FINAL REPORT

of the

Wisconsin Land Information Association
Emergency Management Task Force

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WISCONSIN
LAND INFORMATION
ASSOCIATION

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Table of Contents

1.0 Executive Summary

In the past several years, attention to the vital importance of emergency preparedness has grown, and geospatial data and technology have played a more prominent role in helping communities plan for and respond to natural and manmade disasters. Despite some recent successes, Wisconsin needs a more coordinated, comprehensive, and systematic approach to the application of geographic information technology in emergency management operations.

Unfortunately, like many other states, Wisconsin lacks a broad geospatial strategy, one that includes the following key elements: (1) increased collaboration between geospatial technology professionals and the emergency management community, (2) more clearly defined policies and standards, and (3) an infrastructure designed to meet emergency management related challenges.

For more than a year, the WLIA Emergency Management Task force (EMTF) has worked to identify issues related to a more comprehensive and systematic statewide strategy. The EMTF has sought and researched information from a range of sources, including state, local, and federal organizations; professional literature; and first-hand accounts from emergency management and GIS professionals. The information drawn from this endeavor has provided perspective on what is working – and what is not – for emergency management activities within the state. Based on our research, this report suggests steps that may be taken in the future to better integrate local and statewide emergency management efforts with geospatial technology.

In developing these recommendations, the EMTF considered common barriers encountered by Wisconsin organizations. To be successful, any future strategy must overcome these issues:

- Lack of sufficient resources (e.g., staff, data, hardware, and software)
- Lack of organizational integration of geospatial and emergency management business functions
- Limited understanding by both GIS and emergency management professionals of the potential utility of GIS in emergency management activities
- Irregular and inadequate communication between those involved in GIS and emergency management
- Limited GIS-ready data available for emergency management activities
- Lack of standards, policies, and specific procedures needed to effectively use GIS technology for emergency management operations
- Insufficient funding mechanisms

Addressing these issues and successfully developing and implementing a statewide emergency management geospatial strategy in Wisconsin will require the involvement of many organizations throughout the state. This report reflects the need for increased involvement of various organizations such as state and federal agencies, professional organizations, regional planning commissions, and local

governments. In some cases, the recommendations suggest specific action by one or more of these groups. In others, objectives have been determined but future action and responsibility is left open.

Our recommendations are summarized below in four categories:

Coordination. Coordination is the key to success for nearly all emergency planning and response situations. In the many studies and documents the EMTF reviewed in preparing this report, a lack of coordination was consistently identified as a major stumbling block to effectiveness. This report identifies ways in which the coordination can be improved to provide more effective emergency management at all levels.

- Support the National States Geographic Information Council (NSGIC) recommendations for GIS coordination activities.
- Develop a statewide geospatial strategy for emergency management.
- Identify emergency management and GIS related political and administrative leaders in Wisconsin.
- Establish guidelines for communication between the Wisconsin Emergency Management Association (WEMA) and WLIA.
- Promote better communication between emergency management and GIS communities.
- Develop a relationship between the emergency management community and state geographic information officer (GIO).

Policy. In order to be effective, future policies must recognize the specific needs of the emergency management community. Policies must be developed at both a state and local level and provide detailed guidance to key organizations.

- Identify barriers for inter-jurisdictional cooperation and coordination of Emergency Management-GIS related activities.
- Identify spatial data needs for emergency management.
- Identify and synthesize information policies related to data security, data sharing, and public access of emergency management-related spatial data.
- Revive the Wisconsin Land Information Program annual survey.

Infrastructure. Critical issues include identifying funding mechanisms, providing GIS technical assistance for emergency management agencies, and developing a strategy for deploying a statewide data-sharing system.

- Develop a statewide infrastructure plan to support data sharing at all levels of government in Wisconsin.
- Identify funding strategies for deploying GIS infrastructure and support in emergency management.
- Develop GIS technical assistance for emergency managers.

Education. Many of the most immediate hurdles to better cooperation involve a lack of understanding of emergency management activities and the role that

geospatial technology can play in improving emergency management. Numerous opportunities exist to facilitate interdisciplinary education and training.

- Educate the emergency management community about GIS and other spatial technologies.
- Communicate Wisconsin Emergency Management (WEM) GIS needs assessment to emergency managers and to the GIS community.

The remainder of this document provides background information and a detailed discussion of EMTF recommendations. Clearly, significant work remains to be done. The EMTF hopes the information presented in this report will aid future efforts to develop a comprehensive geospatial strategy for the state of Wisconsin.

2.0 Introduction

Founded in 1987, the Wisconsin Land Information Association (WLIA) is a grassroots organization representing a collection of concerned professionals working to develop, maintain, and apply a network of statewide land information systems. WLIA members include staff and elected officials from all levels of government, academics, consultants, and other private sector users of GIS. WLIA is united by an interest in land records modernization, GIS, and related technologies, and by the need for government policies and programs that support their efficient and effective application.

GIS has become an indispensable tool for hazard planning and mitigation. No other technology can match GIS for visualizing vulnerabilities, opportunities, mitigation, and disaster response strategies, yet many state and local emergency management agencies lack GIS expertise or access to the technology. Furthermore, some emergency managers may be intimidated by the technical nature of GIS or fail to see its value for their work. Likewise, some GIS experts may not understand how to effectively communicate the value and applicability of this technology to emergency management officials.

Emergency management organizations need to effectively and efficiently access and use land information for several reasons. The following are major examples:

- A series of disastrous events, particularly over the last five years, have heightened awareness for the need to leverage geospatial data and technology for planning, response, mitigation, and recovery. The U.S. Department for Homeland Security (DHS) has drastically raised expectations for integrating GIS into all aspects of preparation and response related to "all hazards." This is illustrated most profoundly in the 2005 Homeland Security Grant Program (HSGP) guidance document and again in the 2006 HSGP guidance document.[1]

- Growing expectations and technological advances continue to put pressure on emergency response agencies, which need to know from where requests for service are coming, and how best to respond to them. Recently, the U.S. Department of Transportation issued a call for a "next generation 9-1-1 system," which explicitly calls for the integration of GIS.[2]

- Concerns over West Nile virus and severe acute respiratory syndrome (SARS), among others health threats, have spurred the Centers for Disease Control to promote and support efforts to improve Wisconsin's ability to

[1] See http://www.ojp.usdoj.gov/odp/docs/fy2006hsgp.pdf, Appendix H (Geospatial Guidance)
[2] Next Generation 9-1-1 System Preliminary Concept of Operations, http://www.its.dot.gov/ng911/next_gen_911_sys.htm, accessed on 2/2/2006.

monitor key public health data and to develop surveillance systems that enable effective time-sensitive decisions.

- Instances of avian influenza (bird flu), bovine spongiform encephalopathy (mad cow disease), and to a lesser extent, chronic wasting disease have caused concerns over the quality and safety of the nation's food supply. As a result, the U.S. Department of Agriculture has called for a National Animal Identification System to track each animal through its life.[3]

- The continuing threat of another major terrorist attack is a reality. Domestic terror attacks such as the 1995 Oklahoma City bombing and the September 11, 2001 (9/11) attacks remind us that we must be prepared for any eventuality.

2.1 Purpose

The purpose and mission of the WLIA Emergency Management Task Force (EMTF) arose from the perception that GIS is not widely used in Wisconsin by the emergency management community.

During the summer of 2004, WLIA president Alissa Bails sponsored an initiative to create a task force to deal with issues related to homeland security and emergency management. The idea was presented to the WLIA Board of Directors, and in the fall of 2004 the task force was created. Starting in February 2005, the EMTF met for the first time to discuss the current state of affairs and what might be done to improve the situation. From the first meeting in 2005 through March 2006, EMTF members met in person and via teleconference calls to further discuss the issues. The results of these discussions, conclusions, and recommendations are described in this report.

During the first two meetings, the EMTF identified a mission and four objectives for the task force.

Mission:
Identify the need and scope of a statewide emergency management geospatial strategy. Make recommendations on the steps needed to implement such a strategy.

Objectives:
- Bridge the communication gap between the GIS and the emergency management communities.
- Recommend steps towards developing a statewide geospatial strategy for emergency management.

[3] USDA Animal and Plant Health Inspection Service, http://animalid.aphis.usda.gov/nais/index.shtml

- Recommend how future emergency management plans may better utilize GIS and geospatial data.
- Identify issues related to dataset sharing, inventory, and access for emergency management.

2.2 Emergency Management in Wisconsin

Wisconsin is a "home rule" state. One of the implications of this is that local government officials are in charge when an emergency or disaster occurs. The role of the state is to support the local response with equipment, personnel, or technical assistance when local capabilities and mutual aid from the surrounding jurisdictions have been exhausted.

Following any major natural or manmade disaster, local emergency officials contact the WEM duty officer to report what has happened and request assistance. At that time one of six WEM regional directors and/or the emergency police and fire services coordinators may be dispatched to the scene to support the local response and provide firsthand information on the disaster to WEM Management and the governor's office.

County and state emergency operations centers (EOCs) may be activated to coordinate county and state response efforts. In the EOC, critical information is gathered on the impacted jurisdictions, including the areas evacuated; locations of shelters; number of fatalities or critical injuries; the extent and degree of damage to residences, critical facilities, and infrastructure; essential services impaired or disrupted; and resources such as personnel and equipment in use or potentially needed. This information is used by the EOCs to determine response priorities and whether or not state/federal resources are needed. It is also used to keep key elected and appointed officials, the public, and the media apprised of the response and recovery effort.

Each county emergency management director is responsible for submitting an initial damage report to WEM on the extent of damages to the public and private sectors. These reports are reviewed by WEM in consultation with the Governor's office. If damages are severe and extensive enough, the Governor will request federal disaster assistance from the President through the Federal Emergency Management Agency (FEMA). At that time, FEMA will work with WEM and the impacted counties in doing a second damage assessment, the results of which will be included in the Governor's request to the President for a disaster declaration. If the declaration is received, a variety of grant and loan programs are made available to the individuals and communities that have been affected.

2.2.1 Overview of emergency management plans

Chapter 166 of the State Statutes requires that the state and counties develop emergency operations plans (EOPs) for all hazards. When plans are completed, training and exercising of them must occur in order to ensure they can be effectively implemented in an actual disaster situation. The state and county operations plans

are now being revised to conform to the National Response Plan and the requirements of the National Incident Management System (NIMS). A number of other plans are attached to the emergency response plans, including those dealing with specific hazards or contingencies, such as hazardous materials, pandemic influenza, nuclear power plants, and continuity of government (COG)/continuity of operations (COOP). State agencies involved in emergency response are also required to develop individual agency plans.

A major federal requirement since 2000 is the development of state and county hazard mitigation plans. These plans consist of an in-depth hazard analysis and risk assessment, identification of mitigation projects and opportunities, and a detailed and prioritized plan for implementing those projects. The plan requires coordination with other ongoing comprehensive or land use planning efforts and also must involve public participation. As with the state and local response plans, these plans must be signed by the chief elected officials of the county and/or participating communities.

While county and local emergency response plans are generally developed by the county and local emergency managers in conjunction with local first responders, some of the plans, most often the hazard mitigation plans, may be developed by regional planning commissions or private contractors. In all cases, WEM provides support and guidance to these organizations through resource guides, training seminars, and other materials and assistance.

