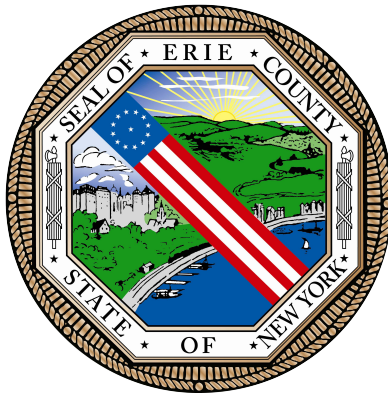


Erie County Broadband Feasibility Study Final Report



March 31, 2017

Prepared by:



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Appendix A – Glossary of Terms

Appendix B – ECIDA Focus Site Maps (under separate cover)

I Commission of the Study

In April of 2016 the Erie County Planning Department contracted with ECC Technologies, Inc. (ECC) to perform a Broadband Feasibility Study in Erie County. The purpose of the study was to provide analysis and guidance for the planning and development of broadband improvement strategies. The study methodology was to gather and document broadband infrastructure and services information and to provide analysis and initiatives for moving forward, which will be used to support economic development and County broadband planning. The Study has five tasks, each with a report.

1. Broadband Infrastructure Overview
2. New York State Broadband Program
3. Public Private Partnership Roles
4. Gap and Market Analysis with Preliminary Recommendations
5. Final Comprehensive Report

This task 5 report is the final comprehensive report and includes summary information for each of the other four study tasks. The information compiled by ECC Technologies is presented in the following pages of this report. Much of this information has also been placed into an interactive electronic geographic information system (GIS) database. This database tool consists of interactive mapping elements that can be used to identify and locate the major telecommunications resources within the area for economic development and County planning purposes. ***The broadband GIS maps and database contain critical infrastructure, and therefore as a matter of security, this report information shall not be made publicly available without the express written consent of the County.***

Special recognition goes out to County Executive Mark Poloncarz and Legislator Patrick Burke for their efforts to secure funding for this study and their commitment to improving broadband access to everyone in the Erie County communities. The County Broadband Committee has provided direction, review and support for the study. Its members include:

- Ken Swanekamp, Environment & Planning, Dir. Business Assistance
- Mark Rountree, Environment & Planning, Sr. Planner
- Dale Morris, Environment & Planning, Dir. GIS Services
- Mariely Ortiz, Environment & Planning, Planner
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II Executive Summary

Broadband infrastructure, the wire line fiber optic, coaxial and telephone cabling, and wireless radio frequencies that deliver the Internet, as well as telephone, television and many other telecommunications and network services, is an increasingly essential utility for our homes, businesses, and communities. In order for our communities to be competitive in attracting and retaining both employers and a talented workforce, we need this critical infrastructure to communicate within our communities and to the world at large.

Our need for broadband bandwidth (speed and capacity) has been expanding and will continue to expand dynamically for the foreseeable future. The Internet of Things (IoT) is the uniform and ubiquitous presence and integration of technology into all facets of our lives. The appliances in our homes, equipment and systems in our business and industries, the content in all types of media and communication devices will require continuous access to the Internet. The IoT will increase our need for broadband infrastructure many times over today's capacity. Meeting the bandwidth requirements is going to require wider deployment of fiber optic cabling throughout our communities as well as integrating with current and emerging wireless technologies.

This study is the initial step for Erie County to better understand its current broadband infrastructure and services, and begin to identify options and formulate plans to develop the infrastructure that our communities will need to stay competitive within our regional, state, national, and global economies.

Current Condition

The leading broadband communities are the Gigabit cities of New York, Los Angeles, Miami, Atlanta, San Francisco, Kansas City, Boston and several other major metropolitan areas. It is important to understand that Gigabit communities are a direct result of community leaders and partners pushing for the establishment of Gigabit services. Investment based providers rarely do this without pressure from the community or competition. Google fiber was a catalyst for many of these cities.

Erie County's broadband, while not in the national forefront, is on par with other Upstate New York metropolitan areas and many metropolitan areas of similar size across the Northeast, Great Lakes, and Midwest. There is the digital divide between businesses and residences that do or do not have access to good affordable broadband, but there is also the divide between regions that are proactive with their broadband development versus those that wait for the market to come to them. This study is a positive step toward a proactive and engaged approach for Erie County.

Private Broadband Infrastructure

There are two predominant private providers of wire line broadband infrastructure in Erie County: Verizon and Charter Spectrum. Charter Communications recently acquired Time Warner Cable (TWC) with the new company called Spectrum. Spectrum provides Internet, digital telephone services, and cable television services across a hybrid infrastructure of fiber optic cabling extending services out of the City to the towns and villages, and then transitioning to coaxial cable into the neighborhoods. Spectrum also provides private network and telecom services to businesses and institutions.

Verizon also has a mix of wired line infrastructure that includes fiber optics and traditional copper cabling. Verizon offers fiber based services to urban and much of the suburban areas of the County. Larger businesses and institutions that have access to Verizon fiber have the option of higher order telecom, network, and Internet services. Verizon offers its fiber optic FiOS™ service for triple play offering of telephone, TV, and Internet to only the five Erie County communities of Tonawanda, Amherst, West Seneca, Hamburg, and Orchard Park.

There are several competitive local exchange carriers (CLECs) that mostly serve business and institutional customers within the urban metropolitan area, such as AT&T, Level 3, Windstream, Lighthouse, Zayo, and others.

The dominant cellular mobile carriers are Verizon Wireless and AT&T, plus Sprint, T-Mobile and others offering 3G, 4G, and 4G LTE services. The recent minimum compliant broadband definition by the FCC of 25Mbps downstream and 3Mbps upstream as well as the fact that they meter their service (i.e. charge by capacity used) makes these cellular services non-broadband compliant. Most of the cellular carriers are now offering unlimited data plans, but these plans are priced for individual users with additional charges for added devices, making these plans expensive. Emerging 5G wireless technology will improve performance but require upgraded and expanded tower and antenna sites, and will come with a premium cost for service.

The map below identifies the major fiber optic routes throughout Erie County.

This and all other maps within this report and study documents, are considered confidential, as it presents proprietary and sensitive information regarding critical infrastructure; and as such, may not be reproduced or distributed without the express consent of the County, ECC Technologies, and the broadband providers.

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Public Broadband Infrastructure

There exists an extensive network of public fiber optic infrastructure primarily serving the NYSDOT, NFTA, and University at Buffalo. There is a loosely based “consortia” of municipal, Higher Ed, and healthcare agencies and institutions that have collaborated over the past ten years or more to build out this public infrastructure. Much of the infrastructure follows the NYSDOT I-190 and I-290 corridor, but also includes fiber throughout the NFTA Light Rapid Rail system. The University at Buffalo initially convened the consortia to work with NFTA to reach its downtown medical campus, including Roswell Park Cancer Institute.

Since then UB has collaborated with NYSDOT to reach Buffalo State College and to have a diverse route back to its North and South Campuses. UB fiber also helps connect parts of the Town of Amherst and Sweet Home School District networks. NYSDOT also provided fiber optic connectivity for the NFTA to reach its Buffalo Niagara International Airport Campus and Niagara Falls International Bus Terminal.

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ECIDA Focus Sites

Included in the project deliverables are focus site maps highlighting the broadband infrastructure and services available at 29 ECIDA development sites. Each site was surveyed for broadband infrastructure serving the site area. The infrastructure is mapped into the project GIS database. These focus site maps are particularly useful for planning and development and responding to developers and site locators for telecom/broadband infrastructure available at the site. The map below indicates the 29 sites.

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Please contact Erie County to obtain a copy.

Market Analysis

The New York State Broadband Program Office (NYS BPO) defines broadband for the purposes of their grant programs as an Internet delivery service of 100Mbps or better to download Internet content to the user. The NYS BPO relaxes these criteria for remote or rural areas that are challenged for infrastructure and may need to rely on wireless, or mixed technologies of fiber optics and wireless to deliver Internet services. In these special cases an eligible broadband service must support 25Mbps download speeds or better. Wireless technologies in these circumstances are fixed wireless transmission points to the home with either a fiber or microwave backhaul. This is sometimes referred to as small cell technology, or fiber to the curb with wireless to the premise.

Larger commercial, corporate, and institutional accounts have a wider selection of providers in addition to Verizon and Spectrum, and include competitive local exchange carriers (CLECs) such as AT&T, Level 3, Windstream, Lighttower and others. This broadband infrastructure primarily focused on the larger commercial, corporate, and institutional organizations in downtown Buffalo and the metropolitan areas of Erie County. The combined infrastructure does bring choice and competition within the metro areas, as well as offer a number of high speed/high capacity services. The infrastructure is less accessible for the City of Buffalo outside of the downtown business district, and noticeably drops off as you travel south and west of the City.

There are two predominant broadband service providers in Erie County—Verizon and Spectrum—who offer broadband services to residential and small business customers. Verizon offers digital subscriber lines (DSL) services over their traditional copper plant and high order services across their fiber optic network service called FiOS™. FiOS™ offers plans ranging from 50Mbps to 500Mbps. Verizon’s DSL services do not meet the FCC’s or NYS broadband bandwidth requirement of 25Mbps download speed.

Charter Communications merged with Time Warner Cable (TWC) and is now called Spectrum. Spectrum offers cable modem service plans ranging from speeds of 15Mbps to 50Mbps. New York State negotiated as part of the TWC acquisition that Spectrum offer a 100Mbps down offering at \$60/month. The NYS Broadband Office announced that Spectrum will begin offering the 100Mbps service option as early as the first quarter of 2017. While not advertised by Spectrum at the time of this report, Spectrum’s WNY Government Affairs Office did confirm that 100Mbps service plan is now available to Erie County customers, as well as customers across New York State.

Verizon and Spectrum service levels vary, depending upon the infrastructure and services available in different parts of the County. Spectrum claims it has coverage for nearly all of Erie County with pockets of non-covered areas. For areas outside FiOS™ coverage, Verizon only offers DSL services with plans ranging from 1Mbps to 7Mbps download speeds. Spectrum offers cable modem service for most of Erie County, offering plans between 15Mbps to 100Mbps.

Another choice in the region is satellite service. Satellite based broadband service typically has a maximum download speed of less than 25Mbps, and satellite Internet services have data caps, similar to cellular data plans. Satellite transmission can also be affected by latency and heavy precipitation. The other caveat to satellite service in this part of the state is clear line-of-sight to the southwestern sky. HughesNET is the region’s predominant satellite Internet provider, and DishTV and DirectTV for satellite television services.

GAP Analysis

Broadband service levels to support Erie County residents need to provide at least a 25Mbps service plan, and ideally 50-100Mbps or more. A four-person household could easily have four or more devices requiring Internet access (smart phones, computers/laptops, tablets, smart TVs, etc.). More affluent households could have eight or more devices. The Internet of Things will compound the number of devices to include appliances, HVAC systems, power and lighting, security, and all kinds of other devices and applications looking for bandwidth off the home's Internet service.

Verizon's FiOS™ website suggests a 50-100Mbps service for up to 1-7 devices, with 150-550Mbps for eight devices or more. Historically, bandwidth requirements have been doubling in five years or less, and at an increasing rate.

The only infrastructures available currently to support 100Mbps or better service is Spectrum's hybrid fiber/coax and Verizon's fiber optic FiOS™ cable plant. Verizon has no plans to expand FiOS™ coverage in Erie County and is prioritizing their investment into their wireless infrastructure. Verizon has in the past tried to sell off its wired line infrastructure for Western NY.

Spectrum has an agreement with New York State to provide access to 145,000 new units and 100Mbps service to two million new homes and business in Upstate New York, which should benefit the residents of Erie County. However, at this time no information has been provided as to where these new units are located.

5G wireless service also has potential to improve access and performance, but 5G is likely to require 10 times or more the number of tower sites, and/or the proliferation of small cell transmitters on utility poles, light poles, buildings, etc. The cellular 4G/5G wireless service still requires fiber optics to backhaul our communities' and neighborhoods' communications to the Internet.

The essential infrastructure missing is a competitive choice of fiber optic service providers to our city, town, and village neighborhoods, besides Spectrum and Verizon FiOS™. There is a fair amount of fiber optic cabling supporting the larger businesses of metropolitan Buffalo, but these providers either do not target residential or small business, or price their fiber optic services in such a way that it is prohibitively expensive to residential users or small business. This lack of infrastructure is only going to become more apparent as the number of devices requiring Internet access and bandwidth continue to increase in all aspects of our lives.

Recommendations

There are a number of options that the County can undertake to improve broadband infrastructure within the County. These options range from low investment, low risk broadband policy development to increasing levels of investment and risk for public infrastructure development.

1. County Broadband Committee

The Broadband Committee should continue to meet, perhaps on a quarterly or semi-annual basis, to review County broadband goals and objectives. The committee meetings are a mechanism to foster inter-department communication of broadband requirements and opportunities, and offer input and consultation to the County leadership in regards to broadband policy. Committee members may periodically meet or communicate with broadband providers to alert them of County or community objectives and review any potential private-public partnerships. As an example, the County could review broadband needs for its IDA focus sites to encourage private carriers to provide infrastructure and services to targeted sites.

The GIS group within the County Department of Environment and Planning should be responsible for maintaining and updating the broadband GIS database and mapping as new information is gathered or updated.

2. Community Collaboration

Similar to the County's Broadband Committee, the County should continue to communicate with its municipal and community partners to identify opportunities for broadband collaboration. Today, this is an informal consortium of municipal partners that meets infrequently, if at all. The County may want to formalize this consortium and take a leadership role in convening an annual meeting to review opportunities and goals.

A potential first collaborative project might be to engage County IS, City IS, and the University at Buffalo's Computing Center to investigate feasibility of a "shared" fiber optic service into the telecom carriers' hotel at 350 Main St. UB has fiber optic service to 350 Main, and may have excess capacity that could be leveraged for municipal access. The project goal would be to provide direct access to the region's major Internet, telecom and broadband services at the carrier hotel, thereby providing greater choice, competition and reduced costs. The County and City data centers are in close proximity to each other, as is the Central Library, NFTA and NIITEC. The County, Downtown ECC Campus, UB, NFTA and NIITEC all have access to UB and NYSDOT fiber at the NFTA Operations Control Center (OCC) at 93 Oak St. Such a project would establish collaborative relationships, potentially inter-municipal agreements, and open dialog for future projects.

Another initiative would be to start the dialog between towns and schools for a shared municipal backbone. The Town of Amherst and Sweet Home CSD are examples, and the Town of Grand Island and the Grand Island CSD are currently evaluating municipal fiber options.

3. Dig Once Policy

County and other local governments should adopt a "dig once" policy requiring the installation of municipal conduit or duct whenever a private or public works project opens up the earth along public Right-of-Way. Over time this has the potential of creating pathway for broadband infrastructure whenever street, water, sewer, lighting, and/or telecom projects can provide pathway for conduit burial.

For highly congested and/or expensive areas, such as downtown areas, bridges, rail crossing, interstate/highway crossings, etc., multiple communications conduit or a duct bank should be installed to minimize future pathway construction and disruptions. Whether a public or a private project, notify all potential public-private providers to coordinate and construct conduit infrastructure with appropriate capacity and cost sharing.

The broadband committee and/or the larger community broadband consortium could review policies and procedures to align permitting, zoning, and franchise agreements for a more consistent and uniform approach to foster broadband infrastructure development across all levels of government. As an example, building permits could include the requirement of a shared broadband/telecom conduit with sufficient capacity for existing and future providers. In many cases, there are separate conduits for telephone vs. cable TV, each minimally sized for the incumbent providers' needs. A more cost effective and efficient requirement would be a 4" or 5" conduit with a minimum of four inner-ducts, from the building entrance facility to a common pull box in the right of way.

The aforementioned options are a lesser cost approach that will yield, over time, improved broadband infrastructure for the community at large. The following options offer greater impact, but also require greater investment.

4. Targeted Broadband Infrastructure Projects

The broadband committee and County agencies could evaluate funding opportunities to include broadband infrastructure for economic development zones or targeted ECIDA sites. Opportunities can include broadband conduit or duct bank providing access to multiple carriers into the site and buildings.

Evaluate block grant or other funding mechanisms to build-out broadband infrastructure for these types of projects. HUD block grant money may also be available to incentivize providers to deliver a subsidized service to lower income households to better access and afford Internet service.

For example, undertake an economic development initiative to make Erie County Industrial Development Agency (ECIDA) focus sites more attractive for investment and development. A minimum investment might be broadband conduit or duct bank, and fiber optics build-out throughout the focus site properties and made available to service providers to offset their construction of pathway and cable facilities into the site. Service providers would connect at one on-site location and use the site's broadband infrastructure to deliver services throughout the site, thereby creating a carrier neutral infrastructure to encourage access and competition of services.

Another level of infrastructure investment might be municipal fiber optic cabling from the "Carrier Hotel" in downtown Buffalo out to the ECIDA focus sites along the Lake Erie (Rt. 5) corridor stretching from Lackawanna to Angola. This is an approximate 25 to 30 mile fiber optic build with an infrastructure design and construction capital investment of \$1.5 million to \$2.5million, dependent upon the number of sites and downtown construction costs.

5. Open Access Network (OAN)

A more proactive broadband strategy is for the County to view broadband infrastructure as a utility necessary to maintain quality of life and keep our communities competitive within the region, state, nation and the world. This is sometimes referred to as a "Technology Led" economic development strategy. The County, through several potential funding streams, would build-out, control, and maintain the broadband infrastructure for both public and private customers. This type of municipal network model for broadband development is often described as an Open Access Network (OAN).

