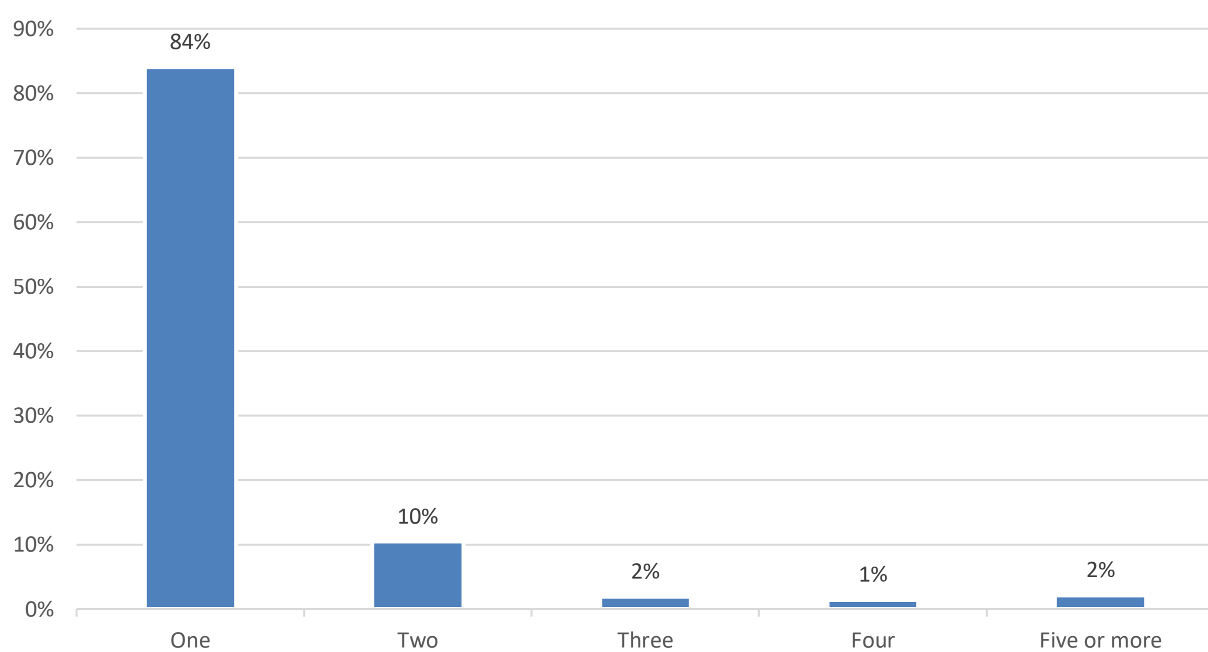
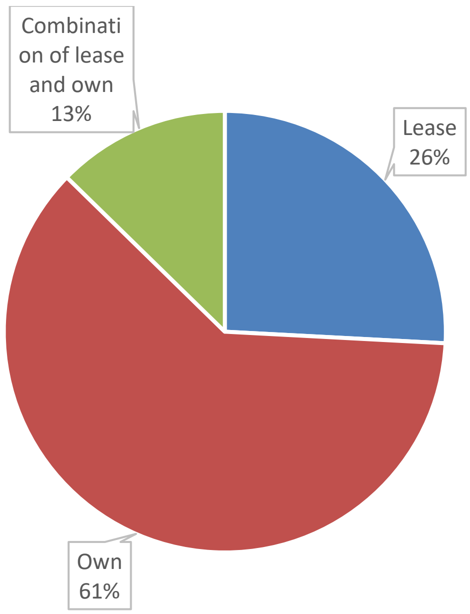


Figure 99: Number of Business Locations in Vermont





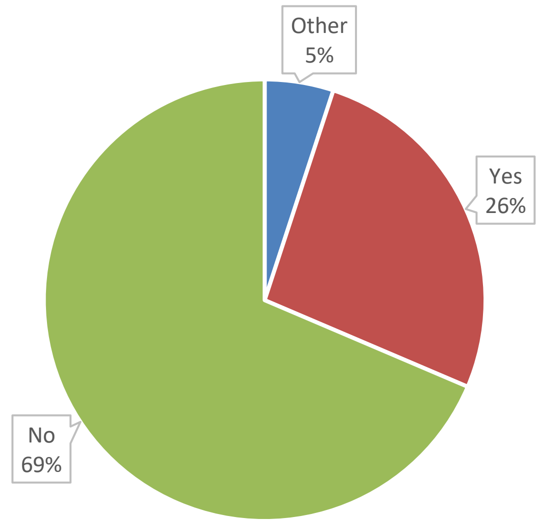


Figure 100: County of Main Business Location

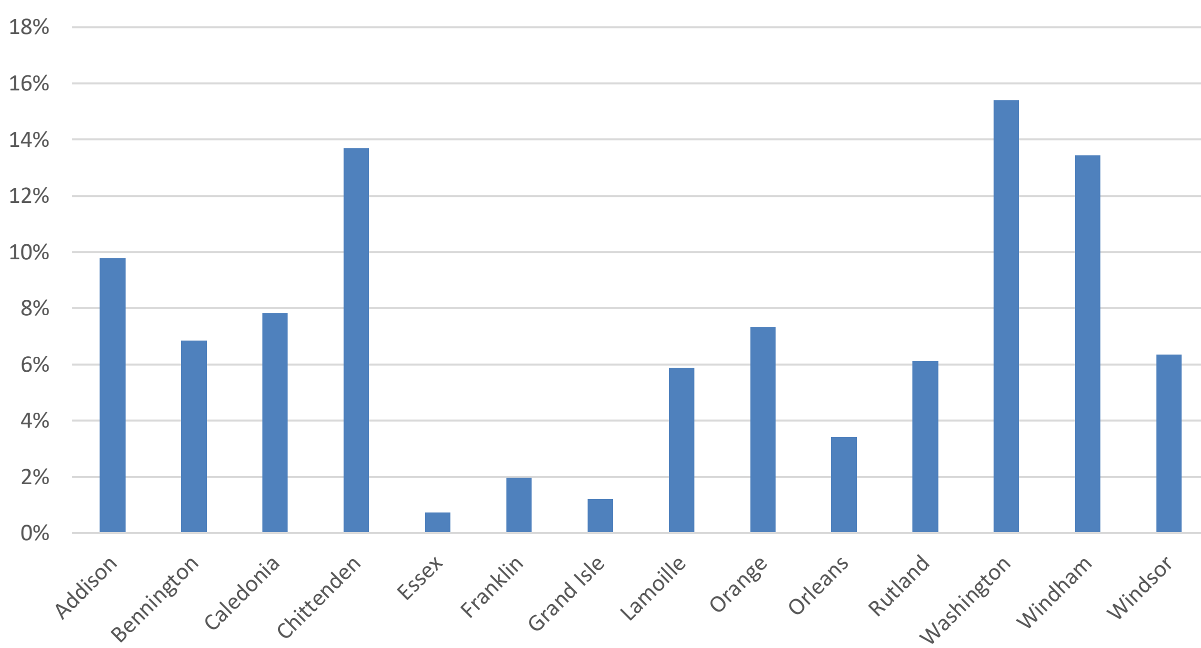


Figure 101: Annual Telecommunications Expense

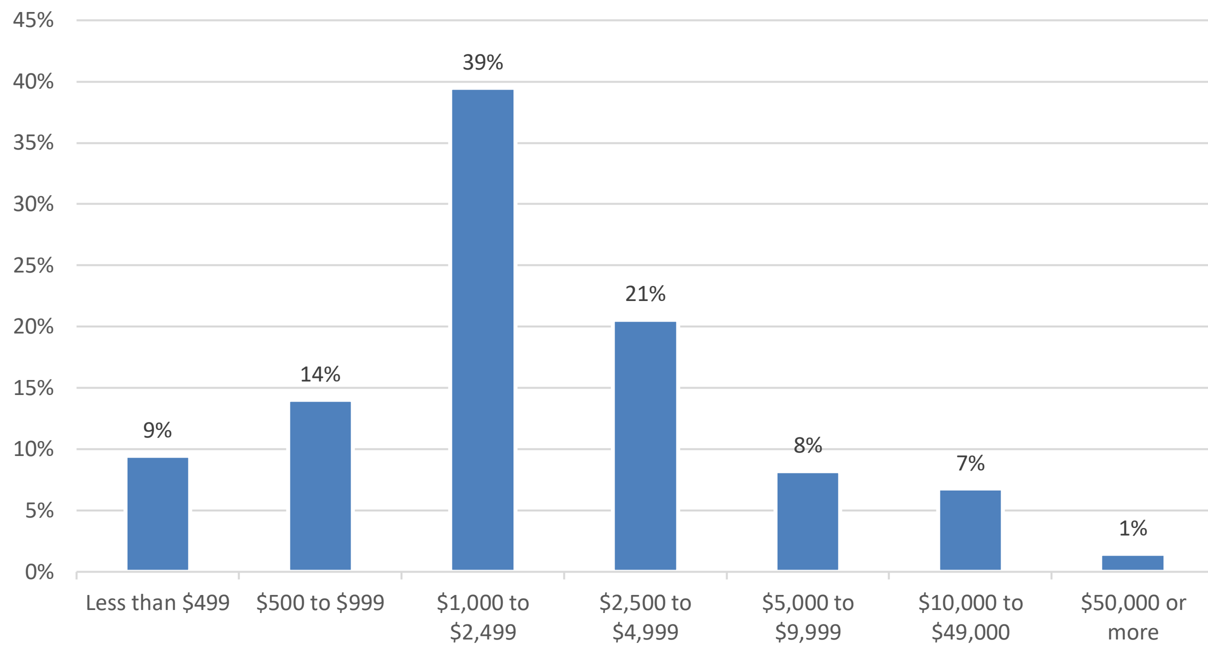


Figure 102: Number of Personal Computers or Terminals at Vermont Location(s)

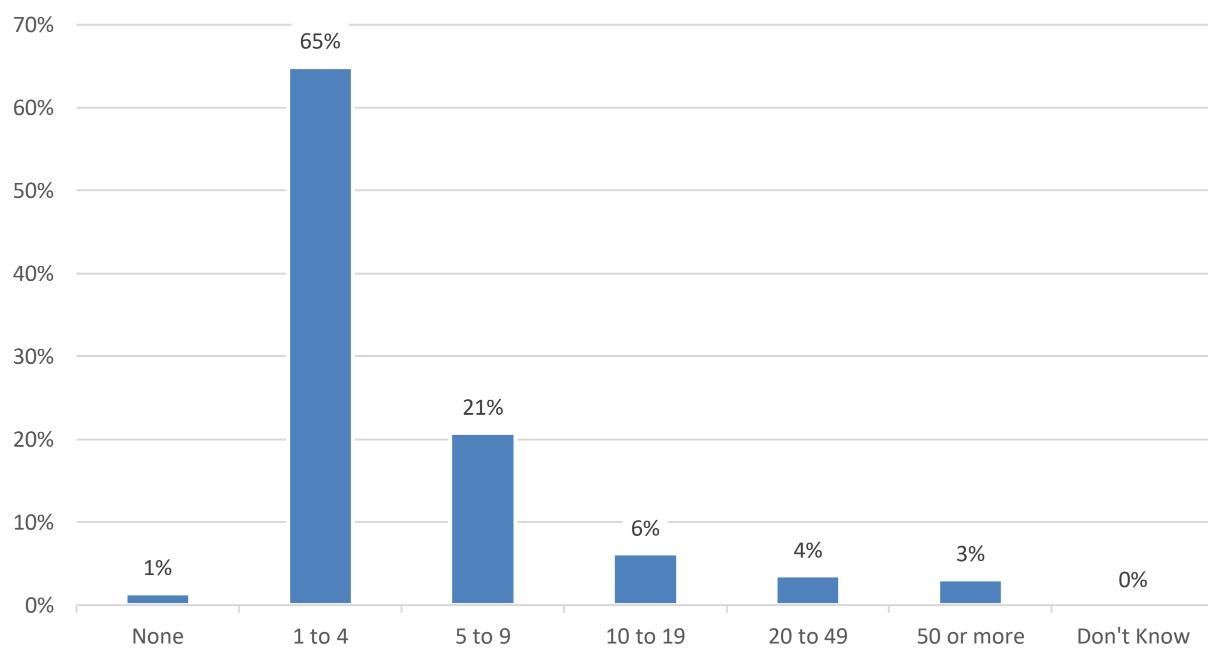


Figure 103: Primary Connectivity Services

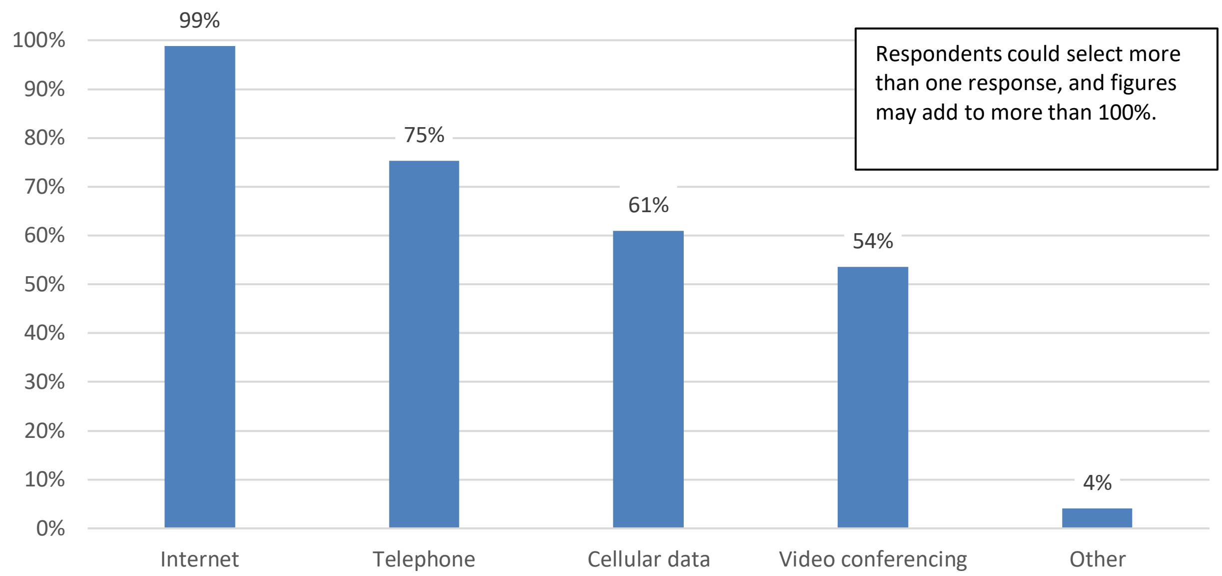


Figure 104: Primary Internet Connection

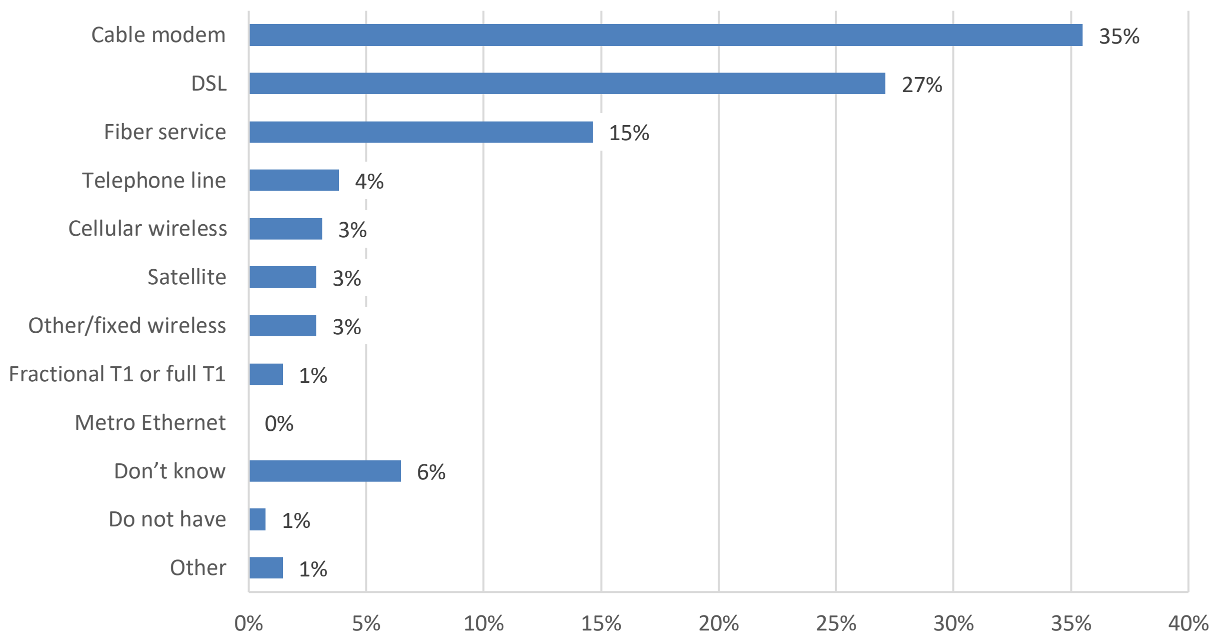


Figure 105: Backup or Secondary Internet Connection

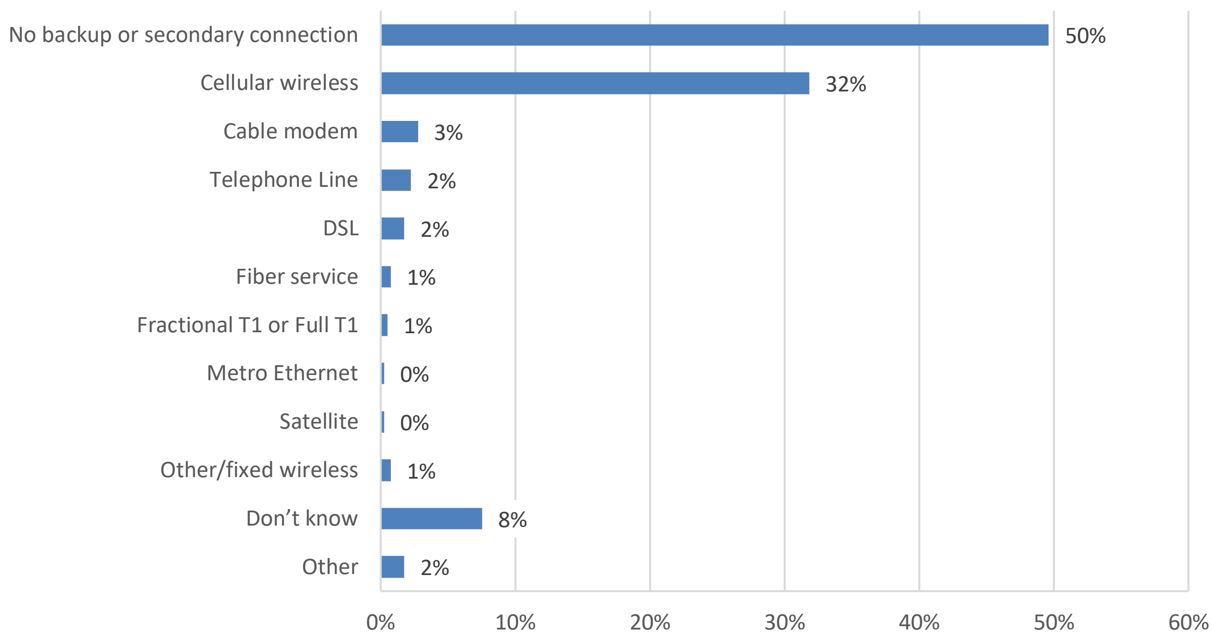
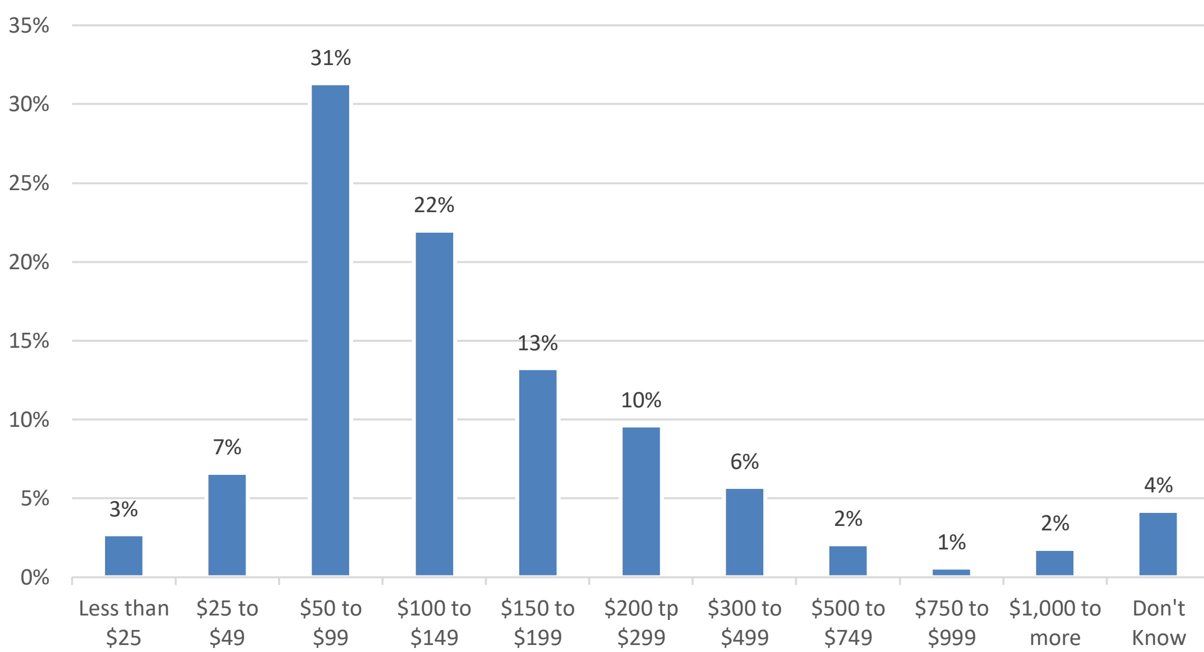


Figure 106: Monthly Cost of Internet Service at Primary Location



Respondents were asked if they would be willing to purchase 1 Gbps internet service for various price levels. The mean willingness to purchase across this array of questions is illustrated in Figure 107, while detailed responses are illustrated in Figure 108.

Figure 107: Willingness to Pay for Access to 1 Gbps Internet Service (Mean Ratings)

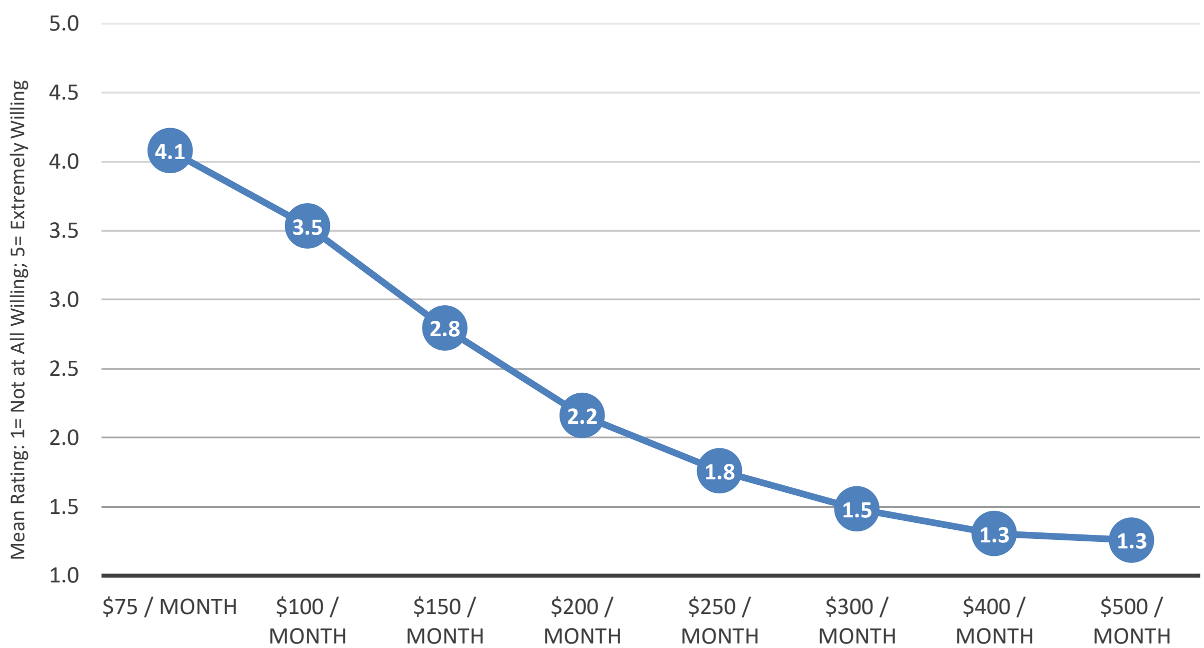
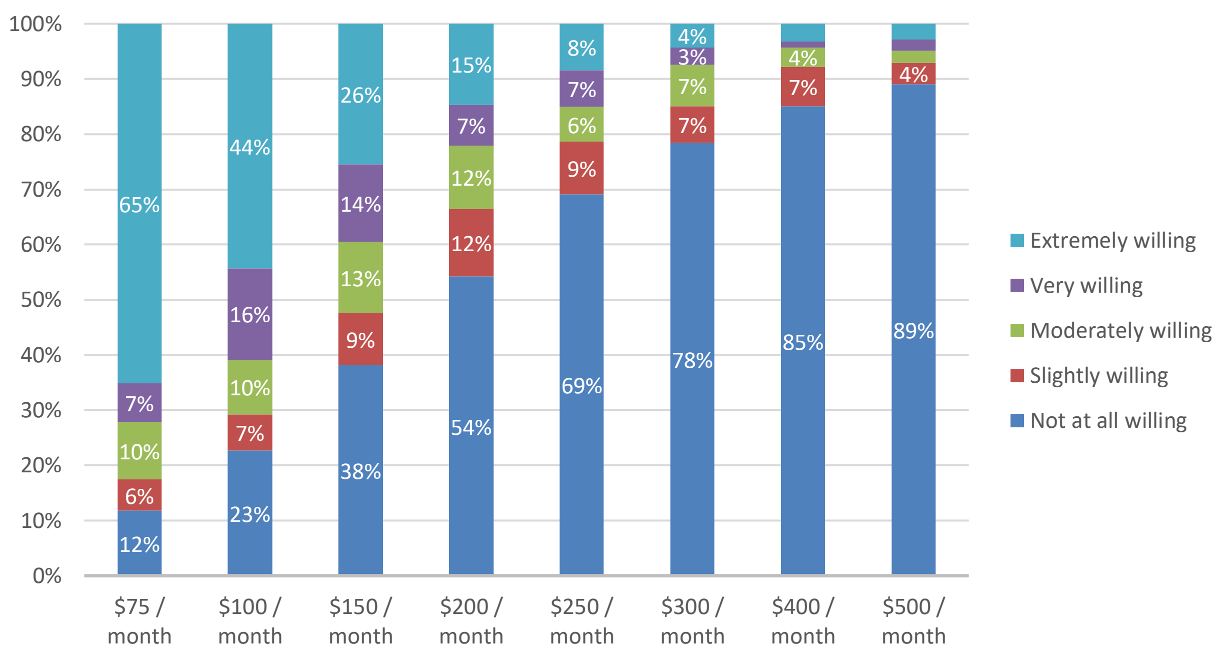


Figure 108: Willingness to Pay for Access to 1 Gbps Internet Service



Respondents' willingness to purchase 1 Gbps internet service is high at $75 per month (4.1 mean), but it decreases as the price increases. The mean rating falls to 3.5 at a price point of $100 per month and 2.8 at a price point of $150 per month (slightly to moderately willing). From another perspective, 65 percent of respondents are extremely willing to purchase 1 Gbps internet for $75 per month, dropping to 44 percent at $100 per month and 26 percent at $150 per month. Very few businesses would pay $400 or $500 per month for very fast internet service.

Businesses were also asked to indicate how willing they would be to pay for access to 1 Gbps carrier-grade Ethernet transport and internet access service. The mean willingness to purchase across this array of questions is illustrated in Figure 109, while detailed responses are illustrated in Figure 110.

Respondents' willingness to purchase 1 Gbps carrier-grade Ethernet transport and internet service is slight to moderate at $250 per month (2.5 mean), and it drops considerably as the price increases. The mean rating falls to 1.6 at a price point of $500 per month and 1.3 at a price point of $750 per month (not at all to slightly willing). From another perspective, 22 percent of respondents are extremely willing to purchase 1 Gbps carrier-grade internet for $250 per month, dropping to five percent at $500 per month and three percent at $750 per month. Very few businesses would pay $400 or $500 per month for very fast internet service.

Figure 109: Willingness to Pay for Access to 1 Gbps Carrier-Grade Ethernet Transport and Internet Service (Mean Ratings)

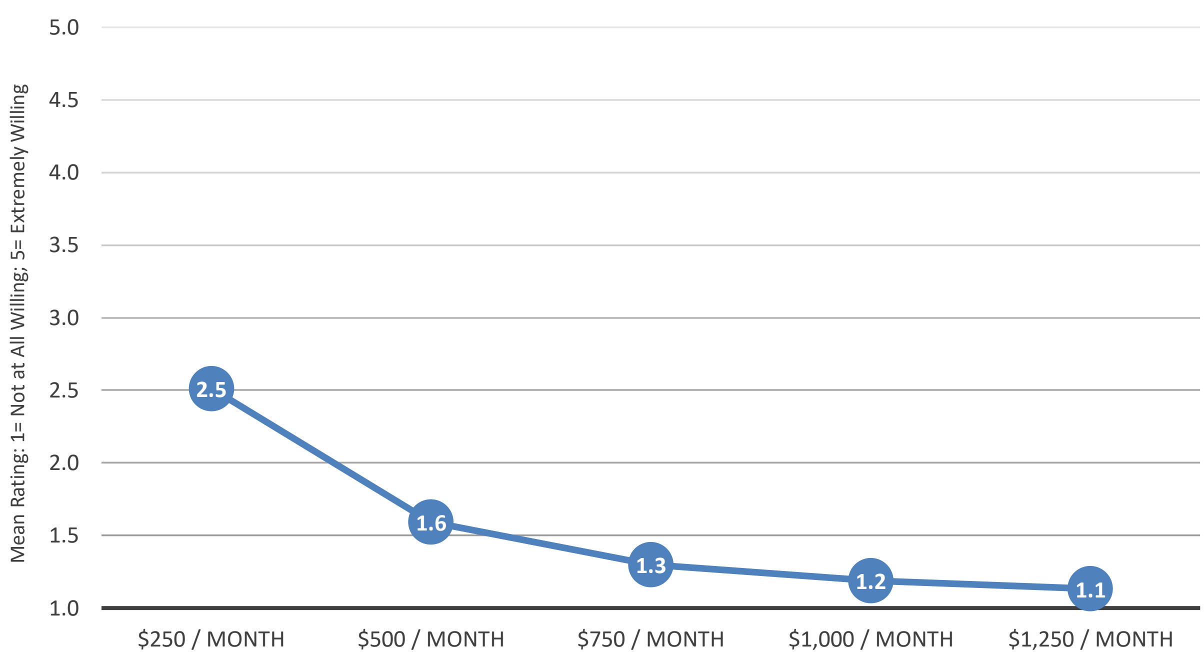
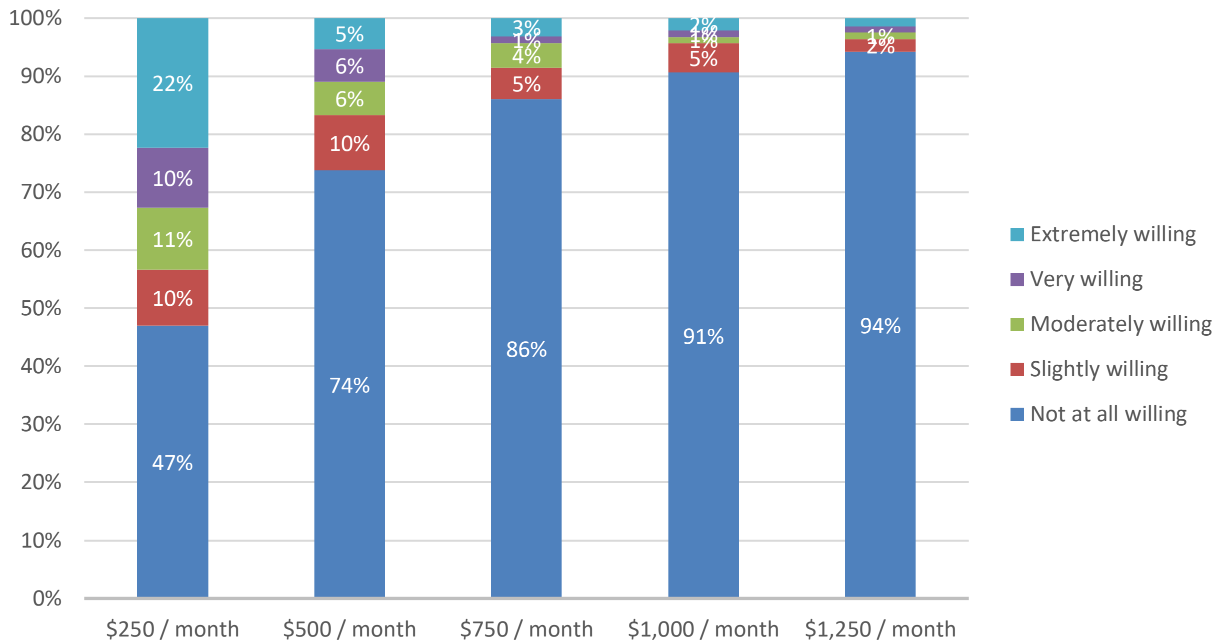


Figure 110: Willingness to Pay for Access to 1 Gbps Carrier-Grade Ethernet Transport and Internet Service



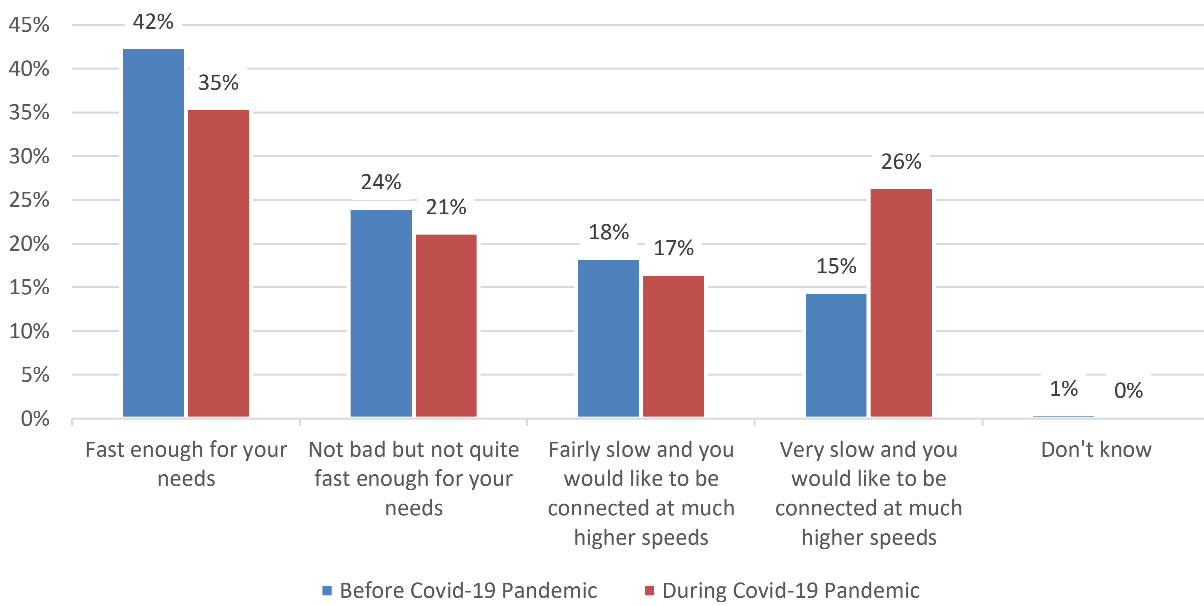
Covid-19 Impacts on Business

Businesses were asked a series of questions on how their broadband use has changed during the Covid-19 pandemic, including impacts on connection speed, satisfaction with internet service, use of online platforms for selling goods or services, amount of time employees worked remotely, and issues experienced due to broadband service during the pandemic. This section also evaluated expected changes in broadband ad computer use over the next 12 months. This information provides valuable insight into demand for broadband service during the pandemic.

Internet Connection Speed

Before the Covid-19 pandemic, more than four in 10 respondents (42 percent) thought their internet connection speed was fast enough for their needs, dropping to 35 percent during the Covid-19 pandemic. Only 15 percent thought their internet connection speed was very slow and would like to be connected at much higher speeds before the pandemic, while during the pandemic this number increased to 26 percent (see figure below).

Figure 111: Internet Connection Speed Before and During Covid-19 Pandemic



Satisfaction with Business Internet Service

Respondents were asked to evaluate their satisfaction with aspects of their current business internet service before and during the Covid-19 pandemic. Average rating scores are highlighted in Figure 112, while Figure 113 shows detailed responses. Overall, respondents were only moderately satisfied with aspects of their internet service prior to the Covid-19 pandemic, and satisfaction has dropped somewhat during the pandemic particularly for connection speed and reliability.

Figure 112: Satisfaction with Internet Business Service Aspects (Mean Ratings)

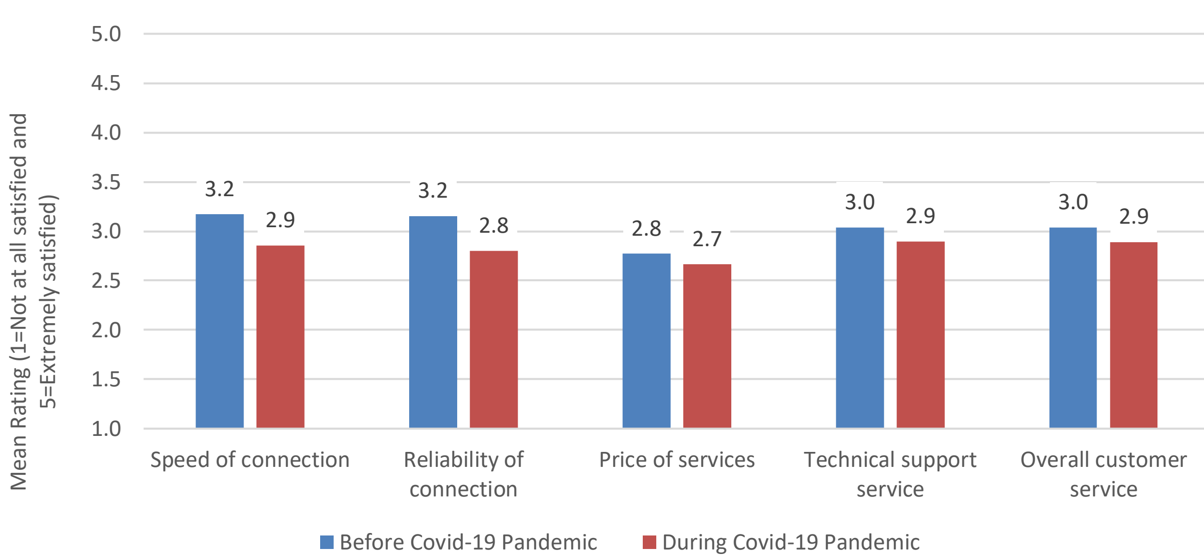
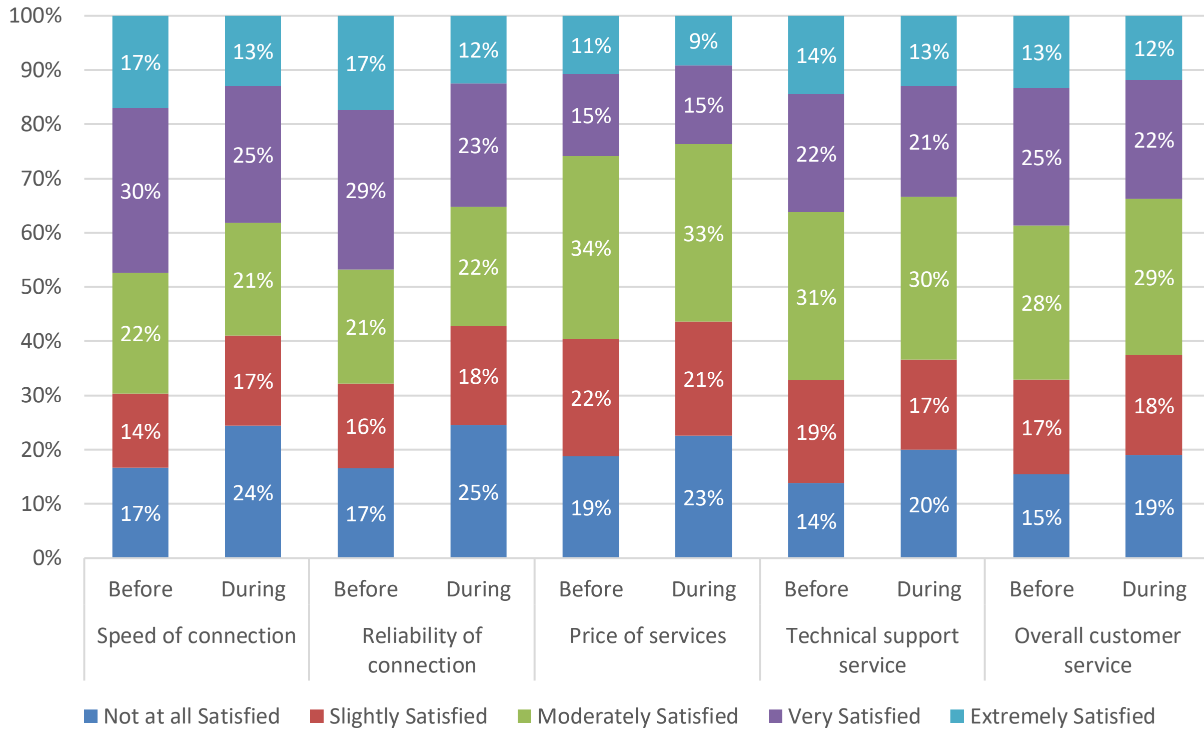


Figure 113: Satisfaction with Internet Business Service Aspects



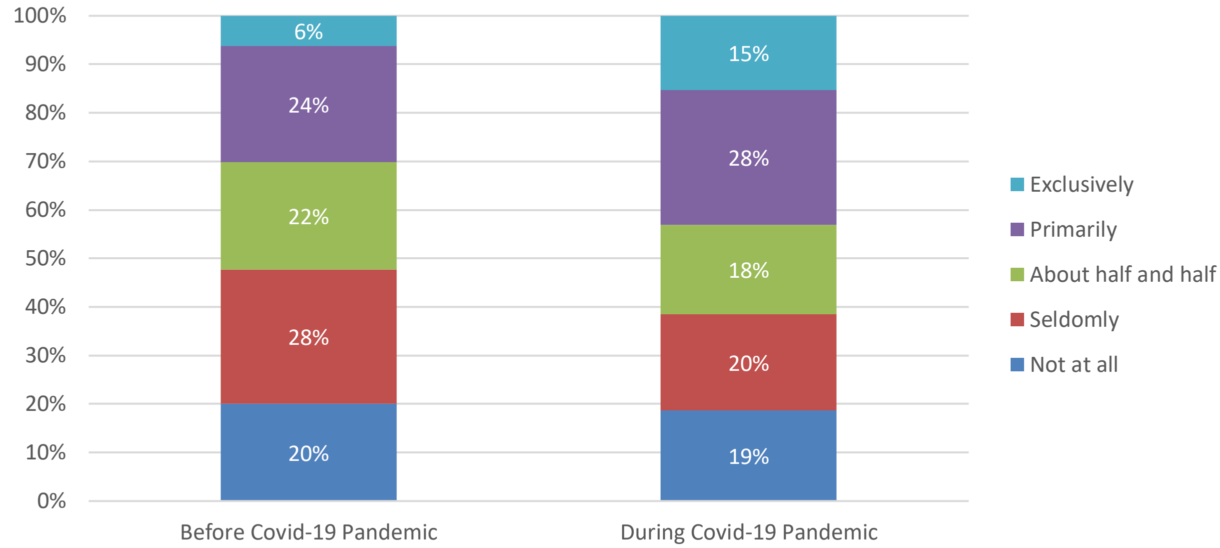
Specifically, nearly one-half of respondents (47 percent) were very or extremely satisfied with their internet's speed of connection prior to the pandemic, while 17 percent were not at all satisfied. During the pandemic, 38 percent of respondents were very or extremely satisfied with their internet's speed of connection, and 24 percent of businesses were not at all satisfied with their internet's speed of connection.

Satisfaction with business internet's reliability of connection decreased during the Covid-19 pandemic as well. Prior to the pandemic, nearly one-half (47 percent) of respondents were very or extremely satisfied with their internet's reliability of connection, while 17 percent being not at all satisfied. During the pandemic, 35 percent of respondents were very or extremely satisfied with their internet's reliability of connection, and 25 percent of businesses were not at all satisfied with their internet's reliability of connection.

Use of Online Platforms

The percentage of businesses that exclusively use online platforms to sell goods or services or to engage in online marketing and promotions has increased from six percent before the Covid-19 pandemic to 15 percent during the pandemic (see the figure below).

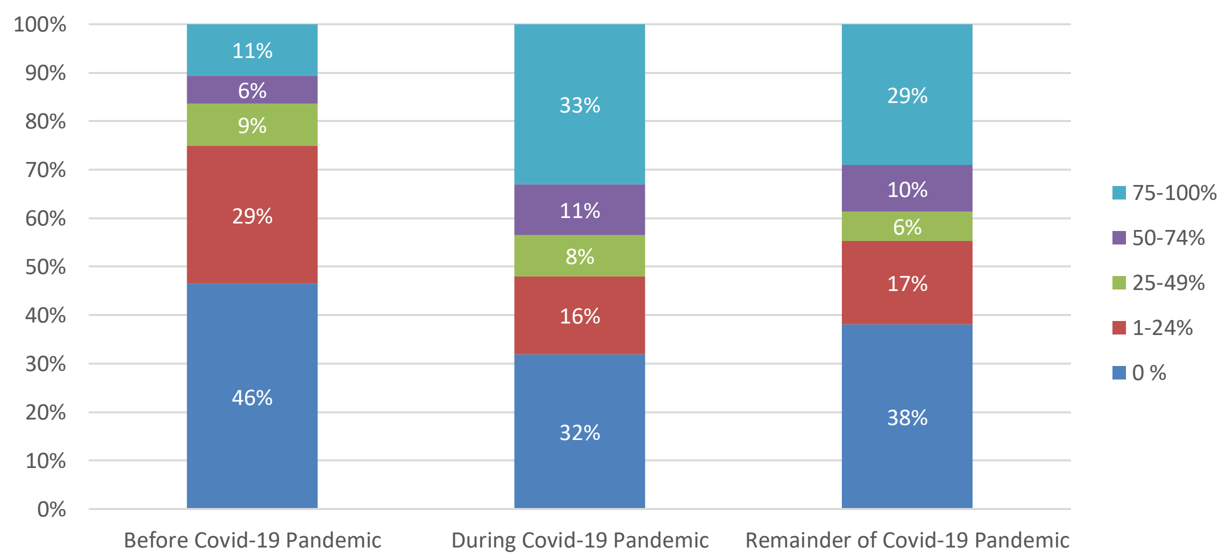
Figure 114: Use of Online Platforms to Sell Goods or Services Online



Remote Work

Businesses were asked a series of questions to help evaluate how remote-work has changed during the Covid-19 pandemic. As illustrated in the figure below, the percent of time that employees work remotely has increased during the pandemic. Specifically, one-third of employees now telework 75 to 100 percent of the time, compared with 11 percent of employees before the pandemic.

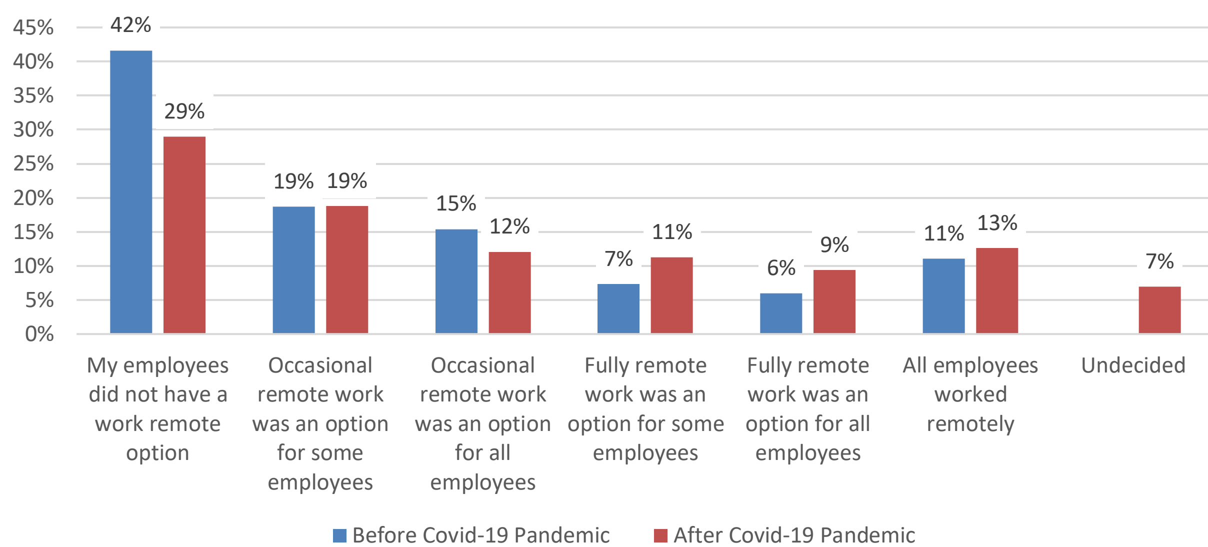
Figure 115: Percent of Time Employees Work Remotely



The percentage of time that employees telework is expected to remain at a similar level for the remainder of the Covid-19 pandemic but may decrease slightly. Prior to the pandemic, 46 percent of businesses said no employees telecommuted, compared with 32 percent during the pandemic and 38 percent for the rest of the pandemic.

The percentage of employees working remotely is expected to increase after the Covid-19 pandemic, as shown in the figure below. More than four in 10 (42 percent) businesses said they did not have a work remote option prior to the pandemic, while 29 percent said they do not plan to have one after the pandemic and seven percent are undecided. One-fifth of businesses plan to have a fully remote work option for some or all employees after the pandemic, compared with 13 percent during the pandemic.

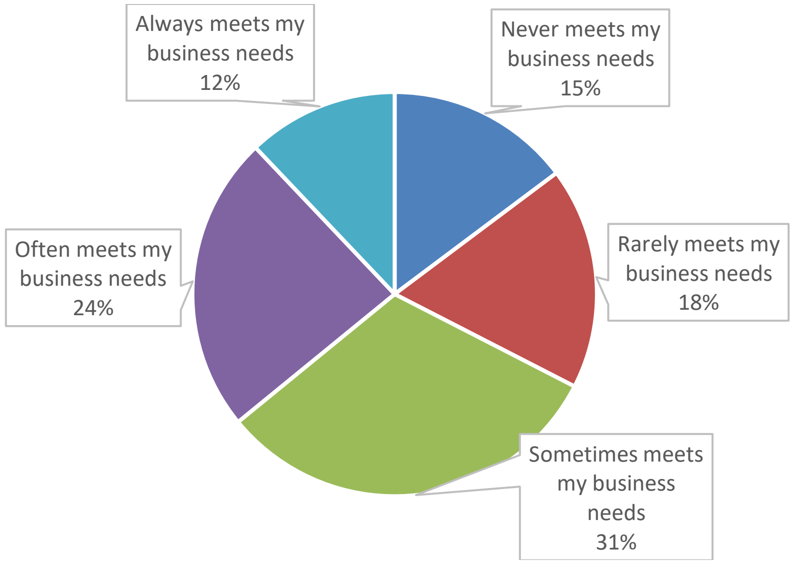
Figure 116: Remote-Work Policy Before and After Covid-19 Policy



Internet Issues During Pandemic

Businesses were asked how well their employees' internet connections meets their company's needs during the pandemic, along with the percentage of employees who have dealt with various issues due to inadequate broadband service.

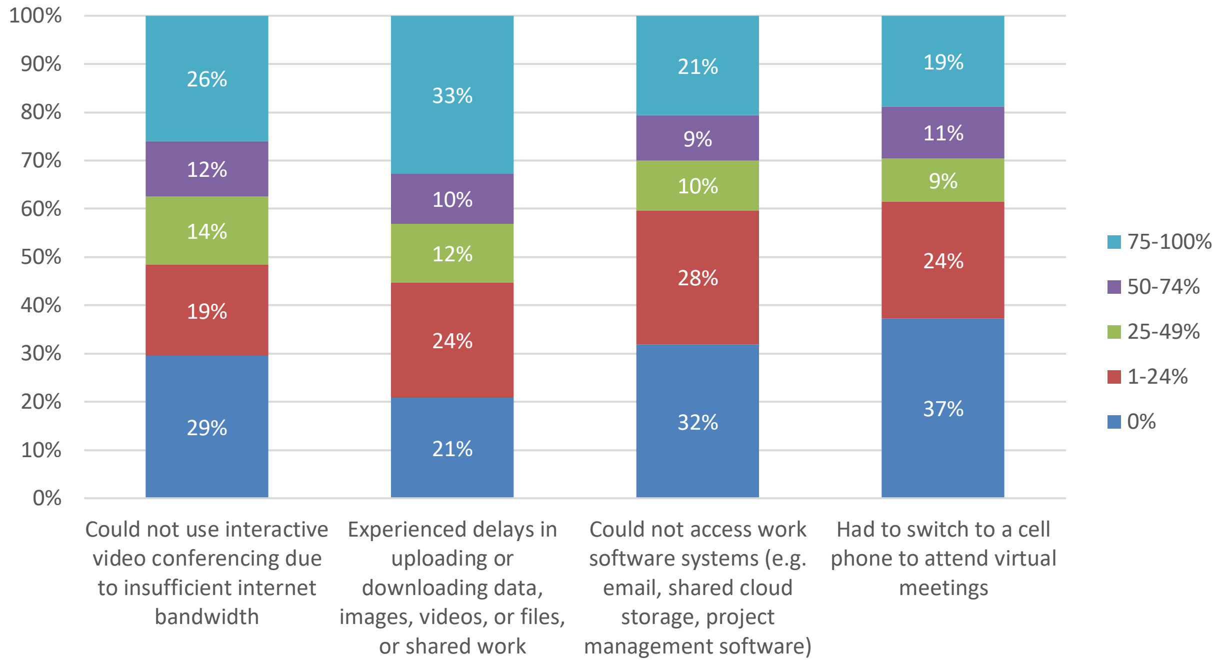
Figure 117: How Employees' Internet Connection Meets Company's Needs



More than one-third of businesses said their employees' internet connection always (12 percent) or often (24 percent) meets their needs. Another 31 percent said it sometimes meets their needs. Another one-third of businesses said their employees' internet connection rarely (18 percent) or never (15 percent) meets their needs.

