MINUTES OF THE SECOND MEETING

REGIONAL TELECOMMUNICATIONS PLANNING ADVISORY COMMITTEE (Reconstituted)

DATE: September 30, 2004

TIME: 2:00 P.M.

PLACE: Commissioners' Conference Room
Regional Planning Commission Offices
W239 N1812 Rockwood Drive
Waukesha, Wisconsin

Members Present

Kurt W. Bauer Chairman	Executive Director Emeritus, SEWRPC
Kenneth Brown	RF Engineer, Nextel Communications, Inc.
Bob Chernow	Chairman, Regional Telecommunications Commission
Michael Falaschi	President, Wisconsin Internet
Brahim Gaddour	Director of Network Operations, Time Warner Telecom of Wisconsin
Barry Gatz	Network Supervisor, CenturyTel
Michael E. Klasen	Director, Regulatory Affairs, SBC Wisconsin
Jeff Mantes	Commissioner of Public Works, City of Milwaukee
Jody McCann	Network Domain Manager, Wisconsin Department of Administration, BadgerNet
George E. Melcher	Director, Office of Planning and Development, Kenosha County
Paul E. Mueller	Administrator, Washington County Land Use and Park Department
Steven L. Ritt	Attorney at Law, Michael Best & Friedrich
James W. Romlein	Managing Director, MVLabs, LLC
Bennett Schliesman	Director, Kenosha County Emergency Management /Homeland Security
Dale R. Shaver	Director, Waukesha County Department of Parks and Land Use
Michael Ulicki	Vice President and Chief Technology Officer, Norlight Telecommunications
Gustav W. Wirth, Jr.	SEWRPC Commissioner
Darryl Winston	Director of Data Services, City of Milwaukee Police Department

Members Absent

William R. Drew Vice Chairman	Vice-Chairman, SEWRPC; Executive Director, Milwaukee County Research Park
Roger Caron	President, Racine Area Manufacturers and Commerce
David L. DeAngelis	Village Manager, Village of Elm Grove
J. Michael Long	Attorney-at-Law, Murn and Martin, SC
Paul R. Schumacher	Program Manager, Tricounty Business Partnerships

Staff
Kenneth J. Schlager, PhD Chief Telecommunications Engineer, SEWRPC
Lynn G. Heis Staff Secretary, SEWRPC

CALL TO ORDER AND ROLL CALL

Chairman Bauer called the meeting to order at 2:05P.M. Roll call was taken by circulating an attendance signature sheet, and a quorum was declared present.

CONSIDERATION OF THE MINUTES OF THE MEETING OF AUGUST 24, 2004

Chairman Bauer noted that copies of the minutes of the first meeting of the Reconstituted Regional Telecommunications Planning Advisory Committee held on August 24, 2004, had been distributed to all members of the Committee for review prior to the meeting, and asked that the Committee consider approval of those minutes.

There being no questions comments, or corrections, on a motion by Mr. Chernow, seconded by Mr. Romlein and carried unanimously, the minutes of the meeting of August 24, 2004, were approved as published.

Chairman Bauer noted that the action just taken gives final Committee approval to the first two Technical Study Design Memoranda and, in effect, authorized the staff to proceed with the work as outlined in those two memoranda.

CONSIDERATON OF TECHNICAL STUDY DESIGN MEMORANDUM NO. 3:

Chairman Bauer then asked the Committee to consider the preliminary draft of Technical Study Design Memorandum No. 3: Wireless Antenna Site and Related Infrastructure Design. He noted that all Committee members had received a copy of the draft memorandum dated May 10, 2004, for review prior to the meeting.

Chairman Bauer then asked Dr. Schlager to undertake a page by page review of the memorandum. The following questions, comments, and proposals for change were raised during the Committee consideration of the memorandum.

In answer to a question by Mr. Ulicki, Chairman Bauer indicated that the purpose of the Technical Study Design Memoranda was to provide specific guidance to the Commission staff with respect to the conduct of the telecommunications planning effort. Review of these memoranda he said, provided the Committee with the opportunity to, in effect, guide the staff's work. In answer to a further question by Mr. Ulicki, Chairman Bauer indicated that the ultimate product of the proposed wireless antenna site and related infrastructure design element of the overall regional telecommunications planning program was to prepare a proposed antenna site location plan for the seven county planning area. He noted that this was in accordance with the approved Prospectus for the program.

In answer to a question by Mr. Romlein, Mr. Schlager indicated that it was not intended to include a demand requirement analysis in the proposed work, although the model proposed to be used could be adopted for such an analyses based upon existing and planned land use development patterns within the Region. Mr. Schlager noted further that in such an application, instead of using minimization of the number of antenna sites necessary to provide the desired coverage as the objective function, would use maximization of the revenue generated by the system.

In answer to a question by Mr. Brown, Mr. Schlager indicated that the intent was to identify, map, and characterize those antennas within the Region that are Federal Communications Commission registered (FCC). He noted that experience in the study to date had already indicated that the FCC data contained errors, such as incorrect address locations, which will have to be found and corrected; and noted that co-location data were not provided by either the FCC or the Federal Aviation Administration (FAA) data bases. Data on co-location would be collected by contacting municipalities concerned which posess such information. The intent, Mr. Schlager said, was to produce an accurate inventory of the existing antenna sites which are used by the existing providers to serve the planning area.

Mr. Ritt expressed concern about the Commission staff's capability to conduct the necessary field studies relating to wireless service coverage, and indicated that, in his opinion, the amount allocated in the budget, as set forth on page 9 of the memorandum, was inadequate for this purpose. Mr. Schlager indicated that any necessary field testing would be done by consultants under a contract to the Commission. He noted that the purpose of the proposed field measurements was to verify the validity of the model to be used in the work. Such model validation, he said, could be accomplished through a statistically sound sample measurement effort involving relatively small subset of the U.S. Public Land Service System sections within the Region. Mr. Ritt expressed concern about the accuracy of the data to be collected in this way on service coverage and therefore, about the validity of the plan to be produced, given that the individual service providers conducted extensive field testing and accurately knew the characteristics of their systems. He indicated that a conflict between the Commission data and the data held by the individual service providers would create problems in the development of a wireless telecommunications service within the Region.

A lengthy discussion then ensued concerning the proposed service coverage analyses and related plan recommendations, during which the following salient comments were made.

Chairman Bauer indicated that the Committee existed to provide a collegial approach to the work; and under long standing Commission practices, the substantive findings of inventories, analyses, and forecasts, as well as recommended plans and alternatives thereto, are presented to the Advisory Committee for review and approval. He said that, if discrepancies were found between the Commission's findings with respect to wireless service coverage within the Region based upon radio propagation modeling and information on such service coverage held by the individual providers, it would be hoped that those discrepancies would be reconciled through the Committee review process.

Mr. Shaver indicated that as a governmental official involved in the review and approval of antenna sites, he believed that the reduction of the number of required sites to the minimum required to provide the desired levels of service, and the encouragement of co-location to the maximum extent practicable, were valid public objectives. He indicated that a technically sound areawide antenna plan would, in these respects, greatly assist in the performance of his responsibilities. He expressed concern however, that any plan based upon radio propagation modeling be valid and not in conflict with service analyses performed by providers. Mr. Ritt indicated that Mr. Shaver had identified the essence of his own concerns with respect to the proposed work. Discrepancies between a plan based on modeling and "real world" data, would at that stage in the development process, be destructive to both the planning effort and to the development of needed facilities.

Mr. Mueller indicated that he did not see a problem in this respect. He observed that when a zoning administrator receives an application for a development that suggests that the technical information in support of the application is different from the existing data record, the later can be adjusted in a sound and orderly manner. For example he said, flood hazard area data within the Region are an important constraint on land use development. An application for a development permit may indeed challenge the

validity of the delineated flood hazard areas based upon changes that may have occurred since the original delineation; the flood hazard area delineations are then adjusted based on additional engineering study.

