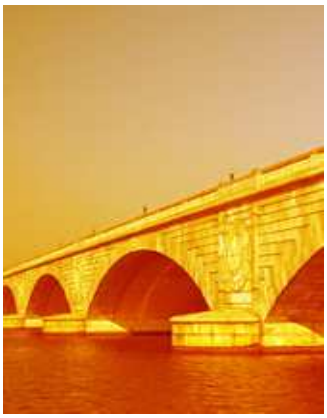

# Final Report

**City of Saint Paul, Minnesota**

Broadband Technology Needs Assessment
and Economic Development Impact Study

May 2006

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***Mission Statement***

Springsted provides high quality, independent financial and management advisory services to public and non-profit organizations, and works with them in the long-term process of building their communities on a fiscally sound and well-managed basis.

**LETTER OF TRANSMITTAL**

May12, 2006

Andrea Casselton
Director of Technology and Communication
15 West Kellogg Blvd, Room 110
Saint Paul, MN  55102

Re: **Broadband Impact Technology Study**

Dear Ms. Casselton:

On behalf of our entire project team, including Dain International Services, Elert and Associates, and Pepin, Hugunin and Associates, I am pleased to submit to the City of Saint Paul the Broadband Technology Needs Assessment & Economic Development Impact Study (BITS). The BITS report concludes over four months' of dedicated effort on the part of the City and the consulting team collecting and analyzing a wide variety of data and the opinions of hundreds of citizens and business owners.

An undertaking of this nature does not happen without tremendous cooperation and support from City staff. I particularly want to thank Cindy Mullan, Information Services Manager who provided expert project management and was ever present to meet our requests and coordinate city responses. I also wish to thank the Steering Committee members who provided valuable feedback and guidance as we navigated the various City Hall and community venues necessary to complete our task.

The subject of broadband technology and what it means to the future of a city or the nation is squarely in front of community leaders around the country. We commend the City of St. Paul for the foresight it demonstrated by authorizing this study. We believe the results will enable the City to make the most informed decision possible on this important issue.

Respectfully submitted,

*Craig Rapp*

Craig R. Rapp
Vice President

mts

# 1. Executive Summary

## Introduction

The Broadband[1] Technology Needs Assessment & Economic Development Impact Study (or Broadband Impact Technology Study [BITS] for short) explores options for enhanced Internet broadband access in the City of Saint Paul. This study also makes recommendations as to how the City might proceed, should the City wish to play a role in the expansion of broadband capacity or availability.

The community's needs for broadband Internet access are diverse. They relate to all areas of the City's economy and to the quality of life of the City's residents. In order to provide a focus for our study, the City requested that the consulting team evaluate the impact of enhanced broadband in light of four broad goals:

1. The impact on economic development;
2. The lessening of the digital divide;
3. The improvement of City operations; and
4. The enhancement of the City's appeal to "the creative class" of knowledge workers upon whom future economic growth appears to depend.

This study analyzed broadband technology from four perspectives including those of businesses, residents, City operations and educational institutions.

## Key Findings

Our study confirmed that basic broadband delivered by wire is generally available to residents and businesses in the City of Saint Paul. Given that reality, what, then, are the problems to be solved or the opportunities to be seized by the availability of enhanced broadband services in the City? This study identifies four key issues and opportunities:

1. **There is an opportunity to improve the affordability of "basic broadband"** (1-6 megabytes per second). Currently the lowest priced broadband option is Qwest DSL (without phone service) at $31.99 per month. Utilization rates are not available (these are trade secrets of the incumbent providers), but this is not generally regarded as affordable to low and moderate income households. A small percentage of businesses also indicated that they do not have Internet connections due to the cost. Many recent municipal broadband initiatives are charging or targeting pricing at $20 per month or less.

2. **There is an opportunity to make mobile broadband available throughout the city.** For most homes and businesses, broadband access is provided by cable modem and DSL technologies. As a practical matter, these technologies do not provide mobility or portability of access. In a survey of Saint Paul businesses, levels of satisfaction with various attributes of Internet services were determined. Among the

[1] Definitions of key broadband terminology are provided in the Introduction to this report (see page 5) and are amplified in Appendix I.

various attributes, the lowest level of satisfaction was with mobility and portability options. Also, management of several City departments – Licensing, Inspections and Environmental Protection, for example – indicated that immediate service improvements could be realized with mobile broadband options.

3. **There is an opportunity to improve fiber infrastructure which can deliver ultra high speed or "big" broadband capacity (20-100 megabytes per second).** A publicly owned fiber infrastructure already exists in some areas of the city, especially downtown. Fiber connections directly to premises are not generally available, however. In cases where such service is available, it is at a high cost. As a result, those who require large bandwidth pay the high cost or do without. This lack of availability and high cost may deter future businesses development, especially among big broadband users.

4. **There is an opportunity to improve city service delivery with enhanced broadband capacity.** Currently, the City depends upon a twenty-year old institutional network (I-Net) provided by the cable company for broadband communications. A replacement for the I-Net is likely to be required at some time, due to the age of the infrastructure, franchise regulation changes or both. City operations may also benefit from greater mobility and portability of broadband access.

Numerous cities in the United States and elsewhere are facing similar issues. Many cities are seeking some form of enhanced broadband services, such as wireless or fiber optics-based networks. Several examples of such broadband projects are outlined in Appendix II of this report. If the City of Saint Paul decides that a broadband initiative is appropriate to capitalize on the opportunities described in this report, it has the advantage of owning a number of useful resources, both wireless and fiber optics-based.

## Framework for Decision Making

This report identifies a number of technology options for the City's consideration. It also identifies alternative ways in which the City may be engaged, should it decide that a broadband initiative is appropriate. This report does not recommend any given technology, nor does it recommend a specific role for the City, nor does it recommend a specific private provider role. What this report provides to the City is a comprehensive analysis of the advantages and disadvantages of each of the options presented.

Determining whether a broadband initiative is justified, what technology seems best, what role is appropriate for the City of Saint Paul, and whether and with whom the City might partner in this effort are all policy decisions left to the judgment of the City.

Implicit in this discussion is the "do nothing" option. The City may choose to wait for the private sector to bring next-generation Internet access technologies to market. Incumbent providers have understandably been reluctant to divulge their plans. Based on a lack of certainty concerning the intentions of private sector providers, and based on the many municipal broadband initiatives now underway throughout the United States, this option

carries with it the risk of St. Paul falling behind other cities in the availability of enhanced broadband.

### Options for the City's Involvement

There are three primary models for the provision of enhanced broadband services, but each model potentially encompasses a wide range of variations depending upon the objectives and technologies involved.

1. **Private Provider Model.** In this model, the City makes no investment or a small investment, but offers incentives to private provider(s) to build, operate and provide services over a new broadband network.
2. **Public Model.** In this model, the City and/or other public entities build, own, operate and provide services over a new broadband network.
3. **Combination Model.** In this model, the City invests in a new broadband infrastructure alone or with other entities as an asset, and leases access to a private provider or providers.

### Technology Options

A wide range of options exist, but the following are the three identified as most appropriate for consideration at this time. Appendix III of this report describes options that were eliminated from consideration.

1. **Wireless + Fiber**: Mesh Wi-Fi with a fiber backbone, in which users connect via wireless (data-only service).
2. **All Wireless**: Mesh Wi-Fi with high-speed wireless backbone. Wireless technology throughout, including to each user (data-only service).
3. **City-wide Fiber to the Premise.** An all-fiber network featuring fiber optic cabling installed directly to users' homes and businesses (potential for voice, video and data services).

### Financial Implications

The estimated start-up plus ongoing costs of Option 1 (Wireless + Fiber) and Option 2 (All Wireless) are very similar. Initial costs may range from approximately $7 million to $10 million, with total cost of ownership over a twenty-year period of $21 million to $27 million. In both cases, the City's revenues through subscription services are projected to generate a positive cash flow as early as Year 3, based on a utilization rate of 15 percent of possible subscribers.

Option 3 (Fiber to the Premise) represents a long term investment strategy with a more complex financial picture. Total cost to build the system is estimated at approximately $296 million, which typically would be planned as a long-term investment over thirty years or more. The revenues necessary

to support or justify this type of investment would typically come from selling video and voice services as well as internet access.

Whether the City would bear or share in these initial or ongoing costs would depend upon how or whether the City chooses to be engaged in the development of an enhanced broadband network.

**Broadband Goals and Options**

How the City chooses to proceed will depend on the relative priority of its four goals. However, all the technology options identified in this report would provide enhanced broadband services that could help the City meet all of the goals to some degree.

- The goal of enhancing the City's **economic development** opportunities would best be met by a focus on big broadband, with fiber optics as the technology of choice. The City would engage in long-term community planning and investment strategies.
- The goal of lessening the **digital divide** would best be met by a focus on wireless as the technology of choice, with policies to ensure city-wide service and affordable access for all.
- The goal of ensuring sufficient broadband infrastructure to support **City operations** is best met by a focus on wireless technology for city-wide service and a fiber backbone for connectivity among City sites.
- The goal of enhancing the City's appeal to **"the creative class" of knowledge workers** would best be met by an initial focus on wireless technology for mobility, and a longer term strategy to provide big broadband to knowledge workers needing high capacity.

As the City endeavors to meet all of its stated goals, it may choose a blend of short-, mid- and long-term solutions involving two or more technologies and various levels of engagement.

## Conclusion

Examining broadband goals and options provides a context for why the City might undertake a broadband initiative. Are there any reasons, conversely, why the City might not wish to undertake a broadband initiative, apart from policy and/or philosophical reasons? The answer appears to be no.

Based on the evidence available from this study – specifically, from the survey of businesses located in the City of Saint Paul – a majority of those who participated in the study believe that the City has a role to play in the enhancement of broadband capacity and availability.

Further, with appropriate marketing – and if a utilization rate of 15 percent is feasible – a new broadband initiative has the potential to generate revenues sufficient to cover costs and to provide "excess" revenues sufficient to subsidize access for those who do not have the ability to pay.

# 2. Introduction

## Background

The past two years have seen a remarkable upswing in the interest of cities, counties and regions in the possibility of implementing broadband Internet services in their communities[1]. These communities are investigating broadband service for a number of reasons. For many entities, the primary concern is that all members of the community should have access to broadband Internet connections in order to lessen the "digital divide." For others, the chief concern is economic development, especially development that may be related to provision of "big" broadband. Some are interested in using broadband for providing educational, city, or medical services. Finally, some entities wish to encourage the entry of new service providers, so all consumers/residents have a choice of competitive providers. Among the hundreds of cities now exploring broadband options, all of these concerns can be found in various combinations.

## Scope

The scope of this project was framed by the City of Saint Paul's request for proposal "for a Broadband Technology Economic Development Impact Study." This RFP and subsequent discussions with the City charged the project team to examine current community needs for broadband services and whether those needs are being met by existing broadband technologies; to analyze the role that expanded broadband could play in the economic development of Saint Paul; and to identify opportunities to improve city operations through the use of broadband services.

## Methodology

The project team was led by Springsted Incorporated and included team partners Dain International Services, Pepin Hugunin & Associates, and Elert & Associates. The consultant team utilized a systematic approach to gather information, synthesize and analyze that information, explore and evaluate options, and develop the study document.

The information gathering phase combined several approaches, including a telephone survey of Saint Paul businesses, open meetings/forums for both residents and businesses, meetings with city department leaders, and meetings and interviews with representatives of telecommunications providers, the Saint Paul school district, and colleges and universities with campuses in Saint Paul.

The approach toward the exploration and evaluation of options encompassed several factors including technological models, ownership and operations models, and economic development impacts.

Throughout the project, the Springsted team met with an appointed City committee to review project progress and status. The City's team facilitated meetings and updated the City Council and the Mayor's Office on project activities. The end result of the project is this report document.

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[1] See Appendix II for examples of current municipal broadband projects.

## City Demographics

Within its 52.8 square miles, Saint Paul has approximately 115,700 available housing units. As of the 2000 Census, there were 112,109 households living in the city, with a total of 287,151 people. Median household income in the city in 2000 was $38,774, and per capita income was $20,216. Approximately 15.6% of the population and 11.7% of families were below the poverty line.

There are approximately 8,000 businesses within the City. Of these, the large majority may be categorized as small businesses, depending on the definition used. Specifically, an estimated 52.5 percent of businesses report only one to four employees, while 69 percent report having nine or fewer employees. More than 83 percent have 19 or fewer employees. Approximately one business in six is based in a residence.

## Broadband Definitions

The term "broadband" can refer to a number of different technologies. These technologies differ in terms of the physical hardware required to carry data, and in the speed of data transfer available to the end user. These speeds often differ depending on the direction of data flow. The rate of data moving from the Internet to a subscriber is described as "downstream" or downloading speed, while data originating at the subscriber's computer is measured by "upstream" or uploading speed.

- The primary delivery methods currently used to deliver broadband services to homes in Saint Paul are DSL and cable. Digital Subscriber Line (DSL) service reaches a subscriber's home through telephone lines; at the basic level of service, DSL provides 256 kilobits per second (Kbps) upload and download speeds. Cable broadband service is delivered by means of cable television lines, and provides 6MB download and 768 Kbps upload speeds. Currently, the lowest prices offered are $26.99 per month for DSL (Qwest) and $42.95 for cable (Comcast). These prices are applicable to current customers of the companies, and do not include taxes and fees.

- Wireless broadband (Wi-Fi) provides broadband Internet access by means of signals through the air, at speeds roughly comparable to DSL or cable modem service. It can provide access for users almost anywhere within range of an antenna, whether indoors or outdoors. Currently, the most high-profile local Wi-Fi installation is that provided by the City of Chaska; the per month charge for the Chaska service is $15.99.

- Fiber optic broadband ("big" broadband) provides access at very high speeds; the term can mean anywhere from 20 Mbps to more than 100 Mbps. Fiber optic is the global standard for communities aiming to make the best investment for long-term economic development benefit.

# 3. Current Environment

## Current Providers and Services

### Comcast Cable

Comcast is the incumbent cable TV service provider for the Saint Paul area. Comcast provided a coverage map and statistics regarding the number of housing units passed (those that could connect, not the number currently taking service). This information indicates Comcast offers service (including Internet access) in more than 90% of Saint Paul's municipal "footprint." Areas not covered are mostly industrial in nature, although there are some areas zoned as Business (various categories) that also are not currently covered. In fact, Comcast's number of "homes passed" exceeds the number of housing units listed in the 2000 census. The larger number is probably accounted for by connections to commercial/business establishments as well as some growth in housing.

Comcast's Internet offering is based on cable modem technology. Cable modem service is by nature a shared medium, in which all users within one "node" or area share a given amount of bandwidth. Downstream speeds are higher than upstream, as shown in the tables below.

Residential Internet services are offered at different levels and costs, and vary according to whether one is a current subscriber to cable television services, as shown below:

| Comcast Internet service offered - Residential | Cost/month |
|---|---|
| 6 Mb (down)/768 Kbps (up) service for current cable video customers | $42.95 |
| 8 Mb (down)/768 Kbps (up) service for current cable video customers | $52.95 |
| 4 Mb (down)/384 Kbps (up) service for non-cable video customers | $57.95 |
| 6 Mb (down)/768 Kbps (up) service for non-cable video customers | $59.95 |
| 8 Mb (down)/768 Kbps (up) service for non-cable video customers | $67.95 |

Additional fees apply for purchase or rental of a cable modem and/or installation services.

Services for small business customers come at two different levels, as summarized below:

| Comcast Internet service offered - Small Business | Cost/month |
|---|---|
| Comcast Workplace – Standard: 6 Mbps downstream, 768 K upstream | $95 |
| Comcast Workplace – Enhanced: 8 Mbps downstream, 1 Mbps upstream | $160 |

Both small business packages include required equipment, firewall and virus scanning services. They also require one-time installation fees (starting at $250) and a one-year contract term. Costs for taxes and fees are not included in the residential or business figures.

For customers wishing to provide content to the web, Comcast offers three web server hosting services at $24.95, $49.95 and $74.95 per month, depending on features such as number of domain pointers, number of FTP accounts, and amount of disk space.

Comcast also offers a Teleworker or Broadband Commuter® program to companies for provision of Internet service at their employees' home offices. Monthly rates are $52-$80, depending on volume and term commitments. No video service is required, and customer-managed virtual private networking (VPN) service is available. At least 10 employees must take part per company and there is an installation fee of $99 per employee location.

Comcast's system in Saint Paul is capable of supporting Virtual Local Area Networks (VLANs) and Multiprotocol Label Switching (MPLS), which are two methods of separating internet traffic from different users. Theoretically, this means that many different entities could securely share the same backbone.

**Qwest Communications**

Qwest is the incumbent telephone service provider for the Saint Paul area. Qwest provided a coverage map and statistics regarding the number of housing units passed (those that could connect, not the number currently taking service). This information indicates Qwest offers service (including Internet access) to approximately 65% of Saint Paul's housing units based out of five central services sites (Central Offices, or COs) within the city.

The areas served by the Emerson CO and the Front CO have service available to higher percentages of homes and businesses in those areas.

Qwest reports that its "take rate," the percentage of subscribers who have signed up where service is available, is consistent with state-wide take rates for its DSL service.

Qwest's internet service offering is based on Digital Subscriber Line (DSL) technology. This technology, like that of cable modem systems, offers higher download than upload speeds, though a significant difference is that capacity is not shared among multiple users. However, overall download speeds are not as high as that of the cable modem system.

Costs for various levels of residential and small business service are listed in the tables on the following page:

| Qwest Internet service offered - Residential | Cost/month |
|---|---|
| DSL with MSN Premium (up to 256 Kbps download and upload) with local phone service | $26.99 |
| DSL with MSN Premium (up to 256 Kbps download and upload) without local phone line | $31.99 |
| DSL Deluxe with MSN Premium (up to 1.5 Mbps download and 896 Kbps upload) with local phone service | $39.99 |
| DSL Deluxe with MSN Premium (up to 1.5 Mbps download and 896 Kbps upload) without local phone service | $44.99 |
| DSL Premier with MSN Premium (up to 3-5 Mbps download and 896 Kbps upload) with local phone service | $49.99 |
| DSL Premier with MSN Premium (up to 3-5 Mbps download and 896 Kbps upload) without local phone service | $54.99 |

| Qwest Internet service offered - Small Business | Cost/month |
|---|---|
| DSL with Internet Basic (up to 256 Kbps download and upload) with business phone service | $24.99 |
| DSL with Internet Prime (up to 256 Kbps download and upload) includes 25 MB web page hosting; with business phone service | $34.99 |
| DSL with Internet Prime (up to 256 Kbps download and upload) includes 25 MB web page hosting; without business phone service | $39.99 |
| DSL Deluxe with Internet Basic (up to 1.5 Mbps download and 896 Kbps upload); with business phone service | $37.99 |
| DSL Deluxe with Internet Basic (up to 1.5 Mbps download and 896 Kbps upload); without business phone service | $42.99 |
| DSL Deluxe with Internet Prime (up to 1.5 Mbps download and 896 Kbps upload) includes 25 MB web page hosting; with business phone service | $47.99 |
| DSL Deluxe with Internet Prime (up to 1.5 Mbps download and 896 Kbps upload) includes 25 MB web page hosting; without business phone service | $52.99 |
| DSL Premier with Internet Prime (up to 3-5 Mbps download and 896 Kbps upload) with business phone service | $57.99 |
| DSL Premier with Internet Prime (up to 3-5 Mbps download and 896 Kbps upload) without business phone service | $67.99 |

Special offers with expiration dates are not included. Costs for taxes and fees are not included. DSL modem costs are not included.

## Existing Technology Infrastructure

The consultant team examined the physical and legal resources available to the City if it chooses to pursue a broadband initiative. These resources include existing assets and limitations which would have effects on either fiber optic or wireless implementations.

### Geographical Considerations

The first element of the city's existing infrastructure studied by the team was the overall physical layout of the area. A few items became noticeable once existing facilities were overlaid on a single map and compared to a topographical map:

A. There is relatively little fiber in the Lowertown area, considering the density of building structures. Only one private provider has fiber through this area, but it isn't known whether any of that fiber is available to area businesses and residents. The District Energy fiber reaches only as far east as Sibley Street. With the ongoing development in that area, the City of Saint Paul may want to consider options to enhance the availability of fiber in Lowertown.

B. The Macalester-Groveland and Highland areas have essentially no publicly owned fiber. In order to connect these neighborhoods to a high capacity backbone, it may be possible to partner with one or more of the private colleges – perhaps Macalester College, the College of St. Catherine, and/or the University of St. Thomas to develop the necessary infrastructure.

C. Topologically, there are few useable high elevations within the city. Those that were identified tended to be between 40 and 70 feet above the surrounding area, not including the building structures themselves. This is not likely to permit for a clear line of sight, which is necessary for high-capacity wireless. The design implication is that a wireless backbone design (as opposed to a fiber backbone, for example) might well require the use of leased tower sites (which are much higher above the ground) in order to make reliable connections. However, for use as local wireless distribution points (covering a few blocks) these sites may indeed be worthwhile. [Note: lines of sight were not physically checked in this conceptual design phase.]

### City of Saint Paul Resources

Although provided maps do not indicate quantity of fibers within pathways, the consultant is aware that the State of Minnesota has a considerable quantity of fiber along the I-94 corridor, as do most of the major providers (to connect to the Internet co-location point /carrier hotel in downtown Minneapolis.)

The City provided the consulting team with various maps and information about its internal assets. Elert & Associates has incorporated most of the map information into a computer-aided design (CAD) drawing with multiple

layers, so the various systems can be overlaid to help comprehend where facilities are available and in what modes.

Currently, the City has a number of resources which could be useful in establishing a City-wide high-speed network. These resources are associated with a number of different city departments, and include:

A. Public Works single mode fiber (6 fibers) in serial runs for traffic signals. Some of this fiber may not be capable of wavelength division multiplexing (WDM) due to its age; much if not all of this would need to be tested to see if it were useable. A map is available, which shows the fiber locations.

   Following is a summary of the main available fiber pathways:
   a. Along a long stretch of Maryland Avenue, east-to-west in the mid-north part of the city
   b. Along White Bear (north to south on the east side) from Suburban Ave (by FS 24) on the south to Iowa St. on the north at Hillcrest Center [These two cross at Maryland]
   c. Along Dale (north and south in middle of city east to west), from Grand at the south to Arlington at the north.
   d. Along new section of Shepard Road from Chestnut at the northeast southwestward to James.
   e. Connecting the downtown section to the Dale St. run
   f. A relatively short section of University Ave. on the west side from Highway 280 to Prior Ave.
   g. Additional relatively short runs in various locations on the west/south side of the city.

B. District Energy lines (12 fibers, though some may be reserved) connecting much of downtown and extending northeastward to near the intersection of Westminster and Whitall (following Olive for part of its path). Lines also south across the Mississippi (along the Wabasha Street bridge), then east to near the intersection of Robert and Fillmore.

C. Traffic camera poles (Public Works) dotted along I-94 from Kellogg and East 3rd in the east to Highway 280 in the west, with a few additional poles downtown, and one at Selby and Snelling. These 14 poles are 50 feet in height and could be good locations for wireless radio receiver/transmitters.

D. 36 warning sirens throughout the city (Fire Department). Some are on 50 foot poles, two are on 65 foot poles, and the rest are mounted to buildings or other facilities, often school buildings. These sites could be good locations for wireless radio receiver/transmitters.

E. 1,149 street light poles 35 feet in height at various locations, including along Payne Ave. from East 7th on the south to the railroad crossing on the north, along most of Snelling Avenue, and along many streets in the commercial area west and north of Holman field, but south of the river (e.g., Plato, Robert, Chester, Fillmore, Eaton, Eva, etc.)

F. Other street light poles including approximately 8,850 poles from 25 feet to 35 feet in height, and 15,812 lanterns at 13 feet or 17 feet tall. (Note: Xcel Energy owns 2,788 wooden light poles within the city.)

G. These City-owned buildings or facilities have been identified as standing at relatively higher elevations (more than 40 feet) than their surroundings, and may therefore be useful for as locations for wireless receiver/transmitters:
   a. City Hall Annex
   b. Dayton's Bluff Recreation Center, 800 Conway Street
   c. Children's Museum parking ramp, 10 Seventh Street West
   d. Main Library, 90 Fourth Street West
   e. Linwood Park Recreation Center, 860 St. Clair Ave.
   f. Asphalt Paving Plant, 456 Burgess Street
   g. Hamline Library, 1558 Minnehaha Ave. West
   h. Former Force Unit site, 699 Seventh Street East
   i. Fire Station 24, 273 White Bear Ave. North
   j. Dunning Field, 1221 Marshall Ave.
   k. Fire Station #19, 2530 Edgcumbe Rd.

**Right-of-Way Ordinances**

In addition to these physical assets, the City's right-of-way ordinances should be considered as a useful resource for establishing a city-wide network. Right-of-way ordinances apply to numerous types of users, including providers of telecommunications services, so City right-of-way policy can affect the services provided to residents.

The City of Saint Paul has a reasonably detailed set of right-of-way ordinances currently in place. This study was not intended to provide a comprehensive review of the ordinances as they affect telecommunications, nor to provide specific language for proposed changes in the ordinances. Instead, this study offers a framework for assessing current and future right-of-way policy in telecommunications, and identifies some ancillary policies that could help in building a better broadband future in Saint Paul

This assessment framework is based on three fundamental questions:

1. **Does the City have sufficient information about fiber installed in its rights of way?**

   This would include information about new fiber implementations for its own record keeping, for responsible management of the rights of way, for regulation of future fiber installation, and for coordinating uses of fiber in its rights of way.

   For example, this question could lead the City to review whether its current fiber policy provides an adequate record on fiber routes, junctions and counts, so that both vertical and horizontal mapping is possible from its records. If not, enhancing its requirements on record

keeping would be consistent with the purposes given in Minnesota Statutes Chapter 7819.4000 for local government management of rights of way, which states that the purpose of a mapping system is to "allow for better information collection and cooperative usage among local government units, telecommunications companies, and other users of the public right-of-way."

If a review concluded that currently required information is inadequate and that collection of adequate information for management of optic fiber use of rights of way was necessary, then the City would also want to review the adequacy of the current fee structure.

2. **Are the ordinances sufficiently forward-looking to enable the City to responsibly and efficiently protect and manage its rights of way?**

   For example, this question would lead the City to review its own needs and to require that whenever a public street is constructed or sufficiently opened, either as a public works project or by a private party, that a conduit with specified innerducts and size be installed by the party constructing the street. The ordinances of the City of Poulsbo, Washington and the City of Chandler, Texas, provide examples. There are related requirements to consider in regard to collector or arterial public streets.

   In addition, this question would lead the City to examine its policies regarding redevelopment areas by considering buildings as the basic building blocks for fiber expansion throughout the City of Saint Paul. Cities with an eye to building a fiber future have laid down various requirements such as conduit access into buildings, setting aside space in the risers for conduit and more. The City may already have missed some opportunities to ensure fiber readiness in redeveloped buildings, but opportunities still exist going forward.

