

1 Executive summary

The City of Dallas (City) and Dallas Independent School District (DISD) commissioned this plan in late 2020 as the Covid-19 pandemic highlighted and exacerbated students' and residents' need for broadband access. Both DISD and the City have taken significant steps to address broadband-related gaps in the City and DISD district, but barriers to equitable internet access and use remain in Dallas, just as they do across the country.

This project aimed to identify the magnitude of digital equity challenges and broadband gaps, and to develop actionable strategies that could be undertaken by the City and the DISD to help Dallas residents, including student households, to access affordable, high-speed home broadband service—and possess the devices and skills necessary to make fullest use of broadband. This Plan represents a vision for achieving digital equity and strategic alignment among community partners. It contains four broad based recommendations with initiatives associated with each of the recommendations. Each has its own track and timeline for completion. This document also provides guidance on a range of federal programs and Economic Development Agency (EDA) grant opportunities.

At the outset, we highlight four primary recommendations:

1. Proceed with the City's plan to construct 100 miles of City fiber and add additional fiber to create a 180-mile network

We recommend the City proceed with its existing plan to build 100 miles of fiber and expand it with additional fiber to support digital divide initiatives and connect City facilities. The 100 miles of fiber would cost about \$13.5 million to build and \$1 million to operate each year and could pay for itself (by enabling the City to avoid the costs of leased circuits of fiber at that scale) in about six years. The backbone could provide backhaul for a range of City applications; spare strands of City fiber could then assist digital equity efforts by, among other things, providing options for connectivity in areas of the City where fiber deployments by private providers has lagged. The connectivity solution could include wider fixed wireless deployments as summarized in the next recommendation.

Adding fiber for a total of 180 miles of fiber would cost approximately \$25 million instead of \$13.5 million. This design incorporates the full 100-mile build, plus additional fiber to further expand the potential of the network to facilitate City applications and reach priority areas for possible broadband solutions. This would make a meaningful impact toward the goal of getting fiber close to every resident and business within the City. Compared to acquiring the same fiber through leased services, this project could provide significant long-term operational savings. We

summarize our recommendation and financial analysis of this option in Section 2.1 and provide the full financial analysis and underlying assumptions in Section 6.

2. Consider expanding targeted fixed wireless infrastructure using school rooftops to supplement existing broadband offerings to serve both DISD families and other residents

Though broadband is widely available in Dallas, broadband-level speeds are not available to all residents—and affordability is an issue for many families. We recommend the City and DISD expand their initial successful fixed-wireless pilot projects to explore additional targeted fixed-wireless broadband buildouts. Using DISD’s fixed-wireless pilot project at Lincoln High School as a template, we created models for expanding such service using equipment mounted on DISD building rooftops. We provide a summary of the capital and operating costs of this approach at a variety of scales and models in Section 2.2, and full technical descriptions and other relevant information in Section 5. However, before making a decision about a wireless buildout, we recommend that the City and DISD evaluate the pilot projects.

3. Increase staffing for digital equity programs, such as by establishing a call center to help qualified low-income residents enroll in subsidy programs

Dallas is already served with near ubiquity by Charter and AT&T and some other providers. Though speeds lag in some areas, the core issue for many residents is one of affordability. We recommend the City increase staffing for digital equity programs to assist residents in enrolling in existing subsidy and low-cost programs including Spectrum Internet Assist, Access from AT&T, and the Federal Communications Commission’s (FCC) Lifeline and Emergency Broadband Benefit programs. The mail survey conducted for this study documented significant gaps between the number of families who are potentially eligible for these programs and the number actually using them—a problem local stakeholders also reported in our meetings. We recommend the City and DISD set up a call center and technical support to assist residents in enrolling in these programs at significant scale. We summarize the potential costs of such an effort in Section 2.3 and provide a fuller discussion in Section 7.

4. Expand programmatic efforts aimed at helping residents access computers and develop digital skills

The broadband gaps and challenges faced by Dallas residents are not limited to service access or affordability. Many residents lack the resources to purchase and maintain up-to-date computers and the skills necessary to make the most effective use of broadband and computers. We recommend increasing the scale of the device and skills efforts already in place in Dallas. We estimate that a one-time device purchase program to provide a device to the roughly 65,000 households that lack a computer would cost \$13 million. We estimate that a program to provide

skills training to an initial 5,000 residents would cost \$1 million and could be scaled further to meet the need. Community-based groups and nonprofits could play a key role in implementing these efforts. We summarize these recommendations in Section 2.4 and provide more detail on all programmatic recommendations in Section 7.

