SAINT PAUL WIRELESS TECHNOLOGY STUDY

April 1, 2005

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INTRODUCTION

The City of Saint Paul is interested in studying and applying, when feasible, new technologies in the provision of services to its residents, businesses and visitors. Wireless broadband technology is becoming more prevalent as an efficient and effective option for high speed internet access.   It has the potential to provide our city employees, residents, businesses, and visitors with access to information when and where they need it.

In January 2005 the City Council adopted a resolution that included the following:

> *Now, therefore be it resolved, that the Saint Paul City Council requests that the Administration, through the Director of the Office of Technology, work with Council Research to develop (1) an inventory of existing City telecommunications infrastructure, and **(2) a proposal for a study of the options for pursuing the creation of a wireless infrastructure with the capacity to serve the entire city**. As appropriate, current service providers, industry experts, representatives of labor and other interest groups may be invited to participate in the development of the report and proposal. The report and proposal shall be delivered to the City Council no later than April 1, 2005….*

Staff from Council Research, the Office of Technology, and the City Attorney's Office have researched the current landscape and received input from some of the current broadband service providers in preparing this report. Included in this report are overviews of current activity in other cities, marketplace activity including the current providers, and the existing City telecommunications infrastructure, basic wireless terms and definitions, and potential benefits to the City operations. The report is divided into four sections – Wireless Technology Overview, Municipal Activity, Potential Roles For the City of Saint Paul, and Options and Direction.

SECTION I – WIRELESS TECHNOLOGY OVERVIEW

What is wireless broadband?

- **Wi-Fi** – A local area network that uses high frequency radio signals to transmit and receive data over distances of a few hundred feet; (syn: wireless area network, WLAN, wireless fidelity, Wi-Fi).
- **WiMAX** - WiMax is the popular name of the 802.16 wireless metropolitan-area network standard that's currently being developed. WiMax, which will have a range of up to 31 miles, is primarily aimed at making broadband network access widely available without the expense of stringing wires (as in cable-access broadband) or the distance limitations of Digital Subscriber Line.
- **Wireless Access Point** - A device that "connects" wireless communication devices together to create a wireless network. A wireless access point acts as the network's arbitrator, negotiating when each nearby client device can transmit.
- **Broadband** – A dedicated line for data with speed at a minimum of 1.5mbps (short for *m* ega*b*its *p*er *s*econd, a measure of data transfer speed, a megabit is equal to one million bits) downstream and 256kbs (*KBs* represents 1,000 bytes) upstream. Types of **broadband** include **DSL**, wireless, cable and T-1s. **Broadband** connections do not use your telephone line, eliminating the choice between tying up your phone line or getting a second phone line to access the Internet. **Broadband** connections are fast and always connected. **Broadband** can be shared among multiple users - each user can be on at the same time. **Broadband** connections can be used in both residential and business environments.

For additional definitions please refer to Appendix A.

What are the current / future trends?

Gartner, Inc., a leading provider of research and analysis on the global information technology industry, issued a report in January 2004 called "U.S. Consumer Broadband Keeps Growing: Online Households Remain Steady". Key findings of the report include:

- The expansion of online households, which has reached a plateau of 60 percent of U.S. households, is inhibited by the fact that four out of five offline households do not have a PC in the home. Nevertheless, one-third of offline households are accessing the Internet from locations other than home – a natural market segment for broadband adoption.

- As of October 2003, 34 percent of all U.S. online households connected to the Internet from home via a broadband connection. This equates to 20.6 percent of all U.S. households, a significant increase from 14 percent of U.S. households in July 2001.
- Despite recent expansion of DSL availability and increased marketing efforts by DSL providers, cable modem continues to be the dominant broadband modality.
- The desire for faster transmission speed from home remains the most important driver for broadband adoption, supporting the migration from dial-up to broadband.

Gartner forecast:
- By 2015, the average urban citizen in the United States and Europe will use at least six wireless networking technologies per day (0.6 probability).
- Wireless is transforming the economics of connectivity. From 2004 to 2012, the world will become increasingly wireless. Even by 2007, wireless will be more inexpensive than wired for some short-range, low-data-rate connections.

What are the benefits of wireless technologies?

The development and implementation of a wireless strategy could serve the public good in a variety of ways, including:

- **Economic Development** – The private and public sectors and non-profit organizations will have expanded opportunities to provide additional network services, applications, e-commerce and other value added services that may increase economic activity within a given area or market.