3. **Are the ordinances flexible enough to avoid inhibiting implementations of fiber in the City of Saint Paul?**

   For example, this question would lead the city to periodically review its requirements and procedures with an eye to reducing the burden on telecommunications providers and making the process or coordination with the City more workable through remote access to City records and other similar adjustments.

The guiding principle in this framework is to view right-of-way policy as a useful tool in the building of a fiber future in the City of Saint Paul, much as economic development and area redevelopment programs should be seen as part of the broadband toolkit.

## Potential Partners

In addition to the City assets referenced above, similar resources exist among both public and private sector entities in the City. As part of its broadband strategy, the City should consider these organizations as potential partners, and include them appropriately in planning and implementation.

**Public Sector Partners and Resources**

A. Ramsey County - rooftop of County Courthouse/City Hall.

B. Saint Paul Regional Water Services owns a water tower in Highland Park, and co-owns with the Public Works department a 12-strand fiber connection from Public Works' Dale Street Garage to SPRWS' McCarrons Center at 1900 Rice Street. Public Works and SPRWS will both need to be approached to discuss use of these resources

C. Fiber owned by the Minnesota State Department of Administration for use by the State Bureau of Criminal Apprehension (BCA), from the State of Minnesota Centennial Office Building eastward along I-94 to near the Griffith Building (Saint Paul Police Department headquarters), then northward along Johnson Parkway to Magnolia, then following same path as PW fiber, and connecting at Maryland.

D. Saint Paul Public Schools owns many building sites and some lighted fields at high elevations compared to surrounding areas. The district has indicated a willingness to allow its sites to be used as part of a broadband project. Details would need to be negotiated should some of the district's sites prove to be good locations. SPPS sites noted specifically include:

    a. Groveland Park Elementary – 2045 St. Clair Ave.
    b. Johnson Elementary – 740 York Ave.
    c. Monroe Community School – 810 Palace Ave.
    d. Cleveland Middle School – 1000 Walsh St.
    e. Washington Middle School – 1041 Marion St.
    f. Humboldt Jr./Sr. High School – 30 E. Baker St.
    g. American Indian Magnet/World Cultures – 1075 E. Third St.
    h. Correctional Programs/Boys Totem Town – 398 Totem Road
    i. International Academy/LEAP – 631 N. Albert. St.
    j. Open School – 90 S. Western Ave.

**Private Sector Partners and Resources**

A. Companies with communications towers in the City. Cellular companies own a number of towers within the city, which are already cited to provide good coverage over a wide area. There are also a number of towers owned by private firms who lease space on them. The City's use of space on these towers would incur annual leasing fees that can vary greatly, and would need to be evaluated on a case-by-case basis.

B. Companies with fiber infrastructure in place could become potential partners with the City through the sale or leasing of that infrastructure. These may include:
   a. American Fiber Systems [http://americanfibersystems.com]
   b. Comcast [www.comcast.com]
   c. Fonorola and IXC
   d. FWR Communication Networks, LLC (Edina, MN)
   e. McLeod USA [www.mcleodusa.com]
   f. Qwest [www.qwest.com]
   g. Sprint [www.sprint.com]
   h. Verizon-MCI (former Brooks Fiber) [uncertain of current ownership]
   i. Other companies to be identified

Note: Fonorola and IXC no longer appear to be in business. Broadwing Communications [www.broadwing.com] may have purchased the IXC system or at least part of it.

## I-Net System

The I-Net (institutional network) system is made available for the City's use by Comcast as part of the its cable TV franchise agreement with the City. Under the current agreement, Comcast is responsible for maintaining the system. There are currently 110 City sites connected to I-Net using the system for data network connectivity (vs. video services). The City pays no fees to Comcast for use of the I-Net system; the City's Cable Communications Office estimates that this saves the city approximately $350,000 per year.

The City does not own I-Net; it is owned and maintained by Comcast. When the current franchise agreement expires in 2013, or if it should become no longer legally binding, Comcast would retain ownership of the I-Net system and could decide to discontinue city services over the system, or to provide those services to the city at some cost.

The I-Net system consists of a combination of hybrid fiber coaxial (HFC) and fiber-only connections. Fiber connections are mostly at 1 Gigabit per second (where 1 Gbps = 1,000 Mbps), while the HFC network connections operate at 10 Mbps. The fiber-only portion of I-Net connects twelve City sites, and another connection (to the new Rondo Branch Library) is to be added in 2006.

The Office of Cable Communications administers the I-Net system. There is a fee to departments to cover administrative costs. HFC connections are charged at $1/month per device on the connected network plus $11/month per site. As an example, the Library system will pay a total of $5,532 for 2006 for 12 HFC sites with 329 devices. For the fiber connected sites, there is a flat rate of $185/month per site or $2,220 per year per site. The Police Department has four fiber connections, so is will pay $8,880 in 2006 in administrative costs for those locations. There is a fee of $6,500 per year to have a dedicated, secure data channel for Police communications. Total administrative costs for the I-Net for 2006 will amount to $59,528 for all city departments.

Two specific concerns exist with respect to the I-Net system: the age of current system components, and the possibility of changes to the franchise law which could alter the current franchise agreement between the City and Comcast. These issues will need to be addressed as part of the City's broadband strategy going forward. Each issue is described below in more detail.

**Deterioration of the I-Net**

The HFC network contains much coaxial cabling that is approximately 20 years old, but reportedly well maintained. In general, the expected useful life of outdoor coaxial cable is 30 to 35 years. However, the cable modems, which provide the 10 Mbps data connections, are no longer in production. Thus, Comcast may soon find itself struggling to maintain reliable connections at the sites connected via coaxial cabling.

The circumstances of an aging network and the need for replacement of critical pieces of the network make it clear the City needs to set an urgent plan for discussion of scheduled maintenance of the network, assuming that the City continues to have access to the network on current terms. This may not be a valid assumption, however, as the following section describes.

**Franchise Law Changes**

The City's access to I-Net is derived as part the franchise it granted for delivery of video services in the City. Comcast now holds that franchise and owns the I-Net. Up to now, franchise negotiation was largely a local affair. A bill pending in Congress, known as the Communications Opportunity, Promotion and Enhancement Act of 2006 Bill or Barton Bill, would remove the authority to franchise from the local to the federal level. At the time of this report's publication, the bill is expected to pass, though specific details are not yet agreed. Even if the Barton Bill should fail this session, barring a shift in control of the House, something similar has a good chance to ultimately prevail. The primary consideration is that current franchise holders are likely to be relieved of their franchise obligations within a reasonably short time, possibly as soon as 2008.

The net result is that Saint Paul could lose its free access to the I-Net and would instead need to buy those services, which now are valued at $350,000 per year. If faced with an annual cost of this size, the City should make it an urgent priority to consider how best to meet its telecommunications needs. Many cities, lacking I-Net or an equivalent system, built city-wide networks of their own and may be little affected by franchise changes. Saint Paul has enjoyed the benefit of an effective and widely deployed I-Net system to this point, but it should be prepared for change.

Should the City determine that replacement of the I-Net system is necessary for whatever reason, a logical approach would be to initiate a schematic design for a fiber system connecting key city facilities. Whether this would include all 110 sites now connected to I-Net or some smaller number of sites would have to be the first question answered. The objectives of the

schematic design phase would be to develop a potential fiber path/route and budgetary cost estimates for the sites designated. Should the City decide to take this step, an overall design that incorporates all City sites would be necessary. Professional services for such design work would be needed.

## Community Input

**Business Survey and Business Forum**

A survey was conducted among 375 representatives of the business community in the city of Saint Paul, yielding an industry standard confidence level of 95 percent with a margin of error of +/-4 percentage points. The sample was drawn primarily from medium and smaller size businesses.

Key findings of the survey include:

A. Internet access – specifically, high speed Internet access – is very important to the efficient operation and the competitiveness of most businesses. This means that "basic broadband" speeds are now a foundation for business function.
B. The reliability of Internet access, on-line security, avoiding the need to dial-up in order to connect, and the speed of the connection are very important characteristics of Internet access.
C. Business respondents were most satisfied with current Internet services in (1) avoiding dial-up, (2) reliability and (3) on-line security. They were least satisfied with service portability, the ability to block access to selected Web sites, and the price of services.
D. The statement that "the competitive market currently offers high speed Internet services at prices that even the smallest business can afford" elicits neither strong agreement nor strong disagreement.
E. Many (almost half of the respondents) are "very likely" to switch to a new supplier offering "10 megabits per second (service) downstream and upstream" at the same price as their current service. The likelihood of switching drops by half if priced at 10 percent more than their current service.
F. The city should have a role in the future evolution of broadband Internet access in Saint Paul. About one-third of respondents believe that the city should "encourage competition" among Internet access providers, while another one-third believes that the city should install a system for high speed Internet access. This latter one-third is divided as to whether the city should lease the facility to a private service provider, or whether the city itself should operate the network and act as an Internet service provider.

In summary, there is not a groundswell of demand today for "big" broadband from medium and small businesses in this survey, though businesses remain open to considering upgrades as new technologies become available. As was said at the business forum, it is difficult to envision what one will do with higher speeds and larger bandwidth. But as was also said at the forum, "Whenever we have upgraded, we've always filled up the capacity." This finding is consistent with introduction of "big" broadband elsewhere, where understanding of its benefits and use is not well defined in advance.

The survey findings generally are very consistent with the results of the Business Forum. Respondents to both data collection methods agreed, for example, that reliability and security are the two most important features of Internet service. The same range of responses concerning the city's role was voiced in the survey and at the Business Forum.

The complete survey report, including Summary and Analysis, and Detailed Findings, is contained in Appendix VI.

**Public Forums**

Two evening forums were held in February to gather input from Saint Paul residents regarding their opinions about existing Internet service options and a potential City-wide wireless broadband system. A third forum was held, which was attended by representatives of the City's district councils. Attendees at all three forums were very computer literate, with more than three-quarters identifying themselves as computer enthusiasts or professionals. A large majority of all forum attendees owned multiple home computers, and most had high-speed Internet service in their homes.

The most common Internet activities among participants were e-mail and online research, followed by personal finance and online shopping activities. Participants under age 25 were very likely to engage in school-related activities on the web, which is consistent with our discussions with the higher education community in Saint Paul (see following section).

Forum participants felt that the most important element of Internet service is reliability, followed closely by cost, speed and security. Satisfaction with current cost options was low, while satisfaction with the other high-importance elements was generally fair.

Participants in all three forums felt that high-speed Internet access would be a very important element in the future. Each group disagreed with the statement that Internet options are currently available at costs affordable to most residents. Members of each forum expressed concern that disadvantaged communities within the city would not be able or willing to subscribe to high-speed Internet access unless costs were brought down significantly.

When asked how much they would be willing to pay for City-wide high-speed wireless Internet access, one-third of the public forum participants indicated that they would pay $30 or more per month for service. Another third responded that they would pay $20-29 per month, meaning that two thirds of the public forum participants would pay $20 or more per month. However, in the community leader forum, nearly half the group was willing to pay no more than $20 per month for such a service.

Forum participants felt strongly that the City has a responsibility to ensure low-cost Internet access to its residents, and especially to its school children. Support for student access was consistent regardless of whether respondents

had children in the home. Respondent feelings regarding the City's responsibility to its small businesses were more muted, though still positive.

A more detailed analysis of the forum results is included in Appendix VII.

**Higher Education**

The City of Saint Paul has a wealth of colleges, universities and other higher educational institutions within its boundaries. Discussions were held with a sample of these institutions to identify potential collaborative partnerships relating to a broadband initiative in Saint Paul. The sample drew from private higher education institutions in St Paul, including Bethel University, the College of St. Catherine, Concordia College, Hamline University, Macalester College, and the University of St. Thomas, as well from public institutions including the St. Paul campus of the University of Minnesota, and the Minnesota State Colleges and Universities campuses of Metropolitan State University and St. Paul College.

There were three main purposes for holding discussions with higher education organizations, including:

A. Gauging reaction to the idea of a city broadband initiative
B. Exploring whether an area-wide wireless service would be of significant value in meeting unmet needs of the institutions
C. Exploring the interest as well as the ability of the institution to collaborate with the City of Saint Paul in addressing digital divide concerns and contributing to the overall development of the City

Reaction to the idea of a city broadband initiative was very positive, and the possibility of a citywide wireless service was welcomed for a variety of reasons. There was strong interest in and approval for the prospect of a city-wide wireless service, in light of the benefit this could confer on both the educational community and the residents of the City. Educators expressed particular concern about Saint Paul residents currently unable to afford service. They offered ideas and cooperation on programs which might be organized to secure tools such as laptops and access to training in conjunction with a possible new service that could offer free or very low cost Internet service. The possibility of cooperation with Saint Paul higher education institutions for all of these purposes seems very real.

Another important topic in the higher education discussions was whether a city-wide wireless service might play a significant role in meeting unmet needs of the institutions themselves. The answer to this question seemed dependent on whether the students, faculty or staff in question were on- or off-campus.

The major private higher education institutions thought that city-wide wireless would make little difference to on-campus users, since they have high-speed wireless already in place, or will have fairly soon. For example, some campuses are already providing wireless speeds in dormitories and around campus at speeds approaching 40 megabits, which greatly exceed the 1-3 megabit speed of a prospective citywide wireless service.

However, off-campus locations for all institutions are a different story. All thought that city-wide wireless access could be an asset for off-campus students, faculty and staff. Some were interested in the way wireless service could help an institution to offer more telework options to faculty and staff, reducing the construction and maintenance costs of additional office space as well as reducing commuting costs, all helping to contribute to a more sustainable environment. Others emphasized the benefits for off-campus students to meet their ordinary educational needs.

There was also great interest in the way wireless could help in offering additional onsite "bricks and clicks" programs in areas around Saint Paul. This concept combines some on-site teaching with a significant body of online teaching. Being able to rely on a standard wireless access platform would increase the range of locations and program options available around the Saint Paul area, especially for non-traditional age learners, for specialized training programs, and for entry programs for learners for whom English is not their first language.

Discussions with higher education institutions also included an exploration of possible collaborative interests on digital divide and economic development goals. First there was a strong sense that partnerships should be explored in respect to reducing digital divide differences. Some campuses already have undertaken community programs with that profile and all expressed an interest to help in appropriate ways once an initiative was identified. One of the institutions indicated that it might be possible for it to act as a data center for a possible citywide project. Another expressed a serious interest in funding a wireless demonstration project in its college neighborhood. However, since the funding for a demonstration project would come from a restricted trust, the college interest is limited to participation in a public or not-for-profit ownership model. Another can bring extensive experience in laptop servicing and management, which is a key component in bringing resources to students in need.

During the course of these discussions, participants suggested that the City should form a Strategic Partnership Advisory Commission in the near future. They recommended that the City draw higher education institutions and their broadband-oriented alumni, community businesses and medical services, foundations, non-profits and others into the goal-setting. The purpose of this Commission would be to further the broadband goals of the City (and the whole community within its boundaries) through the development of viable strategies. This idea originated in discussions with the University of St. Thomas and was also endorsed in discussions with other institutions

**Saint Paul Public Schools**

As previously noted, the district has indicated a willingness to allow its sites to be used as part of a broadband wireless initiative.

The district might also be interested in subscribing to a city-wide network for its own use (to connect school buildings in a district-wide network) provided

that bandwidth would be equivalent to current amounts, and costs would be equivalent or less. For its internal building connections, the District currently uses lines leased from Qwest, and receives substantial federal e-rate subsidies to help pay for those circuits.

## City Operational Requirements

All City Departments require network services to accomplish day-to-day work and communications. Most (approx. 98) city buildings currently have 10 Mbps Comcast I-Net connections at their locations. Twelve sites have 1 Gbps (1,000 Mbps) via Comcast I-Net fiber connections. Three smaller sites have dial-up modem network connections.

In addition to these fixed location links, many departments could make effective use of mobile data connectivity in the field (outside of office locations) if there were a city-wide wireless network. An internal survey was conducted in 2005 to identify ways in which business processes could be improved through mobile access, ultimately providing better customer service to residents. This survey identified fifty-seven (57) field operations business processes that could be enhanced by use of wireless/mobile networking, including at least one from every city department. The departments identifying the largest number of potential uses were LIEP and Public Safety. More detail is available in Appendix IV of this report.

# 4. Policy Analysis

## City's Role in a Broadband Initiative

Based on the analysis of technology models presented later in this study, an important question relates to the City's role in a broadband initiative. This is fundamentally a policy decision. To assist in that policy decision, this report identifies several models in regard to the role a City might play in a broadband initiative. Interest has spread rapidly among cities, and as a result, numerous variations among the basic models are available for comparison especially when one looks at wireless broadband projects.

**Alternatives for City Role in a Broadband Initiative**

1. **Private Provider Model:** City makes no or small investment, but offers incentives to private providers to build, operate and provide services over a new broadband network. Incentives could include access to city facilities, expedited process and coordinated build-out assistance. Provider and the City share benefits that could take different forms such as revenue to the City or free or low-cost service to address city needs, digital divide and/or economic development concerns. This option is more likely to be successful for offering Internet wireless services than for fiber optic services offering voice, video and data services.

   Advantages to this approach include:
   a. avoiding startup costs and the difficult balancing of claims on city resources;
   b. avoiding direct investment in technology which needs regular upgrades and replacement;
   c. avoiding the requirement for new staff and/or training in new service area;
   d. access to a new service for city residents;
   e. possible cost savings to the City and/or meet their telecom needs;
   f. mobility in delivering services;
   g. provides potential revenue.

   Disadvantages are:
   a. City has no asset with which to bring revenues back to the City;
   b. City does not control investment priorities for meeting City needs;
   c. City loses its ability to directly influence pricing of services, investment upgrades and service packages over time;
   d. City loses access to potential profits from the new service, which might be used to keep service costs lower, to reinvest in the service and to contribute to the city budget with excess revenues.

2. **Public/Non-Profit Model:** City builds, owns, operates and provides services on a new broadband network which becomes an asset of the City. This system would be intended to recover its costs over time, play a key role in City service delivery and possibly, though not necessarily, provide revenue (profit from operations) to the City. A City-based broadband service can introduce differential pricing based on public goals. It also can provide a low-cost competitive service within the City that establishes a general benchmark price of service. This option is used successfully for offering Internet wireless services as well as for offering full voice, video and data services over a fiber optic network.

   Advantages to this approach include:
   a. ownership of an asset which appreciates over time;
   b. the ability to keep the cost of service lower to all, depending on its needs for cost recovery and profit;
   c. any revenues that exceed cost recovery are retained by the City; these retained earnings can be used to reinvest to keep pace with technology change and desired service quality;
   d. residents gain access to a new service;
   e. possible cost savings to the City and/or meets telecom needs;
   f. from wireless system, City gains mobility for services;
   g. from fiber to the home/premises, City lays a foundation for long-term economic growth and prosperity.

   Disadvantages are:
   a. startup costs;
   b. need to balance broadband requirements with other claims on City resources;
   c. technology investments may pose difficult choices;
   d. system components that need to be refreshed regularly;
   e. requirements for new staff or training in new service areas.

3. **Combination Model:** City invests in a new broadband infrastructure alone or with other entities as an asset and leases access to a private provider or providers who in turn provide varied services to the public and to the City whose own cost of service may be free or at low cost. The City and provider/s may negotiate differential pricing based on public and market goals to address digital divide and/or economic development concerns. Relations between the City and its investment partners and the service providers would be uniquely determined in each case.

   The advantages and disadvantages of this alternative will be uniquely determined by the contract specifying the role of the city and the provider or providers.

## Case Studies

Recent broadband implementation efforts by a variety of cities and other public entities provide us with a number of case studies which may prove useful in considering the City's broadband policies. In particular, the developments in San Francisco, Philadelphia and Minneapolis illustrate some of the policy options which the City may wish to pursue.

San Francisco provides a model in which a private provider builds a wireless network to offer services at little or no cost, with advertising revenue intended to support the system. San Francisco is aiming to implement this model with Earthlink and Google as key contractors. A primary goal for San Francisco is to ensure access for all residents but it also aims to reduce the cost of City government, assist schools, advance telemedicine, and enhance economic development through availability of the network. Wireless service is also being planned for use while riding the transit system.

The City of Philadelphia offers another model in which the City chose to grant a contract to Earthlink to build a private proprietary wireless network with some oversight rights by a newly formed City-owned non-profit called Wireless Philadelphia. According to the terms of the agreement between the city and the provider, Earthlink will subsidize the cost of services to $9.95 per month for low-income households. Other terms of the deal include a 10-year contract, and the agreement that Earthlink will rent 4,000 light poles from the city at $74 per pole per year. Earthlink will also share revenue including $2 million in the first two years, plus 5% to a non-profit which will provide 10,000 computers and training to kids and low-income households. The city will also get free or very inexpensive wireless and discounted T-1 rates. The City gives up the ability to monitor or set rates on the network, except for low-income households.

The City of Minneapolis is planning to implement yet another form of private/public agreement. The Minneapolis model will provide publicly available wireless service, wireless access for police and fire mobile data service within the city, and connectivity for city-owned buildings for its own operational purposes. The city plans to institute a multi-year contract with a private company, with the city as the primary customer on the network. Part of the project involves installation of fiber optic cabling which would be owned by the City. However, the city's Business Information Services department contends that city ownership of the wireless element of the system would not be optimal due to rapidly evolving technology. Therefore, the plan would be for the private partner to own and operate the wireless component of the system.

Because the city is still testing systems from two potential contractors, costs and system design details are not yet available.

## Policy/Legal Issues

Cities in Minnesota choosing to become involved in broadband wireless projects where the primary service to be offered is Internet or other data services face relatively few policy and legal barriers at the federal or state level today. However, proposed legislation both supporting and limiting municipal entry in telecommunications has been introduced in Congress. Some states have recently adopted legislation whose general impact is to limit the ability of cities to provide telecommunications services. Policy and legal issues can also arise with respect to city charter limits on city

investments or municipal ownership, or in respect to the provision of retail services to the public.

Cities in Minnesota choosing to get involved in broadband fiber-to-the-premises projects do need to meet some state requirements in addition to those from their own charters. Fiber-to-the-home/premises networks generally need to offer voice, video and data services in order to have a hope of cost recovery over time. Therefore, if a city offers services to the public over a network it owns, it will need to satisfy state law requirements in respect to both voice services and video services. For voice services governed under Minnesota Chapter 237, the city must become a certificated operator approved by the Public Utilities Commission, and it must also hold a referendum approving its entry into voice services by a supermajority, as defined in Chapter 237. For video services, it must comply with state cable franchise requirements under Chapter 238 (though a law now pending and likely to pass this term in the U.S. Congress would largely preempt cities and states in the franchise process). The most important service requirement under current state law requires that any new franchise granted by a city have substantially the same terms and conditions as those found in an existing franchise. Particular controversy exists over the obligation to build a service network over the entire service area. One of the major provisions in the proposed federal legislation would relieve new franchisees from franchise-determined build-out obligations, leaving such decisions more in the hands of the providers.

### Political Issues

A major political concern has to do with private provider objections that focus on city use of tax dollars and public facilities to offer a service or services competing with their own. There are fewer objections in principle to City programs that offer free or low-cost access to populations that are generally not able to pay market price for existing services.

### Financial Cost Issues

Major concerns include the reliability and risk of financial projections, and managing the tension around the competition for City resources for basic needs today versus the ability to direct sufficient resources to build for the longer term future.

As a practical matter, cities that wish to build a foundation for long-term economic success will be attracted to the option of a “big” broadband fiber optic network. Such an option is very costly, and requires long-term planning and significant political will to maintain a community’s commitment to achieving the goal. Since the investment trajectory is long and the return on investment relatively slow, the major option for most cities that want fiber somewhere in this decade is self-financing in combination with strategic community partnering.

### Economic Development Issues

The purpose of municipal economic development is to generate new jobs and increase the tax base of a community. The pursuit of these outcomes is a result of efforts to attract, retain or expand commercial and industrial business. Although financial incentives are often highlighted by the news media, most economic development efforts undertaken by cities involve the

provision of basic infrastructure to support the needs of new or expanding business.

Economic research shows that public infrastructure investment is a powerful driver of business productivity, investment, and economic growth. In addition to basic infrastructure like streets, sewer and water, cities often promote the quality of schools, access to affordable health care and the availability of cultural amenities in their efforts to attract new business. The question for this study is: "Does broadband matter to the economic development of the city?"

Numerous studies have focused on whether there is a digital divide, on regulatory impacts and investment incentives, and on the factors influencing where broadband is available. However, given how recently broadband has been adopted, there is little empirical research analyzing its economic impact. The primary problem in determining this impact is that broadband does not act on the economy in isolation, but as a complement to other information technologies.

Two recent studies however, both presented in 2005, provide some answers to this question. Lehr, Osorio, Gillett and Sirbu studied the economic impact of broadband using a comparative analysis of availability and use of broadband over time in different geographic areas. Their study yielded two relevant conclusions:

- Broadband access enhances economic growth and performance, and the assumed economic impacts of broadband are real and measurable. Research revealed that between 1998 and 2002, communities in which mass-market broadband became available by December 1999 experienced more rapid growth in employment, number of overall businesses, and in the IT-intensive sectors

- Wage levels were not significantly impacted by broadband.

A second study by Ford & Koutsky employed an econometric model to compare economic growth in Lake County, Florida, with other similar Florida counties. In 2001 Lake County began offering private businesses and municipal institutions access to an extensive, publicly owned fiber optic system. After comparing economic growth in Lake County to comparable counties since the introduction of broadband, Lake County was found to have 100% greater growth in economic activity, or twice the rate of comparison counties.

The Lake County study observed that publicly provided broadband infrastructure may better serve the overall community than simply relying on private telecommunications firms. Similarly, other theoretical studies have argued that municipalities invest in broadband infrastructure to serve a diffuse "public purpose"( better educated public, more business opportunities, etc.) that private providers acting alone may ignore since these external benefits cannot be captured as profits.

The Bureau of Economic Advisors estimates that for each $1 invested in broadband, the economy benefits nearly $3 – but unless a private communications provider can gain the lion's share of that economic benefit, its incentive will be to under-invest in broadband infrastructure. Economic theory indicates that in the presence of large externalities (costs or benefits of an activity), which broadband Internet probably produces, public ownership of resources may be desirable.

While these early studies appear to provide support for the position that the availability of broadband infrastructure will generate economic benefit for a community, it is also clear that broadband is only one of many factors that influence business decisions. Many other community qualities and assets contribute to the environment for business development and attraction.

Recently, following the publication of Richard Florida's book "The Rise of the Creative Class", cities across the country have been revitalizing their economic development efforts with a focus on providing infrastructure and amenities that will be attractive to the "creative class" - the type of people who start and staff innovative, fast-growing companies.

Broadband has been one of the basic offerings seen as vital to attracting these workers and entrepreneurs. In studies by the Cities of Seattle, New York and Philadelphia, all conclude that their future economic well-being is tied to providing a robust, affordable broadband infrastructure. In particular, each cites the need to provide this, not as a luxury, but as a fundamental part of the city's infrastructure, much like electricity was at the turn of the 20$^{th}$ century.