The OAN concept is for government to not compete directly with private broadband providers, but rather provide a not-for-profit broadband infrastructure that is accessible by public and private organizations, including the broadband providers. Open Access Networks typically provide "dark fiber" infrastructure where the entity leasing fiber optic capacity is responsible for lighting the fiber optics with a broadband service (e.g. Internet, private network, telephone, TV, etc.). In many cases the entity leasing the dark fiber is a broadband provider looking to provide services to their customers.

Community owned fiber infrastructure has gained in popularity across the country over the last decade. Service providers are attracted to Open Access Networks because it removes the barrier to market entry of making long-term capital infrastructure investments. Instead, the service provider can lease network infrastructure for substantially less than the cost to build their own infrastructure.

Typically, these types of systems are developed through public-private partnerships with the telecommunications industry, where the municipal entity has ownership, control, and governance and the telecom/broadband industry provide services. There are opportunities when building and expanding the network to either buy, lease, or swap existing fiber capacity from private carriers and/or public providers.

OANs are revenue based and can be self-sustaining. Through the development of public-private partnerships, including the carriers themselves, the subscribers pay to use the fiber, which creates revenue to recover capital and operating expenditures.

Finally, through the construction of these networks and their operation, jobs are created both directly and indirectly. A global competitive advantage is created within the County by the existence of a 21st century based telecommunications broadband infrastructure serving the Erie County communities.

Erie County Open Access Network

A fully built out Erie County model would require a fiber optic backbone consisting of 300 to 400 miles of fiber optic cabling installed throughout the County, interconnecting key community anchor institutions (CAIs)—including municipal facilities, public safety 911 centers and towers, K-12 schools, libraries—and major employers and healthcare organizations. The final size of the network depends on funding, phasing and diversity requirements. For purposes of this report we have modelled a comprehensive Open Access Network of 360 fiber miles in order to describe the potential scope and order of magnitude of investment needed for community-wide broadband infrastructure development. The proposed OAN map is on the following page.

It needs to be stressed that this is a preliminary route design that requires detailed market analysis, engineering design, and secured funding before any final routes could be released for construction. The amount of fiber construction and costs could potentially be reduced by collaborating with other municipal fiber providers or leasing opportunities from private fiber carriers. The existing public fiber infrastructure overlaps approximately 60 miles of the initially propose Open Access Network routes.

For the purposes of this study, an Open Access, middle mile network is proposed to primarily connect the following community anchor institutes of:

- Public School Districts – this will extend the Open Access Network to each school district’s community. It would also likely include the Western New York Regional Information Center (WNYRIC), an Erie 1 BOCES organization that provides Internet and network services to school districts. WNYRIC is the main data center that Erie County schools connect to for Internet and IT services.
- Public Libraries – similar to schools, libraries will also extend the network out to our communities. The downtown Buffalo Central Library is the hub of the County-wide library network.
- Government Facilities – City, County, Town and Village facilities that need to interconnect to municipal networks. Public Safety 911 centers, emergency operations, and radio towers also extend the network out to nearly all of the County’s communities
- Economic Development – providing broadband infrastructure to incentivize development and offer a competitive advantage to attract and retain local businesses and competitive work force talent.
- Any major employer or institution that commits to be an OAN subscriber prior to construction. These organizations will typically have a geographic footprint in the County with a need to connect multiple sites.

Proposed Erie County Open Access Network

Map has been removed.

Please contact Erie County to obtain a copy.

promoting the region for Technology Led Economic Development.

Tables 1 and 2 summarize the design and construction capital costs and on-going annual operating costs. This is a preliminary construction estimate and would need to be refined during the design and engineering phase of an OAN project. Likewise, the final network route design will be refined after a business and marketing plan is developed.

Table 1 – Estimated Construction (Capital) Cost

Backbone Construction:		
Fiber Miles	360	
Design and Engineering (Fiber Optic Backbone)	\$	1,108,500
Make Ready	\$	2,268,000
Path and Permitting fees	\$	977,186
Right of Way (Easements)	\$	360,000
Material and Fiber	\$	4,752,000
Construction Labor	\$	6,609,600
POP setup	\$	250,000
Total	\$	16,325,286

Table 2 – OAN Annual Operations and Maintenance Costs

EXPENSE ASSUMPTIONS:	
Administrative Costs (Legal, Accounting)	\$75,950
Support Services (Marketing and Sales)	\$408,291
Network Operations	
Line Maintenance (Network Maintenance, response and repair)	\$75,212
Pole Attachment Fees	\$177,284
POP Maintenance and Support	\$12,000
Insurance	\$35,815
Annual Costs	\$837,437

Table 3 on the following page is an estimated income statement that evaluates projected annual revenues against estimated costs. The proposed OAN is cash positive in year 5, and remains cash positive for year 6 through year 20 of the bond term. Again, the \$3 million capital reserve or cash contribution is the needed working capital for the first five years until cash flow goes positive. Over the life of the bond the revenue projections estimate that both the working capital and construction costs would be fully recovered, with a net positive cash flow.

Revenues are estimated using an assumed take rate of potential subscribers. There are more than 400 municipal facilities, school district buildings, and libraries in Erie County, which are classified as municipal subscribers. The assumption made is that 80% of these facilities will subscribe to the OAN.

There are more than a 1,000 potential private sector subscribers that are within a half mile or less of the OAN network backbone. The take rate assumption for private businesses is 5% per year for five years and then levelling off. Lastly, it also assumed that telecom and broadband providers will also want to lease fiber from the OAN, contributing to revenue projections.

This is a conservative financial model based on preliminary route design and broad gauge estimates and projections. A comprehensive business and marketing plan, as well as final network design and engineering, will further refine and develop the OAN financial model.

Table 3 – Estimated Income Statement

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenues										
Revenue	\$ -	\$ 665,804	\$ 1,793,357	\$ 2,416,431	\$ 2,988,102	\$ 3,555,257	\$ 2,761,161	\$ 2,689,449	\$ 2,617,737	\$ 2,546,025
Capital Reserve/Contribution	\$ 3,000,000									
Total Revenues	\$ 3,000,000	\$ 665,804	\$ 1,793,357	\$ 2,416,431	\$ 2,988,102	\$ 3,555,257	\$ 2,761,161	\$ 2,689,449	\$ 2,617,737	\$ 2,546,025
Expenses:										
Total Costs and Expenses	\$ 99,124	\$ 1,069,209	\$ 2,040,437	\$ 2,060,186	\$ 2,080,330	\$ 2,100,876	\$ 1,073,626	\$ 1,100,058	\$ 1,127,193	\$ 1,155,050
Earnings Before Interest and Taxes	\$ 2,900,876	\$ (403,405)	\$ (247,080)	\$ 356,245	\$ 907,772	\$ 1,454,381	\$ 1,687,535	\$ 1,589,390	\$ 1,490,544	\$ 1,390,975
Interest Expense	\$ 640,968	\$ 618,878	\$ 595,887	\$ 571,959	\$ 547,057	\$ 521,140	\$ 494,168	\$ 466,096	\$ 436,881	\$ 406,475
Net Income	\$ 2,259,908	\$ (1,022,282)	\$ (842,967)	\$ (215,715)	\$ 360,715	\$ 933,241	\$ 1,193,367	\$ 1,123,294	\$ 1,053,663	\$ 984,499
Revenues										
Revenue	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313
Capital Reserve/Contribution	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313	\$ 2,474,313
Total Revenues	\$ 4,948,626	\$ 4,948,626	\$ 4,948,626	\$ 4,948,626	\$ 4,948,626	\$ 4,948,626	\$ 4,948,626	\$ 4,948,626	\$ 4,948,626	\$ 4,948,626
Expenses:										
Total Costs and Expenses	\$ 1,183,650	\$ 1,213,015	\$ 1,243,166	\$ 1,274,126	\$ 1,305,919	\$ 1,338,568	\$ 1,372,100	\$ 1,406,538	\$ 1,441,910	\$ 1,478,243
Earnings Before Interest and Taxes	\$ 1,290,662	\$ 1,261,298	\$ 1,231,147	\$ 1,200,187	\$ 1,168,394	\$ 1,135,744	\$ 1,102,213	\$ 1,067,775	\$ 1,032,403	\$ 996,070
Interest Expense	\$ 374,831	\$ 341,898	\$ 307,622	\$ 271,951	\$ 234,826	\$ 196,188	\$ 155,976	\$ 114,126	\$ 70,571	\$ 25,242
Net Income	\$ 915,831	\$ 919,400	\$ 923,524	\$ 928,236	\$ 933,568	\$ 939,556	\$ 946,237	\$ 953,648	\$ 961,831	\$ 970,828

Last Mile Services

An Open Access Network provides the middle mile backbone infrastructure of a County-wide network, interconnecting our city, town, and village communities. The community anchor institutions of municipalities, schools, and libraries will have direct connections to the OAN. Municipal subscribers alone are not sufficient to make an Erie County OAN sustainable. The OAN needs to broaden the subscriber base by serving private sector businesses, institutions and the telecom/broadband providers that want to use the OAN infrastructure to reach new customers.

Gigabit service providers, like Google, are attracted to metropolitan areas that have Open Access infrastructure combined with government policies and ordinances that encourage and streamline broadband development. Data centers and other technology companies want a competitive choice of providers with both infrastructure and service diversity. The same broadband infrastructure that attracts and retains these companies also attracts and retains talented employees and entrepreneurs.

Phasing Options

The preceding Open Access model assumes a comprehensive build out throughout the County to all cities, towns and villages. Open Access infrastructure is likely to be developed in a phased approach to leverage available funding and development goals.

As cited previously, an initial approach might be an economic development initiative to make Erie County Industrial Development Agency (ECIDA) focus sites more attractive for investment and development. Service providers would connect at one on-site location and use the site's broadband infrastructure to deliver services throughout the site, thereby creating a carrier neutral infrastructure to encourage access and competition of services. This phase could also establish the organizational structure needed to launch an Open Access Network. The next level of infrastructure investment might be Open Access fiber optic cabling from the "Carrier Hotel" in downtown Buffalo out to ECIDA focus sites.

A more ambitious Open Access project would be to leverage the Universal Service Fund's (USF) Schools and Library E-rate program to interconnect school districts, libraries and BOCES facilities. E-rate funds pay anywhere from 60%-95% of schools' and libraries' network infrastructure for Internet delivery, with NYS BOCES aid potentially covering 50%-90% of the remaining balance. There are approximately 220 K-12 and BOCES facilities and 37 public libraries in Erie County. Approximately 250-300 miles of Open Access fiber optic infrastructure would need to be constructed to interconnect these schools and libraries, for a design and construction cost in the range of \$12 million. The fiber infrastructure would likely recover its cost within ten years, sooner if the Open Access Network is expanded to include additional subscribers. This would establish a County-wide backbone to support additional expansion for public and private subscribers.

An Open Access Network for schools and libraries could easily be expanded for city, county, town and village offices, Police, Fire and 911 sites for another 30 to 50 miles, at an incremental cost of \$1.5m-\$2.5m.

The USF E-rate program currently offers the most substantial funding vehicle to support community-wide broadband infrastructure. The County, perhaps through the Broadband Committee, should engage Erie 1 BOCES, WNYRIC, local school districts and County libraries to gauge their level of support for such a project. The goal of the project is to offer a robust broadband infrastructure supporting our schools and libraries for comparable or lesser costs. Once the initial build capital costs are recovered, future network costs will only need to cover maintenance and support costs at a substantial savings. Again, the goal is to leverage state and federal funding to provide quality and cost effective services, but also to help expand and support broadband infrastructure benefiting the entire community.

This is not an unprecedented model. There are more than 250 miles of OAN fiber in the Southern Tier that interconnects more than 90 schools to the GST BOCES network leveraging e-rate and BOCES funds. It may not be a solution for every town and district, but if a sufficient number of towns and schools were to collaborate, there may well be the critical mass to launch a County-wide Open Access infrastructure.

The later phases for an OAN project would be lateral builds off the backbone to attract businesses and institutions, as well as private broadband service providers and telecom carriers leasing dark fiber to provide “lit” services to the communities on the OAN backbone. Some network subscribers will require additional fiber construction for a network ring topology, providing diversity or redundancy of services by protecting network communications from a break in the fiber optic infrastructure by routing service in the surviving direction of the ring while repairs are made. Ring topology will be valued by public safety, broadband and cellular carriers, and any organization with mission critical applications and services.

Conclusion

This study found that while the urban and suburban areas of the County are for the most part served in terms of access and competition, many of the rural areas of the County, which are towns and villages to the south and east, are lacking and expected to fall further behind. There is a municipal consortia of fiber optic networks that have successfully collaborated in the past to build out their public infrastructure and are agreeable to future collaborative endeavors.

The challenge that the County faces are that the two major infrastructure providers for the region, Verizon and Charter Spectrum (formerly Time Warner Cable), are not significantly expanding their infrastructure nor replacing aging copper and coaxial cable plant with fiber optics. For much of Erie County, Charter Spectrum is the only provider that can offer a true broadband service to small businesses and residents.

Erie County has competitive telecom and broadband infrastructure and services as compared to other Upstate New York counties and the metropolitan area of Buffalo has sufficient infrastructure and services needed to support its residents and businesses. However, outside of Buffalo and the neighboring suburbs, access to reliable service and choice in providers dwindles, as is the case with many Upstate New York counties.

There are several inexpensive options that require nominal investments that can help support broadband infrastructure over the long term, the most effective being a “Dig Once” policy combined with other policies and ordinances that streamline and encourage broadband development. However, good broadband policy and procedures alone will not project Erie County forward as a national leader in broadband services. Private broadband investment will first target the top economic markets in the U.S., and will not focus on economic development and expansion into underserved rural areas as a priority. Before a community can have true high bandwidth broadband (last mile) services to its businesses and residences, it must extend broadband infrastructure from its metropolitan center out to all of its communities (middle mile).

The establishment of an Erie County Open Access Network is the most proactive of strategies. It lowers barriers of entry for service providers, creates competition and choice for both business and residential customers, and will project the City of Buffalo, Erie County, and the region at large as a leading technological community. The OAN is also a strategy that requires both political and financial capital. It requires political and community leadership to communicate and create a consensus with all of the community stakeholders to undertake a project of this magnitude.

III Infrastructure Overview

Current State of Telecommunications and the Digital Divide

Telephone and other utilities were built out for most of the 20th century because they were regulated monopolies. Regulations enforced that telephone and electric services were built to low population areas by allowing the utilities to subsidize low density areas with high density urban and suburban areas. Similarly, cable TV companies negotiated exclusive franchise agreements with communities to ensure that they could recover their construction operating costs.

Twenty years ago, the Federal Communications Commission (FCC) created the Telecommunications Act of 1996 to establish competition and facilitate growth in the telecommunications industry. After the Telecommunications Act, competitive telephone companies called competitive local exchange carriers or CLECs emerged and provided consumers with a choice of providers and services. During the same period of time, other non-traditional telecommunications providers emerged. These new players to the telecom industry, namely the cable TV providers, network providers, and wireless providers (both cellular and fixed wireless) appeared and offered alternative and competitive broadband services as well.

Many years have passed since the 1996 Telecommunications Act, which succeeded in creating an increase in competition for telecommunication services, and the emergence of many fiber optic interstate carriers connecting our cities. However, local wireline competition has not occurred and is mainly served by the incumbent telephone companies and the local cable TV franchise holder.

Broadband (Internet) providers, while subject to state and federal regulations, are not mandated by law to build infrastructure to non-profitable low density areas. A technology division has occurred: a division between areas of the country that have access to affordable broadband service and those that do not. This division of broadband service has been labeled the “digital divide”.

There are still areas of the country that lack the affordable high bandwidth service that is attractive to both businesses and residential customers – those on the “have not” side of the digital divide. This is due in large part to a perceived lack of return on investment (ROI) for the incumbent service providers and a lack of competition by alternative providers in low income and/or rural areas of the country. It is therefore prudent to make an assessment of the current state of telecommunications in a given area and to plan for the future. The lack of investment in many areas of our communities has led to the redefinition of the digital divide from “those that have vs. those that don’t” to “those communities that get involved vs. those that don’t”.

It is also important to understand that perceived lack of broadband access has as much to do with lack of adoption as it does lack of infrastructure. Federal, state, and local government policies and funding played a critical role in developing and expanding the public utilities of the last century, and broadband is now the 21st century utility that is just as deserving of public funds and support.

What is Broadband Infrastructure

Broadband infrastructure is both wired and wireless technologies delivering high speed voice, data, and video communications to our homes, businesses, and community institutions. The most widely understood broadband service is Internet access. Other broadband services include private networks, cable TV (CATV) services, cellular, telephone, and other telecommunication services.

Broadband infrastructure also includes the pathway, conduit, and aerial utility pole lines that wired broadband uses to deliver services. Wireless infrastructure includes tower sites and other vertical assets needed for broadcast. Wireless communications always find its way back to wired line facilities for local, regional, national, and global communications. Lastly, the central office (CO) and point of presence (POP) facilities that house the switching and routing systems are all part of broadband infrastructure.

Fiber optic is considered the gold standard of broadband infrastructure because of its near unlimited capacity and speed. Fiber optic networks communicate using light waves traveling along a strand of fiber optic glass. Fiber optics support the greatest level of bandwidth—a broadband term of measurement of both capacity and speed. Fiber optic supports speeds between millions of bits per seconds (Megabit) to 1000 Megabits (Gigabit) to hundreds of Gigabits, with technologies under research and development to scale to even greater bandwidth.

The backbone of interstate and international broadband communication is delivered across fiber optic cables. A fiber optic backbone cable can have several hundred strands of glass fibers, where each strand is capable of transmitting dozens of different light wave frequencies. Each light frequency is capable of supporting many thousands of users.

Other wired broadband technologies include coaxial cable widely used for cable TV networks and copper based cables used for Digital Subscriber Lines (DSL). Wireless broadband technologies include satellite, microwave, fixed wireless (Direct and WiFi), 3G cellular, and LTE (4G and future 5G) cellular services.

