

Digital Equity in Beasley:
Internet Access for a Marginalized Community

Julia Bootsma, Dan deGelder, Alissa Heagy, Elisabeth Krstevski, and Rylan Vanderwoude

Redeemer University: CTS-410

Prof. C. Ma, Juliana Weber and Kelly Austin

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Executive Summary

The purpose of this report is to outline the achievable goals in promoting digital access in the Beasley Neighborhood located in Hamilton, Ontario by providing free Wi-Fi access to the community. Emerging from a post-pandemic time, the internet and digital access are becoming more important than ever in connectivity and opportunity. Our driving question: ‘What kind of project can the BNA implement to meet the digital equity needs in the Beasley Neighborhood community in Hamilton, ON, and how can they establish the project in a way that helps them meet the eligibility requirements for the City Enrichment Fund digital equity grant?’ is what guided our research and recommendation. Through the culmination of research, we discovered three main approaches to expanding digital access in underrepresented communities.

Firstly, subscribing to Starlink and installing receivers. This option is easy to implement, reliable and provides fast internet speed. However, Starlink is the most expensive option to maintain. Secondly, installing a mesh network via internet dishes. This option provides strong signals that can handle large amounts of data, but a challenge is maintaining no obstructions between dishes and the complex setup process. Thirdly, providing Wi-Fi hotspots in strategic locations. This option can tap into already existing infrastructure in the area but provides slower internet speeds to users. These three options have complex aspects and do not have to be used independently of each other. In creating this project we ensured that the goals aligned with every party involved for cohesion and efficiency. This project is to be subsidized by funding through the City Enrichment Fund via a grant application, with alternative funding through federal and provincial government programs. With the implementation of these recommendations, Beasley Neighborhood residents can enjoy both short-term and long-term benefits that come with having enhanced digital access and greater participation in their community.

1. Introduction

With the rise of the internet in Western society, digital hardware and software are becoming essential to even the most basic tasks of daily life. Technology is constantly being woven deeper into the fabric of our communities, from the home, to work, to school. Many are accustomed to the plethora of benefits that come with digitizing a society, seeing boosts in efficiency, productivity, and so much more. However, digital technologies come at a cost, and this is most evident in under-serviced communities and marginalized demographics, particularly those of low income who live at or below the poverty line. Often without access to these digital products and services, these individuals become separated further and further from the rest of society as digital connectivity increasingly becomes more essential to their communities. This is often referred to as the digital divide.

1.1 Driving Question

Our team has partnered with CityLAB and the Beasley Neighbourhood Association (BNA) to explore ways in which we can bridge the digital divide. Our project has two primary goals. The first goal is to make recommendations to the BNA concerning ways to tackle the digital divide effectively in the Beasley Neighbourhood, one of the most marginalized communities in all of Hamilton. The second goal of our project is to ensure that these recommendations fit the eligibility criteria for the City Enrichment Fund (CEF). This is a program run by the city of Hamilton which provides funding to organizations that work to improve the quality of life in the city. The digital stream is one of the seven streams in the CEF and is aimed at the goal of digital equity, which is an adequate level of access to digital technologies for all individuals in order to fully participate in our digitized society. The BNA is a not-for-profit organization that seeks to improve the quality of life of residents in the Beasley

Neighbourhood. If we can design our recommendations to fit its criteria, the BNA could potentially attain a significant amount of funding for its efforts. These two goals compose the driving question of our project: What kind of project can the BNA implement to meet the digital equity needs in the Beasley Neighbourhood community in Hamilton, ON, and how can they establish the project in a way that helps them meet the eligibility requirements for the CEF digital equity grant?

1.2 Focus

The project we have done is focused in particular on the issue of internet connectivity in the Beasley Neighbourhood. ACORN Canada conducted a survey in Hamilton which shows that the leading cause for families not having home internet is that it is unaffordable.¹ Our work is focused on recommending internet technologies that the BNA could use to bring internet connectivity to various locations in the neighbourhood so that all residents can have a practical access point. By bringing internet connectivity to more Hamiltonians, we hope to extend their digital reach and provide the intellectual means necessary to bridge the digital divide. While various other research has been done in this area, much is yet to be achieved regarding the goal of digital equity.

2. Context and Significance

With the COVID-19 pandemic, we saw our city become dependent on digital connectivity more than ever before. One of the issues with this was that not all Hamiltonians have full access to the necessary digital devices and services that they need. Many experienced frictions in their workplace, school, and home because of limited or no access to the online world. Digital tools have become essential to being a successful individual in this city, and more

¹ ACORN Canada, "Internet for all: Ending the digital divide in Hamilton."

broadly, across the world. As previously mentioned, the survey released by ACORN Hamilton determined cost as the leading factor to households not having a home internet connection.² This is one of the main reasons that the digital stream of the CEF was launched recently as a pilot program to try and extend the digital reach of Hamiltonians. More information on what has already been accomplished here in Hamilton and across Canada can be found in the survey and on ACORN's website.³

A six-part workshop about overcoming digital divides in Canada, held in part by the Ryerson Leadership Lab, with support from TELUS, revealed that in 2017, digital economic activities in Canada made up 5.5% of the total GDP. Meanwhile, from 2010 to 2017, jobs related to the digital economy grew 37% or three times more than the total economy which was 8.6%.⁴ This growth is likely to continue and is an inescapable reality that needs to be dealt with in a way that ensures digital equity across Hamilton. The big picture objective of our project is to ensure that all Hamiltonians have access to digital networks and connections necessary for daily life.