- **Marketing of Saint Paul** - Use wireless broadband access to attract new residents, new businesses, conventions and tourists to local businesses, parks, hotels, rental units, museums and riverside recreation.

- **Bridge the Digital Divide** – Wireless broadband services, including Wi-Fi, provide high speed accessibility to information and services for residents, businesses, schools, and visitors regardless of their economic status.

- **Public Safety and Services** - Mobile wireless technologies provides public safety personnel, building inspectors, traffic engineers and code enforcement officers the ability to access while "in the field" crime and hazardous materials databases, records management systems, traffic and video incident feeds, and building blueprints during fires and hazardous spills.

- **New Immigrants** - English speaking partners can use wireless broadband access to make health, education, housing, and employment information available to vulnerable new populations.

- **Social Services** – Wireless technologies can aid residents, seniors and the disabled in finding information about social services, including governmental services, county public health information, child protection, child support enforcement, community corrections, welfare, tax preparation services and workforce programs.

- **Educational Institution Applications** - Wireless technologies boost productivity of students and teachers because the computer is in hand and ready for use.   Students remain connected to the school's network while anywhere on campus.   Wireless networks provide constant access to critical information about students and assignments and can provide coverage in classrooms, auditoriums, gyms and the outdoors.

- **Higher Education Connectivity** – Saint Paul's higher educational facilities can be interconnected, to not only each other, but to a vast array of community partners such as businesses, non profits, medical facilities and federal, state and local governments. Schools can experience financial savings by eliminating the need to wire and rewire buildings.

- **Non-Profits** – Wireless technologies can reduce the costs associated with wiring a building and allow staff to be more mobile and interact with clients and customers away from the office. Information can be gathered and given, enhancing the ability to respond to a customer's particular needs.

SECTION II – MUNICIPAL ACTIVITY

Current City Broadband Infrastructure

- **City INet**
  Through the City's cable television franchise agreement, the City was able to negotiate the construction and operation of two INets that serve the City and community. In 2001, a 60-mile fiber INet was constructed, that feeds 18 locations, including State, County and City entities. Most of the active connections run at Gigabit speeds. In 1998, over 200 miles of a networked Hybrid Fiber Coax cable (HFC) system was activated, which today serves 10 Megabit speeds to over 100 City locations and over 100

additional community sites, including schools and churches. Comcast is responsible for the overall maintenance and repair of both systems, with City IS staff handling daily administration and end-user interface of the systems.   To date, the Comcast/City partnership has worked well. Attached is a general operations schematic of the Fiber ring.   Attached is a general operations schematic in appendix B.

- **City Public Works**
  Public Works currently has 18 miles of fiber in the right of way. It is using it to interconnect traffic controllers and to connect SPRWS and the Dale Street campus for CMMS. Public Works is also using AT&T Wireless to allow our Survey crews to access the Survey Website and Survey data on the City's network from the field.

- **Comcast**
  As the City's franchised cable television provider, the company basically blankets the city's residential community with cable tv and broadband Internet service, with four minor exceptions wherein the apartment and/or development have chosen not to offer Comcast's services. Comcast also reports that any commercial property that wants broadband services can get served if they pay for anything beyond a standard drop.   The starting fee for residential Internet service is $43, and commercial starts at $95.

- **QWest**
  87% of the residential living units in Saint Paul have access to Qwest's DSL service and approximately one out of five subscribe to DSL.   The regular residential fee for this service starts at $40 for 1.5Mbps download. Due to proprietary concerns, Qwest was not able to provide information regarding commercial properties' accessibility to Qwest's commercial DSL service. There are numerous business options through Qwest, including DSL and T-1 services. Prices vary depending on service package and speed.

- **Current Wi-Fi Activity in Saint Paul**
  Based on staff research of several websites that provide information on Wi-Fi hotspots, there are at least 20 current hotspots in the Saint Paul area. They are primarily in coffee houses, hotels, and restaurants. Additionally, there are several Wi-Fi providers doing business in the Twin Cities area, including StoneBridge which offers service in Saint Paul.

- **Broadband Service Providers**
  A sample list of providers and services available in appendix C.

Overview/Analysis of Current Activity in other Cities

Gartner, Inc, a leading provider of research and analysis on the global information technology industry, published an analysis at the end of 2004 that looked at the pros and cons of public-access wireless networking. They found that municipal government efforts to bridge the digital divide held promise but also face obstacles.