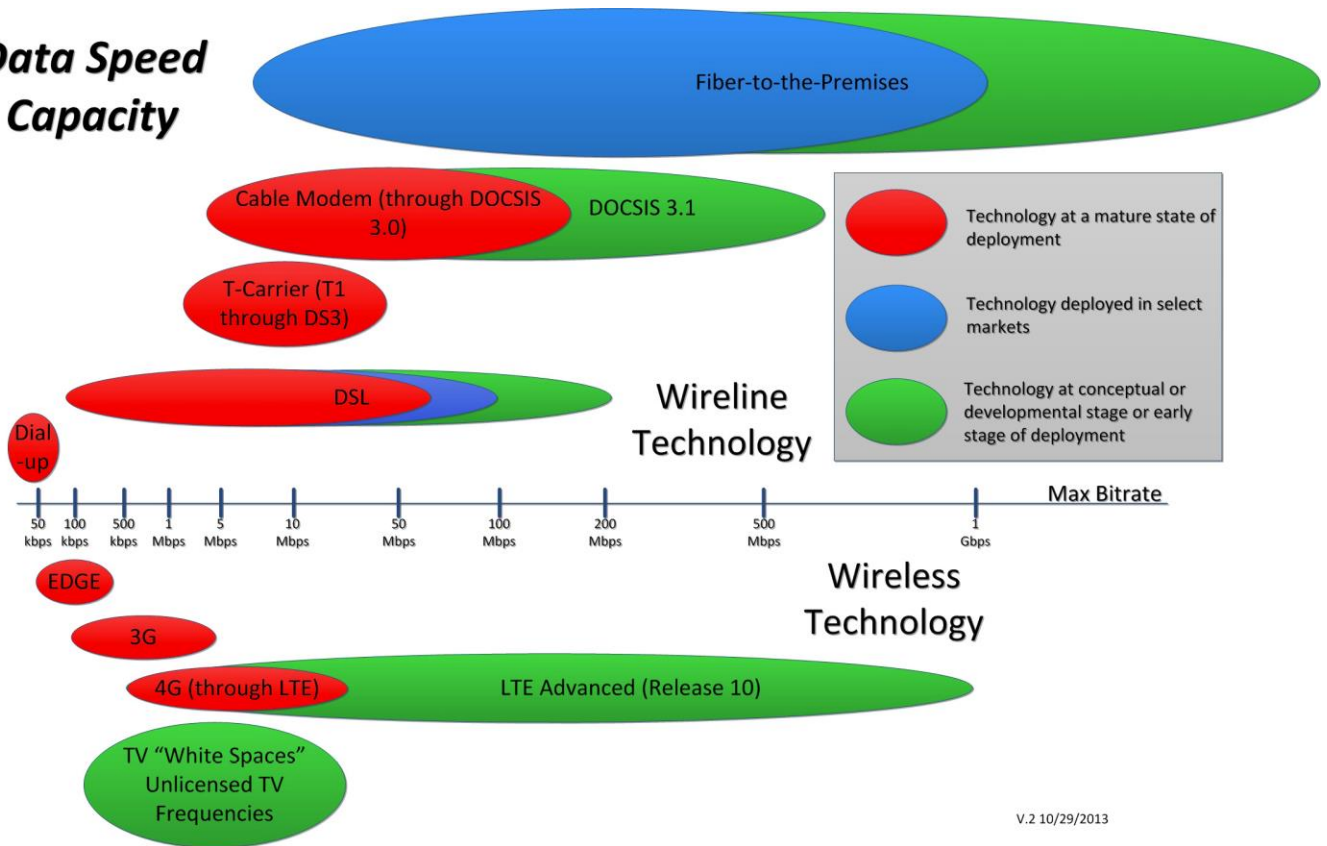
The FCC defines broadband service as providing minimum bandwidth of 25Mbps downstream and 3Mbps upstream. The New York Broadband Office has a desired bandwidth of 100Mbps downstream and 10Mbps upstream. Tables 4 and 5 provide the Internet bandwidth potentially supported by the wired and wireless broadband infrastructures. Actual broadband speeds vary depending upon overall network usage, service plans, equipment, and environment.

Table 4 – Broadband Infrastructure Bandwidth

Broadband (Internet) Technology	Bandwidth Potential (Internet Download Speeds)	Bandwidth Commonly Achieved (Internet Download Speeds)
Fiber Optic Cable	1Mbps-255Tbps+	100-1000Mbps
Coaxial Cable (Cable Modem-DOCSIS 3.0)	1-150Mbps+	1-55Mbps
Fixed Wireless	1Mbps-1Gbps+	1-150Mbps
Satellite Internet	1-50Mbps	1-20Mbps
Copper Cable (DSL)	1-20Mbps	1-10Mbps
Cellular 3G	1-25Mbps	1-3Mbps
Cellular 4G (LTE)	1-100Mbps	1-12Mbps
Cellular 5G (future)	1 Mbps-10Gbps	TBD

Broadband Infrastructure Bandwidth ⁽¹⁾

**Data Speed
Capacity**



V.2 10/29/2013

Table 5 Broadband Applications – Bandwidth Requirements ⁽¹⁾

	56 Kbps	768 Kbps	1 Mbps	10 Mbps	20 Mbps	50 Mbps	100 Mbps	1 Gbps
Download MP3 music file (4 MB)	Poor (10 min.)	OK (42 sec.)	Good (32 sec.)	Good (3 sec.)	Best (1 sec.)			
Online software purchase (500 MB)	Poor (20 hr.)	Poor (87 min.)	Poor (67 min.)	OK (7 min.)	Good (4 min.)	Good (80 sec.)	Good (40 sec.)	Best (1 sec.)
HD movie download (5 GB)	Poor (9 days)	Poor (15 hr.)	Poor (12 hr.)	Poor (67 min.)	OK (34 min.)	Good (14 min.)	Good (7 min.)	Best (40 sec.)
Skype video call	Poor	OK	Good	Best				
Stream HD video	Poor		OK	Good	Best			

(1) New American Foundation, "The Art of the Possible, Overview of Broadband Options", www.newamerica.org/oti/policy-papers/?page=3&, May 6, 2014

Erie County Broadband Infrastructure

Erie County's broadband infrastructure information has been compiled from a number of sources, including broadband service providers and their website information, industry and FCC databases, New York State Broadband Office, and ride out surveys documenting utility pole line infrastructure.

The first step in broadband infrastructure planning is knowing what infrastructure is available within the County. This report is supplemented by a GIS database of wired and wireless infrastructure mapped throughout the County. This report contains snapshots of GIS map layers, but the database is an interactive tool for reviewing existing infrastructure and tracking new infrastructure as its developed.

It needs to be pointed out that these infrastructure maps are sensitive and should not be published onto publicly accessible websites. Each of the infrastructure providers requested their mapping information remain confidential and only distributed outside of the County's planning purposes upon written authorization of both the provider and County.

The inventory summary is a compilation of the telecommunications service providers and supporting infrastructure in the Erie County area. The scope of work for this summary included documenting critical infrastructure and services available in the area to the extent that information is publicly available. The data collected includes all the relevant service providers; namely the incumbent service provider, the competitive service providers, the wide area network (WAN) providers, and the wireless providers. Information on infrastructure includes fiber, telephone company COs with their wireline boundaries, and wireless towers.

Research Methodology

To gather the information required for this study, ECC contacted the major telecommunications providers listed below and obtain their network maps, product offerings and service coverage areas. Publicly available databases managed by Federal and State agencies and information purchased from telecom industry database research organizations were additional sources used to complete the inventory.

Wire Line Providers

- Incumbent Local Exchange Carriers (ILECs)
- Cable TV (CATV)/Modem Service Providers
- Competitive Local Exchange Carriers (CLECs)
- Network Service Providers
- Dark Fiber Providers

Wireless Providers

- Wireless Internet Service Providers (WISPs)

Public Information

ECC obtained telecommunications industry data publicly available from the following Federal and State organizations: the FCC, the NYS GIS Program Office, and the NTIA. On the local level, ECC obtained information on municipal infrastructure from NYSDOT, the University at Buffalo, and the NFTA.

ECC also conducted a two-day survey by an outside plant (OSP) broadband designer driving the County's major transportation corridors and observing the fiber optic cables on utility poles. This OSP survey did not extend into the City of Buffalo, town centers, or villages. The ECC survey included (29) Erie County Industrial Development Park sites and six (6) County facilities with surrounding broadband infrastructure mapped to the study's GIS database.

Contacted Providers

Many of the telecommunications providers in the County were contacted via telephone, in person, and/or by email. Each organization contacted identified the appropriate individual within their respective company and that person was informed of the study and its intent.

Industry Resources

Other resources included GeoTel and Telecordia, telecommunications industry research companies, telecommunications provider websites, and telecommunications industry professionals. All information gathered was to the extent possible.

Interactive GIS Mapping/Database

All infrastructure information discovered in this inventory project has been integrated into a GIS database developed for Erie County. This GIS database will be administered, stored, and updated by the Planning Department of Erie County to ensure security and continuity of the resource. The GIS database supports broadband based and economic development initiatives. This information will be used by the Planning Department for County and regional planning purposes.

Telecommunications Infrastructure

Throughout the course of this study, we found that telecommunications in the County is delivered via a number of competing providers using different technologies and infrastructures. The primary owners of telecommunications infrastructure in the County include:

- The incumbent local exchange carrier (ILEC), which is Verizon
- The incumbent cable TV provider, which is now called Charter Spectrum (formerly Time Warner Cable)
- Competitive local exchange carriers (CLECs)
 - AT&T
 - CenturyLink
 - Level 3 (under acquisition by CenturyLink)
 - Windstream
 - XO Communications
 - Finger Lakes Technology Group
- Regional fiber based providers
 - Regionally based ION Networks
 - Regionally based Lightower Networks (recently acquired FiberTech)
 - Nationally based Cogent Communications
 - Nationally based Zayo Networks
- One (1) Wireless Internet Service Provider (WISP), Transwave
- Several cellular carriers (Verizon Wireless, AT&T, Sprint, T-Mobile, Cricket)

The telecommunications providers in Erie County are delivering service to homes, businesses, and other organizations at varying degrees of access, performance, and cost. The urban areas such as Niagara Falls and Buffalo have extensive fiber infrastructure and therefore highly dense broadband coverage. Meanwhile, in the more rural areas where less investment has been made we find pockets that are unserved or underserved with some limited DSL service available.

There are 102 towers registered on the FCC website constructed in Erie County. This figure does not include the County's fire and emergency management towers. The majority of these towers are located on major roadways and population centers, with the highest concentration of towers being within proximity of the New York State Thruway and in the City of Buffalo.

The map below shows the data ECC collected during the Inventory. It provides insight to where the infrastructure is located and where improvements could be made. Fiber has been identified to the extent possible. Fiber installed underground may not be pictured. Also, note that the fiber routes often follow the same transportation corridor (e.g. I-90, I-190 or I-290), so it is difficult graphically to see all fiber routes together. The GIS database allows viewing of these routes separately and/or combined at any scale.

Map has been removed.

Please contact Erie County to obtain a copy.

ILECs

There is one incumbent local exchange carrier (ILEC), Verizon, that provides service in Erie County. The ILEC is responsible for development and maintenance of the cabling and switching equipment needed to deliver local telephone and other telecom related services to the communities.

Verizon

Verizon’s main headquarters is in Basking Ridge, New Jersey. They are one of the largest ILECs in the country. Verizon’s infrastructure is important to the County for more than just delivering Verizon services. The Verizon ILEC cable plant (copper and fiber) must also be made available to competitive local telecom carriers (CLECs) so that CLECs can offer their services using the ILEC cable plant. The Verizon ILEC central offices must also offer co-location space for CLEC equipment utilizing the ILEC cable plant.

The Verizon FiOS™ Internet and cable TV service uses fiber to the home (FTTH) to deliver high speed broadband services. FiOS™ coverage for Erie County is illustrated on page 12. Verizon did not disclose any significant plans for expanding their fiber optic infrastructure or FiOS™ services in Erie County, but does reserve option for expanding based on individual business case opportunities.

Verizon reported they offer video, voice, data services, DSL, mobile back-up, and machine to machine (asset tracking and supply chain management) to the businesses and residents in the County. Below is Table 6 showing Verizon’s COs and the services available:

Table 6 – Erie County Central Offices

Central Office (ILEC)	Exchanges	DSL	FiOS™	T1/DS1	T3/DS3
Akron	716-542	Yes	N/A	Yes	Yes
Alden	716-937	Yes	N/A	Yes	Yes
Amherst	716-264, 716-564	N/A	Yes	Yes	Yes
Angola	716-549	Yes	N/A	Yes	Yes
Boston	716-941	Yes	N/A	Yes	Yes
Buffalo	716-597, 892, 893, 894, 895, 896, 897, 898	Yes	N/A	Yes	Yes
Buffalo	716-254	Yes	N/A	Yes	Yes
Buffalo	716-447	Yes	N/A	Yes	Yes
Buffalo	716-821, 824, 825, 826, 827, 828	Yes	N/A	Yes	Yes
Cheektowaga	716-608, 656, 668	Yes	N/A	Yes	Yes
Clarence	716-759	Yes	N/A	Yes	Yes

Central Office (ILEC)	Exchanges	DSL	FiOS™	T1/DS1	T3/DS3
Clarence Center	716-741	Yes	N/A	Yes	Yes
Derby	716-947	Yes	N/A	Yes	Yes
East Aurora	716-652, 655, 687, 805	Yes	N/A	Yes	Yes
Eden	716-992	Yes	N/A	Yes	Yes
Grand Island	716-773, 774, 775	Yes	N/A	Yes	Yes
Hamburg	716-312, 646, 648, 649	N/A	Yes	Yes	Yes
Holland	716-537	Yes	N/A	Yes	Yes
Lancaster	716-651, 681, 683, 684, 685, 686, 706	Yes	N/A	Yes	Yes
Lockport	716-433, 434, 438, 439	Yes	N/A	Yes	Yes
Niagara Falls	716-297, 298	Yes	N/A	Yes	Yes
North Collins	716-337	Yes	N/A	Yes	Yes
Orchard Park	716-662,667	Yes	Yes	Yes	Yes
Sanborn	716-731	Yes	N/A	Yes	Yes
Springville	716-592	Yes	N/A	Yes	Yes
Tonawanda	716-620, 623, 629, 690, 692, 693, 694, 695, 696, 743, 744, 807	Yes	Yes	Yes	Yes
Wanakah	716-627	Yes	Yes	Yes	Yes
Williamsville	716-429, 446, 645, 803, 829, 831, 832, 833, 834, 835, 836, 837, 838, 862	N/A	N/A	Yes	Yes
Williamsville	716-565, 616, 626, 630, 631, 632, 633, 633, 634, 635, 730, 810, 839	N/A	Yes	Yes	Yes
West Seneca	716-684, 675, 677	N/A	Yes	Yes	Yes

The ILEC (Verizon) fiber is mapped on the following page. The fiber routes are those that were surveyed for a two-day period in October 2016 along the major transportation corridors, and did not include City and village limits. Verizon’s website showed their FiOS™ coverage areas as depicted by the cross hatched areas.

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Please contact Erie County to obtain a copy.

CLECs

As stated previously, competitive local exchange carriers (CLECs) are a direct result of the 1996 Telecommunications Act, which gave these companies the right to use ILEC infrastructure to deliver competing services. A switched-based CLEC is a company that owns switching equipment for local voice and data services. Since they own their equipment/switches they can provide some competition to the incumbent, offering equipment based redundancy over ILEC services.

There were six Type 1 CLECs identified in Erie County during the study process. A Type 1 CLEC is a telecom provider that provides its own switching and not just simply resells the ILEC services. The six Type 1 CLECs in Erie County are:

- AT&T
- CenturyLink
- Level 3
- Windstream
- XO Communications
- Finger Lakes Technology Group

Table 7 – CLEC service offerings

Company	Dedicated T1/PRI	Ethernet	Wavelength	MPLS VPN
AT&T	Yes	Yes	Yes	Yes
Centurylink	Yes	Yes	Yes	Yes
FLTG	Yes	Yes	Yes	Yes
Level 3	Yes	Yes	Yes	Yes
Windstream	Yes	Yes	Yes	Yes
XO	Yes	Yes	Yes	Yes

T1 – Circuit that can provide either 1.5Mbps of bandwidth or support up to 24 voice calls

PRI – ISDN PRI service provides high capacity digital voice services, typically utilizes a T1 circuit

Ethernet – Private (IP) network service interconnecting a customer’s premises across a wide area network. Bandwidth can vary between 1 Megabit to 1 Gigabit or more.

Wavelength – Optical data service provisioned over single light frequency across a strand of fiber optic glass.

MPLS VPN – Family of methods for multiprotocol label switching (MPLS) to create virtual private networks (VPNs). MPLS VPN allows networks the flexibility to transport and route several types of network traffic using the technologies of a MPLS backbone, while managing quality of service (QoS) of latency sensitive voice and video applications.

AT&T

AT&T Communications is a wire line and wireless service based ILEC telecommunications company that provides services to towns and cities in 22 states across the country. AT&T started over 130 years ago and acquired BellSouth and Cingular Wireless in 2006. AT&T is headquartered in Dallas, Texas and has over 258,000 employees worldwide. AT&T has over 95 million wireless subscribers and millions of landline customers for whom they provide broadband, TV content and distribution, long distance, and local voice services. Their fiber enters Erie County via the NYS Thruway, also known as interstate route I-90, and follows I-90 through the towns of Cheektowaga, Hamburg, and Brant. AT&T has also installed fiber in the Elmwood and downtown areas of Buffalo. Requests to meet with AT&T were not responded to.