Chairman Bauer agreed with Mr. Mueller, indicating that the Commission plans were meant to be "points of departure," in the public decision making process. The intent of the work under consideration is to produce an end plan that identifies the a minimum number of antenna sites required to adequately serve the Region, and that is as technically sound a plan as can be achieved at the areawide system planning stage. He noted that Mr. Ritt had focused on potential discrepancies between such a plan and data held by providers and used in support of specific permit applications and the problems that that might create; but, as Mr. Mueller indicated, in those situations, additional study would resolve the discrepancy. Chairman Bauer indicated further that if the plan is sound, such situations should occur infrequently, and in the majority of situations, the Commission plan and the development proposals of the private providers should be compatible; and this, he said, should be of major benefit to all concerned, the private providers, the public regulatory agencies, and the general public.

Mr. Chernow also agreed with Mr. Mueller indicating that in his experience as both an elected public official and as an appointed member of the Regional Telecommunications Commission, disputes concerning specific antenna site locations involving local legal restrictions and provider proposals could be resolved through a cooperative effort; and that an agreed upon areawide plan would be of significant assistance to the county and local units of government in conducting the necessary reviews, and in reasonably reconciling any differences between the plan and the provider proposals. Mr. Brown also agreed indicating however, that an effort must be made in the public planning process to reconcile preliminary analytical findings and recommendations with respect to antenna site location with the engineering departments of the providers; and that on any site location decisions, a balance must often be struck between what sites would be most cost effective for the provider and what sites may be available given legal and other constraints. He indicated further that the concerns under discussion could be allayed if the descriptive material accompanying the public plan adequately qualified the findings and recommendations presented, and clearly stated that site locations shown on the plan may be subject to change if a carrier provides data supporting change.

Mr. Melcher also supported the need for a public antenna site plan indicating that as a public planner and regulator, he needed to understand what constituted a viable, minimal antenna site configuration which would adequately serve the Region, and not necessarily a configuration that would maximize the financial rate of return to individual providers. He said that such a plan would be helpful to him in achieving not only adequate telecommunication service, but also land and city scapes that are not needlessly cluttered with an excessive number of unsightly antenna. Mr. Ritt responded that he did not believe that the Commission will be able to produce a plan that will eliminate the need for regulators to require third party engineering verification when considering an antenna site location. The proposed plan, he said, would be adding a third layer of data that could only complicate the process. In response, Mr. Melcher indicated that while what Mr. Ritt said may be true, he believed that such a third set of data would be helpful. He indicated that he had relied on Commission information in dealing with many issues over approximately 30 years, and that the Commission's information had never failed him. He, therefore, believed that the planning effort in this new area could be made to work.

Chairman Bauer reiterated that Mr. Ritt was assuming that there would always be a conflict between provider development proposals and Commission plan recommendations. He indicated again that if the planning effort is technically sound, there should be agreement between the recommendations contained in the plan and provider development proposals in the vast majority of the cases. Disputes and differences that remain should be minimal and resolvable through further cooperative study.

Mr. Ritt responded that he was aware of the Commission's record in land use and public infrastructure development, but that he remained skeptical with respect to the Commission's role in this new and complex area of public planning. He indicated that for the plan to be technically sound, input to its preparation would have to be provided by the engineering staffs of the service providers. He indicated further, that the planning process was moving far too rapidly to achieve such participation in a meaningful way.

Mr. Romlein indicated that the analyses were to be based upon radio wave propagation modeling, with resulting delineated coverage areas and identification of potential sites for additional antenna locations. The final determination of the utilization of any particular site identified in the plan would be determined on the basis of further engineering study relative to a particular site identified on the plan or alternative thereto. The point he said, was that it does not really matter whether the plan is 50 percent or 100 percent accurate as long as it properly identifies a requirement in a geographic area that can be met by a site, the practicality of the specific site being determined by further engineering study.

Chairman Bauer agreed with Mr. Romlein, and indicated that the process implied in his observation, mirrored the well established public work facility development process, a process that proceeds from areawide system planning, to facility planning, to preliminary engineering, to final engineering, and then to construction, operation and maintenance. At each stage in that process opportunity is provided through feedback to amend the system plan. In this way the system plan becomes a "living documents"; and as development of the Region and of the Telecommunications System of the Region proceeds, the antenna system plan can be amended if good reasons are presented for amendment. The proposed plan, he said, will provide new information to the constituent counties and municipalities within the Region, information that has been lacking to date, namely: what is the minimum number and configuration of antenna sites that can adequately serve this Region? The needed, number and configuration, he said, may be expected, for various reasons, to vary to a greater or lesser extent over time from the plan.

Chairman Bauer indicated that the active participation of the engineering staffs of the major wireless service providers within the Region could be provided through a Subcommittee comprised of the representatives of such staff created to review the preliminary findings and recommendation of the antenna site planning effort. Such a Subcommittee, he said, would report to this Committee.

Mr. Brown indicated that such more detailed participation in the planning work would be highly desirable; not only to achieve technically sound recommendations, but to provide adequate levels of comfort to both the public regulators and the private providers in the development of the telecommunication facilities of the Region. He indicated that he served on the Committee as an engineering representative of his company to assure that the planning work being done was indeed, technically sound.

Mr. Chernow indicated that many county and municipal officials are highly suspicious of presentations made by service providers in support of development proposals. He indicated that the only company that he had dealt with over many years that has been entirely open and straightforward with the local regulatory agencies, was SBC; his experience indicating that their word could always be relied upon. The distrust that does exist – justifiably on the part of both the providers and the regulators, -- he said, is one reason why the regulators insist on employing third party engineering consultants to assist in the permit approval process. He indicated that the proposed plan should be helpful to both the providers and regulators in this respect. The plan, he said, should help save time and money in achieving needed wireless service improvements. Mr. Falaschi cautioned that the plan should not be used to turn potential antenna sites into a scarce resource, and that the plan may have to recommend alternative sites for alternative applications.

Chairman Bauer then tried to summarize the results of the lengthy discussion to this point in the meeting indicating that a strong consensus apparently continued to exist within the Committee on the need for a public antenna site plan for the Region; and to assure that such a plan is as technically sound as possible, a Subcommittee of provider engineering staff representatives be created to review preliminary inventory findings, analyses, coverage maps, proposed modifications to existing antenna sites and proposed new antenna sites.

He then asked Mr. Schlager to proceed with the page by page review of the memorandum.

Mr. Ritt expressed concern with the text beginning on the bottom of page 4 and extending to the middle of page 5 describing the end outputs of the coverage analyses phase of the work and the coverage analysis of new candidate sites. He indicated that as presently drafted, the text may be expected to raise concern in the wireless industry as an attempt by the Commission to design the systems of the various providers.

A further lengthy discussion ensued. Upon conclusion of that discussion, it was the consensus of the Committee that the staff should prepare a revised draft of the text beginning with the list of end outputs on the bottom of page 4 and extending through the coverage analysis of new candidate sites on page 5. The new text was to clarify the differences between existing sites as inventoried, and potential new sites based upon coverage analyses; potential modifications to existing antenna sites; relationship of the site plans to the four separate technical service categories set forth on page 4 and the relationship of the coverage analyses and site recommendations to not only the existing land use pattern in the Region, but to the planned land use pattern. The text should also clarify the proposed plan as a point of departure for the making of development decisions in the public sector, and should briefly describe the means for resolution of any discrepancies between the recommended plan and any specific provider location proposals.