To help determine the level of GIS integration in emergency management planning within the state, the EMTF reviewed a sample set of hazard mitigation plans and EOPs to determine if and how GIS is being used in the emergency management planning process. The EMTF also sought examples in which organizations illustrated the utility of GIS in the emergency management planning process. These examples may serve as useful resources for other organizations.

2.2.2 The role of geospatial technology in emergency management

It was impossible to review all state and local emergency management plans (EMPs) for the purpose of producing this report. It was necessary, however, to review a sufficient number of plans to gain an understanding of the planning process, the required elements of the plans, and how geospatial technology will be used. Task force members reviewed twelve plans. This review included eight all hazards mitigation plans (AHMPs) (seven from counties and one from a medium-sized municipality), and four EOPs. In addition, the WEM resource guide material was examined[4].

[4] http://emergencymanagement.wi.gov/subcategory.asp?linksubcatid=12&linkcatid=37&linkid=30

This review did not cover any plans currently prepared or maintained by state agencies. The summary below is not intended to be an exhaustive list of all the ways in which local governments are using GIS in EMPs, but rather to be a representative sample of how GIS is commonly used in the emergency management planning process.

A number of common themes emerged after reviewing the plans. In addition, as one may expect, the plans varied in the level with which GIS was identified as a tool for emergency management planning.

A. GIS as a tool for hazard analysis and plan preparation

The most common use of GIS in the plans reviewed is as a tool to organize existing data or to derive additional information necessary for preparation of the plans. Many of the hazards addressed are location- or condition-specific, and GIS is a valuable resource in this regard.

Common uses include:

- Use of digital flood mapping for flood mitigation analysis
- Analysis of structure data to determine structures within flood zones
- Land use classification mapping
- Critical structures identification and analysis
- Organization and mapping of past hazard events such as fires, floods, and tornadoes
- Identification and mapping of risk areas that may be prone to damage from fire, flooding, and dam breaks

B. GIS used to communicate plan content

GIS-generated maps are prevalent throughout many of the plans. These maps are important in accomplishing several goals. Examples of these goals include:

- Providing basic information such as the geographic area covered by the plan, political boundaries, and demographic information
- Defining geographic limits of areas of interest for a particular hazard
- Communicating results of analysis

In plans that relied less heavily on maps, much of the same information was provided in other less effective formats such as tables or narrative.

C. GIS as a tool to mitigate hazards

Only a few plans identified GIS as a tool for mitigation of hazards, and among those plans, GIS was referenced in a limited way. Some examples include:

- Using GIS as the system to house new data in order to continue to identify areas of risk and update plans
- Updating and managing elevation data for improved flood plain analysis
- Mapping and management of better land use data
- Development of additional data for improved base information and analysis

2.3 Case Studies

There have been several recent situations that can be analyzed to understand the role of geospatial information in addressing emergencies. The EMTF reviewed three such situations: floods in Wisconsin, Wisconsin tornadoes of 2005, and Hurricane Katrina. The goal in reviewing these examples was to identify the role of geospatial technologies during emergency response activities. The following case studies illustrate the benefits of geospatial technologies and also highlight some of the barriers that exist in their implementation.

2.3.1 GIS and Floods in Wisconsin

Floods are a significant threat to life and property in Wisconsin. In fact, before the spate of recent hurricanes in the Gulf Coast, Wisconsin ranked tenth in the nation in 2003 with more than $1.5 billion in documented flood damages over the last two decades. Furthermore, flooding has been the principle cause for more than half of the presidential disaster declarations in Wisconsin.[5] As with other types of disasters, GIS can serve as a powerful tool for the collection, management, and analysis of flood-related spatial information. As a recent (2005) WEM GIS needs assessment points out, GIS "can be leveraged for locating critical and vulnerable assets, planning, mitigation activities, assisting in response, and aiding in recovery management."[6]

Many spatial datasets are needed to address flood planning, response, recovery, and mitigation. The most important of which are the FEMA flood hazard maps, which are required for the floodplain zoning, insurance, mitigation, and comprehensive plans.[7] These maps include National Flood Insurance Program maps, flood insurance claims, and flood maps of ongoing events. The four primary data layers

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[5] Lulloff, Alan. 2003. *Flood Map Modernization in Wisconsin*, Wisconsin Department of Natural Resources Floodplain Management Program, published December 17, 2003, accessed January 6, 2006, http://www.dnr.state.wi.us/org/water/wm/dsfm/flood/mapping.htm

[6] GIS Needs Assessment Project Presentation, Wisconsin Emergency Management, published 2005, accessed January 6, 2005, http://emergencymanagement.wi.gov/announcements_detail.asp?annid=18

[7] Bellovary, Tony. Bay-Lake Regional Planning Commission, Wisconsin. Private communication, December 14, 2005

that are needed to support these maps are digital elevation models (DEMs), road centerlines and bridges, critical facilities, and building footprints. A complete list of data layers and maps relevant to flooding is included in appendix D.

While datasets may be available upon request in local communities, frequently they have not been used spatially to identify hazardous conditions or floodplain evacuation routes. Rather, communities often depend on in-depth knowledge of local experts. However, if that person is not available during a crisis, the information cannot be utilized to protect lives and property. Moreover, data access and sharing between departments or jurisdictions (e.g., via email, phone, or CD) is often dependent upon partnerships developed over time based on trust, common goals, and in some instances negotiated license agreements.

Under some circumstances, staff may be reluctant to share their GIS data for a variety of reasons (e.g., proprietary, cost recovery, privacy, security, and sensitivity). This often depends on staff preferences and on individual county policies, which are often informal; there is no consistent statewide policy that addresses what datasets should be made accessible and what should be restricted. Some government agencies regularly charge for copies of their digital orthophotos, DEMs, and parcel maps, which can be burdensome to some emergency-related organizations, both financially and administratively. But at the same time, communities may be willing to share this information for emergency purposes free of charge, albeit with restrictions on redistribution, especially if they will benefit in return (e.g., more accurate floodplain layers).[8]

Ultimately, if these flood management systems are operated in isolation, their full benefit may not be realized. If a disaster occurred that involved multiple jurisdictions under the current status quo, data acquisition and integration would not be easy. For example, parcel data may not match at the jurisdiction boundaries; associated coordinate systems may differ or be nonexistent; attributes for the same objects may be coded differently; assessors' data may be joined in some instances and not others; and not all communities will have complete datasets. On the other hand, a Department of Justice dataset may have statewide coverage, but it may not integrate easily with local data, again due to differing data models.

Ideally, given the time-sensitivity, regional nature, and life-threatening potential of floods, flood-related geographic information and spatial analysis tools should be made accessible to a large number of users for emergency management through a standardized and centralized system. A statewide parcel map, critical facilities map, and levee inventory are especially needed to support flood hazard mitigation.

[8] Bellovary, Tony. Bay-Lake Regional Planning Commission. Private communication, December 14, 2005.

2.3.2 2005 Tornado Outbreak in Wisconsin

On the evening of August 18th 2005, Wisconsin experienced its largest outbreak of tornadoes in recorded history. Of the 27 tornadoes that touched the ground, two reached F2 and F3 on the Fujita scale. The first landed in Vernon County and ripped through the Village of Viola, then continued on through most of Richland County. The second tornado raced across Dane County, causing the most damage in an area north of the City of Stoughton.

During any disaster in Wisconsin, the concept of "home rule" applies. In other words, the local jurisdiction is in charge of managing the disaster response and recovery effort, while WEM serves in a support role to the local government first responders.

As the events of August 18th unfolded, the Dane County Land Information Office (LIO) provided GIS and mapping support for county emergency management staff. In addition to producing a variety of situational maps, LIO staff were asked to assist in preparing damage assessments from incoming field reports. The chaotic situation in the field translated directly into damage reports that followed very few standards. Field crews each used their own terminology ("badly damaged," "very damaged," etc.) to describe properties on the ground. Despite the challenges, the LIO was able to provide preliminary damage assessments by combining field reports with building values from the standard county parcel database.

As the severity of the situation became evident, the WEM EOC was activated to provide assistance to Dane, Richland, and Vernon Counties. One of the first tasks for staff at WEM was to acquire relevant and current GIS data for use in the state EOC.

At the time of the disaster, WEM was aware of the remote sensing research that the University of Wisconsin Environmental Remote Sensing Center (ERSC) was conducting. WEM contacted ERSC to determine if suitable satellite imagery was available that would show the path of the tornadoes. No immediate imagery was available due to cloud cover, but several days after the event WEM staff were able to obtain imagery that clearly showed the path of destruction. In the future, WEM hopes to have contracts in place that will allow high-resolution aerial photography to be acquired on a moment's notice.

In addition to contacting ERSC, WEM contacted the Dane and Vernon County Land Information Offices and the United States Geological Survey (USGS) to acquire relevant GIS data. WEM staff quickly learned that very little digital data were available for Vernon County. In contrast, Dane County has a significant data repository and has sophisticated GIS capabilities.

WEM was able to obtain parcel data from Dane County, along with the field data indicating the severity of damage within each parcel. This data proved very helpful in obtaining initial damage estimates that were used to report to FEMA the magnitude of the damage in Pleasant Springs Township. It also enabled WEM to assess the scope and location of the areas affected.

Important lessons can be learned from the events of August 18th. First, protocols for communication and data sharing must be understood prior to a response and recovery effort. When staff from WEM contacted Dane County for parcel data, the request fell outside the normal communication protocol the LIO was instructed to follow (all information requests are normally routed through the Dane County EOC). This caused some confusion.

In addition, as this situation illustrates, GIS and mapping capabilities of local governments vary widely across the state. This implies that state officials need to be cognizant of the fact that no single data sharing solution or protocol can be expected to work on a statewide basis; agencies at the state level must be flexible in their expectations when working with GIS/land information professionals at the local level.

One lesson should be clear for GIS professionals around the state: Systematic communication, standards development, and protocols must be developed sooner rather than later in order to minimize the loss of life and property in future disasters.

2.3.3 Hurricane Katrina – GIS for the Gulf

In the days after Hurricane Katrina devastated the gulf region, federal, state, and local agencies rushed to provide geospatial information to assist in the recovery effort. Access to detailed geospatial information proved essential to hurricane response and recovery efforts such as the following:

- Determining the location of 911 callers through geocoding and guiding callers' rescuers
- Providing thousands of maps to responders and government officials coordinating response efforts
- Mapping potential shelter locations and how to guide people to those shelters
- Analyzing high water marks and elevation to estimate damage
- Mapping the proximity of flood water to industrial sites for water quality determination
- Acquiring imagery to predict the amount of debris to be hauled away

Yet in the initial rush to respond, federal and state agencies were acting individually and even planning purchases of new data without coordinating their activities.

Following Hurricane Katrina, the USGS, DHS, and National Geospatial Intelligence Agency, working with Environmental Systems Research Institute (ESRI), delivered the combined database, dubbed "GIS for the Gulf," to almost 100 organizations through a password protected site on the Geospatial One-Stop (GOS). This combined database included over 50 different types of information gathered from federal, state, and local governments, in addition to the private sector. The project included data modeling, data acquisition, applications development, and data hosting.