Deterrents to municipal wireless activities include:
- interference with other Wi-Fi deployments,
- quality of service related to interference,
- installation and maintenance costs,
- taxpayer revolt,
- lobbying efforts by commercial providers, and
- the trend of government getting out of the network provider business (privatization of government phone companies).

Drivers of public-supported wireless networks include:
- wireless internet technologies have the most potential to deliver access in the shortest time to underserved households and businesses,
- provides economic development, and
- provides an alternate infrastructure for public operations and employees.

The Gartner analysts concluded that in the short term public wireless access may be a reasonable experiment for some governments to conduct on a trial basis. But traditionally governments have fared poorly at running networks and have been inefficient at providing for-pay services. They also concluded that it is reasonable for cities to provide limited services in public areas as part of a larger economic development program and municipal governments are well-equipped to provide governance and structure for nonprofit and for-profit entities that wish to provide services for the general public or targeted populations.

In March 2005, **Muniwireless.com** published a report that included up-to-date information regarding current projects underway and current municipal wireless broadband implementations. The projects tracked by Muniwireless.com range from downtown hotspots to city-wide wireless broadband networks. The tables of the project information are in appendix D. The entire report is available at www.muniwireless.com.

Muniwireless.com is a website that is devoted to providing information about municipal wireless broadband projects worldwide that are funded or supported by cities and towns. The site has been developed and is maintained by advocates of municipal wireless broadband projects.

Models Matrix

The following are some of the prototypical arrangements that have been used to build and operate broadband networks (with examples). The layout presents some general pros and cons of their possible applications to the City Of Saint Paul.

Arrangements that have been used to build and operate these types of networks (With examples):	Pros for Saint Paul	Cons for Saint Paul
City or county owns the network and delivers broadband service: Allegany county (MD), Chaska (MN), Scottsburg (IN).	Saint Paul could be "autonomous", without relying on "private business" for servicing.	Saint Paul would take on a lot of responsibility that may not be appropriate for an entity the size of Saint Paul.
Local Utility (owned in whole or in part by the city) builds the network and provides broadband service: Mantsala and Porvoo in Finland.	Saint Paul could be "autonomous", without relying on "private business" for servicing.	There are a lot of financial (and other) factors to consider, as well as the amount of responsibility the city of Saint Paul would like to take on.
City or local utility leases out capacity on its fiber network to a local ISP: Benton County (WA), Adel (GA), Fredericton (Canada).	Saint Paul would remain in control of it's physical infrastructure, while also having the benefits of service provided by a private company.	Saint Paul would not have control over the actual service, and because of reliance on established "fiber network", may enter into an agreement which, although it goes well with the existing infrastructure, may not provide the best service possible.
City provides assistance (easing regulations, some financial help) in building the network but licenses operations to an ISP: Cerritos (CA), Rio Rancho (NM).	Saint Paul could use service providers to build the infrastructure without much "on the ground" effort on the City's part.	Although it may be financially inexpensive, Saint Paul may give up more autonomy to private businesses than might be appropriate.

SECTION III – POTENTIAL ROLES FOR THE CITY

What role or roles should the City play in promoting wireless access?

As has been discussed, wireless fidelity is evolving and increasing throughout the world. The question is: What role does Saint Paul want to play in providing wireless fidelity today and in the future?

There are basically **three roles**:

1. **Provider** – The City provides the service. On a large scale, it develops a utility that is responsible for creating and maintaining the physical infrastructure, as well as managing the billing and service standards. On a smaller scale, the City establishes hotspots in public facilities, such as libraries, to provide limited accessibility.

   a. Example of a *large scale provider* is the <u>City of Chaska, MN</u> where it is offering all of its residents a wireless service.
   b. Example of a *small scale provider* is <u>Milwaukee, WI</u> where it has located hotspots in its parks.

2. **Partner** – The City ensures that wireless services are available throughout the City by way of formal or informal arrangements with private or non-profit service providers. The City is not the service provider nor does it preclude several services from operating competitively. It merely works to ensure that those who want service have access to it. A potential arrangement is where the City provides the physical infrastructure, such as light poles or towers, and the service provider manages all other aspects. Examples:

   a. <u>Minneapolis </u>is letting an RFP, seeking vendors for a partner arrangement.
   b. In <u>Cleveland, OH</u>, the city has partnered with a non-profit to provide public and municipal wireless through public facilities.

3. **Private Sector Advocate** – The City relies on the private sector to provide the service without ensuring accessibility to all. It allows market forces to drive the expansion and accessibility.

   a. Example: <u>most US cities</u> currently fall into this category.