Mr. Chernow indicated that the coverage analyses should consider not only the existing land use pattern within the Region, but proposed land use development. Chairman Bauer suggested, and the Committee concurred, that a paragraph be added to page 5 indicating that the adopted regional land use plan will be used in the coverage analysis to identify areas of proposed development within the seven county planning area. The plan, he said, could identify priority areas for the extension of coverage based upon major development proposals contained in the adopted land use plan.

Mr. Ulicki observed that a key variable which did not appear to be accounted for in the proposed coverage analyses was that of subscriber density. In response, Mr. Schlager indicated that consideration of such density could be incorporated in the model analysis; such incorporation, however, would change the basic objective of minimizing the number of antenna sites. Chairman Bauer observed, in this respect, that the regional land use plan classifies areas of existing and proposed development as, -- in effect, -- urban, suburban and rural based upon specified densities of development expressed in terms of housing units per square mile. He indicated that there may indeed be areas of the Region which the plan proposes to maintain in essentially rural -- primarily agricultural -- uses; yet telecommunications service objectives may call for the provision of broadband service to such areas in order to support agriculture as an important economic activity within the Region. If this should become the case, then the plan would not only have to identify how these low density areas might be most cost effectively served, but whether or not the desired level of service would require a public subsidy.

Mr. Romlein observed that in order to ensure practicality in the model application, a consistent constraint with respect to the quality of service expressed in terms of the maximum traffic density to be handled would have to be utilized. He cautioned further that the approach used should be kept as simple as possible.

Mr. Melcher observed that in addition to the issue of development densities, requirements for service within major travel corridors of the Region would have to be addressed in the coverage analysis.

In answer to a question by Mr. Brown, Mr. Schlager indicated that conceptually the model could be represented by a matrix with a set of columns representing antenna sites and a set of rows representing service areas, namely U. S. Public Land Survey sections; together with an optimization function. The optimization function envisioned would minimize the number of antenna sites; but the function could also be used to achieve other objectives.

Mr. Ritt suggested, and the Committee agreed, that the word "may" in the penultimate sentence of the third paragraph ending the text on page 10 be changed to "will".

In answer to a question by Mr. Brown, Mr. Schlager indicated that the model applications could incorporate correction factors based upon information provided by the engineering staffs of the service providers through the medium of the proposed technical Subcommittee.

Mr. Brown noted that the text as written seemed to imply that in the coverage analysis the configuration of existing antenna sites would be held constant; he indicated that the analyses may reveal potential improvements that could be made in that configuration, and such improvements should not be excluded from the recommended plan.

Mr. Romlein indicated that the text proposed to be added on page 6 include an "intended use statement" which would provide comfort to the existing service providers.

There being no further questions or comments, on a motion by Mr. Melcher seconded by, Mr. Chernow, and carried with Mr. Ritt voting no, Technical Study Design Memorandum No. 3: Wireless Antenna Site and Related Infrastructure Design, dated May 10, 2004, was approved as amended. Mr. Ritt indicated that he felt compelled to withhold approval of the memorandum until he is able to review the amendments requested by the Committee. (Copy of revised memorandum attached as Appendix 1.)

CONSIDERATON OF TECHNICAL STUDY DESIGN MEMORANDUM NO. 4:

Chairman Bauer noted that all members of the Committee had received a copy of the preliminary draft of Technical Study Design Memorandum No. 4: Public Networks, dated June 21, 2004, for review prior to the meeting.

Chairman Bauer then asked Mr. Schlager to undertake a page by page review of the memorandum. The following questions, comments, and proposals for change were raised during the Committee consideration of the memorandum.

Messrs. Chernow, Wirth, Klasen, and Ulicki questioned the terminology utilized in the third full paragraph on page 2 of the memorandum indicated that the term "public telecommunications initiatives" was lacking in clarity since the public networks really were defined in terms of uses rather than facilities. After some discussion, it was agreed that the phrase "network service" be inserted in the first line of the third full paragraph between the words "telecommunications" and "initiatives".

Messrs. Chernow and Ulicki suggested, and the Committee agreed, that public access monitoring -- that is public observance of governmental meetings -- be added to the list of functions set forth in the first sentence of the second full paragraph on page 2.

Mr. Romelin observed that it was not clear how the needs analysis described on page 3 was to be conducted. Chairman Bauer agreed, noting that the text as currently drafted implied that the needs analysis would be conducted by this Committee with the assistance of the Commission staff. He indicated that this had been of some concern in the preparation of the memorandum. Alternative approaches considered included a broadly based public opinion survey, more narrowly based surveys of business and industries; and a survey of county and elected officials, such surveys being conducted on a sample basis. He suggested that the staff revisit this issue and report back to the Committee through the addition of an appropriate paragraph on page 3.

Mr. Schliesman noted that the Federal government required all of the states to conduct a needs assessment or analysis relating to emergency service including police, fire, public health, public works, emergency medical services and emergency management, all areas of activity related to Homeland Security. The assessment for the State of Wisconsin has been completed through a consulting service and the findings and recommendations were documented in an approximately 350 page report. He noted further that Federal grant monies were becoming available for use in implementing recommendations contained in the report and that the government had appointed a committee to oversee the use of the Federal grants and to determine how such grant monies might flow to the counties and municipalities. In answer to a question by Mr. Wirth, Mr. Schlager indicated that interoperability of communications systems would clearly be one of the areas emphasized in the implementation measures.

Mr. Klasen indicated that he believed the Committee would require input from others concerned – in the conduct of the proposed needs analysis.

Mr. Chernow indicated that a Foundation for which he was an executive officer, --The Tellier Foundation -- would be willing to consider a grant application from the Commission to fund a survey that could be used to assist in the conduct of the needs analysis.

Mr. Ulicki suggested, and the Committee concurred, changing the phrase “public telecommunications networks” in the first line of the second full paragraph on page 7 to “public telecommunications network service initiative”; noting that the section dealt with services – or uses – rather than facilities. Mr. Ulicki also called attention to the second sentence of the second full paragraph on page 7, and suggested that the use of such phrases as “current popular perceptions” and “may well equal or surpass” be eliminated and the sentence is revised to read: “Public sector applications of broadband telecommunications are as important as private sector applications”. The Committee concurred. Mr. Ulicki further suggested, and the Committee concurred, that the last sentence of the second full paragraph on page 7 be revised as follows: “Although the popular and trade press emphasize the search for highly profitable broadband applications in such areas as video-on-demand, the urgency of needs in public safety, public health, and education are more pressing in today’s environment”. Mr. Chernow suggested, and the Committee concurred, that community access be added to the list of needs in the sentence concerned.

Mr. Ulicki suggested, and the Committee concurred, that the phrase “based on recent experience in Northern Wisconsin and Virginia” be eliminated from the first sentence of the last paragraph on page 11. Mr. Chernow suggested, and the Committee concurred, that the second sentence of the first full paragraph on page 13 be revised to read as follows: “The initiative, however, must come from the school districts and from such public agencies as fire departments that must engage in training programs.”

In answer to a question by Mr. Falaschi, Mr. Schlager indicated that the implementation of a public network did not necessarily involve the creation of any public telecommunication facilities; the network could use existing private facilities.

There being no further questions or comments, on a motion by Mr. Chernow seconded by, Mr. Winston and carried unanimously, Technical Study Design Memorandum No. 4: Public Networks, dated June 21, 2004, was approved as amended. (Copy of revised memorandum attached as Appendix 2.)

DATE AND TIME OF NEXT MEETING

Chairman Bauer then asked the Committee to consider the date and time for the next Committee meeting. After some brief discussion it was determined that the next meeting of the Committee should be scheduled to be held on Tuesday, October 26, 2004, at 2:00P.M. in the Commission offices.

