

Erie County Department of Public Safety

2880 Flower Road
Erie, PA. 16509



Erie County, Pennsylvania
Department of Public Safety



Next Generation Radio System Needs Assessment and Strategic Plan Report

Submitted By

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September 2014

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EXECUTIVE SUMMARY

The Erie County Department of Public Safety is charged with providing 9-1-1 call taking, dispatching and emergency management services for residents, visitors, police, fire, EMA, EMS and rescue services throughout the county. Erie County has a 2013 census population of 280,294. The county is 1,558 square miles square miles in size, of which 798.9 square miles are land and 759.1 square miles are water.

Call taking for both 9-1-1, and non-emergency and administrative calls, along with corresponding dispatch functions are handled through the 9-1-1 center which is part of the Department of Public Safety. The 9-1-1 center handled a call volume for Erie County of 172,596 incoming calls in 2013. Calls to the 9-1-1 center include administrative calls and non-emergency calls as well as 9-1-1 calls. A total of 101,510 calls were wireless 9-1-1 calls, 36,324 were wireline 9-1-1 calls, and 34,762 were non-emergency and administrative calls. Total dispatches in 2013 were 61,433 for police, 36,270 for EMS, 25,270 for fire and 17 for rescue. EMA responds to incidents in addition to performing the regular duties of planning, recovery and mitigation. EMA responded to 15 calls in 2013.

Erie County ranks 12th in population statewide and ranks 13th in 911 call volume.

Erie County requested MCM to conduct a comprehensive needs assessment and formulate a strategic plan to develop a next generation radio communications network for the public safety agencies in Erie County. Erie County's intent is to create an interoperable, single band radio solution serving all law enforcement, fire, emergency medical services (EMS), emergency management (EMA) and other county agencies within Erie County.

The goal of MCM was to provide a comprehensive and complete analysis of Erie County's voice radio communications network for the public safety agencies in Erie County and provide a strategic plan for the county's future next generation radio system.

A critical aspect of this project was to obtain input from the employees and agencies in the county that use and is supported by the Department of Public Safety. As stakeholders, it is important that all recommendations and

solutions address as many of their needs and requirements as possible within the confines of available funding.

MCM Consulting Group, Inc. (MCM) performed this next generation and strategic planning under contract with the Erie County Department of Public Safety. The project team consisted of John Grappy, Director of the Department of Public Safety, Kale Asp, 9-1-1 Coordinator, Abdul Osman, IT Systems Manager, Brian Wedekind, Communications Specialist, Tony Flaminio, Communications Specialist, Keith Comi, IT Systems Administrator, Jeff Harmon, IT Specialist II, Michael McGrady, President MCM Consulting Group, Inc., Jonathan Hansen, Director of Operations, Ron Godava, Senior Consultant, Mike Crago, Senior Consultant; and Michael Rearick, Senior Consultant and Ed Hofmann, Consultant who both participated in the interview portion of the project.

The project kick off meeting was held on October 1, 2013. This meeting introduced all members of the project team and outlined the tasks, deliverables and estimated schedule for the project.

The project was broken into two (2) phases. The scope of each phase was:

Phase I: Needs assessment, space survey and interviews were conducted with the Department of Public Safety employees and representative agencies served by the Department of Public Safety to determine the most needed improvements. This phase included compilation and analysis of all data collected during the survey and interview process, as well as a review of the previously completed assessments. A summary report of the findings was generated. In addition, a physical site survey and equipment inventory of the 9-1-1 center and the 35 county transmit/receive sites was performed. A report detailing the physical survey results is included in phase I.

Phase II: This strategic planning phase included radio vendor presentations and the release of a request for information to obtain budgetary pricing and recommended solutions to replace the 9-1-1 center radio console system and the current radio and microwave systems. After reviewing the aforementioned information with key county stakeholders, a strategic plan was generated. A corresponding budgetary estimate for initial capital cost and ongoing maintenance costs for each improvement was generated. Radio propagation coverage maps depicting predicted signal levels were also provided in this phase.

MCM has completed all tasks included in Phase 1 and Phase 2 of this project. Needs assessment surveys and interviews have been conducted, the data has been compiled, analyzed and incorporated in this report and the physical site surveys and equipment inventory have been completed and included as well.

KEY FINDINGS

Some key findings (based on frequency of response from agencies) from Phase 1 of the project include:

- Erie County does not have a county-wide radio system. It has a system of systems.
- A new county-wide radio system is needed for EMA, EMS, fire and police agencies.
- There is an underlying desire and need for interoperability among the users, bordering counties and Commonwealth agencies.
- Significant grounding and maintenance issues need to be addressed at the county radio sites.
- Radio coverage is inconsistent for many areas.
- Users of the system desire improved portable and mobile radio coverage.
- Portable in building coverage is a perceived issue almost everywhere.
- A consistent across the disciplines desire for more channels is expressed, including more operations channels.
- Users of the system expressed concern over issues in dispatching during high call volume times.
- An additional dispatcher is needed during times of high call volume and during large-scale incidents and weather emergencies.
- There are concerns about what is seen as channel capacity in heavy use disaster periods.
- Weather and time of year (seasons) affect the radio network performance.

- Lack of funding for capital and ongoing cost is the number one financial concern of both users and non-users of the system.

Details about the key findings listed above provide insight into the needs assessment surveys and interviews can be found in subsequent sections of this report.

It must be noted that all agencies MCM surveyed and interviewed during this phase of the project were extremely receptive to the goal of the project and were very responsive and helpful. Everyone involved is committed to improving the service they provide to their constituents as well as the safety of their personnel and view this undertaking as a critical step in the process of improvement.

MCM Consulting Group, Inc. is recommending based on the availability of UHF trunked pairs, unify the radio communications of all “County responsible” entities onto one “platform” or radio frequency band with by recommending a UHF, IP based, P25 phase II (for spectrum capacity) “trunked” (for spectrum efficiency) and a multi zone “simulcast” (for coverage)” configuration.

MCM recommends that the county purchase the initial portable and mobile radios and pagers for the public safety agencies following the formula listed on pages 51 and 52 of this report.

MCM also recommends that the current Canopy microwave system be replaced with a digital Multiprotocol Label Switching (MPLS) microwave “ring” system with ring protection that would be required to link the operational zones. The system must be Ethernet capable and have a minimum bandwidth of 150 mbps for the new system. The selected vendor for this project would be responsible for a complete “turnkey” job to include path surveys, equipment selections and FCC licensing.

Finally, MCM recommends that the current Catalyst radio console system is replaced a new system that is recommended and warrantied to be compatible with the new radio system equipment.

MCM appreciates this opportunity to assist Erie County in developing its plan for the future next generation radio system.

BACKGROUND AND INTRODUCTION

Erie County retained MCM in October of 2013 to complete a two phase contract designed to:

1. Review the existing radio communication system network.
2. Assist key stakeholders with prioritizing needs and requirements
3. Recommend potential solutions to migrate their current radio system(s) to single band, next generation radio network and to improve interoperability & radio network performance.

The Erie County Executive and the County Council have shown their support for their residents and public safety agencies by approving a surcharge to support 9-1-1 through monthly contributions included in their wireline telephone service bill and by having the Erie County 9-1-1 annually apply for wireless 9-1-1 funding. The revenues generated by these surcharges, as well as county general fund monies are used to fund capital improvements as well as offset operating expenses.

An additional source of funding for equipment comes from federal grants received by the Erie County Department of Public Safety through their regional task force. These grants are usually a one-time source of funds and can be used only for specific purposes.

A key goal of the needs assessment and strategic plan project is to match the highest priority needs to the potential available funding. Based upon results of the needs assessment surveys & interviews, site surveys and discussions with agency stakeholders, a final plan has been developed that maximizes the use of potential available funds to improve the radio communication system network. The results of this project will also serve to build a framework for future funding requirements and an evolutionary network improvement plan. All involved parties recognize that current funding sources are not sufficient to accomplish completing all of the improvements at the same time so an incremental, prioritized, multi-phased approach was called for.

The 9-1-1 center is an entity within the Department of Public Safety and provides 9-1-1, non-emergency and administrative call taking and dispatch for its residents, visitors, fire, police, EMA, EMS and numerous county agencies throughout the county.

For normal day-to-day operations the 9-1-1 center currently relies upon the use of multiple low band, VHF, UHF and 800 MHz channels to dispatch and support fire, law enforcement, EMS agencies and EMA throughout the county.

The 9-1-1 Center currently has a budgeted staff of sixty-four (64) including:

Director of Public Safety	1
9-1-1 Administrative Assistant	1
9-1-1 Coordinator	1
9-1-1 Assistant 9-1-1 Coordinator / Relief Shift Commander	1
9-1-1 Administrative Financial Officer	1
9-1-1 Shift Commander	3
9-1-1 Training Administrator	1
911 QA Coordinator	1
IT Systems Manager	1
IT Systems Administrator	1
IT Specialist II	1
Radio/Communications Specialist	2
9-1-1 Database Maintenance/Information Coordinator	1
GIS/Database Administrator	1
9-1-1 GIS Technician	1
9-1-1 Telecommunicator	46

Minimum telecommunicator staffing level for the three shifts includes nine (9) on duty telecommunicators and one (1) supervisor.

Telecommunicators are typically assigned the following dedicated duties as staffing, call volume and call type allow:

- 3 Dedicated call takers
- 3 Law Enforcement dispatchers
- 3 EMS/Fire dispatchers
- 1 Shift Commander

Kale Asp has responsibility for the day-to-day operation of the Erie County 9-1-1 Center. Kale reports to the Director of Public Safety, John Grappy. Director Grappy reports to the Erie County Executive.

Standard Operating Procedures (SOP's) are used by the 911 Center staff to perform their duties.

The 9-1-1 Center and EOC are physically located in the Erie County Department of Public Safety facility , 2880 Flower Road in Erie, PA 16509. The current configuration of the dispatch center includes:

- 4 Call taker positions
- 4 Law Enforcement dispatch positions
- 4 EMS/ Fire dispatch positions
- 2 Shift Commander (Supervisor) positions
- 4 Training positions

The training positions include all three mission critical systems and can be a “live” call taker or dispatch position when needed.

Multiple backup power generators are located in the facility and provide electrical service to the 9-1-1 Center equipment as well as other parts of the 9-1-1 Center and EOC in the event of a commercial power outage. It should be noted that a relatively new UPS is installed in the equipment room to provide backup power to the 911 Center and EOC while the generator comes up to speed.

Erie County operates on low band, VHF; UHF and 800 MHz frequencies located on 35 transmission/receive sites and uses Canopy microwave and phone lines for connectivity to its sites.

It should be also noted that significant remediation work needs to be done at almost all of the Erie County tower sites.

Various frequencies and equipment are located at each site. Please see the individual site surveys in Appendix 7 for specific frequency and equipment inventory.

For more details about the physical infrastructure that makes up the 9-1-1 radio communication system network, please see Appendix 7 to this report as well as the physical site survey reports.

MCM Consulting Group, Inc. personnel conducted needs assessment surveys and interviews from October 2013 through March 2014. The majority of the interviews were conducted face-to-face with participating agencies at the 9-1-1 center and various sites throughout the county, phone interviews were used for those who could not attend an interview in person. A total of all agencies interviewed are included in later sections of this report. A copy of the questionnaire used to collect interview data is included in Appendix 6 to this report. Once the interviews were completed, the data was compiled and a statistical model was developed to tabulate and sort the data elements.

This allowed MCM to analyze the data in unique ways according to type of agency and geographic location of agency. From these assumptions a plan for the immediate, short, medium and long term can be developed and obstacles can be identified.

This report is the deliverable for Phase 1 of this project. The data and observations contained in this report were also used to complete Phase 2 of the project. Phase 2 includes recommendations and potential design scenarios along with their corresponding budgetary estimates.

SECTION 1 – Needs Assessment Summary

Introduction

The needs assessment surveys and interviews were performed during October 2013 through March 2014. The face-to-face interview sessions (telephone interviews were used for those who could not attend the interview sessions) were very productive in terms of gathering detailed, specific information directly from agency personnel who use or would like to use the Erie County radio system network on a daily basis. Participants were eager to provide as much information as possible as they understand the importance of the outcome of this project as it relates to aiding them in performing their duties efficiently and safely.

The interview form used to collect data from participating agencies was developed after MCM met with the project committee to discuss their goals for the project and after collecting some historical background concerning the network. The information set was designed to collect pertinent data that would shed light on real world issues agencies face when using the network and to allow realistic design scenarios to be developed to improve the network. A copy of the interview form is included in Appendix 6 to this report.