1.1 Project overview

This project began with efforts to gather data on the Dallas broadband market, identify gaps in access, evaluate current programmatic solutions, and develop potential pilot solutions for serving unconnected students. In late 2020 and early 2021, CTC conducted research to identify, quantify, and understand the nature of the digital divide affecting DISD families and Dallas residents more broadly, including through a mail survey that provided insights into the interplay of challenges related to broadband access, affordability, device access, and digital literacy.

Among other tasks, CTC:

- Identified gaps in infrastructure and affordability in determining areas for investment and targeted initiatives
- Provided engineering assistance in partner selection and implementation of DISD and City pilot networks to provide broadband to Dallas residents
- Developed a design and cost estimate for a fixed wireless service
- Analyzed the potential for a City-owned fiber ring to connect City facilities and estimated costs to expand fiber to Dallas neighborhoods, with a focus on areas least served by broadband
- Developed strategies to use emerging federal broadband subsidy programs to expand broadband access through existing providers
- Made recommendations for how the data developed could inform expansion of the digital equity initiatives underway in Dallas

This effort was focused on determining gaps for purposes of addressing equity goals. CTC's engineers estimated that a ubiquitous fiber-to-the-premises (FTTP) network for Dallas would exceed \$1.5 billion in capital costs and would, as a result of putting extensive resources into neighborhoods that are already served with broadband, not address equity issues most efficiently. A citywide FTTP approach would divert capital funds to that are more affluent and create long-term costs that could better be directed toward targeted equity efforts.

This work was commissioned by the City of Dallas and the DISD. Although strategic planning for Dallas County was outside the scope of this plan, the County has been a strong partner to the City and the DISD through collaborative efforts and work on the Internet for All Coalition. As such,

there is considerable potential for the County to serve as a strong partner in all of the initiatives recommended here, given the goals and interests it shares with the City and the DISD.

1.2 Network investment has not occurred consistently across all Dallas neighborhoods

Our analysis of the Dallas broadband market found that several providers—chiefly Charter and AT&T, augmented by fixed wireless service—provide service to the great majority of the City. But a review of service availability and some speed test results suggest that there persist gaps in the provision of broadband speeds (defined as at least 25 Mbps download, 3 Mbps upload—a standard set by the FCC in 2015).

At the outset, it is important to note that even speeds of 25/3 are not necessarily sufficient to meet the needs of students and other residents. Those minimum speeds might be workable if internet usage were mainly in the form of internet browsing, email, and even streaming movies (i.e., primarily downloads). But videoconferencing and other common applications demand high bandwidth in the upload direction as well. For example, at the home of a family of four, if two children are attending classes using Zoom and two adults are using their broadband connections to attend occasional meetings, send e-mail, and do research, their combined required bandwidth could easily exceed this FCC-minimum level of broadband service.¹ Bandwidth needs are constantly increasing, too, so even sufficient speeds today may be inadequate tomorrow.

Our analysis found that investment in networks—specifically, fiber deployment or the upgrade of DSL networks to reach higher speeds—has not occurred consistently throughout the City and DISD market area. Online speed testing conducted for this study detected sub-broadband speeds at households using both Charter and AT&T at various locations around the City.²

The parts of Dallas that have seen the least investment fall into two categories and are illustrated in Figure 1 (below):

