

**Conceptual  
And  
Logical Architecture  
For A  
Statewide Wireless  
Communications  
Plan**

**State of Minnesota  
Department of Transportation  
Office of Electronic Communications**

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**A Conceptual  
And  
Logical Architecture  
For A  
Statewide Wireless  
Communications Plan**

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## **PREFACE**

The document that follows is the first step in developing a Statewide Wireless Communications Plan for the State of Minnesota. The second step in the planning process will be to develop a detailed technical design based on comments received as a result of this document. There are two main components to the Conceptual Statewide Wireless Communications Plan. The first component is a Digital Microwave Network. The second is an 800 MHz Trunked Radio System.

This plan focuses on the technical feasibility and a budgetary estimate to implement the above noted systems. The designs presented in this plan are conceptual in nature, and should not be construed as detailed engineering designs. The conceptual system design takes advantage of the latest technological developments that will meet the State's current extensive requirements for day-to-day operations, as well as assuring effective and coordinated communications in times of emergency. Future capacity and system growth capability are also a major consideration in the design of the Wireless Communication System. In addition, the planning effort gave special consideration to accommodate the various political subdivisions of the State of Minnesota who may elect to jointly share in the utilization of the 800 MHz trunked system.

The contributions made by the engineering staff of the Office of Electronic Communications are greatly appreciated. As a result of their efforts, we are confident that the information contained herein will provide a solid foundation on which the State can base future decisions for meeting state government and public safety radio communication requirements.

Sincerely,

Michael D. Hogan,  
Communications Planning Director  
Office of Electronic Communications

# TABLE OF CONTENTS

Preface.....	i
Table of Contents.....	ii
Forward.....	iv

## SECTION I

### TWO-WAY RADIO SYSTEM

Scope.....	I-1
Background.....	I-1
Need.....	I-1
Impact.....	I-2
Feasibility.....	I-2
Phased Implementation.....	I-2
Phase 3 Overview.....	I-3
Phase 4 Overview.....	I-4
Phase 5 Overview.....	I-4
Phase 6 Overview.....	I-5
Project Totals.....	I-5
Mobile & Portable Equipment (Subscriber).....	I-6
Shared System Concept.....	I-6
Interface to Metro Regional System.....	I-6
Interoperational System (Interop).....	I-7

### MICROWAVE SYSTEM

Scope.....	I-8
Background.....	I-8
Need.....	I-8
Impact.....	I-9

## **SECTION II**

### **800 MHz TRUNKED SYSTEM**

Definitions.....	II-1
Conceptual Design.....	II-1
Network Controller.....	II-2
Tower Sites.....	II-2
Existing Towers.....	II-2
New Towers.....	II-2
Network Control Terminals.....	II-3
Antenna System(s).....	II-3
Equipment Shelters/Generators.....	II-3
Frequency Assignments.....	II-4
System Costs.....	II-4

### **BACKBONE (MICROWAVE)**

Topology of System.....	II-5
Network Design.....	II-5
Computer Controlled Network.....	II-5
Microwave Network Cost.....	II-5

## **SECTION III**

### **NETWORK MANAGEMENT STANDARDS**

Protocol & Procedural Standards.....	III-1
Operational Management Standards.....	III-2
Network Management Standards.....	III-4
Network Architecture Standards (Project 25).....	III-5

Licensing Excess Space on Mn/DOT Towers.....	III-7
Non-State Agency Use of Radio System.....	III-9
Excess Capacity of Radio System.....	III-9
Local Involvement.....	III-10
Typical Process Involving Local Entities.....	III-10

## SECTION IV

### EXHIBITS

2001 Report to the Legislature.....	Exhibit 1
Tower Locations, Microwave Paths & Implementation Phases....	Exhibit 2
Time Line .....	Exhibit 3
Land/Tower/Shelter/Generator Costs.....	Exhibit 4
800 MHz Components & Microwave Costs.....	Exhibit 5
Summary of 800 MHz & Microwave Costs.....	Exhibit 6
Frequency Assignments.....	Exhibit 7

*Reference: Copies of documents referenced in this document may be obtained from the MN/DOT-OEC library. For further information, or to obtain a copy please contact the Office of Electronic Communications at (651) 296-7421 or e-mail to: [mike.hogan@dot.state.mn.us](mailto:mike.hogan@dot.state.mn.us)*

- 800 MHz Executive Team Report to the 2001 Minnesota Legislature
- Network Management & Operational Management Standards
- Project 25 Standards
- Policy for Licensing Excess Space on Mn/DOT Towers
- National Public Safety Planning Advisory Committee (NPSPAC)

# FORWARD

The purpose of this plan is to develop a conceptual model for a statewide digital radio network comprised of a digital microwave system, and a statewide 800 MHz digital trunked voice radio system.

Many of the decisions to implement a digital microwave and 800MHz Trunked Radio networks are based three factors. First, a study prepared by the 800 MHz Executive Team which included representatives from the Minnesota Departments of Public Safety, Administration and Transportation, is entitled “800 MHz Executive Team Report to the 2001 Minnesota Legislature, 800 MHz Statewide Shared Public Safety Radio System” dated February 1, 2001. The purpose of this study was to evaluate and determine the needs and concerns of the local units of government as they pertain to two-way radio communications. The results of this study were presented to the 2001 Minnesota Legislature. Please refer to Exhibit 1 for a complete copy of the Report. Second, the proposed system is an extension or natural growth from the system being implemented in the nine (9) county metro area. And finally, trends within the industry and the successful implementation of other similar systems throughout the United States.

This plan consists of four sections.

- Section I outlines the background, need, and impact of implementing a statewide digital microwave system and 800 MHz Trunked radio system.
- Section II contains conceptual site information and specifics about the plan in general. This section should give readers a general idea of the design and requirements of the proposed systems.
- Section III addresses the standards for the “Network Architecture” and “Operational Management” of the proposed Statewide Shared Radio System.
- Section IV contains appendix material, consisting mainly of tables, costs sheets, attachments, and maps. This material is provided to support the data and statements made in Sections I & II.

# **SECTION I**

## **800MHz Trunked Radio and Microwave**

**BACKGROUND  
NEED  
IMPACT  
FEASIBILITY**



## SECTION I

### TWO-WAY RADIO

#### SCOPE

This plan will attempt to provide a conceptual or preliminary design that will serve as the basis for future planning and design. This plan is primarily for budgetary and general guideline purposes. Specific detailed engineering planning will be completed at a later date.

#### BACKGROUND

The Mn/DOT VHF statewide mobile radio system is primarily used to provide wireless two-way voice communications for Mn/DOT personnel responsible for constructing and maintaining the state's highway system. The Minnesota Department of Public Safety (DPS) also owns and operates a statewide VHF radio system. The primary users of this system include the State Patrol, the Bureau of Criminal Apprehension, and the Department of Natural Resources, Criminal Division. The Department of Natural Resources (DNR) owns and operates a VHF radio system that supports the operations of the Forestry and Parks divisions. The DNR system provides coverage to approximately 70% of the State as opposed to a total statewide system. In addition to the VHF radio portion of the system, Mn/DOT owns, operates, and maintains an analog microwave system that plays a vital role in the successful operation of the Mn/DOT mobile radio system today. It has proven to be the most reliable and economical method for linking mobile radio dispatch centers with remote radio tower sites.

Current Mobile/Portable/Base Station Number		
MOBILES	PORTABLES	BASE STATIONS
5,600	4,200	741
<u>These numbers represent the number of radio units (subscribers) in operation in 2002 for Mn/DOT, DPS, and DNR only.</u> It does not include the Dept of Corrections, State Collages & Hospitals, or any other state facility currently using two-way radios in their operations.		

The three VHF systems and microwave system represent an investment in radio sites valued at over \$ 75,000,000 including towers, shelters, radio equipment, microwave radios and dishes, and power generators.

#### NEED

Public safety, and local government radio communications needs throughout the state have grown steadily over the past several years and are expected to grow significantly during the next ten (10) years as a result of regional population growth coupled with an increase in per capita public safety incidents. At the same time that communications needs are growing so rapidly, the ability of governmental and public safety agencies to upgrade their existing VHF/UHF systems is limited due to the lack of available frequencies, and limitations caused by the aging technology of their equipment and system performance in general. Maintaining the systems, and obtaining replacement components for the aging analog systems is becoming more difficult with each passing year. Operational problems are becoming more prominent with increased demands for

channel access. Interference from one district to another is a limiting factor in expanding the current systems. In addition, interference jeopardizes the reliability of the current systems, which affects employees and the general public's safety. These problems are difficult if not impossible to remedy due to the lack of available clear radio spectrum in the VHF/UHF bands. The ability to intercommunicate with other state agencies today is difficult and in some cases non-existent. The requirement for interoperability between multiple agencies and jurisdictions has become a necessity for local government and public safety communications systems.

## **IMPACT**

What if the current VHF systems used by the state are not replaced? In other words, "do nothing". Doing nothing to improve or replace the current VHF radio systems will have broad implications. The current VHF two-way radio systems used by state agencies has reached its capacity. These systems use analog, 25KHz bandwidth equipment. This technology was developed over 40 years ago. This does not mean that the equipment is that old, only that the technology behind the overall operation is slowly being replaced by manufactures with digital, 12.5 and 6.25 KHz equipment. Manufacturers have indicated that they are placing their R&D resources into the development and manufacture of narrowband digital radios. This means that replacement radios and parts will become more difficult to obtain in the future.

## **FEASIBILITY**

An 800 MHz digital trunked radio system is proposed to replace the current systems in use by the State of Minnesota agencies today. A shared 800 MHz digital trunked radio system can fulfill the interoperability requirements, as well as solve numerous other problems facing the aging mobile communication systems in use today. The radio system proposed in this plan will create a seamless statewide system or network. This single shared system could gradually replace the hundreds of individual radio systems currently operated by state agencies and local units of government. This system could provide for a high degree of reliability and interoperability between state agencies as well as between state and local and federal agencies.

This is a quantum leap in technology, going from the old 1965 technology to the state of the art system of the next century. The digital network represents improved performance, increased capacity and new capabilities. The statewide shared system or network will enable instantaneous interoperability among multiple state agencies as well as those jurisdictions routinely working with state agencies. The 800 MHz digital trunked radio system will enable users in one area of the state, to communicate to another individual or group of individuals in another area of the state. The 800 MHz trunked system will provide 95% reliable coverage for portable radios throughout the state. The statewide system will be fully compatible with, and utilize components implemented in the Metro 800 MHz system.

## **PHASED IMPLEMENTATION**

Implementation of the new 800 MHz trunked system in Greater Minnesota will occur in four (4) phases. Each phase will consist of implementing components of the system within two to three complete Patrol districts. For operational purposes, it is highly recommended that complete districts be converted to the new system, rather than portions of a district or specific highway corridors. The tables below show the cost details of each phase. Please refer to **EXHIBIT 2** for phase maps.

The work to be completed during each phase consists of constructing and or installing the following components: towers, 800 MHz base stations, Interop base stations (VHF), controllers, switching equipment, and microwave transmitters/receivers.

Specific tasks that must be completed in each phase are as follows: (Refer to **Exhibit 3** for timeline for each phase)

- Form planning group with local government/public safety entities within district
- Locate suitable existing local government towers in required areas. If none then;
- Identify land parcels for tower construction
- Purchase land
- Prepare specifications for towers and shelters
- Bid for towers and shelters
- Prepare site for tower erection
- Erect towers and place shelters, generators
- Prepare specifications for trunked radio system and microwave
- Bid for trunked radio system and microwave
- Finalize detailed design with successful vendor
- Order trunked radio equipment (base stations) and microwave
- Factory staging of all electronic components
- Equipment delivery and installation
- Testing
- Acceptance

Special consideration will be given to the interoperational system (Interop) that will be needed to permit communications between users of the new 800 MHz trunked system and the users who chose not to migrate or join the new system. See page I-7 for a more detail description of the Interop requirements.

**Phase 3-** Phase 3 will begin in FY2004 if funding is made available. This phase will provide coverage throughout 23 counties in the Rochester and St. Cloud Patrol districts.

	Numbers	Costs
Counties Involved	23	-
New Towers: Includes Land,Shelters,Generators, Site Prep Work	31	\$10,788,000
Existing Towers	8	\$ 0.00
Modifications	13	\$ 1,666,000
800 Fixed Equipment	5 chnl stations	\$10,561,690
Interop Eqp/Control	52 sites / 1 Zone Cont	\$ 4,728,000
Microwave Eqp	Loop, High cap, Hot Stand-by	\$ 9,984,340
Engineering	Trunk & Microwave	\$6,500,000
TOTALS		\$44,228,030

Refer to map in Exhibit 2. Budget information can be found in Exhibit 4-6.

**Phase 4** – Phase 4, which will begin in FY2005 or one year after the start of Phase 3. This phase will cover the Duluth and Brainerd Patrol districts. The two districts cover 12.5 counties (half of St. Louis Co.)

	Numbers	Costs
Counties Involved	12.5	-
New Towers: Includes Land,Shelters,Generators, Site Prep Work	39	\$13,472,000
Existing Towers	27	\$ 0.00
Modifications	3	\$ 498,000
800 Fixed Equipment	5 chnl stations	\$10,669,200
Interop Eqp/Control	69 sites / 1 Zone Cont	\$ 4,966,000
Microwave Eqp	Loop, High cap, Hot Stand-by	\$13,065,000
Engineering	Trunk & Microwave	\$6,500,000
TOTALS		\$49,170,200

Refer to map in Exhibit 2. Budget information can be found in Exhibit 4-6.

**Phase 5** – Phase 5 will begin in FY2006 or 1 year after the start of Phase 4. This phase encompasses three Patrol districts – Mankato, Marshall, and Detroit Lakes. This phase will include 31 counties.

	Numbers	Costs
Counties Involved	31	-
New Towers: Includes Land,Shelters,Generators, Site Prep Work	40	\$13,920,000
Existing Towers	15	\$ 0.00
Modifications	7	\$ 689,000
800 Fixed Equipment	5 chnl stations	\$ 9,727,800
Interop Eqp/Control	62 sites / 1 Zone Cont	\$ 4,868,000
Microwave Eqp	Loop, High cap, Hot Stand-by	\$15,640,000
Engineering	Trunk & Microwave	\$6,500,000
TOTALS		\$51,344,800

Refer to map in Exhibit 2. Budget information can be found in Exhibit 4-6.

**Phase 6** – Phase 6, will begin in FY2007 or 1 year after phase 5 begins. This phase will cover the Virginia and Thief River Falls Patrol districts. These two districts include 11.5 counties.

	Numbers	Costs
Counties Involved	11.5	-
New Towers: Includes Land,Shelters,Generators, Site Prep Work	32	\$11,136,000
Existing Towers	15	\$ 0.00
Modifications	7	\$ 1,220,000
800 Fixed Equipment	5 chnl stations	\$ 8,315,700
Interop Eqp/Control	54 sites / 1 Zone Cont	\$ 4,756,000
Microwave Eqp	Loop, High cap, Hot Stand-by	\$12,200,000
Engineering	Trunk & Microwave	\$6,500,000
TOTALS		\$44,127,700

Refer to map in Exhibit 2. Budget information can be found in Exhibit 4-6.

#### **PROJECT TOTALS**

Phase 3	\$44,228,030
Phase 4	\$49,170,200
Phase 5	\$51,344,800
Phase 6	\$44,127,700
<b>Project Total</b>	<b>\$188,870,730</b>

## **MOBILE & PORTABLE EQUIPMENT (SUBSCRIBER)**

The costs reflected in the Exhibit portion of this Plan do not include the cost of the mobile and portable radios, also referred to as subscriber units. It is anticipated that the cost of the subscriber units will be borne by the individual agencies that participate in the System. This is the same model that was followed for the Metro 800 MHz Radio System. Below is an estimate of the approximate cost for mobile and portable radio units. These costs are provided for fiscal planning purposes and should not be construed as actual price quotes. These costs are based on current prices and the current numbers of subscribers as noted in Section I “Background” of this report.

### **SUBSCRIBER UNIT COSTS**

Approximate cost for Mobile Radios = \$2,800 ea.

Approximate cost for Portable Radios = \$2,800 ea.

State Mobiles – 5,600 units. Cost \$15,680,000

State Portables – 4,200 units. Cost \$ 11,760,000

Total Subscriber costs \$27,440,000

This estimate is for DPS, DNR and MN/DOT users only and does not include other state agencies

## **SHARED SYSTEM CONCEPT**

Due to the size of the statewide system there are certain economies of scale and predicted cost savings that can be realized by sharing in the implementation and use of the statewide 800 MHz System. The State will make every effort to include city and county governments in the initial planning phase of this system. State representatives will conduct regional presentations as well as one-on-one meetings with representatives from local government entities explaining the benefits of a cooperative effort to develop a coordinated public safety communications network to be shared among state, and local agencies. Efforts will be made to enter into cooperative agreements with local units of government similar to the agreements used with participants in the Twin City metro area.

## **INTERFACE TO METRO REGIONAL SYSTEM**

The infrastructure portion of the Metro Regional 800MHz Trunked Radio System is complete and will be operational in October of 2002. Therefore, there is little or no mention of design requirements for the remaining communities that have yet to join the Metro radio system. Each community within the Metro has submitted plans to the Metropolitan Radio Board (MRB) for their future participation if they should so chose to do so. Simply because the Metro is not addressed in this Plan, does not mean to imply that the Metro System is not part of the Statewide System concept. It is planned that the Greater Minnesota (non-metro communities) radio system will be interfaced with the portion or layer of the Metro System called the “Regional Layer”. The term “layer” is used because there are three separate layers to the entire Metro System: Regional, Hennepin County, and Minneapolis. The Regional layer serves the state agencies, while the

other layers support their respective agencies. Yet all three share components of each other's system, and can actually roam (use) to one another's layer if needed.

As stated, the Greater Minnesota System described in this Plan will be interfaced or connected into the Metro Regional Layer. However, it may be premature to speculate on how that may be accomplished at this time. Many factors must be considered before system integration can occur. Since each layer of the Metro System is owned and managed by independent entities, a through study must be conducted to determine the impact to the Metro Layers (and users) as well as the Greater Minnesota system before interfacing the two systems. System compatibility should not be a major concern, since the Plan requires that the same standards used for the Metro System also be applied to the Greater Minnesota system.

Costs to interface the two systems have not been provided for in the Plan.

### **INTEROPERATIONAL SYSTEM (VHF TO 800MHz)**

A separate plan will be needed to establish detail requirements for providing an interoperational system (Interop) that will facilitate communications between non-participating entities and those who choose to join the 800 MHz Trunked System.

A couple of options are under consideration at the time of this writing. It should be noted that these are only offered as topics for discussion.

- Use the existing Minnesota State Patrol VHF radio equipment that exists today. While some of this equipment is somewhat old in terms of electronics, it may serve as a temporary link between entities of dissimilar radio systems. Since the Patrol system and most equipment used by public safety agencies in the state are already programmed with the State Mutual Aid channels (MINSEF, MIMS and the Fire Mutual Aid frequencies) it may be the least expensive route to pursue.
- Use the existing county sheriff's radio systems and equipment. However, this option would require all counties within the district being upgraded to participate in the shared statewide trunked system. It is unlikely that all counties will convert to the new system during the initial implementation phases, which would leave major gaps in the Interop system.
- Use a combination of the two previously described options.

This plan has provided some costs figures to provide for interoperability between the old and the new. Best estimates indicate that the cost to implement the Interop System statewide would be approximately \$3.3 million. Please refer to **Exhibit 5** for details.

Estimates and details of how the Interop issue can be satisfied will be better addressed once funding has been approved and meetings begin with local units of government to determine their interest in participation on the Trunked System as well as their requirements.

## **MICROWAVE**

### **SCOPE**

The microwave system proposed in this plan is capable of supporting large volumes of data. However, it is not the intent of this project to replace existing data transport systems. The main objective of this project is to support mobile voice, data and video applications of the state. The conceptual design for the statewide system will provide a multi-loop digital microwave system operating in the 6.7 GHz frequency range, with hot protected spurs to meet the requirements of the 800 MHz trunked system, conventional 800 MHz system, VHF/UHF stations, dispatch communication centers, ITS initiatives, Mobile Data Computer system, and other future applications that may arise.

### **BACKGROUND**

The current microwave system used by the State of Minnesota was implemented over 20 years ago. The current system uses analog technology operating in the 2 GHz frequency band. The System is comprised of 188 transmitter/receiver sites. The microwave system is used to transmit voice information (two-way radio traffic) back and forth from the radio communication towers located throughout the state back to the dispatch centers located within the districts. The current demands of the two-way radio systems used by DPS, DNR and Mn/DOT have used all available channels of the system.

### **NEED**

A wide area digital microwave network will satisfy two basic criteria: the digital network will replace the aging analog wide area communication system and ultimately show a cost savings to the state, and secondly, the digital network will accommodate and satisfy the new initiatives and requirements of user agencies.

Another reason for the need to migrate to digital has to do with the 2 GHz frequency band that is used by the microwave system. The FCC reassigned the portion of the 2 GHz band used by microwave systems to the Mobile Satellite Service (MSS). Microwave users such as the State of Minnesota has been permitted by the FCC to continue to use these frequencies on a primary basis. However, any modification, including an upgrade, to these systems and or licenses will place the user into a secondary status to the MSS, or even result in the loss of the frequency if the frequency is needed by the primary user in the MSS.

An increase in circuit capability or bandwidth between dispatch centers and radio tower sites is a key requirement for upgrading the current microwave system. More circuits or bandwidth will enable departments to implement systems that lower organizational operating costs, increase productivity, and enhance employee safety, provide information to the traveling public, and provide greater services to the citizens of the State of Minnesota. An example of this is the Mobile Data Computer (MDC) system that is being developed under a separate initiative for the Minnesota State Patrol. The implementation of the MDC is dependant on the development of the digital microwave backbone system. The MDC system will provide statewide mobile data services for the Minnesota State Patrol, Mn/DOT, DNR, and other agencies wishing to participate in the development and cost of the MDC system. Other examples of initiatives that require the digital microwave are: RWIS, VMS/CMS, HAR, AVL, Mayday System, and other ITS initiatives. Connectivity between the Transportation Operations Communication Centers



(TOCC) is also a major function being planned for in the microwave project. Projects requiring connectivity from the right-of-way, or roadside, to the main network will be able to make use of the digital microwave system being developed under this plan. Specifics of how these applications will connect to the proposed system cannot be defined at this time. Each application operates under a proprietary protocol that requires nonstandard equipment that must interface into the proposed system. Therefore, until the requirements and architecture of the ITS initiatives are defined, the actual connectivity requirements cannot be defined.

## **IMPACT**

If the current microwave system is not replaced with a digital microwave system at this point, we could continue to use the present combination of leased analog circuits and the existing Mn/DOT analog microwave system for a limited period of time. However, in doing so, many state government requirements for new and existing applications cannot be satisfied. The state will pay a significant cost for leasing circuits to perform some of the required tasks. The current age of the existing microwave system is approximately 20 years old; the industry trend is migrating to digital wideband services. Because of this industry trend, it has become difficult if not impossible to expand the channel capacity of the existing system. Parts for the existing equipment are nearly non-existent, and this situation will only become worse.

## **SECTION II**

**800 MHz TRUNKED RADIO**

**and**

**BACKBONE (MICROWAVE)**

**RADIO SYSTEM DESIGN CONCEPT**

## SECTION II

### 800 MHz TRUNKED SYSTEM

#### DEFINITIONS

- Trunking is defined as the: “A communications path between two locations. Communications needs of a large number of users can be provided for by efficiently sharing a small number of trunks. Trunking is the automatic sharing of a group of communications paths (trunks) among a large number of users. Trunked radio is simply multiple radio repeaters controlled by a Central Processing Unit (CPU) device that allows a large number of mobile and portable users to share the repeaters”. Trunking combines traditional radio base station technology with network switching technology. A single radio system can be shared by a number of different user groups, eliminating the need for each group to own, operate and maintain its own system. The proposed system is also capable of employing technologies such as “simulcast”, “multi-site”, and “digital modulation”.
- Simulcast simply means that a radio message is simultaneously broadcast from multiple transmitters to cover a large area.
- Multi-site is another trunking technique using multi-site controllers. These controllers track the location of every mobile or portable unit and determine which transmit site has coverage. This allows wide area coverage without using simulcast. Multi-site technology can connect several different trunked systems, some of which are simulcast and some not. (in effect, a multi-site controller treats a simulcast system as if it were a single site system.)
- Digital modulation means that the radio converts the analog voice information into 1's and 0's much the same way a computer handles data. The radio then transmits the digitized data packets over the airwaves. This process is then reversed at the receiving radio. Digitized transmission provides for improved audio quality, secure communications, increased user capacity, and other enhanced operational capabilities.

#### CONCEPTUAL DESIGN

There are a number of conceptual designs that could accommodate the needs of the users throughout Minnesota. Each design has its strong and weak points. No one method may be suitable for the entire state. It is believed that a blend of designs will be used to meet the diverse needs of the users. Areas of high population and large volumes of communications traffic may require the seamless coverage offered by a simulcast system, while a less densely populated area of the state may be best served using a multi-site type of system. This plan will attempt to provide technical and cost data based on anticipated use of both simulcast and multi-site system technology. However, local government involvement in a specific area could result in unforeseen design changes that could effect the overall cost of the system.

## **NETWORK CONTROLLER**

The proposed System will extend the 800 MHz digital trunked simulcast radio system that has been or is currently being implemented in the nine (9) county Twin City Metro area. Although the Metro system is not slated for completion until the year 2002, much of the basic planning principles can be applied to the statewide System.

In a simulcast system the operation and functionality of the 800 MHz system is dependent on continued operation of the network controller. Network controller equipment is very reliable with built in redundancy. While the controller has self-monitoring and switchover capability to limit system failure, there are circumstances that could destroy all equipment at a site. For this reason it is necessary to house a redundant backup controller at a separate physical location. It is anticipated that as many as four (4) additional network controllers will be needed to meet statewide needs. The network controllers will be strategically located at designated MnDOT communications centers located at District Headquarter facilities. Each network controller will be capable of operating a specific portion of the network, as well as perform as a back up to another portion, or several portions, of the network.

## **TOWER SITES**

Without detailed engineering studies, it is difficult to pin point the exact location of all the towers that will be required for the system. Since the microwave network and the 800 MHz system will use the same towers, consideration must be given to the microwave paths between each tower as well as the general propagation coverage for the subscribers. For the purpose of this planning effort we have used 20 miles as a general rule for separation between towers. This mileage requirement is due in part to simulcast requirements and the distance 6GHz microwave signals can travel reliably. It has not been determined as of this writing if simulcast will be required throughout the entire state. This determination will be made after detailed discussions with potential state and political subdivision users. Using the 20 mile tower separation rule for the conceptual plan, an estimated 236 tower sites will be needed to complete the entire statewide system. It is generally believed that the tower locations represented in this plan will provide a reasonably accurate projection of tower requirements. An attempt was made to use as many of the existing state towers as possible. Refer to the map in **Exhibit 2**, for the anticipated location of new towers as well as the location of existing towers.

## **EXISTING TOWERS**

The state currently has 80 existing towers that have been included for use in this plan. State fire lookout towers sites will also be used whenever possible. Existing towers are noted on the map in **Exhibit 2**.

## **NEW TOWERS**

It has been estimated that a total of 156 new tower sites will be needed to augment the 80 existing towers. The term "new tower site", as used in this plan, means that new land must be purchased. However, state land will be used when and where available. Additional existing towers may become available from other governmental entities that may chose to participate in the statewide system. Obtaining additional towers from local participation will contribute to

lowering the overall cost of the system while also helping to limit the proliferation of towers in the state. Based on current experience with leasing commercial tower space, planners have determined that in all probability leased tower space will not be adequate to accommodate the anticipated antenna loading that the new system will require at each transmitter/receiver location (site). Therefore, it is the consensus of those involved with this planning effort that the state should own all towers if at all possible. Construction of new towers will be on state owned land wherever possible. Purchase of privately owned land will be recommended only after a search for state land and a detailed microwave path analysis show that the technical requirements dictate the purchase of private land.

## **NETWORK CONTROL TERMINALS**

Various control functions of a trunked radio system, such as the set up and break down of talk groups, or disabling a lost or stolen radio are controlled with a network control terminal.

Terminal equipment can also be used to obtain statistics on the performance and the usage of the network. More than one terminal can be used on the network. It is recommended that each state agency or public safety center dispatching for an agency subscribing to the trunked radio system be equipped with a terminal.

## **ANTENNA SYSTEM**

A detail propagation study has not been completed for this phase of planning. However, general coverage maps have been completed using the following assumptions for the antenna system:

- All receivers will be equipped with tower top amplifiers
- All transmit and receiver antenna heights are between 300 and 350 feet
- All repeater station transmitter power is 75 watts output power
- All antennas will be omni directional, 7.5 dB gain collinear antennas
  - All coaxial cable will be 50-ohm, 7/8" form dielectric

A detailed propagation study will be completed for each transmitter site during the detailed design phase of this project. Specific technical parameters will be optimized to provide the best coverage from a specific location.

## **EQUIPMENT SHELTERS/GENERATORS**

Each new site will require an equipment shelter. Shelters at some existing tower sites may also have to be replaced on an as needed basis. The approximate general shelter size will be 12' x 26'.

Each new site will require a generator and battery package for backup power. The typical generator size for most sites will be 50 kW. Some existing sites may also require a new or larger generator and or battery package.

Backup power and shelter size will be evaluated during the detailed design phase. The cost for the shelters and generators are contained in **Exhibit 4**.

## FREQUENCY ASSIGNMENTS

The National Public Safety Planning Advisory Committee (NPSPAC) for Region 22 has assigned specific frequencies (channels) in the 821-826 MHz band for use by the State of Minnesota as well as local units of government. The frequencies assigned to the local units of government were not assigned to a specific organization or agency, rather they were assigned to a geographic region, typically by county borders. These frequencies have a 25 KHz bandwidth, but can be used with a 12.5 KHz bandwidth such as in the metro radio project.

In addition to the NPSPAC frequencies, this planning committee has also selected frequencies from the FCC Public Safety Category – 806 MHz, for use in the statewide system. These frequencies are better suited to wide area applications such as those required in this plan. Please refer to **Exhibit 7** for a map indicating approximate assignment locations. Please note that each “Group Number” referenced on the map represents a total of five (5) 806 MHz channels. The term “channel” refers to the base transmit frequency and the mobile transmit frequency that is paired with the base frequency.

The FCC has also allocated 24MHz of spectrum in the 700 MHz band for Public Safety use. In accordance with FCC Docket No. 96-86 Regional Planning Committees (RPC) have been formed to develop local plans for the use of the new 700 MHz spectrum. Planning efforts are currently underway in Minnesota to develop a plan that pre-coordinates the frequency assignments in the 764-776 MHz and 794-806 MHz bands similar to the method used in the NPSPAC Plan noted above.

And finally, the State of Minnesota has applied for and received a license for 2.4 MHz of narrowband 700 MHz spectrum. This spectrum is available statewide to all eligible public safety services. The frequencies assigned under this license will be administered by the State of Minnesota rather than the Regional Planning Committee. No further FCC authorization will be required to construct and operate transmitter sites within the state unless they raise specific environmental, aviation safety, quiet zone, or international issues. Please refer to **Exhibit 7**

## COST

Refer to **Exhibit 5** for a cost estimate to implement the 800 MHz Digital Trunked Radio System described in this plan. The estimates provided are an aggregate sum of the equipment and installation costs for each site. The costs include the following:

- Land
- Towers
- Shelters/generators
- 800 MHz fixed equipment
- Controllers
- Interop equipment
- Microwave equipment
- Installation
- Engineering

A summary of the total system cost estimates are provided in **Exhibit 6**. These figures are the compilation of the totals provided in Exhibits 4 and 5.

## **MICROWAVE**

### **TOPOLOGY OF SYSTEM**

The proposed design topology of the microwave system will provide the necessary DS1 connectivity needed to support the applications being considered for interconnection to this system. The tower spacing was kept at 20 miles or less depending on the terrain, existing tower sites, and availability of new tower sites. The network is routed to most cities with state government offices, State Patrol dispatch centers, and all Mn/DOT owned or leased radio towers. The routing is shown on the maps contained in **Exhibit 2**. The solid lines indicate high capacity loop paths using 1DS3 to 3DS3 digital radios at each site. The dotted lines indicate low capacity paths that will use 1DS1 to 28DS1 digital radios at each site. All microwave paths will be engineered for optimum performance after field survey information is obtained. Final antenna types and sizes will depend on frequency coordination results.

### **NETWORK DESIGN**

The state will be divided into nine (9) regions using the existing State Patrol districts (Metro not included). The tower sites within the district will be connected to the Transportation Operations Communication Centers (TOCC) that are under construction during 2000 thru 2003 using digital microwave. At least one DS1 is proposed to every radio site. Channel banks at each radio site will interconnect all 800 MHz radio sites and at the central network controller site(s). The management and alarm information channels from the radio sites will be routed back to the network control center using dedicated 64 kbps data channels in the channel banks.

The proposed design includes DS1 to DS3 multiplexers at each loop microwave site. The actual connectivity will be determined during the detailed design process. The high capacity microwave will be designed in a loop configuration. The loop configuration will create a redundant path for communications within the district in the event of a point of failure to one of the communication sites.

The required antenna heights and fade margins were planned for 99.9995% path availability for a faded Bit Error Rate (BER) of  $10^{-6}$ . The primary microwave link performance objective is the system availability. The System availability with an objective of 99.999% consists of the propagation availability and equipment availability. Each of these are designed for 99.9995%. Each site has battery backup. If commercial power fails, batteries initially assume the load. The sites also have generators that automatically assume the load for long-term power outages.

### **COMPUTER CONTROLLED NETWORK**

This equipment allows more efficient use of digital facilities and reduces equipment costs associated with traditional means of digital channel cross connections and test access. It allows the flexibility of channel cross connection, network hubbing, digital voice conferencing and data bridging.

### **MICROWAVE NETWORK COST ESTIMATE**

Refer to **Exhibit 5** for a cost estimate to implement the digital microwave network described in this plan. The estimate includes itemized equipment and installation costs for each network site.

# **SECTION III**

## **NETWORK MANAGEMENT**

### **STANDARDS**

**&**

### **EXCESS SPACE POLICY**

**&**

### **LOCAL INVOLVEMENT**



## **SECTION III**

### **NETWORK MANAGEMENT STANDARDS**

#### **STANDARDS**

There are two types of standards that are needed to implement a shared statewide trunked radio system. The first is the “network architecture” standards. For the purpose of this document this standard is defined as Project 25, described later in this section. The second required standard involves the operation and administration of the system. These standards will establish the protocols, and procedures for users of the system. The topics covered by the standards manual will include, but not limited to, the areas listed below. While most standards have already been written, they are too lengthy to include in this document.

#### **PROTOCOL & PROCEDURES STANDARDS**

1. Management
  - a. Agency roles in operational management of system
  - b. Network management
  - c. Database management
  - d. Maintenance of names and naming standards
  - e. Changing policy & standards
  - f. Security
  - g. Equipment standards
  - h. Moves, additions and changes
  - i. Managing participation issues
  - j. Training standards
2. Configuration and Allocation
  - a. Naming conventions
  - b. Talk-group and radio ID allocations
  - c. Fleet-mapping standards
  - d. Use of shared Talk-groups
  - e. Talk-group & radio user priorities
  - f. Telephone interconnect
  - g. Subsystem roaming
  - h. Scanning
  - i. Recording/Logger ports
  - j. Private call
  - k. Status & message transmission/warning signals/AVL/text messaging
  - l. Emergency button
  - m. Multi-group announcement
3. Interoperability Guidelines
  - a. MINSEF
  - b. Statewide Fire Mutual Aid
  - c. MIMS
  - d. Statewide EMS
  - e. Recording common interagency Talk-groups
4. Guidelines for Project 25 Trunked Users
  - a. Talk-group and Multi-group ownership
  - b. Interoperability between statewide 800 MHz system and other 800 MHz systems

- c. Statewide tactical Talk-groups
  - d. Interoperability between statewide 800 MHz and federal agencies
- 5. Guidelines for Conventional Users
  - a. Connecting into the Interop System
  - b. RF control stations and portables
  - c. Radio to radio cross band repeaters
- 6. Maintenance
  - a. Agency maintenance plans
  - b. Develop standards for preventive maintenance
  - c. Record-keeping requirements
  - d. Contact information & procedures
  - e. Spare equipment
  - f. Equipment configuration information
  - g. Software location
  - h. Notification of maintenance activities
  - i. Outage responsibility/Time standards/Repair Standards
- 7. Media Policy
  - a. Media access to Talk-groups
  - b. Selling radios to the media
  - c. Programming media radios
- 8. Agency Billing & Cost Allocation
  - a. New Users
  - b. Fees for service
  - c. Operational costs
  - d. Billing management
  - e. Insurance
- 9. Compliance & Conflict Resolution
  - a. Auditing and monitoring process
  - b. Non-compliance
  - c. Appeal process
- 10. Disaster recovery Plan
  - a. Contingency procedures
  - b. Procedures/responsibility for system restoration
  - c. Levels of response

## **STANDARDS FOR OPERATIONAL MANAGEMENT**

The purpose of these Standards is to define each agency's role in the operational management of the Statewide Shared Digital Trunking System.

Each User of the System will formally designate a Local System Administer (LSA) who will have the authority to represent their respective Agency(s) interests and make decisions on issues related to the day-to-day operation on their portion of the system and any urgent or emergency system operational or repair decisions. The MnDOT System Administrator will represent the statewide infrastructure portion of the system. Each LSA shall designate a backup who shall have the authority to represent their respective portion of the System in the absence of the primary LSA.

An urgent or emergency situation would be one where immediate decision authority is needed to

allow the System as a whole, or any of the Subsystem components, to continue supporting normal wide-area communications services. It is recognized that each Local Systems Administrator (LSA) may have to obtain authorizations from higher levels of their own organization to make longer-term or non-emergency capital or repair expenditure decisions.

Each LSA will be responsible for the day-to-day management, operation and oversight of the system components within their portion of the System. Specific duties will not be detailed in this document. However, the general duties will include, but are not limited to, the following:

1. Monitoring the system and its components for normal operations.
2. Participating in the diagnosis of system performance problems and the development of corrective action recommendations.
3. Dispatching appropriate repair services in the event of a malfunction in the system equipment.
4. Managing the database elements including Subscriber IDs, talk group IDs, and the various parameters that relate to their effective operation.

Due to the complexity and distributed administration & maintenance of the System, typical problems can appear when changes are made to hardware or software.

In order to keep all representatives informed of any updates, notifications will need to be sent to all primary & alternate Local System Administrator (LSA) representatives in the event of any of the following:

- a. Any planned maintenance work being done on the Statewide or Local Systems that would affect the System performance for the other users would be preceded with reasonable notification of the maintenance work being done.
- b. Any equipment malfunctions or failures that would affect system performance for the other users of the local systems or statewide system.
- c. Any configuration changes in equipment or software by any one of the users that may affect system performance for the other users.