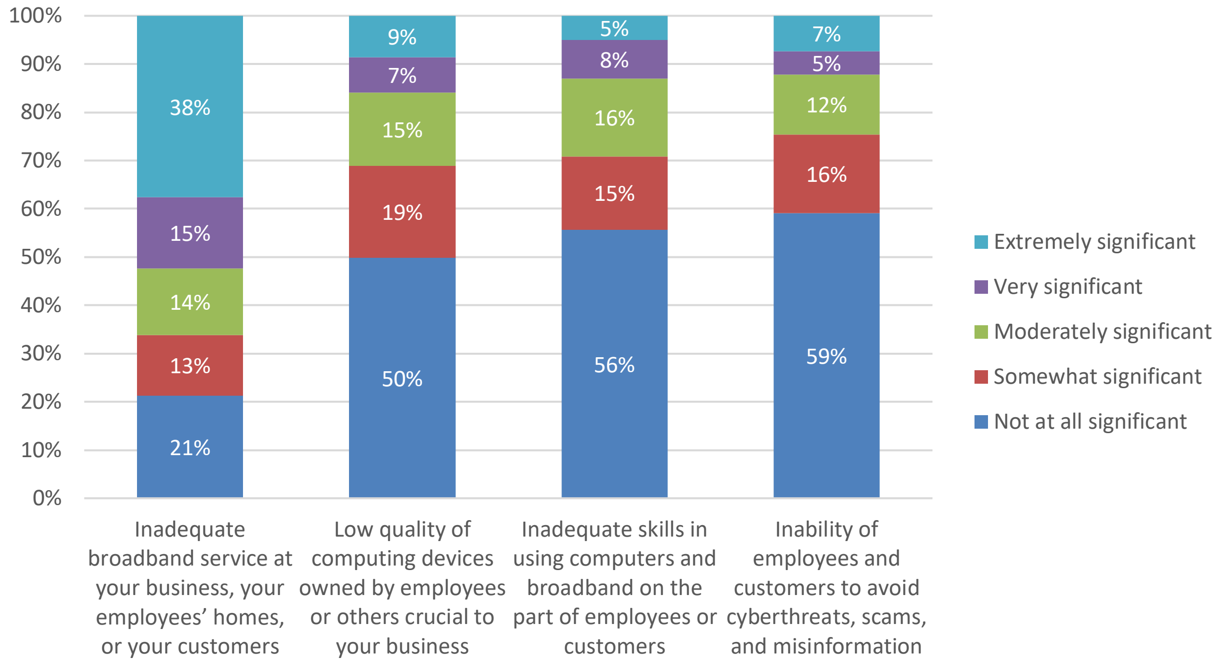
Additionally, a sizeable segment of businesses said that most or all of their employees (75 to 100 percent) experienced issues due to inadequate broadband service during the pandemic (see figure below). Specifically, one-third of businesses said that all or most of their employees experienced delays in uploading or downloading content. One-fourth of businesses said all or most employees could not use interactive video conferencing due to insufficient internet bandwidth. Also, one-fifth of businesses said all or most employees could not access work software systems or had to switch to a cell phone to attend virtual meetings.

Figure 118: Broadband Issues Experienced During the Pandemic



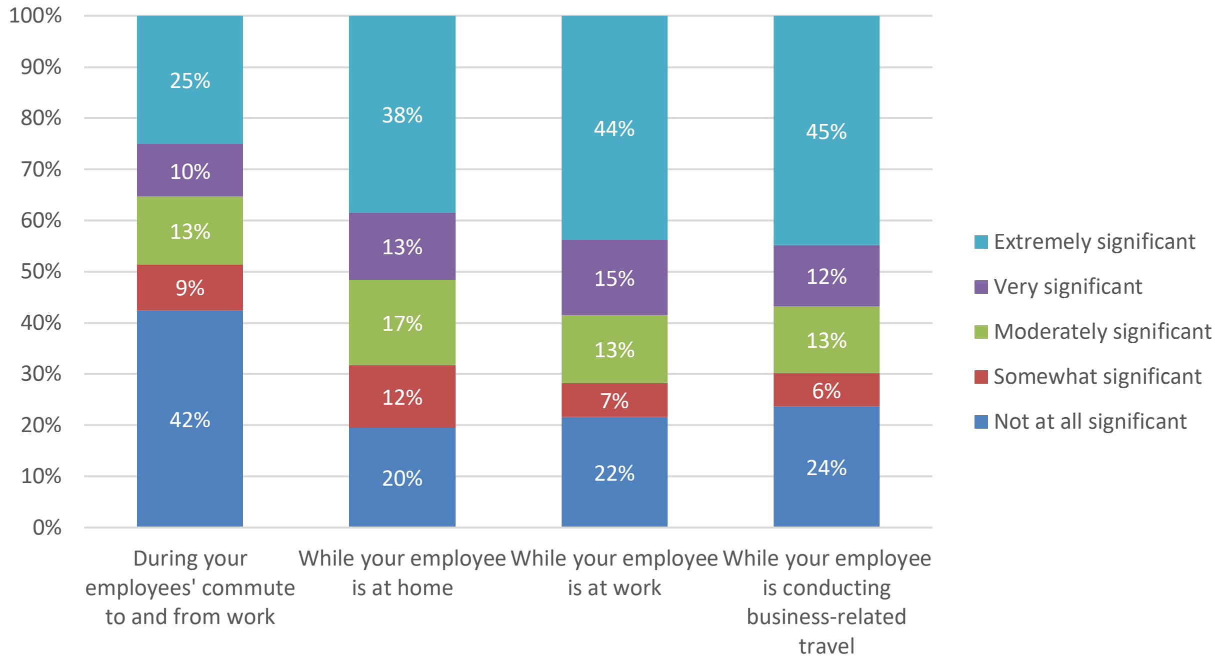
Respondents were also asked to evaluate the significance of problems employees experience with their use of broadband and computers (see the figure below). Overall, more than one-half of businesses said inadequate broadband service is a very significant or extremely significant issue. Just one-fifth said this issue is not at all significant. At the same time, more than one-half of businesses said that other issues are not at all significant.

Figure 119: Significance of Broadband and Computer Issues



As illustrated in the figure below, more than one-half of respondents said that cell phone issues with their employees at home (51 percent), at work (59 percent), or while conducting business-related travel (57 percent) are very to extremely significant situations. More than four in 10 (42 percent) said that cell phone issues during their employees' commute is not at all significant.

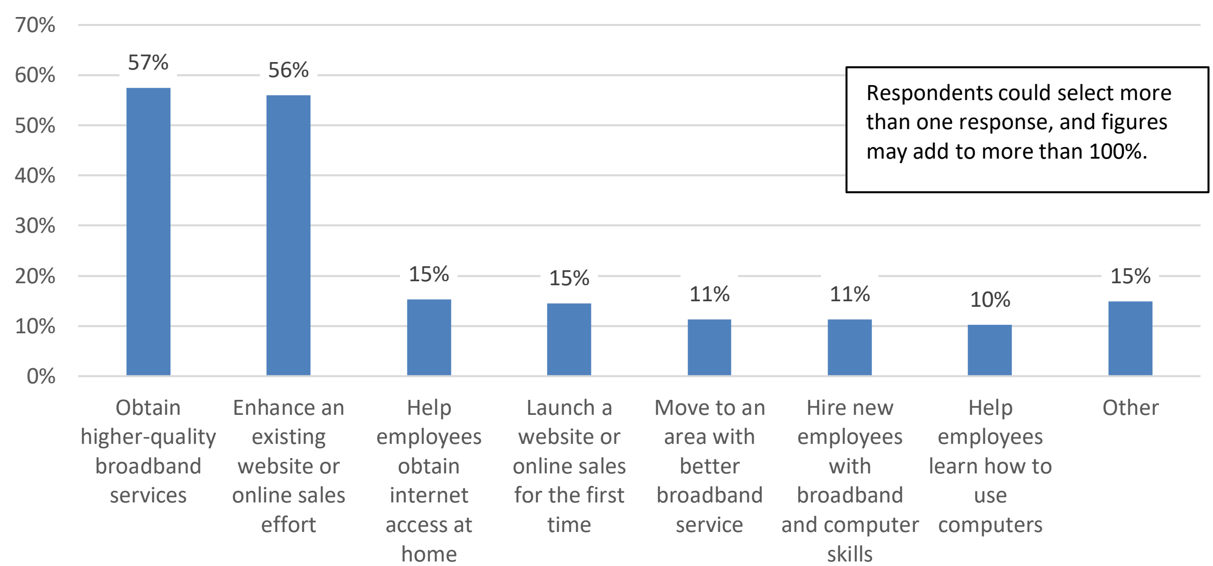
Figure 120: Significance of Cell Phone Issues



Future Actions Related to Computer and Internet Service

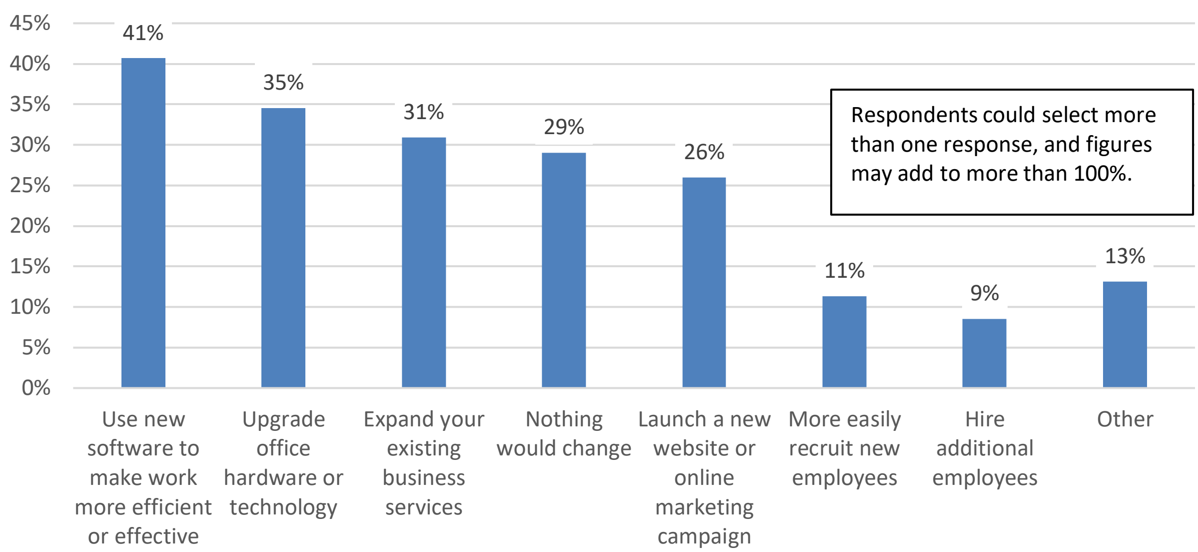
Most businesses expect to obtain higher-quality broadband service (57 percent) and to enhance an existing website or online sales effort (56 percent) in the next 12 months. Fewer respondents expect to take other actions; however, 15 percent plan to help employees obtain internet access at home and 11 percent plan to move to an area with better broadband service (see below).

Figure 121: Actions Will Take in Next 12 Months Regarding Broadband and Computers



Most businesses would make some changes in the next 12 months if they were able to get faster internet service; just 29 percent said they would make no changes (see figure below).

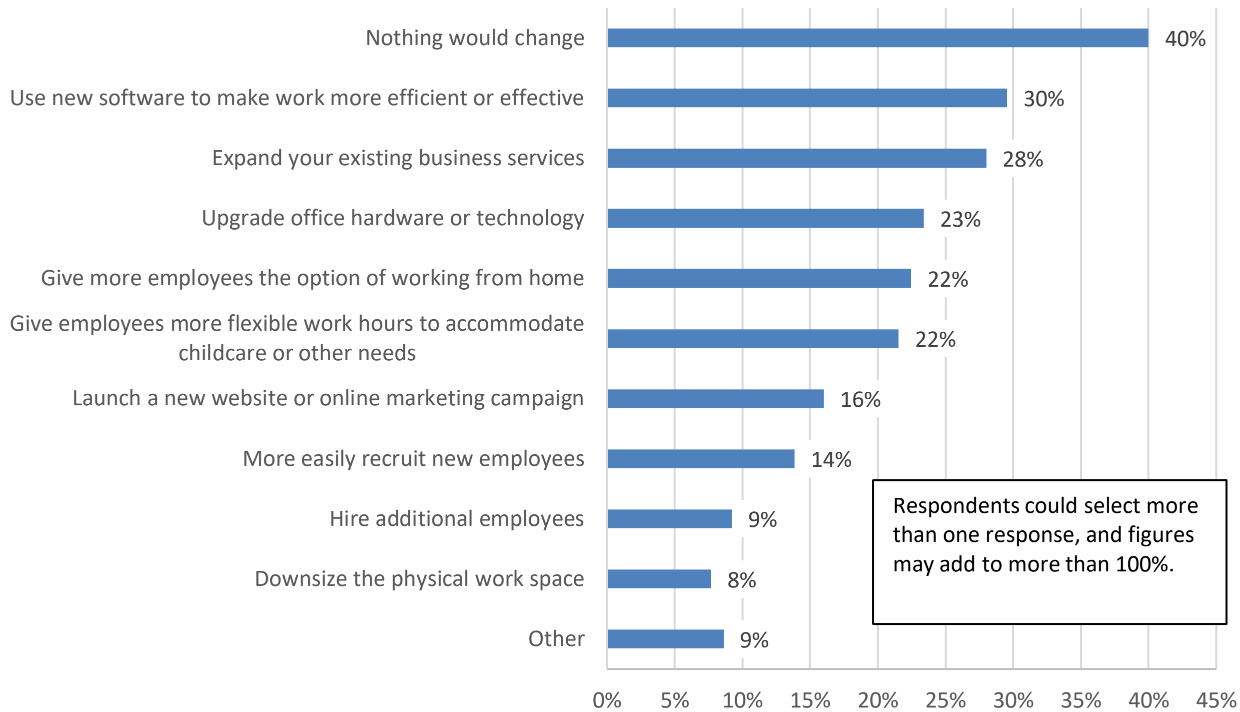
Figure 122: Actions Would Take in Next 12 Months If Able to Get Faster Internet



Four in 10 businesses would use new software to make work more efficient and effective, 35 percent would upgrade office hardware or technology, 31 percent would expand their existing businesses services, and 26 percent would launch a new website or online market campaign.

However, four in 10 businesses said nothing would change if their employees got faster internet service in their home (see figure below). Three in 10 would use new software to make work more efficient and effective, 28 percent would expand their existing business services, and 23 percent would upgrade office hardware or technology. More than one-fifth would give more employees the option of working from home (22 percent) or give employees more flexible work hours to accommodate childcare or other needs (22 percent).

Figure 123: Actions Would Take in Next 12 Months If Employees Got Faster Internet at Home



Appendix C: Phone Survey Results

Appendix C provides a crosstabs analysis from a telephone survey conducted November 11-November 16 2020 by Goodwin Simon Strategic Research (GSSR) among 411 Vermont adults living in residences identified as having slow internet connections. However, based on their reported service providers, it appears that 12 percent of these adults live in residences that have broadband-quality service. Please note that due to rounding, a sum may appear to be one point more or less than its parts.

Vermont residents say that having faster internet service would improve their ability to engage in various activities, including teleworking, using videoconferencing to communicate with friends and family, and to do schoolwork and engage in remote learning.

- Residents identify working from home/teleworking (71%), using videoconferencing to communicate with family and friends (69%), and engaging in remote learning (69%) as the top three activities that would be most improved by better internet service.

How much would having a faster internet connection improve your ability to do each of the following?	Would improve a great deal/fair amount
Working from home/telework	**71%**
Using videoconferencing to communicate with friends/family	69
Doing remote learning, schoolwork, or homework	69
Completing online tasks such as shopping, banking, or accessing government services	65
Speaking to a healthcare provider/ telehealth	60
Accessing information related to the pandemic, such as safety guidelines, current case numbers, and travel restrictions.	58
Finding work or job-seeking	52
Engaging in civic activities, such as town council or school board meetings	49

- Seven out of ten residents (71%) say that having faster internet service would increase their ability to telework either a great deal or fair amount.
    - Residents living in households without broadband service (77%) are significantly more likely than those having access to broadband service at home (54%) to say faster internet would improve their ability to telework by a great deal or fair amount.
    - Female residents in particular are more likely to say that having faster internet service would improve their ability to work from home either a great deal or fair amount (77%), while male respondents are significantly less likely to say so (64%).
    - Those making $100k or more are significantly more likely than residents living in household with lower income levels to say faster internet service would improve their ability to telework by a great deal or fair amount (88%).
    - There are also regional differences in terms of respondents saying faster internet service would improve their ability to work from home. For example, residents in the Northwest region (78%) are significantly more likely than residents in the Southcentral region (56%) to say a faster internet would increase their ability to work home from by a great deal or fair amount.
    - Residents who have been laid off because of the coronavirus pandemic are significantly more likely (84%) than those who have not lost their job or had their hours cut (67%) to say a faster internet would improve their ability to telework by a great deal or fair amount.
    - Those using the internet at home every day (75%) are less likely than residents doing so less often (41%) to say a faster home internet would improve their ability to telework either by a great deal or fair amount.
    - Respondents' likelihood to agree that faster internet would improve their ability to telework also depends on overall satisfaction with their home internet, with almost nine out of ten respondents (89%) who are very <u>un</u>satisfied with their home internet responding that a faster internet would increase their ability to telework by either a great deal or fair amount.
    - Residents living in households where more than one person may have to use the internet at the same time are more likely to agree that faster internet service would improve their ability to telework, with residents living in households where three people may have to access the internet at the same time (83%)—or four people or more (80%)—being particularly likely to agree with this statement.

- Videoconferencing is a popular tool to stay in touch with family and friends, particularly during times of social distancing. Not surprisingly then, nearly seven in ten (69%) of these Vermont residents say faster internet would improve their ability to do so by either a great deal or fair amount.
    - Those between the ages of 18 and 39 (79%), between 40 and 49 (75%), and 50 and 64 (74%) are significantly more likely than those 65 or older (58%) to say faster internet would improve their ability to stay in touch a great deal or fair amount.
    - Residents living in households with an income of $100k or more are more likely than any other income brackets (92%) to say better internet service would improve their ability to videoconference with family and friends.
    - Residents who were laid off during the COVID pandemic are also significantly more likely (83%) than those who had their hours cut (68%) and those who were neither laid off or had their hours cut (66%) to say faster internet service would improve their ability to engage in videoconferencing with family and friends by a great deal or fair amount.
    - Residents who say they are very concerned about COVID impacting their own health or the health of someone living in their household (74%) are significantly more likely than those who are less concerned (63%) to say that faster internet service would improve their ability to videoconference family and friends.
    - Residents living in underserved communities (77%) are significantly more likely than those living in served communities (67%) to say better internet service would improve their ability to videoconference with family and friends by a great deal or fair amount.
    - Those using the internet at home every day (71%) are significantly more likely to say faster internet service would improve their ability to do so than those using the internet at home less often (55%).
    - Residents who are unsatisfied with their home internet (84%) are significantly more likely to say a faster internet would improve their ability to videoconference family or friends.
    - Residents living in households where three (80%) or four people or more people (85%) may have to use the internet at the same time are more likely than residents living in households where only one (46%) or two people (68%) may have to use the internet at the same time to agree with this statement.
    - People living in households where someone is attending school or taking classes (80%) are significantly more likely than those living in households where no one

is attending school (64%) to say faster internet service would increase their ability for videoconferencing by a great deal or fair amount.

- Those paying between $40 and $80 for their home internet (73%) and those paying more than $80 (77%) are more likely than those paying $40 or less for their home internet service (57%) to say so.

- Sixty-nine percent of Vermont residents say that faster internet service would improve their ability to engage in remote learning and doing homework.
    - Again, those living in households with an income of $100k or more are significantly more likely (89%) than any other income brackets to say faster internet service would improve their ability to do schoolwork and engage in online learning.
    - Those living in the Northwest region (74%) and those living in the Central region (72%) are significantly more likely than those living in the Southcentral region (48%) to say better internet service would improve their ability to engage in online learning and doing schoolwork by a great deal or fair amount.
    - Residents who were laid off because of the COVID pandemic (80%) are significantly more likely than those who were not laid off or had their hours cut (65%) to say a faster internet would improve their ability to engage in online learning by a great deal or fair amount.
    - Those living in underserved communities (80%) are significantly more likely than those living in served communities (64%) to say faster internet would improve their ability to engage in online learning and doing schoolwork by a great deal or fair amount.
    - Residents using their home internet every day (71%) are significantly more likely than those using their home internet less often (52%) to say faster internet service would improve their ability to do schoolwork and engage in online learning by a great deal or fair amount.
    - Vermonters who are very unsatisfied with their home internet are significantly more likely (88%) than those with other levels of satisfaction to say better internet service would improve their ability to engage in online learning by a great deal or fair amount.
    - Residents living in households where three (81%) or four + people (83%) may have to be online at the same time are significantly more likely than those living in households where less people have to be online at the same time to say better internet service would significantly improve their ability to do schoolwork and engage in remote learning.

  - Vermonters living in households in which someone is attending school (83%) are significantly more likely to say faster internet service would improve their ability to engage in remote learning than those living in non-school households (55%). Residents living in households in which someone is attending high school (89%) or a college or vocational school (88%) are significantly more likely than those living in households where someone is attending Pre-k or middle school (76%) to say faster internet service would improve their ability to engage in remote learning by a great deal or fair amount.
  - Those paying $81 or more for their home internet service are significantly more likely (80%) than those paying $40 or less (57%) to say faster internet service would improve their ability to engage in online learning by a great deal or fair amount.

2.

Internet Usage by Various Locations

- Eighty-five percent of Vermont residents say they have been using the internet at home every day since the COVID-19 pandemic began in March, while 15% have been using the internet less frequently at home. Four percent say they have never used internet at home during the COVID crisis.
  - There are significant differences across age groups: Those between the ages of 18 and 39 (91%) are significantly more likely than those aged 65 and older (79%) to use internet at home on a daily basis, and those between the ages of 40 and 49 (96%) are more likely than those between 50 and 64 (86%) and those who are 65+ to say they use the internet on a daily basis. Considering both gender and age, women between the ages of 18 and 64 (93%) are more likely than any other subgroup in this category to say they use the internet at home every day.
  - The number of respondents who say they use the internet at home every day increases by income level, with those reporting a household income of $100k or more (98%) being significantly more likely to use the internet at home every day than any other income bracket, and those reporting a household income of $35k or less being the least likely (72%). In addition, those making $35k or less are significantly more likely (11%) than those in the income brackets of $50-75k (2%), $75-100k (1%), and those making 100k+ (2%) to say they never use the internet at home.
  - There are also regional differences when it comes to respondents' internet use at home, with Vermont residents living in the Northwest region (91%) being significantly more likely to report daily internet use than those in the Central region (82%). Those living in the Northeast region (8%) are significantly more

likely than those living in the Northwest region (1%) to report they never use the internet at home.

  - Respondents living in households where four or more people may have to be online at the same time are significantly more likely to report they use the internet at home every day (99%) compared to households where fewer people have to use the internet at the same time. For example, in households where only one person needs access to the internet, this number drops to 67%.
  - Residents living in households where someone is going to school are more likely (96%) than households where no one is attending school to say they use the internet at home every day (80%).
  - Those who report working from home during the COVID pandemic (95%) are more likely than those working outside the home (84%) or those not currently working (74%) to report using their home internet on a daily basis. Similarly, residents who report they frequently telework during the COVID pandemic (95%) are more likely than those who report they rarely or never telework (74%) to say they use their home internet on a daily basis.
  - Respondents who say they use their home internet very or somewhat often to do schoolwork or homework (98%) are also more likely to use their home internet on a daily basis compared to those engaging in these activities less often (70%).
  - Vermont residents with broadband internet service at home are less likely (81%) than those with no broadband service (91%) to use internet at home every day.
  - Those aware of a WIFI hotspot near their home (90%) are more likely than those who are not aware (82%) of a hotspot to report using the internet at home every day.
- While 85 percent of Vermont residents say they have been using the internet at home every day since the pandemic began, fewer residents use the internet at work (38%), at the home of a family member or friend (9%), inside a school, college or university (7%), or at other locations on a daily basis.
- While very few respondents (2%) say they use the internet inside of coffee shops, restaurants or other private businesses on a daily basis, 25 percent have used the internet inside of private businesses at least a few times since the pandemic began.
  - Those between the ages of 18 and 39 (11%) and those between 40 and 49 (9%) are more likely than those 65+ to say they use the internet inside of private businesses at least a few times a week. Considering the intersections of age and gender, women between the ages of 18 and 64 are more likely (6%) than men

who are 65+ (1%) to say they do so at least a few times a week. Men between the ages of 18 and 64 are also more likely to do so (10%) than both women 65+ (3%) and men in that age group.

  - Those who had their work hours reduced during the pandemic are significantly more likely (13%) than those saying they are not working during the pandemic (4%) to report using the internet inside a private business at least a few times a week.
  - Those less concerned about the impacts that COVID may have on their own health or the health of someone living in their household (9%) are more likely to report using the internet inside of a private business at least a few times a week compared to those more concerned about negative health impacts (3%).
  - Respondents saying they work from home during the COVID pandemic (7%) and those working from outside the home (9%) are more likely than those currently not working (1%) to say they are using internet inside a private business at least a few times a week.
  - Respondents who do not have broadband service at home are more likely to say they never use the internet inside a private business (73%) compared to those with broadband service at home (60%). Further, respondents who pay $40 or less for their internet at home are significantly more likely to say they never access the internet inside a private business (77%) compared to those who pay more.

- Some respondents further report they access the internet outside of coffeeshops, restaurants and other private businesses including parking lots at least a few times (26%). These numbers vary across subgroups.
  - For example, those between the ages of 18 and 39 (17%) are significantly more likely than those aged 65 and older (3%) to say they use the internet outside of a private business at least a few times a week.
  - Respondents with a household income ranging from $35-50k (27%) and $50-75k (33%) are more likely than other income groups to say they use the internet outside of private businesses at least a few times.
  - In terms of regional differences, those living in the Southcentral region (86%) are significantly more likely to say they never use the internet outside of a private business as compared to those living in the Central or Northeast region (70% respectively).

- Residents who have not experienced job loss or had their hours reduced are significantly more likely (77%) than those who have had their hours cut (58%) to report never using the internet outside a private business.
- Those using the internet at home every day are significantly more likely (7%) than those who do not use the internet at home every day (2%) to report they use the internet outside of private businesses a few times a month.
- Those working from home (8%) and those working outside the home (10%) are also more likely to report using the internet outside of private businesses a few times a week than those not working during the pandemic (2%).
- Respondents saying they often telework (10%) are more likely than those not teleworking (4%) to say they use the internet outside of private businesses at least a few times a week. The same is true for those who often use the internet to engage in videoconferencing with family and friends (9%) compared to those who do so less frequently (4%).
- School households are significantly more likely to report using internet outside of private businesses a few times a week (12%) than non-school households (4%).
- Residents living in households in which two or more people may have to use the internet at the same time are more likely than households in which only one person has to access the internet to say they use the internet outside of a private business a few times a month or more, though the difference is not statistically significant. Households in which only one person has to access the internet are also significantly more likely (85%) than those in which two (72%), three (71%), or four or more (71%) people may have to use the internet at the same time to say they never use the internet outside of a public business.

3.

Satisfaction with Internet at Different Locations

- Vermont residents are more satisfied with their internet at work (76%), inside of coffeeshops and other private businesses (74%), and inside of schools, colleges/universities (71%) than at other locations.
  - Satisfaction rates differ across subgroups. For example, those reporting they do not use the internet at home on a daily basis (93%) are more likely to say they are satisfied with the internet at work than those using the internet at home every day (75%).
- Vermonters' satisfaction rates with home internet are lower than for all other locations. Just fifty-eight percent of Vermont residents say they are either very satisfied (24%) or

somewhat satisfied (34%) with their home internet, while 41% report either being somewhat unsatisfied (19%) or very unsatisfied (22%).

- Satisfaction rates for home internet differ across age groups, with those between the ages of 50 and 64 (61%) and those 65+ (65%) showing higher satisfaction rates than other age groups, particularly those between the ages of 40 and 49 (40%).
- While 75% of those living in households with an income of less than $35k report being either very or somewhat satisfied with their home internet, satisfaction levels drop with higher incomes, with those living in households with an income of $100k or more being the least satisfied (9% very satisfied and 30% somewhat satisfied).
- Across geographic regions, those living in Northeast (65%) are significantly more likely than those living in the Southern region (45%) to report being satisfied with their home internet.
- Those using home internet every day (25% very satisfied and 30% somewhat satisfied, respectively) are significantly less satisfied than those who do not use their internet service every day (22% very satisfied and 60% somewhat satisfied).
- Satisfaction rates significantly drop for households in which more than one person may have to use the internet at the same time. For example, while 81% of households where only one person has to use the internet say they are either very or somewhat satisfied with their home internet, fewer residents living in households in which four or more people may have to access the internet at the same time report being very (10%) or somewhat satisfied (30%).
- School households (13% very satisfied and 29% somewhat satisfied) are less satisfied with their home internet than households without someone attending school (30% very satisfied and 36% somewhat satisfied).
- Satisfaction rates also differ significantly for respondents working from home during the COVID pandemic, with those working from home being less satisfied (31% very unsatisfied and 20% somewhat unsatisfied) compared to those working outside the home (19% very unsatisfied and 25% very unsatisfied), and those who have not been working during the pandemic (17% very unsatisfied and 13% somewhat unsatisfied).
- Similarly, those who use their home internet more often for teleworking are less satisfied (21% very satisfied and 30% somewhat satisfied) compared to those who telework less often (27% very satisfied and 36% somewhat satisfied).

- Satisfaction rates are also higher for those living in households where household members rarely or never have to use the internet to do home- or schoolwork (20% very satisfied and 50% somewhat satisfied) compared to households where the internet is used for this purpose more frequently (13% very satisfied and 26% somewhat satisfied).
- Respondents paying $40 or less for their home internet service are less likely (14%) than those who pay more for their internet service to say they are very unsatisfied with their internet at home.

4.

Internet use Before and During the Pandemic

- COVID has impacted the frequency with which Vermonters use the internet to engage in certain activities, including doing schoolwork or homework online (61% pre-COVID and 91% during COVID), attending classes online (42% before COVID and 90% percent during COVID), using videoconferencing to communicate with family and friends (38% before COVID and 57% during COVID), and teleworking from home (33% before COVID pandemic and 52% during pandemic).
- Seventeen percent of residents used the internet very or somewhat often to speak to a healthcare provider prior to the pandemic, but those engaged in telehealth surged to 37 percent during the pandemic. Increases in telehealth usage is seen across nearly every subgroup, but is especially pronounced among younger residents. For example, 17 percent of residents ages 18 to 39 used telehealth before COVID, while 48 percent report using telehealth during the pandemic. By comparison. 20percent of residents ages 65 and older report using telehealth before COVID, while 28 percent report using telehealth now.

Using Home Internet to Engage in Various Activities During the Pandemic

- Vermont residents report different satisfaction levels for the types of activities they use their home internet for. Residents are most likely to say their home internet access has been adequate for accessing information related to the pandemic, including safety guidelines and current case numbers (81%), followed by online shopping (80%), and accessing social media (76%). Respondents were least likely to agree that their home internet has been adequate for attending school online (26%), followed by working from home (38%), and telehealth such as attending doctor’s appointments and other healthcare needs (56%).

- More than half of respondents living in households where someone attends school online believe their home internet is adequate for attending school online, and this perspective varies across subgroups.
    - Those making between $75-100k are more likely (29% strongly agree and 38% somewhat agree) than any other income group to respond that their internet is adequate for attending school online, with the most significant difference in contrast to those in the $100k income bracket (16% strongly agree and 25% somewhat agree).
    - Respondents living in underserved communities are more likely than those in served communities to disagree their home internet is adequate for this purpose (24% somewhat disagree and 39% strongly disagree for underserved communities, 16% somewhat disagree and 19% strongly disagree for served communities).
    - Overall satisfaction rates with home internet align with respondents' satisfaction with home internet for online schooling purposes, with those saying they are unsatisfied with their home internet also being more likely to disagree their home internet is adequate for online schooling needs (18% somewhat disagree and 60% strongly disagree).
    - School households are less likely to agree that their home internet is adequate for online schooling (22% somewhat disagree and 24% strongly disagree) than those who do not live in a household where someone attends school (9% somewhat disagree and 27% strongly disagree).
- Nearly six out of ten respondents who use the internet to work from home say their home internet has been adequate for this purpose.
    - Women (19% somewhat disagree and 26% strongly disagree) are less likely than men (11% somewhat disagree and 19% strongly disagree) to say their home internet is adequate for working from home.
    - Those making $100k or more are more likely than any other income group to disagree (26% somewhat disagree and 33% strongly disagree) that their home internet is adequate for working from home.
    - Those in the Southern region (30% somewhat and strongly disagree, respectively) are more likely than those living in other regions to say their home internet is not adequate for working from home. The difference is particularly stark compared to those living in the Northeast region (8% somewhat disagree and 18% strongly disagree) and Northwest region (17% somewhat and strongly disagree, respectively).

- Respondents using their home internet daily are less likely to say it is adequate for working from home (16% somewhat disagree and 24% strongly disagree), compared to those doing so less often (6% somewhat or strongly disagree, respectively).
- Respondents living in households where only one person has to be online at the same time are more likely (41% strongly or somewhat agree, respectively) than households where more people have to access the internet at the same time to say their home internet is adequate for this purpose.
- Households in which at least one person is attending school (21% somewhat disagree and 28% strongly disagree) are less likely than non-school households (10% somewhat disagree and 19% strongly disagree) to say that their internet is adequate for working from home.
- Respondents with broadband service at home (45% strongly agree and 34% somewhat agree) are significantly more likely to say their home internet is sufficient for working from home than those without broadband service (22% strongly agree and 33% somewhat agree). In fact, having broadband service is highly correlated with being able to adequately engage in large number of important activities during the pandemic. For example, two thirds (67%) of those with broadband strongly agree that their home internet has been adequate for accessing information related to the pandemic, compared to barely half (51%) among residents with non-broadband providers. In addition, relatively few residents overall say their home internet has been adequate for attending school online, but the proportion strongly agreeing with that statement is far higher among those with broadband providers (33%) than those without (19%).

- **Percent Strongly Agreeing with Statements about Using Home Internet**

	Broadband	Non-Broadband
My home internet has been adequate for accessing information related to the pandemic, such as safety guidelines, current case numbers, and travel restrictions	67%	51%
My home internet has been adequate for social media-such as using Facebook, Instagram and Twitter	59	42
My home internet has been adequate for shopping-such as ordering food, clothing and other items	57	48

My home internet has been adequate for my finances-such as paying bills and taxes	56	47
My home internet has been adequate for telehealth-such as for doctor's appointments and other health care needs	45	38
My home internet has been adequate for working from home	45	22
My home internet has been adequate for entertainment-such as playing games, streaming music, television shows, and movies	33	30
My home internet has been adequate for attending school online	32	19

Conclusion

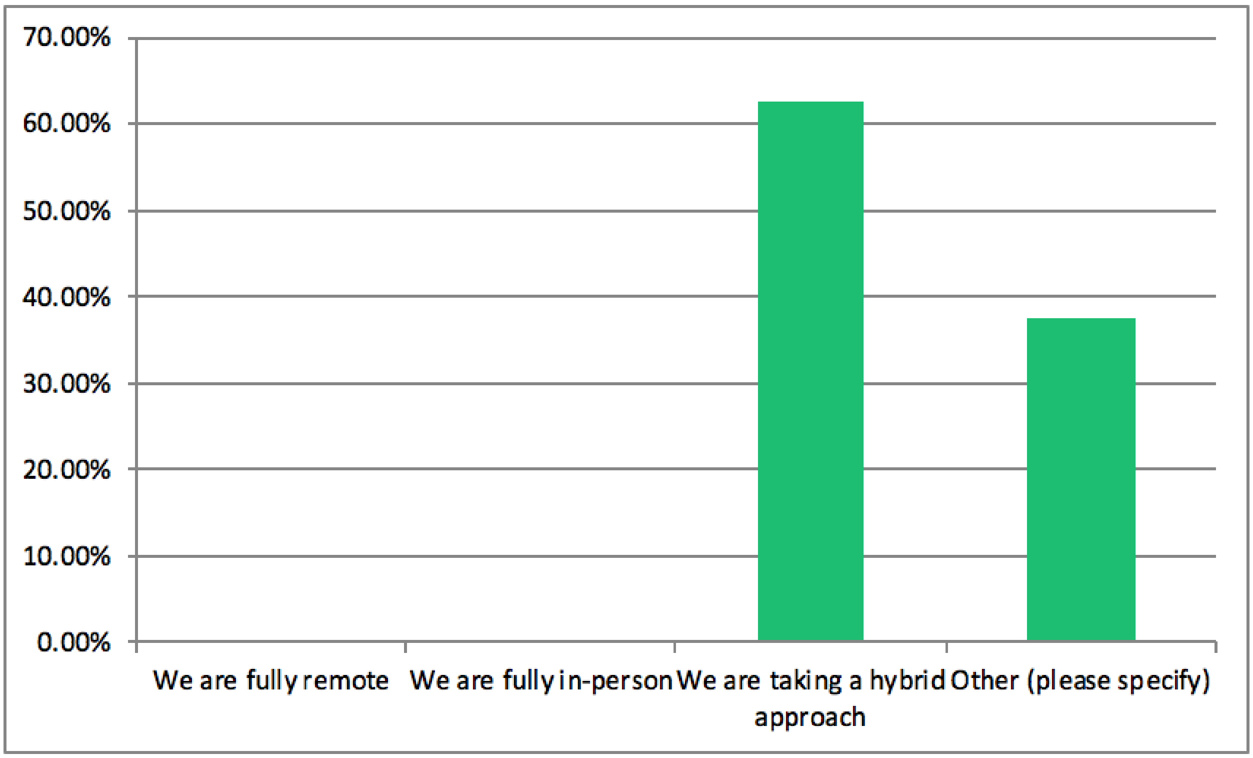
5. Taken collectively, these findings demonstrate the challenges of having slower internet speeds—especially during a global pandemic where people are isolated and/or trying to telework or engage in remote learning. Importantly, many residents say that having faster internet service would improve their ability to engage in many vital activities, including teleworking, using videoconferencing to communicate with friends and family, and to do schoolwork and engage in remote learning. Not surprisingly then, the vast majority of residents say they would be likely to sign up for faster internet if the cost was comparable to what they currently pay (82%), or if the cost were subsidized by the state of Vermont (76%). Notably, nearly half (42%) would be likely to sign up for faster internet even if the cost was higher than what they currently pay. The proportion likely to sign up even with higher costs is significantly higher among younger residents under age 50 (62%), and among higher income household (48% for $75k to $100k; 56% for $100k and higher). These results underscore the importance of high-speed internet, and the many ways having it could improve people's everyday lives.

Appendix D: Superintendent Survey Results

This survey was sent to superintendents of school districts across the State of Vermont. Thirty-two superintendents responded.

4. What is your current back-to-school approach that your school district has taken as a result of the Covid-19 pandemic?

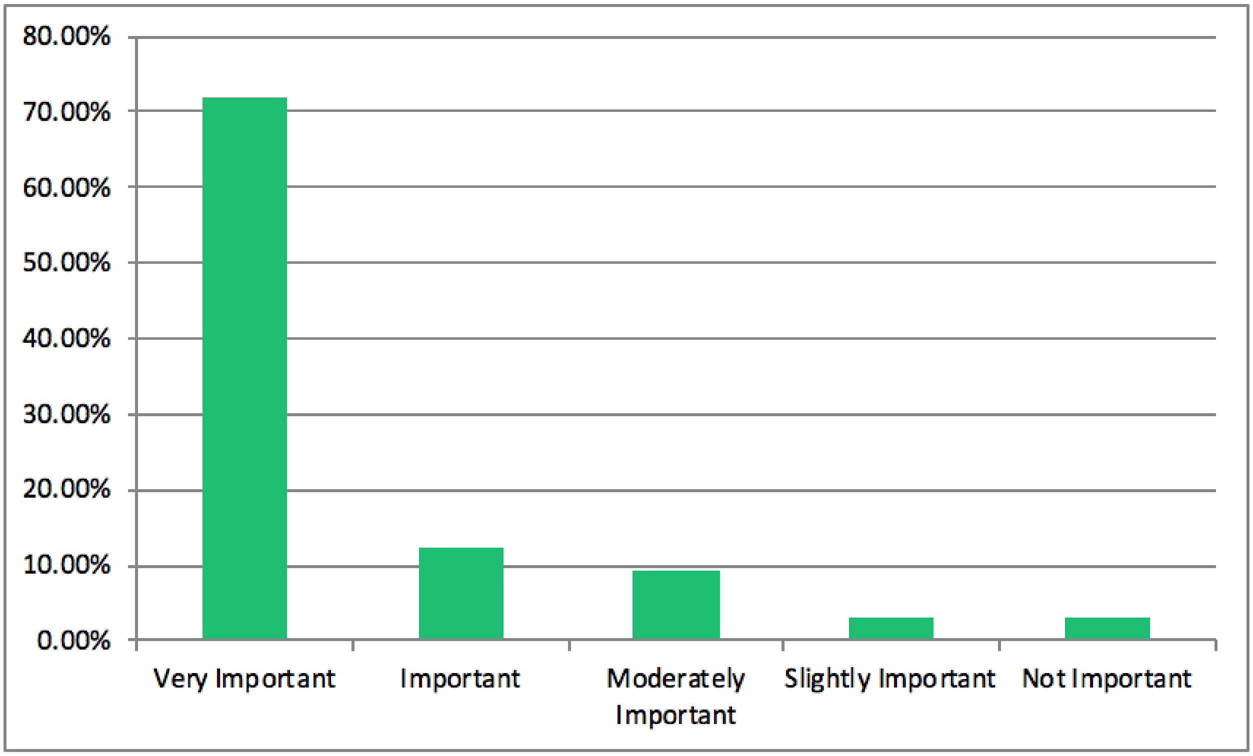
Answered: 32 Skipped: 4



Most respondents who selected "other" stated that their high schools were taking a hybrid approach, and their K-8 students were attending school fully in-person.

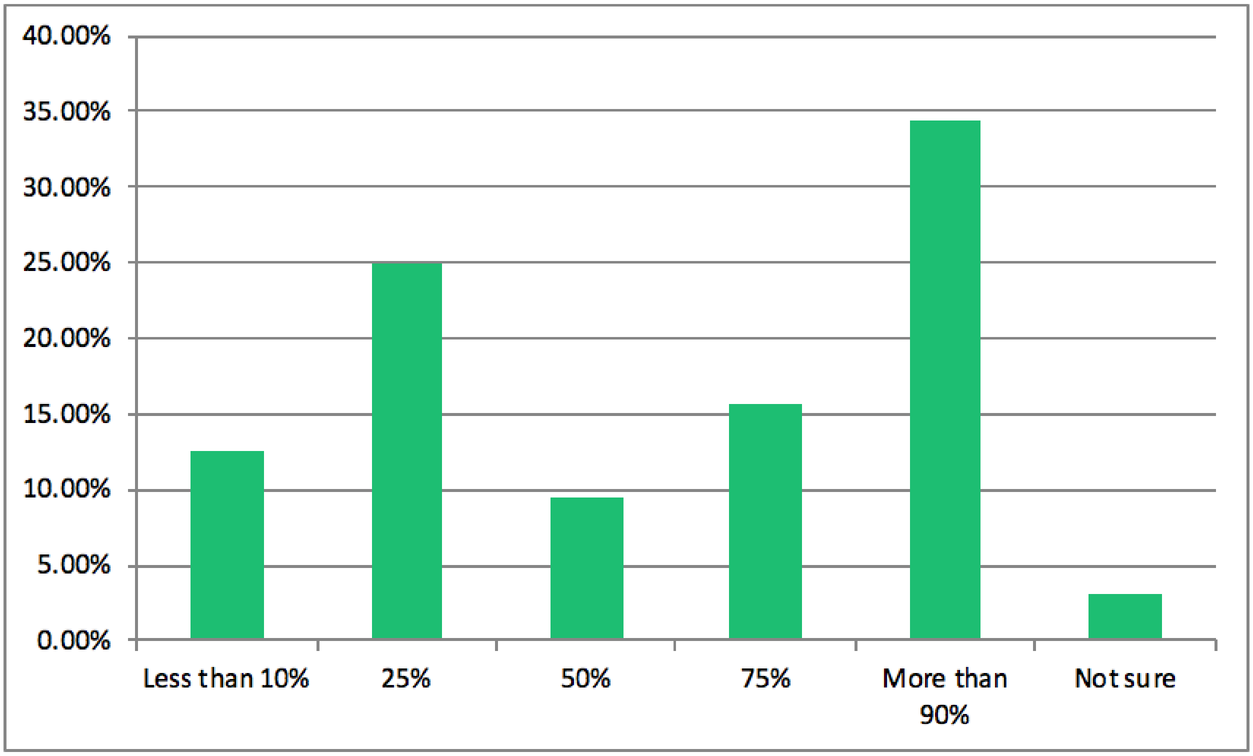
6. How important was your students' and teachers' ability to connect to the internet at home in determining your back-to-school approach to the 2020-2021 school year?

Answered: 32 Skipped: 4



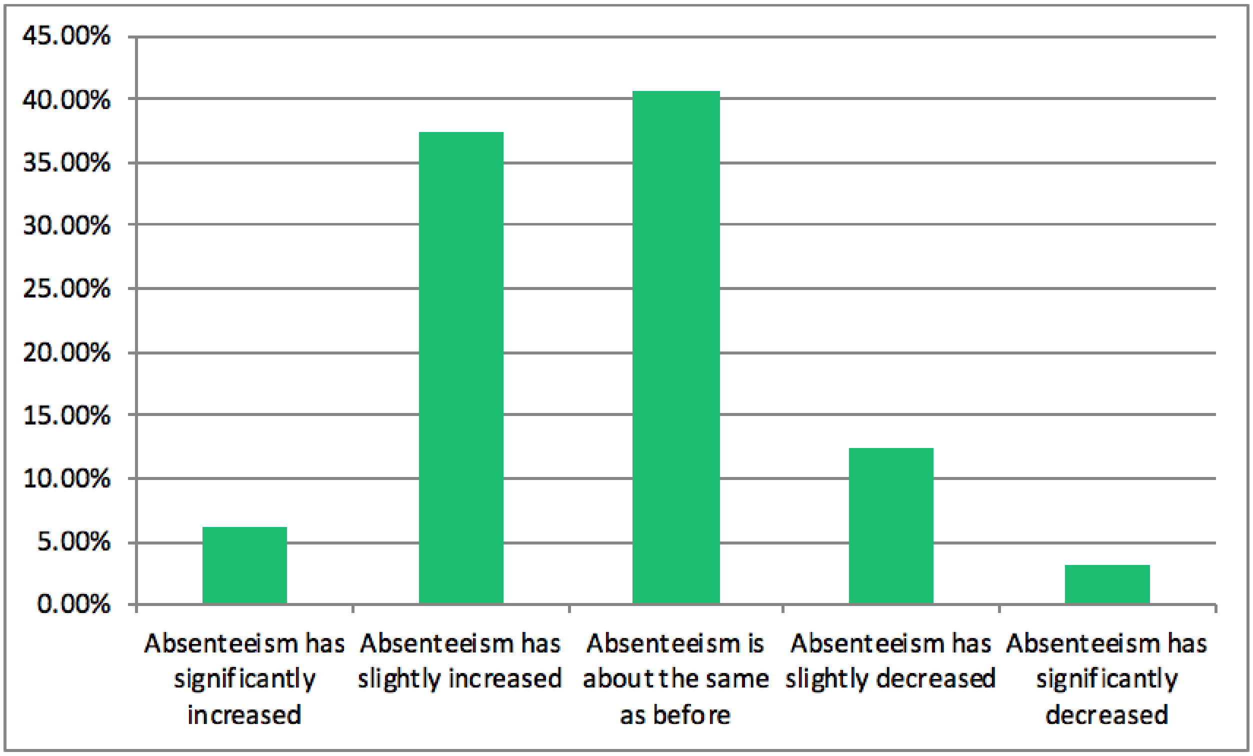
7. What percentage of students are receiving some amount of online instruction within your school district?

Answered: 32 Skipped: 4



8. For students attending school remotely during the Covid-19 pandemic, has there been an increase or decrease in absenteeism (compared to a typical semester)?

Answered: 32 Skipped: 4



9. On a scale from 1 to 5, please rate the following items and their impact on students' inability to participate in remote learning from home.

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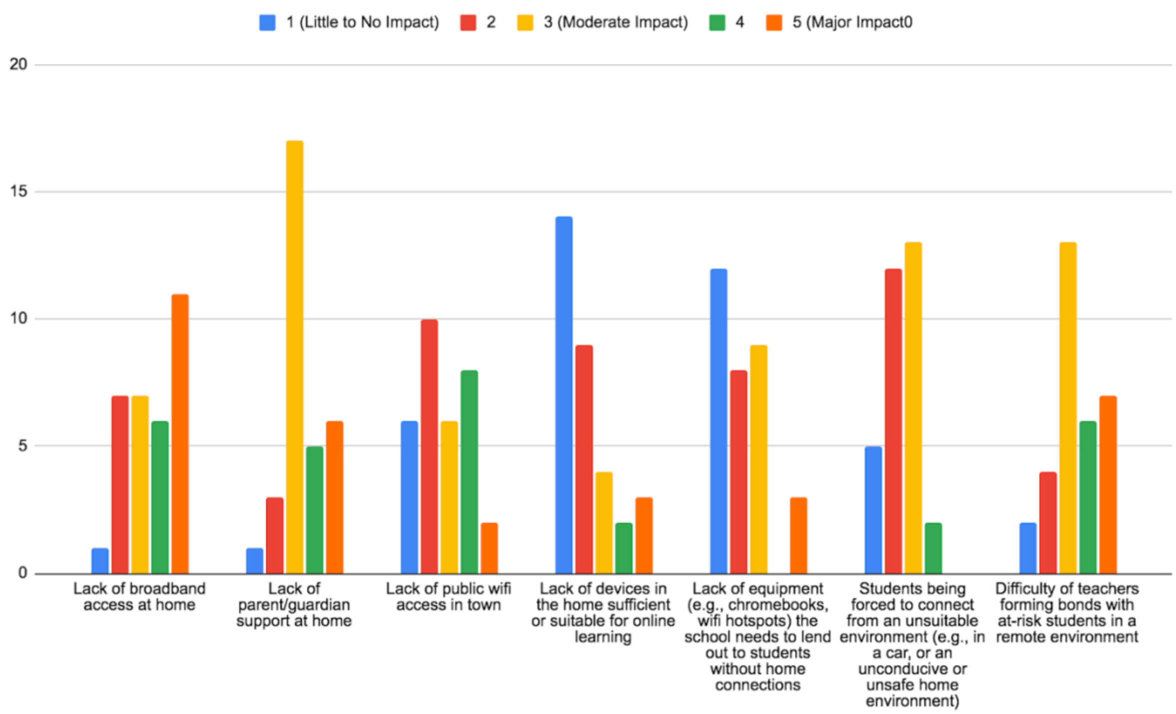
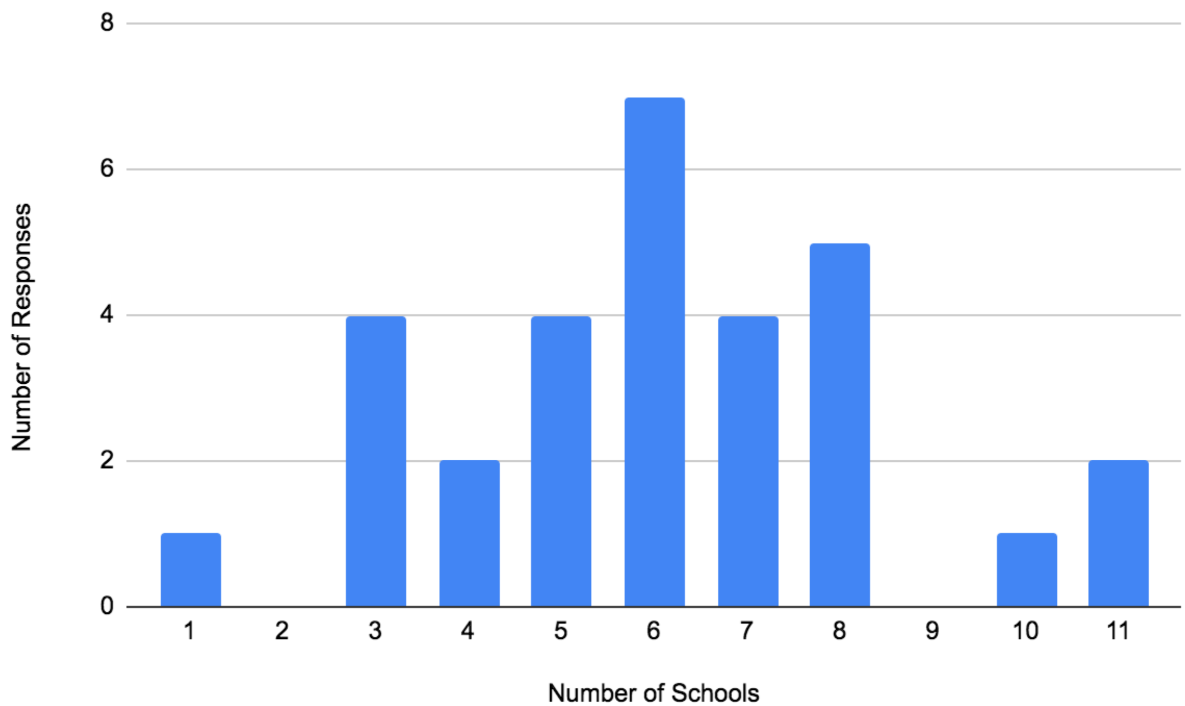


10. How many individual schools are there in your district?

Answered: 32 Skipped: 4



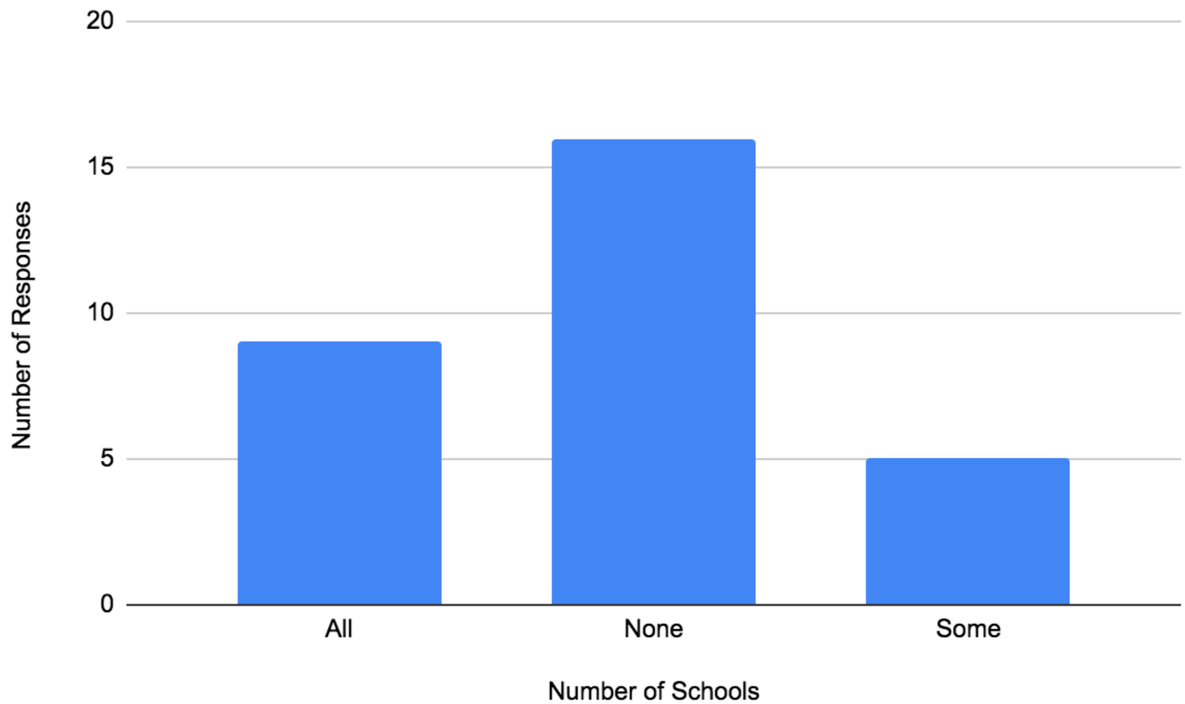
11. DURING the Covid-19 pandemic, how many of the schools in your school district offer Wi-Fi in the building to students?

Answered: 32 Skipped: 4

Every respondent answered this question stating that 100 percent of their schools offer Wi-Fi in the building to their students.