Ultimately, the City of Saint Paul will need to determine which competitive assets it wishes to develop and promote in order to be successful in the economic development arena. Economic development more than any other city endeavor contains elements of investment risk. In the case of broadband, the investment decision revolves around what the City believes about the private provision of services and whether that service will keep the city competitive.

## Risks and Constraints

Every model examined makes some assumptions about useable resources and technology types. Following are some issues we have identified as possible risks or known constraints to the defined models:

- The existing Public Works signal light fiber is designed in a serial rather than a typical point-to-point configuration, and thus has a limited number of strands available. Also, it is possible that some of this fiber may have been damaged since it was originally installed. Thus, the fiber may not all be suitable for use in a network. If the City decides to move forward and intends to use some of this fiber in a backbone, these fibers should be tested to insure they are adequate for the purpose.

- No wireless system can cover 100% of a desired area. Wireless engineers plan for a best case of 95%. This physical limitation needs to be understood by both the builders and the users of the system.

- Outdoor wireless systems have limited penetration into buildings (similar to cell phone coverage). The amount of coverage depends on the frequencies selected and the type of construction materials used in the building.

  As a related issue, high-rise buildings are particularly difficult to provide coverage for, because wireless distribution points are generally at street level. Owners of the buildings in question could improve reception by adding internal cabling and amplifiers, though there would be costs involved. The City needs to determine the extent to which it envisions wireless coverage being provided in high-rise buildings within Saint Paul.

- While the City owns most of the light poles within Saint Paul, Xcel Energy owns 2,788 wooden poles which would require additional consideration. Once a detailed system design is selected, Xcel would need to be consulted as to its willingness to enter into some type of arrangement for use of space on these poles.

- The City's light poles do not have continuous power. This is a factor if the desired network is a mesh topology wherein those light poles would be used as attachment sites for wireless equipment which requires electrical power. A potential wireless network builder would need to determine whether battery power would suffice for daylight hours when the lights are not powered, or whether additional electrical power would be required.

# 5. Selected Technology Models

A number of technology models were considered as part of this study and were eliminated for a variety of reasons. More detail on these options can be found in Appendix III. To best understand the selected models which follow, it is important for readers to be familiar with the difference between getting Internet access to the end user versus carrying aggregated traffic back to a central location at which Internet access is available. The first function is known as distribution, while the second is referred to as backhaul. Differing technologies are often used for these two functions. So when we speak about wireless networks, though it may not be apparent, wired technologies could be in use in the backhaul part of the network

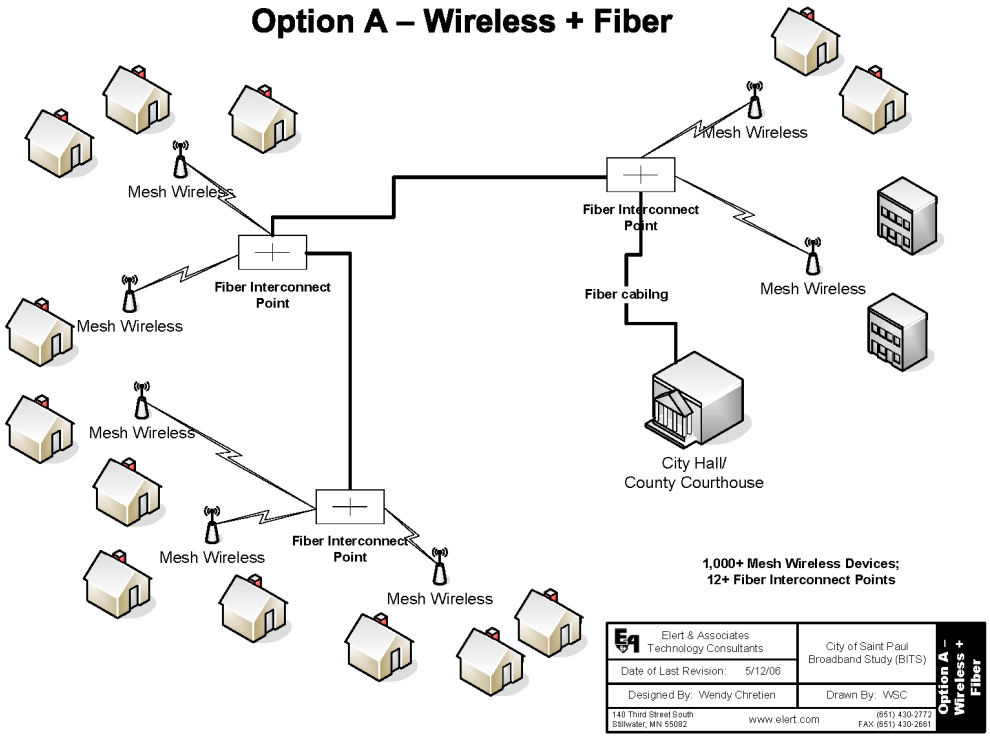
In fact, the first model (Option A) is a combination of wireless distribution to the user and fiber-based backhaul.

The second model (Option B) uses wireless technology throughout the system, for both distribution and backhaul.

The third model (Option C) is an all-fiber network featuring fiber optic cabling installed directly to users' homes and businesses.

## Option A: Mesh Wi-Fi with Fiber Backbone

This design option would combine fiber and wireless technologies. Fiber at 1 Gbps plus some higher-capacity wireless links would be used for backhaul, with wireless mesh Wi-Fi as the distribution method. Subscribers would typically be able to obtain from 800 Kbps to 3 Mbps service, depending on their proximity to the network equipment.



In this case, the fiber could be owned by the City and strategic public partners such as the State of Minnesota. The State was not approached as part of this study regarding potential use of some of its fiber, but this step would need to be taken should the City decide to pursue this option.

Note: this option could be the first phase of or an interim step toward a city-wide FTTP system, offering immediate connectivity and allowing the city to continue installing fiber as it could obtain funding.

**Design issues – Fiber Backbone**

The following design and cost estimate is based on using City-owned fiber augmented by fiber from District Energy and the State of Minnesota, since these design elements are a known quantity. A mesh Wi-Fi network with a fiber backbone could be built using fiber not owned or available to the City of St. Paul. Designs that use a different fiber configuration will vary in cost. Costs for these scenarios cannot be estimated until the fiber configuration is known.

The primary sources of fiber would be the unused single mode portion of the Saint Paul Public Works signal light fiber and the city's portion of District Energy fiber, plus a portion of the State BCA fiber. This design presumes adding fiber in the west and southwest areas of the city, which are not covered by either of those resources.

1. This design would require additional fiber from Dale Street west along University Ave to the existing Public Works fiber at the western edge of University, with a short north-south extension to either the Hamline Library or Civil Warning Siren #A-29. Another add-on would be along Marshall Avenue from Dale Street to Lexington Parkway. Total approximate new fiber length would be 4.3–5 miles. Since the State of Minnesota owns fiber along I-94, it may be possible for the city to partner with the State for part of this stretch. Failing that, however, the city could build its own fiber. If/when a major road project (rail or bus corridor) along University Avenue were to be undertaken, fiber (or at least empty conduit) should be put in place at that time.

2. In the Highland and Mac-Groveland areas this design envisions extending the Public Works fiber from one current southern end at Shepard Street, west to Monroe High School and from there west and then south to Fire Station #19. Another addition would reach from the new north-south link west to Groveland Elementary School. The design would require approximate new fiber length of 5.4–5.9 miles including one crossing of I-35E. The ultimate route could be designed to facilitate additional control of signal lights along pathways needed by Public Works.

3. Another fiber addition presumed in this conceptual design is to extend the District Energy fiber from just south of the Wabasha bridge along

Wabasha/Humboldt to the vicinity of Humboldt High School (approximate new fiber length of 1.1 miles).

4. Further short additional fiber runs would be needed throughout the system to reach high points for the wireless backhaul equipment. Total estimated additional fiber length is 2.1 miles.

Thus, the total estimated fiber required to be built out for this design is approximately 14.1 miles. (If the State BCA fiber is unavailable, an additional 0.7 - 1.5 miles of new fiber may be required, thus increasing the total to up to 15.6 miles. This has been accounted for in the cost estimate.)

**Design Issues – Wireless Systems**

This design would incorporate 802.11 (Wi-Fi) mesh wireless networking using the 2.4 Gigahertz (GHz) frequency range for home and business distribution with higher capacity wireless backhaul in the 5.8 GHz frequencies to reach the available fiber, which would ultimately carry it back to the primary Internet access location downtown.

Estimated backhaul location sites with fiber interfaces: 12-14 (require above ground enclosures); estimated mesh network wireless access point equipment sites: ~1,080 (~54 square miles x 20 access points per square mile.) Bodies of water were not included in the square mileage.

The wireless system components would need replacement approximately every five years. This replacement has been built into the financial models. This replacement schedule will enable the system to adapt to changes in wireless technology.

- **Advantages**
- Lower costs than an all-fiber network
- Takes advantage of existing city assets
- Very good backhaul capacity due to fiber
- Portability and mobility – can use service anywhere, including in moving vehicles
- Relatively quick time to install; 12-18 months from project initiation

- **Disadvantages**
- This design may not reach the far northwest and far southeast corners of the city (may require additional build out to do so)
- Potential for interference with current Wi-Fi hot spots
- Not as well suited for internal City operations as an all-fiber network
- Foliage and other obstructions may block coverage
- Available bandwidth is shared among users in a given coverage area

**Estimated Costs**

Initial costs are estimated on the following page. Fiber installation costs can be reduced by up to 30% if able to use aerial installation.

**Table 1: Option A - Mesh Wi-Fi with City-Owned/Public Fiber Backbone - Estimated Initial Costs**

| Component Description | Estimated Quantity | Estimated Unit Cost | Estimated Total |
|---|---|---|---|
| Fiber (100% boring) including 1 freeway crossing | 14.1-15.6 miles | $117,000 per mile | $1,814,670-$2,007,720 |
| Access points (20/sq. mi.) including installation | 1,080 | $2,350-$3,450 | $2,719,800-$4,098,600 |
| Operations software | | $44,000-$55,000 | $44,000-$55,000 |
| Network/mail systems (servers, etc.) | 1 | $1,885,697-$2,357,124 | $1,885,697-$2,357,124 |
| Backhaul components, e.g. gigabit network switches | 12-14 | $9,000-$11,000 | $118,800-$169,400 |
| Initial network configuration | 1 | $426,515-$533,016 | $426,515-$533,016 |
| Engineering, design, testing | 1 | $264,000-$297,000 | $264,000-$297,000 |
| **Total** | | | **$7,345,382-$9,517,860** |

Ongoing costs are estimated as follows:

**Table 2: Option A - Mesh Wi-Fi with City-Owned/Public Fiber Backbone - Estimated Ongoing Costs**

| Component Description | Estimates/Calculations | Estimated Total Annual |
|---|---|---|
| Fiber maintenance | $1/per foot/year | $74,650-$83,370 |
| Wireless maintenance | 7 percent/year | $195,426-$286,410 |
| Backhaul components | 15 percent/year | $17,820-$25,410 |
| Operations software maintenance | 20 percent/year | $8,800-$11,000 |
| Network systems maintenance | | $86,650-$108,300 |
| Internet access | 200 Mbps @ $17,000/month | $204,000 |
| Operations Mgmt/Tech | 5 FTE @ $60,000/yr | $300,000 |
| **Total*** | | **$887,346-$1,018,942** |

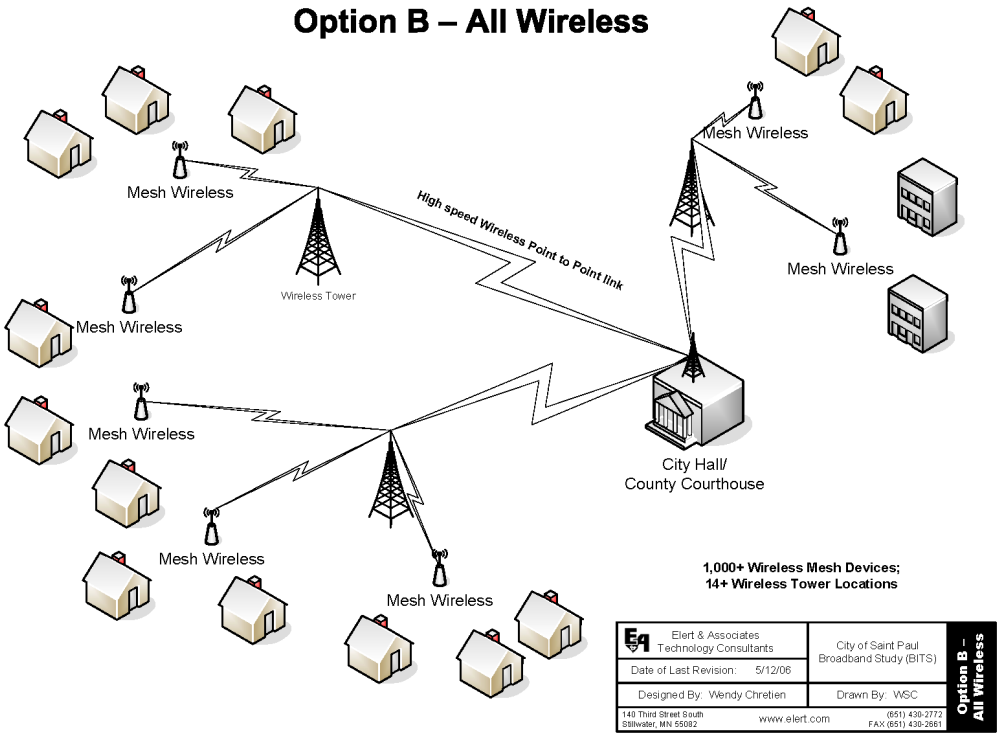
* This total is included in total operating expenses shown in Appendix VIII.

**Table 3: Option A - Mesh Wi-Fi with City-Owned/Public Fiber Backbone - Estimated Total Costs**

| Timing | Assumptions | Total Estimated Costs |
|---|---|---|
| Year One | | $8,232,728-$10,536,805 |
| Five Years | Assumes 1st replacement of network systems | $13,667,809-$16,969,694 |
| 10 Years | Assumes 1st replacement of all wireless equipment and backhaul hardware and 2nd replacement of network systems | $22,900,836-$28,689,528 |
| 20 Years | Assumes 2nd replacement of all wireless equipment and 3rd replacement of backhaul hardware and network systems | $38,456,290-$47,861,196 |

## Option B - Mesh Wi-Fi with High Speed Wireless Backbone

In this scenario the network would be entirely wireless. The distribution technologies used (and expected end user speeds/capacity) would be similar to Option A, but the difference would be that the backhaul sites would then link to City Hall via high-capacity licensed-spectrum wireless links, rather than fiber.



This design would require tall locations/towers (as much as 100 feet above ground level) at the backhaul sites to provide a clear line of sight from each to the roof of City Hall. This may be accomplished by leasing space on some existing towers (where those are conveniently located), and/or constructing some new towers attached to city or school district facilities.

**Design Issues – Wireless Systems**

This design would incorporate 802.11 (Wi-Fi) mesh wireless networking for home and business distribution with higher capacity wireless to reach the locations with very high capacity licensed wireless links, which would then carry it back to the primary Internet access location downtown. [NOTE: it may be necessary to use two or four different frequencies in the high speed wireless links to avoid overlap at the downtown location.]
From one to four antennas would be located one the roof of City Hall to connect all the high-speed backhaul links.

Estimated backhaul location sites: 14-16; estimated mesh network wireless access point equipment sites: ~1,080 (~54 square miles x 20 access points per square mile.)

Licensed wireless components could be in one of many frequencies. For purposes of this estimate 6 GHz equipment with a 45 Mbps capacity was used. The licensed frequency hardware typically has a longer useful life (~10 years) than unlicensed equipment.

The wireless system components would need replacement approximately every five years. This replacement has been built into the financial models. This replacement schedule will enable the system to adapt to changes in wireless technology.

**Advantages**

- Fastest to implement, especially if existing tower space – could be less than 12 months
- Lower costs than an all-fiber network
- Portability and mobility – can use service anywhere, including in moving vehicles
- If the City builds its own towers, it could potentially lease space to other entities

**Disadvantages**

- Less backhaul capacity than other options
- Must go through tower siting approval process per city ordinance for any new towers
- Requires FCC licensing for wireless backhaul
- Potential for interference with current Wi-Fi hot spots
- Not as well suited for internal City operations as an all-fiber network
- Foliage and other obstructions may block coverage
- Available bandwidth is shared among users in a given coverage area

**Estimated Costs**

Initial costs are estimated as follows. This assumes all new tower build out.

**Table 4: Option B - Mesh Wi-Fi with High Speed Wireless Backbone - Estimated Initial Costs**

| Component Description | Estimated Quantity | Estimated Unit Cost | Estimated Total |
|---|---|---|---|
| Licensed 6 GHz wireless components | 14-16 | $34,000 per link | $523,600-$598,400 |
| Access points (20/sq. mi.) including installation | 1,080 | $2,350-$3,450 | $2,791,800-$4,098,600 |
| Operations software | 1 | $44,000-$55,000 | $44,000-$55,000 |
| Network/mail systems (servers, etc.) | 1 | $1,885,697-$2,357,124 | $1,885,697-$2,357,124 |
| Tower build out | 14-16 | $80,000-$100,000 | $1,232,800-$1,760,000 |
| Initial network configuration | 1 | $426,515-$533,016 | $426,515-$533,016 |
| Engineering, design, testing | 1 | $264,000-$297,000 | $264,000-$297,000 |
| **Total** | | | **$6,515,922-$6,187,400** |

Ongoing costs are estimated as follows. If the city leases tower space instead of or in addition to building new towers, some costs would be shifted from initial to ongoing.

**Table 5: Option B - Mesh Wi-Fi with High Speed Wireless Backbone - Estimated Ongoing Costs**

| Component Description | Estimates/Calculations | Estimated Total Annual |
|---|---|---|
| GHz components maintenance | 15 percent/year | $78,450-$89,760 |
| Access points maintenance | 7 percent/year | $195,426-$286,902 |
| Operations software maintenance | 20 percent/year | $8,800-$11,000 |
| Network systems maintenance | | $86,650-$108,300 |
| Tower maintenance | 5 percent/year | $61,600-$88,000 |
| Internet access (200 Mbps) | $17,000/month | $204,000 |

| | | |
|---|---|---|
| Operations management/ tech support | 5 FTE @ $60,000 | $300,000 |
| **Total*** | | **$935,016-$1,087,962** |

* This total is included in total operating expenses shown in Appendix VIII.

**Table 6: Option B - Mesh Wi-Fi with High Speed Wireless Backbone - Estimated Total Costs**

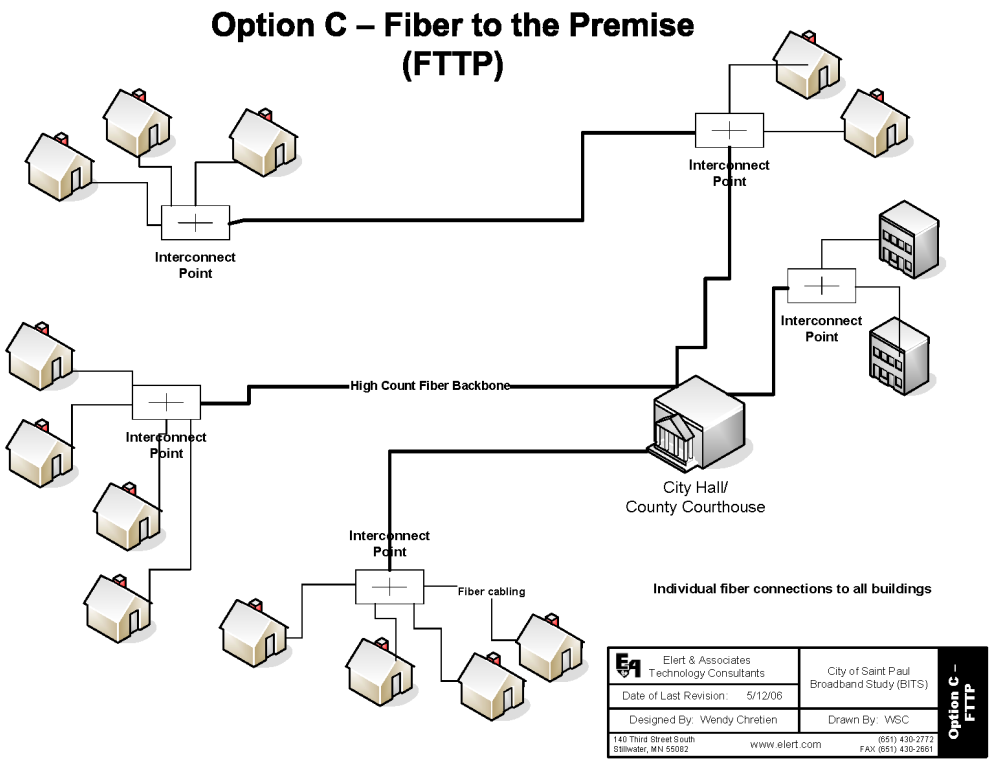
| Timing | Assumptions | Total Estimated Costs |
|---|---|---|
| Year One | | $8,102,528 - $10,787,102 |
| Five Years | First replacement of network systems | $13,728,289 - $17,496,074 |
| 10 Years | Assumes 1st replacement of 2.4 GHz wireless equipment and Internet hardware, and 2nd of network systems | $23,080,866 - $29,391,608 |
| 20 Years | Assumes 2nd replacement of 2.4 GHz wireless equipment and 4th of network systems, plus 1st replacement of 6 GHz equipment | $39,517,820 - $49,682,476 |

## Option C - Fiber to the Business/Home/Premises

This model for technology relies on bringing fiber into individual buildings and private residences, offering truly “big” broadband service. It is widely recognized as the basis for the next generation of economic growth and competitive success. South Korea and Japan lead the world in this type of infrastructure. The US is in sixteenth place in the world with fiber to the home (FTTH) and fiber to the premise (FTTP).

A fiber to the home network is a major investment with an eye to major long-term benefits. Most existing service providers in the US have not seen sufficient profit to be made by the current return on investment calculations to lead the way. However, both Verizon and SBC recently have begun to build big broadband networks. Verizon passed 3 million homes with fiber in 2005, and expects to have fiber at the door of 18-20 million homes by 2009, though their known plans concentrate on areas of higher income. Over 300 municipalities in the US have chosen FTTP, including Windom, Minnesota. Most recently, Seattle adopted a policy to move toward a FTTH/FTTP network in its city area. Portland, Oregon is moving in that direction as well.

A network based on fiber optic technology is very costly, and would be a major decision in any city. One approach is to build out in phases. The city might first focus on connecting its own facilities, and perhaps targeting a specific area for economic development.




## Advantages

- Residential/business fiber to the premise systems typically offer speeds from 10 Mbps to over 100 Mbps[1] per subscriber (can guarantee bandwidth amounts – unlike wireless)
- Fiber has virtually unlimited bandwidth potential – as of March 2006 Lucent Technologies' Bell Labs demonstrated 100 Gigabits capacity over 40 kilometers.[2]
- City operations at fixed locations would all have high speed connectivity
- Fiber has a long useful lifetime (est. at 30 years) and unlike some other technologies, can be considered an asset, rather than something which depreciates in value
- Can readily carry video and voice traffic as well as data (Internet)
- Fiber is immune to interference
- It is very difficult to "tap" fiber without it being obvious, so it is considered the most secure physical medium. (Note: the electronics attached to the ends of the fiber, however, are still vulnerable.)

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[1] Contrast with a modem link of 56 Kbps, DSL of 1-2 Mbps, or a cable modem connection of 4-8 Mbps.

[2] http://www.networkingpipeline.com/181502640 - Lucent Demonstrates 100-Gbit Ethernet Transmission

**Disadvantages**

- No portability/mobility – service only to fixed locations such as offices, homes and businesses
- In urban settings FTTP/FTTH is costly compared to other available technologies due to the need to dig around or under established infrastructure such as streets, sidewalks and utilities. And while it costs about 30% less to install fiber on existing poles (such as electric poles) this is not always an option.
- FTTP takes much longer to build out than wireless options - years rather than months

**Estimated costs**

**Initial:** A preliminary cost estimate for initial build out for an entire city-wide FTTH/FTTP network is between $195 Million and $296 Million. This is based on an average cost per premise of $1,625 - $2,225, multiplied by 120,000 premises (112,000 households plus 8,000 businesses).

**Ongoing:** Operational costs may be estimated at 45% of projected revenues, or $8,775,000 - $12,015,000 per year.

**Table 7: Option C—Fiber to the Business/Home/Premise—Estimated Total Costs**

| Timing | Assumptions | Total Estimated Costs |
|---|---|---|
| Five Years | Assumes no equipment replacement | $238,875,000-$327,025,000 |
| 10 Years | Assumes no equipment replacement | $282,750,000-$387,150,000 |
| 20 Years | Assumes one replacement of equipment at $250-300 per subscriber | $400,500,000-$543,300,000 |

# 6. Summary and Conclusions

One of the principal objectives of this report is to provide options for the city's considerations. This includes technology options and options for the city's role in the provision of enhanced broadband Internet access, as follows:

**Options for the City's Role**

This report discusses three primary models for the provision of enhanced broadband services, but each model may encompass a wide range of variations depending upon the objectives and technologies involved.

1. Private Provider Model: City makes no or small investment but offers incentives to private provider to build and operate and provide services over a new broadband network
2. Public/Non-Profit Model: City or a non-profit entity builds, owns, operates and provides services on a new broadband network.
3. Combination Model: City invests in a new broadband infrastructure alone or with other entities as an asset and leases access to a private provider or providers

**Technology Options**

A wide range of technology options exists. The report describes selected options that were eliminated from consideration, and provides a detailed analysis of the three options that are regarded as most promising for the City's purposes. These three options are:

1. Wireless + Fiber: Mesh Wi-Fi with City-Owned/Public Fiber Backbone
2. Wireless: Mesh Wi-Fi with High Speed Wireless Backbone
3. City-wide Fiber to the Premise: Fiber to the Business/Home/Premise

It is outside the scope of this project to recommend ***which*** of these alternative approaches the city should implement. Rather, the advantages and disadvantages of each is presented for the city's consideration. The purpose of this section, rather, is to provide direction concerning the prior policy choice which the city faces – that is, the reasons why the city would choose to implement ***any*** of the models discussed. This discussion is in light of three major issues and outcomes which the city might wish to address by doing so. These are economic development, the digital divide and the city's own operations.

## Economic Development Next Steps

The following recommendations are provided to assist the City meet its economic development goals, should it decide to pursue the enhancement of broadband capacity in the city.