There are many lessons that can be learned from this effort:

- The data could not be used for search and recovery efforts because it was not available in advance.
- The resultant database contained best available data from many sources, but complete coverage was not possible because not all layers were available in digital form.
- The database contained data with use restrictions that meant access had to be strictly controlled.
- Complete vertical integration of the data was not possible due to time constraints. For example, not all imagery was orthorectified.

Costs for this effort included the use of agency personnel to obtain and integrate data from various sources and a contract valued at approximately $650,000.

3.0 Recommendations

A fundamental goal of the EMTF mission was to develop a series of recommendations for implementing a statewide emergency management geospatial strategy. The EMTF used the expertise of its membership, evaluated existing plans and recent emergency response activities, reviewed publications on the issues, and spoke with experts outside the group to build a set of recommendations that can be categorized into four broad areas: coordination, policy, infrastructure, and education.

While these recommendations are being presented to the WLIA Board of Directors, it is fully recognized that not all recommendations can be implemented solely by the Board or its membership. The EMTF suggests that the WLIA Board of Directors establishes a plan for implementing the recommendations. The plan should identify actions that the WLIA can pursue, along with actions that must be taken by other agencies or organizations.

3.1 Coordination

Data access and sharing between departments or jurisdictions is often dependent upon informal personal relationships developed over time based on trust, common goals, and in some instances, negotiated license agreements. If a key expert is unavailable due to unforeseen circumstances during an emergency or due to staff turnover, that institutional knowledge and trust may be lost. This highlights the need for metadata, for a "who to call" guidebook, and for statewide standards and systematic processes.

Bruce Oswald, retired assistant director and CIO, New York State Office of Cyber Security and Critical Infrastructure Coordination, developed recommendations for improving geospatial capabilities for disaster response. Four of the first five recommendations involved issues related to communication and coordination. As Mr. Oswald points out, having clear lines of communication and identified roles are essential during an emergency situation. Furthermore these issues can be addressed immediately and have significant beneficial impact.[9]

The number of local government interactive mapping websites is growing steadily in Wisconsin.[10] For example, Bay-Lake Regional Planning Commission (RPC) works with eight different counties, 17 cities, 39 villages, 120 towns, and the Oneida Nation of Wisconsin, for a total of 185 local units of government to deliver GIS data

[9] *Recommendations for Improvements to Geospatial Capabilities for Disaster Response*; Suggested by Bruce Oswald, Retired Assistant Director & CIO, NYS Office of Cyber Security and Critical Infrastructure Coordination. http://www.nsgic.org/committees1/documents/Oswald-Recommendations%20for%20Geospatial%20Improvements%20for%20Disaster%20Response.doc

[10] *Internet Map Servers in Wisconsin,* WI Department of Administration, accessed January 9, 2006, http://www.doa.state.wi.us/pagesubtext_detail.asp?linksubcatid=392

such as land use, zoning information, and future development over the Internet via a web mapping site. Web access to spatial data significantly reduces the amount of time needed for data sharing compared to ad-hoc requests.

The rising popularity of these interactive mapping sites is a valuable step in the right direction; however, they do not necessarily offer a complete solution for emergency managers:

- Even if data are available via a website, this alone does not guarantee the data is current.
- Web mapping sites do not always provide the needed functionality or allow users to combine local datasets with information from other sources. The data may be viewable via the web, but it may not be downloadable for use with desktop GIS clients.
- Due to security restrictions, access to the data may be limited to certain organizations and may not be available to all who need the data.
- The custodian may not offer any metadata or technical support with regard to appropriate use of the data.

Given the circumstances, Wisconsin needs improved coordination efforts to ensure geospatial assets are available to assist emergency managers as they plan for and respond to public safety issues. Multi-jurisdictional and multi-disciplinary collaboration facilitates spatial data acquisition, distributes costs, reduces duplication, and leverages expertise and capabilities. The following are a series of recommendations to improve coordination among groups involved in emergency management and response in Wisconsin.

3.1.1 Support the National States Geographic Information Council (NSGIC) recommendations for GIS coordination activities

NSGIC[11] is an organization committed to efficient and effective government through the prudent adoption of geospatial information technologies. Members of NSGIC include senior state GIS managers and coordinators; representatives from federal agencies, local governments, and private entities; academics; and representatives from other professional organizations. In 2004, NSGIC published a "State Model for Coordination of Geographic Information Technology (GIT)," [12] which is being accepted throughout the geospatial community as the optimum model for GIS coordination activities within states.

To better support interaction and coordination between all levels of government, NSGIC began to identify fundamental characteristics of effective statewide coordination of GIT. The end result was a listing of critical factors for measuring

[11] NSGIC website, http://www.nsgic.org/index.cfm
[12] See http://www.nsgic.org/states/statemodel_git.pdf

performance objectives and the criteria needed for an effective statewide GIT coordination program. These critical factors identified in the state model for coordination were intended as guidelines to be considered in the development and administration of any statewide GIT coordination effort. (See Appendix G)

Specific tasks:

- The WLIA board of directors should examine the nine NSGIC coordination criteria and work with the appropriate state and local organizations to promote and implement NSGIC's recommendations.

3.1.2 Develop a statewide geospatial strategy for emergency management

Using GIS to support emergency response activities gained national attention after 9/11, and again during the aftermath of Hurricane Katrina. Unfortunately, the deficiencies in GIS organizational structures were evident in both disasters, including a widespread lack of understanding regarding data ownership and data access policies.

If a major regional disaster were to strike Wisconsin today, it would be difficult to quickly and efficiently integrate state and local data to meet the needs of emergency managers. Few statewide standards are in place, we lack a common infrastructure on which to deliver data, and few formal data sharing policies exist between jurisdictions and agencies at all levels. Given events of the past, we can no longer rely on informal relationships.

To address these issues, we must develop a statewide strategy for the application of geospatial technology in emergency management. The organizational structure and authority of any working group tasked with developing a "statewide" geospatial strategy for emergency management must be clearly defined to help close the gaps in the deficiencies noted.

Specific tasks:

- Identify critical participants such as the WEMA, WEM, Land Information Officer Network (LION), state cartographer's office (SCO), and the state GIO.
- Develop the strategy in phases:
    a. Identify initial stakeholders.
    b. Develop organizational structure and designate clear roles and responsibilities for the working group.
    c. Identify stakeholders to participate in statewide strategy development.
    d. Develop a comprehensive and coordinated statewide plan to facilitate spatial data sharing.
    e. Define interim objectives and milestones, set timeframes for achieving objectives, and establish performance measures.

3.1.3 Identify emergency management and GIS related political and administrative leaders in Wisconsin

A complete and comprehensive list of key players in emergency management and GIS is needed to support emergency management-GIS operations throughout the state. This list must be readily available and reliable, and it must contain enough information to allow officials to contact the correct person as quickly as possible.

A number of organizations and agencies in Wisconsin have lists of people that could be used to establish a "master list." For example, WEM maintains a list of county emergency management directors; LION maintains a list of LIOs; and several agencies and organizations keep lists for specific topical areas such as floods, animal diseases, human health, and amateur radio operators. The state needs to incorporate all of these pieces into a coordinated system or database.

Specific tasks:

- Identify who is responsible for the administration of the list.
- Establish process to ensure the list is maintained for accuracy and currency.
- Establish procedures and protocols for determining access and restrictions to the list.
- Determine what levels of government are to be included.
- Include information about responsibilities of the individuals on the list for "24/7" response.

3.1.4 Establish guidelines for communication between WEMA and WLIA

WEMA is an association of people and businesses that are interested in promoting effective emergency management planning, training, and exercise programs throughout the state of Wisconsin. The purpose of WEMA is to advocate, promote and represent statewide emergency management interests in order to enhance the safety and security of all citizens. [13]

Communication is the key to success in all emergency response, and it needs to begin prior to actual occurrences of disasters. With this in mind, it is imperative for both WEMA and WLIA to begin the communication process as soon as possible.

[13] See http://www.wema.us/infopage.htm

Specific tasks:

- Invite a WEMA representative to the WLIA board of directors meetings and offer to provide a WLIA representative to WEMA board meetings.
- WLIA should send representatives to WEMA's annual conference and vice versa.
- Insert links on WLIA's website for WEMA's website and vice versa.
- Submit WEMA articles to the WLIA's *Land Records Quarterly* newsletter offering information about WEMA's activities.

3.1.5 Establish guidelines and standard operating procedures (SOPs) to improve communication between GIS and emergency management functions

Historically, Wisconsin's land information organizations (local, county, RPC, state) have had little contact with the emergency management community. Recently, however, some organizations have realized the important relationship between land information and emergency management. These organizations have developed relationships between the respective disciplines and fostered a mutually advantageous connection.

This connection can be fruitful to both, offering better spatial information to emergency management when responding to an event and/or planning for an event, and conversely, offering emergency management related information to the LIO and planning offices to assist them in making better decisions with regard to zoning, land use, and future development.

Specific tasks:

- Encourage county LIOs and associated emergency management directors to establish relationships with their RPCs, the state GIO, WEM, and SCO to ensure emergency managers have geographic data in emergency situations.
- Work with county LIOs and county emergency management to identify, develop, and document specific roles during an emergency.
- Work with county LIOs and emergency management personnel to develop SOPs to ensure smooth and efficient information sharing during an emergency.
- Foster a better understanding of (1) the needs, abilities, and roles of the respective professionals and (2) how they can better work together to improve emergency planning, response, recovery, and mitigation.

3.1.6 Develop a relationship between the emergency management community and state GIO

A relationship needs to begin between the emergency management community and the newly hired GIO.

Specific tasks:

- WLIA should contact WEM or WEMA to invite the GIO to attend the annual Governor's Conference on Emergency Management and the WEMA conference.
- The GIO and WEM representatives should be a part of the WLIA's workgroup to develop a strategic plan for GIS in Wisconsin.

3.2 Policies

Data sharing during an emergency is generally an ad hoc activity, often based on personal relationships and trust between individuals rather than on systematic processes. Some data are available to government or certain levels of government, but are not available to all participants who need it, such as private companies or nonprofit groups. The groups involved generally desire a data sharing mechanism or tool for obtaining the required data in the timeframe needed.

Under some circumstances, staff may be reluctant to share their GIS data for a variety of reasons (e.g., proprietary, cost recovery, privacy, security, and sensitivity). This often depends on staff preferences and on individual county policies, which are often informal; there is no consistent statewide policy that addresses what datasets should be made accessible and what should be restricted.

As an event unfolds, community EOCs need access to data and maps in real-time as new information becomes available. Those responding to the crisis at all levels of government will need access to this information immediately; they cannot afford to waste critical time trying to determine the appropriate procedures and protocols for acquiring or releasing spatial information and GIS data. Without widely adopted model data sharing agreements or licensing templates, and with potentially over 72 different information policies statewide, this could be administratively and financially prohibitive.

Clearly, a consistent framework that enables entities at all jurisdictional levels to communicate and coordinate with each other efficiently and effectively would better support collaboration for emergency management.

