National Telecommunications and Information Administration

Broadband Technology Opportunities Program Evaluation Study

Order Number D10PD18645

Case Study Report

Clearwave Communications

Comprehensive Community Infrastructure

Submitted March 28, 2014

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Federal TIN: 20-1204680
DUNS: 15-108-3305
GSA Schedule #: GS-10F-0062R

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About BTOP

The American Recovery and Reinvestment Act of 2009 (Recovery Act) appropriated $4.4 billion in federal funding to the National Telecommunications and Information Administration (NTIA) to implement the Broadband Technology Opportunities Program (BTOP) in order to spur job creation, stimulate economic growth, and increase access to broadband services.[1] BTOP projects are intended to support increased broadband access and adoption, provide broadband training and support through community organizations, and stimulate the demand for broadband. NTIA distributed grant funding to 233 projects, benefiting all 50 states, 5 territories, and the District of Columbia. The types of projects BTOP funded include Public Computer Centers (PCC), Sustainable Broadband Adoption (SBA), and Comprehensive Community Infrastructure (CCI). CCI projects deploy new or improved broadband Internet facilities to connect households, businesses, and community anchor institutions (CAI) such as schools, libraries, hospitals, and public safety facilities.[2] CCI projects funded by BTOP are predominantly middle mile projects, although a small number of last mile projects were awarded.[3]

> Comprehensive Community Infrastructure projects deploy new or improved broadband Internet facilities to connect households, businesses, and community anchor institutions such as schools, libraries, hospitals, and public safety facilities.

About the Evaluation Study

This case study report is one of twelve case studies performed by ASR Analytics, LLC (ASR) on CCI projects. It is part of a larger mixed-methods evaluation of the social and economic impacts of the BTOP program.

The purpose of this case study is to:[4]

- Identify how the grantee maximized the impact of the BTOP investment.
- Identify successful techniques, tools, materials, and strategies used to implement the project.
- Identify any best practices, and gather evidence from third parties, such as consumers and anchor institutions, as to the impact of the project in the community.

> The information presented in this report is intended to capture the social and economic impacts of the grant, and is not an evaluation of Clearwave, its partners, or its subgrantees.

This case study is primarily qualitative. Social and economic impacts are categorized by the five focus areas described in *Interim Report 1*, with the addition of the Government Services focus area.[5] Section 2 includes the presentation of these impacts by focus area.

The evaluation study team collected information to evaluate the social and economic impact of the Delta Communications, LLC (doing business as Clearwave Communications, "Clearwave") project during field visits. From June 18 to June 20 2013, the evaluation study team met with representatives of Clearwave and CAIs connected by the project. In total, the evaluation study team performed fifteen site visit interviews and focus groups. ASR transcribed these discussions and used this information, along with other information and reports provided by the grantee, to supplement Quarterly Performance Progress Reports (PPR), Annual Performance Progress Reports (APR), and other publicly available information. The information presented here is

intended to capture the social and economic impacts of the grant, and is not an evaluation of Clearwave, its partners, or its subgrantees.

About the Grantee

Clearwave is a privately held, facilities-based communications company with headquarters in Harrisburg, Illinois. Established in 1996, Clearwave offers a range of telecommunications services to business and residential customers. Services include voice solutions, high-speed data and Internet access, and other value-added services.[6] Operating as a full-service Internet Service Provider (ISP), Clearwave offers connectivity over optical fiber, T1 lines, digital subscriber lines (DSL), plain old telephone service (POTS) lines, and fixed wireless. In 2010, Clearwave's customer base included 1,100 businesses and 2,773 residential subscribers. Customer accounts represented more than 5,600 access lines and 2,000 broadband lines, nearly all of which were DSL.

The IBOP – Southern project invested a total of $45,395,020 in southern Illinois, including $31,515,253 in federal funds.

On August 1, 2010, NTIA awarded Clearwave a BTOP CCI grant for $31,515,253 to implement the Illinois Broadband Opportunities Partnership (IBOP) – Southern project. Matching funds totaled $13,879,767. Altogether, the project invested a total of $45,395,020 in southern Illinois.

The State of Illinois, through the Department of Commerce and Economic Opportunity (DCEO), supported the project by pledging $11,351,250 in matching funds. In addition, Clearwave supplied approximately $2.1 million in matching funds. Counties of Southern Illinois (CSI) Next Generation 9-1-1 (NG911), a consortium of southern Illinois counties, committed $400,000 to the project in support of NG911 services.

Project Proposal and Status

Clearwave planned to deploy a high-speed, fiber-based middle mile network across a twenty-three-county region of southern Illinois to improve broadband access for CAIs in rural and economically distressed communities. The project planned to replace a leased network with a newly built network twice the size. The new network would facilitate improved CAI connections and permit speeds between 10 Mbps and 1 Gbps.[7] Clearwave proposed the following, with results shown:

- Construct 740 miles of new fiber in the proposed service area and directly connect 232 CAIs.[8] By the end of June 2013, Clearwave had installed 751 miles of fiber, including fiber into 30 interconnection points. Clearwave also reported serving 188 CAIs.[9] Clearwave expects to connect forty-eight additional CAIs by grant closeout at the end of September 2013.[10]
- Partner with the CSI NG911 consortium and local public safety institutions to implement an Internet Protocol (IP)-based NG911 public safety system.[11] Clearwave connected fifteen 9-1-1 public safety institutions that make up the CSI consortium. The consortium, which spans fifteen counties, is currently operating a 9-1-1 pilot project with state-of-the-art equipment worth an estimated $2.2 million. Clearwave contributed $1 million toward the purchase of this technology, which replaced fifteen-year-old equipment.

Clearwave accomplished the following from their proposed goals:

- Installed 751 miles of fiber
- Improved route diversity and reliability
- Provide service to 188 CAIs
- Pilot NG911 program
- Improve the exchange of healthcare information

- Enable broader participation in the Southern Illinois Health Information Exchange (HIE) Initiative to simplify health information access and improve communications among providers and clinicians.[12] Franklin Hospital information technology personnel expect an increase in broadband use when the HIE comes online before December 2013.
- Interconnect with the Illinois Century Network (ICN), which provides a gateway to Internet2 for K-12 schools, libraries, and non-research higher education institutions.[13] ICN also provides route diversity to connect to ISPs in St. Louis and Chicago. Clearwave has not yet completed this agreement for interconnection, although Clearwave subscribers are working with both ICN and Clearwave on delivery of broadband services to their CAIs.
- Facilitate more affordable, accessible, and reliable broadband service for approximately 300,000 households and 55,000 businesses by enabling local ISPs to use the project's open access network.[14] The number of businesses and residents connected by local ISPs is not publicly available. Section 3.2 of this report describes Clearwave's approach to open access and nondiscrimination in more detail.

As shown in Table 1, over half of the CAIs served as of June 30, 2013 are educational institutions (54 percent), followed by medical/healthcare facilities as the second most frequent CAI type (26 percent).[15] The project proposed to connect 232 CAIs with speeds between 10 Mbps and 1 Gbps, including 111 K-12 public schools, 28 public safety entities, 23 libraries, 9 community colleges, Southern Illinois University, and 60 healthcare facilities.[16]

Table 1. Community Anchor Institutions Located in the Service Area

Type	Goal		Served by Grantee		Service Area
	#	%	#	%	#
Library	23	10%	18	10%	81
Medical/Healthcare	60	26%	47	25%	1,066
Public Safety	28	12%	21	11%	312
School (K-12)	111	48%	92	48%	418
University, College, or Other Postsecondary	10	4%	10	5%	15
All	**232**		**188**		**1,892**

There is a substantial opportunity to leverage the Clearwave infrastructure in southern Illinois beyond the scope of the original set of CAIs proposed in the grant application. The fixed cost of laying the middle mile fiber network has already been incurred. The low incremental cost of connecting CAIs is the remaining cost driver. It is likely that at least some CAIs would take advantage of a no-cost or lower-cost connection option similar to that offered at the beginning of the grant period. Some activities, such as telemedicine, could benefit from more CAIs connecting to the new middle mile infrastructure. Based on discussions with the grantee, there is sufficient bandwidth available to serve all of the CAIs in the service area, if CAIs maintain the average bandwidth level to which they currently subscribe. There might be a need to improve some equipment if the number of connected CAIs and the level of bandwidth required by them increase substantially.

Major Outcomes and Impacts

Through interviews and data collection from a number of sources, the evaluation study team observed qualitative and quantitative outcomes and impacts of the project. The list below highlights these outcomes and impacts, with additional detail provided in Section 2.

- Clearwave served 92 of 111 public primary and secondary K-12 schools and all 10 postsecondary institutions proposed in the grant application as of June 30, 2013.[17] Clearwave's service area also includes 326 additional public K-12 schools and 5 additional postsecondary institutions. Teachers at public primary and secondary K-12 schools use digital tools such as SMART Boards, technology labs, iPads, and classroom webpages that provide a wider range of media for classroom instruction and increase students' knowledge through hands-on learning. Connections to broadband enable postsecondary institutions to increase the number of courses offered, increase online course content, and provide online and distance learning courses to help students complete degree programs.

Through BTOP, the project achieved the following community impacts:

- Increased educational opportunities for K-12 institutions
- Improved 9-1-1 services
- Increased telemedicine opportunities for healthcare providers

- Clearwave connected twenty-one of the twenty-eight police departments proposed in the grant application as of June 30, 2013.[18] The use of broadband allows police departments to send and receive larger amounts of data, increase information and resource sharing, improve citizens' access to 9-1-1 services, improve emergency response systems, enhance training for personnel to deliver services more efficiently to the public, and increase cost savings.
- Clearwave provided the core network infrastructure, making it possible for the CSI NG911 consortium to develop and implement an emergency services IP network (ESInet), databases, and data management software for improved emergency response services among fifteen counties in southern Illinois. The increased connectivity will enable greater coordination between 9-1-1 offices, increased redundancy to reduce service outages, new capabilities for rerouting emergency calls, global positioning system (GPS) integration, mapping, texting, and streaming video.
- Clearwave served forty-seven healthcare institutions as of June 30, 2013.[19] The upgrade in the broadband service provides faster uploads for large electronic medical records data and image files, allows physicians to access medical records from home or other locations for greater efficiency in patient care, and enables greater use of teleconferencing to increase staff knowledge about health issues.
- The Clearwave project has enabled innovative job training projects that would not have been possible without increased bandwidth. The Connect SI Foundation, a nonprofit charitable organization that supported collaborative, regional economic strategy, developed the Southern Illinois Online Nursing Initiative (SIONI), a part-time nursing program to address the shortage of registered nurses (RN) in southern Illinois. SIONI graduated forty RNs, which has resulted in a substantial increase in nursing capabilities and wages for these nurses. SIONI has also stopped outmigration of nurses to nearby areas.

Conclusions

Without the BTOP grant, it is unlikely that 188 CAIs would have connections to a fiber-optic network with the available speeds and low prices. All CAIs receiving service from Clearwave already had broadband, but at much lower bandwidths or higher prices. The BTOP grant also provided equipment and support to CAIs as part of the upgrades to broadband access.

The Clearwave network made it possible for last mile providers to expand the availability of broadband service in southern Illinois. Clearwave had agreements with five third-party last mile providers and was in negotiations with nine additional

Community anchor institutions interviewed by the evaluation study team reported that the average price of broadband per megabit per month dropped from $250 to $14, while the average capacity increased by over 600 percent.

