Minnesota All-Hazard Mitigation Plan Update

Approved *date 2011*

Minnesota Division of Homeland Security and Emergency Management

Tables

Figures

APPENDICES

Appendix A	Minnesota Disaster Management Handbook 2010
Appendix B	Minnesota Disaster Recovery Framework 2010
Appendix C	Planning Grant Status
Appendix D	Governor's Executive Order 10-06
Appendix E	EPRC Contact List
Appendix F	MN Flood Risk Assessment
Appendix G	Wildfire Data
Appendix H	Chronological History of Minnesota Disasters
Appendix I	PA Disaster Payments
Appendix J	County Declarations
Appendix K	Crop Loss Data
Appendix L	Silver Jackets
Appendix M	2008 Updated Goals Tracking
Appendix N	Montevideo Flood Insurance Rating
Appendix O	Repetitive Loss Mitigated
Appendix P	Repetitive Loss Unmitigated
Appendix Q	State Building Code Map
Appendix R	Moorhead Losses Avoided Report
Appendix S	Montevideo Losses Avoided Report
Appendix T	Federal Share Allocations
Appendix U	Local Plan Review
Appendix V	Updated Local Plans Completed Tasks
Appendix W	Local Hazards Summary

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Executive Summary

Hazard Mitigation

Hazard mitigation is any sustained action taken to reduce or eliminate long-term risk to people and property from natural or human caused hazards and their effects. The Robert T. Stafford Disaster Relief and Emergency Assistance Act passed in 1988 established in Section 404 the Hazard Mitigation Grant Program (HMGP). The Federal Emergency Management Agency (FEMA) administers several types of mitigation grants that allow a cost-share of 75 to 90 percent federal funding for eligible projects. The intent of these projects is to reduce repetitive losses due to the same hazard. The high federal cost share is an incentive to local and state government to participate in long-term mitigation planning.

The Hazard Mitigation Assistance (HMA) Unified Guidance published annually, has combined the HMGP, Pre-Disaster Mitigation Program (PDM-C), Flood Mitigation Assistance Program (FMA), Repetitive Loss Claims Program (RFC), and Severe Repetitive Loss Program (SRL). In addition, the Flood Mitigation Assistance and Severe Repetitive Loss grant programs are available to applicants that participate in the National Flood Insurance Program (NFIP) and have identified residential structures that qualify. The State of Minnesota Department of Public Safety (DPS) Division of Homeland Security and Emergency Management (HSEM) manage these grants for the local jurisdictions.

In addition to FEMA mitigation grants, the state has access to other grants, and utilizes collaboration with other state agencies to assist making the state more resistant to hazards.

State Mitigation Strategy

The state encourages the following types of mitigation strategies and actions to make the state and its residents safer. While the state has access to multiple funding sources, not all types of project are eligible, (eg. watershed plans, dams/levees, response). The state encourages locals to utilize whatever means available to them to mitigate hazards that affect them.

Prevention

- Develop and promote comprehensive cost-effective recommendations for adoption and enforcement of land use, ordinances and regulations, promote legislation, zoning, and building codes that regulate construction, and decrease risk in areas susceptible to hazards.

Property Protection

- Install and maintain protective measures for the safety and security of critical facilities.

Public Education

- Develop educational materials for the general public and decision makers, educational projects and information regarding public and private volunteer initiatives as well as information regarding health safety and alternatives to improve the public's awareness of hazard risks and ways to prevent or reduce their impact with a sustainment mechanism to distribute educational materials.

Natural Resources

- Develop and implement watershed studies and implement watershed plans and conduct hydrology studies and studies of groundwater problems, support of siltation removal projects, and creation of retention/detention basins.

Emergency Services

- Train, exercise, and equip key state and local leaders for emergency/disaster/and response efforts.
- Install safety and warning signage in appropriate vulnerable locations.

Structural Improvements

- Electrical utility retrofit/hardening.
- Construct, retrofit or maintain drainage systems (pipes, culverts, and channels) to provide adequate and proper functioning systems to include sewage systems and retention and detention systems.
- Install soil stabilization, drainage and erosion protection measures.
- Construct, retrofit or maintain levees, dams, floodwalls, culverts, and floodgates to ensure adequate capacity and protection levels for property and critical facilities.

Examples of Mitigation in Minnesota

The state of Minnesota has administered nearly $100 million in federal mitigation funding from 1989 to the present. One of the requirements of mitigation is to provide cost beneficial, technically feasible and environmentally sound projects, which benefit the community over the long term. The following types of mitigation projects have been implemented in Minnesota to reduce the impact of natural hazards on property and people in the state.

Property Acquisition A major mitigation activity in the state is to reduce the vulnerability of structures to floods. Floods are the top natural hazard in the state so reducing, removing or elevating structures in flood prone zones results in less damage to structures, less economic impact, increases the quality of life after a disaster and saves lives. 1076 properties were acquired through HMA funding to remove structures from flood prone areas. Eight structures were elevated above the 100-year flood return period to make them less susceptible to flood damage.

Electric Distribution Electrical cooperatives retrofit electric distribution systems to make them more damage resistant from ice and severe storms in order to reduce power outages. High winds and ice during severe storms make electric power lines vulnerable to damage. Power outages may last from several minutes up to several weeks depending upon the severity of the disaster and availability of repair crews. The impacts of prolonged power outages are business interruption, livability in residences, and social such as education and elder care. The state has funded 93 electric distribution projects, typically electrical line and poles are buried or reinforced above ground to become wind and storm resistant.

Drainage Retrofit Local infrastructure, such as storm water systems, water treatment plants and roads are improved to reduce flood damages. Floods from rivers and/or substantial rain events result in flash floods that may cause damage to structures. The basic idea with drainage mitigation is to reduce vulnerability by moving water away from the flood prone areas or preventing the buildup of water on streets or roads. Projects in this category include improving culverts and storm water drains, mitigation actions to protect water processing plants, and pumping and lift stations. There were 38 projects involved with diverting or pumping floodwaters to lower the risk of impact to structures and critical facilities.

Wildfire Retrofit Wildfires not only affect the lumber industry but impact tourism and structures in the woodland/urban interface. The initial wildfire grant involved clearing combustibles around structure but changed to the installation of wildfire sprinkler systems. Wildfire sprinkler systems saturate the structure and surrounding vegetation to lower the ignition point for those materials. This results in wildfires being contained or going around the structure. The state has provided the Arrowhead Region (Lake, Cook and St. Louis counties) with FireWise compliant residential sprinkler systems and defensible space to make hundreds of homes more resistant to wildfire.

Other The 5% Initiative is part of HMGP and covers projects that do not meet the criteria for a traditional cost benefit analysis. One type of project that falls in this category is the installation of NOAA transmitters to provide 100% coverage in the state for the transmission of warnings via NOAA weather radios and the Emergency Alert System to rural areas. Another funded initiative project is Stream Gages. An interagency cooperation between NOAA, USGS, MN DNR, and HSEM has resulted in the place of new stream gages or upgrading stream gages in areas of high flood risk. To date three projects resulted in 30 stream gage placements or upgrades.

Hazard Mitigation Planning Hazard mitigation plans are required for the state and each jurisdiction to be eligible for HMA funding. The state received funding for the 2011 Minnesota State All Hazard Mitigation Plan (Plan), eighty-six counties were funded for initial multi-jurisdictional plans, thirty counties have been funded for the five-year review, and two cities have been funded for both the initial plan and the five year review. Four tribal communities have received funding for mitigation plans through the state: Prairie Island Indian Community, Mille Lacs Band of Ojibwe, Upper Sioux Agency, and the White Earth Reservation.

State Mitigation Goals

The goals and objectives for mitigation in the state of Minnesota have not changed, and continue to be broad enough to consider all types of mitigation for all sectors of the state. A natural hazard specific actions section has been added. The state aims to focus on natural hazards and projects that make the state and its residents more resistant to damages. Dam Failure was previously in the infrastructure hazards and has been moved into the natural hazard analysis.

Goal 1. Maintain and enhance the State's capacity to continuously make Minnesota less vulnerable to all hazards.

- Institutionalize Hazard Mitigation.
- Improve organizational efficiency.
- Maximize the utilization of best technology.

Goal 2. Build and support local capacity and commitment to continuously become less vulnerable to natural hazards.

- Increase awareness and knowledge of hazard mitigation principles and practice among local public officials.
- Provide direct technical assistance to local public officials and help communities obtain funding for mitigation planning and project activities.
- Encourage communities to develop, adopt, and implement local hazard mitigation plans.
- Improve compliance with State floodplain regulations and encourage participation in the National Flood Insurance Program (NFIP).
- To assist jurisdictions in developing mitigation projects and identifying funding for cost-beneficial mitigation projects.
- Continuously demonstrate and capitalize upon the connection between hazard mitigation and sustainable development.

Goal 3. Improve coordination and communication with other relevant entities.

- Establish and maintain lasting partnerships
- Streamline policies to eliminate conflicts and duplication of effort
- Incorporate hazard mitigation into the activities of other organizations

Goal 4. Increase public understanding, support, and demand for hazard mitigation.

- Identify hazard-specific issues and needs.
- Heighten public awareness of natural hazards.
- Publicize and encourage the adoption of appropriate hazard mitigation measures.
- Educate the public on the benefits of mitigation measures.
- Help educate the public on the benefits of hazard-resistant construction and site planning.
- Maximize available post-disaster "windows of opportunity" to implement major mitigation outreach initiatives.