3.2.1 Identify barriers for inter-jurisdictional cooperation and coordination of emergency management-GIS related activities

During an emergency, the first responders have the heaviest burden as lives hang in the balance. Police, firefighters, EMS personnel, and other responders must work expeditiously and utilize every resource available to them to maximize their effectiveness. One resource that has proven to be highly effective in aiding emergency response is GIS. Almost every disaster has a significant geographic component. The logistics of responding involves, for example, the locations of routes, infrastructure, buildings, equipment, debris, people, hazards, nearby resources, and water.[14]

It is critical that federal, state, and local governments, along with private organizations, work together to allow for inter-jurisdictional cooperation that will build partnerships allowing information to be shared for hazard mitigation planning and emergency response.

Specific tasks:

- Establish institutional arrangements for data sharing as soon as possible.
- Establish communication protocols and participative commitment from public, private, academic, military, and native tribal communities for emergency management geospatial collaboration.
- Create and manage comprehensive memoranda of understanding for geospatial and supporting data sharing. Participate in appropriate forums across organizational entities where spatial data access issues are debated.
- Develop and propose standards to enhance efficiency and effectiveness in the maintenance and use of land information of value to emergency managers.
- Ensure that emergency managers, GIS coordinators, and LIOs sit on the same committees at all levels of government.
- Coordinate existing activities, standards, and policies of the WLIA, WEMA, LION, SCO, GIO, and WEM.

3.2.2 Identify spatial data needs for emergency management

The original intent of the Wisconsin Land Information Program (WLIP) was to meet the need to convert to electronic format the county land records information that was stored in a paper environment. While the main goal of the WLIP did not directly address issues relating to emergency planning and response, the WLIP was instrumental in developing the foundation of what land base layers and related databases needed to be included in all 72 county land records offices' GIS and in

[14]See http://www.co.brown.wi.us/land_information_office/GIS%20in%20Emergency%20Management.htm

turn became essential during emergencies. For instance, orthorectified aerial photographs and parcel information have proved valuable in response efforts to floods and tornadoes. But still there are large data gaps.

In 2002 the DHS, USGS, and the National Governors Association met to "define the needs and set forth the strategy for the creation of the *Homeland Security Infrastructure Program (HSIP).*"[15] As a result, a set of requirements was developed called the minimum essential datasets (MEDS), a defined set of critical infrastructure for urbanized areas. While MEDS was largely developed to support federal response and recovery efforts, it can be used as a basis for evaluating data gaps at the local and state level.

In order to identify data gaps in Wisconsin, a critical infrastructure list should be developed. However, critical infrastructure can be defined in many ways. State agencies will have a different view of what constitutes critical infrastructure compared to local governments. For example, the Wisconsin Department of Transportation (WDOT) will most likely view roads and bridges as critical, and while the Department of Agriculture and Trade and Consumer Protection (DATCP) will likely view the location of farms and food suppliers as critical. Any effort to develop a list should go beyond the MEDS and include both urban and rural features.

Lastly, once a list is developed, a significant effort will need to be made in identifying dataset custodians and acquiring funding for the development and maintenance of these datasets.

Specific tasks:

- Identify spatial data gaps.
- Develop a plan to address spatial data gaps (e.g., funding and custodianship).
- Identify and define potential legislation that may be required to ensure the effective and efficient use of land information for emergency management, within and across jurisdictions.
- Support the formation of a task force to identify and prioritize a detailed critical infrastructure list.

[15] Homeland Security Infrastructure Program Tiger Team Report; DHS, USGS, NIMA; September 2002.

3.2.3 Identify and synthesize information policies related to data security, data sharing, and public access of emergency management related spatial data

After the terrorist attacks of 9/11, homeland security concerns prompted the establishment of policies and statutes that restricted access to information, including spatial data that was once publicly available and used to meet a variety of needs. As a result, government entities now must weigh security concerns against the benefits of widespread use of spatial data.

Several fundamental but difficult questions need to be answered regarding data sharing and public access: *Who should share what information? When? How? Why? With whom?* Only a few national documents currently address these issues. These include:

- The 2004 RAND report, "Mapping the Risks: Assessing the Homeland Security Implications of Publicly Available Geospatial Information."[16]
- The Federal Geographic Data Committee's (FGDC) "Guidelines for Providing Appropriate Access to Geospatial Data in Response to Security Concerns."[17] This report offers a decision tree for providing appropriate access to geospatial data in response to security concerns.
- The DHS published a "Geospatial Enterprise Architecture" document to guide state and local government investments. This document is available by e-mailing gmo@dhs.gov.

As of yet, no consistent statewide policy or guidelines exist in Wisconsin that address what spatial datasets should be made accessible and to whom, what should be restricted, and who can make these determinations. One notable exception is the WDNR's "Water Supply System Information and Maps in Community Comprehensive Plans."[18]

Moreover, government entities at all levels in Wisconsin are developing their own policies for spatial data sharing and public access, often *without* regard for statewide emergency management needs or overall statewide goals. Thus, answering any question about data access on a regional or statewide level is virtually impossible,

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[16] Baker, John C. et al. "Mapping the Risks: Assessing the Homeland Security Implications of Publicly Available Geospatial Information." 2004. Prepared for the National Geospatial-Intelligence Agency. National Defense Research Institute, p. 6. RAND Website, Accessed January 16, 2006. http://www.rand.org/pubs/monographs/2004/RAND_MG142.sum.pdf

[17] FGDC. 2005. "Final Guidelines for Providing Appropriate Access to Geospatial Data in Response to Security Concerns," p. 1. FGDC Website, accessed January 17, 2006, http://www.fgdc.gov/fgdc/homeland/access_guidelines.pdf

[18] WDNR. 2003. Water Supply System Information and Maps in Community Comprehensive Plans – Addressing Security Concerns. WDNR Website, accessed January 20, 2006. http://dnr.wi.gov/org/es/science/publications/SS_988_2003.pdf

and obtaining data on a regional or statewide level is currently very difficult, if not impossible.

Specific tasks:

- Establish or assign an interagency workgroup or similar body to identify and synthesize information policies as well as relevant laws and court cases related to data sharing, data security, and public access of emergency management related spatial data.
- Create a centralized, statewide resource, such as a website, that would allow for the discovery, indexing, categorizing, and analysis of local and state spatial information policies.
- Develop and adopt statewide, emergency management spatial data policy standards or guidelines, including SOPs. [19]

- Develop guidelines to ensure compliance with appropriate sections of the Wisconsin State Statutes and federal law on information privacy and open records.

3.2.4 Revive the WLIP Annual Survey

In order to better prepare for any emergency and to avoid the problems identified after 9/11, it is in our best interest to identify critical datasets and data sharing issues prior to any emergency. The information collected through the WLIP annual survey met the business needs of the WLIP. It provided a strong understanding of data holdings in Wisconsin at the county level.

Unfortunately, the WLIP annual survey has been on hiatus for the past two years. Still, it is essential that a mechanism similar to the WLIP annual survey be implemented, preferably on an annual basis, and be expanded to include emergency management issues. Such a survey would need to inventory current data holdings, identify associated information policies, and assess GIS capacity and available staff so that we may evaluate our capabilities to react and respond to any disaster event.

Specific tasks:

- Create or revive an annual survey like the former WLIP survey that includes emergency management related questions. The RAMONA (random access metadata tool for online national assessment) survey promoted by the NSGIC is one option to explore.

[19] Standard Operating Procedures (SOPs) are formal written guidelines or instructions for handling events as they occur.

3.3 Infrastructure

In addition to significant coordination and policy issues that must be resolved, Wisconsin currently lacks a statewide, coordinated infrastructure to support seamless data sharing across municipal, county, and RPC jurisdictional boundaries. In many cases, data sharing in Wisconsin is achieved largely through informal relationships between people and organizations. The ad hoc nature of the current situation does not effectively meet the needs of emergency managers where timeliness and currency of data is critical.

The days immediately following 9/11 demonstrated the importance of GIS as an analytical tool. According to research conducted after the World Trade Center disaster, "geographic data and information systems (GIS) emerged as the most versatile analytical resource associated with the response."[20] Many of the datasets were unusable because analysts could not determine simple pieces of information that could have been easily captured in metadata. Information that seemed trivial prior to 9/11 proved extremely valuable. At what scale was the data collected? What is the vintage of the dataset? Some datasets were incomplete and some were not accessible or even usable. When the World Trade Center was destroyed, so was the city's EOC. Pier 92 was established as the new EOC. Those involved at Pier 92 believed many of the datasets they needed existed but did not know who owned the data or how to acquire it. Some of the greatest challenges pertained to data availability, the quality of the data, and the use and management of information.

The EMTF believes considerable energy must be devoted to solving our statewide infrastructure problem. By our definition, *infrastructure* includes the hardware, software, data, and staffing to support statewide data sharing. Further, we believe that emergency management can and should be a significant business driver for improving the status quo with regard to data sharing in Wisconsin.

3.3.1 Develop a statewide infrastructure plan to support data sharing at all levels of government in Wisconsin

Currently, Wisconsin lacks a common infrastructure on which data can be shared during a catastrophic emergency. If Wisconsin needed a large GIS mobilization to support an emergency response, how would one be put together? How would a county or city retrieve data in a timely fashion?

A report released by the State University of New York in Albany's Center for Technology in Government (CTG) highlighted two challenges that responders had to overcome after the 9/11 attacks on the World Trade Center. First, there was a need to replace the technology and no plan existed to replace (1) the data, (2) the

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[20] Sharon S Dawes, Thomas Birkland, Giri Kumar Tayi, Carrie A. Schneider. *Information, Technology, and Coordination: Lessons from the World Trade Center Response.* (June 2004)

hardware, and (3) access to software licensing. Second, a suitable facility needed to be identified to house a large mapping operation in order to rapidly meet the first responders' mapping needs.

"This effort demonstrated that a loss of hardware is less important than the loss of software and data if two conditions are met: software and data are properly backed up and maintained off site and it is possible to obtain the requisite hardware on short notice."[21]

Shortly after 9/11, the NSGIC board of directors adopted a set of recommendations that all states should consider. The EMTF believes these recommendations have merit and should be the basis for any discussion on future infrastructure planning:

Specific tasks:

- Develop a geospatial strategic requirements plan for cooperative efforts between state and local government organizations.

- Develop a single GIS infrastructure that will become the primary focus of managing geospatial data for emergency management activities.

- Create and maintain a current inventory of all geospatial assets (including data, hardware/software, equipment, and personnel).

- Establish communication protocols and participative commitment from public, private, academic, military, and native tribal communities for emergency management geospatial collaboration. Primary state GIS coordinators need to interact effectively with all local, state, federal, and private partners to inventory available data for metropolitan and rural areas to reflect the unique hazards faced in each setting.

- Create and manage comprehensive memoranda of understanding for geospatial and supporting data sharing. Participate in appropriate forums across organizational entities where spatial data access issues are debated. Establish institutional arrangements for data sharing as soon as possible.

- Identify and manage where essential geospatial data is stored. Increase accessibility to these data and reduce redundancy. Determine if that data is readily accessible to first responders and to emergency operations centers. Ensure that geospatial data is fully accessible to critical cooperating organizations within Wisconsin.

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[21] Sharon S Dawes, Thomas Birkland, Giri Kumar Tayi, Carrie A. Schneider. *Information, Technology, and Coordination: Lessons from the World Trade Center Response.* (June 2004) Page 19.

- Create and manage a comprehensive backup methodology for the geospatial data and systems.