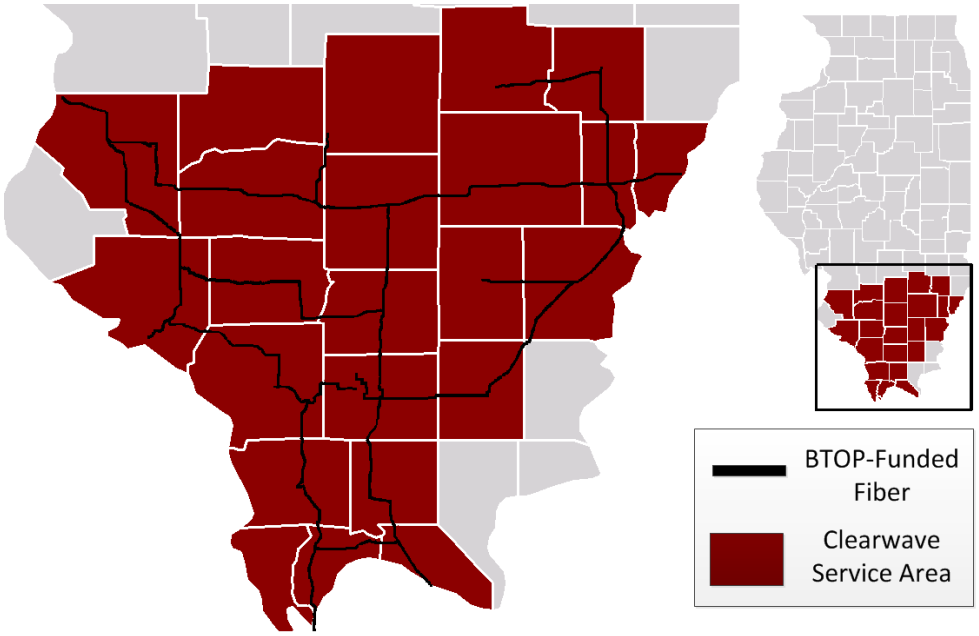
providers as of June 30, 2013.[20] Clearwave deployed multiple interconnection points to give all last mile providers and network subscribers equitable and reliable access to the middle mile network. Through an interconnection agreement under development with ICN, Clearwave will establish a redundant Internet connection in Chicago. The interconnection is through colocation facilities in Olney, Illinois and Collinsville, Illinois. This agreement upgrades the connectivity of the ICN point of presence (POP) at Southern Illinois University (SIU), an improvement attributable to the BTOP grant.

Price and capacity data from ten CAIs interviewed by the evaluation study team show that the average price of broadband per megabit per month was reduced from $250 to $14, while the average capacity increased by over 600 percent. The CAIs on average reported a 36 percent decrease in broadband costs.

Section 1. Introduction

Clearwave's goal was to connect 232 CAIs and to provide middle mile broadband connectivity in a twenty-three-county area. As shown in Figure 1, the area served by Clearwave includes the following counties: Alexander, Clay, Clinton, Edwards, Franklin, Hamilton, Jackson, Jefferson, Johnson, Marion, Massac, Perry, Pulaski, Randolph, Richland, Saint Clair, Saline, Union, Wabash, Washington, Wayne, White, and Williamson. The fiber route, shown in black captures route changes made by Clearwave as of December 31, 2012.[21]

Figure 1. Clearwave Service Area Map



The project targets an area with relatively fewer broadband options than the rest of the State of Illinois. The service area is predominantly rural. The grant application describes the service area as being composed of thirty-three predominantly rural communities. All but one of these communities have fewer than 20,000 residents.[22] The greatest obstacles to expanding broadband to consumers, businesses, and public institutions in the rural markets in this service area are the lack of affordable high-capacity middle mile infrastructure and high-capacity access to the Internet.

The American Community Survey (ACS) Five Year Summary for 2007 to 2011 shows slightly more than 6 percent of the state's population resides in these twenty-three counties. Eighty-two percent of the residents of the service area are White.[23] More than half (56 percent) of the service area residents have a household income of less than $50,000 per year, compared to 44 percent of the population in the rest of Illinois.[24] Using publicly available data, the evaluation study team identified 1,892 CAIs in the service area, including 81 libraries, 1,066 medical/healthcare facilities, 312 public safety institutions, 418 K-12 schools, and 15 universities, colleges, or other postsecondary institutions.

Table 2 shows the percentages of the populations in the service area and the rest of Illinois by the number of broadband providers available according to data and speed thresholds defined by the National Broadband Map (NBM).[25] A much larger portion of the service area population does not

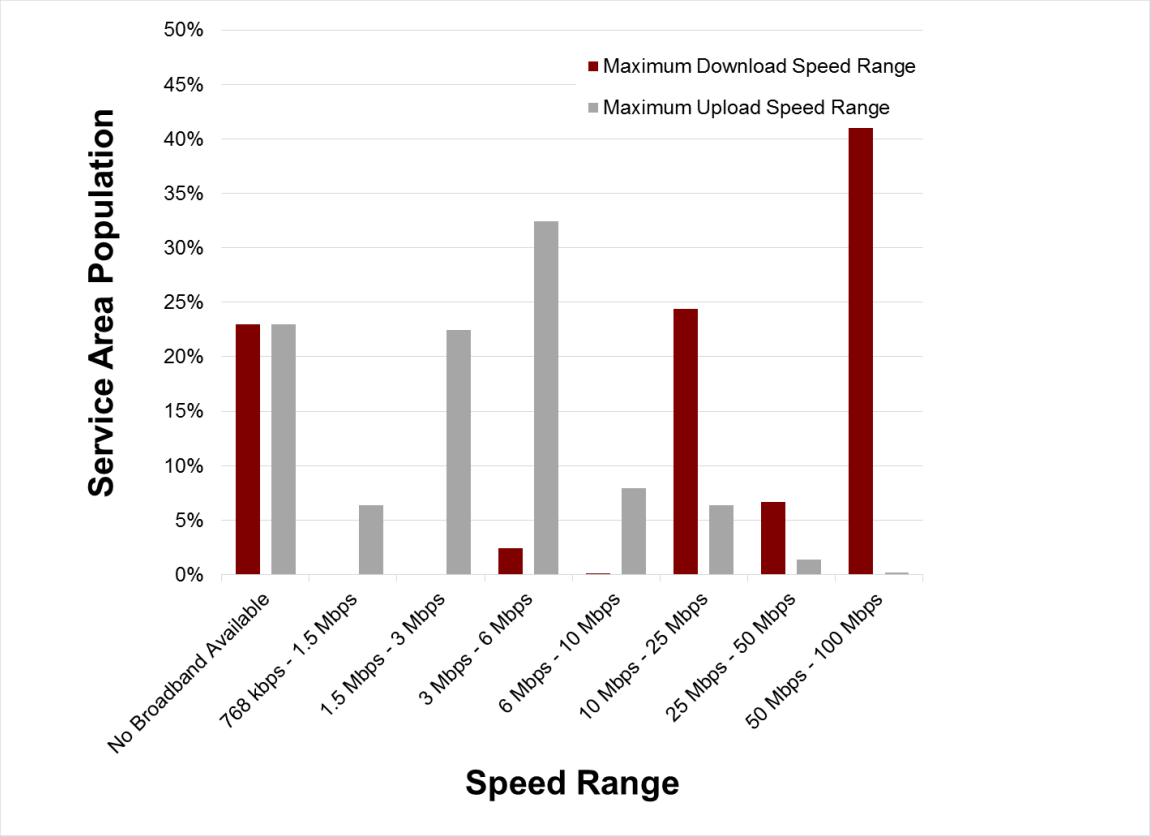
have access to any broadband providers (23 percent) compared to the rest of Illinois (5 percent). The same is true of the relative populations of the service area and the rest of Illinois, with only one broadband provider available: 34 percent of service area residents have access to only one provider, compared to 18 percent of residents in the rest of Illinois. All provider statistics use the June 2011 release of the NBM and 2010 population data from GeoLytics.

Table 2. Number of Broadband Providers Available in Illinois

Number of Providers	Service Area	Rest of Illinois
0	22.94%	4.81%
1	33.59%	18.37%
2	26.70%	29.16%
3	16.48%	43.26%
4	0.30%	4.39%

Figure 2 shows the percentages of the service area population with respect to the fastest download and upload speed range available to them.[26] According to the NBM, there are seventeen broadband providers in the service area. Three of the service area providers deliver service in the fastest download speed range of 50 Mbps to 100 Mbps. Maximum available download speeds range from 3 Mbps to 100 Mbps, while maximum upload speeds range from 768 kbps to 100 Mbps.

Figure 2. Maximum Speed Ranges Available for the Service Area Population



Broadband subscribership rates are also lower in the service area than across the state. Federal Communications Commission (FCC) data from June 2012 show that 49 percent of the service area

households subscribe to an Internet service that has at least 768 kbps download speeds and 200 kbps upload speeds.[27] Nearly 64 percent of the state's households subscribe to an Internet service with the same minimum thresholds.[28]

Figure 3 presents a summary of CAI subscriptions at different speed tiers since Clearwave first served an institution in the fourth quarter of 2011.[29] Service (subscriptions) did not begin until the second quarter of 2012. Most subscribers have service in the 10 to 49 Mbps range, which provides increased speeds over older technologies, and increased reliability, a frequently noted benefit of the fiber network. The technology used by Clearwave allows for rapid software-based expansion of connection speeds up to 1 Gbps. At the time of the site visit, only SIU subscribes to service of 1 Gbps, but all CAIs have this option in the future.