SECTION IV – OPTIONS AND DIRECTION

Based on the study five options have been identified for consideration. Staff is seeking direction regarding the role(s) the City would like to consider and the outcomes it hopes to achieve.   The next steps that the City selects can be one or more of these options being proposed.

OPTION ONE: Expand City's Government Information Access

The City should review and examine how wireless technology can improve and enhance the way the City communicates, with its internal municipal needs, as well as communicating with external clients and enhancing the City's public services.

While the City has in place a fairly comprehensive information/data infrastructure, with over 200 sites connected via the two INets and the Public Works fiber lines, wireless connectivity would enhance the efficiency and effectiveness of over 800 city employees who would benefit from having access to the right information when and where they need it.   These are just a few examples:

- **Police & Fire:** Police Squads, Investigators, Fire Ambulances, trucks and Command vehicles would be able to communicate to Public Safety systems.
- **LIEP:** Inspectors would have ability to get to Amanda records at the inspection sites.
- **Public Works:** The department could implement Automatic Vehicle Location Systems (AVLS) to track Snow emergencies and to populate the CMMS system. Staff would have the ability to do CMMS work orders in the field and to get to engineering documents which would increase their capacity to perform the right types of repairs and have the right types of equipment at the job site.
- **Water:** Needs are similar to Public Works.
- **Parks:** Data acquisition could occur on the spot in the field and would improve the ability to keep inventory up to date. CMMS could be accessed by the Forestry Division in the field.
- **Mayors Office & Council:** Increase mobility and communication. Allow them to bring their computers and data with them when they go outside their chambers.

Not only could WiFi enhance the business performance of City departments, it also should be considered as an alternative to enhance the current existing infrastructure. While today the HFC INet system provides broadband connectivity to over 200 city and community sites, and was basically "lit up" as recently as 1998, a significant portion of this INet was built in the 1980's.   With the life expectancy of a coaxial cable system between 25 – 30 years, the City will

eventually need to consider how it will replace the aging infrastructure. Wireless connectivity could provide a solution.

City development of wireless services would also enhance City services to the community and help bridge the "digital divide." By providing wireless service in libraries, recreational centers and parks the City of Saint Paul integrates wireless hotspots with limited neighborhood mobility. Saint Paul Public Library and the Parks and Recreation department have requested a feasibility study for implementing wireless hotspots in City library and park locations. Several library and park sites have been identified as potential pilot Wi-Fi hotspots for public use.   Based on the findings of the feasibility study, recommendations will be provided for how to proceed with implementing pilot hotspots in park and library locations.

In summary, the City should consider how to enhance, improve and provide alternative solutions to the City of St. Paul's current information, data and communications infrastructure, for both its internal and external uses, including the pilot program featuring selected libraries and park locations.

OPTION TWO: Establish a Broadband Wireless Internet Access Staff Committee

The mission of this committee would be to continue to monitor and research municipal wireless projects and industry trends. The committee would update the Administration and the Council quarterly. At the time of the quarterly update, discussion should occur about whether the City needs to embark on a particular initiative or pursue a new course of action. The staff committee would be coordinated by the Office of Technology and include staff from Council Research. The committee would consult with service providers, industry experts and other interested groups as appropriate.

OPTION THREE: Establish a Broadband Wireless Access External Committee

The mission of this committee would be to continue to monitor and research municipal wireless projects and industry trends. The committee members should include representatives from service providers, industry experts, business representatives, and community members interested in wireless technology. The committee would be staffed by internal staff.

OPTION FOUR: City Administration and City Council determine a role

Three potential roles were outlined in Section III of this study – Provider, Partner, and Private Sector Advocate. If agreement occurs about the desired role, staff

would be directed to develop a plan to achieve or move forward in the direction to implement that role. Depending on the role selected and the desired timeframe for action, consultant input and assistance would be beneficial and increase the likelihood of success.   If that is the case, this would lead into Option Five.

OPTION FIVE: Develop a Strategic Plan for Broadband Access in Saint Paul

A strategic planning process could be initiated to define the vision, goals, and strategy for wireless and wired broadband for the City. The process would involve the studying of current models implemented for municipalities, identifying the needs of city government, residents, and businesses, and focus group discussions about the direction that the City should take. The outcome of this process would be a strategic plan. The recommended course of action for pursuing this option would be to hire an outside consultant with expertise in telecommunications and strategic planning to work with staff to develop the plan.