- Establish and manage a team of established geospatial personnel that can reliably provide 24/7 expertise and equipment support for emergencies statewide.

- Evaluate and establish a geospatial preparedness metrics methodology.

- Evaluate, create, and manage an enterprise geospatial systems support infrastructure for analysis and mapping activities (e.g., HSPD-7), readiness assessments (e.g., HSPD-8), and incident management.

3.3.2 Identify funding strategies for deploying GIS infrastructure and support in emergency management

Since 9/11, the federal government has provided billions of dollars to state and local governments throughout the United States. In 2005 Hurricane Katrina left many communities in Louisiana, Mississippi, and Alabama in shambles, with the federal government providing billions of dollars for relief efforts.

The long-term impact of past funding remains to be seen, but state and local governments in Wisconsin should be prepared and have a plan to leverage additional funds when they become available. WLIA should play a role in helping emergency management organizations identify and develop future funding strategies.

Specific tasks:

- Identify and itemize all geospatial funding sources (e.g., National Spatial Data Infrastructure [NSDI] Cooperative Agreement Program grants and DHS equipment grants).
- Identify and list all contacts for each funding source.
- Establish and maintain formal communications with each funding organization.
- Coordinate a statewide geospatial funding strategy with the state GIO.
- Communicate the funding strategy with WLIA membership.

3.3.3 Develop GIS technical assistance for emergency managers

Emergency management organizations have long recognized the importance of maps in executing their mission of preparing for and recovering from disasters of all types. However, due to limited technical expertise, few of these same organizations have an understanding or appreciation for the capabilities of GIS.

The EMTF believes Wisconsin emergency managers could significantly benefit from having formal GIS technical assistance available. Some of these activities can be provided as ongoing activities of WLIA, WEMA, and various organizations that are involved with emergency management. However, there is a need to determine where the gaps are so that all emergency response agencies have appropriate access to GIS data and capabilities in a reasonable timeframe.

Two kinds of GIS technical support needs were identified:

- The development, documentation, and adoption of GIS technical standards are critical to meet the rising expectations of emergency management agencies.

- There is a clear need for direct technical assistance, including general education, training, user support, application development, application hosting services, data development, manipulation and aggregation, and mapping and analysis.

Specific tasks:

- Form a new task force to implement the following:
    - Identify and define needed GIS technical standards and guidelines to support data sharing and timely access to MEDS.
    - Assess the status and need for GIS technical assistance in Wisconsin emergency management agencies.
    - Develop a proposal for meeting the technical assistance needs of emergency management agencies.
    - Promote and advocate for the implementation of the proposal so that needed GIS technical assistance is made available.

As WLIA works on these recommendations, it will be critically important that it reaches out to GIS and emergency management professionals in a variety of organizations. WEM, WEMA, RPCs, academia, and the private sector can all play important roles in achieving these recommendations.

3.4 Education

Currently in Wisconsin, GIS is not being leveraged to its full potential for emergency management. Emergency professionals from all levels of government, as well as from other organizations, need to be made aware of what GIS data exists in the state, who creates and maintains it, and how it might be employed for emergency management planning, mitigation, response, and recovery.

WLIA can play a key role by facilitating communication between GIS and emergency management professionals and by providing educational outreach, training, and guidance.

3.4.1 Educate the emergency management community about GIS and other spatial technologies

In an effort to bridge communication between the GIS community and emergency management professionals, the WLIA could provide training opportunities for emergency management personnel to learn about the benefits of GIS and other spatial technologies. There are many positive outcomes that could be achieved by creating an education plan that targets emergency management personnel.

By creating on open dialogue, the WLIA in turn will gain a better understanding of emergency management business needs. In addition, promoting the use of GIS could help identify new funding for application development and data creation and maintenance, promote data sharing between jurisdictions, and generate increased involvement in WLIA.

Ideally, training workshops offered by the WLIA should bring GIS and emergency management personnel together so that they can learn each other's responsibilities, terminology, and procedures, thereby enabling them to operate as a team when called upon in the future.

Specific tasks:

- Support the formation of a special interest group to develop a cross-disciplinary training plan for emergency managers and GIS professionals.
- Offer targeted training workshops for emergency managers at the WLIA annual conference and offer to help WEMA develop training workshops at the WEMA annual conference.
- Develop and document proposed best practices for applying land information and GIS technology to assist in the objectives of emergency managers.
- Encourage WLIA members to attend the Annual Governor's Conference on Emergency Management and Homeland Security, sponsored by WEM.
- Publish emergency management GIS "success stories" in the WLIA *Land Records Quarterly*.

- Promote training workshops and presentations related to emergency management using GIS at Governor's, ESRI Wisconsin Users Group, and RPC conferences.

3.4.2 Communicate WEM GIS needs assessment to emergency managers and to the GIS community

In July of 2005, WEM released the final report of a comprehensive GIS needs assessment, which included interviews with federal, state, and local government agencies, as well as private and nonprofits organizations.[22] This report addressed issues related to data standards, data security, GIS technology needs, and more. In total, the report identified ten key findings, enumerated 46 project activities, and specified 95 business needs.

The EMTF endorses this report as an important first step towards developing a geospatial strategy for emergency management in Wisconsin. Effectively communicating the results of this report throughout the state is necessary in order to (1) garner widespread support and understanding from GIS professionals and emergency managers and (2) achieve the goals identified in this report in the most effective, efficient way.

[22] See http://emergencymanagement.wi.gov/announcements_detail.asp?annid=18

4.0 Conclusion

It is critical that the emergency management community and the geospatial community begin working together immediately to develop processes needed for the most effective responses to natural and manmade emergencies. It is not a matter of *if* but *when* the next major disaster will occur in the U.S. The events of 9/11 demonstrated to us all the value of GIS in emergency response and the importance of collaborative information sharing prior to the occurrence of a major event. Unfortunately, four years later in 2005, Hurricane Katrina further exposed deficiencies in these areas. The next major emergency could be in the Midwest and could directly affect the citizens of Wisconsin. Whether it will be a catastrophic natural event such as a massive flood or an avian flu outbreak, or an emergency situation created from a terrorist attack, we all must do our part to prepare.

This report outlined 15 separate recommendations, organized in four key areas: coordination, policy, infrastructure, and education. As a starting point, we believe GIS professionals and emergency managers must make a concerted effort to understand each other's needs and abilities. Both groups need to better understand how they can proactively lend their expertise during all stages of emergency management.

While the EMTF was chartered by the WLIA Board of Directors, and this report was developed for WLIA, many of our recommendations cannot be addressed solely by WLIA. Our hope is that the WLIA will engage with other organizations to foster relationships between the GIS and emergency management communities, help develop a statewide geospatial strategy, identify uses for GIS within emergency management plans, and provide guidance to improve information sharing and data access.

Appendix A - Task Force Members

Chair:

Chris Diller	Wisconsin Department of Military Affairs

Members:

Tony Bellovary	Bay-Lake Regional Planning Commission
Jane Grabarski	Adams County Emergency Management Office
Andrew Jennings	East Central WI Regional Planning Commission
Thom Jones	MDA Federal
Diane Kleiboer	Wisconsin Emergency Management
Linda C. Kollmann	Winnebago County Emergency Management
Mike Koutnik	ESRI, Minneapolis
Jim Lacy	Wisconsin State Cartographer's Office
Dave Levine	Winnebago County Planning/GIS
Kent MacLaughlin	Wisconsin Emergency Management
David Mockert	Wisconsin Department of Administration
Jason Nyberg	Ayres Associates
Ken Parsons	Wisconsin Department of Natural Resources
Lea Shanley	UW-Madison Land Information & Computer Graphics Facility
Jerry Sullivan	Wisconsin Department of Administration
Dick Vraga	United States Geological Survey

Appendix B - Overview of Emergency Management Plans in Wisconsin

Listed below are plans, reports, and manuals created and maintained by WEM. Most, if not all, of these have a spatial component to them.

The second page is a list of plans that the counties create and maintain.

WEM State Plans

- State EOP[1] (Emergency Operations Plan) includes:
    1. Basic Plan
    2. Annex A – Direction and Control
    3. Annex B – Communication and Warning
    4. Annex C – Resource Coordination
    5. Annex D – Law Enforcement
    6. Annex D A1 WMD – Weapons of Mass Destruction
    7. Annex E – Evacuation and Shelter
    8. Annex F – Human Services
    9. Annex G – Public Works and Engineering – Assessing Damage
    10. Annex H – Health, Medical, and Mortuary Services
    11. Annex H – Emergency Animal Disease
    12. Annex H A2 REP – Radiological Emergency Preparedness
    13. Annex J – Public Information
- COOP – continuity of operations
- COG – continuity of government
- Hazard mitigation
    1. State hazard mitigation plan ftp://doaftp04.doa.state.wi.us/wem/Hazard_Mitigation_Plan/Index.htm
    2. Hazard analysis for the state of Wisconsin http://emergencymanagement.wi.gov/docview.asp?docid=116
    3. Repetitive loss report http://emergencymanagement.wi.gov/docview.asp?docid=117
    4. Administrative plan for HMGP, PDM-C, and FMA
    5. State facilities database
- Public assistance
    1. Administrative plan
- Disaster response and recovery
    1. Response and recovery plan
    2. Wisconsin natural disasters report[2] – http://emergencymanagement.wi.gov/docview.asp?docid=105
    3. Debris management
    4. Documenting disaster damages
- GIS needs analysis http://emergencymanagement.wi.gov/docview.asp?docid=3385&locid=18
- Duty officer
    1. Duty Officer Manual

    2. Annual Report
- Mobile command center(s)
    1. MCP Manual
- Radio room
    1. WEM EOC Radio Room (Ham Shack) Activation Plan – http://emergencymanagement.wi.gov/docview.asp?docid=1125&locid=18
- Emergency police services
    1. Regional map – http://emergencymanagement.wi.gov/docview.asp?docid=1138&locid=18
    2. Prison plans
    3. Light tower/radio repeater deployment procedure
- Spill response map

County Plans

- County EOP
    1. Counties with nuclear plants have special sections pertaining to special needs.
    2. EPCRA (Emergency Planning and Community Right to Know Act) – Countywide Strategic Plan
- Countywide all-hazard mitigation plans
- Flood mitigation plans
- Offsite emergency response plan for facilities that exceed EPCRA thresholds. Produced by facility in cooperation with LEPC (local emergency planning committee).
- EAP (emergency action plans) for high hazard dams (created by dam operators)
- Special events planning (e.g. Rhythm and Booms, golf tournaments, professional sporting events)
- DNR – Exercise plan for water supply
- DNR – Exercise plan for wastewater treatment

Appendix C - Emergency Management Activity in Surrounding States

Compiled by Thom Jones
MDA Federal
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As part of our background research, the EMTF compiled information on emergency management activities in the states surrounding Wisconsin. This information was obtained from websites and/or telephone discussions with knowledgeable officials.

Michigan

The Michigan State Police have taken the lead on emergency management GIS, although it seems for obvious reasons to be oriented to incident command applications. It is a web-based system and is therefore accessible from anywhere with Internet access.

Michigan's eventual goal is to provide access to the system to all First Responder organizations.