Figure 3. CAI Subscribers by Connection Speed

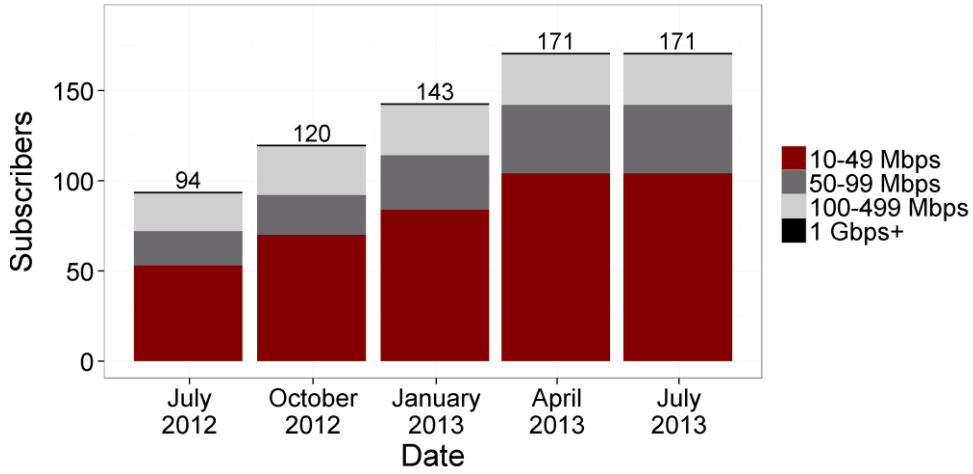
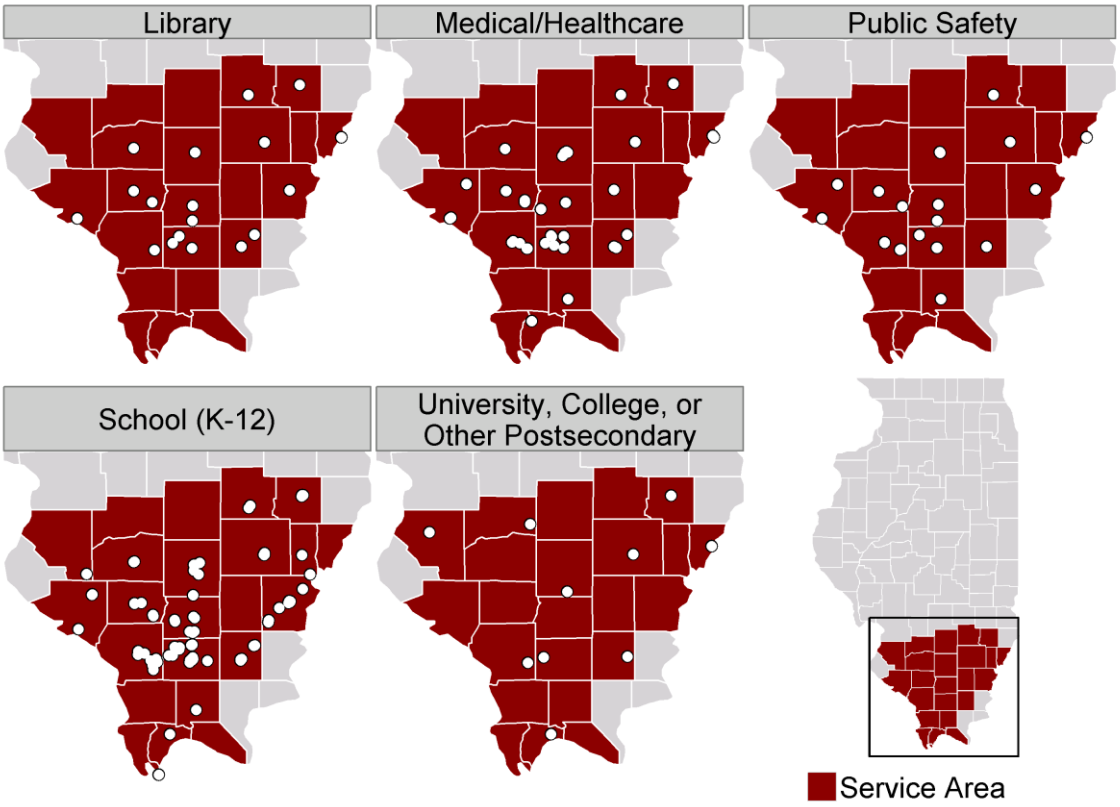


Figure 4 displays maps of Clearwave's service area and the locations of the CAIs served as of June 30, 2013.[30]

Figure 4. Map of CAIs in the Service Area



The evaluation study team met with Clearwave staff, project partners, economic development specialists, and civic and government leaders. These interviews helped the team understand the grantee's approach to project implementation and the strategies used to create demand for the broadband service. Additional interviews with key CAIs and partners throughout southern Illinois focused on describing the impact on CAIs in relation to several factors, including the quality of service of the upgraded network, especially speed, reliability, flexibility, and cost. The analysis in this report focuses on outcomes and impacts to CAIs. Interviews conducted include the following:

- School Districts
  - **Mt. Vernon District #80 Schools** includes one pre-kindergarten center, a kindergarten through 3rd grade center, a 4th and 5th grade intermediate center, and a 6th, 7th, and 8th grade middle school.[31] The BTOP-funded Clearwave project provided the Mt. Vernon School District with broadband connectivity through a ring architecture to the administration building, which serves the rest of the buildings through the district's wide area network. More than seventy new wireless access points were set up inside the schools to enable a new digital learning program using tablets.
  - **Frankfort Community Unit School District #168** is a school district serving West Frankfort, IL. The district serves approximately 1,775 students from prekindergarten to 12th grade, divided across four schools: Denning Elementary (pre-K-2), Frankfort Intermediate (3-6), Central Junior High School (7-8), and Frankfort Community High School (9-12).[32] Frankfort Community Unit School District #168's bandwidth has increased by a factor of five, while cost is approximately 65 percent of what it had been with the previous vendor. The cost of a 10 Mbps connection from the previous provider, plus a 5 Mbps point-to-point connection, was $1,500 per month. The most noticeable improvement has been a reduction in the number of outages due to network load issues and severe weather conditions.

- Higher Education
  - **Southern Illinois University**, **Carbondale** (SIU) is a major public higher education institution dedicated to: quality academic endeavors in teaching and research; supportive programming for student needs and development; effective social and economic initiatives in community, regional, and statewide contexts; and affirmative action and equal opportunity.[33] Because of the BTOP-funded project, in mid-2013, SIU added an additional 1 Gbps connection to its pre-existing 1 Gbps connection to ICN connecting SIU to other state institutions and to the Internet. Clearwave provides the 1 Gbps connection to SIU for $10,000 per month.
  - **Shawnee Community College** (SCC) is dedicated to providing quality, cost-effective, and comprehensive programs to all individuals within the district and the region who can benefit from such activities. The college strives for continuous improvement through the evaluation of programs, institutional effectiveness, and assessment of student academic achievement.[34] The Clearwave connection has made educational tools available to SCC that were previously unavailable.
  - **Illinois Eastern Community Colleges** (IECC) offers a broad range of degree and certificate programs. IECC has campuses in Olney, Fairfield, Robinson, and Mount Carmel. The colleges divide their offerings into career categories for both transfer and technical programs. IECC provides classes in-person and online.[35] Before Clearwave, IECC had two T1 lines (1.5 Mbps each) from each college going out to the Internet and a single T1 connecting the college to the district office for data connectivity to the enterprise resource planning (ERP) system and e-mail. IECC replaced its T1 connections with a 50 Mbps connection to Clearwave for Internet access, and installed network components to distribute access to the 50 Mbps connection across its campuses. In order to distribute broadband connectivity among its campuses, IECC had to purchase several hardware items, including network switches, and had to lease a two-mile section of fiber from ICN at a cost of approximately $15,000. The estimated payback on the fiber lease is two years. The leased fiber replaces T1 with dark fiber at a cost of $600 per year for unlimited bandwidth, versus $600 per month for a T1 connection. Hardware maintenance costs are expected to be minimal after the new network configuration is complete.
- Public Safety
  - **Carbondale Police Department** is a full-service agency that provides twenty-four hour service to the community and is responsible for the enforcement of all laws and ordinances of the State of Illinois and the City of Carbondale.[36] The police department is planning to connect to the network in its new building to add redundancy.
  - **Saline County Sheriff's Departmen**t works with more than thirty agencies and meets the law enforcement needs of the people in Saline County.[37] The Saline County Sheriff's Office, a participant in NG911, was one of the first CAIs to be served by the new Clearwave network.
- Healthcare
  - **Franklin Hospital**, located in Benton, Illinois, aims to serve all of the residents of Franklin County by providing high quality care that is professional and compassionate in order to achieve positive outcomes for patients.[38] The hospital previously relied on twisted copper T1 lines and upgraded to a 100 Mbps fiber-based connection on the Clearwave network. This improved its internal administrative capacity and allowed staff to use a distributed method to read radiology images.
  - **Christopher Rural Health** is a federally qualified health center (FQHC) with thirteen locations in southern Illinois that provides accessible, comprehensive healthcare services, including family practice, internal medicine, obstetrics and gynecology, pediatrics, and behavioral health.[39] Using Clearwave's managed services, Christopher Rural Health uses a virtual local area network to connect its main center and its satellite locations.
- Public Libraries

- **Illinois Heartland Library System** (IHLS) provides delivery and automation (online catalog) software to the libraries of southern and parts of central Illinois, as well as audio book services, and grant program services, including the Cataloging Maintenance Center and WebJunction Illinois, to libraries statewide.[40] Before BTOP, IHLS had a DS3 (45 Mbps) connection, but only used about 8 Mbps of it consistently. The cost was $4,500 a month. IHLS then switched to another cable company, which installed an 8 Mbps fiber connection for $1,500 per month. Clearwave then offered an increase in speed to 20 Mbps and a reduction in cost to $300 per month. The Clearwave connection is five times cheaper and 250 percent faster than the connection maintained by the previous provider.
- The **Harrisburg Public Library** maintains a collection of professionally selected materials that meet patrons' educational, informational, cultural, technological, and recreational needs. In addition to providing more than 41,000 materials such as books, audio books, and DVDs, Harrisburg Public Library gives patrons access to the Internet through its fiber-optic connection.[41] Harrisburg Public Library is transitioning its Internet service from a pre-existing ISP contract at 1.5 Mbps through a T1 line to 10 Mbps through a fiber lateral connected to the library from Clearwave. Both services were in use during the site visit interview.
- Carbondale, Herrin, Marion, Benton, and West Frankfort are libraries in the service area that switched to Clearwave. The cost to these libraries is $300 per month for 20 Mbps service, whereas they were receiving 1.5 Mbps for $350 per month before the Clearwave project.

The evaluation study team also met with the following groups that provided information on the social and economic impacts of the grant, although they did not directly receive broadband service because of it.

- **Man-Tra-Con Corporation** supports the economic health of southern Illinois by providing services designed to build a quality workforce. Additionally, Man-Tra-Con aims to identify the needs of local employers in order to provide the quality workers that employers need.[42]
- **Connect SI Foundation** is a nonprofit charitable organization that supports a collaborative, regional economic strategy for the twenty counties of southern Illinois. Its vision is to become a national leader for collaborative rural economic transformation fueled by world-class broadband and healthcare.[43]

Section 2 provides a summary of the outcomes and impacts the evaluation study team observed.

Section 2. Impacts

This section describes the outcomes and impacts of the Clearwave project in relation to the five focus areas described in *Interim Report 1*, with the addition of the Government Services focus area.[44] These outcomes and impacts focus on understanding the effect on CAIs. Digital Literacy is not a focus of CCI grants and the evaluation study team did not note significant Digital Literacy impacts outside of the outcomes and impacts related to the other focus areas.

As the CAIs obtained service from Clearwave, each CAI began to expand its services to meet the information needs of its users. All CAIs that benefitted from the improved bandwidth provided by the BTOP grant were already broadband users, often with broadband service supplied by T1 lines. The Clearwave project provided additional supply to meet the demand for bandwidth with these existing users, rather than increasing broadband adoption at CAIs that had no broadband connection.

2.1 Education and Training

Impacts within the Education and Training focus area are measured as changes to elements of educational content distribution and instruction. These impacts occur at K-12 institutions, community colleges, four-year institutions, universities, and other education providers. This focus area includes how the broadband Internet connections help the educational CAIs to perform activities that lead to helping students earn a certificate or diploma or receive training that is recognized as valuable for career advancement. Examples of certificates or diplomas include community college degrees, four-year college degrees, advanced degrees, general equivalency degrees, certifications in advanced software technologies such as network engineering, and other licenses or certifications that reflect knowledge of a particular subject at a level that would typically be taught at an educational institution.

When assessing impacts it is important to understand the characteristics and composition of education providers within the service area. Table 3 identifies all schools in the service area.[45] Clearwave connected more primary schools than schools of any other kind, but the distributions of school levels among the connected, unconnected, and total groups are similar. Almost 22 percent of the K-12 institutions in the service area were connected to the new network as of June 30, 2013.