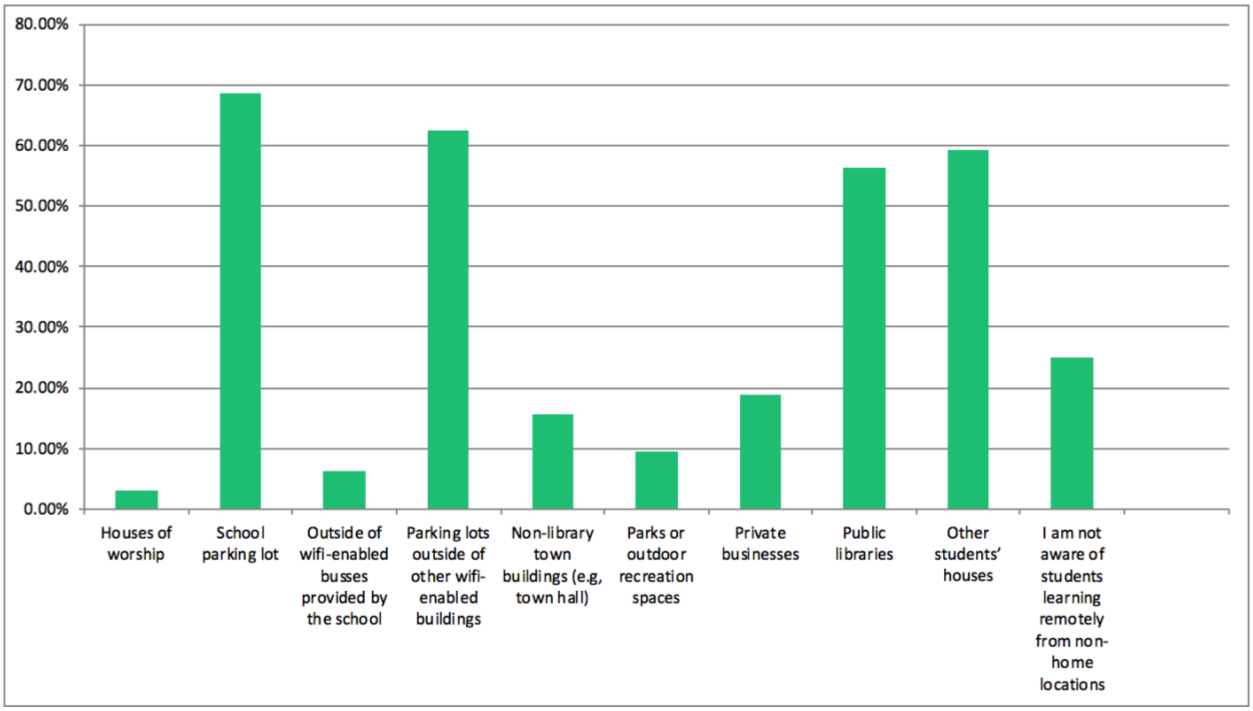
12. How many schools offer expanded hours before and after school to provide students a location with good internet access to do homework?

Answered: 32 Skipped: 4



13. During Covid-19, outside of Wi-Fi available inside school buildings, where are students learning remotely going to access public Wi-Fi (including from parking lots outside these locations). Select all that apply.

Answered: 32 Skipped: 4



14. Since the start of the Covid-19 pandemic, has your district added equipment to extend or strengthen Wi-Fi signals at school facilities?

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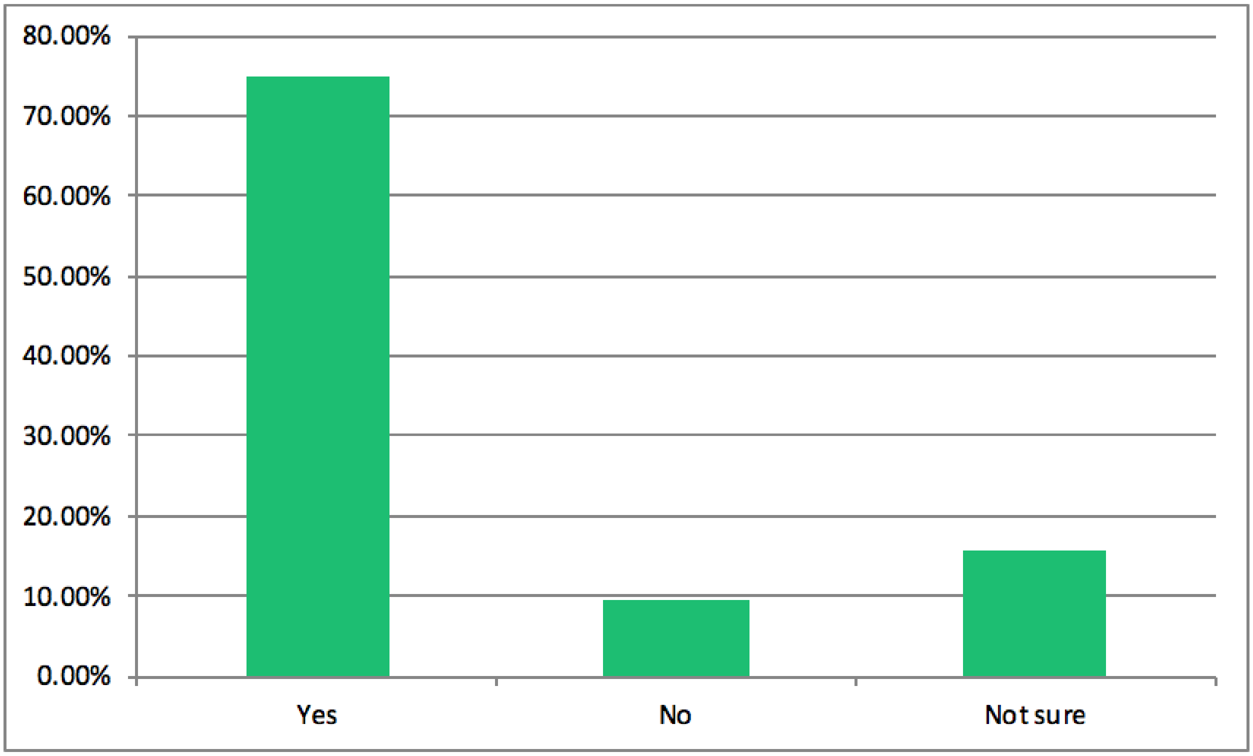
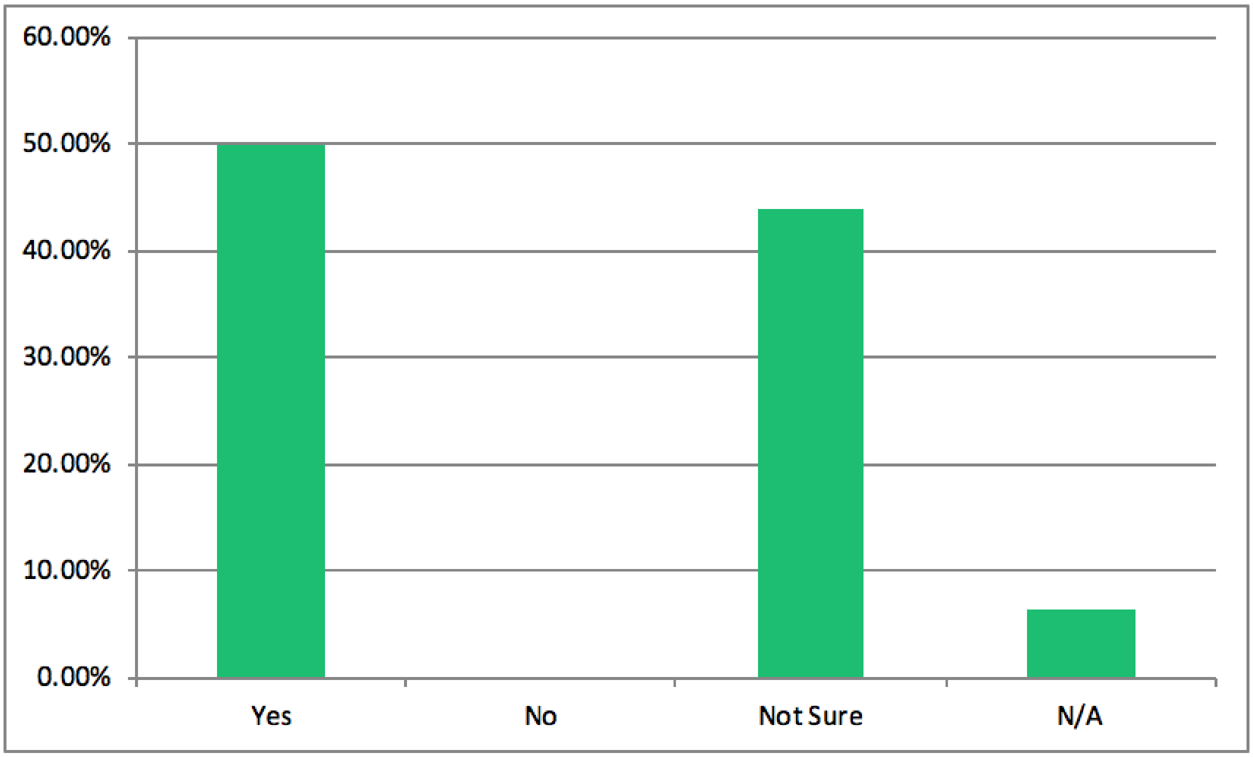


15. If the area around your schools has limited broadband or cell service access, would you be willing to participate in a program to install equipment at the library to provide better cell service or broadband to surrounding homes?

Answered: 32 Skipped: 4



16. Does your school district provide equipment for students to connect to the internet for remote learning? (e.g., portable Wi-Fi hotspots)

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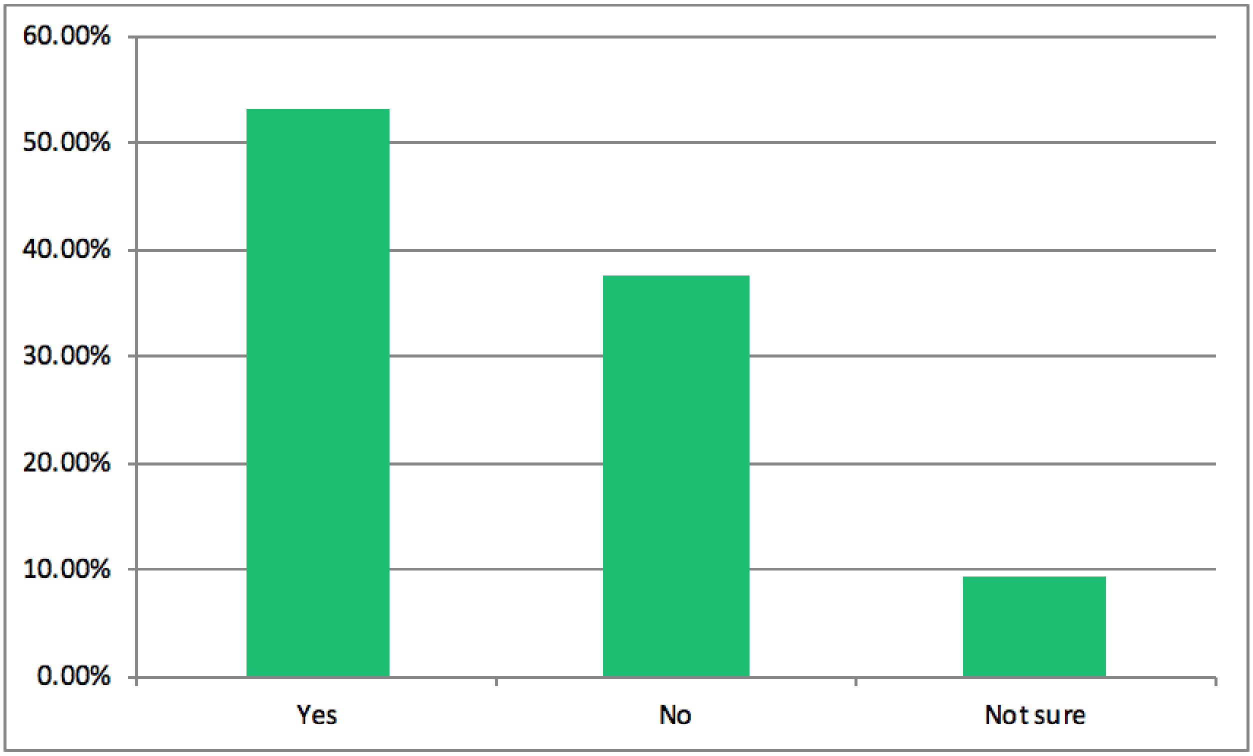
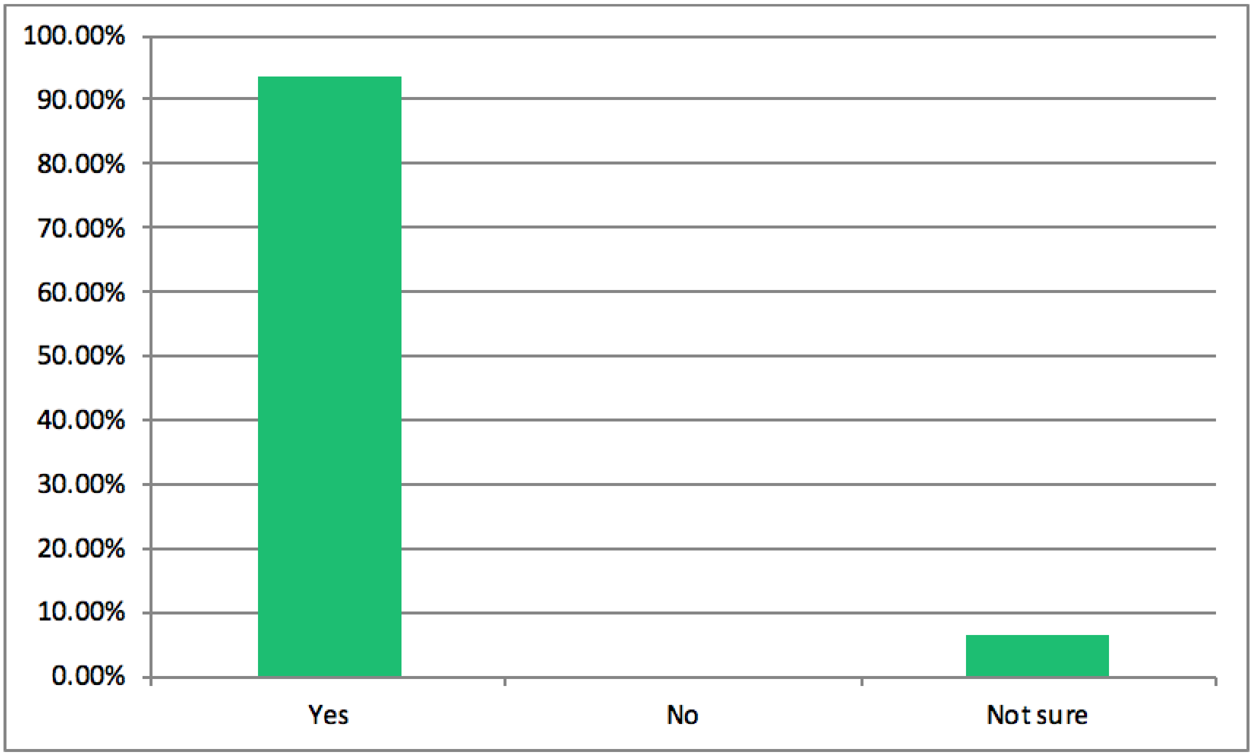


17. Does your school district provide other equipment for students to use for remote learning? (e.g., Chromebooks, earphones, etc.)

Answered: 32 Skipped: 4



18. Does your school district participate in a subsidy program or promote a program with an Internet Service Provider to bring low-cost internet to low-income families (e.g., Comcast Essentials)?

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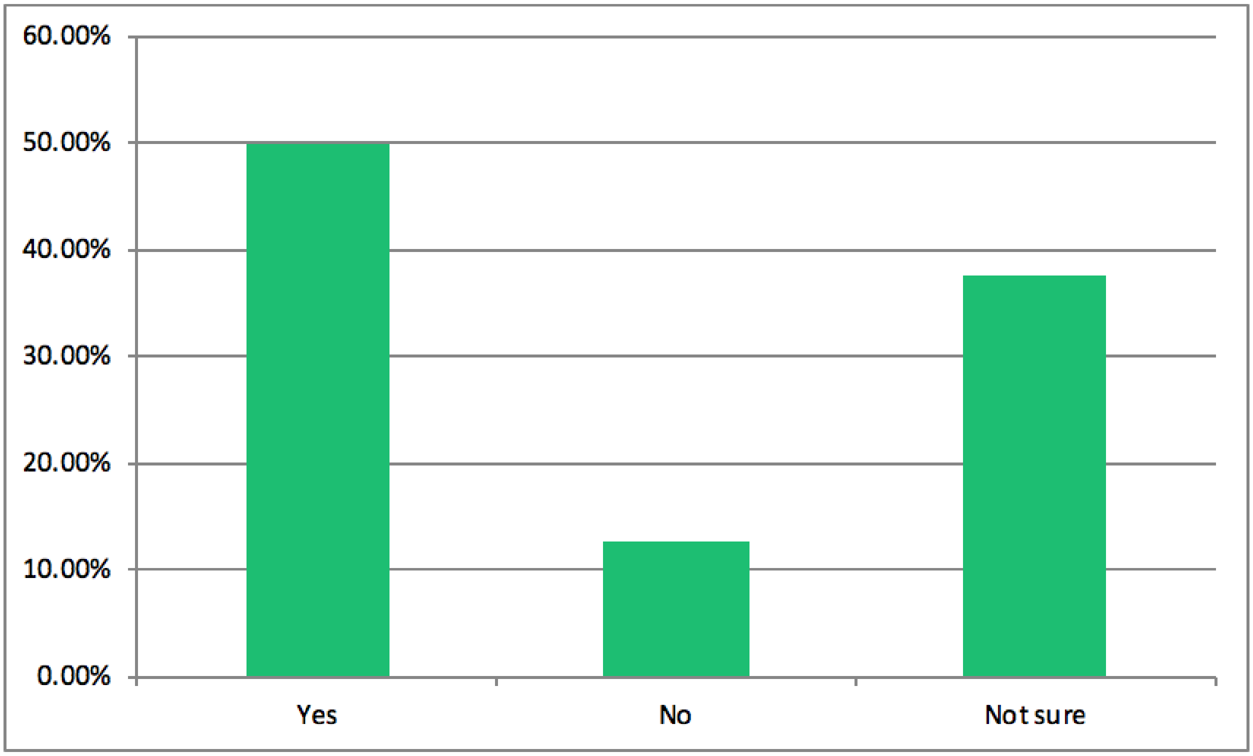
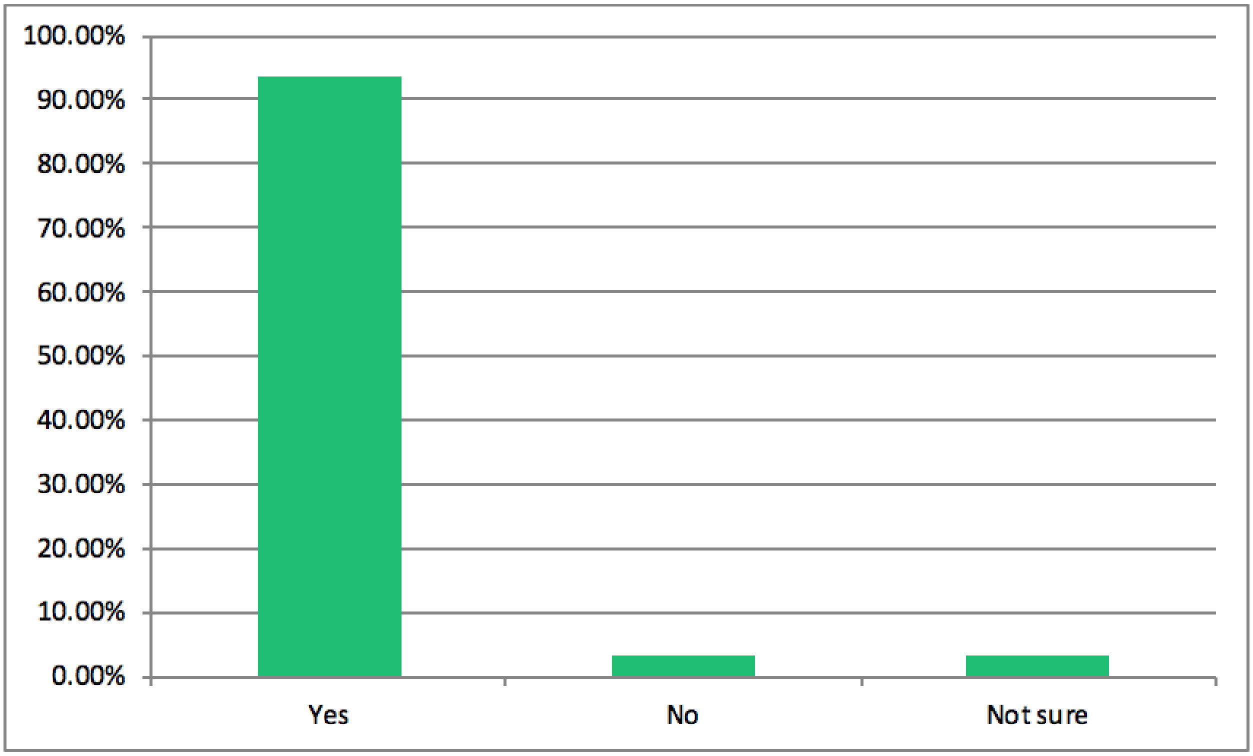


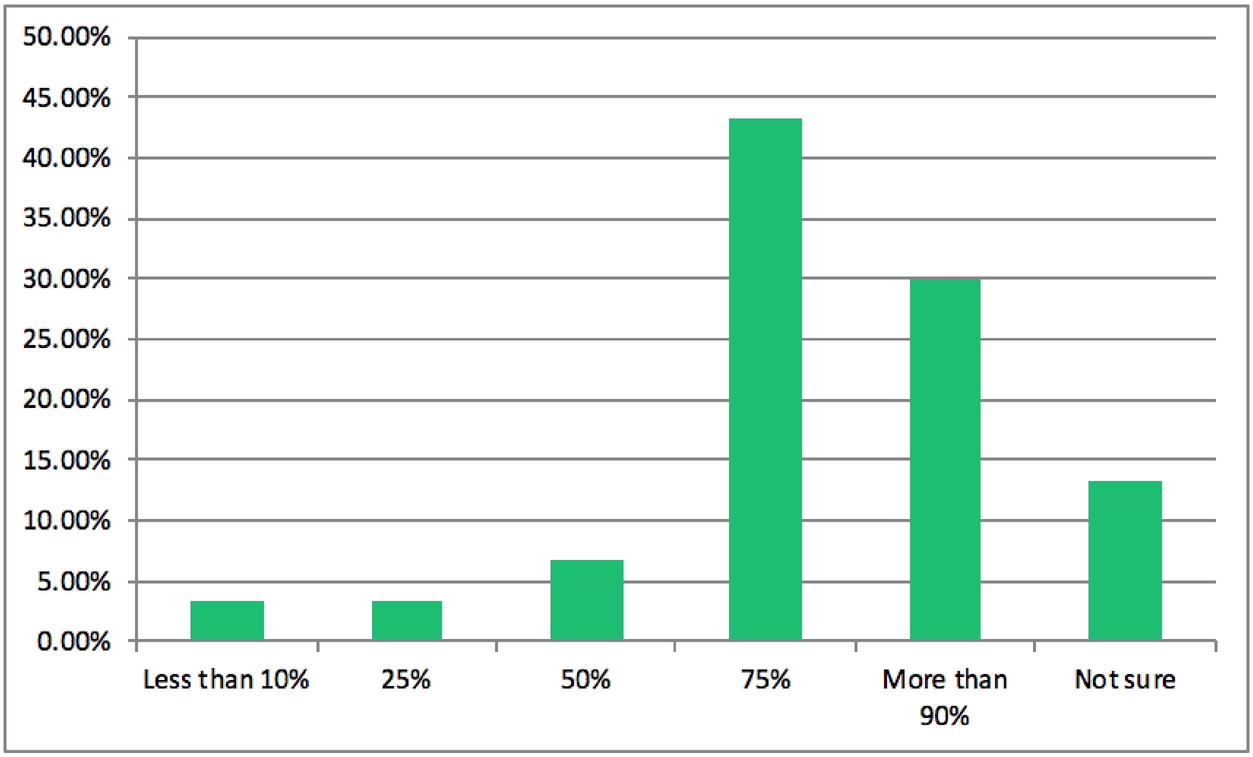
19. Have you surveyed your students to understand who has broadband access at home for remote learning and who doesn't?

Answered: 32 Skipped: 4



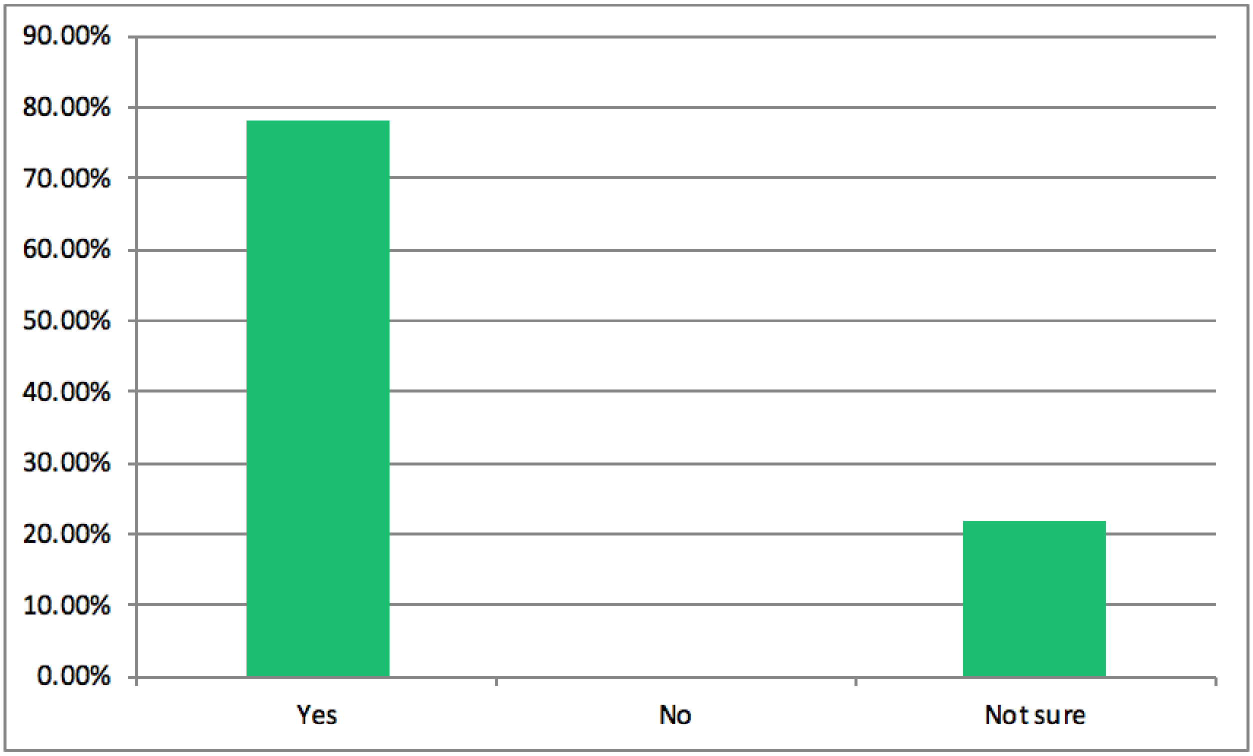
20. If you know, what percent of students have broadband access at home?

Answered: 30 Skipped: 6



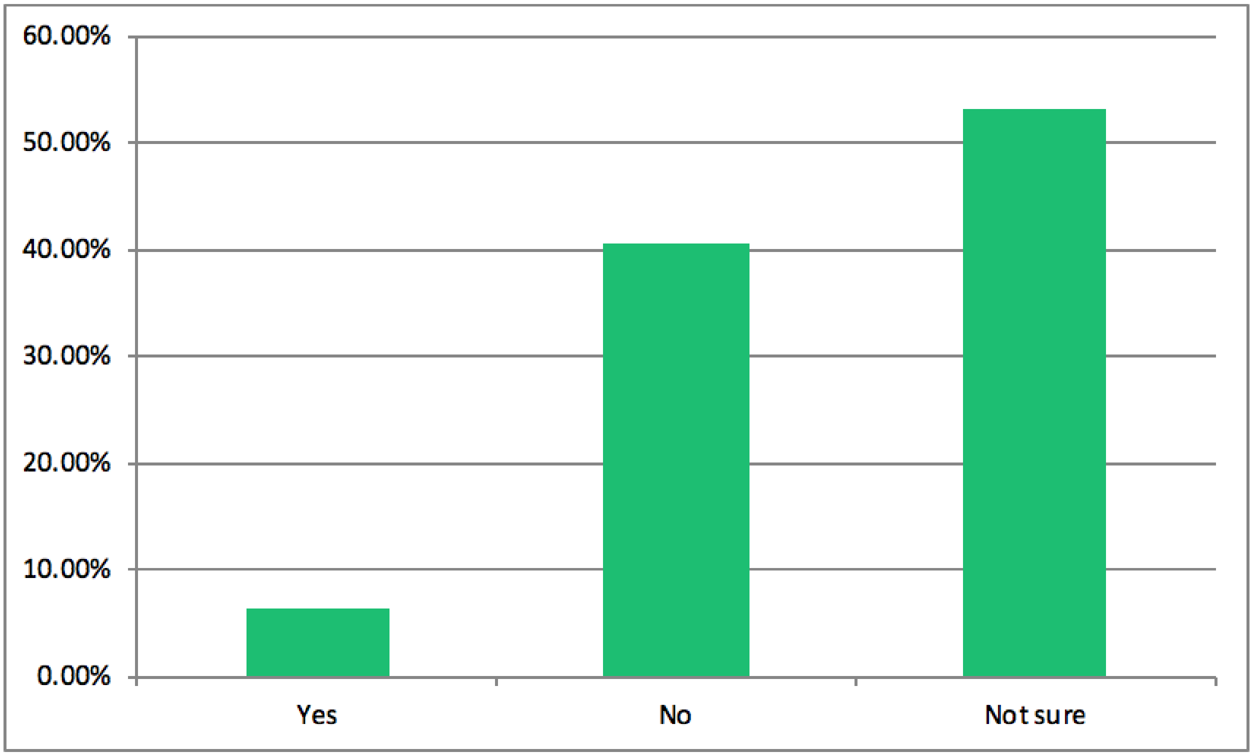
21. Did your school district assist the State of Vermont in finding households with K-12 students without access to broadband as part of a Connectivity Initiative program?

Answered: 32 Skipped: 4



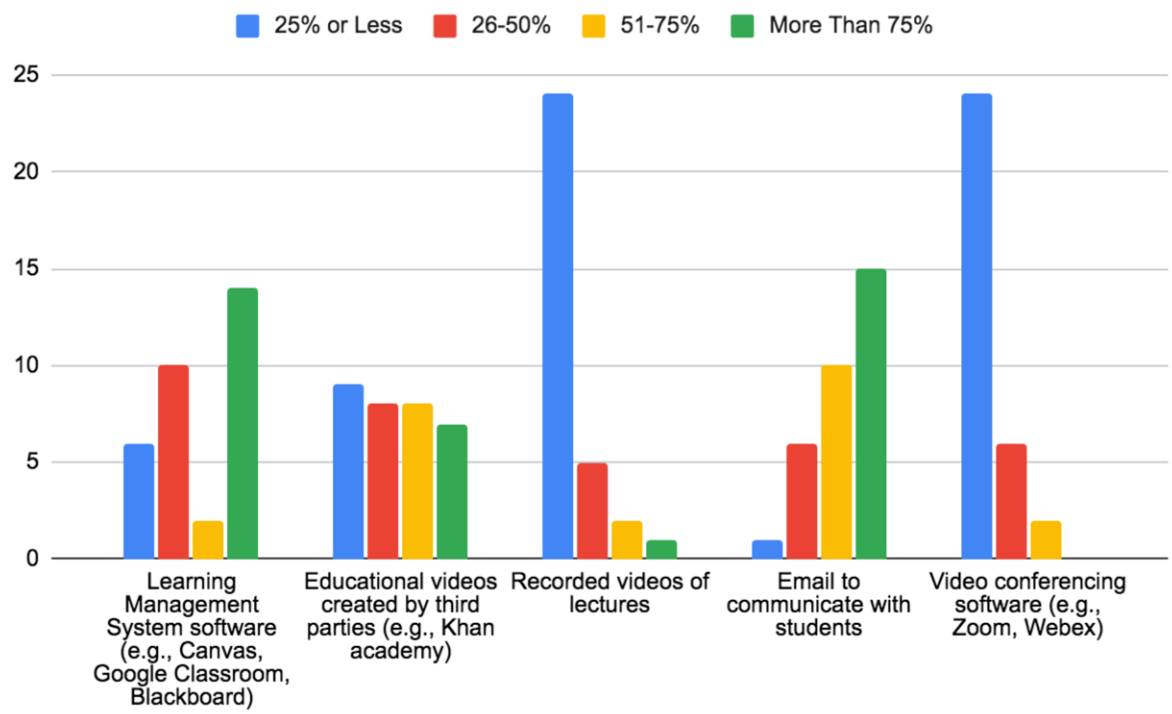
22. To-date, has Vermont's Connectivity Initiative and/or Get Vermonters Connected Now Initiative made a measurable impact in expanding broadband access for students in your district?

Answered: 32 Skipped: 4



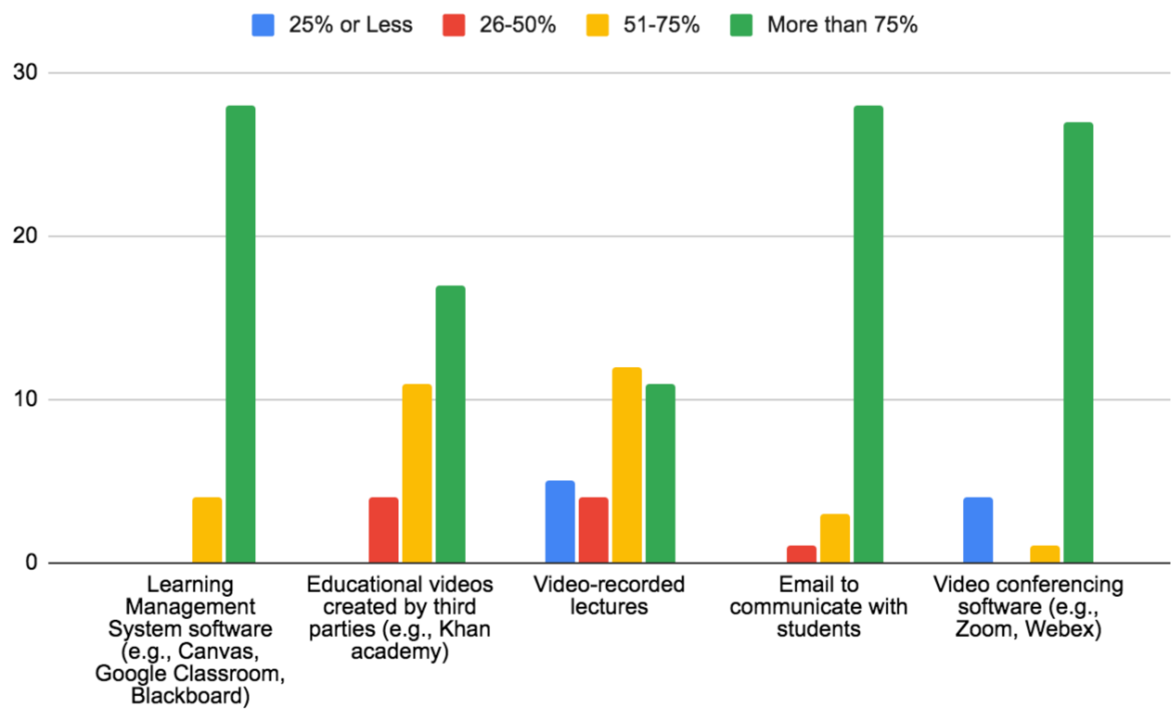
23. BEFORE Covid-19 pandemic, approximately what percent of teachers in your school district used the following tools for teaching?

Answered: 32 Skipped: 4



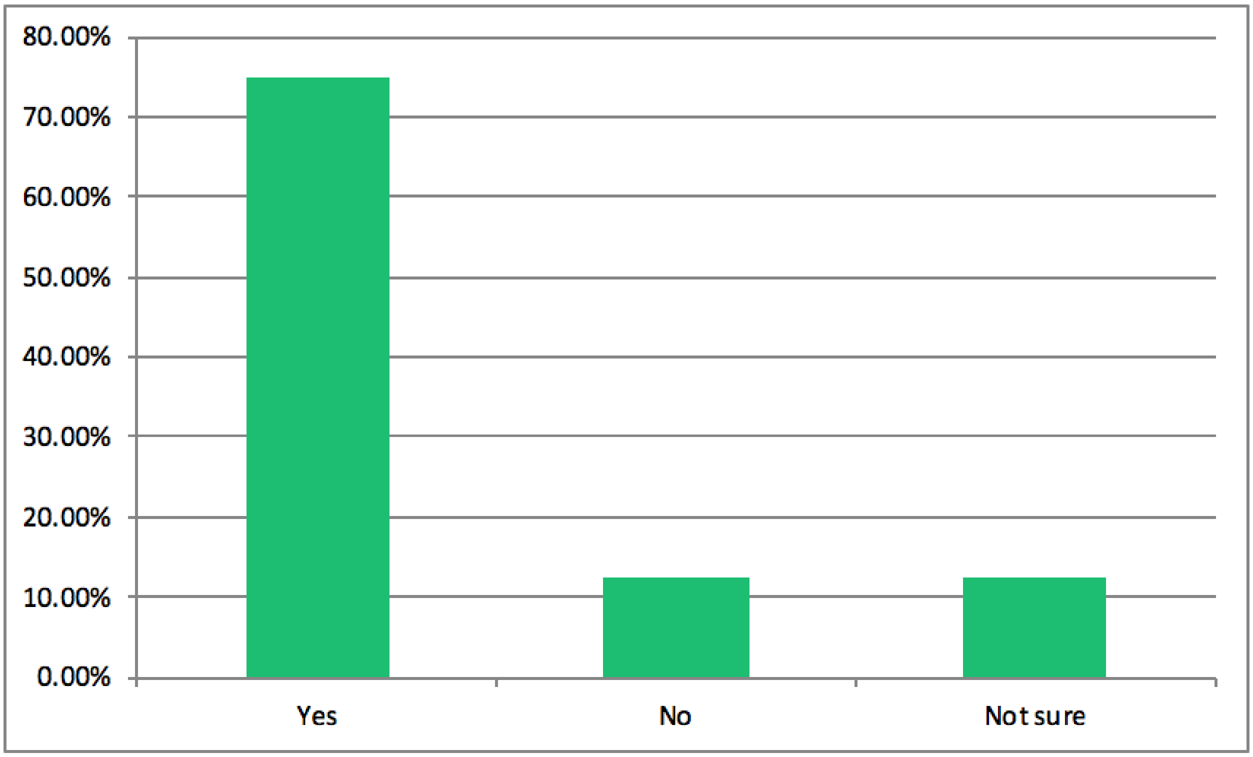
24. DURING the Covid-19 pandemic, approximately what percent of how often did teachers in your school district used the following tools for teaching?

Answered: 32 Skipped: 4



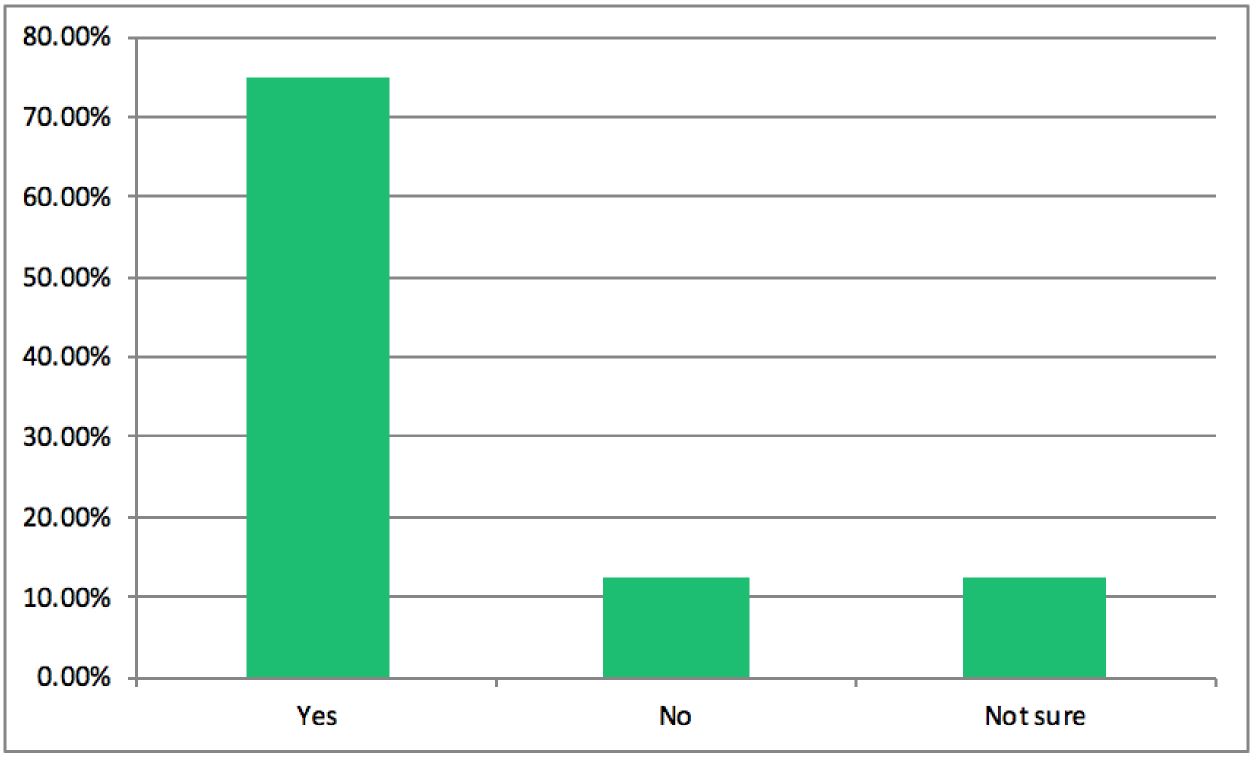
25. DURING the Covid-19 pandemic, have you had increased challenges addressing health or mental health issues faced by students (usually handled in person by a school nurse, counselor, or faculty) through video conferencing?

Answered: 32 Skipped: 4



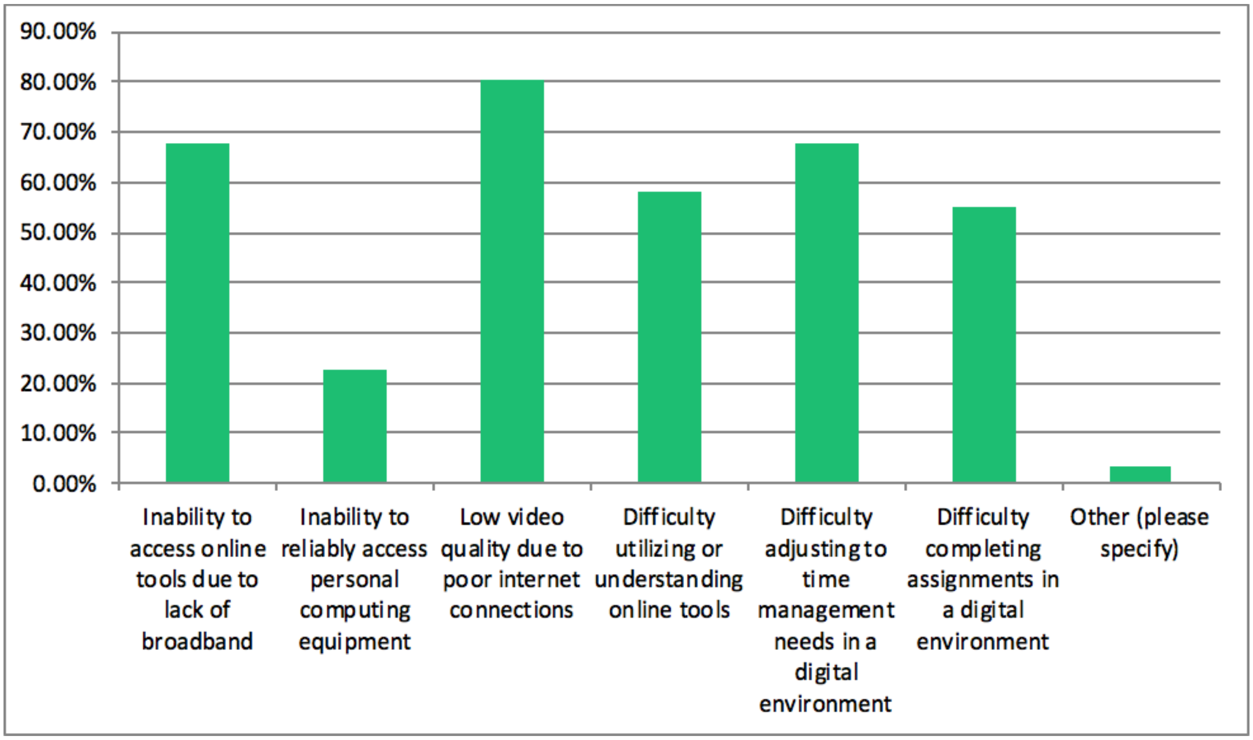
26. If yes, has the increased difficulty in addressing health or mental health challenges been exacerbated by insufficient broadband access leading to difficulty communicating with, empathizing with, or establishing connections with students?

Answered: 24 Skipped: 12



27. DURING the Covid-19 pandemic, which of the following challenges have teachers in your school district faced with regards to online learning? Select all that apply.

Answered: 31 Skipped: 5



28. Are there any groups of students that have faced particular challenges with remote learning during the Covid-19 pandemic?

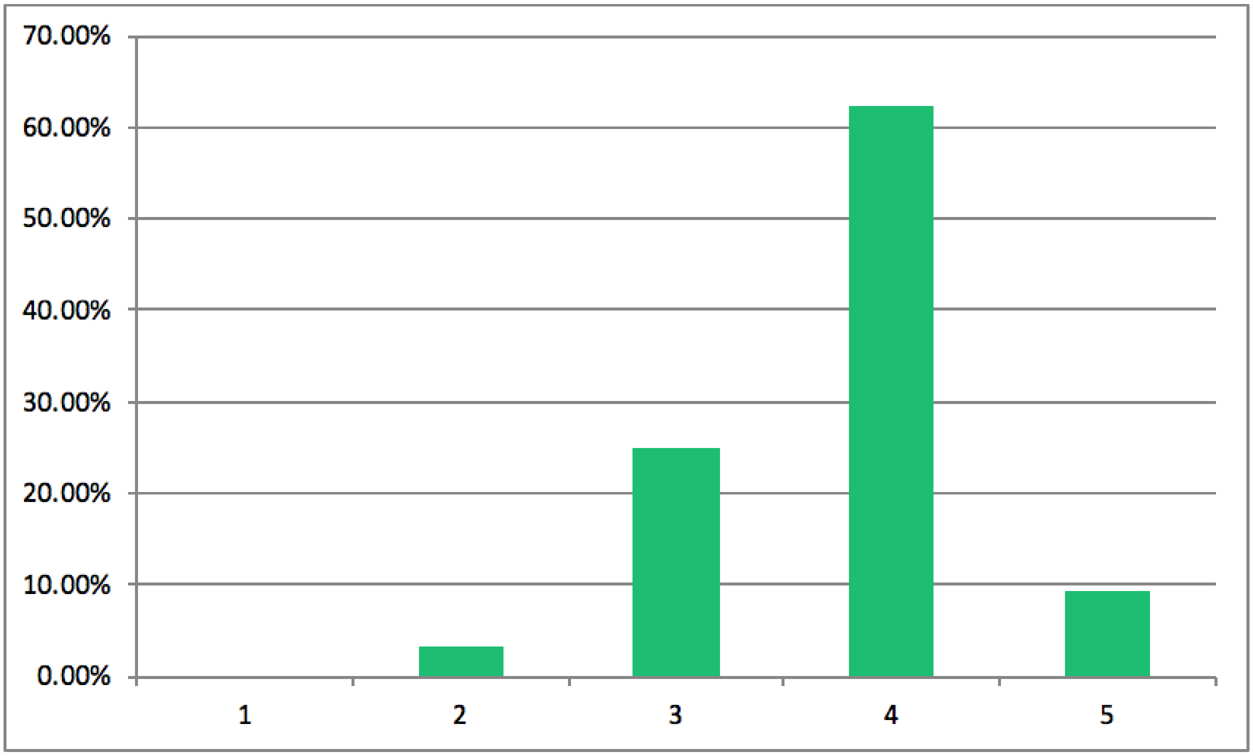
Answered: 30 Skipped: 6

Responses fell into these general categories:

- Rural students
- Students of color
- Students at risk of dropping out of school
- Students living in poverty
- Students who need access to reduced-price lunches
- Students with disabilities
- Young children
- Students without adult support at home
- ELL students
- Students without internet access

29. If an outbreak of Covid-19 forced your school district to immediately switch to fully remote learning for a period of time, do you feel like you have access to all possible short-term telecommunications resources, tools, programs, or equipment you would need in order to make this switch as effectively as possible? Answer on a scale of 1-5, where 5 is extremely prepared and 1 is not prepared at all

Answered: 32 Skipped: 4



30. What additional telecommunications-related resources would be useful to your school district to facilitate online learning and/or make an immediate shift to fully remote learning during the Covid-19 pandemic?

Answered: 26 Skipped: 10

Most respondents shared the following answers:

- High-speed internet access for 100% of students
- Additional hotspots

31. Is there anything else we should know about how the State can assist school districts with regards to telecommunications policies, programs, equipment, or resources, during the pandemic?

Answered: 21 Skipped: 15

All the respondents who answered stated that ensuring all students have access to high-speed internet would be the most helpful.

32. What were some of the learnings you applied during the 2020-2021 that you learned from having to switch to remote learning in Spring 2020?

Answered: 21 Skipped: 15

Respondents had a wide range of answers, including the following:

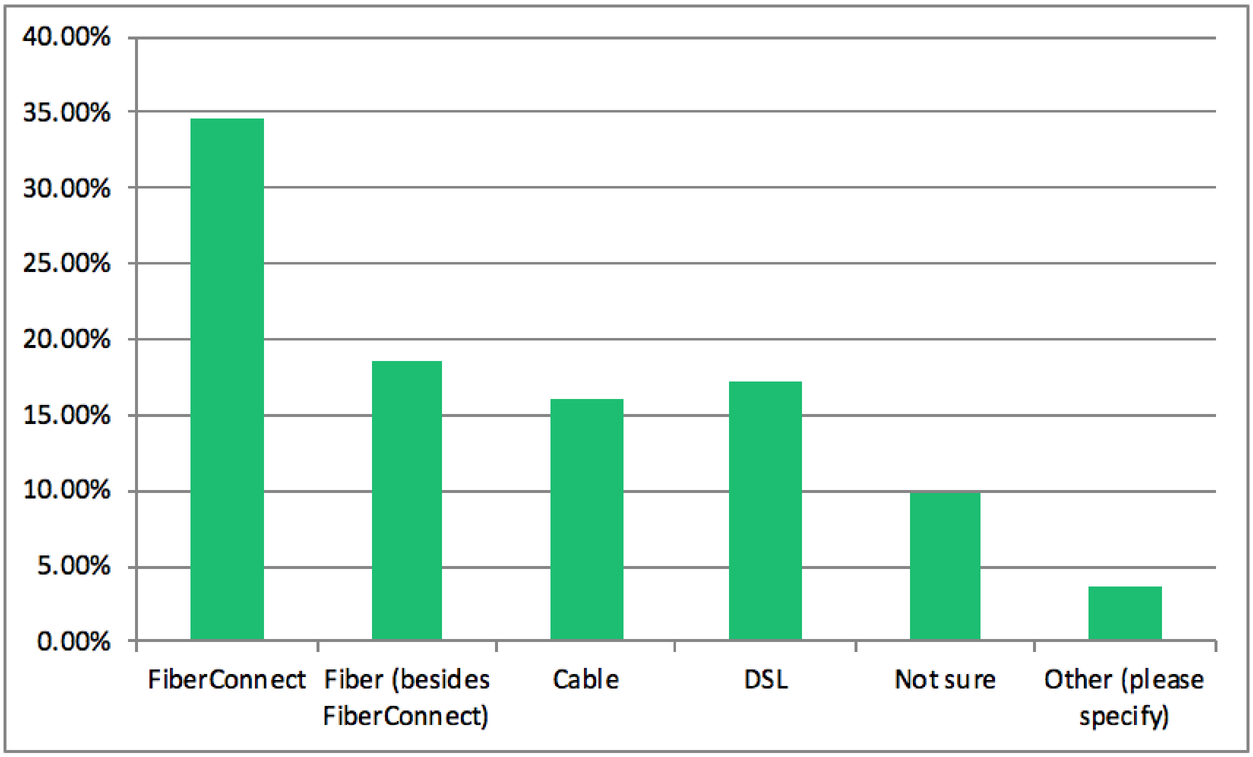
- “Not to recreate everything that was being done in in-person instruction remotely”
- “Greater knowledge of online resources.”
- “We have shifted our hybrid model to sending students home with learning application materials because we could not guarantee access to zoom for all our families.”
- “Breaks from screens need to be explicitly build into the day”
- “Increased use of zoom and more appropriate assignments”

Appendix E: Librarian Survey Results

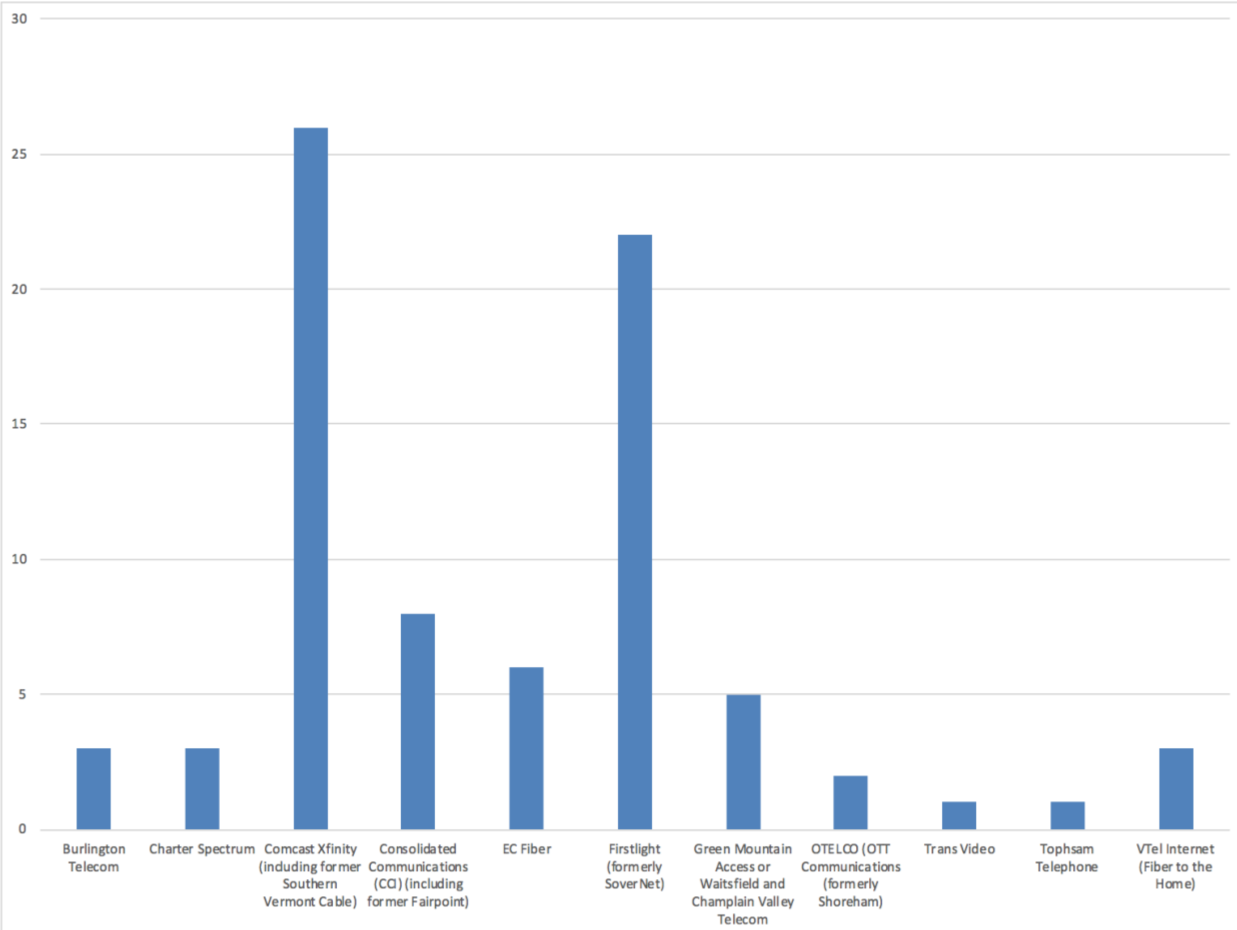
This survey was sent to librarians across the State of Vermont. Eighty-two librarians responded.