Digital equity is becoming important as of late because of the rate at which the city (and the world as a whole) is shifting towards operating on an exclusively digital platform, the foundation of which is the internet. The COVID-19 pandemic accelerated the already fast paced transition to the online world by demanding solutions to the limitations of social distancing. A clear example of this is Hamilton's public transit system. In 2020, it was announced that the Hamilton Street Railway would end the sale of paper tickets and passes, transitioning to an exclusively digital fare payment system. Councillor John-Paul Danko wrote, "Presto is an

² "ACORN Hamilton calls on the city to tackle the digital divide." ACORN Canada, April 6, 2022. <https://acorncanada.org/news/acorn-hamilton-calls-city-tackle-digital-divide/>

³ "Internet for all: Ending the digital divide in Hamilton," ACORN Canada, last modified April 6, 2022, https://acorncanada.org/wp-content/uploads/2022/04/Internet-for-All-Hamilton_0.pdf.

⁴ N. Abdelaal, S. Andrey, *Overcoming Digital Divides Series: What We Heard*. (January, 2022): 13. <https://www.ryersonleadlab.com/overcoming-digital-divides>

electronic fare system that allows transit users to pay for their journey quickly, easily, and securely.”⁵ The easiest way to manage a user’s Presto card is through the app that requires the user to own a smartphone. The most seamless way to use public transit is by using digital technology.

In our increasingly digital society, education is also transforming into a technologically dependent industry. For those who live in marginalized neighbourhoods and are part of lower income households, access to the necessary technology at school or in the home is often limited. This leads to a decrease in the quality of education and learned skills regarding information technology which is essential to the increasing majority of job openings in this new age. Bodong Chen writes, “Given ICT is increasingly mediating social and cultural participation in the information age, such a digital divide could potentially leave many people behind. Yet, this divide is reportedly growing wider, reinforcing existing economic inequalities and transferring to other areas including skills of effectively using ICT.”⁶ The problem with technology is that it remains unaffordable for large demographics of Hamiltonian students who are falling further behind in their education. The pandemic also saw many changes to the means of education itself in North America, and Hamilton was no exception. To contain the virus, governments decided to close educational institutions, and as a result, students were forced to learn online. We saw this in our very own universities, as students who did not use digital technology were then forced to do so if they were to continue their studies. Yet for those who could not afford the necessary technology, the digital divide only further distanced them from their peers. It was more difficult for low-income families to homeschool children as they often were left with

⁵ John-Paul Danko, “The HSR has ended paper ticket sales and passes as of October 31,” November 1, 2020, <https://ward8hamilton.ca/the-hsr-has-ended-paper-ticket-sales-and-passes-as-of-october-31/>.

⁶ Chen Bodong, “Exploring the Digital Divide: The Use of Digital Technologies in Ontario Public Schools,” *Canadian Journal of Learning and Technology* 41, vol. 3 (October 2015): 2. <https://cjltd.ca/index.php/cjlt/article/view/26970/19878>.

fewer options in public schools to support remote learning. Jean-Louis Denis et. al. write, “...the costs of taking care of children who are not in school are not shared equally across social classes. Private schools were better equipped to quickly set up home schooling systems for children at home.”⁷ The unaffordability of digital technology caused major setbacks for children in public schools with less funding. The discussion of digital equity thus applies especially to families who faced these challenges.

As most cities move toward what seems to be a post-pandemic society, many of the technological developments we saw take root across the globe are here to stay. Hamilton is no exception to this because workplaces across the city are beginning to require access to digital devices that enable employees to work from home. New employment opportunities are being found exclusively online and this type of employment continues to grow after its massive spurt during the pandemic. One example of this is Startek, a company that is vacating Hamilton now that its employees are all working remotely in their homes. Michael Pitman writes in a news article for Journal-News, “The company specifically advertised for remote workers that lived within an hour from Hamilton back in January. Startek has remote jobs it’s currently seeking to fill, according to its online careers site.”⁸ When companies shift towards an exclusively remote workplace, this effectively eliminates all potential employees who lack the resources necessary to connect to the online workplace. The digital divide only widens when opportunities such as these are taken away from those in low-income demographics. This is why digital equity is important and solutions must be found for those who are at a disadvantage regarding the online world. Statistics Canada recently did a survey that showed that high-income families were more

⁷ Clara Champagne et. al., *Pandemic Societies*. (Montreal: McGill-Queen’s University Press, 2021).

<https://search-ebshost-com.redeemer.idm.oclc.org/login.aspx?direct=true&db=nlebk&AN=3030933&site=eds-live>, 72-73.

⁸ Michael D. Pitman, “Startek appears to vacate Hamilton location as employees work remotely,” Journal-News, April 27, 2022, <https://www.journal-news.com/news/startek-vacates-downtown-hamilton-location-as-most-employees-work-remotely/Y2SOR2IYNBKFHFFYDMMIWLJK3Q/>

likely to work from home. “From April 2020 to June 2021, 45% of dual-earner salaried couples in the top 10% of the earnings distribution had both spouses working from home. This was nine times the rate of 5% observed for their counterparts in the bottom 10% of the earnings distribution.”⁹ High-income families are more likely to work from home because they have the resources to afford the necessary technologies as well as the skills needed to use them. A lacking effort to establish digital equity in the city of Hamilton means that jobs accessible to low-income families will continue to diminish in our post-pandemic society.

3. Research Methods

Regarding our research methods, we started by forming a driving question for our project and we did this by considering the BNA’s goals for the Beasley Neighbourhood as well as the eligibility criteria of the CEF digital stream grant. Then we began to research what other cities have done for digital equity and identified what showed plausible results. With this initial research, we began to form suggestions that the BNA could implement with the help of our team champions, Juliana Weber, a CityLAB Project Coordinator, and Kelly Austen, a Senior Project Manager of Digital Innovation. We gleaned from other cities for inspiration to provide reasonable options for digital equity and ensured the suggestions would keep the BNA eligible for the CEF grant. After this, we performed our research on databases like Ebscohost and Google Scholar. To keep our research relevant, we used these key terms: Beasley Neighbourhood Association, Digital equity programs, City Enrichment Fund, MESH programs, city hotspots, and Starlink receivers.