It is recommended that the City align and coordinate its broadband strategies with its economic development strategies and action plans. This will require the City to undertake a number of steps:

a. Define and assess the competitive marketplace. The City has economic development and redevelopment strategies in place. If the City is satisfied with these competitive strategies, then determining how enhanced broadband can reinforce strengths and minimize or eliminate competitive disadvantages should be a priority. Specifically, assessing whether these strategies adequately address the needs of entrepreneurs and businesses who require significant broadband capacity is the first step in aligning these efforts.

b. Define opportunities to leverage private sector investment. Incumbent telecommunications companies already have significant investments in broadband infrastructure. The City should assess the options it has to work cooperatively and leverage current and future investments to support the City's economic development and enhanced broadband system objectives. This could include removing obstacles, providing incentives or similar actions.

c. Establish a committee of information technology entrepreneurs. This committee would advise the city on the ways to make its broadband and economic development strategies deliver the infrastructure and incentives necessary for small business incubation, and the attraction and expansion of businesses that require 'big' broadband. This group could also be used to monitor and evaluate new broadband technologies on behalf of the City.

d. Evaluate broadband incentives for both new projects and redevelopment/retrofit projects. If ubiquitous broadband becomes a goal of the City, it will become necessary to address the private investment cost of including broadband infrastructure in both new and existing development. While a regulatory approach may be a viable option for achieving broadband capacity in new development, a significant number of older existing buildings require retrofitting. A careful examination of the City's role in providing incentives or support to the private sector is a prudent step to take.

## Digital Divide Next Steps

The following broad recommendations could help the City meet its digital divide and City Operations goals.

1. To lessen disparities of access to broadband among the residents of Saint Paul, the City could adopt a plan that would bring citywide Wireless (Wi-Fi) to Saint Paul in the near future, with specific policies ensuring access for the very poor.

There is a broad understanding that households without effective broadband access are at a decided life disadvantage both from an educational standpoint and an ability to compete for good jobs, as well as other aspects. Many companies have abolished paper applications for example. Children who cannot obtain web access are deprived of an essential educational tool at home. Models on digital equity include free or subsidized access, a community benefits clause in operator agreements which help fund tools (computers) and training, and special community partnership projects such as with higher education institutions.

2. To increase the choices for all residents in broadband services at more competitive prices.

   The encouragement of additional providers to enter as a broadband Wi-Fi provider should provide choice and price point benefits for all resident consumers, based on the experience in other communities where an effective additional service became available.

**City Operations**

The City could improve the delivery and effectiveness of City services through City-wide wireless services. Policies to ensure city employee access to training and applications will allow the benefits from the increased broadband capacity to flow through to the residents.

The City's service departments are ready to capitalize on the availability of Wi-Fi broadband. A fairly comprehensive internal inventory was completed in 2005 outlining the importance of Wi-Fi access anywhere in the city for those activities and services. That document is available in Appendix IV.

The City needs to take account of the likelihood that the I-Net will need replacement at some time, due to age, franchising issues or both. One alternative is to plan for a fiber backbone throughout the City to maximize the benefit from the fiber already in place.

## Additional Next Steps

1. **Long Term Broadband Strategy Advisory Committee:** To lay the foundation for directing its broadband future and to help secure next generation broadband capabilities, the City could establish a Long-Term Broadband Strategy Advisory Committee to work on key issues. This committee would expect to address long-term issues such as community partnerships, existing provider investments, city capacity to invest, city needs and community needs, among others. This study revealed that key higher education institutions in St. Paul are eager to participate.

2. **University Avenue Redevelopment:** To take advantage of current major infrastructure in the City, the City should consider installation of fiber (or at the least the installation of city conduit) in the University Avenue corridor redevelopment. Some cities now include such installation requirements as a condition of contract.

The City has a golden opportunity to create an innovation magnet in that area of the City through foresight in technology planning. It fits well with the planned emphasis on encouragement of bio-science clusters of economic activity in that area. As an example, San Francisco has announced a project to install broadband in its rapid transit system.

3. **Wireless Hot Spots**: In the event the City should choose to become the public provider of wireless access, there is strong interest from an area college to partner with the City in some wireless hot spot facility in its immediate area.

   There is another concern about wireless hot spots. Because some wireless hot spots now exist provided by private businesses within the city, coordination would be necessary to avoid interference between those and any new wireless service provided. A small technical group should be assigned responsibility for this coordination. A list as well as a map of these current hot spots is provided in Appendix V.

4. **Modification of City Regulations:** The report identifies a number of steps the city should consider dealing with rights of way, burying conduit whenever any street is dug up, fiber entrances to buildings, and internal fiber backbones in new or redeveloped buildings.

5. **Coordination with the City of Minneapolis:** If the City decides to do a wireless initiative by whatever path, the City should take timely steps to coordinate with the Minneapolis wireless project to try to achieve seamless wireless use across the two cities.

6. **Work for Regional Coordination:** The City is situated in a key geographic location for taking the lead in a regional discussion about the broadband future of the area. A number of regional developments can be studied from around the country and in this area Dakota County has begun looking at regional benefits from enhanced broadband development.

## Key Questions:

### Why Not Join With Minneapolis?

The City of Minneapolis is planning to contract with a private company with the City itself as a primary subscriber/anchor tenant on the network to link its city-owned buildings/facilities together (it currently uses leased circuits). Part of that involves installation of fiber optic cabling the city would own. Minneapolis will be investing considerable sums (on the order of hundreds of thousands or the low millions of dollars) each year to pay for these services to support city operations.

Conversely, the City of Saint Paul already has network connections (many of them via fiber) at practically no cost through its I-Net. Saint Paul also has some fiber infrastructure in place on which to build should it so choose. Thus, the two cities' opportunities and requirements differ at this time. Still,

if the City decides to go forward with a wireless broadband initiative by whatever path, coordination efforts should be planned with Minneapolis, with an eye toward providing users with seamless wireless access across the cities.

**Why Not a Regional Network?**

Implementing a regional broadband network would require the involved cities and counties to be prepared to move forward in a similar timeframe. A great deal of planning and cooperation would need to take place for this to occur. If Saint Paul were to wait for this alignment, it would have to put off fulfilling the immediate needs of its own residents and operations.

With that said, we have suggested that the City of St. Paul take a leading role in organizing further discussions with surrounding cities and counties as well as with the Metropolitan Council, but we suggest moving ahead with the recommended immediate next steps simultaneously.

**Can Saint Paul Do What Chaska Did?**

The City of Chaska operates its own electric utility, and has access to poles, electricity, bucket trucks, and trained maintenance personnel. The City of Saint Paul owns most of the light poles, but does not have the other infrastructure owned by Chaska. Additionally, differences in population mean that Saint Paul's implementation would require much more hardware, equipment and ongoing support.

These factors make a city-owned and operated system considerably more costly for Saint Paul, both on a per-user basis, and an overall monetary investment.

**Why Implement Fiber if Wireless Has So Much Future Capacity?**

The differential between the available end user bandwidth of fiber and wireless technologies has historically (for what little history we've had with wireless), been at a factor of about 100 to 1. Although we expect wireless technology to make significant strides in bandwidth capacities, the same will be true of fiber as technology advances continue. Thus those familiar with the capabilities and limitations of both technologies believe fiber will continue to be able to provide significantly greater capacity than wireless for many years to come.

Fiber also has a long useful life, and therefore the benefit of being a long-term asset. In a fiber-based system, components requiring replacement are limited to the active electronics. In a wireless installation, when a major upgrade is required or when access points have reached the end of their useful lives, all those access points (over 1,000 in a wireless mesh design) must be replaced.

# APPENDIX I
# Technology Primer and Glossary

This section attempts to provide concise information about some important factors to consider when thinking about the design of a city-wide network.

## Fiber

Without question, fiber would be the first choice if sheer capacity (bandwidth) was the sole deciding factor. Currently it is possible to send 32 Gigabits per second[1] of traffic across one pair of fiber strands. That amount is projected to increase by a factor of 10 within five years.

Thus using fiber for at least some part of the city's network is a very logical choice. Most commonly fiber is used for backhaul, but it can also be brought closer to the end user, as is the case with fiber to the neighborhood (FTTN), fiber to the node (also FTTN), fiber to the curb (FTTC), fiber to the premise (FTTP) or fiber to the home (FTTH). The latter two of these are discussed further previously in this report. Unbeknownst to many of us, the incumbent providers are already using some version of FTTN in their networks.

### Installation

The typical methods to install fiber are to place it underground (either directly buried or inside conduit) or attach it to existing poles. However, these are not the only options. Over the past few years two other installation techniques have been devised that are designed to work in urban settings. Due to their newness, however, these two techniques are not yet proven over long time periods.

In the first, fiber is installed directly within existing water or sewer pipes via small robots. We were able to find one company that currently offers this technique – CableRunner (www.cablerunnerusa.com). CableRunner LLC (owned by the City of Vienna Power & Light Company) put in place 400 km of fiber in Vienna, Austria in 2003. The firm claims that in one, three-person, eight-hour shift, the CableRunner [technique] can safely place over 500 feet of cable per day.

In the second technique, fiber is installed in separate conduit attached to the exterior of sewer pipes when those pipes are replaced. A firm currently offering this technology is Renaissance Integrated Solutions (RIS) [www.rensols.com] This firm's method is patented as Dual Purpose Rehabilitation or DPR. Its technique adds up to 8 conduits capable of carrying fiber installed around the exterior of new sewer or water pipe. This could be a prudent tool and investment when there is a need to replace large amounts of sewer piping.

## Wireless

For the connection to the end user/customer, contrasted with fiber, wireless technologies with the same amount of coverage (though much less bandwidth capacity) cost much less and can be set up in months rather than over multiple years.

All wireless technologies are shared media, like cable modem systems, but unlike DSL technology. That is, all users within the coverage area of any one access point or base station share the available bandwidth service in that area.

Most wireless systems require a clear line of sight (LOS) between the transmitter/receiver units. This is why there are towers all over; they're needed to ensure that multiple transmitters can connect to one another. Mesh technology is somewhat different, being considered "near line of sight". Mesh access points can reach one another through some obstructions like foliage, though there are limits to this ability.

[1] Equivalent to 32,000 Mbps, 32,000,000 Kbps, or 32,000,000,000 bps

Licensed vs. unlicensed frequencies

Every type of wireless technology including cellular is assigned to certain frequencies in the radio spectrum. The Federal Communications Commission (FCC) controls the assignment of frequencies. In the US, most frequency ranges require a license from the FCC at some cost (such as for cellular frequencies). But the FCC has also set aside a small amount of spectrum for unlicensed use and at no cost. All of the "Wi-Fi" or 802.11 technologies use unlicensed frequencies in either the 2.4 GHz or 5.8 GHz ranges.

While these frequencies are freely available, one downside is that there are no guarantees against interference, so your in-house wireless network could be overcome by another nearby stronger signal and you would have no legal recourse. Another disadvantage is that there is relatively little unlicensed spectrum available, so as more and more unlicensed networks are built, interference becomes likelier.

Wi-Fi

Wi-Fi is the first truly mass market wireless technology. It was designed primarily for indoor use, but has been tweaked by several manufacturers for outdoor use as well.

People often do not know there are multiple types of Wi-Fi. The IEEE 802.11 standard now includes several variations, including "a", "b", "g" as well as the newest standard "n". These are not all compatible with each other, which can lead to confusion. Most of today's laptop computers have built-in support for the "b" and "g" variations. Among some of the differences in these versions is the amount of capacity and the frequencies used. 802.11n can use a larger quantity of frequencies and is expected to provide up to 100 Mbps of bandwidth, which is a large increase over the other versions. However, 802.11n is so new that products haven't yet been brought to market.

This ever-changing technology solution set makes it difficult to maintain a wireless network that will be useful over a period of time long enough for it to pay for itself.

WiMAX

There are currently two incompatible WiMAX standards, one for fixed (non-portable) use (802.16-2004) and one for mobile use (802.16e). As of March 2006, some products are available for the fixed version although it hasn't hit the mass market yet. Equipment for the mobile version is only just now being designed. Intel has created a chip for 802.16e, and expects it to be widely available in 2007.

Many of the manufacturers of Wi-Fi equipment are currently designing and testing WiMAX systems, however, there is open debate in the telecommunications industry as to whether newer/upcoming cellular technologies will undercut the potential for WiMAX. Most industry experts predict the first WiMAX implementations (fixed type) will compete with DSL in terms of bandwidth (1-2 Mbps.)

Mesh Networking

This technology permits multiple lower capacity radios to inter-connect with one another, thus allowing greater coverage plus some ability for the network to heal itself when a node fails. BelAir, Cisco, Motorola, Proxim, Strix and Tropos are all manufacturers of Wi-Fi based mesh networking equipment. Tropos has the largest installed base of city-wide mesh networks, including that at Chaska.

For a good basic understanding of mesh networking, we refer the reader to the primer Proxim Corporation has available on its web site at
www.proxim.com/learn/library/whitepapers/mesh_primer_PP3-1005.pdf

Point-to-Point Wireless

In this wireless topology, two end points are determined, and then a link is designed between them.

Possible techniques include long-range microwave, millimeter wave or E-band, and a plethora of licensed frequency technologies.
So far, all point to point links require a clear line of sight. Technologies currently under development may change this limitation, but probably not within the next 3-5 years.

## Glossary

**Access Point (AP)** – a piece of equipment in a wireless network that provides a way for the end user/subscriber to connect to the wireless network

**Bandwidth** – the capacity of a network to carry traffic, usually measured in bits per second

**Bit** – a single digit of information – a 0 or 1. It takes 8 bits to make a byte, which represents one character such as the letter "a."

**Bits per second** – the quantity of bits that can be sent/received in one second

**Dark fiber** – fiber optic cabling that has been installed, but is not currently in use ("lit"). Some owners of unused fiber are willing to either lease or sell it to other entities

**E-band** – a relatively new wireless technology which uses very high frequency (71-76 GHz, 81-86 GHz, and 91-95 GHz – all require FCC licensing) pencil-thin signals that can carry up to 2.7 Gigabits per second (Gbps). The FCC refers to this as "virtual fiber" and it is also known as millimeter wave technology. The current distance limitation for this technology is approximately one mile.

**Fiber to the "Something" (FTTx)**—In most of these technologies, fiber is run to some point near to but not at the customer site, and then another mechanism (usually some form of copper cabling) takes over for the final link to the customer. This is also known as partial fiber. The following are examples of partial fiber systems: Fiber to the Neighborhood (FTTN), Fiber to the Node (also FTTN) and Fiber to the Curb (FTTC.) The main deployments in North America for FTTN usually have a node that can handle 400 to 600 customers or homes. Fiber to the Curb deployments go even closer to the customer, usually serving eight to 24 customer drops.

**Gbps, Mbps, Kbps** - Gigabits per second, Megabits per second, and Kilobits per second, respectively. Think of Giga as billion, whereas Mega is million, and Kilo is thousand.

**Line of sight (LOS)** – this refers to a need to have an unobstructed path between sites one needs to connect.

**Millimeter Wave**– see E-band

**Multiple Input Multiple Output (MIMO)** – a wireless technology involving the use of multiple antennas within a single unit. A few products are currently available, but not widely adopted. The IEEE is in the process of developing a standard for MIMO.

**Passive Optical Networking (PON)** – is a particular technique for implementing fiber to the home or fiber to the premise, wherein the active electronic components required for the network are installed at the end points, not throughout the entire system (note: this is a generalization), thus making the system "passive." There are multiple PON types, including BPON, EPON and GPON. So far there is no de facto standard, but GPON is gaining ground in North America.

**Wavelength Division Multiplexing (WDM)—**A technique to support multiple, separate network traffic streams on a single pair of fiber. The net effect is to make each pair of fiber capable of carrying from two (2) to thirty-two (32) different network connections. WDM requires special hardware at each end of the fiber to be used.

**WiMAX wireless -** There are two incompatible WiMAX standards, one for fixed (non-portable) use (802.16-2004) and one for mobile use (802.16e).

# APPENDIX II
# Examples of Municipal Wi-Fi

A good overview of recent municipal activity in broadband may be found at http://news.com.com/Municipal+broadband+and+wireless+projects+map/2009-1034_3-5690287.html

Following are a few examples of systems that are either already in use or currently being deployed. There are scores of additional projects that are now in the bidding phase.

**Austin, Texas**

Austin, Texas, plans to create a high-speed wireless network that will deliver free broadband Internet access to parts of downtown Austin, East Austin and Zilker Park.

The city is partnering with Cisco Systems and the World Congress on Information Technology. Cisco will donate nearly $700,000 worth of wireless networking equipment for the project to the group hosting the international gathering of technology leaders in Austin in early May.

With Cisco's equipment and engineering assistance, the city's communications and technology management department and Austin Energy will build and maintain the network, which will deliver high-speed Internet access to attendees at the technology convention and, ultimately, to various city workers, academic and private researchers, and the public.

**Cuyahoga Falls, New York**

Contingent upon final City Council review, Cuyahoga Falls will provide downtown fixed and mobile access, with both free and fee-based services and open to multiple Internet service providers. The technology being considered is an unspecified combination of WiMAX and Wi-Fi mesh. The city plans to eventually expand to cover all 28 square miles of the city.

System to be deployed by NeoReach Wireless: http://www.neoreach.com.

**Chaska, Minnesota**

The metro-scale Wi-Fi network in Chaska was constructed using a combination of mesh architecture, with point-to-multi-point (P2MP) wireless backhaul connections. It also made use of the city’s existing fiber network, which is owned and operated by chaska.net.

The City of Chaska runs its own electric utility that owns the street lamps throughout the community and provided use of them for mounting the mesh routers. Users pay $15.99/month with no time-term contracts required. The broadband access charges are added as a line item to the utility bill of each individual user. For $24.99 per month, small businesses receive up to three network connections.

Financing for the network was obtained through a form of municipal debt known as equipment certificates. Under Minnesota law, municipalities can, within limits, raise debt for equipment purchases with city council approval only, provided that the term of the debt does not exceed five years. The equipment certificates are generally placed privately, with institutions such as banks, rather than floated as a public debt offering. The process has been described as being as simple as doing a mortgage

**Corpus Christi, Texas**

The city is deploying one of the nation's first carrier-class citywide Wi-Fi mesh networks. The citywide Wi-Fi mesh will link water and gas utilities, public safety officers, public works department employees and building inspectors to vital online information while they are in the field.

Corpus Christi plans to partner with Internet Service Providers to deliver a host of revenue-generating services over the Wi-Fi network. The city can set up a variety of service plans: for example, free access for public safety and municipal users, a monthly fee for residents and a 24-hour charge for visitors.

Case study: http://www.tropos.com/pdf/corpus_casestudy.pdf

**Granbury, Texas**

In September 2005, Frontier installed 100 mesh routers on city streetlights to create a Wi-Fi mesh that spans all of Granbury, except for a few industrial areas. The Wi-Fi network links to Frontier's private broadband network via 5.7 GHz radios.

Frontier deployed, owns and maintains the Wi-Fi network in Granbury. The city has a five-year, $305,000 contract for total network access and network services. Frontier also receives all the revenues it generates from offering residential Internet services to Granbury's 5,700 residents at $19.95 a month.

Case study: http://www.tropos.com/pdf/casestudy_granbury.pdf

**Lexington, Kentucky**

In downtown Lexington SkyTel has rolled out a commercial Wi-Fi service. The company, which is a unit of MCI, has designed, built and is managing the service. UnpluggedCity Residential Wireless Broadband provides in-home Internet service at $24.99 a month and UnpluggedCity Small Business Wireless Broadband has a monthly rate of $69.99 a month. Both of these services provide Internet access speeds of up to 3 Mbps.

News article: http://websphere.sys-con.com/read/155697.htm

**Miami Beach, Florida**

On March 8, 2006, the Miami Beach City Commission awarded a multimillion-dollar contract to install a municipal wireless network on street poles throughout the seven-square-mile city.
Because the Internet wave will only go so high, people on the third floor or higher of a hotel or condominium won't have access to the system.

The city plans to pay for the proposed project -- about $5 million -- from its information and communication technology fund. Under the proposal, IBM will build and maintain the system in the next six years. The company will provide five computers to each of the city's six public schools, and residents will be able to buy computers at discounted prices. It also agreed to host a major event in the city. The system will also have a built-in security network.

News article: http://www.miami.com/mld/miamiherald/news/14052845.htm

**Moorhead, Minnesota**

A substantial fiber optic network owned by Moorhead Public Service (MPS), the city's 100-year old public utility rings the community, and is used for backhaul. Go Moorhead's basic residential service costs $19.95 a month. Subscribers get 1 Mbps Internet access. The $29.95 deluxe service, which offers a static IP address, is designed for small businesses and heavy Internet users. Visitors and sporadic users pay $5.95 a day to access the service.

**Tempe, Arizona**

Tempe is implementing a city-wide, border-to-border wireless network. Full deployment is scheduled to be complete early in 2006. NeoReach is the owner/operator.

**Upper Dublin, Pennsylvania**

In January, Upper Dublin became the first municipality in southeastern Pennsylvania to offer its citizens wireless broadband Internet service. Upper Dublin's $12-a-month service provides speeds of 3Mbps. The township also offers more expensive, and faster, tiers of service. At the moment, the network does not use Wi-Fi or WiMAX technologies, which allow access to the Internet for anyone with a wireless modem. Upper Dublin customers must install antennas on the side of their houses to access the network.

News article: http://www.phillyburbs.com/pb-dyn/news/147-03142006-626105.html

# APPENDIX III
# Options Considered but Not Recommended

A number of technology models were considered as part of this study, but were considered impractical for a variety of reasons. A summary of these models follows.

**Fiber to the Neighborhood/Fiber to the Node (FTTN)**

In this technology option, fiber is installed to a location intended to serve 80-500 subscribers. From that point, another technology is used to reach the individual businesses and households. In the cable TV industry, that other technology is usually coaxial cabling; in the telephone industry, the outgoing cable would be the existing phone cabling.

FTTN could be a phased step toward fiber to the premise/fiber to the home (FTTP/FTTH). Option A could be expanded to become an FTTN system, and from there potentially even further to Option C.

**Leased Dark Fiber**

Although this could be a valid option, potential providers are justifiably sensitive about divulging the extent of their fiber networks during a preliminary study such as this. If the City wishes to further explore this option it could develop and issue a Request for Information (RFI) or Request for Proposals (RFP) to find willing providers (potentially Comcast, FWR, MCI/WorldCom, American Fiber Systems and Qwest, among others) and learn about costs.

**WiMAX Wireless**

While WiMAX holds great promise as a wireless technology, it is too new to estimate coverage or costs since commercial products are not yet readily available, and certainly not at commodity pricing.[1]

At this point, because the market hasn't yet shaken out or even started, WiMAX isn't a feasible technology choice for the next 12-18 months.[2] If the City has not yet begun an initiative or is still in the design phase at that time, then it would make sense to re-examine WiMAX as an option. Please refer to the Glossary for information about the two versions of WiMAX.

**Free Space Optics (FSO)**

FSO technology uses light beams through the air to make connections. While this technology offers high capacity (speed), traffic can only travel short distances (up to about half a mile in the best of circumstances.) And like backbone wireless links, FSO also requires line of sight. In a completed detailed design, it may be that FSO would be used in a handful of special situations for backbone connections (for example from the roof of one high-rise to another). However, it does not make sense to consider this technology as a major part of a city-wide network due to distance limitations.

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1 *WiMAX Not Cheap or Easy, Carriers Say:* http://www.networkingpipeline.com/showArticle.jhtml?articleID=172900642

2 *Telcos To Roll Out WiMAX By 2006-2007:* http://www.networkingpipeline.com/showArticle.jhtml?articleID=181500255

**Point-to-Multipoint/Sectorized Wireless**

Fixed point-to-multipoint (PMP) wireless is in use in several locations, and is less expensive than a mesh network at today's cost points. It uses "base stations" from which signals are sent/received in 60 degree sectors. (Think of a circle with three lines through it to make six pie-shaped sections.)

PMP can provide approximately 600 – 800 Kbps of two-way service per end user, but if there were high numbers of simultaneous users in any given area, the bandwidth per user could decline.

Although PMP systems are still available for sale, there seem to be no new installations occurring. We believe it is destined to be replaced in the market by mesh technology, which offers higher bandwidth to individual subscribers. Due to the potential for early obsolescence, we cannot recommend this solution.

# APPENDIX IV
# City Operations Uses

# Field Operations Business Requirements Report
# November 15, 2005

## Executive Summary

Timely access to key information enhances the business performance of City departments. Providing the right information when and where it is needed reduces downtime and improves decision-making. The evolution of technology makes remote, away from the office access to information more cost effective than ever. Business requirements for the mobile workers information needs have been assembled. The requirements gathered in this project will be incorporated into the ongoing wireless technology planning initiative.

The requirements will be used to:

- Provide input to technology planning for field and mobile workers
- Create an inventory of field and mobile worker information and application needs. Looking at the needs from a city-wide standpoint will help in the identification of common access requirements and for potential synergies across departments.
- Find ways that operations can be enhanced to improve service quality and timeliness and achieve administrative efficiencies.

A framework was established that was used to assemble the information for the business processes that occur entirely or in part in the field or on the go. The requirements were categorized, compared, analyzed, and summarized. Current solutions and the associated costs were included. Potential benefits associated with implementing the solutions that address the information access and workflow requirements were identified.

## How the Study Was Conducted

The Office of Technology systems consultants met with the department directors and/or staff to identify business processes that occur away from the office or "on the go" for each department or office. A common template was used to format the information gathered in a consistent manner. Fifty seven field operations business processes were identified with at least one from every city department. The business process information summaries are attached in Appendix A.

## Findings

The identified business processes were categorized. A chart listing the processes and categories is below. The business process summary for each process can be found in the appendix.

Fifteen operations were identified that relate to current inspection or enforcement capabilities. While some capabilities are already available to these field workers, expansion and enhancement could streamline activities more. For example, trips back to the office for data synchronization and updates could be eliminated. Public safety accounted for five operations in the inventory. This is an area that will continue to grow in need and options due to the continued development of specific sophisticated technology and focus on the ability to provide more detailed information in emergency response situations.

Nine processes in the field operations inventory relate to the handling of work orders. The ability to create, update, and view work orders in the field eliminates the need for clerical staff to create and enter work orders that for those created in the field. Also access to work order information while on site could provide access to the system to see a history of requests and progress.

The option to perform basic office capabilities while outside of a traditional office location was identified by a number of departments as a way to improve efficiency and customer service. The Human Resources department conducts off-site recruitment, testing, and exam processing. The ability to do exam check-in procedures online would streamline the information handling process. City Attorney Office staff, like staff from many departments, have a need to access important files and data while not at their desk. Field access to their currently office based information would eliminate trips back to the office and typing up of handwritten information gathered in the field.

Providing real time access in the field for the majority of the processes offered savings in time of services and costs while offering improved customer service because of the ability have the information on the spot and also to respond more effectively to problem or emergency situations. The vast majority of the fifty seven processes identified ways that mobile access to city systems would directly improve customer service.