A total of 70 agencies/users were either surveyed or interviewed throughout the county. Agencies/users were from the follow groups:

- 9-1-1
- Education
- EMA
- EMS
- Fire
- Law Enforcement
- Misc. (Governmental, Public Works, Etc.)

There were a number of common themes that emerged during the process of collecting data from all of the agencies.

The following sections provide details from responses to each area of the questionnaire (a copy of the interview form used may be found in Appendix 6). Interview data was compiled and a database was developed to sort and analyze the data elements for each section. Data was sorted by agency type. Where applicable, rating data was averaged by agency type and location to reveal any underlying trends.

Needs Assessment Survey Form Section Results

Highlights of the results from each section of the Needs Assessment Survey will be presented in this portion of the report. Summary statistics in graph form are included where applicable. A copy of the interview form used may be found in the Appendix 6 this report.

Part 1: Usage and Interoperability

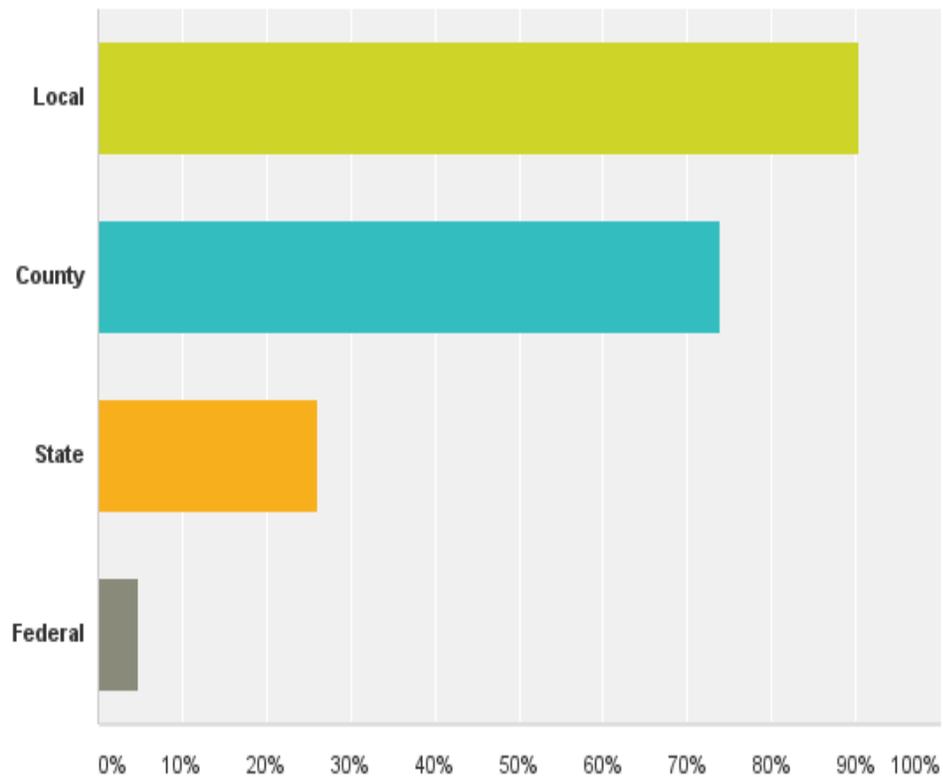
This section of the interview was designed to capture background information about the agency being interviewed such as services provided, area served, mutual aid responsibilities and interoperability requirements. Interoperability requirements with local, county, state and federal agencies were defined. Every agency provides a level of mutual aid to neighboring municipalities and in the instance of agencies located near county borders, the neighboring county as well. For example, the Commonwealth of Pennsylvania uses an 800 MHz network for all of their dispatch communications. With the exception of the 9-1-1 Dispatch Center and EMA, Erie County agencies have limited 800 MHz capabilities; therefore an inter-band solution (interoperability communication system unit) would be needed for seamless interoperability.

The following charts depict interoperability tabulated results obtained in this section:

Typical interoperability requirements:

Interview Section 1, Question 6

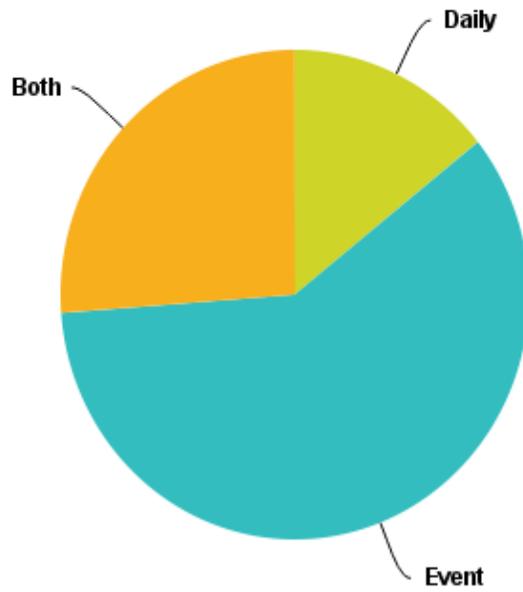
Q6 What are your most typical interoperability requirements? Check all that apply.



Typical interoperability requirements:

Interview Section 1, Question 7

Q7 Do you have any ongoing, daily interoperability requirements or are they event based needs?



Part 2: Current Equipment Inventory in Use

This section of the interview form was used to collect data describing the communication radio system network equipment used by each agency. Important data elements collected include the quantity, type and age of equipment being used. Any network-based solution must consider the impact on the equipment being used by all agencies in the county. The cost to replace or upgrade portable, mobile and base radios already in use can be a major issue when deciding what type of network infrastructure upgrades or improvements are feasible. Equipment age is also a factor because some older models of equipment are not capable of being upgraded or expanded.

Radio channels used by each agency were also documented, including “private” or “secondary” channels. A limited number of agencies have and use their own secondary channels. Also, there are a limited number of cell phones in use to aid in communications capacity and interoperability between agencies.

Secondary channels, unless maintained by the 9-1-1 Center and cell phones, are acceptable to use for interdepartmental communications, however they are not considered acceptable for emergency communications.

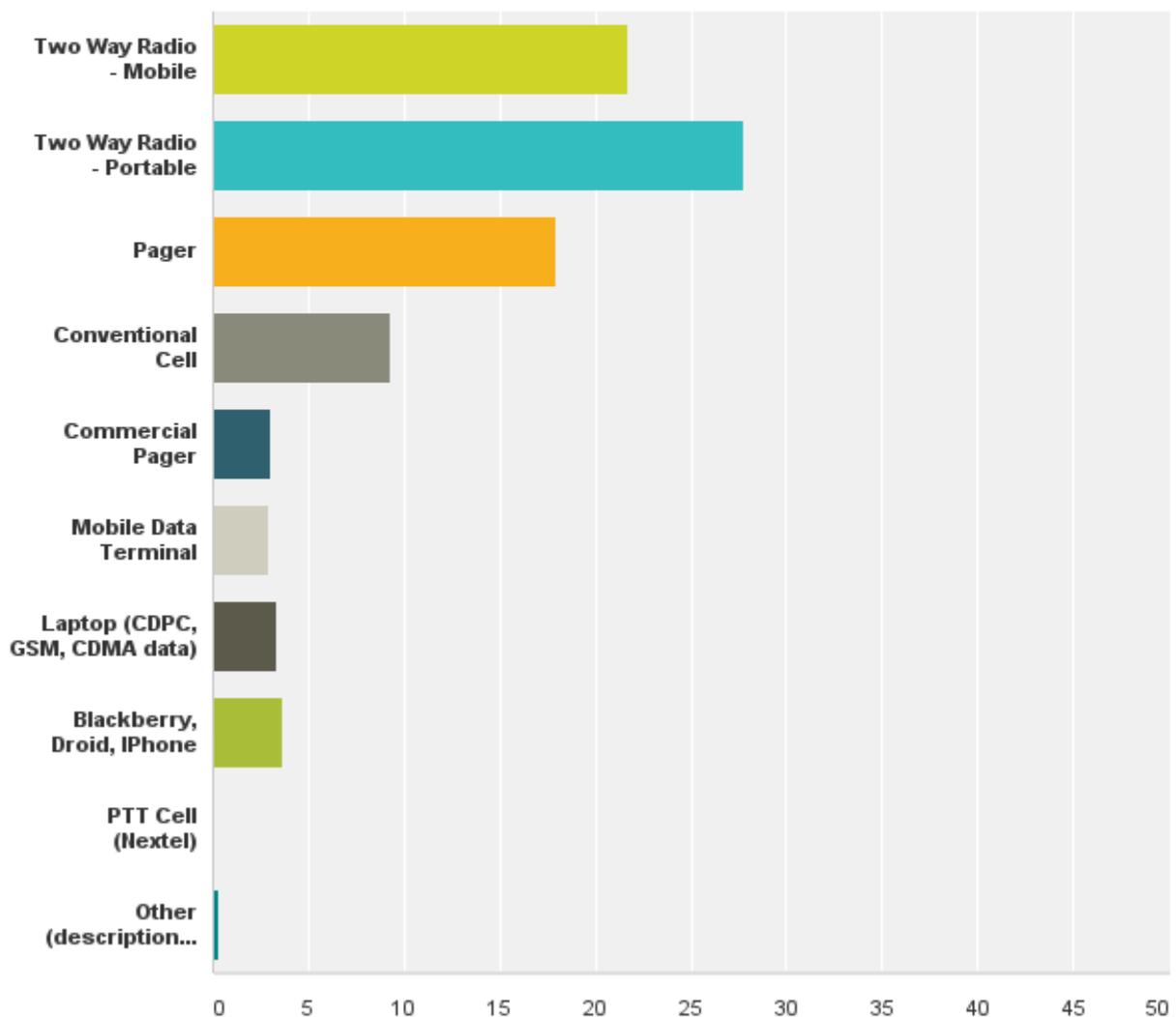
This solution may provide adequate interoperability on a daily basis if no major incident occurs. In the event of a major event of any kind the cell network will quickly become overloaded and prove to be useless to agencies in the county. In discussions with residents and users and from our experience traveling the county, cellular coverage is not universal. Realistically, from the standpoint of the cellular carriers the population base in rural areas drives their allocation of resources and unfortunately it is unrealistic to anticipate significantly more assets being deployed in the region that would increase coverage or capacity.

The following charts depict the type of equipment tabulated average results obtained in this section:

Current Inventory in Use:

Interview Section 2, Question 8

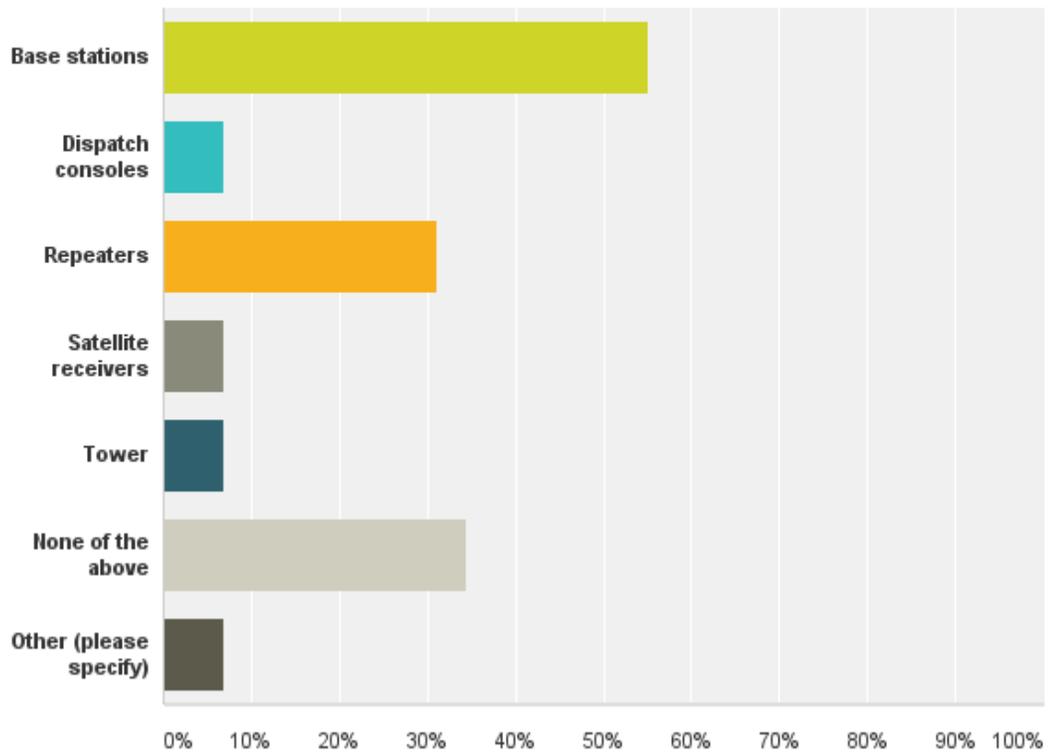
Q8 Please provide the quantity of all the listed communications devices utilized by personnel within your agency. [A separate inventory list of all two way radios (mobile and portable) and pagers including manufacture, model number, age and number of units will be required in Appendix A



Current Inventory in Use

Interview Section 2, Question 10

Q10 Does your agency own and operate any of its own network infrastructure that are not dispatched or monitored by the Erie County 9-1-1 Center such as:



Part 3: Radio Network Coverage and Capacity

Section 3 captures information relating to the quality of service (QoS) and capacity provided by the radio portion of the communication system network. Participants were asked to rate the coverage and capacity of the network in terms of pagers, mobile and portable radios. The number of radio channels available for their use during normal daily operations as well as emergency/disaster situations was also surveyed. The rating scale was from 1 to 5 (1 – Poor; 3 – Average; 5 – Excellent).