⁹ “Working from home during the COVID-19 pandemic, April 2020 to June 2021,” Statistics Canada, last modified August 4, 2021, <https://www150.statcan.gc.ca/n1/daily-quotidien/210804/dq210804b-eng.htm>.

4. Results

4.1 Other Cities

The following section provides the results found from many different organization websites across Canada and the US. The information is provided in **Table 1** and the data is organized into six sections: the initiative, location, organization, infrastructure and maintenance, good feedback, and concerns. This information allowed for a better analysis of the best programs that could be beneficial for the city of Hamilton.

Table 1: Layout of Initiatives for Digital Equity Done in the US and Canada

Initiative	Location	Organization	Infrastructure and Maintenance	Good Feedback	Concerns
BCWireless¹⁰	Vancouver, British Columbia, Canada	ABC Communications	<ul style="list-style-type: none"> - Goal is to build digital communities at the local level - Focus on developing and deepening mesh networks, especially for rural locations¹¹ - They coordinate with other community members to set up mesh access points - Work on opening hotspots 	<ul style="list-style-type: none"> - Can offer 50 Mbps of wireless internet packages in 14 locations, two of them are rural. - Overall good informal reviews - Urban wireless offered 	<ul style="list-style-type: none"> - Heavy focus on providing for rural communities instead of large cities
Chebucto Wireless¹²	Halifax, Nova Scotia, Canada	Chebucto Community Net	<ul style="list-style-type: none"> - Non-profit organization that provides internet access to low income individuals by a wireless project in housing manors - Provides dial-up services to rural members - Provides web hosting services for free or at a low cost for non-profit organizations and local small businesses 	<ul style="list-style-type: none"> - Organization has a Twitter account for easy communication with the community members about service and outages 	<ul style="list-style-type: none"> - Relatively frequent outages - Smaller city so the efficiency it would have in a bigger city is unknown

¹⁰ “Your local BC Internet Provider”, ABC Communications, last modified 2022, <https://www.abccommunications.com/>.

¹¹ Allison Powell and Leslie Regan Shade, “Going Wi-Fi in Canada: Municipal, and Community Initiatives,” *CRACIN Working Paper*, no. 6 (June 2005): 7.

¹² “Chebucto Community Net,” Chebucto Community Net, last modified November 28, 2022, <http://www.chebucto.ns.ca/>.

Digital Canopy ¹³	Toronto, Ontario, Canada	Partnership of Cisco Canada and the City of Toronto	<ul style="list-style-type: none"> - Investment of more than one million dollars to expand WiFi to Toronto's most vulnerable communities - Hope to set up free internet hotspots in 25 places that allows 6,600 units and 13,000 residents to have WiFi - Cisco's Country Digital Acceleration Program has active initiatives in 36 countries across the world 	<ul style="list-style-type: none"> - Gave free internet access to two buildings in Toronto with 2,000 low income residents - More reliable financial source 	<ul style="list-style-type: none"> - Takes some time to put the hotspots into place - Only one area at a time, requires the need to narrow down the places in highest need
Fred-eZone ¹⁴	Fredericton, New Brunswick, Canada	e-Novations	<ul style="list-style-type: none"> - One of the most successful municipal Wi-Fi endeavors - Coverages all across the downtown business district, municipal parks, local arenas, business hotels, Kings Place Mall, and the Fredericton Mall¹⁵ - Municipal fibre-optic community network - Variety of high powered signals fixed to antennas bridges and other structures¹⁵ 	<ul style="list-style-type: none"> - Part of taxpayer supported municipal infrastructure 	<ul style="list-style-type: none"> - Not self-healing, if one access point fails, connection would not reroute to another access point - Does not extend to every neighbourhood in the city - Residents who want web space, email, etc. must partner with local businesses in which there is a required cost.
Îls Sans Fil Hotspots ¹⁶	Montreal, Quebec, Canada	Îls Sans Fil	<ul style="list-style-type: none"> - Over 50 wireless hotspots and over 6,000 people with accounts - Volunteer-run initiative - Allows for local community content and new media art to reach new audiences - They believe that internet is a public 	<ul style="list-style-type: none"> - Has a large amount of hotspots present all over the city - Makes people feel more like a community - Contributes to the local culture and aids the 	<ul style="list-style-type: none"> - Only provides free internet to public places - Map of hotspots are on the website, not helpful for those who do not initially have Wi-Fi

¹³ Briar Wells, "Cisco and the City of Toronto launch 'Digital Canopy' to expand internet access for underserved communities," Cisco: The Newsroom, September 9, 2020, <https://newsroom.cisco.com/c/r/newsroom/en/us/a/y2020/m09/cisco-and-the-city-of-toronto-launch-digital-canopy-to-expand-internet-access-for-underserved-communities.html#:~:text=Cisco's%20Toronto%20Innovation%20Labs%20team,of%20Toronto's%20most%20vulnerable%20communities.>

¹⁴ "About," goFred, last modified 2022, <http://www.gofred.ca/about/>.

¹⁵ Powell and Shade, "Going Wi-Fi in Canada," 4-5.

¹⁶ "FAQ-English," Il Sans Fil, last modified 2011, <http://portail.ilesansfil.org/faq-english/>.