1. INTRODUCTION

Purpose

This updated version of the Minnesota All-Hazard Mitigation Plan (Plan) follows the Disaster Mitigation Act (DMA) of 2000 plan revision requirements. The authority for this document is the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended by Public Law 106-390, October 30, 2000, the Disaster Mitigation Act of 2000. This Plan conforms to the 44 CFR Parts 201 and 206: Mitigation Planning and the Hazard Mitigation Grant Program Requirements. The State will continue to comply with all applicable Federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c), and will amend its plan whenever necessary to reflect changes in State or Federal laws and statutes as required in 44 CFR 13.11(d).

The state of Minnesota is vulnerable to a variety of potential hazards. These hazards, both natural and human-caused, threaten loss of life and property. Events such as riverine and flash flooding, urban fire, and wildfire, blizzard, tornado and straight-line wind, hailstorm, earthquake, ice storm, drought, and chemical, biological, radiological, nuclear, and explosive incidents have the potential for inflicting devastating economic loss and personal hardship. Natural disasters cost the state and its taxpayer's money, both directly and indirectly. Many disasters in the state do not warrant federal disaster designation, which often result in local governments, businesses and citizens bearing the costs of recovery. Risk and vulnerability to natural and human caused hazards will continue to increase as Minnesota's population grows.

Hazard mitigation planning is an effective instrument to reduce losses by reducing the impact of disasters upon people and property. Although mitigation efforts cannot completely eliminate impacts of disastrous events, the state shall endeavor to reduce the impacts of hazardous events to the greatest extent possible.

This All Hazard Mitigation Plan (Plan) represents the efforts of the state of Minnesota in fulfilling the responsibility for hazard mitigation planning. The purpose of this Plan is to identify the State's major hazards, assess the vulnerability to those hazards, and take steps to reduce vulnerability using the technical and program resources of Minnesota agencies. The Plan identifies goals and recommended actions and initiatives for state government to reduce and/or prevent injury and damage from hazardous events. The intent of the plan is to provide unified guidance for ensuring coordination of recovery-related hazard mitigation efforts following a major emergency/disaster, and to implement an on-going comprehensive state hazard mitigation strategy intended to reduce the impact of loss of life and property due to disasters.

Scope

The overall goal of the Plan is to eliminate or reduce the impact of natural and human-caused incidents on the people and property of the state of Minnesota. The Plan evaluates and ranks the major natural and human caused hazards affecting the state of Minnesota as determined by frequency of event, economic impact, deaths and injuries. The Plan assesses hazard risk, reviews current state and local hazard mitigation capabilities, develops mitigation strategies and identifies state agency and other interagency working group's actions to address mitigation needs. The Plan does not attempt to develop local mitigation plans or projects. Mitigation recommendations are based on input from state and local agencies and national best practices. The Plan identifies existing resources and develops tools to assist communities to help them succeed in their mitigation efforts. This is accomplished by establishing statewide mitigation policies, providing technical resources through state agency staff expertise and support, providing financial assistance through various programs, training and education and other agency initiatives.

Mitigation Definition

Hazard mitigation may be defined as any action taken to eliminate or reduce the future risk to human life and property from natural and human caused hazards. Potential types of hazard mitigation measures include the following:

- Structural hazard control or protection projects
- Retrofitting of facilities
- Acquisition and relocation of structures
- Development of mitigation standards, regulations, policies, and programs
- Public awareness and education programs
- Development or improvement of warning systems

Benefits

The benefits of hazard mitigation include the following:

- Saving lives, protecting the health of the public, and reducing injuries
- Preventing or reducing property damage
- Reducing economic losses
- Minimizing social dislocation and stress
- Reducing agricultural losses
- Maintaining critical facilities in functioning order
- Protecting infrastructure from damage
- Protecting mental health
- Reducing legal liability of government and public officials

In line with goals of hazard mitigation planning in the state of Minnesota Homeland Security and Emergency Management vision is keeping Minnesota Ready through collaboration and coordination at all levels of government.

MN HSEM Vision and Mission:

Keeping Minnesota Ready

The mission of HSEM is to help Minnesota prevent, prepare for, respond to and recover from natural and human caused disaster. Our team develops and maintains partnerships; collects and shares information; plan; train and educates; coordinates response resources; and provides technical and financial assistance.

Authority

On April 26th, 2010 the revised the **Governor's Executive Order** (EO) 10-06 rescinded the Governor's Executive Order 07-14 and assigned emergency responsibilities to state agencies. This document clarified the roles and responsibilities of state agencies in emergencies and is included in the appendices. HSEM is directed to do the following mitigation/recovery activities:

A. Each state agency that has a role in emergency management shall participate in the development of hazard mitigation strategies to reduce or eliminate the vulnerability of life and property to the effects of emergencies and disasters.

B. Following a presidential declaration of a major disaster, state agencies shall be responsible for carrying out the hazard mitigation responsibility assignments contained in this Executive Order and elaborated upon in the State All-Hazard Mitigation Plan.

C. State agencies shall, when requested by the Division of Homeland Security and Emergency Management, provide appropriate personnel to assist with the damage assessment activities associated with the Public Assistance, Individual Assistance, and Hazard Mitigation programs. They shall also provide personnel to serve on an Interagency Hazard Mitigation Team or Hazard Mitigation Survey Team, when requested.

D. State agencies shall, when requested by the Division of Homeland Security and Emergency Management, provide appropriate personnel to serve on the Minnesota Recovers Task Force, and be prepared to commit and combine resources toward the long-term recovery/mitigation effort.

XX. DEPARTMENT OF PUBLIC SAFETY (excerpts from)

E. The Division of Homeland Security and Emergency Management shall designate personnel to serve as the State Hazard Mitigation Officer (SHMO). The SHMO is responsible for ensuring that the hazard mitigation requirements contained in the federal Stafford Act (Public Law 93-288, as amended) including implementation and administration of the Hazard Mitigation Grant Program are carried out.

F. The Division of Homeland Security and Emergency Management shall facilitate long-term disaster recovery by maintaining communication and leading the activities of the Minnesota Recovers Task Force.

G. The Division of Homeland Security and Emergency Management shall facilitate hazard mitigation efforts statewide by: coordinating maintenance of the State All-Hazard Mitigation Plan and working with local jurisdictions to develop and enhance mitigation plans and projects.

H. The Division of Homeland Security and Emergency Management shall provide ongoing coordination of hazard mitigation planning efforts in Minnesota, to include maintaining a comprehensive, state all-hazard mitigation plan, and coordinating the preparation of local government hazard mitigation plans.

As part of the mitigation programs implementation, the HMGP is narrated by the HMGP Administrative Plan and the Sub-grantee handbook. These documents give directions to sub-grantees regarding management of their grants. As summary of both follow:

HMGP Administrative Plan

The state of Minnesota HMGP Administrative Plan and Procedures is required as Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288 as amended, and the Disaster Mitigation Act of 2000, Public Law 106-390, establishes a cost-sharing Hazard Mitigation Grant Program (HMGP) to be used to fund state and local hazard mitigation projects. This section is closely tied to the post-disaster hazard mitigation plans defined and required in Section 409 of the Act and the Disaster Mitigation Act of 2000. Sections 322 and 404 in combination with several other state and federal programs and activities help to form an overall pre-and-post disaster hazard mitigation strategy for the State of Minnesota and affected local governments in the state. The purpose of the administrative plan is to describe the organization, staffing, and procedures the State of Minnesota will use when implementing the Section 404 Hazard Mitigation Grant Program in both the post and pre-disaster mitigation environment. This manual is updated to reflect changes in policy, lessons learned administering the plan and procedures, post disaster after action reports, and input from the Minnesota Recovers Task Force. This document is updated for each disaster declaration.

HMGP Sub-grantee Handbook

As part of the HMGP process the purpose of the sub-grantee handbook is both to provide general HMGP information and to summarize specific sub-grantee responsibilities relative to the program. HMGP is implemented following a presidential declaration of a major disaster. The program’s objective is to reduce repetitive losses from natural disasters by funding cost-effective projects intended to eliminate/reduce future disaster expenditures for the repair/replacement of public and private property, and for the relief of personal loss, hardship, and suffering. Under the Section 404 HMGP, Federal Emergency Management Agency (FEMA) hazard mitigation monies are provided to the state. In Minnesota, these monies are awarded to the Minnesota Division of Homeland Security and Emergency Management (HSEM) which serves as the grantee. Potentially eligible sub-grantees (applicants) include: state and local governments, certain private non-profit organizations or institutions, and Indian tribes or authorized tribal organizations.

1.1 Hazard Mitigation Programs

FEMA offers five hazard mitigation assistance programs–although all five programs have unique statutory authorities, program requirements and triggers for funding, all of the programs also have the common goal of providing funds to States and local communities to reduce the loss of life and property from future natural hazard events. In 2009, FEMA integrated the guidance for the five hazard mitigation programs into one document, the Hazard Mitigation Assistance (HMA) Unified Guidance.

The HMA grant programs provide funding opportunities for pre- and post-disaster mitigation. While the statutory origins of the programs differ, all share the common goal of reducing the risk of loss of life and property due to natural hazards. Brief descriptions of the HMA grant programs are listed below. For more information on the individual programs see http://www.fema.gov/government/grant/hma/index.shtm

Hazard Mitigation Grant Program (HMGP)

HMGP assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities.

Pre-Disaster Mitigation (PDM)

PDM provides funds on an annual basis for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The goal of the PDM program is to reduce overall risk to the population and structures, while at the same time, also reducing reliance on Federal funding from actual disaster declarations

Flood Mitigation Assistance (FMA)

FMA provides funds on an annual basis so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the National Flood Insurance Program (NFIP).