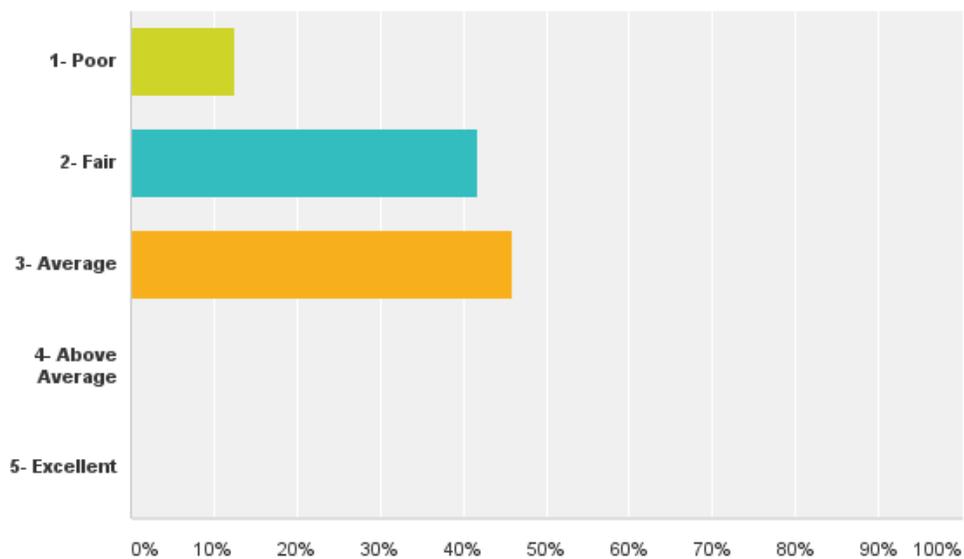
If participants felt more channels were needed, they were asked to describe the quantity of channels and how they would use the channels. Any additional channels would have a direct impact on the capacity needed for a future radio and microwave system.

The following charts depict some of the tabulated results in regard to system capacity obtained in this section:

Performance of the System:

Interview Section 3, Question 12

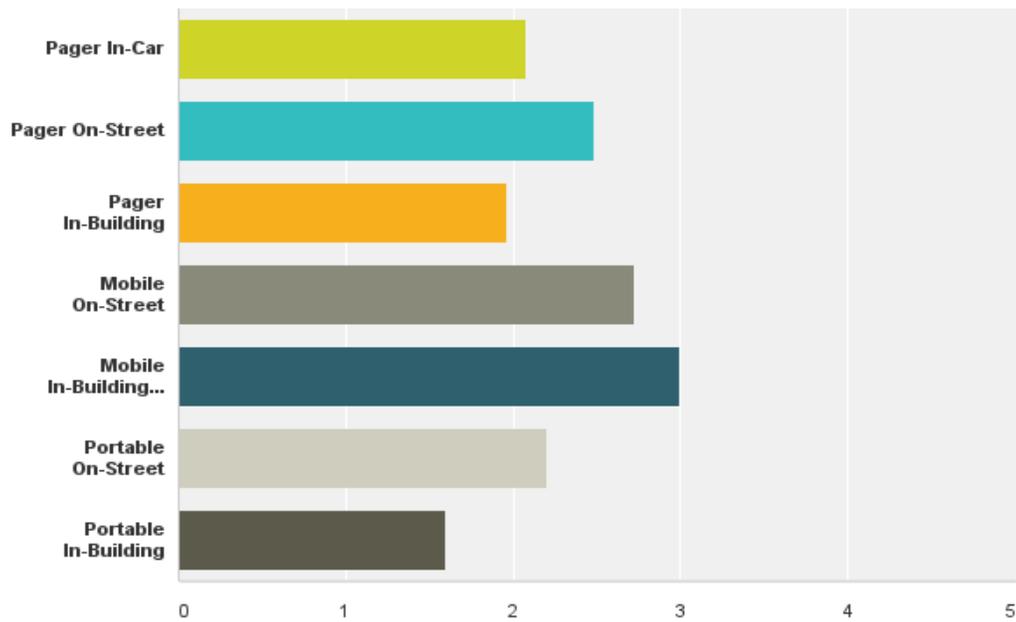
Q12 Overall, how would you rate the performance of the County 9-1-1 Public Safety Radio and Communications Network being utilized by your agency?



Interview Section 3, Question 13

Each participant was also asked to rate the quality of the coverage provided by the network for mobile, portable and pager units. The rating scale was from 1 to 5 (1 – Poor; 3 – Average; 5 – Excellent).

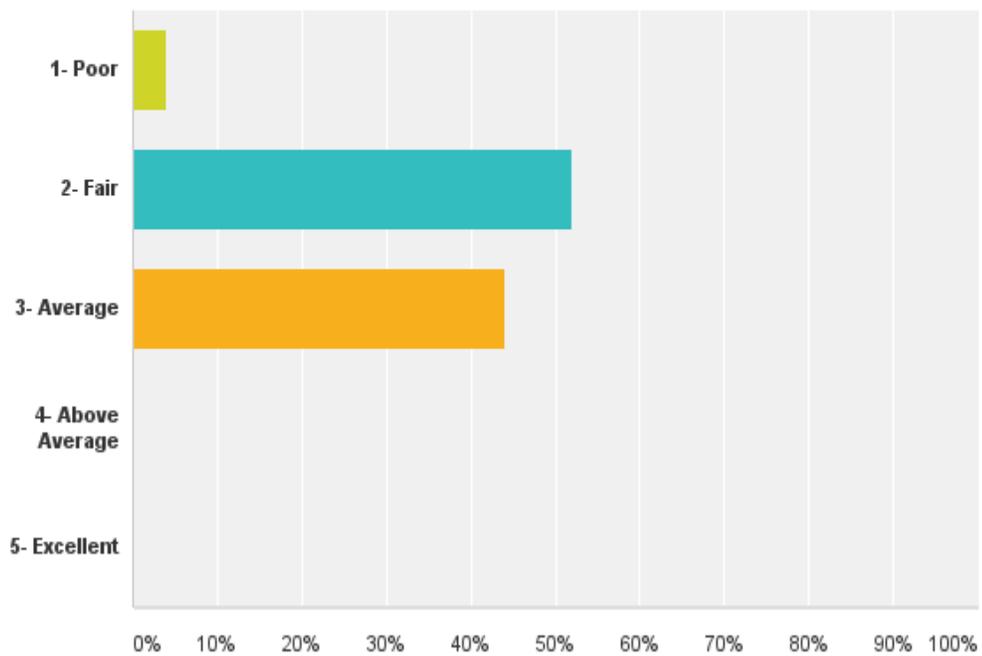
Q13 Using the rating system: 1- Poor, 2- Fair, 3- Average, 4- Above Average, and 5- Excellent; specifically how would you rate the coverage provided by the County 9-1-1 Public Safety Radio and Communications Network utilized by your agency.



Radio Channel Capacity Normal Conditions:

Interview Section 3, Question 22

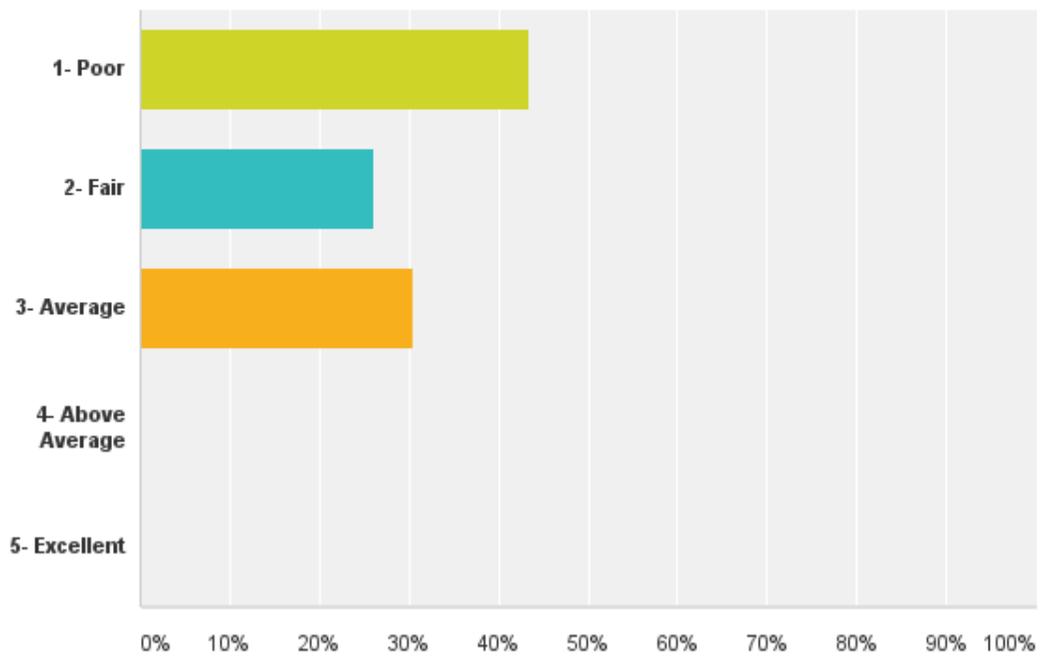
Q22 Specifically how would you rate the radio channel capacity of the County 9-1-1 Public Safety Radio and Communications Network utilized by your agency under normal, daily conditions?



Radio Channel Capacity Emergency Conditions:

Interview Section 3, Question 23

Q23 Specifically how would you rate the radio channel capacity of the network utilized by your agency under emergency or disaster (natural or manmade) conditions?



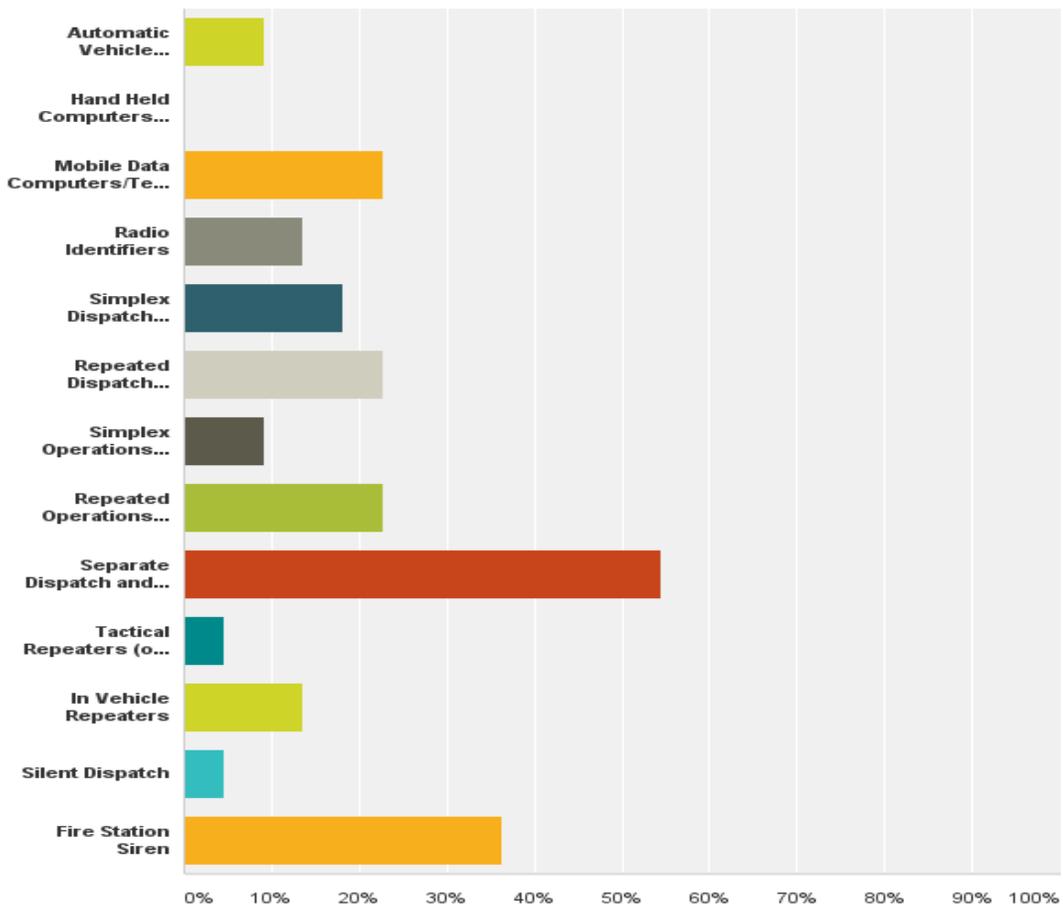
Part 4: Network Functions and Capabilities

This portion of the interview was meant to collect data relating to functions and capabilities currently provided by the existing radio communications system network and what functions or capabilities participants felt were most lacking. This is an important data point that will be used to help identify and prioritize the amount of capacity the new microwave system will require.