1. **Which library do you represent?**
   Answered: 82 Skipped: 0

1. **What kind of internet connection does your library have?**
   Answered: 81 Skipped: 1

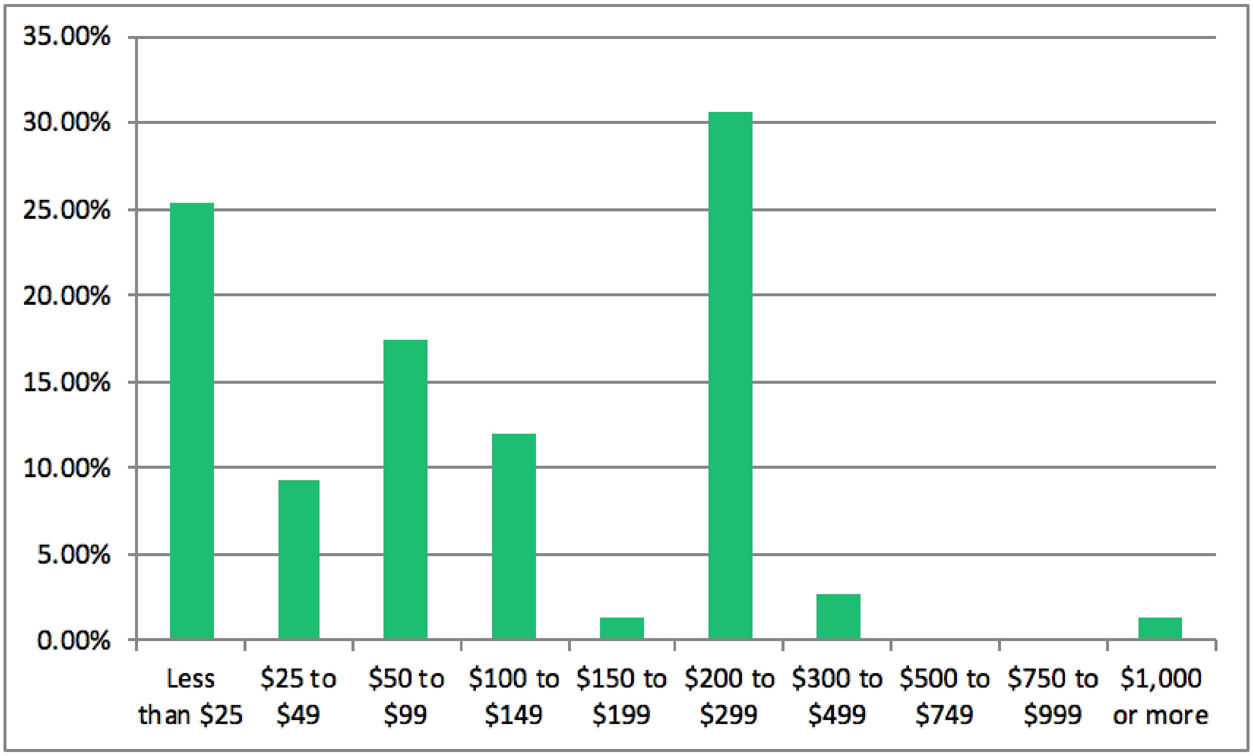


6. Which company is your library's internet service provider?
Answered: 80 Skipped: 2



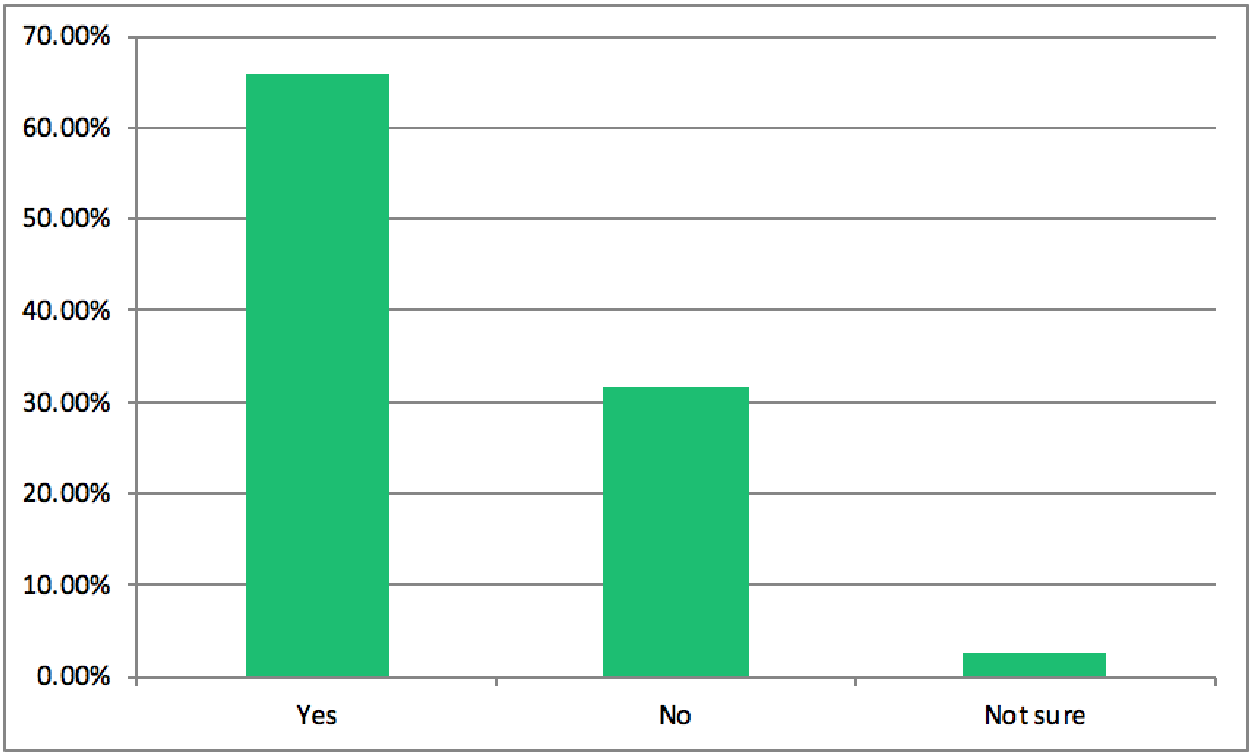
1. Approximately how much do you pay PER MONTH for internet service at your primary location?

Answered: 75 Skipped: 7

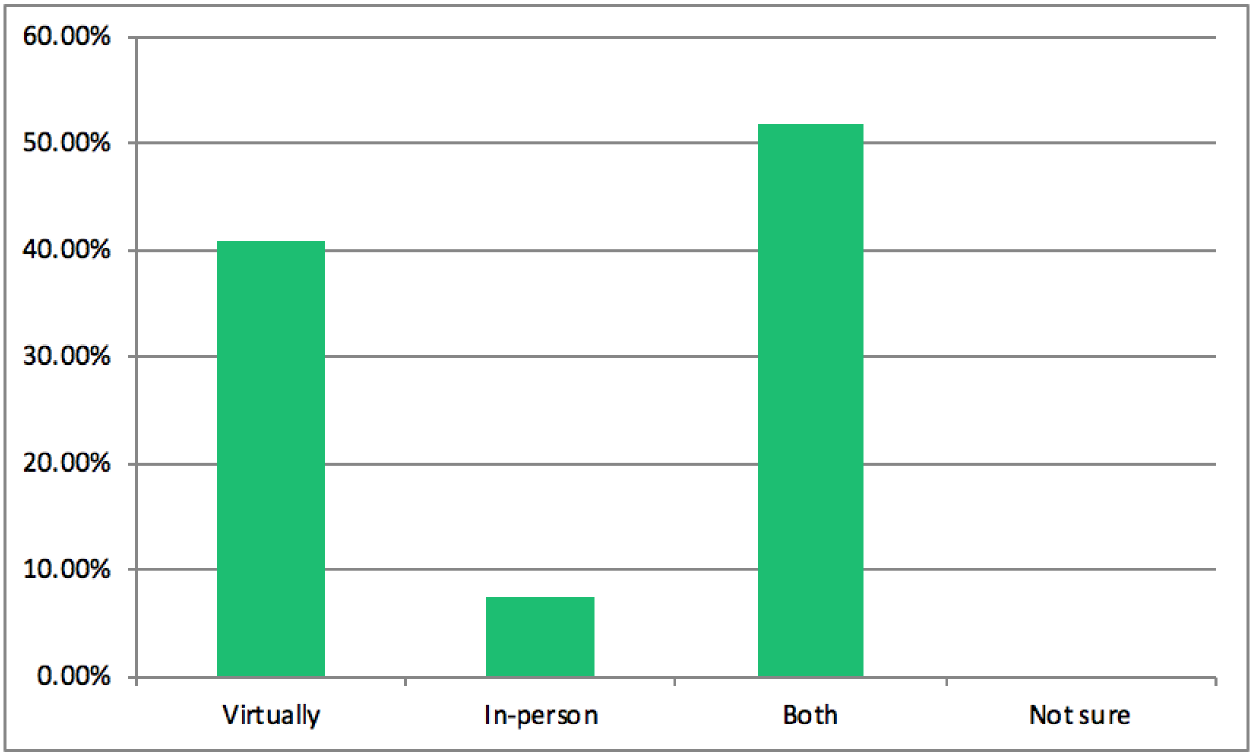


1. What is the current status of your library building?
Answered: 82 Skipped: 0

1. Is your library providing programming/training for the general public at this time?
Answered: 82 Skipped: 0

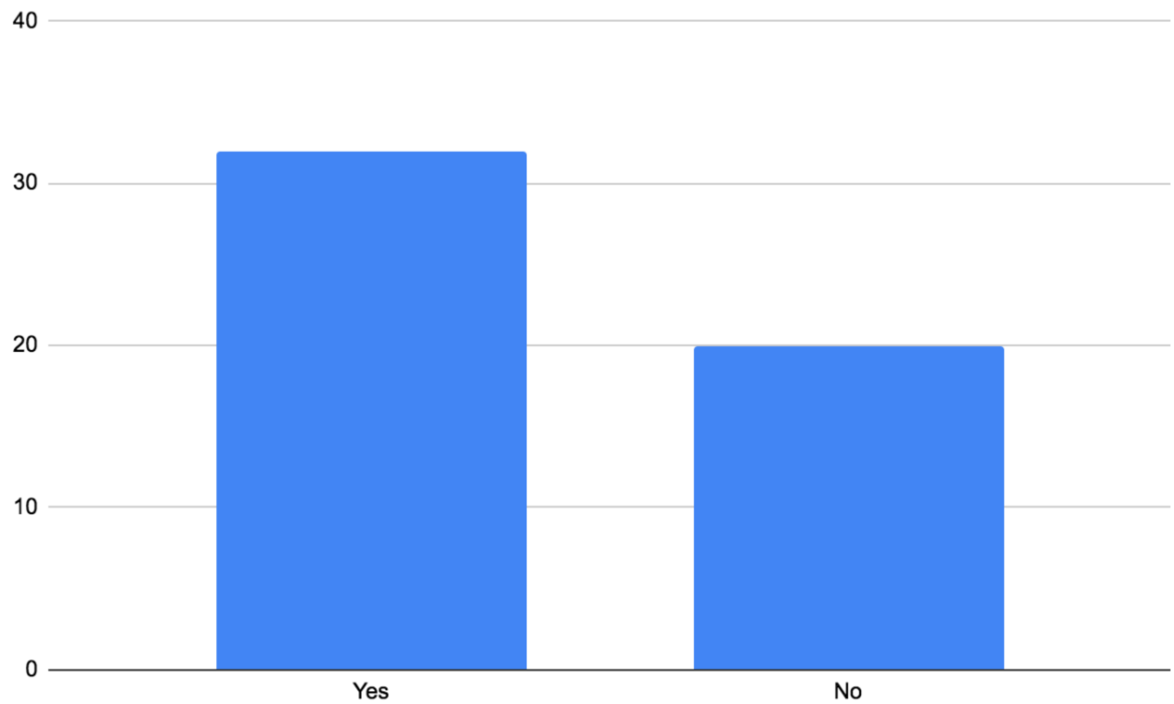


1. Is that programming available virtually, in-person, or both?
Answered: 54 Skipped: 28



1. Has your library created or provided programming as a direct response to community needs or community demand during the pandemic?

Answered: 52 Skipped: 30



1. If so, please briefly describe the programs here

Answered: 37 Skipped: 45

Respondents highlighted a variety of programs serving children, families, and seniors including:

- Virtual book clubs
- Virtual or outdoor storytimes
- Trainings for digital services
- Homeschooling supports
- Zoom classes/clubs for activities such as knitting, mushroom foraging, cooking, etc.
- Take-home craft kits and book

1. What other programming (in-person or virtual) is your library offering?

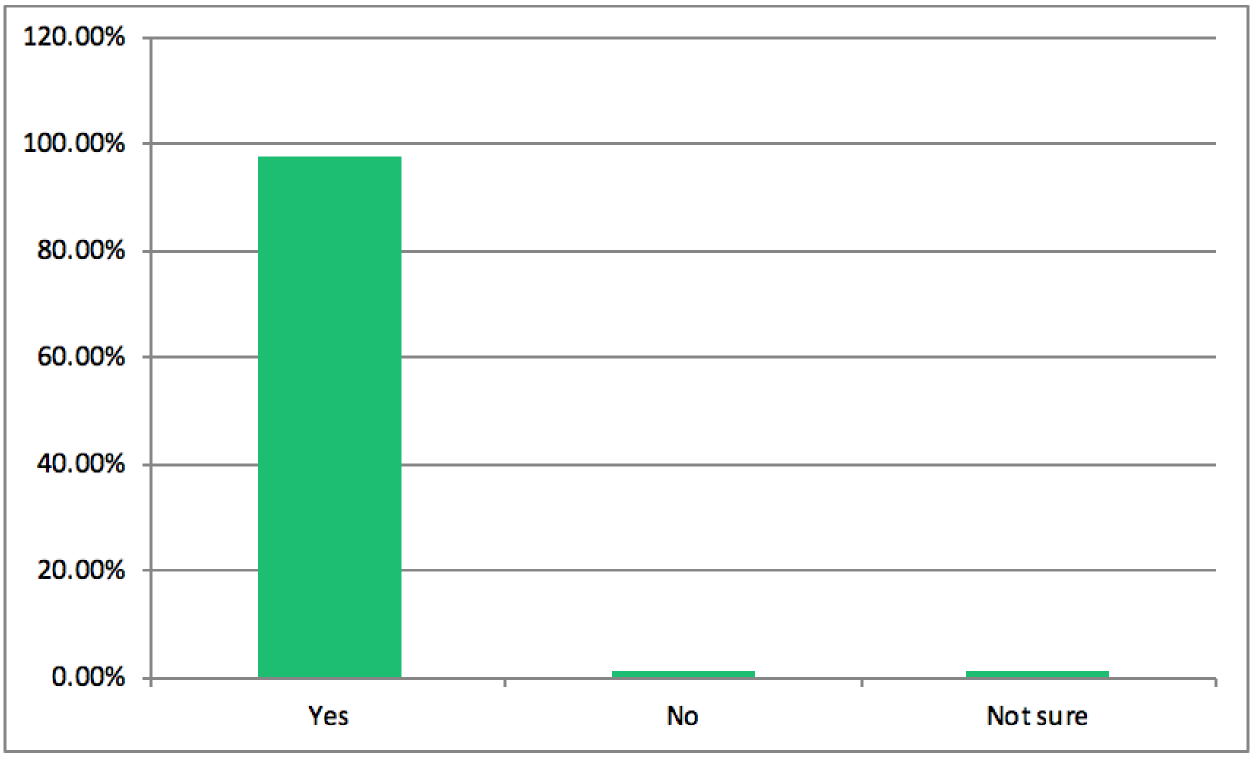
Answered: 45 Skipped: 37

Respondents highlighted a variety of programs serving children, families, and seniors including:

- Storytimes

- Lecture series
- Book groups
- Classes in yoga, cooking, etc.
- Naturalist programs
- Craft kits
- Socially-distant Halloween parties
- D&D
- Trivia

1. **Do you offer Wi-Fi outside the building?**
   Answered: 82 Skipped: 0



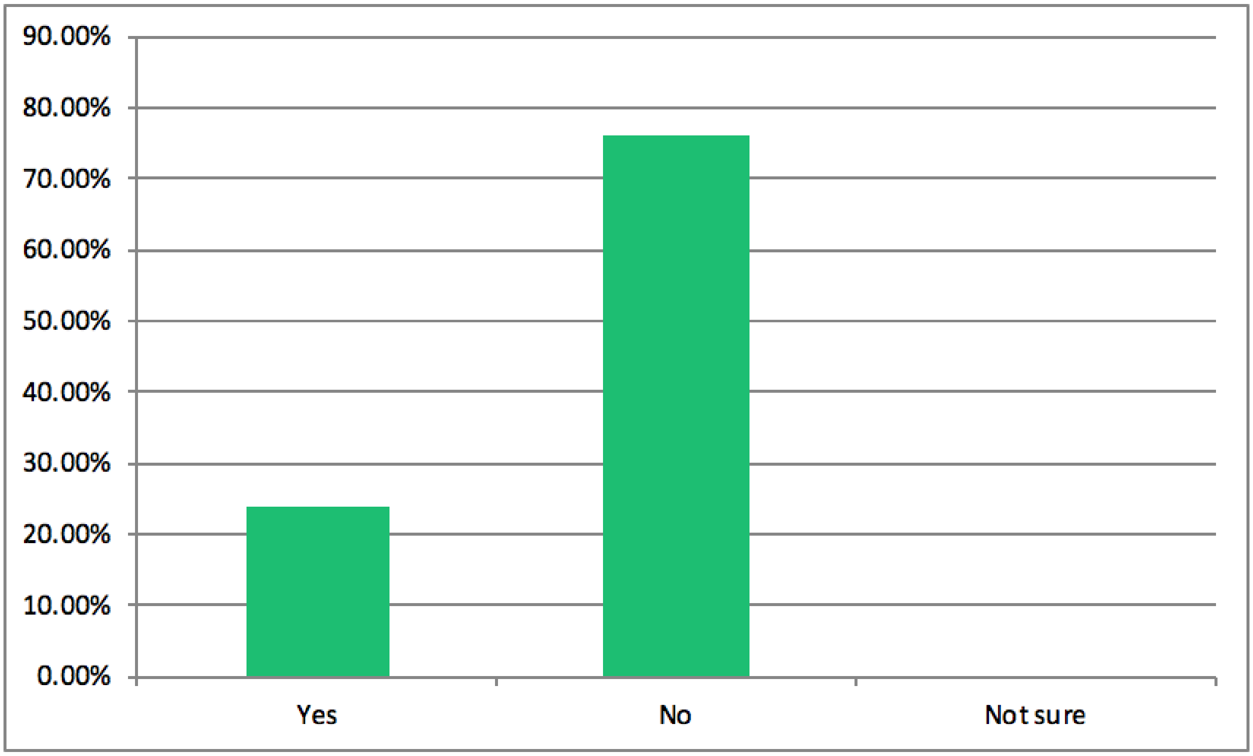
1. **Since the start of the Covid-19 pandemic, how many people would you estimate use the Wi-Fi outside of your library on an average day?**
   Answered: 80 Skipped: 2

Respondents provided the following range of answers:

- 44 stated that 10 or fewer people use the Wi-Fi
- 20 stated the number was between 10-40
- 2 stated that the number was 65

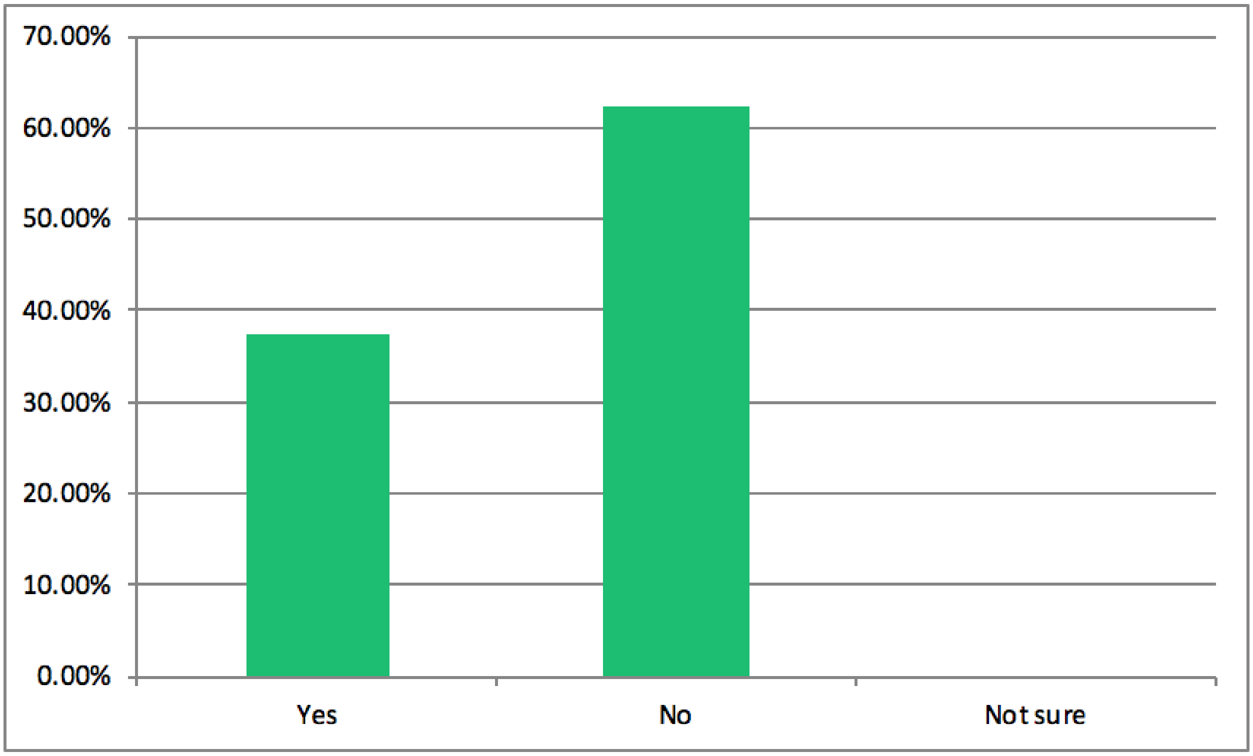
1. Since the start of the Covid-19 pandemic, has your library added equipment to extend or strengthen Wi-Fi signals outside of the building?

Answered: 80 Skipped: 2

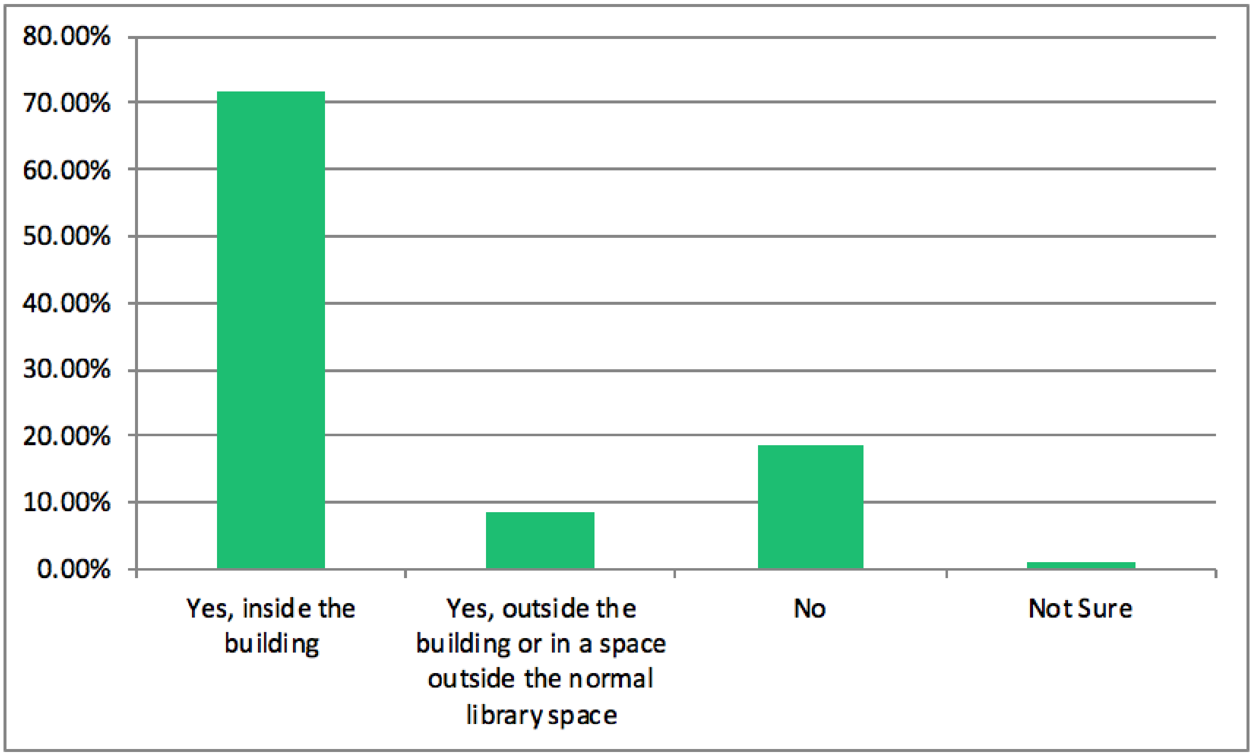


1. Since the start of the Covid-19 pandemic, have you made any accommodations to make Wi-Fi outside the building more comfortable to use (tents, tables, etc.)?

Answered: 80 Skipped: 2



1. Are you allowing patrons to use public computers at present?
Answered: 81 Skipped: 1



1. Have you made any changes/accommodations to public computer use during the Covid-19 pandemic?
Answered: 81 Skipped: 1

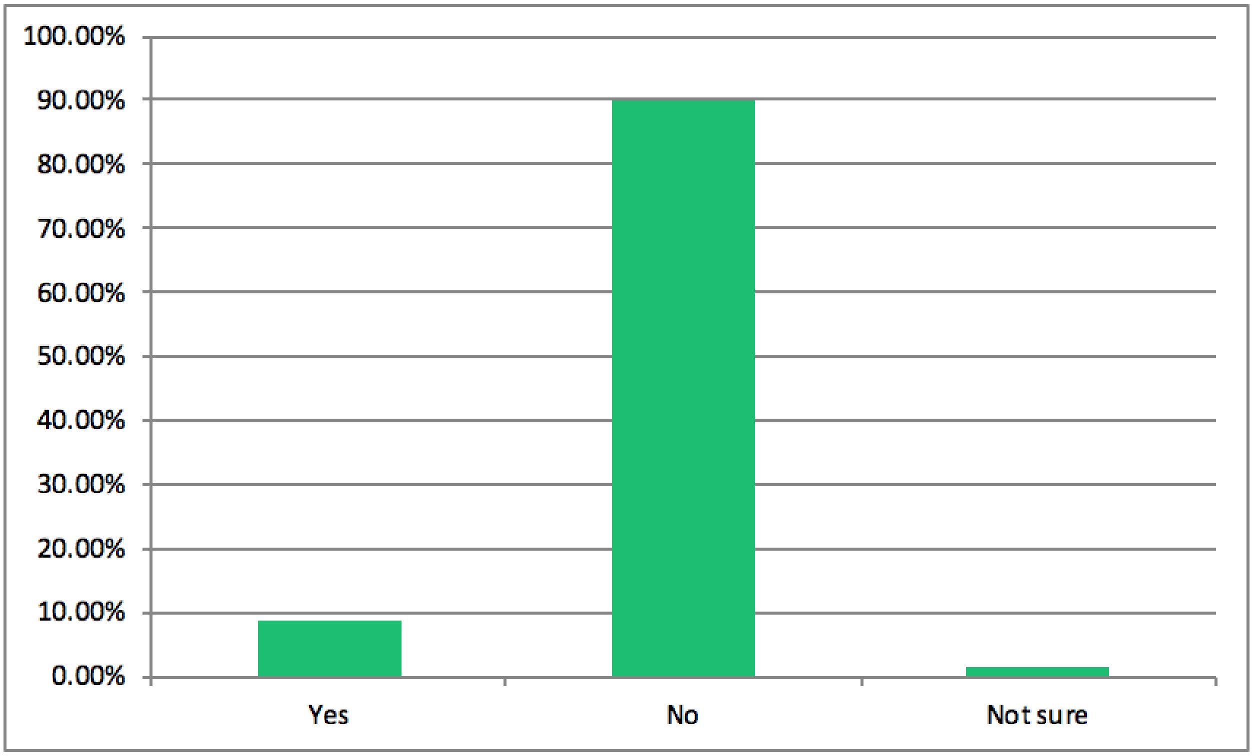
Accommodations listed by respondents included:

- Limiting the number of computers used at a time
- Placing computer 6 feet apart
- Sanitizing computers
- Limiting the amount of time an individual could use the computer
- Requiring patrons to reserve computers ahead of time
- Checking out laptops and iPads for home use
- Reducing the number of computer stations in order to maintain social distancing
- Purchase washable keyboard covers

Several respondents indicated that they made no changes.

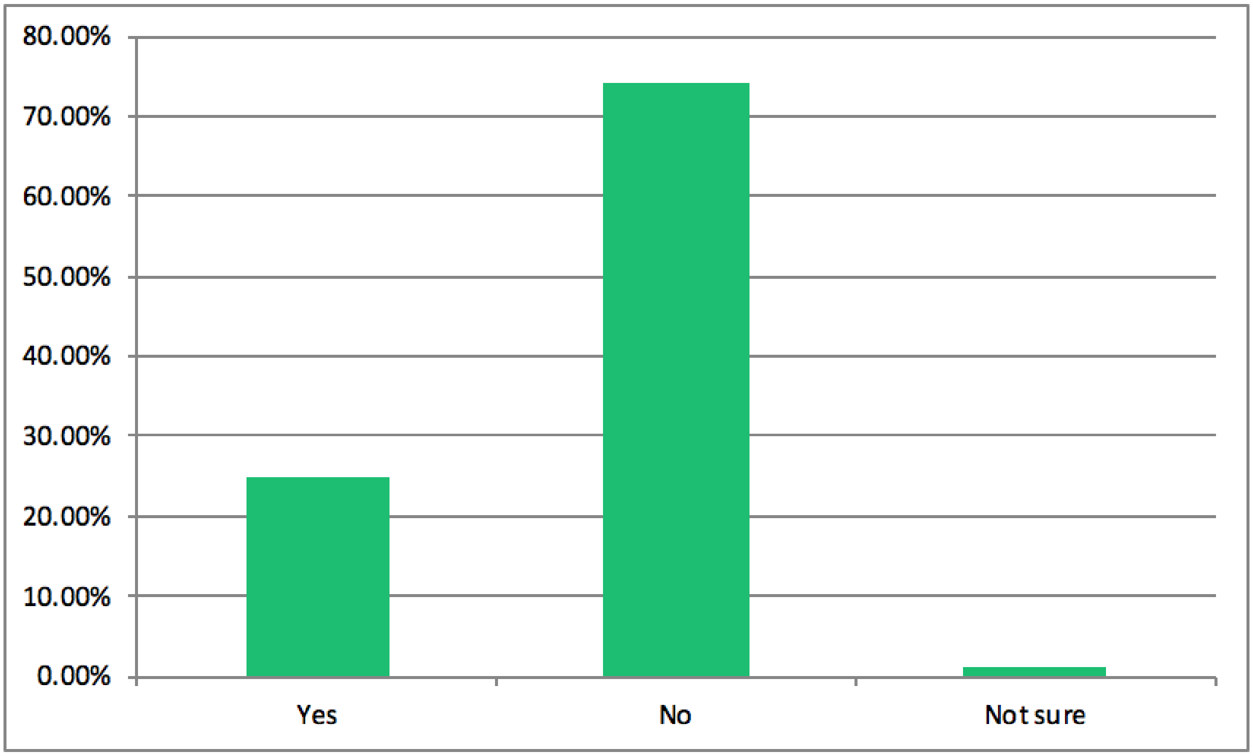
1. BEFORE the Covid-19 pandemic, were patrons able to check out laptop computers or tablets to use at home?

Answered: 81 Skipped: 1



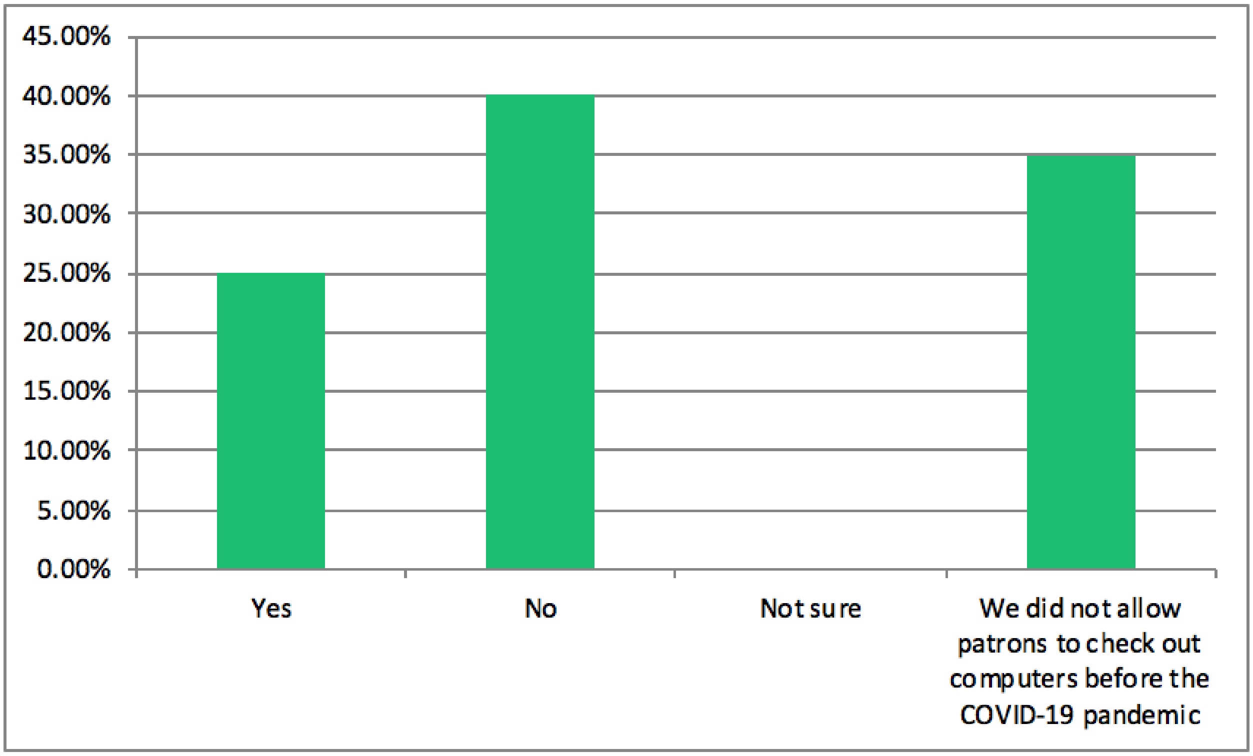
1. DURING the Covid-19 pandemic, are patrons able to check out laptop computers or tablets to use at home?

Answered: 81 Skipped: 1



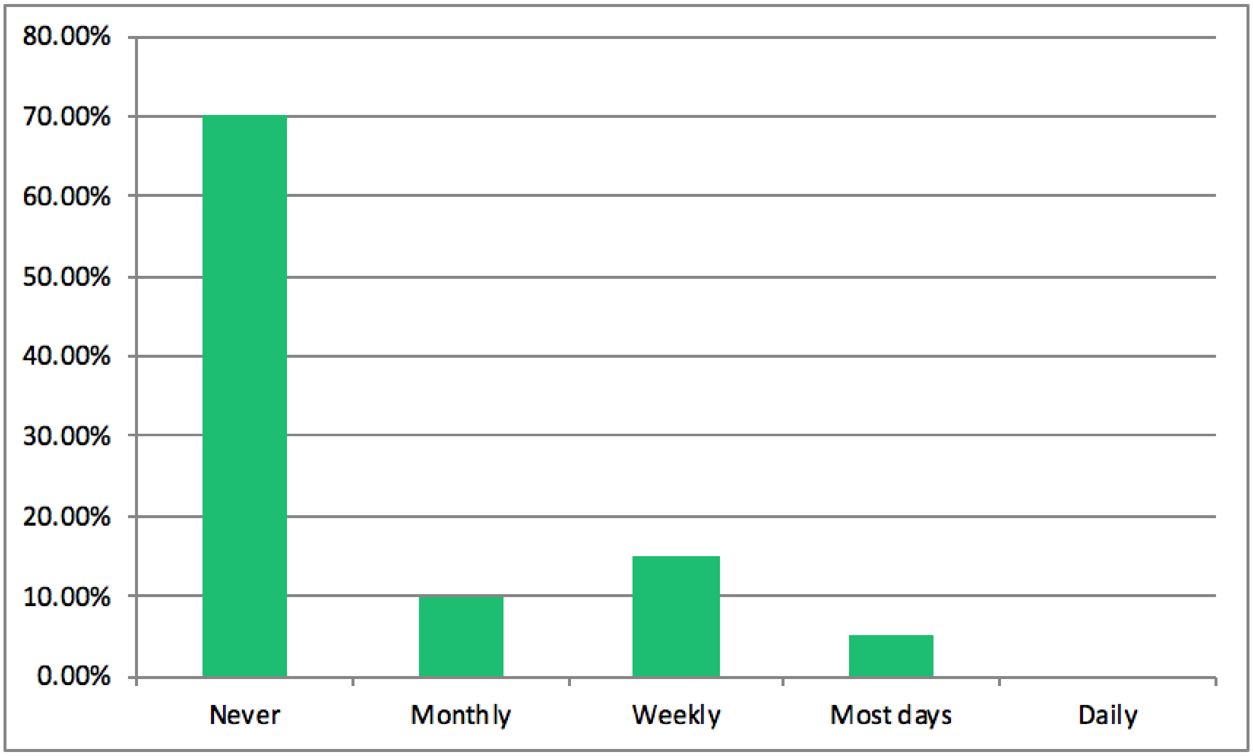
1. Since the start of the Covid-19 pandemic, have you seen an increase of patrons checking out library laptops or tablets for use at home?

Answered: 20 Skipped: 62



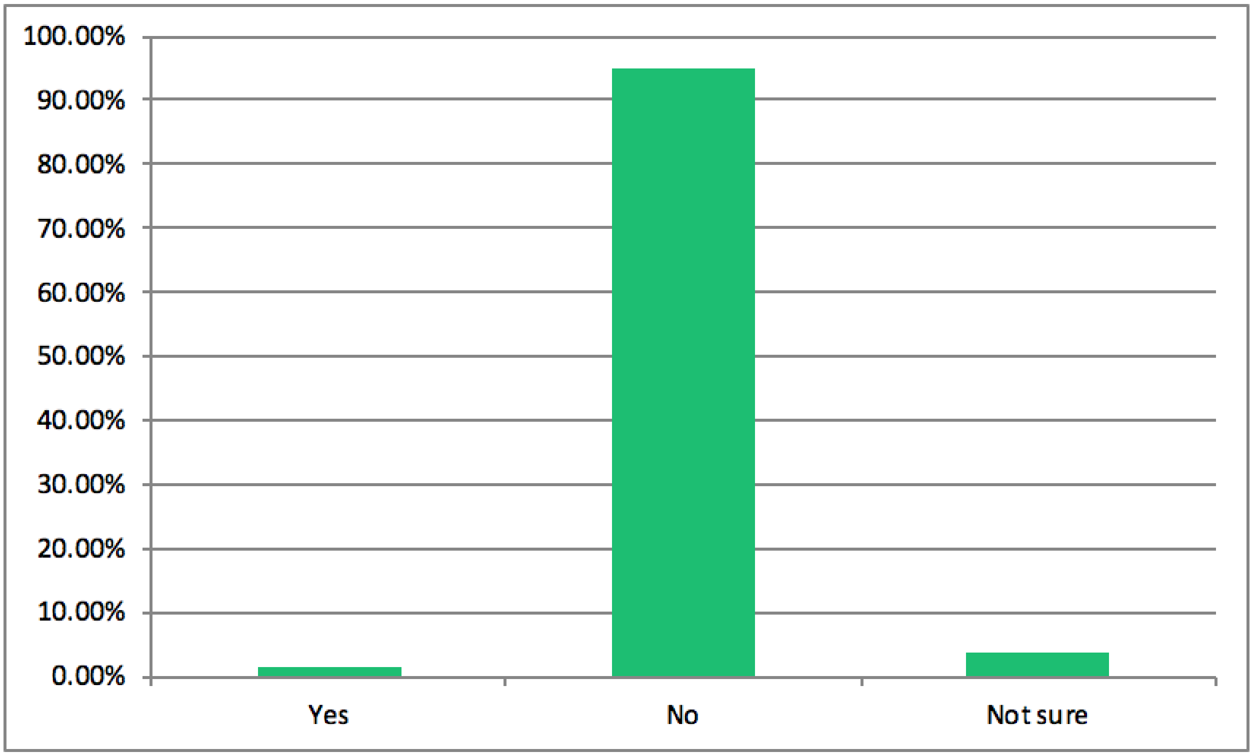
1. How often do you have more demand for laptops or tablets than you have equipment available?

Answered: 20 Skipped: 62



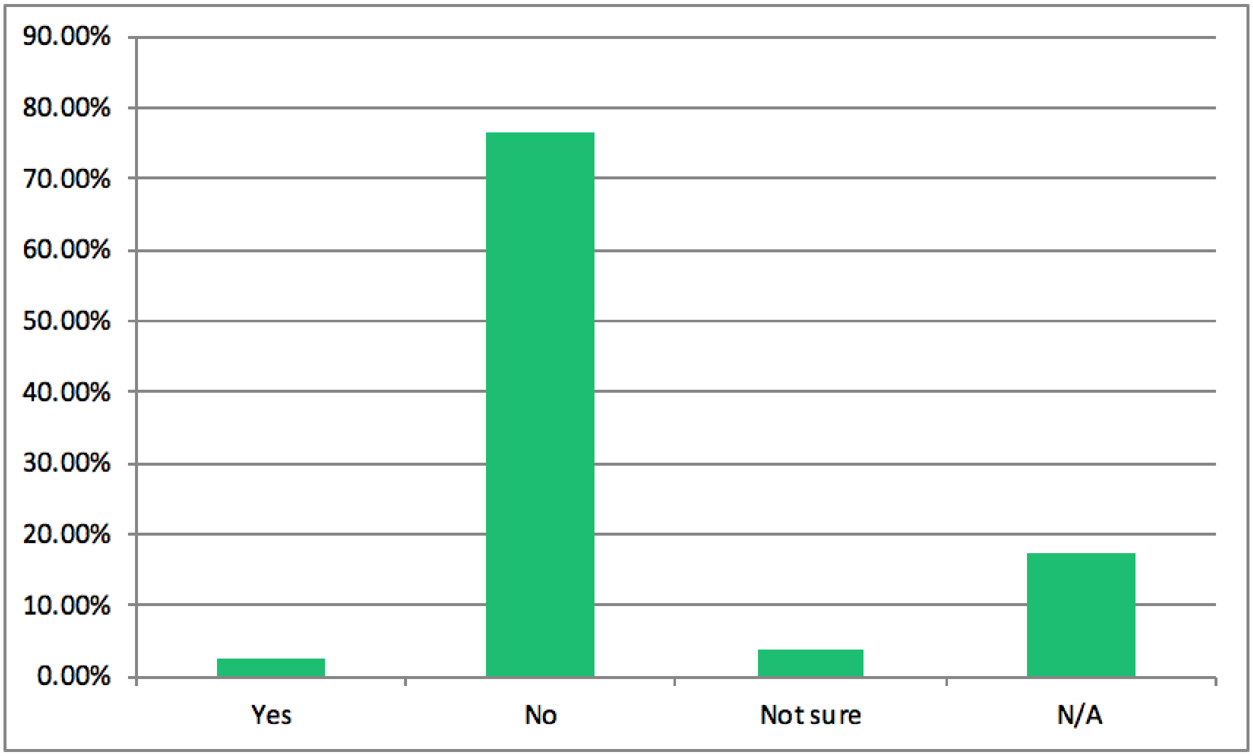
1. BEFORE the Covid-19 pandemic, was your library allowing patrons to check out hotspots (e.g., MyFi Connect) or other equipment to expand broadband access?

Answered: 81 Skipped: 1



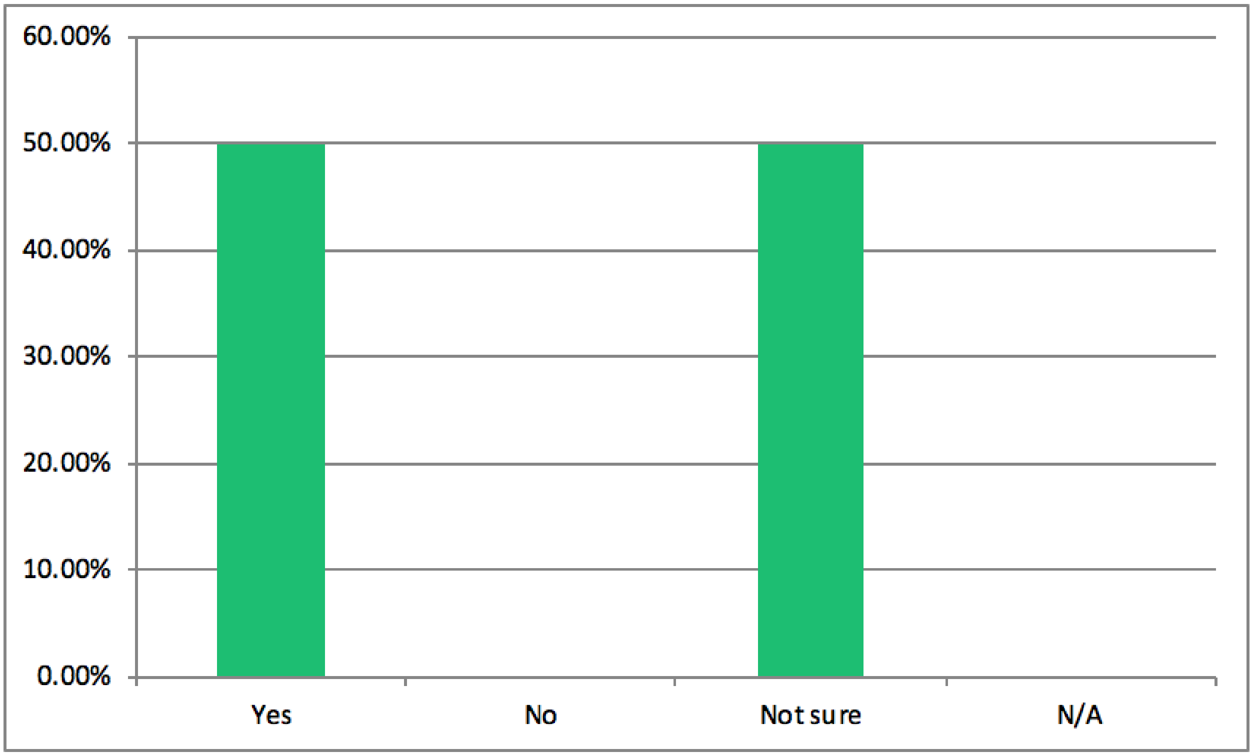
1. DURING the Covid-19 pandemic, is your library allowing patrons to check out hotspots or other equipment to expand broadband access?

Answered: 81 Skipped: 1



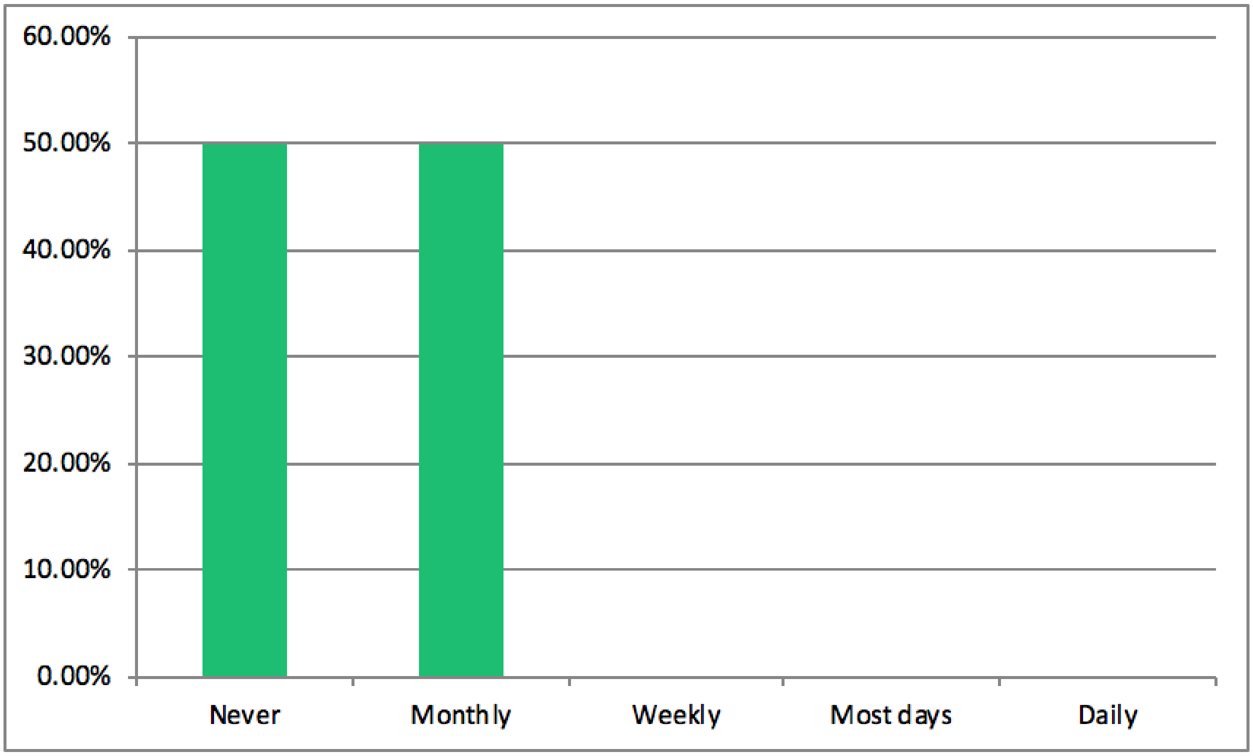
1. Since the start of the Covid-19 pandemic, have you seen an increase of patrons checking out hotspots or other equipment to expand broadband access?

Answered: 2 Skipped: 80



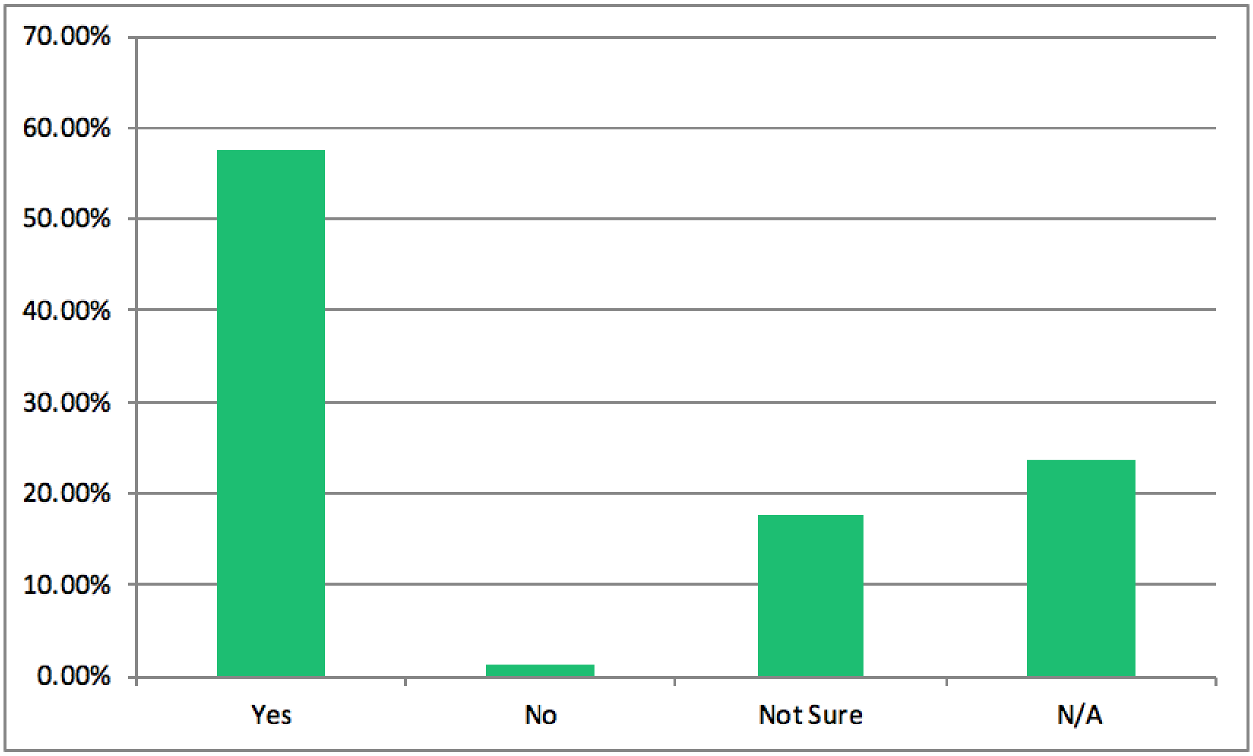
1. How often do you have more demand for portable hotspots than you have equipment available?

Answered: 2 Skipped: 80



1. If the area around your library has limited broadband or cell service access, would you be willing to participate in a program to install equipment at the library to provide better cell service or broadband to surrounding homes?