Repetitive Flood Claims (RFC)

RFC provides funds on an annual basis to reduce the risk of flood damage to individual properties insured under the NFIP that have had one or more claim payments for flood damages. RFC provides up to 100% federal funding for projects in communities that meet the reduced capacity requirements

Severe Repetitive Loss (SRL)

SRL provides funds on an annual basis to reduce the risk of flood damage to residential structures insured under the NFIP that are qualified as severe repetitive loss structures. SRL provides up to 90% federal funding for eligible projects.

1.2 Plan Organization

Each section in the plan has been reviewed and updated. The state aims to focus on natural hazards and projects that make the state and its residents more resistant to damages. To help accomplish this, a natural hazard specific actions section has been added. Dam Failure was previously in the infrastructure hazards and has been moved into the natural hazard section. The overall format of the Plan has been revised and is now organized in the following sections:

Section One: Introduction Purpose, scope and a description of changes included in the Plan Update.

Section Two: State Profile Geographic, climatic and demographic characteristics. How mitigation relates to development trends and climate adaptation.

Section Three: The Planning Process Description of how the Plan was updated utilizing the new state and federal collaborative risk management group, the Silver Jackets.

Section Four: Hazard Identification This Hazard Identification of the Risk Assessment identifies and profiles natural hazards. All 20 hazards that potentially affect the state are described, as is the nature of each hazard, history, location of occurrence, and probability of future occurrence.

The probability ranking and criteria for mitigation potential and hazard identification and disposition are based on data from known reliable sources for all 20 hazards and have not changed for the 2011 plan update. Flooding, Tornadoes, Straight Line Winds and Wildfire remain the top four natural hazards the state categorizes as having both High Probability Ranking and High Mitigation Potential Ranking.

Criteria for High Probability Ranking:

- The hazard has impacted the State annually, or more frequently
- The hazard is widespread, generally affecting regions or multiple counties in each event
- There is a reliable methodology for identifying events and locations

Criteria for Mitigation Potential High Ranking:

- Methods for reducing risk from the hazard are technically reliable
- The state or counties have experience in implementing mitigation measures
- Mitigation measures are eligible under federal grant programs
- There are multiple possible mitigation measures for the hazard
- The mitigation measure(s) are known to be cost-effective
- The mitigation measures protect lives and property for a long period of time, or are permanent risk reduction solutions

Section Five: Vulnerability Assessment This section of the state Risk Assessment contains the methodology for probability ranking and mitigation potential for natural hazards in the state. The 2011 update includes the statewide risk assessment for flooding utilizing HAZUS, a geographic information system based disaster mitigation tool. This tool enables communities of all sizes to estimate damages and losses from floods to measure the impact of various mitigation practices that might help to reduce those losses.

The vulnerability assessment for jurisdictions for wildfire, tornadoes and windstorms are based on past losses. Data sources for estimating potential losses include agricultural insurance claims and disaster payments for Public Assistance due to Presidential Disaster Declarations.

The HAZUS methodology is estimates potential damages on state facilities and jurisdictions due to flooding. The best available data has an inventory of approximately 66%-75% of the state owned facilities. A variety of technical issues has been identified in the attempt to complete a state facility listing. At this time, the state does not have the labor to complete this task. Data gathering is ongoing and may be completed for the 2014 Plan update. Assessing vulnerability for state facilities it is difficult to analyze for tornadoes, windstorms and wildfires as there is no history to base future estimations.

Section Six: Mitigation Strategy Updated mitigation goals, objectives, strategies, and actions. Natural hazard specific mitigation goals have been added to the Plan. While each action is linked to one of the six state strategies, the actions are broad enough for any jurisdiction to utilize them the development mitigation action plans. Assessment of state and local capabilities, pre- and post-disaster funding programs. The severe repetitive loss strategy requirement is addressed.

The Inventory of Hazard Mitigation Programs, Policies, and Funding Resources section provides information on resources available to assist with hazard mitigation planning and actions. Many organizations have capabilities that may assist local jurisdictions or the state to increase resiliency to hazards. A comprehensive list of federal, state agencies and other related organizations that may assist in mitigation projects is included. This section lists resources that may be used in mitigation research and planning may be used in the future for mitigation planning.

The Mitigation Strategy states goals, objectives, actions, and projected funding sources to guide the mitigation program. The State Capability Assessment lists the programs and the funding sources that are used in statewide mitigation efforts and addresses gaps.

Section Seven: Coordination of Local Mitigation Planning. The integration of local plans is a new requirement; the state completed a pilot project for submission for this update. A description of how the state prioritizes local jurisdictions funding and technical assistance has been revised. This section describes how local mitigation planning and projects are prioritized, coordinated and funded. Local Funding and Technical Assistance is available from the local, state, and federal levels. Local planning capabilities differ but a lack of capability does not exclude a community from any of the grant programs.

Local Plan Integration portrays the importance of having a FEMA approved and locally adopted mitigation plan at the time of a disaster. Prior to or shortly after the request for the declaration of a presidential disaster, the FEMA regional office routinely confirms the plan status for counties potentially included in the disaster declaration.

Local All Hazard Mitigation Plan update status: as of December 2010, of the 87 counties in Minnesota, 80 jurisdictions have FEMA approved plans, three are at the state for review, three are in process, and one is FEMA approved pending adoption. Six counties have FEMA approved updated all-hazard mitigation plans. Impediments to jurisdictions lacking funding for plan updates or local match for projects plans and capabilities for implementing hazard mitigation projects are identified.

Section Eight: Plan Maintenance Process. How the Plan will be monitored, evaluated and updated during the next three years. How the progress of mitigation planning and projects will be monitored and by whom.

1.3 HSEM Update

The past three years at HSEM have been eventful – four presidential disaster declarations and several other severe weather events occurred. Staffing at HSEM has also been through changes, with the departure of the State Hazard Mitigation Officer (SHMO) in June of 2010, leave of absences by both mitigation planners in 2010 and the hiring of a new SHMO in October 2010. A new position was created in Disaster Response, Recovery and Mitigation Branch at HSEM in 2008, the Disaster Recovery Coordinator.

With the addition of the new **Disaster Recovery Coordinator** at HSEM the flow of information between state agencies has improved. The position leads the Minnesota Recovers Task Force, as a long-term recovery committee at the state level. The state offers multiple Disaster Response and Recovery Workshops to local emergency managers and other interested parties. The Coordinator created the Disaster Management Handbook and the Disaster Recovery Assistance Framework.

The updated **Minnesota Disaster Management Handbook** is a tool local jurisdictions are encouraged to utilize in times of disaster. The four phases of emergency management – mitigation, preparedness, response, and recovery – are ongoing, interdependent, and to some degree, overlapping. To ignore the actions required by any one of the four phases jeopardizes the jurisdiction's overall ability to "manage" disasters and emergencies. The purpose of the handbook is to provide a variety of tools to help emergency managers mitigate hazards, prepare for emergencies, and enhance the response and recovery phases of any emergency. The handbook contains damage and impact assessment forms for the state, county and local officials. See Appendix A.

Minnesota Disaster Recovery Assistance Framework is another new document developed for local emergency managers to utilize post disaster. The framework is a resource document that provides assistance program information from state, federal, local, and voluntary agency resources following a disaster. The guide is intended to be of assistance to government officials and community leaders involved in managing, organizing, or leading disaster recovery efforts. It provides a comprehensive overview of the roles, responsibilities, and assistance programs that may be available. The Framework describes and highlights assistance that is typically available after disasters. See Appendix B.

1.4 Hazard Mitigation Funding Update

The total funding for HMA in the state of Minnesota for the federal share of 75% of the project totals is $108,062,046. The breakout for major projects types follows:

- A major mitigation activity in the state is the acquisition of flood prone properties. Property acquisition completely reduces the vulnerability of structures to floods. Floods are the top natural hazard in the state so reducing removing or elevating structures in flood prone zones results in less damages to structures, less economic impact, increases the quality of life after a disaster and saves lives. 1076 properties have been acquired with HMA funding. The federal share for property acquisition to date is $57,291,530. Eight structures were elevated to make them less susceptible to flood damage.

- Retrofitting or hardening electric distribution lines is another successful project type in the state. High winds and ice during severe storms make electric power lines vulnerable to damage. Power outages may last from several minutes up to several weeks depending upon the severity of the disaster and availability of repair crews. The impacts of prolonged power outages are business interruption, livability in residences, and social such as education and elder care. There were 93 projects where electric distribution was buried or reinforced above ground to become wind and storm resistant. The federal share for this project type is $19, 218,633.

- Mitigation plans are required for the state and each jurisdiction to be eligible for HMA funding. The state received funding for the 2011 Minnesota State All Hazard Mitigation Plan, eighty-six counties were funded for initial multi-jurisdictional plans, thirty counties have been funded for the five year review, and two cities have been funded for both the initial plan and the five year review. Four tribal communities have received funding for mitigation plans through the state. They were the Prairie Island Indian Community, Mille Lacs Band of Ojibwe, Upper Sioux Agency, and the White Earth Reservation. The federal share for planning to date is $3,594,825.

- Floods from rivers and/or substantial rain events result in flash floods that may cause damage to structures. The basic idea with drainage mitigation is to reduce vulnerability by moving water away from the flood prone areas or preventing the buildup of water on streets or roads. Projects in the drainage category include improving culverts and storm water drains, mitigation actions to protect water processing plants, and pumping and lift stations. There were 38 projects involved with diverting or pumping flood waters to lower the risk of impact to structures and critical facilities. Federal Share: $14,606,984.

- HMA has funded ten wildfire projects with a federal cost share of $8,696,100. Wildfire projects protect vulnerable structures in areas where forest fires are a high risk. Sprinkler system projects saturate the structure and surrounding vegetation to lower the ignition point for those materials. This results in wildfires being contained or going around the structure.