**Field Operations Inventory**
**October 2005**

| Department | Business Process | Category |
|---|---|---|
| CAO | Weekend Hold Book Arrests | Basic Office Capabilities |
| CAO | Domestic Abuse City/County Joint Prosecution Unit (JPU) | Basic Office Capabilities |
| CAO | Sentencing Hearings | Basic Office Capabilities |
| CAO | Community Meetings and general Field Work | Citizen Outreach |
| | | |
| Council | Meet w/Constituents and Attend Community Meetings | Citizen Outreach |
| | | |
| Fire | Certificate of Occupancy Inspections | Inspection/Enforcement, Basic Office Capabilities |
| Fire | Emergency Operation Center (EOC)<br>Field Mobile Worker Communications | Public Safety |
| Fire | Fire and EMS Incident Responses | Public Safety |
| | | |
| H Resources | E-Learning | Employee Outreach |
| H Resources | General Remote Connectivity | Basic Office Capabilities |
| H Resources | Off-site Recruitment, Testing, Exam Processing | Citizen Outreach |
| H Resources | Virtual meeting/Web Forums | Employee Outreach |
| | | |
| H Rights | Meet w/Constituents and Attend Community Meetings | Citizen Outreach |
| | | |
| Library | Book Transport and Delivery | GPS |
| Library | Bookmobile | Citizen Outreach |
| Library | Building Security and Safety Systems | Facilities Management |
| Library | Community Meetings, Outreach, Off-Site Training | Citizen and Employee Outreach |
| Library | Wireless Access for Citizens | Wifi for Citizens |
| Library | Wireless Access for Staff | Wifi for Staff |

| Department | Business Process | Category |
|---|---|---|
| LIEP | Building Permit Inspections | Inspection/Enforcement |
| LIEP | Charitable Gambling Inspections | Inspection/Enforcement |
| LIEP | Community Meetings | Citizen Outreach |
| LIEP | Environmental Health Inspections | Inspection/Enforcement |
| LIEP | Historic Preservation Field Reviews and Inspections | Inspection/Enforcement |
| LIEP | Licensing Inspections | Inspection/Enforcement |
| LIEP | Trade Inspections (Electrical, Mechanical, etc.) | Inspection/Enforcement |
| LIEP | Zoning Inspections | Inspection/Enforcement |
| | | |
| Mayor's Office | Meet w/Constituents and Attend Community Meetings | Citizen Outreach |
| | | |
| NHPI | Code Enforcement Inspections | Inspection/Enforcement |
| NHPI | Field Find Inspections | Inspection/Enforcement |
| NHPI | Vacant Building Inspections | Inspection/Enforcement |
| | | |
| OT | IS – Conference Room Setup | Wifi for Staff |
| OT | IS – Customer Service | Work Orders |
| | | |
| Parks | Administration - Director | Basic Office Capabilities |
| Parks | Administration – Security | Facilities Management |
| Parks | Design | GPS |
| Parks | Operations - Forestry Tree Inventory | GPS, Data Collection |
| Parks | Operations - Work Orders | Work Orders |
| Parks | Recreation Area Supervisors | Basic Office Capabilities |
| Parks | Recreation Athletic and Camp Supervisors | Citizen Outreach |
| Parks | Recreation Centers | Wifi for Citizens |
| Parks | Special Service Operating Engineer | Facilities Management |
| | | |
| PED | Community and Business Meetings | Citizen Outreach, GIS |

| Department | Business Process | Category |
|---|---|---|
| Police | Mobile Command Center | Public Safety |
| Police | Patrol Wireless | Public Safety, Work Orders |
| Police | Remote SubStations | Public Safety, Work Orders |
| | | |
| Public Works | Bridge Inspection and Design | Inspection/Enforcement, Basic Office Capabilities |
| Public Works | Construction Inspection | Inspection/Enforcement |
| Public Works | GIS Mapping and Records | GIS, Data Collection |
| Public Works | Sewer Maintenance | Work Orders, E-learning |
| Public Works | Sidewalk Inspection | Inspection/Enforcement |
| Public Works | Surveying | Basic Office Capabilities |
| Public Works | Traffic Design, Timing and Geometrics | Specialized Equipment |
| | | |
| Water | Asset Location and Attribute Identification | Work Orders, GPS |
| Water | Meter Reading | Data Gathering, Specialized Equipment |
| Water | Meter Setting | Work Orders |
| Water | Plumbing Inspection | Inspection/Enforcement |
| Water | Water Service Turn-On/Shut-Off | Work Orders |
| Water | Work Order Completion | Work Orders |

**How the Findings Will Be Used**

The business process information assembled during the requirements gathering project provides an excellent overview of the "information on the go" needs for city employees. The current situation and current situation deficiencies give good insight into technology investment opportunities. Information technology planning for 2006 and then for the 2007 budget cycle will incorporate the field operations business process requirements.

The information will serve as a good starting point for department directors and management when looking for ways to improve the effectiveness and efficiency of their operations. The critical information needs for city operations can be looked at on an enterprise-wide level to reduce costs of individual projects. Technology infrastructure components can be put in place to support the field operational needs. The business process information is critical input for technology planning initiatives. The investments can be leveraged across departments. When identifying project priorities and project plans for 2006, this inventory will encourage big picture planning that takes mobile needs into account.

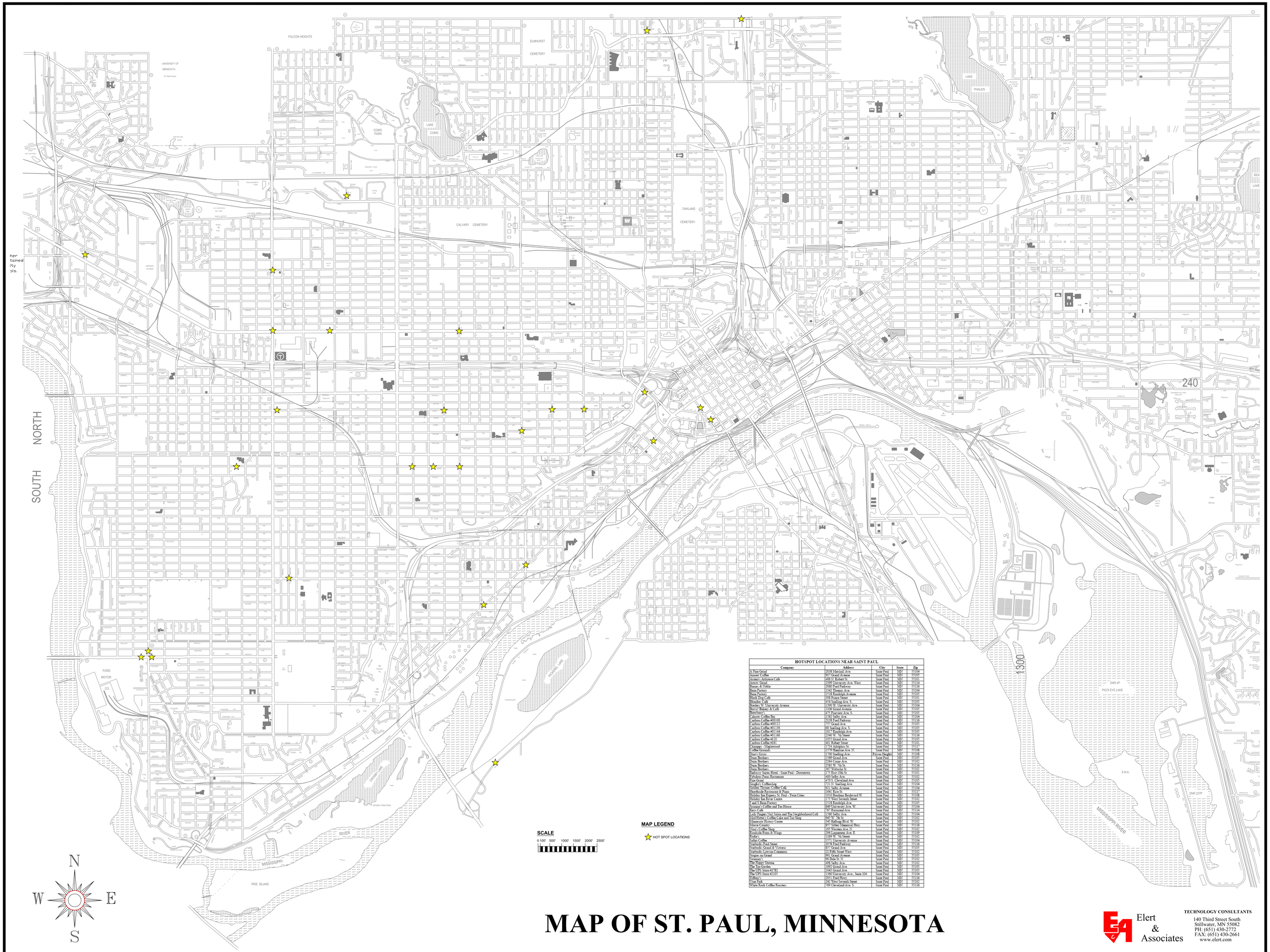
The findings will be provided to the Broadband Technology Needs Assessment and Economic Development Impact Study project team. The inventory will serve as an excellent reference guide when planning the broader scale initiatives that will be analyzed during the study. The needs of city mobile and field operations will be incorporated into the study recommendations.

# APPENDIX V
# Existing Wireless Hotspots

This list includes those wireless hot spots known as of April 20, 2006:

HOTSPOT LOCATIONS IN/NEAR SAINT PAUL

| Company | Address | City | State | Zip |
|---|---|---|---|---|
| A Fine Grind | 2038 Marshall Ave. | Saint Paul | MN | 55104 |
| Amore' Coffee | 917 Grand Avenue | Saint Paul | MN | 55105 |
| Aroma's Arthouse Caf˘ | 488 N. Robert St. | Saint Paul | MN | 55101 |
| Artists' Grind | 2399 University Ave. West | Saint Paul | MN | 55114 |
| Barnes & Noble | 2080 Ford Parkway | Saint Paul | MN | 55116 |
| Bean Factory | 1342 Thomas Ave. | Saint Paul | MN | 55104 |
| Bean Factory | 1518 Randolph Avenue | Saint Paul | MN | 55105 |
| Black Dog Caf˘ | 308 Prince Street | Saint Paul | MN | 55101 |
| Blondies Caf˘ | 454 Snelling Ave. S. | Saint Paul | MN | 55105 |
| Borders W. University Avenue | 1390 W. University Ave. | Saint Paul | MN | 55104 |
| Bravo! Bakery & Caf˘ | 1106 Grand Avenue | Saint Paul | MN | 55105 |
| Brewberry's | 475 Fairview Ave. S. | Saint Paul | MN | 55105 |
| Cahoots Coffee Bar | 1562 Selby Ave. | Saint Paul | MN | 55104 |
| Caribou Coffee #00108 | 2138 Ford Parkway | Saint Paul | MN | 55116 |
| Caribou Coffee #00112 | 757 Grand Ave. | Saint Paul | MN | 55105 |
| Caribou Coffee #01136 | 68 Snelling Ave. S. | Saint Paul | MN | 55105 |
| Caribou Coffee #01144 | 1817 Randolph Ave. | Saint Paul | MN | 55105 |
| Caribou Coffee #01166 | 2340 W. 7th Street | Saint Paul | MN | 55116 |
| Caribou Coffee #110 | 1055 Grand Ave. | Saint Paul | MN | 55105 |
| Caribou Coffee #161 | 401 Robert Street | Saint Paul | MN | 55101 |
| Champps - Maplewood | 1734 Adolphus St. | Saint Paul | MN | 55117 |
| Coffee Grounds | 1579 Hamline Ave. N. | Saint Paul | MN | 55108 |
| Dino's Gyros | 1700 Snelling Ave. | Falcon Heights | MN | 55108 |
| Dunn Brothers | 1569 Grand Ave. | Saint Paul | MN | 55105 |
| Dunn Brothers | 2264 Como Ave. | Saint Paul | MN | 55102 |
| Dunn Brothers | 2583 W. 7th St. | Saint Paul | MN | 55116 |
| Dunn Brothers | 367 Wabasha St. | Saint Paul | MN | 55102 |
| Embassy Suites Hotel - Saint Paul - Downtown | 175 East 10th St. | Saint Paul | MN | 55101 |
| Fabulous Ferns Restaurant | 400 Selby Ave. | Saint Paul | MN | 55102 |
| Fine Grind | 470 S. Cleveland Ave. | Saint Paul | MN | 55105 |
| Gingko's Coffeeshop | 721 N. Snelling Ave. | Saint Paul | MN | 55104 |
| Golden Thymes Coffee Caf˘ | 921 Selby Avenue | Saint Paul | MN | 55104 |
| Hearthside Restaurant & Pizza | 1641 Rice St. | Saint Paul | MN | 55117 |
| Holiday Inn Express St. Paul - Twin Cities | 1010 Bandana Boulevard W. | Saint Paul | MN | 55108 |
| Holiday Inn River Centre | 175 West Seventh Street | Saint Paul | MN | 55102 |
| J and S Bean Factory | 1518 Randolph Ave. | Saint Paul | MN | 55105 |
| Jasmine's Coffee and Tea House | 849 University Ave. W. | Saint Paul | MN | 55104 |
| Keys Caf˘ | 767 Raymond Ave. | Saint Paul | MN | 55114 |
| Lady Fingers Nail Salon and The Neighborhood Caf˘ | 1560 Selby Ave. | Saint Paul | MN | 55104 |
| Mad Hatter's Coffee Cake and Tea Shop | 945 W. 7th St. | Saint Paul | MN | 55102 |
| Minnesota History Center | 345 Kellogg Blvd. W. | Saint Paul | MN | 55102 |
| Moose Country | 857 Sibley Memorial Hwy. | Saint Paul | MN | 55118 |
| Nina's Coffee Shop | 165 Western Ave. N. | Saint Paul | MN | 55102 |
| Roadside Pizza & Wings | 296 Larpenteur Ave. E. | Saint Paul | MN | 55109 |
| Rudie's | 1169 W. 7th Street | Saint Paul | MN | 55102 |
| Safari Coffee | 1571 University Avenue | Saint Paul | MN | 55104 |
| Starbucks Ford Street | 2078 Ford Parkway | Saint Paul | MN | 55116 |
| Starbucks Grand & Victoria | 857 Grand Ave. | Saint Paul | MN | 55105 |
| Starbucks Lawson Commons | 21 Fifth Street West | Saint Paul | MN | 55102 |
| Stogies on Grand | 961 Grand Avenue | Saint Paul | MN | 55105 |
| Sweeney's | 96 Dale St. N. | Saint Paul | MN | 55102 |
| The Happy Gnome | 498 Selby Ave. | Saint Paul | MN | 55102 |
| The Tea Garden | 1692 Grand Ave. | Saint Paul | MN | 55105 |
| The UPS Store #1782 | 1043 Grand Ave. | Saint Paul | MN | 55105 |
| The UPS Store #2105 | 1360 University Ave., Suite 104 | Saint Paul | MN | 55104 |
| Tiffany's | 2051 Ford Pkwy. | Saint Paul | MN | 55116 |
| Vine Park | 242 West Seventh Street | Saint Paul | MN | 55102 |
| White Rock Coffee Roasters | 769 Cleveland Ave. S. | Saint Paul | MN | 55116 |




**HOTSPOT LOCATIONS NEAR SAINT PAUL**

| Company | Address | City | State | Zip |
|---|---|---|---|---|
| A Fine Grind | 2038 Marshall Ave. | Saint Paul | MN | 55104 |
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| Aroma's Artisanal Cafe | 488 N. Robert St. | Saint Paul | MN | 55101 |
| Artisti Grind | 3399 University Ave. West | Saint Paul | MN | 55114 |
| Barnes & Noble | 2080 Ford Parkway | Saint Paul | MN | 55116 |
| Bean Factory | 1242 Thomas Ave. | Saint Paul | MN | 55104 |
| Bean Factory | 1518 Randolph Avenue | Saint Paul | MN | 55105 |
| Black Dog Cafe | 308 Prince Street | Saint Paul | MN | 55101 |
| Blondie's Cafe | 454 Snelling Ave. S. | Saint Paul | MN | 55105 |
| Bogart's W. University Avenue | 1390 W. University Ave. | Saint Paul | MN | 55104 |
| Brave! Bakery & Cafe | 1196 Grand Avenue | Saint Paul | MN | 55105 |
| Brewhouse | 475 Fairview Ave. S. | Saint Paul | MN | 55105 |
| Caboot Coffee Bar | 1562 Selby Ave. | Saint Paul | MN | 55104 |
| Caribou Coffee #00108 | 2138 Ford Parkway | Saint Paul | MN | 55116 |
| Caribou Coffee #00112 | 957 Grand Ave. | Saint Paul | MN | 55105 |
| Caribou Coffee #02156 | 68 Snelling Ave. S. | Saint Paul | MN | 55105 |
| Caribou Coffee #01144 | 1811 Randolph Ave. | Saint Paul | MN | 55105 |
| Caribou Coffee #01166 | 2340 W. 7th Street | Saint Paul | MN | 55116 |
| Caribou Coffee #110 | 1055 Grand Ave. | Saint Paul | MN | 55105 |
| Caribou Coffee #163 | 401 Robert Street | Saint Paul | MN | 55101 |
| Chatoyant - Maplewood | 1754 Adolphus St. | Saint Paul | MN | 55117 |
| Coffee Gecomich | 1579 Hamline Ave. N. | Saint Paul | MN | 55108 |
| Dean's Grotto | 1700 Snelling Avenue | Falcon Heights | MN | 55108 |
| Dunn Brothers | 1569 Grand Ave. | Saint Paul | MN | 55105 |
| Dunn Brothers | 2264 Como Ave. | Saint Paul | MN | 55108 |
| Dunn Brothers | 2183 W. 7th St. | Saint Paul | MN | 55116 |
| Dunn Brothers | 387 Wabasha St. | Saint Paul | MN | 55102 |
| Embassy Suites Hotel - Saint Paul - Downtown | 175 East 10th St. | Saint Paul | MN | 55101 |
| Fibulens Fusion Restaurant | 400 Selby Ave. | Saint Paul | MN | 55102 |
| Fort Grind | 470 S. Cleveland Ave. | Saint Paul | MN | 55105 |
| Gaughe's Coffeeshop | 721 N. Snelling Ave. | Saint Paul | MN | 55104 |
| Golden Voyage Coffee Cafe | 921 Selby Avenue | Saint Paul | MN | 55104 |
| Heartbeats Restaurant & Pizza | 1841 Rice St. | Saint Paul | MN | 55117 |
| Holiday Inn Express St. Paul - Twin Cities | 1010 Bandana Boulevard W. | Saint Paul | MN | 55108 |
| Holiday Inn River Centre | 175 West Seventh Street | Saint Paul | MN | 55102 |
| J and S Bean Factory | 1518 Randolph Ave. | Saint Paul | MN | 55105 |
| Jeanine's Coffee and Tea House | 849 University Ave. W. | Saint Paul | MN | 55104 |
| Kay's Cafe | 787 Raymond Ave. | Saint Paul | MN | 55114 |
| Lady Finger: Nail Salon and The Neighborhood Cafe | 1560 Selby Ave. | Saint Paul | MN | 55104 |
| Mad Hatter's Coffee Cake and Tea Shop | 845 W. 7th St. | Saint Paul | MN | 55102 |
| Minnesota History Centre | 345 Kellogg Blvd. W. | Saint Paul | MN | 55102 |
| Moose Country | 857 Sibley Memorial Hwy | Saint Paul | MN | 55118 |
| Nina's Coffee Shop | 165 Western Ave. N. | Saint Paul | MN | 55103 |
| Randolph Pizza & Wings | 504 Longpreme Ave. E. | Saint Paul | MN | 55109 |
| Rosha's | 1169 W. 7th Street | Saint Paul | MN | 55102 |
| Sofia Coffee | 1371 University Avenue | Saint Paul | MN | 55104 |
| Starbucks Ford Street | 2078 Ford Parkway | Saint Paul | MN | 55116 |
| Starbucks Grand & Victoria | 857 Grand Ave. | Saint Paul | MN | 55105 |
| Starbucks Lawson Commons | 211 Fifth Street West | Saint Paul | MN | 55102 |
| Stogies on Grand | 961 Grand Avenue | Saint Paul | MN | 55105 |
| Sweeney's | 96 Dale St. N. | Saint Paul | MN | 55103 |
| The Happy Genome | 498 Selby Ave. | Saint Paul | MN | 55102 |
| The Tea Garden | 1692 Grand Ave. | Saint Paul | MN | 55105 |
| The UPS Store #1382 | 1043 Grand Ave. | Saint Paul | MN | 55105 |
| The UPS Store #2105 | 1360 University Ave., Suite 104 | Saint Paul | MN | 55104 |
| Tiffany's | 2071 Ford Pkwy. | Saint Paul | MN | 55116 |
| Vine Park | 242 West Seventh Street | Saint Paul | MN | 55102 |
| White Rock Coffee Roasters | 769 Cleveland Ave. S. | Saint Paul | MN | 55116 |

# MAP OF ST. PAUL, MINNESOTA

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# APPENDIX VI
# Business Survey Results

PEPIN HUGUNIN
& ASSOCIATES

# Broadband Technology Needs and Economic Development Impact Survey

## DRAFT Final Report

## City of Saint Paul
## March 27, 2006

PEPIN HUGUNIN & ASSOCIATES

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***10775 Kimbro Ave. Ct. N.***
**Stillwater, MN 55082**

# INTRODUCTION

The City of Saint Paul, Minnesota, is conducting a Broadband Internet Technology Study (BITS) to determine the broadband Internet access needs of various constituencies, as well as the appropriate role of the city in responding to those emerging needs. As a part of the BITS study, the city commissioned a telephone survey of business owners and operators within the city.

The objectives of the survey are as follows.

**Objectives of BITS Business Telephone Survey**

• Determine the broadband technology needs of businesses operating in the city
• Determine the adequacy of and levels of satisfaction with current broadband access
• Identify gaps between the needs and the current service offerings
• Determine demand for new services at specified price points
• Determine what business owners and operators believe is the appropriate role for the city in meeting emerging needs and/or providing new services

## Method

A total of 375 interviews was conducted with representatives of Saint Paul businesses who were able and qualified to respond concerning their businesses' use of and needs and wants for Internet technology. The sample was drawn from a list of approximately 7,500 businesses provided by the City of Saint Paul, which list also was supplemented by a list of 129 certified minority-owned businesses also provided by the city.

The survey instrument was developed and the survey project directly supervised by Pepin Hugunin & Associates, Stillwater, MN, as a sub-contractor to the prime consultant/contractor for the BITS project, Springsted Incorporated, Saint Paul, MN. Data collection (the telephone interviews) was conducted by JEM Research, Valparaiso, IN, as the low responsible bidder for this portion of the work. Data collection was conducted from February 13 through February 24, 2006. The survey instrument consists of approximately 25 questions, and the average interview was completed in approximately 10 minutes.

## Sample

All 129 businesses listed on the certified minority-owned list were called, though not all of these businesses participated. This is because the city and the consulting team were particularly interested in the needs of smaller and minority-owned businesses. As a result, 120 of the respondents (32%) reported being minority- and/or woman-owned. We believe this to be an over-sample of the actual universe, but cannot state with certainty as such or by how much this might be the case.
Further, 197 respondents (52.5%) report that their business employs from one to four employees. This appears to fairly represent the universe of Saint Paul businesses.

## Cross Tabulations

Data was cross–tabulated on ten different variables for a total of 44 sub-groups—for example, size of business defined in seven different sub-groups by number of employees, and the type of Internet connection reported (dial-up versus high speed).

Few if any statistically significant differences among sub-groups on the approximately 25 responses were found. This is due in part to the small sample sizes within most of the cells, but also because differential responses generally were not found. A few differentials are reported here as being intriguing and/or suggestive, but the reader of this report should be aware that they do not rise to the level of statistical significance.

## About This Report

Apart from this Introduction, the report consists of three parts.

**Report Contents**

1. Summary and Analysis of Findings—page 4

2. Detailed Findings—page

3. Data Tables*

The data tables are not attached here, as they run to 257 pages in their raw form and 210 pages in a slightly edited form. Those interested in obtaining the data tables should contact Marc Hugunin at Pepin Hugunin & Associates at 651-351-1235 or marc@pepinhugunin.com. Unless otherwise indicated, we will supply the edited form—all of the data is intact but is somewhat consolidated simply to reduce the number of pages. ***When using the data tables, refer to the Detailed Findings section of this report for a quick reference to the subject matter and the N for each table.***

# EXECUTIVE SUMMARY

The primary purpose of this survey was to gauge market demand among businesses for a new and improved (probably wireless) broadband Internet service, and to determine the opinions of business owners and operators concerning the city's role in providing such a service. The findings may be summarized as follows (each of these findings is discussed in greater detail below).

## Key Findings

The 375 respondents to the business survey, taken in the aggregate, believe that:

1. Internet access—and specifically, high speed Internet access—is very important to the efficient operation and the competitiveness of most businesses.

2. The reliability of Internet access, on-line security, avoiding the need to dial-up in order to connect, and the speed of the connection are very important characteristics of Internet access.

3. Current Internet services generally are meeting the needs of businesses. Satisfaction is highest with avoiding the need to dial-up, reliability of Internet access and on-line security. Satisfaction is lowest with portability, the ability to block access to selected Web sites, and the price of services.

4. The statement that "the competitive market currently offers high speed Internet services at prices that even the smallest business can afford" elicits neither strong agreement nor strong disagreement.

5. Many (almost half of the respondents) are "very likely" to switch to a new supplier offering "10 megabits per second (service) downstream and upstream" at the same price as their current service. The likelihood of switching drops by half if priced at 10 percent more than their current service.

6. The city should have a role in the future evolution of broadband Internet access in Saint Paul. About one-third of respondents believe that the city should "encourage competition" among Internet access providers, while another one-third believe that the city should install a system for high speed Internet access. This latter one-third is divided as to whether the city should lease the facility to a private service provider, or whether the city itself should operate the network and act as an Internet service provider.

In summary, there is not a general clamor for improved Internet services, yet businesses are open to considering an upgrade as new technologies become available. As was said at the business forum, it is difficult to envision what one will do with higher speeds and larger bandwidth. But as one individual said at the forum, "Whenever I have upgraded, I have always filled it up."

## Respondent Profile

More than half of the 375 respondents represent very small businesses with 1 to 4 employees. Another 30% have fewer than 20 employees. About 1 in 6 respondents represent a home-based business. We believe that these numbers are representative of the distribution of businesses in the city.

14.4% of respondents represent minority-owned and 21.3% represent woman-owned businesses. A total of 120 respondents, or 32% of the sample, represent minority- and/or woman-owned businesses, as 17 represent firms that are BOTH minority- and woman-owned. We believe that this represents a slight over-sampling of such firms.

More than 85% of respondents either have Internet access at the present time, or plan to obtain it in the next 12 months. More than three-quarters of those with Internet access have a high speed connection. More than 60% of these, in turn, are DSL connections. Just under one-quarter have a dial-up connection.