Existing Network Functions and Capabilities Normal Conditions:

Section 4, Question 25

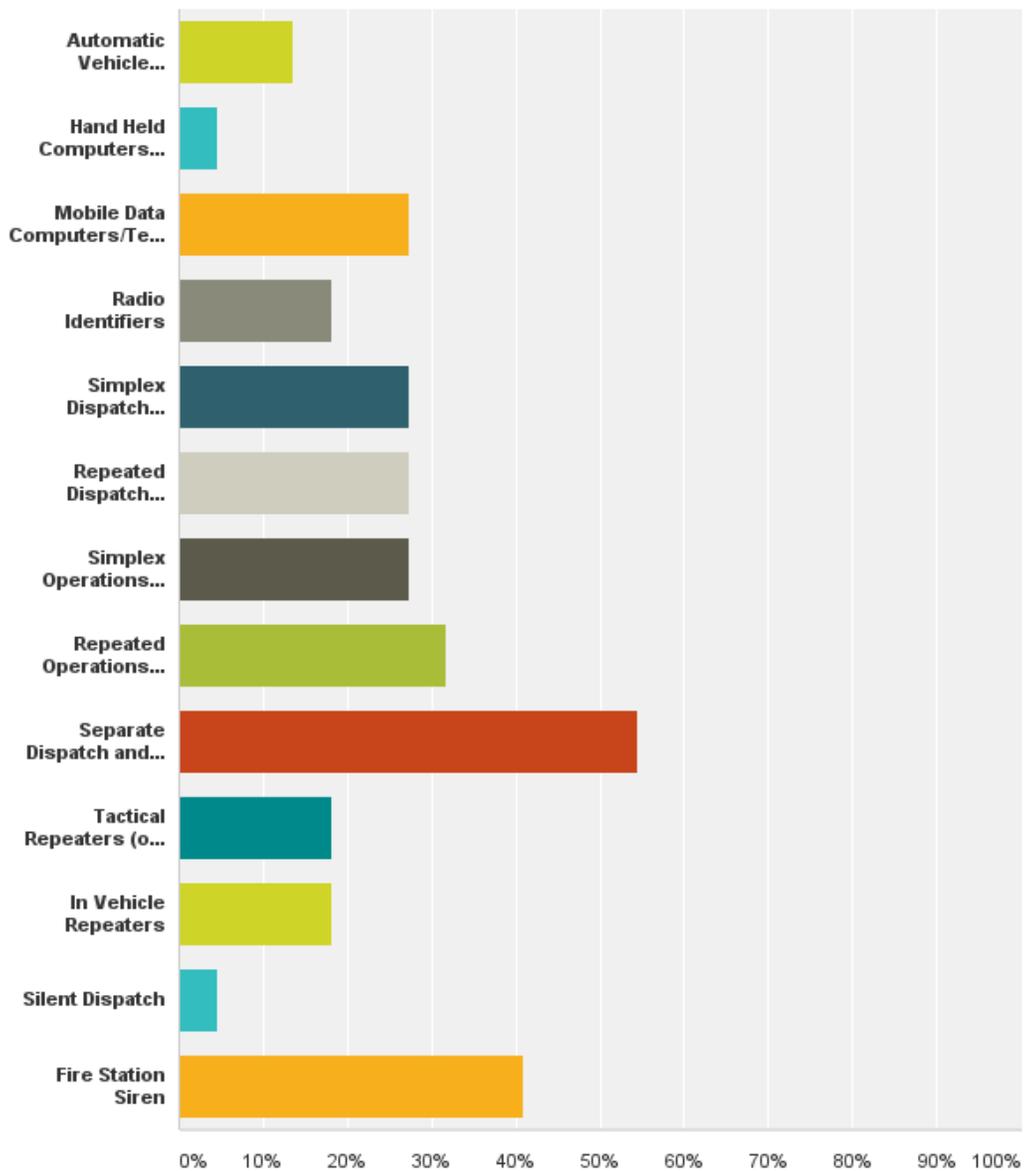
Q25 What existing County 9-1-1 Public Safety Radio and Communications Network functions and/or capabilities do you find most useful in your daily operations? Check as many as apply:



Existing Network Functions and Capabilities Emergency Conditions

Section 4, Question 26

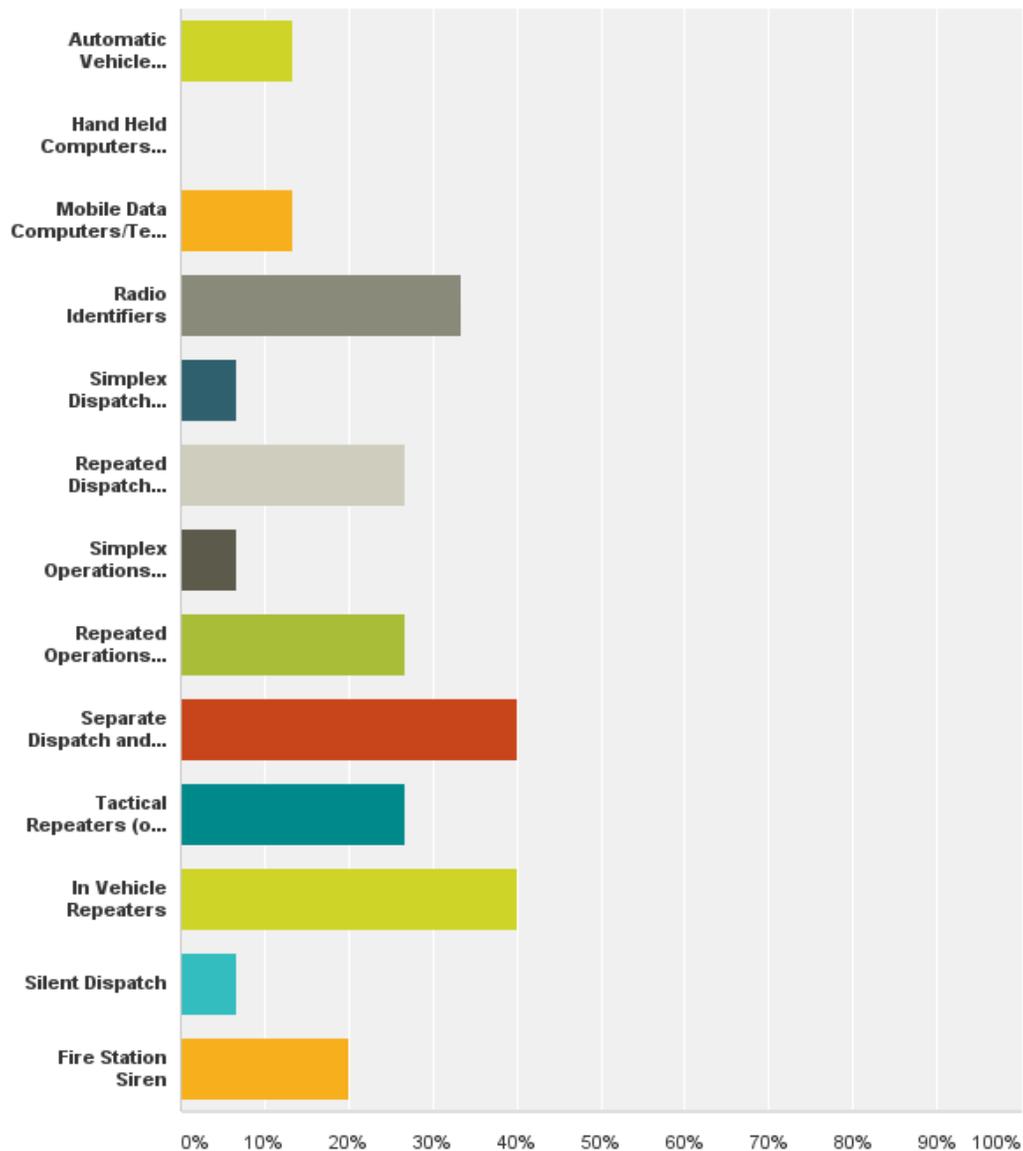
Q26 What existing County 9-1-1 Public Safety Radio and Communications Network functions and/or capabilities do you find most useful in major emergency or disaster situations? Check as many as apply:



Most Lacking Network Functions and Capabilities:

Section 4, Question 27

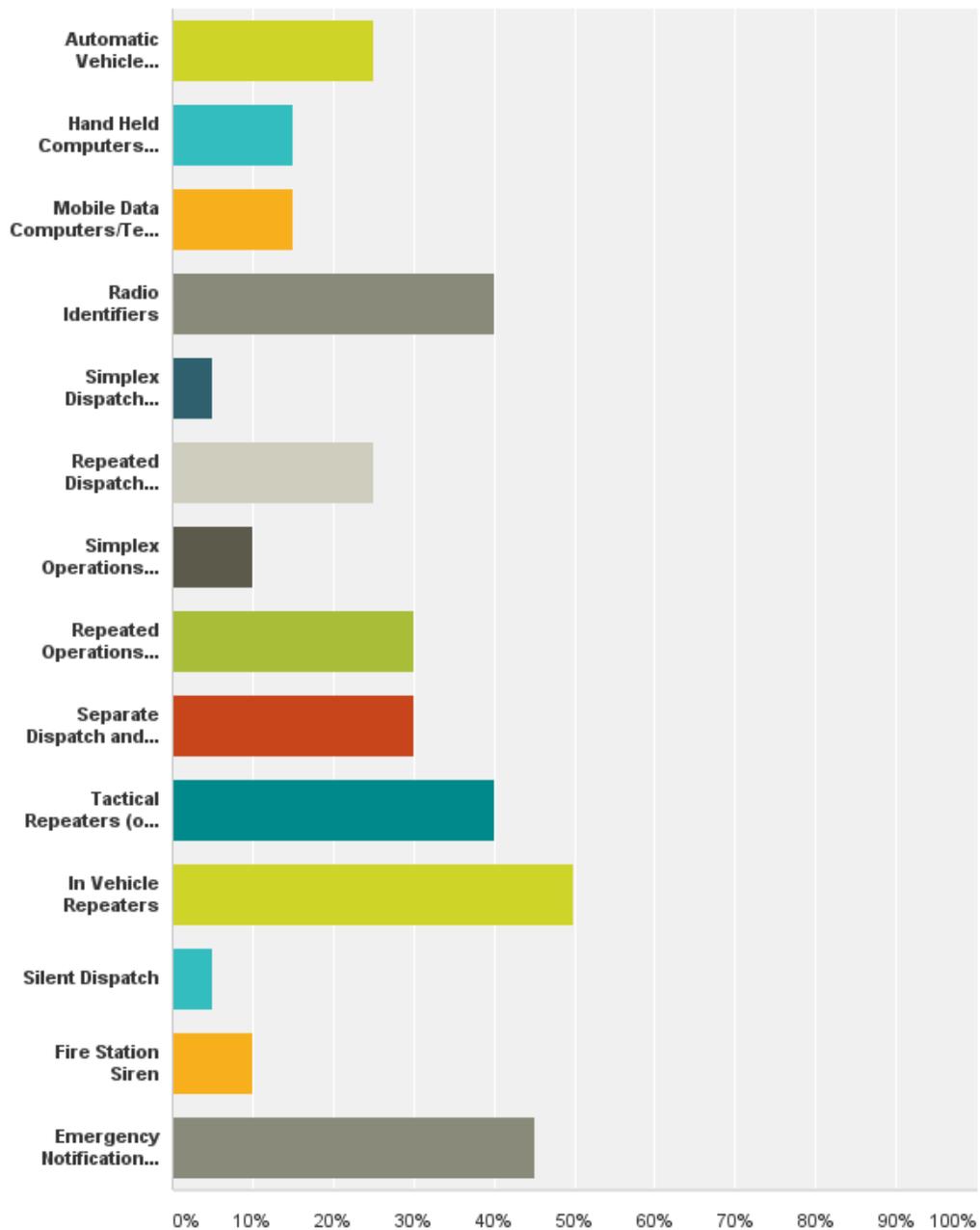
Q27 What functions or capabilities do you feel are most lacking in the existing County 9-1-1 Public Safety Radio and Communications Network for either day-to-day or major emergency/disaster situations? Check as many as apply:



Most Useful Future Network Functions and Capabilities:

Section 4, Question 28

Q28 What functions or capabilities that you do not currently have that you feel would be useful in your department.