A full accounting of federal funding for pre and post disaster grants is contained later in the Plan.

Presidential Disaster Declarations (and other Severe Weather Events) Update

During the revision of this document multiple severe weather events occurred, including three disaster declarations in 2010 alone. The following disasters and severe weather events took place since the approval of the previous Plan in April of 2008.

In September of 2010, flooding in southern portion of the state resulted in Presidential Disaster Declaration DR-1941-MN for 29 counties. In June 2010 DR-1921-MN was declared for severe storms, tornadoes and flooding for 13 counties throughout the state. DR-1900-MN was issued on April 19, 2010 following an Emergency Declaration for flooding for the Red River Valley. Twenty-six counties were included in the disaster declaration. In the spring of 2009 DR-1830 MN was declared for severe storms and flooding in the Red River Valley. In the summer of 2008 DR-1772-MN was declared due to severe storms and flooding for six counties in south central Minnesota. In addition, the National Climatic Data Center (NCDC) maintains reported 96 flood events (flood and flash flood) in the state since 2008. The update includes one death, two injuries and nearly $17 million in property damages and over $13 million in crop damages (as of August 2010).

In August of 2009, an EF-0 Tornado hit the southwest area of the City of Minneapolis, Hennepin County, resulting in $500K in damages. The system also caused damages in nearby areas resulting in $150K in damages and $75K in crop damages. On May 25, 2008 a tornado hit the City of Hugo and killed a two-year old child, seventeen others were injured. While a disaster was not declared for this event, this F3 tornado is considered a major event in the state. Per the NCDC, there were 74 tornadoes in the past there years resulting in over $44.5 million in property damages and nearly 3 million in crop damages.

Thirty ‘high wind’ events were reported, however only three events resulted in damages to property or crops. Thirteen ‘strong winds’ (over 40 knots) were recorded resulting $12,000 in damage. For the category ‘thunderstorm winds’ 408 events were reported, resulting in two injuries, $2.758 million in property damages and $2.601 million in crop losses. These winds are over 50 knots.

While low pressure is not a state hazard, a record for low pressure in the state was set on October 26, 2010. The lowest pressure recorded was 28.21 inches at 5:13 pm at Bigfork in Itasca. The old record was 28.43 inches on November 10, 1998 at Albert Lea. Because of the lower pressure, water at Bigfork at that moment would boil three degrees cooler Fahrenheit than at a standard atmosphere of 29.92 inches (209 degrees F instead of 212 degrees F). While there wasn't abundant moisture with this system, there were some very strong winds. The peak wind gust reported in Minnesota was 65mph at Georgeville in Stearns County and Mehurin Township in Lac Qui Parle County.

Five lightning events were reported, two resulting in deaths and others with injuries. Moderate to severe drought was recorded in the state in the autumn of 2009. There were 871 hail events reported in the past three years. These hail events had damages totaling $872K for property damages and crop damages of $1.25 million.

The December 10-11, 2010 blizzard is the 5th largest snowstorm on record for the Twin Cities since 1891. This snowfall was on top of heavy snow the region received December 3-4. The area received even more snow on December 20-21, 2010.

Multiple extreme cold/wind chill warnings issues during the past three years No property damages or crops were damages as a result, however two people died due to exposure. Multiple winter weather events occurred in the past three years, most notably two blizzards. In December 2008, a blizzard occurred throughout the state, causing Interstate 94 and other roads to close. In April of 2008, another blizzard hit many parts Minnesota, causing 11,000 Minnesota Power customers to be without power. Many schools and businesses closed.

Per NCDC there were three wildfires reported. All three occurred in April of 2009. The first was a controlled burn that grew out of control near Dodge Center in Dodge County and burned six acres of grass. The other two fires were northeast and southwest of Rochester in Olmsted County burned respectively, and two acres and five acres burned.

Hazard Mitigation Planning Update

In an effort to streamline the HMGP grant process, FEMA requires states to develop their mitigation plans before disaster strikes. This allows for two courses of action. Pre-Disaster Mitigation (PDM) grants are offered so that communities may mitigate the effects of a hazard prior to a disaster. Communities affected by disaster are eligible to participate in both HMGP and PDM grants since the mitigation measures are built into plans to rebuild the community. The 2011 Minnesota All-Hazard Mitigation Plan meets the FEMA requirement that state mitigation plan be revised every three years to update hazard and risk analysis in the state. FEMA also has a requirement that local communities have plans that are revised in five-year cycles to qualify for mitigation grant funding.

State and local community mitigation plans essentially review the potential hazards in their respective jurisdictions and how those hazards may affect residents, infrastructure, services, business and industry. The planning then identifies the priorities and techniques to mitigate the effects from a particular hazard. Some techniques may be low cost and can be done at the local level while other measures may need the assistance of state and federal funding.

The difference between the Minnesota All-Hazard Mitigation Plan and local plans is that the state plan contains strategies on how to support mitigation planning and programs statewide. The goals do not recommend specific mitigation techniques for a specific location but outline support for local governments with technical assistance and grant funding from state and federal agencies in regards to mitigation planning and projects. The state program goals also point to how mitigation planning needs a broad base of input from state agencies, regional development commissions, universities, private sector and communities.

Since the approval of the State Plan in April of 2008, approximately forty (40) planning applications have been submitted to FEMA and FEMA V has successfully approved fifty-four (54) plans. See Appendix C for Planning Grant Status.

Acknowledgements

The current review of the Plan was a multi-agency effort with Homeland Security and Emergency Management serving as the lead agency for the updated plan review process. The mitigation staff at HSEM would like to acknowledge and thank the members of the Minnesota Natural Hazards Risk Management Team aka Silver Jackets for their involvement in the review and update of the Minnesota All-Hazard Mitigation Plan and members of the .

HSEM mitigation staff would also like to thank MnGeo staff, Polis Center staff, and University of Minnesota at Duluth GISL staff. Byron Paulson, Fire Weather Focal Point/Incident Meteorologist, NOAA Twin Cities/Chanhassen NWS Forecast Office, Jason Boyle, Dam Safety Engineer, MN DNR Dam Safety Program, Linda Glaser, Minnesota Board of Animal Health also provided information for the Plan.

Finally, HSEM mitigation staff would like to thank the Federal Emergency Management Agency (FEMA) Region V staff for their assistance in disaster, response, recovery and mitigation projects and planning.

The following agencies have reviewed the updated Plan:

Coordinating Agency:

Department of Public Safety, Division of Homeland Security and Emergency Management (HSEM)

Support Agencies:

Department of Administration

Department of Agriculture

Board of Animal Health

Department of Commerce

Department of Corrections

Department of Education

Department of Employment and Economic Development

EMS Regulatory Board

Department of Health

MN Housing Finance Agency

Department of Human Services

Department of Labor and Industry

Metro Transit

Department of Military Affairs

Department of Natural Resources

Pollution Control Agency

Department of Public Safety - Fire Marshal, Pipe Line Safety

Department of Revenue

Minnesota State Colleges and Universities

Department of Transportation

University of Minnesota

Disability Council

Office of Enterprise Technology

Board of Water and Soil Resources

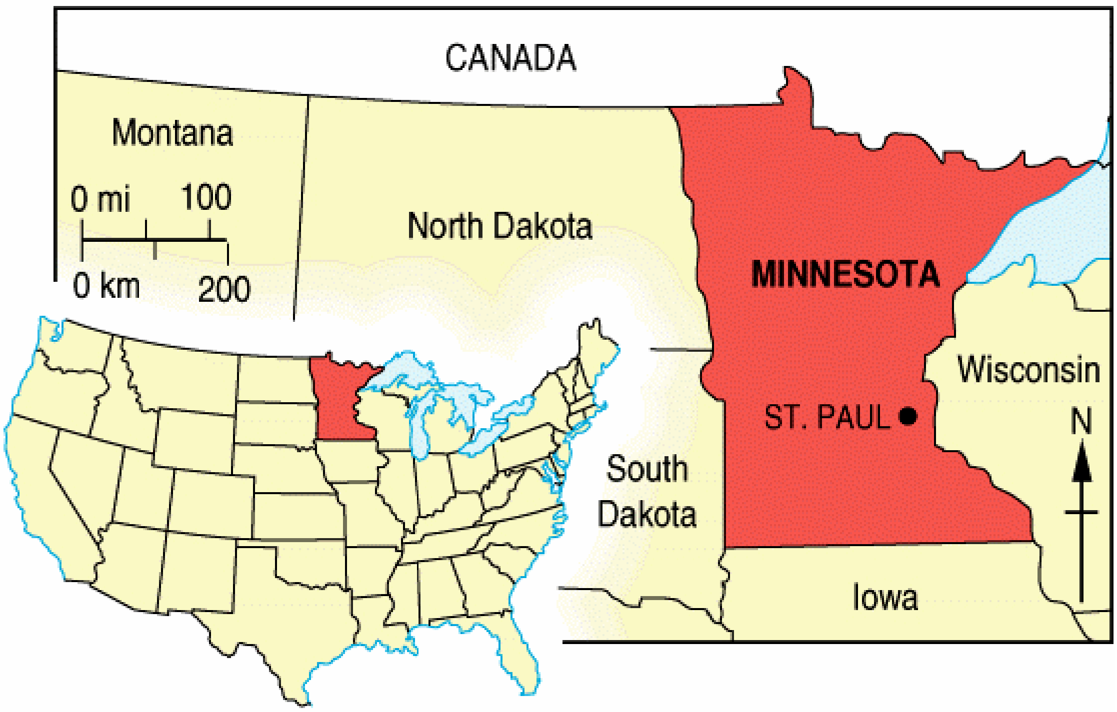
Minnesota Management and Budget

2. STATE PROFILE

2.1 Geographic Characteristics

Minnesota is located in the north central United States. Near the geographic center of North America, it is bordered on the north by the Canadian provinces of Manitoba and Ontario, on the west by North Dakota and South Dakota, on the south by Iowa, and on the east by Wisconsin and Lake Superior. Minnesota entered the Union on May 11, 1858, as the 32nd state.