Table 3. Illinois Schools (K-12) by School Level

School Level	Served by Grantee	Others in Service Area
Primary	42	168
Middle	20	52
High	27	72
Other	2	33
Undefined	1	2
All	**92**	**327**

Clearwave connected schools that serve over 39,000 students, 31 percent of all primary and secondary school students in the service area. More than 6,200 of these students are minorities, and nearly 20,000 qualify for free or reduced lunch, representing 19 percent and 33 percent of the

respective populations at public schools in the service area. These schools employ nearly 2,400 full-time equivalent teachers, representing 30 percent of all teachers in the service area. Clearwave served only public, not private, postsecondary institutions, connecting all ten public institutions in the service area.[46]

This section summarizes the activities observed by the evaluation study team during site visits. The literature review presented in *Interim Report 1* provides evidence that these activities and situations lead to economic and social impacts. This report lists these impacts from the literature along with the evaluation study team's observational evidence supporting either the realization of impacts or their potential to occur.

- **Distance learning opportunities allow schools to broaden the variety of courses offered. They also represent an educational resource for nontraditional or disabled students, or those living in geographically remote or poor areas.[47]**
  - SCC delivers more than thirty online classes each semester. The average size for an online class is 700 to 800 students. Most students are in the local area, although there are some students from other areas of the state. SCC tries to get students who are going elsewhere, such as the University of Illinois, to take courses online. Students can now take courses from community college locations near them, and can change the location where they take the course based on their daily schedule.
  - SIU was not able to offer online programs to the extent that it wanted because of bandwidth constraints. The Clearwave connection has alleviated these constraints and allows SIU to maintain enrollment without having to bring students to one campus.
  - Broadband enables SIU to use videoconferencing to reduce travel costs. There are approximately fifty videoconferencing devices on the SIU campus that are used for distance learning and interviewing. Increasing bandwidth is expected to increase the frequency with which these devices are used. SIU is nearing the implementation of desktop videoconferencing, which they expect will increase the need for bandwidth.
- **The use of digital tools enabled by broadband can save teachers time, allowing them to devote more time to instruction.[48]**
  - The Clearwave connection has made educational tools available to SCC that were previously unavailable. Before the improvement in broadband access at SCC, the use of YouTube for online videos was not possible. Staff members downloaded videos to local storage before use in class, rather than referring to streaming video during presentations. One IT manager said, "For a three-minute video, if they got in there right at the beginning of class and hit Play and then paused it and let it buffer, maybe by the end of class they might be able to show that video. It was horrible."
  - The Internet2 Group recently selected SIU to participate in the Dynamic Network System (DYNES) Networking Project. The goal of the project is to facilitate the rapid transfer of large amounts of data from international research centers such as the European Organization for Nuclear Research (CERN) to participating universities. Connectivity was not established at the time of the site visit. The vision for this type of connection includes speeds as high as 40 to 100 Gbps. Before the Clearwave connection, SIU planned to take 500 Mbps of the ICN connection and dedicate it to DYNES when needed.
- **Research has shown that computer use among students leads to improved academic performance, greater levels of educational attainment, improved school enrollment and graduation rates, and increased earning potential for students.[49]**
  - Frankfort Community Unit School District #168 has a new technology lab, enabled by the BTOP project, that gives students hands-on training in a variety of vocational modules. Seventh and eighth graders also attend the lab to learn the Google suite of products. Students will use their Google accounts through their middle and high school career. The additional bandwidth provided by Clearwave was necessary to implement this course, as the earlier connection to the lab was limited to 1.5 Mbps, which would not support the lab.

- SIU added greater broadband capacity for students to access the Internet from the residence halls because of the Clearwave network. Before the grant, SIU provided students in the residence halls with connection speeds of approximately 700 kbps, barely meeting the minimum requirements for high-speed access. With the Clearwave network, SIU has increased the broadband speed to 3 Mbps for each student. The SIU network management team is modifying the network configuration to expand the access speeds to 5-7 Mbps.
- SCC uses videoconferencing to broadcast class content from the main campus or an extension center to the other locations in the Shawnee system. The site visit team observed an algebra class where the teacher was in one location with some students, and other students were in satellite locations. Smart classroom use is growing, with dynamic use of the Internet and streaming video becoming more common.

- **Innovative use of web resources, such as using social networking sites as learning management tools, leads to greater student-teacher engagement.[50]**
  - Frankfort Community Unit School District #168 is using Google for e-mail and is exploring the use of Google drive or Dropbox for document storage and management. The district is also using the Khan Academy and YouTube.[51]
  - IECC students have been able to take tests in groups using computer labs, which was previously not possible because of bandwidth issues. IECC had also been working with Khan Academy resources, but had to download a local version of it because of bandwidth constraints. With the increase in bandwidth, IECC can use these resources more spontaneously for classroom instruction. Before the Clearwave connection, IECC had to throttle bandwidth, which impeded streaming video performance.
  - IECC moved to a cloud-based solution for online education. IECC just completed the shift from Angel, which IECC maintained in house, to Desire to Learn, a cloud-based solution. IECC is also exploring how to move its e-mail system to the cloud. Moving to Office 365 online will provide the benefits of cloud-based software, with the additional benefit that students would have access to Microsoft Office without requiring them to purchase it. This would save each student $70 to $100.
  - SIU produces a software training tool for human anatomy that many medical schools use. Before the Clearwave project, there was insufficient bandwidth to communicate between the main SIU campus and a second location near St. Louis, which was necessary to facilitate development of the product. The Clearwave project has provided sufficient bandwidth to meet these communication needs.
- **School administrations leverage broadband infrastructure to carry out internal operations. Broadband represents a rapid, reliable channel of communication to improve interactions among administrators, teachers, parents, and students.[52]**
  - Frankfort Community Unit School District #168 uses Pulse, an online reporting system, which compiles information out of its student management system. State reporting requirements are data-intensive and require the use of large amounts of bandwidth in order to comply. The Clearwave project allowed Frankfort to maintain compliance with reporting requirements while increasing the use of broadband for other educational activities.
  - IECC replaced its T1 connections with a 50 Mbps connection to Clearwave for Internet access. Before Clearwave, IECC had two T1 lines from each college going out to the Internet and a single T1 connecting the college to the district office for data connectivity to the enterprise resource planning (ERP) system and e-mail.
  - SCC changed from using external hard drives for backups to cloud-based backups. At the time of the site visit, SCC had just completed the first successful online backup. This has removed the need for the network administrator to store tapes at the local bank.
  - SCC IT personnel have found that the Clearwave network greatly simplified maintenance of computer systems. Previously, IT personnel had limited access to software patches due to limited bandwidth. IT personnel often took a laptop to McDonald's or to their homes to download software.

- Frankfort Community Unit School District #168's purchasing requests, staff leave requests, job applications, board reports, and board meeting minutes are now online. The school district uses EdAutomate for purchasing and staff leave. The school district uses AppliTrack for job applications. The school district also uses the network to process the daily lunch count. This was cumbersome on the earlier network, but the increase in bandwidth to 20 Mbps has removed difficulties in this area.

- **Broadband infrastructure may give school districts or higher education institutions a competitive edge over similar institutions that are not connected, boosting enrollment rates.[53]**
  - Nursing and automotive technology are two examples of IECC programs that have all of their content online. Automotive students access schematic diagrams online. Nursing students use Adam software online to learn anatomy. Before Clearwave, the Adam software used to teach nursing students was maintained onsite, and IECC had to perform updates in order to keep the software current.
  - SIU increased the capacity of its on-campus network from 1 Gbps to 10 Gbps. SIU focused on improving connectivity for students, including Wi-Fi service in dorms, and expanded wireless service to all indoor areas on campus. Wireless service is expected to cover all classrooms before the start of the fall 2013 semester. SIU is also working on a project to provide a tablet to each of the 4,000 freshmen students, which is anticipated to substantially increase bandwidth needs at the university and require the use of the Clearwave connection to meet these needs.
  - SIU trains more Federal Aviation Administration (FAA) flight controllers than any other program in the United States. This program is a heavy user of broadband connectivity for accessing online information for aircraft management. The airport campus is 2.7 miles from the main campus and had a 300 Mbps connection to the main campus. Clearwave agreed to let SIU use fiber from the BTOP project between the airport campus and the main campus, increasing throughput to 1 Gbps. This improved access at a new $56 million transportation education center that provides improved instructional facilities. It also allowed SIU to move its automotive technology program from the main campus to the new facility. The automotive technology program is another heavy user of broadband for access to online maintenance documents. The cost to achieve the 1 Gbps connection speed between the airport and main campus was independently estimated at approximately $890,000 without assistance from the Clearwave project. The cost of upgrading the 300 Mbps connection to 1 Gbps would have been financially prohibitive, and moving the automotive technology program to the airport campus' new facility would have overburdened the 300 Mbps connection.

2.2 Government Services

One of the five core purposes established by the Recovery Act was to "improve access to, and use of, broadband service by public safety agencies."[54] The Government Services focus area identifies how broadband improves services provided by government organizations to the public and includes both the provision and administration of public safety activities. Examples of public safety agencies include law enforcement agencies, fire departments, and emergency medical services (EMS). Some potential government service impacts include enhanced government efficiency, improved ability to save lives and reduce injuries, prevention of criminal activity, and improved information sharing between citizens and public safety entities.

When assessing impacts it is important to understand the characteristics and composition of government service entities within the service area. Table 4 identifies the agency type of all police departments in the service area.[55] Clearwave connected eight local police departments and twelve sheriff's offices as of June 30, 2013.

Table 4. Illinois Police Stations by Agency Type

Agency Type	Served by Grantee	Others in Service Area
Local police department	8	97
Sheriff's office	12	11
Special jurisdiction	1	5
All	**21**	**113**

Police departments served by Clearwave employ 437 full-time sworn officers, 29 percent of all full-time sworn officers in the service area. Connected police departments also employ 338 civilians full-time, 50 percent of the full-time civilian workforce across all service area police departments.[56]

Clearwave established a partnership with the Counties of Southern Illinois (CSI) Next Generation 9-1-1 (NG911) consortium and local hospitals, police, fire stations, EMS agencies, and the Southern Illinois University Police Department to implement the nation's first Internet Protocol (IP)-based NG911 public safety system. The system is expected to improve access for service area residents to 9-1-1 services, offer improved emergency information sharing, and enhance training opportunities among numerous CAIs involved in emergency response, including hospitals, fire stations, and EMS. Clearwave will provide the necessary broadband infrastructure to enable this emergency response system. This section focuses on provision of NG911 due to its broad reach and applicability to many of the social and economic impacts described above. Based on the evidence found in the academic literature relating activities to impacts, the activities surrounding NG911 should have large, demonstrable social and economic impacts.

This pilot project modernizes the phone-based 9-1-1 service by upgrading it to an IP-based service in fifteen counties and one municipality.[57] NG911 has many capabilities that can serve the public much more effectively. 9-1-1 centers can receive messages from the public in all digital formats such as text and video. The incoming calls will have pinpoint location information to identify the exact whereabouts of the caller, the public safety organizations can manage the demand for 9-1-1 service better by adding operators from other jurisdictions quickly, and the public safety agencies can coordinate with each other more effectively. Clearwave's broadband infrastructure enables the public safety agencies that are part of CSI to deploy NG911 in a cost-effective manner. Clearwave has the connections to all of the Public Safety Access Points (PSAP) in the fifteen counties that are participating in the initiative. Clearwave configured a mesh network using a ring architecture to connect the command centers.