Michigan's Critical Incident Management System (CIMS) – E Team
In 1998 the Emergency Management Division of the Michigan State Police (EMD/MSP) examined alternate operation arrangements for the State Emergency Operation Center (SEOC). The SEOC had been operating with a paper-based information management system since the early 1980s. Major disasters in 1997 and 1998 stressed the system when trying to keep pace with both response and recovery operations using manual processes and paper documents. Interoperability had become a critical problem that affected the ability to carry out an efficient response.

To address these issues, the EMD contracted with Science Applications International Corporation (SAIC) to analyze SEOC operations and design, develop, and implement an integrated GIS and an enterprise-wide CIMS for the state of Michigan. The E Team web-based CIMS software application was selected as the preferred information management tool. EMD purchased an Enterprise Level License for the E Team deployment to the governor's office; all 20 state agencies; over 110 local emergency management programs; numerous local police, fire, hospital/medical facilities; emergency medical technicians; and other critical infrastructures within Michigan. Because E Team is a web-based application, users can access the system regardless of their location. E Team enables the state to easily share disaster response and recovery information in real-time with affected local response organizations, federal agencies, neighboring states, the Province of Ontario, and appropriate non-governmental response and recovery organizations such as the American Red Cross.

E Team allows users to summarize and track emergencies in incident reports, enter messages in the duty log reports, monitor resource requests and critical assets, view

agency and jurisdiction readiness in their respective situation reports, view incidents and other geographic information on a map, as well as upload and access reference documents right from the E Team system. These are just a few capabilities of E Team; it is a very dynamic system that facilitates communication and data exchange within and between organizations.

How the statewide system is structured
The Michigan State Emergency Operations Center (SEOC) is currently in the process of creating a statewide E Team system with several servers distributed across the state for users to access. All of these servers will replicate with each other so that they all will contain the same information. This builds in a great factor of redundancy across the system – meaning if one server goes down a user can log into another E Team server and continue with the response. There are currently several E Team servers housed at the SEOC that it and state agency users can access. There are also two regional servers in place in Grand Traverse and St. Clair Counties. Local governments and other local response organizations are able to access the regional servers at this time, once they have been through an E Team training session.

According to the last progress report, 21 of 29 deliverable products or services are either on or ahead of plan as of 05 January 2006.

http://www.michigan.gov/msp/0,1607,7-123-1593_33474_33479-103784--,00.html

Indiana

The Indiana Department of Homeland Security (IDHS) is responsible for both hazard mitigation and emergency response. Like the WLIA EMTF they realized that terrorism is not the only potential hazard to a Midwestern state.

A well-evolved program that originated as an anti-terrorism plan was described in GeoComm (www.geocomm.com) in 2003:

The Indiana Counter-Terrorism and Security Council (C-TASC) was created by the Governor of Indiana in response to the 9/11 attacks. Its mission is to develop and implement a comprehensive state strategy to address terrorism in Indiana, and coordinate activities between the State and the Department of Homeland Security. As a key part of this mission, C-TASC contracted with Innovative Mapping Solutions to integrate GIS technology into the State Emergency Management Agency's current Comprehensive Emergency Management Plan (CEMP).

The CEMP covers all hazards most likely to affect Indiana. The state's CEMP is tied directly to the federal government's disaster plans. Innovative Mapping Solutions analyzed Indiana's CEMP to determine where and how GIS could benefit all agencies.

The result of this research and analysis is an implementation plan outlining how best to incorporate GIS technology – data, software and applications – to provide a comprehensive solution for Indiana.

The new plan defines over 300 GIS tasks to support emergency support functions for hazard mitigation, preparedness, and response and recovery efforts by addressing the following elements:

- Communication and warning
- Public information
- Fire fighting
- Health and medical
- Medication and medical supply
- Search and rescue
- Hazardous materials
- Law enforcement
- Shelter and mass care
- Food and water
- Animal health and care
- Donations/volunteer management
- Transportation
- Public works and engineering
- Energy (utilities)
- Damage assessment
- Terrorism consequence management

Several related off-the-shelf GIS applications and data available to state and local governments are also addressed in the plan. These include:

- ADIOS - Automated Data Inquiry for Oil Spills
- ALOHA - Aerial Locations of Hazardous Atmospheres
- CAMEO - Computer Aided Management of Emergency Operations
- CATS - Consequence Assessment Tool Set
- CVAT - Community Vulnerability Assessment Tool
- GNOME - General NOAA Oil Modeling Environment
- HAZUS - Hazard US (Natural Hazard Loss Estimation Methodology)
- Inland Waterways Spill Response Mapping Project/Inland Sensitivity Atlas

With GIS as a key component for emergency management and homeland security in Indiana, federal funds and industry grants are being used to implement the new plan. Clifford Ong, director of C-TASC, has already created a new "IndianaMAP Crisis and Response Mapping Center" that will provide GIS data, technology, and expertise to support the state's emergency management response.

Additional information was retrieved in email and phone conversations. The Indiana DHS (IDHS) is not creating a separate emergency management GIS but instead a “plus” set of critical infrastructure datasets for use with the “IndianaMap,” its piece

of the USGS "National Map." These critical infrastructure datasets are used both in planning and mitigation, as well as in actual response mode.

The "plus" data are served from their home repositories via ESRI ArcGIS v.9.0 and web services (ArcSDE and ArcIMS). IDHS does not host any of the data. Its authorized users include the IDHS plus all public safety, environmental, health, animal health, and military departments of the state government, as well as local emergency management users. Individual departments maintain the data. Security is achieved through database and application level access controls. At present, there is no statutory protection for critical infrastructure, but in this "stewardship" model of data distribution, since IDHS does not own the data, it cannot release the data to the general public. Work is continuing in this area.

Roger Koelpin, GIS Coordinator, IDHS: (317) 232-0181

C-TASC's website is worth spending some time for ideas:
http://www.in.gov/ctasc/mapping/

As well as the IDHS website:
http://www.in.gov/dhs/

Illinois

Responsibility for emergency preparedness and response lies with the Illinois Emergency Management Agency (IEMA). Its website is oriented to providing the average citizen with ideas on how to prepare for and respond to an emergency, and does not contain any information on statewide GIS applications as they pertain to emergency planning or response.

The lead for GIS (not titled as "GIS coordinator") was reached by telephone and was willing to share information. The state does maintain availability to GIS layers using the ESRI ArcGIS platform. There are two sets of data layers: non-sensitive and sensitive. The former are available publicly via a clearinghouse. Sensitive data are not yet available from a clearinghouse; they must at present be individually requested from IEMA. A future goal is to make these data available to authorized users with a password-controlled system.

The emergency management GIS data reside on a statewide network via dedicated terminals. It is intended as an incident-based decision support tool, but is also used for pre-planning. Another future goal is to develop a web-based application that would be similarly restricted to authorized users only. Additionally, funding is expected in next year's budget to include a full-time GIS technician position. At present it is not known if this position will be a coordinator or to whom this person will report.

Limiting access to critical infrastructure data in Illinois is managed under state statute. The Illinois Freedom of Information Act (FOIA) law states that although state funding may be used to create the GIS database, the state is under no

obligation to share such data with the general public. The GIS lead recommends ensuring that a statutory protection of similarly sensitive data layers be prepared at the outset of a statewide emergency management GIS development campaign.

The GIS is available for use by any authorized user of the state EOC. IEMA shares their data with local governments and statewide agencies by official request. These agencies will often take the statewide data and make corrections or additions, returning the updated information to the state. Database maintenance is a major activity at IEMA, and the coordinator recommends using a "link" approach as opposed to a "clearinghouse" approach wherever possible. This allows each link contributor to maintain its own data, reducing the need for multiple corrections at multiple levels of government, and reducing the demand on the statewide coordinating agency for database maintenance.

The foundation of the GIS is statewide street data with census data attached from TeleAtlas (formerly GDT). These data are updated by subscription every six months. Additional layers are linked from other statewide agencies with GIS capability (e.g., state police, DNR, emergency management). Additionally, federal GIS data from The National Map (such as wetlands) are available on an as-needed "pay-to-play" basis.

The GIS lead strongly recommends polling the state government to determine what agencies already use GIS and what type (and who therefore have data), and similarly polling to locate GIS user resources to assist in GIS exploitation in an emergency. The IEMA has too few GIS-qualified employees to provide long-term GIS support in the event of a long-term disaster. By maintaining a list of state employees with GIS background, and with a little advance training on the database available, IEMA has a ready on-call cadre of emergency GIS technicians who can be mobilized quickly to assist in an emergency.

Cheryl Roethlinger, GIS Lead, IEMA: (217) 785-9908 (Note: This is not her full-time assignment.)

Website: http://www.state.il.us/iema/

Iowa

Responsibility for emergency preparedness and response lies with the Iowa Department of Public Defense. Within that department is the Homeland Security and Emergency Management Division, which has responsibility of planning for and responding to emergency events, including terrorist attacks. The website does not contain reference to GIS activities. Telephone contact was required. According to the website, the Division of Homeland Security and Emergency Management is a recent addition to the Department.

Like its neighbors Nebraska and Missouri, the Iowa state government does not have a central GIS coordinator. Nonetheless, they have extensive GIS datasets that are managed through the Iowa Geographic Information Council, made up of state

agency representatives and representatives of Iowa's two major universities, Iowa State University at Ames, and the University of Iowa at Iowa City. There are extensive agreements between departments for the sharing of critical infrastructure data and other information through memoranda of understanding (MOUs).

Critical infrastructure data are protected through state statute (Iowa Code Chapter 22) that allows release only to authorized users. These layers include transportation and census data (updated every 6 months from TeleAtlas, formerly GDT), plus the holdings of the Iowa Department of Transportation and Iowa Department of Natural Resources, and USDA-NRCS imagery for the entire state. Other imagery sets and more detailed transportation data are available from individual counties.

The various data layers at present reside on the networks of the member organizations and institutions. It is possible through a state network to access various data layers in time of crisis using the ESRI ArcGIS platform. The data may be served to authorized users (password protected) via either ESRI ArcIMS or MapServer (University of Minnesota, public domain software).

John Paoli, Emergency Management Division: (515) 323-4384

Website: http://www.iowahomelandsecurity.org/asp/about_HS/index.asp

Minnesota

The Emergency Preparedness Committee of the Governor's Council on Geographic Information works to organize the GIS community to help minimize the impact of, recover from, and avoid natural- and human-caused emergencies in Minnesota. Responsibility for response lies with the Homeland Security and Emergency Management Division of the state government.