Part 5: Reliability, Availability and Stability

In Section 5 of the interview, participants were asked to provide information rating the reliability, availability and stability of both the radio portion of the communications system network as well as the overall 9-1-1 network (including 9-1-1 center equipment infrastructure, personnel and SOP's). The rating scale was from 1 to 5 (1 – Poor; 3 – Average; 5 – Excellent).

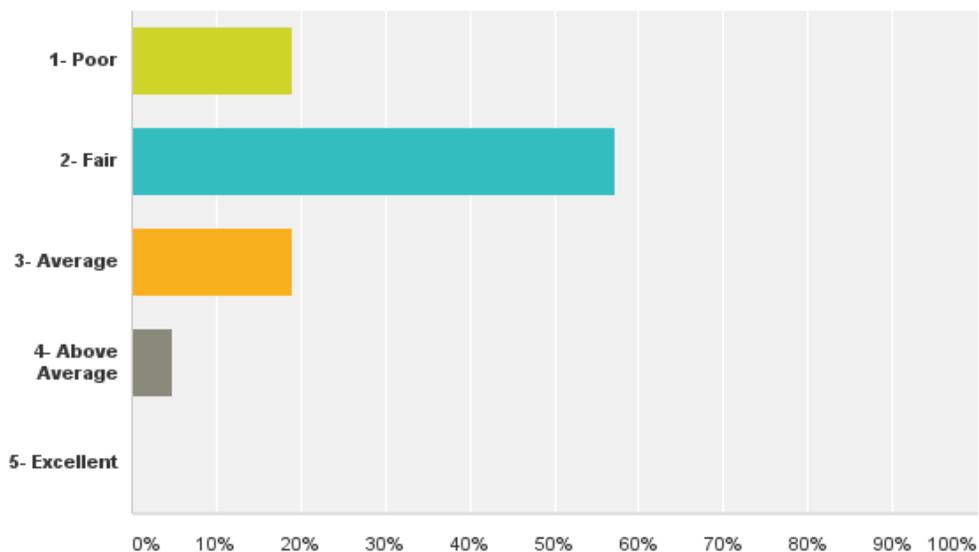
They were also asked to describe any performance degradation noticed during periods of high call volume and if they experienced any operational problems in the last 3 years which may have been caused by a network outage or period of degraded performance. These questions were included to gain insight into the performance of the network from the actual user agency perspective.

The following charts depict some of the tabulated results obtained in this section:

Reliability of the Network:

Interview Section 5, Question 30

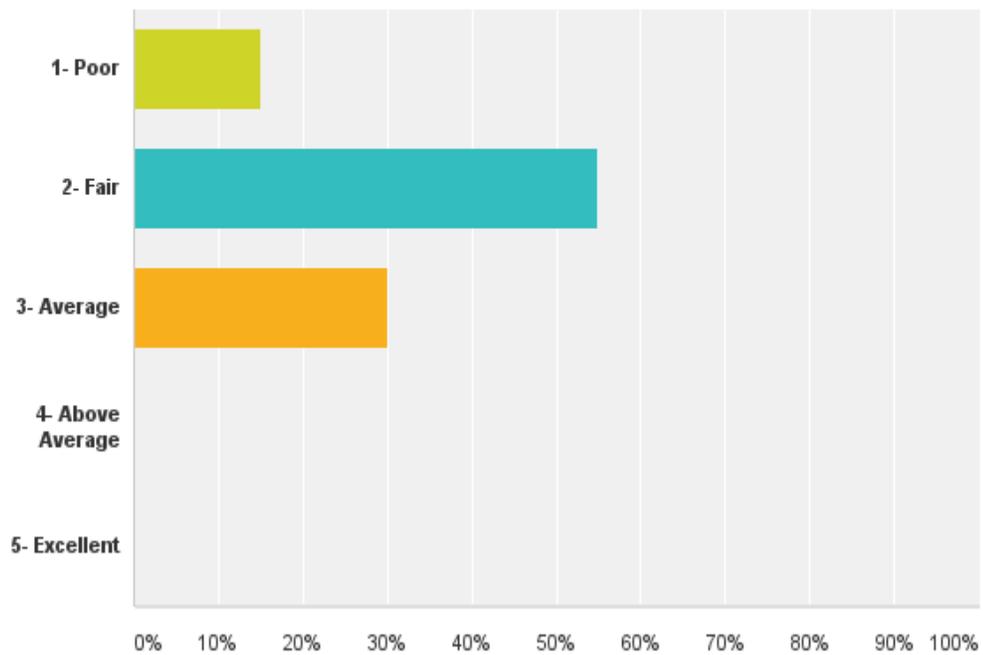
Q29 Specifically how would you rate the overall reliability of the County 9-1-1 Public Safety Radio and Communications Network used by your agency?



Availability of the Network:

Interview Section 5, Question 30

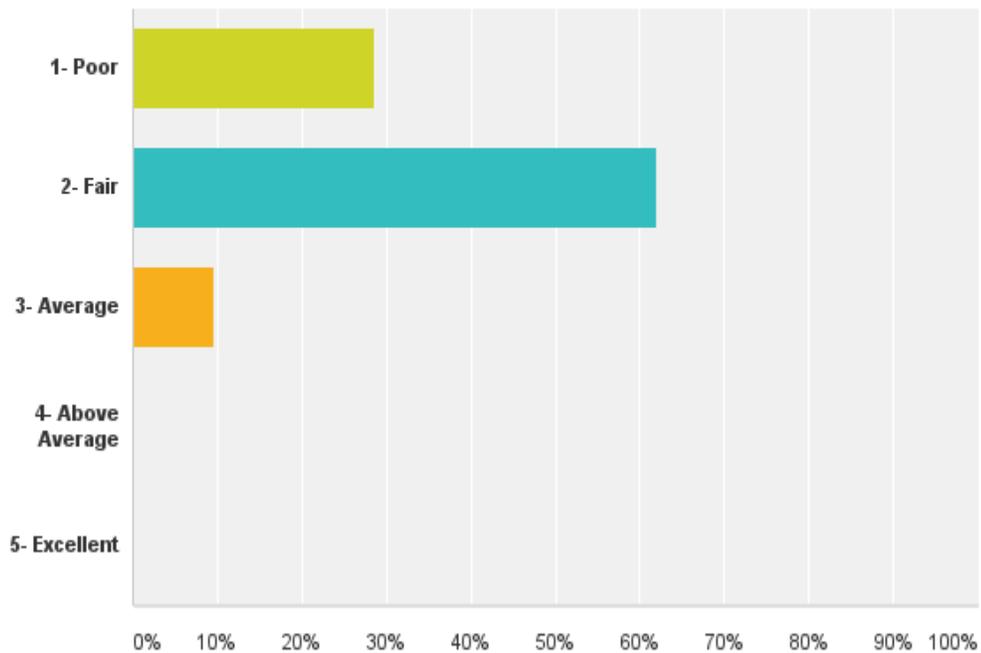
Q30 Specifically how would you rate the overall availability of the County 9-1-1 Public Safety Radio and Communications Network used by your agency?



Stability of the Network

Interview Section 5, Question 31

Q31 Specifically how would you rate the overall stability of the County 9-1-1 Public Safety Radio and Communications Network used by your agency?



Part 6: Use in High Call Volume Situations

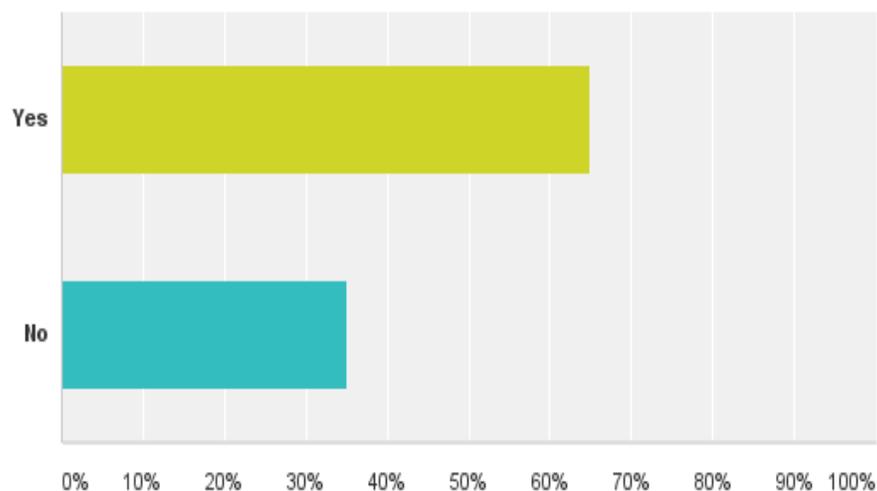
Section 6 was designed to gain further detailed insight into the types of difficulties users encountered during various operational scenarios that stress the capabilities of the 9-1-1 network beyond normal day-to-day operations. This information will help develop improvement plans. Participants were also asked if they had experienced difficulties in the past, could they, from their user perspective, attribute the difficulties to a particular area of the network. Looking at these issues from the user perspective and then comparing this input to the perspective from the 9-1-1 center staff can help reveal gaps between user needs and service provided.

The following charts depict some of the tabulated results obtained in this section:

Difficulties During High Call Volume:

Section 6, Question 38

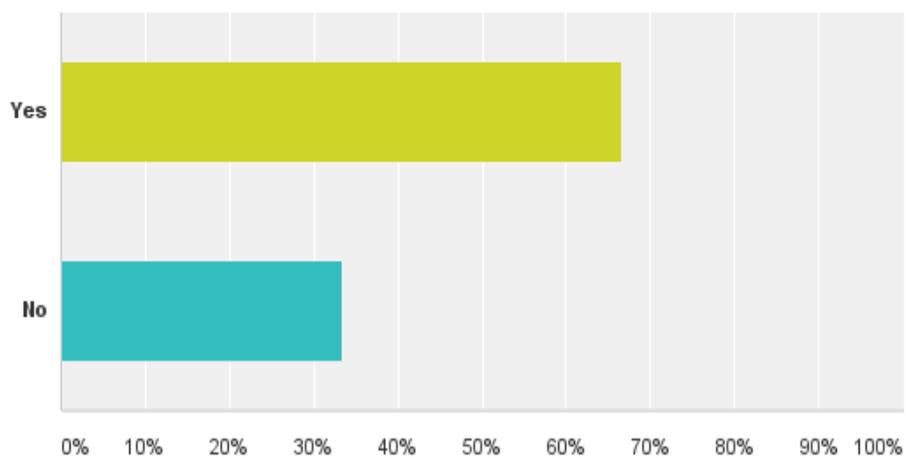
Q38 Does your agency experience any degradation in overall network performance during times of high call volume or during major emergency/disaster situations?