The NG911 system will allow pooling of call center resources across counties. Calls to 9-1-1 do not currently roll over to other local 9-1-1 centers. The NG911 system will roll calls over automatically to call centers within the system, expanding the potential number of calls serviced simultaneously from eight to forty-seven. Text messaging will also be a potential means to submit a request for 9-1-1 assistance.

Broadband technology is required to implement NG911. Current switch-based 9-1-1 technology includes single points of failure, and does not allow for flexible routing of calls during peak load events. The CSI NG911 project will establish two data centers, one in Murphysboro and one in Harrisburg, with a fiber link between them, to provide redundant storage. The remaining hardware and software requirements are the responsibility of the NG911 participants. The PSAPs are receiving 10 Mbps service at a cost of $250 a month per PSAP.

The Saline County Sheriff's Office, a participant in NG911, was one of the first CAIs to be connected. The Clearwave connection will increase available bandwidth to allow better connectivity

with the NG911 system. Before Clearwave, the courthouse was using most of the available bandwidth for the transmission of law enforcement documents between the courthouse and the Sheriff's Office. Transmission speeds have increased because of the increased bandwidth provided by the Clearwave project. The Corrections Department uses substantial bandwidth to send data to off-site storage, and the connection to the BTOP network has increased the amount of bandwidth available for other uses. One of the major needs for bandwidth is for the courthouse to upload sex offender files to a website hosted by the Illinois State Police. Other occasional needs include the county clerk uploading election results to the department of elections.

Interviewees described how the project would have additional benefits beyond NG911. The assessor's office is working to upload maps and other data. This facilitates the development of gas and oil resources. There are additional cost savings benefits to the Clearwave network from radio over IP, which leverages existing radio towers to provide over-the-air connections to the broadband network. This eliminates the need for relays and reduces licensure and fees for the use of the airwaves.

2.3 Healthcare

This focus area includes activities intended to increase elements of the provision and administration of healthcare services, including health information technology, e-Care, electronic health records (EHR), telehealth, and mobile health. Impacts in the Healthcare focus area include broadband-enabled activities aimed at improving personal health or that of someone else. This definition includes not only sophisticated tasks, such as viewing medical records online, but also more common activities that might not involve a medical provider at all. Healthcare impacts might be observed at primary care physicians' offices, hospitals, or in areas served by nurse practitioners.

When assessing impacts it is important to understand the characteristics and composition of healthcare providers within the service area. Clearwave had connected forty-seven healthcare institutions as of June 30, 2013.[58] Table 5 identifies the taxonomy groups of these connected institutions and the taxonomy groups of all healthcare institutions in the service area according to the National Plan and Provider Enumeration System (NPPES).[59] All forty-seven of the healthcare institutions connected by Clearwave fall in the agency, ambulatory healthcare facilities, and hospitals taxonomy groups. Relative to the baseline provided by NPPES, Clearwave connected a larger percentage of hospitals than any other taxonomy group.

Table 5. Illinois Healthcare Institutions by Taxonomy Group

Taxonomy Group	Served by Grantee	Others in Service Area
Agency	10	327
Ambulatory Health Care Facilities	22	330
Hospital Units	0	16
Hospitals	15	63
Managed Care Organizations	0	13
Nursing & Custodial Care Facilities	0	204
Residential Treatment Facilities	0	66
All	**47**	**1,019**

This section summarizes the activities observed by the evaluation study team during site visits. The literature review presented in *Interim Report 1* provides evidence that these activities and situations

lead to economic and social impacts. This report lists these impacts from the literature along with the evaluation study team's observational evidence supporting either the realization of impacts or their potential to occur.

- **Broadband access enables providers to rapidly share patient information with other healthcare providers.[60]**
  - At Franklin Hospital, switching from twisted copper T1 lines to the Clearwave fiber network greatly improved the network capacity and reliability. This allowed for the use of off-site reading of radiological images. With the exception of a radiologist who is on-site two half-days per week, radiology readings are performed remotely. The radiology group currently affiliated with the hospital is located more than fifty miles away, and it works with hospitals in the entire area. The constraint on remote reading of radiological images is no longer Franklin Hospital, but the receiving broadband connection at the radiology center, which must handle transmission and receipt of large images sent from multiple locations.
- **Broadband connectivity enables providers to adopt new technologies and practices that enhance productivity, achieving outcomes such as improved appointment and treatment scheduling and more complete medical records at lower costs.[61]**
  - Franklin Hospital has been able to improve its billing efficiency because of the improved broadband service. Before Clearwave, IT personnel throttled connections in other parts of the hospital to complete the billing process.
  - Christopher Rural Health uses a Citrix IT infrastructure and NextGen software solutions for healthcare to expedite operations, which includes patient eligibility processing, claims processing, patient billing, bulk pricing, and patient scheduling. According to the Christopher Rural Health staff, the IT applications would take on average three to four times longer to run using the T1 (1.5 Mbps) connection speed than on the Clearwave network. The upgrade in the broadband service provides faster uploads for large electronic medical records data and image files. A 30 MB file uploads in half a day in comparison to one to two days using the T1 line according to the health center staff.
  - Connect SI recently applied for a United States Department of Agriculture (USDA) business cooperative grant for southern Illinois. The USDA grant does not pay for broadband connectivity. Connect SI also ordered bidirectional video conferencing equipment for hospitals in that region, and some of the hardest-to-serve or underserved regions. The goal of the grant is to allow more participation of hospitals in instruction provided by the SIU School of Medicine. The equipment also provides a platform for future telemedicine initiatives, which are currently limited to a few pilot projects in the region.
  - Christopher Rural Health now uses its Cisco teleconferencing system to provide medical programs for staff at the health clinics. Management is exploring the feasibility of using the teleconferencing system for medical services and activities that include staff and medical provider training and medical care for patients at remote sites.
  - Christopher Rural Health plans to incorporate disaster recovery into its operations, using the increased bandwidth available due to the Clearwave project to send backup files to a remote location.
- **Patients obtain improved access to health records and test results.[62]**
  - Franklin Hospital uses the Internet to provide information for patient care, including providing information to patients on drug interactions, medical conditions, and courses of treatment.
  - The Illinois Health Information Exchange (HIE) will expand the range of information accessible to providers and patients. Patients will have the ability to access their medical records. Some of this functionality will be implemented with the HIE, and some will come later. Franklin Hospital plans to have a patient portal that will allow patients to access medical records from anywhere with an Internet connection.

2.4 Workforce and Economic Development

Impacts within the Workforce and Economic Development focus area can occur through activities intended to increase overall employment of the target population, or to assist employed members of that population in finding jobs that offer increased salaries, better benefits, or a more attractive career path, including self-employment. This focus area also includes activities to attract new businesses to locate along the fiber path or to expand the economic activity of existing businesses connected to the network. While this focus area primarily describes jobs, it also includes other economic impacts such as wages, property values, and the number of firms in a region.

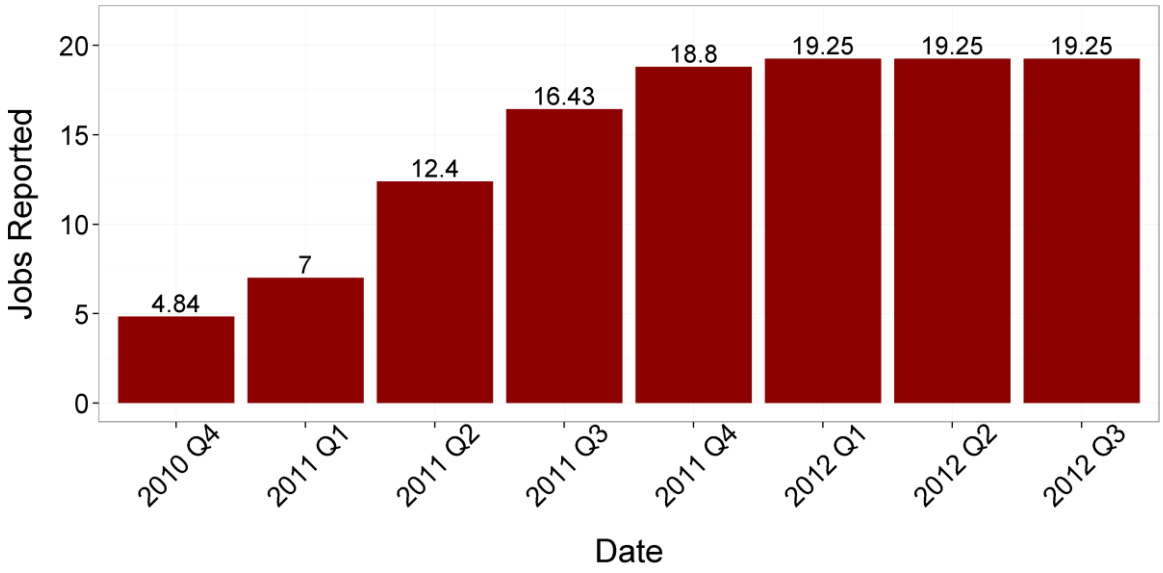
This section summarizes the activities observed by the evaluation study team during site visits. The literature review presented in *Interim Report 1* provides evidence that these activities and situations lead to economic and social impacts. This report lists these impacts from the literature along with the evaluation study team's observational evidence supporting either the realization of impacts or their potential to occur.

- **Access to computers and broadband helps to reduce unemployment by enabling job seekers to engage in training programs, facilitating their ability to search and apply for open positions online, and reducing geographic limitations associated with employment search.[63]**
  - Harrisburg Public Library reports that patrons use Illinois Job Match to search for employment. One or two people a month need assistance with these resources. Approximately one person per day uses the library to search for work. Two or three per week request help attaching résumés to e-mails for jobs they are applying for online. Users also search for jobs using the online Daily Register classified section, which has local employment listings.[64]
  - Southern Illinois Online Nursing Initiative (SIONI) is a part-time, online nursing program for licensed practical nurses who wish to continue their education to become an RN. The purpose of SIONI is to address the shortage of RNs in southern Illinois. Students who complete the program receive an Associate's Degree in Nursing. The improved broadband connectivity provided by Clearwave has increased the use of online resources for the nursing program. SIONI has graduated forty RNs, which resulted in a substantial increase in capabilities and wages for these nurses. SIONI has also stopped outmigration of nursing students to nearby areas. Connect SI believes that being able to stay in the same job and family setting while completing coursework is key to keeping trained nurses in the area.
  - Broadband is a necessary resource in the education and training of nurses using a nursing simulation and learning lab created at John A. Logan College in partnership with Southern Illinois Healthcare (SIH), a private sector healthcare provider. A $500,000 Utility Services grant from USDA partly funded this system. Nurses who require training for their professional development are now trained locally, and EMS technicians are likely to receive training in the future. The establishment of the simulation and learning lab created five jobs immediately, in addition to providing training in nursing and healthcare jobs to participants in the program. The development of this lab required the availability of broadband, which Clearwave provided. The lab connects to two middle schools, and will connect to all local community college nursing programs. The goal is, within a year, to provide bidirectional videoconference access to local middle school students to make the students aware of nursing programs, thereby increasing student participation in necessary science and math instruction so they can choose healthcare as a career option upon graduation. The cost of instruction with the broadband-enabled system is also lower than in a traditional classroom setting. The broadband-enabled system reduces instructor costs to one-third of their previous costs.
- **Broadband access allows businesses to enhance marketing strategies by growing or establishing a web presence and increasing the frequency of customer interaction, thereby increasing customer bases.[65]**

- Connect SI is developing a new program promoting economic development across southern Illinois using an eCommerce portal that will promote Bed & Breakfast (B&B) businesses in the service area. The portal will allow guests to book nights in local B&Bs, and will provide vacancy information on all participating locations.
- Connect SI reports that new providers are coming to the region, including, Whisper, a local wireless provider, which has begun to serve the Cobden and Makanda areas. These communities, which have many small businesses and artisans who do not have broadband service, are expected to benefit from the increased connectivity made possible by the new middle mile infrastructure.