In addition to the responsibilities as a Statewide System Administrator, the MnDOT System Administrator will also be responsible for:

- a. Arranging for System Administration meetings at least monthly to review operations of the System and share ideas or issues that have arisen in local subsystems that may be of interest to the other Local System Administrators.
- b. Being available to work with any of the other Local System Administrators or the technical staff of any of the local systems to diagnose and resolve any system operational problem that involves parameter changes, maintenance or repair of the regional equipment.
- c. Being the identified point of contact with the vendor for issues related to the statewide network equipment.
- d. Providing timely information to the other Local System Administrators on any System issue that arises or repair/maintenance issue related to the system equipment.
- e. Monitoring the performance of the entire network for normal operations, particularly the performance of the statewide infrastructure equipment.
- f. Monitoring the configuration of the system database for normal operations, particularly the properties of the statewide equipment & database objects. And conducting the periodic database backups.

The Local System Administrators along with Mn/DOT's System Administrator will be the representatives forming the System Managers Group (SMG). The SMG is responsible for the operational management of the entire statewide system.

## **STANDARDS FOR NETWORK MANAGEMENT**

The statewide network consists of, but not limited to, channel banks, hubs, switches, routers, servers, Local Area Networks at the equipment locations, and Wide Area Links connecting sites together consisting of the microwave & fiber optic equipment, and the network management tools provided by the equipment manufacturer.

The System architecture is primarily constructed around an Internet Protocol based network. The network is composed of industry standard equipment, which also provides flexibility and a large variety of management & diagnostic tools.

The vendor will provide equipment configuration information as part of the system documentation. The system network is complex and unusual problems may be difficult to identify and resolve. The system documentation will have to be kept up to date or will lose its value in supporting the system network.

The system network is protected from other agency data networks, and shall remain so. This is to protect the security and functionality of the system. If there is a connection to another data network, it shall be through an appropriately designed & maintained firewall.

The components of the network shall be considered as “owned” by the State of Minnesota, unless otherwise designated as a local component. In which case that component would be owned by the local unit of government. The individual owners will then be responsible for the maintenance of the sites & equipment that they own. Agreements between the Owners and/or Maintenance Contractors are at each agency’s discretion, but the Owner is still ultimately responsible for their portion of the system.

The Backbone system is structured on an integrated network; any infrastructure hardware and software upgrades or changes that may impact the system network will need reasonable discussion and subsequent approval by the System Managers Group. All maintenance work being scheduled that may affect the statewide system and/or a local system performance shall be preceded by reasonable and appropriate notification to the other Local System Managers.

The equipment configurations of the components of the network will need to be documented. This is primarily for the purpose of maintenance, but also affects future planning. The vendor will provide the original “as built” documentation.

The methods for performing detailed network operations will be defined in the technical resource manuals and training for the system. The technical resource manuals will be classified as “Security Information” and “General Non-Public Data” pursuant to Minn. Stats. §13.37 Subd. 1a.

The details on procedures not otherwise defined will be at the discretion of the System Managers Group.

The Mn/DOT System Administrator and Local System Administrators are responsible for managing the data attributes that they are individually responsible for. The MnDOT System Administrator shall be responsible for the statewide portion of the network.

## **NETWORK ARCHITECTURE**

### **PROJECT 25 STANDARDS**

APCO Project 25 is a joint effort of U.S. federal, state, and local government, with support from the U.S. Telecommunications Industry Association (TIA). State government is represented by the National Association of State Telecommunications Directors (NASTD) and local government by APCO. The standards process is called “APCO Project 25” and the standards themselves are called “Project 25.” Of the three groups of users, APCO (i.e., local government) members are the largest group of users of Land Mobile Radios (LMR).

The primary objectives of the APCO Project 25 (P25) standards process are to provide digital, narrowband radios with the best performance possible, to meet all public safety user needs, and to permit maximum interoperability. Secondary objectives include obtaining maximum radio spectrum efficiency, ensuring competition throughout the life of systems, and ensuring that equipment is user-friendly. During the process, the needs of the user have been put first. Performance and meeting user needs were always placed higher in priority than spectrum efficiency or reducing technical complexity.

The Project 25 documents were developed by TIA, based on user needs, and then approved by the APCO Project 25 Steering Committee (representing federal, state, and local governments) before being published as TIA documents.

Project 25 Phase I (12.5 kHz bandwidth) is essentially complete, 30 of the 32 Phase I Project 25 documents have been published by TIA, containing more than 1,800 pages of technical information. The two remaining documents are on inter-sub-system interface conformance and network management conformance. These documents are expected to be published shortly.

The basic characteristics of Project 25 radios are these:

- a Phase I emission designator 8K10F1E (C4FM [compatible four-level frequency modulation]) for operation in a 12.5 kHz channel and a Phase II emission designator of 5K76G1E (CQPSK [compatible quadrature phase shift keying]) for operation in a 6.25 kHz channel.
- use of a common receiver for both C4FM and CQPSK to ensure full interoperability between the two signals.
- encryption defined for the U.S. Data Encryption Standard (DES) algorithms, but other techniques can also be employed.
- use of an IMBE (improved multiband excitation) vocoder with 4400 bits/s of digitized voice, 2800 bits/s of error correction on the voice, and 2400 bits/s of signaling overhead, for an aggregate bit rate of 9600 bits/s.

**Project 25 Migration Strategy and Phase II Plans** Project 25 has a well-planned migration strategy, both in the forward and backward direction. It was assumed in the basic planning that (1) no virgin spectrum was available and (2) users would need to effect a gradual phase-in and phase-out of equipment.

For the transition from 25-kHz to 12.5-kHz digital, all Project 25 Phase I radios will be capable

of both 25 kHz analog FM and 12.5-kHz digital C4FM operation. Radios can thus be procured gradually, and channels or talk-groups converted to P25 operation whenever all the radios on them are P25

The primary track of Project 25 Phase II has been announced to be 6.25-kHz CQPSK. The only difference between Phase I C4FM and Phase II CQPSK is the modulation method in the radio transmitter. A smooth transition is possible since Phase I radios can be gradually replaced by Phase II radios. The Project 25 Steering Committee is currently receiving proposals for a secondary TDMA [Time Division Multiple Access] track for Phase II. Here are two requirements for such.

A TDMA radio:

- to have a Phase I mode of operation (non-trunked minimum), for operation with other P25 radios.
- to be able to patch digital audio (i.e., have a common vocoder) and signaling information to/from other P25 radios.

Other Standards Planned for Project 25 Phase II the U.S. Telecommunications Industry Association is pursuing standards for more than a basic radio air interface as a part of the APCO Project 25 Phase II standards process. One of these efforts is to develop a standard interface to consoles.

Another standard that TIA plans to develop as a part of Project 25 Phase II is a standard interface between repeaters and other subsystems (e.g., trunking system controller). This will allow users to purchase equipment from multiple manufacturers for a single site, rather than being locked into the offerings of any one company.

Users should consider their individual situation in making procurement decisions. Overall, the users in the United States have concluded that FDMA is the preferred solution for the vast majority of their needs.

Project 25 standards were designed primarily for the public safety user, with range and performance given high priority. Also, unique flexibility has been designed into the standards to enhance interoperability, privacy, gradual phase-in of new technologies, and the reliable

transmission of voice and data. Several other of the seven techniques provide greater spectrum efficiency, and several are less complex (with potentially lower costs). However, the Project 25 Steering Committee believes none of the others provides greater performance, at greater range, or has more public safety-oriented features.

REF: A complete copy of the Standards described in this document may be obtained from the MN/DOT-OEC library. Contact the Office of Electronic Communications at (651) 296-7421 for further information.

## **LICENSING EXCESS TOWER SPACE**

Minnesota Statute 174.70 Subdivision 2 empowers the Department of Transportation to enter into agreements to permit privately owned communications equipment on Mn/DOT owned communications towers. The following process has been created to enable the Lease of excess space.

## **PROCESS**

Following is the process that is followed to lease space on Mn/DOT towers to commercial wireless providers or other eligible private companies. At the recommendation of the Dept. of Administration, Real Estate Management Div. it was agreed upon that Mn/DOT will enter into License Agreements, rather than a Lease. This process is not necessary when dealing with local units of government, or federal government requests.

STEP 1 – The Department of Administration (DOA) publishes annual notice to potential lessees.

STEP 2 – Mn/DOT, Office of Electronic Communications will review each requests to License space on Mn/DOT towers. Criteria for selecting who will be granted a License are described below. Requests must be submitted to DOA in writing.

Criteria:

1. Licensing will be done on a first come, first served basis. The date of receipt at DOA will establish the receipt date. If more than one request is received on the same day, then the time indicated on the postmark will be the next criteria for establishing the date of receipt.
2. Technical compatibility of the requested system with existing or planned systems at the tower site.
3. Agreement by requesting company to accept published fee and all other terms of the License Agreement

Written request must include as a minimum, the following data:

- a. A statement indicating the desire to install antennas, and house equipment, or construct a shelter (platform) at a MnDOT tower.
- b. The request should include a site plan that describes the specific number, size, make and model of the antenna(s), the desired height and azimuth on the tower, type of coax cable, shelter, power, and other utility arrangements.

STEP 3 - Mn/DOT's Office of Electronic Communications will request an intermodulation (intermod) study from the commercial carrier. The intermod study will consider all existing and planned frequencies for the site, against the frequencies proposed to be used at the site by the carrier. This study must be submitted in a format that can be easily reviewed by the OEC engineering staff.

STEP 4 - If the intermod study is deemed satisfactory by the OEC engineering staff, then the requesting commercial carrier must submit a structural analysis of the MnDOT tower. The analysis must be completed and certified by a licensed engineering firm qualified to do structural analysis in the State of Minnesota. This report must be in a format that is easily read and interpreted by engineering staff.

STEP 5 – If the structural analysis is favorable, then the process to develop the License Agreement will begin.

- a. If the structural analysis is not favorable, then a letter will be sent to the requesting carrier informing them that they cannot install their equipment as proposed. They would have the option to modify their request, or withdraw.
- b. If withdrawn, the state would consider the next request as determined in STEP 2, and begin the process over again.

#### STEP 6 – Draft License Agreement Terms

- a. License term for a five-year period, with the option to renew for three (3) additional five-year periods.
- b. Fees – As published annually. Once an Agreement has been signed then the rate in effect at that time will remain for the entire License Term.

#### STEP 7 – Execute License documents as prescribed by policy/law.

### **REVENUE ISSUES**

The revenue received as a result of Licensing Mn/DOT towers will be used to operate and maintain the communications systems of the State of Minnesota. This includes but is not limited to:

- Mn/DOT, State Patrol, and DNR two-way radio system equipment.
- Tower maintenance (reinforcement, painting, lighting, and new construction)
- ITS wireless applications (road signs, cameras, sensors, R/WIS etc.)
- Microwave system

Ref: A complete copy of the Policy and Licensing Package described in this document may be obtained from the MN/DOT-OEC library. Contact the Office of Electronic Communications at (651) 296-7421 for further information.



## **NON-STATE AGENCY USE OF RADIO SYSTEM**

This discussion pertains specifically to Public Safety Agencies. Public Safety for the purpose of this plan is defined as: Law Enforcement, Fire, Emergency Medical Services, Highway Dept's. Public Works, Forestry Conservation, School Districts, and any other service provided for and funded by government agencies. Herein after referred to as: "local(s)", "local government" or "public safety agency".

As noted previously in this Plan, the Radio System will be planned and implemented to meet the needs of the State. However, attempts will be made to adjust the system design to meet local needs where and when feasible. This may involve moving a planned tower to an area that will meet local coverage needs while still meeting the needs of the state. However, it must be noted that this must be done at no additional cost to the state. If the local government needs exceed or expand the system beyond that needed by the state, then that portion of the system will be the fiscal responsibility of the locals. As a minimum this plan recommends the following:

- The expanded local portion of the system must meet the Network and Operational Standards as stated in this plan. This will ensure compatibility to the statewide system.

There may be times when the state system as planned and implemented may meet the local needs. As a minimum this plan recommends the following when and where this occurs:

- A policy be developed that prescribes the manner in which local units of government will be allowed access to use the system.

## **EXCESS CAPACITY OF RADIO SYSTEM**

This discussion pertains specifically to Public Safety Agencies. Public Safety for the purpose of this plan is defined as: Law Enforcement, Fire, Emergency Medical Services, Highway Dept's. Public Works, Forestry Conservation, School Districts, and any other service provided for and funded by government agencies. Herein after referred to as: "local(s)", "local government" or "public safety agency".

As noted previously in this Plan, the Radio System will be planned and implemented to meet the needs of the State. However, attempts will be made to design the system to meet local needs where and when feasible. This may involve moving a planned tower to an area that will meet local coverage needs while still meeting the needs of the state. However, it must be noted that this must be done at no additional cost to the state. If the local government needs exceed or expand the system beyond that needed by the state, then that portion of the system will be the fiscal responsibility of the locals. As a minimum this plan recommends the following:

- the expanded local portion of the system must still meet the Network and Operational Standards as stated in this plan. This will ensure compatibility to the statewide system.

There may be times when the state system as planned and implemented may meet the local needs. As a minimum this plan recommends the following when and where this occurs:

- a policy be developed that prescribes the manner in which local units of government will be allowed to use the excess capacity of the system.

## LOCAL INVOLVEMENT

Early on in the Planning Process for each phase as described in Section I, local government agencies will be involved in the planning process through information exchange meetings. These meetings will assist planners in determining where local resources can be used in the system. It will also identify local agency radio requirements that may be resolved by the proper placement of the state infrastructure. The infrastructure of the statewide system will be available to local government agencies that chose to use the system. Locals may accept the system performance as provided by the state, or add enhancements to the system to meet their specific needs. This plan recommends the following:

- Local use should be on a voluntary basis.
- Enhancements will be the fiscal responsibility of the affected local unit of government.
- Locals will be responsible for purchasing and maintaining their subscriber units (mobiles and portables).
- Locals using the system will pay an annual subscriber fee. The fee will be based on the previous year cost to maintain the system. The total number of mobiles and portables on the statewide system would then divide this cost. Each agency would then be charged this amount based on the number of mobile and portable radios used by that agency.

Other tasks of the Planning Team working with locals:

- Explain project goals and benefits of system to local representatives
- Determine local interest in system participation
- Review Plan to determine if local needs can be met, and or what changes could be made to meet local needs while still satisfying state needs at no additional expense.
- Inform local representatives of how state will proceed and how the plan may or may not fulfill local requirements.

## TYPICAL PROCESS WITH LOCAL ENTITIES

- State Engineers target area
- State arrange meeting with local officials of targeted area(s)
  - Meeting
    - Discuss local communication status
    - Discuss what state is proposing
    - Look for common areas
- State engineers develop detail design for targeted area
  - Meeting
    - Present plan to locals
    - Adjust plan if necessary
    - Work out details of shared resources (if any)

- State begins process to acquire land (if necessary)
- Modifications to existing facilities if necessary
  - Work with locals if involves their facility
- State Bid letting for tower(s) shelter(s) etc
- Site construction
  - Meet with locals to keep informed of progress
- Specifications for radio equipment developed
- Bid letting
- Negotiate contract
- Award contract
- Negotiate Service Agreements with Locals for use of system
  - What system will do for locals State responsibilities
  - Local responsibilities
  - Rates
  - Maintenance
  - Training
  - Administration

## **SECTION IV**

### **EXHIBITS – DOWNLOAD SEPARATELY**

Exhibit 1..2001 Report to the Legislature

Exhibit 2..Tower Locations, Microwave Paths & Implementations Phases

Exhibit 3..Time Line

Exhibit 4..Land/Tower/Shelter/Generator Costs

Exhibit 5..800 MHz & Microwave Component Costs

Exhibit 6..Summary of all Fixed Component Costs

Exhibit 7..Frequency Assignments

# **Exhibit 1**

## **800 MHz Executive Team Report to the 2001 Minnesota Legislature**

**800 MHz Statewide Shared Public Safety Radio System  
February 1, 2001**

**Commissioners:**

David Fisher, Department of Administration  
Elwyn Tinklenberg, Department of Transportation  
Charles Weaver, Department of Public Safety

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Owatonna/Steele County Pearl Street  
Communications  
St. Louis County Communications  
Moorhead/Clay County Communications

## Table of Contents

<b>800 MHz Statewide Shared Radio System Initiative . . . . .</b>	<b>5</b>
<b>Major Survey Findings . . . . .</b>	<b>6</b>
<b>Recommendations . . . . .</b>	<b>11</b>
<b>Summary . . . . .</b>	<b>20</b>
<b>800 MHz Digital Trunked Radio System Benefits . . . . .</b>	<b>21</b>
<b>Approaches to a Statewide Radio System . . . . .</b>	<b>22</b>
<b>System Costs . . . . .</b>	<b>25</b>
<b>Unified Approaches to a Statewide Radio System . . . . .</b>	<b>25</b>
<b>Glossary of Terms . . . . .</b>	<b>28</b>
<b>Appendix “A” Statewide Radio Communications Survey Results and Respondents’ Comments (September, 2000) . . . . .</b>	<b>30</b>
<b>Appendix “B” Statewide Public Safety Radio Communications Initiatives in Other States . . . . .</b>	<b>54</b>
<b>Appendix “C” 800 MHz Executive Team Methodology . . . . .</b>	<b>57</b>
<b>Appendix “D” Local Input to Draft Report . . . . .</b>	<b>58</b>

## Figures and Table

<b>Figure 1 . . . . .</b>	<b>6</b>
<b>Figure 2 . . . . .</b>	<b>6</b>
<b>Figure 3 . . . . .</b>	<b>6</b>
<b>Figure 4 . . . . .</b>	<b>7</b>
<b>Figure 5 . . . . .</b>	<b>9</b>
<b>Figure 6 . . . . .</b>	<b>26</b>
<b>Table 1 Cost Projections if Agencies Upgrade Alone . . . . .</b>	<b>26</b>

February 2001

Pursuant to 2000 Minnesota Session Laws chapter 475, Section 15, I am pleased to submit the planning committee report of the 800 Megahertz (MHz) statewide shared public safety radio system. The planning committee, also referred to as the 800 MHz Executive Team (E-Team), is comprised of individuals designated by the commissioners of Administration, Public Safety and Transportation, but also includes representatives from other agencies, including the Departments of Natural Resources and Corrections, the Minnesota State Patrol, the Metropolitan Radio Board and the Association of Minnesota Counties.

Over the past eight months, the E-Team developed a survey with input from local users, officials and radio system managers to determine the common issues facing public safety radio users. This survey was distributed to radio users in over 800 cities and 80 counties. The survey results assisted the E-Team in determining the current status and needs of public safety radio users, and is the basis of this report and recommendations.

In addition, this report, in draft form, was distributed and discussed among local users in ten community meetings across the state. Nearly 100 individuals attended the meetings. Individuals included representatives from police and fire departments, sheriff's offices, State Patrol, highway and transit departments, emergency management divisions, utilities divisions, city and county administrators and state agency representatives. The feedback received from these meetings, as well as other comments received after the report was more widely distributed by those in attendance, has been incorporated into this report. Comments include views expressed by over 50 local agencies and 37 communities throughout the state.

E-Team recommendations recognize the benefits of a shared statewide radio system, as well as training and transmission standards required should the 800 MHz radio project advance. In addition, the report outlines options for governance structure and funding, but does not include recommendations in these areas until further research is conducted and local input can be incorporated.

The Ventura Administration is not requesting funds in the FY 2002-03 budget to implement a statewide 800 MHz radio system. Instead, state agency and local government representatives should work together over the next two years to explore options for a statewide system that addresses the needs of users outside the seven county metropolitan area. This work includes performing additional design and cost analysis of system options, exploring and refining alternatives for shared financing of a statewide system and establishing a framework for governance that responds to local concerns outside the Metropolitan area as well as within it. The active cooperation of radio system users at all levels of government will be necessary if this project is to go forward.

The goal of the Department of Administration is to assure that any investment in technology such as the public safety radio system adds value to the state and its users. I look forward to your own comments regarding this project.

Sincerely,

A handwritten signature in dark ink, appearing to read "David Fisher", with a stylized, flowing script.

David Fisher  
Commissioner  
Department of Administration



**Chapter No. 475**

**H.F. No. 2891**

- 17.35 Sec. 15. [PUBLIC SAFETY RADIO SYSTEM STUDY.]
- 17.36 Subdivision 1. [PLANNING COMMITTEE.] The commissioners of
- 18.1 administration, transportation, and public safety shall convene
- 18.2 a planning committee to report to the Legislature on a plan for
- 18.3 development of an 800 megahertz statewide shared public safety
- 18.4 radio system. The planning committee must provide a means for
- 18.5 inclusion of input from representatives of local governments and
- 18.6 major system user groups.
- 18.7 Subd. 2. [REPORT CONTENTS.] The committee shall review:
- 18.8 (1) current and future needs and capacities of radio
- 18.9 systems in outstate areas;
- 18.10 (2) the potential for implementation of a multi-agency and
- 18.11 multijurisdictional shared radio system;
- 18.12 (3) potential guidelines for governance and system
- 18.13 participation by state and local units of government; and
- 18.14 (4) statutory changes required to implement a statewide 800
- 18.15 megahertz shared public safety radio system.
- 18.16 Subd. 3. [REVIEW CONSIDERATIONS.] In performing the duties
- 18.17 under this section, the planning committee may consider:
- 18.18 (1) assessment of current uses, needs, and capacities,
- 18.19 including growth and expansion capacities, by each local
- 18.20 government and by each major user group;
- 18.21 (2) estimates of future needs by each local government and
- 18.22 by each major user group;
- 18.23 (3) estimates by each local government and by each major
- 18.24 user group of the anticipated level and timeline for utilizing
- 18.25 the radio system;
- 18.26 (4) analysis of the expected costs of implementing the
- 18.27 radio system; and
- 18.28 (5) proposed funding mechanisms, including options for
- 18.29 allocating costs among local governments and user groups.
- 18.30 Subd. 4. [PUBLIC MEETINGS.] After completing its duties
- 18.31 under subdivisions 2 and 3, the planning committee shall prepare
- 18.32 a draft report to local governments and major user groups in all
- 18.33 outstate areas. The draft report must also be made available to
- 18.34 the public. After preparing and disseminating the draft report
- 18.35 and before presenting the final report to the Legislature, the
- 18.36 planning committee shall meet with representatives of local
- 19.1 governments and user groups in each department of public safety
- 19.2 radio communication district to explain the report and seek
- 19.3 comment.
- 19.4 Subd. 5. [REPORT.] By February 1, 2001, the commissioner
- 19.5 of administration shall report to the Legislature on the
- 19.6 findings and recommendations of the planning committee. The
- 19.7 report must also identify any changes in statutory authority and
- 19.8 funding options necessary to provide for implementation of the
- 19.9 statewide, 800 megahertz, shared, public safety radio system.
- 19.10 Sec. 16. [EFFECTIVE DATE.]
- 19.11 Sections 2 to 11 and 13 to 15 are effective the day
- 19.12 following final enactment.

## 800 MHz Statewide Shared Radio System Initiative

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### Origins of the Initiative

In the early 1990s, cities, counties and state agencies (primarily in the Twin City Metro area) experienced rapid growth in radio communications. The increased radio traffic on the public safety systems in the Metro created a severe interference problem among existing users. All FCC radio frequencies within the Metro area were in use, which limited system expansion and, in some cases, prohibited growth of radio systems. Interoperability among public safety agencies was hampered and cumbersome. The 1996 Minnesota Legislature funded the construction of a Metro-wide 800 MHz regional backbone system (Chapter 463, Sec.19, Subd. 3) to meet the demands of the Metro area, and provide capacity for local subsystems to join the network. The implementation of this system is in progress and will be operational in 2002. The problems in Metro are not unique to the area. Outstate public safety communications systems are facing many of the same problems that Metro faced ten years ago. For that reason, the 2000 Legislature directed the commissioners of the departments of Administration, Transportation and Public Safety to convene a planning committee to report to the Legislature on a plan for the development of a statewide, shared public safety radio system. The legislation further directed the planning committee to develop a means to include input from representatives of local governments and major system user groups. As a result of the legislative directive, an 800 MHz Executive Team was formed to study and assess the current and future wireless communication requirements, needs and concerns of the local units of government and major system user groups such as the state of Minnesota, the Emergency Medical Services (EMS) community and school districts.

### Local Involvement in Developing Report

From the beginning, the 800 MHz E-Team recognized that implementing a statewide radio system would require a collaborative approach because of the common issues and overall benefits for all public safety radio users. Members from the 800 MHz E-Team conducted briefings with radio system managers, users and local officials around the state to communicate the technical and regulatory issues that are facing wireless users in each region. In order to determine the current status and needs of public safety wireless communication users throughout Minnesota, the 800 MHz E-Team developed a communications survey. To ensure that the survey was understandable and contained the appropriate questions, members from the E-Team conducted several focus group meetings with public safety officials in selected communities to identify issues and refine survey questions. The survey was then mailed to all cities, counties and other major wireless user groups (excluding the Metro area). The responses to the survey helped determine the level of need for improved communications and also helped develop recommendations for this project.

A draft report was developed by the 800 MHz E-Team and then distributed to local governments throughout Minnesota. Ten (10) regional meetings were held throughout Minnesota. With the assistance of organizations such as the Association of Minnesota Counties, League of Minnesota Cities, Minnesota Sheriff's Association, Association of Minnesota Chiefs of Police and the Association of Minnesota Fire Chiefs, the 800 MHz E-Team sent invitations to county and city

administrators requesting their agency's and department's participation at the nearest regional meeting to review and discuss the draft report to the Legislature. The comments received as a result of the regional meetings are reflected in Appendix D of this report. In addition, the report is posted on the Office of Electronic Communications Web page at: [www.dot.state.mn.us/oec/os800Report.html](http://www.dot.state.mn.us/oec/os800Report.html).

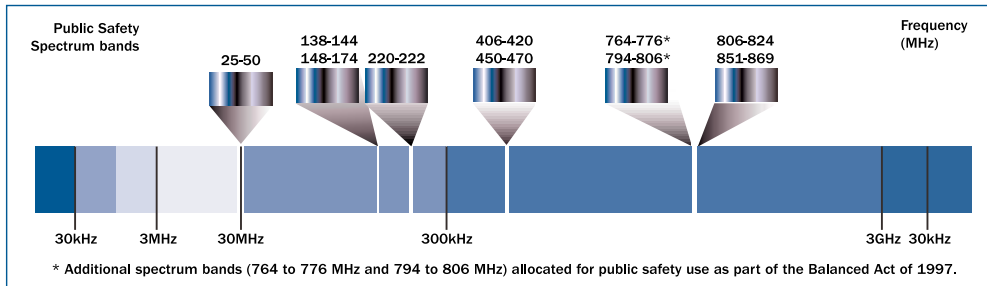
## Major Survey Findings

### 1 Spectrum Issues

The VHF and UHF radio frequency bands are heavily used by public safety agencies throughout

Minnesota. This congestion makes using these bands for today's radio systems very difficult. Expansion of these systems, while maintaining a relatively clear channel, is nearly impossible. Not only do co-channel assignments cause interference, adjacent channel assignments also cause harmful interference to existing users.

#### Public Safety Spectrum Bands



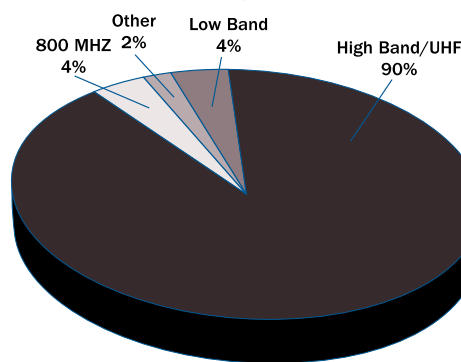
"On a daily basis too many agencies using one frequency. During any multi-agency response radio system almost becomes useless."

– Fire Department –

"When Fire, EMS, Sheriff's and Police cars are involved in a major incident or if separate incidents occur at the same time we only have one frequency that we all can communicate on (sheriff's frequency). Individuals begin to interfere with each other as well as the dispatch. The adjustment (if you want to call it that) is to use different frequencies that are unique to Fire and EMS. This eliminates dispatch and law enforcement cars being able to communicate with them." – Sheriff –

**Figure 1** ☉ Nearly 90% of all respondents to the survey indicated that they operate on either the VHF or UHF frequencies. Comment: *This finding lends support to the argument that VHF/UHF frequency bands are saturated with users, thus limiting system expansion for many agencies and departments.*

#### Frequency Usage by Bands

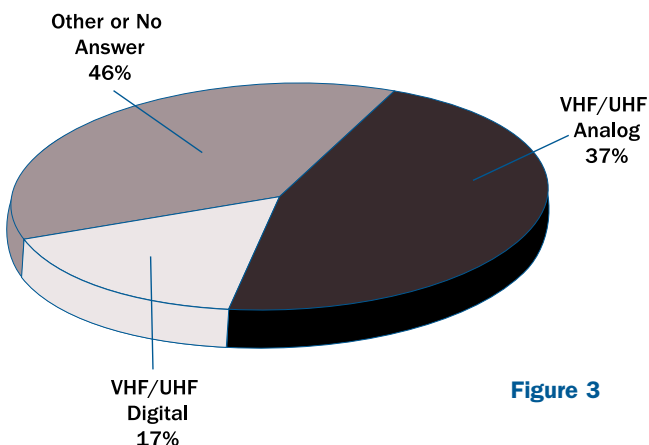


☉ Almost half of the respondents indicated that the lack of sufficient VHF/UHF radio channels was a problem.

☉ At least 77% of those questioned share their radio frequencies with other departments or agencies to obtain the necessary level of interoperability. Sharing also occurs as a result of partnerships in order to save money.

**Figure 2**

#### Percent of Agencies with Plans to Upgrade Current Systems



**Figure 3**

☉ Nearly 30% indicated that they are planning to upgrade their radio systems within the next six years.

☉ Thirty-seven percent of the agencies that plan to upgrade plan to stay within the VHF/UHF frequency band. Of those who plan to upgrade, 46% do not know which frequency band they should use for their next system. Comment: *Based on survey responses, it appears that a lack of knowledge of technological advances in radio, a lack of funding and the need to remain compatible with agencies in surrounding communities are key*

factors for community radio systems to remain in the congested VHF/UHF frequency bands.

- ☉ The conversion from the heavily used VHF/UHF radio spectrum seems more prevalent in larger departments and coincides with a growing national trend. Individual states and larger communities realize that there are not enough frequencies in these bands to accommodate their growing needs. (Source: U.S. Department of Justice, National Institute of Justice Report "State and Local Law Enforcement Wireless Communications and Interoperability: A Quantitative Analysis".
- ☉ Nearly 50% of survey respondents indicated that frequency congestion is now occurring within their area of operation in rural Minnesota.

## 2 Technology Issues

New technological advances in radio will help resolve the frequency congestion problems noted above. However, the vast majority of public safety radio systems used in Minnesota today are the old analog wide-band technology and not the new digital narrowband technology. Although the migration from analog to digital has been underway for nearly four years, few departments outside of the Metro area have migrated to the new digital narrowband technology.

- ☉ The average age of radio system infrastructure (when the system was designed and first installed) in Greater Minnesota is 18.1 years. Systems range from 1 to 50 years old. The actual equipment (mobiles, portables and base stations) used on those systems also vary over a wide range from 1 to 45 years old, with the average age of 15.4 years.
- ☉ Nearly 55% of those responding to the survey indicated that outdated equipment was a problem for their operations. Another 40% indicated that they did not have enough equipment to adequately outfit employees in their department or agency. Comment: *The survey responses suggest that outdated or insufficient equipment is a contributing factor to the declining performance of radio systems in Greater Minnesota. Many agencies in Minnesota cannot integrate the new digital technology available in radio systems today into their existing infrastructure. This is due mainly to the fact that a majority of the systems use wideband analog technology and the two technologies are not compatible.*
- ☉ Sixty-three percent indicated that their radio systems have dead spots within their jurisdictions. Another 60% said that their systems had inadequate range, 53% stated that frequency interference was a major problem to their systems and atmospheric skip caused problems to over half of those who responded to the survey question. Comment: *These findings suggest that technical problems plague a majority of the systems in operation today.*

“Our system’s city channel is shared by utilities, public works, police and fire departments. During emergencies communicating is difficult to impossible we all need to support separate channel use.” – Utility Department –

“There is a lack of technology in greater Minnesota. State and federal agencies have different radio frequencies than local agencies.” – Sheriff –

“On a rescue call and a house fire that were both about 4 miles from town we could not communicate with our base station or our trucks.” – Fire Department –

Problems with Existing Radio Systems

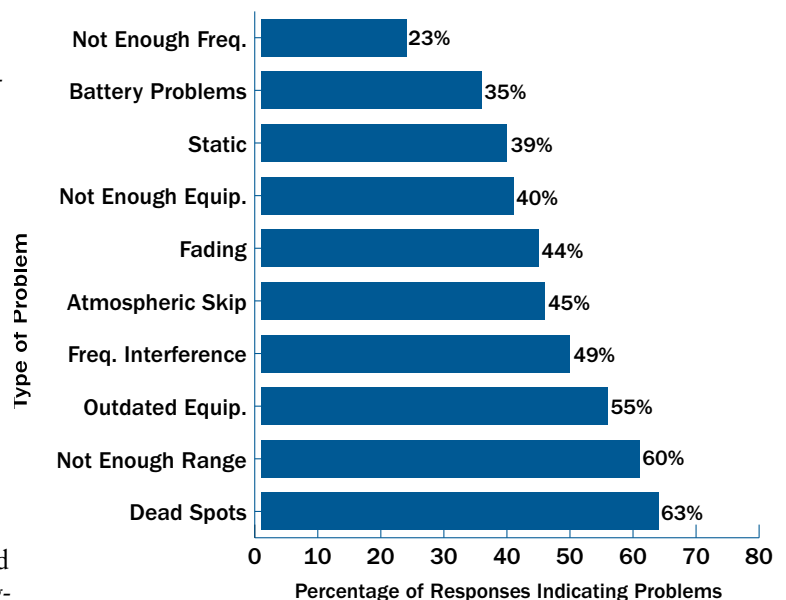


Figure 4

### 3 Regulatory and Standards Issues (FCC and Industry)

Rapidly advancing technology in radio communications systems, coupled with the introduction of several competing and non-compatible digital standards, has made it difficult for radio-systems managers to navigate through the maze of options available for modifying or replacing their present systems. To keep pace with the technological advances, the Federal Communications Commission made rule changes to deal with these new technologies. Most significant of these changes is FCC Docket 92-235, also known as the "Refarming Docket." This docket was adopted to create additional spectrum through the use of a technology called "narrowband" (see glossary). Other regulations that are influencing public safety radio communications systems are restrictions on system antenna heights and limits on transmitter power.

The Refarming Docket has been successful in creating the new frequencies. However, in order to use the new frequencies, radio users must purchase radio equipment that uses the new narrowband technology. The FCC did not set mandatory dates for radio users to change-out or replace older, existing radio equipment. In fact, the existing equipment can be used indefinitely. However, older equipment is not capable of operating on the new frequencies. Also, the Refarming Docket includes a second equipment migration that will open the door to even more radio frequencies in 2005. However, this migration will require manufacturers to develop radios that use another new technology called "digital" (see glossary).

In response to the requirement for a digital product, a national effort was undertaken to define a digital industry standard that the marketplace would embrace. Communications officials and organizations from across the country have defined a standard known as Project 25. There are five objectives of the Project 25 standard: a) Frequency efficiency using narrowband channels b) Interoperability among agencies and different levels of government c) Backward compatibility d) Graceful system migration (forward and backward) and e) Scaleable trunked and conventional capabilities.

In spite of the FCC's efforts at "refarming," it has made little impact on the radio frequency shortage problem that exists not only in Minnesota, but nationwide. Why? For whatever reason, radio users have been reluctant to migrate to the new narrowband technology required to use the new frequencies, opting to stay with their existing crowded analog systems. Another contributing factor is the uncertainty among manufacturers about specific technical details of the Project 25 standard. This has delayed the certification by the American National Standards Institute (ANSI) and thus slowed the introduction of affordable digital equipment. Another factor that may be affecting the migration to the new technology is the lack of knowledge or understanding of these issues. Many managers may not be sure how these changes will affect their departments; nor do they understand how these new technologies and standards will benefit them.

So, what is the impact of these two issues? Some users may choose to stay with their existing equipment indefinitely. However, manufacturers now have a standard to follow and are manufacturing narrowband digital equipment. Since the current allotments of existing frequencies are used up, the manufacturers see little economic value in continuing

"It should be mandatory for all agencies in Public Service to have the same emergency statewide channel to operate on in a large emergency." – Sheriff –

to manufacture the older equipment. Users will eventually have problems finding equipment compatible to their older technology radios. Parts to repair their equipment will become harder and harder to find. Interoperability will be harder to accomplish, if not impossible, with the various non-compatible technologies in use.

☞ Findings show that nearly 90% of the respondents were either not familiar, or had little familiarity, with industry standards such as Project 25 and TERrestrial Trunked RAdio (TETRA). Predictably, 90% also indicated that industry standards were of little importance to their agencies. Of the respondents who indicated that industry standards were very important to their systems, all were very familiar with the industry standards issues. Comment: *The findings suggest that there is a direct correlation between knowledge of standards and the importance of standards to their systems.*

☞ The majority of individuals (75% of those polled) responsible for making decisions related to the operation, maintenance and upgrading of their agency radio system are not familiar with industry standards and their relationship to their current and future radio systems.

☞ Only half of the individuals who are responsible for daily management of their radio system have any involvement in the decision-making process for that system.

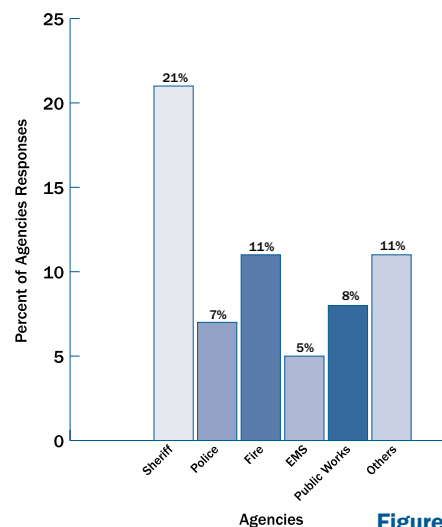
☞ Only 27% of the agencies with plans to upgrade their radio systems within the next six years plan to implement systems using the newer digital technology.

☞ Over half of the agencies that plan to upgrade their systems did not know if they would adopt Project 25 or TETRA standards in their next radio system.