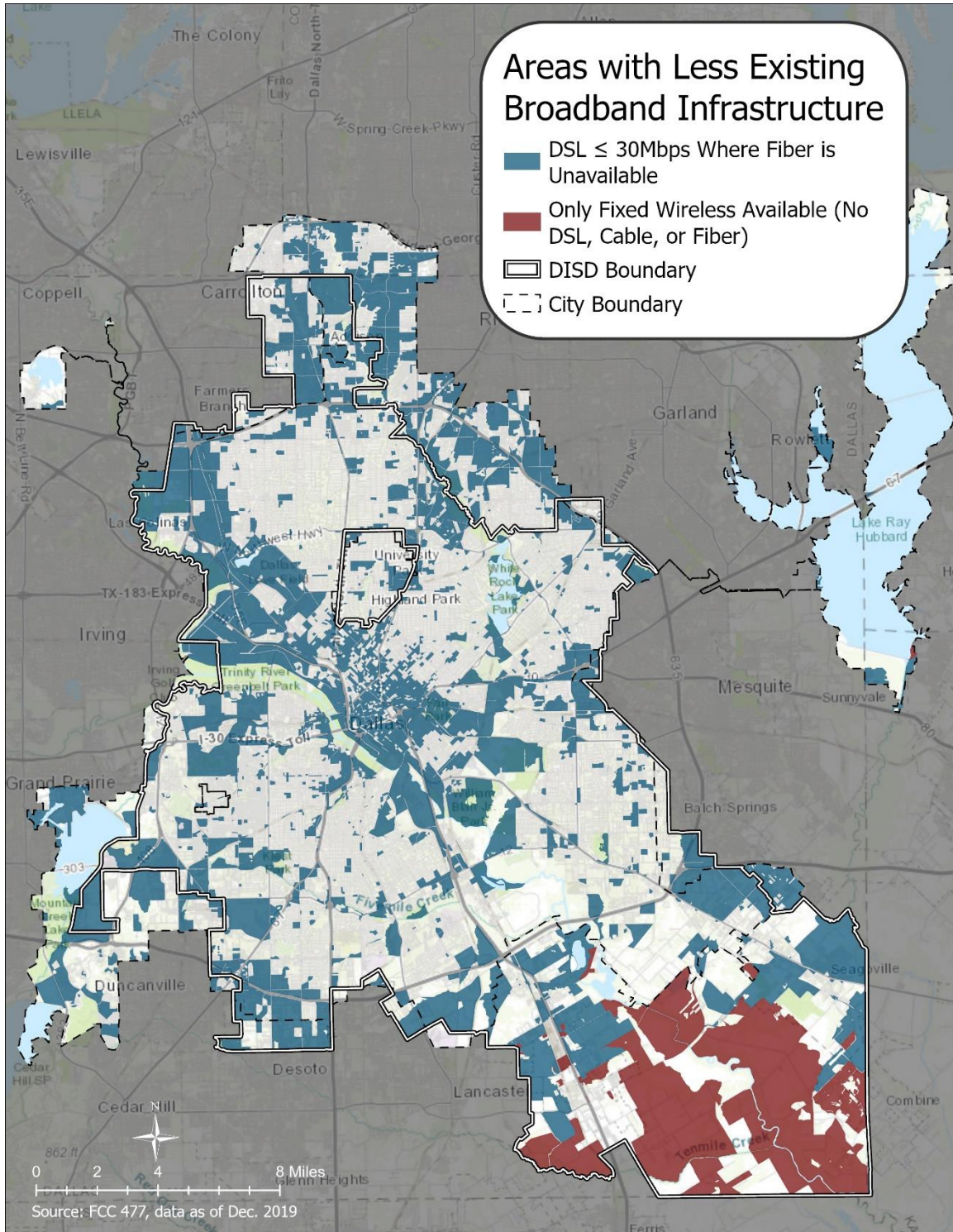
1. Areas in which the maximum reported DSL download speed is 30 Mbps or lower, **and** where fiber service is not available. The only option for a wired internet service in these areas would be cable, or DSL operating at download speeds of 30 Mbps or less.
2. Areas in which fixed wireless is the only fixed service reported to be available (i.e., areas in which there is no option for a wired service).

¹ “Broadband Speed Guide,” Federal Communications Commission, [https://www.fcc.gov/consumers/guides/broadband-speed-guide?contrast=.](https://www.fcc.gov/consumers/guides/broadband-speed-guide?contrast=)

² See Section 1.3 for more details. Identifying potential factors in the home that could contribute to a reduction in speeds was beyond the scope of this effort.

This figure is based on structures in these zones (not population) but we estimate that more than 210,000 people live in the DSL-only areas (teal) and that about 5,000 people live in the areas served only by fixed wireless service (red).