As required by the Recovery Act, Clearwave reported the number of jobs created quarterly as a direct result of the project. As shown in Figure 5, Clearwave funded more than eighteen full-time equivalent positions during four consecutive quarters beginning quarter four of 2011.[66] It is important to note that this includes only direct jobs created, and does not include indirect or induced job creation.[67] Clearwave did not report any direct jobs with BTOP funding following the third quarter of 2012.

Figure 5. Direct Jobs Created by Clearwave



Job creation because of the grant appears to have occurred mostly within Clearwave itself, where employment expanded from thirty-two to seventy. Most of the interviewees did not report increases in employment because of receiving improved broadband service. Connect SI reported that, because of improved broadband availability, Continental Tires in Mt. Vernon expanded, creating 200 jobs in addition to the 3,000 that were already in the area. Many respondents reported increases in operational efficiency of their CAI, but none had quantitative measures that could describe the extent of these gains.

No studies are available to illustrate the effect of the Clearwave project on job growth in the service area. Clearwave and Connect SI pointed out that the network helps southern Illinois "check the boxes" when companies are considering a location in that part of the state.

2.5 Quality of Life/Civic Engagement

The Quality of Life/Civic Engagement focus area includes activities that create stronger and more integrated communities through broadband. Impacts within this focus area are measures of

broadband capacity for local institutions that provide public access and training in technology, such as libraries and other community centers.[68] These institutions provide support for individuals to participate in activities that benefit their communities and society, access information about government, participate in communities and civic associations, engage in education and training, seek employment, and establish or support small businesses. For some residents, this public access provides their only means of Internet connectivity. For others, it provides a place to seek assistance, to learn, and to share ideas and information with others. Support of public broadband access is therefore a means of enhancing the civic commons and the quality of life in the community. There is growing evidence that while libraries are beginning to offer more services to support quality of life and civic engagement, over 75 percent of public libraries are falling behind in having adequate broadband speeds to meet the needs of the public.[69]

When assessing impacts, it is important to understand the characteristics and composition of libraries or other institutions offering public access within the service area. Clearwave connected seventeen of the eighty-one libraries in its service area and one library support system.[70] Table 6 identifies the locales of all libraries in the service area.[71] The Institute of Museum and Library Services (IMLS) determines locales based on the proximity of libraries to urban centers and their location in Census-designated rural territories.[72] All seventeen libraries connected are located in towns; fourteen of these are located in remote towns. By contrast, only twenty-one out of the sixty-four other libraries in the service area are located in towns. More than half of the other libraries in the service area are located in rural areas.

Table 6. Illinois Libraries by Locale

Locale	Served by Grantee	Others in Service Area
City	0	0
Suburb	0	10
Town	17	21
Rural	0	33
Undefined	1	0
All	**18**	**64**

This section summarizes the activities observed by the evaluation study team during site visits. The literature review presented in *Interim Report 1* provides evidence that these activities and situations lead to economic and social impacts. This report lists these impacts from the literature along with the evaluation study team's observational evidence supporting either the realization of impacts or their potential to occur.

- **Broadband lowers the effective cost of civic engagement by offering citizens flexibility in when, where, and how they can participate.[73]**
  - Harrisburg Public Library gives patrons access to the Internet through its fiber-optic connection. The Harrisburg Public Library system provides public access to computers for citizens of Harrisburg, and residents of Galeton, Hardin, and Polk counties, which are extremely rural. Most visitors come from the local district, but some come from Galeton, Hardin, or Polk counties. There has been a reduction in visitors from out of the district due to Clearwave installing broadband at other libraries, such as El Dorado. The Harrisburg Public Library averages 1,500 uses of the public computer center per month. This number could include returning users. The Harrisburg Public Library receives a 10 Mbps connection through its contract with Clearwave, which is an upgrade from the 3 Mbps speed received from its former ISP.

- **Online government services improve communication between citizens and government agencies.[74]**
  - Four hundred fifty libraries in southern Illinois connect to IHLS services to share patron information and books with each other. These libraries use databases to keep an inventory of everything in the library, such as books, shelves, people, and cataloged items, and manage rules that govern how those things interact with each other. This facilitates the use of a single library card to access libraries in multiple cities, as long as the patron is from another library served by IHLS. IHLS provides services to identify delinquent patrons to prevent them from abusing the library system. Smaller libraries do not have dedicated IT staff, so using the services provided by IHLS gives them access to more IT resources. In addition to county and public libraries, IHLS serves school, law, and special libraries within the State of Illinois. In order to provide these services, IHLS requires constant broadband connectivity.

Section 3. Grant Implementation

This section presents Clearwave's strategy to maximize the social and economic impacts of the BTOP grant. The following subsections describe Clearwave's implementation strategies; Clearwave's approach to open access; major results of Clearwave's implementation strategy; an overview of sustainability efforts; and successful tools, techniques, and strategies identified during interviews with the grantee.

3.1 Implementation

Clearwave is a facilities-based Competitive Local Exchange Carrier (CLEC). It is a for-profit entity with privately held ownership. Clearwave provides wholesale point-to-point and Internet services for Local Exchange Carriers (LEC), ISPs, wireless ISPs, and mobile wireless carriers.[75] Clearwave services include voice solutions, high-speed data and Internet access, and Internet services for businesses and CAIs. Clearwave also provides managed services for telemedicine and distance learning using private networks such as virtual private networks rather than the public Internet.

Before the project, Clearwave served roughly 1,100 business customers across 22 communities in southern Illinois. The grantee indicated that there is only a small change in the number of communities added to its range of service area offerings. As Clearwave designed the network, its objective was to expand the coverage provided by fiber. The Illinois Broadband Opportunity Program (IBOP) – Southern project built a network double the size of Clearwave's leased fiber network by placing 740 miles of 96-count fiber cable throughout the service area as of June 30, 2013. In general, Clearwave operates within the same areas under the BTOP grant, but the new middle mile infrastructure allows Clearwave to offer service through fiber rather than legacy copper connections. The CAIs connected by Clearwave are most heavily concentrated between Marion and St. Louis and along that route (the northern portion of the service area). There are also some CAIs located in the western portion of the service area between Carbondale and Harrisburg.

Clearwave coordinated with stakeholders statewide to locate routing and interconnection points, and to assess the demand for broadband. Before the BTOP grant, Clearwave offered service in twenty-one markets in southern Illinois. This gave Clearwave insight into the bandwidth needs of the communities they served. As part of the expansion, Clearwave also began serving some markets, such as Belleville and Nashville, which it had not served before.

As an established CLEC, Clearwave had pre-existing relationships with local and regional government entities, nonprofits, private sector businesses, and CAIs. Clearwave relied on these relationships when rapidly developing the grant application and quickly building out to the selected CAIs. Clearwave's previous experience positioned it well to build the physical infrastructure of the network, connect and give users access to the network, and offer network connections to CAIs. Clearwave established partnerships with a number of construction, engineering, and financial firms to support the implementation of the project:

- CCI Systems serves as the general construction contractor and is responsible for deploying fiber-optic cable.
- Baxter and Woodman is a civil engineering firm that assists Clearwave in the design of its telecommunications network, secures environmental assessment (EA) and railway permits, and produces aerial images for each segment of Clearwave's network route.
- Brown and Roberts is an engineering consulting firm that helps Clearwave secure municipal-level permits, conducts route staking, and blowing fiber.

- Tanner Marlow, CPAs provides Clearwave with financial and accounting support.

Clearwave deployed a new fiber-optic network to provide the region with affordable and reliable connectivity between CAIs and backhaul connections to Internet peering locations in St. Louis and Chicago, which provide reduced costs for connectivity to the Internet. For the middle mile, Clearwave built the network's physical infrastructure including laying the fiber-optic network, installing the network equipment, building colocation facilities, and establishing interconnection points to backhaul networks.

Clearwave deployed the data link layer using Dense Wave Division Multiplexing (DWDM) and Ethernet standards. The network supports service offerings that include high capacity, symmetrical, point-to-point data, and Internet services starting at 10 Mbps and reaching up to 1 Gbps. The total capacity of the fiber backbone is 100 Gbps, with approximately 2 Gbps of that capacity in use. Implementing the network through buried fiber improves the reliability of the network. During interviews with CAIs, many interviewees noted the importance of improved reliability over their previous connections.

The network built by Clearwave is, for the most part, route redundant, although there are some locations that are not. In general, locations without route redundancy were extensions to the planned project, and a non-redundant connection was considered superior to no connection at all. In addition to providing the physical network, Clearwave installed and maintains the data link layer. The data link layer consists of the network services that transfer the data across the fiber network for all data traffic. The Clearwave network connects to the Internet in St. Louis. Through an interconnection agreement under development with ICN, Clearwave will establish a redundant Internet connection in Chicago. The interconnection is through colocation facilities in Olney and Collinsville, Illinois. It also built two redundant paths to the carrier hotels in St. Louis and Chicago.

Clearwave established a marketing and community outreach strategy that included the development of a project website, use of social networking sites, engagement of CAIs with existing relationships, deployment of sales staff to engage new CAIs in the field, networking through partners, and conference and workshop attendance. The project's website steadily brings in more than fifty unique viewers a week. Clearwave hired a media specialist to lead promotion of the project through Facebook, Twitter, and YouTube. The social media following has amassed more than 1,050 likes on Facebook, 600 followers on Twitter, and 350 views of Clearwave's promotional video on YouTube. Clearwave's social media campaign included a contest and prizes to increase the number of individuals following news and announcements of project activities. These combined efforts allowed Clearwave to quickly enroll over half of the number of CAIs targeted in its baseline, all within a few months.

Clearwave used its legacy business sales force and a presence in twenty-one of thirty-one targeted communities to rapidly communicate the benefits of grant-funded resources to current customers. Clearwave had an existing sales force and a number of established relationships with CAIs through its CLEC business. Clearwave targeted these CAIs in its initial sales outreach efforts. From its legacy business experience, Clearwave recognized that customers in the region prefer conducting business face-to-face. With both existing and prospective customers, Clearwave placed sales staff in the field with detailed analysis of customer telecommunications needs and challenges. Clearwave also used these face-to-face meetings to highlight BTOP and its importance as an economic and community-building stimulus project.