☞ Almost 90% of respondents indicated that interoperability was an important or extremely important feature for their next radio system. Comment: *System standards are significant for agencies trying to obtain interoperability.*

☞ The majority of respondents to the survey did not know what frequency band, or how many frequencies, they would need to implement or upgrade their system.

**Percent of Agencies Familiar with Standards**



**Figure 5**

“Use a frequency that is easy for all types of equipment to access and that is affordable for small community.” – City Administrator –

#### 4 Funding Issues

The vast majority of comments received from survey respondents indicated that funding is their biggest concern. Many survey respondents, especially from smaller agencies and/or departments, indicated in their comments that participating in a statewide, shared system was not feasible due to cost considerations.

☞ Only 57% of all respondents indicated they had a budget for their radio system. They ranged from \$25 to \$1.25 million. The median



range was approximately \$2,300. The average budget overall was approximately \$38,000. However, if the top 15 budgets for the larger state and county departments are removed, the average budget is cut in half, or \$16,000 per year.

- ☉ Larger government agencies (state, county and city) tend to have larger budgets, while smaller agencies have little or no budgets.
- ☉ A majority of those polled (70%) share radio systems with other governmental agencies. While at least 77% of those questioned share their radio frequencies with other departments or agencies.  
*Comment: This finding would appear to be significant as it indicates a willingness to share resources in order to save money already exists.*
- ☉ The primary concern of respondents was adequate funding for the statewide shared system. Many respondents stated that their communities are concerned that the state will mandate the system and require the local units of government to pay for a share of the infrastructure regardless of their participation in the system. Ongoing operational costs are also a concern of the local units of government, especially the smaller departments.

## 5 Governance Issues

At present, few formal linking mechanisms exist to encourage and support coordination and partnership between local jurisdictions and the state. Strengthening the partnership between state and local units of government will require a comprehensive strategy. There is no simple solution to address the full range of obstacles.

- ☉ A large majority (71%) of respondents to the survey stated that they would be willing to participate in a multi-agency, multi-jurisdictional shared radio system.
- ☉ The method of governance most preferred (51%) by those responding was state government with local governance representation by those agencies participating on the radio system within the same region. State governance, along with some fashion of local involvement, accounted for another 17%. While 32% of those responding indicated that this decision would have to be made at a higher level than the individual completing the survey. *Comment: Based on written comments, it was clear that outstate local units of government did not feel that they could get equal status and representation if there was Metro involvement in the governing structure within their region.*

## 6 Interoperability Issues

The ability to intercommunicate (interoperability) with other local and state agencies today is difficult and, in some cases, non-existent. The requirement for interoperability among multiple agencies and jurisdictions is a critical component of today's radio systems. With our fast pace and the need to exchange information among agencies and beyond jurisdictions, interoperability is a key piece in any communication system.

- ☉ A large majority (71%) of respondents to the survey stated that they would be willing to participate in a multi-agency, multi-jurisdictional

“Our concern is funding for small County and Local Agencies to acquire the new technology.” – Sheriff –

“If planning and implementation take place local entities not just metro entities must be involved.” – Sheriff –

shared radio system. Comment: *This demonstrates a need and the desire for interoperability.*

- ☉ Interoperability was important to 88% of those responding to the survey. Comment: *This is extremely significant.*
- ☉ In order to obtain some level of interoperability, nearly 70% of those surveyed indicated that they share their radio infrastructure with other public safety agencies.
- ☉ Nearly 80% of local units of government in Minnesota made it clear that interoperability was very important and some form of multi-jurisdictional interoperability would best meet their needs. Another 20% said that statewide interoperability is required. A small number of respondents felt that interstate communications was essential.
- ☉ The survey sought information on the amount and frequency of interoperability that now exists among local units of government and state and federal government agencies. It was found that nearly 71% of all respondents have communications on a daily basis with other local government agencies. Day-to-day communications between local jurisdictions and the state happens less frequently with 22% indicating that this is a need, while 44% indicated that they never talk to the state. A mere 2% indicated that they have a need to talk to the federal agencies on a daily basis and 80% said they never have a need to talk to these agencies.
- ☉ Nearly 80% indicated that they share their frequencies with other departments and agencies. Comment: *This finding suggests that agencies share frequencies in order to be able to intercommunicate with one another.*

“During St. Peter tornado, interoperability was a problem with locals. It was difficult to manage crisis. – State Agency –

“A major train derailment in Otter Tail County involved several departments not on our radio system.” – Sheriff –

## Recommendations

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### The State Should Take the Lead in Planning and Design

An 800 MHz digital trunked radio system is proposed to replace the current collection of stand-alone radio systems. The state should take the lead in the design, implementation and maintenance of an 800 MHz digital trunked radio system that will be available to all jurisdictions across the state. This system will serve as a key to ensuring that public safety entities across the state have an effective, reliable tool to perform their duties today and well into the 21st century.

### Why the State Should Take the Lead

The state should take the lead for this project because the three major state radio users (the Minnesota State Patrol, the Department of Natural Resources and the Department of Transportation) have the most significant need for statewide radio communications. In order to meet this requirement, the state will have to construct the infrastructure to provide the necessary services. The single infrastructure of the state could be capable of supporting all local government services as well as the state's. Designing and implementing a statewide system to meet both state and local needs will require close cooperation and coordination among local agencies responsible for wireless communications in their jurisdictions and the state (primarily Mn/DOT).

“Don't make mandates or Laws without making sure there are monies available for Local government agencies to use.”  
– Fire Department –



However, some local agencies, such as Rochester/Olmsted County, St. Cloud, Moorhead, Rice/Steele Counties, etc. have already begun the process of building partnerships with others and, in some cases, to coordinate and share systems or components of their systems. In order to achieve the vision of a shared statewide interoperable radio system, coordination will be required on a statewide basis, and the state of Minnesota is in the best position to oversee or lead this process.

The following recommendations are the first steps in facilitating the cooperation and coordination, and ultimately the construction and operation, of a shared, statewide radio system.

1. Based on the findings from our research, an incremental approach is recommended, beginning with efforts to achieve voluntary participation among governmental jurisdictions. Stronger intervention through legislative mandates to obtain participation is not recommended.
2. Education, training and technical support are essential first steps that may go a long way toward achieving the necessary level of cooperation and consistency among the jurisdictions on a voluntary basis.
3. Develop a governance system that will give local units of government in Greater Minnesota fair and equal representation. Establish regional planning committees of state, county and municipal officials to incorporate local needs and concerns into the initial planning of the system and the identification of necessary next steps.
4. Full statewide consistency among jurisdictions may not be achievable through education and voluntary cooperation alone. The Legislature should mandate adoption of industry standards for the radio system, and give the state technical oversight of local decisions impacting access to the system, the design of the system and the overall implementation of the system.
5. Cooperative cost participation guidelines and associated procedures for the proposed outstate 800 MHz trunked radio system will need to be developed. Costs associated with the project should be borne by the unit of government benefiting from the element of the project.

#### **Start with Standards, Preliminary Design and Education**

##### **1. Establish Radio System Standards as Guidelines**

To provide a common basis for decision-making by all jurisdictions, the state should establish the standards and recommended guidelines for components of the system. The state should consult with the affected local jurisdictions to communicate the fundamental benefits of the standards or guidelines to the overall system and users.

##### **2. State Develop Preliminary Design**

The state, in cooperation with local units of government, should appoint a committee of engineers, planners and others involved in communications for each of the yet-to-be-determined regions of the state. These committees are intended to ensure that all aspects of

the system design are considered and appropriate input from local jurisdictions is received.

### 3. Provide Education to Potential Users of System

The state should initiate an education program for state and local officials that will be affected by the implementation of the statewide radio system. The education effort should include, but not be limited to, the following: FCC rules and regulations, Industry Standards, public safety market, technology, partnership/governance.

### 4. Planning and Transition

Implementation of the new 800 MHz digital trunked radio system needs to be carefully planned for orderly growth. A complete network infrastructure including towers, base stations, controllers, switching equipment, microwave links and fiber optics (Connecting Minnesota) must be installed in order to provide a functioning system. The initial system technical design must take future growth into consideration to ensure that adequate facilities are implemented to accommodate future requirements. Therefore, a great deal of the planning effort will be directed toward the transition from the current radio system over to the new 800 MHz trunked system.

While it may appear to be financially desirable to extend the implementation of the entire system over a period of seven to 10 years, that may not be practical from a technical standpoint. Implementing portions of the 800 MHz system in limited areas around the state, while leaving other portions of the state still operating with the old VHF/UHF systems, could pose some challenging operational problems. Additionally, maintaining two distinct radio systems places a large technical and financial burden on state resources. Realizing that agencies will be at different stages of budgetary readiness for the transition to the new system presents additional difficulties.

Therefore, the 800 MHz E-Team recommends that the system should be implemented in phases over a five year period. This implementation plan will reduce the amount of time and money the state must invest in maintaining two radio systems. The system should first be installed in areas where there is already interest from the communities (Rochester/Olmsted County and St. Cloud).

“There should be uniform radio language protocol and protocol for radio procedures (operations).” – Ambulance –

“Smaller agencies lack the personnel with enough knowledge to properly operate radio systems and the money to properly maintain them.”  
– Public Works –

## Governance Alternatives

### Introduction

There are several options that could be considered for governance of a statewide public safety radio system. These include:

- ☞ Establishing a statewide board that would incorporate the functions of the existing Metropolitan Radio Board.
- ☞ Assigning the responsibility for either the non-Metropolitan area or the entire state to an existing state agency (e.g., the Department of Transportation, the Department of Public Safety or the Department of Administration).
- ☞ Establishing a separate board for the counties, cities and other local units of government outside of the Metro area.

## Alternative 1

### **Statewide Board**

A board could be created with responsibility for planning, technical oversight, coordination among users, financial administration and other functions. This organization could receive revenue, including legislative appropriations and authority to issue bonds, for construction of a statewide public safety radio system. Members would include representatives of the state agencies most affected – the Department of Transportation, the Department of Natural Resources, the Department of Public Safety and representatives of local governments. It could be given powers of a state agency, such as the power to enter into contracts, incur debt and the like. The board would employ an executive director and staff. Depending on the funding options chosen, the board could be the organization empowered to make grants and/or loans to local units of government for costs attributable to those organizations. The Metropolitan Radio Board would be abolished and the newly created statewide board would assume all of its responsibilities. The Metropolitan area could be represented by an organization of its own choosing, or Metropolitan counties and cities could determine how they would be represented in the same manner as outstate local units of government determined their representation.

#### **Advantages:**

1. This could provide a single statewide focal point for leadership and coordination of this program.
2. Broad representation and participation in decision making could occur through membership on the board by representatives from a variety of organizations.
3. Decisions would have greater local involvement, resulting from participation by persons who may better understand local needs and concerns.

#### **Disadvantages:**

1. The new board could be so large that it would be hard to make decisions by consensus.
2. There could be some difficult transitional problems associated with abolition of the Metropolitan Radio Board (note that the Board is scheduled to sunset on July 1, 2002).

## Alternative 2

### **State Agency Leadership**

Under this alternative, the overall planning, technical oversight and related functions could be assigned to a state agency – e.g., the Department of Transportation, the Department of Public Safety or the Department of Administration. This agency could establish various advisory and planning committees to assure participation by local government and other affected interest groups.

#### **Advantages:**

1. The responsibility for the development and leadership for the 800 MHz system would be clearly defined so that accountability is clear.
2. Legislative appropriations could be directed to the chosen state agency, whose commissioner would report directly to the governor.
3. Relying on an existing state agency could reduce the start-up difficulties and the need to establish basic administrative processes (e.g.,

accounting and human resource functions).

**Disadvantage:**

1. There may be a perception that a board directed by a state agency in St. Paul would be less receptive to addressing the concerns of local governments, particularly those outside of the Metropolitan area.

**Alternative 3**

**Separate Board for Non-Metropolitan Counties**

This option is similar to Alternative 1, except that the Metropolitan Radio Board would continue to handle its existing responsibilities for the seven county Metropolitan area. A separate board could be created with responsibility for planning, technical oversight, coordination among users, financial administration and other functions. This organization could receive revenue, including legislative appropriations and authority to issue bonds for construction of a statewide public safety radio system. Members would include representatives of the state agencies most affected – the Department of Transportation, the Department of Natural Resources, the Department of Public Safety and representatives of local governments. It could be given powers of a state agency, such as the power to enter into contracts, incur debt and the like. The board could employ an executive director and staff. Depending on the funding options chosen, the board could be empowered to make grants and/or loans to local units of government for costs attributable to those organizations. Different areas of the state could form regional committees for consolidating planning and choosing representatives to serve on the non-Metro statewide board.

**Advantages:**

1. A separate organization representing the non-Metropolitan area could deal with the concerns of the rest of the state.
2. Broad representation and input to decision making would occur through membership on the board by representatives from a variety of organizations.
3. Decisions would have greater local involvement, providing for participation by representatives from outside the Metro area who may better understand local needs and concerns.

**Disadvantages:**

1. The greatest difficulty would be ensuring the compatibility and interoperability of public safety radio systems across the geographic boundary between the Metro and non-Metro systems. Having two separate systems would require careful timing of funding and extensive negotiation and coordination of infrastructure and equipment selection decisions.
2. The new board might be so large that it would be hard to make consensus decisions.
3. Since the Metropolitan Radio Board would continue to exist, the two separate boards would compete for available funding (the Metropolitan Radio Board is scheduled to sunset on July 1, 2002).

**Funding Alternatives**

**Introduction**

The discussion of funding options is divided into three parts:

- I. Initial infrastructure needs;

- II. Initial equipment needs; and
- III. Ongoing maintenance requirements.

Under each part, several possible funding alternatives are presented. There are probably other alternatives that could be developed.

## **I. Initial Infrastructure Needs**

This discussion assumes that state revenues will be used to pay for the initial capital infrastructure costs associated with a statewide public safety radio system, except for costs incurred specifically to meet needs that are unique to a local government (Final financing plans may make a different assumption). Infrastructure includes land, towers and shelters and will cost an estimated \$183 million over five years.

### **Alternative 1**

#### **General Obligation Bonds of the State of Minnesota**

The state could issue general obligation bonds (in most cases 20-year repayment scheduling) and use the bond proceeds to fund these capital costs. The bonds could be repaid with state general fund revenues. Proceeds from the sale of trunked highway bonds could be used to pay for infrastructure directly related to trunk highway system needs. The trunk highway bonds would be repaid with revenues from the trunk highway fund (e.g. gas tax revenues) or a combination of general obligation and trunk highway bonds could be used.

#### **Advantages:**

1. Bonds carry a known repayment schedule and provide predictable cash flow.
2. Bonds could provide an up-front commitment of funds for the entire project.
3. The money provided by the sale of bonds would reduce the need for cash general fund appropriations.

#### **Disadvantages:**

1. Interest on bonds adds to the cost of the project.
2. Bond proceeds can be used only to purchase capital assets, not consumable items such as equipment.
3. Because the Legislature has a policy that only 3% of state revenues may be used for debt service, the total amount of state general obligation bonds that may be authorized each biennium is limited, resulting in intense competition to have projects included in the state bonding bill.

### **Alternative 2**

#### **Direct Appropriation by the Legislature**

Direct appropriations from the state's general fund and/or trunk highway fund could be made to fund the infrastructure costs. Under this scenario, a state agency, such as Mn/DOT, Department of Administration or Public Safety, could receive and expend or distribute the funds so appropriated. Since appropriations are made on a two-year budget cycle, and expenditures for this project are planned over a five-year time period, it would be necessary to return to the Legislature for financial resources in future years.

#### Advantages:

1. Statewide needs could be met with state funds.
2. There would be no interest payments.
3. State funding would relieve local governments of the need to find money they will be unable to obtain individually.

#### Disadvantages:

1. Competition for state funding is intense and this project would compete with other important needs such as school aid, human services and tax reduction strategies.
2. Trunk highway funds could be used to fund only the parts of the infrastructure that served a trunk highway purpose.

### Alternative 3

#### Public Facilities Authority

The state Public Facilities Authority operates similar to a traditional banking institution in that it makes low-interest loans to public entities, principally local governments, to finance public works projects. This option would require some “seed money” to provide capital for initial loans. A specific governmental body could enter into a loan agreement and commit to repayment based on revenues at its disposal, which could include a dedicated revenue source such as 9-1-1 fees, future federal funds, property tax levies or user fees. This option would require amending Minnesota Statutes, chapter 446A to allow the PFA to make loans for costs or projects associated with the construction of the statewide public safety radio system.

#### Advantages:

1. Loans could be made for both capital and consumable equipment.
2. This would allow borrowers to avoid the competition for general obligation bonding authority.
3. The PFA offers lower interest rates to borrowers than state general obligation bonds.

#### Disadvantages:

1. This would require statutory amendments
2. Interest on the bonds would add to the total project cost.

### Alternative 4

#### Lease Agreements with Private Sector for Tower Capacity

With a change in state law, the state could lease its excess tower capacity and use those receipts to offset the trunk highway system costs of the public safety radio system.

#### Advantages:

1. This would provide a new, non-tax source of revenue.
2. There would be a direct relationship between this revenue and the public safety radio system.
3. Sharing tower space could potentially reduce the proliferation of towers.

#### Disadvantage:

The amount of revenue that could be derived from tower leases is unknown.

## **II. Initial Equipment Requirements**

This discussion assumes that a combination of state and local dollars, depending on ownership of the equipment, will be used to fund the initial equipment requirements. Equipment requirements are defined as antenna systems, repeaters, controllers, receivers, consoles, microwave dishes and radio units. The initial equipment costs for complete conversion are estimated to be \$36.5 million. State bond proceeds cannot be used for these costs, since the life cycle for this equipment is less than would qualify for state bonding.

### **Alternative 1**

#### **State General Fund Loan Account**

The Legislature could create and fund an account to provide loans, grants or both to state agencies and local governments to pay for equipment. Loan repayments would be deposited in the general fund as non-dedicated receipts (to avoid creating a revolving account). Direct appropriations could be made to fund this account.

#### **Advantages:**

1. This would provide up-front funding for local governments and allow them to spread repayment over a longer time period.
2. Grants to local governments would provide an incentive for them to participate in the statewide system.
3. Grants could be directed to local government entities with the greatest need.

#### **Disadvantages:**

1. Competition for state funds is intense.
2. Trunk highway funds could be used only for the part of the radio system that served the trunk highway system.

### **Alternative 2**

#### **Public Facilities Authority**

The PFA, as described above, could be used to fund the initial equipment requirements up to the expected lifetime of that equipment. The advantages and disadvantages are the same as described in that section.

### **Alternative 3**

#### **9-1-1 Fee**

Currently, a portion of the statewide 9-1-1 fee collected by the Department of Administration is made available to the Metropolitan Radio Board for 800MHz operations in the Metropolitan area. The Legislature could increase this fee to provide additional funds for the construction and operation of a statewide public safety radio system.

#### **Advantages:**

1. This would provide an ongoing and broad-based revenue source.
2. The cost to an individual telephone customer is small.

#### **Disadvantages:**

1. An increase in the 9-1-1 fee may be seen as an indirect tax increase.
2. The amount of funds that can be raised through an increase in the 9-1-1 fee may not be large enough to fund both debt service and on-going maintenance.

## Alternative 4

### **Special Taxes/Fees**

Any one or more of a variety of new fees, surcharges and/or special taxes could be used to generate revenue to purchase needed equipment. Approaches used by other states to fund 800MHz initiatives have included emergency room surcharges, ambulance surcharges, special excise tax on radio equipment and traffic violation surcharges. Any new special tax or fee would likely need to meet the test of a direct, or at least indirect, relationship between benefits received from the new system and payment of the tax, fee or surcharge. The Legislature could enact a new fee or surcharge or could authorize local governments to impose or raise fees or special taxes.

#### **Advantage:**

There is a strong relationship between the local benefits of the public safety radio system and fees to taxes imposed to construct and maintain it.

#### **Disadvantage:**

There may be resistance to the imposition of new taxes for fees at both state and local government levels.

## Alternative 5

### **Federal Grants**

There are a number of federal programs that provide grants to states, counties and cities for public safety purposes. The following list of federal programs is illustrative only:

COPS MORE

Edward Byrne Memorial State and Local Law Enforcement Assistance

Local Law Enforcement Block Grant

Rural Outreach Network Development Program

FEMA Grants

TOPS Grants

DOJ Assets Forfeitures Funds

#### **Advantage:**

Reduce the need for state or local financial resources.

#### **Disadvantages:**

1. This program would compete with other criminal justice and law enforcement programs for these funds.
2. It is unknown whether the public safety radio system would be eligible for the kinds of grants listed above.

## **III. Ongoing Maintenance Requirements**

This discussion assumes that local units of government will be responsible for the ongoing maintenance of the subscriber equipment.

Subscriber equipment refers to mobile and portable equipment and other components directly benefiting their jurisdiction. The state will be responsible for maintaining its subscriber and dispatch-related equipment. The following alternatives are methods that can be used to generate revenue to pay for the ongoing maintenance and upgrade of the infrastructure that is being used by all users of the system. This includes items such as infrastructure component repairs, software upgrades to the system controller(s), but does not include system



expansion for new transmitter locations.

### **Alternative 1**

#### **Annual Radio Fee for Users of the 800 MHz System**

If the state were responsible for maintaining the statewide public safety radio system (infrastructure), it could charge an annual radio user fee. The fee could be cost averaged based on the number of subscriber radios used on the entire statewide system by all agencies including the state.

#### **Advantages:**

1. An annual fee lowers the ongoing operational and maintenance costs for all users of the system. The more users, the lower the annual fee.
2. Since the annual fee is fairly constant (adjusted periodically based on the number of system users), entities can budget each year for the cost of operating on the radio system as opposed to incurring costs on a case-by-case basis.

#### **Disadvantage:**

1. Local governments would have to find a way to generate the revenue needed each year to pay the annual fee.

### **Alternative 2**

#### **General Local Revenues**

As stated above, it is assumed that a local unit of government would have responsibility for maintaining its radios and component equipment. This alternative discusses ways that local units of government could obtain revenue to pay for the annual fee as well as money to pay for the repair of their subscriber equipment. This alternative could involve direct payment of these expenses from a local revenue source. The predominant source of local revenue is property taxes.

### **Alternative 3**

#### **Subscription Charges**

This option would involve the local unit of government assessing local users of the system who are operating on the system under the authority of the local unit of government, a one-time (or recurring) subscription fee. These receipts could then be used to pay for local equipment maintenance or perhaps offset future equipment replacement costs. Examples of "local users" that could be assessed the subscription charge may include schools districts, private tow truck operators under contract with a governmental entity, the media, private hospitals or it could even include all agencies within their jurisdiction.

### **Summary**

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Funding options and governance options should not be viewed in isolation. In order to create a system that serves both state and local needs, a governance structure that addresses and responds to local concerns and needs outside the Metropolitan area must be developed. Because of the large capital costs of the radio system and the widely varying sizes and budgets of its potential users, a combination of approaches will be necessary to provide adequate funding. These two issues are both very complex and very political. Additional discussions and plan-

ning that includes representatives of radio users outside the Metropolitan area will be necessary to move this project forward.

## **800 MHz Digital Trunked Radio System Benefits**

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### **What is Trunking?**

First, what is a trunk? A trunk is a communications path between two locations. Communication needs of a large number of users can be provided for by efficiently sharing a small number of trunks. In the context of this report, trunking means the automatic sharing of a group of communication paths (trunks) among a large number of users. A trunked radio system simply uses multiple radio repeaters controlled by a central processor device that allows a large number of mobile or portable radio users to share the repeaters. This is similar to the technology used by the telephone companies for the shared use of telephone lines. A single radio system can be shared by a number of different user groups, eliminating the need for each group to own, operate and maintain its own system.

### **Spectrum Considerations**

The 800 MHz digital trunked radio system will make optimal use of spectrum that is already assigned to the state and local jurisdictions through a previous frequency plan. The 800 MHz trunked system will provide 95% reliable coverage for "on the street" portable radios throughout the state. The statewide system will be fully compatible with, and utilize components implemented in, the Metro 800 MHz system.

### **Technology Changes**

The proposed system is a quantum leap in technology, going from the old 1965 technology, to the state of the art system for the next century. The digital network represents improved performance, increased capacity and new capabilities. The proposed system will meet the current industry standards for digital trunked radio systems. The central processor devices (Zone Controllers) that will be used in the Metro 800 MHz system can be used to control many of the transmitter sites throughout Minnesota. This will reduce the number of controllers required for the outstate system. Units (radio users) traveling from outstate Minnesota to the Metro area will be able to communicate while en-route as well as within the Metro area. The same holds true for Metro users traveling throughout Minnesota.

### **Interoperability Issues**

The statewide shared system or network will enable instantaneous interoperability among multiple state agencies as well as those jurisdictions routinely working with state agencies. The proposed 800 MHz digital trunked radio system will enable users in one area of the state to communicate to another individual, or group of individuals, in another area of the state. It will create a seamless statewide system or network. This single shared system could gradually replace the hundreds of individual radio systems currently operating and could provide for a high degree of reliability and interoperability among state agencies as well as among local, state and federal agencies.

### **Direct Benefits**

The digital network represents improved performance, increased

capacity and new capabilities. The system would be capable of supporting not only state operations, but could also be shared with local jurisdictions throughout the state.

- ⊕ Shared resources such as frequencies, towers, land and infrastructure equipment
- ⊕ Enhanced radio coverage
- ⊕ Multi-agency, multi-jurisdictional interoperability
- ⊕ Capacity to accommodate local units of government
- ⊕ Wide-area communications
- ⊕ Shared or lowered costs
- ⊕ Digital transmissions that make it difficult for unauthorized monitoring of frequencies
- ⊕ Lost or stolen radios can be disabled by the agency that will prohibit unauthorized use

## Approaches to a Statewide Radio System

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Why 800 MHz? Why not cellular or personal communication services? Has satellite been considered? What about leasing radio services from a commercial system? These are commonly asked questions that the E-Team heard when meeting with local officials from across the state. The answer is yes; all of the above have been given consideration, as well as some other options that are discussed below. Each of the above options has its pros and cons and a niche that it fulfills. However, because of the unique requirements of public safety, each was dismissed from consideration.

Why is public safety unique? Public safety radio systems provide communications to and among fleets of vehicles, officers and or employees. Interoperability among dissimilar departments is critical to public safety operations. Many departments operate their communications equipment on a 24-hours-per-day/seven-days-per-week basis. Therefore, the equipment used in a public safety system must meet very high standards for reliability and durability along with a high degree of functionality. Public safety systems must be versatile and capable of meeting daily operational and administrative needs. They must also meet the needs of special operations such as S.W.A.T. units, drug interdiction units, undercover operations and emergencies such as floods, tornadoes, aircraft accidents and acts of terrorism. Law enforcement systems are typically designed to provide 90 to 95% reliability and coverage within a department's geo-political boundaries.

Following is a brief explanation of why the options noted above were dismissed:

**Cellular/PCS** –PCS is basically a digital version of the older analog cellular systems, only PCS has greater capacity and functionality. Cellular/PCS commercial systems have developed comprehensive systems that provide service or coverage to a large portion of the population of Minnesota. However, cellular and PCS services are mainly concentrated in urban areas and along the main highway systems of the state. This is especially true for digital PCS services. Cellular and PCS services are primarily a one-to-one mode of communications. A public safety dispatcher communicating to a fleet of officers or employees

with cellular/PCS would have to generate numerous calls to communicate a single message to each officer. Precious time would be lost informing police officers that shots have been fired, or a dozen firemen that a burning building must be evacuated using cellular/PCS technology.

**Satellite** –Satellite has found a niche in the wireless communications market. The trunking industry has found satellite communications to be a useful means of keeping track of shipments and truck drivers on a national basis. However, satellite has a major drawback for public safety, because it does not work if the radio unit is not within line-of-sight to the satellite. Buildings, parking garages, tunnels and large stands of trees can all obscure a radio's ability to communicate to the satellite. This would not be acceptable for critical communications such a police, fire and emergency medical incidents. Satellite is not frequency efficient for land mobile operations contending for channels against users from all over the U.S. or worldwide.

**Leased service** – Several wireless companies now provide wireless radio systems that use much of the same technology that this report is recommending for the statewide 800 MHz system. These systems are sometimes referred to as Specialized Mobile Radio Systems. SMRS are widely used by contractors, other non-critical business operations and private citizens for communications. SMRS are implemented in highly populated urban areas where there is a high financial return on the investment of constructing and operating such a system. These systems are not designed to provide the degree of reliability and coverage required by public safety. This is not to say that a commercial wireless provider could not design and build a system that would meet user needs. However, the cost to do so would undoubtedly be passed onto the subscriber through monthly lease rates. Since SMRS are primarily used by thousands of non-public safety users, there is always a chance that the system would not have a channel available during critical situations. A busy channel, even if only for three seconds, could be like an eternity for an officer calling for help.

The E-Team gave consideration to three additional options. Each of these options involve making use of existing systems or constructing a new dedicated private system.

State and local officials can take three basic approaches to upgrade or replace their aging radio systems:

- I. Do nothing
- II. Upgrade to VHF/UHF digital radio systems
- III. Upgrade to 800 MHz digital trunked systems

Each of these approaches has its strengths and limitations. All three approaches provide different levels of performance, interoperability, functionality and cost.

### **I. Do Nothing Approach**

Agencies, including the state, that have new or adequate systems may choose the wait-and-see approach. However, planners and managers should be aware that purchasing replacement equipment in the future will become complicated and expensive due to FCC type acceptance

requirements (Refarming Docket 92-235) for future narrowband and backward compatible radios. While it may appear to be more cost effective to do nothing now, eventually the current radio systems will become old and obsolete. Therefore, replacement is inevitable.

Drawbacks to this approach are:

- ⊕ The current analog systems cannot deliver the new features that are offered with the new digital radio systems.
- ⊕ Current radio systems are unable to meet user needs of delivering fast, reliable, secure communications to the officer or employee in the field.
- ⊕ Equipment failures will become more common and repair costs will increase as system components become more difficult to obtain.
- ⊕ Interference from co-channel and adjacent channel users will increase due to frequency congestion.
- ⊕ Opportunities will be lost for partnerships and for sharing resources and costs.
- ⊕ Interoperability will continue to rely on a patchwork of systems.

## **II. Upgrade to VHF/UHF Digital System**

This approach involves replacing the current VHF or UHF wideband analog system with a digital VHF or UHF narrowband system. This requires that all components of the existing system be replaced. Although this approach will provide a new system, there will still be some inherent problems typical of the VHF and UHF frequency bands. This approach incorporates all of the current FCC requirements for type acceptance for narrowband systems. However, the FCC has mandated one additional type acceptance migration to take place on January 1, 2005. Therefore, this approach could require considerable upgrading in just a few short years.

Drawbacks to this approach are:

- ⊕ Co-channel and adjacent-channel interference from existing and new users
- ⊕ Expensive system change-out.
- ⊕ FCC mandated migration to 6.25 kHz in 2005
- ⊕ Inherent characteristics of VHF band will still be present and users will still be plagued with atmospheric skip.
- ⊕ Interoperability remains a patchwork of systems.

## **III. Upgrade to 800 MHz Digital Trunked Radio System**

As with the VHF/UHF digital upgrade, changing to 800 MHz also requires a complete system change-out. Therefore, it is also an expensive option. However, this is the best option when considering the performance and features offered compared to VHF/UHF conventional or trunked digital systems or 800 MHz conventional or trunked analog systems. This type of system offers clear channel assignments and greater expansion opportunities. An 800 MHz trunked system offers interoperability to all participating agencies, as well as simulcast capability for better spectrum efficiency. FCC rules have already been incorporated into the design of 800 MHz subscriber equipment. Therefore, there is no type acceptance migration to contend with at a later date.

Drawbacks to this option are:

- ⊕ Expense

- ☉ Additional towers required to obtain the high level of coverage desired (95% for portables on the belt, on the street).

## System Costs

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### Costs

Due to its size, there are certain economies of scale and predicted cost savings that can be realized by sharing in the implementation and use of the statewide 800 MHz system. There is not a specific detailed design for the 800 MHz digital trunked radio system. Preliminary planning has been completed for budgetary and general guideline purposes. Specific detailed engineering planning will be completed at a later date.

### Preliminary Cost Estimates Are As Follows:

Infrastructure equipment (land, towers, shelters, generators, antenna systems, repeaters, controllers, microwave)

**Infrastructure sub-total . . . . . \$183,124,000.00**

Subscriber Equipment (mobile and portable radios)

The exact number of radios required cannot be determined at this time. Therefore, 8,500 radios was used for budgetary purposes. The number of radios was based on estimated users for the state of Minnesota agencies (State Patrol, Mn/DOT, DNR, BCA, Emergency Management, colleges, hospitals, etc.) only.

**Subscriber sub-total. . . . . \$20,000,000.00**

Additional Costs:

\*The exact number of Zone Controllers cannot be determined until the system design and number of users has been determined. Therefore, the following costs are estimates for budgetary purposes.

ITEM	NUMBER REQUIRED	COST
Zone Controller with		
Omni link. . . . .	*3 . . . . .	\$12,000,000.00

Interoperability costs. . . . . \$ 4,500,000.00

**STATEWIDE GRAND TOTAL . . . . . \$219,624,000.00**

## Unified Approaches to a Statewide Radio System

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A trend that has continued since the early 1990's is that public safety and local government radio communications needs throughout the state have grown steadily and are expected to grow significantly. At the same time that communications needs are growing so rapidly, the ability of governmental and public safety agencies to upgrade their existing VHF/UHF systems is limited due to the lack of available frequencies, lack of funding and limitations caused by the aging technology of their equipment and system design in general (refer to findings).

For these reasons, the 800 MHz E-Team believes that a single system can best meet the needs of all governmental and public safety entities at significant savings to the taxpayers of Minnesota.

### Individual Systems (Alone)

Without a doubt, the cost for the state to design and build a single system will cost in the hundreds of millions of dollars. However, if each agency designs and installs its own system the cost to tax payers could, by some estimates, come close to one billion dollars. Worse yet, independent systems will be islands unto themselves with little or no capability for interoperability with other governmental agencies. Or, at best, agencies will have to continue with the patchwork of systems to obtain the desired level of interoperability.

Taxpayer monies are used to purchase multiple systems within a jurisdiction. For example, city "A" may have a police radio system, a fire system and public works system that taxpayers will eventually have to pay for. The county that city "A" resides in may also have three systems: county sheriff, highway department and parks radio systems that will be paid for with city and county taxes. The state of Minnesota also maintains multiple radio systems such as the State Patrol, Mn/DOT and DNR systems that are funded by city, county and state taxes.

Table 1 reflects cost projections for system replacement or upgrade based on typical costs for systems serving a general range of population. These projections exclude the nine-county Metro area and state of Minnesota government agencies

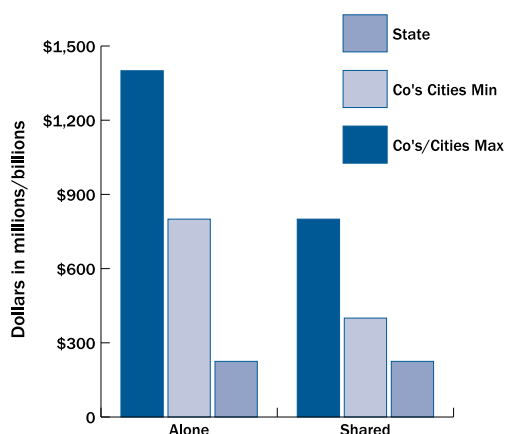
**Table 1 Cost Projections if Agencies Upgrade Alone**

No. & Pop. of Community	# of Radios	Min/Max.Cost
3 entities w/pop over 100k	600 + radios	\$14 million
30 entities w/pop between 50k-100k	450-600 radios	\$ 75 million
48 entities w/pop between 25k-50	350-450 radios	\$ 48 - \$120 mil.
60 entities w/pop between 10K-25K	250-350 radios	\$ 60 - \$150 mil.
949 entities w/pop under 10k	50-250 radios	\$ 475 - \$ 949 mil.
<b>TOTAL 1,090 entities</b>		<b>\$672 mil - \$1.30 bil.</b>

*Typical industry costs based on numbers of radios:  
System upgrade costs include fixed & subscriber equipment:  
System serving 600 + radios @ \$4.7 million each  
System serving 300-600 radios @ \$2.5 million each  
System serving 100-300 radios @ \$1 million each  
System serving 100 or less radios @ \$500,000 each*

*Source: Motorola C&E and Transcript Intl.*

**Alone vs Shared Cost Estimates**



### Shared System

Using the shared system approach, there is only one infrastructure, resulting in significant savings to taxpayers. With either scenario, the state cost remains constant. There may be a slight savings to the state with the shared approach due to sharing of land or tower facilities. The costs reflected in Figure 6 for the shared approach represents the cost of mobiles, portables, console upgrades and other enhancements required or desired by the local jurisdictions.

**Figure 6**

## Obstacles to a Shared Statewide Radio System

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Many local communities around the state are willing to work closely with the state to develop a comprehensive plan for a shared, statewide radio system. But the degree of coordination and cooperation is not sufficient for a successful plan and eventual implementation of a system.

Our investigation has identified a variety of obstacles to developing this project with local communities and impeding the progress of this project.

### Many players

Planning for a statewide radio system involves many players - landowners, neighborhood groups, local elected officials and the state - each having somewhat differing goals and perspectives. Each tries to maximize its benefits and minimize its costs, often seeking to shift costs from one to another or even to future generations by postponing or rejecting recommended changes to their current systems.

### Time lags

Large problems arise over time, from many small, uncoordinated decisions. Many local officials are simply not aware of the problems that can result from poor decisions made with regard to the present radio systems. Radio system problems may not show up immediately. But when the problem becomes apparent, the best solution is no longer available, and they must struggle with their prior decisions.

### Knowledge

While we do not have any concrete evidence, it appears from our discussions with representative from local units of government that many local elected officials are not aware of the importance of the radio systems used by their agencies. They may not be fully acquainted with the strategies, technology and regulatory changes that impact their radio systems

### Staffing

Because the radio communications planning function is not a core business for most local units of government, staff resources always seem to be in short supply. Based on discussions with communications managers in smaller communities, the management of communication systems is handled by staff that have other major responsibilities or have not been trained to deal with wireless communication issues.

### Cost-effective

A shared statewide system may be cost-effective in the long run, but it requires significant up-front investment. Local communities may have inadequate funding for planning and construction of a system. Local funding options through assessments or general taxes may be limited.



## Glossary of Terms

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**ANSI** – The American National Standards Institute. ANSI facilitates the development of national standards by establishing consensus among qualified groups. ANSI promotes the use of U.S. standards internationally, advocates U.S. policy and technical positions in international and regional standards organizations, and encourages the adoption of international standards as national standards where these meet the needs of the user community.

**APCO** – Associated Public-Safety Communications Officers, Inc., International

**AVL** – Automatic Vehicle Location – a technique using radio frequency energy to automatically determine the location of vehicles and to report their positions to a central control facility. Typically done via global positioning system.