The Council has a published work plan with the following items:

- Approach from a statewide perspective
- Define multi-level government responsibilities
- Develop emergency response contacts and outreach
- Clarify relationship with MetroGIS

Workgroups are being formed for three focus areas:

- Data coordination, standards, and development
- Build relationships with the emergency management and response community
- Build awareness in the GIS community and coordinate efforts between metropolitan and state interests

The MetroGIS Emergency Management Workgroup (seven counties around the Minneapolis-St. Paul area) has made significant progress in this area.

http://www.gis.state.mn.us/committe/emprep/

http://www.metrogis.org/data/info_needs/emergency_prep/index.shtml

Appendix D - Flood Maps and Data Layers

National Flood Insurance Program Maps

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) depict flood risk information and serve as the primary source for determining the relationship between, for example, flood hazard zones, structures, streets, and jurisdictional boundaries. Scales range from 1:4,800 to 1:24,000. In the mid-1990s, FEMA began digitizing existing FIRMs, which are called Q3s. But, as a federal report concluded, cited by Monmonier (1997, 107), FIRMs and resulting Q3 datasets frequently are outdated, inaccurate, or difficult to obtain.[23] In Wisconsin, for example, 30% of the effective map panels were 10 to 15 years old, while 33% were more than 15 years old. Furthermore, these maps do not have an updated road network and in many instances do not include streams that could affect homes during flooding events.[24]

Thus, FEMA initiated a map modernization initiative in 2003 in collaboration with state agencies. As part of this process, the WDNR Floodplain Management Program (http://www.dnr.state.wi.us/org/water/wm/dsfm/flood/title.htm) is generating the updated Digital Flood Insurance Rate Maps (DFIRM) database for every county in Wisconsin. DFIRMs are generated from better topographical data, are quality assurance/quality control (QA/QC) tested, and will be available in GIS format. Because of the improved accuracy over the old FIRMs and Q3, DFIRMs can be used for planning, permitting, and regulatory purposes. To this end, the WDNR is collecting planimetric data (such as roads, hydrography, structures, bench marks, and elevations) and topographic data directly from counties and communities. This information will be viewable within the WDNR Web Viewer, which is discussed below. The WDNR also is collecting and creating flood hazard boundaries, cross sections, and hydrologic and hydraulic models, which also will be made available via the Internet when they are finalized. Through the WDNR Web Viewer, all of this data will be viewable and some will be downloadable. In addition, the data will be maintained and be made available via CD, DVDs or external hard drives. [25] This entire process may take up to five years to complete.

Currently, the WDNR Floodplain Management Program enables public access to scanned existing FEMA paper maps that have been geo-registered through its

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[23] Monmonier, Mark. 1997. Cartographies of Danger: Mapping Hazards in America (Chicago: University of Chicago Press), p. 107; Interagency Floodplain Management Review Committee, *Sharing the Challenge: Floodplain Management into the 21st Century* (Washington, D.C., 1994), 100.

[24] Lulloff, Alan. 2003. *Flood Map Modernization in Wisconsin*, Wisconsin Department of Natural Resources Floodplain Management Program, published December 17, 2003, accessed January 6, 2006, http://www.dnr.state.wi.us/org/water/wm/dsfm/flood/mapping.htm

[25] Schwoegler-Boos, P Amanda L. Map Modernization Project Manager, Floodplain Management Program, Bureau of Watershed Management, WDNR. Personal communication, December 21, 2005.

interactive web-mapping site (http://www.dnr.state.wi.us/org/water/wm/dsfm/section/mapindex.htm), although these maps are not official and therefore cannot be used for zoning purposes. These maps can be viewed in combination with USGS topographic maps, air photos, and historic flood photos and recorded flood elevations where available. Users also can access the Wisconsin Floodplain Analysis database as well as the Floodplain Insurance Studies and Engineering Input Models, but these would require an engineer or consultant to evaluate properly.[26]

Flood Insurance Claims
The National Flood Insurance Program (NFIP) compiles a database of flood insurance claims (which includes repetitive loss properties) with the property address, the name and address of the property owner, the amount and date of the loss due to flooding, as well as other relevant information. For example, it could include "a summary table of flood-related information, a digital photograph, a GIS map showing the location of the structure in relation to the 100-year (or 1% chance) floodplain, and recommendations for mitigation."[27] Due to proprietary and privacy concerns however, access to this database is restricted. This database can be accessed by state agencies, such as WEM, and by local communities for planning purposes, but other emergency-related organizations, such as the Association of State Floodplain Managers, may have a difficult time obtaining access.[28] Needless to say, this information is not available for download over the Internet and would have to be obtained in advance.

Flood maps of ongoing events
These maps could be obtained from aerial or satellite imagery and overlaid with other datasets to determine impacted critical facilities or washed out roads, bridges, and railroads.

Four other priority data layers for flood hazard management include:

- **Digital Elevation Models.** Historically, the USGS has maintained nationwide elevation datasets, but the USGS 30-meter statewide DEM is not sufficient at the county level for the creation of FEMA maps.[29] Rather, topographic datasets adequate for floodplain mapping are being generated by

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[26] In addition, the Mapping Information Platform (MIP), which is part of FEMA's Federal Insurance and Mitigation Administration's Multihazard Mapping Initiative, supplies multihazard maps over the Internet (http://www.hazards.fema.gov; https://hazards.fema.gov/femaportal/wps/portal).
[27] *Using GIS for Floodplain Management* , Maryland Dept of Environment, http://www.mde.state.md.us/Programs/WaterPrograms/Flood_Hazard_Mitigation/floodMgmtGis/index.asp
[28] Alan Lulloff, Project Manager, Association of State Floodplain Managers, Inc., personal communication, December 13, 2005.
[29] Bellovary, Tony. Bay-Lake Regional Planning Commission, Wisconsin. Personal communication with Lea Shanley, December 14, 2005.

local governments, often in collaboration with the WDNR Floodplain Management Program for the FEMA remapping effort (e.g., high-accuracy LIDAR with bare earth points and surface models, derived contours and break lines).[30] Redistribution agreements with individual counties may limit access to a statewide compilation of these datasets.

- **Road Centerlines and Bridges.** These are needed to evaluate evacuation routes and carrying capacity and to assess potential for submersion. Local roads data can be obtained through the WDOT Wisconsin Information System for Local Roads (WISLR) (http://www.dot.wisconsin.gov/localgov/wislr/); however, only authorized representatives of local government are eligible to obtain access privileges, and access requests may require a few days to process and to confirm registration. Similarly, bridge information can be accessed through a restricted WDOT website. Counties also maintain this information.

- **Critical Facilities**. Examples include locations of fire stations, police stations, hospitals, nursing homes, day care facilities, schools, immediate care clinics, refugee shelters, airports, bus stations, and so forth; and

- **Building footprints.** These are used in combination with the floodplain boundaries to determine the total number of structures and buildings that may be at risk. Critical facilities and building footprints largely come from local GIS offices, and in some instances, from regional planning commissions. In Wisconsin, critical facilities, for example, must be identified for county All Hazards Mitigation Plans.

Additional flood-relevant GIS data layers include:

- **Railroad centerlines** (WDOT)

- **Stream centerlines** (local government; WDNR Flood Management Program; WDOT, USGS[31]). The WDNR is mapping the sinuosity of stream channels at scales of 1:1000 and 1:6000 as part of the modernization effort.

- **Utility lines** (private companies)

- **Pipelines** (Wisconsin Public Service Commission, Pipeline Safety Program; and, U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety [OPS],

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[30] Schwoegler-Boos, P Amanda L. Map Modernization Project Manager, Floodplain Management Program, Bureau of Watershed Management, WDNR. Personal communication with Lea Shanley, December 21, 2005.

[31] Walker, J.F. and W.R. King. 2005. *Water-Resources Investigations Report 03–4250: Flood-Frequency Characteristics of Wisconsin Streams*. USGS and WDOT. Published September 1, 2005, accessed January 6, 2006, http://pubs.usgs.gov/wri/wri034250/

http://www.npms.phmsa.dot.gov/). There are roughly 68,631 miles of hazardous liquid and natural gas pipelines in Wisconsin, according to the OPS website. "Prior to 9/11, OPS made pipeline maps universally accessible through an online mapping application. At this time [however], OPS is providing detailed pipeline data [including GIS data] to pipeline operators, and local, state, and federal government officials only [including emergency responders]."[32] All applicants are screened in advance and so access may take time. Data is proprietary.

- **Culverts and smaller structures** (WDNR Flood Management Program)

- **Dam inventory and failure inundation zones** (WDNR Dam Safety Program, http://www.dnr.state.wi.us/org/water/wm/dsfm/dams/datacentral.html; also Public Safety Commission). A statewide dam GIS dataset is available for download over the Internet but is nearly two years out of date; on the other hand, requests for current datasets may be made, but may take time to process and a fee may be assessed.

- **Levies** (Local government; WDNR Flood Management Program). With few exceptions, levies are monitored by local communities without state oversight. Thus, a statewide levies inventory does not exist; information regarding levies is largely in hardcopy format and maintained by the local communities. Ideally, a statewide or nationwide inventory of levies should be compiled, including maps depicting "residual risk" for adjacent areas that may be affected by levy failure. Homeowners may not have insurance as they are not in the official floodplain, but if their community is participating in the FEMA Flood Program, they can purchase flood insurance. Furthermore, residual risk and inundation maps could be used to target residents for educational programs.

- **Property parcel points or parcel boundaries, building footprints and lowest adjacent grades/elevations above water** (County LIO or emergency management). This data may not exist or may not be complete for all counties.

- **Locations of hazardous materials and bulk storage facilities** (County LIO or emergency management). This includes location address, location within building, and owner address. In most communities, these locations exist only in hardcopy tabular format.

- **Coastal erosion susceptibility** (UW SeaGrant, WDNR, RPCs).

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[32] Office of Pipeline Safety, accessed January 6, 2006, http://primis.phmsa.dot.gov/comm/Security.htm

- **Aerial imagery, digital orthophotography, satellite imagery, or LIDAR** (e.g., county, RPC, WDNR; USACE).

- **Driveways or access points for E-911** (county LIO or emergency management). This data may not exist or be complete for all counties.

Appendix E - Acronyms and Abbreviations

AHMP	All Hazards Mitigation Plan
ArcIMS	Arc Internet Map Server
COGO	Coordinate Geometry Computations
COOP	Continuity of Operations
COG	Continuity of Government
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
DHS	Department of Homeland Security
E-911	Enhanced 9-1-1
EAP	Emergency Action Plan
emergency management	Emergency Management
EMP	Emergency Management Plan
EMS	Emergency Medical Service
EMTF	Emergency Management Task Force
EOP	Emergency Operations Plan
EPCRA	Emergency Planning and Community Right to Know Act
ESRI	Environmental Systems Research Institute
FGDC	Federal Geographic Data Committee
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FTP	File Transfer Protocol
GIO	Geographic Information Officer
GIS	Geographic Information System
GOS	Geospatial One Stop
HSPD	Homeland Security Presidential Directive
HSWG	Homeland Security Work Group
IS/IT	Information System/Information Technology
LiDAR	Light Detection and Ranging
LIO	Land Information Officer
LION	Land Information Officer Network
MCP	Mobile Command Post
MEDS	Minimal Essential Dataset
MOU	Memorandum of Understanding
NENA	National Emergency Numbering Association
NACO	National Association of Counties
NSDI	National Spatial Data Infrastructure
NSGIC	National States Geographic Information Council
OGC™	Open Geospatial Consortium
OPS	Office of Pipeline Safety
RPC	Regional Planning Commission
SARS	Severe Acute Respiratory Syndrome
SCO	State Cartographer's Office
SOP	Standard Operating Procedure
URISA	Urban Regional Information Systems Association
USACE	United States Army Corps of Engineers

USGS	United States Geological Survey
WDNR	Wisconsin Department of Natural Resources
WDOA	Wisconsin Department of Administration
WDOT	Wisconsin Department of Transportation
WISLR	Wisconsin Information System for Local Roads
WEM	Wisconsin Emergency Management
WEMA	Wisconsin Emergency Management Association
WLIA	Wisconsin Land Information Association
WLIP	Wisconsin Land Information Program

Appendix F - Information Policy Resources for Homeland Security

Compiled by L. A. Shanley, the National Consortium for Rural Geospatial Innovations (RGIS), Land Information & Computer Graphics Facility, University of Wisconsin-Madison, on behalf of the Wisconsin Land Information Association (WLIA) Information Policy and Emergency Management Task Forces.