Recent business news sources announced a buyout offer from AT&T to acquire Time Warner, Inc. the television content provider (a separate company from Time Warner Cable). The estimated cash value of the transaction is \$108.7 billion.

A map of AT&T’s fiber in Erie County is provided on the following page.

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Please contact Erie County to obtain a copy.

CenturyLink

CenturyLink has fiber in Buffalo that follows the NYS Thruway. Although they are the ILEC in several states where they operate, in Erie County they do not offer residential service. They offer Internet service to businesses in Erie County. They have a point of presence (POP) at 350 Main Street in the City of Buffalo. In order to provide service to end-users they need to lease last mile infrastructure from another provider. They do not plan on expanding in Erie County due to the high capital investment that would be required. Their preference would be to remain an upstream Internet service provider by leasing Internet services to other service providers.

In terms of future plans CenturyLink has made a buyout offering to Level 3 for \$34 billion. If approved, the deal will make CenturyLink the second largest provider of telecommunications to businesses in the U.S., after AT&T. CenturyLink would acquire nearly 200,000 miles of fiber optic lines supporting large business customers.

Level 3

Level 3 is headquartered in Broomfield, Colorado with a supporting office at 350 Main Street in Buffalo, NY, and is one of only six Tier 1 Internet providers in the world. Level 3 is an international company with business offices around the world. With its purchase of Global Crossing in 2011 and TW Telecom in 2014, Level 3 has become one of the largest CLECs in the country. Level 3 can provide data (MPLS, Private Line, Ethernet) anywhere in the U.S. Level 3 is a nationwide VoIP provider, which allows them to use the Internet for phone service.

Level 3 has a significant amount of fiber within the County. Their fiber is installed on the main roadways within the County including, route I-90, I-190, 240, and 263. The highest concentration of their fiber can be found in the more populated areas but they have installed fiber throughout the County.

Maps of Level 3 and CenturyLink networks can be viewed below and on the following page.

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Windstream

Windstream is a fortune 500 company with headquarters in Little Rock, Arkansas. They have a presence in Buffalo due to their acquisition of Paetec Communications in 2011. Locally, Erie County is supported from a regional office located at 100 College Parkway in Williamsville. Windstream is the ILEC in many areas where they provide service. In Erie County, Windstream provides their service to the commercial sector and does not offer residential service. As with many of the other providers we have discussed, Windstream has fiber that follows route I-90 in Erie County. They have also installed fiber in the populated areas such as Amherst, Cheektowaga, Buffalo, and Tonawanda. They do not have fiber in the more rural areas of the County, like Orchard Park, Elma, and Aurora to name a few.

XO Communications

XO Communications is based in Herndon, Virginia and was one of the very first CLECs to form in the United States after the Telecommunications Act of 1996. XO has fiber that starts on I-190 in the City of Buffalo and then heads South along Route 62 all the way to Gananda. They do not sell dark fiber to their end users, focusing on lit services to businesses. In order to reach end-users outside of Buffalo, they would need to lease services from Verizon or another provider. XO will only consider extending their fiber network if the service is a Gigabit or higher.

Finger Lakes Technology Group

Finger Lakes Technologies Group, Inc. (FLTG) is headquartered in Victor, NY. The company has connections from Binghamton to Syracuse, Rochester, and Elmira. FLTG serves the Finger Lakes region of New York. FLTG owns and operates a 2,500-mile fiber network in New York State. FLTG’s fiber in Erie County was initially built as a private network to connect a school district. FLTG will lease both dark and lit fiber except in Hamburg, where they only have dark fiber available. In addition to their fiber in the Hamburg area, they also have built a small amount of fiber in Buffalo that connects two private schools together. FLTG works with commercial customers only and does not offer residential service. They are very interested in providing competitive pricing to any business along their fiber network. They have no plans for expansion at the present time but they will consider fiber builds to reach specific locations on an individual case basis. At the time of this publication, FLTG is under acquisition by Albany, NY based FirstLight, a Sovernet company.

The maps below and on the following page show Windstream, XO Communications, and FLTG fiber networks for Erie County.

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Fiber Based Providers

Fiber based providers are similar to a CLEC in that they offer competition to the ILEC. To enter a new marketplace, fiber based providers will either lease fiber from the incumbent or another fiber owner or build their own fiber to access customers. Since fiber is expensive to install, these types of providers will look for high dollar, long term contracts for their service from anchor customers that have multiple locations and high bandwidth needs. Typical anchor customers of fiber based providers include school districts, government, large healthcare systems, and cellular providers. These types of customers help the fiber based provider recoup a large portion of the initial cost to build the fiber.

Typically, the fiber provider will light the fiber providing Internet or private (IP) network connections to their customers. In other cases, they will sell direct use of a certain number of “dark” fibers to a company or organization and that company or organization “lights” the fiber using their own equipment.

Cogent Communications

Cogent Communications, based in Washington, DC., is an Internet service provider with a fiber network that spans the United States and several other countries. In general, they focus primarily on bringing inexpensive bandwidth and last mile services via fiber to their customers and do not sell dark fiber. They have a presence in all of the cities in the U.S. that have football teams in the NFL. Currently Cogent has fiber in two downtown locations in Buffalo: 325 Delaware St. and 350 Main St. Their fiber in Erie County follows the NYS Thruway. They also have fiber on I-290 and I-190 heading into Tonawanda and Grand Island.

ION Networks

ION is a not-for-profit statewide fiber network headquartered in Albany, New York. The company was originally formed in 2004 by 12 regional ILECs. In 2009 they were awarded \$40 million from the Federal stimulus grant to build-out their network. They have approximately 3,000 route miles of fiber in New York. Their primary focus is on education, healthcare, and other service providers operating in the rural areas of New York. They do not offer residential service. Their parent company is Sovernet, which is based in Vermont.

ION’s fiber runs along the NYS thruway, I-90, from the Town of Akron to Cheektowaga and southbound to the County limits. They also have fiber that heads north on I-290 towards Tonawanda. A portion of their fiber is leased from another carrier. As a result, the amount of fiber that they have is limited so they will only lease lit services. ION will provide speeds up to 10 Gig for wholesale customers. Enterprise speeds are more limited.

Lighttower Networks

Lighttower is a regional fiber provider with headquarters in Boxborough, Massachusetts and a regional office in Rochester, New York. Lighttower merged with Rochester based Fibertech Networks in the summer of 2015. The company has a network presence from Chicago to the East Coast of the United States. In the Buffalo region they have built a fiber network in the northwestern portion of Erie County. Lighttower has fiber in the towns of Tonawanda, Amherst, Cheektowaga, and West Seneca, and also in the cities of Buffalo and Tonawanda. Lighttower leases both dark fiber and lit services to the commercial market. They do not provide residential service.

Zayo

Zayo is a fiber based telecommunications provider headquartered in Louisville, Colorado. Similar to the other companies we have discussed, they focus on the commercial market and do not provide residential service. Much of their business comes from constructing fiber for large enterprise businesses and other telecommunications companies such as Verizon and Cogent. They have grown into one of the largest telecommunications companies in the world due to several mergers and acquisitions. Their fiber in Erie County is from an acquisition of another company. In the metro area of Buffalo, they will lease fiber to businesses provided the company wants a service such as fiber optic wavelengths or Ethernet.

Zayo would be interested in building a fiber network for Erie County but the County would be responsible for attracting the anchor tenants. Zayo is currently working with other entities in the County, which could help offset some of the IRU cost.

Maps of the Cogent, ION, Lightower, and Zayo networks for Erie County follow.

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Cable Providers

Charter Spectrum Communications

Charter Spectrum Communications is the result of a merger of Time Warner Cable (TWC) and Charter Communications in May of 2016. The new company has been rebranded as Charter Spectrum. The merger has made the new company the second largest cable company in the United States. The corporate headquarters is located in Stamford, Connecticut, although the company also has a regional office located on Chicago St. in Buffalo. They are currently the only cable provider in Erie County.

Charter Spectrum's Internet access service is available in multiple levels of bandwidth, starting at 15Mbps to 50Mbps. As part of the merger with TWC, Charter agreed to provide service to an additional 145,000 homes in New York State. Erie County was named as one of six priority counties by Charter to satisfy their build-out requirement. The NYS Broadband Program Office has not yet released into which areas in Erie County Charter will be expanding.

Time Warner Cable's (Spectrum) website states that all but a small portion of reservation land in the Southwest corner of the County is covered by their services. The map on the following page indicates CableTV aerial fiber cables on utility poles observed by ECC's ride-out survey. The two-day ride-out did not survey poles within City or village limits. The map also highlights in purple the areas defined by the NYS Broadband Program Office as being unserved by broadband providers.

Map has been removed.

Please contact Erie County to obtain a copy.

Wireless Providers

Fixed wireless service providers are commonly called Wireless Internet Service Providers (WISPs). WISPs offer WiFi broadband technology utilized in the 900MHz, 2.4GHz, and 5GHz unlicensed radio frequency bands developed under and in compliance with the 802.11 international standards. WISPs can be the most cost effective technology for serving rural unserved and underserved markets, particularly when the terrain is mountainous and the cost of building out last mile fiber optic infrastructure is prohibitive. The cost of entry into the market using these technologies is much less than the cellular broadband carriers, and may be incrementally implemented. These factors can make a WISP a preferable option in many unserved areas' circumstances.

Fixed wireless technologies require wireless access points (APs), which can be located on radio towers, tall buildings, utility poles, or other high structures. Remote households receiving broadband service will require a roof mounted antenna that will feed an indoor modem. Internet service is then available at the modem, and can be redistributed to an in-home wired or wireless network.

WISPs can be an attractive alternative to traditional landline services. In many cases, customers of WISPs can avoid very costly landline builds, resulting in more affordable bandwidth. In many areas of the state WISPs fill the void in unserved and underserved areas.

Transwave

Transwave is a commercial fixed wireless provider headquartered in Clarence, New York. They cover most of Erie County and parts of the surrounding counties as well. The company began as a construction company, building private networks for utility companies and expanded to building cell towers and working with service providers. They have installed equipment on several public safety structures and tall buildings throughout Erie County. Transwave would like to expand into other areas of Erie County where they do not currently offer service, but the municipalities do not always allow them to use water or public safety towers and leasing space on cell towers can sometimes be cost prohibitive. Their service speeds range from 1 Megabit to 1 Gigabit. Transwave did not provide a map of their coverage area.

Cellular Service Providers

The cellular providers in the County are AT&T Wireless, Verizon Wireless, T-Mobile, and Sprint. All of these cellular companies have equipment on towers strategically placed in the County to provide mobile wireless service to the maximum number of customers. The cellular providers offer 3G and 4G (LTE) services and are widely available throughout the County. The higher the cellular frequency the greater the bandwidth capacity, but with smaller coverage areas. Remote or high terrain areas of the County will have cellular coverage gaps.

Cellular 5G services are still under development and a FCC approved standard does not yet exist. Still, this technology will greatly increase wireless speeds, but again high speeds come with the cost of smaller coverage areas requiring either more and/or higher towers, or small cell technologies of deploying fixed wireless transmitters closer to homes and residences for “last mile” services.

Wireless Towers

The towers used by the cellular service providers are owned by a number of different corporations. There are 102 private sector towers in the County. They can be found along the major traffic corridors throughout the County. Cellular companies prefer fiber optic based services for backhauling tower communications, but when fiber is unavailable microwave or copper based telecom services are utilized.

Map has been removed.

Please contact Erie County to obtain a copy.

Municipal Fiber

In addition to service providers there are many other entities within a community that may own and maintain fiber for their own use. Among these entities are utility companies, universities, and municipalities. The following paragraphs describe the other organizations in Erie County that own fiber optic infrastructure.

There exists in Erie County an informal, but effective, consortium of public institutions that have provided mutual support and resources for the development of broadband connections throughout Erie County. The consortium is led by SUNY at Buffalo with key support from NYSDOT and NFTA. Other consortia members that have benefited include Erie County, Buffalo State College, downtown medical campus, NIITEC and others. This fiber optic infrastructure has a termination presence in the “Carrier Hotel” in downtown Buffalo for access to the interstate carriers.

SUNY University at Buffalo (UB)

In 2003 the University at Buffalo determine it was to their long-range benefit to own and control their own broadband and telecommunication infrastructure interconnecting their North and South Campuses and their downtown medical facilities.

UB had fiber optic cabling installed to connect the North Campus to the South Campus and then through negotiations with NFTA, UB placed fiber in the NFTA subway tunnel under Main Street to extend the University's network to the downtown medical campus as well as connecting to the downtown Buffalo "carrier hotel", where all the major interstate telecom and Internet providers have colocation facilities.

Since 2003, UB has expanded their infrastructure, with the support of NYSDOT, to reach Buffalo State College, Daemon College, additional healthcare institutions, and redundant and diverse connections for network resiliency. The University continues to extend their fiber optic network and works cooperatively and collaboratively with its municipal consortia partners.

New York State Department of Transportation (NYSDOT)

NYSDOT has an extensive fiber optic network for its traffic control systems, video surveillance, digital signage, and other network applications. The department had the vision to install high strand count cables with excess capacity that can support other municipal and community networks, such as the Niagara Frontier Transportation Authority, NIITEC, and UB.

NYSDOT noted the major transportation highways where their fiber optic infrastructure has been installed, with the provision that this information is confidential and maps indicating NYSDOT fiber optics shall not be made publicly available without the express written permission of the NYSDOT.

Niagara Frontier Transportation Authority (NFTA)

The NFTA constructed a communications duct bank throughout its light rail tunnel and rail right of way, with a limited number of fiber optics supporting rail communications, at the time of the original subway construction. In 2003, the NFTA obtain additional fiber optic capacity when providing UB with access to spare tunnel conduit. The NFTA fiber optic backbone extends from the University Station to its Operations Control Center (OCC), as well as to its Yards and Shops facilities in downtown Buffalo.

NYSDOT supports the NFTA with spare fiber optic capacity assigned to NFTA to connect the Buffalo Niagara International Airport and the Niagara Falls International Bus Station back to its OCC data center.

The NYSDOT, UB, and NFTA fiber overlaid onto a single map. As previously stated, the three organizations share the same pathway and/or fiber cables and as such the map will not always show each organization's route, but the GIS database does.

Map has been removed.

Please contact Erie County to obtain a copy.

ECIDA Focus Sites

Included in the project deliverables are focus site maps highlighting the broadband infrastructure and services available at 29 ECIDA development sites. Each site was surveyed for broadband infrastructure serving the site area. The infrastructure is mapped into the project GIS database. These focus site maps are particularly useful for planning and development and responding to developers and site locators for telecom/broadband infrastructure available at the site. The map below indicates the 29 sites.

Map has been removed.

Please contact Erie County to obtain a copy.

IV Market Analysis

The New York State Broadband Program Office (NYS BPO) defines broadband for the purposes of their grant programs as an Internet delivery service of 100mbps or better to download Internet content to the user. The NYS BPO relaxes these criteria for remote or rural areas that are challenged for infrastructure and may need to rely on wireless, or mixed technologies of fiber optics and wireless to deliver Internet services. In these special cases an eligible broadband service will support 25Mbps download speeds or better. Wireless technologies in these circumstances are fixed wireless transmission points to the home with either a fiber, fiber-coax hybrid or microwave backhaul. This is sometimes referred to as small cell technology, or fiber to the curb with wireless to the premise.

Broadband is increasingly becoming a required utility service for people of all ages, occupations and locations. The most common of appliances are becoming web enabled, communicating across the Internet 24x7. This proliferation of appliances and applications is what is being termed the “Internet of Things” (IoT) and industry experts tell us to expect an exponential growth in broadband services and bandwidth demand. The IoT devices often communicate using low bandwidth, but it is the cumulative demand that will place significant demand and required growth of broadband bandwidth to support these billions of devices.

The next generation of broadband technologies will deliver services using both fiber optics and wireless technologies. Wireless provides a more economical and larger coverage area than directly wiring homes and buildings with fiber optics. However, to increase wireless bandwidth requires shorter transmission distances and shrinking coverage areas, with backhaul of wireless data from tower/transmission sites across fiber optics to the Internet distribution centers across the world.

When planning for a community’s broadband infrastructure development there are a number of factors to consider and balance. You want to maximize access and performance while minimizing costs, but still achieve a level of satisfactory service. It is a challenge for the broadband providers to build infrastructure in areas where either adoption of services is low (i.e. impoverished areas), and/or out to areas where potential customer density is low (i.e. rural or remote areas).

There are two predominant broadband service providers in Erie County, Verizon and Spectrum, who offer broadband services to residential and small business customers. Verizon offers digital subscriber lines (DSL) services over their traditional copper plant and high order services across their fiber optic network service called FiOS™. FiOS™ offers plans ranging from 50Mbps to 500Mbps. Charter Communications merged with Time Warner Cable and is now called Spectrum. Spectrum offers cable modem service plans ranging from speeds of 15Mbps to 50Mbps. The only service in Erie County that meets the NYS Broadband definition of true broadband service of 100Mbps or more is FiOS™.

Residential and small businesses are primarily served by Verizon and Spectrum. Service levels vary, depending upon the infrastructure and services available in different parts of the County. Spectrum claims it has coverage for nearly all of Erie County with only small pockets of non-covered areas represented by the shaded census block areas.

For all areas outside FiOS™ coverage, Verizon only offers DSL services with plans ranging from 1Mbps to 7Mbps download speeds. Spectrum offers cable modem service for most of Erie County, offering plans between 15Mbps to 50Mbps. Again, the non-FiOS™ areas of the County do not currently meet the Governor’s definition of a true broadband service.