**Analog** – Analog is the way humans hear the human voice over most broadcast radio, television, telephones and two-way radios.

**Digital** – The radio converts the analog voice information into 1's and 0's in much the same way as a computer handles data. The radio then transmits the digitized data packets over the airwaves. This process is then reversed at the receiving radio.

**FCC** – Federal Communications Commission

**GHz** – Gigahertz unit of frequency measurement; one Gigahertz is equal to one billion events (cycles) per second. Frequencies in this range are usually called microwaves.

**Industry Standards** – Standards such as TETRA and Project 25 are examples of industry standards. Standards are established for a frequency efficient digital trunked radio communication system and provide integrated voice/data services on one secure digital trunked radio system.

**Interoperability** – The ability of radio users in one agency to talk to radio users of another agency.

**kHz**– The abbreviation for Kilohertz - 1000 cycles per second.

**MHz** – Megahertz a unit of frequency measurement; one Megahertz is equal to one million events (cycles) per second.

**Multi-site** – Multi-site is a trunking technique using multi-site controllers. These controllers track the location of every mobile or portable unit and determine which transmit site has coverage. This allows wide area coverage without using simulcast. Multi-site technology can connect several different trunked systems, some of which are simulcast and some not. (In effect, a multi-site controller treats a simulcast system as if it were a single site system.) Multi-site systems require more frequencies to cover a specific geographical area than does a simulcast system.

**Narrowband** – A channel plan that splits existing VHF frequencies

from 15 kHz spacing to 7.5 kHz and UHF frequencies from 25 kHz spacing to 12.5 kHz. After Jan 1, 2005, the channel will be further split to 6.25 KHz spacing.

**Project 25** – Project 25 was developed within the standards process driven by the Project 25 Steering Committee, which is made up of customer representatives from federal, state and local public safety organizations. The Project 25 standards are developed under the guidance of the Telecommunications Industry Association whose standard formulating committees include manufacturer representatives. There are five objectives of the Project 25 standard:

- a) Spectral efficiency using narrowband channels.
- b) Interoperability between agencies and different levels of government.
- c) Backward compatibility.
- d) Graceful system migration (forward and backward).
- e) Scaleable trunked and conventional capabilities

**Repeater** – A fixed radio transmitter/receiver device operating on two separate frequencies. One frequency to transmit and one to receive. This device is normally located at an equipment shelter at the base of a communications tower. The repeater is connected to an antenna via a coaxial cable. A repeater receives the transmission from one radio and relays (repeats) that transmission to another mobile radio. Repeaters are used to obtain a wider area of coverage for mobile and portable radios.

**SMRS** – Specialized Mobile Radio Systems.

**Simulcasting** – A technique of transmitting from two or more separate sites simultaneously on a common frequency. Careful control of both audio and radio frequencies at each site is required to preclude destructive interference in regions covered by more than one simulcasting transmitter. Simulcast systems use fewer frequencies to cover a specific geographical area than does a multi-site system.

**Site** – A location that accommodates the transmitter and receiver equipment for the radio system. Typically, a site consists of a tower, equipment shelter, back-up generator with LP tank, antennas, coax cable and other ancillary equipment. A site can also be the roof-top of a building.

**TDMA** – Time Division Multiple Access. In TDMA, the channel is accessed in separate slots in a time sequence. Users have different time slots for each call that is set up.

**TETRA** – TERrestrial Trunked RAdio is a European open digital trunked radio standard. It is defined by the European Telecommunications Standards Institute under the cooperative development of manufacturers, users, operators and other experts. TETRA, which defines standardized interfaces to a digital trunked radio system, is not a product or a system platform. TETRA's main objectives are to establish standards for a frequency efficient digital trunked radio communication system and provide integrated voice/data/telephony services on one secure digital trunked radio system. TETRA uses four time slot Time Division Multiple Access technology to achieve four channels in a single 25 kHz bandwidth.

**Trunked System** – A trunk is a communications path between two locations. Trunking in the context of this report: Trunking is the automatic sharing of a group of communication paths (trunks) among a large number of users. A trunked radio system simply uses multiple radio repeaters controlled by a central processor device that allows a large number of mobile or portable radio users to share the repeaters. This is similar to the technology used by the telephone companies for the shared use of telephone lines. A single radio system can be shared by a number of different user groups, eliminating the need for each group to own, operate and maintain its own system.

**UHF** – Ultra High Frequency (450-470 MHz) Public Safety

**VHF** – Very High Frequency (150-170 MHz) Public Safety

**Wideband** – A channel plan that assigns frequencies using 15 kHz spacing between frequencies in the VHF frequency band and 25 kHz spacing between frequencies in the UHF band.

**800 MHz**–Frequency band most commonly used for trunked radio systems (806-859 MHz) Public Safety

## Appendix “A”

### Statewide Radio Communications Survey Results and Respondents’ Comments (September, 2000)

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#### Response Statistics:

The overall response was outstanding with a total 648 survey forms returned:

#### Survey forms sent out to:

862 Cities

80 Counties (did not include the seven-county Metro area)

#### Survey responses returned from:

Counties: 70 out of 80 Greater Minnesota counties

(88% of total) representing 138 county departments.

Cities: 273 cities representing 483 city departments

Independent School Districts: 16

State agencies/education institutions: 11

### SECTION I. ADMINISTRATIVE INFORMATION

#### Q1: Survey responses returned from:

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<b>County responses:</b>	<b>138 surveys returned</b>
County sheriff’s office:	57
County public works (Highway Dept)	47
County administration:	16
County transit:	8
County hospital:	5
County ambulance:	4
County parks:	1
<b>Total:</b>	<b>138</b>

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<b>City responses:</b>	<b>483 surveys returned</b>
Volunteer fire department:	122
City police:	20
City public works (Street Dept):	92
City administration:	55
City ambulance:	29
City fire:	22
City utilities:	18
City parks:	12
City transit:	6
City hospital:	5
Special police department	2
<b>Total:</b>	<b>483</b>
Independent School District responses:	16
State agency/educational institutions:	11
<b>GRAND TOTAL RESPONSES RETURNED:</b>	<b>648</b>

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**Q2: Dispatch for multiple agencies, or dispatch for agencies outside of your agency, or no dispatch center.**

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Consolidated dispatch center serving both city and county agencies:	274 ( 44%)
Consolidated dispatch center serving either the city or county only:	110 (18%)
None of the above pertain to my operation:	237 (38%)

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*Comment: Almost half (44%) have consolidated dispatch centers serving both city and county agencies. Only 18% have dispatch centers serving only their local government entity.*

**Q3: Number of full-time employees. Including volunteers. Average size**

The average number of full-time employees of the departments responding to this survey was 31 people.

**Q4: Population served. Broken into categories.**

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Community size	Number of Communities
1000 or less	45
1001-10,000	110
10,001-50,000	77
50,001-1000,000	5
Over 100,000	8 (Include state responses)

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**Q5: Existing radio systems: (Most local units of government have some type of radio systems.**

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589 91% of 648) have radio systems

59 (9% of 648) did not have a radio systems

50 city agencies

9 county agencies

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**Q6: Familiarity with Industry Standards: (603 responses to this question).**

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1. (Not Familiar)	459 (76%)
363 cities	
91 counties	
5 state institutions (colleges, hospitals, park)	
2. (Little Familiar)	83 (14%)
61 cities	
21 counties	
1 state (college)	
3. (Familiar)	45 (7%)
26 cities	
17 counties	
2 state (courts & state patrol)	
4. (Very Familiar)	7 (1%)
3 cities	
4 counties	
5. (Extremely Familiar)	9 (1%)
3 cities	
3 counties	
3 state agencies/institutions	

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*Comment: 90% of all respondents were either not familiar or had little familiarity with the industry standards such as Project 25 and TETRA. 89% (536/603) of the respondents were local government entities who were either not familiar or had little familiarity with the industry standards.*

**Q8: Are Industry Standards Important: 521 (438 +83) responses or 90% (521/581) stated that industry standards were not important or were little important. Direct correlation between familiarity of industry standards and whether believe standards are important. Of the 521 (438 + 83) responses who stated that industry standards were not or little important, 230 (44%) had no or little familiarity with industry standards. To the contrary, of the 16 responses that stated that industry standards were very or extremely important, 13 (81%) were very or extremely familiar with the industry standards.**

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1. (Not important)	438
Familiarity with Industry Standards:	
Not familiar	147
Little familiar	54
Familiar	135
Very familiar	53
Extremely familiar	49
2. (Little important)	83
Familiarity with Industry Standards:	
Not familiar	5
Little familiar	24
Familiar	22
Very familiar	22
Extremely familiar	10

3.(Important)	44
Familiarity with Industry Standards:	
Not familiar	2
Little familiar	3
Familiar	20
Very familiar	10
Extremely familiar	9
4.(Very important)	7
Familiarity with Industry Standards:	
Not familiar	—
Little familiar	—
Familiar	2
Very familiar	2
Extremely familiar	3
5.(Extremely important)	9
Familiarity with Industry Standards:	
Not familiar	—
Little familiar	—
Familiar	1
Very familiar	1
Extremely familiar	7

**Q9: Average annual budget to operate, maintain and upgrade owned radio system).**

Responses	374
Range:	\$25 to \$1,250,000
Median:	\$2,300
Average:	\$38,143
Average (w/o top 15):	\$16,346

*Comment The largest counties and cities skew the average results due to their size and cost compared to the smaller counties and cities. Most of the counties and cities annual budget for radio systems is \$2,000-\$3,000.*

**Q10: Average annual budget to lease radio system.**

*Comment: 26 departments responded to this questions. The highest annual lease was \$265,000. This figure skewed the results to obtain the average annual lease budget. Discounting the above noted lease, the average annual lease rate for those responding was \$3,400.00 Based on other data contained in each of he responses that indicated that they leased communication services, we assume that these figures reflect fees for cellular, and paging and in some instances for two-way radio services.*

## SECTION II. OPERATIONS

**Q1: Number of agencies that share radio frequencies with other organizations.**

YES	381 (77%)
NO	113 (23%)

**COMMENT:** Most of the entities (77%) share frequencies with other organizations.

**Q2: How often does your agency have radio communications with the following levels of public safety and/or public service organizations?**

	Day to Day	Weekly	Monthly	Yearly	Never
Local Level:	341 (71%)	59 (12%)	35 (7%)	12 (3%)	35 (7%)
State Level:	104 (22%)	60 (13%)	54 (11%)	49 (10%)	205 (44%)
Federal Level:	9 (2%)	12 (3%)	24 (5%)	47 (10%)	380 (80%)

*Comment: By far the major requirements are at the local level on a day-to-day basis. There is some requirement at the state level and minimal at the federal level. Most of the requirements are driven by the type of emergency situation or disaster.*

**Q3: What level of interoperability would best serve your agency?**

No. of Responses	
Local region (multi-jurisdiction):	351 (76%)
State-wide:	87 (19%)
Multi-state:	9 (4%)
Nation-wide:	2 (1%)
<b>Total:</b>	<b>459 (100%)</b>

*Comment: The major requirements (76%) are at the local level. There is some requirement at the state level (19%) and multi-state (4%) for the border towns and counties. Most of the requirements are driven by the type of emergency situation or disaster.*

**Q4: Does your agency have the ability to patch across frequencies?**

YES	76 (18%)
NO	353 (82%)

*Comment: Most entities (82%) DO NOT have the ability to patch across frequencies.*

**Q5: If answered NO to question above, do you feel that having capability to patch across frequencies a useful feature?**

YES	166 (47%)
NO	187 (53%)

*Comment: Almost half (47%) believe this would be a useful feature.*

**Q6: Does your agency currently use encryption or scrambling devices on your current radio system?**

YES	36 (8%)
NO	397 (92%)

*Comment: Most entities (92%) DO NOT use encryption or scrambling devices on their current radio systems.*

**Q7: If answered NO to question above, do you consider encryption or scrambling important to your agency?**

YES	131 (33%)
NO	266 (67%)

*Comment: Only one-third of the entities consider encryption or scrambling important.*

**Q8: Does your agency share radio system infrastructure (towers, base stations/antenna systems, etc.) with other organizations?**

YES	330 (70%)
NO	141 (30%)

Comment: *Over two-thirds (70%) share radio system infrastructure with other organizations.*

**Q10: How involved is your agency in the decision-making process related to the operation of the shared system noted in the question above?**

Extensively	98 (23%)
Considerably	51 (12%)
Somewhat	66 (15%)
Little	76 (18%)
Not at all	140 (32%)

Comment: *About half of the entities are somewhat to considerably involved with the decision making process related to the operation of the shared system.*

### SECTION III. Communications

**Q1: Frequencies Used:**

Frequency	Number of Responses	% of Total
Low Band VHF (25 – 50 MHz)	14	4%
High Band VHF (150 – 174 MHz)	308	79%
UHF (450 – 470 MHz)	43	11%
800 MHz (806 – 869 MHz)	15	4%
Other	8	2%

Comment: *The frequency used by a vast majority of the respondents is high band VHF reported by 79% . The second highest frequency was UHF, which was far behind with 11% of the respondents.*

**Q2: Age of Oldest Piece of Equipment: 401 Responses**

<b>401 Responses</b>	
Range of age:	1 – 45 years
Median age:	15 years
Average age:	15.4 years

Comment: *The radios being used today are fairly antiquated with an average age of 15 years.*

**Q2a: How long used current radio system:**

<b>400 responses</b>	
Range of age:	1-50 years
Median age:	18 years
Average age:	18.1 years

Comment: *The radio systems being used today are analog and are also antiquated with an average age of over 18 years.*

**Q3: Number of radio units in agency:**

No. of Radios	Responses	% of Total
Less than 10 radios	147	33%
Between 11 – 20 radios	134	30%



No. of Radios	Responses	% of Total
Between 21 – 30 radios	65	15%
Between 31 – 50 radios	51	12%
Between 51 – 60 radios	17	4%
Between 61 – 70 radios	4	1%
Between 71 – 80 radios	5	1%
Between 81 – 90 radios	5	1%
Between 91 – 100 radios	6	1%
Between 101 – 150 radios	5	1%
Between 151 – 200 radios	0	<1%
Between 201 – 250 radios	1	<1%
Between 251 – 300 radios	1	<1%
Between 301 – 400 radios	2	<1%
Between 401 – 500 radios	2	<1%
Greater than 500 radios	2	<1%

**Q4: Problems with current radio system: (Listed in order of most serious)**

<b>1. Dead spots:</b>		<b>2. Not enough range:</b>	
Seriousness	Number of Respondents	Seriousness	Number of respondents
5. Major problem	97 (24%)	5. Major problem	92 (22%)
4. Significant problem	81 (20%)	4. Significant problem	70 (17%)
3. Problem	78 (19%)	3. Problem	89 (21%)
2. Minor problem	72 (17%)	2. Minor problem	58 (14%)
1. Not a problem	84 (20%)	1. Not a problem	105 (26%)
<b>Total:</b>	<b>412 (100%)</b>	<b>Total:</b>	<b>414 (100%)</b>
<b>3. Outdated equipment:</b>		<b>4. Frequency interference:</b>	
Seriousness	Number of Respondents	Seriousness	Number of Respondents
5. Major problem	55 (13%)	5. Major problem	51 (13%)
4. Significant problem	70 (17%)	4. Significant problem	63 (15%)
3. Problem	101 (25%)	3. Problem	85 (21%)
2. Minor problem	74 (18%)	2. Minor problem	100 (24%)
1. Not a problem	112 (27%)	1. Not a problem	112 (27%)
<b>Total:</b>	<b>412 (100%)</b>	<b>Total:</b>	<b>411 (100%)</b>
<b>5. Atmospheric skip:</b>		<b>6. Fading:</b>	
Seriousness	Number of Respondents	Seriousness	Number of Respondents
5. Major problem	40 (10%)	5. Major problem	45 (11%)
4. Significant problem	54 (13%)	4. Significant problem	45 (11%)
3. Problem	88 (22%)	3. Problem	88 (22%)
2. Minor problem	101 (25%)	2. Minor problem	86 (21%)
1. Not a problem	126 (30%)	1. Not a problem	145 (35%)
<b>Total:</b>	<b>409 (100%)</b>	<b>Total:</b>	<b>409 (100%)</b>
<b>7. Not enough equipment</b>		<b>8. Static:</b>	
Seriousness	Number of Respondents	Seriousness	Number of Respondents
5. Major problem	32 (8%)	5. Major problem	16 (4%)
4. Significant problem	40 (10%)	4. Significant problem	48 (12%)
3. Problem	90 (22%)	3. Problem	91 (23%)
2. Minor problem	89 (22%)	2. Minor problem	106 (26%)
1. Not a problem	161 (39%)	1. Not a problem	139 (35%)
<b>Total:</b>	<b>412 (100%)</b>	<b>Total:</b>	<b>400 (100%)</b>

9. Battery problems:		10. Not enough frequencies:	
Seriousness	Number of Respondents	Seriousness	Number of Respondents
5. Major problem	24 (6%)	5. Major problem	29 (7%)
4. Significant problem	28 (9%)	4. Significant problem	19 (5%)
3. Problem	81 (20%)	3. Problem	47 (11%)
2. Minor problem	99 (24%)	2. Minor problem	75 (18%)
1. Not a problem	167 (41%)	1. Not a problem	239 (59%)
<b>Total:</b>	<b>409 (100%)</b>	<b>Total:</b>	<b>409 (100%)</b>

Comment: *The most serious problem experienced by users is that of "dead spots" where their radios won't work. Sixty-three (63%) percent of the respondents indicated this was a problem. Forty-four (44%) percent indicated this was a significant or major problem.*

*The second most serious problem listed was "not enough range". Sixty (60%) percent indicated this was a problem. Thirty-nine (39%) percent indicated this was a significant or major problem.*

*The third most serious problem was "outdated equipment". Fifty-five (55%) percent indicated this was a problem for them. Thirty (30%) percent indicated this was a significant or major problem. This probably reflects the fact that the average age of the oldest piece of radio equipment is 15.4 years and the average age of the radio systems is 18.1 years.*

#### SECTION IV. FUTURE CONSIDERATIONS

**Q1: Plan to replace or substantially upgrade radio system:**  
(470 responses)

Yes:	125 responses (27% of total)
No:	345 responses (73% of total)

**Q2: Approximate time frame for replacement or upgrade:**

Time Frame	Number of Responses	% of Total
1-2 Years	59	47%
3-4 Years	32	26%
5-6 Years	26	21%
7+ Years	8	6%
<b>Total</b>	<b>125</b>	<b>100%</b>

Comment: *A little more than one fourth of the respondents stated they plan on replacing or substantially upgrading their radio system within the next seven years.*

**Q3: Preference for next radio system: (125 responses)**

Type of Radio System	Number of Responses	% of Total
VHF or UHF Analog (150 or 450 MHz)	46	37%
VHF or UHF Digital (150 or 450 MHz)	21	17%
Trunked Digital (800 MHz)	13	10%
Trunked Analog(800 MHz)	5	4%
Unknown	40	32%

Comment: *The large number of unknown preferences and the preferences for analog systems seems to be a reflection of the fact that there is a definite lack of knowledge and understanding regarding this technology, standards, and future trends.*

**Q4: Likelihood agency will adopt Project 25 or TETRA Standards for next radio system:**

Likelihood	Number or Responses	% of Total
5. Highly likely	6	4%
4. Somewhat likely	7	5%
3. Likely	7	5%
2. Maybe	4	3%
1. Highly unlikely	9	7%
U. Unknown	76	56%
Don't know about Project 25/TETRA	26	19%
<b>Total:</b>	<b>135</b>	<b>100%</b>

*Comment: Only 14% of the respondents indicated they were likely to highly likely to adopt Project 25 or TETRA standards. This coupled with the high number (19%) of respondents who indicated they didn't know about Project 25 or TETRA standards indicates the limited knowledge that most have regarding this technology and trends.*

**Q5: How important will interoperability issues be to your agency when purchasing a new radio system?**

Importance	Number or Responses	% of Total
5. Extremely important	84	45%
4. Somewhat important	49	27%
3. Important	29	16%
2. Little importance	16	9%
1. Not important	5	3%
<b>Total:</b>	<b>183</b>	<b>100%</b>

*Comment: 88% of the respondents indicated that interoperability is important to extremely important for radio systems. This is an indicator of the end user requirements rather than a knowledge of the technology. Per the notes from the survey forms, there is a need for interoperability among local police, sheriff, highway department (snow plows, etc.), ambulances, etc. especially during an emergency or a disaster situation.*

**Q6: Identify the radio frequencies your agency needs for its next system.**

Low Band/# of Dept.	VHF/# of Dept.	UHF/# Dept.	800 MHz/# of Dept.
15/4	413/67	40/12	197/14

**Q7: Would your agency/department consider participating in a multi-agency, multi-jurisdictional shared radio system?**

YES	326 (71%)
NO	136 (29%)

*Comment: Overwhelming majority of responses said they would be willing to participate in a share radio system.*

**Q8: Preferred method of governance for shared radio system.**

State government only:	2 (<1%)
State & county government:	49 (13%)
State & local government participants in same region:	187 (51%)
State & regional government representation, including non-participating agencies:	5 ( 2%)
Governing board including state & local government and Metro Radio Board:	6 ( 2%)
Decision would have to be made on a higher level:	118 (32%)
<b>Total:</b>	<b>367 (100%)</b>

Comment: *Of those that responded to this question, a majority (51%) indicated the governance should be state and local government participants in the same region. 13% indicated that governance should be at the state and county level. These two categories indicated that 64% of the respondents feel that governance should be between the state and some local level of participation.*

## SECTION V. COMMENTS

Following are the comments received as a result of the survey.

**Question 1: Has your agency experienced a situation where the ability to inter-operate with other agencies was impeded? Yes or No If yes, briefly describe the situation and adjustments that were made. NOTE: Please do not include 9-1-1 issues, this question pertains to radio situations only.**

### Municipal Fire Department

- ☉ Multiple users on the only county fire frequency.
- ☉ Mutual aid fire operation – departments did not have shared channels – the East Range Fire Department coalition has developed a radio system, which provides multiple channels for fire department operations. So far, we have developed 5 channels including 2 repeaters for use. The DNR and USFS have access to these channels.
- ☉ Over loaded channel on mutual aid calls
- ☉ Our jurisdiction has mutual aid with a fire department in another state (Wisconsin).
- ☉ On a daily basis too many agencies using one frequency. During any multi-agency response radio system almost becomes useless.
- ☉ Unable to talk to other departments at mutual aid calls. Only shared channel is the county paging channel. We also have some bad areas in our territory where a radio or pager will not work.

### Volunteer Fire

- ☉ Trying to work with state DNR and Federal Fire departments.
- ☉ Departments are on different frequencies could not match them.
- ☉ We are in need of more radio towers. The hills and bluffs hamper our ability to communicate with the Winona law enforcement center and also our mutual aid, fire and EMS departments.
- ☉ In 1997 a tornado hit our area causing power outage. Were unable to communicate with anyone. Has been corrected by installation of back-up generator.
- ☉ On a rescue call and a house fire that were both about 4 miles from town we could not communicate with our base station or our trucks.
- ☉ Multi jurisdictions – Multi agency situations. Major fires and emergencies.
- ☉ The frequencies are too busy when multiple agencies are using it. The other county's system dominates our counties system. (both counties share the same frequency) They broadcast over other users on the system without regards.
- ☉ We have too many spots in our County where the signal is not strong enough for good transmissions. We use the Sheriff's channel for relay if needed and even then sometimes there are still dead spots.
- ☉ Range has been a problem, we are on the far end of our County, problems reaching dispatch.
- ☉ Major barn fire – trucks could not communicate with Iowa fire personnel. Found one portable radio with one matching frequency.
- ☉ There are times that we respond to areas outside our normal response area and work with the fire Departments that do not have the same radio frequencies.
- ☉ Inability to communicate with New Prague Police Department & New Prague Ambulance at some training sessions.
- ☉ Inability to talk from truck to truck in our own Fire Dept area.
- ☉ Statewide fire does not utilize repeater in our area. This hinders communications with other departments.
- ☉ Ability to communicate on mutual aid fires. Received permission to use neighboring Department frequencies.
- ☉ Ambulance service has trouble switching to fire frequencies.
- ☉ Have difficulty communication with neighboring towns with whom we have mutual aid agreements.
- ☉ Communication with DNR for wildfires situation was made better with newer multi channel radios.

### School District

- ☹ None

### Ambulance

- ☹ Could not talk point to point because of poor radio reception. Putting in a repeater.
- ☹ Due to the large rural area we serve there have been times when radio communications was impeded because we were simply too far from the base station or repeater tower.
- ☹ In 1997 a tornado hit our area causing power outages. We were unable to communicate with anyone. Has been corrected by installation of back-up generator.
- ☹ Limited range at present. Need repeater or relay tower which will hopefully be erected soon. Designated telephone communications should be better soon hopefully reducing expense.
- ☹ County law enforcement frequencies vary and many times the only communications we have is through our dispatch center to the other counties dispatch center and eventually down to the other counties or city law enforcement level.

### Hospital

- ☹ None

### Utility

- ☹ Interoperability is not desired or substantially beneficial.
- ☹ Radio system is city channel shared by utilities, public works, police and fire departments. During emergencies communicating is difficult to impossible we all need to support separate channel use.
- ☹ Not able to patch to other frequency users.

### County Emergency Management

- ☹ During a major disaster (Tornado).
- ☹ I can not answer for sheriff's dispatch.
- ☹ Communication among inter-state units and among federal, state and county units.

### City Administration

- ☹ Coordination among Police, Fire, Ambulance, as well as airport and public works functions. Dead spots police radio systems. No local emergency operations center all distributed separate radio systems and locations. No facility with backup electrical power capabilities.

### Animal Control

- ☹ None

### City Parks Department

- ☹ None

### Transit

- ☹ Only when cell phone does not have enough signal.
- ☹ Communication with maintenance workers from other governmental agencies during snow removal operations. Call between offices and rely messages.
- ☹ City crew and police departments along with 3 members of ambulance have the very same 16 channel radios. Fire department has radios that are older than 20 years – communication is very limited. Batteries on fire radio don't last over 2 years.
- ☹ We have installed the frequencies of neighboring counties in our mobile units.
- ☹ Unable to communicate with Sheriff vehicle and snowplow during emergency situation in snowstorm.
- ☹ Too much traffic.
- ☹ Major storm clean up. The lack of ability to communicate directly with other agencies to coordinate the clean up efforts.

### Public Works

- ☹ During storm disasters communication among highway departments, police and fire departments would have been helpful – rare occurrences.
- ☹ Yes, at times getting hold of Sheriff dispatcher has been problems busy monitor set low.

- ☉ County highway would have liked the ability to inter-operate with Mn/DOT but they would not allow the county to access their TX frequency.
- ☉ Surrounding city carries our emergency channel we can usually receive but not send to their radio system many dead spots.
- ☉ Sometimes the law enforcement center does not scan our city frequency, therefore it is impossible to contact them other than by phone line.

### Civil Defense.

- ☉ Only do during emergencies and have no communication unless they have one of our radios
- ☉ Fire department and City maintenance have to work together.
- ☉ Smaller agencies like Townships and smaller cities lack the personnel with enough knowledge to properly operate and maintain radio systems within FCC rules. They also do not or cannot allocate money to properly maintain the system or share costs.

### Sheriff's Department

- ☉ The Minnesota River Valley presents lay of the land problems. In the process of installing a repeater system to help with this problem.
- ☉ Otter Tail County was the site of a major train derailment that involved several departments not on our radio system. The command center programmed monitors to cover the other frequencies, borrowed portables and used the cell phone extensively.
- ☉ When Fire, EMS, Sheriff's, and Police cars are involved in a major incident or if separate incidents occur at the same time we only have one frequency that we all can communicate on (sheriff's frequency). Individuals begin to interfere with each other as well as the dispatch. The adjustment (if you want to call it that) is to use different frequencies that are unique to Fire and EMS. This eliminates dispatch and law enforcement cars being able to communicate with them.
- ☉ State money for county and local agencies to update equipment for law enforcement and emergency services.
- ☉ Skip from other agencies. Lack of technology in Greater Minnesota. Different radio frequencies that state and federal agencies have compared to local agencies.
- ☉ Inter-agency cooperation in criminal cases is impeded due to lack of common radio frequencies to encryption devices. At the present time only unencrypted radio frequencies are available, telephone, cell phones are also utilized.
- ☉ Repeater on main sheriff's channel failed. Difficulty occurred when trying to make radio contact with officers out in the field due to distance of office from sheriff's dispatch. (Repair repeater). Uninterrupted power source (UPS) did not provide radio support. Equipment adjusted, problem solved no problems since equipment adjusted.
- ☉ VHF Skip.
- ☉ In house portable coverage – funding from state for system.
- ☉ During tornado (07-25-00) could not talk to state emergency management and other state agencies.
- ☉ We have problems talking to our own jurisdictions.
- ☉ Forest fires 1999 blow down
- ☉ We have had situations where local deputies were unable to talk to Federal officers who were working in our area.
- ☉ When we need to talk to a trooper by radio, we sometimes can't get a hold of them because they need to be monitoring our frequency to hear us and they can't always do that. In order to resolve this we must call State Patrol dispatch and ask them to contact the trooper.
- ☉ Dispatch problems during transition. Not familiar with new equipment (dispatcher training).
- ☉ St. Cloud PD uses 800 and we don't so we can't communicate on portable or in squads. We can now use MDC's and share portables on special operations.

### Municipal Police Department

- ☉ Due to not having enough repeaters in the county it is often difficult to communicate with other agencies in the county including the Sheriff's deputies who may be on the other end of the county
- ☉ In trying to communicate among Fire, Ambulance and Police during an emergency drill at our airport we found the command post was not getting all traffic and as the drill started the first personnel on scene were not able to communicate to these other agencies to coordinate set-up measures.
- ☉ Other agencies in other parts of the state and other states having the same frequencies. Skipping over our communications. Main terminal "county dispatch" complete new system our agency also upgrade our radios with

new frequency. Dead spots within community – upgrade our entire radio system put in trip repeater prior to county upgrade.

- ☉ Our radio system uses VHF frequency channels. The portables cannot receive or transmit on many occasions. They are useless at times. Portables are static and garbled. The squad trunking radio sometimes is weak and scratchy at times.
- ☉ For several years our county had different frequencies. Several times officers in our area on major incidents that affect safety. We had to upgrade to scan radios so we could monitor. The same situation is beginning to happen, presently; due to small departments not able to upgrade to mobile computer equipment due to costs of yearly maintenance.
- ☉ When monitoring city channel we have problems with paging tones on our frequency. At times unable to locate source and channel can not be left in scan mode on portable units or base when monitoring channel.
- ☉ Lack of frequencies. Congested existing frequencies. Unable to talk directly to State Patrol on our main frequency.
- ☉ Currently the department is dispatched by the Pearl street dispatch center out of Owatonna. At times it is very difficult to get airtime due to the radio traffic. Officers also cover one another. Also as a smaller agency we are not given enough input verses the larger agencies in Rice and Steele Counties.
- ☉ Transmission dead spots within the city limits atmospheric conditions affect transmission and receiving.
- ☉ Frequently distance between cars is too great and lack of repeater towers make it difficult to communicate. Problem is even more pronounced with portable hand-held radios.
- ☉ Mutual aid situations where no common frequency other than statewide existed.
- ☉ Dead spots within county. Inability to communicate with other agencies/officers with hand held and mobile radios except when in close proximity.
- ☉ Portables are not able to communicate with dispatch both. Hearing dispatch and transmitting to dispatch.
- ☉ Mainly in hand held use not good enough reception.
- ☉ Interop during flooding was difficult.
- ☉ Worked around by having dispatch relay for us. Or we will go to the cell phone and use that for communication purposes. Some time it may be a dead spot and by moving the vehicles it helps.
- ☉ On certain specific days and evening we get a lot of "skip" from the Metro departments we cannot hear our dispatcher at times and some departments that are coming across on skip have the same call numbers as ours. Therefore were not sure if dispatch is calling or not!
- ☉ Not for a long time. 911 dispatch center and radio frequencies, inter-operating with 5 other law enforcement agencies pretty much problem free.
- ☉ Can't talk directly to state patrol on the radio unless they have our channel in their radio. They won't allow us to program their frequency into our radio.
- ☉ City administration support, City council support, County board support, Township support, state legislative support, financial support (city and state), technological changes, fee change to digital, governance issues (control).
- ☉ Out of the area radio skips.
- ☉ Our most common problem is monitoring and communicating with the LaCrosse, Wisconsin Police department, which we border. We operate on high band. The LaCrosse police department operates on 800 MHz.
- ☉ Local agencies in St. Louis County are unable to communicate on our frequencies. This sometimes hinders our ability to get information to them.
- ☉ The radio was bad, had it fixed
- ☉ Worn out Radio System. Skip Interference.
- ☉ Problems with range and dead space.
- ☉ Outstate, and Iowa.
- ☉ Distance factors
- ☉ Repeater tower failed.
- ☉ Police and Fire Department were involved in a mock disaster drill. Fire Department does not monitor police car to car frequency. Police do not monitor Fire Departments. On scene frequency. Not able to interact or assist each other as well as we could. Adjustments: making sure we can contact each other on one known channel.
- ☉ RFI problems or problems in radio and scanning priorities.
- ☉ Sometimes the county West of us overpowers our communication and interferes with our communication with dispatch.
- ☉ Several situations where units have been out of Dispatch area and have been unable to communicate with other Departments.



- ☉ It is difficult for us to communicate with dispatch on portable from inside structures, such as The City Hall, the Local schools, etc. It is almost impossible. Portables "hear" but do not transmit with enough strength.
- ☉ Flood of 1997 inundated our base, rendered our system useless. State and Private Radio people got a system set up in a matter of a few hours.
- ☉ Current Rice County Radio shop cannot adequately manage all the users. We have had situations where officer safety was jeopardize because officers can't get on the radio to request help. The joint dispatch project for Rice and Steele Counties is dysfunctional. There have been no corrective actions taken.
- ☉ Being on the Western border of Minnesota, we many times need to contact agencies from either North Dakota or South Dakota. With different bands and frequencies we find ourselves going through dispatch and calling on the telephone, as it is the quickest. This should not be, we should have direct contact.
- ☉ Can't use Statewide channel 4.
- ☉ We can no longer hear the Ely Police Departments frequencies from the squads.

### Special Police

- ☉ None

### State Government

- ☉ Numerous cross-jurisdictional surveillances where communications were not possible with involved jurisdictions due to differences in frequency bands. Numerous surveillances with federal counterpart with same problem as listed above.
- ☉ St. Peter tornado – interoperability was a problem with locals. Difficult to manage crisis.
- ☉ Among states at our borders, land, water and air. Disasters – St. Peter, Granite Falls, floods.

**Question 2: What operational, technological or political issue do you or your agency think should be considered in the planning and implementation of a statewide radio network for public safety and emergency preparedness entities at all levels of state, and local government, including the federal government?**

### Municipal Fire Departments

- ☉ A statewide radio system would infringe on the radio rights of the private operators.
- ☉ Multiple frequencies available. Separate paging frequency, not for operations.
- ☉ It's the old adage: Too many chiefs spoil the broth. I have tried to work with state, federal, county and local units of government to establish radio networks and there were major issues over jurisdiction, use of the network, which operations had priority. The development of networks should be done regionally with a clear "up front" understanding of these types of issues.
- ☉ Cell phone systems, Fax from dispatch to land and mobile.
- ☉ Maintain local involvement. Listen to rural and local government needs.
- ☉ During any multi-agency response radio system almost becomes useless.
- ☉ Ease of using. Better quality. Products / availability open to departments. Cost efficiency.
- ☉ There needs to be multiple channels for Fire departments to use on fire ground to communicate to each other.

### Volunteer Fire

- ☉ What impact it will have on each entity. Their current system and the need to upgrade, if any. The frequency (how often) there is a need to communicate with other agencies that they aren't communicating with already. The ability to finance the upgrade. How compatible their existing system is versus the new system. Is there a real need to go statewide versus Metro?
- ☉ Funding for low budget emergency service providers.
- ☉ We need to be able to keep our own radio communication frequency.
- ☉ The cost – who pays for it- making sure it is simple – easy to operate.
- ☉ A cooperative where small departments like us could purchase communication equipment including hand held and pagers.
- ☉ Many outstate volunteer departments do not have the funds or the knowledge to upgrade and or operate to their current equipment. If a higher level of government gets involved, ROI may get too cumbersome for some members.
- ☉ Operationally – at least for the fire service we're pretty well set at least in Lake City. Those organizations that need a state implemented system – fine, for those that don't leave well enough alone.



- ☉ Fire and Law Enforcement people that went through the tornadoes in the past 2 years state that there was so many people using state and local channels often no one could communicate. Will this be a problem when a major situation occurs.
- ☉ It should be mandatory for all agencies in Public Service to have the same emergency statewide channel to operate on in a large emergency.
- ☉ Try and keep agencies on their own frequency. Eliminating all of the skip static. Also try to regulate scanner capabilities.
- ☉ I believe it would be very easy to complicate the fire and rescue process with too much information being monitored at once. I believe the current county wide network works very well.
- ☉ I think we have this. We need to train more on this and hold agencies accountable to use the correct frequencies.
- ☉ I would request additional information on this prior to commenting.
- ☉ Try to use equipment that can upgrade easily. Keep the politics out of it completely. Try to keep it cost effective for us small entities.
- ☉ Will be in on 800 MHz trunking system approximately 4-2000 with Carver county fire department.
- ☉ Keep dispatch center with county sheriff departments.
- ☉ Keep it easy to use.
- ☉ Political issues should have no part of public safety or emergency preparedness. As a small department (Fire) that in a years time we use our radio's very little. We just hope that our radio's work when we need them. With a very limited budget, we have to do with what we got.
- ☉ Many outstate volunteer departments do not have the funds or the knowledge to upgrade and/or operate their current equipment. If a higher lever of government gets involved, ROI may get too cumbersome for some members.
- ☉ What impact it will have on each entity. Their current system and the need to upgrade, if any. The frequency (how often) there is to communicate w/other agencies that aren't communicating with already. The ability to finance the upgrade. How compatible their existing system is versus the new system. Is there a real need to go statewide versus Metro?
- ☉ Multiple channels should be considered that cross emergency response teams. One for on-site personnel, another for voice traffic associated with the incident command to handle site team and other response teams independent of each other.
- ☉ Funding is #1. When re-farming of radios comes into effect funding could be a key.
- ☉ Make the system affordable and accessible to local fire departments. We are currently not given 1st priority when comes to paging system use.
- ☉ The implementation needs to be done with all users involved in decision making. There needs to be special note that this is a statewide deal and not done with the METRO area in mind only with the outstate lost in the shuffle.
- ☉ Issues should be left to local units of government to work out. The more units of government involved the bigger the communication problems become. If local units need to communicate with state units, it is best to follow chain of command, i.e. local to county to state and back.
- ☉ Whatever it takes to get the job done. Regional fire districts communications committees, which would recommend to a "state" Committee.
- ☉ Statewide won't work, leave at County level.
- ☉ Most of our radios don't have the new bandwidth spacing.
- ☉ Keep Local control with County being one point of contact with the state.
- ☉ Don't make mandates or Laws without making sure there are monies available for Local government agencies to use.
- ☉ Making sure that carry over does not happen from radio traffic. Keeping frequencies apart from areas in close areas (such as some frequencies a town or two away).
- ☉ Must have enough towers/transmitters for adequate range for radios 20-25 mile radius.
- ☉ Full funding @ state level
- ☉ State or Federal funding for radio and pager upgrades.
- ☉ Local resources able to operate the radio system, many have volunteers and have limited contact.