ADJOURNMENT

There being no further business to come before the Committee, on a motion by Mr. Chernow seconded by, Mr. McCann and carried unanimously, the meeting was adjourned at 4:45 P.M.

Respectfully Submitted,

Lynn G. Heis
Staff Secretary

KWB/lgh
10/06/04
#99538 V1 - T/C Adv. Comm. Minutes - Second Mtg.

APPENDIX 1

REVISED TECHNICAL STUDY DESIGN MEMORANDUM NO. 3: WIRELESS ANTENNA SITE AND RELATED INFRASTRUCTURE DESIGN

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

REGIONAL TELECOMMUNICATIONS PLANNING PROGRAM

TECHNICAL STUDY DESIGN MEMORANDUM No. 3: WIRELESS ANTENNA SITE AND RELATED INFRASTRUCTURE DESIGN

May 10, 2004

INTRODUCTION

The Southeastern Wisconsin Regional Planning Commission is the official areawide planning agency for the seven-county Southeastern Wisconsin region comprised of Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha. The Commission is charged with the responsibility for the collection, analysis, and dissemination of basic planning and engineering data on a uniform, areawide basis, for the preparation of a framework of long range plans for the physical development of the Region, and for the promotion of intergovernmental cooperation and coordination in the adoption and implementation of such long range plans.

The Commission recognized that following the breakup of the Bell System and the American Telephone and Telegraph Company, and with the subsequent rapid advances in communications technology, telecommunications, while becoming increasingly important in the local, national, and global economy, also was becoming increasingly chaotic. The Federal Telecommunications Act of 1996, intended to further encourage local competition, has led to the development of a "network of networks" largely beyond the regulatory purview of any level of government.

Recognizing that telecommunications networks form a critical part of the regional infrastructure, the Commission, in December 2002, created an Advisory Committee to assist the Commission in addressing telecommunication issues within the Region. The Committee recommended that the Commission undertake a regional telecommunications planning program, and set forth the need for, and the scope and content of, such a planning program in a Prospectus published in December 2003.

The Prospectus recognized that the conduct of the recommended planning program must be preceded by the preparation of a study design. That study design was to include the preparation of a series of detailed staff memoranda setting forth the methods and procedures to be followed in accomplishing certain critical elements of the planning program. One of these technical study design memoranda was to address a regional wireless antenna site and related infrastructure plan.

SYSTEM DESIGN SEQUENCE

The antenna site and related infrastructure plan will be developed in a nine-stage sequence:

1. Coverage analysis of existing antenna sites
2. New antenna site search
3. Coverage analysis of new candidate sites
4. Field study measurement verification
5. Mathematical programming model development
6. Antenna site location optimization
7. Development of preliminary antenna site location plan
8. Advisory committee review process
9. Antenna site location plan

Coverage analysis of existing antenna sites, begun in the wireless infrastructure inventory, will be extended with the employment of a canopy data base that provides for the incorporation of the effects of building structures as well as terrain topography in radio propagation modeling. This expanded coverage analysis will be followed by a systematic search for new antenna sites in order to provide full regional wireless coverage at higher as well as existing frequency bands. These new candidate sites will be screened for inclusion in the antenna site database based on coverage needs.

Radio propagation model-based site selection must be verified by field measurements. Following such verification, all existing and newly-selected antenna sites will be evaluated in a mathematical programming model that will minimize the number of antenna sites required to provide coverage in the designated frequency bands subject to various technical and other constraints, resulting in a preliminary antenna site location plan. The preliminary plan will be reviewed by the advisory committee for reasonability, practicality and other considerations.

Advisory committee recommendation will then be incorporated in a revised antenna site set in an iterative repetition of the earlier design steps until an acceptable final antenna site plan results.

SYSTEM DESIGN PROCEDURE

Coverage Analysis of Existing Antenna Sites

Employing a canopy as opposed to a terrestrial topographic data base provides two major advantages in radio propagation modeling for antenna site location:

1. More accurate coverage analysis

   -Canopy recognition of buildings and other structures, as well as topographic features particularly in urban and suburban areas, greatly improves modeling accuracy.

2. Structural antenna sites

   -Canopy data allows for identification of new structural antenna site candidates. Many promising sites are located on tall buildings or other structures not included in terrestrial topographic data bases.

Canopy GIS data bases, as the name implies, represent virtual surface levels formed as a net or canopy cast over both structures and natural terrain. These data are captured from either satellite or aerial photography and processed into a new combined building/terrain surface. Such a canopy data base for the seven county region will be obtained from I-Cubed, Inc., of Colorado Springs, Colorado. This data base has a specified accuracy of ±10 meters vertically and ±30 meters horizontally. This data base is also compatible with the EDX Signal Pro radio propagation modeling software scheduled for application in the required coverage analyses.

A range of propagation models will be employed for coverage analysis. Empirical as well as physical modeling will be required to achieve the desired accuracy for the various service and technology categories. Empirical models are based on field measurements for a particular technology in a designated class of terrain. Physical models are based on explicit consideration of physical radiation phenomena such as free space propagation, diffraction and reflection.

Model selection will also vary with the technology-service category. Four separate technology service categories will be analyzed:

1. 1G/2G/2.5G Cellular/Personal Communication Systems (PCS);
2. 3G Cellular;
3. Fixed Broadband; and
4. Advanced 4G

The 1G/2G/2.5G digital technology for mobile cellular is currently the dominant technology in the Region. 3G Cellular is yet to make its appearance although Verizon Wireless is deploying this service elsewhere in the United States. Analog 1G technology is fast disappearing except in some rural areas. Advanced 4G wireless technology is still in the standardization stage, but it will become an important future alternative.

Technology-service categories also imply frequency band selection. For 2G/2.5G service, the predominant bands are: 800-900 MHz and 1900 MHz. Higher frequencies may be employed in emergency technologies. Public wireless networks such as the 800 Trunk System used by some counties in the Region will be evaluated with the 2G/2.5G category since this category operates in the 800 MHz frequency band.

The antenna site plan will clearly deal with antenna locations for mobile cellular telecommunications services. The plan will also deal with the few established fixed wireless networks within the Region. Potential future fixed wireless networks, however, will be evaluated as part of the Regional Network Design work element. Radio propagation modeling will require the input of a set of transmitter-receiver parameters for each technology-service. Some of these parameters such as transmitter power are set by FCC regulation. Other parameters such as antenna height will be available from the program infrastructure inventory. Still others, however, such as receiver sensitivity, must be obtained from individual wireless carriers.

~~The end outputs of this coverage analysis phase will be:~~

~~1. A set of antenna sites~~
   ~~- by geographic coordinates~~
   ~~- by technology-service category~~

~~2. Antenna site coverage map~~

~~- by antenna site~~

~~- by technology-service category~~

~~- by Region~~

Measurement Verification:

- *The end outputs of this coverage analysis phase will be:*

1. *A set of antenna sites*
   - *by geographic coordinates*
   - *by technology service category*
   - *with technical specifications for antenna and support transceiver equipment*
   - *with a listing of the U.S. Public Land Survey sections covered by each antenna site*

2. *Antenna Site Coverage Map*

   Map
   - *by antenna site*
   - *by technology service category*
   - *by service provider*
   - *by areal unit -- county and Region*

In recognition of the fact that this initial coverage analysis of existing antenna sites provides the foundation for all future Regional wireless antenna site planning, it is important that the coverage information be accurate to the extent practicable and consistent with the coverage information of all wireless service providers in the Region. To realize this coverage consensus, the Advisory Committee has recommended the formation of a Technical Subcommittee comprised of representatives of the engineering staffs of all of the wireless service providers operating in the Region. This Subcommittee would review coverage data developed by SEWRPC staff in order to identify areas of disagreement, with the objective of producing a consensus set of coverage areas for all of the existing antenna sites in the Region. Details relating to the formation and mode of operation of this Subcommittee will be decided by the full Advisory Committee at a meeting at which this issue will be an agenda item.