The broadband infrastructure is primarily focused on the larger commercial, corporate, and institutional organizations in downtown Buffalo and the metropolitan areas of Erie County. The combined infrastructure does bring choice and competition within the metro areas, as well as offer a number of high speed/high capacity services. The Infrastructure is less accessible for the City of Buffalo outside of the downtown business district, and noticeably drops off as you travel south and west of the City. Larger commercial, corporate, and institutional accounts have a wider selection of providers in addition to Verizon and Spectrum, and include competitive local exchange carriers (CLECs) such as AT&T, Level 3, Windstream, and Light Tower.

Another choice in the region is satellite service. Satellite based broadband service typically has a maximum download speed of less than 25Mbps, and satellite Internet services have data caps, similar to cellular data plans. Satellite transmission can also be affected by signal latency (delay) and heavy precipitation. The other caveat to satellite service in this part of the state is clear line of sight to the southwestern sky. HughesNET is the region’s predominant satellite Internet provider, and DishTV for television channels.

The NYS Broadband map, however, indicates that the majority of Erie County is served by at least one broadband provider. Spectrum has agreed to provide access to 145,000 new upstate NY homes or business units, with Erie County being one of six counties prioritized for this build out. Spectrum has also agreed to upgrading service plans to include two million homes or business units having access to 100Mbps service by the end of the first quarter 2017 for \$60/month.

Table 8 - Provider Plans, Service Levels and Monthly Costs

Service Provider	Service Plan	Cost/Month
Verizon DSL	1-3Mbps down (384K-768K upload)	\$29.99
Verizon DSL	3-7Mbps down (768K up)	\$39.99
Verizon DSL	7-15Mbps down (1mbs up)	\$39.99
Verizon FiOS™	50Mbps down/up	\$49.99
Verizon FiOS™	100Mbps down/up	\$59.99
Verizon FiOS™	150Mbps down/up	\$69.99
Verizon FiOS™	300Mbps down/up	\$169.99
Verizon FiOS™	500Mbps down/up	\$269.99
Spectrum Cable Modem	Up to 15Mbps down (2mbs up)	\$34.99
Spectrum Cable Modem	Up to 20Mbps down (5mbs up)	\$44.99
Spectrum Cable Modem	Up to 30Mbps down (5mbs up)	\$54.99
Spectrum Cable Modem	Up to 50Mbps down (5mbs up)	\$64.99
HughesNET Satellite	10Mbps down/1Mbps up, 5GB data cap	49.99
HughesNET Satellite	10Mbps down/1Mbps up, 10GB data cap	59.99
HughesNET Satellite	10Mbps down/2Mbps up, 15GB data cap	79.99
HughesNET Satellite	15Mbps down/2Mbps up, 20GB data cap	129.99

Market Demand Analysis

In effort to gauge both demand for broadband services and customer perception of existing services, ECC Technologies launched a website and coordinated with Erie County for an outreach program to obtain online survey data. The website is <https://eriecounty.crowdfiber.com>

The website was launched in November 2016 and will go offline at the end of March 2017. Approximately 2000 people have responded to the survey. A map depicting the locations of all respondents to date appears below.

Map has been removed.

Please contact Erie County to obtain a copy.

The online survey reports the following:

- 91% responded that they have Internet Service.
- Those who do not have service state: None Available (55%) or Too Expensive (27%)
- 71% with service are not satisfied with their service
- Of those with service, 55% are Spectrum and 27% are Verizon customers
- 28% have less than 25Mbps download speed (below FCC broadband standard)
- 31% have speeds between 25Mbps and 50Mbps
- 13% have speeds in excess of 50Mbps (Verizon FiOS™ Customers)
- 48% have only one provider choice (15% don't know how many are available)
- 53% of respondents with school age children have difficulty with homework or school projects due to no or slow Internet access

The survey provided for general comments, while anecdotal, the comments broadly fell into categories of:

- No service available, or limited to slow service options (DSL, Satellite)
- Lack of choice
- Slow service speeds
- Speeds less than advertised
- Too expensive
- Desire FiOS™ -like service

SWOT Analysis - Strengths/Weaknesses/Opportunities/Threats

Strengths

Erie County has a large amount of telecommunications infrastructure within the more populated areas of the County. For the most part, the business areas of the County have broadband access.

In terms of providers and competition, there is one incumbent local exchange carrier (ILEC), one cable TV provider, six competitive local exchange carriers (CLEC), and four fiber based providers identified that have built or leased infrastructure. Additionally, one Wireless Internet Service Provider and four cellular service providers were identified.

From an infrastructure standpoint, there are 30 central offices providing service to residents and businesses. There are 102 wireless towers, with the majority of these located in close proximity to developed areas and the major transportation corridors. In addition, there are miles of fiber infrastructure installed along the major transportation corridors linking towns and communities.

The study found that infrastructure supporting broadband access in the County, primarily DSL and cable Internet, is available in the populated areas and some of the rural areas. DSL based service is available to businesses and residents located close enough (within three miles) to the local incumbent telephone company central offices or remote terminals, which can extend DSL service.

Additionally, Verizon offers FIOS™ service, a fiber-to-the-home (FTTH) Internet service, in some of the more populated northern suburban areas of the County. Verizon has no expressed plans of expanding its FIOS™ service into the City of Buffalo or to other towns and villages.

From a Wireless Internet Service Provider standpoint, Transwave covers a large portion of the County and is interested in potential future expansion for business, commercial and institutional customers.

The City of Buffalo has the greatest density of telecommunications services and competition in the County. Verizon, Lighttower, FLTG, Level 3, and Time Warner Cable (Charter Spectrum) are the major owners of telecommunications and cable TV infrastructure, respectively.

Weaknesses

Although businesses in the County have access to competitive broadband service they are limited in terms of costs, speeds, and potential access to diverse fiber infrastructure. The more rural areas have severely limited access. In this regard, Erie County is not unlike many other counties across the State and nation. The telecommunications study found that the vast majority of existing fiber infrastructure in Erie County is owned by some of the CLECs.

Since these are private organizations that have fixed capital infrastructure development plans and quarterly/yearly revenue goals, new infrastructure is constructed primarily in the more densely populated areas. Therefore, these organizations will place fiber in areas that can provide them with a quick return on investment (ROI), typically within two to three years. Since many of the areas in Erie County do not fit into this ROI model, there are areas outside of Buffalo and more populated suburbs that are lacking. Additionally, there is fiber in the metro areas that is unusable to get to specific locations in Buffalo because the provider is using it for long-haul transport only, to get their data traffic from one major metropolitan area to another.

There is also a lack of fiber in the outlying areas of Erie County, most notably in the southern and eastern areas of the County. DSL service may be available to residences and businesses in these areas, depending on how far they are located from the CO. However, in January 2015 the FCC changed the definition of broadband to 25Mbps (down)/3Mbps (up) and as a result DSL service is no longer considered to be broadband. These areas that have DSL only available are considered underserved.

Satellite Internet/TV services are nearly universally available, however heavy precipitation can affect performance, and data transmissions traversing to orbiting satellites can introduce latency and degrade performance. Satellite providers typically cap data plans that may also result in interruptions or adversely affect service.

Opportunities

As part of the Charter-Time Warner Cable merger agreement, Charter Spectrum committed to providing service to 145,000 new homes and businesses in New York State that previously had no access to broadband services. Erie County has been designated as one of six priority counties in the state that will receive a portion of the 145,000 homes. The NYS Broadband Program Office also announced that the new named Charter Spectrum will have 100Mbps Internet service availability to two million upstate NY customers in early 2017.

Erie County also has a significant amount of municipally owned fiber optic infrastructure controlled by NYSDOT, University at Buffalo, and the NFTA. These organizations have been supportive of municipal broadband infrastructure collaboration projects. In many segments of their infrastructure there exists excess fiber capacity that could potentially support other municipal and community needs.

5G wireless and fix wireless technologies will continue to develop and be deployed. This will require a mix technology infrastructure development of fiber optic backbones, cell towers, and small cell deployments. PC world magazine had the following excerpt in its June 21, 2016 article "What is 5G," which can be read in its entirety at <http://www.pcmag.com/article/345387/what-is-5g>:

AT&T, for instance, has talked to me about potentially using 5G to replace its old DSL offerings, letting the company deliver a "quad play" of DirecTV TV service, 5G home Internet, wireless phone, and home phone. Verizon says "[fixed wireless](#)," meaning home Internet, will be its first 5G application.

5G Might Be For Cities

Another aspect of 5G is that it will connect many more devices. Right now, 4G modules are expensive, power-consuming, and demand complicated service plans, so much of the Internet of Things has stuck with either Wi-Fi and other home technologies for consumers, or 2G for businesses. 5G networks will accept small, inexpensive, low-power devices, so they'll connect a lot of smaller objects and different kinds of ambient sensors to the Internet.

Threats

There is a large amount of provider choice for telecommunications and Internet service within the downtown and metropolitan business community, but the service providers' infrastructure dissipates as it extends southward and eastward toward the County's more rural communities. The residential community has only two true broadband choices at this time: Verizon FiOS™ or Charter Spectrum. DSL and satellite services will not keep up with long term residential demand for greater bandwidth.

Residential provider choice is not likely to improve given that Charter has already negotiated its expansion commitment to New York State. Verizon is not developing new wired or fiber optic infrastructure in Western New York, nor does it intend to expand its FiOS™ service. The Verizon copper infrastructure continues to age, with no significant new builds planned. Verizon Wireless is prioritizing its wireless infrastructure investment, and as previously stated, wireless technology plays a key role in broadband services, but fiber backhaul of tower traffic is essential to keep paced with ever growing cellular demand.

Cellular 4G LTE, advanced, and emerging 5G technologies will offer faster mobile and wireless communication. However, this will require a significant increase in the number of cell towers and/or smaller transmitters networked between high rises, water towers, light and utility poles, adding new challenges to zoning and permitting ordinances and regulations.

GAP Analysis

Broadband service levels to support Erie County residents need to provide at least a 25Mbps (down/up) service plan, and ideally 50-100Mbps or more. A four-person household could easily have four or more devices requiring Internet access (smart phones, computers/laptops, tablets, smart TVs, etc.). More affluent households could have eight or more devices. The Internet of Things will compound the number of devices to include appliances, HVAC systems, security, et. al., all looking for bandwidth off the home's Internet service.

Verizon's FiOS™ website suggests a 50-100Mbps service for up to 1-7 devices, with 150-550Mbps for 8 devices or more. Historically, bandwidth requirements have been doubling in five years or less, and at an increasing rate.

The only infrastructures available currently to support 100Mbps or better service is Spectrum's hybrid fiber/coax and Verizon's fiber optic FiOS™ cable plant. Verizon has no plans to expand FiOS™ coverage in Erie County, and is prioritizing their investment into their wireless infrastructure.

Spectrum has an agreement with NYS to provide access to 145,000 new units and 100Mbps service to two million new homes and business in upstate NY, which should benefit the residents of Erie County. However, at this time no information has been provided as to where these new units are located.

5G wireless service also has potential to improve access and performance, but 5G is likely to require ten times or more the number of tower sites, and/or the proliferation of small cell transmitters on utility poles, light poles, buildings, etc. The cellular 4G/5G wireless service still requires fiber optic to backhaul our community's and neighborhood communications.

The essential infrastructure missing is a competitive choice of fiber optic service provider(s) to our city, town, and village neighborhoods, besides Verizon FiOS™. There is a fair amount of fiber optic cabling supporting the larger businesses of metropolitan Buffalo, but these providers either do not target residential or small business, or price their fiber optic services such that they are prohibitively expensive to residential users or small business.

This lack of infrastructure is only going to become more apparent as the number of devices requiring Internet access and bandwidth continue to increase in all aspects of our lives.

V New York State Broadband Program

The NYS Broadband Program Office provides a single point of contact for statewide broadband issues. Its goal is to ensure every New Yorker has access to affordable high-speed Internet service. The NYS BPO website can be found at: <http://nysbroadband.ny.gov/program-office>.

The NYS BPO has a broadband goal of widely available Internet service that can download content at a minimum bandwidth of 100 megabits/second (Mbps). In order to realize broadband speeds of 100Mbps or more requires either a fiber optic infrastructure or a hybrid fiber/coaxial cable infrastructure, typically provided by the incumbent cable TV provider. Higher order broadband services of 1 Gigabit (1000Mbps) or more require fiber to the home (FTTH) or fiber to the premise (FTTP). An example of this is Verizon's FiOS™ service.

In remote, difficult to serve rural areas of the State, the bandwidth goals have been relaxed to include services with 25Mbps download speed. Wireless technologies in these circumstances are fixed wireless transmission points to the home with either a fiber, fiber-coax hybrid, or microwave backhaul. This is sometimes referred to as small cell technology, or fiber to the curb with wireless to the premise.

The NYS BPO goal is to promote and incentivize broadband infrastructure development so that each resident or business in New York state has at least one viable broadband service provider. Until that goal is met, they are not prioritizing areas of the State that may be seeking more choice and competition between broadband providers.

NYS BPO Phase 1 Grants

Phase 1 grants of the NYS BPO were accepted between March 1st – April 15th, 2016, with grant awards announced on August 3, 2016. Eligible service areas were restricted to census tracts with no Time Warner Cable TV service, which made the overwhelming majority of Erie County ineligible. This statement needs to be understood in the context that NYS and the FCC determine that a census block is served by a broadband provider if only one or more customers are served within the census block.

NYS negotiated the Time Warner Cable (TWC) and Charter cable companies' merger into Charter Spectrum and required that Charter Spectrum would provide new 100Mbps or better service to 145,000 households and business in unserved areas of the State for no more than \$60/month.

The BPO awarded \$46 million in Phase 1 grants out of the total \$500 million program. According to the BPO, at the completion of Round 1 projects, 97% of New York State will have access to broadband services.

There were no direct Phase 1 grant awards made to Erie County, but Erie was one of six counties to be prioritized for the 145,000 households. The BPO has not declared how many of the 145,000 household/business units will be in Erie County. The BPO did state at the September 20, 2016 presentation at UB's Center for Tomorrow that the Erie County units are a year 1 (2017) priority build.

The other result of the NYS and TWC/Charter merger negotiations is that two million Upstate homes/businesses will have 100Mbps or better service available as early as Q1 2017. While not advertised by Spectrum at the time of this report, Spectrum's WNY Government Affairs Office did confirm that 100Mbps service plan is now available to Erie County customers, as well as customers across New York State.

NYS BPO Phase 2 Grants

Round 2 grants were announced on August 3, 2016 with applications due by November 30, 2016. The criteria for a Phase 2 grant were:

- Application must serve 250 or more unserved or underserved households/business (units).
- Application must provide a broadband Internet service with 100Mbps download speed for no more than \$60/month.
- If no Application for a region can provide 100Mbps service, then a 25Mbps minimum download speed would be acceptable.
- 50% local match is the targeted goal, but applications will be considered for 20% local match.
- Priority will be given to applications for unserved units, libraries, and Educational Opportunity Centers.

If there are competing grants for a given area, then a reverse auction is used to evaluate and award to the highest level of service for the lowest cost.

The BPO provided the following information regarding unserved and underserved units in Erie County that are eligible for Phase 2 grants:

691 – Unserved Units

0 – Underserved Units

255 – Additional Service Units

946 Potential Eligible Phase 2 units within Erie County

Erie County has approximately 381,000 households, so Phase 2 eligibility represents less than 0.3% of total households. One reason cited by the BPO for such a low number of Phase 2 eligible units is that they have subtracted off the number of units identified by TWC/Charter (Charter Spectrum) that are to be built out in 2017 as part of the merger agreement with New York State. Again, at the date of this report, the number of Erie County units to be built out has not been disclosed, only that they are included in the agreed to 145,000 Statewide units.

Phase 2 Awards

NYS BPO announced 26 awards for Phase 2 totaling nearly \$212 million in grants, covering 10,378 census blocks and 89,411 household or business units. Armstrong Telecommunications was awarded a statewide grant, which includes only eight census blocks for Erie County, for 24 units.

On the following page is a map indicating the census tracks that contain the eligible census blocks (highlighted as green or purple).

Map has been removed.

Please contact Erie County to obtain a copy.

As the BPO map indicates, there are only pockets of eligible units throughout the County. As an example, all the eligible units for the Town of Grand Island only equal 22. There are fewer than 30 units for the entire City of Buffalo. The lack of any significant cluster of eligible units make it infeasible for a broadband provider to submit a viable application, even for the minimum goal of 250 eligible units.

The NYS BPO has been clear that Phase 2 grants are targeted to the highly unserved areas of the State, including the Southern Tier, North Country, Adirondacks, Catskills, and Hudson Valley. Erie County, in conversations with the BPO, is relatively well served by comparison, and the BPO feels that the aforementioned TWC/Charter merger agreement is what will be beneficial to Buffalo and Erie County.

ECC Technologies does not see a viable project for a Phase 2 application. Rather, our recommendation is that the County focus its efforts on strategic economic development zones as well as exploring collaboration with municipal, educational, and public-private partnerships for community broadband development.

We believe that by focusing the County's broadband efforts on defining strengths and weakness of economic development sites across the County we can position the County to better attract corporations seeking to expand or relocate to sites within the County that have strong broadband access, all the while working behind the scenes to strengthen those that do not. During this process, it is likely the need for additional broadband infrastructure will be defined to select areas of the County. This may also potentially serve to close the gaps in residential areas where broadband availability is lacking.

VI Public-Private Partnerships

This study task identifies and evaluates the potential roles that public and private organizations can play to develop broadband infrastructure and services within Erie County, and how can these organizations align and collaborate together to accomplish each organizations' goals. Also included are case studies of public-private partnerships (PPPs) developed in New York and elsewhere in the United States that have impacted community broadband infrastructure development.

Public Organizations

Public and private organizations both contribute significantly to a region's infrastructure development. Public organizations can be broadband consumers and/or broadband providers. State and municipal governments represent a large market for broadband providers to deliver communications to interconnect their facilities and agencies and to provide Internet and telecommunication services, as do our primary and secondary schools, higher education institutions, and healthcare organizations.