Unplanned Network Outages:

Section 6, Question 39

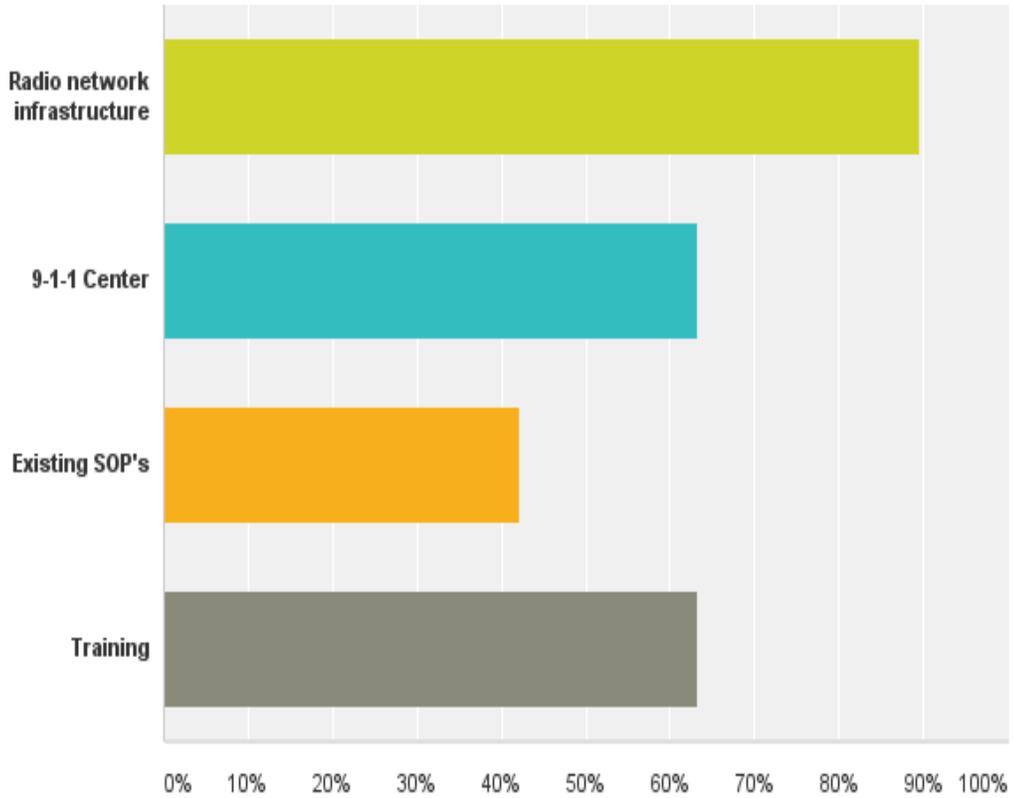
Q39 In the last 3 years has any unplanned network outage or performance degradation occurred which impaired your ability to be dispatched or respond appropriately to an emergency?



Reasons for Difficulty:

Interview Section 6, Question 42

Q42 If difficulties have been experienced, would you attribute them to:



Part 7: Maintainability of Network

Section 7 deals with maintenance issues related to field unit equipment elements in the network. Data collected here will help provide insight into equipment performance as it relates to operational readiness and potential quality of service (QoS) issues. Financial data was collected to be able to determine the amount of money being spent countywide on an annual basis to keep equipment in an operationally ready state. This can also reveal problems caused by aging equipment.

The data reveals that the majority of the users of the system do not have a preventive maintenance program or service agreements in place. They use what is termed in the industry as a PPU (pay per use) agreement or have no agreement in place at all. This is cost effective only if a budget fund is maintained by the departments for large unexpected repair expenses. We recommend each pager, mobile and portable radio has preventive maintenance once a year.

Pagers and portable radios were the equipment named most often to be in need of repair or maintenance.

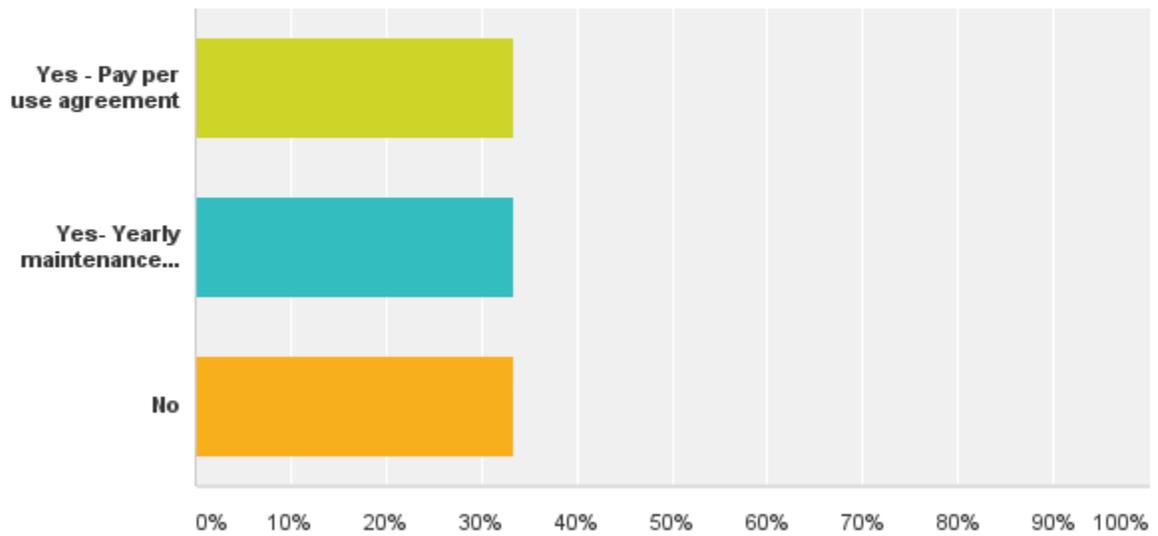
The majority of the users of the system were overall satisfied with the service they received from their two-way radio dealers.

The following charts depict some of the tabulated results obtained in this section:

Maintenance Contracts in Place:

Section 7, Question 43

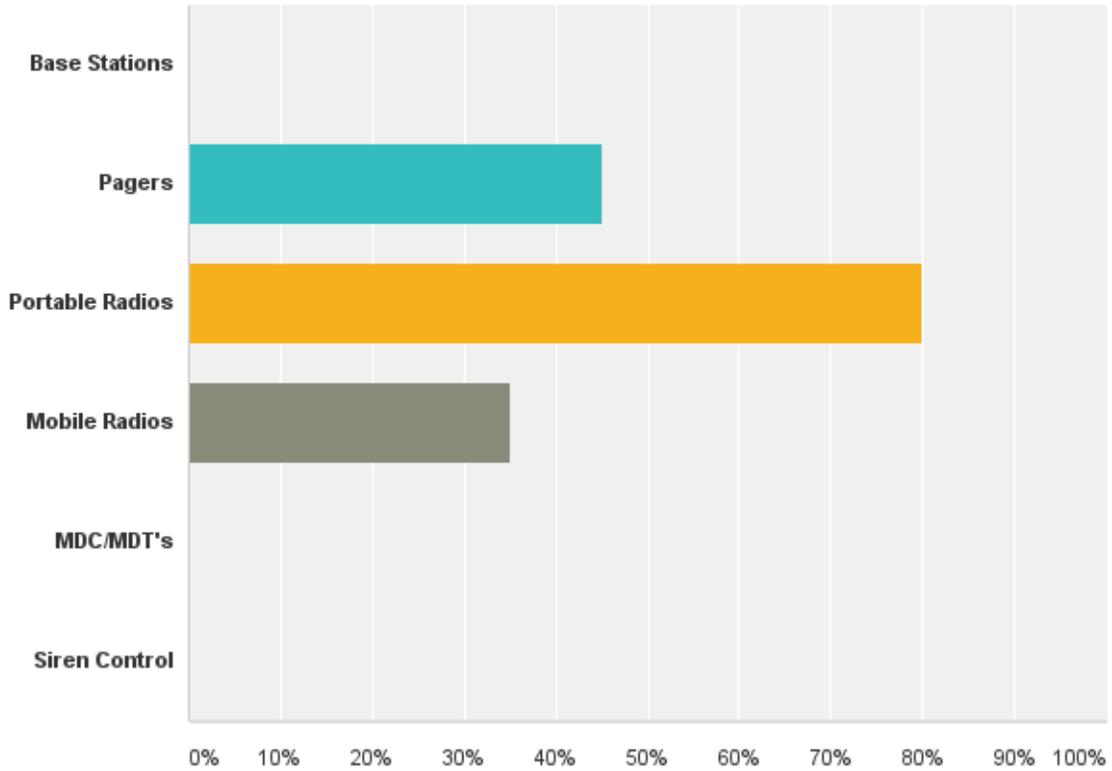
Q43 Does your agency have maintenance contracts in place for all Communications/Radio network related equipment you use?



Equipment with Most Frequent Maintenance Needs:

Section 7, Question 45

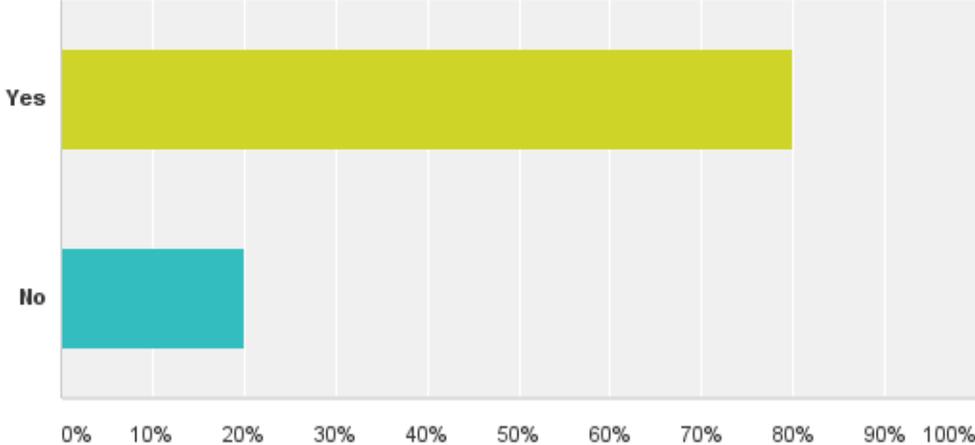
Q45 Which network equipment requires the most frequent maintenance routines?



Responsiveness of Maintenance Providers:

Section 7, Question 49

Q49 Are your maintenance service providers timely, responsive and effective?



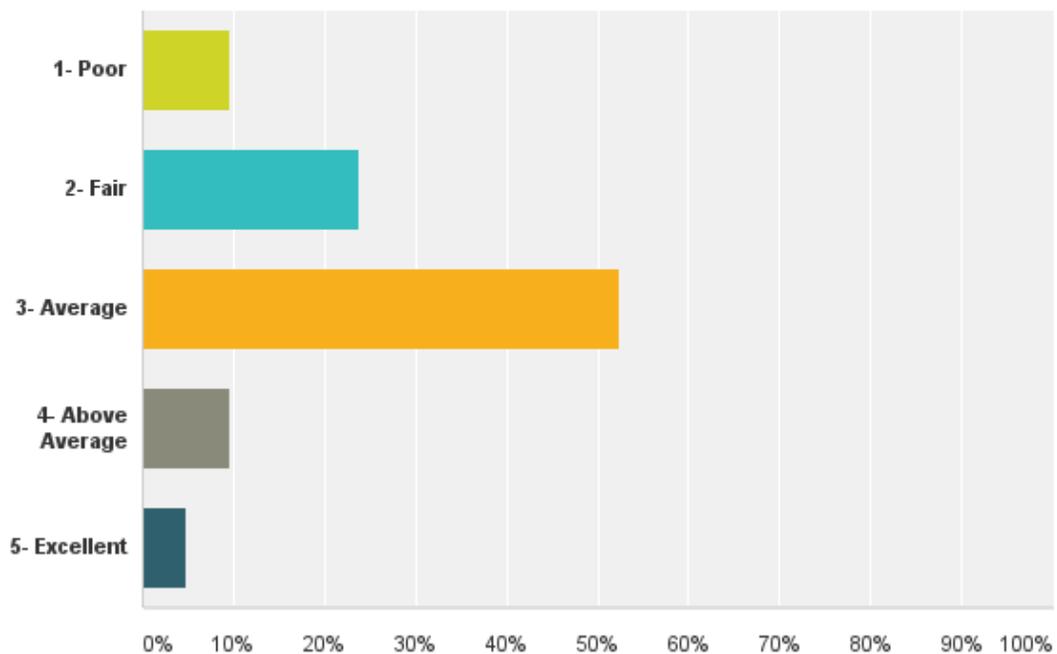
Part 8: Expansion Capability

This portion of the interview was meant to provide data regarding the expansion/upgrade capabilities of network components. Data collected here helped to develop an understanding of potential limitations that exist due to age and type of equipment in use as well as other constraints including limited available funds.

Expanded or Upgrading of Equipment:

Section 8, Question 51

Q51 How would you rate the ability of your existing Communication/Radio network components to be easily and cost effectively expanded or upgraded?