FIGURE 1 MINNESOTA LOCATION MAP



Minnesota covers 86,943 square miles, of which 4,780 square miles are inland waters and 2,546 square miles consist of a portion of Lake Superior under the state's jurisdiction. Of the 50 states, Minnesota ranks 12th in total land area. From north to south the state measures 406 miles, and from east to west it measures 358 miles at its maximum extent and about 180 miles at its narrowest point.

The mean elevation is approximately 1,200 feet. Three areas in the state reach higher than 1,600 feet: the Iron Range (paralleling the north shore of Lake Superior), the Coteau Des Prairies (also known as Buffalo Ridge), and a small area in the Lake Itasca region. The highest point in the state is Eagle Mountain in the extreme northeast, at 2,031 feet. The lowest elevation is 602 feet along the shores of Lake Superior.

The natural environment of the state is broken into three distinct biomes. The coniferous forest in Minnesota is found in the northern half of the state, but grades into the deciduous forest then prairie grassland in the northwestern part of the state. The

FIGURE 2 LAND COVER IN MINNESOTA

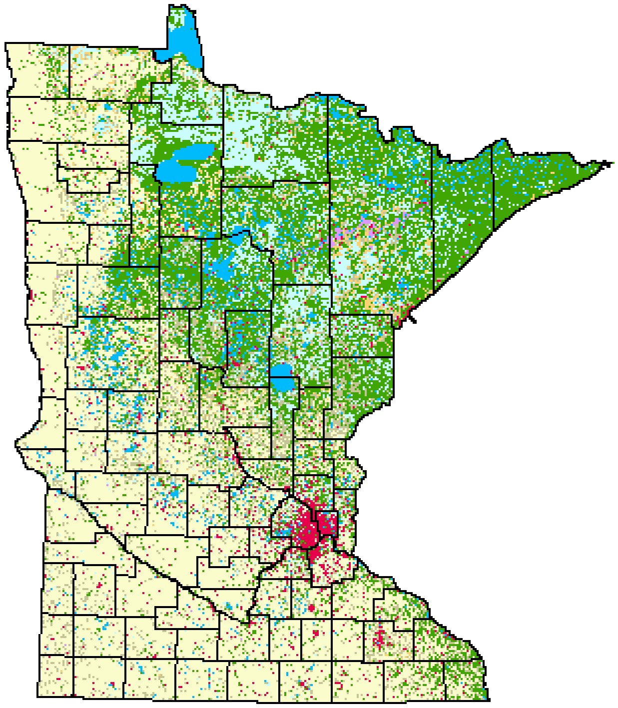


TABLE 1 LAND COVER LEGEND		
DESCRIPTION	ACREAGE	PERCENT OF STATE
Urban and rural development	1,472,267	2.7
Cultivated land	22,694,200	42
Hay/pasture/grassland	4,977,451	9.2
Brushland	1,326,796	2.5
Forested	14,434,482	26.7
Water	3,211,643	5.9
Bog/marsh/fen	5,728,056	10.6
Mining	147,175	0.3
State total	53,992,070	100

Source: http://www.mngeo.state.mn.us/chouse/land_use.html

deciduous forest biome extended in a diagonal line from the southeastern part of the state to the northwest. Most of these forests were cleared and converted to farmland during Minnesota's first 50 years of statehood. The State once had 18 million acres of prairie that stretched across the southern portion of the state and northward along the western border. Like the deciduous forest, the vast majority of the prairie biome has been converted to agricultural land.

Monitoring Minnesota's Changing Landscapes has links to historic data, including the changes in impervious surfaces in the Twin Cities Metropolitan Area and the state. Available data sets and maps can be helpful to communities to monitor land use and plan. http://land.umn.edu/quickview_data/index.html.

2.2 Climate

Minnesota has a continental-type climate and is subject to frequent outbreaks of continental polar air throughout the year, with occasional Arctic outbreaks during the cold season. Occasional periods of prolonged heat occur during summer, particularly in the southern portion of Minnesota, when warm air pushes northward from the Gulf of Mexico and the southwestern United States. Pacific Ocean air masses that move across the western United States produce comparatively mild and dry weather at all seasons.

Mean annual temperatures range from 36 degrees Fahrenheit (° F) in the extreme north to 49° F along the Mississippi River in the southeast. State temperature extremes range from -60° to 114° F.

Monthly mean temperatures vary from 85° F in the southwest to -11° F in the northwest. Mean temperatures during January in the northern portions of the state average near 40°F; this is 10 degrees colder than temperatures recorded at stations near Lake Superior and in southern Minnesota. The mean temperature in July for the state averages about 70° F in most places. This is five to 10 degrees warmer than at stations near Lake Superior. Thus, Lake Superior stations are cool in the summer and relatively warm in the winter.

Although total precipitation is important, its distribution during the growing season is more significant. For the most part, native vegetation grows for seven months (April to October) and row crops grow for five months (May through September). During the crop growing period, approximately two-thirds of the annual precipitation occurs. Mean annual precipitation is 35 inches in extreme southeast Minnesota but gradually decreases to 19 inches in the extreme northwest portion of the State. At most locations there have been months with no precipitation recorded. Statewide, two of the driest years were 1910 and 1976, while two of the wettest were 1965 and 1977.

Seasonal snowfall averages near 70 inches in the highlands along the north shore of Lake Superior in northeast Minnesota and gradually decreases to 40 inches along the Iowa border in the south and along the North Dakota and South Dakota borders in the west.

Heavy snowfalls of greater than 4 inches are common anytime from mid-November through mid-April. Heavy snowfalls with blizzard conditions affect the State on the average about two times each winter.

Conditions of severe drought with an annual Palmer Drought Index of -3 or lower are expected on the average about once in 10 years in southwest and west central Minnesota, to about once in 25 years over eastern Minnesota. The northeast part of the state experiences severe drought about once in 50 years.

The state of Minnesota has been granted Presidential Disaster Declarations 43 times between 1965 and 2010 (45 years). Of those declarations, 36 involved flooding. Those numbers translate into approximately an 80% chance of a major flood annually somewhere in the state.

2.3 Demographic Characteristics

In the past three years, no additional census data has been updated, resulting in this version of the state Plan not updating the overall demographics section. When 2010 Census data is available, it will be incorporated into future state Plan revisions. According to estimates by the U.S. Census Bureau, Minnesota's population on July 1, 2008 was 5,220,393. The Minnesota State Demographic Center estimates the states population in 2008 to be 5,287,976. This is a 7.49% increase from 2000 to 2008.

Since the 2000 Census, Minnesota has grown by 247,609 people, or 5.0 percent, ranking 19th among states in the number of people added and 23rd in the percent of growth. Minnesota remains one of the fastest-growing states in the Midwest. Only New Hampshire, among Northeast and Midwest states, has grown at a faster rate over the past six years. Minnesota continues to rank among the leading states in income level, educational attainment, and labor force participation according to a 2007 report from the Minnesota State Demographic Center.

Minnesota's rankings include:

1st in home ownership (75.8% owner-occupied)

2nd in labor force participation (72.2% for ages 16 and over)

3rd in high school completion (90.9% for ages 25 and over)