Figure 1: Low-Investment Areas Within the City and DISD Boundaries



In addition, we analyzed the low-investment areas' overlap with other factors throughout the City and DISD service area, including the City of Dallas Office of Equity and Inclusion's Covid-19 risk score data. The City developed the risk scores with consideration of the following questions:

- “Do Black, Hispanic and Native American populations together make up more than 70% of the community?”
- Does the area have 15% or more of its families at or below 100% of the federal poverty level?
- Do less than 50% of the area's households own the home they live in?
- Is the area rated “High” on the CDC's Social Vulnerability Index, Socioeconomic Level?
- Are more than 12% of the area's residents 65 or older?”³

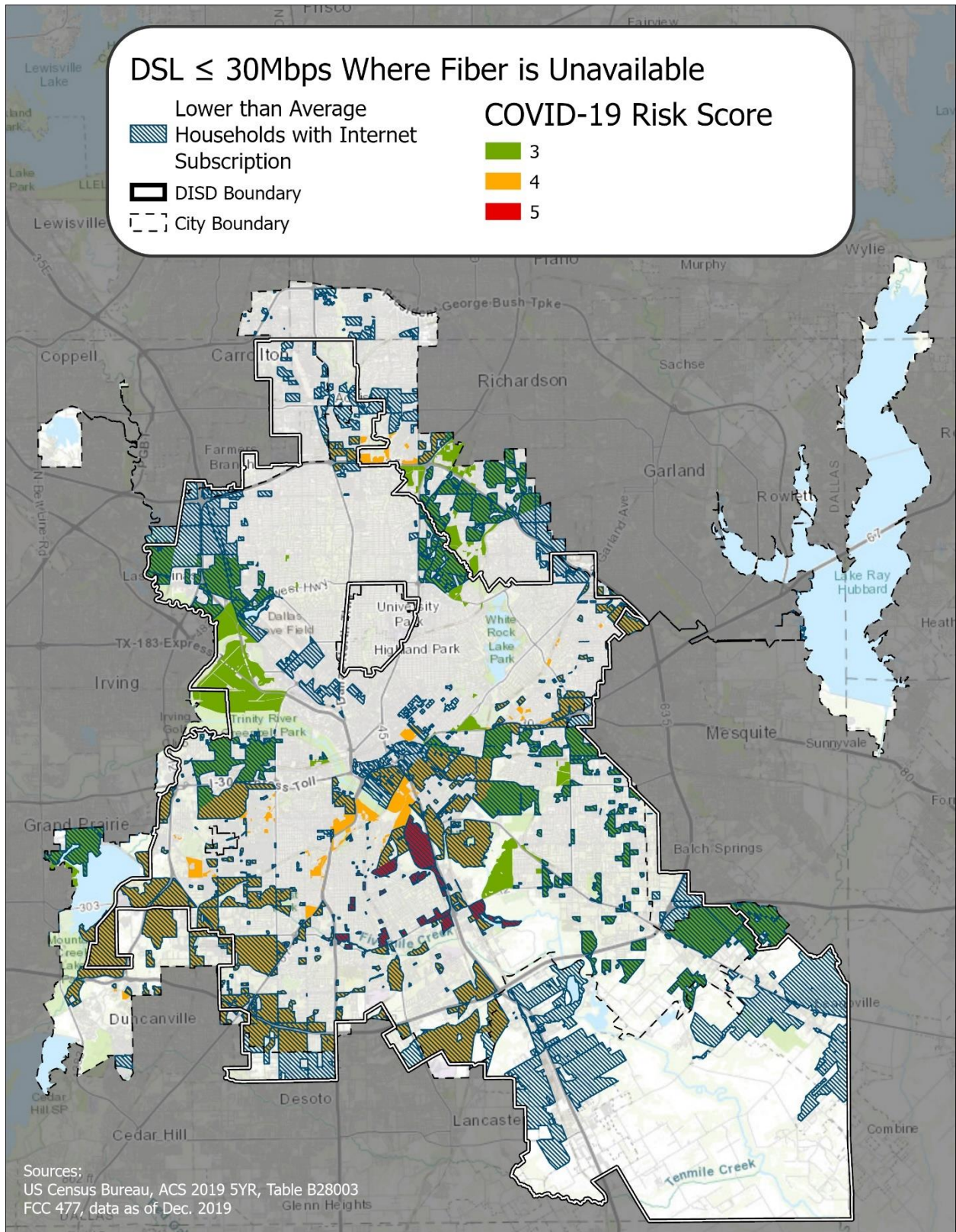
The City's Covid-19 risk scores were used in this context not to evaluate the pandemic's relationship to broadband needs (though it certainly has accentuated those needs) but rather as a local data proxy for a range of social and economic challenges facing segments of the Dallas community.