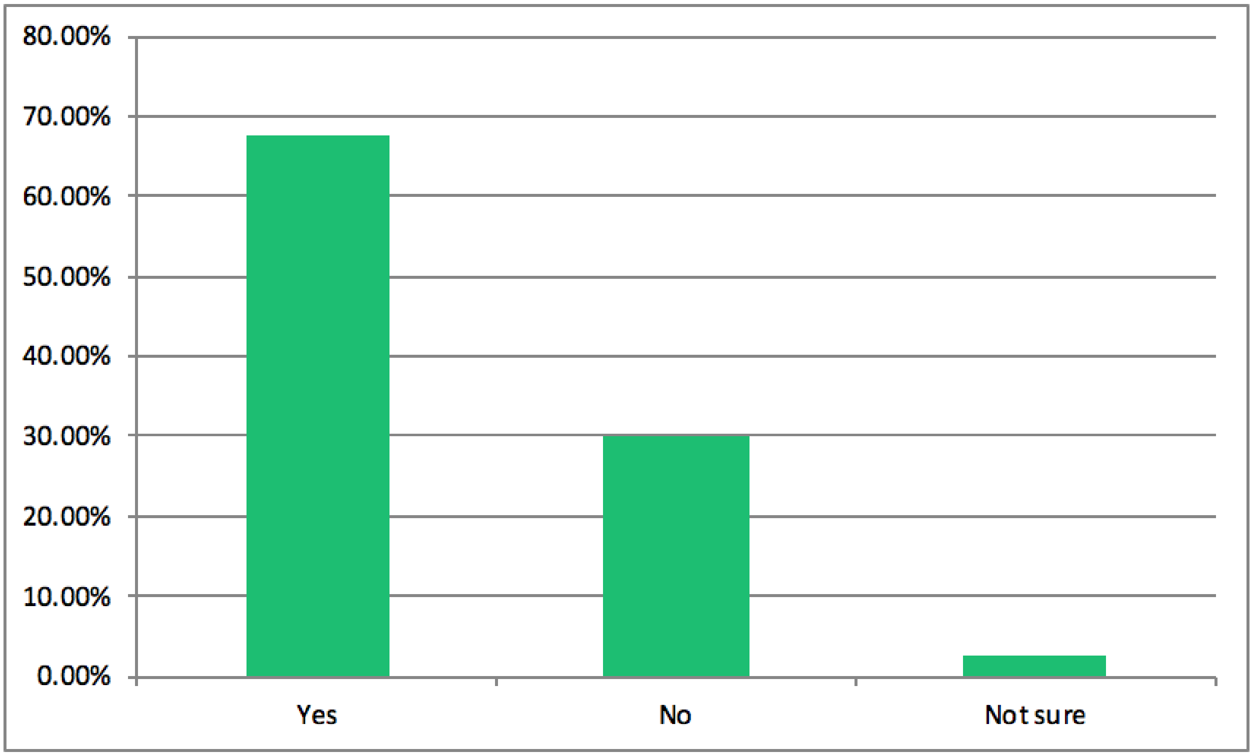
Answered: 80 Skipped: 2



1. Did your library add or increase access to electronic collections (downloadable items, databases, and the like) due to the Coronavirus (Covid-19) pandemic? This includes adding services or

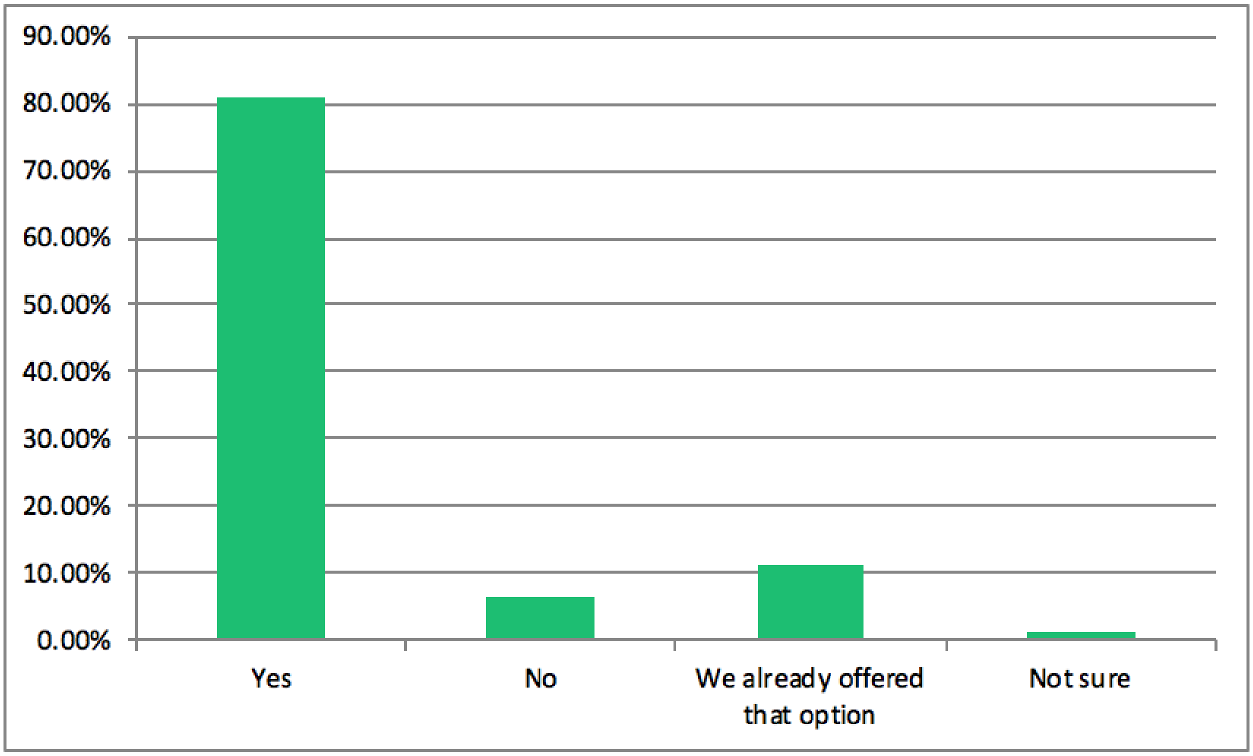
individual items, increasing borrowing limits, or otherwise improving the public's access to electronic materials.

Answered: 80 Skipped: 2



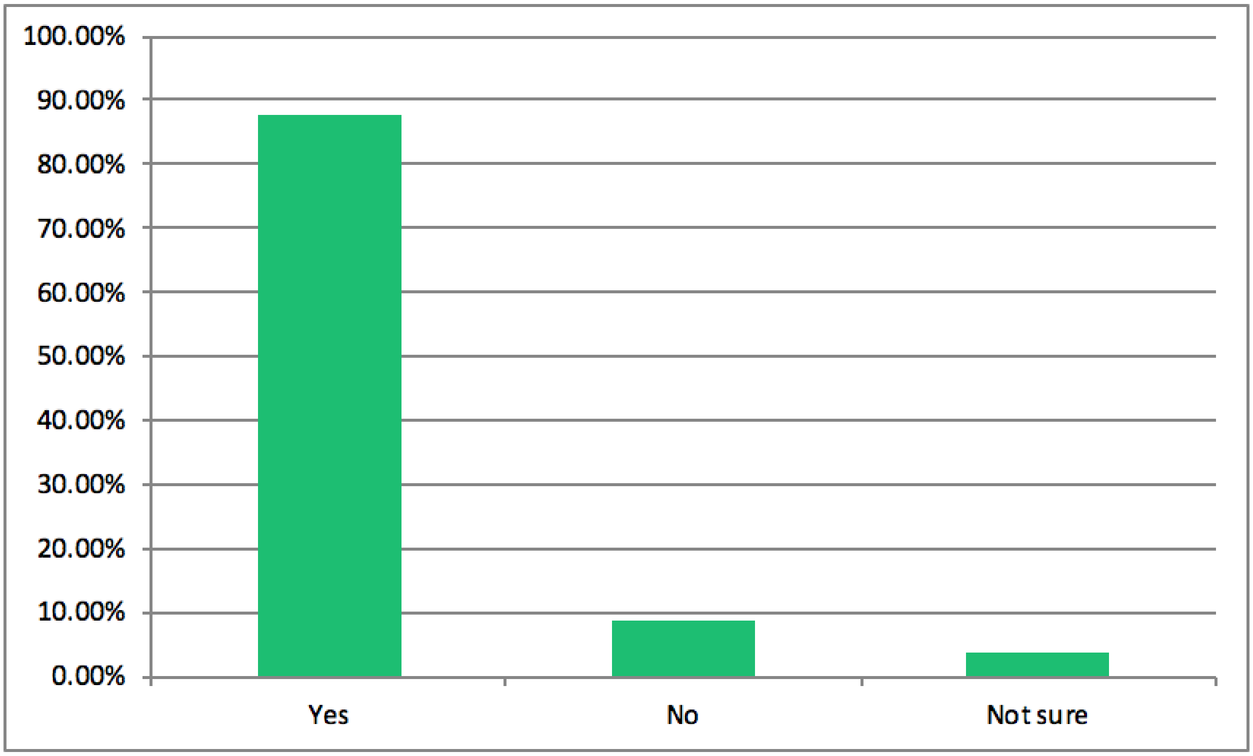
1. During the Covid -19 pandemic, did the library allow users to register for a library card online or by phone, without coming into the building? This includes "online-only" cards that allow patrons to access online resources.

Answered: 79 Skipped: 3



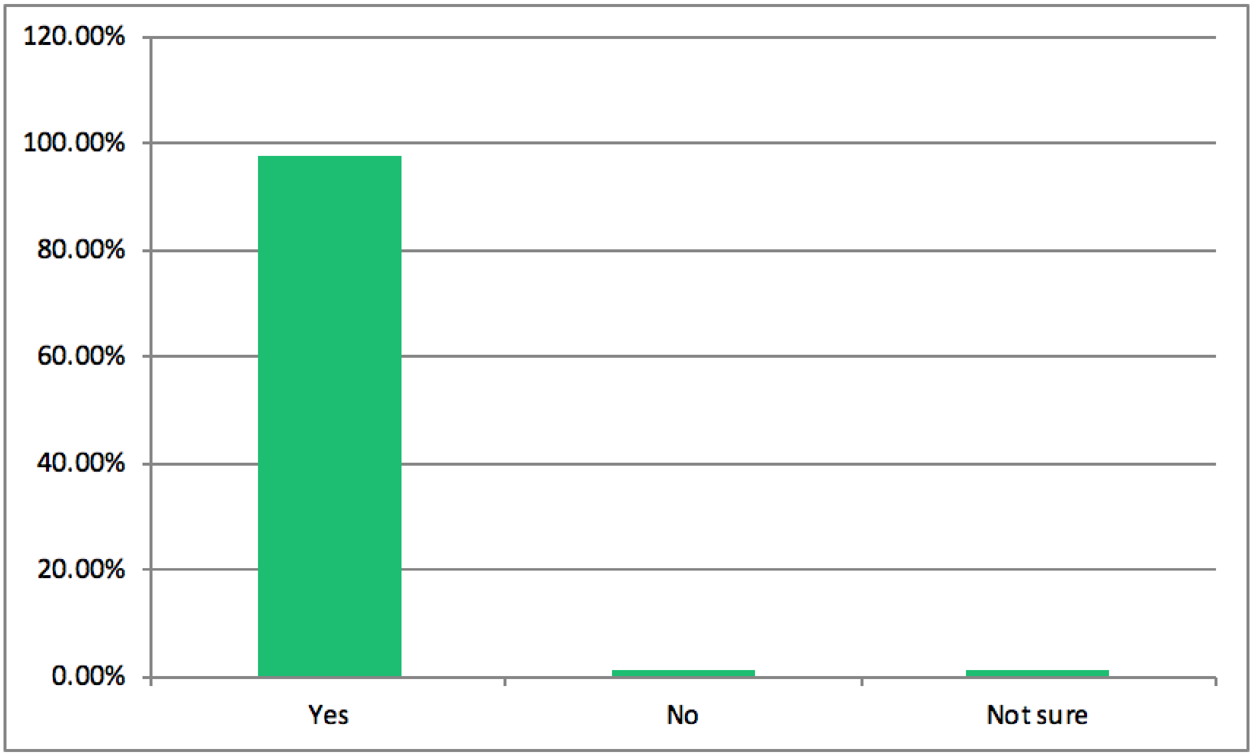
1. Did the library provide reference service via the Internet or telephone when the building was physically closed?

Answered: 80 Skipped: 2



1. Did the library provide 'outside' service for circulation of physical materials during the pandemic? This includes any contactless or minimal contact circulation, such as curbside or vestibule pickup, mailing, or drive-thru.

Answered: 80 Skipped: 2



1. What efforts has your library taken to assist patrons in accessing online resources?

Answered: 76 Skipped: 6

Respondents provided the following responses:

- Made resources more visible on library website
- Providing technical assistance
- Offered tips, tricks, and lessons in newsletters
- Increased PR via social media, email, Front Porch Forum, and posters to advertise resources
- How-to videos and booklets
- Made librarians available via phone for assistance
- Updated website to be more user-friendly

1. Has your library partnered with other entities to assist patrons during the Covid-19 pandemic? (e.g., schools, the town, healthcare providers) If so, please describe said partnerships.

Answered: 68 Skipped: 14

Several responded said that they did not partner with other entities, those who did partner with other entities listed the following:

- Local schools (the overwhelming majority of respondents stated they partnered with schools)
- Vermont Humanities Council
- Town Assistants
- Various organizations that provide meal giveaways
- Nature museums
- Opioid task force
- Mutual aid groups
- Elder care communities

1. Is there anything that could potentially help you to better serve your patrons during the Covid-19 pandemic? Examples might include better bandwidth or signal strength, specific training or resources, updated furnishings or equipment, or anything else you can think of.

Answered: 60 Skipped: 22

A number of respondents indicated that improved bandwidth would help better serve their patrons. The complete list of responses is below.

"Funding for online subscriptions and e-items" -*Dorothy Alling Memorial Library*

"Better signal" -*Butterfield Library, Westminster*

"Laptop computers or ipads for patrons to take home" -*Jaquith Public Library*

"We are hemmed in by the hardware restrictions of Fiberconnect. We would LOVE to add an outdoor WAP to better extend our wifi." -*Kellogg-Hubbard Library*

"Better access to wireless internet, reach farther outside the building, stronger connection to internet, and better cell phone service." -*West Hartford Library*

"If we are still social distancing in the spring, the library would benefit from funds to purchase outdoor furniture and better laptops." -*Solomon Wright Public Library*

"Better exterior Wi-Fi and seating would greatly improve usage" -*Swanton Public Library*

"Better bandwidth; and my I add a comment to an earlier question which didn't seem to have space for it: our outside accommodations for wifi were already pretty good before Covid - bench, shade, electrical outlet" -*Baldwin Memorial*

"I would love to offer tablets or laptops for patrons to borrow and take home." -*Chelsea Public Library*

"More air filtering devices for this 114 year old building for the winter." -*Cobleigh Public Library*

“Updated computers and better signal strength” -*Enosburgh Public Library*

“Updated furnishings, so that we could make room for people to be in the building safely/more space for computers. Our programs are being held in another location because the building is not big enough to be socially distanced here. Also, our wifi barely reaches outside the building, so we could use some boosters to help increase the signal strength, especially in the winter when people do not want to sit outdoors, but would prefer to be in their cars in the parking lot.” -*Pettee Memorial*

“We have terrible terrible upload speeds here, and many many patrons in the NEK who do not have either cell signal OR broadband services and terrible speeds. We need every home in the NEK connected to affordable broadband.” -*Alice M. Ward Memorial Library*

“Better signal strength in our parking lot, a robust tent for using the internet during bad weather.” -*Putney Public Library*

“Having some assess whether our WIFI equipped in positioned properly and working at its best would be great.” -*Whiting Library*

“Better bandwidth is always an issue here. I'd love to add a collection of laptops and hotspots to lend, but worry that I wouldn't be able to keep up on maintenance, updates and repairs on these items.” -*John G. McCullough Free Library*

“updated laptops or tablets for public use” -*Waterbury Public Library*

“Updated furnishings (interior and exterior); PPE, laptops, wifi hotspots” -*Winooski Memorial Library*

“We need ventilation in our meeting room to allow students to use it as a study space or social service agencies to hold client meetings.” -*Rutland Free Library*

“laptops/chromebooks” -*Johnson Public Library*

“We considered lendable hot spots, but found the data plans cost-prohibitive under our own current Covid-19 budget crunch. Staff training on delivering services digitally or in mixed formats would also be a boon.” -*Manchester Community Library*

“Laptops and hot spots to check out.” -*Fletcher Free Library*

“Hotspots (we aren't in the coverage area of the affordable option), more bandwidth (available but must be agreed upon by our building board and they think we have plenty of bandwidth), wider radius of strong wifi signal in the village” -*Orwell Free Library*

“In spite of being a FiberConnect library, we sometimes have issues with connections, and beyond the village our patrons internet access is extremely spotty. This situation has been terrible for people trying to work from home, especially anyone with children attempting to access schoolwork at the same time. Patrons have had issues with our wifi outside, but I'm not sure if the cause is signal strength or something else. We do not have adequate sneeze guards at our tables/work desks. I do wish that we had equipment that we could lend, or a means of improving access in the hills & hollows around the lakes & ponds where many patrons live. Both cell service and broadband are awful in so many spots in our two communities (Castleton/Hubbardton)." -*Castleton Free Library*

"The ability to check out laptops and additional e-resources like Hoopla, Canopy, and more funds for Overdrive." -*Essex Free Library*

"Better bandwidth, stronger signal. Boosted wifi signal (in terms of strength and distance for our patrons accessing it from outside the building.) Resources or materials (laptops, chromebooks, tablets and wifi hotspots WITH SECURITY OPTIONS) to distribute to our patrons. Outdoor furnishings, windscreens/"weather-proof" tents or awnings or somehow making it possible for our patrons without cars to access our wifi in inclement/snowy weather." -*Bixby Memorial Free Library*

"Our building is 126 years old and we are working on an addition which would have an HVAC system which we don't have now so we are limiting in-person visits to 3 people. It is hard to do more with only 900 sq. feet." -*Jeudevine Memorial Library*

"Bottles of 70% isopropyl alcohol are hard to find." -*Abbott Memorial Library*

"Resources for home schooling both online, print, and dvd, grants for GMLC to purchase more content, DOL providing funding toward subscription services like HULU or Mango," -*Rochester Public Library*

"It would be wonderful to have access to chromebooks to lend to patrons" -*Norman Williams Public Library*

"Funding for laptops to be able to check out. Perhaps wifi hotspots patrons could check out (I don't know much about these). We plan to apply for a DOL grant for $300 to upgrade our router/transmitter to improve our signal within the building and in the parking lot." -*Greensboro Free Library*

"ipads or tablets for training and/or loan, staff time to plan training sessions" -*Martha Canfield Memorial Free Library*

"Better cellphone service and additional furniture for porch area as wi-fi spot" -*Charlotte Library*

"There is always room for improvement when dealing with the public. Stronger internet or hotspots to check out would be huge, as we are in a valley and depending where you reside depends on your service. Laptops to check out would be amazing! Updates children's furniture, would be incredible. Budgets are tight and spending outside line items is difficult. Additional resources are always welcomed" -*Proctor Free Library*

"The internet goes out periodically, perhaps a better amount of signal strength would help." -*Russell Memorial Library*

"more money for digital resources (ebooks and audiobooks, or even something like Kanopy)" -*Baxter Memorial Library*

"Better cell service" -*Westford Public Library*

"Better bandwidth -- our upload speeds are pretty miserable. Being able to have WiFi that extends to the whole town green would be nice as well." -*Platt Memorial Library*

"staff could use tech training to better support devise use, we need a new wifi printer so patrons can print from personal devices" -*Bradford Public Library*

"hotspots with better coverage area....we use Sprint as a carrier because of the expense of an AT&T or Verizon hotspot" -*Hartland Public Library*

"Improving internet and cell service, devices to loan" -*Peacham Library*

"better bandwidth, signal strength, hot spot equipment to lend, devices to lend" -*Whitingham Free Public Library*

"Take home wifi hotspots and laptop computers or tablets" -*Lawrence Memorial Library*

"Hotspots that would actually work at people's homes. The issue with all the hotspots i've looked at is that they would only work at homes where people already have cell service" -*Moore Free Library, Newfane*

"Hot spots and laptops that could be checked out" -*Windsor Public Library*

"more reliable connection speeds especially on remote learning days." -*Deborah Rawson Memorial Library*

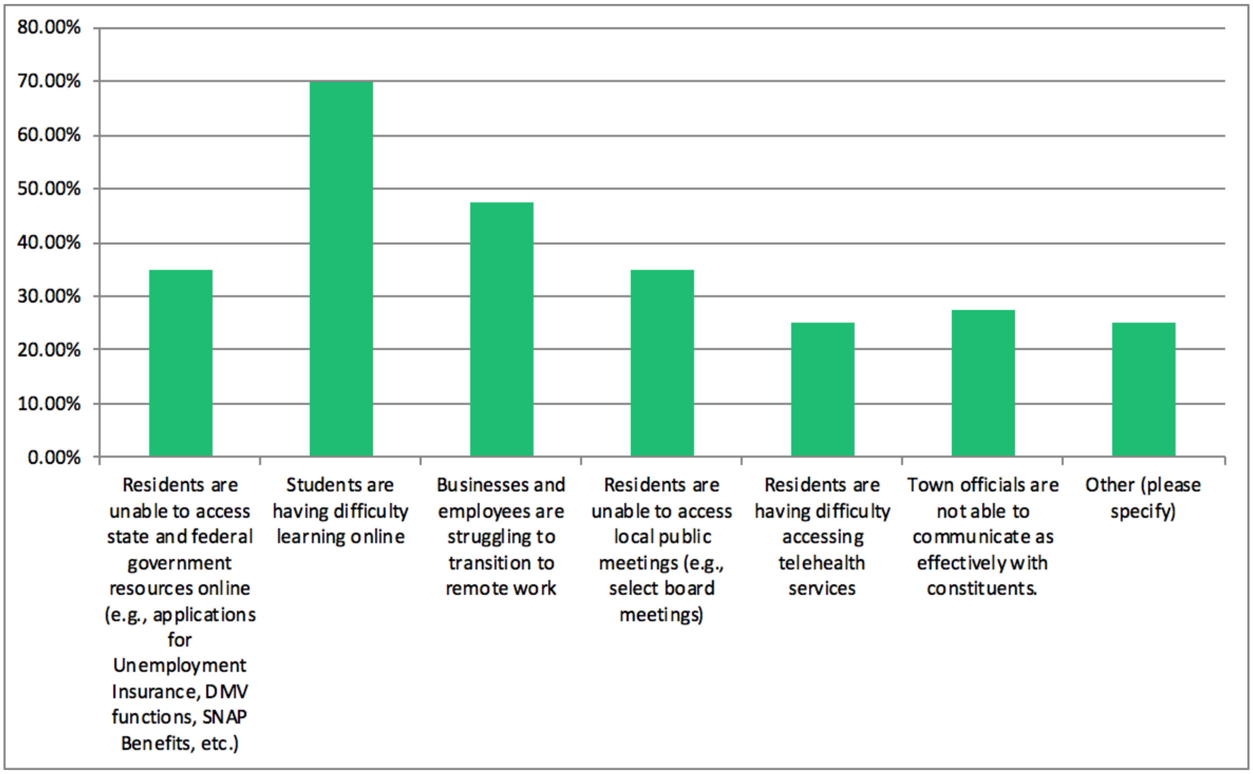
"We would benefit from and will soon receive better Wi-Fi range; we would lend mobile hotspots, tablets, etc. if we were given those resources to lend; we would welcome further training and resources; we would welcome partnership with other agencies." -*Morristown Centennial*

Appendix F: Town Administrator Survey Results

This survey was sent to town managers, town clerks, town administrators, and selectboard chairs across the State of Vermont. Forty-nine of them responded.

3. What are the most challenging issues facing your community during the Covid-19 pandemic? (Select all that apply)

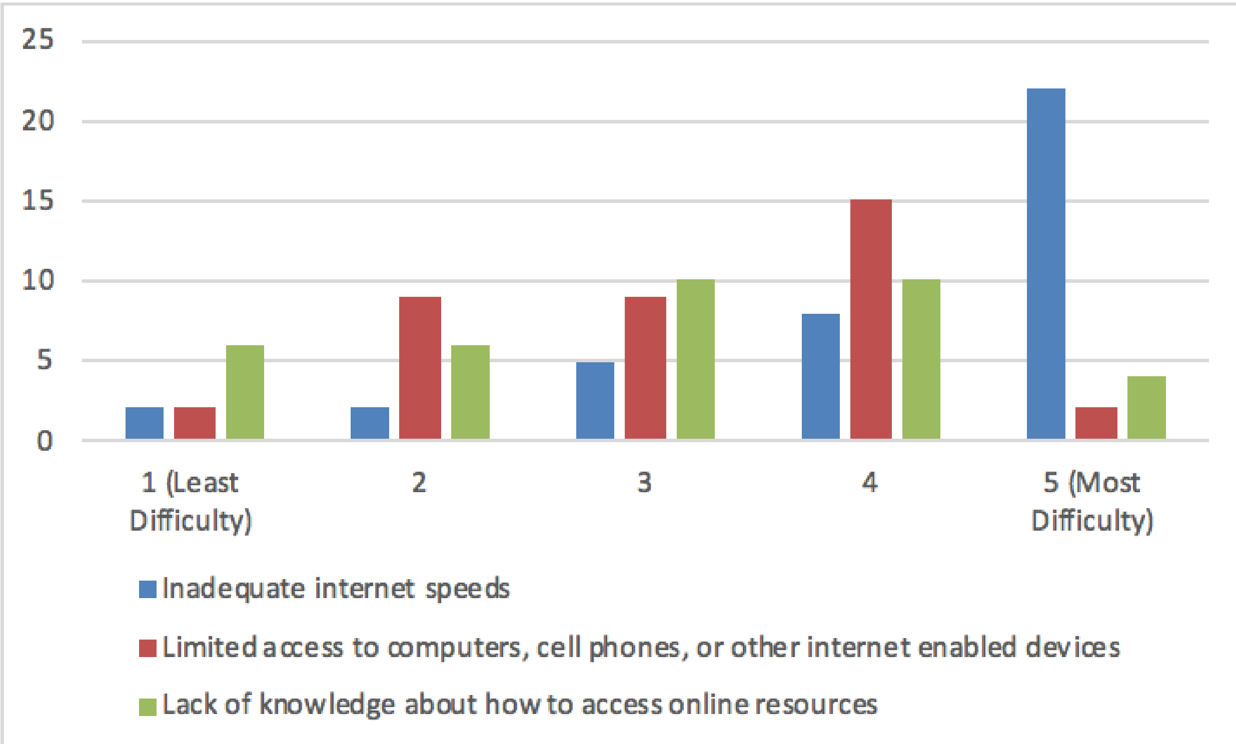
Answered: 40 Skipped: 9



Most respondents who selected “other” added that slow internet was an issue. Some also stated that they were unsure what the most challenging issues are.

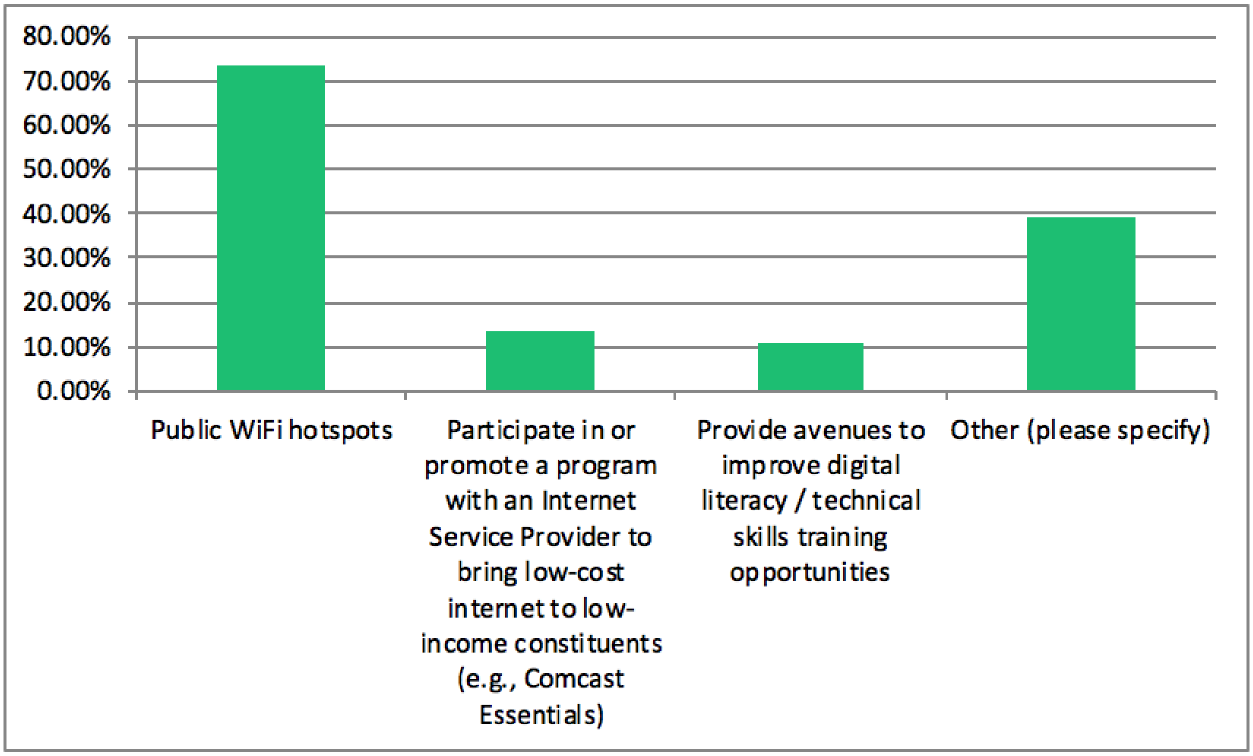
4. Please rank the following reasons of why constituents may have difficulty accessing online resources:

Answered: 41 Skipped: 8



5. In what ways has your town worked to help constituents access online resources and adjust to the Covid-19 pandemic? (Check all that apply)

Answered: 38 Skipped: 11

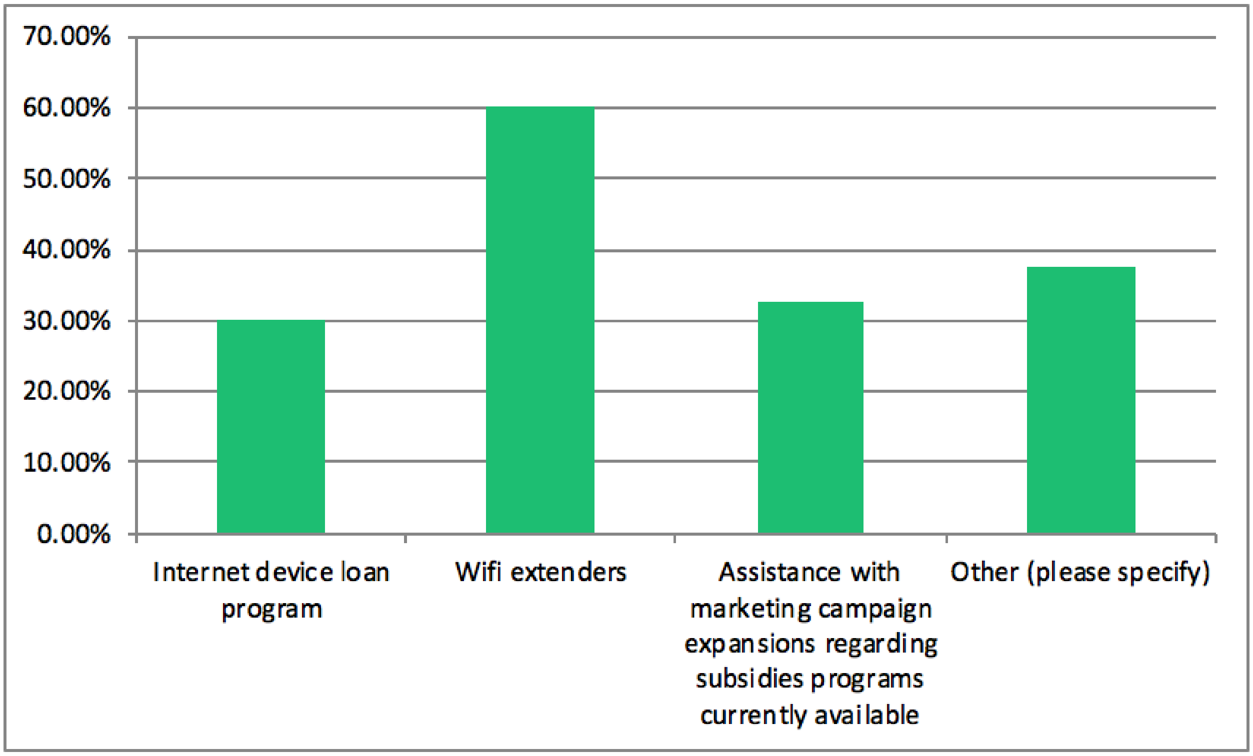


"Other" responses included:

- None
- Digitizing of records
- Joining CUDs
- Increased communication with constituents through advertising

6. What resources from the State of Vermont would allow your town to better serve your constituents and help constituents access online resources?

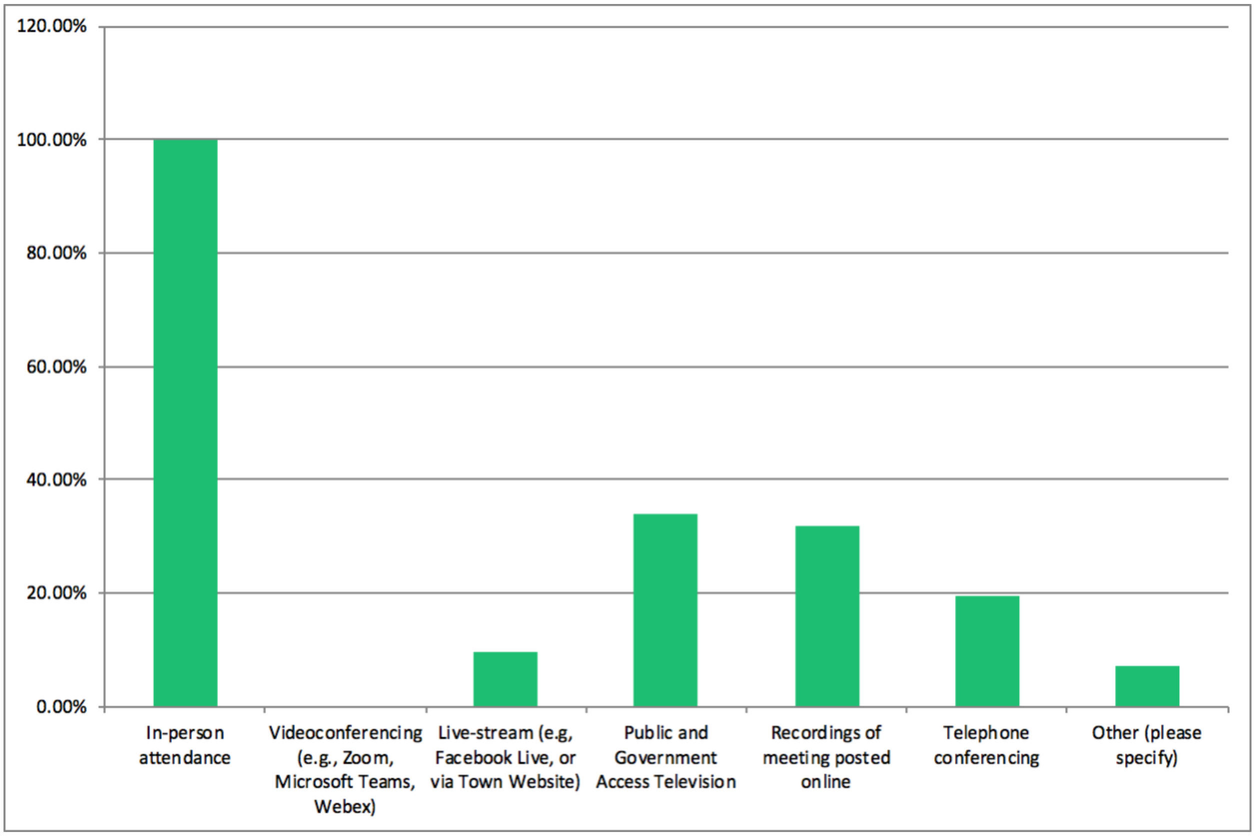
Answered: 40 Skipped: 9



Most "other" responses stated that help from the State with increasing access to broadband and cell service would be useful.

7. BEFORE the Covid-19 pandemic, how could constituents access public meetings (e.g., selectboard meetings, school board meetings, informational meetings)? Select all that apply.

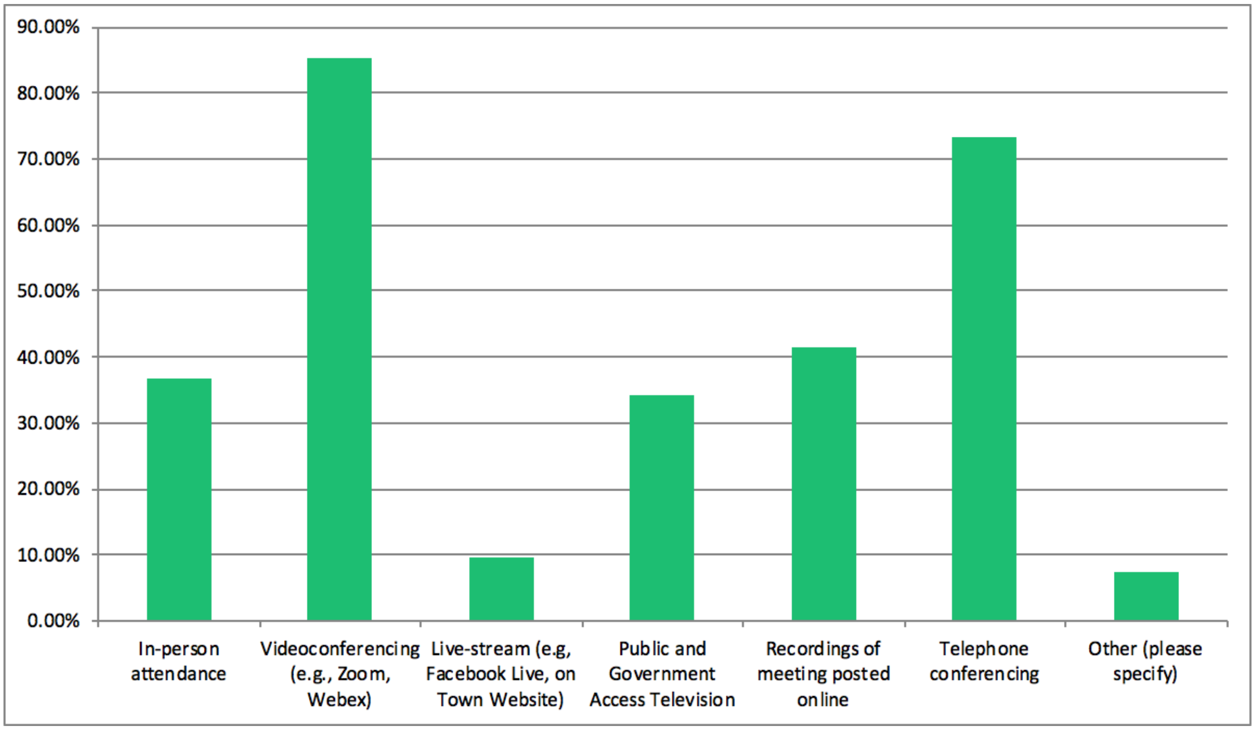
Answered: 41 Skipped: 8



All “other” responses stated that constituents could access meeting minutes posted online.

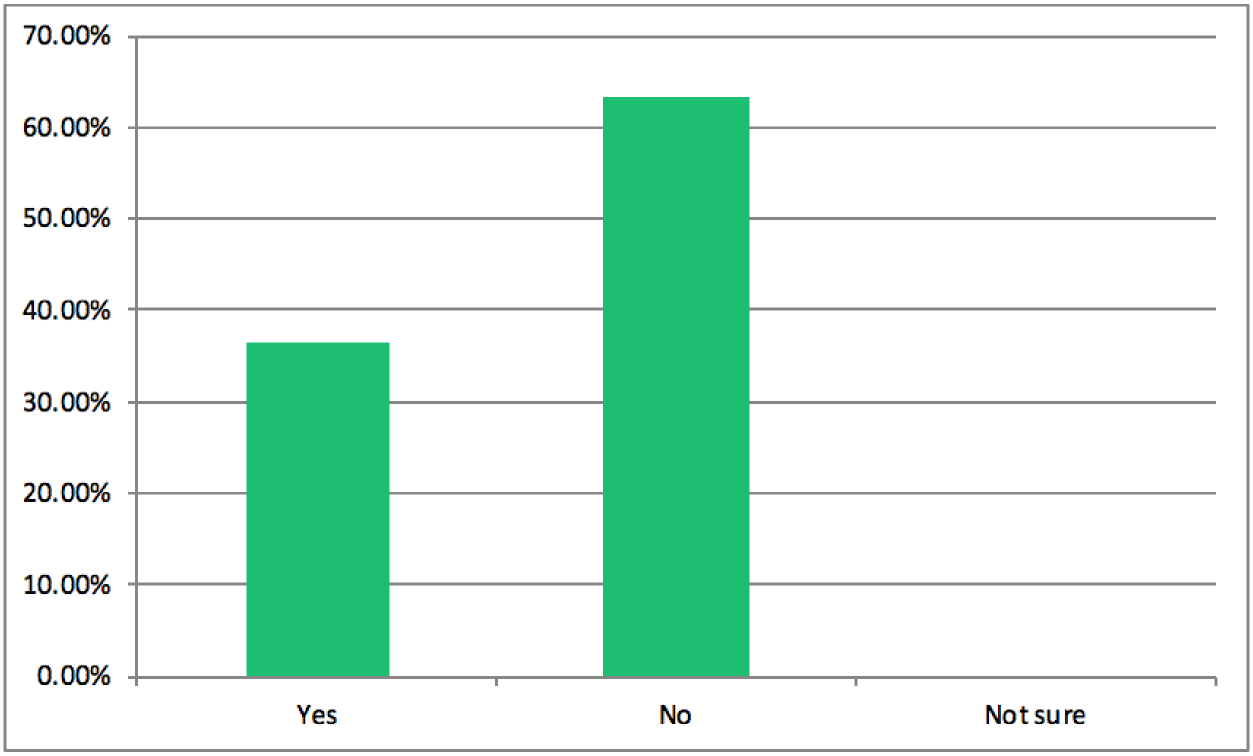
8. DURING the Covid-19 pandemic, how can constituents access public meetings (e.g., selectboard meetings, school board meetings, informational meetings)? Select all that apply.

Answered: 41 Skipped: 8



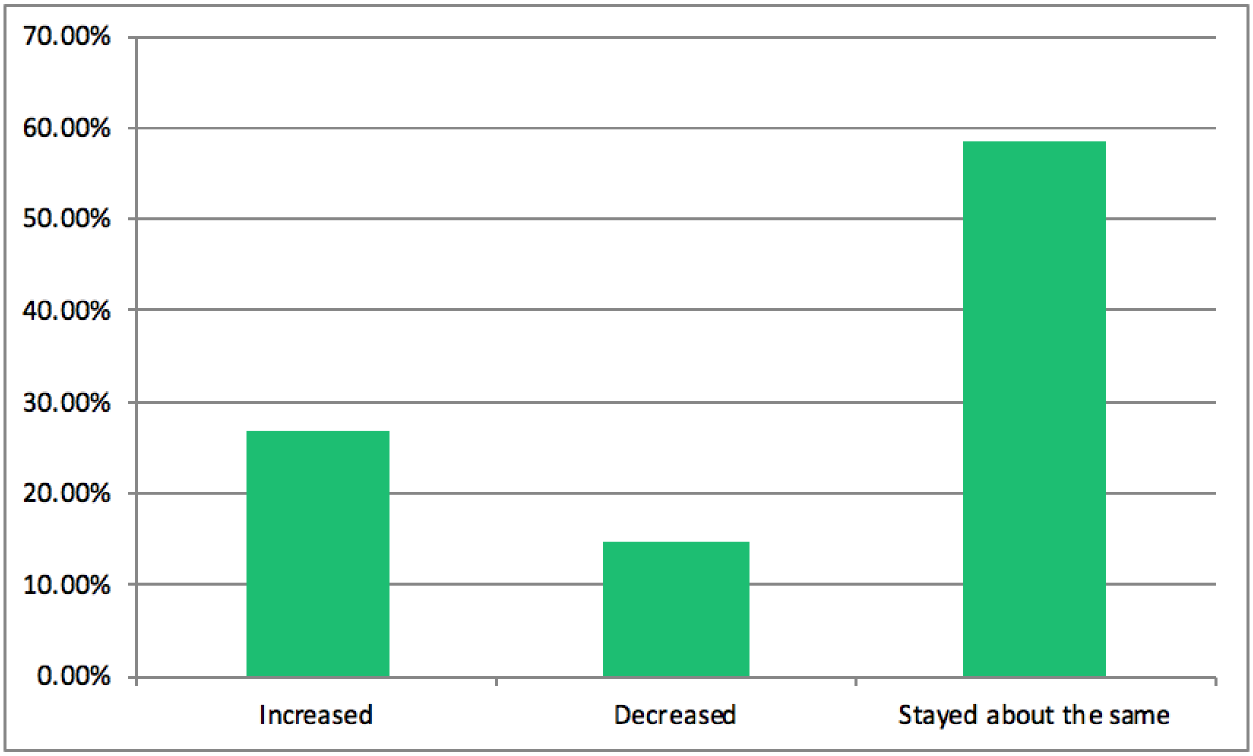
9. Are elected officials attending public meetings in-person currently ?

Answered: 41 Skipped: 8



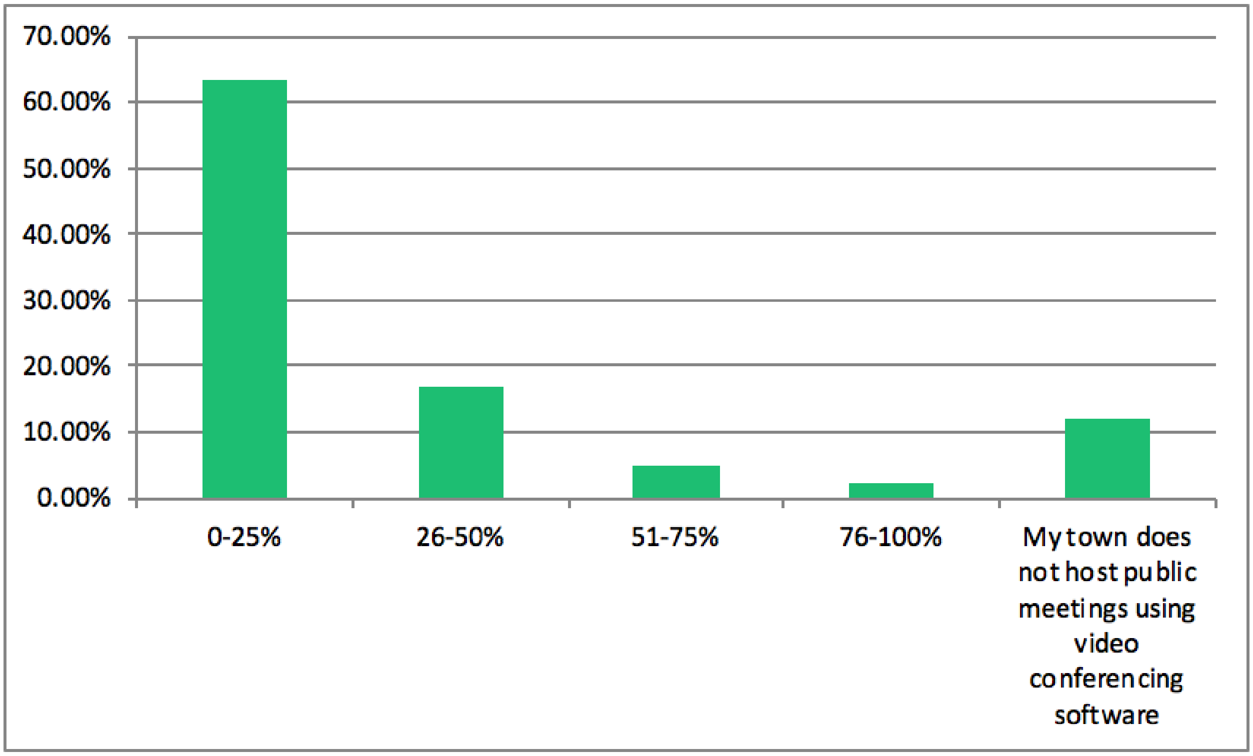
10. Compared to before the Covid-19 pandemic, regardless of being held virtually or in-person, would you say attendance and participation in public meetings has:

Answered: 41 Skipped: 8



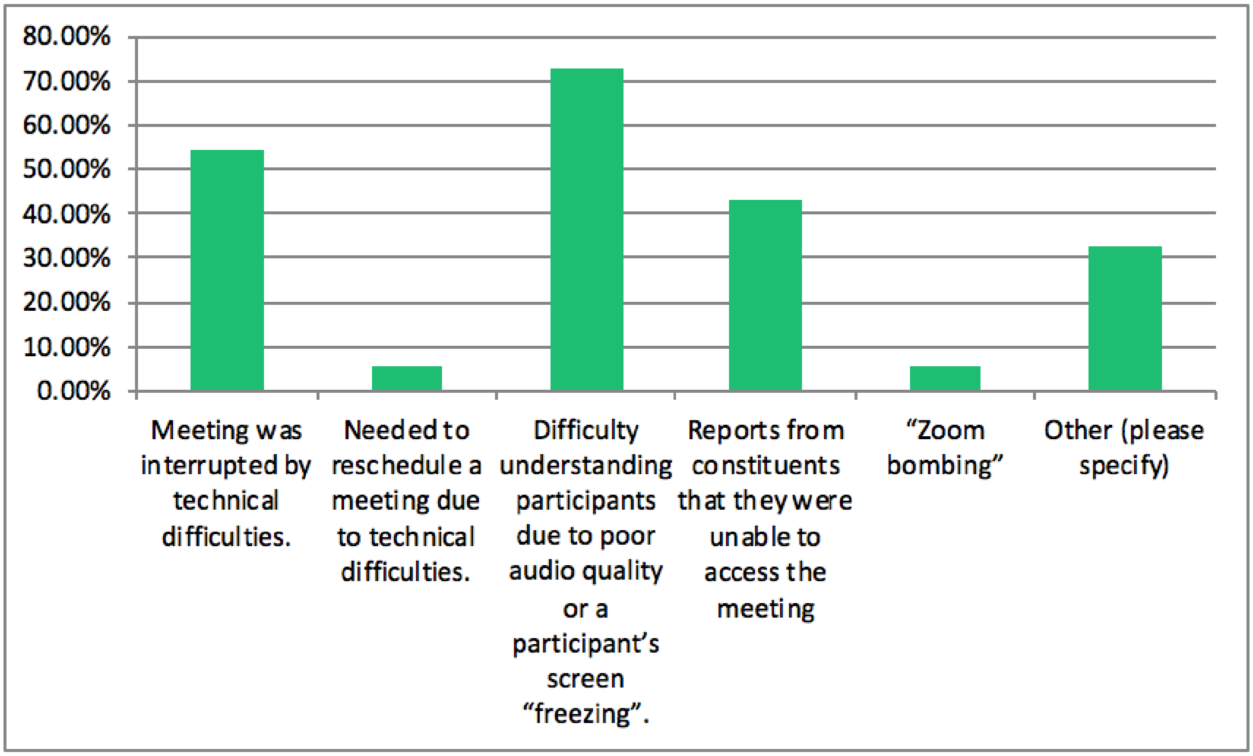
11. If your town hosts public meetings using video conferencing software (e.g., Zoom, WebEx), about what percentage of participants are dialing in from a phone?

Answered: 41 Skipped: 8



12. What are the difficulties, if any, with hosting public meetings during the Covid-19 pandemic? (Select all that apply.)

Answered: 37 Skipped: 12

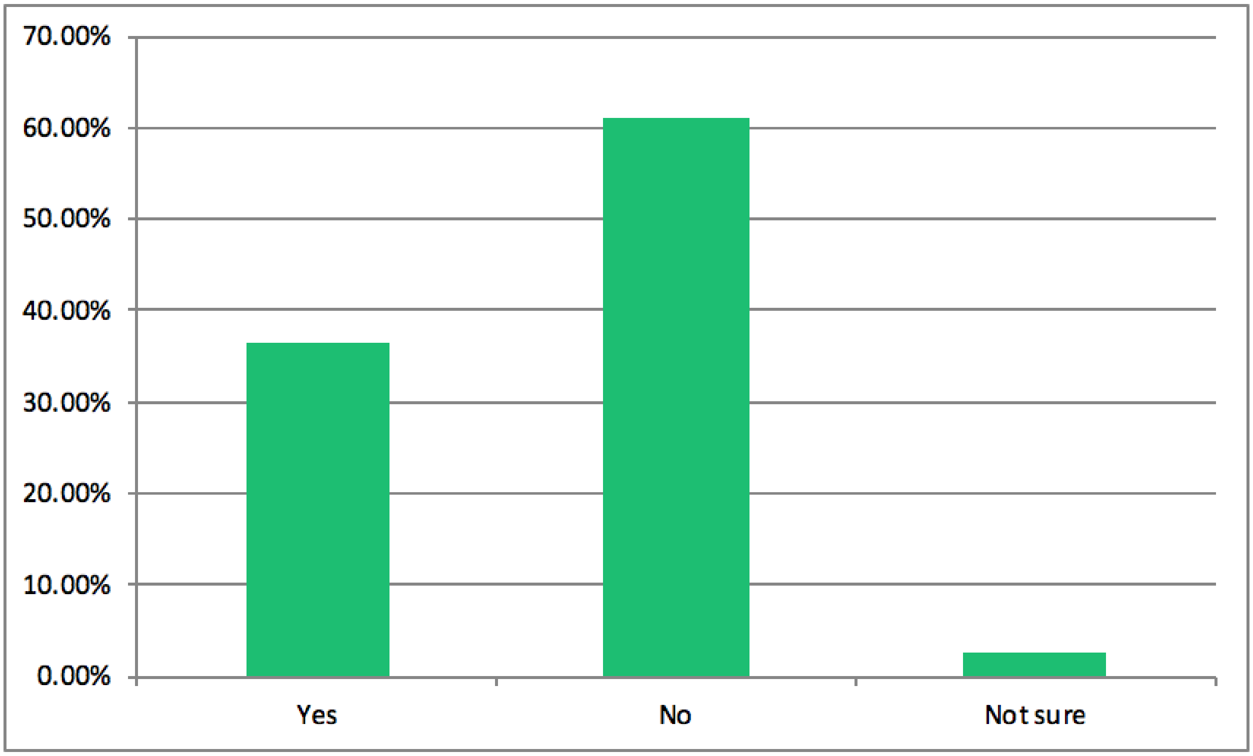


"Other" answers included:

- Excess background noise
- Constituents unable to understand how to use online interface (particularly elderly constituents)

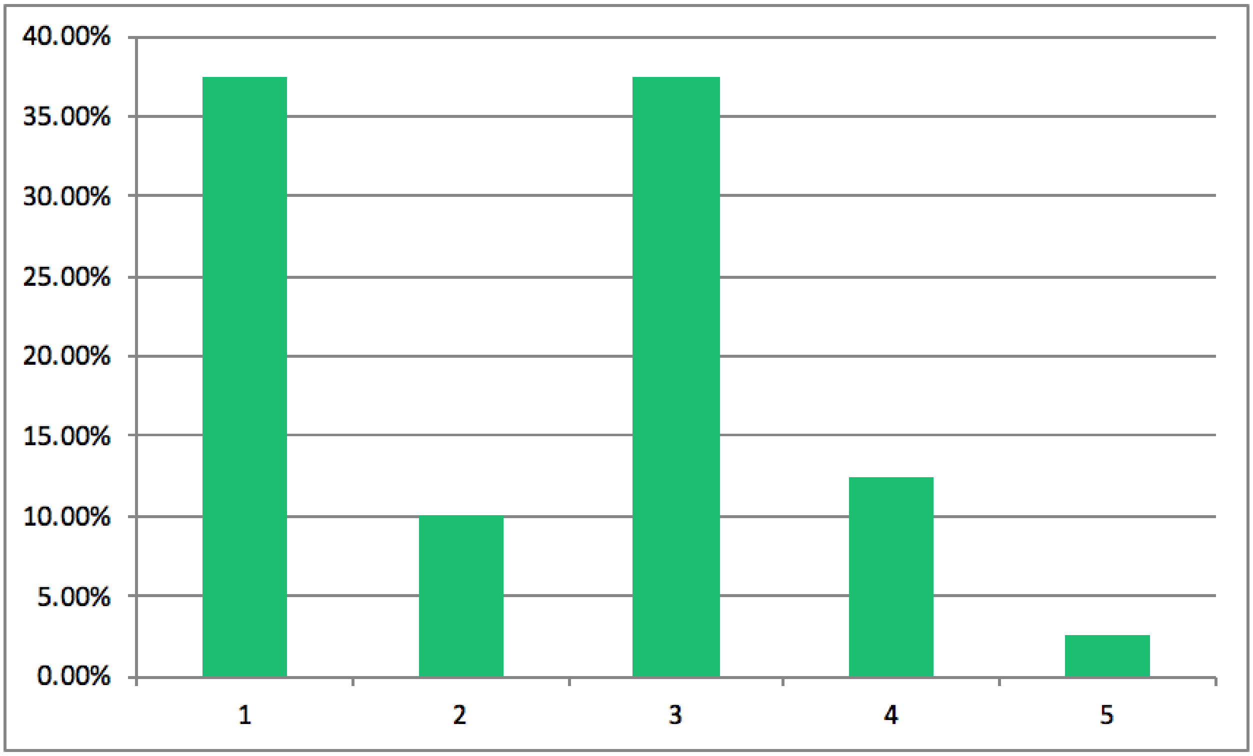
13. Has your town begun planning for an online town meeting, should the pandemic preclude an in-person town meeting this spring?