# SUMMARY AND ANALYSIS OF FINDINGS

## Importance of Internet Access

The respondents indicated in several different ways their belief that Internet access is very important to the success of their businesses. See Figure 1 (over) for a summary of these responses.

1. Q25-3 asked respondents to agree or disagree with the following statement: "High speed Internet access is (or soon will be) as essential a service as water, sewer and electricity." Respondents were asked to rate their agreement or disagreement on a scale from 1 to 10 with 1 representing "strongly disagree" and 10 "strongly agree." 38.7% of respondents strongly agreed with the statement by rating their agreement as a 9 or 10. The median response (half of the responses were higher, half were lower) was an 8, and the mode (the single most frequent response) was a 10.

2. Q25-4 similarly asked respondents to agree or disagree, using the same scale, with the following statement: "In the near future, most businesses will be able to function efficiently only if they and their customers have high speed Internet access." 22.9% agreed strongly, rating their agreement as a 9 or 10. The median response was a 7 and the mode was 10,

3. Q18-1 similarly asked respondents how important Internet access is "to your ability to achieve your strategic goals." Responses again were given on a scale from 1 to 10 with 1 being "not at all important" and 10 being "very important." More than half of the respondents (56.5%) rated the importance of Internet access a 9 or 10 on this dimension. The median response was a 9 and the mode, again, was 10.

4. Q18-3 similarly asked about the importance of Internet access "to your ability to remain competitive." 48.3% of respondents rated the importance of Internet access on this dimension as a 9 or 10. The median response was 8 and the mode 10.

At the conclusion of the interview, respondents were asked if they had any additional comments that they would like to make. 2.4% of respondents used that opportunity to repeat their opinion that the Internet is extremely important to their business and/or to their community.

Respondents indicated the importance of the Internet not only in their opinions but also in their behaviors.

1. About 91% of respondents report that computers or terminals are used, and 84.5% report that they have Internet access at their place of business. Another 2.4% plan to obtain Internet access in the next 12 months.

2. Almost 60% report receiving (downloading) large emails or files of more than one megabyte in size, while more than 50% report sending such files via the Internet.

**Figure 1: Importance of Internet Access**

| Question | Strongly Agree* | Strongly Disagree+ | Median Response | Mode |
|---|---|---|---|---|
| Q25-3. High-speed Internet access is (or soon will be) as essential a service as water, sewer and electricity | 145 (38.7%) | 32 (8.5%) | 8 | 10 |
| Q25-4. In the near future, most businesses will be able to function efficiently only if they and their customers have high-speed Internet access. | 86 (22.9%) | 36 (9.6%) | 7 | 10 |
| | **Very Important*** | **Very Unimportant+** | | |
| Q18-1. How important is Internet access to your (businesses') ability to achieve your strategic goals? | 179 (56.5%) | 17 (5.4%) | 9 | 10 |
| Q18-3. How important is Internet access to your (businesses') ability to remain competitive? | 153 (48.3%) | 34 (10.7%) | 8 | 10 |

* Based on a rating of 9 or 10 on a scale from 1 to 10
+ Based on a rating of 1 or 2 on a scale from 1 to 10

## Importance of Characteristics of Internet Access

Respondents were asked how important various different characteristics of their Internet connections are. Responses were given on a scale from 1 to 10, with 1 representing "not at all important" and 10 representing "very important." More than half of the respondents rated three characteristics at the highest level of importance (10): reliability of the system, on-line security and avoiding the need to dial up to make a connection. The speed of the connection and the price of the service are also rated at a high level of importance. Choice of providers and portability are somewhat less important, though still important. The ability to block access to selected Web sites is of less importance.

**Figure 2: Importance of Characteristics of Internet Access**

| Characteristic | Very Important* | Median response | Mode response |
|---|---|---|---|
| Reliability, "system is up" | 83.3% | 10 | 10 |
| On-line security | 73.2% | 10 | 10 |
| Eliminates need to dial-up | 62.1% | 10 | 10 |
| Speed of connection | 51.1% | 9 | 10 |
| Price of services | 42.6% | 8 | 10 |
| Choice of providers, "there is competition" | 28.7% | 7 | 10 |
| Portability, ability to connect away from your office | 24.9% | 5 | 10 |
| Ability to block access to selected Web sites | 25.2% | 5 | 1 |

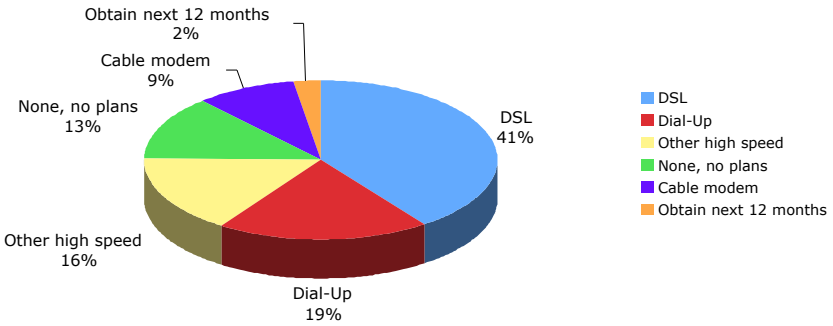
* Based on a rating of 9 or 10 on a scale from 1 to 10

## Current Internet Services

• Of the 84.5% of respondents who have Internet access, 77% have high speed access while 23% have dial-up access.

• 61.5% of high speed connections are DSL, and 14.3% are cable modems. 13.1% are full or fractional T1 lines, and a small number of other connections also were reported.

**Figure 3: Current Internet Access**




Among those who have Internet access, Qwest (24.6%) and Comcast (12.9%) are most often named as the primary Internet Service Provider (ISP). Others with more than 10 mentions (3.5% market share or greater) include:

• Integra—21 mentions (6.6%)
• AOL—15 (4.7%)
• Popp Telecomm—12 (3.8%)
• Vector (Visi)—12 (3.8%)
• Eschelon—11 (3.5%)

Others with more than 2 mentions include: Earthlink, McCloud, USFamily, IPHouse, MSN, TDS, TIES, Onvoy, Web Lake, Pixius, Stonebridge, NetZero, CP and USInternet.

## Satisfaction with Current Internet Access

Respondents were then asked to rate their satisfaction with their current Internet service on these same characteristics. A scale from 1 to 10 again was used, with 1 representing "very UNsatisfied" and 10 representing "very satisfied." Levels of satisfaction with current services rate highly, especially on the ability to avoid dialing up to get a connection, reliability of the system, and on-line security.

It is worth noting that satisfaction is highest with those characteristics of Internet access that are most important.

**Figure 4: Satisfaction with Current Internet Access**

| Characteristic | Very Important | Median response | Mode response |
|---|---|---|---|
| Eliminates need to dial-up | 61.2% | 10 | 10 |
| Reliability, "system is up" | 59.6%` | 9 | 10 |
| On-line security | 52.1% | 9 | 10 |
| Speed of connection | 46.1% | 8 | 10 |
| Price of services | 35.6% | 8 | 10 |
| Ability to block access to selected Web sites | 35.6% | 7 | 10 |
| Choice of providers, "there is competition" | 34.7% | 8 | 10 |
| Portability, ability to connect away from your office | 29.3% | 6 | 10 |

## Gap Analysis

One might also note, however, that a gap exists between the level of importance and the level of satisfaction on two key characteristics.

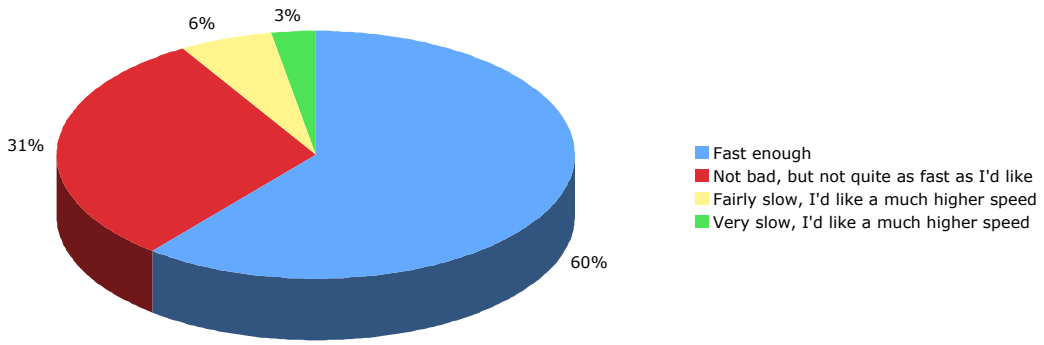
**1. Reliability, "system is up."** 83.3% of respondents rate the importance of this characteristic as a 9 or 10, and the median response is a 10. Meanwhile, 59.6% rate their satisfaction on this characteristic as a 9 or 10, and the median response is a 9. There is a slight gap, then, in customer satisfaction on this dimension of Internet access.

**2. On-line security.** Similarly, 73.2% of respondents rate the importance of this characteristic as a 9 or 10, and the median response is 10. Meanwhile, 52.1% rate their satisfaction on this characteristic as a 9 or 10, and the median response is a 9. So, again, there is a very slight gap in customer satisfaction on this dimension.

***Despite these gaps, we repeat our earlier assertion that satisfaction with current Internet services runs very high. The mode (most frequent) response on all eight characteristics is a 10.***

**Speed of connections.** Further, there is no obvious gap between the importance of and satisfaction with the speed of Internet connections. Further, respondents were asked directly if their connection speed is fast enough. 60.6% said their current connection is “fast enough,” while another 30.6% said it is “not bad (though) not quite as fast as I’d like.” Fewer than 10% said their current connection speed is “fairly slow” or “very slow.”

**Figure 5. Speed of Connections**



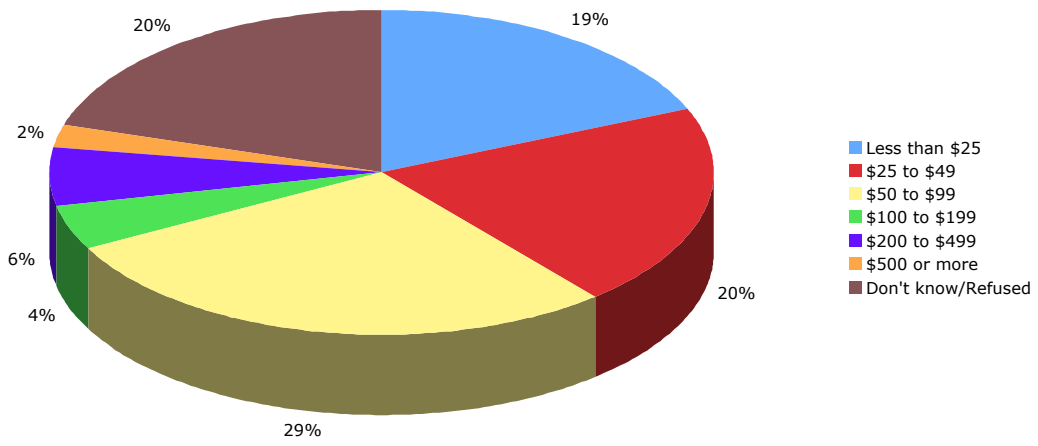

This finding is supported by responses to the question of why some businesses do not have Internet access today. Exactly half of such respondents reported that they do not have Internet access because monthly charges or installation costs are too high. Still, more than two-thirds also said that they don’t have Internet access because they “don’t need it to interact with their customers or suppliers.” Verbatim responses include:

• “We communicate with our customers in other ways.”
• “We tried it but it didn’t increase our business.”

Some who do not have Internet access at work also report that they use Internet access at home for business purposes.

• About two-thirds report that they pay less than $100 per month for Internet access. Another 20% said they did not know how much their company was paying, and only 12.6% reported paying more than $100 per month.

**Figure 6: Monthly Cost of Internet Service**




**Pricing.** Speaking of pricing, respondents rated the price of services as the fifth (out of eight) most important characteristic of their Internet service, and also rated the price of services as the fifth (out of eight) characteristics in terms of their satisfaction levels with that characteristic. There is in this sense not a high level of dissatisfaction with the current pricing of Internet access services.

On the other hand, price sensitivity was indicated in answer to other questions which are reported in the next to sections of this discussion: “The Private Market” and “Market Demand.”

## The Private Market

Respondents were further asked for their opinions concerning the performance of private markets in meeting their needs and the needs of the community for Internet access. They were asked, for example, to indicate their agreement or disagreement (using a scale from 1 to 10) with the following statement: “The competitive market currently offers high speed Internet services at prices that even the smallest business can afford.” 21.9% of respondents strongly agreed with this statement (rated their agreement as a 9 or 10), while the median response was 7 and the mode 5.

This represents a lesser degree of agreement than the assertion, “In the near future, most businesses will be able to function efficiently only if they and their customers have high-speed Internet access,” for example.

**Figure 7: Performance of Private Market**

| Question | Strongly Agree* | Strongly Disagree+ | Median Response | Mode |
|---|---|---|---|---|
| Q25-2. The competitive market currently offers high speed Internet services at prices that even the smallest business can afford. | 82 (21.9%) | 38 (10.1%) | 7 | 5 |
| Q25-4. In the near future, most businesses will be able to function efficiently only if they and their customers have high-speed Internet access. | 86 (22.9%) | 36 (9.6%) | 7 | 10 |

Agreement with this more "philosophical" statement also is considerably weaker than the levels of satisfaction that are reported with the more tangible services which the private market is delivering today.

Of course, insofar as satisfaction levels with current Internet services are fairly high and current Internet services are provided by private providers, this represents a general level of satisfaction with the performance of the private market.

On the other hand, satisfaction with "your choice of providers—e.g. there is competition" is lower than with other characteristics of Internet services. 8.2% of respondents are "very UNsatisfied" with their choice of providers.

**Market Demand for New Broadband Internet Service Provider**

Respondents were asked to rate their likelihood of switching to a new Internet service at 10 mb per second both downstream and upstream. While this is 10 times faster than DSL, respondents generally were unwilling to pay more for this service than they are paying today.

• 42% said they were "very likely" to switch to such a service—that is, they rated their likelihood to switch as a 9 or 10 on a scale from 1 to 10—if the service was priced the same as their current service.

• This fell to only 20.6% who were "very likely" to switch if the new service were priced 10% higher than their current service.

• More than half said they would be "very likely" to switch if the new service were priced 10% to 20% lower than their current service.

**Figure 8: Likelihood of Switching to New High Speed Internet Service**

| Question | Very Likely* | Very UNlikely+ | Median Response | Mode |
|---|---|---|---|---|
| At same price as your current service | 137 (42%) | 45 (13.8%) | 8 | 10 |
| 10% more per month than your current service | 67 (20.6%) | 84 (25.8%) | 5 | 1 |
| 20% more per month than your current service | 22 (6.7%) | 138 (42.3%) | 3 | 1 |
| 10% less per month than your current service | 171 (52.5%) | 33 (10.1%) | 9 | 10 |
| 20% less per month than your current service | 194 (59.5%) | 25 (7.7%) | 10 | 10 |

The willingness of many to consider switching to a new service is also supported by their levels of agreement with the statement, "The competitive market currently offers high speed Internet services at prices that even the smallest business can afford." 21.9% strongly agreed with this statement, but 10.1% strongly disagreed. The median response was a 7 on a scale from 1 to 10 and the mode (most frequent response) was just a 5. These represent lower levels of agreement than on any other statement that was tested.

Further, exactly half of those who do not have Internet access today attribute their lack of an Internet connection to cost—whether monthly charges or installation costs.

In summary, the likelihood of switching to a new Internet service appears to be more closely related to price than to other characteristics of the proposed new service. Fewer than 10% of respondents said their current Internet connection speed is "fairly slow" or "very slow, and the levels of satisfaction with the "speed of connection" is somewhat higher than satisfaction with the "price of services."

**Economic Development Impact**

Respondents were asked two questions about the economic development impact of high speed Internet access. They were asked generally whether "***businesses*** are more likely to locate in a community where competitively priced high-speed Internet services are available." They were also asked more specifically "how important is Internet access… to ***your*** decisions about where to locate your facilities?"

• 29.6% of respondents agreed strongly (rated their agreement 9 or 10 on a scale from 1 to 10) that "***businesses*** are more likely to locate in a community where competitively priced high-speed Internet services are available."

• Fewer (19.2%) agreed strongly (rated their agreement 9 or 10 on a scale from 1 to 10) that competitively priced high speed Internet services are important to their own decisions about where to locate their business facilities.

## The City's Role

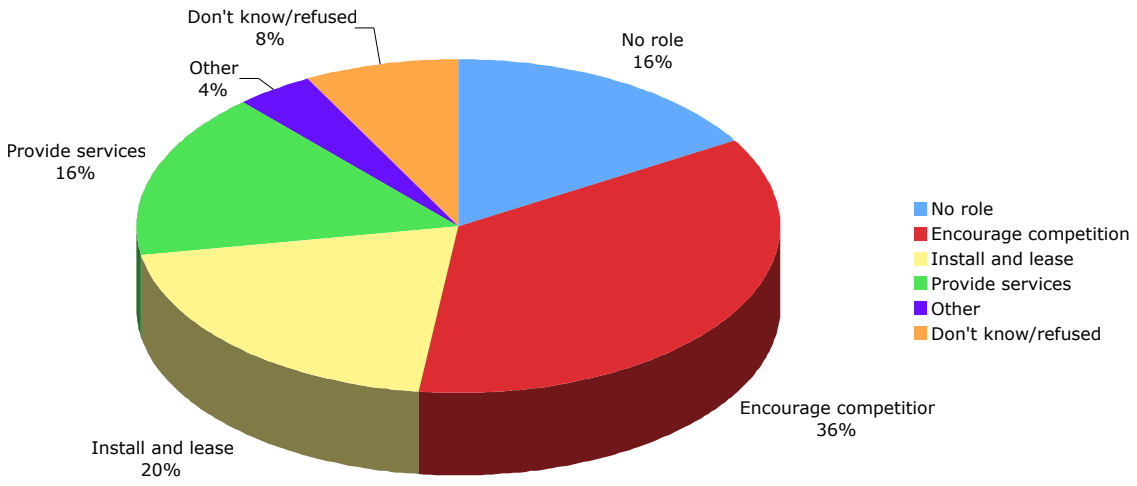
Respondents were asked directly what role the city should play "in order to help ensure that high-speed Internet access is available and affordable?"

• 16.3% said the city should have no role.
• 16.0% said the city should install, own and operate a high-speed network.

In between these two opposing views came various shades of gray.

• 35.7% said the city should encourage competition among private service providers.
• 20.3% said the city should install a high-speed network, and lease access to the network to private service providers to operate and deliver services over the network.

**Figure 9: The City's Role**




Then, at the conclusion of the interview, respondents were asked if they had any other or final comment that they wished to make. 12.3% of respondents used this as an opportunity to say that they "like" or support the idea of the city becoming involved in enhancing Internet access within the city. A little more than half as many respondents (7.2%) used this as an opportunity to say "don't do it," "government should stay out of business," and other comments to that effect.

## Respondent Profile

More than half of the 375 respondents represent very small businesses with 1 to 4 employees. Another 30% have fewer than 20 employees. 11.5% have 20 to 99 employees, while 3.7% have 100 employees or more. We believe that these numbers are representative of the distribution of businesses in the city.

About 1 in 6 respondents represent a home-based business.

14.4% of respondents represent minority-owned and 21.3% represent woman-owned businesses. A total of 120 respondents, or 32% of the sample, represent minority- and/or woman-owned businesses, and 17 represent firms that are BOTH minority- and woman-owned. We believe that this represents a slight over-sampling of such firms.

The sample is fairly equally divided between businesses that lease (53.3%) and own (42.4%) their facilities, while 2.7% report having a combination of owned and leased space.

Almost two-thirds of respondents represent service businesses. About one-quarter represent retail businesses, while fewer than 10% represent manufacturing businesses.

Almost 60% reported that they serve an essentially local customer base, and 52% also reported that their competitors are locally based. About one-third serve regional or national customers, and compete with regional and/or national competitors. About 5% reported serving customers internationally and competing in international markets.

## Computer and Internet Usage

As noted above, about 80% of respondents have from 1 to 19 employees. Similarly, about 80% of respondents report having from 0 to 9 computers at their business location.

More than 85% of respondents either have Internet access at the present time, or plan to obtain it in the next 12 months. More than three-quarters of those with Internet access have a high speed connection. More than 60% of these, in turn, are DSL connections. Just under one-quarter have a dial-up connection.

Of those who do not have Internet access at the present time, only 15% plan to obtain it in the next 12 months. About half of those who do not have Internet access attribute this to high monthly charges and/or installation costs. More than two-thirds say, however, that they simply “don’t need (Internet access) to interact with their customers or suppliers.”

# DETAILED FINDINGS

## I. Demographics and City's Role

The following questions (Q1 through Q9 and Q24 through Q27) were answered by all respondents, with the exception of Q2a. ***This data is drawn from tables 1-10, 77-81, 83-92, 158-163, 165-174 and 240-245.***

**Q1. How long has this business been located in the City of Saint Paul? (N = 375)**

| | Number | Pct. |
|---|---|---|
| 1. Less than 1 year | 8 | 0.8% |
| 2. 1 to 5 years | 71 | 18.9 |
| 3. 6 to 10 years | 60 | 16.0 |
| 4. More than 10 years | 238 | 63.5 |
| 888/999. Don't know/Refused | 3 | 0.8 |

**Q2. How many employees work at this location?**

| | Number | Pct. |
|---|---|---|
| 1. 1 to 4 **IF YES, Q2a.** | 197 | 52.5% |
| 2. 5 to 9 | 62 | 16.5 |
| 3. 10 to 19 | 55 | 14.7 |
| 4. 20 to 49 | 33 | 8.8 |
| 5. 50 to 99 | 10 | 2.7 |
| 6. 100 or more | 14 | 3.7 |
| 888/999. Don't know/Refused | 4 | 1.1 |

**Q2a. Does this business operate out of a private residence? (N = 197)***

| | Number | Pct. |
|---|---|---|
| 1. Yes | 62 | 16.5% of total (31.5% of establishments with 1 to 4 employees) |
| 2. No | 135 | --- |
| 888/999. Don't know/Refused | --- | |

* Asked only of those reporting 1 to 4 employees

**Q3. Do you consider that this is a minority-owned business?**

| | Number | Pct. |
|---|---|---|
| 1. Yes | 54 | 14.4% |
| 2. No | 307 | 81.9 |
| 888/999. Don't know/Refused | 14 | 3.7 |

**Q4. Do you consider that this is a woman-owned business?**

| | Number | Pct. |
|---|---|---|
| 1. Yes | 80 | 21.3% |
| 2. No | 284 | 75.7 |
| 888/999. Don't know/Refused | 11 | 2.9 |

There are 54 minority-owned and 80 woman-owned businesses. 17 of the firms are minority woman-owned—that is, they are both minority-owned and woman-owned. Therefore, the total number of minority-owned and woman-owned businesses in the sample is 120, or 32% of the total.

**Q5. Do you own or lease this facility?**

| | Number | Pct. |
|---|---|---|
| 1. Own | 159 | 42.4% |
| 2. Lease | 200 | 53.3 |
| 3. Both/Neither | 10 | 2.7 |
| 888/999. Don't know/Refused | 6 | 1.6 |

**Q6. How would you describe your customer base?**

| | Number | Pct. |
|---|---|---|
| 1. Local | 223 | 59.5% |
| 2. Regional | 81 | 21.6 |
| 3. National | 44 | 11.7 |
| 4. International | 20 | 5.3 |
| 888/999. Don't know/Refused | 7 | 1.9 |

**Q7. How would you describe your competitors?**

| | Number | Pct. |
|---|---|---|
| 1. Local | 195 | 52.0% |
| 2. Regional | 67 | 17.9 |
| 3. National | 62 | 16.5 |
| 4. International | 20 | 5.3 |
| 888/999. Don't know/Refused | 31 | 8.3 |

**Q8. Where are voice and data connectivity decisions made for your organization?***

| | Number | Pct. |
|---|---|---|
| 1. Locally (here in St. Paul) | 311 | 82.9% |
| 2. Elsewhere (not in St. Paul) | 14 | 3.7 |
| 3. Combination St. Paul, elsewhere | 45 | 12.0 |
| 888/999. Don't know/Refused | 5 | 1.3 |

* This data (Q8) not representative of the market. 50 firms reported that these decisions are made elsewhere (not in St. Paul) but that the respondent who makes those decisions (located elsewhere) could not respond to questions concerning the St. Paul operation. These 50 interviews were terminated, and are not included in the findings. (One could infer that these decisions are made elsewhere in 64 of 425 firms, or 15.1%.)