New Antenna Site Search

The Regional canopy data base and the Federal Aviation Administration (FAA) database will be used to search for new antenna site candidates for each technology service category. A computer band search will be used to uncover candidates that will be subsequently screened for availability and practicability. Initial site candidates will also be screened for coverage area requirements. New sites will be considered only in areas where existing sites do not provide adequate coverage. In the search for new antenna sites consideration will be given to the potential relocation of existing sites. The end output of this phase will be a set of new antenna site location candidates expressed in geographic coordinates for coverage analysis.

It is recognized that service providers may select antenna site locations other than those identified in the antenna site plan. Service provider participation in the regional antenna site location planning process should minimize the number of such conflicts through the afore referenced Technical Subcommittee . A procedure will be established as a part of plan implementation, however, for antenna site location conflict resolution. Under this procedure a proposed new antenna site not in the current plan would be analyzed in conjunction with its consensus coverage area using the mathematical programming site set optimization model. If the proposed site is consistent as a substitution for a site previously identified in the plan, while satisfying the model objective of site set minimization, the proposed site would be accepted and the regional antenna site plan amended accordingly.

~~New Antenna Site Search~~

~~The canopy database will be used to search for new antenna site candidates for each technology service category. A computer search will be used initially to uncover candidates that will be subsequently screened for availability and practicality. The end output of this phase will be a set of new antenna site location candidates expressed in geographic coordinates for coverage analysis.~~

Coverage Analysis of New Candidate Sites

The same procedure followed in the coverage analysis of existing antenna sites will be applied to the new antenna site candidates. The output of this phase will be an expanded set of sites

specified by technology-service category and geographic coordinates. An expanded and modified antenna site coverage map will also be prepared. *Special emphasis will be placed on the service needs of areas proposed for development in the adopted regional land use; and on needed service along major travel corridors within the Region.*

Field Study Measurement Verification

The radio propagation coverage modeling analysis will have essentially estimated the average received power level and signal-noise ratio for each frequency band and service-technology by geographic quarter section. Since any mathematical modeling technique is limited in its estimation accuracy, it is necessary to verify modeling estimates with randomized field measurements. Since it is not physically or financially feasible to verify each geographic quarter section for each service-technology category, some form of statistically randomized experimental design is required.

It is necessary, however, to first recognize that field measurements will result in at least two classes of signal level indications:

1. Measurements that are members of a statistical population used to estimate mean values and associated variances of parameters such as received power level or signal-noise ratio

2. Measurements that represent parameter values clearly outside statistical distributions and that indicate a modeling failure due to miscalculations or erroneous information

For the first class of measurement, experimental design requires the determination of the sample size necessary to achieve a confidence interval of specified extent. This sample size will then determine the number of field measurements necessary to verify the radio propagation modeling coverage analysis. Standard statistical methods exist for such sample size estimates that involve the use of normal or other distribution tables or their computational equivalent.

The second class of outlier measurements call for a different type of response, i.e. an investigation into the cause of the outlier measurements. The most common cause for such outlier measurements may be expected to relate to the existence of topographic or structural

features not included in the canopy data base. While such data bases are periodically updated, there is no way to assure adequate modeling accuracy except through field measurements and subsequent corrections and revisions. Since a primary goal of the antenna site plan is complete areal coverage, it is particularly important to identify and correct quarter-sectional areas of low signal levels which will result in either low quality communications or actual "dead zones".

Statistical verification of radio propagation modeling coverage must be based on a geographic stratification of the planning Region into three areal classes: urban; suburban; and rural. Such stratification is necessary because radio propagation modeling experience shows that modeling accuracy varies significantly within the three types of areas. Such a stratification for field measurement verification will be employed in this work element.

Radio frequency field measurements require the use of sensitive broadband, multiple frequency radio receivers with multiple band channels together with spectrum analyzers which classify and record frequency spectra. Such spectral measurements are necessary to determine signal-noise ratio and radio frequency interference. Instrumentation of this type will be employed for use in the radio frequency measurements.

The end outputs of the field measurements work phase will be:

1. Estimates of radio propagation modeling accuracy by areal category - urban, suburban; and rural; and

2. A narrative description of the experience with the identification and correction of outlier measurements.

Mathematical Programming Model Development

The final phase of antenna site location planning involves evaluating of all of the existing and new candidate sites and determining the optimal combination for regional coverage at least cost to the Region. The term cost here is used in a generic, not financial, sense and should be interpreted to include environmental, social and political as well as direct financial costs.

The modeling tool to be employed in this optimization process is a form of mathematical programming known as integer programming. All mathematical programming models maximize,

or minimize, some objective function. The most popular form of mathematical programming is linear programming in which the model variables are linear and continuous. In integer programming the model variables are binary and discrete. An integer programming model is ideal for antenna site location optimization since a potential antenna site is either present (1) or absent (0) in the final solution. Like all mathematical programming models, an integer programming model allows for any number of constraint functions to limit the search space for the optimal solution.

Developing an integer programming model involves two technical tasks:

1. Developing an integer programming computer program; and
2. Developing the integer programming model equations

The first of these tasks, computer programming, will involve the conversion of an existing basic integer programming model into an updated and user-friendly integer programming modeling package featuring an easy-to-use graphical user interface using the Visual Basic language. The original code of the selected basic model was programmed in the Fortran language. The end output of the conversion will be a Visual Basic integer programming model program with a user's manual. The second task involving model equation development is described below as part of the optimization process.

Antenna Site Location Optimization

There are two types of functions in any integer programming model:

1. Objective function; and
2. Constraint functions

The simplest objective function for antenna site location would be a function in which all sites are weighted equally, each variable having a constant value of one(1). Unequal weighting is also possible to reflect the sunk costs in existing sites versus the new costs necessary to develop new sites. Even existing sites could be assigned varying parameters depending on their current value. It will be desirable, however, to have at least one regional solution with equal weighting to estimate the minimal number of sites that could serve the Region.

The constraint equations represent a more complex formulation procedure. The most important constraints relate to universal coverage. To reduce model size, the basic quarter section data element may need to be aggregated to a larger area such as a section. Such aggregation will reduce precision somewhat, but will also produce a more conservative solution. Alternatively, the Region may be subdivided into smaller sub-regions with multiple sub-regional optimizations. Whatever the areal unit, each areal unit will be represented by a single coverage constraint function that must be satisfied in the optimal solution.

Other constraint functions may be added to reflect environmental, technical, political or socio-economic constraints as required. The end output of this work element is an optimized set of regional antenna sites for each service-technology category. The optimization process, however, is expected to be an iterative one after review by the Technical Advisory Committee.

Advisory Committee Review Process

Active participation in the Advisory Committee review process will be essential especially from wireless service providers. It is important that any omission of a key existing or potential site of a provider be identified and corrected. Multiple iterative integer programming model runs with newly introduced constraints will probably be necessary to produce an antenna site plan acceptable to the Advisory Committee. All wireless service providers should be asked to comment on the preliminary antenna site plan selections. This ~~may~~ *will* require appointment of a special Sub-committee with an expanded provider membership. The final output of this review process will be an approved antenna site location and related infrastructure plan.

Contribution to Regional Network Plan Design

The approved antenna site and related infrastructure plan will provide a foundation for the regional wireless-wireline telecommunications network planning, but will not in itself constitute a comprehensive telecommunications network plan. The preparation of such a plan may also introduce wireless network technologies and topologies that reach beyond existing and projected fixed and mobile wireless networks.