Answered: 41 Skipped: 8



14. On a scale of 1 to 5, where 1 is not at all confident and 5 is extremely confident, how confident are you that your town could provide an online town meeting that includes all voters at their current levels of connectivity?

Answered: 40 Skipped: 9



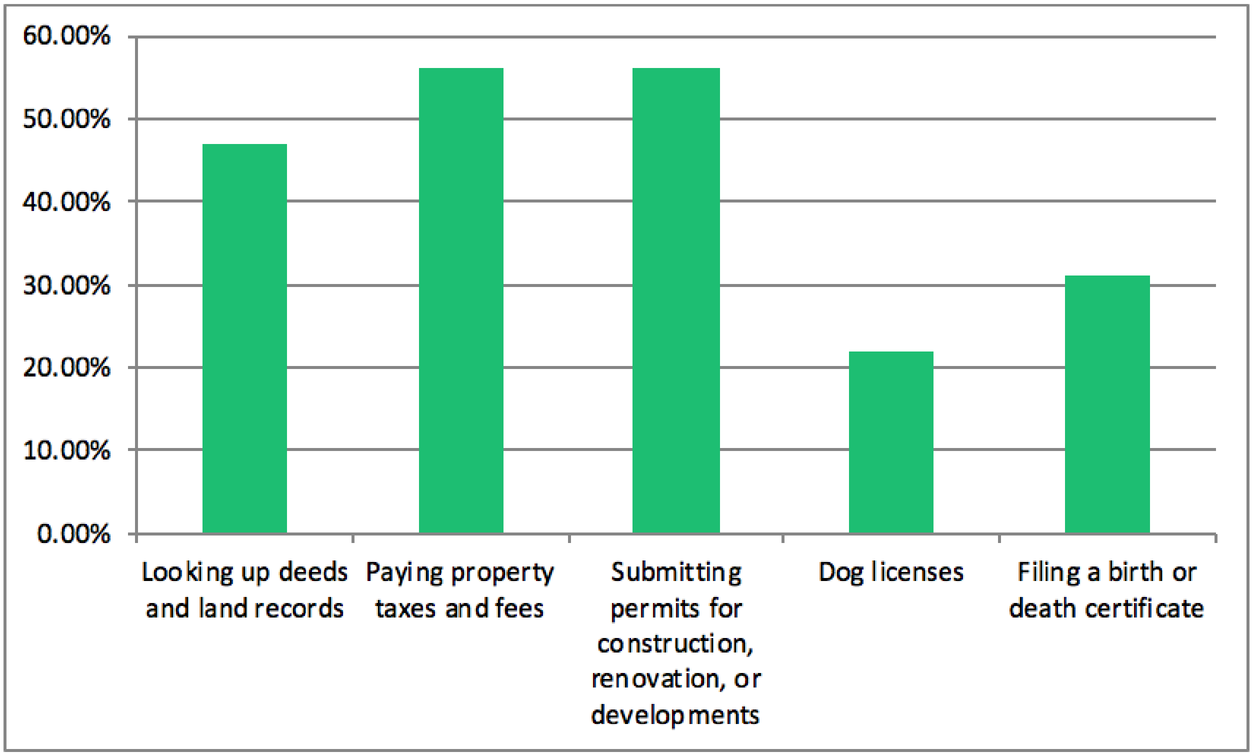
15. What resources would be helpful to your town to ensure all citizens are able to participate in municipal meetings and annual town meetings during the Covid-19 pandemic?

Answered: 36 Skipped: 13

The vast majority of respondents stated that increased high-speed internet access would be most helpful. Other respondents also asked the State to provide guidance as to what the best practices would be for online municipal meetings. How-to videos and technical assistance were also requested.

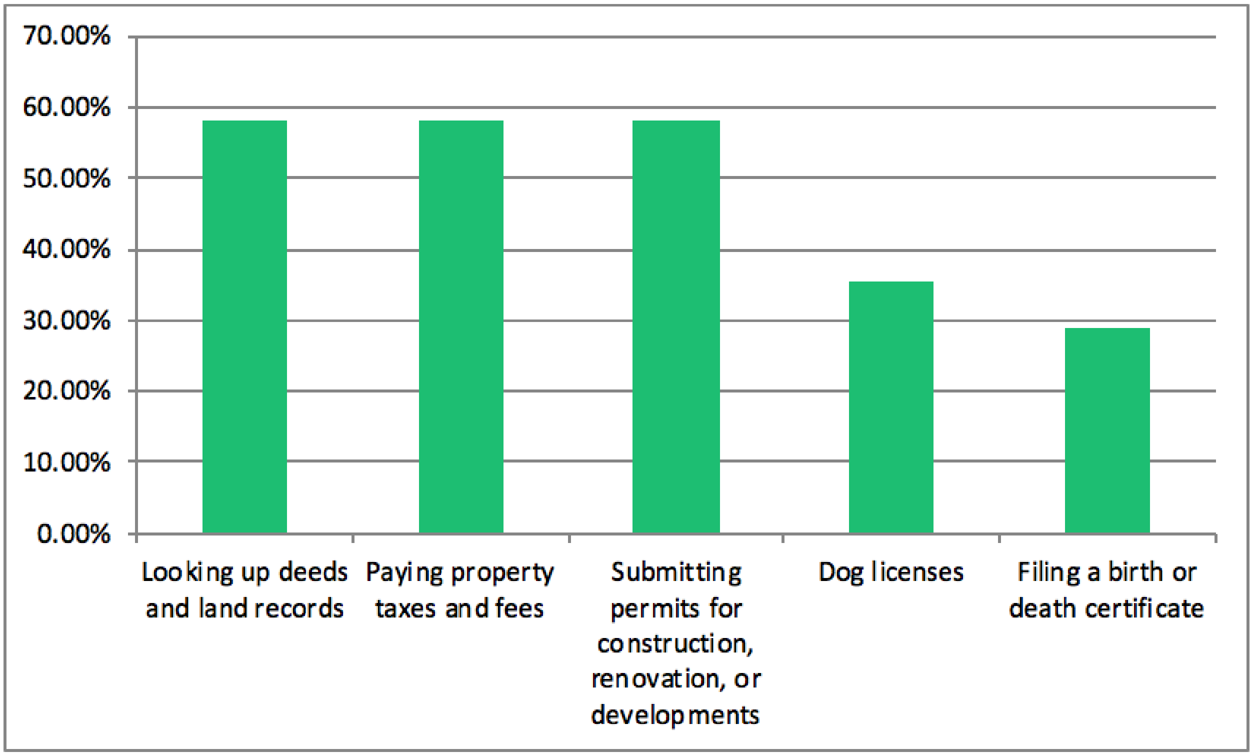
16. BEFORE the pandemic, what municipal functions were available to residents online?

Answered: 32 Skipped: 17



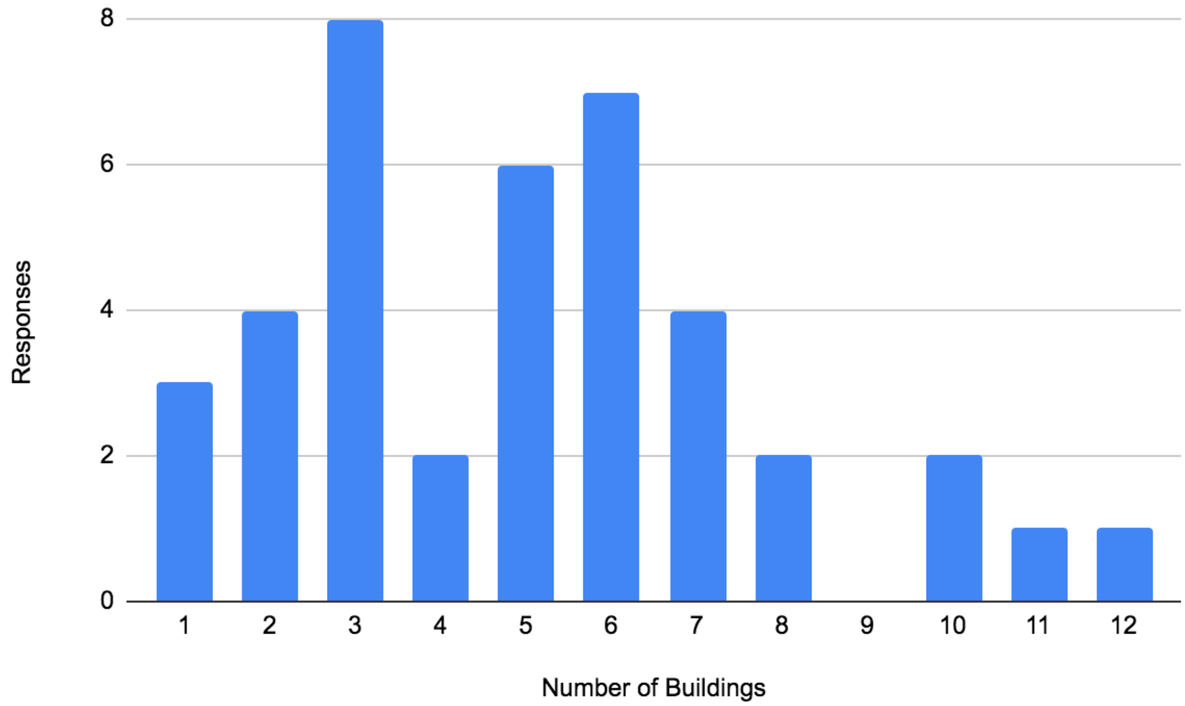
17. DURING the pandemic, which municipal functions are available to residents online?

Answered: 31 Skipped: 18



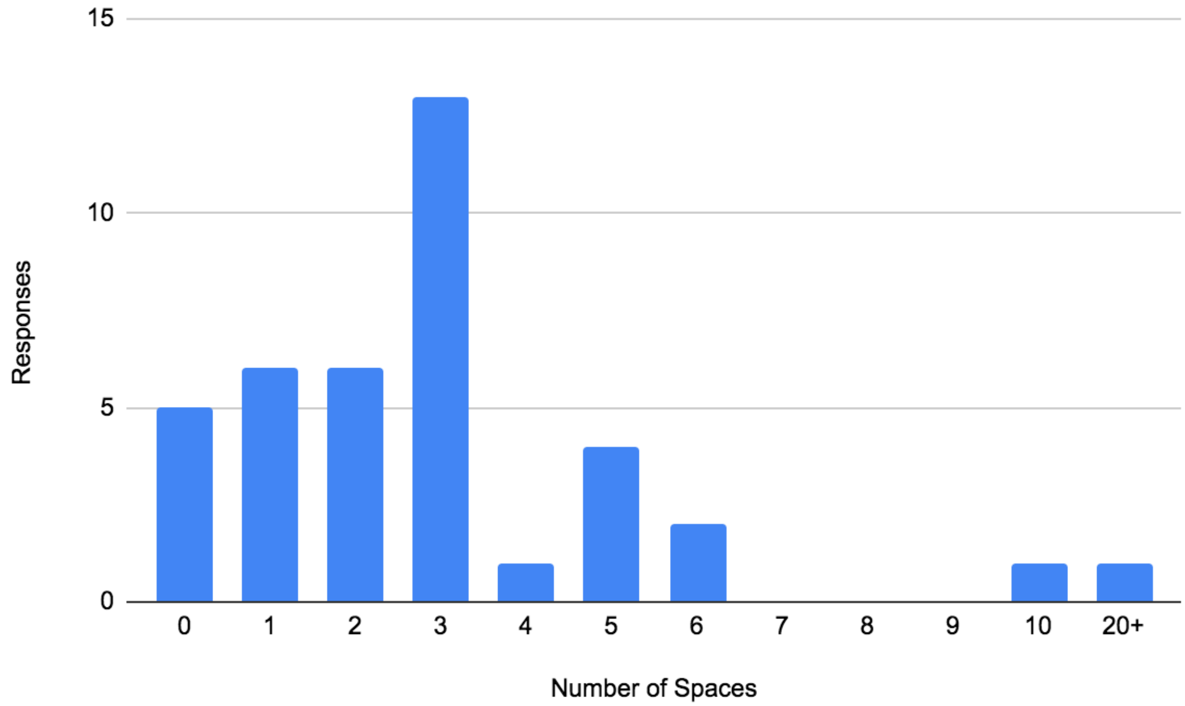
18. Approximately how many buildings in your town are owned or leased by your town?

Answered: 40 Skipped: 9



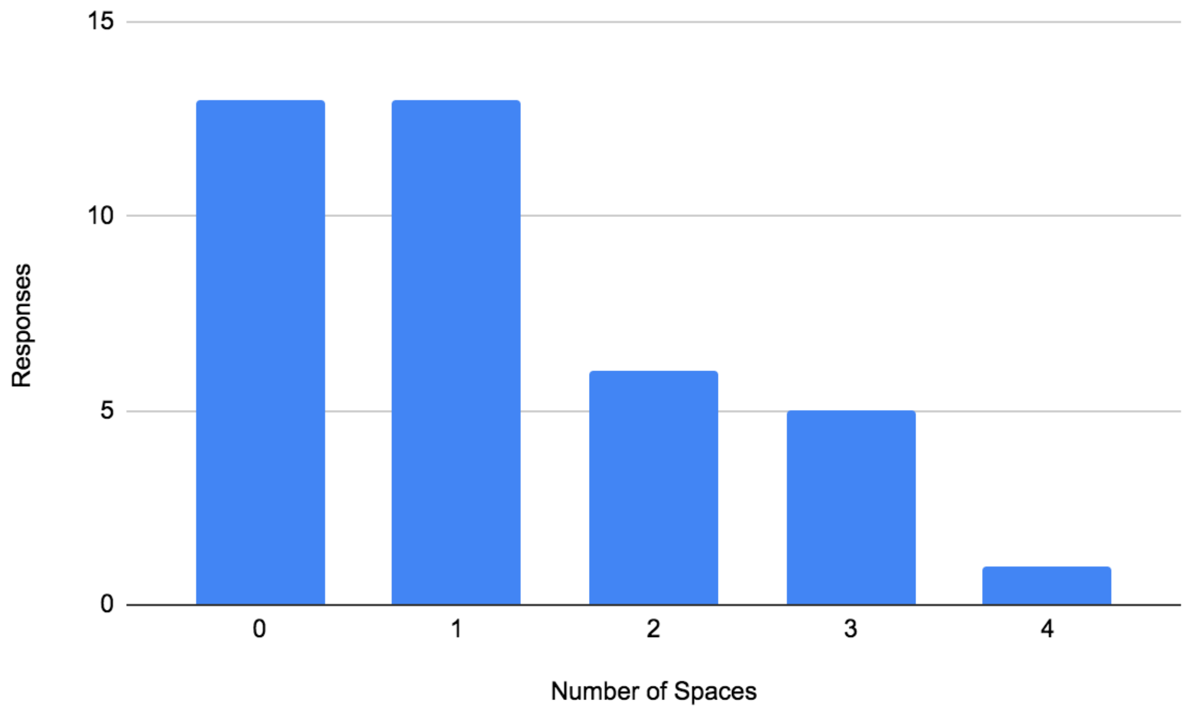
19. How many outdoor spaces of at least one acre (e.g., parks) are owned or leased by your town?

Answered: 39 Skipped: 10



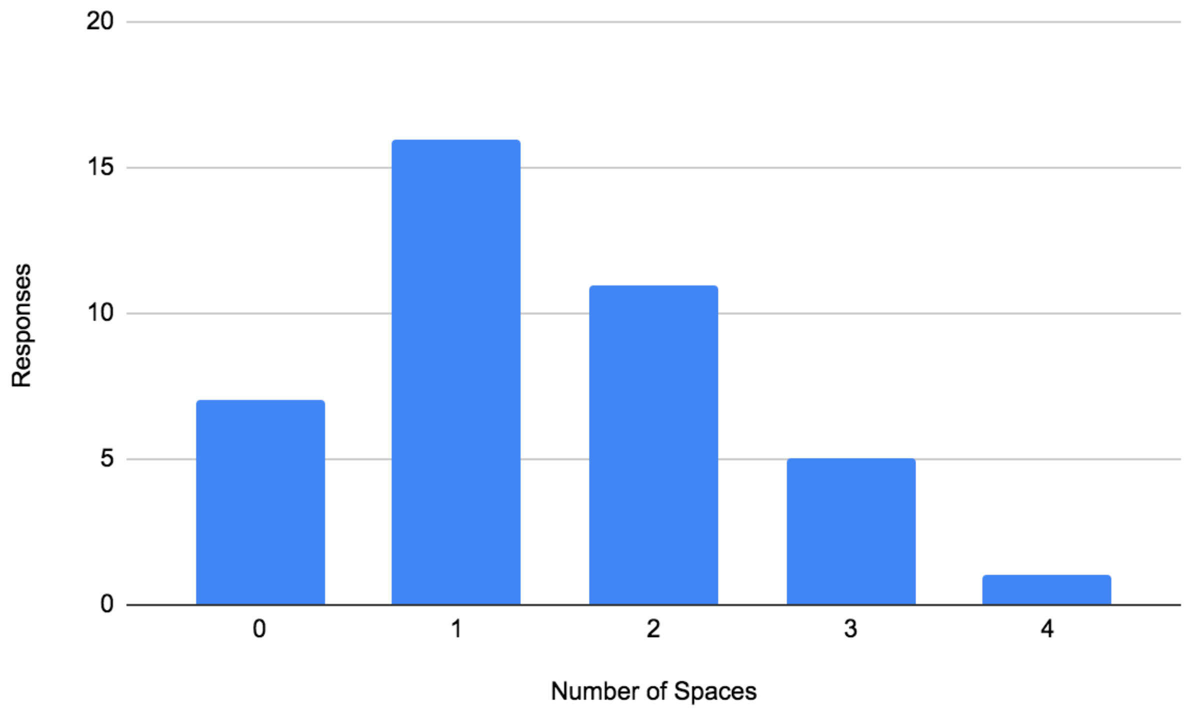
20. BEFORE the Covid-19 pandemic, how many town buildings or outdoor spaces offered public Wi-Fi access?

Answered: 40 Skipped: 9



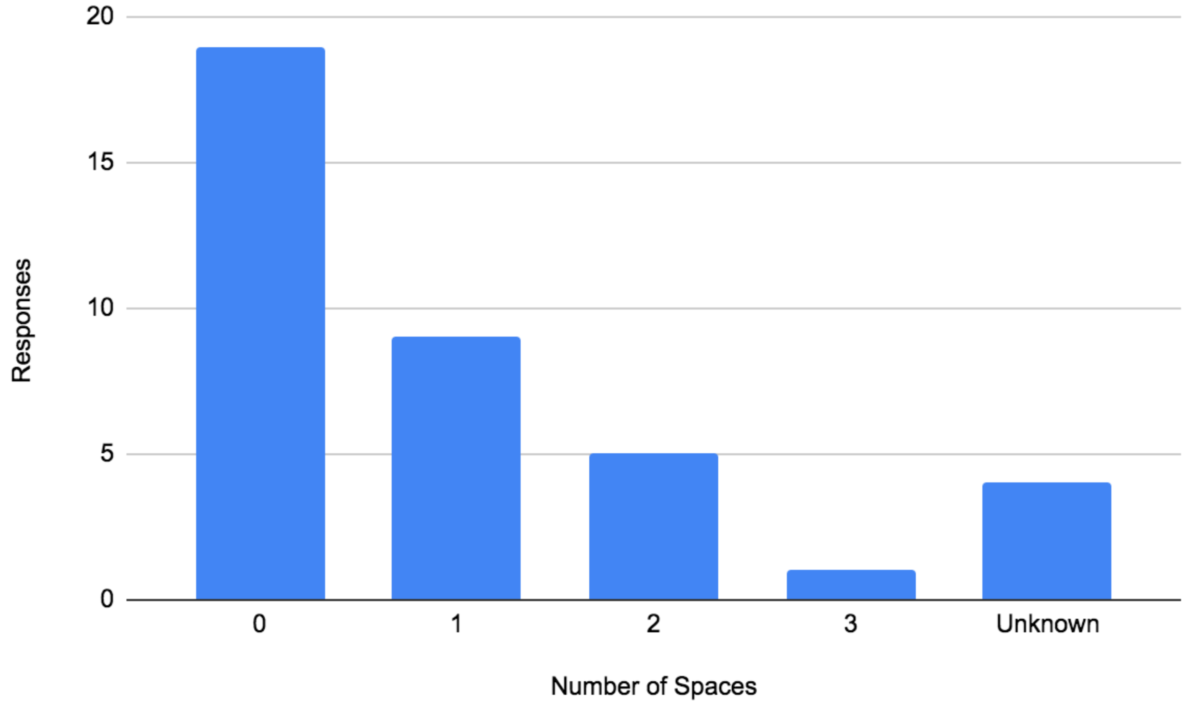
21. DURING the Covid-19 pandemic, how many town buildings or outdoor spaces offer public Wi-Fi access, including places where constituents can connect from a parked vehicle?

Answered: 40 Skipped: 9



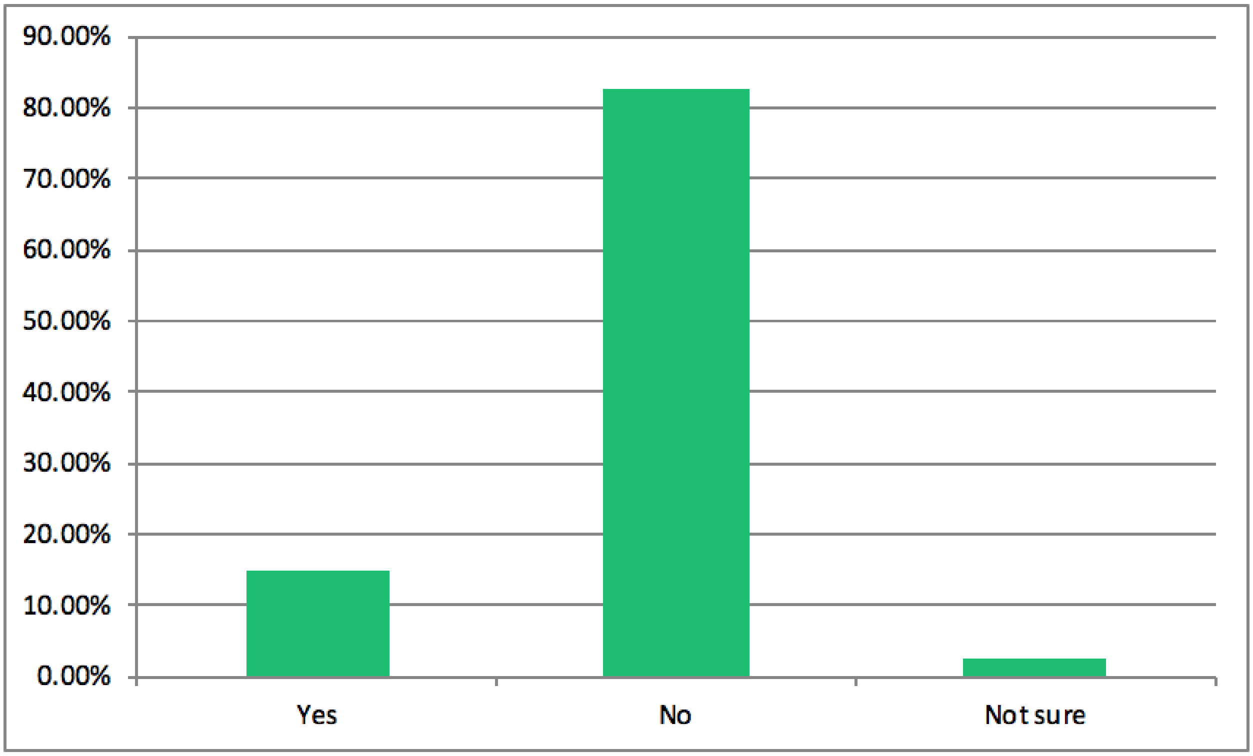
22. Considering town buildings that do not currently offer public Wi-Fi, how many have a fiber internet connection?

Answered: 40 Skipped: 9



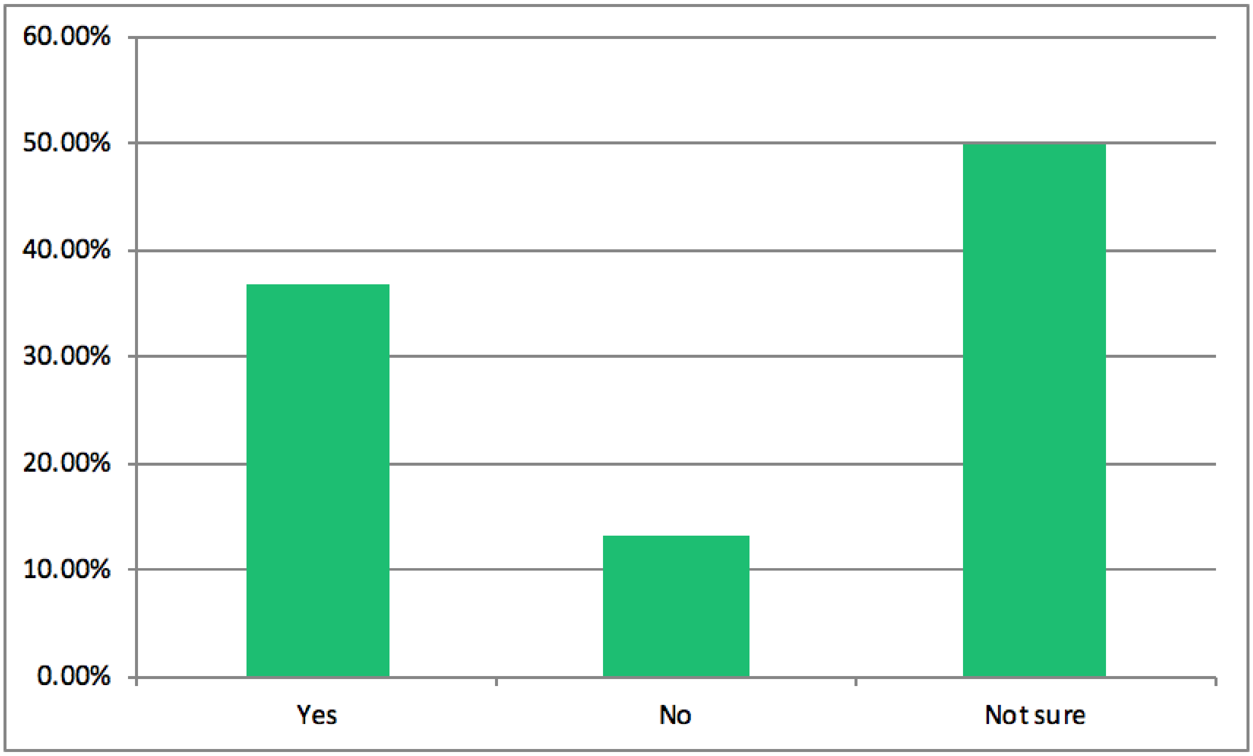
23. Since the start of the Covid-19 pandemic, has the town added equipment to extend or strengthen Wi-Fi signals for these hotspots?

Answered: 40 Skipped: 9



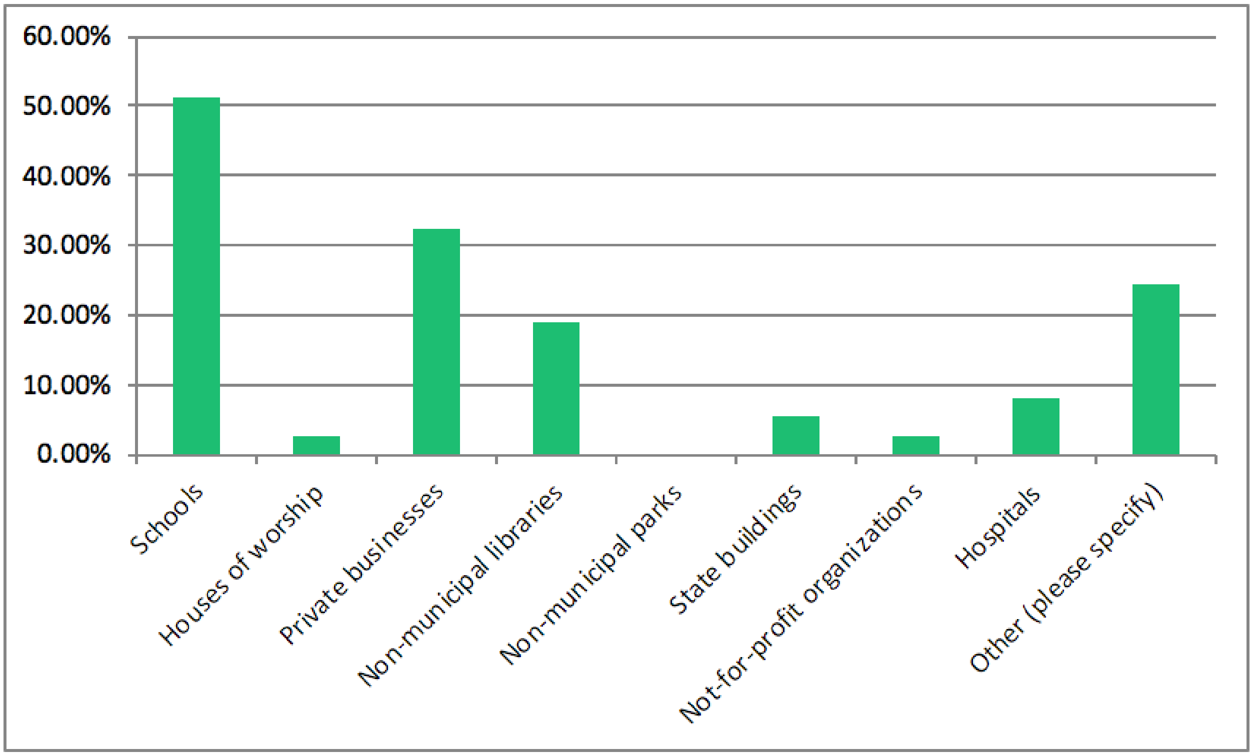
24. If the area around your library has limited broadband or cell service access, would you be willing to participate in a program to install equipment at the library to provide better cell service or broadband to surrounding homes?

Answered: 38 Skipped: 11



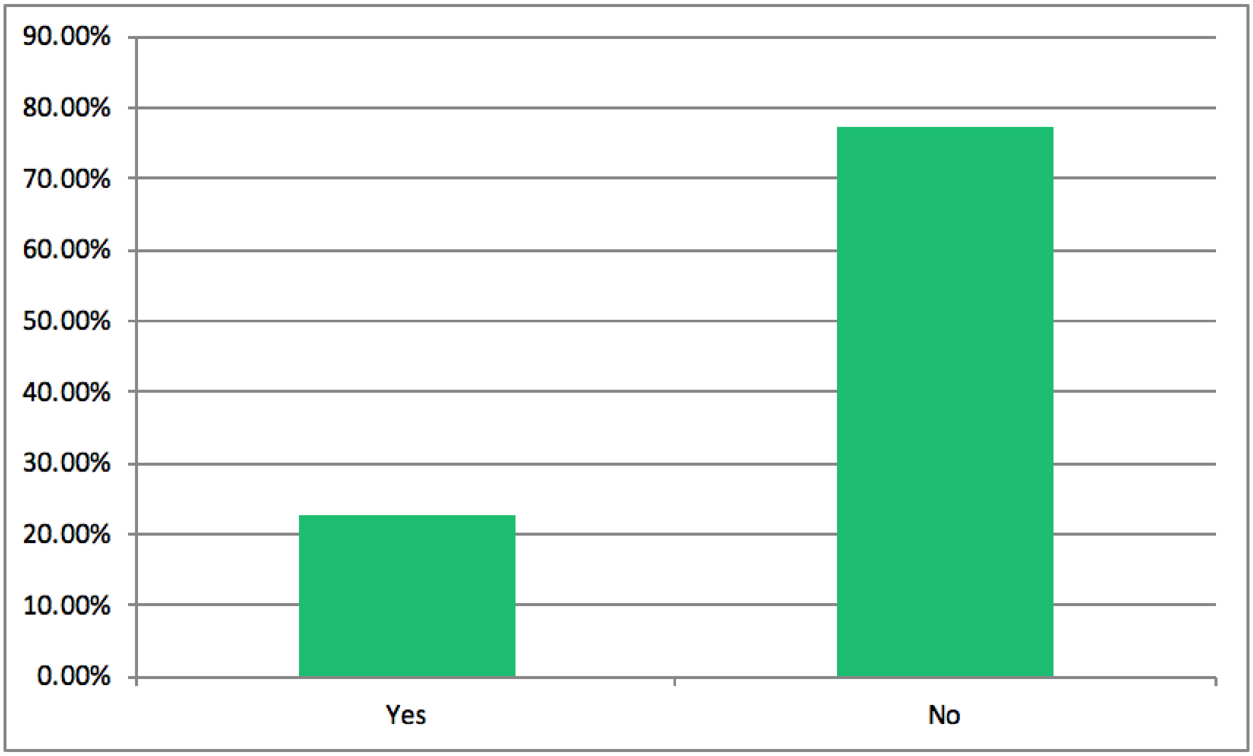
25. Are you aware of free Wi-Fi hotspots in your town at the following non-municipal buildings / spaces? (Select all that apply)

Answered: 37 Skipped: 12



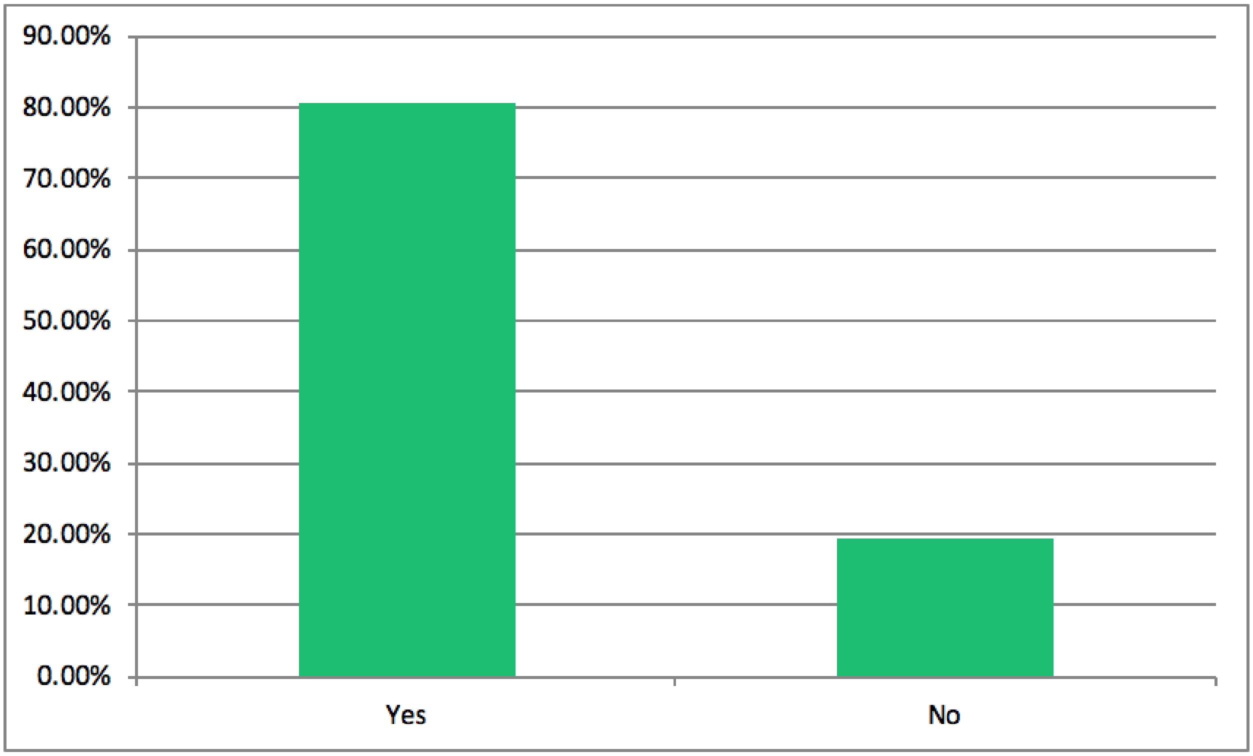
26. Do you believe that there are an adequate number of Wi-Fi hotspots in your town for your constituents?

Answered: 40 Skipped: 9



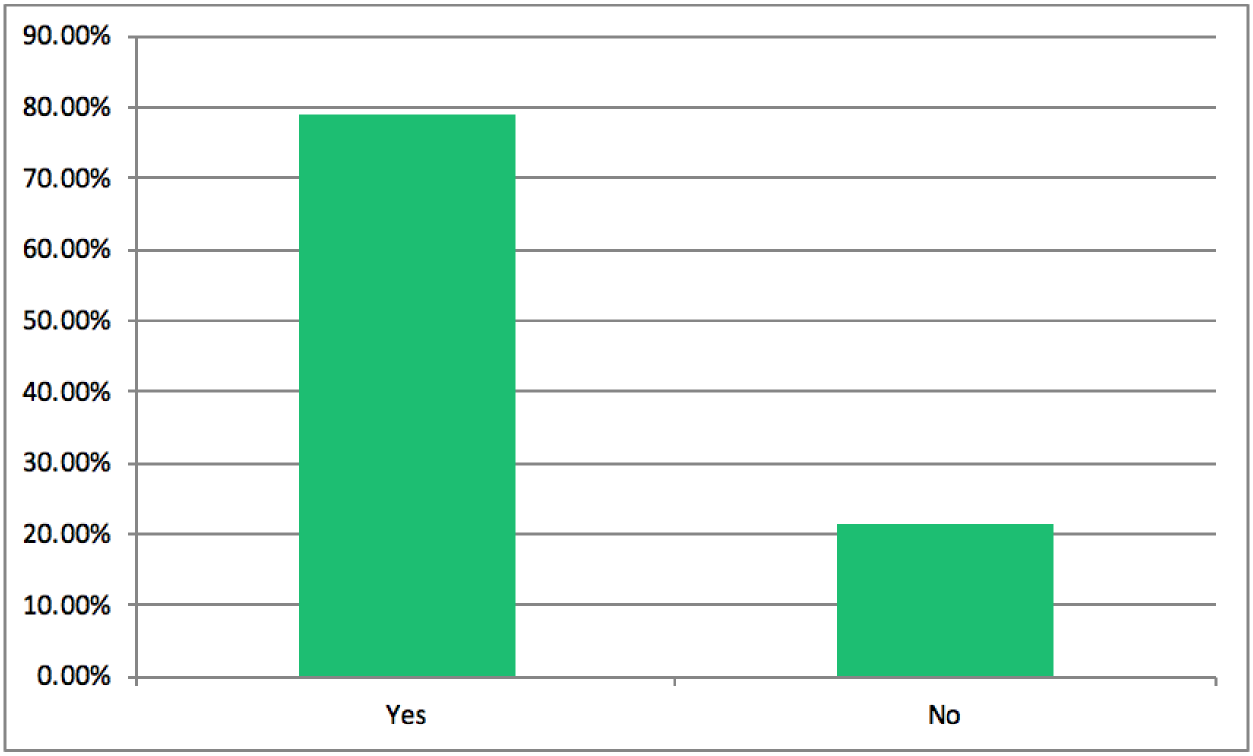
27. Are you aware of towns forming Communication Union Districts (CUD) to provide broadband?

Answered: 41 Skipped: 8



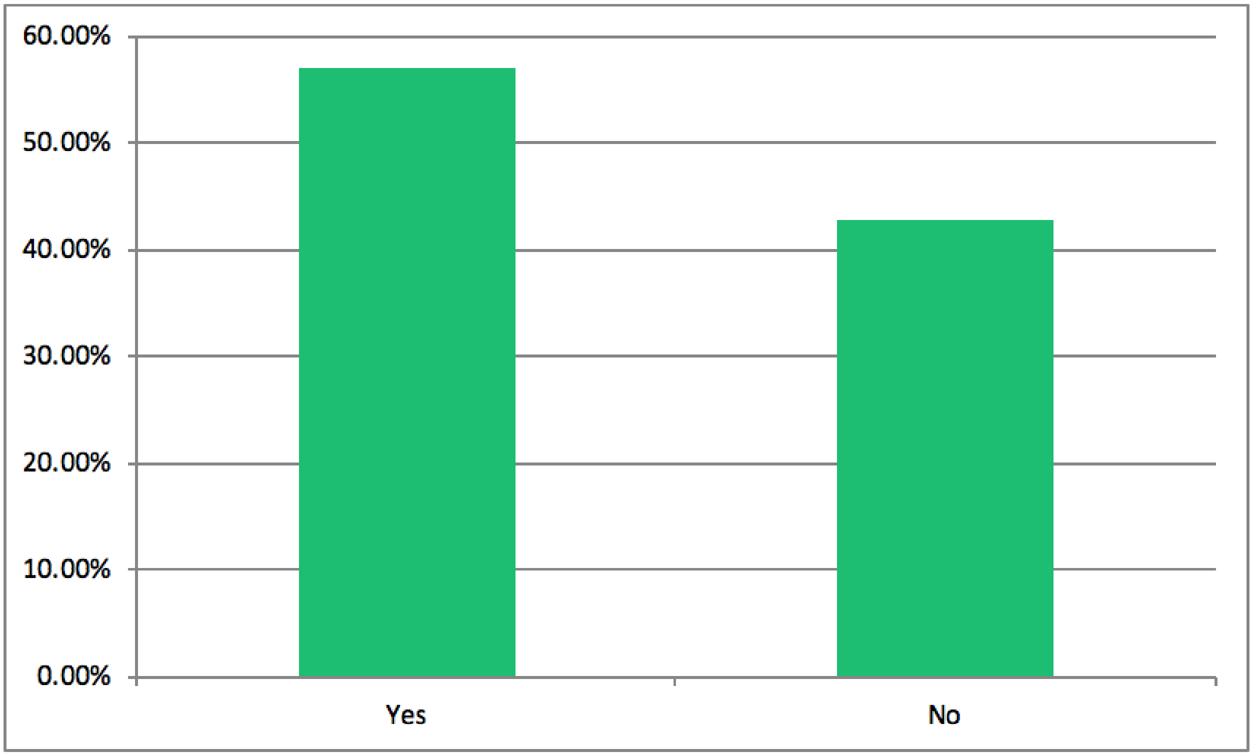
28. Has your town joined a CUD?

Answered: 33 Skipped: 16



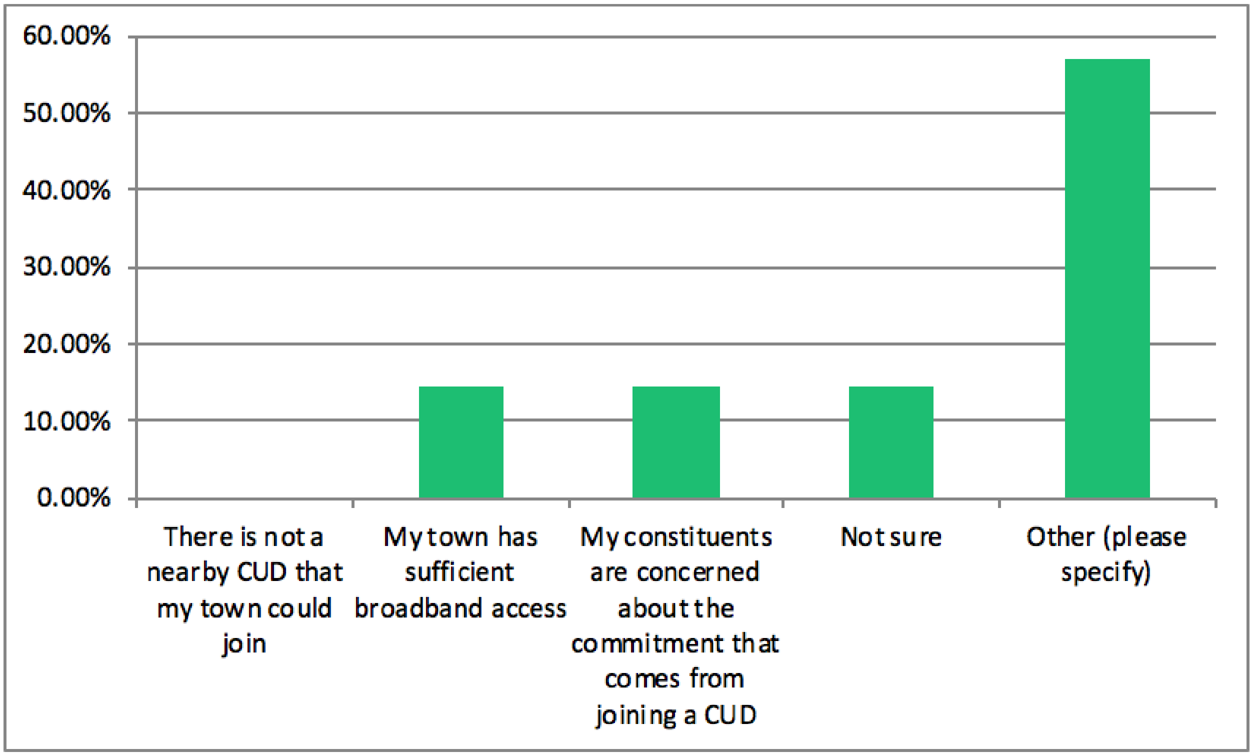
29. Is your town actively considering joining a CUD?

Answered: 7 Skipped: 42



30. Why hasn't your town joined a CUD?

Answered: 7 Skipped: 42

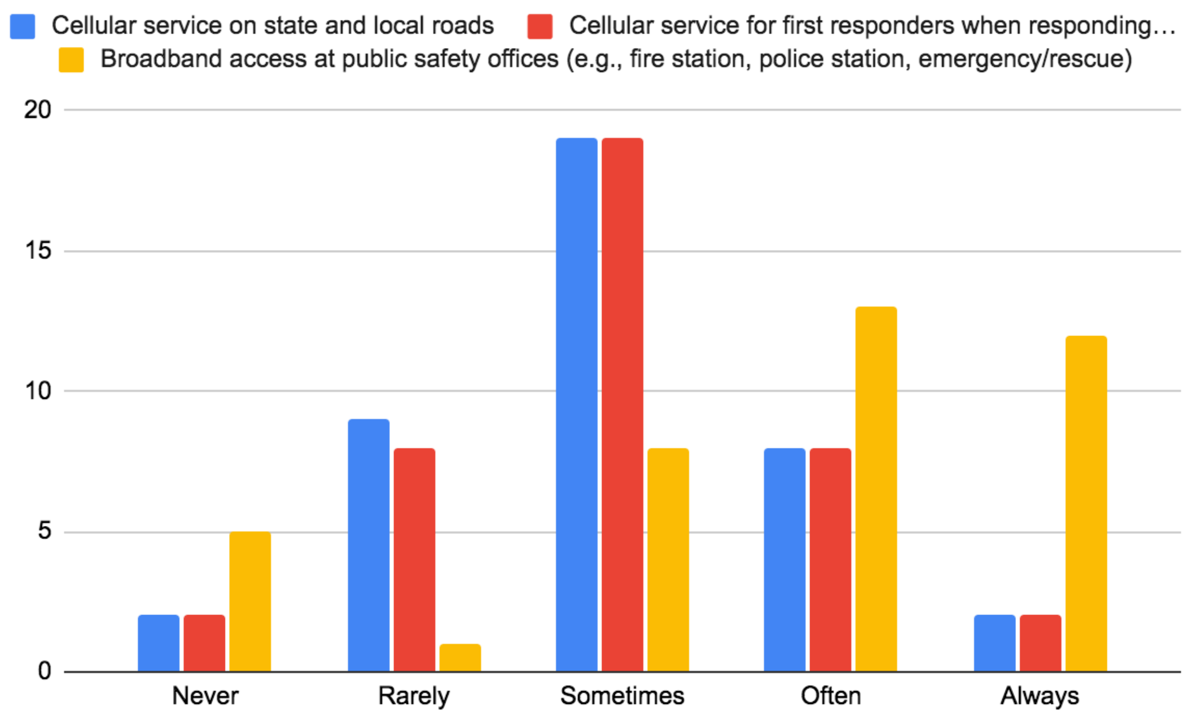


"Other" responses include:

- Still learning about CUDs
- Would prefer to install fiber independently

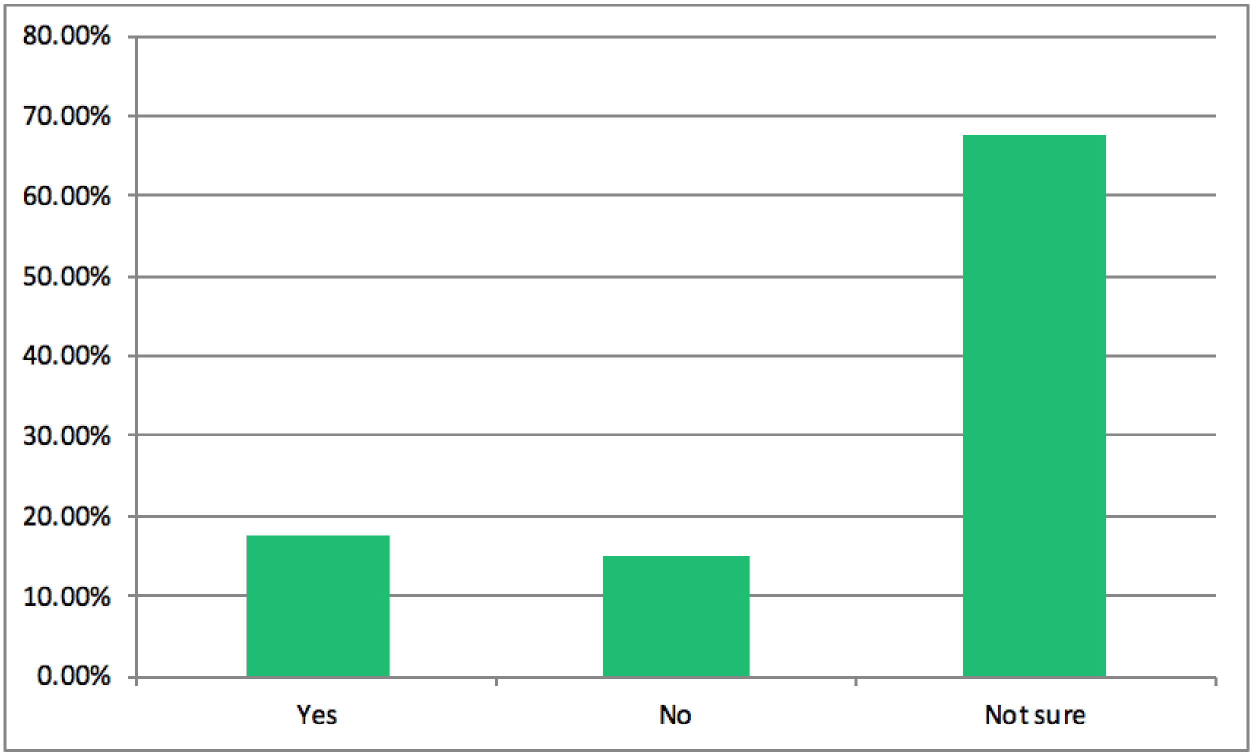
31. How often does the following existing telecommunication coverage meet your town's public safety needs?

Answered: 40 Skipped: 9



32. Have your town's public safety departments adopted FirstNet?

Answered: 40 Skipped: 9



33. Regarding telecommunications access (e.g., internet access, cellular service), what challenges have your public safety departments and staff faced during the Covid-19 pandemic?

Answered: 34 Skipped: 15

The vast majority of respondents stated that lack of cell coverage and internet access were the biggest challenges.

34. What other thoughts, questions or concerns do you have relating to broadband access in your town?

Answered: 24 Skipped: 25

The vast majority of respondents stated that broadband access needs to be increased quickly and affordably.

Appendix G: Summary of ISP Pricing – Vermont and Other States

Vermont Pricing

The table below summarizes the pricing, speed, and availability of services delivered by internet service providers in Vermont:

Provider	Starting price*	Download speed range	Tech	State availability
Xfinity	**$39.99/mo.**	Up to 300 Mbps	Cable	97%
Spectrum	**$49.99/mo.**	Up to 200 Mbps	Cable	39%
CenturyLink	**$49.00/mo.**	Up to 80 Mbps	DSL	93%
Burlington Telecom	**$55.00/mo.**	Up to 150 Mbps	Fiber	28%
Vermont Telephone Company	**$34.95/mo.**	Up to 1,000 Mbps	Fiber	2%
Consolidated Communications	**$62.00/mo.**	Up to 100 Mbps	DSL, fiber	1%
Viasat	**$70.00/mo.**	Up to 12 Mbps	Satellite	99%
HughesNet	**$99.99/mo.**	Up to 25 Mbps	Satellite	56%

*Pricing per month plus taxes for length of contract. Additional fees and terms may apply. Pricing varies by location and availability. All prices subject to change at any time. May or may not be available based on service address. Speeds may vary. As of 09/24/20.

Source: https://www.allconnect.com/local/vt

Pricing in Neighboring States

The following tables include prices presented on the providers' websites:

Table 8: Xfinity/Comcast Pricing

(Mbps)	VT	NH	ME	MA	CT	RI
25	$49.95	$49.95	$49.95	$49.95	$49.95	-
100	$39.99	$77.95	$77.95	$77.95	$77.95	-
200	$54.99	$39.99	$39.99	$39.99	$39.99	-
300	$59.99	$59.99	$59.99	$59.99	$59.99	-
600	$69.99	$69.99	$69.99	$69.99	$69.99	-
1000	$79.99	$79.99	$79.99	$79.99	$79.99	-
2000	$299.95	$299.95	$299.95	$299.95	$299.95	-

Table 9: Consolidated Communications

(Mbps)	VT	NH	ME	MA	CT	RI
10	-	-	-	$27.00	-	-
20	$37.09	-	$37.09	-	-	-
25	-	-	-	$43.95	-	-
40	$47.59	-	$47.59	-	-	-
50	-	$49.89	-	$46.95	-	-
100	-	$62.00	-	-	-	-
1000	-	$74.55	-	-	-	-

The following tables include prices presented on the BroadbandNow website:

Pricing by Provider – National

Table 10: Charter Spectrum

Speed	Price/Month
100/10	$49.99
400/20	$69.99
940/35	$109.99

Table 11:Viasat

Speed	Data Cap in GB	Price/Month
12/3	12	$50
12/3	25	$75
12/3	50	$100
25/3	Unlimited	$150

Table 12:HughesNet

Speed	Data Cap in GB	Price/Month
25/3	10	$49.99
25/3	20	$59.99
25/3	30	$89.99
25/3	50	$139.99

Pricing by Provider – State-Level

Vermont

Table 13:VTel

Speed (Mbps)	Price/Month
1000 (Fiber Optic Internet)	$34.95
1000 (GigE Solo)	$69.95
1000 (GigE Gamer)	$79.95
10,000	$399.95

Table 14:ECFiber

Speed (Mbps)	Price/Month
25	$72.00
100	$104.00
300	$134.00
800	$164.00

Table 15:Burlington Telecom

Speed (Mbps)	Price/Month
5	$40.00
150	$55.00
300	$65.00
1000	$70.00

Table 16:Waitsfield & Champlain Valley Telecom

Speed (Mbps)	Price/Month
10	$46.95
25	$53.95
50	$63.95
100	$76.95
500	$91.95
1000	$103.95

New Hampshire

Table 17:Granite State Communications

Speed (Mbps)	Price/Month
25	$49.95
50	$69.95
100	$89.95

Table 18:Tamworth Wireless Cooperative

Speed (Mbps)	Price/Month
1	$29.99
2	$49.99
3	$69.99
4	$89.99

Maine

Table 19:Coastline Wireless

Speed (Mbps)	Price/Month
20	$39.99
40	$54.99
60	$69.99

Table 20:RedZone

Speed (Mbps)	Price/Month
25	$44.99

Massachusetts

Table 21: Starry Internet

Speed (Mbps)	Price/Month
100	$30
200	$50

Table 22: NetBlazr Inc.