We found that several areas of the City that have been assigned Covid-19 risk scores of three, four, or five (i.e., the three highest scores, indicating the most risk) overlap with areas that do not have access to fiber—suggesting that some areas with high social and economic challenges are further challenged by lower levels of broadband investment and availability of high-speed services.

Further, we identified areas with high Covid risk that also, according to the Census Bureau's American Community Survey data, have lower-than-average rates of residential internet subscription. Figure 2 shows the overlap of the high-risk areas with areas lacking fiber investment and areas having lower-than-average residential internet subscriptions.

³ Covid-19 risk score description and methodology, City of Dallas, <https://dallasgis.maps.arcgis.com/home/item.html?id=186b98f0fab940118dbd9a4422db7eaa&view=table&sortOrder=desc&sortField=defaultFSOrder#overview> (accessed April 29, 2021).

Figure 2: Areas Without Fiber, Lower-Than-Average Internet Subscriptions, and High Covid-19 Risk



1.3 Speed-test survey results identified lack of uniform broadband speeds

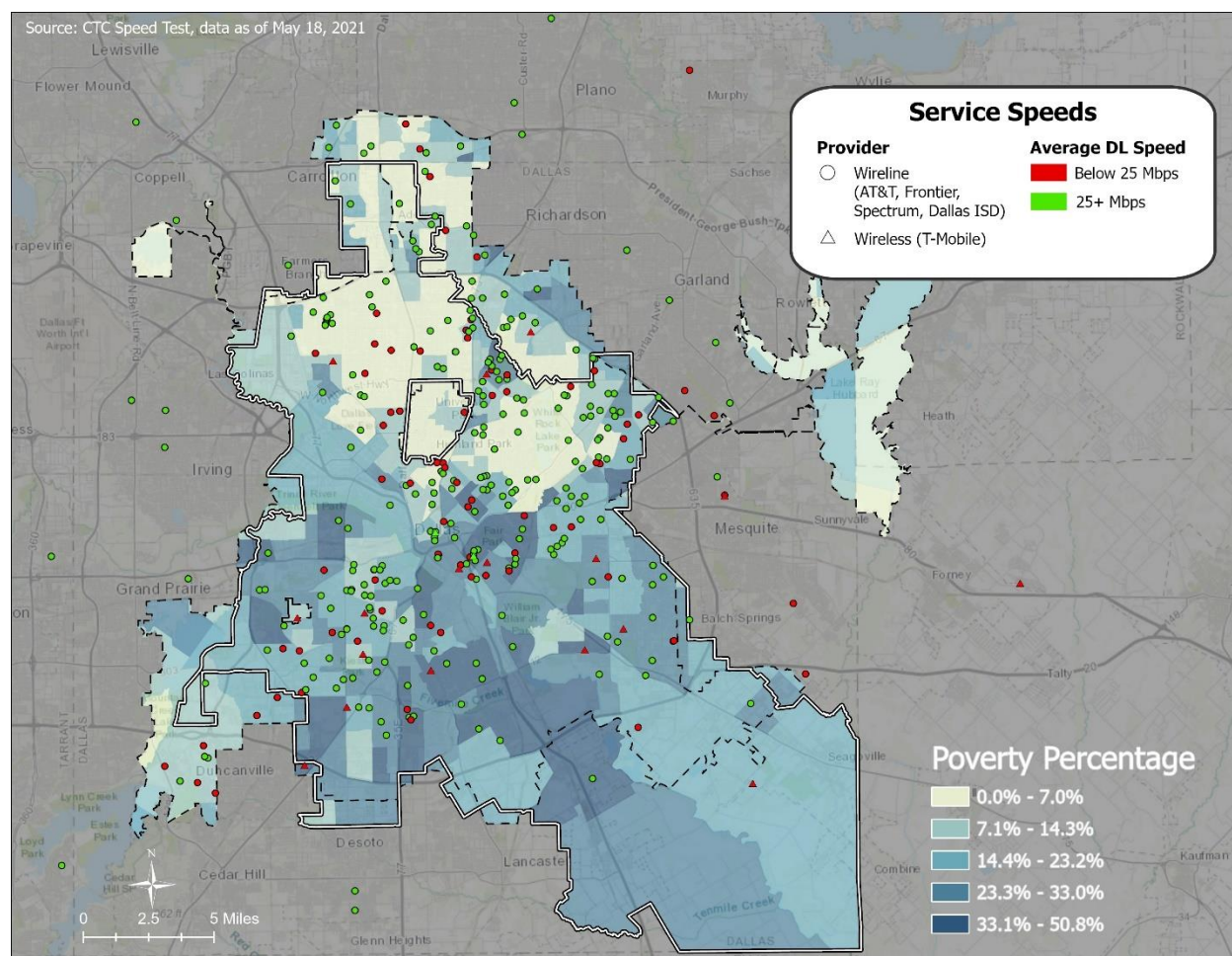
CTC developed, launched, and hosted a custom online speed test website (SpeedSurvey, <https://dallas.speedsurvey.org/>) to gather additional data on broadband in Dallas. The website included a means to conduct an internet speed test, a brief survey about levels of satisfaction with service, and an option to enter an address where no service was available. DISD, the City, and the Internet for All coalition promoted the SpeedSurvey link and encouraging participation by DISD households and other Dallas-area residents.