			<p>technology, so the focus is to deploy free hotspots in public spaces</p> <ul style="list-style-type: none"> - Have a second goal, to create a community and bring “Montreals to one another”¹⁷ - A software that has unique content at each hotspot 	<p>lives and work of artists, activists, etc.</p>	<ul style="list-style-type: none"> - Limit use to 10GB per access point and 20GB on the network every 7 days
MetaMesh ¹⁸	Pittsburgh, Pennsylvania USA	Community Internet Solutions	<ul style="list-style-type: none"> - One of the first US nonprofit wireless internet service providers - Their statement: “help bridge the digital gap in a permanent and meaningful way” - Repairs computers for beer money - Collaborate with local organizations who work with communities that have no access to internet 	<ul style="list-style-type: none"> - Good informal reviews - Bringing internet to areas where there is none, providing more job opportunities for the people in those neighbourhoods 	<ul style="list-style-type: none"> - Some issues exposed through COVID-19 for those who needed to work from home, so they needed to begin a new program, Every1Online - Slow process of adding nodes to other areas overtime
Redhook Wi-Fi ¹⁹	Brooklyn, New York, USA	Red Hook Initiative	<ul style="list-style-type: none"> - Community-led - Provides free and reliable Wi-Fi through a mesh network - Argues for internet as a human right - Supported by solar energy backup system - The mesh network is “self healing” - Maintenance done by local residents - Currently 17 live sites - 22 pending or future internet sites 	<ul style="list-style-type: none"> - Resilient - Survived and proved vital during Hurricane Sandy - Became the backbone of communication in Brooklyn 	<ul style="list-style-type: none"> - Needs to be fixed by people frequently, high maintenance - Costs and time taken to train young adults to maintain the network
Starlink in Pikangikum First Nation ²⁰	Kenora, Ontario, Canada	FSET	<ul style="list-style-type: none"> - FSET is a major consulting firm - Pikangikum First Nation is an indigenous community that needed 	<ul style="list-style-type: none"> - Quick fix: deployed received kits to Indigenous community 	<ul style="list-style-type: none"> - Community members needed to be taught how to install the receivers

¹⁷ Powell and Shade, “Going Wi-Fi in Canada,” 8.

¹⁸ “About Meta Mesh,” Community Internet Solutions/MetaMesh Wireless Communities, accessed November 30, 2022, <https://www.metamash.org/about>.

¹⁹ “Mission: Resilience, Opportunity, Community and Social Justice,” Red Hook WiFi, last modified 2022, <https://redhookwifi.org/about/mission/>.

²⁰ Katie Rose Quandt, “Delivering Digital Equity,” last modified August 11, 2022, <https://mendoza.nd.edu/news/delivering-digital-equity/>.

			<p>an internet connection that would provide the capability to support local organizations and businesses, as well as online school and the accessibility of health care</p> <ul style="list-style-type: none"> - FSET got into contact with Starlink by Elon Musk and implemented satellites in the community - FSET technicians installed the kits 	<p>“within weeks”</p> <ul style="list-style-type: none"> - Had internet speed as high as 130 Mbps when it was 60 Kbps before - The community was able to access services during COVID-19 such as health care - Connected 2,600 homes to Starlink receivers and more than 350 businesses along the North 	<ul style="list-style-type: none"> - More commonly used in rural areas where the skies are clearer, may not be as efficient in cities
Toronto MESH²¹	Toronto, Ontario, Canada	Civic Tech Toronto	<ul style="list-style-type: none"> - Group of volunteers begun in early 2016 - MESH network in process, not many in the city yet - Plans to build community-owned infrastructure by using off-the-shelf hardware and open-source technology - Make a network with open source and peer-to-peer technologies 	<ul style="list-style-type: none"> - Peer-to-peer communication instead of centralized systems allows for better control of personal data - open, lower-cost - Resilient and redundant - More private and can freely access information 	<ul style="list-style-type: none"> - Toronto is a large city to cover, will take many years to make a significant difference - Reliant on fundraisers and donations for funding
WiFi Map App²²	Available in 200+ countries	WiFi Map	<ul style="list-style-type: none"> - Main goal: Provide free internet access to people worldwide - An application on a phone that shows a map with all the locations to connect with free Wi-Fi - Has around 100 million free hotspots network and 1 billion connections - Over 100 million users 	<ul style="list-style-type: none"> - Available worldwide - Completely free, good for low income individuals - Secure connections - Very good reviews from news reports and the app store 	<ul style="list-style-type: none"> - Does not provide Wi-Fi, just shows where the best connections could be found - Must have a mobile phone to use
Wireless	Toronto,	Wireless	- Not-for-profit	- Powered by	- Expensive to

²¹ “Toronto Mesh,” Toronto Mesh, last modified 2021, <https://tomes.net/>.

²² “#1 WiFi Finder,” WiFi Map, last modified 2021, <https://www.wifimap.io/>.

Toronto Hotspots ²³	Ontario, Canada	Toronto	community group that works on bringing no-fee wireless internet to public areas in Toronto - New hotspot in Dawes Crossing has all the equipment powered by solar panels and a wind turbine, has air conditioning, USB outlets, LED lighting, seating and shelter. - Provide a map of the hotspots	clean energy, environmentally friendly - Provides comfortable seating for computer work - Cover extreme weather concerns of Canada for the hot summers and cold winters - Has a blog to allow communication of when a hotspot goes offline	build and set up - Reliant on donations for funding - Not secure connections, required to use encrypted methods especially for passwords, such as email accounts or other logins
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4.2 Alternatives

4.2.1 Starlink Receivers

One of the fastest solutions to the lack of internet connectivity would be the use of Starlink receivers. These receivers are a satellite connected to a power supply and router provided by an organization called SpaceX. With a clear view of the sky, users can connect to low-latency wireless internet through low-orbit satellites.²⁴ The needed technologies are shipped to the user including the Starlink dish, Wi-Fi router, necessary cables, and the base, all of which can be set up quickly with little to no assistance. Although the service does not become available to the Hamilton area until 2023,²⁵ this does not set the BNA back as the grant application for the CEF will be happening in roughly the same time frame.