**Q9. How many personal computers or terminals do you have at this location in Saint Paul?**

| | Number | Pct. |
|---|---|---|
| 1. None | 33 | 8.8% |
| 2. 1 to 4 | 204 | 54.4 |
| 3. 5 to 9 | 69 | 18.4 |
| 4. 10 to 19 | 36 | 9.6 |
| 5. 20 to 49 | 18 | 4.8 |
| 6. 50 to 99 | 5 | 1.3 |
| 7. 100 or more | 8 | 2.1 |
| 888/999. Don't know/Refused | 2 | 0.5 |

**Q24. What role do you think the City of Saint Paul should play in order to help ensure that high-speed Internet access is available and affordable?**

| | Number | Pct. |
|---|---|---|
| 1. No role | 61 | 16.3% |
| 2. Encourage competition | 134 | 35.7 |
| 3. Install and lease | 76 | 20.3 |
| 4. Provider of high-speed services | 60 | 16.0 |
| 5. Other* | 15 | 4.0 |
| 888/999. Don't know/Refused | 29 | 7.7 |

* See verbatims at end of detailed findings

**Q25. Using a scale from 1 to 10, where 1 is Strongly Disagree and 10 is Strongly Agree, please indicate whether you agree or disagree with the following statements.**

| | Strongly Disagree (1-2) | Strongly Agree (9-10) | Median | Mode |
|---|---|---|---|---|
| 1. The competitive market currently offers high speed Internet services at prices that even the smallest business can afford. | 38 (10.1%) | 82 (21.9%) | 7 | 5 |
| 2. Businesses are more likely to locate in a community where competitively priced high-speed Internet services are available to them. | 31 (8.3%) | 111 (29.6%) | 7 | 10 |
| 3. High-speed Internet access is (or soon will be) as essential a service as water, sewer and electricity. | 32 (8.5%) | 145 (38.7%) | 8 | 10 |
| 4. In the near future, most businesses will be able to function efficiently only if they and their customers have high-speed Internet access. | 36 (9.6%) | 86 (22.9%) | 7 | 10 |

Q26. Do you have any additional comments or insights to share with the City of Saint Paul concerning Internet access for your business?*

| | Number | Pct. |
|---|---|---|
| 1. Yes | 243 | 64.8* |

* See verbatims at end of Detailed Findings

**Q27. ENTER RESPONDENT'S ZIP CODE FROM DATABASE**

**Q. 28 ENTER RESPONDENT'S SIC CODE FROM DATABASE**

| | Number | Pct. |
|---|---|---|
| 1. 10-19 or 60-99 (Services) | 251 | 66.9% |
| 2. 20-49 (Manufacturing) | 33 | 8.8 |
| 3. 50-59 (Retail) | 91 | 24.3 |

## II. Internet Access (or Not)

Q10, indicating whether the respondent's firm has Internet access or not, was answered by all 375 respondents. Q10a, indicating why some respondents do not have Internet access, was answered by the 58 respondents who do not indeed have Internet access at the present time. ***This data is drawn from tables 11-17, 93-98 and 175-180.***

**Q10. Do you have Internet access from this location? (N = 375)**

| | Number | Pct. |
|---|---|---|
| 1. Yes | 317 | 84.5% |
| 2. No | 58 | 15.5 |
| 888/999. Don't know/Refused | 0 | |

**Q10a. Why do you not use the Internet? (N = 58)**

| | Yes | No | DK/REF |
|---|---|---|---|
| 1. Monthly charges are too expensive | 18 (31.0%) | 39 (67.2%) | 1 (1.7%) |
| 2. It is too costly to install | 11 (19.0%) | 44 (75.9%) | 3 (5.2%) |
| 3. High speed access is not available and dial-up is too slow | 6 (10.3%) | 47 (81.0%) | 3 (5.2%) |
| 4. Don't need it to interact with our customers or suppliers | 40 (69.0%) | 18 (31.0%) | --- |
| 5. Other reasons* | 53 91.4%) | --- | |

* See verbatims at end of Detailed Findings

**10b. Do you plan to obtain Internet access in the next year? (N = 58)**

| | Number | Pct. |
|---|---|---|
| 1. Yes | 9 | 15.5% |
| 2. No | 45 | 77.6 |
| 888/999. Don't know/Refused | 4 | 6.9% |

## III. Current Internet Connections

These questions were asked of the 317 respondents who report having Internet access—except Q11a, which was asked only of those who have ***high speed*** Internet access. ***This data is drawn from tables 18-47, 99-129 and 181-211.***

**Q11. How do you connect to the Internet today?**

| | Number | Pct. |
|---|---|---|
| 1. Dial-up—Dedicated Phone Line | 42 | 13.2%, **and skip to Q 12** |
| 2. Telephone Line Shared with Voice | 31 | 9.8, **and skip to Q 12** |
| 3. High Speed Internet Connection, | 244 | 77.0, **continue with Q11a.** |

**Q11a. What type of high speed Internet connection is that? (N = 244)**

| | Number | Pct. |
|---|---|---|
| 1. Cable modem | 35 | 14.3% |
| 2. DSL (Digital Subscriber Line) | 150 | 61.5 |
| 3. Frame Relay | 1 | 0.4 |
| 4. ISDN | 1 | 0.4 |
| 5. Fractional T1 or Full T1 | 32 | 13.1 |
| 6. Fractional T3 or Full T3 | 2 | 0.8 |
| 7. Satellite | 0 | --- |
| 9. Wireless | 6 | 2.5 |
| 10. Other* | 5 | 2.0 |
| 888/999. Don't know/Refused | 12 | 4.9 |

* See verbatims at end of Detailed Findings

**Q12. Would you say that your Internet connection speed is:**

| | Number | Pct. |
|---|---|---|
| 1. Fast enough | 192 | 60.6% |
| 2. Not bad, but not quite as fast as I'd like | 97 | 30.6 |
| 3. Fairly slow; I would like to be connected with a much higher speed | 18 | 5.7 |
| 4. Very slow; I would like to be connected with a much higher speed | 9 | 2.8 |
| 888/999. Don't know/Refused | 1 | 0.3 |

**Q13. What are the things that your company does that takes a lot of bandwidth? Does your company use the Internet to:**

| | Yes | Pct. |
|---|---|---|
| 1. Send large emails or files over 1 megabyte in size | 164 | 51.7% |
| 2. Receiving (downloading) large emails or files over 1 megabyte in size | 189 | 59.6 |
| 3. Send or receive streaming video | 55 | 17.4 |
| 4. Send or receive streaming audio | 57 | 18.0 |
| 5. Video conferencing | 30 | 9.5 |
| 6. Other* | 50 | 15.8 |

* See verbatims at end of Detailed Findings; these totals do not add up to 100%

**Q14. Who is your main Internet Service Provider?***

| | Yes | Pct. |
|---|---|---|
| Total answering* | 278 | 87.7% |
| 888/999. Don't know/Refused | 39 | 12.3 |

* See verbatims at end of Detailed Findings

**Q15. Approximately how much do you pay PER MONTH for Internet service at this location?**

| | Number | Pct. |
|---|---|---|
| 1. Less than $25 | 59 | 18.6% |
| 2. $25 to $49 | 64 | 20.2 |
| 3. $50 to $99 | 90 | 28.4 |
| 4. $100 to $199 | 14 | 4.4 |
| 5. $200 to $499 | 19 | 6.0 |
| 6. $500 or more | 7 | 2.2 |
| 888/999. Don't know/Refused | 64 | 20.2 |

**Q16. I'm going to read a list of characteristics of Internet access. Using a scale from 1 to 10, where 1 is Very Unimportant and 10 is Very Important, how important are the following characteristics of Internet access to you?**

| | Very UNimportant (1-2) | Very Important (9-10) | Median | Mode |
|---|---|---|---|---|
| 1. Speed of connection | 9 (2.8%) | 162 (51.1%) | 9 | 10 |
| 2. Price of services | 5 (1.6%) | 135 (42.6%) | 8 | 10 |
| 3. Reliability; system is "up" | 2 (0.6%) | 264 (83.3%) | 10 | 10 |
| 4. Your choice of providers e.g. there is competition | 30 (9.5%) | 91 (28.7%) | 7 | 10 |
| 5. Eliminates need to dial up | 24 (7.6%) | 197 (62.1%) | 10 | 10 |
| 6. On-line security | 11 (3.5%) | 232 (73.2%) | 10 | 10 |
| 7. Ability to block access to selected Web sites | 104 (32.8%) | 80 (25.2) | 5 | 1 |
| 8. Portability—e.g. ability to connect away from your office | 72 (22.7%) | 79 (24.9%) | 5 | 10 |

**Q17. Now, I'd like you to think about your current Internet access. Using a scale from 1 to 10, where 1 is Very Dissatisfied and 10 is Very Satisfied, how satisfied are you with your current Internet access?**

| | Very UNsatisfied (1-2) | Very Satisfied (9-10) | Median | Mode |
|---|---|---|---|---|
| 1. Speed of connection | 14 (4.4%) | 146 (46.1%) | 8 | 10 |
| 2. Price of services | 11 (3.5%) | 113 (35.6%) | 8 | 10 |
| 3. Reliability; system is "up" | 6 (1.9%) | 189 (59.6%) | 9 | 10 |
| 4. Your choice of providers e.g. there is competition | 26 (8.2%) | 110 (34.7%) | 8 | 10 |
| 5. Eliminates need to dial up | 21 (6.6%) | 194 (61.2%) | 10 | 10 |
| 6. On-line security | 14 (4.4%) | 165 (52.1%) | 9 | 10 |
| 7. Ability to block access to selected Web sites | 33 (10.4%) | 113 (35.6%) | 7 | 10 |
| 8. Portability—e.g. ability to connect away from your office | 43 (13.6%) | 93 (29.3%) | 6 | 10 |

**Q18. On a scale from 1 to 10 where 1 is Not At All Important and 10 is Very Important, how important is Internet access to your business?**

| | Very UNimportant (1-2) | Very Important (9-10) | Median | Mode |
|---|---|---|---|---|
| 1. To your ability to achieve your strategic goals? | 17 (5.4%) | 179 (56.5%) | 9 | 10 |
| 2. To your decisions about where to locate your facilities? | 103 (32.5%) | 61 (19.2%) | 5 | 1 |
| 3. To your ability to remain competitive? | 34 (10.7%) | 153 (48.3%) | 8 | 10 |

## IV. Future Internet Needs

Q19 was asked of the 317 respondents who reported having Internet access at the present time, plus the 9 respondents who plan to acquire Internet access during the next 12 months. ***This data is drawn from tables 48-52, 130-134 and 212-216.***

**Q19. Now I'd like you to think about what you would do if another Internet Service Provider entered the market in competition with your current provider, and offered a service with 10 Megabits per second downstream AND upstream speed. This is 200 times faster than dial-up and 10 times faster than DSL. How likely is it that you would switch to that scale rated on a scale from 1 to 10, where 1 is Very Unlikely and 10 is Very Likely, if the price was:**

| | Very UNlikely (1-2) | Very Likely (9-10) | Median | Mode |
|---|---|---|---|---|
| 1. Same price as your current service | 45 (13.8%) | 137 (42.0%) | 8 | 10 |
| 2. 10% more per month | 84 (25.8%) | 67 (20.6%) | 5 | 1 |
| 3. 20% more per month | 138 (42.3%) | 22 (6.7%) | 3 | 1 |
| 4. 10% less per month | 33 (10.1%) | 171 (52.5%) | 9 | 10 |
| 5. 20% less per month | 25 (7.7%) | 194 (59.5%) | 10 | 10 |

NOTE: Q20 through Q23 were asked only of the 9 respondents who plan to acquire Internet access during the next 12 months. As only 9 of the respondents (2.4% of the total) fell into this category, the results for these questions are not statistically significant. ***This data is reported in tables 53-75, 135-157 and 217-239.*** Because the findings are not statistically valid, they are not reported here.

## V. Verbatims

### Q10a. Other reasons they don't use the Internet

| Reason | Number | E.g. |
|---|---|---|
| Don't need it | 8 | Small business, communicate with customers in other ways (e.g. fax), tried it but it didn't increase our business |
| Use it elsewhere | 6 | Use it at home (e.g. nights and weekends), other employees use at other locations |
| Don't know how to use it | 5 | |
| Employees (and others) abuse it | 3 | One (home-based) said their children abuse it |
| Don't want it | 2 | We're "old fashioned" |
| Will get in the future | 2 | |
| Cost | 1 | |

## Q11a. Other types of high speed Internet

• One respondent each said: VPN, dedicated circuit, partial DS3, Wi-Fi, bonded T1

## Q13. Other things company does that require lots of bandwidth

| Reason | Number | E.g. |
|---|---|---|
| Host/manage Web site/Intranet | 8 | |
| Downloading from the Web | 4 | |
| On-line database | 3 | Connect to corporate database, database search |
| Medical records | 2 | |
| Video conference, Web conference | 2 | |
| Customer/student data | 2 | |
| On-line teaching/learning | 2 | |
| Reservations | 2 | One downloads travel arrangements, another sends reservation confirmations |
| Voice over IP | 1 | |
| On-line survey | 1 | |
| Support | 1 | |
| Firewall | 1 | |
| Brochures | 1 | |
| Inventory control program | 1 | ASP |
| Audio | 1 | |
| Trades currencies | 1 | |
| Download MDS | 1 | |
| Upload files | 1 | |
| Data | 1 | |
| VPN connection | 1 | |
| HR system | 1 | |

## Q14. Who is your main ISP? (N = 317)

| ISP | Number | Pct. |
|---|---|---|
| Qwest | 78 | 24.6% |
| Comcast | 41 | 12.9 |
| Integra | 21 | 6.6 |
| AOL | 15 | 4.7 |
| Popp | 12 | 3.8 |
| Vector (Visi) | 12 | 3.8 |
| Eschelon | 11 | 3.5 |
| 9—Earthlink, 7—McCloud, 5—USFamily, ATT, IPHouse, 3—MSN, TDS | | |
| 2 each—TIES, Onvoy, Web Lake, Pixius, Stonebridge, NetZero, CP, US Internet, | | |
| 1 each—BattleFoundry, IPOD, Infinetivity, Heat Seekers, Multicorp, Lightedge, Phaunas, ECQ, Inter.net, Golden Gate, Axis, Lachnet, Weblate, Mainstreet, Allegiance, Sound, ISP, University of Minnesota, Northwest Computer Services, Amadeus, BEHosting, US Link, Avenet, Fox, Manage.Net, Blackhole, DM, Netpia, Carlson Companies, Sprint, F1, Main Stream, Skypoint, Microsoft Internet Explorer | | |

## Q24. What other role should the city play?

| Comment | Number | E.g. |
|---|---|---|
| City operate the system | 3 | Offer connection to everyone at low price<br>"Go with the government, that way we can help each other"<br>"The city should do it itself, in order to encourage competition" |
| Keep pricing down | 2 | |
| If city does it, it should be very good | 1 | |
| Provide it for free | 1 | |
| Do whatever is best | 1 | |
| City install and include monitoring for public safety | 1 | |
| Depends on what it is going to cost the taxpayer | 1 | |
| "When government gets into something that is competitive, they don't do it right." | 1 | |
| Depends on what they are offering | 1 | |

## Q26. Additional comments

Respondents used this invitation for a closing comment to voice five different categories of opinions. 101 of 375 respondents 26.9%) offered a closing comment.

| Category | Number | Pct. of respondents | E.g. |
|---|---|---|---|
| Like/support the idea | 46 | 12.3% | •It would draw people to the city<br>• Close the digital divide<br>• Wireless is the way to go<br>• Education is a priority<br>• Libraries<br>• It is cheaper if it is publicly owned, non-profit |
| Don't do it | 27 | 7.2% | • Government should stay out of business<br>• There are other things government should do<br>—provide drinking water and leave the rest to us<br>--I'd rather see them fix the potholes<br>• Private sector does a great job<br>• Don't want givernment to have access to my data |
| Dissatisfied with current service | 13 | 3.5% | • Can't get DSL at my location<br>• There's very little competition<br>--We don't have much of a choice<br>• DSL prices are too expensive |
| I like it, but not sure it will be done right | 10 | 2.7% | • It better be reliable<br>• Do it, but it should be free<br>• If they are serious, don't delay<br>• I hope I don't need more hardware<br>• Just be sure you don't create a monopoly |
| The Internet is very important to my business/ my community | 9 | 2.4% | • I could not survive without high speed<br>• We have to use the tool or we will be left behind<br>• Our kids all need to have access<br>• I don't think we could be in business without the Internet |

# APPENDIX VII
# Public Forum Summary

# City of Saint Paul
# Broadband Information Technology Study (BITS)

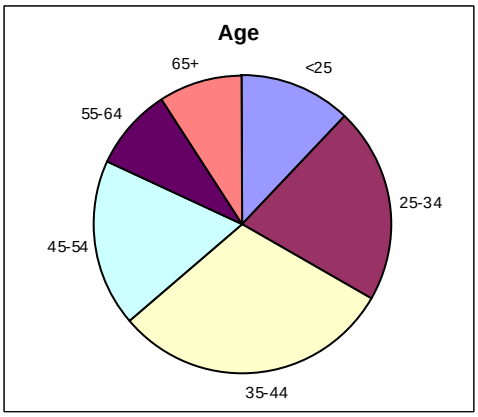
## Public Feedback Forums

On February 22 and 27, Springsted facilitated a pair of public forums to get feedback from St. Paul residents regarding their opinions about various facets of a potential citywide broadband Internet solution. These forums were facilitated with the help of a wireless polling tool, which allowed participants to choose their responses to a variety of questions in a multiple-choice format. A total of 33 people participated in voting at the two forums.

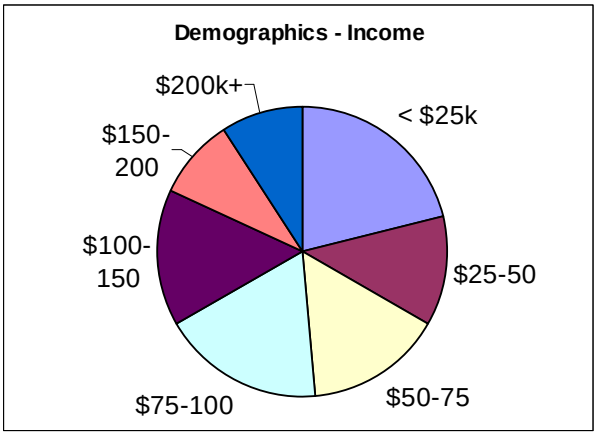
A brief analysis of these results follows. It should be emphasized that these results are the opinions of a self-selected group of participants, and do not represent a statistically or demographically representative sample. Just the same, the provide a qualitative insight into the values of those residents who chose to attend the public forums.

### Demographics

A wide range of age levels was represented at the meetings. The most numerous was the 35-44 cohort, followed by the 25-34 and the 45-54 year age groups. Nearly 80 percent of respondents described themselves as computer professionals or enthusiasts; the remainder were either casual or regular computer users.




One-quarter of respondents were relative newcomers to St. Paul, having lived here five years or less. A third were long-time residents, having lived in the city for more than twenty years. The remainder were spread fairly evenly between the two extremes.




Household income saw representation across the board. Twenty-two percent of participants had an annual household income below $25,000. Another twelve percent had income of $25,000-$50,000. The remaining respondents were fairly evenly divided among the higher categories. Nearly 80% of participants were homeowners. Two-thirds responded that they work from home often or almost always.

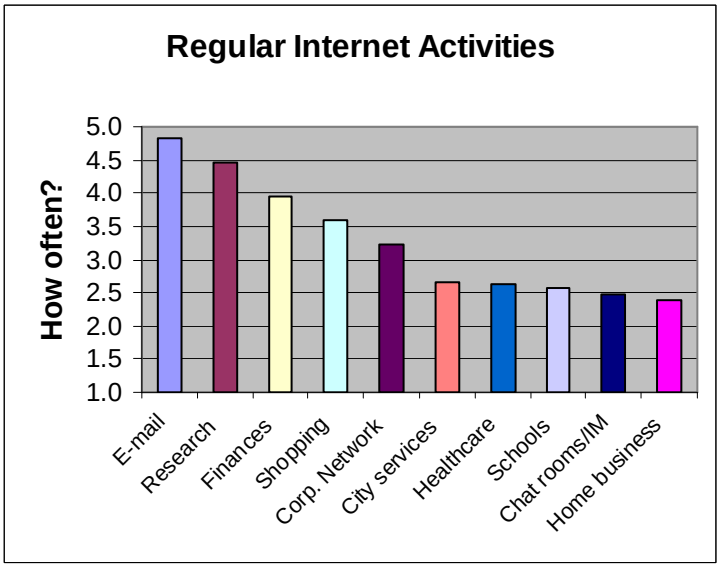
Slightly more than half the respondents were childless. Thirty percent had children at home, and the remaining 18% had children living away from home.

### Home Setup

On the whole, the participants were a very Internet-savvy group. All participants had at least one home computer; more than half had 3 or more. More than 90% had high-speed Internet access at home, while the remainder had dialup access. Three-quarters of respondents paid between $20 and $60 per month for Internet access. Twelve percent paid less than $20 per month, and another nine percent received service for free.

The most common use given for high-speed Internet access was for sending and receiving large e-mail messages or files, followed by sending and receiving photographs. Video and music downloading were not as popular as uses,

though they were listed as fairly frequent uses by those in the 25-34 and 35-44 year old groups. Online gaming and videoconferencing were listed as infrequent activities; while gaming scored well in the under-25 group, the overall average was much smaller.

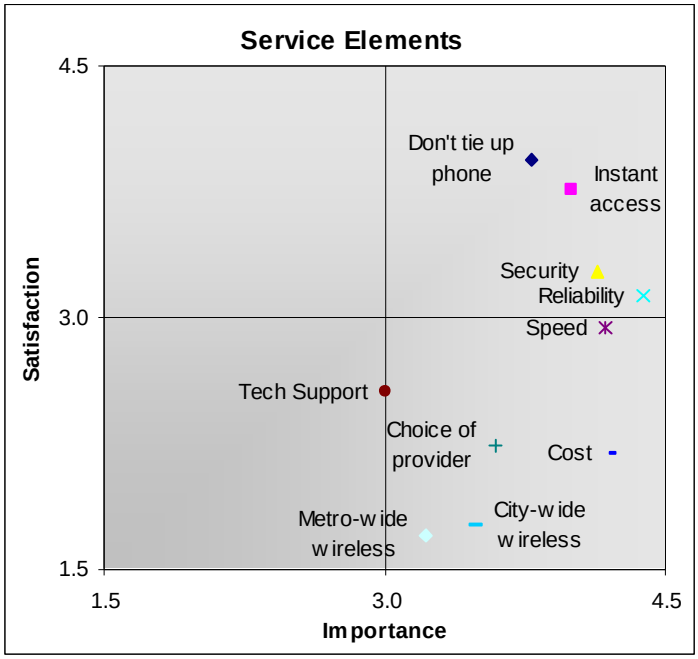



The most common Internet activities (regardless of connection speed) listed by participants were clearly e-mail and general research. These were followed by personal finance, shopping, and accessing a corporate or office network. City services, healthcare information, school information, chat rooms and home business followed well behind the other activities.

A closer look at the responses shows that respondents under 25 are far more likely to check school websites on a regular basis. A comment from one participant noted that many college students use the web almost daily to keep up with schedules, assignments, and communications with teachers and classmates. One remarkable result was the high response given by the 25-34 year age group for chat rooms and instant messaging. This group rated the activity higher than online shopping. Members of the 45-54 year age group were far more likely than the others to access their office or corporate network from home, while members of the over-65 group ranked home-business activities very highly.

**Service Elements**

To the right is a graph showing a number of Internet service elements ranked by importance and by level of satisfaction. Each criterion was scored on a scale of 1 to 5; importance is graphed on the x-axis, and satisfaction on the y-axis.



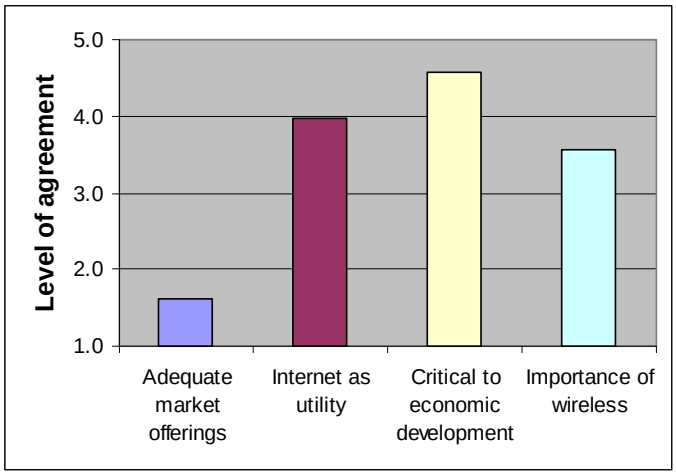

One can see that every service element is seen as fairly important by the respondents; no data points lie on the left side of the graph. The most important element is reliability, followed closely by cost, speed, security, and instant access. Technical support was listed as the least important element, which may be reflective of the high level of expertise among the participants.

On the satisfaction axis, we see most respondents are satisfied that they need not tie up a telephone line and that they have instant access to the Internet when they need it. Security, reliability, and speed issues had moderate scores for satisfaction. Respondents were much less satisfied with the remaining service elements. The poor satisfaction in choice of provider and wireless access options is relatively easy to explain, as options in these categories are very limited or nonexistent. Cost and technical support also scored poorly in customer satisfaction.

## Opinions About Internet Access

Participants were next asked to agree or disagree with the following statements:

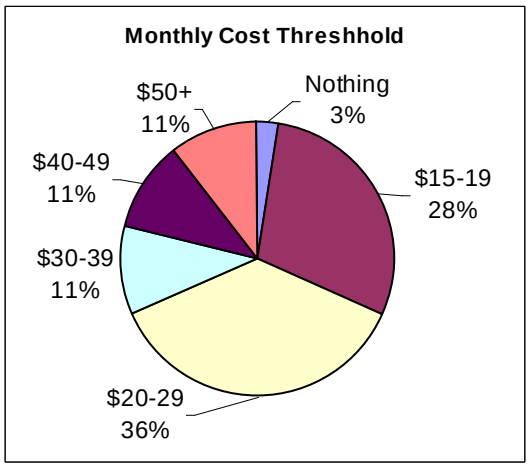
1. The competitive market currently offers high-speed Internet services that most people can afford.
2. High-speed Internet access is (or soon will be) as important a service as water, sewer and electricity.
3. High-speed Internet access will be a critical element of the community's economic development and sustainability.
4. High-speed Internet access regardless of my location (in cars, parks, buildings, etc.) will be essential for me to function effectively in my business and personal life.




As can be seen in the above chart, there was little agreement by participants that affordable high-speed service is currently available. The other three statements saw a much higher level of agreement, with very strong support given to the idea that high-speed access will be critical to the community's economic development efforts in the future. These responses were remarkably consistent across age groups and income levels.

## Monthly Cost Threshold

When asked how much they would be willing to pay for City-wide high-speed wireless Internet access, one-third of the participants indicated that they would pay $30 or more per month for service. Another third responded that they would pay $20-29 per month. There was little correlation between age or income level and willingness to pay for the potential service.

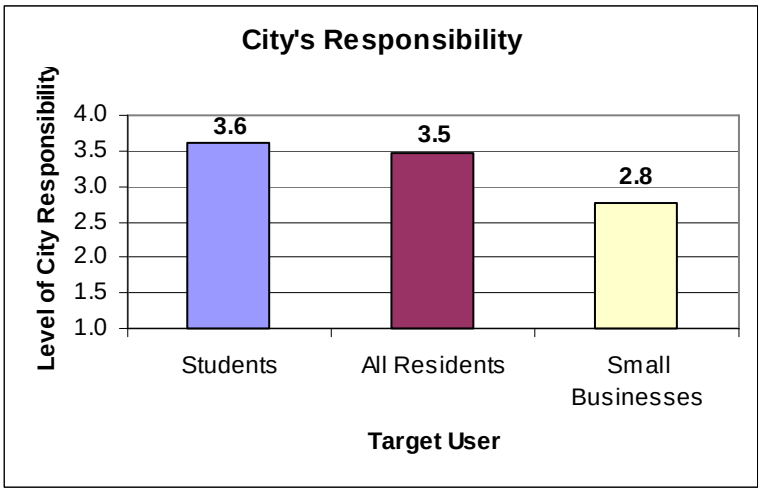



In discussions following the voting process, a number of participants raised concerns about the potential difference between the amounts they were currently willing or able to pay, versus the amounts that groups not represented at the meetings would be willing or able to pay. There was a belief expressed by a number of meeting participants that the city's economically disadvantaged communities might be hard-pressed to take advantage of the potential service, even if the monthly rate was in the range that the voting group was personally willing to pay.