Public organizations that provide broadband infrastructure, in almost all cases, do so for other public organizations. Examples in Erie County are:

New York State Thruway Authority (NYSTA)

NYSTA (I-90) provides right-of-way to many of the Interstate telecom carriers for their conduit and fiber. Carriers providing services to the WNY region connect to point of presence (PoP) facilities (often major LEC and CLEC central offices) or the carrier hotels in Downtown Buffalo. Carrier hotel refers to the facilities at 350 Main Street and 325 Delaware Avenue that houses major data centers where most all the carriers co-locate their services for interconnections to other carriers, or distribution to local infrastructures to area business, institutions, and residences.

New York State negotiated that these carriers provide conduit and fiber along the NYSTA for State operations. However, this fiber is fully utilized for State purposes. There is a portal in Erie County for local and state government agencies to access the NYS fiber network, called NYeNET at the Erie County Office Building.

New York State Department of Transportation (NYSDOT)

NYSDOT Region 5 is responsible for 3,876 miles of State highways and roads within the four counties of Cattaraugus, Chautauqua, Erie, and Niagara. The first and foremost broadband infrastructure that NYSDOT has to offer the region is Right-of-Way. These State roads, highways, and bridges interconnect all our villages, towns, and cities and provide valuable potential Right-of-Way for broadband conduit and duct banks.

NYSDOT provides ROW to broadband, telecom, and cellular providers, as well as other State and municipal agencies. As stated in our Task 1 – Infrastructure Overview Report, NYSDOT provides fiber and/or conduit for University at Buffalo, NFTA, NIITEC, and municipal agencies.

State University of New York (SUNY) University at Buffalo

University at Buffalo (UB) has fiber optic cabling connecting the North Campus to the South Campus. Then, through negotiations with NFTA, UB placed fiber in the NFTA subway tunnel under Main Street to extend the University's network to the downtown medical campus, as well as connecting to the downtown Buffalo "carrier hotel", where all the major interstate telecom and Internet providers have colocation facilities.

Since 2003 UB has expanded their infrastructure, with the support of NYSDOT, to reach Buffalo State College, Daemen College, additional healthcare institutions, and redundant and diverse connections for network resiliency. The University continues to extend their fiber optic network and works cooperatively and collaboratively with local partners.

Niagara Frontier Transportation Authority (NFTA)

The NFTA operates the bus and light rapid rail transit service for Niagara and Erie counties, as well as the operations of the Buffalo Niagara International Airport, and Niagara Falls International Airport. NFTA, at the time of the original subway construction, installed a communications duct bank throughout its light rail tunnel and rail Right-of-Way, with a limited number of fiber optics supporting rail communications. In 2003 NFTA obtain additional fiber optic capacity when providing UB with access to spare tunnel conduit. The NFTA fiber optic backbone extends from the University Station to its Operations Control Center (OCC), as well as to its Yards and Shops facilities in Downtown Buffalo.

NYSDOT supports the NFTA with spare fiber optic capacity assigned to the NFTA to connect the Buffalo Niagara International Airport and the Niagara Falls International Bus Station back to its OCC data center. The OCC data center has fiber aggregation facilities for NYSDOT, NFTA, and NIITEC networks.

Niagara International Transportation Technology Coalition (NITTEC)

NITTEC is a coalition of agencies providing real-time traffic and roadway information to improve traffic flows, and enhance emergency assistance for motorists using the transportation system. NITTEC operates a Traffic Operations Center (TOC) 24 hours a day, 7 days a week that monitors traffic and informs the public, as well as the member agencies, stakeholders, and first responders, about traffic situations. The TOC is collocated at the NFTA's Operations Control Center.

NIITEC utilizes a mix of carrier based and municipal broadband infrastructure for their network operations, including NYSTA and NYSDOT fiber optics.

Municipal Networks

Village, Town, City, and County governments all require broadband infrastructure and services. While there is some municipally owned fiber, the majority of these networks are leased services from broadband carriers. There is County owned fiber between the Public Safety facility on 45 Elm Street back to the Rath Building.

The City holds franchise agreements with several telecom carriers for conduit access and has some private network infrastructure using Fire Department conduit. There is a fiber ring around Niagara Square interconnecting City Hall with its downtown police, fire, and court buildings.

The Town of Amherst has its own municipally owned fiber partnering with the Sweet Home School District and leveraging UB fiber. The Town of Grand Island is investigating a similar municipal fiber plan for its Town and school facilities.

Public Schools & Libraries

Every public-school district requires network infrastructure to interconnect their schools and facilities for high speed network and Internet services. Districts centrally located on a single campus have an easier time as they control their Right-of-Way for their own private infrastructure development.

Typically, the case is that school district buildings are distributed throughout the community and require a broadband provider to lease services to the district for their networks. The predominant providers are Charter Spectrum (Time Warner Cable) or Lightower (FiberTech) in Erie County.

School districts fund these networks through the Universal Service Administration Company (USAC), a not-for-profit company that manages more than \$10 billion of FCC's Universal Service Fund. These funds are used to provide broadband and Internet services to schools, libraries, and rural health care organizations. The Schools and Libraries Division (SLD) program is commonly known as E-rate. A school's E-rate discount is determined by its school lunch participation. The higher the participation, the higher the discount, where impoverished urban or rural schools can be as high as 90% or more off their recurring broadband connection and Internet charges.

BOCES often administers the E-rate program for their component districts and further discount these services through their Network Cooperative Services (COSER) Agreement, making broadband services highly affordable. Public libraries are also eligible for E-rate discounts for both Internet services direct to a public library and any broadband services interconnecting a regional network of libraries.

Private Organizations

Private organizations include broadband providers, electric utilities, major employers, businesses, and residential users. The broadband providers obviously provide the services to businesses and residential users. The telephone and electrical utilities control the access to utilities poles for aerial fiber optic cables and conduit for buried infrastructure.

The Task 1 – Infrastructure Overview Report identifies the major broadband providers operating in Erie County. The large and medium scale businesses are targeted by these carriers for higher order telecom, broadband, and Internet services.

Charter Spectrum, formerly Time Warner Cable, is the predominant provider of Internet services for smaller business and residential users, with the exception of those areas in the northern and eastern suburbs that have Verizon FiOS™ service. The more remote areas of the County, outside village limits, have an increasingly limited mix of broadband choices of cable TV, DSL, satellite, and/or cellular services depending upon coverage and availability.

Public-Private Roles

Public organizations play a significant role in private broadband infrastructure through the use of:

Right-of-Way access to broadband conduit via:

- Streets, roads, highways, railways, bridges, and tunnels
- Water and waste lines
- Vertical assets such as Public Safety towers, water towers, high rise buildings

- **Overbuild capacity in anticipation of collaboration** – If public works projects result in opening the ground for utilities, streets/roads, bridges, etc., improvement projects, place additional conduit for broadband, or if the project includes broadband infrastructure, include additional conduit and fiber strand counts to cables to accommodate future requirements and collaboration opportunities.
- **Include broadband in permitting process** – The City of Rochester, NY added as a requirement to any permit requesting buried conduit to include, at a minimum, a 1.25” inner duct and pull rope within a conduit for future access and use by the City for its broadband infrastructure. Over time this has resulted in over a hundred miles of spare duct available for the City’s use.

Similarly, when approving zoning and/or permits for cell towers, negotiate access for public safety and municipal communications. Likewise, when negotiating cable TV franchise agreements, leverage for incentivizing those providers to build out infrastructure that aligns with community goals. The most recent example of this type of negotiation is when the State leveraged their approval of the Charter merger with Time Warner Cable, to include access to 145,000 new homes and business, and provide 100Mbps or better service to two million upstate customers.

- **Develop relationships and communications** – The County CIO, Public Works Commissioner, and EIDA Director should maintain and develop relationships with their peers and counterparts in other municipal and State agencies and authorities to alert each other of broadband improvement opportunities. Communicate when and where public work projects may have broadband development and/or collaboration opportunities. A very good example of this was back in the early 2000s when the University at Buffalo reached out to several agencies to explore collaboration before UB committed to final design and installation of its initial fiber optic backbone routes. This informal “consortia” continued to meet periodically over the following decade and identified broadband collaboration projects involving NYSDOT, NFTA, towns, colleges, and hospitals.
- **Understand broadband private sector objectives** – The private sector broadband provider bases infrastructure decisions accordingly to their best interests. Expanding infrastructure and/or services is typically reviewed on a 1- to 3-year return on investment horizon. Building out fiber optic cabling into new areas requires a realistic “take rate” of new customers of at least 10-15 customers per fiber mile. Occasionally the private sector may look at a longer 5-year investment horizon if there is a long-term contract (5+ years) as an incentive.

The public sector has the advantage when looking at infrastructure investment horizon of ten, twenty, or more years to recover capital costs. Capital and operating financial models evaluate investment on a not-for-profit basis, as well as considering what is in the best interest of the “public good.”

- **Build off this broadband study** – Maintain the GIS database to include future broadband infrastructure improvements. Periodically reach out to the private broadband providers and review goals and project objectives to determine if private sector providers can provide solutions. An example is the 29 EIDA focus sites included with this Study. Each site wants to promote these sites to developers and site selectors. The developers and site selectors will want to know in addition to the traditional utilities and infrastructure what the availability is of the broadband infrastructure and services to these sites.

Public-Private Partnerships - Case Studies

The following case studies are presented to review how other regions and communities have approached broadband development. Each case has its own unique case of goals and circumstances, with varying degrees of success.

A public-private partnership (PPP) can be defined as a contractual agreement between a public agency and a private sector organization. Typically, the arrangement uses resources from both entities and delivers a service for public use. Infrastructure projects are a popular form of PPPs. Internet and broadband projects are gaining in popularity amongst PPPs.

According to the National Telecommunications and Information Administration (NTIA), there are three basic types of PPPs related to broadband projects.⁽²⁾

1. Private Sector Led – This is a partnership where a commercial operator builds, owns and operates the network. The operator can be either a private company or a not-for-profit company. Community anchor institutions and economic development agencies support the business case by contributing planning, monetary, and regulatory support, and by aggregating demand and securing customer commitments in advance.

This type of PPP is typical of Open Access Networks. There are two models of this type that are operating successfully in New York State. An overview of the projects is highlighted below.

Southern Tier Network

The Southern Tier Network (STN) is a not-for-profit local development corporation based in Corning, New York. STN owns and operates a 280-mile Open Access dark fiber backbone throughout the three counties of New York State’s Southern Tier: Steuben, Chemung, and Schuyler. STN was created as a result of the need to create a foundation to support broadband expansion, quality of life improvements for citizens, and foster economic development opportunities.

The STN is a highly successful example of a public-private collaboration to expand broadband into rural communities, serving public safety, healthcare, education, energy delivery, and commercial and residential broadband needs. The partnership includes private funding of \$9.7 million by Corning Incorporated and public funding of \$2.2 million from Steuben, Schuyler, and Chemung Counties with an additional \$6.5 million investment from industries and broadband providers across the region. The leadership of the STN board is made up of an amalgamation of public and private representation from the region, including government, public safety, education, healthcare, and manufacturing.

Construction began on the 280-mile fiber optic network in the summer of 2012. It was anticipated that the network would become sustainable within five years of operation. The STN has surpassed its original goals by partnering with many different entities in the region. Among them are nearly a dozen service providers supporting the broadband, cellular, and utilities industries. The partnerships established have enabled the STN to bring 4G service to rural areas that had no broadband or cellular coverage prior to its inception. To date the STN has established a foundation enabling public-private collaboration for more than 100 diverse entities across the region, including but not limited to colleges, universities, k-12, hospitals, medical centers, government, the business community, and broadband providers.

(2) http://www2.ntia.doc.gov/files/ntia_ppp_010515.pdf

The establishment of the Southern Tier Network has resulted in the following benefits in the communities of Steuben, Schuyler, and Chemung Counties:

- The STN serves as the foundation supporting collaborative Next Generation public safety programs being developed by Schuyler, Chemung, and Steuben Counties and serves as the critical link for a potential 11 county program encompassing the Finger Lakes region. Reliability of Public Safety is being enhanced with operating cost reductions being realized.
- Communications between County facilities have been improved with reduction in operating costs.
- The school districts of the area have seen a dramatic reduction in costs with a major increase in bandwidth capabilities.
- Healthcare providers are leveraging the STN network to improve health care delivery, electronic data record keeping, and reduction in healthcare operating costs.
- Telecommunications carriers have expanded services in the rural parts of the community.
- 4G broadband services have been deployed via wireless carriers using the STN fiber.
- STN has generated over \$12 million in private investment within the community as a direct result of the Open Access Network. Continued expansion by carriers and enterprise entities will continue to generate the revenues needed to offset operating costs.

The STN has been so successful that it recently completed the expansion of another 68 miles of backbone fiber in Yates County and the expansion of another 140 miles into four additional counties of Allegheny, Tioga, Tompkins, and Broome, with construction started in September 2016. Both of these expansions are made possible through a combination of NYS ESD grants and private investment.

Access Ontario

Access Ontario (AO) was founded on October 25, 2005 and operates a 200+ mile dark fiber network with over 16,000 fiber strand miles of fiber-optic cable available for lease. The corporation is certified by the New York State Public Service Commission as a “Common Carrier” (i.e., Phone Company). AO directly serves business-to-business users who use their fiber infrastructure to maximize cost savings, security, control, and reliability through diversity.

AO’s dark fiber is being used to reliably deliver critical voice and data services to over 100 locations in the Finger Lakes region. The fiber ring was constructed in less than three years. Originally planned to be 180 miles when it was first conceived, the fiber ring is more than 200 miles long and runs throughout Ontario County. The fiber ring was also completed under budget and with no federal or state funding. Initial budget expectations were \$7.5 million, but the ring’s final costs were in the \$5.5 million range, saving roughly \$2 million. A lease agreement with Ontario Telephone Co., an incumbent local exchange carrier (ILEC), was pivotal in allowing the fiber ring to come in under budget. Access Ontario has signed master agreements with several telecom and broadband companies, including Verizon Wireless and national broadband provider TW Telecom. Access Ontario is in continual discussions with other service providers.

Access Ontario has been successful in attaining its goal of increased broadband choice with competitive pricing, and currently is cash positive due to long term contracts paid in advance. The local development corporation is nearly at sustainable operating revenues, but new revenue sources are still needed to ensure long term sustainability.

2. A second type of PPP according to the NTIA is Government led and private supported. – In this type of arrangement, a public entity such as a county government, a rural co-op or a municipal electric company owns the network, and private partners construct, operate, and maintain the network in exchange for financial support, as well as contributions described in the private sector-led model.

Two arrangements of this type are described below.

North Georgia Network

The North Georgia Network was set up as a non-profit organization with a board of directors composed of public and private investors. It received \$33 million in federal funding in 2010 under the Broadband Technology Opportunities Program, and secured \$9 million in local funding to provide the necessary grant match.

The major contributors for the local funding were the State of Georgia with \$2.5 million, the University of North Georgia with \$1 million, and two local rural electric companies with \$3.4 million. The governing board was set up as a cooperative with three initial members, the two rural electric companies representing the private interest, and a third member representing the State, county, and university public interest.

The North Georgia Network non-profit received a total of \$42 million and built 1,100 miles of fiber optic network across eight counties. The majority of the construction was in the rural electric company territories, which built connections to their electric members. The goals of the project, set forth by the federal government, were to build a fiber optic network to community anchors to include schools, hospitals, libraries, local governments, public safety and other critical-to-the-public facilities. The project also allowed builds to commercial centers and some residential areas after the community anchor goals were satisfied.

The project had an advantage in that the rural electric companies (the private partners) had some previous experience in building fiber to large electric customers. They had the know-how and construction capability to design and build fiber on their own power poles. They also had the marketing ability to sell the connections and the new Internet service offered by the North Georgia Network. The companies also funded the shortfalls of the operation of the new network for three years until the network acquired enough customers to break even. The customer-members of these rural electric companies benefitted from this new, affordable service and the electric companies took ownership of the risks of operating a new network.

The public partners facilitated the complicated and highly-regulated public funding side. They viewed the project as a long-term infrastructure improvement that would facilitate better education, health, and economic development, and make rural communities more competitive and livable.

The rural electric companies continued to make investments in fiber connections to serve their members, which grew the network and sustained its independent operations. The public involvement allows the non-profit network to continue to apply for grants for expansion. The continuing public participation on the board of directors also maintains the emphasis on the public good and supports education, health, public services and economic development. The non-profit status of the North Georgia Network keeps its focus on affordability of Internet service, quality of customer service, and local presence. These generally distinguish the company from private Internet service providers who do not have the local relationship with their customers.

Fibernet, Monticello, MN – from Successful Strategies for a Public Private Partnership by Patrick Lucey & Christopher Mitchell

Monticello is a small community with a population of 12,000 residents located 40 miles northwest of Minneapolis. Frustrated with the limited services offered by incumbent phone and cable companies, Monticello decided to invest in its own fiber-optic network in 2008. The local government would own the infrastructure, but sought a private sector partner that would offer retail services to local residents and businesses. Monticello selected Hiawatha Broadband Communications (HBC), a very successful and well-liked competitive firm serving nearby communities.

The network had to face many challenges beyond its control, most notably the aggressive response of incumbent telephone and cable companies. The telephone company TDS sued to stop the project before it even finished securing its financing. While that lawsuit was eventually thrown out, it still created a full year of project delays, during which TDS improved its dismal DSL service to a FTTH offering. Monticello next faced apparently predatory pricing from the incumbent cable television company, Charter. Charter went door-to-door, dropping the price for its top TV and Internet access bundle from \$145/month to \$60/month guaranteed for two years. It's unlikely that Charter could recoup its costs in Monticello from the lowered rate. Industry experts estimate that Charter was losing at least \$20 per subscriber per month on the deal. It's speculated that they were able to absorb the loss due to the large number of areas where they have no competition and higher profits. As a result of Charter's price drop, Monticello's subscriber growth plateaued, causing Monticello and HBC to sever their partnership.