²³ “What is Wireless Toronto?” Wireless Toronto, accessed November 2, 2022, <http://wirelesstoronto.ca/index.php>.

²⁴ “World’s Most Advanced Broadband Satellite Internet,” Starlink, accessed November 24, 2022, <https://www.starlink.com/technology>

²⁵ “Order Starlink,” Starlink, accessed November 24, 2022, <https://www.starlink.com/>

4.2.1.1 Benefits and risks

Starlink receivers would bring an ultra-fast Wi-Fi connection to various residents of the Beasley Neighbourhood without having to install new and expensive infrastructure such as the fiber-internet cable. These low-orbit satellites provide both more reliability due to their number and a faster connection as signals travel at the speed of light, 50% faster than traveling through fiber optic cables.²⁶ Users can connect to low-latency wireless internet via low-orbit satellites with simple technologies that are accessible and easy to use.²⁷ Service can be regularly interrupted during storms because of the extra barrier, but while fiber optic cables may need repairing after heavy storms, Starlink receivers only need to wait for the sky to clear up. But this means they may be difficult to install in a heavily populated area with limited clear access to the sky. Though the installation of the service is not provided by Starlink, it is a simple process and does not require special technology-related skills.

4.2.1.2 Costs

The main issue with this recommendation would be the cost, as Starlink is priced at \$759 per unit before tax.²⁸ Although funding from the grant may help to cover the initial hardware costs, the internet subscription fee (\$140 per month before tax)²⁹ would not be covered and would need to be funded through other sources. This means that this recommended solution would only be a temporary fix for those who are in urgent need of the internet in the neighbourhood, as the costs do not make it an effective long-term solution. However, the cost for

²⁶ Tom Watts, "Starlink: Good or Bad?," *Armagh*, December 5, 2019, <https://armaghplanet.com/starlink-good-or-bad.html>

²⁷ "Pros and Cons of Starlink Internet," *ProVsCons*, Copyright 2019-2022, <https://provcons.com/pros-and-cons-of-starlink-internet/>

²⁸ Starlink, "Order Starlink."

²⁹ Starlink, "Order Starlink."

Starlink is justified given the service it provides, as many rural users claim that they are achieving record internet speeds in locations where it had never before been possible.³⁰

4.2.2 Mesh Networks

We also recommend using mesh networks that use point-to-point access technology to bring internet connectivity to various locations around the neighbourhood. Point-to-point access technologies are a very simple way to deliver wireless internet to those who live within visible distance of an access point. Two of these dishes would be facing each other (one sending an internet signal, one receiving it), or one dish would receive a signal facing a wireless internet service provider. The receiving dish would send the signal to a router which outputs a wireless internet connection.³¹ For optimal use, there must be little to no obstruction between the access point and the receiver, meaning that the access point may need to be in a very specific location, typically elevated on a pole or tower of some sort.³²

4.2.2.1 Benefits and Risks

For those who lack infrastructure or cannot afford their own wireless internet, mesh networks are a perfect solution that enables the user to use some of the bandwidth available from places that have it in surplus. They are an effective way to eliminate ‘dead spots’ as the range can be extended to longer distances and improve connection with a strong signal.³³ However, for optimal use, there must be little to no obstruction between the access point and the receiver, meaning that the access point may need to be in a very specific location, typically elevated on a

³⁰ Paul Webster, “‘Crazy good’: Rural Canadians are raving over Elon Musk’s Starlink satellite-based internet service. Should Canada’s big telcos be worried?” *Toronto Star*, January 8, 2022, https://www.thestar.com/business/2022/01/08/crazy-good-rural-canadians-are-raving-over-elon-musks-starlink-satellite-based-internet-service-should-canadas-big-telcos-be-worried.html?rf&fbclid=IwAR2Uk4-7DKgZg-iXir8j_x5z40ph_IK-yOk21gTgTc-bQIwCXivke0sb9Q

³¹ “Tenda 08 CPE Point to Point Long Range Outdoor WIFI 23dbi,” SignalBoosters, accessed November 24, 2022, <https://www.signalboosters.com/tenda-08-cpe-point-to-point-long-range-outdoor-wifi-23dbi/>.

³² “Tenda 08 CPE Point to Point Long Range Outdoor WIFI 23dbi.”

³³ Dr. Chris Pierson, “Mesh Networks: Benefits and Impact on Cybersecurity,” *BlackCloak*, <https://blackcloak.io/mesh-networks-benefits-and-impact-on-security/>

pole or tower of some sort.³⁴ This network is able to handle larger amounts of data because of the multiple devices that work together and contribute to data transmission.³⁵ Many devices can connect without requiring new routers although performance speed can be decreased with each new ‘hop’ created by the nodes.³⁶ Having multiple mesh nodes working together increases stability as data can continue to be transmitted even with the failure of one node.³⁷ It is a more complex system as each node acts as a router as well as transmitting data which gives more opportunity for failures. This extensive range of equipment can become increasingly complex to manage with all the interconnectivity as new nodes are added. The time needed to build the mesh network from start to finish can be time-consuming but it is made simpler to install and maintain by an app that controls it.³⁸

4.2.2.2 Costs

The technology is very cheap to purchase at about \$109 per point before tax.³⁹ The amount of this product needed to be purchased would largely vary depending on how it is used. If it is used by sending a signal between two points to form a mesh network, then it will require two points which would cost \$218 per mesh network connection before tax. If it is pointed towards a wireless internet service provider, it will only require one point. For mesh networks, an organization could start with two per link, and possibly have three. In time, however, an organization can add more as needed to increase connectivity.