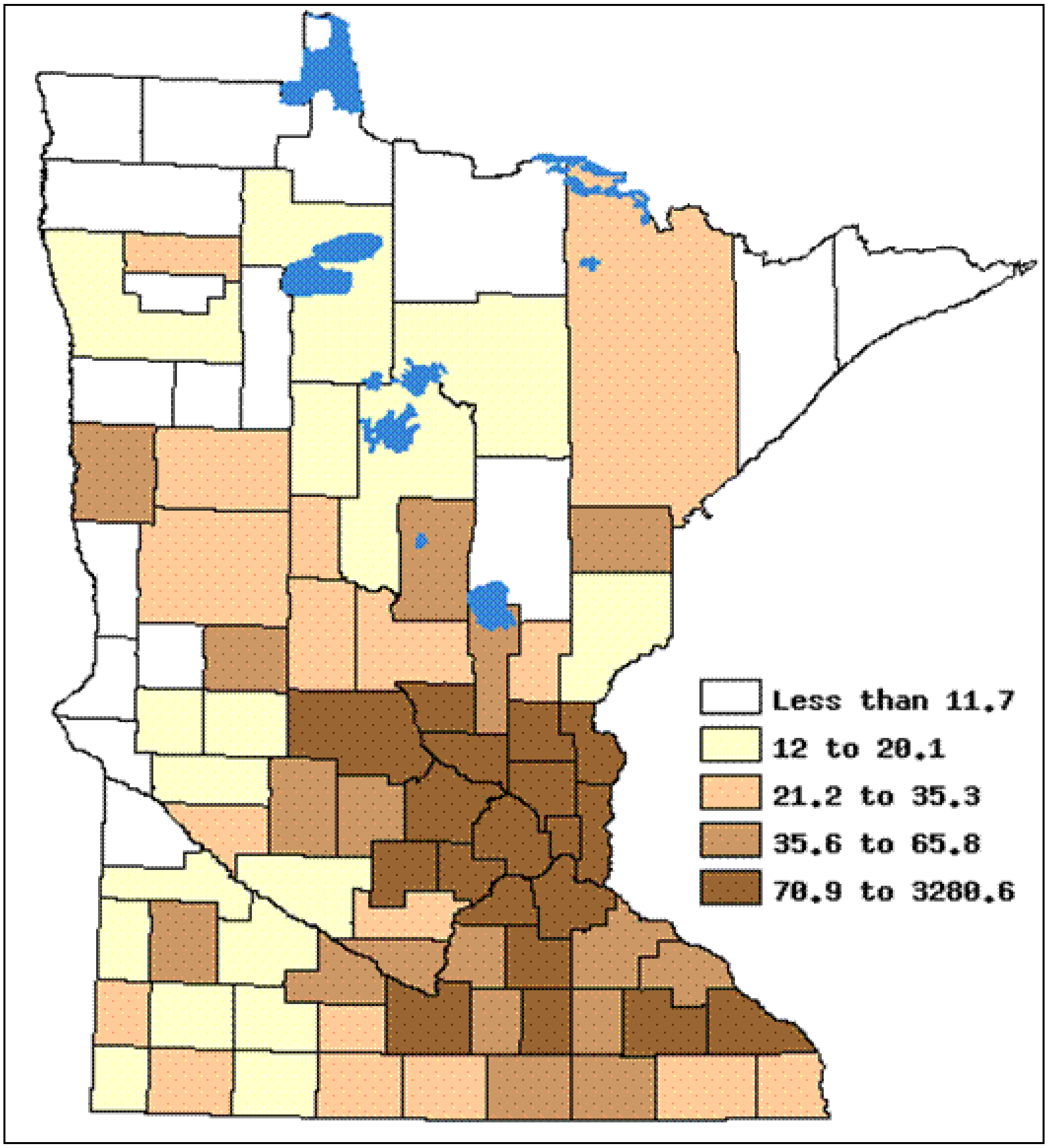
5th lowest poverty rate (9.2% of all people)

9th highest per capita income ($37,373).

Population projections indicate that the strongest areas of growth will remain the outer ring suburbs within the seven county metropolitan area surrounding the twin cities of Minneapolis and St. Paul. The seven county metro area is made up of the following counties: Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington. 2030 projections also indicate significant growth in the counties immediately adjacent to the seven county metro area, and in counties across the state possessing high lake densities. These projections indicate that 79 of the state's 87 counties will experience population increases. Six of the eight counties with projected population declines are spread along the western border of the state, with the other two counties located in southwestern Minnesota.

The population density per square mile at the county level is illustrated in Figure 3, a more detailed graphic may be viewed at http://www.gis.leg.mn/pdf/pop/dens00.pdf.

FIGURE 3 POPULATION DENSITY PER SQUARE MILE



Minnesota currently ranks 9th in the nation with 19 Fortune 500 Companies. The 19 companies in Minnesota had combined total revenues of $300.7 billion in 2006. Minnesota's corporations also compete in the private sector. With 11 of the largest private companies in the country, the state ranks 12th in the Forbes Largest Private Companies list. One of these companies (Cargill) ranks second with $69.9 billion in revenues. The largest industries in Minnesota are manufacturing, agriculture, services, wholesale and retail trade, and finance insurance and real estate. Home health care and community health care for the elderly are the industries with the highest projected rate of growth over the next 10 years, while textiles and motor vehicle manufacturing are expected to see the greatest decline. Data processing services, management and technical consulting, and scientific research and development are projected to be the fastest growing high pay industries over the next 10 years. High pay industries are those industries at the 4-digit

North American Industry Classification System level that have an average weekly wage higher than the area's average, and that comprise at least 0.2% of total area employment.

Minnesota's agriculture has a long history of serving as an economic cornerstone for the state's economy. The market value of production was $8,575,627,000, and crop sales accounted for $4,562,882,000 and livestock sales accounted for $4,012,745,000 of the total value. The market value of production average per farm was $106,083.

Agriculture supports many other industries, such as manufacturing, transportation, wholesale and retail trade, services, construction, banking, insurance, and real estate. Minnesota is the fifth largest agricultural producer in the nation with 80,839 farms covering 27.5 million acres, generating $9.8 billion. Minnesota ranks first in the nation in production of sugar beets, turkeys, sweet corn for processing, and green peas for processing. 80% of agricultural jobs are located off the farm. The economic contribution of Minnesota's agricultural industry reaches far beyond the agricultural sector due to the "multiplier effect".

- Output impact: The "multiplier effect" of Minnesota's agricultural production and processing generates $55 billion in economic activities for the state.
- Employment impact: The "multiplier effect" of Minnesota's agricultural production and processing supports over 367,000 jobs.

The average size of farm was 340 acres, however the current trend in agriculture in Minnesota is towards larger farms. Family farms are showing slight declines in numbers, but many are finding success in organic farming and other specialty niches.

Tourism is also a key section of Minnesota's economy, comparable to agriculture in its contribution to the gross state product. Leisure and hospitality in Minnesota generates $10 billion in gross annual sales, and more than $600 million is generated in state sales taxes. Minnesota's leisure and hospitality industry employs more than 236,000 workers. The annual number of travelers in Minnesota (28.6 million) is nearly five times the total population of the state.

2.4 Development Trends

Overall, the state is showing growth in both population and industry. One on-going challenge associated with this growth is maintaining a balance between development and natural resource protection. Each community is responsible for ensuring ordinances that protect residents from flooding, wildfire and other hazards are enforced. Communities with floodplain ordinances and communities that participate in FireWise are more resistant to associated hazards. Comprehensive, land-use plans, watershed management plans and all types of long-term community planning are a local responsibility. Hazard mitigation plans requiring federal funding aim to give incentives to these communities to reduce vulnerability to all hazards for existing properties. The state does not dictate how communities grow; however, the current participation of all counties (some tribes and some cities) in Minnesota in all-hazard mitigation planning is a positive step towards making the state and its residents disaster resistant.

In each community, risk assessments are based on past damages to existing structures. The risk assessment addresses the hazards with the highest potential for loss. Addressing hazards for the increased potential for flood damages and areas vulnerable to tornados/winds with intense development pressures is identified for each community based on its risk assessment.

In addition, counties in the northern portion of the state are encouraged to address growth and the proximity of (typically second) homes near lakes and in heavily forested areas to utilize best management practices for the wildland-urban interface, and other thinning projects, defensible space, and utilization of federally funded sprinklers for wildfire protection.

The growing population in Minnesota along rivers, lakes and forested areas must be done with potential hazards in mind. Utilizing land use and comprehensive planning resources will ensure Minnesota remains safe for its residents, as well as environmentally and economically sound. It is up to local jurisdictions to enforce existing regulations, and it is work with communities to develop and grow sustainably, and out of harm’s way, to the maximum extent possible.

Figure 4 indicates actual population change from 2006 through 2009. Figure 5 illustrates projected population growth by percent from 2005 to 2015.