### Digital Divide Issues

The final voting exercise measured participants' opinions regarding the City's responsibility to ensure low-cost Internet access to a variety of specific user populations. Specifically, the responsibilities listed were:

- Helping ensure that all students have low-cost access to the Internet for educational services
- Helping ensure that all City residents have low-cost access to Internet services
- Helping ensure that small, medium and home office businesses have low-cost access to Internet service

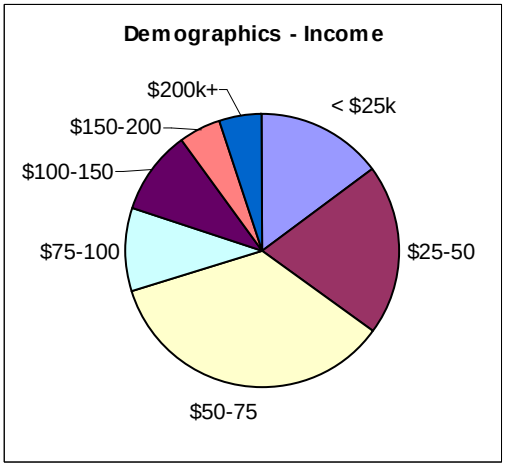



The level of responsibility was measured on a scale of 1 to 4, from No responsibility to Great responsibility. The overall results are shown at left.

One can see that participants felt strongly that the City has a responsibility to ensure low-cost Internet access to its residents, and especially to its school children. Support for student access was consistent regardless of whether respondents had children in the home. Respondents felt that the City also has a responsibility to its small businesses, although not to the same extent.

## Community Leader Forum

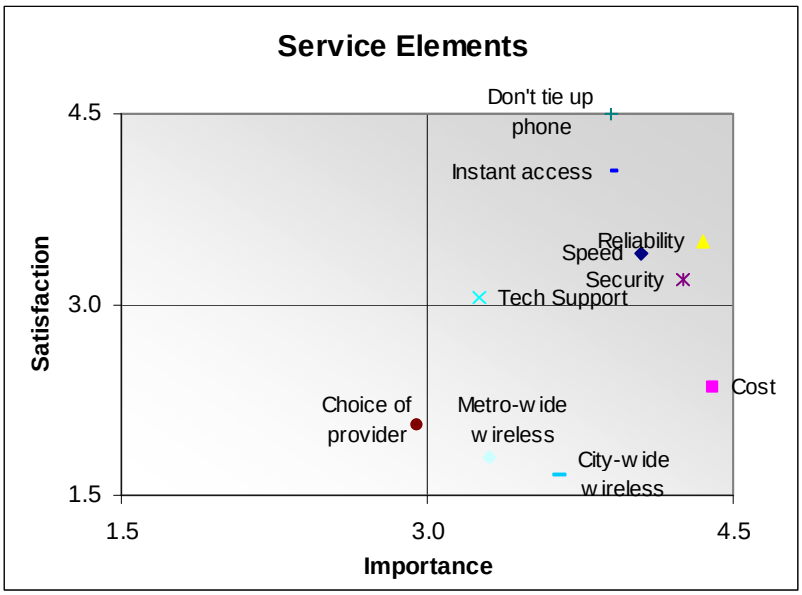
On March 6, an additional meeting was held. This meeting was attended by 20 members of the City's district councils. These participants were asked the same questions as the public forum attendees were. Overall, the responses were remarkably similar to the earlier group.




Demographically, the community leader forum had less representation in the 35-44 year age group, but otherwise had a similar age profile as the public group. The group had a much lower income profile; more than two-thirds had household incomes of less than $75,000 per year.

Forty percent of the group was childless; one-third had children in the home, and another quarter had children away from home. More than half the group said they work from home often or nearly all the time.

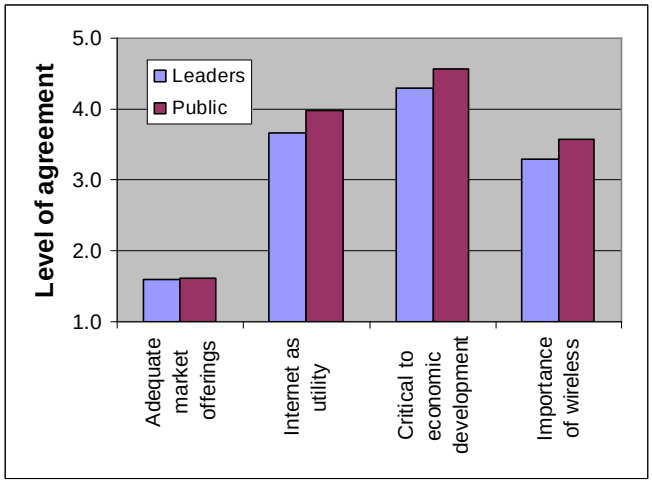
Similar to what was seen in the public forums, the attendees were all computer users; half described themselves as enthusiasts, and another 20% were computer professionals. A large majority had more than one personal computer at home, and 85% had high-speed Internet service. Most paid between $20 and $60 per month for this service. The Internet usage profile of the community leader group closely mirrored that of the public forum participants, with e-mail and general research outstripping all other uses.

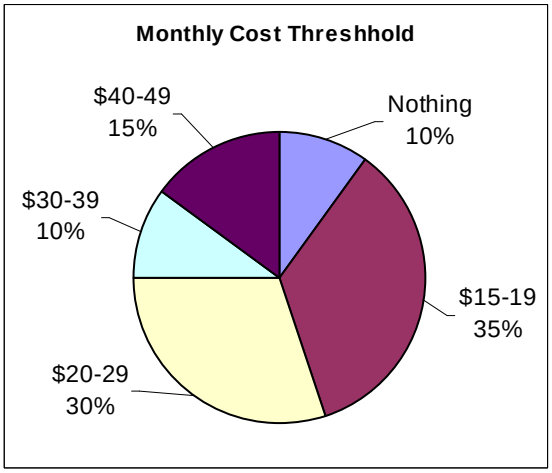



In terms of the different elements of Internet service, the March 6 leadership group expressed opinions similar to the earlier public forum groups, with few exceptions. It rated technical support higher in terms of both importance and satisfaction. This group found choice of provider much less important than did the public group, though they were no more satisfied.

Apart from these differences, the two groups shared similar opinions in terms of the importance of the various service elements and the options currently available. Cost remains the element with the highest importance and lowest satisfaction.

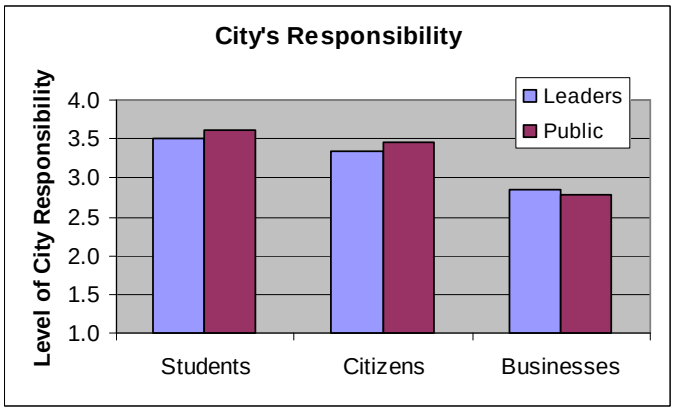
Asked the same four questions about current affordable service offerings and the future importance of Internet access, the community leadership group expressed almost identical sentiments as did the public forum participants. While the level of agreement was not as high, the relation between the scores was the same.




In terms of a monthly service cost, the community leader group was much less willing to pay for the potential City-wide high-speed Internet access. Only one-quarter indicated that they would pay more than $30 per month, and there was no support at all for a cost over $50 per month.

Finally, when asked about the City's responsibility to address certain digital divide issues, the community leader group expressed nearly identical opinions as the earlier groups did.

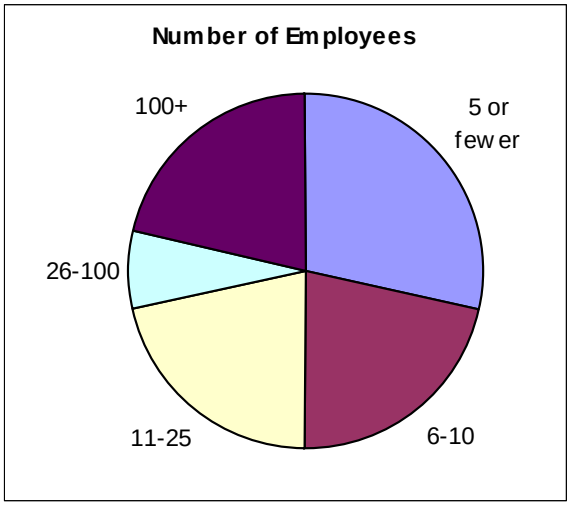


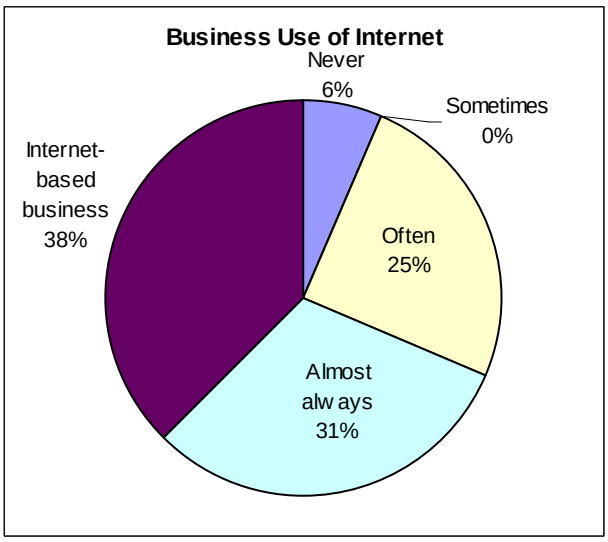
## Business Forum

On the morning of February 24, Springsted hosted a forum for St. Paul's business community. Invitations were extended to the Chamber of Commerce, neighborhood development companies and business associations, and minority business associations. Sixteen representatives of the business community attended the forum.

### Business Profiles

A variety of business sizes were represented, as shown by the chart at right. Approximately half the businesses employed ten or fewer people, while three businesses of more than 100 employees were represented. These businesses were long-established for the most part. More than half have been in the city for ten years or more.



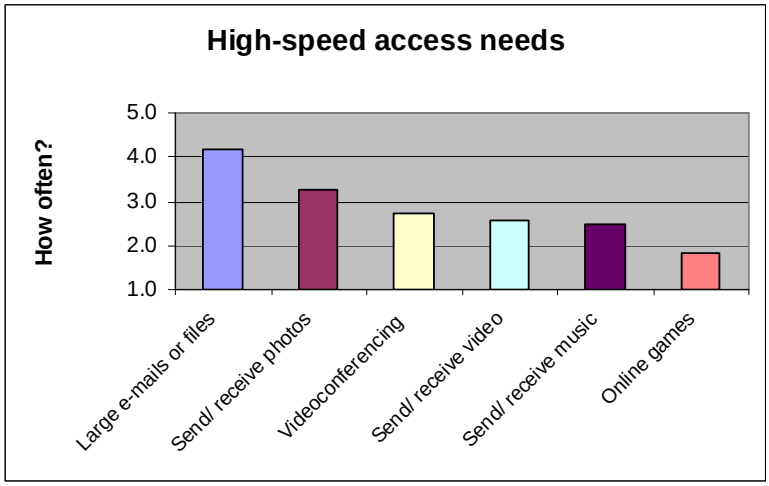



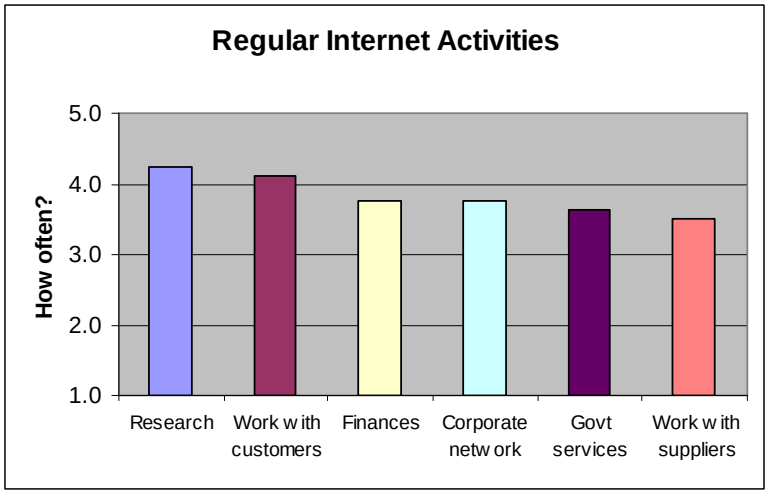

The attendees were quite savvy in terms of computer and Internet use. Nearly two-thirds of the group had businesses with more than 20 office computers; three-quarters had Internet access through T1 or T3 lines.

More than 90% used the internet on a regular basis; more than a third had Internet-based businesses. As individuals, the participants described themselves as very familiar with computers. All of the respondents were at least regular computer users, and more than half described themselves as computer professionals or enthusiasts.

### Internet Use

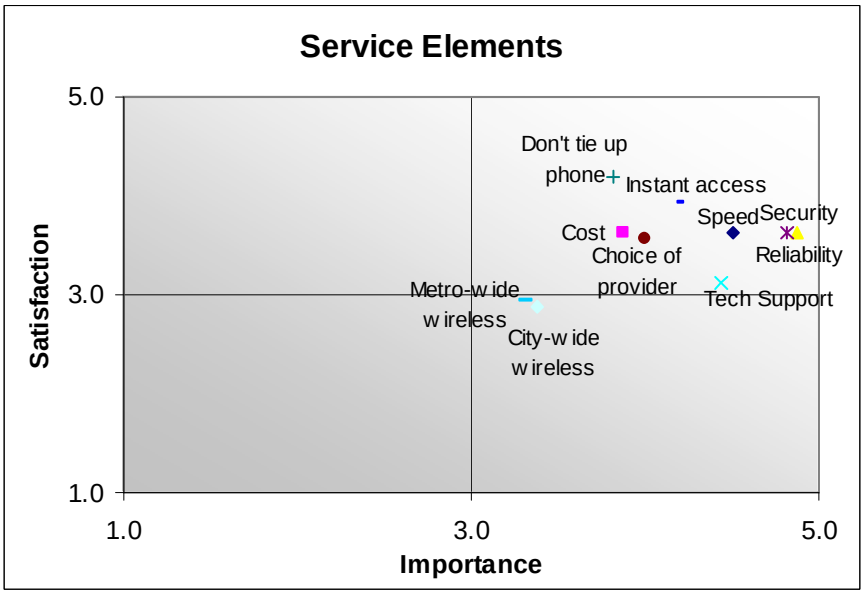
When asked how often their businesses needed high-speed access for various tasks, the most common activity was sending and receiving large files or documents. Sending and receiving photographs was a far less frequent use, followed by videoconferencing and sending/receiving video or music. Not surprisingly, online gaming was listed as a very infrequent use of high-speed connectivity.






Taking a look at regular Internet use, regardless of connection speed, we see that participant businesses most often use the Internet for doing research. This is closely followed by working with customers, which in discussions was defined as taking orders, providing product and service information, customer service and the like.

Less-frequent activities include financial management and accessing a corporate network from the road. These were followed by accessing government services, and working with suppliers.




In terms of the importance of various aspects of their existing Internet service, and their satisfaction with the options available to them in each aspect, the respondents were generally satisfied with current commercial offerings.

Every element was listed as being important, with security and reliability leading the pack by a significant margin. These were followed by connection speed and technical support. Among the elements ranked as the highest in importance, tech support was the lowest-rated in terms of satisfaction with current options. City-wide or Metro-wide wireless options were the areas with the smallest overall satisfaction level, though neither was considered a very important service element by most respondents.

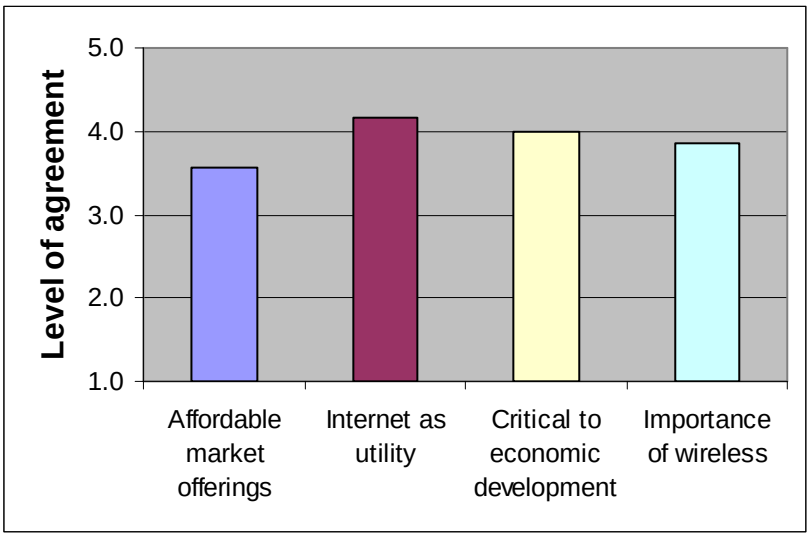
Participants were next asked to consider the possible uses to which they might put ultra-high bandwidth Internet service. The initial examples given to start the discussion were virtual showrooms, online catalogs, and virtual conference rooms. To this list, the group added:

- Internet radio
- Realtime interaction with clients
- Online education
- Video streaming
- Secure transfer of data
- Global telecommunications
- Distributed R&D
- Enhanced security

A number of respondents noted the difficulty of speculating on services or applications well outside of their realm of experience.

Participants were next shown four statements regarding current and future Internet services, and asked to indicate their level of agreement with each statement. The statements were:

1. The competitive market currently offers high-speed Internet services affordable to most businesses.
2. High-speed Internet access is (or soon will be) as important a service as water, sewer and electricity.
3. High-speed Internet access will be critical to the future economic development of the community.
4. High-speed Internet access regardless of my location (in cars, parks, buildings, etc.) will be essential for me to function effectively in my business and personal life.

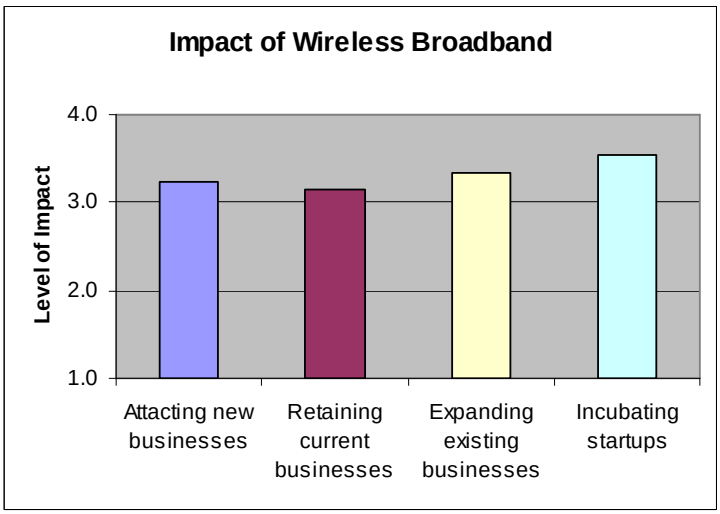



Participants generally agreed with all four statements, though there was far less consensus of opinion regarding current affordable services. The average level of agreement for each statement can be seen in the graph above.

**Potential Business Impacts**

Participants were next asked to express the level of impact which City-wide broadband would have on the following:

- Attracting new business to St. Paul
- Retaining current businesses
- Expanding existing businesses
- Incubating new startup businesses



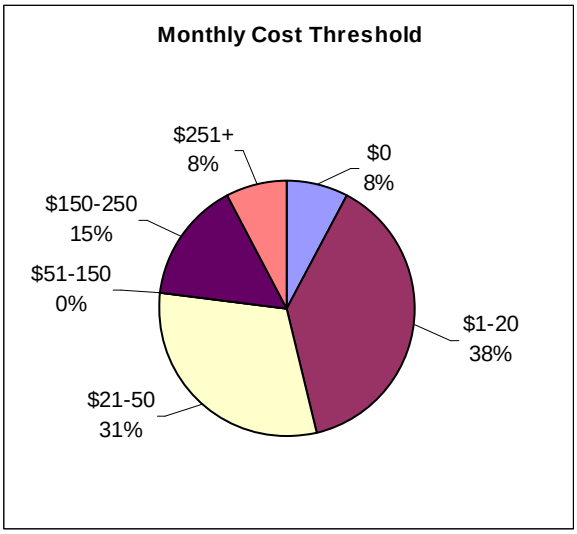

By and large, respondents thought that wireless broadband services would have a moderate to high impact on the city's business community. The greatest impact was predicted for the incubation of new startup businesses; in discussions, Internet-based businesses were singled out as the most likely candidates for startup businesses.

The attracting of businesses from elsewhere, retention of the City's current businesses, and expansion of existing businesses were also predicted to be moderately to highly impacted by City-wide high-speed Internet access.

## Cost Threshold

When asked how much they would pay for City-wide high-speed Internet service, participants showed surprisingly little willingness to pay more than $50 per month. Nearly half the respondents were unwilling to pay more than $20 per month for the service.

While this result is consistent with the participants' stated satisfaction levels with their current Internet service, it runs counter to the opinions expressed previously, where respondents thought that wireless access would become an essential part of their business and personal life in the future. It also is inconsistent with the business impact predictions given earlier. These inconsistencies may warrant further investigation.

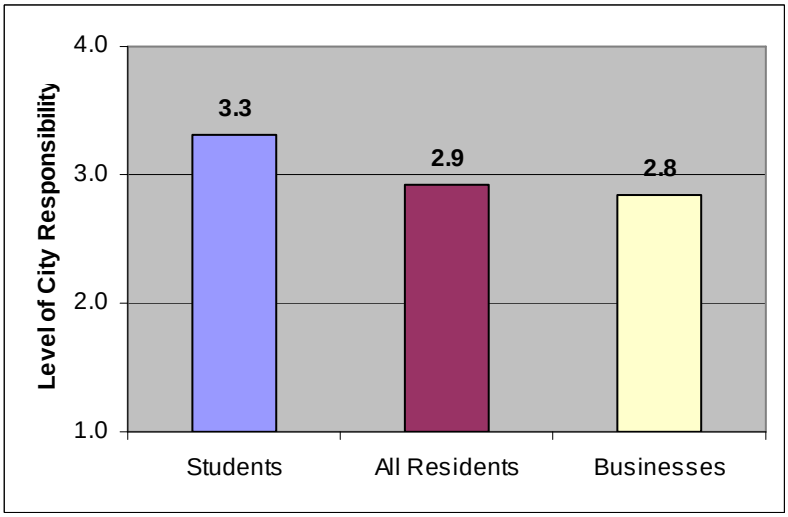



## Digital Divide Issues

The last questions posed to the business leaders involved the same digital divide issues as were asked of the public groups. Specifically, the group was asked:

How much responsibility does the City have to address these "Digital Divide" issues?

1. Help ensure that all students have low-cost access to the Internet for educational services
2. Help ensure that all City residents have low cost access to Internet services
3. Help ensure that small, medium and home office businesses have low-cost access to Internet service




The participants generally agreed that the City has some responsibility to ensure that all community members have access to low-cost Internet services. Low-cost access for students was rated highest in terms of the City's responsibility; access for residents and businesses was ranked lower, though each still received high marks.

# APPENDIX VIII
# Analysis of Implementation Options

## Background

The "Broadband Technology Needs Assessment and Economic Development Impact Study" explores the options available to the City for enhanced residential and commercial access in the City of Saint Paul. This summary endeavors to describe the financial feasibility of the two major options.

## Approach

The fundamental approach to the project has been to identify service delivery options within financially conservative assumptions that are affordable to the consumer of broadband/wireless services in the St. Paul municipal boundaries. In addition, the study includes cost estimates to provide service to the economically disadvantaged citizens. The numbers presented in the study are in today's dollars. No attempt has been made to project the impact of inflation on the plan of finance. The initial capital investment would be paid from bond proceeds, which would be retired from user fees. Subsequent capital replacement would be financed from a capital replacement account funded from user fees and depreciation expense. A working capital reserve has also been included in the plan of finance for the two major options.

The conservative approach to the numbers, both utilization rates, revenues, and expenditures is reasonable given the nature of this start-up business. Also, the method to finance the start-up costs has yet to be determined whether revenue or general obligation and tax-exempt or taxable bonds.

## Options

**Option 1** includes 16 miles of fiber-optic cable and 1,080 access points.

**Option 2** includes 16 miles of licensed wireless backhaul and 1,080 access points, with 14 communication towers.

For Options 1 and 2, the monthly fee for service is expected to be $20 per month for both residential and commercial consumers. The utilization rate is assumed to be 15 percent of all potential consumers. Annual revenue is estimated to be approximately $4,320,000. Capital replacement costs would be financed on a pay-as-you-go basis from operating revenues and reserves.

For Options 1 and 2, operating expenses (including depreciation) are estimated to be equivalent to 45 percent of annual operating revenues, or approximately $1,944,000 per year. The annual debt service would be approximately $1,208,000, assuming a 5 percent interest rate with a 10-year payoff schedule.

A working capital reserve would be $1,080,000, equal to 3 months of annual revenues.

For informational purposes only, a third option glanced at the cost implications of complete fiber-optic cable to the property build-out (FTTP), which is the most costly of the options. While this was not within the scope of the study, It is useful to understand its implications.

For all options, capital replacement schedules would be every five years for the network systems, ten years for the access points and backhaul components, and 30 years for the fiber-optic cable.

**Option 1 First Year of Full Service**

Option 1 would require an initial capital investment of approximately $10 milllion, including a contingency of ten percent of capital expenditures. Annual operating revenues, operating expenses, and debt service expense are summarized below. Net cash flow would be used to fund necessary reserves for working capital purposes.

| | |
|---|---|
| Operating Revenues | $4,320,000 |
| Operating Expenditures | $1,944,000 |
| Debt Service Expenditures | $1,233,000 |
| Cash Flow Reserve | $1,143,000 |

**Option 2 First Year of Full Service**

Option 2 would require an initial capital investment, revenues, expenses and debt service very similar to that of Option 1 and is summarized below.

| | |
|---|---|
| Operating Revenues | $4,320,000 |
| Operating Expenditures | $1,944,000 |
| Debt Service Expenditures | $1,256,000 |
| Cash Flow Reserve | $1,112,000 |

**Option 3**

Option 3 would require an initial capital investment of approximately $296 million for the citywide fiber-optic build-out. Implementation of this system would occur over a five-year period. Annual operating and debt service expenses would be approximately dramatically higher than Options 1 or 2. And, the fee for service would be substantially higher as well. All related to the higher build-out costs and operating costs associated with the FTTP system.

No estimate has been determined for video and voice services on this network.

**Potential for bridging the Digital Divide**

After the first full year of service and funding the reserve levels, it appears from these rough projections that resources may be available to provide access to the system for Saint Paul residents below the poverty level. Approximately 38,700 persons in the City live in poverty. Assuming the utilization rate would be the same as for residential and commercial users, approximately 5,775 persons would be utilizing any incentive programs established by the City.