³⁴ “Tenda 08 CPE Point to Point Long Range Outdoor WIFI 23dbi.”

³⁵ Louise Gaille, “18 Advantages and Disadvantages of a Mesh Topology Network,” *Vittana*, January 29, 2020, <https://vittana.org/18-advantages-and-disadvantages-of-a-mesh-topology-network>

³⁶ Sam Bocetta, “Why Mesh Networks Are the Future of Free Internet Access,” *FeeStories*, October 9, 2018, <https://fee.org/articles/why-mesh-networks-are-the-future-of-free-internet-access/>

³⁷ Louise Gaille, “18 Advantages and Disadvantages of a Mesh Topology Network”

³⁸ Dr. Christ Pierson, “Mesh Networks: Benefits and Impact on Cybersecurity”

³⁹ “Tenda 08 CPE Point to Point Long Range Outdoor WIFI 23dbi.”

4.2.3 Hotspots

A hotspot is an internet router that wirelessly provides Wi-Fi for individuals in close proximity to the router.⁴⁰ Hotspot technologies are the best way to open an internet access point to the public. The hotspot we recommend provides a range of up to 1000 feet, while also being able to tap into the existing infrastructure.⁴¹ It has a 120-degree coverage, so three of these would need to be installed for a full 360-degree signal (which would then provide service to an area 2000 feet in total diameter). Regardless of how the internet is delivered to a specific location, these hotspots would be able to push out fast internet connectivity anywhere in the Beasley Neighbourhood.

4.2.3.1 Benefits and Risks

Hotspots provide an opportunity to give access to the internet anywhere without relying on coffee shops or business hours.⁴² Several people can access the Wi-Fi simultaneously in the same area. In general, however, hotspots have slower internet speeds affecting usage such as downloading information and data usage could especially be limited as the number of users increase. The hardware associated can be more complicated to set up especially as it has to be in sight of a WISP station or another access point. Additionally, security threats such as “man in the middle” cyberattacks or eavesdropping, especially when considering the community members of the Beasley Neighborhood, pose a risk. Since a hotspot would require it to be an unsecured network for public use, this opens the door to the exploitation of security and the interception of data, especially that of login credentials and credit card numbers.⁴³ To help mitigate this, the

⁴⁰ Powell and Shade, “Going Wi-Fi in Canada,” 3-4.

⁴¹ “2.4GHz, 2x2 MIMO, 120 Degree Sectorized Antenna, Los Wireless Hotspot Setup (AP Not Included) - 1000FT. Range,” GNS Wireless, accessed November 24, 2022, <https://www.gnswireless.com/2-4ghz-2x2-mimo-120-degree-sectorized-antenna-l>.

⁴² Volcano Communications Group, “The Advantages & Disadvantages of Mobile Wi-Fi Hotspots,” *Connect2Local*, December 17, 2018, <https://connect2local.com/l/102823/c/572937/the-advantages---disadvantages-of-mobile-wi-fi-hotspots>

⁴³ “Protecting your organization while using Wi-Fi,” Cyber Security Guidance, Government of Canada, last modified October 19, 2020, <https://www.cyber.gc.ca/en/guidance/protecting-your-organization-while-using-wi-fi-itsap80009>.

BNA could institute as part of their program, an internet safety educational module or graphic. This would serve to educate the public users of their free Wi-Fi about how to avoid cyberattacks on their own devices. It would include information about the latest cyber threats, as well as online habits that result in safer usage.⁴⁴

4.2.3.2 Costs

These hotspots cost \$459 per unit.⁴⁵ Three of them will be needed for each hotspot for a full 360-degree coverage of a given area, so the final cost for this hotspot recommendation would be \$1407 before tax.

4.3 Barriers

The barriers to implementing these alternatives consist of potential cybersecurity threats, such as the hotspot threat mentioned earlier, and potential legal ramifications. The Government of Canada has an initiative for cybersecurity to ensure people using public Wi-Fi protect their privacy as it is an unsecured public network. These are mostly safeguarding that the individual user of the network has to do.⁴⁶ Although the organization sources this public network, the Government of Canada provides ways to ensure organizations like the BNA can keep this Wi-Fi network secure. Regardless of which network is chosen for the program, there are protection threats that need to be mitigated. One threat is that of spoofing where a threat actor—a name to describe someone who can impact an internet network⁴⁷—makes a fraudulent Wi-Fi network that mimics your own; this causes people to be tricked into using this fake network instead of the BNA’s safe one.⁴⁸ To mitigate this, the BNA could make it known to the community what their

⁴⁴ Robert Izquierdo, “5 Ways to Prevent a Man-in-the-Middle Cyberattack,” last modified August 5, 2022, <https://www.fool.com/the-ascent/small-business/endpoint-security/articles/mitm/>

⁴⁵ “2.4GHz, 2x2 MIMO, 120 Degree Sectorized Antenna, Los Wireless Hotspot Setup (AP Not Included) - 1000FT. Range.”

⁴⁶ “Public Wi-Fi,” Get Cyber Safe, Government of Canada, last modified October 27, 2021, <https://www.getcybersafe.gc.ca/en/secure-your-connections/public-wi-fi>.

⁴⁷ “What is a Threat Actor and Why Should You Care?” Security News, Sophos Home, last modified March 26, 2021, <https://home.sophos.com/en-us/security-news/2021/what-is-a-threat-actor>.