FIGURE 4 POPULATION CHANGE 2006 TO 2009

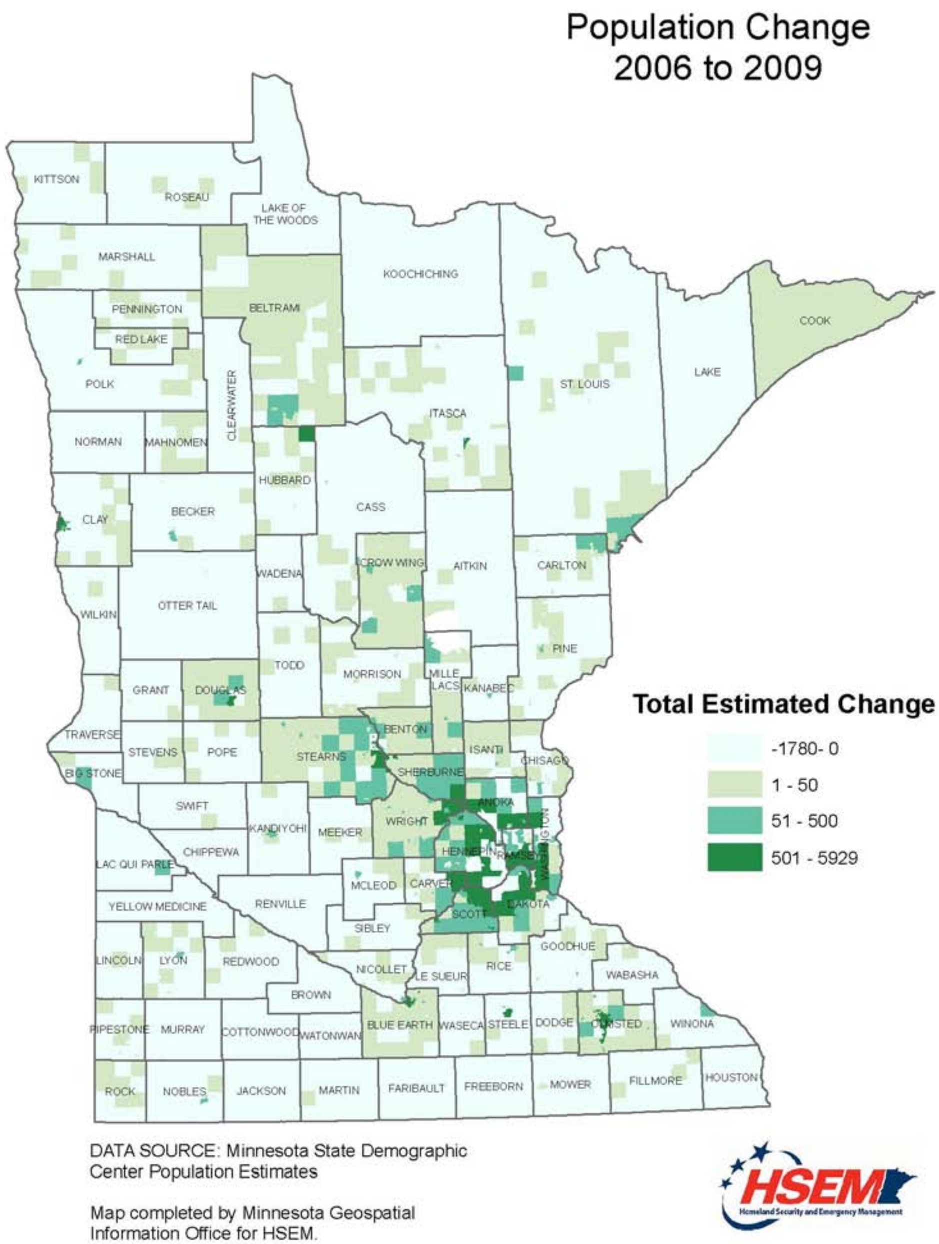
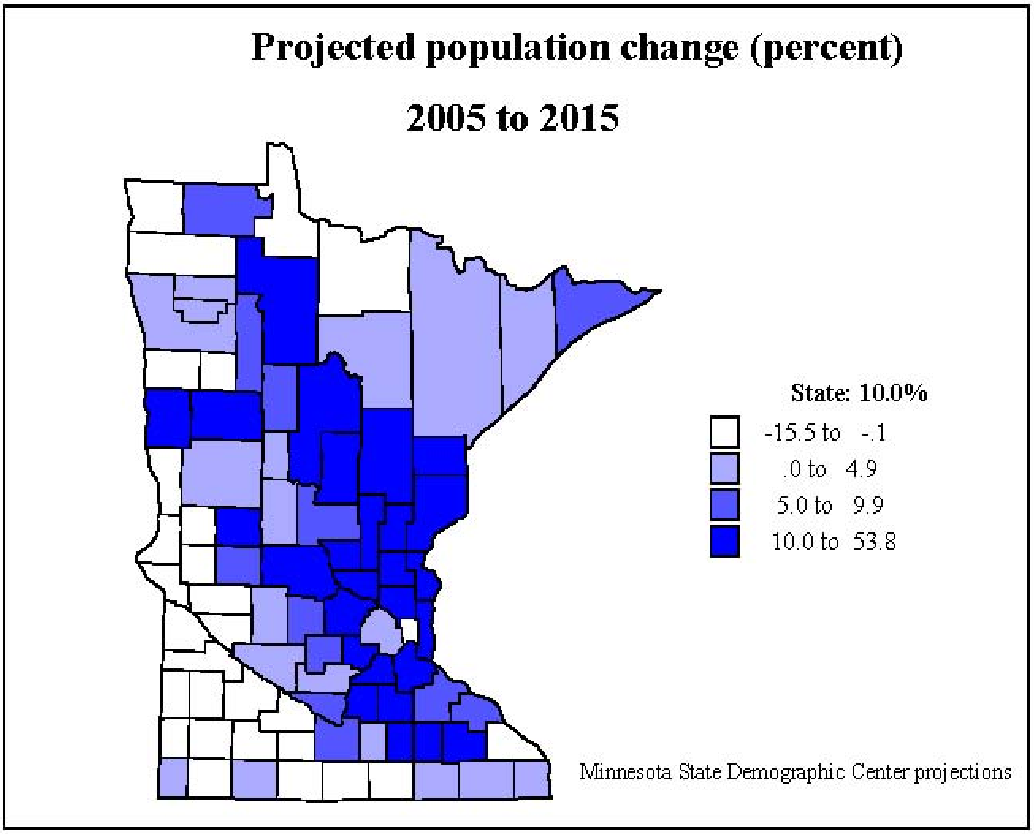


FIGURE 5 PROJECTED POPULATION CHANGE



2.5 Climate Adaptation

The United States Global Change Research Program published a report that highlights potential impacts to the Midwest because of climate change. The federal multi-agency study results are summarized here:

- During the summer, public health and quality of life, especially in cities, will be negatively affected by increasing heat waves, reduced air quality, and increasing insect and waterborne diseases. In the winter, warming will have mixed impacts.
- The likely increase in precipitation in winter and spring, more heavy downpours, and greater evaporation in summer would lead to more periods of both floods and water deficits.
- While the longer growing season provides the potential for increased crop yields, increases in heat waves, floods, droughts, insects, and weeds will present increasing challenges to managing crops, livestock, and forests.
- Native species are very likely to face increasing threats from rapidly changing climate conditions, pests, diseases, and invasive species moving in from warmer regions.

For the full report, see:

www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/regional-climate-change-impacts/midwest

The state of Minnesota has developed an Interagency Climate Adaptation Team. Staff from Public Safety participated, including Hazard Mitigation staff. This is a topic of growing interest for the state and mitigation staff and will be addressed as necessary.

3. PLANNING PROCESS

Requirement §201.4(c)(1): *[The State plan **must** include a] description of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated.*

The State All Hazard Mitigation Plan Update began with the securing of federal fiscal year 2009 Pre-Disaster Mitigation funding for a statewide flood risk analysis utilizing HAZUS (risk assessment software). As indicated in the 2008 Plan, "One action item that will have a major impact on the planning process for the 2011 Plan will be the addition of a mitigation planner, equipment, and training to run HAZUS. Once training is completed a level I and II analysis will be available for risk assessments for each of the top hazards."

Each section of the Plan was reviewed and revised by state hazard mitigation staff and multiple state and federal agency staff. The newly formed Minnesota Natural Hazards Risk Management Team aka Silver Jackets were the leading committee to review the Plan and provide input. The Membership on the Silver Jackets team includes members of federal and state agencies. The EPRC also reviewed the Plan. An opportunity for the public, businesses and other organizations to review and comment will be provided during the posting of the Plan on the MN HSEM website.

3.1 Timeline of 2011 Plan Update

April 23, 2008	Minnesota All-Hazard Mitigation Plan approved.
June 25, 2008	DR-1772-MN declared from severe storms and flooding.
June 2008	HSEM partners with the Polis Center and University of Minnesota at Duluth (UMD) - Geographic Information Sciences Laboratory (GISL) to develop a project plan for the statewide HAZUS flood loss estimate report.
October 28, 2008	Jim McClosky meets with five Regional Development Commissions for HAZUS education and to determine what is needed for local mitigation plans.
December 2008	HSEM submits PDM application for statewide HAZUS flood loss estimate.
April 9, 2009	President Declares Disaster DR-1830-MN for flooding in Red River Valley.
October 27, 2009	EPRC meeting. Jim McClosky presented information on MN HAZUS study.
November 19, 2009	Silver Jackets Meeting – Kickoff meeting. The group will become the lead for the State Mitigation Plan update.
December 1, 2009	SHMO attended Regional Silver Jackets meeting in Indiana and discussed formation of group and its role in updating the state Plan.

December 1, 2009	MN HAZUS Statewide Flood Analysis Kickoff Meeting for state agencies in St. Paul. The project was presented and requests for data were made to state agencies and the Minnesota State College and Universities (MnSCU).
December 2, 2009	MN HAZUS Statewide Flood Analysis Training at University of Minnesota-Duluth (UMD). This was a HAZUS technology transfer from Polis to GISL.
December 18, 2009	Silver Jackets Meeting – Review outline of state Plan, it will follow crosswalk requirements.
January 7, 2010	USACE Flood Meeting – Levee Inventory.
January 28, 2010	Silver Jackets Meeting – Section 4 Hazard Analysis and Section 5 Risk Assessment handed out for review.
February 9, 2010	Polis, GISL, and HSEM met to finalize the method of completing the county HAZUS flood loss estimate reports, the state HAZUS report, and the maps for the state mitigation Plan. These agencies met with state agencies to review the Plan and to confirm data sources.
February 10, 2010	Silver Jackets Meeting – Focus on flood forecasting and pending disaster.
March 31, 2010	Interview potential intern to work on state plan – later found to be not eligible for hire.
April 19, 2010	Disaster DR-1900-MN declared for flooding.
May 14, 2010	Silver Jackets Meeting: Section 4 Hazard Analysis and Section 5 Risk Assessment handed out for review along with Actions section. Previous occurrences and natural hazard sections updated. Input for flood and wildfire section incorporated into update.
May 18, 2010	Meeting with All Hazard Planning Section of HSEM regarding updates to “other hazards” utilizing the Minnesota Emergency Operations Plan (MEOP), Comprehensive Preparedness Guide (CPG 101) and Nationwide Plans Review 2010 Matrix.
June 21-24, 2010	USACE Flood Risk Management and Silver Jackets Combined Spring Workshop.
June 23, 2010	Silver Jackets Meeting – discuss most current severe weather events – disaster. Begin work on tasks or “Work Plan” for implementation.
July 2, 2010	Tornadoes, severe storms and flooding lead to Disaster Declaration DR-1921-MN.
July-September 2010	HSEM staff work with MnGeo staff on Local Plan Integration section of Plan.