3.2 Open Access Policies

CCI projects funded by BTOP are predominantly middle mile projects, although a small number of last mile projects were awarded. These grants are intended to improve available broadband capabilities for CAIs, to facilitate the development of last mile services in unserved and underserved areas, and to promote economic growth. This investment through the BTOP grant is

intended to “lay the foundation for the ultimate provision of reasonably priced end-user broadband services” through open and nondiscriminatory interconnection strategies to enable last mile providers to have open access to the network.[76]

There is considerable debate on the impact of open access policies on the competiveness of the broadband market.[77] Open access is implemented through a wide variety of strategies. “These can range from commercial or voluntary arrangements, between communication operators and third-parties, through to regulatory intervention aimed at promoting certain policy objectives, such as expanding broadband availability, increasing competition, or promoting investment that may otherwise not be economic, such as in the case of enabling the establishment and treatment of shared facilities.”[78] The impact of open access will be dependent upon how well the practices and policies help to reduce the time, cost, and difficulty for last mile providers to interconnect to the network.[79] The impact also depends on how well the policy mechanisms ensure competitive pricing for wholesale services in the event of the presence of a middle mile provider that may also be a last mile provider.[80]

Clearwave has set up an open access network, setting its prices without regulatory guidelines. Clearwave has not published an open access policy. However, it did provide NTIA with its commitment to nondiscrimination and transparency to support its open access policy. The site visits undertaken by the evaluation study team showed that this pricing was generally in use at the sites included in this case study.

The Clearwave project is building laterals to CAIs, although CAIs might already have existing agreements in place with other ISPs. Clearwave builds the lateral to the CAI and often offers better rates for bandwidth. Clearwave is not offering dark fiber for sale at this time.

Clearwave serves as a wholesale middle mile provider and competes with other last mile providers for retail CAI subscribers. Clearwave’s wholesale point-to-point and Internet pricing will be available for other carriers, such as LECs, ISPs, wireless ISPs, and mobile wireless carriers. Clearwave anticipates that several last mile service providers will use the newly constructed network because of the attractive wholesale rates established by the project. With the cost structure supported through the grant, subscription rates will represent a significant savings to current and future users of the network.

3.3 Results

There were three major results of the Clearwave project observed by the evaluation study team:

- The Clearwave project implemented technologies providing increased broadband speed to CAIs. These levels of increased speed and reliability were not possible with the older technologies used at the CAIs in the service area, typically T1 lines, or sets of bonded T1 lines. In the longer term, the implementation of the Clearwave project allows for a hundred-fold increase in bandwidth at CAIs. This enables new uses of broadband technology that were simply not attainable before. Section 2, above, provides descriptions of early impacts observed by the evaluation study team.
- The Clearwave network is more reliable than the technology it replaces. Clearwave selected buried fiber-optic cable as the foundation of its network, which provides a high level of reliability. Increased route redundancy in the new network also improves potential reliability. The increased reliability of the network provides CAIs and last mile providers with a more stable platform to implement new systems using broadband technologies, and encourages the use of broadband in areas where reliability is critical, such as emergency response.
- The Clearwave network provides middle mile connectivity at lower prices than before the construction of the network. Price and capacity data from ten CAIs interviewed show that the average price of broadband per megabit was reduced from $250 to $14, while the average capacity increased by over 600 percent. The CAIs on average reported a 36 percent decrease

in broadband costs. The availability of lower priced middle mile bandwidth also encourages the entry of new providers of broadband-based services. As of June 30, 2013, Clearwave had signed five agreements with broadband wholesalers or last mile providers and was in negotiations with nine providers.[81] Clearwave indicated that the process for finalizing these agreements is taking between six months to a year to complete.

The longer-term impact of the Clearwave network will depend on several factors related to the results listed above:

- The impact of open access will be dependent upon how well the practices and policies help to reduce the time, cost, and ease for last mile providers to interconnect to the network.[82] The use of the newly available broadband capacity will depend on the creativity and investment of local economic actors. Before the BTOP-funded project, regional economic development specialists conducted a survey of the Clearwave project service area to determine these needs and to discuss economic development opportunities, especially those requiring broadband connectivity. They also had numerous conversations with network providers and CAIs to determine what broadband speeds the service area needed. Clearwave used the results of these efforts during its proposal-writing phase, during route planning, and as a basis for its network engineering efforts. To the extent that these initial surveys and studies were accurate, the network has been constructed to meet local needs for improved broadband service.
- Clearwave must maintain the reliability of the network over time. At present, the network is fully managed and monitored on a 24x7x365 basis and offers service-level agreements guaranteeing up to 99.999 percent network uptime. Clearwave staff report that the new network is substantially easier to manage than the older, leased network, even taking the larger scope of the network into consideration. Clearwave's successful track record suggests that future network maintenance is well within its capabilities.
- The impact also depends on how well the policy mechanisms ensure competitive pricing for wholesale services.[83] As of the site visit, CAI subscribers were being offered pricing that was substantially better than they received from other sources. Clearwave also provided potential last mile providers with attractive rates for wholesale services. To the extent that Clearwave maintains this pricing structure, it should be able to increase the use of the new network and the social and economic benefits it provides. These benefits depend on BTOP funding, as Clearwave found in its preliminary financial analyses that the middle mile infrastructure it is providing would not have been economically sustainable without the level of BTOP funding it received.

3.4 Sustainability

The sustainability of the Clearwave project will depend in part on the recruitment of last mile providers that will require wholesale service. Based on discussions with Clearwave management, operation of the Clearwave network will not be an economically viable long-term project without an increase in bandwidth sold. The best opportunity to make the network economically viable is to expand its commercial customer base and to add additional last mile providers. Clearwave has entered into five agreements and is in discussions with nine providers.[84] Although the evaluation study team was not provided with information about these agreements, they could include WiMax providers, cell phone carriers, ISPs, or other types of last mile providers that would provide Clearwave with revenues in exchange for use of its middle mile infrastructure. ASR will check in with Clearwave in the second quarter of 2014 to learn more about the sustainability of the project.

One threat to the provision of access to middle mile broadband services is pre-existing agreements between CAIs and other ISPs. These arrangements preclude the use of the middle mile architecture because of long contract terms and the absence of escape clauses for the customer. Specifically, some schools are currently in long-term agreements with service providers.

3.5 Successful Tools, Techniques, and Strategies

This subsection describes successful techniques, tools, and strategies identified by the grantee and interviewees. Successes and challenges described in earlier sections are not repeated here.

- With the scope of the broadband network reaching across southern Illinois, Clearwave worked with intermediary organizations as a successful strategy to help with increasing demand for the service, help coordinate network deployment, and raise awareness of how to use broadband. During the proposal phases and as the project started, Connect SI worked to explain the benefit of broadband to smaller communities, including providing local governments with information on ways citizens benefit from better city administration through broadband use. Connect SI worked specifically with mayors in the region, who were often part-time officials with full-time jobs in addition to their elected office. Some of these elected officials did not use broadband technology in their official capacities. Connect SI co-presented at Chamber of Commerce meetings and made calls to public officials to explain the Clearwave project and the benefits to the community. Connect SI relied on its longstanding relationships with elected officials and members of the business community to help it present the benefits of the Clearwave project. Connect SI also worked with hospital IT administrators, and convened a meeting among them to explain the benefit of the Clearwave project.
- Clearwave worked closely with a larger coalition of providers to eliminate overlap in provision of broadband services. The broadband needs of southern Illinois have been a long-term focus of several groups, including the Southern Illinois Opportunity Network (SION) and IBOP. Clearwave is a member of IBOP, a statewide coalition established to ensure that all Illinois communities have access to affordable and sustainable communication services. Clearwave is one of five BTOP participants in the IBOP initiatives. The objective of the IBOP initiative is to implement a statewide core broadband foundation, based on optical fiber. Each of the regions participating in the IBOP partnership will implement the same core broadband foundation of resources to meet near-term, intermediate-term, and long-term needs. IBOP participants include Illinois Department of Central Management Services (Illinois Broadband Opportunities Partnership, East Central); UC2B Board of Trustees of the University of Illinois (Urbana-Champaign Big Broadband); DeKalb County Government (DeKalb Advancement of Technology Authority Broadband); and Northern Illinois University (Illinois Broadband Opportunities Partnership Northwest Region). IBOP was formed during Round 2 of BTOP funding to eliminate duplication and overlap among applicants to meet the Notice of Funds Availability (NOFA) requirements of integration and non-duplication. The IBOP projects interact with each other and meet once or twice a year to share best practices.
- Clearwave used interconnection agreements and fiber swaps to increase the scope and utility of its network. The Clearwave network connects to the Internet in St. Louis. Through an interconnection agreement under development with ICN, Clearwave will establish a redundant Internet connection in Chicago. The interconnection is through colocation facilities in Olney and Collinsville, Illinois. This agreement connects SIU to ICN, completing a statewide education and research network. It also builds two redundant paths to the carrier hotels in St. Louis and Chicago.
- Clearwave implemented a system of dynamic bandwidth allocation that allows CAIs to increase their level of service as their needs grow, with pricing predefined. This has allowed CAIs to get on to the network quickly, without as much concern for the parameters of the connection agreement with Clearwave. As CAIs begin to use the broadband Internet service from Clearwave, many are also beginning to implement additional strategies to leverage the faster and more reliable connectivity to make improvements in existing services. For many of the subscribers, IT directors are benchmarking their broadband use to determine if they have enough bandwidth or if there is a need to add more. The IT Director for Franklin Hospital anticipates using this capability to meet the hospital's needs by emphasizing that, "we have that reassurance that I can always turn it up if I need to, so I don't worry too much about that."

3.6 Challenges

- Building the network was time-constrained. The environmental assessments took a considerable amount of time, leaving only two-and-a-half years to complete the build of the network.

Section 4. Conclusions

The American Recovery and Reinvestment Act of 2009 (Recovery Act) instructed NTIA to implement BTOP to promote five core purposes:[85]

1. Provide access to broadband service to consumers residing in unserved areas of the country.
2. Provide improved access to broadband service to consumers residing in underserved areas of the country.
3. Provide broadband education, awareness, training, access, equipment, and support to:
   a. Schools, libraries, medical and healthcare providers, community colleges and other institutions of higher learning, and other community support organizations.
   b. Organizations and agencies that provide outreach, access, equipment, and support services to facilitate greater use of broadband services by vulnerable populations (e.g., low-income, unemployed, seniors).
   c. Job-creating strategic facilities located in state- or federally designated economic development zones.
4. Improve access to, and use of, broadband service by public safety agencies.
5. Stimulate the demand for broadband, economic growth, and job creation.

This section summarizes how Clearwave's implementation of BTOP has encouraged the fulfillment of the Recovery Act's goals. Clearwave supported Recovery Act goals to improve access in unserved and underserved areas. With these connections, CAIs are beginning to transform their services for healthcare and education and provide digital literacy training in libraries and schools. The Clearwave network is enabling the public safety agencies from a fifteen-county consortium to pilot test an IP-based NG911 service. Clearwave is also collaborating with economic development organizations to help CAIs and other employers enhance the demand for broadband across its service area.

4.1 Improve Access to Unserved and Underserved Areas of the Country

The first two goals of the Recovery Act encourage improved access for unserved and underserved areas:

- Provide access to broadband service to consumers residing in unserved areas of the country.
- Provide improved access to broadband service to consumers residing in underserved areas of the country.