⁴⁸ “Protecting your organization while using Wi-Fi.”

connection name is and IP address. That way even if a fraudulent network is available with a similar network name, the user can check the IP address to ensure it is the BNA's provided network.⁴⁹

Our team also conducted extensive research on any legal ramifications that the BNA may have to work through. From a regulatory perspective, we could not find any legal restrictions for the BNA providing Wi-Fi coverage since the Wi-Fi would be a free offering. An issue would arise if the BNA started charging for their service, but for now, this issue is not one to be dealt with. In our conversations with the Director from the City of Hamilton, we discovered that an area to be proactive on is for the BNA to carefully examine the service agreements with its providers for Wi-Fi. Often providers of the connection do not have an issue with how an individual or organization may choose to use the service. However, the BNA should read the service agreement thoroughly to ensure there are no clauses that limit the use of the services.

5. Discussion & Next Steps

5.1 Grant Eligibility

An essential aspect of project eligibility is aligning goals and objectives with the City of Hamilton itself. Hamilton created the CEF to grant community organizations and support groups a means to enrich their local communities.⁵⁰ The BNA as an organization has a similar goal in regards to the community with a focus directly on the Beasley Neighbourhood, to engage with residents in promoting health and wellbeing, safety, anti-racism and inclusion, and parks and recreation.⁵¹ Given this framework, our project meets these shared objectives by implementing a

⁴⁹ "Public Wifi Security," Kaspersky, accessed November 7, 2022, <https://www.kaspersky.com/resource-center/preemptive-safety/public-wifi>.

⁵⁰ "City Enrichment Fund." *City Enrichment Fund* | *City of Hamilton*, <https://www.hamilton.ca/people-programs/community-funding-grant-programs/city-enrichment-fund>.

⁵¹ "Our BNA | Plan." *Our BNA*, <https://www.ourbna.com/plan>.

Wi-Fi infrastructure project that promotes equal opportunity, targeting the underrepresented area of Beasley, and improves the holistic health of the neighbourhood.

As we continued to develop our project we had to consistently refer to the application of the CEF, or more specifically the digital equity portion. Eligibility requirements include implementing the project within city borders, being associated with a reputable non-profit organization, and must target a direct need with a genuine desire to help.⁵² One of the more challenging qualifications to meet is to have this project 70% funded before funding can be released.⁵³ This proves difficult for an already resource-stretched organization like the BNA, but there are a variety of funding opportunities available for underrepresented communities. The federal government provides funding for communities in need through a community support program that can offer over \$250,000 to individual projects.⁵⁴ The provincial government provides funding through the Ontario Trillium Foundation Seed Grant. The Seed Grant supports the research, development, and testing of new ideas and different approaches to enriching communities, which can award qualifying projects between \$5,000 and \$75,000 per year.⁵⁵ Another funding opportunity can be found with the Hamilton Community Foundation, which offers grants to charitable organizations and initiatives with open call funds and grants.⁵⁶ All of these alternative funding opportunities are similar to the CEF in that a thorough application must be completed before a deadline. Audited financial statements and extensively researched project information must also be submitted in order to qualify. A limiting factor is that aspects of the application itself also require the input of internal members of the BNA, and as such we are not

⁵² “City Enrichment Fund Digital Program - Hamilton.ca.”

⁵³ “City Enrichment Fund Digital Program - Hamilton.ca.”

⁵⁴ Heritage, Canadian. “Government of Canada.” *Projects – Community Support, Multiculturalism, and Anti-Racism Initiatives Program - Canada.ca*, / Gouvernement Du Canada, 13 Jan. 2021, <https://www.canada.ca/en/canadian-heritage/services/funding/community-multiculturalism-anti-racism/projects.html>.

⁵⁵ “Seed Grant.” *Ontario Trillium Foundation*, <https://www.otf.ca/our-grants/community-investments-grants/seed-grant>.

⁵⁶ “Grants and Student Awards - Hamilton Community Foundation .” *Hamilton Community Foundation*, 20 Oct. 2022, <https://www.hamiltoncommunityfoundation.ca/grants/>.

equipped with the information necessary to fully implement this project ourselves. When going through the steps of making this project a reality, the BNA can be reassured that other funding opportunities exist to help the residents of Beasley Neighbourhood. One way is through fundraising to larger donors and having options such as pledged giving. Pledged giving is when a donor ‘pledges’ to give a certain amount of money over a specific period of time. Oftentimes this is used for larger donations. There is a risk of the donor not being able to hold up to their pledge, but this is rare.

5.2 Discussion and Connection

Throughout this project, we placed a heavy emphasis on clear communication as a group and frequent interaction with our given connections. We were fortunate to be in direct contact with CityLAB representatives who met with us on a weekly basis. They were able to answer the many questions we had about the community, put us in contact with individuals who could answer further questions in depth, and help us understand the practical logistics needed. Unfortunately, about halfway through the school term, we were informed that the original plan of working directly with the BNA was no longer feasible. In response to this challenging circumstance, our group decided to create our own project from the ground up, with the intent of providing the BNA with the beginnings of a project that could help Beasley residents meet their needs. From our research, we became aware of how important it is for digital access opportunities in underrepresented communities and wanted to help the Beasley Neighborhood in any way we could.

Ongoing discussions are needed to better understand how to help the Beasley Neighbourhood. From our research, we believe this project to be specifically important to Beasley because despite being in a central city location, it is underrepresented in comparison to

other neighbourhoods. This is because they are made up of a very vulnerable population with more than 40% of families headed by lone parents, 40% of residents identifying with a visible minority group, 14% newcomer immigrants compared to 3% for the city as a whole, and poverty rates three times higher than the average for the city.⁵⁷ We are aware that providing accessible Wi-Fi will not entirely solve the challenges Beasley residents face, but can provide more opportunities for them and their families to alleviate personal struggles.

5.3 Implications of the Research

All of these recommended technologies would be ideal for students to get involved in STEM projects. For example, our project team was informed about the McMaster Climate Program. With this project in mind, these technologies would enable the expansion of Wi-Fi to places where students would be able to activate their climate sensors, which would then enable them to send data straight to the Beasley website. The BNA could also launch another student STEM program in which the students help them to deploy these signal boosters around the Beasley Neighbourhood for houses that want to wirelessly tap into the bandwidth of some larger business or organization that is willing to share with them, such as a church or local business that wants to contribute towards digital equity.