Speed (Mbps)	Price/Month
200	$39.95
1000	$59.95

Table 23: Shrewsbury Electric and Cable Operations

Speed (Mbps)	Price/Month
100	$54.95
200	$69.95
300	$99.95

Connecticut

Table 24: Thames Valley Communications

Speed (Mbps)	Price/Month
6.6	$29.99
110	$39.99
330	$59.99
1000	$79.99

Rhode Island

We did not identify any independent ISPs based in Rhode Island.

Appendix H: Unserved Premises Suitable for Line Extensions

To identify premises suitable for line extensions (see Section 8.2.2.2), we used VT Public Service Department data to identify how many premises in each town are served by 25/3 or not. Using a GIS layer of existing residential cable plant and fiber plant, we ran a geospatial analysis to determine how many unserved premises were within half a mile, and then within a mile, of the existing infrastructure. We then calculated how many unserved premises fell within that 0.5 mile or 1 mile "buffer" that extended beyond the existing plant, as well as how many road miles fell within the same buffer. This allowed us to understand the number and density of unserved premises in every town that could be covered by building on roads within half a mile or a mile of existing plant.

After running this calculation for every town, we then sorted towns by the percentage coverage of 25/3 service they already had. Our assumption was that the "pockets" of unserved premises that should be targeted would be found in towns with robust existing covers; a town with only 50 percent coverage was likely to have large, contiguous unserved areas, whereas a town with 85+ percent coverage was less likely.

After removing the towns with 100 percent coverage, like Springfield, we arrived at a list of towns that were almost fully covered, but still had unserved premises within 0.5 or 1 mile of existing plant. We then removed towns known to be in the process of construction (e.g., West Windsor) and towns in which a visual inspection showed there was not really a "pocket" of unserved premises. The table below lists the 32 towns with more than 85 percent existing coverage, and with premises that according to the analysis could be served by line extensions. Maps following the table illustrate the unserved premises in the towns.

Table 7: Details on Line Extensions by Town

Town	County	Total Premises	Premises Served by 25/3	Estimated % of Road Miles Covered by Cable/Fiber	Unserved Premises	Unserved Prems Within 0.5 Mile of Any Cable/fiber	Unserved Prems Within 1 Mile of Any Cable/Fiber	Unserved Road Miles	Density of Unserved Road Miles
BARRE TOWN	Washington	3357	3268	96.28	89	86	89	2.51	35.51
BENNINGTON	Bennington	6151	6083	85.03	68	39	50	12.37	4.04
BRIDGEWATER	Windsor	647	610	90.18	37	31	37	5.85	6.32
BUELS GORE	Chittenden	16	14	90.62	2	1	2	0.31	6.55

Town	County	Total Premises	Premises Served by 25/3	Estimated % of Road Miles Covered by Cable/Fiber	Unserved Premises	Unserved Prems Within 0.5 Mile of Any Cable/fiber	Unserved Prems Within 1 Mile of Any Cable/Fiber	Unserved Road Miles	Density of Unserved Road Miles
BURLINGTON	Chittenden	11817	11807	95.76	10	10	10	1.16	8.59
CHARLOTTE	Chittenden	1891	1636	87.32	255	247	255	11.04	23.10
CLARENDON	Rutland	1191	1154	93.67	37	37	37	3.35	11.06
COLCHESTER	Chittenden	6461	6333	87.63	128	71	127	10.39	12.23
DANBY	Rutland	793	791	99.41	2	2	2	0.32	6.16
ESSEX	Chittenden	7324	7165	86.24	159	127	159	10.49	15.16
GRAND ISLE	Grand Isle	1316	1306	89.88	10	5	6	4.63	1.29
HARTLAND	Windsor	1625	1582	97.18	43	43	43	2.45	17.59
HIGHGATE	Franklin	1833	1794	90.04	39	35	39	8.27	4.72
IRA	Rutland	225	212	87.97	13	10	13	2.35	5.53
KILLINGTON	Rutland	1387	1377	94.24	10	9	10	3.34	3.00
LEICESTER	Addison	699	673	86.90	26	21	25	3.91	6.39
MIDDLETOWN SPRINGS	Rutland	450	447	99.25	3	3	3	0.28	10.85
MONTPELIER	Washington	2900	2894	98.75	6	6	6	0.29	20.97
MOUNT HOLLY	Rutland	1123	1107	98.12	16	16	16	1.43	11.20
NEWPORT CITY	Orleans	1883	1868	95.05	15	8	15	0.87	17.22
PLYMOUTH	Windsor	841	744	90.68	97	48	85	6.66	12.77
RICHMOND	Chittenden	1756	1667	87.78	89	82	89	6.60	13.48
ROCKINGHAM	Windham	2176	2119	91.73	57	46	57	5.82	9.79

Town	County	Total Premises	Premises Served by 25/3	Estimated % of Road Miles Covered by Cable/Fiber	Unserved Premises	Unserved Prems Within 0.5 Mile of Any Cable/fiber	Unserved Prems Within 1 Mile of Any Cable/Fiber	Unserved Road Miles	Density of Unserved Road Miles
RUTLAND	Rutland	1842	1821	97.53	21	21	21	0.95	22.18
SHREWSBURY	Rutland	609	590	92.96	19	12	19	4.93	3.85
SOUTH BURLINGTON	Chittenden	7010	6971	94.69	39	38	38	2.27	16.74
SOUTH HERO	Grand Isle	1539	1510	85.48	29	13	25	6.49	3.85
SWANTON	Franklin	3110	2916	85.54	194	180	185	11.73	15.78
VERNON	Windham	886	837	86.28	49	30	49	4.35	11.27
WELLS	Rutland	964	945	91.80	19	16	19	3.29	5.77
WILLISTON	Chittenden	4361	4241	85.77	120	104	120	9.60	12.51
						Total unserved miles		148.3	
						Cost at 30,000/ mile		$4,449,000	