Part 9: What Works Well Today

Section 9 and Section 10 deal with the same categories used to describe key aspects of the communication system network. Section 9 is designed to collect data about what is working well in the existing network while Section 10 asks the contrary – What are the most needed improvements? Participants were asked to answer these questions in a priority order. This data summarizes many of the questions asked throughout the interview and will help prioritize which improvements and upgrades will affect the future capacity of the microwave system.

Part 10: Most Needed Improvements

As described above, this portion of the interview was meant to summarize and capture the most critical improvements network users feel are needed. For the majority of participants, this was the most important section and a great deal of information was gathered and will help prioritize which improvements and upgrades will affect the future capacity of the microwave system.

Items by Number of Responses are Listed Below:

Section 10

1. New radio system
2. New microwave system
3. New radio console system

Part 11: Comments and Suggestions

The final section of the interview was used to capture any other input from participants which either did not fit into the other sections, or for information that they wanted to highlight.

Almost all of the responses mirrored the responses throughout this report, that the current radio network needs to be replaced.

SECTION 2 - Physical Site Survey and Equipment Inventory

Introduction

Each of the transmission sites in the microwave and radio communications system network was physically surveyed to determine their operational status and to inventory equipment located at each site. The site surveys were conducted October 2013 to March of 2014. Additional information was obtained from the county and the county's two-way radio service dealer.

Contents of the site survey report includes a list of channels in use at the sites, digital photos of each site including the tower and equipment shelter, antenna at the site along with information describing site security, power, interconnect, lightning and surge suppression, etc.

Once again, several common themes emerged when looking at the results of the site surveys. This information is included in the attached site survey reports located in Appendix 7 along with recommended detailed remediation steps and improvements plans.

Below is a summary of the finding:

Summary

After completing the surveys/interviews and field surveys of thirty five (35) communications equipment sites throughout the county which included "prime" and "secondary" locations, plus the 911 center we offer the following:

For clarification, a "prime" location is one, which due to its geographical location and possible use of its sheltering facilities, could serve as a county-wide area coverage site.

Be advised that some of the sites did not contain radio equipment and do not appear as part of the site survey reports. They serve as only dispatch points such as Corry and Millcreek Hospitals having only a "desk set" wireline connection into a remote controlled MED base station. Also not surveyed, were, Erie City dispatch and backup locations which have been decommissioned.

The Erie County radio system that it is a “patch work” configuration. It is a “system of systems” that is inefficient, electronically complicated, unreliable, and costly to operate and maintain.

Additionally, a majority of the locations are poorly installed, with a lack of proper grounding techniques, cable management and security. General maintenance or lack thereof is also a concern with clutter that includes decommissioned “junk” equipment and unkempt weed infested compound areas.

These can be seen by referencing the individual site survey reports, along with exhibit “A” which is a summation of site problems and remediation needs” and a provided “flash drive” collection of photographs. This information is located in Appendix 7.

In addition there are also some questions concerning FCC licensing of equipment at the various locations.

Patch work, in that it is a system that has grown over the years without much thought to organization. When the county established its 911 center the task was to connect the many local, municipal and city communications systems that existed within the county without upsetting their normal operations. That led to a “spider web” system of telephone circuits and microwave links being installed wherever and whenever the need arose. Basically it is a Band-Aid solution that has led to the “systems of systems” configuration.

Some areas of the county did not want to participate in the idea of having a central dispatch center and still hold to that idea today. However circuits and equipment were installed, “just in case”.

You have, under the umbrella of county dispatching responsibilities, some fifty six (56) “radio active” public safety entities which would include thirty four (34) volunteer fire departments, two (2) cities (Corry & Erie) police departments, nineteen (19) municipal police departments, one (1) Sheriff’s department, EMA and EMS all operating on either Low-band VHF, high-band VHF, UHF and 800 MHz radio frequencies without any real ability to communicate with one another.

Add to the list several other agencies such as the airport, prison, college and university campus police departments along with state police and federal agencies. Although none of these are the direct responsibility of the county to dispatch, they could become part of a county-wide public safety situation.

Interoperability is difficult at best in Erie County. In fact the two major entities, the City of Erie and Millcreek Township use a combination of VHF and UHF within their boundaries for police and fire. However the two entities are not configured the same in that the fire services in Erie City operate on VHF 150 MHz frequencies and the adjacent township of Millcreek operates fire on UHF 450 MHz frequencies. The same holds true of police operations. This arrangement seems questionable when it comes to mutual aid responses.

Inefficient due to the fact that information is not passed between public safety entities as quickly as it could be if the overall system was configured differently to allow for interoperability. Consider a scenario of a real time police incident that spills beyond the borders of the city into the neighboring township and beyond, that would require coordinated radio communications between the city, township and state police.

With the present system this may require the dispatch center to electronically connect or "patch" the three systems together. This can be a time consuming effort.

A common radio operational channel to which all entities could switch would solve this problem.

Electronically complicated, refers to the many connections into local communications systems that are achieved through copper / fiber telephone circuits and the FCC licensed but not coordinated or protected Canopy microwave network that should not be used for public safety operations.

Unreliable, covers many aspects of the system. When there are so many connections as pointed out previously the chance of bad connections due to poor installations, weather and age is ever present.

The 4.9/5.8 GHz microwave system should not be used for public safety communications link due to its uncoordinated FCC licensing status that can lead to interference by various other users that can come online at any time. In addition, the existing microwave system has no backup protection such as a "hot standby" or "ring" configuration.

The use of low cost mobile radios configured as base stations is highly questioned. These units do not possess the necessary receiver selectivity to avoid adjacent

channel interferences that are evident in the existing system due to the very congested radio spectrum.

Costly to maintain, would encompass the maintenance contracts for the console and overall system. The microwave equipment has its electronics contained within the antenna assembly which is all mounted on the tower. When there is a failure, a technician must climb the tower and swap out the assembly. Tower climbing is costly and sometimes impossible in foul weather. This could be resolved with a different type of microwave system that allows the “electronics” to be located in the shelter. Other questionable costs are related to telephone circuits that parallel the microwave system in case it fails. We would also suggest a complete evaluation of phone line charges.

There is also the question of tower site rental fees that can be addressed with a re-evaluation of the tower sites. As one example the county pays a rental fee for use of the SBA Peach Street tower, a stone’s throw away from the Flower Road County tower.

Poor installations can be supported by the many photographs taken during our survey but usually center around grounding techniques that do not meet published R56 standards. We realize that many of the sites “are not” under the direct control of the county but effort should be made to force the site owners into a proper site. After all, the county is paying rent and deserves protection for their equipment. This would extend to shelter (building) maintenance, security and environmental conditions as related to HVAC.

The county has paid thousands of dollars for equipment and relies on it for public safety communications. They need to maintain and protect it at the highest level in order to support the responsibilities associated with it.

We would like to point out that in working with the county radio technicians we have found them to be very knowledgeable and capable of performing general day to day maintenance of the system. Some of the failures are beyond their control when it relates to the console but they can diagnose the problem and report intelligently to the contracted service agency.

MCM has provided Erie County with a corrective action summation for the tower sites in question. The county’s radio technicians have already begun to implement the remediation work at the sites which will take up to six months to complete.

If it is the intent of the county to continue to support an in-house technical staff, budgetary allowances should be made to support their ongoing education with product exposure and training. It would also be wise to consider the issuance of proper four-wheeled drive vehicles to the technicians. This would enhance their ability to access the off road equipment sites and not use their personal vehicles.

With these improvements, less reliance on a contracted service agency could be achieved.

There is an issue with the contracted radio service agency. There seems to be a lack of coordination between the service agency and the 911 center staff when they decide to work on the system. Without notification, outages have occurred and equipment has been modified. We would suggest that no one touches the system without first contacting management.

With all of this said, the question is, what can be done to improve the system? The first consideration is to not alienate any existing system users. Do not force change because no one likes change. Our initial user interviews indicate a high level desire for a system that will provide better coverage, interoperability and reliability

Foremost it is understood that the securing of additional channels is imperative for this project to continue forward and would be a project unto itself. The task is further complicated by licensing in the “line A” area requiring coordination with Canada. Based on a time line of at least one year or more this task should begin immediately disregarding project approval. It must be understood that no manufacture can build a system or provide a final quote without knowing the frequencies to be used. This is due to frequency spreads that impact antenna systems design. This would include transmitter combiners, receiver multi-couplers and antenna configurations.

Transmitter site locations must be pre-constructed shelters and new towers erected where necessary. There are several “prime” geographical locations currently being occupied by the county but many of facilities at those locations are of inferior construction. It may be necessary to establish a new site nearby making use of the geographic location.

At the present time only three existing locations meet standards for equipment sheltering. They are Hill Top, Flower Road and WICU, which is a rented location. There is the possibility of using several SRND tower sites.

The primary goal is to establish “rent free” sites where ever possible and to build new towers to replace existing towers the county is currently paying annual rent of \$209,000.00 per year. Rent free sites include State Radio Network Division tower sites and privately owned sites where a municipality or the county is granted tower and ground space at no cost. MCM recommends that municipalities have in their local zoning ordinance that the municipality or county Department of Public Safety be granted free tower and ground space as part of any new tower build.

The average cost to build a new 180’ self-support tower with a prefabricated shelter, uninterruptable power supply and emergency generator is \$375,000.00. MCM recommends that the County replace rental sites with county owned sites where needed. These sites should be built on county, municipal, school district and university owned property to limit public resistance to the locations and zoning issues.

SECTION 3 – Recommendations

Philosophy of the Plan

Our philosophy in any plan is to provide an evaluation of all the current and existing systems and evaluate their life cycle; we look for issues and potential problems in these systems and make recommendations for improvement. A key component of this plan is to present a wide range of potential solutions and to identify any systems that are proprietary in their equipment.

Today there are very high quality and sophisticated technologies in the marketplace that are totally proprietary in their equipment and if purchased will limit your ability to obtain competitive bids for equipment and force you into a single source situation for a supplier and therefore provide you with no ability to obtain the best competitive cost for equipment. There are some features and advantages that these systems provide that are unique and provide enhanced security and unique operational components, although many of these will not significantly enhance the fundamental operational value to the end user. These systems are generally significantly more expensive than the high quality open source equipment available. There are also high quality sophisticated open source systems available with very attractive pricing.

Purchasing systems that are proprietary is a decision that government agencies must make, taking into consideration all of the factors involved in the value of the technology versus the price and value of open source technologies. MCM Consulting Group, Inc. as a matter of course does not recommend proprietary systems. It is our philosophy that the cost/value relationship does not, in most areas, have validity. In a major metropolitan area these purchases can be necessary, but virtually unlimited financial resources must be available. We do not, however, provide information and descriptions on these systems, unless the client specifically requests their inclusion. We can provide budgetary estimates from past experience if the client requests.

The Plan

During the process of this project, we defined a number of tasks and evaluations that needed to be concluded to determine a number of facts and to measure the existing systems and the users of these systems. As a component of this, an in-depth survey of the entire systems infrastructure was undertaken. Additionally, face-to-face interviews were conducted as well as an interview form created and telephone interviews were offered to gather and quantify the issues the community recognizes in this communications system. Our goals were multifaceted; it is our belief that to develop a long-term plan for a large community (the County of Erie) we need to understand the following conditions.

- The compatibilities of the current systems.
- The locations of the current systems.
- An in depth inventory of the current systems and sites.
- Review via the interview process the needs of the users and potential users.
- Document the perceptions of the current and potential users.
- Develop a list of the needs of the first responder network and develop a series of plans to satisfy these requirements.

The results of these surveys were documented previously in this document. Here we develop the plan in phases that implements the needs identified by the public safety community and incorporates our past experience in developing and implementing these systems.

After a detailed evaluation of the existing (as built) system and an extensive interview process in addition to the extensive investigations conducted, MCM Consulting Group, Inc. has developed a plan with recommendations for Erie County.

Recommendations

It is recommended that steps be taken to replace the current radio, microwave and radio console equipment/systems/network as soon as possible since it serves as the “back bone” for communications within the county for the public safety departments within Erie County. A failure in these vital systems cannot be tolerated.

MCM Consulting Group, Inc. is recommending based on the availability of UHF frequency pairs, unify the radio communications of all “County responsible” entities onto one “platform” or radio frequency band with by suggesting a UHF, IP based, P25 phase II (for spectrum capacity) “trunked” (for spectrum efficiency) and a multi zone “simulcast” (for coverage)” configuration.