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Leon Jagim, QWest
Jon Kerr, resident and business owner
Donna Swanson, Ward 2, Councilmember Dave Thune's office
Andy Shriner, Qwest
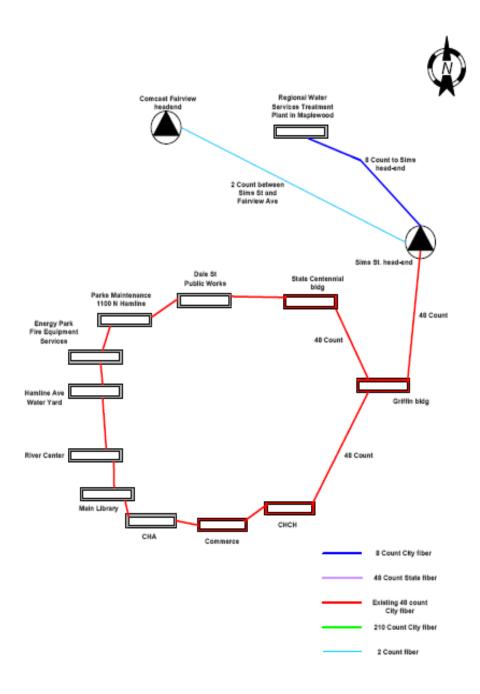
Appendix A – Wi-Fi Definitions

- **Wi-Fi** – A local area network that uses high frequency radio signals to transmit and receive data over distances of a few hundred feet; (syn: wireless area network, WLAN, wireless fidelity, Wi-Fi).
- **WiMAX** - WiMax is the popular name of the 802.16 wireless metropolitan-area network standard that's currently being developed. WiMax, which will have a range of up to 31 miles, is primarily aimed at making broadband network access widely available without the expense of stringing wires (as in cable-access broadband) or the distance limitations of Digital Subscriber Line.
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- **Broadband** – A dedicated line for data with speed at a minimum of 1.5mbps (short for *m egabits per second,* a measure of data transfer speed, a megabit is equal to one million bits) downstream and 256kbs (*KBs* represents 1,000 bytes) upstream. Types of **broadband** include **DSL**, wireless, cable and T-1s. **Broadband** connections do not use your telephone line, eliminating the choice between tying up your phone line or getting a second phone line to access the Internet. **Broadband** connections are fast and always connected. **Broadband** can be shared among multiple users - each user can be on at the same time. **Broadband** connections can be used in both residential and business environments.
- **Digital Divide –**
  (1) The difference in technologies used and/or developed in two companies, countries, ethnic groups, etc., where one is more advanced than the other.
  2) The difference between those who have computers and high-tech devices in general and those who do not.
- **WIFI Hot Spots-** are Wi-Fi enabled locations that offer Free Wireless High Speed Internet Access.
- **DSL** - Refers collectively to all types of *digital subscriber lines,* the two main categories being ADSL and SDSL. Two other types of xDSL technologies are *High-data-rate DSL (HDSL)* and *Very high DSL (VDSL).* DSL technologies use sophisticated modulation schemes to pack data onto copper wires. They are sometimes referred to as last-mile technologies because they are used only for connections from a telephone switching station to a home or office, not between switching stations.
- **Radio Frequency** – (RF) The range of electromagnetic frequencies above the audio range and below infrared light (from 10 kHz to 300 GHz). Except for infrared (IR) transmission, all wireless transmission uses RF, including AM and FM radio, TV, satellites, portable phones, cellphones and wireless networks. RF signals can be focused in one direction (directional), or they can transmit in all directions (omnidirectional).