Figure 124: Unserved Premises Suitable for Line Extensions in Town of Barre

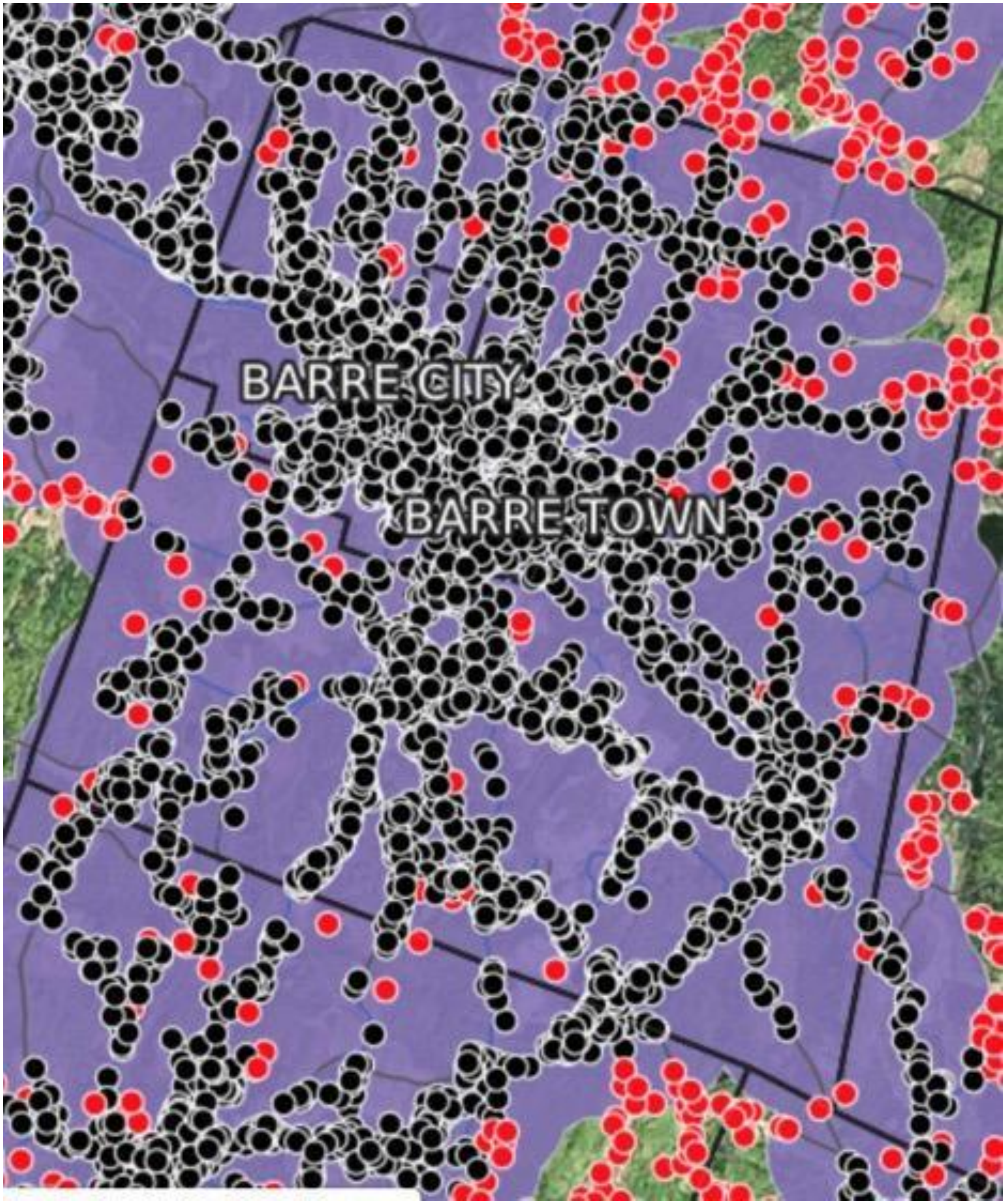


Figure 125: Unserved Premises Suitable for Line Extensions in Bennington

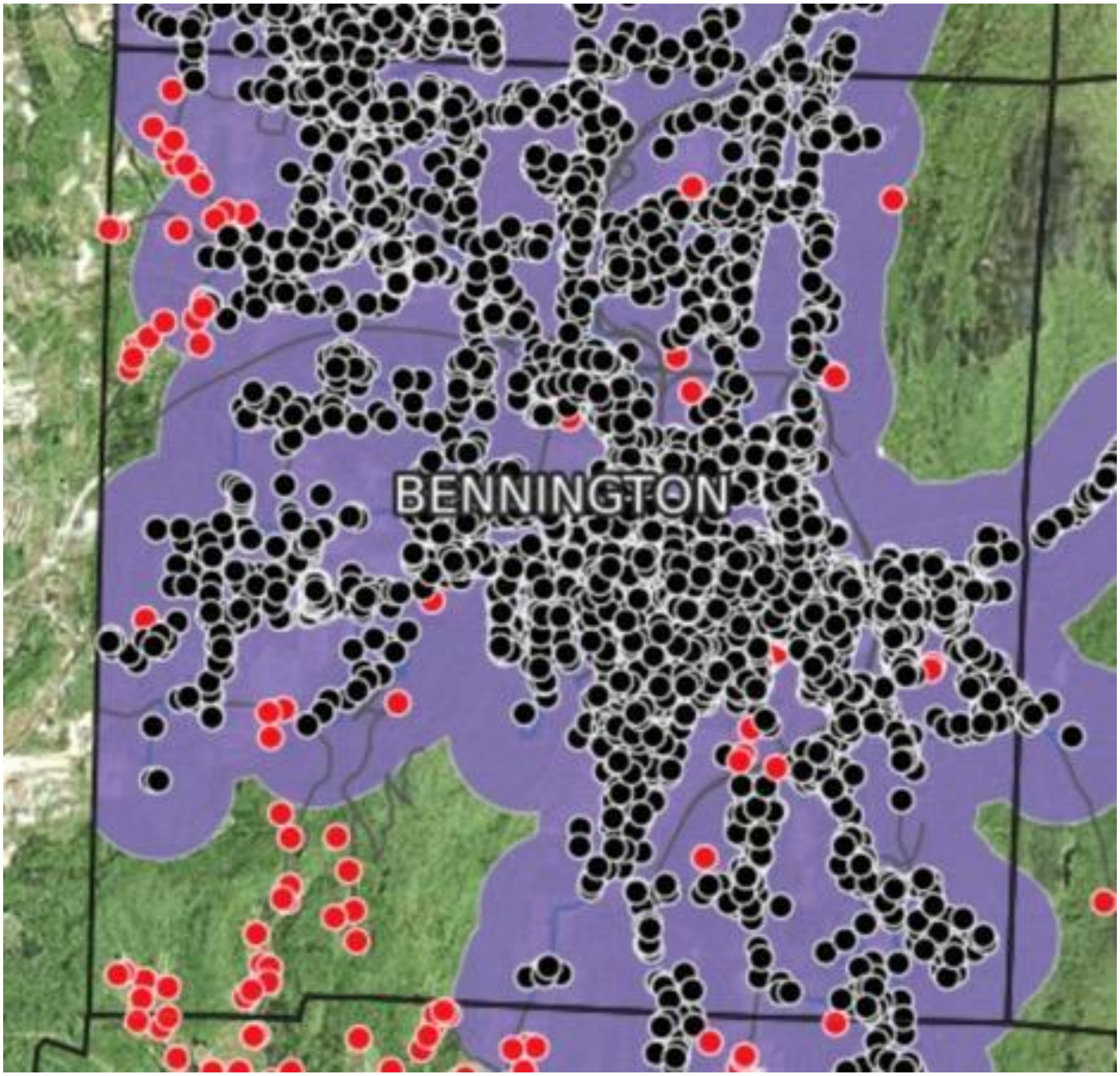


Figure 126: Unserved Premises Suitable for Line Extensions in Bridgewater

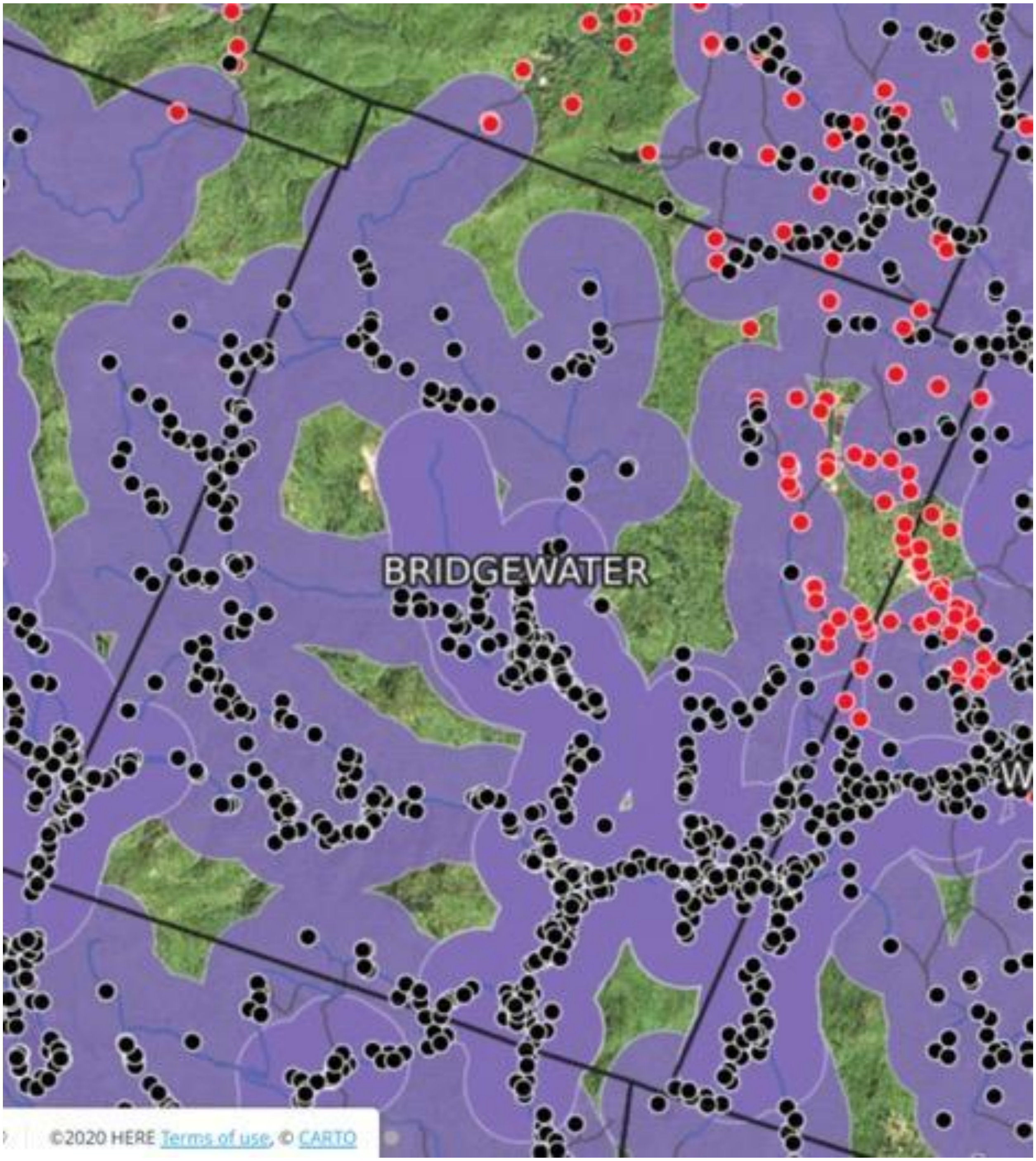


Figure 127: Unserved Premises Suitable for Line Extensions in Buels Gore

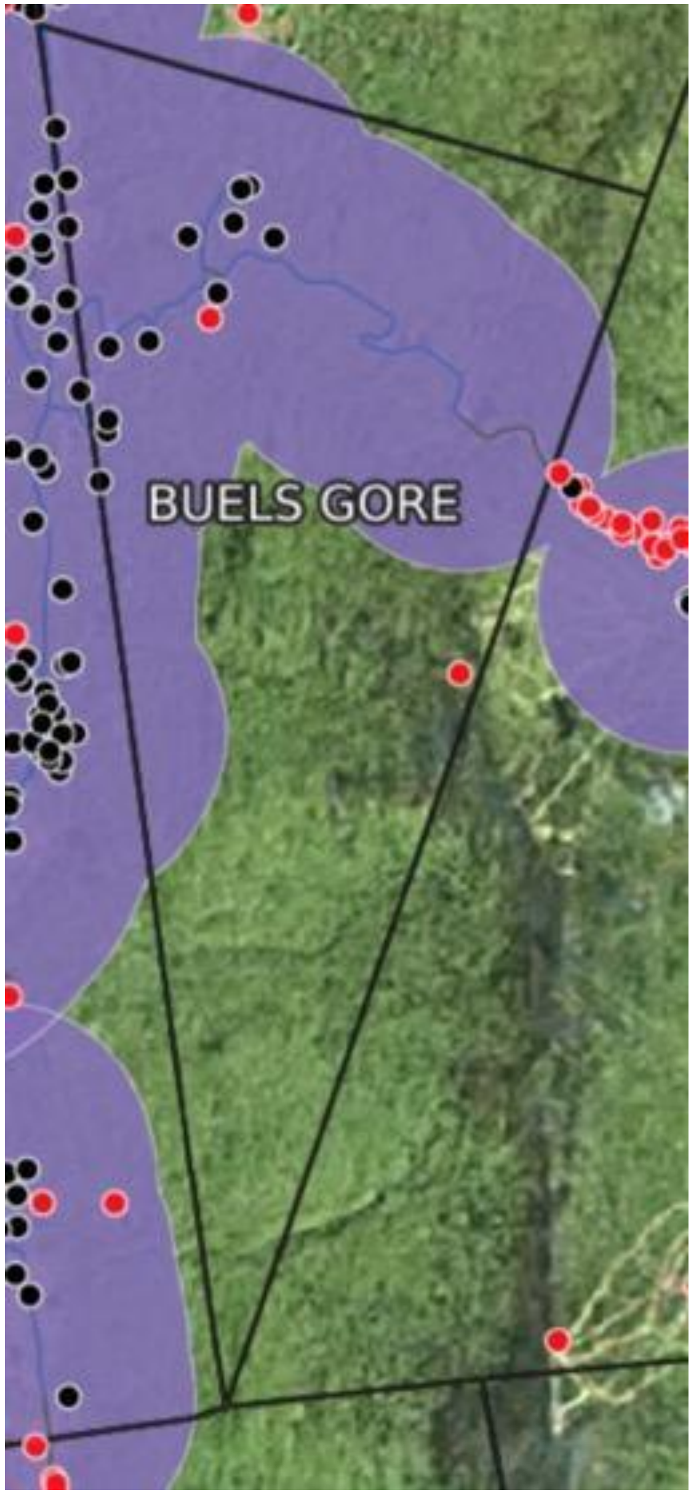


Figure 128: Unserved Premises Suitable for Line Extensions in Burlington

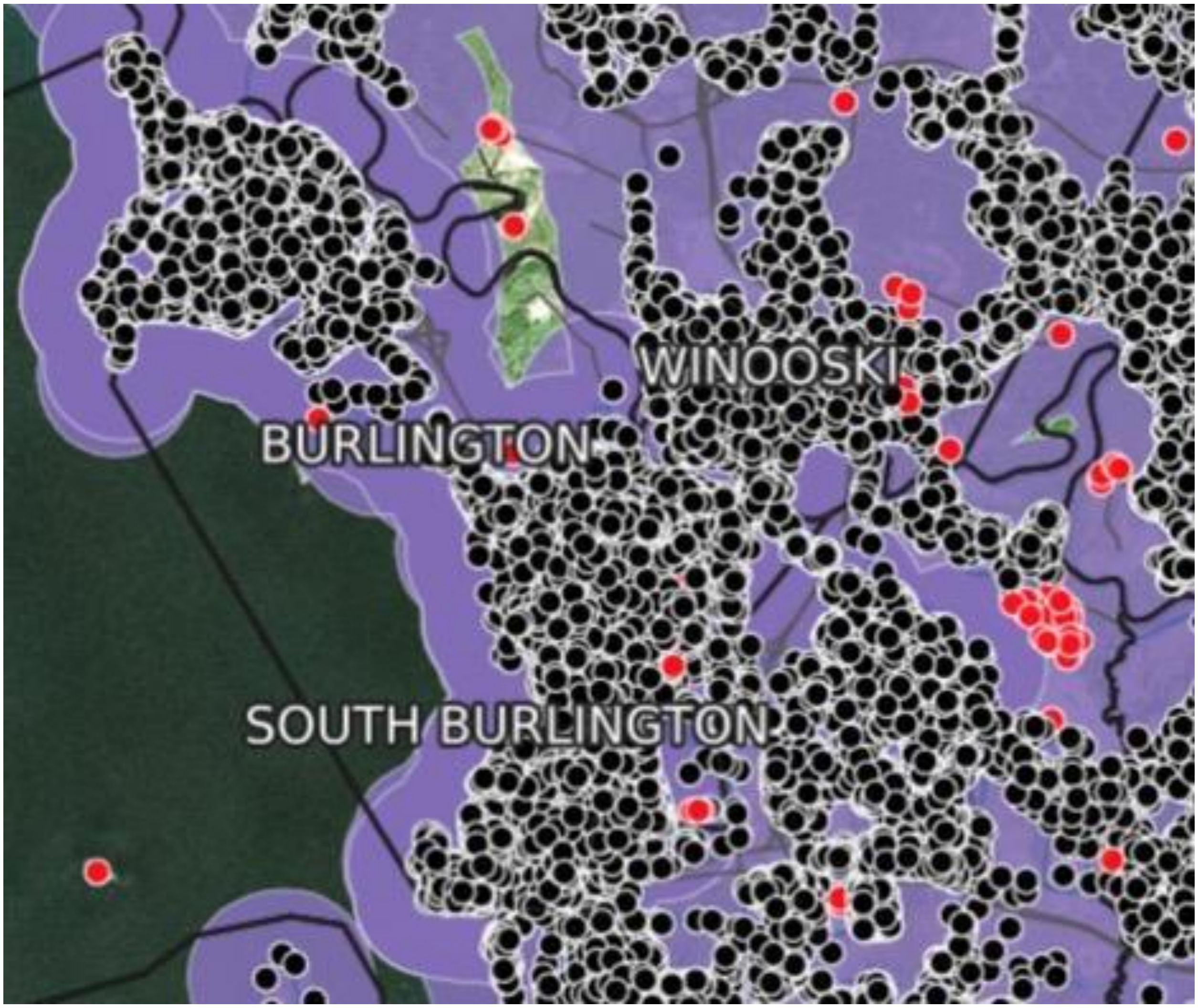


Figure 129: Unserved Premises Suitable for Line Extensions in Charlotte

Figure 130: Unserved Premises Suitable for Line Extensions in Clarendon

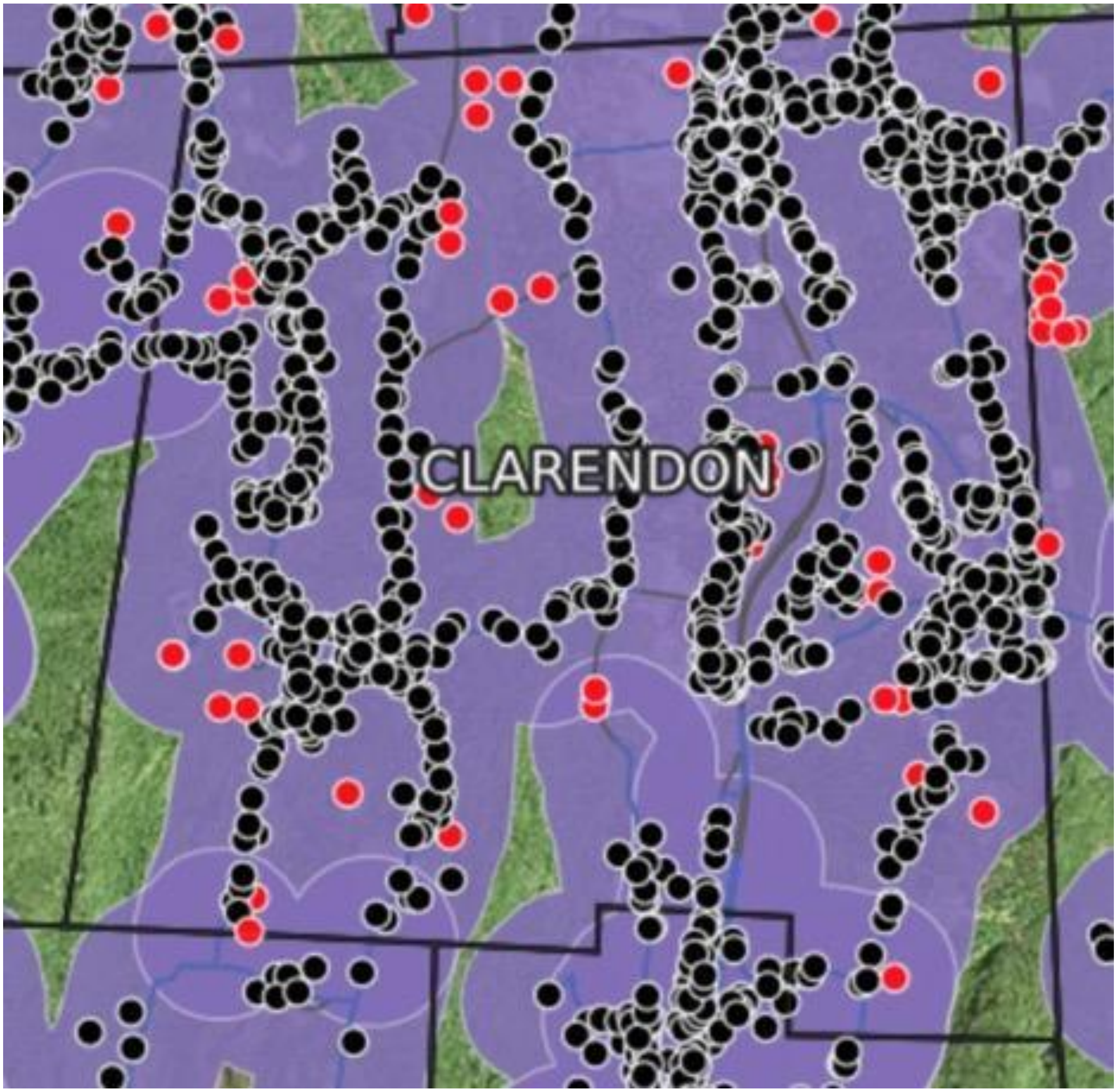


Figure 131: Unserved Premises Suitable for Line Extensions in Colchester

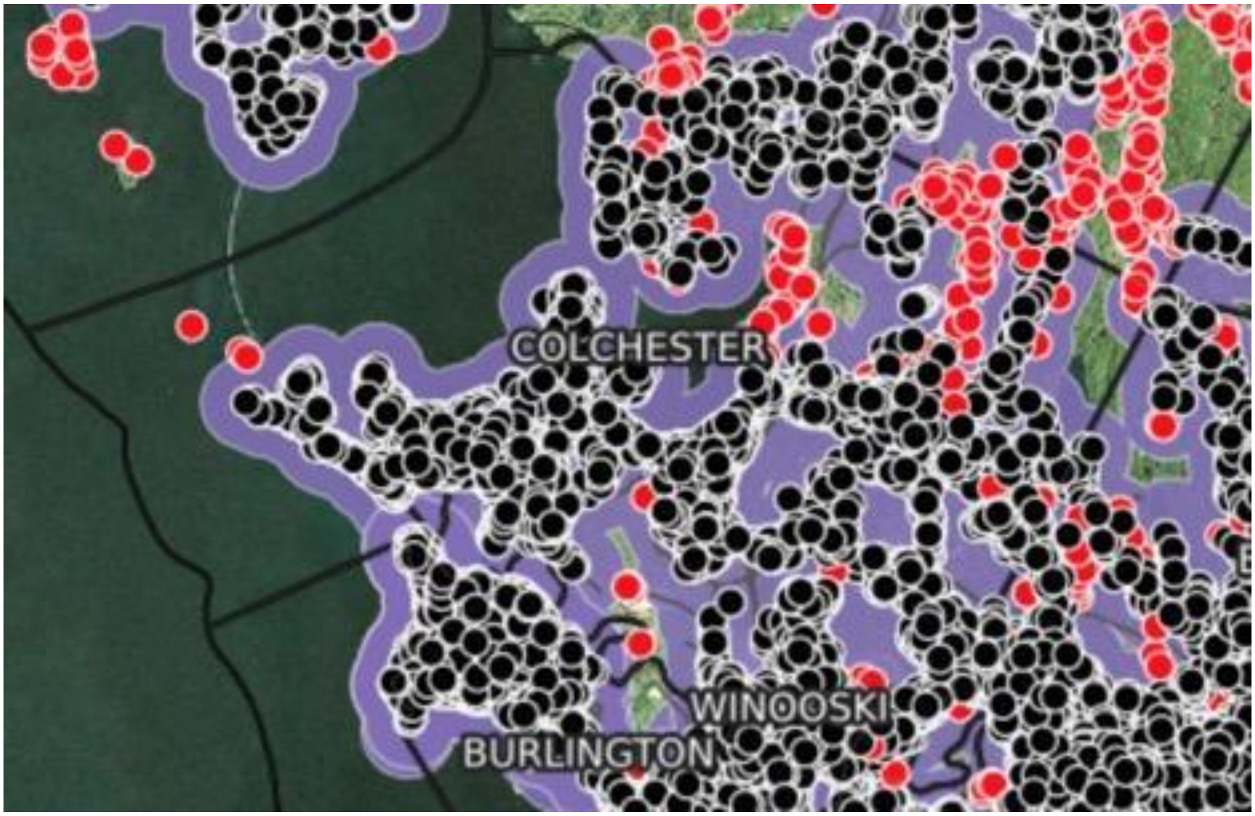


Figure 132: Unserved Premises Suitable for Line Extensions in Danby

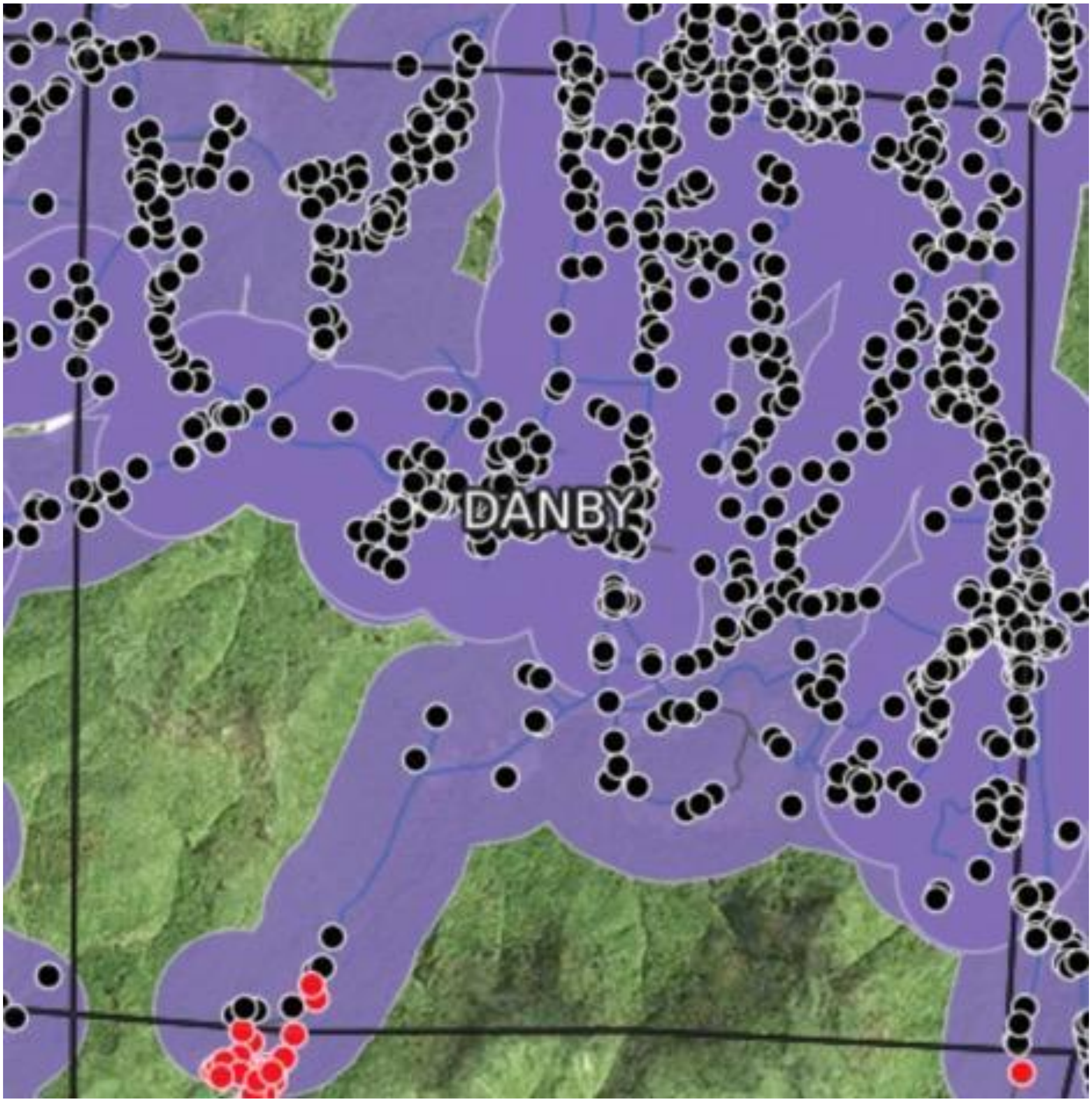


Figure 133: Unserved Premises Suitable for Line Extensions in Essex

Figure 134: Unserved Premises Suitable for Line Extensions in Grand Isle

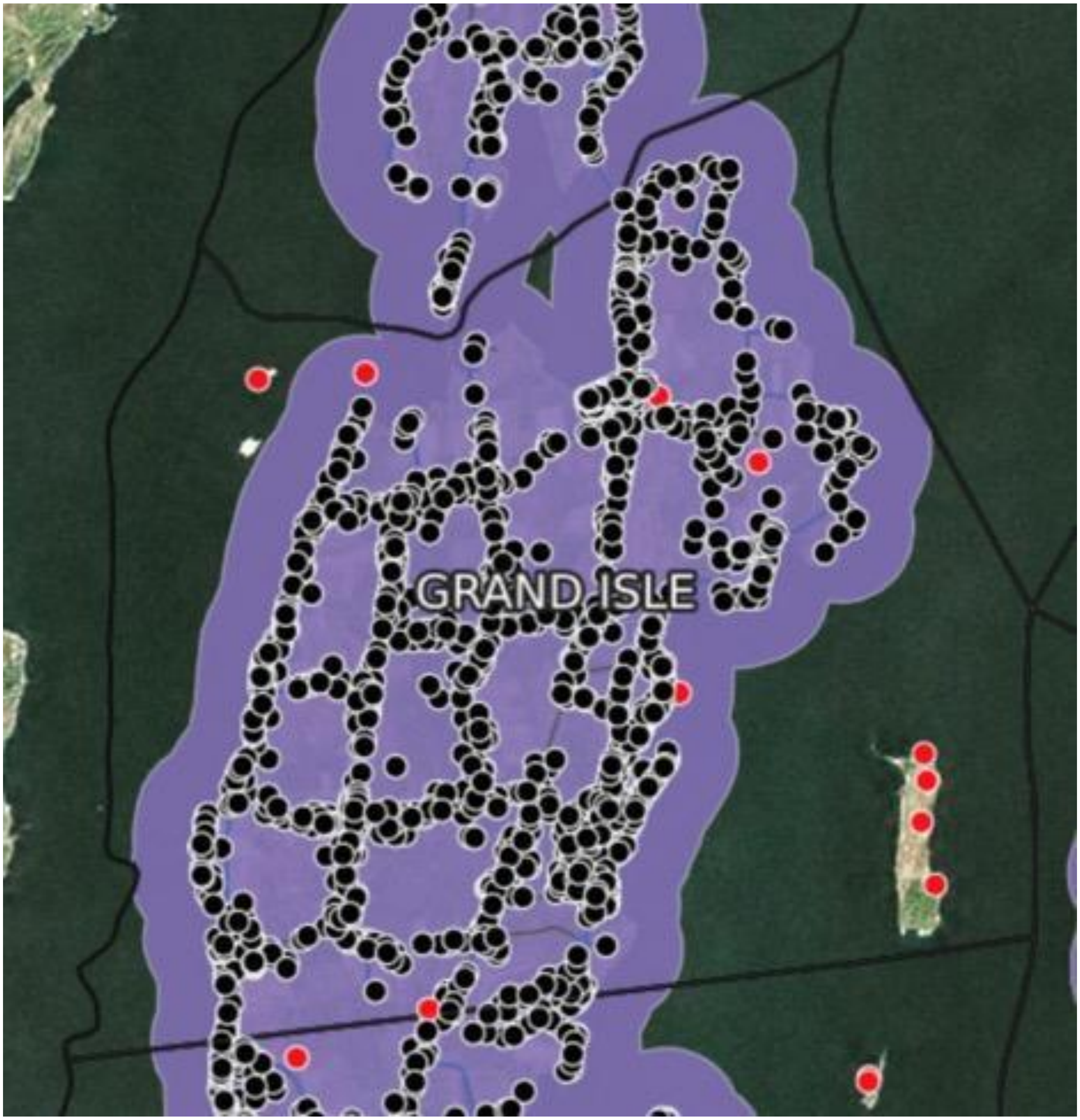


Figure 135: Unserved Premises Suitable for Line Extensions in Hartland

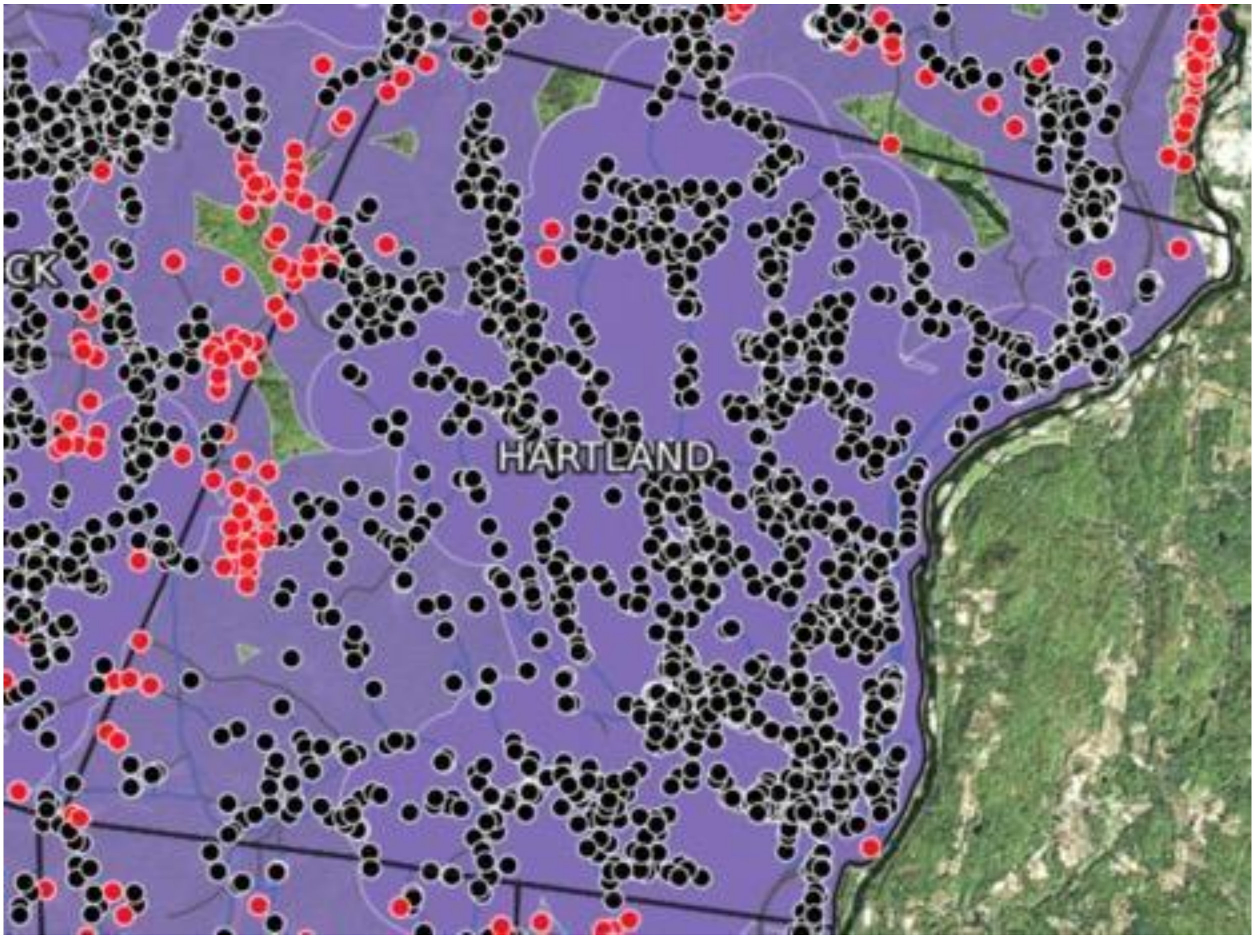


Figure 136: Unserved Premises Suitable for Line Extensions in Highgate

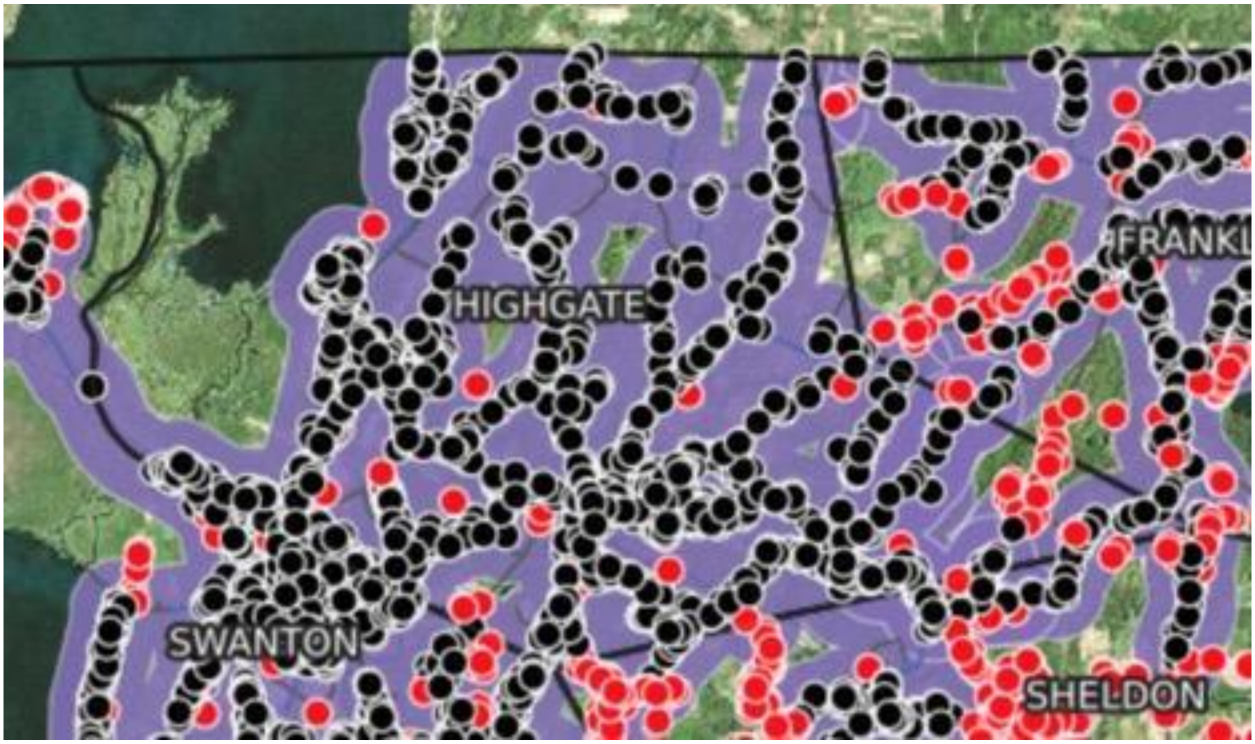


Figure 137: Unserved Premises Suitable for Line Extensions in Ira

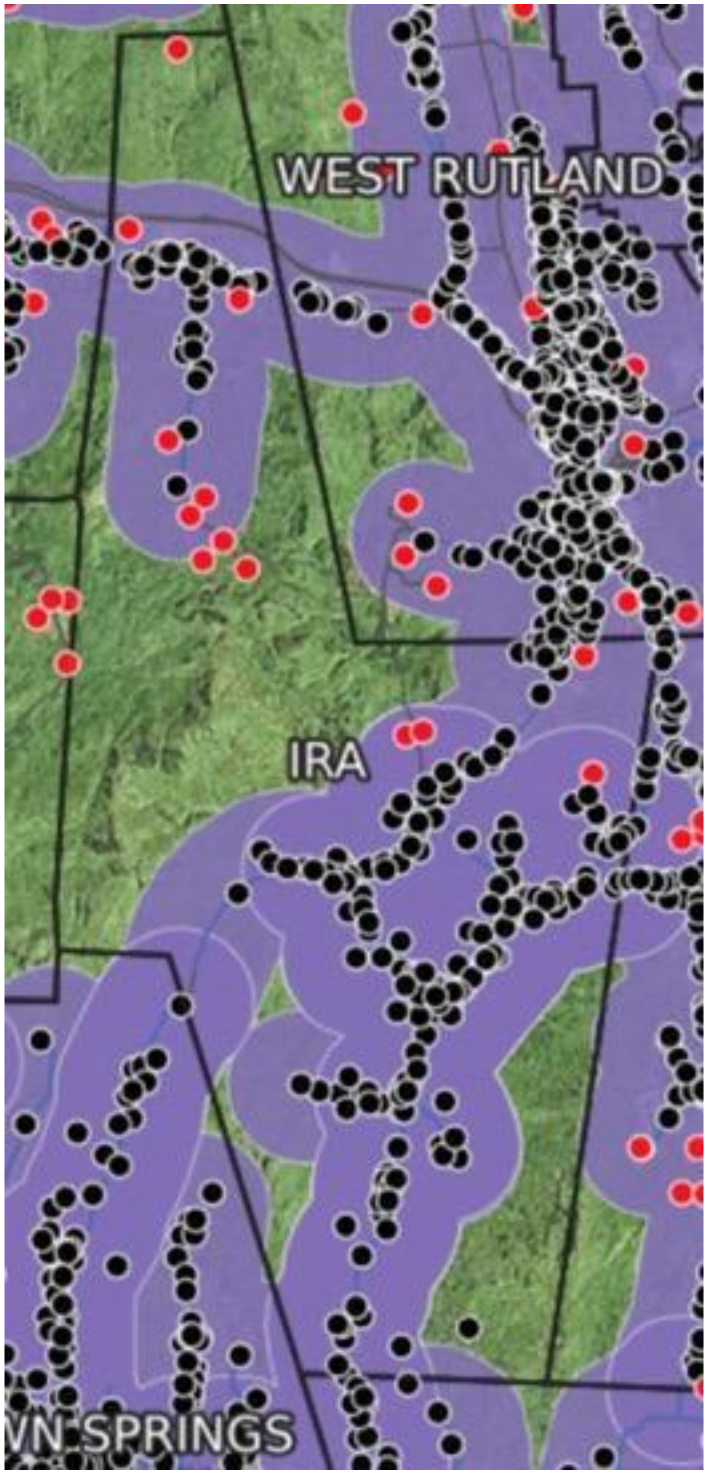


Figure 138: Unserved Premises Suitable for Line Extensions in Killington

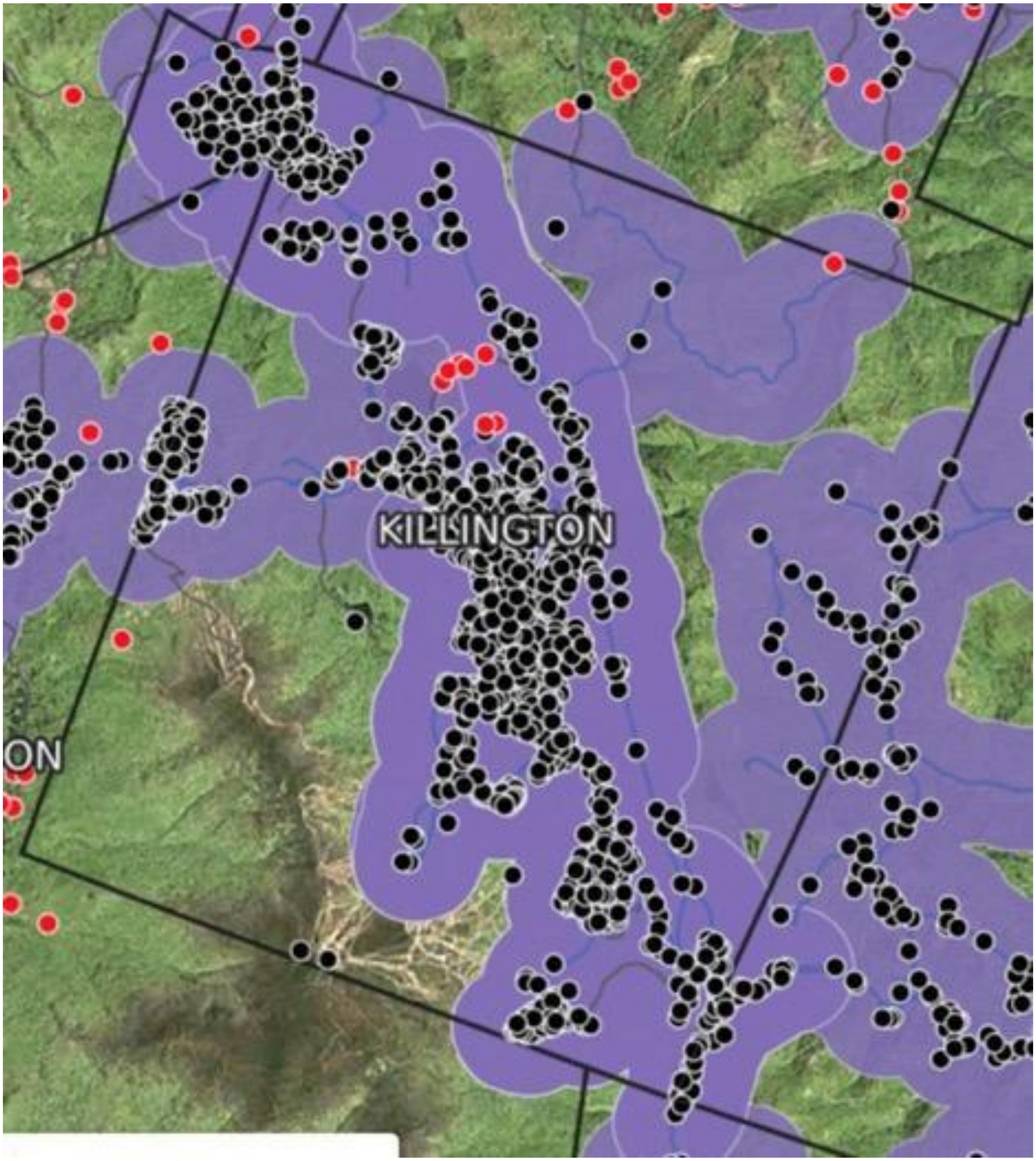


Figure 139: Unserved Premises Suitable for Line Extensions in Leicester

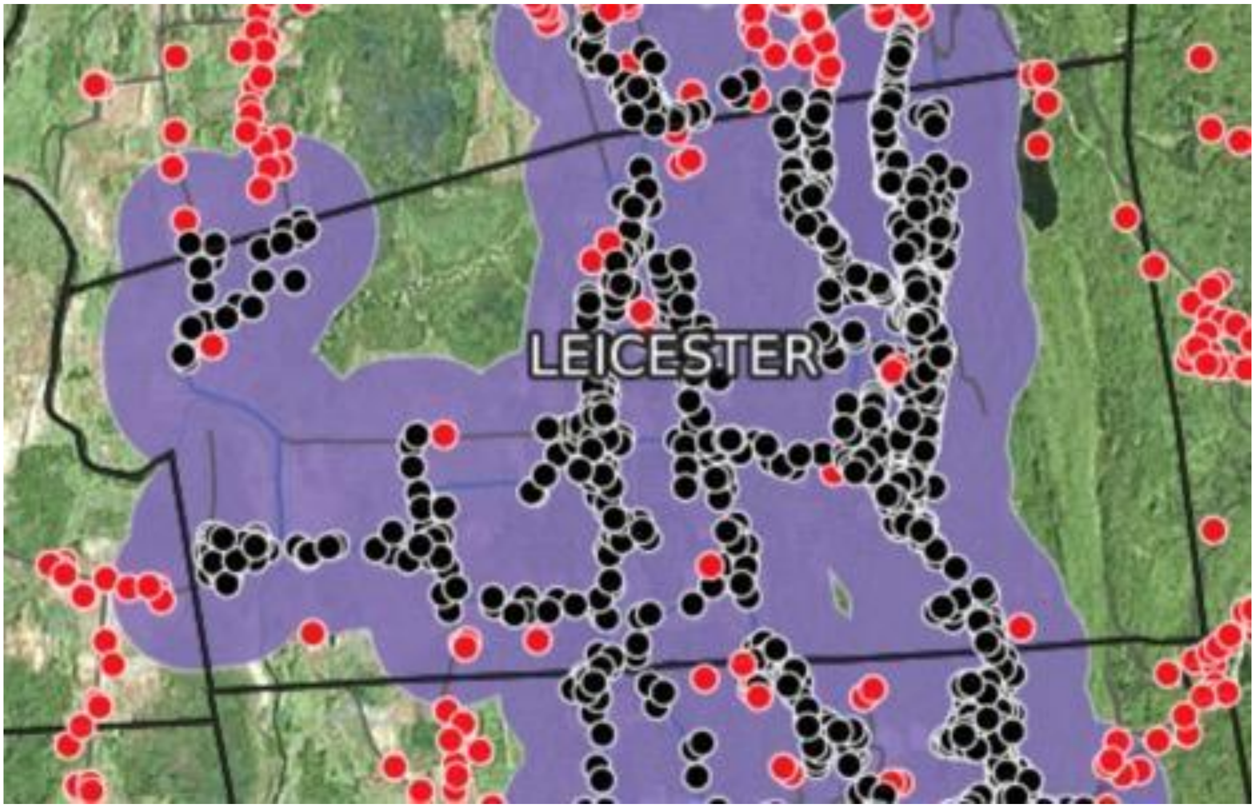


Figure 140: Unserved Premises Suitable for Line Extensions in Middletown Springs

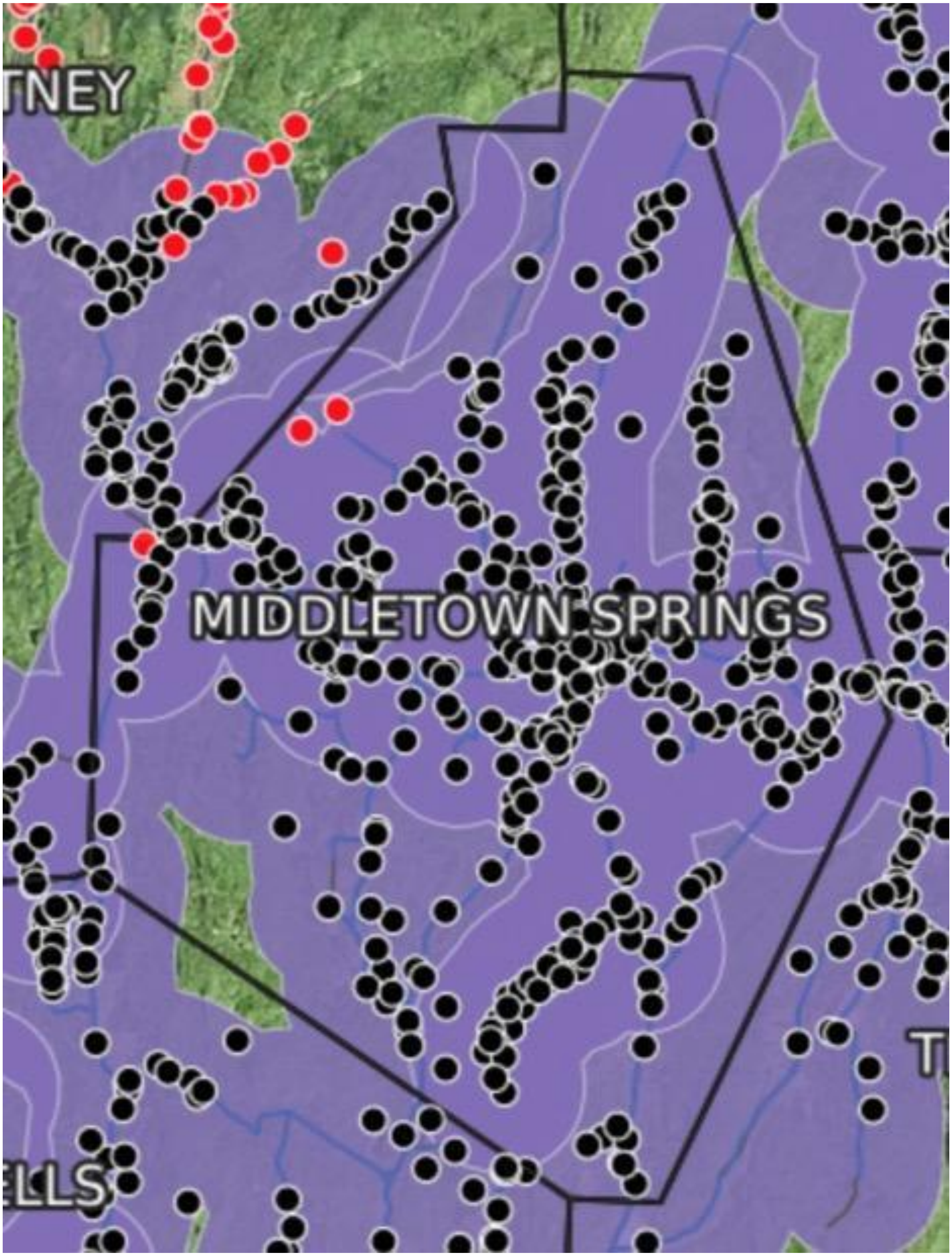


Figure 141: Unserved Premises Suitable for Line Extensions in Montpelier

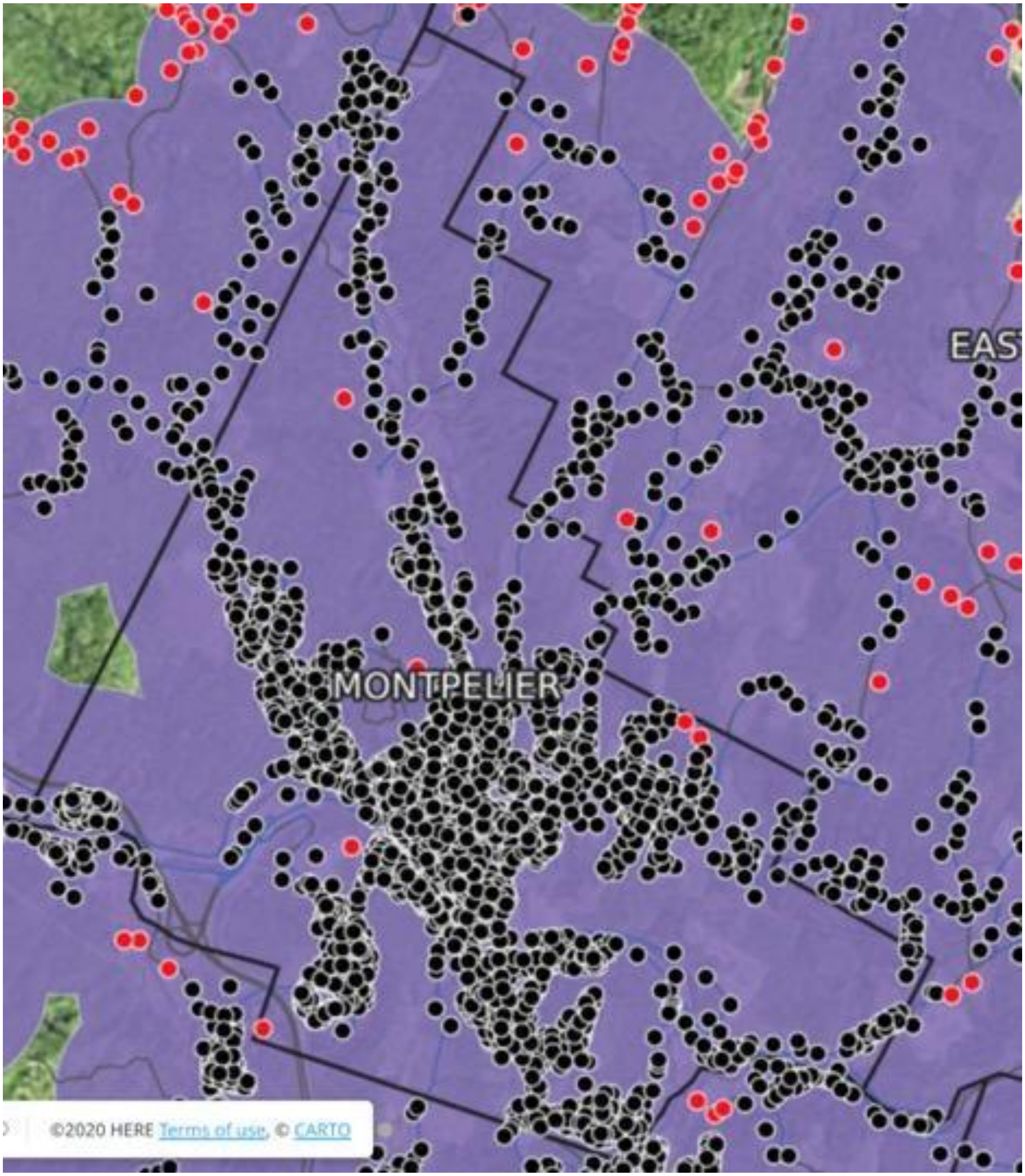


Figure 142: Unserved Premises Suitable for Line Extensions in Mount Holly

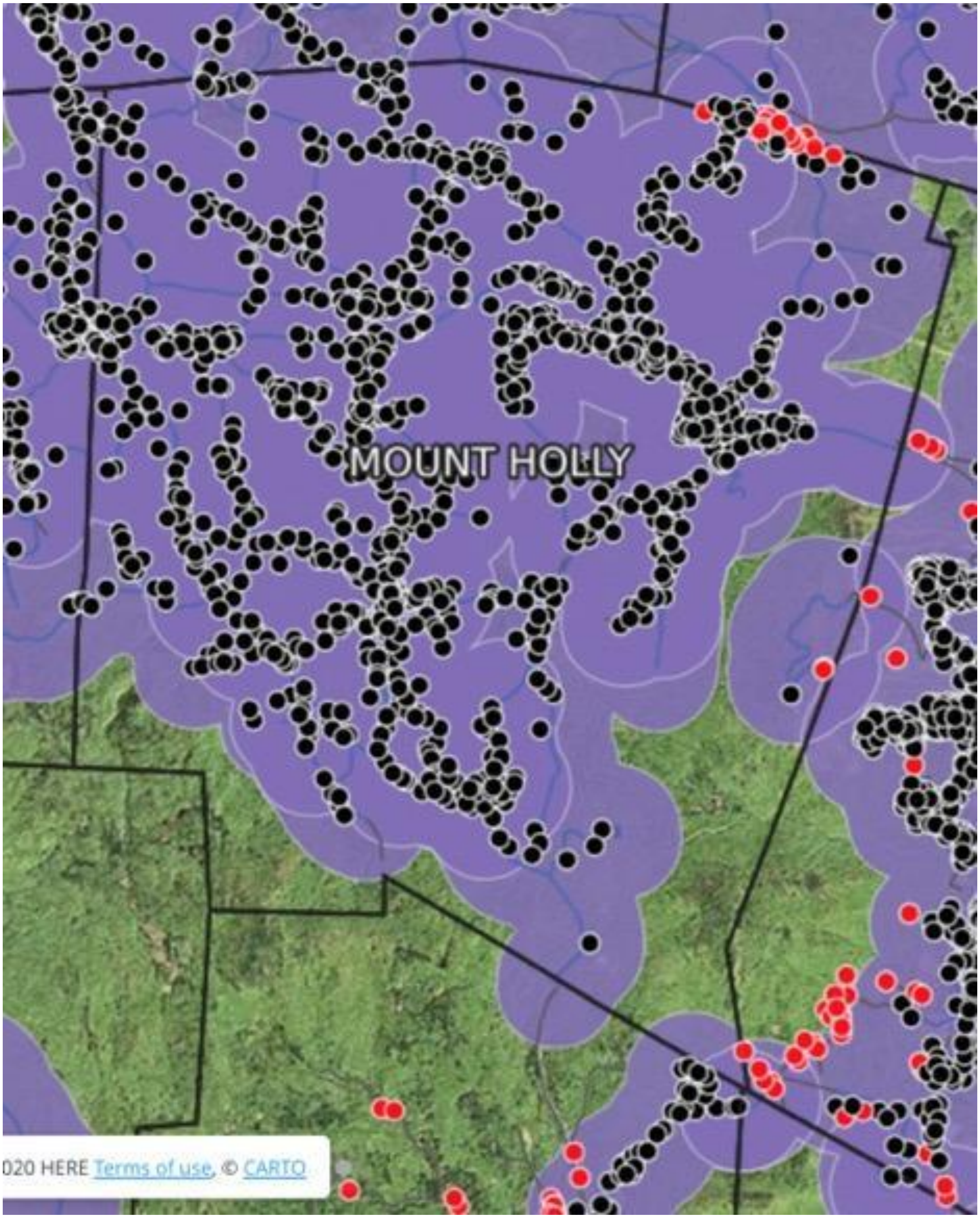


Figure 143: Unserved Premises Suitable for Line Extensions in Newport City

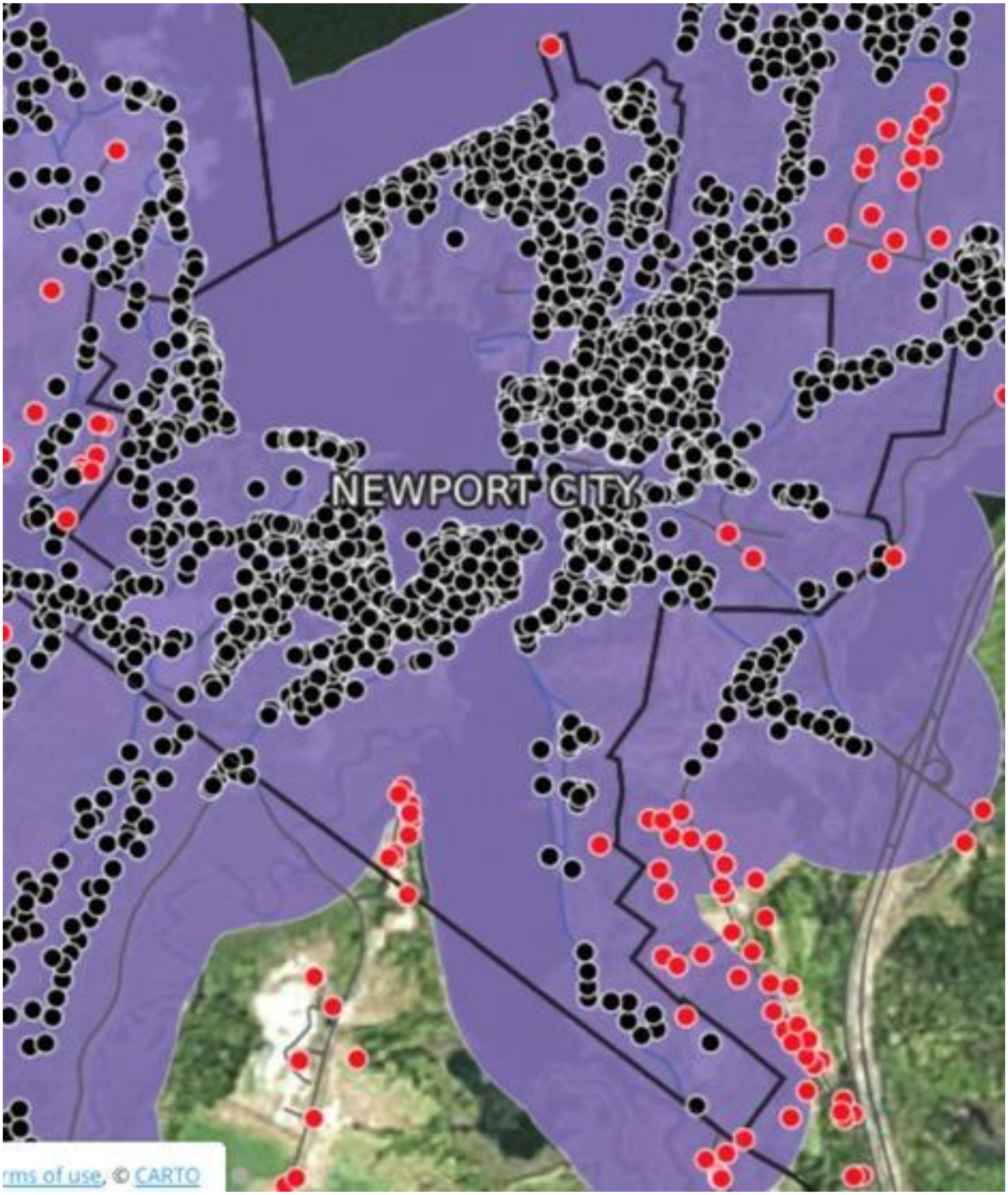


Figure 144: Unserved Premises Suitable for Line Extensions in Plymouth

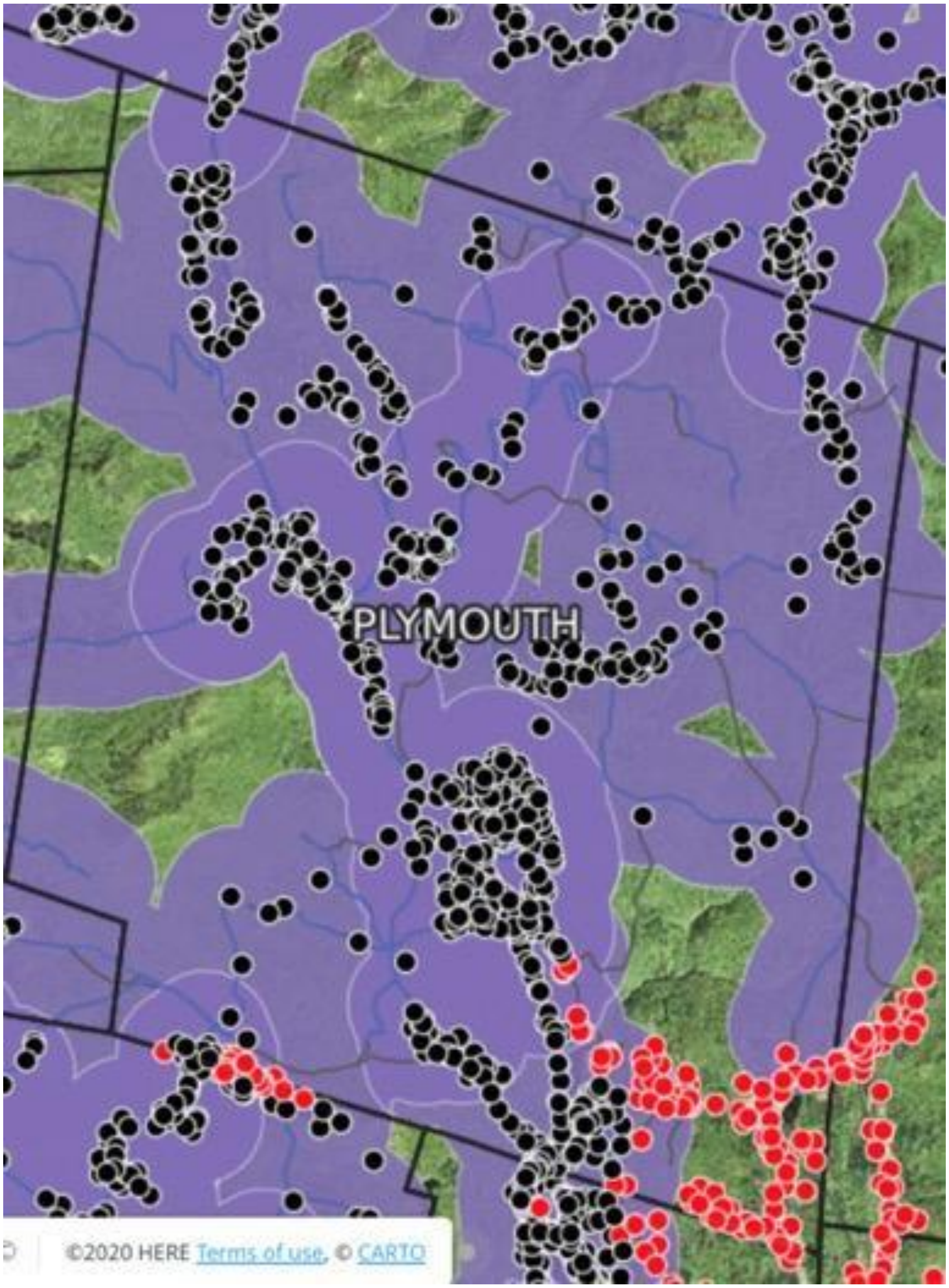


Figure 145: Unserved Premises Suitable for Line Extensions in Richmond

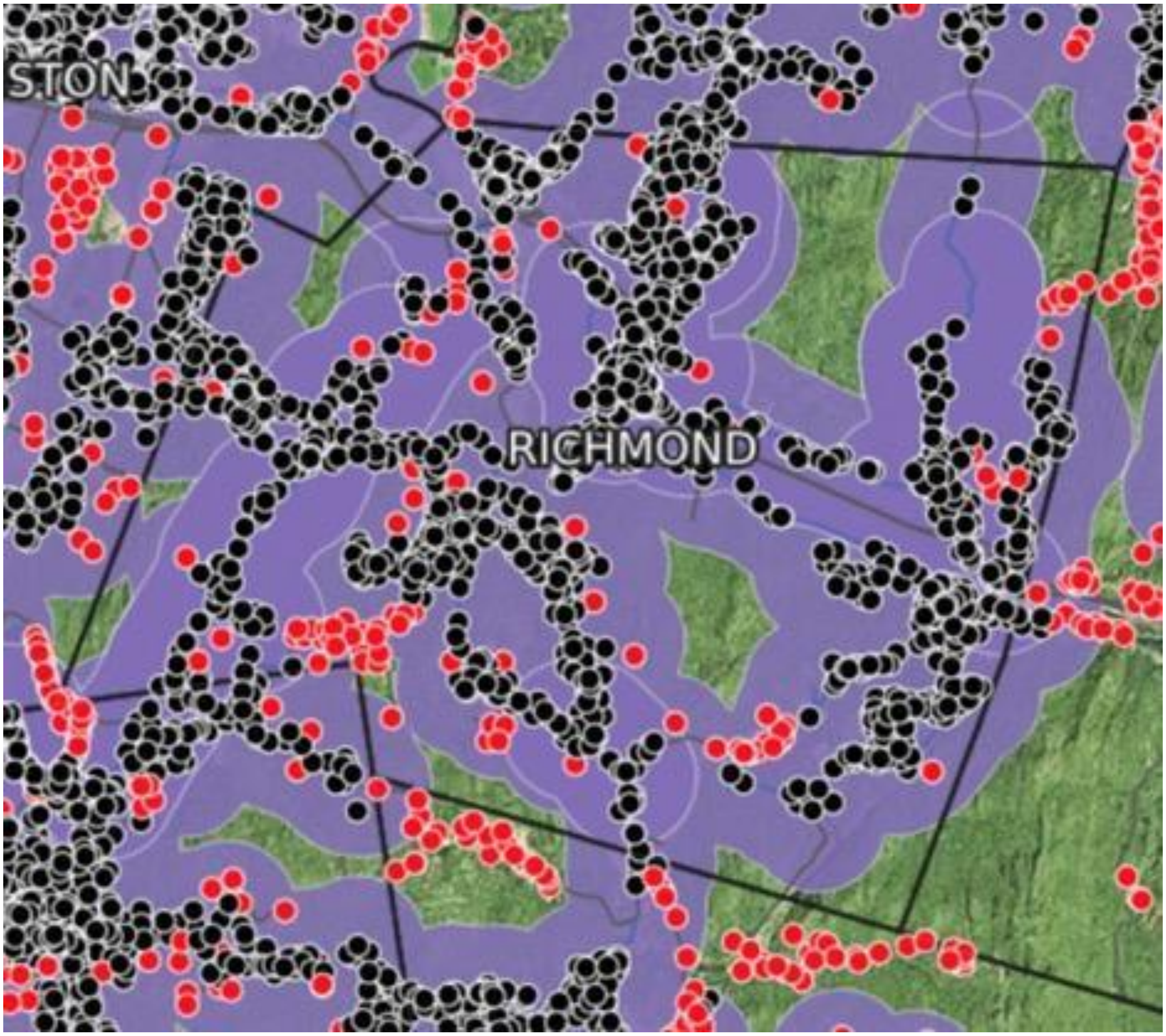


Figure 146: Unserved Premises Suitable for Line Extensions in Rockingham

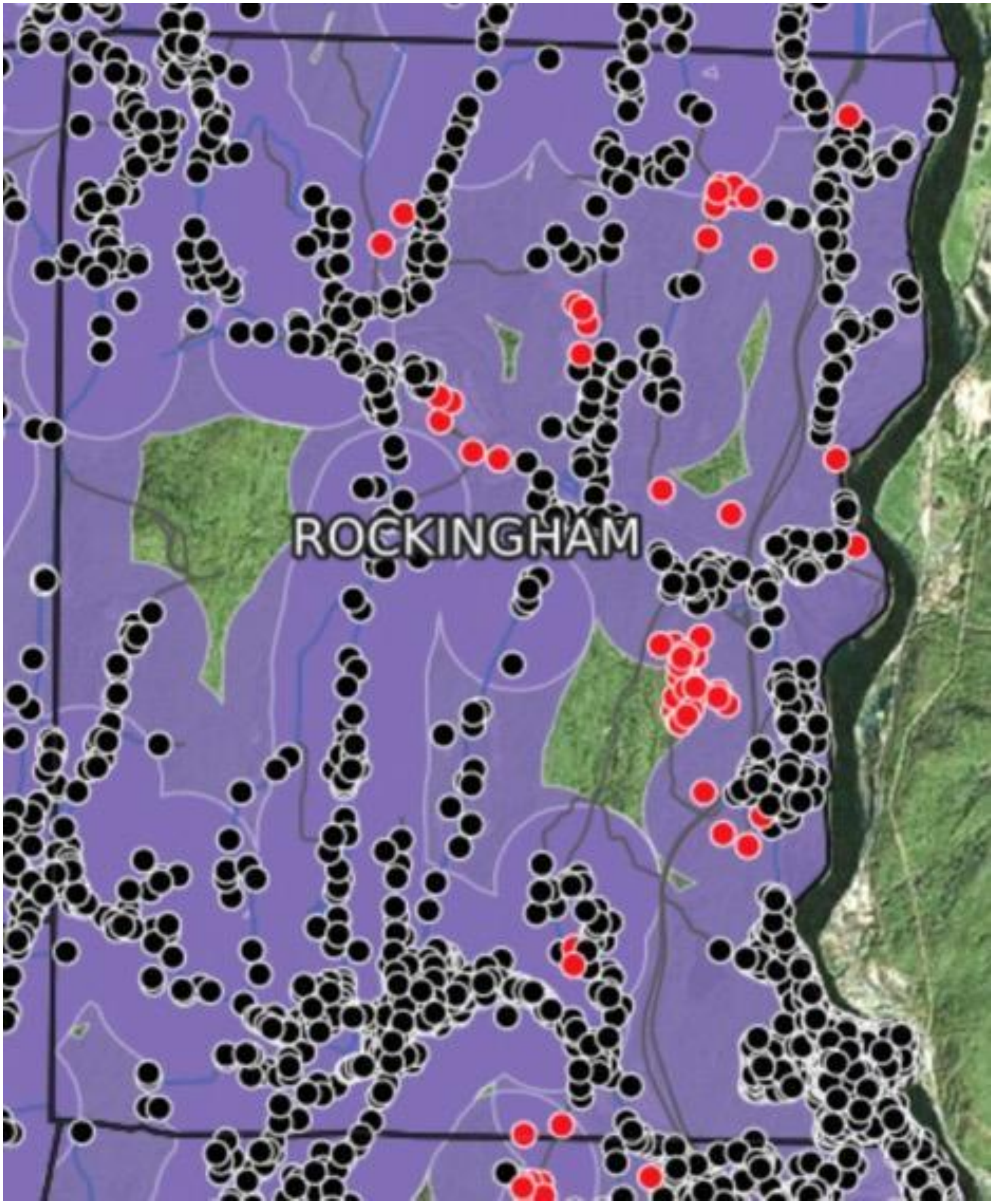


Figure 147: Unserved Premises Suitable for Line Extensions in Rutland

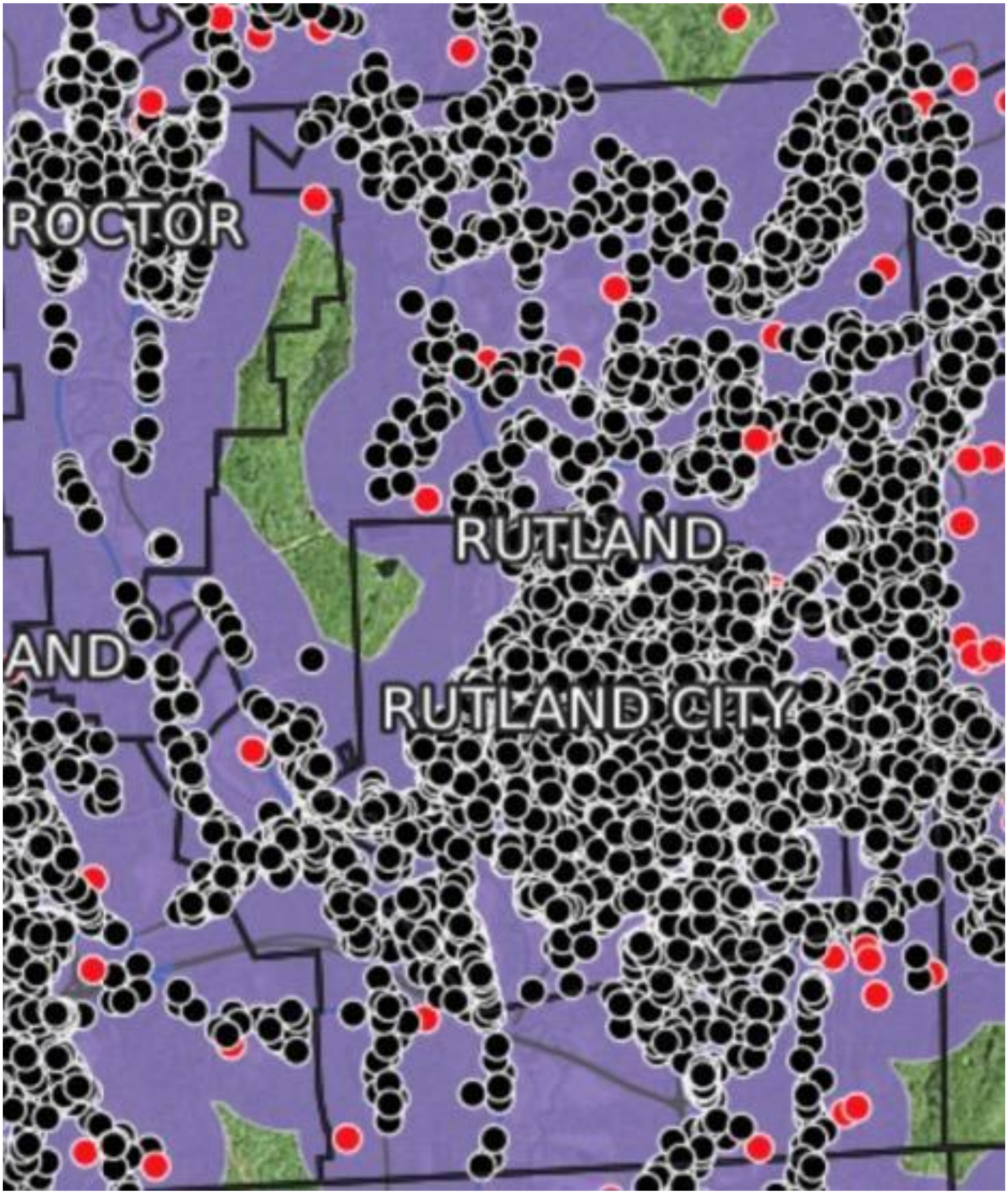


Figure 148: Unserved Premises Suitable for Line Extensions in Shrewsbury

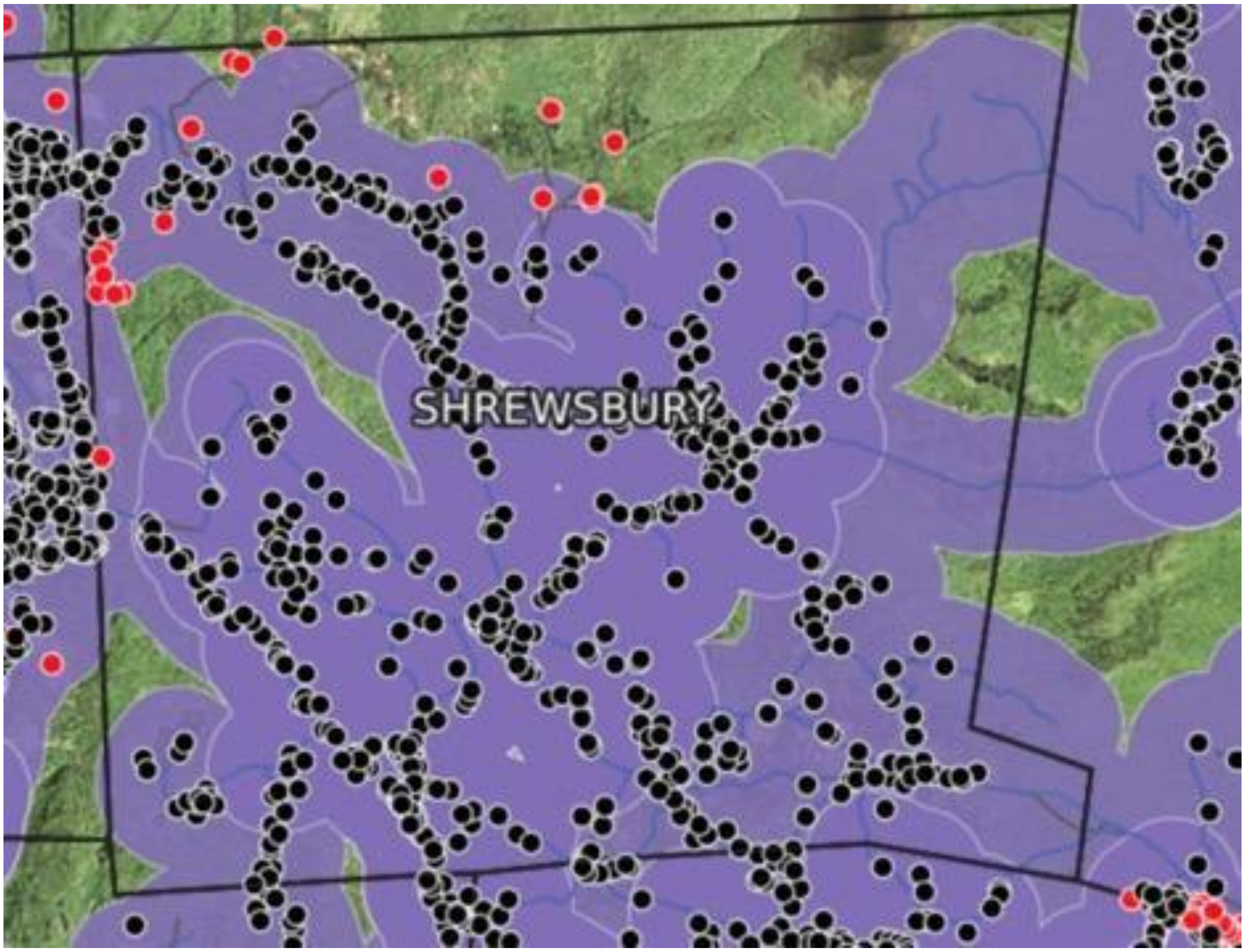


Figure 149: Unserved Premises Suitable for Line Extensions in South Burlington

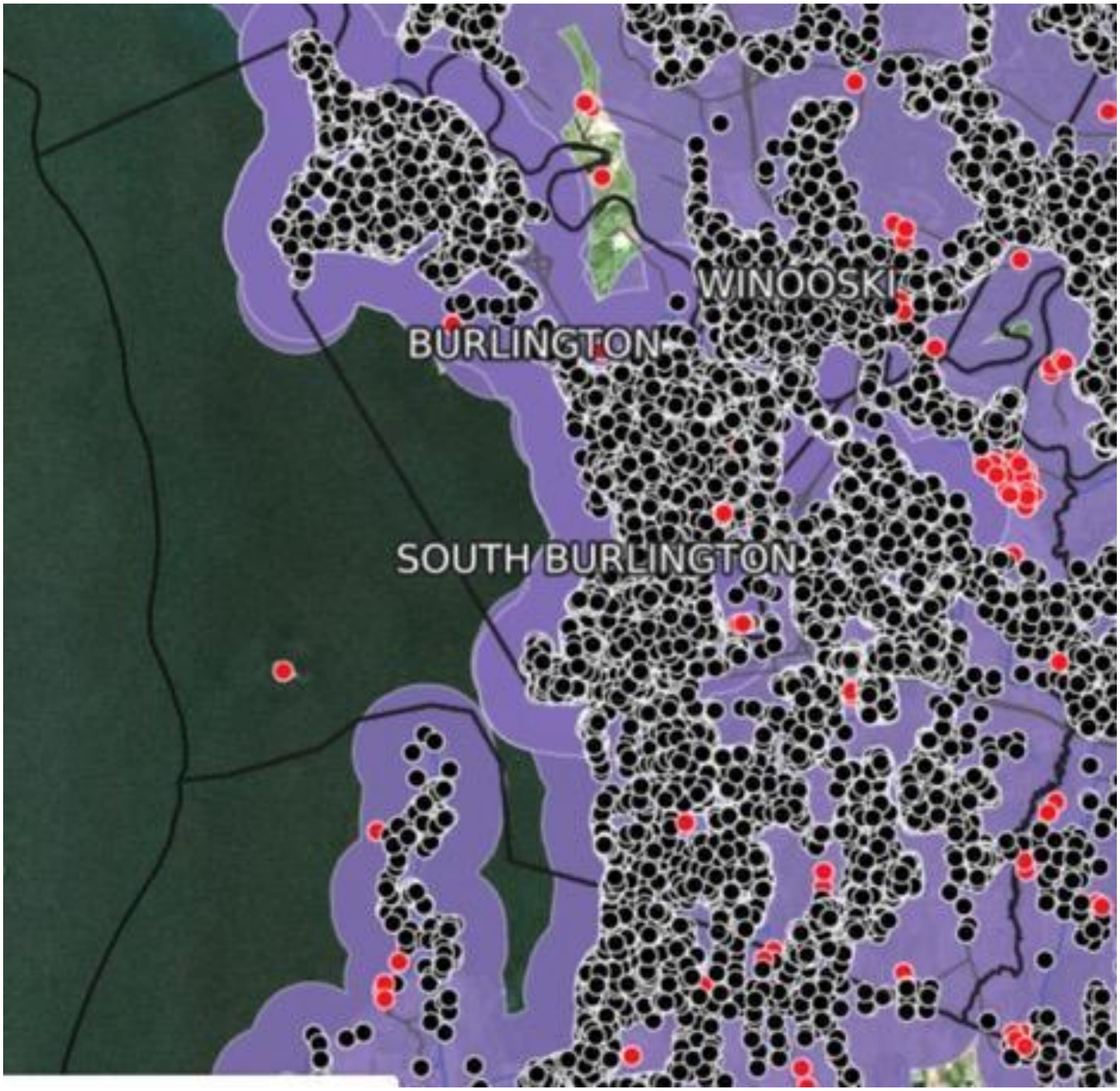


Figure 150: Unserved Premises Suitable for Line Extensions in South Hero

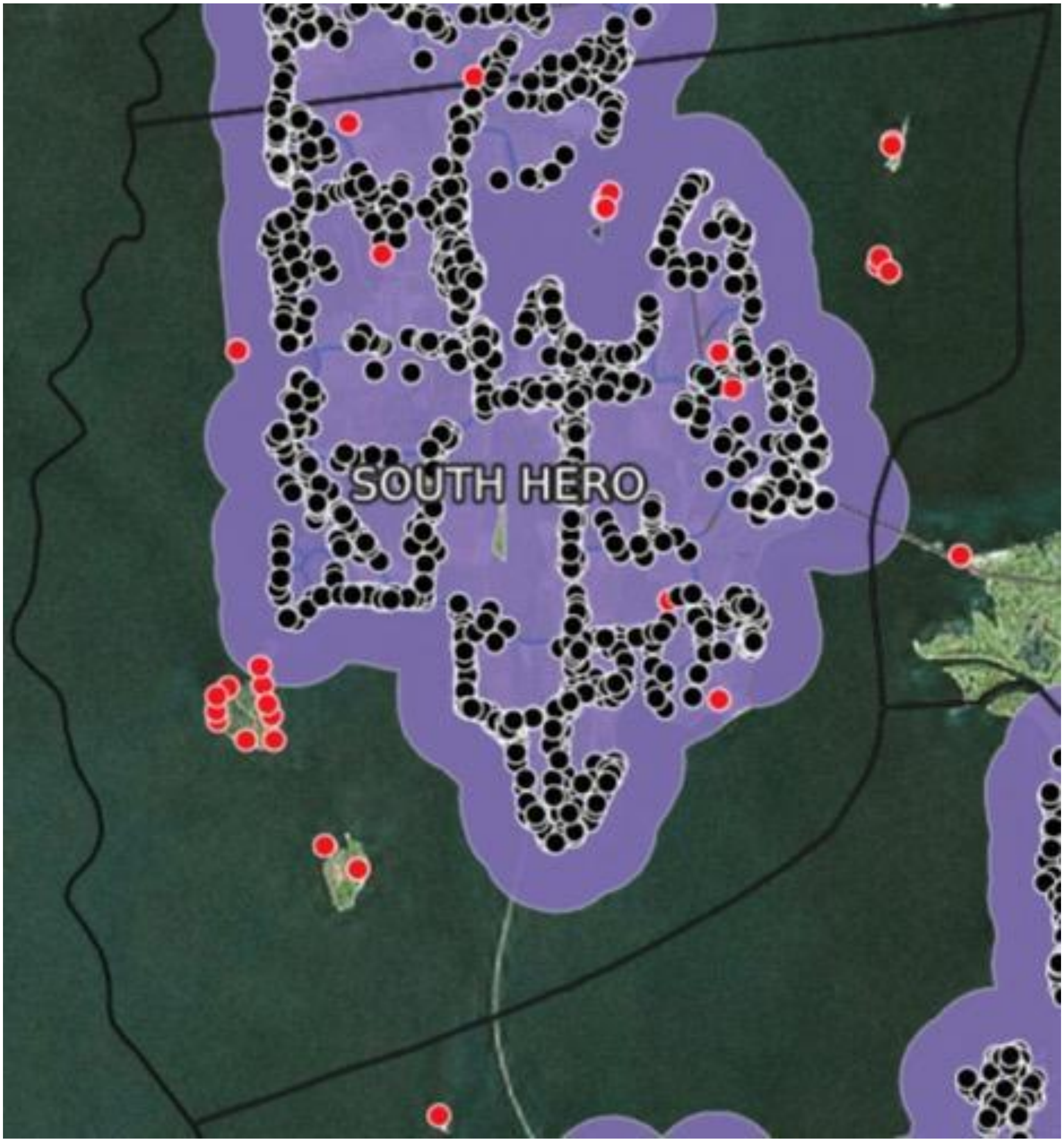


Figure 151: Unserved Premises Suitable for Line Extensions in Swanton

Figure 152: Unserved Premises Suitable for Line Extensions in Vernon

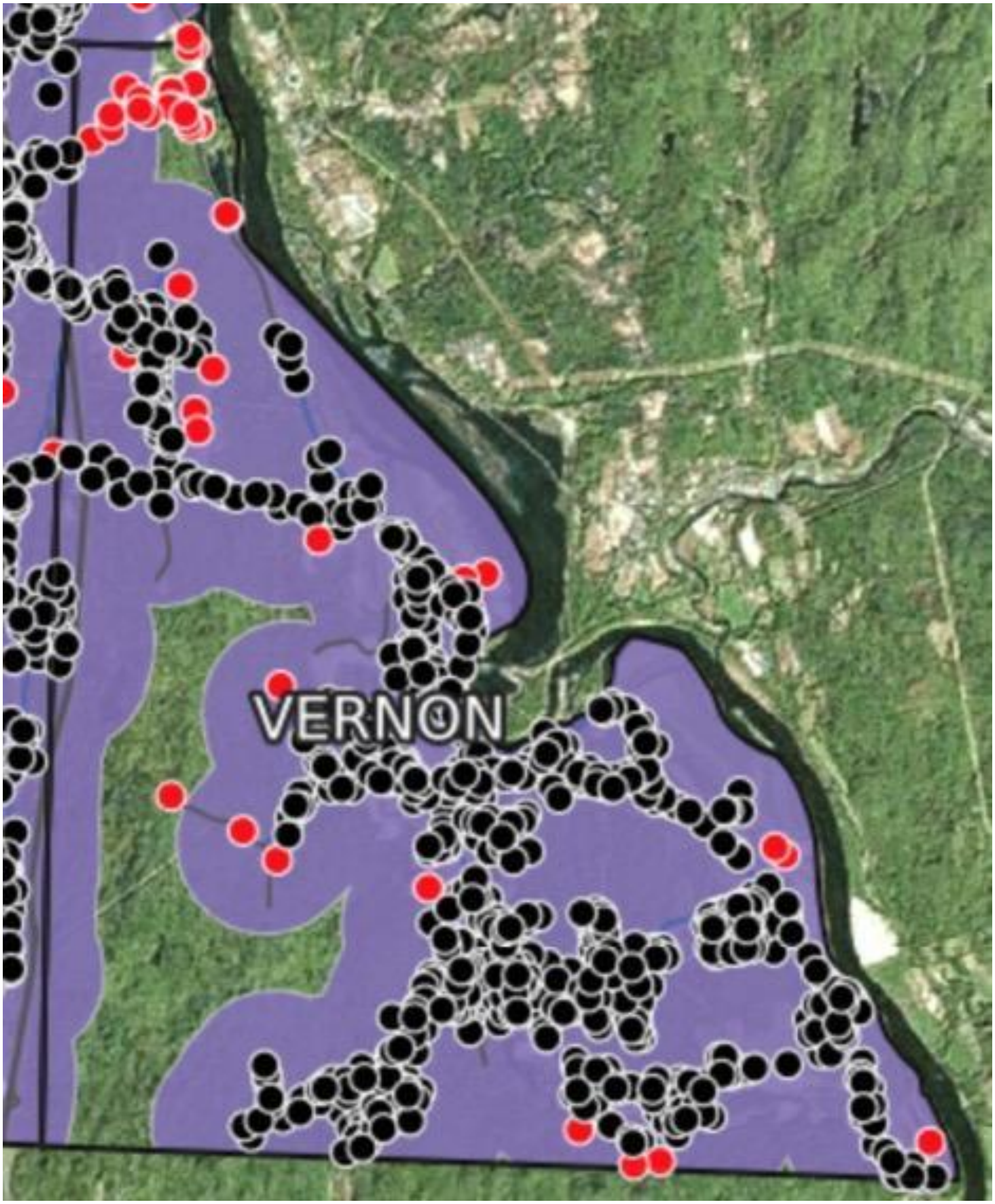


Figure 153: Unserved Premises Suitable for Line Extensions in Wells

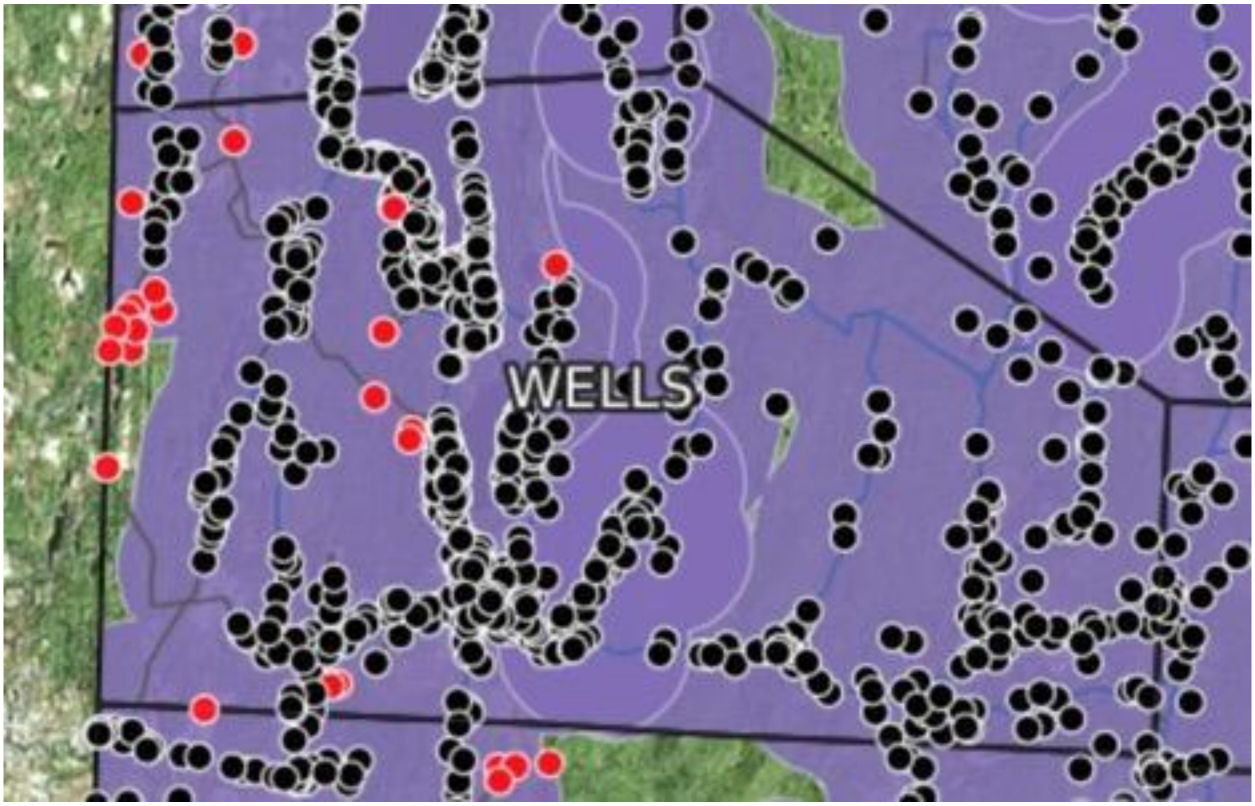
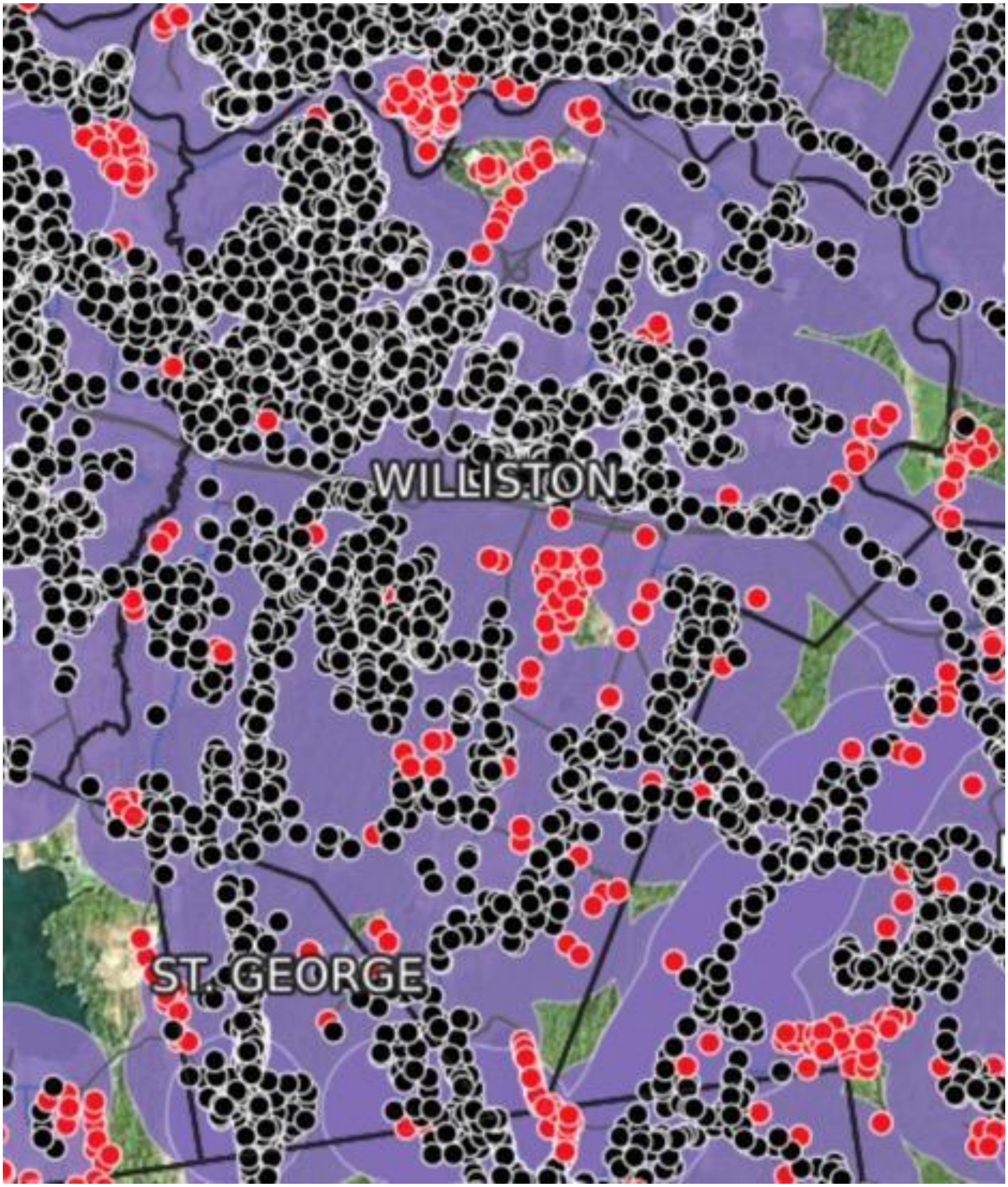


Figure 154: Unserved Premises Suitable for Line Extensions in Williston



Appendix I: Interviews Conducted for This Study

State Agencies and Departments

- Agency of Commerce and Community Development: Kenneth Jones, *Economic Analyst*
- Agency of Digital Services: Frank Costantino, *ADS Manager – IT Shared Services*
- Agency of Education: Jess DeCarolis, Lisa Helme
- Agency of Natural Resources: Billy Costner
- Agency of Transportation: Costa Pappis, *Policy and Planning Manager*
- Department of Buildings and General Services: Marc O'Grady
- Department of Libraries: Jason Broughton, Joshua Muse, Thomas McMurdo
- Department of Public Safety: Terry Lavalley, *Director of Radio Services*
- Department of Public Service: Clay Purvis, Rob Fish, June Tierney, *Commissioner*
- Department of Vermont Health Access: Chris Brynga
- Vermont Enhanced 911 Board: Barb Neal, *E911 Board Director*

CUDs

- NEK Community Broadband: Evan Carlson, Christine Hallquist
- Southern Vermont CUD: Tim Scoggins, Sheila Kearns

Internet Service Providers

- AT&T: Owen Smith
- Burlington Telecom: Mike Loucy
- Charter Spectrum: Jennifer Young, Melinda Kinney, Michael Chowaniece, Paul Wolf
- Consolidated Communications: Erika Smith
- Comcast Xfinity: John Sutich and Alicia Matthews
- FirstLight: Mary Burgess, Debby Bunce
- Microsoft Airband: Fatema Kothari, Sidney Roberts, Erica Myers
- RTO Wireless: Steve Hubbard
- Vermont Telephone Company: Michel Guité
- Waitsfield & Champlain Telecom: Kurt Gruendling

Utilities

- Green Mountain Power: Brian Otley and Liz Miller
- Vermont Electric Power Company (VELCO): Dan Nelson and Kerrick Johnson
- Washington Electric Cooperative: Patty Richards

Healthcare Sector

- Bi-State Primary Care Association: Helen Labun
- Dartmouth-Hitchcock: Mary L. Lowry
- Northeast Telehealth Resource Center: Reid Plimpton, MPH
- UVM Health Network: Todd Young
- Vermont Information Technology Leaders: Caroline Stone, Beth Anderson
- Vermont Program for Quality Health Care: Seema Kumar, Hillary Wolfley

Elected Officials

- Representative Laura Sibilia
- Representative Tim Briglin
- Senator Ann Cummings

Other Stakeholders

- Addison County Economic Development Corporation: Fred Kenney
- Brattleboro Development Credit Corporation: Laura Sibilia
- Center for Media and Democracy/CCTV: Lauren-Glenn Davitian
- Central Vermont Economic Development Corporation: Jamie Stewart
- Greater Burlington Industrial Corporation: Sam Anderson, Seth Bowden
- League of Cities and Towns: Karen Horn, Abby Hall
- Northeastern Vermont Development Association: David Snedeker
- Rutland Economic Development Corporation: Tyler Richardson
- Vermont Economic Development Authority: Cassie Polhemus