#### School District

- ☉ None

### Ambulance

- ☹ Availability, simplicity used in instructions, a phone number or help to understand the system.
- ☹ Cost for small services to upgrade radios to meet new standards
- ☹ Make sure that radio contact can be made anywhere.
- ☹ Scrambling signals so scanners can't pick it up.
- ☹ It would need to be affordable. Also would need to be tested extensively in rural areas. Too often things are simply for Metropolitan areas and simply do not work well in the rural setting.
- ☹ Police, Fire, EMS should have a better radio system than our highway department.
- ☹ It is important with a volunteer service that operation channels and frequency selection be simple. Many don't have the experience and time for training is limited with state mandated training already required for EMTs.
- ☹ Cost is probably the most important issue. Any cost share from where?
- ☹ Leave under local control. State and Federal people do not understand local needs.
- ☹ Any mandate needs to be fully funded.
- ☹ More towers eliminating dead areas where communications not good.
- ☹ Anytime statewide regulations are mandated to control local issues political problems arise – they are far too numerous to list here.
- ☹ Uniform radio language protocol and protocol for radio procedures (operations).
- ☹ Confidentiality

### Hospital

- ☹ Need to work set-up Metro (Pls./St. Paul) first and work your way out to rural areas. Digital radios for clarity is a must.

### Utility

- ☹ Operational/Political. Our utility does not want to be forced to participate and spend money for a system that won't substantially enhance operations.
- ☹ I've felt for some time that a statewide utility channel would greatly enhance mutual aid.
- ☹ Number 1 issue is cost. Our current system allows for us to adequately communicate for our needs. We also communicate with other city departments on their system, which works quite well. The various city agencies have their systems at various sites which avoids the "all eggs in one basket" scenario. In law enforcement, hospital, or another agency would move from the VHF band to say 800 MHz, and extreme burden would be placed on all other agencies should they deem it necessary to continue communications. If we were forced to change frequency bands, we would be abandoning a 3-4 year old VHF repeater system along with portable and mobile radios, which are mainly less than 7 years old. We are very pleased with our current system. And communications abilities with all other city government agencies.

### County Emergency Management

- ☹ Adequate portable and paging coverage in remote rural areas. High level of responsiveness to local needs. Strong local control.
- ☹ Able to communicate with all agencies during emergencies and amateur radio also is a must.

### City Administration

- ☹ I think it would be very important especially in care of flood and tornadoes. Presently we rely on a bar that closes at 1 p.m. to react when one of the above conditions arises.
- ☹ Use a frequency that is easy for all types of equipment to access. Make it affordable for small communities.
- ☹ Our radio system needs to be kept to local radio traffic only. Too much radio traffic would cause confusion during normal day to day operations.
- ☹ Remember we have unique problems in rural Minnesota especially in Bluff County.
- ☹ The system should be dependable, it should have full capabilities of radio communication. It should be easily accessible.
- ☹ Separate frequency just for Emergency Management. Standardized frequencies each community.
- ☹ Training, shared resources.
- ☹ Need for inter-agency communication in disasters and day to day response. Need for local emergency operations center with backup electrical power and capabilities to communicate with local (and mutual aid) assistance.

- ⊗ How much will it cost local tax payers; sounds like a good idea; how many frequencies would we have to add; we can presently dispatch/communicate with Fire, Ambulance, County Sheriff, through Fire and Ambulance Frequency.

### Animal Control

- ⊗ In helping other cities, a statewide channel would be helpful.

### City Parks Department

- ⊗ None

### Transit

- ⊗ Our Transit repeater shares a local Government repeater with the County Highway department and county school districts. We have no other control or planning issues.
- ⊗ Cost to local units of Government.
- ⊗ Keep it simple with no new costs to counties.
- ⊗ Cost and compatibility with all equipment both new and existing privacy.
- ⊗ Maintain a local attitude for response to local situations in a timely manner.
- ⊗ Funding for equipment. Full coverage of all areas. Develop technology to use cell phones instead of radios. Everyone will be carrying some type of communication device. Cell phone tower coverage is in-place. We are developing many parallel redundant systems. Radio tower, cell phone towers, pager towers. Consolidate technology to eliminate the need to carry a fire, pager, cell phone, two-way radio etc. In order to communicate with various entities. Are two-way radios going to be around 5 to 10 years from now?
- ⊗ Better communications among different cities within local area mutual aid for whatever most departments are able to talk to each other more towers are needed.
- ⊗ Responsibility for maintenance and the ability of other agencies using the system to get their problems resolved. (The state is non-responsive in dealing with other problems under their responsibility in some cases). Priority usage during emergency operations. Designated inter-agency contact people. (Authority) specific procedure as to when inter agency contact should be made (under what circumstances)
- ⊗ Cost is a major factor.
- ⊗ The level of flexibility each agency would have percent of cost to each agency would there be a priority agency or equal?
- ⊗ Make sure it is extremely easy to use, any complications in ease of use will bring down time. Consider separate systems for emergency or public safety purposes and local government use purposes.
- ⊗ This looks like a very large system with many control problems. It will be interesting to watch this develop.
- ⊗ Provide enough frequencies so each unit can keep outside "chatter" to a minimum.
- ⊗ A better paging system.
- ⊗ Have no comment and am not interested in joining with others e.g. state.
- ⊗ To assure an open and enough frequencies to ensure use of all times.
- ⊗ To make this affordable for all participants and not send down some mandate that is not supplied by money to help pay for it! The system works now does bigger government have to interfere to try to fix something that isn't broke.
- ⊗ A pager with voice attachment.
- ⊗ The true effectiveness and advantages of this system. The current conditions and life expectancy of the existing system. The ability for entities to pay for a new system.
- ⊗ We would be concerned about the costs.
- ⊗ If a statewide radio network is implemented. I wonder if the equipment costs and the maintenance costs are going to be excessive for a small community like ours.
- ⊗ Do not mandate participation and protect frequencies.

### Public Works

- ⊗ It would be an extreme waste of money.
- ⊗ Participation in planning and development.
- ⊗ Not that knowledgeable.
- ⊗ Do not have any comments at this time.
- ⊗ In cases of mutual aid a statewide channel would be helpful.

- ☉ There should be the ability of different levels of Government to be able to communicate in times of emergencies. It is very hard to effectively communicate with different government agencies unless we can all go to a specific frequency that all can use. It would be nice if there was one statewide frequency that all agencies could use during emergencies. You would have to train how to use them and have a designated net control operator when using that frequency.
- ☉ The ability to communicate with all agencies in our region for emergency work and sharing of resources.
- ☉ I don't believe we have a need for a statewide radio system in our department because our radio system is adequate for our use.
- ☉ Keep it simple to use, have a statewide channel for all agencies to use in situations where different levels of government are working together.
- ☉ The cost of implementing a statewide radio network would have to be kept within reason.
- ☉ The decision would have to be made on a higher level.
- ☉ The emergency response personnel are able to use our frequency when situations such as disasters occur. So that we may monitor forecast and local emergency channel when necessary.
- ☉ The safety of our staff is also important.
- ☉ No mandates with out funding. If a statewide network is institutional it should be an addition to and not a replacement for local systems outside the Metro area. I believe that there is a better way to use the resources we now have. There is more than enough equipment cluttering the landscape already.
- ☉ Need frequency of use, cost/ benefit.
- ☉ Interference.

### **Sheriff's Department**

- ☉ The monies needed to pay for a statewide radio network would be a huge problem for outstate agencies with limited budgets. We just installed new consoles and updated mobile radios. We cannot afford more updates for a long time. However we also believe it is important to be able to communicate with all other entities and are working on this issue.
- ☉ Local control over policy issues, state funds to defray costs take extreme care not to end up with too much radio traffic on the same frequency.
- ☉ Rural regional planning needs to be considered as to the individual needs of that area. I'm not sure if a Metro Radio Board has the ability to recognize the uniqueness of the individual agencies.
- ☉ If planning and implementation take place local entities not just Metro entities must be involved. Many agencies such as our county have already upgraded their systems. How would these effect agencies such as ours? Counties such as ours won't support unfounded mandates or negative changes to our current system
- ☉ If the system is going to be implemented then it should be for all public safety agencies not just a select few. However it is a good idea for larger jurisdictions to go to the 800 MHz system that will add a lot new frequencies for those who don't change cost would be a major factor for this county it would be over 5,000,000.00 from a previous survey/study. Renting towers and equipment maybe a cheaper route.
- ☉ In the rural areas of the state the State Patrol district boundaries could be utilized to make it more workable on a local level. State government needs to set-up the parameters that all systems will operate on with input from the sheriff's associations.
- ☉ The two issues that come to mind are will this system work in certain areas, with hills, valleys, etc. Is it right for everyone? Financing without state and or federal money many small emergency services, cities etc. Including my agency will not be able to afford changing out all the portables, mobiles, dispatch stations etc. Matching funds aren't much help.
- ☉ Law enforcement, Fire and EMS are all on the same repeater system in our county. When an emergency occurs we have problems because different agencies are using the repeater at the same time. When we design our new system law enforcement will have its own repeater system that is encoded or digital for privacy. EMS needs a statewide repeater system Fire needs a statewide repeater system.
- ☉ I don't have a problem with a state network. I'm not interested in regional dispatch. We have our own local concerns and I don't want an outside agency telling us what to do or how to do it.
- ☉ Geographic location, knowledge of dispatchers, elimination of 'skip' and bleed over. The state has been running a surplus for some time while local jurisdictions have had to rely on property tax increases to provide the most basic of services. This has left no money to improve infrastructure that is vital for new equipment such as radios etc. Maybe it is time to set priorities right.
- ☉ The problems I see with a statewide radio system are many. Unable to get on air because of heavy usage. Lack of control as for us usage, equipment etc.

- ⊗ Cost, size, area
- ⊗ All agencies should be able to talk to each other
- ⊗ Money
- ⊗ What do you get? Who pay for it? Funds not available on local levels. Frequency coordination throughout state.
- ⊗ For us and one statewide frequency with us for federal department.
- ⊗ Something that works and isn't out dated before it's installed.
- ⊗ The interests of public safety need to be considered and needs and interests must be balanced with available resources.
- ⊗ Funding new system is a problem. Control of the system could cause political problems. I'm sure it could be done with current technology but the funding and political barriers are considerable.
- ⊗ If a change is made for pager frequencies all small town Fire and ambulance services would need to buy pager and radios. Political Price tag!
- ⊗ Radio networking across state lines
- ⊗ Who will maintain equipment? Who will manage traffic on frequencies?
- ⊗ The cost of implementing a shared system who is going to pay for all new equipment such as 800 MHz.
- ⊗ The system cannot be so complex that the user has to stop what they are doing to figure out how to operate it.
- ⊗ I feel MDT needs to be installed in all outstate law enforcement vehicles better communications will save lives and save money.
- ⊗ Allow for local government impute prior to decisions being made.
- ⊗ Cost and who will pay. Fairness in allocating resources. Big city / small county
- ⊗ The main concern I have is that this does not end up being another non-funded mandate from the federal or state government down to the local level this seems to be the way the state is doing business these days.
- ⊗ The majority of the funding and at a minimum regional change over not just 1 or 2 counties or cities.
- ⊗ Not able to cross talk to border patrol.
- ⊗ Cost to local government.
- ⊗ Consider leaving Northwest Minnesota as is, thing are working fine.
- ⊗ Left up to local government.
- ⊗ Funding – who is going to fund the project.
- ⊗ Need for many frequencies. Coverage for all jurisdictions. Who will administrate and how will representation be chosen.
- ⊗ To be sure all radios work for all agencies consistently. Cost carefully for reception

### **Municipal Police Department**

- ⊗ Keep it regional in division. Too many departments on same frequency would cause delays in radio traffic.
- ⊗ First I see a problem with budget and money allocated for such projects in outstate. In our present leadership outstate appears to be left out. Our area presently has an 800 MHz tower operated privately that has better communications abilities then our present system. Teaming with private industry in our area could prove helpful.
- ⊗ I'm assuming this statewide network would be similar to law enforcement's statewide frequency. Educating when to use network. Who picks up the cost of upgrading systems in operation now.
- ⊗ Keep the planning and implementation at a county level
- ⊗ Consider having representatives from smaller agencies on the planning and implementation committee. Use as much of the existing equipment each agency has. Should upgrades or outdated equipment need to be replaces, financial assistance should be provide to smaller agencies that have limited funds for the costly changeover
- ⊗ I do not want to wait for 10-28 and 10-US (plate registration and DL information). What will the wait be on a statewide system? The cost to our small low budgeted department? Will everyone on the system would on each other? How many users per area or region.
- ⊗ Make it affordable to the smaller agencies. Metro departments obtain many from Legislature; leaving small departments behind.
- ⊗ Each department works the radio/communication system differently. Such as running vehicle registrations or drivers license checks or use of dispatchers for phone calls and notifications. Local dispatchers also know the communities they serve as well as the people who live in that community. Problems with dispatch outside the area may arise and the public may not get or feel they were given the same type of service as in the past.

- ⊕ Keep all operational technological issues as local as possible. Poetically I can't see how system could work beyond local area. Too much impute to operation and budget if system too broad. Smaller departments such as ours would have hard time with cost of operation of large system if we had no say where system located.
- ⊕ Strict users guide for all with local involvement in planning. Will there be enough frequencies. What will be the cost? Who will pay? Will it be "mandated" by state.
- ⊕ Consider multi-channels for talk around Versus Emergency traffic get everyone's impute. Have policies in place and guidelines up before starting or going live.
- ⊕ Funding – federal – state- vs. city. If the city has to purchase the equipment give us notice so that there is time to convince council the need and budget for the equipment.
- ⊕ Trunked, digital, non-800 MHz. In our part of the state skip/congestion is minimal. But in a consolidated dispatch S.O. put everyone on one frequency. We have enough frequencies that could be pooled and provide much better coverage to field units. Too spread out for cost effective 800 towers.
- ⊕ Smaller local government municipalities – will not be able to fund for this Fire, Police.
- ⊕ Too complex to describe here.
- ⊕ Cost, timing
- ⊕ Staffing competency. Users and techs make decisions they should rather than some know nothing politician.
- ⊕ All areas of the state should have access/coverage regardless of population.
- ⊕ Just so they do not overcrowd the airways so people walk all over each other's conversations.
- ⊕ Co-operation with Stearns County Sheriff's department would have to be must. Also cost would be a large factor.
- ⊕ Severe weather alerts need to be addressed.
- ⊕ More repeaters and towers. Ability to communicate with all emergency service entities from all hand held and mobile radios.
- ⊕ Each unit of government is unique each has its own operational methodology as well as different missions. Attempting to coordinate the different methodology will be difficult at best.
- ⊕ Cost to small agencies, reliability of system, we are looking for something better than what we have.
- ⊕ Affordable for all agencies
- ⊕ Consider all agency and government to the same don't let state or fed take command and do it their way. Don't let only one big name radio company try telling everyone what's needed.
- ⊕ Due to the increasing radio traffic with the volume of police calls- more dispatchers – for the reason of officer safety.
- ⊕ Outstate regions represented equally with Metro area. Under operations - who pays for maintaining system/updating. Would there be cost to any all who use system. Don't see much benefit to a statewide system as far as our department.
- ⊕ It should have enough repeaters so that local and outlying areas are covered unlike MNSEF.
- ⊕ The facts need to be set in stone prior to any agreement. "Financial and control of system.
- ⊕ HIGH PRIORITY! Mobile data terminals access for rural agencies.
- ⊕ System needs to be kept simple and easy to operate.
- ⊕ Digital technology at no cost to municipality.
- ⊕ You would need to sell local councilmen and to have money or grant to pay for system if it is a high cost to Small City it will not happen.
- ⊕ I don't think it an issue.
- ⊕ Expand the number of statewide frequencies that can be used for Public Safety.
- ⊕ Range of towers, the ability to communicate with agencies further than 6 miles.
- ⊕ I believe it is very important to be able to access all other agencies with one radio. There must be enough channels for every one to have access to, without having to wait. Funding to pay for it.
- ⊕ Enough channels and distance for rural Minnesota.
- ⊕ Involvement or representation from each entity involved for the implementation process. Technological consideration for future updates, expansion. Provide privacy/security for transmissions.
- ⊕ Frequencies that are not scannable to the Public. Laws prohibiting Public from scanning any Law enforcement activity.
- ⊕ Constant access and method of payment.
- ⊕ Do not believe this to be an issue. I believe we should have this technology already.
- ⊕ Keeping in mind that smaller agencies don't have the capital to keep up with technology. If changes are mandated, make sure there are grants available so we can afford it.



- ☞ One of the biggest issues will be money. Will there be state or federal monies made available for small agency upgrades?
- ☞ Solve communication problems listed above.
- ☞ I would worry that dispatchers would give certain agencies priority because they are perceived as bigger and more powerful rather than priority given to the seriousness or potential seriousness of the call.
- ☞ We would just like to have a safe, clear line of communications.
- ☞ Low Band Frequencies on mobile units so one does not cover other units in use. A strict guide policy using the radio network only in emergency use.
- ☞ Funding for small County and Local Agencies to acquire the new technology.
- ☞ System should be an open-ended design with the flexibility to adapt to specific locales. Should integrate both voice and data systems. Politically, a lot of turf issues will have to be resolved. 800 trunked systems handle volume of traffic but you still have to spend money to staff adequate levels of dispatchers.
- ☞ It should be "inter"-state.
- ☞ Don't forget remote Rural areas where numbers of possible officers for response are limited.
- ☞ What considerations are to be given Greater Minnesota outside the 7 County Metro area? Will there be regional operations points? What are cost factors to be considered for rural small communities?

### Special Police

- ☞ A statewide radio system would infringe on the rights of the private radio operators.

### State Government

- ☞ Data privacy
- ☞ Should have full state coverage with seamless operation to radio user. Should include in building coverage should have a high level of voice security available in all areas. System should permit secure in-agency communications and seamless secure interoperability with local and federal jurisdictions. A continuing funding source not dependent on specific agency budget should provide equipment and other system costs. Operations standards should be uniform throughout the state.
- ☞ Funding, staffing, equipment (compatibility with existing)
- ☞ We will follow the lead of the state patrol. Cross communications are very important to us.

### Question 3: Place additional comments here.

### Municipal Fire Department

- ☞ None

### Volunteer Fire

- ☞ I have been Fire Chief for 8 months and this is reflected in my response. I have a concern of having multi-users on our radio channel. I would like to maintain our present system.
- ☞ We are a very small town, with a number of calls each year. Radio Communication is very important as we are out as far as possible in one County. Pagers, Radios, and our current radio system is not that old (we have spent a lot of money to update in the last 5 years). Refarming of Radios is beyond our budget, but know that it is needed to improve our system. Waseca County is currently trying to upgrade their system, which is going to put a major strain on our budget.
- ☞ More funding to small fire departments

### School District

- ☞ Radios need to be small and mobile so they can be used beyond the vehicle and accessible 100% of the time. They need to be on the person, not the vehicle.
- ☞ To be able to have long-range communication that is clear and static free without the ability of home scanners to listen. Also to be able to communicate with local authorities.
- ☞ Our system is simply for our bus operators to communicate with the school office and bus contractors base and garage.

### Ambulance

- ☞ Need a radio system that works and a service department that does work for police ambulance fine on a timely basis. More frequencies with repeaters more towers all over our area, to many dead spots.

- ⊕ Our biggest problem is with 911 paging. We are near the county line and the only ways Douglas County can page us is by telephone/encoder or calling Otter Tail county dispatcher and having them relay the information. Either way is out of normal dispatch procedures and delays our being dispatched. In regard to section 3 Question 4 our biggest problem with range is on our local government frequency on our local tower. More then 3-4 miles out we have to shift to Otter Tail Sheriff Vining tower, which is already a very busy channel.

### Hospital

- ⊕ We are a hospital, which operates an ambulance service we use the standard HEAR radio system for base and mobile operations. We also operate a paging base for internal use.

### Utility

- ⊕ Due to organizational control and operational money benefit issues, Rochester public utilities would limit its participation to having its independent dispatch center participate on a trunked system. For emergency needs only if at all. All mobiles and portables would remain on our own VHF and UHF frequencies. Our dispatch center is staffed 24/7 and is in a better position to relay instructions rather than interoperability directly to individual units.

### County Emergency Management

- ⊕ The maintenance department use two-way portable radios for communications between two buildings and a total of 41,000 square feet.

### City Administration

- ⊕ We are a small community of 52 people. We contract all our services and have no full time employees. Work that can be done by council members is done for pay by the hour otherwise its hired done. Police and Fire protection is contracted.
- ⊕ We have one radio in the car and one radio in the office – shared system with Highway department.
- ⊕ We have a CB radio between the City Hall and the Grader operator. We can also call Pine County and a garage in Pine City with this CB. We have no plans for any other type radio.
- ⊕ Approximately 3 times a year – depends on if assistance is needed by other city personnel. Share a repeater station with Fire, Ambulance when operating on these frequencies.

### Animal Control

- ⊕ The city of Madelia, Animal Control does at times use the police channel in which the county law enforcement has the licenses.

### City Parks Department

- ⊕ We prefer cell phones. Hearing constant talk on the radios is very annoying and when you need it the most you are out of range.

### Transit

- ⊕ We believe that some kind of center based radio dispatch system will be needed soon in order to take our small system to the next level of expansion or to consolidate it with neighboring systems.
- ⊕ Our transit system has vehicle units of the highway department two-way radios but we seldom use them. We deal with cellular phones.
- ⊕ The public safety departments – Police, Fire and County Sheriff have much more of a need to talk to outside agencies – any communication with the street department (during an emergency or disaster) can be through those departments. Street department needs are simple with no need to scramble (all those scanners have to have somebody to listen to it might as well be street) and no need to communicate with state or federal agencies over a two-way radio. In the last 2 disasters of recent years the record flood of 1197 and the windstorm in 1998. Any contact the street department had with the state or federal agencies would not have taken place over the radio.

### Public Works

- ⊕ The city of Madelia – street department does use the city channel for our use this channel does belong to the city of St. James, Minnesota
- ⊕ There have been times when we could have used the state DOT frequency when working with them during times of emergencies. When we installed our new radio system we went multi- channel with some room for additional channels for just such future use. We went this route for emergency preparedness reasons, so that all county



agencies could use some frequency in case one system went down due to tornadoes etc. This way all county and city units can be radio controlled on any frequency by the CD director and Sheriff department. It would be nice to have that capability with the state agencies also.

- ☉ This survey was difficult to complete because of a lack of expertise involving the technical end of radio communications.
- ☉ We currently use cellular telephones for communications.

### Sheriff's Department

- ☉ Grant planning needs to start including the entire state not just Metro. I'm not aware of any grants going out-state except for Olmsted County.
- ☉ Maintenance over all according to radio area experts would be costly but they all agree would be an over all good system. Clear better distance and fit the modern technology changes. Public works need to stay in the VHF system.
- ☉ I answered some of the questions "never plan to use". It doesn't mean that we "never" will plan to use them. We just don't have plans in place to use them "within" 5 years. The MDT and MDC is something that I would believe we could use and be of benefit to my department. Again it is money that prevents us from either having them or planning for them.
- ☉ While no plans are made to replace the "system" we are finding the need to replace units. The older units do not have the capabilities of the newer models. I would say that within a few years replacing base stations might need to be addressed.
- ☉ #8 - As sheriff I'd expect to remain in control of our radio and dispatching services for our county. As an elected official I'm responsible for all emergency services in the county.
- ☉ A regional dispatch study was done 4 years ago. Project was rejected for lack of saving money, staff, cross training to do multi-task jobs. Loss of efficiency. Loss of contact with community. Loss of economy. Concern from public on loss of local control.
- ☉ Instead of returning the money in the form of refunds and other quick fixes, money that is already been paid in the form of taxes should be used to upgrade vital emergency services functions.
- ☉ We communicate well with other agencies using the statewide radio frequency for our area that's all we need.
- ☉ While this department utilizes the listed # of radios other public safety providers use the same radio frequencies.
- ☉ A trunked system capability is certainly desirable. Will the 800 MHz system work here?

### Municipal Police Department

- ☉ Section I – because of the immensity of the county and that the county seat (Dispatching Center) is so far away, we have difficulty communicating with the Sheriff's office with our portable radios. Most of our calls for service come through civilian answering service hired by the city. The answering service does not have radio contact with us they page us on our pagers and then we call them by phone, either cellular or landline. We feel this works better for us because the Sheriff's office couldn't handle the additional workload plus it would be a long distance phone call for a resident to call the S.O. In summary, the radios systems is archaic at least, certainly unreliable.
- ☉ The New Prague Police department utilizes radio frequencies from Scott, Rice and Le Sueur Counties due to our geographical location. A 800 MHz trunking system would not be feasible for our agency. If Scott county was included in a 800 MHz trunking system (Scott County is our primary dispatch) we would have to maintain two systems in area to communicate with Rice and Le Sueur counties who may not be included in 800 MHz trunking.
- ☉ Will there be grounds for small, low budgeted departments? The cost? Is it necessary to consolidate? What is the benefit? What is the plan if the system fails? Down time etc.
- ☉ Great need to help smaller agencies get at least MDT's in not MCTs
- ☉ Unsure at this time.
- ☉ Technology is changing so fast and so rapidly updating seems to be a situation where we are running only to stand still. By the time the seed is planted to the time some new system gets implemented could be five years. Within that time frame tech. Could be much more advanced.
- ☉ I think a very good system can be built and work, but it needs time and work to be put together. Planning for 20 or 30 years down the road. I remember the last radio program back in the 70's and it was only good for 2 years before department went on their own.
- ☉ Cooperative efforts of all governments

- ☺ I think that local, county and state government should all provide shared funding to have enforcement agencies equipped with MDT or MDC devices.
- ☺ HIGH PRIORITY! We would like to see mobile data terminal access for rural Minnesota.
- ☺ Access to surrounding law enforcement records via MDT's would be of great help. Today's society is very mobile. Anything that can be done to assist in obtaining or disseminating information among law enforcement agencies would enhance our effectiveness for enhancing public safety.
- ☺ APCO is too involved in the allocation of Public Safety radio systems. At minimum, all Police frequencies should reside at the UHF range or better. All equipment, like Radar Units, Mobile Video, and remote transmitters operate between 122.00 – 165.00 UHF. This interfered with mobile radio operations as does high power transmission lines and peripheral electronic devices and computers. I've been told that all the frequencies are used up in our area and we can't obtain additional ones. I don't understand this as I was led to believe that Police had priority for radio frequencies. The state needs to lobby the FCC directly for more available frequencies.

### Special Police

- ☺ None

### State Government

- ☺ We are a statewide agency and work with federal, state and local counterpart's everyday. We need interoperability with them on a secure radio system, which has in-building coverage throughout the state. We also need statewide secure car to car coverage among our investigators on a daily basis.

**Appendix “B”**  
**Statewide Public Safety Radio Communications Initiatives in Other States**

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**Statewide Public Safety Radio Communications Systems in Other States**

Submitted by Pam Newsome, Mn/DOT Library

October 17, 2000

The object of this project to gather information from several states regarding safety radio communications systems, in order to determine: whether there is a trend toward the implementation of statewide systems; how systems are authorized and funded; how system governance works and how the relationship among member agencies works; what technology is being used; and how migration from older systems is handled.

Among the states that were successfully contacted, Delaware, North Dakota and South Carolina have systems in place. Colorado, Florida, Michigan and Ohio are well along in the implementation process for new systems. Alaska, Nebraska and Wisconsin are in preliminary or planning stages. Kentucky, Louisiana and Washington state do not have statewide systems.

Statewide public safety radio communication systems provide interoperability among state, federal and local public safety agencies in a state. They include law enforcement, corrections, natural resources, transportation, fire and emergency medical personnel. Some states have, or are implementing, such all-inclusive systems and some are more limited in scope. The following table gives a summary of each state that was included in the study. A state-by-state narrative is available upon request.

**Statewide Public Safety Radio Communications Systems in Other States**

The table below summarizes the status and characteristics of statewide public safety radio systems in ten other states. Seven are fully or partially implemented; three are in the planning stages. Of the systems that are in place or being implemented, most use 800 MHz technology. The North Dakota system, which has been operational since 1977, uses VHF. In four of the states, the agency responsible for the system is the agency that handles telecommunications/technology for the state. Two systems are under the State Police/State Patrol, two are under Management & Budget & Control Boards, and one is governed by a multi-agency steering committee. In Delaware, implementation was under the Department of Administrative Services and ongoing maintenance is under the Department of Public Safety. Most of the systems were funded with state bonds and one through a state trust fund. Only one system has any federal funding. Several of the systems have or are planning user fees to help pay for equipment and/or ongoing operation and maintenance costs.

State	State Governance	Advisory Bd./User Group	Status of System	System Users	Technology	Funding Sources	Cost	Web site URL
Alaska	Dept. of Admin, Info. Technology Group		Engineering evaluation being done	State, Local, Federal	To be determined	To be determined		
Colorado	Dept. of Personnel, Telecom. Services	Cooperative Communication Network of Colorado	In Phase 3 of implementing	State, Local	800 MHz	Public safety trust fund; local users purchase their equip.	\$150-200 million est.	<a href="http://www.state.co.us/gov/dir/gss/cits/comm/dtrs/dtrsinde.htm">http://www.state.co.us/gov/dir/gss/cits/comm/dtrs/dtrsinde.htm</a>
Delaware	Dept. of Telecom. & Tech; Dept. Public Safety	Informal user committee	In place since 1998	State, Local	800 MHz	Bonds; general fund and local funds for ongoing cost	\$52 million	<a href="http://www.state.de.us/pcomm/800a.htm">http://www.state.de.us/pcomm/800a.htm</a>
Florida**	State Technology Office	Joint Task Force	50% of state is covered	State law enforcement	800 MHz	\$1 of each vehicle registration and voter registration fee	\$220 million est.	<a href="http://www.stste.fl.us/dms/tools/plnpl/r9p1n10.pdf">http://www.stste.fl.us/dms/tools/plnpl/r9p1n10.pdf</a>
Michigan	State Police	Local user meeting; planning a formal user committee	In Phase 4 of implementing	State, Local, Federal	800 MHz	Bonds (State Bldg. Authority); user fees and general fund of upgrades.maintenance	Approx. \$200 million	<a href="http://www.mpscs.com/">http://www.mpscs.com/</a>
Nebraska	Dept. of Admin. Services	Public Safety Wireless Communication Advisory Board	Planning the system	State, Local	Will be either VHF or 800 MHz	To be determined; will include state funding and user fees	\$210 million est.	<a href="http://www.doc.state.ne.us:80/radio/Intro-towebpage.html">http://www.doc.state.ne.us:80/radio/Intro-towebpage.html</a>
North Dakota	Office of Mgmt. & Budget, Radio Communications Div.	N.D. Peace Officers Communication Committee	In place since 1977	State, Local, Federal	VHF	75% federal grant, 25% general fund to implement. Ongoing from general fund and county 9-1-1 rev-		<a href="http://www.state.nd.us/radio">http://www.state.nd.us/radio</a>

\*\* The state of Florida information above may no longer be applicable. Florida has made an administrative decision to privatize their state radio facilities. Information not available as of this writing.

State	State Governance	Advisory Bd./User Group	Status of System	System Users	Technology	Funding Sources	Cost	Web site URL
Ohio	Six-agency Steering Committee	No local users yet	Beginning to implement	State, open to local	800 MHz	Bonds (State BLDG. Authority); member state agencies pay ongoing costs	\$275 million	<a href="http://www.state.oh.us/das/dcs/marcs">http://www.state.oh.us/das/dcs/marcs</a>
South Carolina	Budget & Control Bd., Info. Resource Office	Users advisory committee	75% of state covered	State, Local	800 MHz	Paying fees to share infrastructure owned by utilities; seeking leg. approp. to purchase	\$16 million est. tp purchase sites form utilities	
Wisconsin	State Patrol	State /local committee	Planning the system; conducting pilots	State, Local	Leaning toward VHF	To be determined		

## Appendix “C”

### 800 MHz Executive Team Methodology

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In order to determine the current status and needs of public safety wireless communication users throughout Minnesota, the 800 MHz Executive Team met once every month. The process began by educating 800 MHz E-Team members on the issues that are, or will impact, wireless communication users. The 800 MHz E-Team then identified main categories that they felt needed to be addressed. Those issues include:

1. Spectrum (radio frequencies)
2. Technology issues
3. FCC regulatory issues
4. Funding
5. Governance
6. Interoperability

The 800 MHz E-Team then determined that additional information would be required to assess the impact of a shared statewide wireless system. The 800 MHz E-Team listed the following:

1. What are other states doing?
2. Is there any interest in a shared statewide system by the local public safety agencies in Minnesota?

In order to get a better understanding of the above issues, the 800 MHz E-Team developed a questionnaire with specific questions pertaining to each issue. The survey was mailed to all city, county and other major wireless user groups on August 4, 2000. The survey responses were used to help the 800 MHz E-Team gain a better understanding of several of the issues raised in the legislation. Those issues include:

1. Current and future needs and capacities of radio systems in outstate areas.
2. The potential for implementation of a multi-agency, multi-jurisdictional shared radio system.
3. Potential guidelines for governance and system participation by state and local units of government
4. Statutory changes required implementing a statewide shared public safety radio system.
5. Expansion capacities of each local government and major user group.
6. Estimates of local government and major user groups of the anticipated level and timeline for using the radio system.
7. Analysis of the expected costs of implementing the radio system.
8. Proposed funding mechanisms, including options for allocating costs among local governments and major user groups.

The survey data was compiled and analyzed by members of the 800 MHz E-Team. (See Appendix A for an itemized account of each question contained in the survey.) The 800 MHz E-Team developed proposed recommendations based on the findings from the survey and other data gathered. Those final recommendations are included in this report.

A draft report was developed by the 800 MHz E-Team and then distributed to local governments throughout Minnesota. Ten (10) regional meetings were held throughout Minnesota. With the assistance of organizations such as the Association of Minnesota Counties, League of Minnesota Cities, Minnesota Sheriff's Association, Association of Minnesota Chiefs of Police and the Association of Minnesota Fire Chiefs, the 800 MHz E-Team sent invitations to county and city administrators requesting their agency's and department's participation at the nearest regional meeting to review and discuss the draft report to the Legislature. The comments received as a result of the regional meetings are reflected in Appendix D of this report

## **Appendix "D"**

### **Local Input to Draft Report**

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#### **Local Reaction to Statewide, Shared 800 MHz System Report**

The final component of preparing this report entailed a series of meetings with local entities. Ten meetings were held throughout the state to review the draft report findings and recommendations. Notices were again sent out to county and city administrators. They were asked to distribute the meeting notice to any radio users within their jurisdictions. The meetings were conducted in informal settings and attendees were encouraged to give verbal feedback during the meetings. The attendees were also given comment sheets that they could fill out anonymously and send back to the 800 MHz E-Team. They were also asked to take additional copies of the report back to their communities for further distribution to any other stakeholders they felt may have an interest in the issue of a shared statewide radio system.

There were approximately 90 attendees at the regional meetings. There was representation from the following departments at all meetings: sheriff's office, police department, fire department and Minnesota State Patrol. There was also representation from the highway departments, utility departments, park departments, public works departments, city and county administrators and school districts at some of the meetings. As of January 3, 2001, fifty (50) of the departments represented at the meetings have sent their comment sheets to the 800 MHz E-Team.

#### **Metro Input**

Although the report is centered around Greater Minnesota communications issues, it was pointed out to the E-Team that the governance alternatives included discussions about the Metro area and specifically the Metropolitan Radio Board. Because of this, the E-Team met with members of the Metropolitan Radio Board, and other government and communications officials from within the seven (7) county Metro area, to discuss this report. Comments from the Metro meeting are also included in this appendix.

#### **Comments:**

Six specific questions were asked on the comment sheet as well as to the participants at the regional meetings. These questions with responses follow:

1. Which of the governance options presented in the report do you believe would be best suited for your type of government service?

Of those responding, 42% indicated that a Statewide Board that included the Metro Area (Alt. 1) would best suit their needs. 8% said that the State Agency Leadership (Alt. 2) would be the best governance board.

40% indicated that Two Separate Boards (Alt. 3), one for Greater Minnesota and one for the Metro, would be best suited to their needs.

10% indicated that some other alternative should be explored.

- ☞ Three (3) boards based on geographic locations.
- ☞ We have no options, we are too small.
- ☞ Needs to have equal representation from Greater Minnesota
- ☞ Three (3) boards; one Metro, one for small agencies and one for large agencies. All three coordinate for legislation and funding.
- ☞ Can have separate subcommittees, Metro, non-Metro, state. Also must have non-participants in the planning to facilitate growth and coordination.

**2. Which of the funding options presented in the report do you believe would be best suited for your type of government service? This pertains to Item II, Initial Equipment Requirements.**

16% selected the State General Fund Loan Account (Alt. 1) as the best method.

10% indicated that the PFA (Alt. 2) would be the best source of funding for their equipment.

18% indicated that 9-1-1 Fees (Alt. 3) would be best suited to fund their equipment needs.

0% Alt. 4.

0% Alt. 5.

Of those responding, 50% believed that Federal Grants (Alt. 6) would be the best way to obtain money to fund the purchase of the equipment they would need.

6% felt that some other method should be examined.

- ☞ The state pays for everything.
- ☞ Use a combination of the three alternatives.
- ☞ Some type of lease arrangement.

**2a. Which of the funding alternatives presented in the report do you believe would be best suited to your type of government service? This pertains to Item III, Ongoing Maintenance Requirements.**

Of those responding, 34% indicated that Annual Radio Fees (Alt. 1) would best suit their needs.

22% selected General Local Revenues (Alt. 2) as the best method to cover maintenance costs.

36% believed that Subscription Charges (Alt. 3) would best meet their needs.



8% offered other methods to obtain maintenance revenues.

- ⊕ Time for federal government to step in and help the local governments in updating their system.
- ⊕ State pays for everything.
- ⊕ Combination of local revenues and annual fees.

**3. Based on the recommendations in the report, do you believe that your government agency could get fair representation in the planning and operational control of the system?**

80% believed that their agency could get fair representation based on the board make-up described in the governance section of the report.