The overall goal was to develop the most granular data possible about broadband speeds available to households in the area. Between October 19, 2020, and May 18, 2021, 444 individuals filled out the SpeedSurvey survey or conducted speed tests. Tests were conducted mainly by Spectrum, AT&T, and DISD fixed wireless pilot project users.

Although the tests could not determine the cause of slower speeds in any given household—meaning, whether it is caused by slow service to the premises or factors in the home—the data suggest that Dallas-area residents may not be uniformly obtaining the minimal broadband speeds needed to meet the demands of remote learning and telework.

Figure 3 (below) shows the locations of tests and whether they met the 25 Mbps threshold. We mapped the speed test results on a base map of poverty levels but did not have enough datapoints to show any relationship between the two.

Figure 3: Distribution of SpeedSurvey Tests Above or Below Broadband Speeds



1.4 Survey results indicate gaps in broadband access, affordability, device ownership, and digital skills among DISD families and Dallas residents

The City and DISD commissioned a mail survey of households to gather data about the types of services to which residents subscribe (including subsidized programs such as AT&T Access and Spectrum Internet Assist) and a wide range of other topics including residents’ ability to afford services, their ownership and ability to maintain computers, their skills in using broadband and computers, and their concerns about online harms. The survey was printed in both English and Spanish (of 790 responses, 23 replied in Spanish) and documented significant increased reliance on broadband during the Covid-19 pandemic. The full survey report is provided in Section 4.

The following is a sample of report highlights:

- **Some low-income households lack access.** Overall, 96 percent reported having internet service (either home or mobile/cellular connection). However, 18 percent of low-income households earning under \$25,000 per year have no internet service. Eleven percent of

the lower-income segment with children (<\$50,000, children in home) do not have internet.

- **Most households with children have internet access, but it may be insufficient for some families.** About 16 percent of respondents agreed or strongly agreed that their children cannot complete their homework because they do not have internet access. One-third of households earning under \$50,000 per year (with children) agreed or strongly agreed.
- **Residents may be significantly underutilizing existing broadband subsidy programs.** Just 4 percent of AT&T customers are enrolled in the ISP's Access program for low-income households, and 3 percent of Spectrum customers are enrolled in its Internet Assist program. Just 1 percent of low-income subscribers receive the FCC Lifeline program's \$9.25 monthly subsidy, and 7 percent are unsure whether they receive the subsidy.
- **Residents want affordable broadband internet service.** Most respondents strongly agreed the City or DISD should ensure all students (81 percent) and residents (65 percent) have access to affordable broadband service. Three-fourths of respondents strongly agreed the City or DISD should provide free access at home to internet-based educational resources for students from low-income families. Households with children were even more likely to support these efforts to reduce broadband access gaps.
- **Lower-income residents have fewer computing resources than higher-income residents.** Nine in 10 respondents indicated they have a computer in the home (desktop, laptop, tablet) with internet access. But only two-thirds of low-income households (earning less than \$25,000 per year) have both internet access and a computer.
- **Many households experienced frequent issues with their computing devices breaking down.** Six in 10 respondents with internet access have experienced trouble with their computer not working properly; 15 percent experience problems at least weekly.
- **More than one-fourth of internet subscribers would not be able to quickly replace non-working computers.** Eight percent of respondents said they could not replace their computer in the foreseeable future if it became unusable, and 19 percent said it would take one to six months to replace it. Adding these two datapoints, 27 percent of households with home internet service are at risk of not being able to use broadband for long periods because of computer problems.
- **Low-income households are at greater risk of computer issues.** One-fourth of internet subscribers earning less than \$25,000 experience issues at least weekly with their primary computer becoming inaccessible or unusable. Furthermore, six in 10 low-income

subscribers would not be able to replace their computer (30 percent) or would take one to six months to replace it (30 percent) should their computer become unusable.