5.4 Limitations of the Research

The key limitation of our research is that throughout the development of our project we lacked critical documentation. The main requirements of the application for the digital equity fund require financial statements, employee information, and proof of being a valid non-profit

⁵⁷ Mayo, Sara, et al. "Neighbourhood Profiles Report." *Neighbourhood Profiles: BEASLEY, CROWN POINT, JAMESVILLE, KEITH, LANDSDALE, MCQUESTEN, QUIGLEY ROAD, RIVERDALE, ROLSTON, SOUTH SHERMAN AND STINSON.*, Mar. 2012, https://capc.hamilton.on.ca/wp-content/uploads/2021/05/2012-Report-Neighbourhood_Profiles_March.pdf

organization.⁵⁸ In light of this, we believe we have provided as much information as we are able without the direct contribution of the BNA.

Furthermore, none of our group members have expertise in the technology industry or implementing wide-scale Wi-Fi infrastructure projects, nor do any of us live in or around the Beasley Neighbourhood to have firsthand experience of the pressing needs of residents.

5.5 Further Research to be done for the BNA

Since the CEF only funds up to 30% of a given digital equity project, the BNA would need to source the rest of its funding elsewhere, which would require further research into other potential funding opportunities. The BNA can also work on providing student-friendly projects to bridge the digital divide in Beasley, as well as starting device recycling programs for increased accessibility to digital hardware in the neighbourhood.

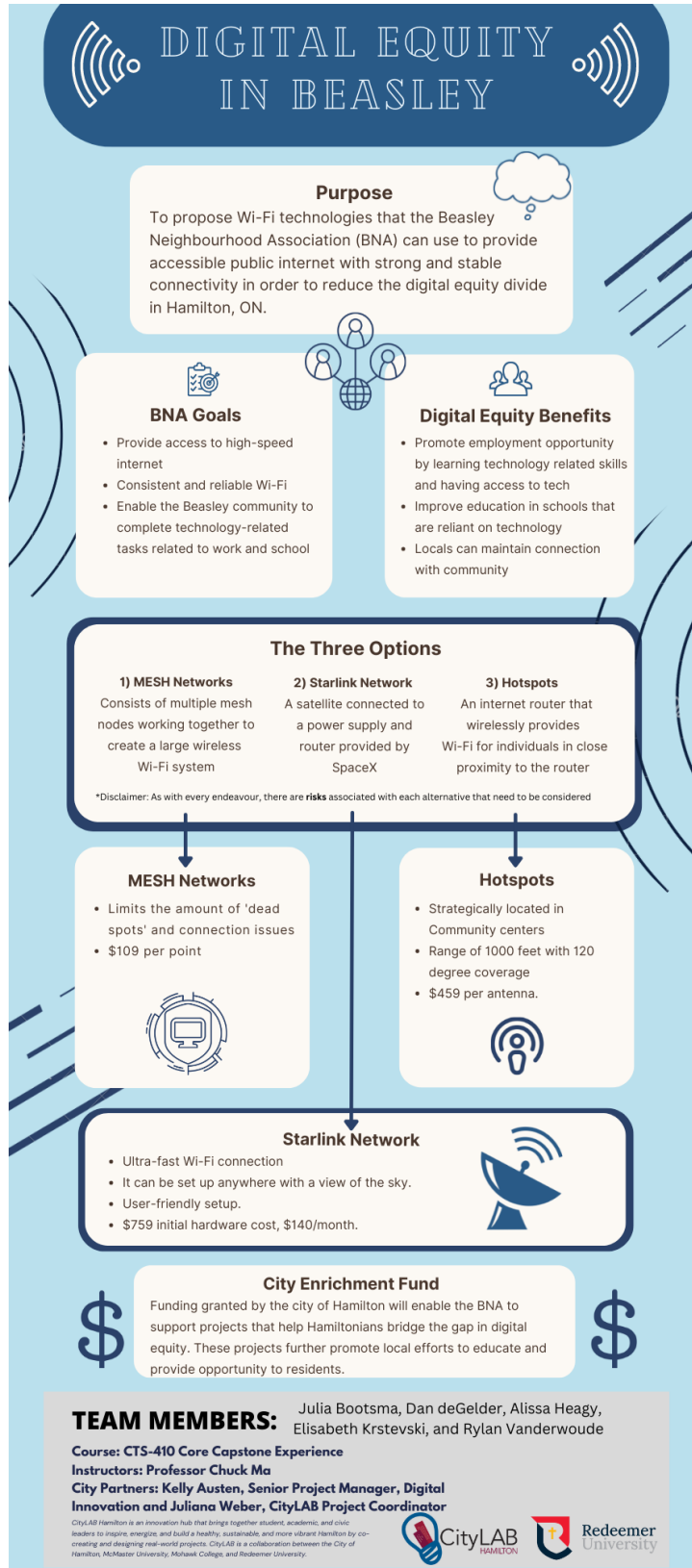
6. Conclusion

Ultimately, the recommendations provided in this project are concepts that the BNA can implement in the neighbourhood in ways that are tailored to the needs of its residents. The BNA is able to use the technologies to the extent that the organization sees fit, as we do not have insights into the specific needs of this intricate community. However, we believe that if the BNA implements one or some of these alternatives, long-term benefits can result in the flourishing of the Beasley Neighborhood and the bridging of the digital equity divide.

⁵⁸ “City Enrichment Fund Digital Program - Hamilton.ca.”

Appendix

Digital Equity Infographic



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