20% indicated that they did not believe their agency could get fair representation. All indicated that because of their small community size that they would be at an unfair advantage.

Reasons why they felt they could not get fair representation:

- ⊕ Too small of a department (to get equal representation).
- ⊕ You should have one entity leading the charge on this issue. It should be responsible to all on an equal basis.
- ⊕ We're not really sure why at this point.
- ⊕ Outstate Minnesota is insignificant.
- ⊕ Smaller agencies get run over by the larger ones. It all comes down to dollars and is evident in the report.

**4. Based on the report, would your agency/department give serious consideration to participate in a shared statewide 800MHz radio system?**

68% indicated that they would consider participation in a shared statewide radio system.

32% indicated that they would not participate. Comments on why they would not participate:

- ⊕ Need more information on costs. (Several comments)
- ⊕ Just bought a new VHF radio system.
- ⊕ Somebody else fund it.
- ⊕ Need more local input. Too much is decided in the Metro. Needs to be better representation in Greater Minnesota.
- ⊕ Just spent money to upgrade our current radio system

**5. Does the report address all of your (agency) concerns and or issues?**

56% indicated that the report addressed all of their issues.

44% indicated that the report did not satisfy all of their issues.

Concerns:

- ⊕ Where will the money come from? How much will it cost locals?
- ⊕ Are there plans to be able to talk across state borders with the new system? We need to be able to talk to North Dakota officials. (Several comments)
- ⊕ The report doesn't discuss funding for small departments.

- ☞ Will the system talk across state lines?
- ☞ We could not afford the expense of changing over to a new 800 system.
- ☞ The report does not present any clear funding mechanism.
- ☞ The report does not explain how the education will be done and how the money will be made available.
- ☞ Should discuss data issues.

#### **6. Other comments or concerns?**

- ☞ Needs to provide for equal partnership responsibilities. Local participation is critical for success.
- ☞ A mixture of alternatives for funding and governance would be best. Any federal funds would be positive, but I think there is limited availability.
- ☞ Our radio budget is \$8,000. A shared 800 system is not sensible due to cost considerations without a state or federal grant.
- ☞ No interest lease arrangements may be necessary to provide for local participation.
- ☞ The state doesn't have to stay completely out of the governance. Just leave local decisions to local officials and keep the locals informed throughout the process.
- ☞ I believe, at least in NW Minnesota that you should look at a public/private partnership in setting up the system. With the vast area that needs to be covered and the low population, I believe that this can be more effectively done through this type of a partnership.
- ☞ We are interested, but only if we have some control of policy and funding choices.

#### **The Following Comments Were Received Through Discussions at the Regional Meetings Held in Greater Minnesota.**

Tabulated below are the comments, both verbal and written, from representatives of the local units of government. The comments are sorted into categories matching the recommendations of the report.

#### **State Take the Lead Allowing for Voluntary Local Participation:**

- ☞ Can this (the radio project) happen based on Governor Ventura's administration cutting back on other services to cities and counties (dollars and cents)?
- ☞ The vision for project is good. There needs to be some global direction set by the state.
- ☞ Need to sell other advantages of the system such as Mobile Data Computers, officer safety, tools and capabilities.
- ☞ Must have phased in process.
- ☞ Why is state sending back rebates when locals need to raise money to fund participation?
- ☞ What is time frame for the statewide shared radio system?

#### **Education and Technical Assistance:**

- ☞ What are the capabilities of the system, will it provide coverage to fill in holes?
- ☞ You will have no problem selling law enforcement on the idea. However, you need to hit (make presentations to) the county boards.

Education- your presentations will have to go way back to basics of radio and how the system will meet the needs. Your education program should be targeted on decision makers.

- ⊕ Are controllers located in counties?
- ⊕ Did your survey find out how important communications is within the total scheme of things on a day-to-day basis verses an emergency or critical incident?
- ⊕ VHF band has problems with interference.
- ⊕ Operationally will it be easy to use for officers and dispatchers (patches, channel selection, etc.)?
- ⊕ Does the trunking concept work with analog or digital technology?
- ⊕ Have you talked with Association of Minnesota Counties?
- ⊕ What about cellular (is this a viable option)?
- ⊕ What about statewide roaming?
- ⊕ What about coverage with 800 MHz verses VHF?
- ⊕ What about private industry systems, will they have better foundation?
- ⊕ What about the present equipment on our systems, can it be used on the new network?
- ⊕ How will small agencies like ours get educated on the features and capabilities of the system?

#### **Establish Local Planning Committees:**

- ⊕ What is your plan for migration from the old systems to the new system?
- ⊕ Who's responsible for coverage guarantees?
- ⊕ How will all this participation take place and what is the timing?
- ⊕ Does everyone need to talk statewide or just on a regional basis?
- ⊕ Need migration strategy, from now and into the future so we can prepare for this.
- ⊕ Need a migration plan to address timing of people joining the system.

#### **Establish Standards:**

- ⊕ What if some departments go onto the system and some don't? What happens if all surrounding agencies go on system, but our agency does not? How will the new system work? We need migration options.
- ⊕ Will this system give us in-building coverage?
- ⊕ This system must form a solid technical foundation so locals can use for the next 20 years.
- ⊕ What is the back-up scenario? Is the proposed system fail-safe?
- ⊕ Will there be two radios in vehicles?
- ⊕ Will we be able to join later to use mobile data but not the voice system? (unbundle)

#### **Develop Cost Participation Guidelines:**

- ⊕ What will the system cost the local units of government?
- ⊕ How will you use tower space to generate revenue? What will that money be used for?

- ☞ Cost figures need to look at the size of the geographic areas, especially in large areas like St. Louis Co. There will be cost differences due to greater hardware demand.
- ☞ Needs migration plan and put money aside to make the leap.
- ☞ What does it cost?
- ☞ Why do the locals have to pay maintenance on backbone or infrastructure of the system?
- ☞ The state should pay for everything and run the whole system.
- ☞ The feds should help the locals out like they did with the L.E.A.A grants.
- ☞ Our community has no money for participation in a system like this. What will the state do to provide assistance?
- ☞ Who will pay for this?
- ☞ The report does not discuss how small departments can generate revenue to support the use of this system.
- ☞ Our department just bought a new system, do you expect us to come over to this new system and just throw out our new system?

#### **Determine Governance Structure:**

- ☞ What about breaking state into regions?
- ☞ Can we use different alternatives in different regions? Needs in geographic areas may dictate different solutions. However, the state should still provide the overall plan and vision for this project.
- ☞ Different regions may get by with different approaches.
- ☞ What about the layout of the board and who will be on it? We need equitable representation.
- ☞ What about the 60% of survey respondents that have no plans to change out their radio systems within the next six years, do they pay now or later after the system is up and running?
- ☞ If Metro is funded separately, they will get more money than Greater Minnesota, we want equal representation.
- ☞ Because of the size of this system and the governing board, the small local agencies will have no input into the design and operation of the system. (At least six (6) comments were received stating the same thing)
- ☞ Why don't you consider making three boards? One for northern Minnesota, one for southern Minnesota and one for the Metro area.

#### **Determine Funding Options:**

- ☞ Would join if they could lease radios (Fillmore Co.).
- ☞ How will small local agencies pay for installing the equipment?
- ☞ Planners and legislators cannot separate the concept from the cost. Local agencies need to know how much to put aside to make the transition.
- ☞ Do not want to dip further into 9-1-1 fee (there are other needs that are tapping 9-1-1 fees).
- ☞ Some counties have more money than others.
- ☞ Is there a possibility of a joint public/private partnership in the rural areas? Wouldn't this offer a lower cost system?
- ☞ A word of caution about using grants. Look at what happened in the L.E.A.A. days. Federal grants were given to locals. However, the grant money could not always be used for what the county felt was

best. Some grant programs have hooks that restrict how the grant money can be used.

- ☞ Money issue needs to be defined like back in L.E.A.A. days.
- ☞ It all comes down to money.
- ☞ Let's not battle over funding like we did with 9-1-1.
- ☞ Our utility department does not see a need and cost justification for a system like this.
- ☞ What is typical cost for county/city?

#### **Other General Comments:**

- ☞ Will the system be phased in to provide mobile data capacity?
- ☞ A northern county sheriff supports the shared radio system concept and he needs a replacement system. He needs to somehow inform his county board of what the state is working on. Will we (E-Team members) be available to discuss this with his board?
- ☞ Will Mobile Data Computers operate on this system?
- ☞ Please keep in mind as you plan the system that day-to-day service is vital to most public safety operations.
- ☞ If our system is working good today, how can I justify going to the new system?
- ☞ Will paging be a part of the new system?
- ☞ A southwest sheriff has lots of problems with radio system, has to do something soon! Is now leasing services on a commercial analog 800 MHz trunking system.
- ☞ Most of the systems installed in 1974 are still in operation today.
- ☞ Interference on VHF channels is getting worse.

#### **Metro Comments**

Following are comments received at the Metropolitan area meeting that was held on January 5, 2001.

- ☞ Why is there such a negative perception of the Metro and the Radio Board in Greater Minnesota?
- ☞ At what level were the regional meetings held? Were policy makers involved, or were the meetings with supervisory or below staff members?
- ☞ Developing standards for the radio system are well underway in the Metro, do you plan to use these standards in Greater Minnesota or create new ones?
- ☞ Whatever the governance model selected, the Metro area needs significant representation.
- ☞ Your efforts need to streamline governance and have representation balanced with power base and money.
- ☞ Consider three (3) governing boards, north, south and central.
- ☞ This discussion today on governance is mirroring what occurred in the Metro ten (10) years ago while we were developing the Metropolitan Radio Board. The Greater Minnesota governance will need a lot of work. You need to assure balanced representation.
- ☞ You need to involve a core group of decision-makers to resolve the governance issues.
- ☞ All cities and counties need money. Funding issues are not unique to entities in Greater Minnesota; money issues are still pertinent in the Metro.
- ☞ Alternatives presented in the report do set the stage for discussion. However, a governance structure does exist here in the Metro, it is called the Metropolitan Radio Board. This Board could be modified

to be representative of the entire state. Their powers already exist. Representation could be drawn from the regions in dealing with local operational and technical issues.

- ☉ The report recommended education campaign – you need to get the League of Minnesota Cities and the Association of Minnesota Counties involved in your process.
- ☉ Representatives of the Metro feel that the financial benefits given to Greater Minnesota local government entities, needs to be equitable with the investment government entities have put into the Metro system.
- ☉ Eight or nine separate regions/districts would be difficult to manage in terms of convening and coordinating local input and decision making. No more than four local user regions should be established. Consider organizing local governance groups around the four State Tourism Districts: south, north central/west, northeast, and Twin Cities.
- ☉ Only one statewide system "policy board" is needed, not one in each region/district and not a separate one for the Metro area. The policy board should primarily be made up of local elected officials accountable directly to the voters and should be "evolved from" the current Metro Radio Board by statutory changes.
- ☉ Each region/district should have a "user group/technical operations committee" that recommends policy and makes local decisions. The regional group should be made up of government administrators and user agency representatives.
- ☉ There should be one statewide "system managers group" made up of the technical managers accountable to the "system owners" who administer the system and implement policy.
- ☉ Implementation of two State Patrol districts at a time over four to five years is a good plan. A better plan would be to first implement along the major freeway corridors and the top four or five population centers. This would provide the greatest benefit to the largest number of citizens the fastest and cheapest and would be the easiest initial deployment plan to support from a political perspective.

**Survey information and copies of the report are available upon request.**

**E-mail us at: [mike.hogan@dot.state.mn.us](mailto:mike.hogan@dot.state.mn.us)**

**Or visit our Web site at [www.dot.state.mn.us/oec/os800Report.html](http://www.dot.state.mn.us/oec/os800Report.html)**

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Layout and graphics by Kim Lanahan-Lahti, Office of Communication and Public Relations and staff.

## **Exhibit 2**

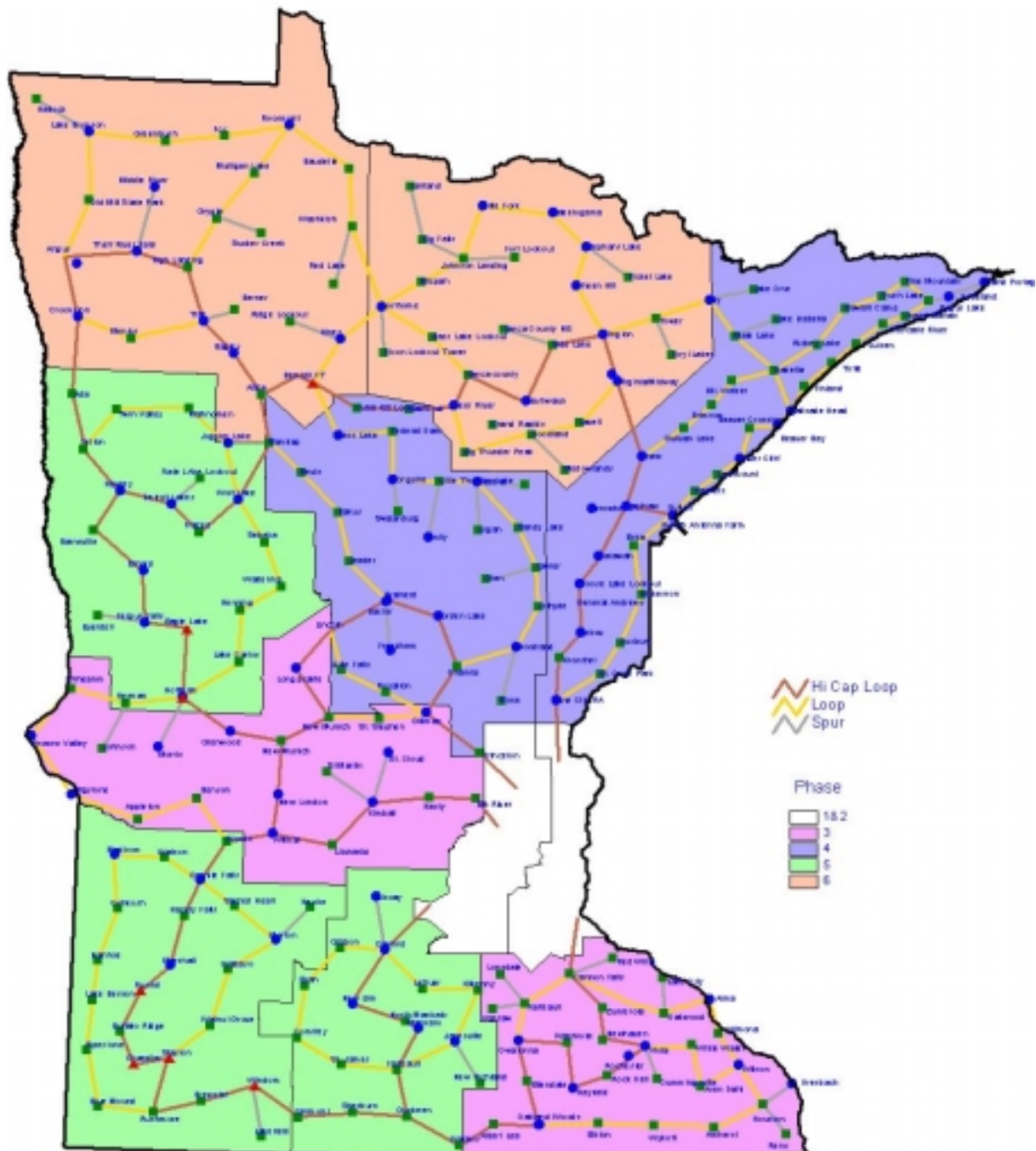
**TOWER LOCATIONS**

**MICROWAVE ROUTING**

**&**

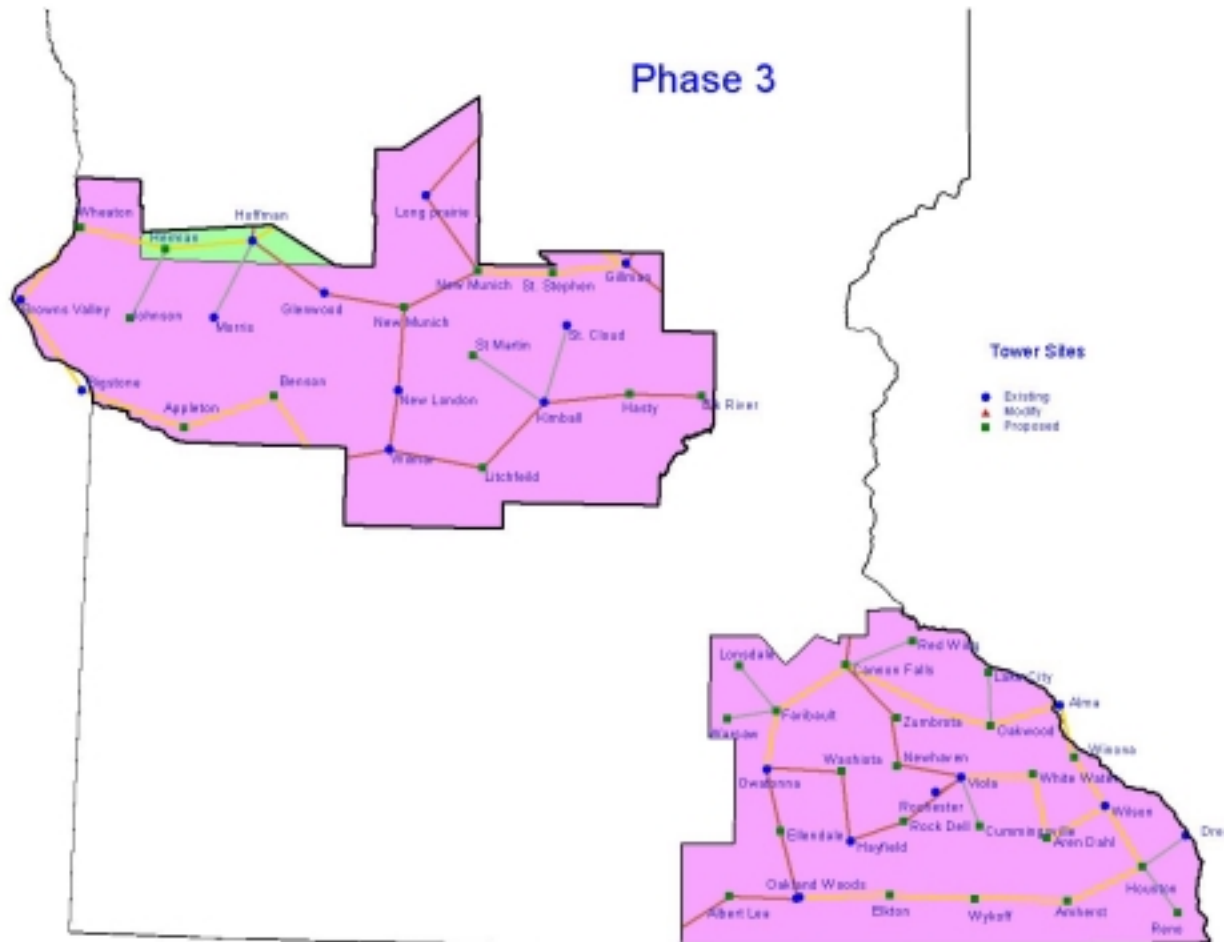
**IMPLEMENTATION PHASES**

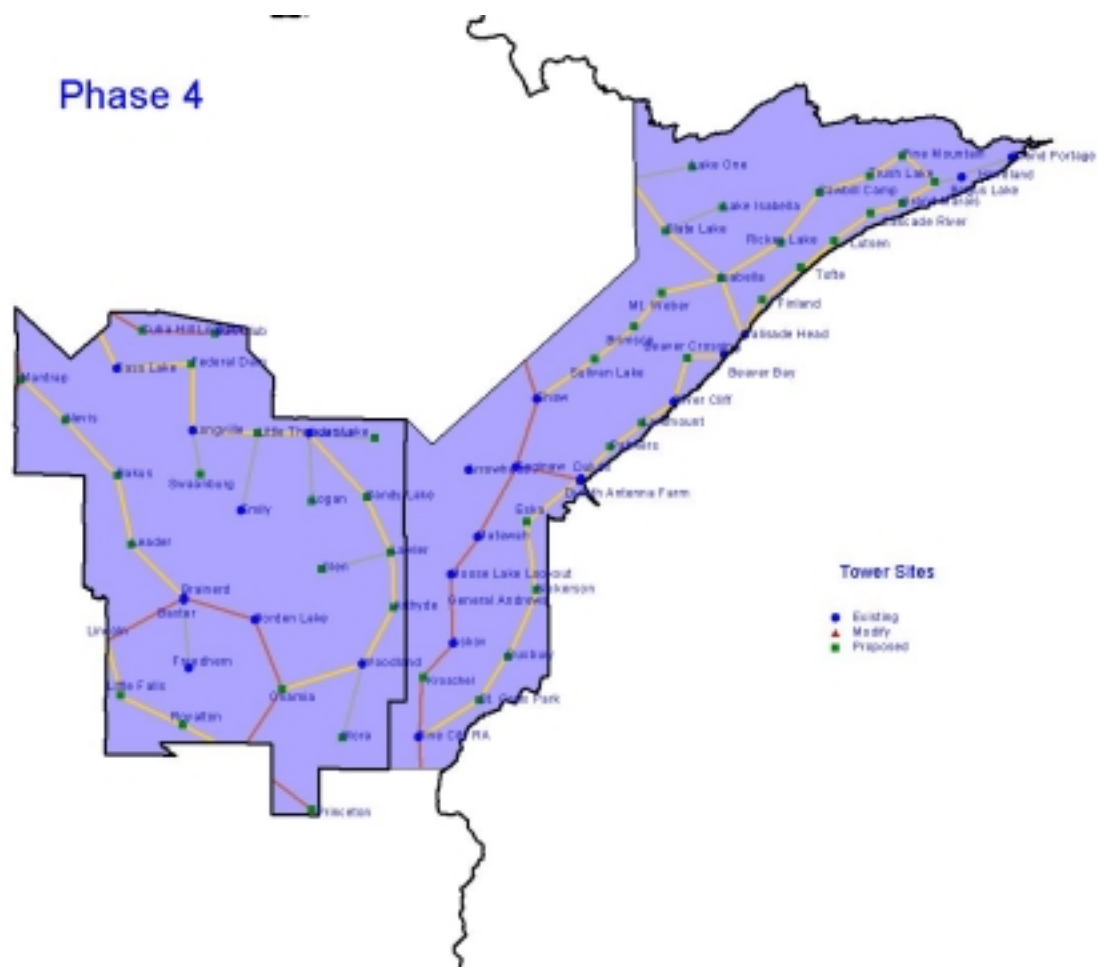
# Overview of Statewide Microwave Paths & Tower Sites



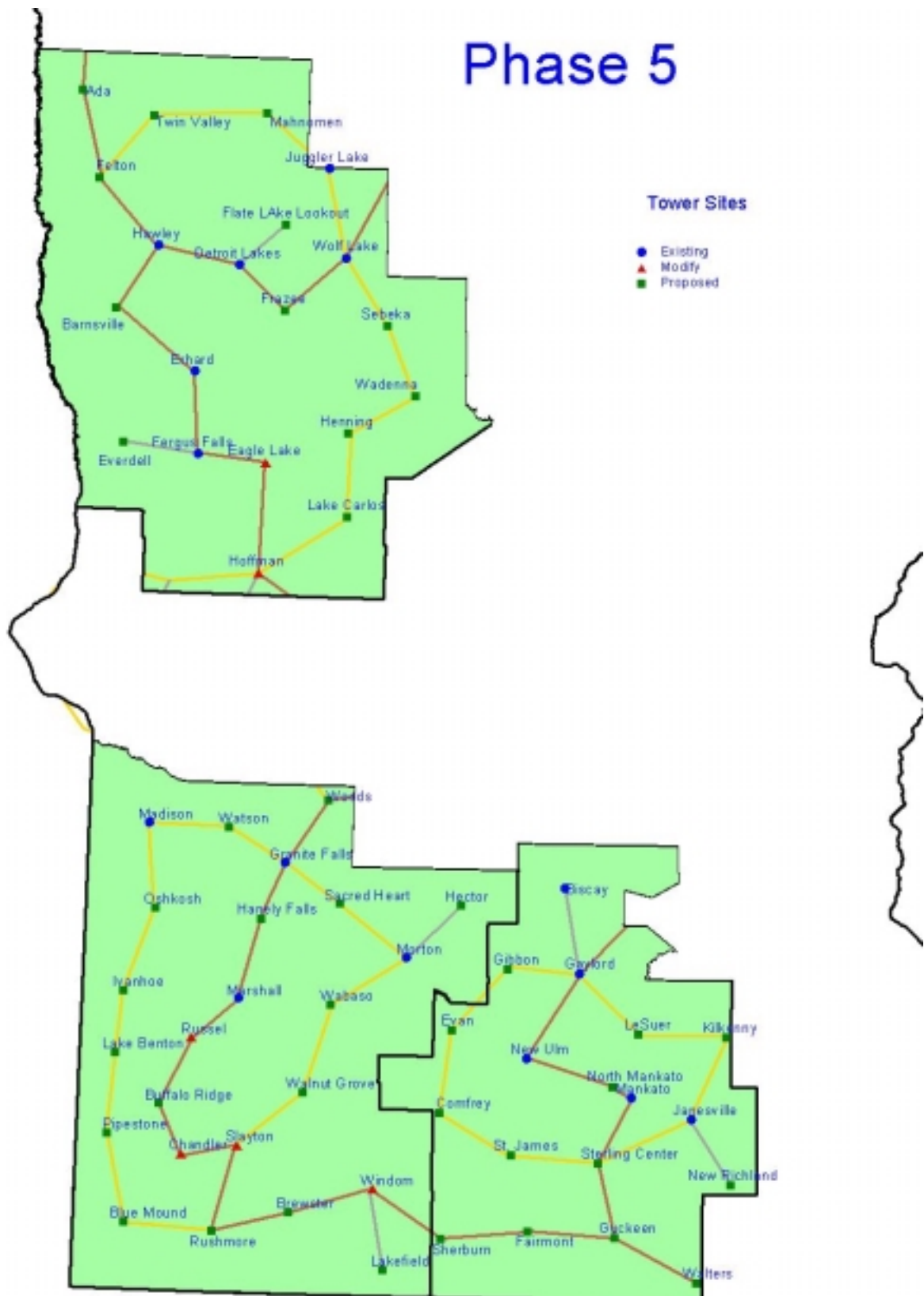


### Phase 3

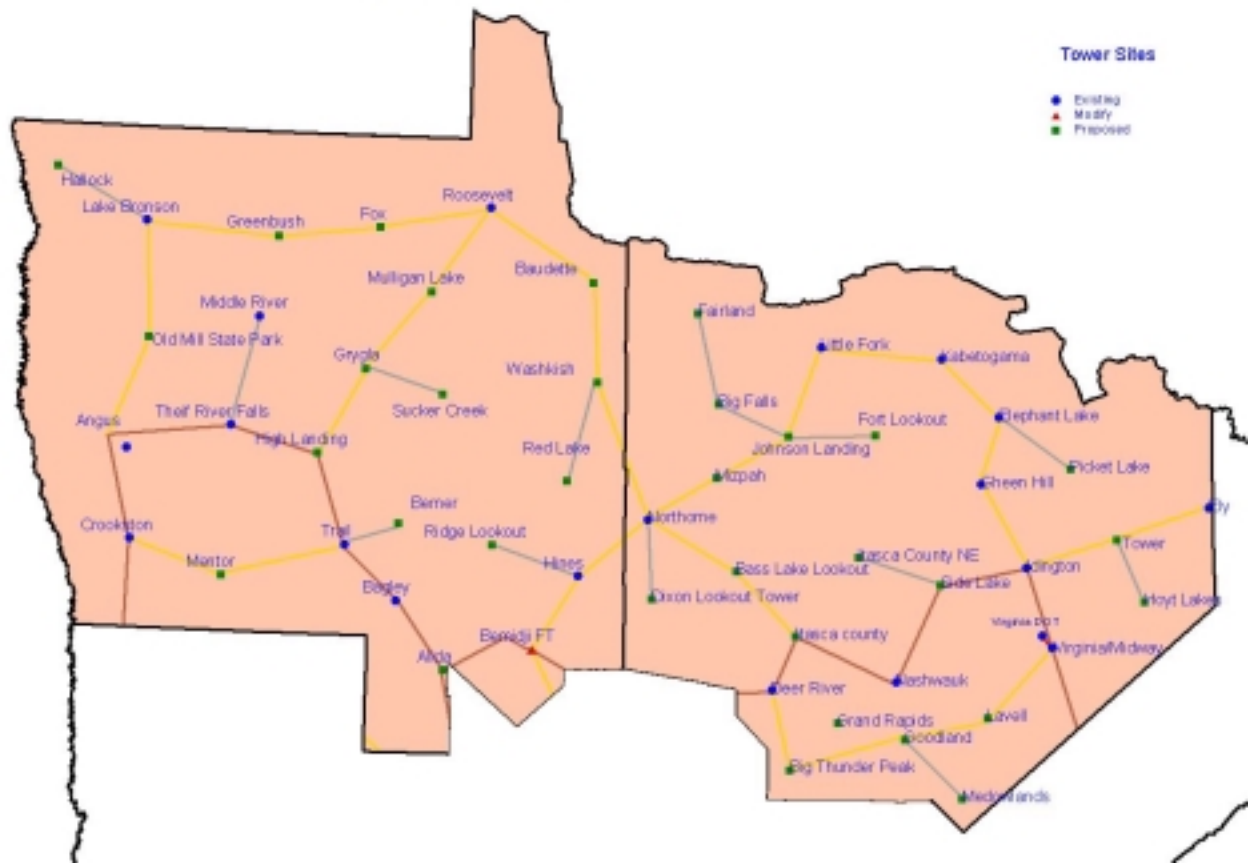




## Phase 5



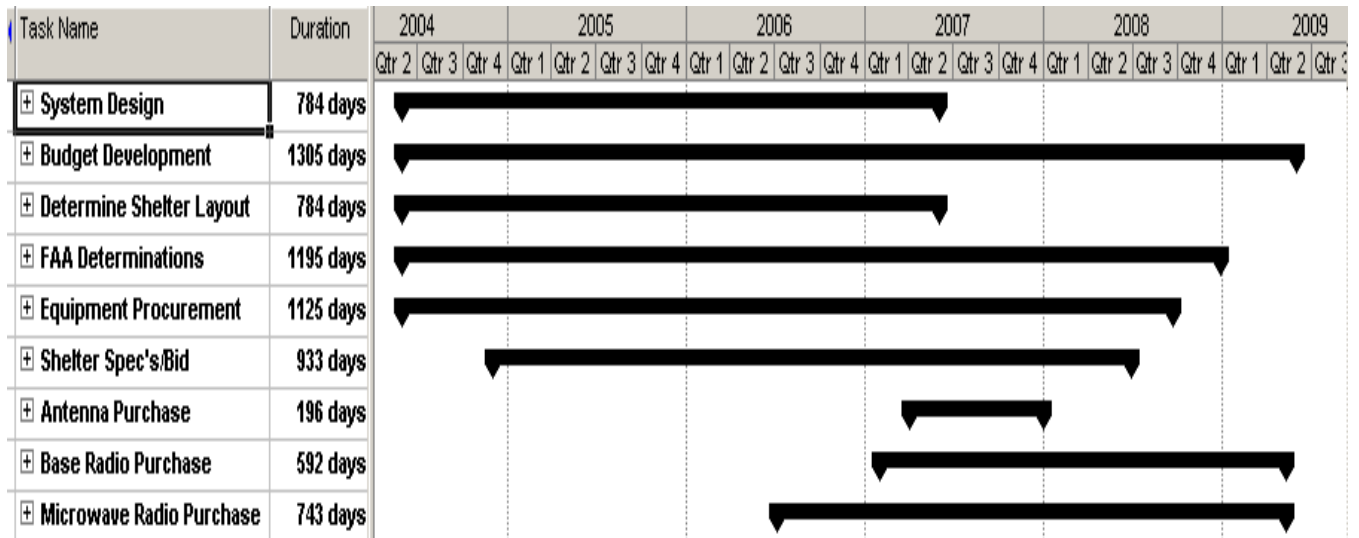
## Phase 6



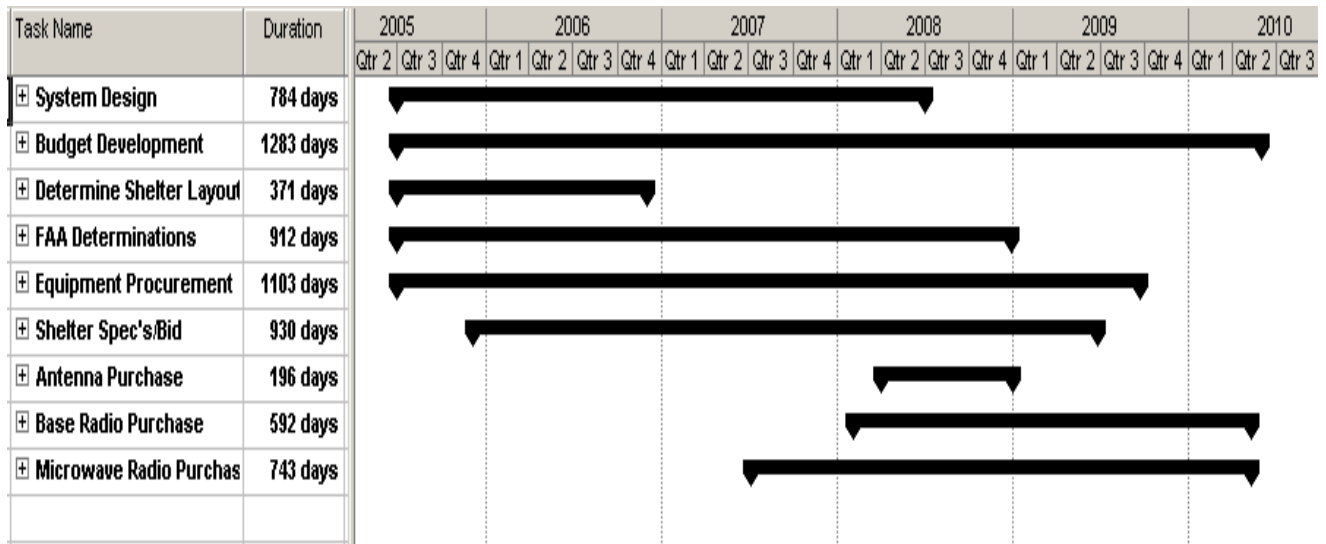
# **EXHIBIT 3**

## **TIME LINE**

### PHASE 3 - Rochester and St. Cloud Districts



## PHASE 4 – Duluth and Brainerd Districts

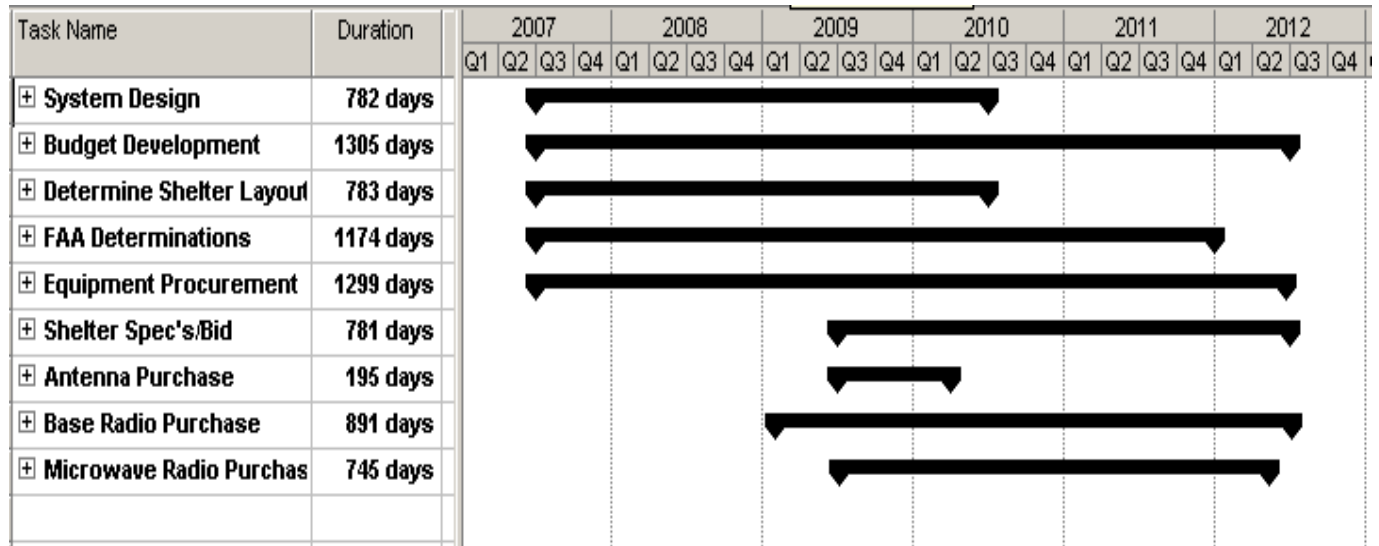


PHASE 5 – Mankato, Marshall and Detroit Lakes Districts

Task Name	Duration	2006				2007				2008				2009				2010				2011			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
+ System Design	1305 days																								
+ Budget Development	1304 days																								
+ Determine Shelter Layout	783 days																								
+ FAA Determinations	1242 days																								
+ Equipment Procurement	1125 days																								
+ Shelter Spec's/Bid	931 days																								
+ Antenna Purchase	196 days																								
+ Base Radio Purchase	593 days																								
+ Microwave Radio Purchas	743 days																								