UHF can be justified as it is already in use by the City of Erie, one of the largest communicators in the county, so integration would be less upsetting for that entity. Colleges, universities and neighboring Crawford County also use UHF. Erie County is already FCC licensed for five UHF pairs and finding additional radio frequency “pairs” may be easier in the UHF band. Preliminary frequency searches indicate possible channels are available. The paired frequencies lend themselves well to repeater type systems and make transmitter combiner designs somewhat easier. The VHF frequencies are not paired.

MCM also recommends that the current Canopy microwave system be replaced with a digital Multiprotocol Label Switching (MPLS) microwave “ring” system with ring protection would be required to link the operational zones. The system must be Ethernet capable and have a minimum bandwidth of 150 mbps for the new system. The selected vendor for this project would be responsible for a complete “turnkey” job to include path surveys, equipment selections and FCC licensing.

Finally, MCM recommends that the current Catalyst radio console system be replaced with a new system that is recommended and warrantied to be compatible with the new radio system equipment.

UHF IP P25 Radio System

Our recommendation creates a common platform of operation by locating all agencies into a single band of UHF radio frequencies.

The preliminary “conceptual” plan would be an IP based, UHF P25 Phase II trunked / simulcast configuration. P25 is digital so one UHF “analog” channel will be needed for paging.

Phase II allows two conversations at the same time on one channel which increases the capacity of the system and trunking increases the efficiency of the system by making use of idle channels.

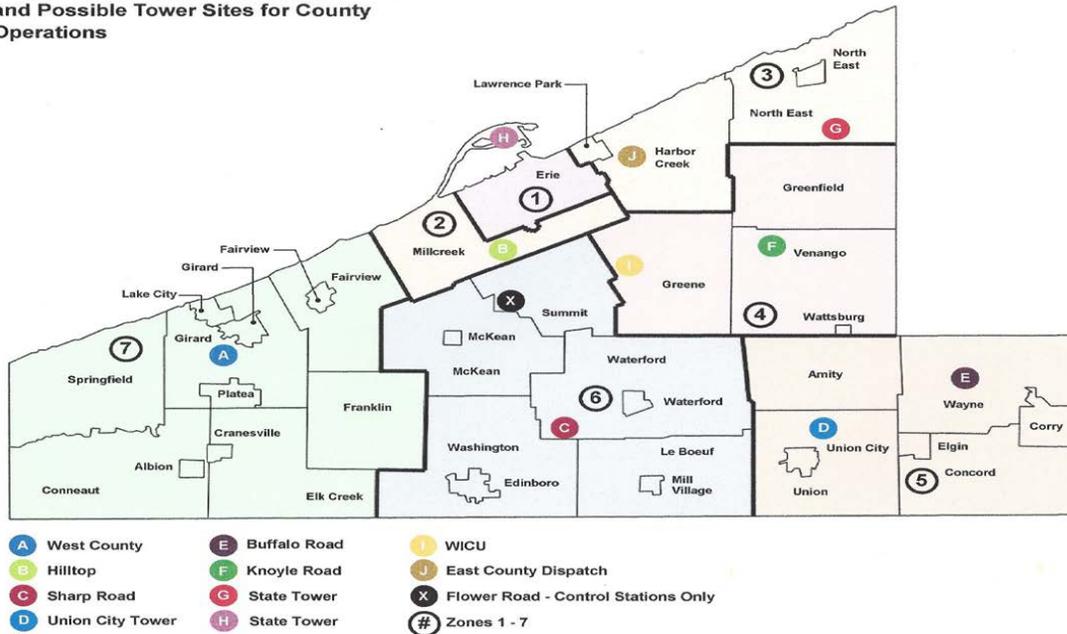
Simulcast allows the broadcasted signal to be heard over the entire County at one time or simultaneously.

The system should be designed to provide 95% “portable” coverage over the entire County and within urban and suburban structures and including certain geographical areas, providing a minimum DAQ (delivered audio quality) of 3.4. This is to be achieved without the use of in vehicle repeaters.

Referring to the attached map (below) showing the existing “primary” tower sites and the county being divided into seven (7) operational zones for fire and police with the City of Erie and Millcreek Township being zones unto themselves. Each zone would have sufficient tower sites that would allow a “transmitted” signal to cover the zone on a 95% level to mobiles and portables in buildings. Receive signal levels from the portables can be enhanced with voting receivers. Sites picked for the zones could also be the same sites used for county-wide coverage.

Erie County

Proposed Communications Zones and Possible Tower Sites for County Operations



Most likely the sites picked for the zones would also be the same sites used for county-wide coverage.

The complete County wide trunked simulcast UHF coverage would include one (1) City of Erie fire dispatch channel, one (1) City of Erie operation channel, one (1) Millcreek Township fire dispatch channel, one (1) Millcreek Township operation channel, one (1) county-wide fire dispatch channel, five (5) zoned fire operation channels, one (1) fire “analog” UHF paging channel, one (1) City of Erie police dispatch channel, one (1) City of Erie police operation channel, one (1) Millcreek Township police dispatch channel, one (1) Millcreek Township operation channel, one (1) county-wide police dispatch channel, five (5) zoned police channels, one (1) MED dispatch channel, one (1) MED operation channel, one (1) MED command channel and one EMA channel. The EMA channel could also serve as the school bus emergency channel when school buses are being used as emergency evacuation vehicles.

A summary of the system configuration is listed below:

Police

1. 1 City of Erie repeated trunked simulcast dispatch channel
2. 1 City of Erie repeated trunked simulcast operation channel
3. 1 Millcreek Township trunked repeated simulcast* dispatch channel
4. 1 Millcreek Township trunked repeated simulcast* operating channel
5. 1 County-wide trunked repeated simulcast dispatch channel
6. 5 Zoned repeated trunked simulcast* operation channels

7. Portable and mobile equipment will have at least 2 low power encrypted channels to conduct on the ground operations. There is no plan to monitor these channels at the 911 Center.

Fire

8. 1 City of Erie trunked repeated simulcast dispatch channel
9. 1 City of Erie trunked repeated simulcast operation channel
- 10.1 Millcreek Township trunked repeated simulcast* dispatch channel
- 11.1 Millcreek Township trunked repeated simulcast* operation channel
- 12.1 County-wide repeated trunked simulcast dispatch channel
- 13.1 County-wide fire “analog” simulcast UHF paging channel
- 14.5 Zoned repeated trunked simulcast* operation channels
15. Portable and mobile equipment will have at least 2 low power encrypted channels to conduct on the ground operations. There is no plan to monitor these channels at the 911 Center.

EMS

16. 1 County-wide trunked repeated simulcast dispatch channel
17. 1 MED trunked repeated simulcast operation channel
18. 1 MED trunked repeated simulcast command channel

19. Portable and mobile equipment will have at least 2 low power encrypted channels to conduct on the ground operations. There is no plan to monitor these channels at the 911 Center.

EMA

20. 1 trunked repeated simulcast EMA channel

The system should have the capacity to support thirty four (34) volunteer fire departments; two (2) cities (Corry & Erie) police departments, nineteen (19) municipal police departments, one (1) Sheriff's department, EMA and EMS. Some of the agencies will require multi-channel access.

In addition the system should be configured as to permit "direct" interfacing to other non-county entities such as local municipal public works departments, Federal and State communications systems, schools, colleges, airport facilities and neighboring County communications systems.

It is also required that the system be of a robust design that failure of single component of the system "will not" render the system inoperable and access time for a channel must be minimal. Reliability and redundancy are key aspects of the systems operation.

MCM recommends that the county purchase the initial portable and mobile radios and pagers for the public safety agencies following the formula listed below:

Law Enforcement

1 Patrol Vehicle = 1 Mobile, 2 Portables

EMS

1 Ambulance = 1 Dual-head Mobile, 2 Portables

Pagers = # of employees, per agency (i.e. ECI, MPS, WECEMA)

Fire

Fire Chief = 1 Mobile, 1 Portable

Assistant Chief = 1 Mobile, 1 Portable

Deputy Chief = 1 Mobile, 1 Portable

Engine = 1 Dual-head Mobile, 4 Portables

Aerial = 1 Dual-head Mobile, 4 Portables

Rescue = 1 Mobile, 4 Portables

Tanker = 1 Mobile, 2 Portables
Brush = 1 Mobile, 2 Portables
Pagers = 25 per department (Average)

Additional mobile and portable radios as well as pagers could be purchased by the individual departments at the discounted “bid” rate the county obtains from the winning system vendor.

Several grant opportunities exist for funding for the mobiles, portables and pagers, including the Federal Assistance to Fire Fighters Grant and the COPS More Technology Grant. MCM recommends that the fire, EMS and law enforcement agencies collectively apply for these grants. Revenue received from the grants can offset the total cost incurred by the county.

One final source of revenue could come from the Erie Gaming Revenue Authority.

Note: No fire or EMS service should receive more pagers or portable radios than they currently have members.

Microwave Network

Multiprotocol Label Switching (MPLS) is a standards-approved technology for speeding up network traffic flow and making it easier to manage. MPLS involves setting up a specific path for a given sequence of packets, identified by a label put in each packet, thus saving the time needed for a router to look up the address to the next node to forward the packet to. MPLS is called multiprotocol because it works with the Internet Protocol (IP), Asynchronous Transport Mode (ATM), and frame relay network protocols. With reference to the standard model for a network (the Open Systems Interconnection, or OSI model), MPLS allows most packets to be forwarded at the Layer 2 (switching) level rather than at the Layer 3 (routing) level. In addition to moving traffic faster overall, MPLS makes it easy to manage a network for quality of service (QoS).

We also recommend that any future expansion of the system be prepared for now to save cost and allow for faster expansion of the system if needed. The 150 mbps bandwidth will allow the county to address all current needs, with additional capacity for future needs including:

- Additional Voice Radio Channels
- Data Channels
- Video
- Next Generation 911 (NG911)
- Integrating into a State-wide Emergency Services IP network (ESInet)
- Private/Public Partnerships

Our surveys and interviews with the public safety users of the system clearly indicate a desire for additional repeated voice radio channels as well as a move towards a data centric type of communications in the future. Our recommendations have taken this into account.

Radio Console System

MCM recommends that the current Catalyst radio console system is replaced a new system that is recommended and warranted to be compatible with the new radio system equipment.

Budgetary Estimate

MCM scheduled vendor presentations during the months of April and May of 2014. Each vendor was able to present on the products and services that they provided.

Each vendor was presented with the current and future needs of Erie County's radio system and was asked to provide via a request for information (RFI) released in July of 2014 a budgetary estimate for replacing the current radio, microwave and radio console network/systems with a UHF, IP based, P25 Phase II "trunked", multi zone "simulcast", network/system and a 6 GHz, 150 mbps, MPLS, with Ethernet capabilities digital microwave system, along with a new radio console system.

MCM reviewed each response and asked questions of the vendors when necessary.

The budgetary estimate below is based on a design of 20 transmit/receive sites, including paging.

Listed below are the budgetary costs of each system, including maintenance:

Budgetary Cost Estimate

Initial Infrastructure Capital Cost: \$13,485,553.04.

Subscriber Units: \$6,318,864.00.

One Year Warranty \$ Included in above cost.

Years Two & Three System Maintenance Included in above cost.

Estimate Years Four & Five Maintenance Cost is \$441,000.00 annual cost.

Tower Sites

MCM also recommends that the county budget to build 11 tower sites to replace the current towers the county is renting for an annual sum of \$209,000.00 per year, which increases every year at the rate of 3% to 5% depending on the lease.

Initial capital cost \$4,620,000.00

Strategic placement of towers can eliminate the necessity of multiple sites saving millions of dollars in upfront capital cost and ongoing maintenance cost.

Please see the tower site cost spreadsheet in Appendix 8.

Consulting, Engineering & Project Management/Contingency

In addition to the above cost, MCM recommends the following items be budgeted for:

Consulting, Engineering & Project Management Services: \$1,324,881.22

5% Contingency of infrastructure cost: \$674,249.70

Totals:

Capital \$13,485,553.04
Subscriber Units \$6,318,864.00
Tower Sites \$4,620,000.00
Project Management \$1,324,881.22
Contingency \$674,249.70

Grand Total \$26,442,988.96

Implementation Timeline

October 2014 – September 2015 - FCC Licensing

October 2014 – September 2015 - Tower Location Scouting, Prepare for Acquisition of Land or Leases

January 2015 – December 2015 – IFB for Radio System/Award Contracts

January 2015 – December 2015 – IFB for Microwave System/Award Contracts

January 2015 – December 2015 – IFB for Towers & Shelters/Award Contracts

January 2015 – December 2015 – IFB for Tower Construction Services/Award Contracts

January 2016 – December 2017 – Project Implementation