Antenna Site Plan - Costs and Schedule

The wireless antenna site plan is separately in the budget for the regional telecommunications planning program set forth in the Prospectus. The budget of $129,135 is allocated as follows:

Labor Cost - $59,335

-Resident Systems Engineer - 2.0 man-months
-Staff Telecommunications Planner - 5.0 man-months

Outside Costs - $69,800

-EDX Radio Propagation Planning Model - $28,000
-GIS Canopy Data - $2,000
-Site Infrastructure Data - $2,800
-Wireless Engineering Consultant - $25,000
-Software Engineering Consultant - $12,000

The schedule for the antenna site planning work element remains as specified in the prospectus (Figure 3, page 45)

Start - Month 4, Year 1
Finish - Month 9, Year 1

DOCUMENTATION

The antenna site and related infrastructure plan will be documented in a SEWRPC Technical Report published after the completion of the plan in month 9, year 1. The report will include county-level maps of the recommended antenna sites for each service-technology category. Cross-referenced by site number will be a detailed description of each site with its topographic and infrastructure characteristics. A detailed description of the study methodology, model programs and procedures will also be included in the report.

References

1. Sherali, H.D., et.al., "Optimal Location of Transmitters for Micro-Cellular Radio Communications System Design", IEEE Journal on Selected Areas in Communications, Vol. 14, No. 4, May, 1996, pp. 662-673.

2. Unbehaun, M., et.al., "On Deployment of Picocellular Wireless Infrastructure", IEEE Wireless Communications, Vol. 10, No. 6, December, 2003, pp. 70-80.

APPENDIX 2

REVISED TECHNICAL STUDY DESIGN MEMORANDUM NO. 4: PUBLIC NETWORKS

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

REGIONAL TELECOMMUNICATIONS PLANNING PROGRAM

TECHNICAL STUDY DESIGN MEMORANDUM No. 4: PUBLIC NETWORKS

June 21, 2004

~~Section I -~~ INTRODUCTION

The Southeastern Wisconsin Regional Planning Commission is the official areawide planning agency for the seven-county Southeastern Wisconsin region comprised of Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha. The Commission is charged with the responsibility for the collection, analysis, and dissemination of basic planning and engineering data on a uniform, areawide basis, for the preparation of a framework of long range plans for the physical development of the Region, and for the promotion of intergovernmental cooperation and coordination in the adoption and implementation of such long range plans.

The Commission recognized that following the breakup of the Bell System and the American Telephone and Telegraph Company, and with the subsequent rapid advances in communications technology, telecommunications, while becoming increasingly important in the local, national, and global economy, also was becoming increasingly chaotic. The Federal Telecommunications Act of 1996, intended to further encourage local competition, has led to the development of a "network of networks" largely beyond the regulatory purview of any level of government.

Recognizing that telecommunications networks form a critical part of the regional infrastructure, the Commission, in December 2002, created an Advisory Committee to assist the Commission in addressing telecommunication issues within the Region. The Committee recommended that the Commission undertake a regional telecommunications planning program, and set forth the need for, and the scope and content of, such a planning program in a Prospectus published in December 2003.

The Prospectus recognized that the conduct of the recommended planning program must be preceded by the preparation of a study design. That study design was to include the preparation of a series of detailed staff memoranda setting forth the methods and procedures to be followed in accomplishing certain critical elements of the planning program. One of these technical study design memoranda was to address the needs and the prospects for public networks in the Region.

~~Section II —~~ DEFINITION OF PUBLIC NETWORKS

The term public networks, as used in this memorandum, refers to telecommunications networks serving functions generally considered to be in the public domain such as public safety, education, ~~and~~ transportation*, and public access inventory*. These functions may also include emerging public functions, such as homeland security, as well as the more traditional functions such as fire fighting and the provision of pre-hospital emergency medical services.

In identifying the public telecommunications *network service* initiatives to be considered, precise definitions of the scope of the initiatives concerned is important. Broad, general, designations, such as “telemedicine”, lack required precision and do not allow for meaningful identification of implementation projects, budgets, or schedules. More precise definitions would include narrower telemedical sub-categories such as pre-hospital emergency medicine, home healthcare, and public health monitoring. The key definitional issues concern whether the initiative relates to an existing or emerging public function and whether successful implementation of a network would address a pressing public need. More precise definitions prevent the consideration of large, unwieldy and poorly defined initiatives with such broad objectives and organizational scope that they are foredoomed to failure.

The objectives of the initial public networks planning work element include evaluations of the needs for the current and potential public networks, together with evaluation of the likelihood of successful implementation of the various networks considered. Such successful implementation is usually dependent on the availability of adequate personnel and financial resources reinforced by strong public and private interest. The end result of the identification and evaluation effort will be definitions of, and recommendations for proceeding with, the next stage of planning for each of the networks considered. These definitions and recommendations are thus intended to constitute potential next step planning projects.

~~**Section III - Evaluation Procedure**~~

~~Needs Analysis~~

~~Each of the existing regional public networks will be evaluated for expansion and/or modernization in terms of perceived needs within the planning region. Prospective new candidate public networks will be subject to the same evaluation. This needs analyses will take the form of a commentary on each existing or prospective network in terms of the potential to meet public needs such as: public safety and security; public health; economic development; education; preservation of the environment; and effective and efficient government.~~

~~Each current network and each potential or new network development will be rank ordered sequentially under each need category with the highest ranked project receiving the highest score. In a five project ranking in a need category, the highest ranked project would receive a value of 5 and the lowest a 1. The ranking scores for each network project will then be summed to produce a composite project score. This composite score will then be combined with a probability value that reflects the likelihood of successful network implementation as presented in the next section to produce a final figure of merit for project priority preference.~~

PUBLIC NETWORKS IMPLEMENTATION PROCESS

Each of the prospective new candidate public networks to be considered for implementation, together with each of the existing public networks to be considered for expansion or improvement within the Region, will be described in the planning report documenting the findings and recommendations of the public networks planning element of the regional telecommunications planning process. The following public networks are proposed to be listed and described in the planning report as candidates for potential implementation:

1. *Public Safety, Emergency Response, and Homeland Security Network*

   This network would constitute a seven-county telecommunications system adequate to provide interoperable communication and information transfer between and within the emergency management, police, fire, and public health agencies operating within the seven-county region, and to do so under major emerging events.

2. *Environmental Monitoring Network*

This network would constitute a system for monitoring air and surface water quality within the seven county planning region. The water quality monitoring would include major inland lakes and perennial streams within the Region. The telecommunication facilities comprising this network would be supplemented by sensor detection and measurement instrumentation located at carefully selected sites within the Region. The instrumentation would be designed to detect and measure the presence of nuclear radiation and chemical and microbial agents in the air and in the surface waters of the Region. The instrumentation could be expanded to also provide data for real time evaluation of air and water quality conditions within the Region. For air this could include detection and measurement of particulate matter; carbon monoxide and ozone; for water quality this could include temperature, conductivity, dissolved oxygen, suspended solids, and microbial population density at selected stream flow monitoring stations, together with data on stream flows and stages.

3. *Home Health Care Network*

This network would provide a multimedia broadband system linking county home health care operation centers to patient homes, emergency medical responders, and other medical resources within the seven county planning region.

4. *Emergency Medical Services*

This network would provide multimedia communication service to ambulances and "flight for life" aircraft responding to emergency calls, linking emergency medical technicians with emergency medical centers at selected hospitals with voice and video services.

5. *Transportation System Control*

   This network would link freeway on ramp signal facilities to a central control station, integrating real time data on system wide traffic volumes with freeway access signal control timing to maximize system throughput at desired operating speeds.