Monticello ultimately decided to run the project in-house and many investors lost money on the project. Monticello's experience was certainly a disappointment to those that wanted to see a competitive option without using any subsidies from the local government. However, both businesses and residents have gone from some of the worst connectivity in the upper Midwest to some of the best, and at some of the lowest prices available in this industry. A major lesson from Monticello is that these partnerships may be subjected to the most stressful pressures imaginable in this business. Competitive rivals will seek to exploit any weakness in a desire to preserve their market power. Partnerships have to survive hard times as well as good.

3. The third type of PPP is a joint-ownership model. – This is an arrangement where a commercial operator, either private or non-profit, and the public enterprise jointly invest in the network and share capacity. Both partners also contribute a mix of financial, in-kind and other support to the project. An example of this type of partnership is detailed below.

Case Study: Scott County, MN – Joint Public-Private Investment Approach Overview ⁽³⁾

Scott County, Minnesota began assessing its options for building a broadband network after observing a neighboring county reap financial benefits from its municipally owned network. It determined that the annual interest and principal payments on a bond, which could fund a fiber ring, would be lower than the annual charges for using slower, copper-based leased lines. To implement this vision, the County entered into a collaborative partnership with commercial providers and the State of Minnesota. In 2007, Scott County developed its 90-mile ring for \$3.3 million and expanded the network to 11 adjacent counties.

(3) <http://ilsr.org/wp-content/uploads/2014/04/mn-bb-policy-brief-01.pdf>

The network connects all County-owned facilities, including schools, libraries, city halls, police and fire departments, and public safety towers. It also interconnects with the State's high capacity backbone and with multiple private providers. Scott County saw significant benefits as a result of this investment. Schools tripled their broadband capacity for 35 percent of what they previously paid, and fiber has helped to attract and retain businesses, driving the County's economic development.

Business Model: Scott County provided the upfront deployment costs and owns the fiber network. It partnered with three commercial middle-mile network providers to maintain and manage the network because it lacked the capacity and experience to do so by itself. The commercial providers maintain the network at no charge to Scott County in exchange for including their own fiber strands in the buried conduit—a significant construction-cost saving. Scott County also partnered with the State of Minnesota's Office of Enterprise Technology (OET) to operate the network and provide services to its own facilities and schools. The OET provides these services at no charge in exchange for fiber capacity across connected counties in which the state network serves government and community enterprises. OET found that the cost of operating its total network would be less than its cost for leased lines.

Scott County's fiber network has helped create more than 1,000 jobs and tremendously improved access in area schools. In Sibley County and part of Renville, cities and townships joined together to help launch a new cooperative, RS Fiber, which shows tremendous promise. Cooperatives, which are effectively community-owned as well, offer some of the best connectivity in rural regions of the state.

VII Recommendations

There are a number of options that the County can undertake to improve broadband infrastructure within the County. These options range from low investment, low risk broadband policy development to increasing levels of investment and risk for public infrastructure development.

1. County Broadband Committee

The Broadband Committee should continue to meet, perhaps on a quarterly or semi-annual basis, to review County broadband goals and objectives. The committee meetings are a mechanism to foster inter-department communication of broadband requirements and opportunities, and offer input and consultation to the County leadership in regards to broadband policy. Committee members may periodically meet or communicate with broadband providers to alert them of County or community objectives and review any potential private-public partnerships. As an example, the County could review broadband needs for its IDA focus sites to encourage private carriers to provide infrastructure and services to targeted sites.

The GIS group within the County Department of Environment and Planning should be responsible for maintaining and updating the broadband GIS database and mapping as new information is gathered or updated.

2. Community Collaboration

Similar to the County's Broadband Committee, the County should continue to communicate with its municipal and community partners to identify opportunities for broadband collaboration. Today, this is an informal consortium of municipal partners that meets infrequently, if at all. The County may want to formalize this consortium and take a leadership role in convening an annual meeting to review opportunities and goals.

A potential first collaborative project might be to engage County IS, City IS, and the University at Buffalo's Computing Center to investigate feasibility of a "shared" fiber optic service into the telecom carriers' hotel at 350 Main St. UB has fiber optic service to 350 Main, and may have excess capacity that could be leveraged for municipal access. The project goal would be to provide direct access to the region's major Internet, telecom and broadband services at the carrier hotel, thereby providing greater choice, competition and reduced costs. The County and City data centers are in close proximity to each other, as is the Central Library, NFTA and NIITEC. The County, Downtown ECC Campus, UB, NFTA and NIITEC all have access to UB and NYSDOT fiber at the NFTA Operations Control Center (OCC) at 93 Oak St. Such a project would establish collaborative relationships, potentially inter-municipal agreements and open dialog for future projects.

Another initiative would be to start the dialog between towns and schools for a shared municipal backbone. The Town of Amherst and Sweet Home CSD are examples, and the Town of Grand Island and the Grand Island CSD are currently evaluating municipal fiber options.

3. Dig Once Policy

County and other local governments should adopt a "dig once" policy requiring the installation of municipal conduit or duct whenever a private or public works project opens up the earth along public Right-of-Way. Over time this has the potential of creating pathway for broadband infrastructure whenever street, water, sewer, lighting, and/or telecom projects can provide pathway for conduit burial.

For highly congested and/or expensive areas, such as downtown areas, bridges, rail crossing, interstate/highway crossings, etc., multiple communications conduit or a duct bank should be installed to minimize future pathway construction and disruptions. Whether a public or a private project, notify all potential public-private providers to coordinate and construct conduit infrastructure with appropriate capacity and cost sharing.

The broadband committee and/or the larger community broadband consortium could review policies and procedures to align permitting, zoning, and franchise agreements for a more consistent and uniform approach to foster broadband infrastructure development across all levels of government. As an example, building permits could include the requirement of a shared broadband/telecom conduit with sufficient capacity for existing and future providers. In many cases, there are separate conduits for telephone vs. cable TV, each minimally sized for the incumbent providers' needs. A more cost effective and efficient requirement would be a 4" or 5" conduit with a minimum of four inner-ducts, from the building entrance facility to a common pull box in the right of way.

The aforementioned options are a lesser cost approach that will yield, over time, improved broadband infrastructure for the community at large. The following options offer greater impact, but also require greater investment.

4. Targeted Broadband Infrastructure Projects

The broadband committee and County agencies could evaluate funding opportunities to include broadband infrastructure for economic development zones or targeted ECIDA sites. Opportunities can include broadband conduit or duct bank providing access to multiple carriers into the site and buildings.

Evaluate block grant or other funding mechanisms to build-out broadband infrastructure for these types of projects. HUD block grant money may also be available to incentivize providers to deliver a subsidized service to lower income households to better access and afford Internet service.

For example, undertake an economic development initiative to make Erie County Industrial Development Agency (ECIDA) focus sites more attractive for investment and development. A minimum investment might be broadband conduit or duct bank, and fiber optics built-out throughout the focus site properties and made available to service providers to offset their construction of pathway and cable facilities into the site. Service providers would connect at one on-site location and use the site's broadband infrastructure to deliver services throughout the site, thereby creating a carrier neutral infrastructure to encourage access and competition of services.

Another level of infrastructure investment might be municipal fiber optic cabling from the "Carrier Hotel" in downtown Buffalo out to the ECIDA focus sites along the Lake Erie (Rt. 5) corridor stretching from Lackawanna to Angola. This is an approximate 25 to 30-mile fiber optic build with an infrastructure design and construction capital investment of \$1.5 million to \$2.5million, dependent upon the number of sites and downtown construction costs.

5. Open Access Network (OAN)

A more proactive broadband strategy is for the County to view broadband infrastructure as a utility necessary to maintain quality of life and keep our communities competitive within the region, state, nation and the world. This is sometimes referred to as a “Technology Led” economic development strategy. The County, through several potential funding streams, would build-out, control, and maintain the broadband infrastructure for both public and private customers. This type of municipal network model for broadband development is often described as an Open Access Network (OAN).

The OAN concept is for government to not compete directly with private broadband providers, but rather provide a not-for-profit broadband infrastructure that is accessible by public and private organizations, including the broadband providers. Open Access Networks typically provide “dark fiber” infrastructure where the entity leasing fiber optic capacity is responsible for lighting the fiber optics with a broadband service (e.g. Internet, private network, telephone, TV, etc.). In many cases the entity leasing the dark fiber is a broadband provider looking to provide services to their customers.

Community owned fiber infrastructure has gained in popularity across the country over the last decade. Service providers are attracted to Open Access Networks because it removes the barrier to market entry of making long-term capital infrastructure investments. Instead, the service provider can lease network infrastructure for substantially less than the cost to build their own infrastructure.

Typically, these types of systems are developed through public-private partnerships with the telecommunications industry, where the municipal entity has ownership, control, and governance and the telecom/broadband industry provide services. There are opportunities when building and expanding the network to either buy, lease, or swap existing fiber capacity from private carriers and/or public providers.

A benefit of an OAN is that it allows any telecommunications service provider, regardless of size, access to the infrastructure, thereby leveling the playing field for all. The result is an environment with a higher level of competition and choice of providers for businesses and consumers in the area. A CLEC may lease capacity on the OAN so they can deliver Internet and telecom services to businesses and institutions. Another example is a residential provider of Internet, voice, and TV who leases OAN capacity to deliver services out to the Erie County communities and then build their own “last mile” fiber or wireless infrastructure into the neighborhoods.

Another benefit of the OAN is that organizations have the opportunity to own their fiber optics to reduce their own operating costs associated with voice and data communications, and develop collaborative opportunities with other organizations, including public safety, education, healthcare, and more. The OAN can also lease point-to-point and ring configurations as determined by the needs of its customers.

As a means to ensure service provider neutrality, the OAN entity owning the infrastructure does not “light” the fibers or provide services to end users, so that the OAN is not competing with the telecommunications industry. In addition, the infrastructure is built and maintained (24x7x365) to standard service level agreements (SLAs) by the owner that are put in place to ensure end user availability.

OANs are revenue based and can be self-sustaining. Through the development of public-private partnerships, including the carriers themselves, the subscribers pay to use the fiber, which creates revenue to recover capital and operating expenditures.

These OANs are accessible by many diverse entities throughout a community. They are equitable and attractive to many, providing a foundation to develop and support community-wide programs throughout the foreseeable future. More often than not, these models become regional opportunities because they provide widespread cost reduction, public benefit, and access to metropolitan based services.

Customers will acquire the individual fiber strands from the network backbone through many purchasing methods. The Open Access Network allows for short and long term contractual agreements, which include term leases paid on a monthly basis, lump sum capital agreements, or Indefeasible Right to Use Agreements (IRUs) for one-time payment for long term agreements. The OAN seeks to partner with existing service providers to provide all services that may be needed across the subscriber base.

A fundamental decision when developing Open Access infrastructure is the organizational structure of the Open Access provider. The fiber is municipally owned and managed, although in most cases network managed service providers are contracted by the OAN to manage, operate, market, and sell OAN services. In some cases, there already exists a municipal authority or utility that can take on the role of an OAN provider. In other cases, a local development corporation (LDC) is established. Typically, the LDC is comprised of a board selected by the County with limited or no staff, and services are contracted out.

In parts of the U.S. an Electrical Municipal Corporation (EMC) that provides power to rural communities takes on the new role as a broadband utility provider. In New York State the Development Authority of the North Country (DANC) was the organization that took on broadband services for Jefferson, Lewis, and St. Lawrence counties and has been expanded for additional North Country areas. In the Finger Lakes region, an LDC named Axxess Ontario operates an OAN in Ontario County, and the Southern Tier Network (STN) is an LDC providing OAN services to Allegheny, Steuben, Yates, Schuyler, Chemung, Tioga, Tompkins and Broome counties throughout the Southern Tier of New York.

Lastly, through the construction of these networks and their operation, jobs are created both directly and indirectly. A globally competitive advantage is created within these counties by the existence of a 21st century based telecommunications broadband infrastructure.

Erie County Open Access Network

A fully built out Erie County model would require a fiber optic backbone consisting of 300 to 400 miles of fiber optic cabling installed throughout the County, interconnecting key community anchor institutions (CAIs), including municipal facilities, public safety 911 centers and towers, K-12 schools, libraries, and major employers and healthcare organizations. The final size of the network depends on funding, phasing and diversity requirements. For purposes of this report we have modelled a comprehensive Open Access Network of 360 fiber miles in order to describe the potential scope and order of magnitude of investment needed for community-wide broadband infrastructure development. The proposed OAN map is on the following page.

It needs to be stressed that this is a preliminary route design that requires detailed market analysis, engineering design, and secured funding before any final routes could be released for construction. The amount of fiber construction and costs could potentially be reduced by collaborating with other municipal fiber providers, or leasing opportunities from private fiber carriers. The existing public fiber infrastructure overlaps approximately 60 miles of the initially propose Open Access Network routes.

For the purposes of this study, an Open Access, middle mile network is proposed to primarily connect the following community anchor institutes of:

- Public School Districts – this will extend the Open Access Network to each school district’s community. It would also likely include the Western New York Regional Information Center (WNYRIC), an Erie 1 BOCES organization that provides Internet and network services to school districts. WNYRIC is the main data center that Erie County schools connect to for Internet and IT services.
- Public Libraries – similar to schools, libraries will also extend the network out to our communities. The downtown Buffalo Central Library is the hub of the County-wide library network.
- Government Facilities – City, County, Town and Village facilities that need to interconnect to municipal networks. Public Safety 911 centers, emergency operations, and radio towers also extend the network out to nearly all of the County’s communities
- Economic Development – providing broadband infrastructure to incentivize development and offer a competitive advantage to attract and retain local businesses and competitive work force talent.
- Any major employer or institution that commits to be an OAN subscriber prior to construction. These organizations will typically have a geographic footprint in the County with a need to connect multiple sites.

Proposed Erie County Open Access Network

Map has been removed.

Please contact Erie County to obtain a copy.

This fiber infrastructure would have additional capacity (dark fiber) that could be used to provide a number of options, including private dark fiber networks for organizations that require it, and becoming a basis for promoting the region for Technology Led Economic Development and leveling the playing field for all telecom and broadband providers. Technology Led Economic Development can help position the region as a leading edge 21st century community. The establishment of a county-wide, world class broadband infrastructure is critical to achieving this goal.

Table 9 is a proforma model for building and operating an Erie County OAN. The pro forma is estimated using a 20-year bond at an annual interest rate of either 3%, 4% or 5%. The fiber optic infrastructure is a capital asset with a 50-year life, so a 20-year bond term is reasonable. A ten-year bond in our opinion is too short an investment horizon and will drive up the market price of the OAN fiber to a less competitive level.

Table 9 – Erie County Open Access Model Pro Forma

Bond Term (Yrs)	Bond Rate	Construction Cost	Capital Reserve Cash Contribution	Bond Amortization Annual Cost	Annual O&M Costs	Capital Replacement Fund Annual Costs	Total Annual Costs
20	3%	\$ 16,270,929	\$ 3,000,000	\$1,082,858	837,437	\$ 150,000	\$ 2,070,295
20	4%	\$ 16,270,929	\$ 3,000,000	\$1,183,184	837,437	\$ 150,000	\$ 2,170,621
20	5%	\$ 16,270,929	\$ 3,000,000	\$1,288,571	837,437	\$ 150,000	\$ 2,276,008

The fiber optic routes are to interconnect municipal facilities, schools, and libraries, resulting in approximately 360 miles of fiber optic cabling. The routes are designed in multiple ring topologies to provide redundancy and resiliency to the network. The ring topology is particularly important for public safety communications, as well as to potential private carriers. The proposed backbone will be supportive of these potential customers in the second map on the previous page (major employers, healthcare, cell towers and county IDA sites), and the routes have been designed to minimize lateral construction to reach these potential sites.

The initial and preliminary construction cost of \$16,270,929 is estimated by Table 10 on the next page.

Table 10 – Estimated Construction (Capital) Cost

Backbone Construction:	
Fiber Miles	358.2
Design and Engineering (Fiber Optic Backbone)	\$ 1,103,043
Make Ready	\$ 2,256,345
Path and Permitting fees	\$ 972,164.28
Right of Way (Easements)	\$ 358,150
Material and Fiber	\$ 4,727,580
Construction Labor	\$ 5,479,695
POP setup	\$ 200,000
Total	\$ 15,096,977
Contingency (5%)	\$ 754,849
Total with Contingency	\$ 16,229,250
Equipment and Training:	
Equipment	\$ 41,679
Total Equipment and Training	\$ 41,679
TOTAL PROJECT COST:	\$ 16,270,929

This is a preliminary construction estimate and would need to be refined during the design and engineering phase of an OAN project. Likewise, the final network route design will be refined after a business and marketing plan is developed.

Table 9 capital reserve or cash contribution is the amount of working capital needed to launch, operate and market the network until the OAN reaches a positive cash flow. Table 9 bond amortization annual cost is the \$16,270,929 construction cost amortized over 20 years. Annual operations and maintenance of \$837,437 is estimated using Table 11 at the top of the next page.

Table 11 – OAN Annual Operations and Maintenance Costs

EXPENSE ASSUMPTIONS:	
Administrative Costs (Legal, Accounting)	\$75,950
Support Services (Marketing and Sales)	\$408,291
Network Operations	
Engineering, Design, Construction, Facilities Management	\$52,886
Line Maintenance (Network Maintenance, response and repair)	\$75,212
Pole Attachment Fees	\$177,284
POP Maintenance and Support	\$12,000
Insurance	\$35,815
Annual Costs	\$837,437

The Pro Forma estimates an annual capital replacement fund of \$150,000, which is needed for upgrading network capacity and replacement of cable that is beyond repair. The net result of the pro forma for a 20-year bond at 4% is an annual OAN cost of \$2,170,621.