According to the June 2011 release of the NBM, nearly 23 percent of the Clearwave service area residents do not have a broadband provider available to them.[86] The service area has a higher concentration of individuals without a broadband provider available than the rest of the state, where almost 5 percent of the population do not have a broadband provider available.[87] Broadband subscribership rates are also lower in the service area than across the state. FCC data show that 49 percent of the service area households subscribe to an Internet service that has at least 768 kbps download speeds and 200 kbps upload speeds. Nearly 64 percent of state households subscribe to an Internet service with at least the same minimum thresholds.[88]

The Clearwave network improved access to broadband. First, Clearwave made the greatest impact in improving access in southern Illinois by directly serving 188 CAIs. The benefits are significant as school districts, libraries, health-related organizations, community colleges, and universities are

experiencing different gains in cost savings and network reliability from the new broadband connections. Additionally, the network's routing now establishes a fiber-based broadband infrastructure that passes all of the major population centers in southern Illinois. Clearwave also located interconnection points strategically along the route to facilitate future expansion of the network. These interconnection points offer last mile providers that wish to use the open access network the possibility of connecting.

The network not only provides physical access to the network, it also provides services to enhance virtual access to network services. Clearwave made direct lateral connections to CAIs and ring connections to school districts and other larger CAIs. The middle mile service is also built on a network that has considerable virtual capabilities to provide network-level services that were not possible when using earlier generations of copper-based T1 lines. For example, Clearwave now provides network management services for CAIs with multiple satellite locations spread out over a wide area in southern Illinois. Now, a virtual wide area network connects the Christopher Rural Health organization to its locations in rural areas. Not only is Christopher Rural Health experiencing better speeds and reliability, it is able to use new applications for sharing data and collaborating. This network also makes it easier and more economical to comply with Health Insurance Portability and Accountability Act (HIPAA) regulations because of enhanced network security. These capabilities also help to support the NG911 service described in Section 2.

4.2 Broadband Education, Awareness, Training, Access, Equipment, and Support

Most closely aligned with PCC and SBA grants, the next Recovery Act goal is for grantees to provide broadband education, awareness, training, access, equipment, and support to:

1. Schools, libraries, medical and healthcare providers, community colleges and other institutions of higher learning, and other community support organizations.
2. Organizations and agencies that provide outreach, access, equipment, and support services to facilitate greater use of broadband services by vulnerable populations (e.g., low-income, unemployed, seniors).
3. Job-creating strategic facilities located in state- or federally designated economic development zones.

The Clearwave grant focused on providing middle mile broadband network and last mile connections to CAIs. This included providing information to community members through public events and meetings, and increasing awareness of the benefits of broadband through cooperation with Connect SI. The BTOP grant also provided equipment and support to institutions as part of the upgrades to broadband access at the CAIs. Clearwave provides ongoing support to the connected institutions, and seeks to provide increased bandwidth as needed. Each CAI may be increased to 1 Gbps upload and download speeds, although only one had done this as of the site visit.

The CAIs using the Clearwave network are now able to access the Internet at faster speeds or lower costs to meet their growing information needs. The public libraries are moving to faster broadband speeds allowing them to offer better computer access to the public. Schools are using the improved access to pilot new learning initiatives using digital tools. Healthcare organizations are hiring informatics specialists and beginning to try out telemedicine approaches in their service model. As the CAIs continue to learn how to leverage the new broadband service, it is expected that larger impacts will emerge.

SCC reports that teaching students from out of state is difficult due to fees required to teach classes within a state. Registering in every state would cost $1.5 million. SCC is working on registering to teach online courses in Kentucky and Missouri, which are the home states for some

SCC students. This legislatively induced restriction inhibits competition in the market for online educational services, which SCC would be able to serve with its online content.

Telemedicine is facing acceptance barriers at Franklin Hospital because doctors are accustomed to practicing medicine face-to-face. Franklin Hospital is working with a group of five hospitals to come to an agreement with larger hospitals to provide telemedicine support, especially for the Emergency Department. The goal is to use telemedicine to identify cases where a patient transfer is required to provide care. At present, Franklin Hospital sends patients thirty miles to larger hospitals for evaluation.

4.3 Public Safety Agencies

The fourth goal of the Recovery Act is to improve access to, and use of, broadband service by public safety agencies. As described in Section 2.2 of this report, Clearwave partnered with the CSI NG911 consortium to provide a new regional 9-1-1 service for public safety.

4.4 Demand for Broadband, Economic Growth, and Job Creation

The final Recovery Act goal is to stimulate the demand for broadband, economic growth, and job creation. All CAIs that benefitted from the improved bandwidth provided by the BTOP grant were already broadband users, often with broadband service supplied by T1 lines. The Clearwave project provided additional supply to meet the demand for bandwidth with these existing users, rather than increasing broadband adoption at CAIs that had no broadband connection. Many respondents reported increases in operational efficiency of their CAI, but none had quantitative measures that could describe the extent of these gains.

No studies are available to illustrate the effect of the Clearwave project on growth in the service area counties. Clearwave and Connect SI pointed out that the network helps southern Illinois to "check the boxes" when companies are considering location in that part of the state. Section 2.4 presents a summary of other Workforce and Economic Development impacts.

Clearwave believes it would have remained in business without the BTOP project, but the BTOP grant enabled it to build the network and grow from thirty-two to seventy employees. Clearwave believes they would never have built the network without the grant, nor would Clearwave have been able to serve nearly 200 CAIs with a staff of 32 people.

Section 5. Next Steps for the Evaluation Study

In early 2014, ASR will deliver *Interim Report 2* to NTIA. This report will include a summary of the site visits to twelve CCI projects. It will also include a summary of the second round of site visits to the fifteen PCC and SBA grants.

For the CCI projects, *Interim Report 2* will summarize the activities underway by twelve CCI grantees and the social and economic impacts of these projects. For the PCC and SBA projects, *Interim Report 2* will provide an update to and refinement of the analysis presented in *Interim Report 1*.

In September 2014, ASR will deliver a *Final Report* that quantitatively and qualitatively assesses the economic and social impact of BTOP grants (including CCI, PCC, and SBA grants). The centerpiece of the *Final Report* will be an assessment of how and to what extent BTOP grant awards have achieved economic and social benefits in areas served by the grantees. To the extent that such information is available, ASR will use results from studies performed by the grantees to round out the conclusions presented.

Notes

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- Last mile project – any infrastructure project the predominant purpose of which is to provide broadband service to end users or enduser devices (including households, businesses, community anchor institutions, public safety entities, and critical community facilities).
- Middle mile project – a broadband infrastructure project that does not predominantly provide broadband service to end users or to end-user devices, and may include interoffice transport, backhaul, Internet connectivity, or special access.

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- Primary: lowest grade offered is in pre-kindergarten through third grade and highest grade offered is in pre-kindergarten through eighth grade
- Middle: lowest grade offered is in fourth through seventh grades and highest grade offered is in fourth through ninth grades

- High: lowest graded offered is in seventh through twelfth grades and highest grade offered is twelfth grade
- Other: grades offered do not follow the primary, middle, or high school level configurations, or the school does not have a grade system
- Undefined: missing value

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[67] Recovery.org provides the following guidance and example for calculating grant-funded jobs:

1. If a normal full-time schedule is 40 hours a week, multiply 40 hours x 52 weeks = 2,080 Total Hours per year.
2. Divide 2,080 Total Hours by 4 to equal 520 regular quarterly hours.
3. If two full-time employees each worked 520 hours (1,040 hours) for the quarter and another half-time employee worked 260 hours, the Total Hours for the three employees is 1300 (520 + 520 + 260 = 1300).
4. Divide 1300 by 520 to equal 2.5 Recovery funded jobs during that quarter.

For more information, visit http://www.recovery.gov/News/featured/Pages/Calculator.aspx

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- City, Large: Territory inside an urbanized area and inside a principal city with population of 250,000 or more
- City, Midsize: Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000
- City, Small: Territory inside an urbanized area and inside a principal city with population less than 100,000
- Suburb, Large: Territory outside a principal city and inside an urbanized area with population of 250,000 or more
- Suburb, Midsize: Territory outside a principal city and inside an urbanized area with population less than 250,000 and greater than or equal to 100,000
- Suburb, Small: Territory outside a principal city and inside an urbanized area with population less than 100,000
- Town, Fringe: Territory inside an urban cluster that is less than or equal to 10 miles from an urbanized area
- Town, Distant: Territory inside an urban cluster that is more than 10 miles and less than or equal to 35 miles from an urbanized area
- Town, Remote: Territory inside an urban cluster that is more than 35 miles from an urbanized area
- Rural, Fringe: Census-defined rural territory that is less than or equal to 5 miles from an urbanized area, and rural territory that is less than or equal to 2.5 miles from an urban cluster
- Rural, Distant: Census-defined rural territory that is more than 5 miles but less than or equal to 25 miles from an urbanized area, and rural territory that is more than 2.5 miles but less than or equal to 10 miles from an urban cluster
- Rural, Remote: Census-defined rural territory that is more than 25 miles from an urbanized area and is also more than 10 miles from an urban cluster
- An "Undefined" locale is a missing value.

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[86] National Telecommunications and Information Administration, “State Broadband Initiative June 30, 2011.”

[87] National Telecommunications and Information Administration, “State Broadband Initiative June 30, 2011.”

[88] Federal Communications Commission, “Local Telephone Competition and Broadband Deployment Form 477.”

Glossary

Acronym	Definition
ACS	American Community Survey
APR	Annual Performance Progress Report
ASR	ASR Analytics, LLC
B&B	Bed and Breakfast
BTOP	Broadband Technology Opportunities Program
CAI	Community Anchor Institution
CCI	Comprehensive Community Infrastructure
CERN	European Organization for Nuclear Research
CLEC	Competitive Local Exchange Carrier
CSI	Counties of Southern Illinois
DCEO	Department of Commerce and Economic Opportunity
DSL	Digital Subscriber Line
DWDM	Dense Wave Division Multiplexing
DYNES	Dynamic Network System
EA	Environmental Assessment
EHR	Electronic Health Record
ELSi	Elementary/Secondary Information System
EMS	Emergency Medical Services
ERP	Enterprise Resource Planning
ESInet	Emergency Services IP Network
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FQHC	Federally Qualified Health Center
Gbps	Gigabit per second
GPS	Global Positioning System
HIE	Health Information Exchange
HIPAA	Health Insurance Portability and Accountability Act
IBOP	Illinois Broadband Opportunity Partnership
ICN	Illinois Century Network
IECC	Illinois Eastern Community Colleges
IHLS	Illinois Heartland Library System

Acronym	Definition
IMLS	Institute of Museum and Library Services
IP	Internet Protocol
IPEDS	Integrated Postsecondary Education Data System
ISP	Internet Service Provider
LEC	Local Exchange Carrier
Mbps	Megabit per second
NBM	National Broadband Map
NCES	National Center for Education Statistics
NG911	Next Generation 9-1-1
NOFA	Notice of Funds Availability
NPPES	National Plan and Provider Enumeration System
NTIA	National Telecommunication and Information Administration
PAM	Post-Award Monitoring Database
PCC	Public Computer Centers
POP	Point-of-Presence
POTS	Plain Old Telephone Service
PPR	Quarterly Performance Progress Report
PSAP	Public Safety Access Point
Recovery Act	American Recovery and Reinvestment Act of 2009
RN	Registered Nurse
SBA	Sustainable Broadband Adoption
SCC	Shawnee Community College
SIH	Southern Illinois Healthcare
SION	Southern Illinois Opportunity Network
SIONI	Southern Illinois Online Nursing Initiative
SIU	Southern Illinois University
USDA	United Stated Department of Agriculture

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