- **Many respondents are interested in becoming more confident in using computers, smartphones, and the internet.** Specifically, 43 percent of respondents agreed or strongly agreed that they would like to become more confident in using computers and related technology, and 29 percent agreed or strongly agreed they would like to attend training.
- **Online harms are of significant concern in Dallas.** Many respondents disagreed or strongly disagreed that their children have the skills to detect and avoid false or misleading information (56 percent), avoid online bullying (43 percent), detect and avoid financial scams and predators (51 percent), and avoid exposure to graphic violence or pornography online (41 percent). Six in 10 respondents agreed or strongly agreed that they have the time and skills to protect their children from online risks.

1.5 The City and DISD's infrastructural and programmatic efforts to ameliorate digital inequities provide a strong foundation for expansion

The City, DISD, and other nonprofits and stakeholders are actively engaged in addressing digital equity issues related to:

- **Access:** that broadband infrastructure exists, and reliable high-speed broadband plans are available for purchase
- **Affordability:** that broadband service is not only available but can be obtained at reasonable prices by all
- **Devices:** that residents own or have access to well-functioning, up-to-date computers—and have the capacity to maintain and replace these devices if needed.
- **Skills:** that residents have the ability to make full use the often-complex functions and computers and online resources—and thus are able to use these tools to communicate, work, learn, attend medical appointments, and so on—and avoid online harms.

A wide range of entities provide support services in Dallas, including device rentals and digital skills training. In Section 7 we summarize the existing range of programs in the Dallas area that offer reduced-cost broadband service and access to devices and training, highlight data from our research that may prove useful to guide program development, discuss examples of programs in other cities, and make recommendations about potential ways to build on efforts already underway in Dallas.

DISD and the City have also launched wireless pilots to explore solutions to their broadband gaps. The pilots are in place as of the writing of this report. We recommend the City and DISD continue to rigorously evaluate the outcomes of the pilots in light of their goals.

1.5.1 DISD operates an educational wireless network pilot at Lincoln High School

In late 2020 and early 2021 DISD began to pilot an educational network to provide broadband service to DISD families located near Lincoln High School. (More details are in Section 5.2.) This effort to explore options for meeting students' broadband needs used low-cost, open-access wireless spectrum, as well as radios located at DISD buildings (to avoid facility lease fees), and fiber connectivity to DISD's network.

BearCom, in partnership with Motorola, installed an antenna and related radio equipment on the rooftop of the school and, in the first months, about 50 participating families living in close proximity to the school were provided indoor Wi-Fi routers (also called customer premises equipment, or CPE) to deliver service within their homes. The first phase included indoor CPE equipment with Wi-Fi and USB interfaces, capable of connecting to DISD-provided Chromebooks and other Wi-Fi-based devices.

As of the writing of this report, DISD is planning to expand the pilot to more families and schools and test different CPE equipment to expand the range of the network and improve performance to homes with more challenging lines of sight. One option is a window-mounted CPE radio that can be installed by the DISD family at a location with the best connection to the network, which then acts as a Wi-Fi hotspot connecting to student devices.

1.5.2 The City of Dallas launched two Wi-Fi pilots in priority zones

At approximately the same time as the DISD pilot, the City of Dallas also began two pilots using Wi-Fi technology. The City selected Neo Networks for the first pilot. Locations were selected in 10 priority zones consistent with proximity to City facilities, DISD and City collaborative projects, and areas with limited household connectivity.

This pilot provides a Wi-Fi wireless mesh network with five to 10 outdoor access points in each of the areas. Wi-Fi access points were installed for this purpose. Devices on the poles are solar powered, with battery backup. In this proof-of-concept phase, residents in the area would connect using their own Wi-Fi-enabled devices.

The second pilot was completed by city contractors. Locations were selected in 10 priority zones consistent with the findings of the Mayor's Task Force on Safe Communities, as well as in strategic lighting zones which take into account factors such as the Market Value Analysis, and areas of racial and ethnically concentrated poverty. This pilot included the installation of streetlights and fiber optic network connections from adjacent City facilities to wireless access points (WAP) on the streetlights installed on the selected blocks.