Disclaimer: The following list of resources is not comprehensive and may not be up-to-date. It is provided for informational purposes only. See also the WLIA Website (http://www.wlia.org) for a more extensive version.

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http://www.jud.state.ct.us/external/supapp/Cases/AROcr/CR274/274CR82.pdf

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Appendix G - NSGIC Coordination Criteria for GIT

States need to establish strong coordination efforts to minimize the costs and minimize the impact on existing efforts. Also, a cooperative approach ensures that opportunities are leveraged to benefit all levels of government. Significant cost savings can be realized through coordinated efforts using the "Collect Data Once and Use It Many Times" approach employed by many states and endorsed by NSGIC. Additionally, if the federal government places demands on local governments, independent of the states, there are no assurances that the needs of the states will be met and significant collaborative assets may be misdirected or inefficiently utilized.[33]

The NSGIC believes the following nine criteria are needed for effective geospatial data coordination in a state:

1. A full-time, paid coordinator position is designated and has the authority to implement the state's business and strategic plans.

   Explanation: Many states have created one or more full-time positions to oversee coordination of geospatial technologies. These individuals are responsible for implementing the state's business plan and are typically assigned to the Governor's office, Chief Information Officer (CIO), Budget Department, or the Technology Office. In some states, these duties fall on a volunteer, and in other states no one is willing to assume this role. It is presumed that having a full-time paid individual is advantageous and that a significant portion of his or her energy is channeled into ongoing statewide coordination council activities.

2. A clearly defined authority exists for statewide coordination of geospatial information technologies and data production.

   Explanation: A responsible individual or group has been designated in many states through executive orders, budget authorizations, or legislation. These individuals, or groups, are usually better able to deal with difficult coordination issues since they are empowered to perform this function. In other cases, "all volunteer" efforts are very effective at coordinating statewide activities through consensus building. In some instances, these groups are recognized as a "clearly defined authority," although they have no specific powers.

3. The statewide coordination office has a formal relationship with the state's Chief Information Officer (or similar office).

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[33] NSGIC State Model for Coordination of Geographic Information Technology, http://www.nsgic.org/states/statemodel_git.pdf

Explanation: Geospatial technologies are clearly a component of any state's information technology architecture, but they are not always viewed as such by "old school" IT leaders. A close relationship with the state CIO is essential to move major geospatial technology initiatives forward.

4. A champion (politician or executive decision-maker) is aware and involved in the process of coordination.

   Explanation: A visionary political champion who understands geospatial technologies is a valuable ally that can help obtain recognition and funding to support new initiatives. Without a strong political champion, new initiatives often fail.

5. Responsibilities for developing the National Spatial Data Infrastructure and a state clearinghouse are assigned.

   Explanation: The responsibility for the component pieces of the NSDI should be assigned to appropriate staff and agencies to ensure that stewards are identified, and to prevent duplication of effort. Assignment of responsibilities should happen in advance of actual need to ensure that the appropriate activities are appropriately planned and incorporated into the state's business plan.

6. The ability exists to work and coordinate with local governments, academia, and the private sector.

   Explanation: Each state must have the capability to routinely meet and coordinate with all other sectors. Safeguards should be developed to ensure that the needs of other sectors can be incorporated through consensus building activities.

7. Sustainable funding sources exist to meet projected needs.

   Explanation: Sustainable funding is the foundation of effective partnerships. Data production tends to be the highest component cost for implementation of geospatial technologies and most users have requirements for continuous updating of data layers that requires a steady fund source. Effective consortia can only be established when each of the players brings something to the partnership and non-lapsing funds help stabilize partnerships.

8. Coordinators have the authority to enter into contracts and become capable of receiving and expending funds.

   Explanation: To be effective, individual state GIS coordinators or the agencies identified as the stewards for the component pieces of the NSDI must be able to readily contract for software, systems integration, training,

and data production costs. Often partnerships can be "brokered" to capture end-of-year funds when contracting mechanisms are already in place.

9. The federal government works through the statewide coordinating authority.

   Explanation: It is essential that federal agencies use statewide GIS coordination offices and councils as a type of "clearinghouse" to make sure that grant opportunities are being used wisely to implement the business plans of the states. Going through the coordination offices and councils will also help to minimize duplications of effort.

Appendix H - Wisconsin Emergency Management

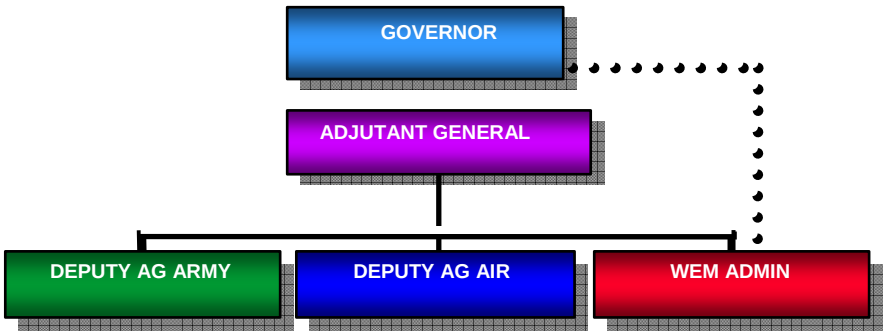
History of Wisconsin Emergency Management (WEM) - Chapter 166 Replaced the Wisconsin Civil Defense Act of 1951, organized and defined the powers and duties of the Division of Emergency Management and county emergency management agencies.

CHAPTER 166
EMERGENCY MANAGEMENT
166.01 Declaration of policy.
166.02 Definitions.
166.03 Emergency management.
166.04 State traffic patrol and conservation warden duties during civil disorder.
166.05 Emergency seat of state government.
166.06 Emergency temporary locations of government for counties, towns and municipalities.
166.07 Succession to local offices.
166.08 Succession to office.
166.09 Public shelters; immunity from civil liability.
166.10 Preservation of essential public records.
166.15 Radioactive waste emergencies.
166.20 Hazardous substances information and emergency planning.
166.21 Emergency planning grants.
166.215 Hazardous substance emergency response.
166.22 Local agency response and reimbursement.
166.23 Emergency powers of cities, villages and towns.
166.30 Emergency management assistance compact.
http://folio.legis.state.wi.us/cgi-bin/om_isapi.dll?clientID=28583065&infobase=stats.nfo&j1=166&jump=166&softpage=Browse_Frame_Pg

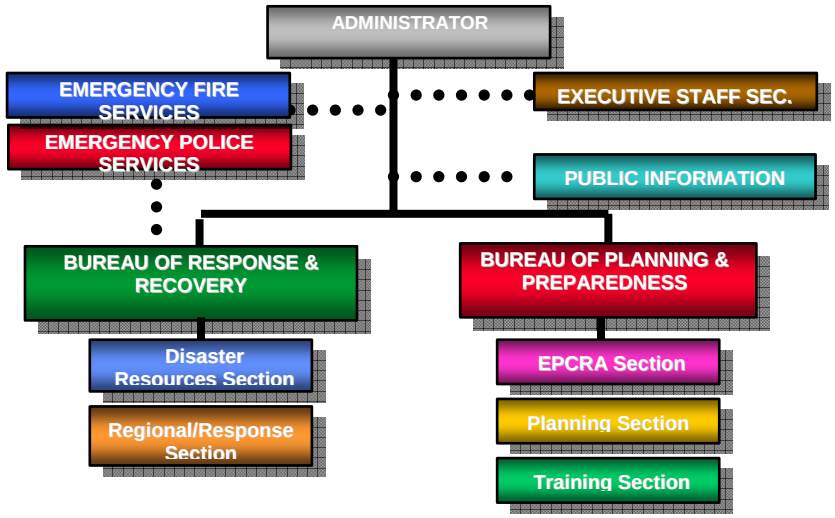
There are 4 phases of Emergency Management and each phase can benefit from GIS enhancements. The phases are:

1. Preparedness
2. Response
3. Recovery
4. Mitigation

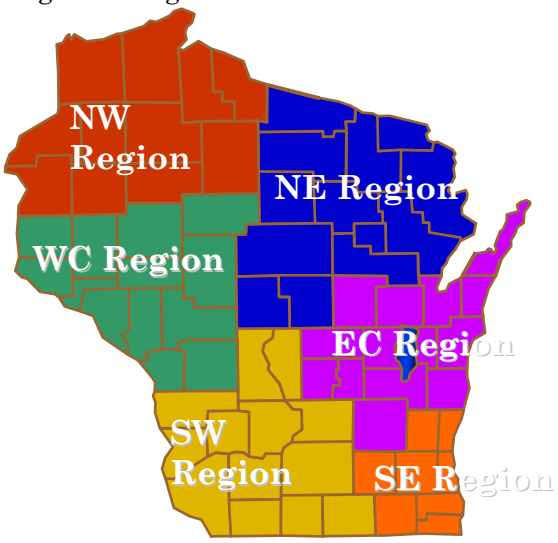
Organization – **Department of Military Affairs**



Organization – **Wisconsin Emergency Management**



Regional Organization



Bureau of Response and Recovery

- Regional Offices and Coordinators
    - help guide and support the Local Emergency Management Director located in each county

- Emergency Police Services
    - Support to Law Enforcement
    - Mutual Aid Program/Directors
    - Coordinates Prison Disturbance Plans

- Emergency Fire Services
    - Support to Fire
    - Mutual Aid

- Natural Disaster Planning
    - Enhance State/Local Capabilities to Respond to Disasters
    - Disaster Recovery Efforts
    - Promotes Weather Awareness Campaigns

- Hazard Mitigation Program
    - All Hazard Mitigation Planning
    - Pre disaster Mitigation Planning and Projects
    - Flood Mitigation Planning and Projects
- Warning & Communications

Response and Recovery - When Disaster Strikes

Bureau of Planning & Preparedness

- EPCRA (Emergency Preparedness and Community Right to Know Act)

- In Wisconsin, 7,000 Facilities Plan/Report
- 72 Local Emergency Planning Committees (LEPCs)

REP (Radiological Emergency Planning)
- Develop and maintain Wisconsin's emergency plans to a nuclear incident

Emergency Planning
- National Response Plan
- Emergency Support Functions
- National Incident Management System (NIMS)

Training & Exercising
- Training Courses Offered – 313 classes with 7,381 Students
- All-Hazards Exercises conducted – 84 with 4,276 participants

Hazmat Transportation/Safety
- Coordination of Regional and County Hazmat Response Teams
- US DOT Hazardous Materials Emergency Preparedness Grant – Hazmat Training

VOAD - Volunteer Emergency Services
- VOAD (Voluntary Organizations Active in Disasters), e.g., American Red Cross, Salvation Army, religious organizations

Terrorism Preparedness

Governors Homeland Security Council