PHASE 6 – Virginia and Thief River Falls Districts



## **EXHIBIT 4**

**LAND / TOWER / SHELTER /  
AND GENERATOR COSTS**

LAND/TOWER/SHELTER/GENERATOR LOCATIONS AND COSTS

DIST	SITE NAME	COUNTY	NEW OR EXIST TWR	LAT	LONG	HT	TOWER & LAND	SHLTR/ GEN	TOTAL
21	Albert Lea	Freeborn	N	43 38 47	93 22 15	330	\$248,000	\$100,000	\$348,000
21	Alma	Wisconsin	M	44 18 10	91 53 28	330	\$0	\$85,000	\$85,000
21	Amherst	Fillmore	N	43 36 08	91 53 11	330	\$248,000	\$100,000	\$348,000
21	Amherst	Fillmore	N	43 36 08	91 53 11	330	\$248,000	\$100,000	\$348,000
21	Aren Dahl	Winona	N	43 51 53	91 55 23	330	\$248,000	\$100,000	\$348,000
21	Bear Valley	Wabasha	N	44 16 17	92 29 48	330	\$248,000	\$100,000	\$348,000
21	Cummingsville	Olmsted	N	43 54 05	92 16 14	330	\$248,000	\$100,000	\$348,000
21	Dresbach	Winona	M	43 51 35	91 18 58	330	\$170,000	\$100,000	\$270,000
21	Elba	Winona	N	44 04 34	91 56 10	330	\$248,000	\$100,000	\$348,000
21	Elkton	Mower	N	43 39 29	92 42 30	330	\$248,000	\$100,000	\$348,000
21	Faribault	Rice	N	44 17 28	93 12 40	330	\$248,000	\$100,000	\$348,000
21	Hader	Goodhue	E	44 20 53	92 49 48	330	\$0	\$0	\$0
21	Hayfield	Dodge	M	43 50 51	92 51 41	330	\$248,000	\$0	\$248,000
21	Houston	Houston	N	43 45 30	91 34 21	330	\$248,000	\$100,000	\$348,000
21	Lake City	Wabasha	M	44 25 20	92 18 50	330	\$0	\$85,000	\$85,000
21	Lonsdale	Rice	N	44 28 45	93 25 21	330	\$248,000	\$100,000	\$348,000
21	New Haven	Olmsted	N	44 11 27	92 39 57	330	\$248,000	\$100,000	\$348,000
21	Oakland Woods	Freeborn	M	43 39 43	93 06 51	330	\$170,000	\$85,000	\$255,000
21	Oakwood	Wabasha	N	44 11 49	92 07 44	330	\$248,000	\$100,000	\$348,000
21	Owatonna	Steele	M	44 05 37	93 15 14	330	\$53,000	\$0	\$53,000
21	Red Wing	Goodhue	M	44 32 43	92 34 40	330	\$0	\$85,000	\$85,000
21	Reno	Houston	N	43 33 17	91 20 08	330	\$248,000	\$100,000	\$348,000
21	Rochester	Olmsted	E	44 03 49	92 21 11	330	\$0	\$0	\$0
21	Salem Corners	Olmsted	N	43 56 08	92 36 25	330	\$248,000	\$100,000	\$348,000
21	Summit	Steele	N	43 55 00	93 11 01	330	\$248,000	\$100,000	\$348,000
21	Viola	Olmsted	E	44 03 48	92 21 12	330	\$0	\$0	\$0
21	Warsaw	Rice	N	44 14 32	93 23 36	330	\$248,000	\$100,000	\$348,000
21	Washiota	Dodge	N	44 03 57	92 59 38	330	\$248,000	\$100,000	\$348,000
21	Wilson	Winona	M	43 57 42	91 41 16	330	\$53,000	\$0	\$53,000
21	Winona	Winona	N	44 03 12	91 39 11	330	\$248,000	\$100,000	\$348,000
21	Wykoff	Fillmore	N	43 42 11	92 15 45	330	\$248,000	\$100,000	\$348,000
30			N=19/E=3/M=8				\$5,406,000	\$2,340,000	\$7,746,000

LAND/TOWER/SHELTER/GENERATOR LOCATIONS AND COSTS

DIST	SITE NAME	COUNTY	NEW OR EXIST TWR	LAT	LONG	HT	TOWER & LAND	SHLTR/ GEN	TOTAL
22	Biscay	McLeod	E	44 49 57	94 16 50	160	\$0	\$0	\$0
22	Comfrey	Watonwan	N	44 05 49	94 49 40	330	\$248,000	\$100,000	\$348,000
22	Evan	Brown	N	44 22 03	94 46 46	330	\$248,000	\$100,000	\$348,000
22	Fairmont	Martin	N	43 42 59	94 46 21	330	\$248,000	\$100,000	\$348,000
22	Gaylord	Sibley	E	44 33 22	94 12 37	330	\$0	\$0	\$0
22	Gibson	Sibley	N	44 34 04	94 32 11	330	\$248,000	\$100,000	\$348,000
22	Guckeen	Faribault	N	43 38 03	94 13 37	330	\$248,000	\$100,000	\$348,000
22	Janesville	Waseca	E	44 05 16	93 42 07	300	\$0	\$0	\$0
22	Kilkenny	LeSueur	N	44 21 23	93 32 42	330	\$248,000	\$100,000	\$348,000
22	LeSuer	LeSueur	N	44 21 43	93 56 22	330	\$248,000	\$100,000	\$348,000
22	Mankato	Blue Earth	E	44 09 19	93 58 13	330	\$0	\$0	\$0
22	New Richland	Waseca	N	43 52 42	93 31 15	330	\$248,000	\$100,000	\$348,000
22	New Ulm	Brown	E	44 16 36	94 26 27	330	\$0	\$0	\$0
22	North Mankato	Blue Earth	N	44 11 35	94 03 20	330	\$248,000	\$100,000	\$348,000
22	Sherburn	Martin	N	43 43 13	94 25 28	330	\$248,000	\$100,000	\$348,000
22	St James	Watonwan	N	43 57 51	94 30 24	160	\$248,000	\$100,000	\$348,000
22	Sterling Center	Blue Earth	N	43 51 27	94 00 17	330	\$248,000	\$100,000	\$348,000
22	Walters	Faribault	N	43 33 36	93 40 11	330	\$248,000	\$100,000	\$348,000
<b>18</b>			<b>N=13/E=5/M=0</b>				<b>\$3,224,000</b>	<b>\$1,300,000</b>	<b>\$4,524,000</b>

LAND/TOWER/SHELTER/GENERATOR LOCATIONS AND COSTS

DIST	SITE NAME	COUNTY	NEW OR EXIST TWR	LAT	LONG	HT	TOWER & LAND	SHLTR/ GEN	TOTAL
23	Blue Mound	Rock	N	43 42 59	96 13 19	180	\$248,000	\$100,000	\$348,000
23	Brewster	Nobles	N	43 45 51	95 29 31	330	\$248,000	\$100,000	\$348,000
23	Buffalo Ridge	Pipestone	N	44 06 18	96 05 09	330	\$248,000	\$100,000	\$348,000
23	Chandler	Murray	M	43 56 03	95 59 16	200	\$0	\$75,000	\$75,000
23	Granite Falls	Chippewa	E	44 53 29	95 33 16	360	\$0	\$0	\$0
23	Hanely Falls	Yellow Medicine	N	44 42 37	95 39 21	330	\$248,000	\$100,000	\$348,000
23	Hector	Renville	N	44 46 15	94 45 08	330	\$248,000	\$100,000	\$348,000
23	Ivanhoe	Lincoln	N	44 27 49	96 15 58	330	\$248,000	\$100,000	\$348,000
23	Lake Benton	Lincoln	N	44 15 46	96 17 27	330	\$248,000	\$100,000	\$348,000
23	Lakefield	Jackson	N	43 35 06	95 03 56	330	\$248,000	\$100,000	\$348,000
23	Madison	Lac Qui Parle	E	45 00 42	96 10 45	180	\$0	\$0	\$0
23	Marshall	Lyon	E	44 26 59	95 44 44	100	\$0	\$0	\$0
23	Morton	Renville	E	44 33 12	94 12 46	140	\$0	\$0	\$0
23	Oshkosh	Yellow Medicine	N	44 44 08	96 08 12	330	\$248,000	\$100,000	\$348,000
23	Pipestone	Pipestone	N	44 00 01	96 18 57	330	\$248,000	\$100,000	\$348,000
23	Rushmore	Nobles	N	43 37 59	95 53 03	330	\$248,000	\$100,000	\$348,000
23	Russell	Lyon	M	44 18 49	95 57 27	305	\$0	\$53,000	\$53,000
23	Sacred Heart	Renville	N	44 46 03	95 18 03	330	\$248,000	\$100,000	\$348,000
23	Slayton	Murray	M	43 58 40	95 44 00	200	\$0	\$53,000	\$53,000
23	Wabasso	Redwood	N	44 25 41	95 14 55	330	\$248,000	\$100,000	\$348,000
23	Walnut Grove	Redwood	N	44 09 09	95 26 22	330	\$248,000	\$100,000	\$348,000
23	Watson	Chippewa	N	45 00 24	95 48 54	330	\$248,000	\$100,000	\$348,000
23	Windom	Cottonwood	M	43 50 51	95 07 19	300	\$0	\$53,000	\$53,000
23	Woods	Chippewa	N	45 06 05	95 22 03	330	\$248,000	\$100,000	\$348,000
<b>24</b>			<b>N=16/E=4/M=4</b>				<b>\$3,968,000</b>	<b>\$1,834,000</b>	<b>\$5,802,000</b>

LAND/TOWER/SHELTER/GENERATOR LOCATIONS AND COSTS

DIST	SITE NAME	COUNTY	NEW OR EXIST TWR	LAT	LONG	HT	TOWER & LAND	SHLTR/ GEN	TOTAL
26	Benson	Swift	E	45 19 06	95 33 40	300	\$0	\$0	\$0
26	Big Stone	So. Dakota	N	45 18 13	96 30 39	300	\$248,000	\$100,000	\$348,000
26	Browns Valley	Traverse	M	45 36 01	96 48 57	330	\$170,000	\$100,000	\$270,000
26	Elk River	Sherburne	N	45 18 31	93 34 17	300	\$248,000	\$100,000	\$348,000
26	Enfield	Wright	E	45 20 55	93 54 32	300	\$0	\$0	\$0
26	Gilman	Benton	M	45 46 54	93 56 07	300	\$0	\$7,000	\$7,000
26	Glenwood	Pope	M	45 40 20	95 23 00	330	\$0	\$85,000	\$85,000
26	Hancock	Swift	N	45 27 02	95 53 43	300	\$248,000	\$100,000	\$348,000
26	Herman	Grant	N	45 47 57	96 08 05	300	\$248,000	\$100,000	\$348,000
26	Kimball	Sterns	E	45 18 48	94 18 53	300	\$0	\$0	\$0
26	Litchfield	Meeker	N	45 08 51	94 30 18	300	\$248,000	\$100,000	\$348,000
26	Long Prairie	Todd	E	45 58 49	94 51 58	300	\$0	\$0	\$0
26	Louriston	Chippewa	N	45 05 15	95 22 41	300	\$248,000	\$100,000	\$348,000
26	Morris	Stevens	M	45 34 06	95 53 37	330	\$0	\$85,000	\$85,000
26	New London	Kandiyohi	N	45 20 34	95 00 30	330	\$248,000	\$100,000	\$348,000
26	New Munich	Sterns	N	45 36 51	94 44 28	300	\$248,000	\$100,000	\$348,000
26	Richmond	Sterns	N	45 26 46	94 31 38	300	\$248,000	\$100,000	\$348,000
26	Sauk Rapids	Sterns	N	45 55 45	94 11 58	330	\$248,000	\$100,000	\$348,000
26	St Cloud	Sterns	E	45 34 32	94 12 24	330	\$0	\$0	\$0
26	St. Stephen	Benton	N	45 42 30	94 17 29	300	\$248,000	\$100,000	\$348,000
26	Wheaton	Traverse	N	45 48 50	96 28 42	300	\$248,000	\$100,000	\$348,000
26	Willmar	Kandiyohi	M	45 09 02	95 00 33	300	\$0	\$85,000	\$85,000
<b>22</b>			<b>N=12/E=5/M=5</b>				<b>\$3,146,000</b>	<b>\$1,562,000</b>	<b>\$4,708,000</b>

LAND/TOWER/SHELTER/GENERATOR LOCATIONS AND COSTS

DIST	SITE NAME	COUNTY	NEW OR EXIST TWR	LAT	LONG	HT	TOWER & LAND	SHLTR/ GEN	TOTAL
27	Argus	St Louis	E	46 50 40	92 27 34	190	\$0	\$0	\$0
27	Arrowhead	St Louis	E	46 49 55	92 42 48	160	\$0	\$0	\$0
27	Askov	Pine	E	46 11 37	92 48 12	240	\$0	\$0	\$0
27	Beaver Bay	Cook	E	47 15 07	91 19 22	140	\$0	\$0	\$0
27	Beaver Crossing	Lake	N	47 14 27	91 31 33	180	\$248,000	\$100,000	\$348,000
27	Bogus Lake	Cook	N	47 52 05	90 08 47	300	\$248,000	\$100,000	\$348,000
27	Brimson	St Louis	N	47 21 42	91 48 38	330	\$248,000	\$100,000	\$348,000
27	Cascade River	Cook	N	47 45 33	90 30 04	330	\$248,000	\$100,000	\$348,000
27	Duluth Ant Farm	St Louis	E	46 47 46	92 07 24	325	\$0	\$0	\$0
27	Duluth DOT	St Louis	E	46 47 52	92 06 33	20	\$0	\$0	\$0
27	Duxbury	Pine	N	46 08 42	92 30 38	330	\$248,000	\$100,000	\$348,000
27	Eska	Carlton	N	46 41 16	92 22 03	330	\$248,000	\$100,000	\$348,000
27	Finland	Lake	N	47 27 00	91 06 36	180	\$248,000	\$100,000	\$348,000
27	Grand Portage	Cook	E	47 57 28	89 49 13	160	\$0	\$0	\$0
27	Hovland	Cook	E	47 52 53	89 59 47	120	\$0	\$0	\$0
27	Isabella	Cook	N	47 32 09	91 19 52	250	\$248,000	\$100,000	\$348,000
27	Kroschel	Pine	N	46 01 18	93 00 53	300	\$248,000	\$100,000	\$348,000
27	Lake Isabella	Lake	N	47 47 46	91 18 43	330	\$248,000	\$100,000	\$348,000
27	Lake One	Lake	N	47 56 56	91 28 42	330	\$248,000	\$100,000	\$348,000
27	Larsmount	Lake	N	47 00 14	91 46 22	330	\$248,000	\$100,000	\$348,000
27	Lutzen	Cook	E	47 39 42	90 42 21	100	\$0	\$0	\$0
27	Maple Hill	Cook	E	47 47 44	90 19 53	180	\$0	\$0	\$0
27	Mahtowa	Carlton	E	46 35 14	92 40 00	200	\$0	\$0	\$0
27	Moose Lake Lookout	Carlton	E	46 26 51	92 48 36	120	\$0	\$0	\$0
27	Mt. Weber	Cook	N	47 29 04	91 39 25	330	\$248,000	\$100,000	\$348,000
27	Nickerson	Pine	N	46 23 28	92 21 10	330	\$248,000	\$100,000	\$348,000
27	Palisade Head	Lake	E	47 19 11	91 12 48	300	\$0	\$0	\$0
27	Palmers	St Louis	N	46 55 03	91 56 50	180	\$248,000	\$100,000	\$348,000
27	Pine City	Pine	E	45 50 28	92 58 57	330	\$0	\$0	\$0
27	Pine Mountain	Cook	N	47 58 09	90 18 57	180	\$248,000	\$100,000	\$348,000
27	Rickey Lake	Cook	N	47 39 41	90 59 58	330	\$248,000	\$100,000	\$348,000
27	Sawbill	Cook	N	47 50 41	90 46 50	330	\$248,000	\$100,000	\$348,000
27	Shaw	St Louis	E	47 05 49	92 20 34	300	\$0	\$0	\$0
27	Silver Cliff	Lake	E	47 04 50	91 36 17	160	\$0	\$0	\$0
27	Slate Lake	Lake	N	47 42 57	91 37 39	330	\$248,000	\$100,000	\$348,000
27	St Croix St Park	Pine	N	45 59 02	92 39 36	330	\$248,000	\$100,000	\$348,000
27	Sullivan Lake	St Louis	N	47 14 35	92 01 29	330	\$248,000	\$100,000	\$348,000
27	Tofte	Cook	N	47 34 00	90 53 31	180	\$248,000	\$100,000	\$348,000
27	Trush Lake	Cook	N	47 53 58	90 30 06	330	\$248,000	\$100,000	\$348,000
39				N=23/E=16/M=0			\$5,704,000	\$2,300,000	\$8,004,000

LAND/TOWER/SHELTER/GENERATOR LOCATIONS AND COSTS

DIST	SITE NAME	COUNTY	NEW OR EXIST TWR	LAT	LONG	HT	TOWER & LAND	SHLTR/ GEN	TOTAL
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LAND/TOWER/SHELTER/GENERATOR LOCATIONS AND COSTS

DIST	SITE NAME	COUNTY	NEW OR EXIST TWR	LAT	LONG	HT	TOWER & LAND	SHLTR/ GEN	TOTAL
28	Arthyde	Aitkin	N	46 19 45	93 06 59	330	\$248,000	\$100,000	\$348,000
28	Bakus	Cass	N	46 48 21	94 36 32	330	\$248,000	\$100,000	\$348,000
28	Ball Bluff Lookout	Aitkin	M	46 57 21	93 13 05	100	\$0	\$100,000	\$100,000
28	Ball Club	Cass	N	47 20 19	94 05 22	250	\$198,000	\$100,000	\$298,000
28	Baxter	Crow Wing	E	46 20 57	94 13 48	300	\$0	\$0	\$0
28	Borden Lake	Crow Wing	E	46 16 43	93 51 27	180	\$0	\$0	\$0
28	Brainerd DOT	Crow Wing	E	46 20 51	94 14 29	20	\$0	\$0	\$0
28	Cass Lake	Hubbard	E	47 11 56	94 37 34	300	\$0	\$0	\$0
28	Cuba Hill Lookout	Cass	M	47 20 32	94 29 21	100	\$0	\$100,000	\$100,000
28	Emily	Crow Wing	E	46 40 51	93 56 18	280	\$0	\$0	\$0
28	Federal Dam	Cass	N	47 13 27	94 12 57	330	\$248,000	\$100,000	\$348,000
28	Freedhem	Morrison	E	46 05 48	94 12 34	180	\$0	\$0	\$0
28	Glen	Aitkin	N	46 28 14	93 30 03	330	\$248,000	\$100,000	\$348,000
28	Lawler	Aitkin	N	46 32 02	93 07 53	330	\$198,000	\$100,000	\$298,000
28	Leader	Cass	E	46 33 10	94 31 22	330	\$0	\$0	\$0
28	Lincoln	Morrison	E	46 11 24	94 38 57	300	\$0	\$0	\$0
28	Little Falls	Morrison	N	45 59 38	94 33 57	330	\$248,000	\$100,000	\$348,000
28	Little Thunder Lake	Cass	N	46 58 12	93 51 17	330	\$248,000	\$100,000	\$348,000
28	Logan	Aitkin	N	46 43 20	93 33 41	330	\$248,000	\$100,000	\$348,000
28	Longville	Cass	M	46 58 30	94 12 07	180	\$198,000	\$100,000	\$298,000
28	Mantrap	Hubbard	E	47 09 09	95 08 26	180	\$0	\$0	\$0
28	Mora	Kanabec	N	45 50 49	93 23 15	330	\$248,000	\$100,000	\$348,000
28	Nevis	Hubbard	N	47 00 24	94 53 44	330	\$248,000	\$100,000	\$348,000
28	Onamia	Mille Lacs	N	46 01 25	93 42 36	330	\$248,000	\$100,000	\$348,000
28	Princeton	Mille Lacs	N	45 34 41	93 32 50	330	\$248,000	\$100,000	\$348,000
28	Quadna	Aitkin	E	46 58 03	93 34 41	100	\$0	\$0	\$0
28	Royalton	Morrison	N	45 53 15	94 14 11	330	\$248,000	\$100,000	\$348,000
28	Sandy Lake	Beltrami	N	47 47 27	95 10 10	100	\$248,000	\$100,000	\$348,000
28	Swaanburg	Cass	N	46 48 50	94 09 42	330	\$248,000	\$100,000	\$348,000
28	Woodland	Kanabec	E	46 007 04	93 16 59	300	\$0	\$0	\$0
30			N=16/E=11/M=3				\$4,066,000	\$1,900,000	\$5,966,000

LAND/TOWER/SHELTER/GENERATOR LOCATIONS AND COSTS

DIST	SITE NAME	COUNTY	NEW OR EXIST TWR	LAT	LONG	HT	TOWER & LAND	SHLTR/ GEN	TOTAL
29	Ada	Norman	N	47 18 43	96 35 19	300	\$248,000	\$100,000	\$348,000
29	Barnsville	Clay	N	46 35 16	96 25 35	300	\$248,000	\$100,000	\$348,000
29	Detroit Lakes	Becker	E	46 49 22	95 51 38	300	\$0	\$0	\$0
29	Eagle Lake	Otter Tail	M	46 11 16	95 42 27	300	\$170,000	\$100,000	\$270,000
29	Erhard	Otter Tail	E	46 28 26	96 02 53	300	\$0	\$0	\$0
29	Everdell	Wilkin	N	46 15 04	96 25 09	300	\$248,000	\$100,000	\$348,000
29	Felton	Clay	N	47 03 56	96 36 18	300	\$248,000	\$100,000	\$348,000
29	Fergus Falls	Otter Tail	E	46 17 15	96 06 16	300	\$0	\$0	\$0
29	Flat Lake Lookout	Becker	N	46 57 34	95 38 55	330	\$248,000	\$100,000	\$348,000
29	Luce	Otter Tail	M	46 40 51	95 38 21	330	\$0	\$100,000	\$100,000
29	Hawley	Clay	E	46 52 36	96 43 16	300	\$0	\$0	\$0
29	Henning	Otter Tail	N	46 19 36	95 25 36	300	\$248,000	\$100,000	\$348,000
29	Hoffman	Douglas	M	45 49 54	95 43 16	330	\$0	\$85,000	\$85,000
29	Juggler Lake	Becker	E	47 09 00	95 27 03	162	\$0	\$0	\$0
29	Lake Carlos	Douglas	N	46 01 16	95 19 08	330	\$248,000	\$100,000	\$348,000
29	Mahnomen	Mahnomen	N	47 19 37	95 45 46	330	\$248,000	\$100,000	\$348,000
29	Sebeka	Wadena	N	46 38 47	95 09 32	330	\$248,000	\$100,000	\$348,000
29	Twin Valley	Norman	N	47 17 51	96 17 23	330	\$248,000	\$100,000	\$348,000
29	Wadena	Wadena	N	46 25 01	95 00 59	330	\$248,000	\$100,000	\$348,000
29	Wolf Lake	Becker	E	46 51 28	95 21 11	151	\$0	\$0	\$0
20			N=11/E=6/M=3				\$2,898,000	\$1,385,000	\$4,283,000

LAND/TOWER/SHELTER/GENERATOR LOCATIONS AND COSTS

DIST	SITE NAME	COUNTY	NEW OR EXIST TWR	LAT	LONG	HT	TOWER & LAND	SHLTR/ GEN	TOTAL
31	Bass Lake Lookout	Itasca	N	47 42 52	93 55 06	330	\$248,000	\$100,000	\$348,000
31	Big Falls	Koochiching	N	48 12 57	94 00 27	330	\$248,000	\$100,000	\$348,000
31	Big Thunder Peak	Itasca	N	47 07 16	93 40 21	330	\$248,000	\$100,000	\$348,000
31	Deer River	Itasca	M	47 21 34	93 45 17	300	\$170,000	\$85,000	\$255,000
31	Dixon Lookout	Itasca	N	47 37 41	94 17 29	110	\$248,000	\$100,000	\$348,000
31	Elephant Lake	St Louis	E	48 10 47	92 45 01	180	\$0	\$0	\$0
31	Ely	St Louis	M	47 54 03	91 48 54	300	\$170,000	\$0	\$170,000
31	Fairland	Koochiching	N	48 29 18	94 06 16	330	\$248,000	\$100,000	\$348,000
31	Ft Lookout Tower	Koochiching	N	48 07 38	93 18 09	300	\$248,000	\$100,000	\$348,000
31	Gheen	St Louis	E	47 58 44	92 49 50	100	\$0	\$0	\$0
31	Goodland	Itasca	N	47 12 50	93 10 09	330	\$248,000	\$100,000	\$348,000
31	Grand Rapids	Itasca	E	47 15 49	93 27 51	260	\$0	\$0	\$0
31	Hoyt Lakes	St Louis	N	47 37 23	92 06 21	330	\$248,000	\$100,000	\$348,000
31	Idington	St Louis	E	47 43 37	92 37 22	170	\$0	\$0	\$0
31	Itasca County	Itasca	N	47 31 13	93 39 07	400	\$248,000	\$100,000	\$348,000
31	Itasca County NE	Itasca	N	47 45 29	93 22 39	180	\$248,000	\$100,000	\$348,000
31	Johnson Landing	Koochiching	N	48 07 12	93 41 32	330	\$248,000	\$100,000	\$348,000
31	Kabetogma	St Louis	N	48 21 18	93 00 34	300	\$248,000	\$100,000	\$348,000
31	Lavell	St Louis	N	47 16 41	92 48 18	330	\$248,000	\$100,000	\$348,000
31	Little Fork	Koochiching	M	48 23 21	93 33 00	300	\$170,000	\$100,000	\$270,000
31	Meadowlands	St Louis	N	47 02 07	92 54 52	330	\$248,000	\$100,000	\$348,000
31	Mizpah	Koochiching	N	47 59 41	94 00 45	330	\$248,000	\$100,000	\$348,000
31	Nashwauk	Itasca	M	47 23 07	93 12 26	180	\$0	\$85,000	\$85,000
31	Northome	Koochiching	M	47 51 57	94 18 51	200	\$0	\$85,000	\$85,000
31	Picket Lake	St Louis	N	48 01 27	92 25 50	330	\$248,000	\$100,000	\$348,000
31	Side Lake St Park	St Louis	M	47 38 50	93 00 03	300	\$170,000	\$100,000	\$270,000
31	Tower	St Louis	N	47 48 38	92 13 32	330	\$248,000	\$100,000	\$348,000
31	Virginia DOT	St Louis	E	47 31 24	92 33 41	20	\$0	\$0	\$0
31	Virginia/Mid	St Louis	E	47 29 14	92 31 12	300	\$0	\$0	\$0
<b>29</b>			<b>N=17/E=6/M=6</b>				<b>\$4,896,000</b>	<b>\$2,155,000</b>	<b>\$7,051,000</b>

LAND/TOWER/SHELTER/GENERATOR LOCATIONS AND COSTS

DIST	SITE NAME	COUNTY	NEW OR EXIST TWR	LAT	LONG	HT	TOWER & LAND	SHLTR/ GEN	TOTAL
32	Alida	Clearwater	N	47 24 03	95 12 38	330	\$248,000	\$100,000	\$348,000
32	Angus	Polk	E	48 00 27	96 33 07	330	\$0	\$0	\$0
32	Bagley	Clearwater	E	47 36 18	95 25 33	330	\$0	\$0	\$0
32	Baudette	Lake of Woods	N	48 30 43	94 38 52	330	\$248,000	\$100,000	\$348,000
32	Bemidji Fire Tower	Beltrami	M	47 28 13	94 49 18	250	\$0	\$85,000	\$85,000
32	Berner	Clearwater	N	47 50 11	95 25 38	330	\$248,000	\$100,000	\$348,000
32	Crookston	Polk	E	47 45 45	96 37 03	250	\$0	\$0	\$0
32	Fox	Roseau	N	48 43 24	95 32 49	330	\$248,000	\$100,000	\$348,000
32	Greenbush	Roseau	N	48 43 04	96 10 56	300	\$248,000	\$100,000	\$348,000
32	Grygla	Beltrami	N	48 17 57	95 35 29	330	\$248,000	\$100,000	\$348,000
32	Hallock	Kitson	N	48 46 29	97 02 28	180	\$248,000	\$100,000	\$348,000
32	High Landing	Pennington	N	48 02 07	95 49 53	330	\$248,000	\$100,000	\$348,000
32	Hines	Beltrami	E	47 41 27	94 37 29	200	\$0	\$0	\$0
32	Lake Bronson	Kitson	E	48 42 54	96 36 09	180	\$0	\$0	\$0
32	Mentor	Polk	N	47 39 54	96 12 18	330	\$248,000	\$100,000	\$348,000
32	Middle River	Marshall	E	48 26 36	96 04 46	283	\$0	\$0	\$0
32	Muligan Lake	Lake of Woods	N	48 32 24	95 18 33	330	\$248,000	\$100,000	\$348,000
32	Old Mill State Park	Marshall	N	48 22 11	96 34 23	330	\$248,000	\$100,000	\$348,000
32	Red Lake	Beltrami	N	47 58 42	94 40 44	330	\$248,000	\$100,000	\$348,000
32	Ridge Lookout	Beltrami	N	47 46 49	95 00 17	330	\$248,000	\$100,000	\$348,000
32	Roosevelt	Lake of Woods	E	48 47 20	95 03 00	300	\$0	\$0	\$0
32	Sucker Creek	Beltrami	N	48 13 43	95 14 36	330	\$248,000	\$100,000	\$348,000
32	Thief River Falls	Pennington	E	48 06 54	96 11 20	305	\$0	\$0	\$0
32	Trail	Polk	E	47 46 05	95 39 54	190	\$0	\$0	\$0
32	Washkish	Beltrami	N	48 16 37	94 33 02	330	\$248,000	\$100,000	\$348,000
<b>25</b>		<b>N=15/E=9/M=1</b>		<b>\$3,720,000</b>		<b>\$1,585,000</b>		<b>\$5,305,000</b>	
<b>237</b>		<b>N=142/E=65/M=30</b>		<b>\$37,028,000</b>		<b>\$16,361,000</b>		<b>\$53,389,000</b>	

# **EXHIBIT 5**

**800 MHz TRUNKED RADIO**

**&**

**MICROWAVE**

**EQUIPMENT COSTS**

800 MHz FIXED BASE EQP/CONTROL EQP AND MICROWAVE

DIST	SITE NAME	COUNTY	800MHz BASE/ANT	CONTROL & INTEROP	MICROWAVE EQP/ANT	TOTAL
21	Albert Lea	Freeborn	\$156,900	\$14,000	\$87,100	\$258,000
21	Alma	Wisconsin	\$202,700	\$14,000	\$174,200	\$390,900
21	Amherst	Fillmore	\$156,900	\$14,000	\$174,200	\$345,100
21	Aren Dahl	Winona	\$194,510	\$14,000	\$87,100	\$295,610
21	Bear Valley	Wabasha	\$194,510	\$14,000	\$174,200	\$382,710
21	Cummingsville	Olmsted	\$218,230	\$14,000	\$174,200	\$406,430
21	Dresbach	Winona	\$156,900	\$14,000	\$261,300	\$432,200
21	Elba	Winona	\$194,510	\$14,000	\$435,500	\$644,010
21	Elkton	Mower	\$156,900	\$14,000	\$174,200	\$345,100
21	Faribault	Rice	\$580,570	\$14,000	\$348,400	\$942,970
21	Hader	Goodhue	\$194,510	\$14,000	\$261,300	\$469,810
21	Hayfield	Dodge	\$156,900	\$14,000	\$174,200	\$345,100
21	Houston	Houston	\$156,900	\$14,000	\$261,300	\$432,200
21	Lake City	Wabasha	\$115,600	\$14,000	\$87,100	\$216,700
21	Lonsdale	Rice	\$194,510	\$14,000	\$87,100	\$295,610
21	New Haven	Olmsted	\$218,230	\$14,000	\$87,100	\$319,330
21	Oakland Woods	Freeborn	\$156,900	\$14,000	\$261,300	\$432,200
21	Oakwood	Wabasha	\$194,510	\$14,000	\$261,300	\$469,810
21	Owatonna	Steele	\$156,900	\$14,000	\$261,300	\$432,200
21	Red Wing	Goodhue	\$115,600	\$14,000	\$87,100	\$216,700
21	Reno	Houston	\$156,900	\$14,000	\$87,100	\$258,000
21	Rochester	Olmsted	\$265,650	\$4,014,000	\$87,100	\$4,366,750
21	Salem Corners	Olmsted	\$218,230	\$14,000	\$174,200	\$406,430
21	Summit	Steele	\$156,900	\$14,000	\$174,200	\$345,100
21	Viola	Olmsted	\$625,600	\$14,000	\$338,000	\$977,600
21	Warsaw	Rice	\$194,510	\$14,000	\$87,100	\$295,610
21	Washiota	Dodge	\$156,900	\$14,000	\$174,200	\$345,100
21	Wilson	Winona	\$194,510	\$14,000	\$261,300	\$469,810
21	Winona	Winona	\$580,570	\$14,000	\$87,100	\$681,670
21	Wykoff	Fillmore	\$156,900	\$14,000	\$174,200	\$345,100
<b>30</b>			<b>\$6,579,860</b>	<b>\$4,420,000</b>	<b>\$5,564,000</b>	<b>\$16,563,860</b>

800 MHz FIXED BASE EQP/CONTROL EQP AND MICROWAVE

DIST	SITE NAME	COUNTY	800MHz BASE/ANT	CONTROL & INTEROP	MICROWAVE EQP/ANT	TOTAL
22	Biscay	McLeod	\$156,900	\$14,000	\$90,000	\$260,900
22	Comfrey	Watonwan	\$156,900	\$14,000	\$150,000	\$320,900
22	Evan	Brown	\$156,900	\$14,000	\$150,000	\$320,900
22	Fairmont	Martin	\$156,900	\$14,000	\$300,000	\$470,900
22	Gaylord	Sibley	\$156,900	\$14,000	\$690,000	\$860,900
22	Gibbon	Sibley	\$156,900	\$14,000	\$150,000	\$320,900
22	Guckeen	Faribault	\$156,900	\$14,000	\$450,000	\$620,900
22	Janesville	Waseca	\$156,900	\$14,000	\$240,000	\$410,900
22	Kilkenny	LeSueur	\$156,900	\$14,000	\$150,000	\$320,900
22	LeSuer	LeSueur	\$156,900	\$14,000	\$150,000	\$320,900
22	Mankato	Blue Earth	\$156,900	\$14,000	\$300,000	\$470,900
22	New Richland	Waseca	\$156,900	\$14,000	\$90,000	\$260,900
22	New Ulm	Brown	\$156,900	\$14,000	\$300,000	\$470,900
22	North Mankato	Blue Earth	\$156,900	\$14,000	\$300,000	\$470,900
22	Sherburn	Martin	\$156,900	\$14,000	\$300,000	\$470,900
22	St James	Watonwan	\$156,900	\$14,000	\$150,000	\$320,900
22	Sterling Center	Blue Earth	\$156,900	\$14,000	\$600,000	\$770,900
22	Walters	Faribault	\$156,900	\$14,000	\$300,000	\$470,900
<b>18</b>			<b>\$2,824,200</b>	<b>\$252,000</b>	<b>\$4,860,000</b>	<b>\$7,936,200</b>

800 MHz FIXED BASE EQP/CONTROL EQP AND MICROWAVE

DIST	SITE NAME	COUNTY	800MHz BASE/ANT	CONTROL & INTEROP	MICROWAVE EQP/ANT	TOTAL
23	Blue Mound	Rock	\$156,900	\$14,000	\$150,000	\$320,900
23	Brewster	Nobles	\$156,900	\$14,000	\$300,000	\$470,900
23	Buffalo Ridge	Pipestone	\$156,900	\$14,000	\$300,000	\$470,900
23	Chandler	Murray	\$156,900	\$14,000	\$300,000	\$470,900
23	Granite Falls	Chippewa	\$156,900	\$14,000	\$300,000	\$470,900
23	Hanely Falls	Yellow Medicine	\$156,900	\$14,000	\$300,000	\$470,900
23	Hector	Renville	\$156,900	\$14,000	\$90,000	\$260,900
23	Ivanhoe	Lincoln	\$156,900	\$14,000	\$150,000	\$320,900
23	Lake Benton	Lincoln	\$156,900	\$14,000	\$150,000	\$320,900
23	Lakefield	Jackson	\$156,900	\$14,000	\$90,000	\$260,900
23	Madison	Lac Qui Parle	\$156,900	\$14,000	\$150,000	\$320,900
23	Marshall	Lyon	\$156,900	\$14,000	\$300,000	\$470,900
23	Morton	Renville	\$156,900	\$14,000	\$240,000	\$410,900
23	Oshkosh	Yellow Medicine	\$156,900	\$14,000	\$150,000	\$320,900
23	Pipestone	Pipestone	\$156,900	\$14,000	\$150,000	\$320,900
23	Rushmore	Nobles	\$156,900	\$14,000	\$450,000	\$620,900
23	Russell	Lyon	\$156,900	\$14,000	\$300,000	\$470,900
23	Sacred Heart	Renville	\$156,900	\$14,000	\$150,000	\$320,900
23	Slayton	Murray	\$156,900	\$14,000	\$450,000	\$620,900
23	Wabasso	Redwood	\$156,900	\$14,000	\$150,000	\$320,900
23	Walnut Grove	Redwood	\$156,900	\$14,000	\$150,000	\$320,900
23	Watson	Chippewa	\$156,900	\$14,000	\$150,000	\$320,900
23	Windom	Cottonwood	\$156,900	\$14,000	\$390,000	\$560,900
23	Woods	Chippewa	\$156,900	\$14,000	\$475,000	\$645,900
<b>24</b>			<b>\$3,765,600</b>	<b>\$336,000</b>	<b>\$5,785,000</b>	<b>\$9,886,600</b>



800 MHz FIXED BASE EQP/CONTROL EQP AND MICROWAVE

DIST	SITE NAME	COUNTY	800MHz BASE/ANT	CONTROL & INTEROP	MICROWAVE EQP/ANT	TOTAL
26	Benson	Swift	\$156,900	\$14,000	\$191,670	\$362,570
26	Big Stone	So. Dakota	\$156,900	\$14,000	\$191,670	\$362,570
26	Browns Valley	Traverse	\$156,900	\$14,000	\$191,670	\$362,570
26	Elk River	Sherburne	\$156,900	\$14,000	\$95,840	\$266,740
26	Enfield	Wright	\$218,230	\$14,000	\$191,670	\$423,900
26	Gilman	Benton	\$156,900	\$14,000	\$95,840	\$266,740
26	Glenwood	Pope	\$156,900	\$14,000	\$191,670	\$362,570
26	Hancock	Swift	\$156,900	\$14,000	\$191,670	\$362,570
26	Herman	Grant	\$156,900	\$14,000	\$191,670	\$362,570
26	Kimball	Sterns	\$625,600	\$14,000	\$383,340	\$1,022,940
26	Litchfield	Meeker	\$156,900	\$14,000	\$191,670	\$362,570
26	Long Prairie	Todd	\$156,900	\$14,000	\$95,840	\$266,740
26	Louriston	Chippewa	\$156,900	\$14,000	\$191,670	\$362,570
26	Morris	Stevens	\$156,900	\$14,000	\$95,840	\$266,740
26	New London	Kandiyohi	\$156,900	\$14,000	\$287,500	\$458,400
26	New Munich	Sterns	\$156,900	\$14,000	\$287,500	\$458,400
26	Richmond	Sterns	\$156,900	\$14,000	\$287,500	\$458,400
26	Sauk Rapids	Sterns	\$156,900	\$14,000	\$287,500	\$458,400
26	St Cloud	Sterns	\$156,900	\$14,000	\$203,600	\$374,500
26	St. Stephen	Benton	\$156,900	\$14,000	\$95,840	\$266,740
26	Wheaton	Traverse	\$156,900	\$14,000	\$191,670	\$362,570
26	Willmar	Kandiyohi	\$156,900	\$14,000	\$287,500	\$458,400
<b>22</b>			<b>\$3,981,830</b>	<b>\$308,000</b>	<b>\$4,420,340</b>	<b>\$8,710,170</b>