6. *Public Administration*

   This network would interconnect county court houses and city, village and town halls within the seven-county planning area to facilitate interchange of data and to coordinate administrative operations.

Specifically excluded from the candidate public networks list at this time would be education and criminal justice networks. These are excluded because of their complexity and the extensive development of supporting public networks presently underway for these applications. Public access would also be excluded as a candidate network since such access involves essentially one-way broadcast application; and, therefore, is not within the scope of the regional telecommunications planning program.

The descriptions of the afore listed candidate public networks in the planning report would be intended to serve as preliminary proposals to potential interested parties and funding agencies; and as foundations for more extensive final proposals. The later would involve the preparation of a prospectus under the guidance of a task force or committee. In most cases, public network descriptions may be expected to call for the conduct of relatively small pilot scale demonstrations prior to consideration of the actual development of a full scale network.

The implementation process envisioned would thus entail the selection of one or more public network candidates by the stake holders concerned for further planning toward implementation. The stake holders could include general purpose county and municipal governments, public agencies within such governments -- such as police, fire, and public works departments; or semi-public or private agencies concerned with the provision of public or quasi public services. Those candidate public networks that are successful through the envisioned process in obtaining public support would be organized as a public network development project and, as already noted, proceed to develop a prospectus for a pilot scale development project. Based upon the findings

of the pilot scale project, and with continued public support and funding, the public network development project would proceed. In some cases, the project may require the construction of new telecommunication facilities; in others, only communication software development. For all networks, however, a system engineered plan would be required to design, develop and deploy the public network involved.

~~Implementation Analysis~~

~~The needs analysis will be followed by an investigation of the selected public networks to determine the likelihood of successful implementation. This investigation will include consideration of the following factors:~~

~~1.Definition of the project scope of work.~~
~~2.Estimated project budget~~
~~3.Potential public and private partners~~
~~4.Availability of funding~~
~~5.Potential political support~~

~~The cost of any public network expansion or new public network initiation together with the availability of funding will largely determine the likelihood of project implementation. Other factors related to the availability of public and/or private partners coupled with the probable political support in the Region will also influence the probability of a successful network deployment.~~

~~The end result of implementation analysis is an estimated probability value for each prospective public network considered that reflects the likelihood of success.~~

~~Rank-based Expected Value Analysis~~

~~The rank-based expected value method has been used previously in the comparative evaluation of public works projects as an alternative to more traditional methods of engineering economy such as benefit-cost analysis, present value, or return on investment. Such quantitative approaches are often difficult to apply in the public sector because of the qualitative nature of benefits in areas such as public safety or public health. In the rank-based expected value method, project ranking values are multiplied by estimates of the probability of implementation to obtain a composite value of project worth. In the public networks application here, the original project ranking~~

~~resulting from value analysis will be combined with the probability of implementation to produce the final measure of expected project value. These expected values can then provide guidance to public officials in the selection of public network deployments.~~

~~The public networks evaluation process and its expected value based recommendation will be scrutinized by the Commission Advisory Committee on Regional Telecommunications Planning. The Committee will provide a checks and balances function in the review process by discerning the credibility of the public networks rankings and the factors involved in successful implementation, as initially proposed by the staff. Committee suggested changes, additions and other recommendations may require repetition in both the value analysis and implementation analysis phases of the process in order to arrive at a consensus based public networks development program.~~

~~Section IV~~ PUBLIC NETWORKS IN SOUTHEASTERN WISCONSIN

Any consideration of ~~a~~ public telecommunication~~s~~ network~~s~~ *service initiative* evaluation methodology must be supplemented by presentation of the current status of such networks in Southeastern Wisconsin. Such consideration is necessary to an appreciation of the nature and scope of this aspect of the regional telecommunications planning program.

First of all, it is important to understand the importance and potential impact of public versus private usage of broadband telecommunications in the regional context. ~~Contrary to current popular perceptions,~~ ~~public~~ *Public* sector applications of broadband~~,~~ telecommunications ~~may well equal or surpass~~ *are as important as* private sector applications. Public needs in the areas of public safety/emergency response/homeland security; telemedicine/telehealth; transportation; environmental monitoring; and education all are subject to significant potential improvements based on broadband telecommunications usage. Although the popular and trade press ~~continually~~ emphasize the search for highly profitable broadband applications in such areas as video-on-demand, the urgency of needs in public safety, public health, *public community access,* and education ~~would seem more~~ *are more* pressing in today's environment.

Equal in importance to any public networks planning program is awareness of current public networks initiatives in the Region. The existence of the City of Milwaukee's CSWAN fiber optic

network as well as the Wisconsin Department of Transportation's fiber optic network have been noted in the afore-referenced Prospectus. Other regional communities such as West Allis and Waukesha are also planning public fiber networks that could play important roles in any future regional public network. These networks will be assessed during the inventory work element of the planning program. Some of these public fiber networks are being initially deployed in dark fiber form with only very general plans for specific application. Regional planning could play a critical role in determining the future direction and usefulness of these networks.

The public network candidates reviewed here represent what are believed to be telecommunication initiatives of current and potential importance to the Region. They also represent network projects with varying prospects for funding. The roster of potential projects is not meant to be comprehensive or exhaustive. There are undoubtedly other potential networks worthy of consideration, and such candidates may surface in the Advisory Committee review process.

Public Safety/Emergency Response/Homeland Security

One class of public networks of particular importance in the present environment relates to public safety, emergency response, and homeland security. Such networks could emphasize one or more of the following functions:

1. Interoperable communications
2. Information sharing
3. Infrastructure/biochemical monitoring

Each of these functions constitutes a public networks project in itself, but combinations of these functions could prove useful both in increasing the value of the project and the likelihood of obtaining funding.

Interoperable communications refers to the capability of multiple public agencies and jurisdictions to communicate with each other, particularly during major disasters, such as terrorist attack, multiple highway collisions, tornadoes, fires, and floods. Shortcomings in this area were revealed in the aftermath of the September 11, 2001, attack on the World Trade Center in New

York, when police, fire and emergency medical services personnel were unable to communicate with their heterogeneous communication equipment. Since the "9-11" attack, there has been much discussion nationally of remedies to this problem and some Federally-sponsored studies, but little in the way of implementation in most metropolitan areas of the United States including Southeastern Wisconsin.

The alternative technical approaches to interoperable communication are fully described in a recent publication of the National Institute of Justice, a division of U.S. Department of Justice.[1] One approach to interoperability involves private-public partnerships with wireless service providers such as Nextel Communications that employs a specialized mobile radio (SMR) approach that avoids the publicly switched telephone network (PSTN) for reliable communications during emergencies. A number of municipalities are already pursuing this approach, but none has been known to expand such interoperability on a metropolitan or regional basis. Funding for projects developing interoperable public communications system is available from both the National Institute of Justice and the U.S. Department of Homeland Security.

Closely related in function, but quite different in implementation, is the area of information sharing. The value of communications is greatly enhanced if there is real information to share. The foundation for such an information sharing network in Southeastern Wisconsin has already been laid out by the City of Milwaukee's Community Safety Wide-Area Network (CSWAN). This Dense Wave-Length Division Multiplexing (DWDM) fiber optic network has great transmission capacity and already links over 100 police, fire, emergency medical services and public works locations within the City. If this network were expanded to link all public safety jurisdictions within the Region, it would become not only the infrastructure for public safety/emergency response network but also the framework for a number of other public networks. The capacity of DWDM networks measured eventually in terabits per second is such that this core network could service a wide variety of public applications.

In regard to information sharing, however, a word of caution is appropriate. The availability of broadband networks is a necessary but not sufficient condition for such sharing. The other major requirement relates to computer database compatibility among agencies and jurisdictions. A current Federal/states funded project in this area is the Capital Wireless Integrated Network

[1] Guide to Radio Communications Interoperability Strategies and Products, Report No. TE-02-02, National Law Enforcement and Corrections Technology Center, April, 2003.