- **HomePlug -** HomePlug is the specification for a technology that connects devices to each other through the power lines in a home. Enabling utility companies to deliver high-speed Internet access.   HomePlug certified products connect PCs and other devices that use Ethernet, USB and 802.11 "Wi-Fi" technologies to the power line via a HomePlug "bridge" or "adapter" - some products even have HomePlug technology built-in. These products provide a simple solution for consumers interested in networking their home without adding any new wires.
- **ISDN** Integrated Services Digital Network. In layman's terms, ISDN is a digital telephone line that can be used for voice, fax, and data communications like a regular telephone line, but can transport data five times faster (or more) than a 28.8Kbps V.34 modem and allow you talk on the phone with one person while sending data to another.
- **T-1 -** A dedicated phone connection supporting data rates of 1.544Mbits per second. A T-1 line actually consists of 24 individual channels, each of which supports 64Kbits per second. Each 64Kbit/second channel can be configured to carry voice or data traffic. Most telephone companies allow you to buy just some of these individual channels, known as *fractional T-1* access. T-1 lines are sometimes referred to as *DS1* lines.
- **DS-3** For many years, the fastest, and unfortunately, the most expensive way to connect to the outside world was through a ds1 or T1 connection. DS stands for Digital Signal or Digital Service. Now more commonly used and not near as expensive as it used to be, DS3 or Data Service Level 3 is the connection of choice for many large companies and places that require a lot of bandwidth. DS3 technology is used for T3 lines and allows connections to the Internet to reach speeds of up to 44.736 megabits per second.
- **802.11** - A family of wireless specifications developed by a working group of The Institute of Electrical and Electronics Engineers. These specifications are used to manage chunk of data sent over a network and ensure that packets do not collide—which could result in loss of data—while traveling from their point of origin to their destination (that is, from device to device).

Appendix B – City INet Schematic

Comcast Fairview headend

Regional Water Services Treatment Plant in Maplewood

8 Count to Sims head-end

2 Count between Sims St and Fairview Ave

Sims St. head-end

Dale St Public Works

State Centennial bldg

Parks Maintenance 1100 N Hamline

48 Count

Energy Park Fire Equipment Services

48 Count

Hamline Ave Water Yard

Griffin bldg

River Center

48 Count

Main Library

CHCH

CHA

Commerce

▬▬▬	8 Count City fiber
▬▬▬	48 Count State fiber
▬▬▬	Existing 48 count City fiber
▬▬▬	210 Count City fiber
▬▬▬	2 Count fiber

Appendix C – Sample list of providers and services

Broadband and DSL in Saint Paul

Battle Foundry
Bitstream Underground
Blackhole Internet
Covad
Comcast
Earthlink
Frostbit
Golden Gate
Hutman
Infinity AccessNET
Internet Exposure
Minnesota Micronet
Minnesota Online
Netqwest
Outtech.com
PC Online
Pixius
Qwest DSL w/ MSN
Realtime
Sihope
Sound Internet
Spacestar
Tcq
Twin Cities Internet
TwinCitizen
US Family
Visi (Frontier DSL)
Visi (Qwest DSL)
Webb Lake
Winternet

Wireless Service in Saint Paul

Sihope
http://www.sihope.com/_internetaccess.htm
Service starting at $44.95 per month residential

Stonebridge
http://www.sbwireless.net/coverage.html
Service starting at $59.00 per month residential

Implex
http://www.implex.net/services/access/wireless.cfm
Business only provider

PCS Technologies
http://www.pcs-tech.com/
Sells technology to implement system

NexNet
http://nextnet.com/
Provides variety of services including wireless

Wi-Fi Hotspots in Saint Paul

A Fine Grind - 2038 Marshall Ave - (651) 645-9700
Amore Coffee - 917 Grand Avenue - (651) 222-6770
Artists' Grind - 2399 University Ave West - 651.641.1656
Bean Factory - 1518 Randolph Ave - (651) 699-7788
Blondies Cafe - 454 Snelling Ave S. - 651-204-0152
Brewberry's Coffee Place - 475 Fairview Avenue South - (651) 699-1117
Cahoots Coffee Bar - 1566 Selby Ave - (651) 644-6778
Dino's Gyros - 1700 Snelling Ave. - 651-645-8800
Fabulous Ferns Restaurant - 400 Selby Avenue
Jasmine's Coffee And Tea House - 849 University Ave W - (651) 379-4880
Minnesota History Center - Cafe Minnesota, Library and Auditorium - 345 Kellogg
Blvd. West
White Rock Coffee Roasters - 769 Cleveland Ave. S. - 651-699-5448
Mac Library
Caribou Coffee 401 N. Robert St.
Holiday Inn Rivercentre
MSP Airport Lindbergh Terminal
Hearthside Pizza- 1641 Rice St.
Starbucks- 2078 Ford Parkway
Starbucks- Grand and Victoria
Starbucks- Lawson Commons
Border's Books- University
Holiday Inn Express- 1010 Bandana Blvd
Embassy Suites- 175 E. 10th St.
Gabes by the Park- 991 Lex. Pkwy
Golden Thyme Coffeeshop- 921 Selby
Green Mill Restaurant and Bar- 57 S. Hamline
Kinkos- 58 Snelling (and Grand)
UPS Store- 1360 University Ave.

Appendix D - Wireless project information from Muniwireless