800 MHz FIXED BASE EQP/CONTROL EQP AND MICROWAVE

DIST	SITE NAME	COUNTY	800MHz BASE/ANT	CONTROL & INTEROP	MICROWAVE EQP/ANT	TOTAL
27	Argus	St Louis	\$156,900	\$14,000	\$450,000	\$620,900
27	Arrowhead	St Louis	\$156,900	\$14,000	\$90,000	\$260,900
27	Askov	Pine	\$156,900	\$14,000	\$300,000	\$470,900
27	Beaver Bay	Cook	\$156,900	\$14,000	\$150,000	\$320,900
27	Beaver Crossing	Lake	\$156,900	\$14,000	\$150,000	\$320,900
27	Bogus Lake	Cook	\$156,900	\$14,000	\$240,000	\$410,900
27	Brimson	St Louis	\$156,900	\$14,000	\$150,000	\$320,900
27	Cascade River	Cook	\$156,900	\$14,000	\$150,000	\$320,900
27	Duluth Ant Farm	St Louis	\$156,900	\$4,014,000	\$240,000	\$4,410,900
27	Duluth DOT	St Louis	\$0	\$14,000	\$90,000	\$104,000
27	Duxbury	Pine	\$156,900	\$14,000	\$150,000	\$320,900
27	Eska	Carlton	\$156,900	\$14,000	\$150,000	\$320,900
27	Finland	Lake	\$156,900	\$14,000	\$150,000	\$320,900
27	Grand Portage	Cook	\$156,900	\$14,000	\$90,000	\$260,900
27	Hovland	Cook	\$156,900	\$14,000	\$180,000	\$350,900
27	Isabella	Cook	\$156,900	\$14,000	\$300,000	\$470,900
27	Kroschel	Pine	\$156,900	\$14,000	\$300,000	\$470,900
27	Lake Isabella	Lake	\$156,900	\$14,000	\$90,000	\$260,900
27	Lake One	Lake	\$156,900	\$14,000	\$90,000	\$260,900
27	Larsmount	Lake	\$156,900	\$14,000	\$150,000	\$320,900
27	Lutzen	Cook	\$156,900	\$14,000	\$150,000	\$320,900
27	Maple Hill	Cook	\$156,900	\$14,000	\$150,000	\$320,900
27	Mahtowa	Carlton	\$156,900	\$14,000	\$300,000	\$470,900
27	Moose Lake Lookout	Carlton	\$156,900	\$14,000	\$300,000	\$470,900
27	Mt. Weber	Cook	\$156,900	\$14,000	\$150,000	\$320,900
27	Nickerson	Pine	\$156,900	\$14,000	\$150,000	\$320,900
27	Palisade Head	Lake	\$156,900	\$14,000	\$150,000	\$320,900
27	Palmers	St Louis	\$156,900	\$14,000	\$150,000	\$320,900
27	Pine City	Pine	\$156,900	\$14,000	\$315,000	\$485,900
27	Pine Mountain	Cook	\$156,900	\$14,000	\$150,000	\$320,900
27	Rickey Lake	Cook	\$156,900	\$14,000	\$150,000	\$320,900
27	Sawbill	Cook	\$156,900	\$14,000	\$150,000	\$320,900
27	Shaw	St Louis	\$156,900	\$14,000	\$240,000	\$410,900
27	Silver Cliff	Lake	\$156,900	\$14,000	\$150,000	\$320,900
27	Slate Lake	Lake	\$156,900	\$14,000	\$240,000	\$410,900
27	St Croix St Park	Pine	\$156,900	\$14,000	\$150,000	\$320,900
27	Sullivan Lake	St Louis	\$156,900	\$14,000	\$150,000	\$320,900
27	Tofte	Cook	\$156,900	\$14,000	\$150,000	\$320,900
27	Trush Lake	Cook	\$156,900	\$14,000	\$150,000	\$320,900
39			\$5,962,200	\$4,546,000	\$7,155,000	\$17,663,200

800 MHz FIXED BASE EQP/CONTROL EQP AND MICROWAVE

DIST	SITE NAME	COUNTY	800MHz BASE/ANT	CONTROL & INTEROP	MICROWAVE EQP/ANT	TOTAL
28	Arthyde	Aitkin	\$156,900	\$14,000	\$150,000	\$320,900
28	Bakus	Cass	\$156,900	\$14,000	\$150,000	\$320,900
28	Ball Bluff Lookout	Aitkin	\$156,900	\$14,000	\$90,000	\$260,900
28	Ball Club	Cass	\$156,900	\$14,000	\$300,000	\$470,900
28	Baxter	Crow Wing	\$156,900	\$14,000	\$480,000	\$650,900
28	Borden Lake	Crow Wing	\$156,900	\$14,000	\$300,000	\$470,900
28	Brainerd DOT	Crow Wing	\$156,900	\$14,000	\$90,000	\$260,900
28	Cass Lake	Hubbard	\$156,900	\$14,000	\$150,000	\$320,900
28	Cuba Hill Lookout	Cass	\$156,900	\$14,000	\$300,000	\$470,900
28	Emily	Crow Wing	\$156,900	\$14,000	\$90,000	\$260,900
28	Federal Dam	Cass	\$156,900	\$14,000	\$150,000	\$320,900
28	Freedhem	Morrison	\$156,900	\$14,000	\$90,000	\$260,900
28	Glen	Aitkin	\$156,900	\$14,000	\$90,000	\$260,900
28	Lawler	Aitkin	\$156,900	\$14,000	\$240,000	\$410,900
28	Leader	Cass	\$156,900	\$14,000	\$150,000	\$320,900
28	Lincoln	Morrison	\$156,900	\$14,000	\$450,000	\$620,900
28	Little Falls	Morrison	\$156,900	\$14,000	\$150,000	\$320,900
28	Little Thunder Lake	Cass	\$156,900	\$14,000	\$240,000	\$410,900
28	Logan	Aitkin	\$156,900	\$14,000	\$90,000	\$260,900
28	Longville	Cass	\$156,900	\$14,000	\$240,000	\$410,900
28	Mantrap	Hubbard	\$156,900	\$14,000	\$270,000	\$440,900
28	Mora	Kanabec	\$156,900	\$14,000	\$90,000	\$260,900
28	Nevis	Hubbard	\$156,900	\$14,000	\$150,000	\$320,900
28	Onamia	Mille Lacs	\$156,900	\$14,000	\$450,000	\$620,900
28	Princeton	Mille Lacs	\$156,900	\$14,000	\$30,000	\$200,900
28	Quadna	Aitkin	\$156,900	\$14,000	\$300,000	\$470,900
28	Royalton	Morrison	\$156,900	\$14,000	\$150,000	\$320,900
28	Sandy Lake	Beltrami	\$156,900	\$14,000	\$150,000	\$320,900
28	Swanburg	Cass	\$156,900	\$14,000	\$90,000	\$260,900
28	Woodland	Kanabec	\$156,900	\$14,000	\$240,000	\$410,900
<b>30</b>			<b>\$4,707,000</b>	<b>\$420,000</b>	<b>\$5,910,000</b>	<b>\$11,037,000</b>

800 MHz FIXED BASE EQP/CONTROL EQP AND MICROWAVE

DIST	SITE NAME	COUNTY	800MHz BASE/ANT	CONTROL & INTEROP	MICROWAVE EQP/ANT	TOTAL
29	Ada	Norman	\$156,900	\$14,000	\$300,000	\$470,900
29	Barnsville	Clay	\$156,900	\$14,000	\$300,000	\$470,900
29	Detroit Lakes	Becker	\$156,900	\$4,014,000	\$240,000	\$4,410,900
29	Eagle Lake	Otter Tail	\$156,900	\$14,000	\$300,000	\$470,900
29	Erhard	Otter Tail	\$156,900	\$14,000	\$300,000	\$470,900
29	Everdell	Wilkin	\$156,900	\$14,000	\$90,000	\$260,900
29	Felton	Clay	\$156,900	\$14,000	\$450,000	\$620,900
29	Fergus Falls	Otter Tail	\$156,900	\$14,000	\$375,000	\$545,900
29	Flate Lake Lookout	Becker	\$156,900	\$14,000	\$90,000	\$260,900
29	Luce	Otter Tail	\$156,900	\$14,000	\$150,000	\$320,900
29	Hawley	Clay	\$156,900	\$14,000	\$450,000	\$620,900
29	Henning	Otter Tail	\$156,900	\$14,000	\$150,000	\$320,900
29	Hoffman	Douglas	\$156,900	\$14,000	\$600,000	\$770,900
29	Juggler Lake	Becker	\$156,900	\$14,000	\$150,000	\$320,900
29	Lake Carlos	Douglas	\$156,900	\$14,000	\$150,000	\$320,900
29	Mahnomen	Mahnomen	\$156,900	\$14,000	\$150,000	\$320,900
29	Sebeka	Wadena	\$156,900	\$14,000	\$150,000	\$320,900
29	Twin Valley	Norman	\$156,900	\$14,000	\$150,000	\$320,900
29	Wadena	Wadena	\$156,900	\$14,000	\$150,000	\$320,900
29	Wolf Lake	Becker	\$156,900	\$14,000	\$300,000	\$470,900
<b>20</b>			<b>\$3,138,000</b>	<b>\$4,280,000</b>	<b>\$4,995,000</b>	<b>\$12,413,000</b>

800 MHz FIXED BASE EQP/CONTROL EQP AND MICROWAVE

DIST	SITE NAME	COUNTY	800MHz BASE/ANT	CONTROL & INTEROP	MICROWAVE EQP/ANT	TOTAL
31	Bass Lake Lookout	Itasca	\$156,900	\$14,000	\$150,000	\$320,900
31	Big Falls	Koochiching	\$156,900	\$14,000	\$150,000	\$320,900
31	Big Thunder Peak	Itasca	\$156,900	\$14,000	\$150,000	\$320,900
31	Deer River	Itasca	\$156,900	\$14,000	\$450,000	\$620,900
31	Dixon Lookout	Itasca	\$156,900	\$14,000	\$90,000	\$260,900
31	Elephant Lake	St Louis	\$156,900	\$14,000	\$240,000	\$410,900
31	Ely	St Louis	\$156,900	\$14,000	\$240,000	\$410,900
31	Fairland	Koochiching	\$156,900	\$14,000	\$90,000	\$260,900
31	Ft Lookout Tower	Koochiching	\$156,900	\$14,000	\$90,000	\$260,900
31	Gheen	St Louis	\$156,900	\$14,000	\$150,000	\$320,900
31	Goodland	Itasca	\$156,900	\$14,000	\$240,000	\$410,900
31	Grand Rapids	Itasca	\$156,900	\$14,000	\$90,000	\$260,900
31	Hoyt Lakes	St Louis	\$156,900	\$14,000	\$90,000	\$260,900
31	Idington	St Louis	\$156,900	\$14,000	\$600,000	\$770,900
31	Itasca County	Itasca	\$156,900	\$14,000	\$450,000	\$620,900
31	Itasca County NE	Itasca	\$156,900	\$14,000	\$90,000	\$260,900
31	Johnson Landing	Koochiching	\$156,900	\$14,000	\$300,000	\$470,900
31	Kabetogma	St Louis	\$156,900	\$14,000	\$150,000	\$320,900
31	Lavell	St Louis	\$156,900	\$14,000	\$150,000	\$320,900
31	Little Fork	Koochiching	\$156,900	\$14,000	\$150,000	\$320,900
31	Medowlands	St Louis	\$156,900	\$14,000	\$90,000	\$260,900
31	Mizpah	Koochiching	\$156,900	\$14,000	\$150,000	\$320,900
31	Nashwauk	Itasca	\$156,900	\$14,000	\$30,000	\$200,900
31	Northome	Koochiching	\$156,900	\$14,000	\$390,000	\$560,900
31	Picket Lake	St Louis	\$156,900	\$14,000	\$90,000	\$260,900
31	Side Lake St Park	St Louis	\$156,900	\$14,000	\$375,000	\$545,900
31	Towre	St Louis	\$156,900	\$14,000	\$240,000	\$410,900
31	Virginia DOT	St Louis	\$0	\$4,014,000	\$150,000	\$4,164,000
31	Virginia/Mid	St Louis	\$156,900	\$14,000	\$375,000	\$545,900
<b>29</b>			<b>\$4,393,200</b>	<b>\$4,406,000</b>	<b>\$6,000,000</b>	<b>\$14,799,200</b>

800 MHz FIXED BASE EQP/CONTROL EQP AND MICROWAVE

DIST	SITE NAME	COUNTY	800MHz BASE/ANT	CONTROL & INTEROP	MICROWAVE EQP/ANT	TOTAL
32	Alida	Clearwater	\$156,900	\$14,000	\$390,000	\$560,900
32	Angus	Polk	\$156,900	\$14,000	\$490,000	\$660,900
32	Bagley	Clearwater	\$156,900	\$14,000	\$300,000	\$470,900
32	Baudette	Lake of Woods	\$156,900	\$14,000	\$150,000	\$320,900
32	Bemidji Fire Tower	Beltrami	\$156,900	\$14,000	\$600,000	\$770,900
32	Berner	Clearwater	\$156,900	\$14,000	\$90,000	\$260,900
32	Crookston	Polk	\$156,900	\$14,000	\$490,000	\$660,900
32	Fox	Roseau	\$156,900	\$14,000	\$150,000	\$320,900
32	Greenbush	Roseau	\$156,900	\$14,000	\$150,000	\$320,900
32	Grygla	Beltrami	\$156,900	\$14,000	\$240,000	\$410,900
32	Hallock	Kitson	\$156,900	\$14,000	\$90,000	\$260,900
32	High Landing	Pennington	\$156,900	\$14,000	\$450,000	\$620,900
32	Hines	Beltrami	\$156,900	\$14,000	\$240,000	\$410,900
32	Lake Bronson	Kitson	\$156,900	\$14,000	\$240,000	\$410,900
32	Mentor	Polk	\$156,900	\$14,000	\$150,000	\$320,900
32	Middle River	Marshall	\$156,900	\$14,000	\$90,000	\$260,900
32	Muligan Lake	Lake of Woods	\$156,900	\$14,000	\$150,000	\$320,900
32	Old Mill State Pk	Marshall	\$156,900	\$14,000	\$150,000	\$320,900
32	Red Lake	Beltrami	\$156,900	\$14,000	\$90,000	\$260,900
32	Ridge Lookout	Beltrami	\$156,900	\$14,000	\$90,000	\$260,900
32	Roosevelt	Lake of Woods	\$156,900	\$14,000	\$240,000	\$410,900
32	Sucker Creek	Beltrami	\$156,900	\$14,000	\$90,000	\$260,900
32	Thief River Falls	Pennington	\$156,900	\$14,000	\$390,000	\$560,900
32	Trail	Polk	\$156,900	\$14,000	\$540,000	\$710,900
32	Washkish	Beltrami	\$156,900	\$14,000	\$150,000	\$320,900
<b>25</b>			<b>\$3,922,500</b>	<b>\$350,000</b>	<b>\$6,200,000</b>	<b>\$10,472,500</b>
<b>TOTALS</b>	<b>237</b>		<b>\$39,274,390</b>	<b>\$19,318,000</b>	<b>\$50,889,340</b>	<b>\$109,481,730</b>

# **EXHIBIT 6**

## **SUMMARY OF ALL FIXED COMPONENT COSTS**

SUMMARY OF ALL FIXED COMPONENTS

DIST	SITE NAME	COUNTY	TOWERS	800MHZ	INTEROP/CONTROL	MICROWAVE	TOTAL
21	Albert Lea	Freeborn	\$348,000	\$156,900	\$14,000	\$87,100	\$606,000
21	Alma	Wisconsin	\$85,000	\$202,700	\$14,000	\$174,200	\$475,900
21	Amherst	Fillmore	\$348,000	\$156,900	\$14,000	\$174,200	\$693,100
21	Aren Dahl	Winona	\$348,000	\$194,510	\$14,000	\$87,100	\$643,610
21	Bear Valley	Wabasha	\$348,000	\$194,510	\$14,000	\$174,200	\$730,710
21	Cummingsville	Olmsted	\$348,000	\$218,230	\$14,000	\$174,200	\$754,430
21	Dresbach	Winona	\$270,000	\$156,900	\$14,000	\$261,300	\$702,200
21	Elba	Winona	\$348,000	\$194,510	\$14,000	\$435,500	\$992,010
21	Elkton	Mower	\$348,000	\$156,900	\$14,000	\$174,200	\$693,100
21	Faribault	Rice	\$348,000	\$580,570	\$14,000	\$348,400	\$1,290,970
21	Hader	Goodhue	\$0	\$194,510	\$14,000	\$261,300	\$469,810
21	Hayfield	Dodge	\$248,000	\$156,900	\$14,000	\$174,200	\$593,100
21	Houston	Houston	\$348,000	\$156,900	\$14,000	\$261,300	\$780,200
21	Lake City	Wabasha	\$85,000	\$115,600	\$14,000	\$87,100	\$301,700
21	Lonsdale	Rice	\$348,000	\$194,510	\$14,000	\$87,100	\$643,610
21	New Haven	Olmsted	\$348,000	\$218,230	\$14,000	\$87,100	\$667,330
21	Oakland Woods	Freeborn	\$255,000	\$156,900	\$14,000	\$261,300	\$687,200
21	Oakwood	Wabasha	\$348,000	\$194,510	\$14,000	\$261,300	\$817,810
21	Owatonna	Steele	\$53,000	\$156,900	\$14,000	\$261,300	\$485,200
21	Red Wing	Goodhue	\$85,000	\$115,600	\$14,000	\$87,100	\$301,700
21	Reno	Houston	\$348,000	\$156,900	\$14,000	\$87,100	\$606,000
21	Rochester	Olmsted	\$0	\$265,650	\$4,014,000	\$87,100	\$4,366,750
21	Salem Corners	Olmsted	\$348,000	\$218,230	\$14,000	\$174,200	\$754,430
21	Summit	Steele	\$348,000	\$156,900	\$14,000	\$174,200	\$693,100
21	Viola	Olmsted	\$0	\$625,600	\$14,000	\$338,000	\$977,600
21	Warsaw	Rice	\$348,000	\$194,510	\$14,000	\$87,100	\$643,610
21	Washiota	Dodge	\$348,000	\$156,900	\$14,000	\$174,200	\$693,100
21	Wilson	Winona	\$53,000	\$194,510	\$14,000	\$261,300	\$522,810
21	Winona	Winona	\$348,000	\$580,570	\$14,000	\$87,100	\$1,029,670
21	Wykoff	Fillmore	\$348,000	\$156,900	\$14,000	\$174,200	\$693,100
<b>30</b>			<b>\$7,746,000</b>	<b>\$6,579,860</b>	<b>\$4,420,000</b>	<b>\$5,564,000</b>	<b>\$24,309,860</b>



SUMMARY OF ALL FIXED COMPONENTS

DIST	SITE NAME	COUNTY	TOWERS	800MHZ	INTEROP/CONTROL	MICROWAVE	TOTAL
22	Biscay	McLeod	\$0	\$156,900	\$14,000	\$90,000	\$260,900
22	Comfrey	Watonwan	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
22	Evan	Brown	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
22	Fairmont	Martin	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
22	Gaylord	Sibley	\$0	\$156,900	\$14,000	\$690,000	\$860,900
22	Gibbon	Sibley	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
22	Guckeen	Faribault	\$348,000	\$156,900	\$14,000	\$450,000	\$968,900
22	Janesville	Waseca	\$0	\$156,900	\$14,000	\$240,000	\$410,900
22	Kilkenny	LeSueur	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
22	LeSuer	LeSueur	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
22	Mankato	Blue Earth	\$0	\$156,900	\$14,000	\$300,000	\$470,900
22	New Richland	Waseca	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
22	New Ulm	Brown	\$0	\$156,900	\$14,000	\$300,000	\$470,900
22	North Mankato	Blue Earth	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
22	Sherburn	Martin	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
22	St James	Watonwan	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
22	Sterling Center	Blue Earth	\$348,000	\$156,900	\$14,000	\$600,000	\$1,118,900
22	Walters	Faribault	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
<b>18</b>			<b>\$4,524,000</b>	<b>\$2,824,200</b>	<b>\$252,000</b>	<b>\$4,860,000</b>	<b>\$12,460,200</b>

SUMMARY OF ALL FIXED COMPONENTS

DIST	SITE NAME	COUNTY	TOWERS	800MHZ	INTEROP/CONTROL	MICROWAVE	TOTAL
23	Blue Mound	Rock	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
23	Brewster	Nobles	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
23	Buffalo Ridge	Pipestone	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
23	Chandler	Murray	\$75,000	\$156,900	\$14,000	\$300,000	\$545,900
23	Granite Falls	Chippewa	\$0	\$156,900	\$14,000	\$300,000	\$470,900
23	Hanely Falls	Yellow Medicine	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
23	Hector	Renville	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
23	Ivanhoe	Lincoln	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
23	Lake Benton	Lincoln	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
23	Lakefield	Jackson	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
23	Madison	Lac Qui Parle	\$0	\$156,900	\$14,000	\$150,000	\$320,900
23	Marshall	Lyon	\$0	\$156,900	\$14,000	\$300,000	\$470,900
23	Morton	Renville	\$0	\$156,900	\$14,000	\$240,000	\$410,900
23	Oshkosh	Yellow Medicine	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
23	Pipestone	Pipestone	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
23	Rushmore	Nobles	\$348,000	\$156,900	\$14,000	\$450,000	\$968,900
23	Russell	Lyon	\$53,000	\$156,900	\$14,000	\$300,000	\$523,900
23	Sacred Heart	Renville	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
23	Slayton	Murray	\$52,000	\$156,900	\$14,000	\$450,000	\$672,900
23	Wabasso	Redwood	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
23	Walnut Grove	Redwood	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
23	Watson	Chippewa	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
23	Windom	Cottonwood	\$53,000	\$156,900	\$14,000	\$390,000	\$613,900
23	Woods	Chippewa	\$348,000	\$156,900	\$14,000	\$475,000	\$993,900
24			\$5,801,000	\$3,765,600	\$336,000	\$5,785,000	\$15,687,600

SUMMARY OF ALL FIXED COMPONENTS

DIST	SITE NAME	COUNTY	TOWERS	800MHZ	INTEROP/CONTROL	MICROWAVE	TOTAL
26	Benson	Swift	\$0	\$156,900	\$14,000	\$191,670	\$362,570
26	Big Stone	So. Dakota	\$348,000	\$156,900	\$14,000	\$191,670	\$710,570
26	Browns Valley	Traverse	\$270,000	\$156,900	\$14,000	\$191,670	\$632,570
26	Elk River	Sherburne	\$348,000	\$156,900	\$14,000	\$95,840	\$614,740
26	Enfield	Wright	\$0	\$218,230	\$14,000	\$191,670	\$423,900
26	Gilman	Benton	\$7,000	\$156,900	\$14,000	\$95,840	\$273,740
26	Glenwood	Pope	\$85,000	\$156,900	\$14,000	\$191,670	\$447,570
26	Hancock	Swift	\$348,000	\$156,900	\$14,000	\$191,670	\$710,570
26	Herman	Grant	\$348,000	\$156,900	\$14,000	\$191,670	\$710,570
26	Kimball	Sterns	\$0	\$625,600	\$14,000	\$383,340	\$1,022,940
26	Litchfield	Meeker	\$348,000	\$156,900	\$14,000	\$191,670	\$710,570
26	Long Prairie	Todd	\$0	\$156,900	\$14,000	\$95,840	\$266,740
26	Louriston	Chippewa	\$348,000	\$156,900	\$14,000	\$191,670	\$710,570
26	Morris	Stevens	\$85,000	\$156,900	\$14,000	\$95,840	\$351,740
26	New London	Kandiyohi	\$348,000	\$156,900	\$14,000	\$287,500	\$806,400
26	New Munich	Sterns	\$348,000	\$156,900	\$14,000	\$287,500	\$806,400
26	Richmond	Sterns	\$348,000	\$156,900	\$14,000	\$287,500	\$806,400
26	Sauk Rapids	Sterns	\$348,000	\$156,900	\$14,000	\$287,500	\$806,400
26	St Cloud	Sterns	\$0	\$156,900	\$14,000	\$203,600	\$374,500
26	St. Stephen	Benton	\$348,000	\$156,900	\$14,000	\$95,840	\$614,740
26	Wheaton	Traverse	\$348,000	\$156,900	\$14,000	\$191,670	\$710,570
26	Willmar	Kandiyohi	\$85,000	\$156,900	\$14,000	\$287,500	\$543,400
<b>22</b>			<b>\$4,708,000</b>	<b>\$3,981,830</b>	<b>\$308,000</b>	<b>\$4,420,340</b>	<b>\$13,418,170</b>

SUMMARY OF ALL FIXED COMPONENTS

DIST	SITE NAME	COUNTY	TOWERS	800MHZ	INTEROP/CONTROL	MICROWAVE	TOTAL
27	Argus	St Louis	\$0	\$156,900	\$14,000	\$450,000	\$620,900
27	Arrowhead	St Louis	\$0	\$156,900	\$14,000	\$90,000	\$260,900
27	Askov	Pine	\$0	\$156,900	\$14,000	\$300,000	\$470,900
27	Beaver Bay	Cook	\$0	\$156,900	\$14,000	\$150,000	\$320,900
27	Beaver Crossing	Lake	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Bogus Lake	Cook	\$348,000	\$156,900	\$14,000	\$240,000	\$758,900
27	Brimson	St Louis	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Cascade River	Cook	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Duluth Ant Farm	St Louis	\$0	\$156,900	\$4,014,000	\$240,000	\$4,410,900
27	Duluth DOT	St Louis	\$0	\$0	\$14,000	\$90,000	\$104,000
27	Duxbury	Pine	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Eska	Carlton	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Finland	Lake	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Grand Portage	Cook	\$0	\$156,900	\$14,000	\$90,000	\$260,900
27	Hovland	Cook	\$0	\$156,900	\$14,000	\$180,000	\$350,900
27	Isabella	Cook	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
27	Kroschel	Pine	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
27	Lake Isabella	Lake	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
27	Lake One	Lake	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
27	Larsmount	Lake	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Lutzen	Cook	\$0	\$156,900	\$14,000	\$150,000	\$320,900
27	Maple Hill	Cook	\$0	\$156,900	\$14,000	\$150,000	\$320,900
27	Mahtowa	Carlton	\$0	\$156,900	\$14,000	\$300,000	\$470,900
27	Moose Lake Lookout	Carlton	\$0	\$156,900	\$14,000	\$300,000	\$470,900
27	Mt. Weber	Cook	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Nickerson	Pine	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Palisade Head	Lake	\$0	\$156,900	\$14,000	\$150,000	\$320,900
27	Palmers	St Louis	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Pine City	Pine	\$0	\$156,900	\$14,000	\$315,000	\$485,900
27	Pine Mountain	Cook	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Rickey Lake	Cook	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Sawbill	Cook	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Shaw	St Louis	\$0	\$156,900	\$14,000	\$240,000	\$410,900
27	Silver Cliff	Lake	\$0	\$156,900	\$14,000	\$150,000	\$320,900
27	Slate Lake	Lake	\$348,000	\$156,900	\$14,000	\$240,000	\$758,900
27	St Croix St Park	Pine	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Sullivan Lake	St Louis	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Tofte	Cook	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
27	Trush Lake	Cook	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
<b>39</b>			<b>\$8,004,000</b>	<b>\$5,962,200</b>	<b>\$4,546,000</b>	<b>\$7,155,000</b>	<b>\$25,667,200</b>

SUMMARY OF ALL FIXED COMPONENTS

DIST	SITE NAME	COUNTY	TOWERS	800MHz	INTEROP/CONTROL	MICROWAVE	TOTAL
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SUMMARY OF ALL FIXED COMPONENTS

DIST	SITE NAME	COUNTY	TOWERS	800MHZ	INTEROP/CONTROL	MICROWAVE	TOTAL
28	Arthyde	Aitkin	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
28	Bakus	Cass	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
28	Ball Bluff Lookout	Aitkin	\$100,000	\$156,900	\$14,000	\$90,000	\$360,900
28	Ball Club	Cass	\$298,000	\$156,900	\$14,000	\$300,000	\$768,900
28	Baxter	Crow Wing	\$0	\$156,900	\$14,000	\$480,000	\$650,900
28	Borden Lake	Crow Wing	\$0	\$156,900	\$14,000	\$300,000	\$470,900
28	Brainerd DOT	Crow Wing	\$0	\$156,900	\$14,000	\$90,000	\$260,900
28	Cass Lake	Hubbard	\$0	\$156,900	\$14,000	\$150,000	\$320,900
28	Cuba Hill Lookout	Cass	\$100,000	\$156,900	\$14,000	\$300,000	\$570,900
28	Emily	Crow Wing	\$0	\$156,900	\$14,000	\$90,000	\$260,900
28	Federal Dam	Cass	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
28	Freedhem	Morrison	\$0	\$156,900	\$14,000	\$90,000	\$260,900
28	Glen	Aitkin	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
28	Lawler	Aitkin	\$298,000	\$156,900	\$14,000	\$240,000	\$708,900
28	Leader	Cass	\$0	\$156,900	\$14,000	\$150,000	\$320,900
28	Lincoln	Morrison	\$0	\$156,900	\$14,000	\$450,000	\$620,900
28	Little Falls	Morrison	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
28	Little Thunder Lake	Cass	\$348,000	\$156,900	\$14,000	\$240,000	\$758,900
28	Logan	Aitkin	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
28	Longville	Cass	\$298,000	\$156,900	\$14,000	\$240,000	\$708,900
28	Mantrap	Hubbard	\$0	\$156,900	\$14,000	\$270,000	\$440,900
28	Mora	Kanabec	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
28	Nevis	Hubbard	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
28	Onamia	Mille Lacs	\$348,000	\$156,900	\$14,000	\$450,000	\$968,900
28	Princeton	Mille Lacs	\$348,000	\$156,900	\$14,000	\$30,000	\$548,900
28	Quadna	Aitkin	\$0	\$156,900	\$14,000	\$300,000	\$470,900
28	Royalton	Morrison	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
28	Sandy Lake	Beltrami	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
28	Swaanburg	Cass	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
28	Woodland	Kanabec	\$0	\$156,900	\$14,000	\$240,000	\$410,900
30			\$5,966,000	\$4,707,000	\$420,000	\$5,910,000	\$17,003,000

SUMMARY OF ALL FIXED COMPONENTS

DIST	SITE NAME	COUNTY	TOWERS	800MHZ	INTEROP/CONTROL	MICROWAVE	TOTAL
29	Ada	Norman	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
29	Barnsville	Clay	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
29	Detroit Lakes	Becker	\$0	\$156,900	\$4,014,000	\$240,000	\$4,410,900
29	Eagle Lake	Otter Tail	\$270,000	\$156,900	\$14,000	\$300,000	\$740,900
29	Erhard	Otter Tail	\$0	\$156,900	\$14,000	\$300,000	\$470,900
29	Everdell	Wilkin	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
29	Felton	Clay	\$348,000	\$156,900	\$14,000	\$450,000	\$968,900
29	Fergus Falls	Otter Tail	\$0	\$156,900	\$14,000	\$375,000	\$545,900
29	Flat Lake Lookout	Becker	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
29	Luce	Otter Tail	\$100,000	\$156,900	\$14,000	\$150,000	\$420,900
29	Hawley	Clay	\$0	\$156,900	\$14,000	\$450,000	\$620,900
29	Henning	Otter Tail	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
29	Hoffman	Douglas	\$85,000	\$156,900	\$14,000	\$600,000	\$855,900
29	Juggler Lake	Becker	\$0	\$156,900	\$14,000	\$150,000	\$320,900
29	Lake Carlos	Douglas	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
29	Mahnomen	Mahnomen	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
29	Sebeka	Wadena	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
29	Twin Valley	Norman	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
29	Wadena	Wadena	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
29	Wolf Lake	Becker	\$0	\$156,900	\$14,000	\$300,000	\$470,900
<b>20</b>			<b>\$4,283,000</b>	<b>\$3,138,000</b>	<b>\$4,280,000</b>	<b>\$4,995,000</b>	<b>\$16,696,000</b>

SUMMARY OF ALL FIXED COMPONENTS

DIST	SITE NAME	COUNTY	TOWERS	800MHZ	INTEROP/CONTROL	MICROWAVE	TOTAL
31	Bass Lake Lookout	Itasca	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
31	Big Falls	Koochiching	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
31	Big Thunder Peak	Itasca	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
31	Deer River	Itasca	\$255,000	\$156,900	\$14,000	\$450,000	\$875,900
31	Dixon Lookout	Itasca	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
31	Elephant Lake	St Louis	\$0	\$156,900	\$14,000	\$240,000	\$410,900
31	Ely	St Louis	\$170,000	\$156,900	\$14,000	\$240,000	\$580,900
31	Fairland	Koochiching	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
31	Ft Lookout Tower	Koochiching	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
31	Gheen	St Louis	\$0	\$156,900	\$14,000	\$150,000	\$320,900
31	Goodland	Itasca	\$348,000	\$156,900	\$14,000	\$240,000	\$758,900
31	Grand Rapids	Itasca	\$0	\$156,900	\$14,000	\$90,000	\$260,900
31	Hoyt Lakes	St Louis	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
31	Idington	St Louis	\$0	\$156,900	\$14,000	\$600,000	\$770,900
31	Itasca County	Itasca	\$348,000	\$156,900	\$14,000	\$450,000	\$968,900
31	Itasca County NE	Itasca	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
31	Johnson Landing	Koochiching	\$348,000	\$156,900	\$14,000	\$300,000	\$818,900
31	Kabetogma	St Louis	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
31	Lavell	St Louis	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
31	Little Fork	Koochiching	\$270,000	\$156,900	\$14,000	\$150,000	\$590,900
31	Madowlands	St Louis	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
31	Mizpah	Koochiching	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
31	Nashwauk	Itasca	\$85,000	\$156,900	\$14,000	\$30,000	\$285,900
31	Northome	Koochiching	\$85,000	\$156,900	\$14,000	\$390,000	\$645,900
31	Picket Lake	St Louis	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
31	Side Lake St Park	St Louis	\$270,000	\$156,900	\$14,000	\$375,000	\$815,900
31	Tower	St Louis	\$348,000	\$156,900	\$14,000	\$240,000	\$758,900
31	Virginia DOT	St Louis	\$0	\$0	\$14,000	\$150,000	\$164,000
31	Virginia/Mid	St Louis	\$0	\$156,900	\$4,014,000	\$375,000	\$4,545,900
29			\$7,051,000	\$4,393,200	\$4,406,000	\$6,000,000	\$21,850,200



SUMMARY OF ALL FIXED COMPONENTS

DIST	SITE NAME	COUNTY	TOWERS	800MHz	INTEROP/CONTROL	MICROWAVE	TOTAL
32	Alida	Clearwater	\$348,000	\$156,900	\$14,000	\$390,000	\$908,900
32	Angus	Polk	\$0	\$156,900	\$14,000	\$490,000	\$660,900
32	Bagley	Clearwater	\$0	\$156,900	\$14,000	\$300,000	\$470,900
32	Baudette	Lake of Woods	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
32	Bemidji Fire Tower	Beltrami	\$85,000	\$156,900	\$14,000	\$600,000	\$855,900
32	Berner	Clearwater	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
32	Crookston	Polk	\$0	\$156,900	\$14,000	\$490,000	\$660,900
32	Fox	Roseau	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
32	Greenbush	Roseau	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
32	Grygla	Beltrami	\$348,000	\$156,900	\$14,000	\$240,000	\$758,900
32	Hallock	Kitson	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
32	High Landing	Pennington	\$348,000	\$156,900	\$14,000	\$450,000	\$968,900
32	Hines	Beltrami	\$0	\$156,900	\$14,000	\$240,000	\$410,900
32	Lake Bronson	Kitson	\$0	\$156,900	\$14,000	\$240,000	\$410,900
32	Mentor	Polk	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
32	Middle River	Marshall	\$0	\$156,900	\$14,000	\$90,000	\$260,900
32	Muligan Lake	Lake of Woods	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
32	Old Mill State Pk	Marshall	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
32	Red Lake	Beltrami	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
32	Ridge Lookout	Beltrami	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
32	Roosevelt	Lake of Woods	\$0	\$156,900	\$14,000	\$240,000	\$410,900
32	Sucker Creek	Beltrami	\$348,000	\$156,900	\$14,000	\$90,000	\$608,900
32	Thief River Falls	Pennington	\$0	\$156,900	\$14,000	\$390,000	\$560,900
32	Trail	Polk	\$0	\$156,900	\$14,000	\$540,000	\$710,900
32	Washkish	Beltrami	\$348,000	\$156,900	\$14,000	\$150,000	\$668,900
25			\$5,305,000	\$3,922,500	\$350,000	\$6,200,000	\$15,777,500
237			\$53,388,000	\$39,274,390	\$19,318,000	\$50,889,340	\$162,869,730
RF & MW Engineer		Statewide	\$12,000,000		\$14,000,000		\$26,000,000
Project Total			\$188,869,730				

# **EXHIBIT 7**

## **FREQUENCY ASSIGNMENTS**



Federal Communications Commission Page 1 of 1  
Wireless Telecommunications Bureau

Licensee: MINNESOTA, STATE OF

MINNESOTA, STATE OF, OEC  
MINNESOTA, STATE OF  
395 JOHN IRELAND, BLVD  
SAINT PAUL MN 55155

Call Sign WPTZ762	File Number 0000535733
Radio Service  SL – Public Safety 700 MHZ Band-State License	
Regulatory Status  PMRS	

Grant Date 01-18-2002	Effective Date 01-18-2002	Expiration Date 01-18-2017	Print Date 01-22-2002
1 <sup>st</sup> Build Out Date 01-01-2012	2 <sup>nd</sup> Build Out Date 01-01-2017		

State License Area: MN - Minnesota  
State License Channels: All State Channels 764-776/794-806 MHz

#### WAIVERS/CONDITIONS

In accordance with Section 90.531, only frequency designated for direct licensing to each state (including U.S. territories, districts, and possessions) are authorized .

In accordance with Section 90.533, operation of public safety transmitters must not cause harmful interference to the reception of television broadcasts transmitted by UHF TV broadcast stations located in Canada. Public safety base, control, and mobile transmitters must comply with the interference protection criteria in Section 90.545 for TV/DTV station in Canada. Public safety facilities must accept any interference that may be caused by operations of UHF television broadcast transmitters in Canada.