(CAPWIN) involving the states of Maryland and Virginia together with the District of Columbia. This multiple year, multi-million dollar effort represents a massive database integration effort with International Business Machines Corporation (IBM) currently functioning as the system integration contractor. The goal of this project is to integrate the computer and communications systems of over 100 fire, transportation, police and emergency medical services agencies in the Washington Metropolitan Region. If this project is successful, it should be able to provide the structure, tools and even hardware/software for similar efforts in other metropolitan regions throughout the United States.

The final public safety/emergency response area of infrastructure/biochemical monitoring has recently been given impetus by a new wireless technology known as Zigbee based on IEEE Standard 802.15.4. This technology involves the use of small, wireless, low-cost, low-power, sensor/telecommunication modules organized into mesh networks and able to communicate low-speed, narrowband data back to a central location with structural, physical and biochemical information on the status of the physical infrastructure and the air/water/power distribution status throughout a region. Such information could serve as an early warning network for terrorist attacks or other life threatening incidents that impact public safety. Selection of this public safety network application as a proposed project would represent the first attempt in the United States and would be a strong candidate for Homeland Security funding. It also could serve as an environmental monitoring network as discussed below.

Because of the current perception of urgent need and the potential availability of Federal funding, the public safety – emergency response – homeland security function can serve as the foundation for a general purpose broadband public telecommunications network in the Region. Although such a network would have built-in priority controls to assure network availability for emergency response functions, the capacity of the network could be so designed as to allow for other public functions to operate at broadband transmission rates except at times of extreme emergency. Since last mile access networks rather than core networks are the limiting bottleneck in current day broadband networks, providing access to other public network functions such as emergency medical services, home health care or environmental monitoring should rarely tax the capacity of a general purpose public network.

Environmental Monitoring

Zigbee technology with its low-cost, low-power, wireless modules makes environmental monitoring on a large scale feasible for the first time. The availability of miniature low-cost sensors suitable for Zigbee integration would support a region-wide network of environmental monitoring for water quality or air quality. Such a network would seem particularly suitable for water quality monitoring of rivers, lakes and streams. This same network could also monitor municipal water distribution systems at multiple points in the pipe network. Such distribution monitoring will soon be required of water utilities for chlorine residual measurements, so that additional analytical information could serve both environmental and security concerns at the same monitoring locations.

Given the historical role of SEWRPC in water resource planning and monitoring, an environmental monitoring public network based on Zigbee technology would seem quite appropriate. The link with Homeland Security with its funding availability further increases the attractiveness of this network alternative.

Telemedicine/Telehealth

Of interest here are those segments of the healthcare system traditionally or potentially under the public sector such as:

1. Pre-hospital emergency medicine or Emergency Medical Services (EMS)
2. Home Healthcare - including nursing homes "without walls"

Both of these applications are potentially cost-effective and could be implemented using low-cost IEEE Standard wireless hardware (802.11 and 802.16) and mesh networking.

~~Based on recent experiences in Northern Wisconsin and Virginia, t~~ *T*here is a perceived need for the EMS application on the part of both rescue squad and emergency medical personnel. In the EMS application, ambulance vehicles would have direct contact by voice, data and video with hospital emergency room professionals. Since minute-by-minute life and death decisions often take place in EMS operations, such real time communication could not only save lives but also upgrade the overall quality of pre-hospital emergency medicine especially since some EMS volunteers have only very basic skills in emergency medicine.

The second telemedical application is in recognition of the current situation in United States healthcare:

1. Rising healthcare costs particularly in hospitals and nursing homes
2. Aging population
3. Aversion to long stays in hospitals or residence in nursing homes

Again, voice, video and data information would be communicated from each home to a central monitoring facility.

Funding availability for EMS could also link with homeland security as a part of emergency response. Funding for the home healthcare application is possible through the National Institutes of Health.

Intelligent Transportation Systems

A wide variety of possible broadband communications applications exist under the general category of intelligent transportation systems (ITS). Only two will be considered here:

1. Centralized freeway traffic control
2. Centralized traffic control for arterial streets

The first application has been considered by SEWRPC in recent years. The nature of the application task here is not so much one of communications infrastructure development as it is traffic systems engineering. The communications infrastructure is mostly in place. What is required is the development of algorithms that would control freeway access and diversion based on the overall state of the freeway network and not just local ramp conditions. Much effort has been devoted to this type of freeway control in Europe that would serve as the basis for work here.

The second application for arterial traffic light control is in some ways an extension of freeway control and could be integrated with it later. The communications infrastructure, however, is largely absent. Such a narrowband network though would be another excellent Zigbee application. The City of Milwaukee has already initiated a study of this application.

Funding for these ITS application is more problematic given the current budget shortfalls at the Wisconsin Department of Transportation and also at the Federal level.

Education

Public education is a potentially extremely fruitful area for broadband telecommunications applications. The initiative, however, must come from the school districts *and from such public agencies as fire departments that must engage in training programs*. Other than providing the broadband telecom infrastructure, it is beyond the scope of the regional telecommunications planning program to restructure how the K-12 education systems operate.

General Government Applications

A number of potential applications for broadband communications have been suggested in the administrative, judicial, and correctional functions of local governments. Here too, the role of SEWRPC is best limited to prescribing the communications infrastructure. The regional infrastructure described above under the regional public safety network would provide both the core network and the access networks for general government applications. Beyond this infrastructure, the application task is one of computer system design and programming rather than telecommunications systems engineering.

~~Section V –~~ PUBLIC NETWORKS STRATEGY AND ACTION PLAN

The final result of the public networks segment of the regional telecommunications planning program must be as public networks strategy and action plan. The strategy will encompass a selected sequence of public networks initiatives and an approach for their implementation. The action plan will include statements of work, budgets and schedules for each selected public network project. This strategy and action plan will furnish the guideline for individual public network project initiation.

The Advisory Committee can play an important role in formulating a recommended regional public networks strategy. Public sector committee members may advise on potential political support and availability of funding. Other members may provide technical or non-technical commentary that would influence project value or the likelihood of successful implementation. Finally, non-financial resource limitations will constrain the number of public network planning projects that can be initiated. In this very new field of regional planning, staff capabilities are

limited, and the availability of competent trained personnel for hire is uncertain. Most new hires, even those with good telecommunications backgrounds, will require some degree of orientation and familiarization. For this reason, considerable attention and effort should be devoted to public networks strategy formulation.

One approach to public networks strategy would initiate a limited number of planning projects beginning with the highest ranked from the rank-based expected value method. The precise number of projects authorized would depend upon resource limitations – financial, personnel or other. Each selected public networks project would be the subject of a prospectus which will document the background of the proposed public network, the need for it in the region and a statement of work with related budgets and time schedules.

A second approach based on the general purpose public networks concept would focus all initial effort on an emergency response/homeland security initiative preparing a prospectus for this regional need providing a core network with initial emergency response access sub-networks, but with provision for later access for other public functions such as environmental monitoring home health care and traffic control. This second approach has the advantage of better integration of multiple public functions into a single comprehensive network serving the public telecommunications needs of the Region.

~~STRATEGY VI –~~ DOCUMENTATION

The public telecommunications networks strategy and action plan together with supporting background information on needs analysis and implementation analysis will be documented in a SEWRPC Technical Report published in Month 7 of Year 1. This timeline represents a change from the prospectus which scheduled this publication in Month 5 of Year 2. The urgency of public networks implementation will justify this acceleration. The publications of this report will then be followed by the preparation of a prospectus for each selected project which will be documented in the normal manner.