Table 12 on the following page is an estimated income statement that evaluates projected annual revenues against estimated costs. The proposed OAN is cash positive in year 5, and remains cash positive for year 6 through year 20 of the bond term. Again, the \$3 million capital reserve or cash contribution is the needed working capital for the first five years until cash flow goes positive.

Revenues are estimated using an assumed take rate of potential subscribers. There are potentially 396 municipal facilities, school district buildings, and libraries in Erie County, which are classified as municipal subscribers. The assumption made is that 80% of these facilities will subscribe to the OAN.

There are 1,043 potential private sector subscribers that are within a half mile or less of the OAN network backbone. The take rate assumption for private businesses is 5% per year for five years. Lastly it also assumed that telecom and broadband providers will also want to lease fiber from the OAN, contributing to revenue projections.

This is a conservative financial model based on preliminary route design and broad gauge estimates and projections. A comprehensive business and marketing plan, as well as final network design and engineering, will further refine and develop the OAN financial model.

Last Mile Services

An Open Access Network provides the middle mile backbone infrastructure of a County-wide network, interconnecting our city, town, and village communities. The community anchor institutions of municipalities, schools, and libraries will have direct connections to the OAN. Municipal subscribers alone are not sufficient to make an Erie County OAN sustainable. The OAN needs to broaden the subscriber base by serving private sector businesses, healthcare, and the telecom/broadband providers that want to use the OAN infrastructure to reach new customers.

Gigabit service providers, like Google, are attracted to metropolitan areas that have Open Access infrastructure combined with government policies and ordinances that encourage and streamline broadband development. Data centers and other technology companies want a competitive choice of providers with both infrastructure and service diversity. The same broadband infrastructure that attracts and retains these companies, also attracts and retains talented employees and entrepreneurs.

The New York State based OAN, Southern Tier Network (STN), successfully negotiated agreements with private broadband providers to provide fiber to the home (FTTH) services to several communities in the Southern Tier region. The OAN fiber allowed the broadband provider to extend their services out to these rural communities and the private broadband provider built the last mile connections to provide fiber optic based Internet, telephone, and TV services. The provider offers a range of plans, including Internet service between 50Mbps to 1000Mbps (Gigabit) speeds.

Another potential option is to extend OAN fiber to a community or neighborhood and use wireless technologies to connect to homes and businesses. The other result experienced in other OAN regions is an increase in private provider infrastructure build out to compete with the OAN, the end result being more competition and choice for that region.

Phasing Options

The preceding Open Access model assumes a comprehensive build out within the County to all cities, towns and villages. Open Access infrastructure is likely to be developed in a phased approach to leverage available funding and development goals.

As cited previously, an initial approach might be an economic development initiative to make Erie County Industrial Development Agency (ECIDA) focus sites more attractive for investment and development. Service providers would connect at one on-site location and use the site's broadband infrastructure to deliver services throughout the site, thereby creating a carrier neutral infrastructure to encourage access and competition of services. This phase could also establish the organizational structure needed to launch an Open Access Network. The next level of infrastructure investment might be Open Access fiber optic cabling from the "Carrier Hotel" in downtown Buffalo out to ECIDA focus sites.

A more ambitious Open Access project would be to leverage the Universal Service Fund's (USF) Schools and Library E-rate program to interconnect school districts, libraries and BOCES facilities. E-rate funds pay anywhere from 60%-95% of schools' and libraries network' infrastructure for Internet delivery, with NYS BOCES aid potentially covering 50%-90% of the remaining balance.

There are approximately 220 K-12 and BOCES facilities and 37 public libraries in Erie County. Approximately 250-300 miles of open access fiber optic infrastructure would need to be constructed to interconnect these schools and libraries, for a design and construction cost in the range of \$12 million. The fiber infrastructure would likely recover its cost within ten years, sooner if the Open Access

Network is expanded to include additional subscribers. This would establish a County-wide backbone to support additional expansion for public and private subscribers.

An Open Access Network for schools and libraries could easily be expanded for city, county, town and village offices, Police, Fire and 911 sites for another 30 to 50 miles, at an incremental cost of \$1.5m-\$2.5m.

The USF E-rate program currently offers the most substantial funding vehicle to support community-wide broadband infrastructure. The County, perhaps through the Broadband Committee, should engage Erie 1 BOCES, WNYRIC, local school districts and county libraries to gauge their level of support for such a project. The goal of the project is to offer a robust broadband infrastructure supporting our schools and libraries for comparable or lesser costs. Once the initial build capital costs are recovered, future network costs will only need to cover maintenance and support costs at a substantial reduction in costs. Again, the goal is to leverage state and federal funding to provide quality and cost effective services, but also to help expand and support broadband infrastructure benefiting the entire community.

This is not an unprecedented model. There is more than 250 miles of OAN fiber in the Southern Tier that interconnects more than 90 schools to the GST BOCES network leveraging e-rate and BOCES funds. It may not be a solution for every town and district, but if a sufficient number of towns and schools were to collaborate, there may well be the critical mass to launch a County-wide Open Access infrastructure.

The later phases for an OAN project would be lateral builds off the backbone to attract businesses and institutions, as well as private broadband service providers and telecom carriers leasing dark fiber to provide “lit” services to the communities on the OAN backbone. Some network subscribers will require additional fiber construction for a network ring topology, providing diversity or redundancy of services by protecting network communications from a break in the fiber optic infrastructure by routing service in the surviving direction of the ring while repairs are made. Ring topology will be valued by public safety, broadband and cellular carriers, and any organization with mission critical applications and services.

VIII Conclusion

This study found that while the urban and suburban areas of the County are for the most part well served in terms of access and competition, many of the rural areas of the County, which are towns and villages to the south and east are lacking and expected to fall further behind. Several regional and interstate carriers have made infrastructure investments to the metropolitan area, most notably Level 3, Windstream, Lighttower, and Zayo, however their build programs have levelled off.

There is a municipal consortia of fiber optic networks that have successfully collaborated in the past to build out their public infrastructure and are agreeable to future collaborative endeavors. The challenge that the County faces are that the two major infrastructure providers for the region—Verizon and Charter Spectrum (formerly Time Warner Cable)—are not significantly expanding their infrastructure nor replacing aging copper and coaxial cable plant with fiber optics. With that being said, Charter Spectrum has committed to system wide upgrades that would enable them to provide broadband speeds in excess of 100Mbps to all of their current customer base. For much of Erie County, Charter Spectrum is the only provider that can offer a true broadband service to small businesses and residents.

Fiber optics to the premise (FTTP home or business) has stalled, with Verizon’s FiOS™ service the only true FTTP offering and limited to only a few suburban areas. Across the U.S., virtually all major providers of residential broadband who were building fiber to the home have ceased these programs in favor of developing middle mile fiber and last mile wireless solutions. The primary reasons for this are that first, the cost to build fiber to the home is very costly, and second, wireless technologies that are capable of providing capacity at or near the Gigabit range are rapidly emerging. Many communities across the U.S. are choosing to lead the charge, rather than wait, in developing Gigabit to the premise programs.

Erie County has competitive telecom and broadband infrastructure and services as compared to other upstate New York counties, and the metropolitan area of Buffalo has sufficient infrastructure and services needed to support its residents and businesses. However, outside of Buffalo and the neighboring suburbs, access to reliable service and choice in providers dwindles, as is the case with many Upstate counties.

There are several inexpensive options that require nominal investments that can help support broadband infrastructure over the long term. The most effective being a “Dig Once” policy combined with other policies and ordinances that streamline and encourage broadband development. However, good broadband policy and procedures alone will not project Erie County forward as a national leader in broadband services. Private broadband investment will first target the top economic markets in the U.S., and will not focus on economic development and expansion into underserved rural areas as a priority. Before a community can have true high bandwidth broadband (last mile) services to its businesses and residences, it must extend broadband infrastructure from its metropolitan center out to all of its communities (middle mile).

The establishment of an Erie County Open Access Network is the most proactive of strategies. It lowers barriers of entry for service providers, creates competition and choice for both business and residential customers and will project the City of Buffalo, Erie County, and the region at large as a leading technological community. The overall quality of life is enhanced, our government and public safety operations are improved, and our schools and communities are better connected. The OAN is also a strategy that requires both political and financial capital. It requires political leadership to communicate and create a consensus with all of the community leaders to undertake a project of this magnitude. It certainly is not unprecedented. It’s being done successfully in many cities and regions across the US, and in some of the most rural areas of New York, but typically with some level of significant federal or state financial support.

Appendix A – Glossary of Terms

All terms and definitions listed in this Glossary of Terms originated from various public resources

BACKBONE

Backbone, in the context of networking, refers to the highest speed and widest bandwidth point of a communications circuit or path. In most cases, all information central to the users is connected to the backbone (e.g., shared databases or servers).

BANDWIDTH

Bandwidth is the amount of data that can be carried by a circuit between two points of a network. Bandwidth is typically measured in Hertz (cycles per second), bits per second or kilobits per second (shortened to Bps or Kbps). The top speed of today's modems is 56,000Bps or 56Kbps. The wire connecting a private home to the telephone company carries up to 128,000Bps while one strand of fiber optics can carry 20,000,000,000 (20 Gigabits). A 20Gbps fiber optic strand can interconnect 357,000 telephone calls.

BROADBAND

Broadband is a descriptive term for evolving digital technologies that provide consumers a signal switched facility offering integrated access to voice, high-speed data service, video-demand services, and interactive delivery services.

CATV (Cable Television System)

A broadband communications system capable of delivering multiple channels of programming from a set of centralized satellite and off-air antennae, generally by coaxial cable, to a community. Many cable-television designs integrate fiber-optic and microwave links.

CATV (Community Antenna Television)

A service through which subscribers pay to have local television stations and additional programs brought into their homes from an antenna via a coaxial cable.

CARRIER

A telecommunications company that offers communication services to the general public via shared circuits at published tariff rates. In the United States, the Federal Communications Commission and various state public-utility commissions regulate common carriers.

CELLULAR TECHNOLOGY

This term, often used for all wireless phones regardless of the technology they use, derives from cellular base stations that receive and transmit calls. Both cellular and PCS phones use cellular technology.

CENTRAL OFFICE (CO)

A CO is a major equipment center designed to serve the communications traffic of a specific geographic area. CO coordinates are used in mileage calculations for local and interexchange service rates. A Central Office usually has less than 100,000 telephone lines within its wire boundary. COs are usually owned and operated by LECs.

CLEC (Competitive Local Exchange Carrier)

A CLEC is a telephone company that competes with the incumbent telephone company. The formation of these organizations is a direct result of the Telecommunications Act of 1996.

COAXIAL CABLE

A type of cable used for broadband data and cable systems. Also known as “coax.” Coaxial cable is composed of an insulated central conducting wire wrapped in another cylindrical conducting wire. It is usually wrapped in another layer and an outer protective layer and has the capacity to carry great quantities of information.

DARK FIBER

Dark Fiber is fiber optic cable, typically between end user locations, that the end user owns, lights and operates.

DIGITAL

A function that operates in discrete steps as contrasted with a continuous, or analog, function. Digital computers manipulate numbers encoded in binary (on-off) forms, while analog computers sum continuously varying forms. Digital communications is the transmission of information using discontinuous, discrete electrical or electromagnetic signals that change in frequency, polarity, or amplitude. Analog forms may be encoded for transmission on digital communications systems.

DIGITAL DIVIDE

The availability of service between the areas that have access to advanced broadband services and those that do not.

DS-0

DS-0 (see also 56Kbps) is the bandwidth required for one voice conversation. It is 64Kbps and is one of 24 channels in a DS-1, or T1.

DSL (Digital Subscriber Line)

DSL is new technology that allows for the simultaneous transmission of voice and Internet data over a single telephone line. Central Offices that have DSL technology can support DSL services to customers within approximately 18,000 feet of the Central Office.

DSL is delivered either asymmetrically (ADSL) or symmetrically (SDSL). ADSL lines have download transmission rates higher than upload rates and are typical for residential or business users that receive much more Internet content than they send. SDSL are for businesses that generate and receive large amounts of Internet data.

ETHERNET

Private (IP) network service interconnecting a customer's premises across a wide area network. Bandwidth can vary between 1 megabit to 1 Gigabit or more.

FIBER OPTICS

The technology of guiding and projecting light for use as a communications medium. Hair- thin glass fibers that allow light beams to be bent and reflected with low levels of loss and interference are known as "glass optical wave guides" or simply "optical fibers." This cable comes in two types, single mode and multimode, each with its own unique place in communications. Single mode FO cable is typically used where long distances and very high speeds are required, while multimode is used for intra-building communications and places where lower bandwidths are required.

FIBER-OPTIC CABLE

A cable containing one or more optical fibers.

HEADEND

The control center of a cable-television system, where incoming signals are amplified, converted, processed, and combined into a common cable for transmission to subscribers.

INCUMBENT LOCAL EXCHANGE CARRIER (ILEC)

An ILEC is the local telephone company that provides service to business, organizations and residence within the LATA. The ILEC is responsible for the development, maintenance and support of cabling infrastructure necessary to provide telecommunications services within the LATA.

INTERNET

A widely used public computer network, initially developed by the U.S. military that links smaller computer networks and allows users on different electronic-mail systems to communicate with one another on a global scale.

INTERNET PROTOCOL (IP)

In TCP/IP, a connection Internet layer protocol that provides a best-efforts datagram delivery service. Note the functional layer (TCP/IP) corresponds to the OSI model network layer. The Internet layer provides routing and relaying functions that are used when data must be passed from a host to some other network in the Internet. It operates in the source and destination hosts and in all the routers along the path between the hosts.

ISP (Internet Service Provider)

A company that provides access to the Internet to individuals or companies. Some ISPs lease connections from Internet backbone providers.

LANDLINE

Traditional wired phone service.

LAST-MILE

Last Mile is used to describe the final connection to a building, as differentiated from the high capacity circuits extending across a city or County. The connection from the cable television trunk cable to your house is considered a “last-mile” connection.

LOCAL EXCHANGE CARRIER (LEC)

A LEC is a telephone company or Telco that offers local and long distance telephone service within a defined region referred to as the LATA— Local Access & Transport Area. A LATA or is the regional calling area within which the incumbent local telephone company provides local and long distance services. Service to points outside the LATA is provided by long distance carriers.

MPLS VPN

Family of methods for multiprotocol label switching (MPLS) to create virtual private networks (VPNs). MPLS VPN allows networks the flexibility to transport and route several types of network traffic using the technologies of a MPLS backbone, while managing quality of service (QoS) of latency sensitive voice and video applications.

NETWORK

Any connection of two or more computers that enables them to communicate. Networks may include transmission devices, servers, cables, routers and satellites. The phone network is the total infrastructure for transmitting phone messages.

POTS (Plain Old Telephone System)

POTS refers to an un-enhanced telephone service with the ability to send and receive phone calls. Features like call-waiting and call-forward are available. Also referred to as a Land Line.

PRI

ISDN PRI service provides high capacity digital voice services, typically utilizes a T1 circuit

RF (Radio Frequency)

RF refers to the electromagnetic waves operating between 10KHz and 3MHz propagated without guide (wire or cable) in free space.

RIGHT-OF-WAY

ROW refers to a designated space alongside a street or other access (such as a railroad line). An entity wishing to install fiber optic cable between various sites/locations must first obtain the rights to a path along those routes. As the cable may be installed underground or on poles, right-of-way access may be granted by a city, a private landowner or the owner of poles such a cable company, a telephone company or power company. Cities typically require written permits— usually for a fee.

SERVICE PROVIDER

A telecommunications provider that owns circuit switching equipment.

SONET (Synchronous Optical Network)

SONET is an optical network used to transport many unique digital signals (ATM, T-1, etc.) over the same optical carrier. Its physical interface is the OC (Optical Carrier), which has a base rate of OC-1 (or 51.84Mbps), and continues to as high as the theoretical limit of 13Gbps; however, OC-48 (2.5Gbps) is the current limit.

SUPER-FI BROADBAND

Super-Fi broadband, also known as white space broadband, refers to the unused broadcasting frequencies in the wireless spectrum. Television networks leave gaps between channels for buffering purposes, and this space in the wireless spectrum is similar to what is used for 4G and so it can be used to deliver widespread broadband Internet.

T1 (DS-1)

The T1 standard has a speed of 1.544Mbps in the United States. The T1 standard has carried over to data networking from the voice arena where it was used to describe a carrier that could carry 24 voice conversations over a clear channel (64Kbps, DS-0).

T1 LINE (DS-1)

Telecommunications line with bandwidth capacity of 1.54Mbps.

T3 LINE (DS-3)

Telecommunications line with bandwidth capacity of 45 Mbps.

WAN (Wide Area Network)

WAN is used to extend LAN connectivity beyond a city or County, usually through common carrier facilities.

WAVELENGTH

Optical data service provisioned over single light frequency across a strand of fiber optic glass

WHITE SPACE

White space broadband, also known as Super-Fi, refers to the unused broadcasting frequencies in the wireless spectrum. Television networks leave gaps between channels for buffering purposes, and this space in the wireless spectrum is similar to what is used for 4G and so it can be used to deliver widespread broadband Internet.

WIRELESS

Wireless describes a means of sending signals (voice, video or data) “over the air” rather than using cables. To date, wireless bandwidth rates (capacities) are significantly lower than wire rates. There are significant new developments in wireless, many of which will come to market in 2014 and beyond.

Appendix B – ECIDA FOCUS SITE MAPS

(under separate cover)