July 14, 2010	Silver Jackets Meeting. Review Indiana State All Hazard Mitigation Plan. Develop technical and education subcommittees to address items in draft Work Plan.
August 1, 2010	The HAZUS flood loss estimate project is interrupted by the state mitigation program. The county loss estimate reports were complete at this time. The PDM-09 was closed and a new application for funding under DR-1830 was sent to FEMA. This was done to fund work for the state Plan to be done by the Minnesota Geospatial Information Office (MnGeo). Only the state report and maps remained.
August 3, 2010	EPRC meeting – Jim presents overview of State All-Hazard Mitigation Plan and update.
August 18, 2010	Silver Jackets meeting. HSEM provides update on State Plan, specifically local plan integration section.
August 2010	Silver Jackets subcommittee reviews and updates goals, strategies and actions sections.
September 15, 2010	Silver Jackets meeting. Discuss Work Plan development.
October	New Hazard Mitigation Program Administrator/State Hazard Mitigation Officer hired.
October 13, 2010	Severe flooding due to rainstorms lead to declaration of DR-1941 for 22 counties in the state.
November 29, 2010	The agreement between HSEM and MnGeo takes effect and update of the risk assessment begins.
December 15, 2010	Silver Jackets meeting. Goals and action items updated, funding sources section to be updated. Target dates for review and Plan finalization.
January 7, 2011	The contracts for Polis and GISL were approved and work commenced on the HAZUS flood loss estimate for the State Mitigation Plan.
January 7, 2011	Silver Jackets meeting. Group reviewed the prioritization and ranking of project types. Priorities for state have not changed. Flooding remains highest hazard due to the amount of annual damages and mitigation potential. Tornados and windstorms also remain high priority due to recent events. Wildfire is still high priority even thought there has not been a catastrophic wildfire in a few years. The State Capability Assessment was reviewed and updated by the group.
January 14, 2011	Real Time Flood Modeling webinar at HSEM with Central HAZUS Users Group, Polis Center and USGS. Demonstrate research done over the past two years as part of a collaborative

	project done by the Indiana Silver Jackets on the use of the HAZUS-MH tool. Review web-based tool that is anticipated to be available for real-time analysis in the near future. The purpose of this research was to derive a methodology for producing rapid and credible estimates of flood losses based on credible local structure and hazard data.
January 18, 2011	EPRC meeting – The non-natural/other hazards section given to committee for review. The overall review was positive with only minor typographical errors cited.
January 21, 2011	The final version of the Minnesota Flood Risk Assessment Report and associated maps are approved. The county reports are in the process of being transferred to HSEM. Information seminars with state and county agencies are in the process of being scheduled.
February 1, 2011	Submit Plan to FEMA V for review.
February 2011	Post Plan on HSEM website for public comment. Publicize availability via Facebook, Twitter, and public notice.
March 2011	Review and incorporate changes to Plan and resubmit to FEMA V for approval – *if required.*
April 2011	Obtain Governor's and other state agencies Commissioners signatures. Submit signatures to FEMA V.

3.2 Agency Coordination

Requirement §201.4(b): *The [State] mitigation planning process* **should** *include coordination with other State agencies, appropriate Federal agencies, and interested groups.*

Mitigation plans, policies and programs are directed by federal legislation (CFR 44 Emergency Management and Assistance), and Executive Orders (19988 and 19900). The state takes its role very seriously regarding emergency management. HSEM and other state agencies that participate in preparedness, recovery, response and mitigation abide by the following policies and executive orders. The Governor's Executive Order is in Appendix D. This policy indicates the importance of coordination with federal, other state agencies and locals in emergency management.

The MN State Statute Chapter 12 Emergency Management Policy Declaration (12.02):

> *It is further declared to be the purpose of this chapter and the policy of the state that all emergency management functions of this state be coordinated to the maximum extent with the comparable functions of the federal government, including its various departments and agencies, of other states and localities, and of private agencies of every type, to the end that the most effective preparations and use may be made of the nation's labor supply, resources, and facilities for dealing with any disaster that may occur.*

Governor's Executive Order, Section 1864

> *HSEM shall have overall responsibility for supporting both local government emergency operations planning and all-hazards mitigation planning. This responsibility includes the development and maintenance of prototype emergency operations plans, mitigation plans and supporting documents, as well as planning requirements guidance.*

The following interagency groups exemplify how planning goals can be achieved and how mitigation planning and project implementation can be integrated into existing efforts.

Minnesota Natural Hazard Risk Management Team aka Silver Jackets

The newly formed Minnesota Natural Hazards Risk Management Team aka Silver Jackets was the leading committee to review the Plan and provide input. Membership on the Silver Jackets team includes members of federal and state agencies. The name Silver Jackets comes from the different colored jackets, which various agencies wear when responding to disasters, such as, USACE personnel wear red and FEMA personnel wear blue. The "Silver" Jackets represents a unified interagency team. While Silver Jackets typically provide information on flooding, the Minnesota group is all-hazard oriented. The Silver Jackets website holds meeting minutes and contact information at http://www.nfrmp.us/state/factMinnesota.cfm. Core agencies and representatives include:

- U.S. Army Corps of Engineers
  - St. Paul District & Regional – Terry Zien
  - National – Jennifer Dunn
- Federal Emergency Management Agency
  - Region V Hazard Mitigation Officers – Morgan Holloway
- National Flood Insurance Program
  - Region V – John Devine
- Minnesota Homeland Security and Emergency Management
  - Hazard Mitigation Program Administrator and Planners – Jim Russell, Jim McClosky, Jennifer Nelson
  - Disaster Recovery Coordinator - John Moore
  - Individual Assistance and Community Education and Outreach Coordinator – Brian Curtice
- Minnesota Department of Natural Resources
  - Water and Ecological Resources – Pat Lynch, Ceil Strauss, Suzanne Jiwani,
  - Dams - Jason Boyle
- U.S. Geological Survey – James Fallon, Dave Lorenz
- National Weather Service
  - Twin Cities – Diane Cooper
  - LaCrosse, Wisconsin - Mike Welvaert

- Minnesota Department of Labor and Industry – Bill Mesaros
- Minnesota Board of Water and Soil Resources – Al Kean
- Minnesota Department of Commerce - Tina Armstrong, Robert Commodore
- U.S. Department of Agriculture - National Resource Conservation Service – Pete Cooper

The Minnesota Silver Jackets was born out of the **Regional Flood Risk Management Team** (RFRMT). The Regional Team aims to integrate pre-flood mitigation with a long-term strategy to plan and implement pre- and post-flood emergency actions, while developing promising nonstructural alternatives and other flood risk mitigation actions recognized to reduce future flood risk within the region. In order to fully understand the Silver Jackets, it is imperative to understand the regional and national connections.

Goals of the RFRMT:

- Carry out flood risk and watershed management programs and activities that complement existing mitigation activities;
- Ensure that initiatives encompass federal, tribal, state, and local, programs and authorities from a holistic or systemic approach, with the objective to minimize risk to life, property, and agriculture, and protect natural resources in a reasonable and cost-effective manner;
- Ensure that both potential Structural Alternatives and Non-Structural Alternatives (NSAs) that have regional merit receive consideration;
- Lead a collaborative, comprehensive, and sustainable regional flood risk management strategy to improve public safety, reduce flood damages, and reduce holistic flood risk;
- Ensure vertical (national/tribal level to state level) and horizontal (interstate) communication and information sharing, to include developing a comprehensive intergovernmental approach to flood risk management planning, policies, and activities;
- Provide oversight of regional activities in consonance with the National Flood Risk Management Program;
- Pursue potential funding mechanisms from the represented agencies in order to address other requirements impacting the integrity of flood risk management systems and/or comprehensive study efforts within the flood affected areas (including upstream and downstream);
- Develop, implement, and maintain an effective Interagency Public Outreach Program through a comprehensive communication and FRM policies and priorities education strategy to local governments, communities, and those who have property at flood risk; and
- Grow in understanding of state long-term mitigation plans, and enable the implementation of those plans.

Minnesota Recovers Task Force

The Minnesota Recovers Task Force (MRTF) formed in response to the Great Flood of 1993, when the Mississippi and Missouri Rivers and their tributaries overflowed, causing one of the most costly and devastating floods in the history of the United States. The task force's purpose is to combine government resources toward long-term recovery efforts and hazard mitigation activities. The MRTF helps get funds and assistance directly to those areas most affected by a recent disaster. This approach is an example of how funds, ideas and resources can cross agency and political boundaries to accomplish mitigation actions. Based on type, severity and extent of disaster, different subcommittees are formed to assist individuals and communities in need.

Following a major disaster, state disaster relief funds MAY be allocated to assist local units of government in their disaster recovery. These funds are appropriated to address those needs, which are not met by other disaster assistance programs. In a presidentially declared disaster, this is typically grant assistance from the FEMA Public Assistance and Individual Assistance Programs, and loan assistance from the Small Business Administration.

Funds are typically allocated to the different state agencies, and their programs, to acquire and to better publicly owned land and buildings and for other public improvements of a capital nature.

In some instances, funds may become available to assist local homeowners, businesses, and non-profit organizations. In these cases, the impact on the community will be weighed when funding decisions are made. The local unit of government should apply on behalf of these groups when a significant impact exists.

While this group is mainly recovery focused, mitigation actions are often funded, including acquisitions and drainage and infrastructure improvements. Funding the local match for mitigation projects has been a priority for the subcommittee as the local share has been identified as an unmet need for many communities post-disaster.

The Presidential Disaster Declarations DR-1921-MN and DR-1941-MN for flooding in southeastern Minnesota brought together the Housing, Infrastructure, Mitigation/Natural Resources, Business and Human Services subcommittees. Subcommittees formed, met and reported to the task force as a whole. For Disaster DR-1830-MN, the task force convened, however, only the Mitigation/Natural Resources subcommittee met. Disasters DR-1772-MN and DR-1900-MN did not lead to additional state funding, however the task force met informally to address unmet needs.

Emergency Preparedness Response Committee (EPRC)

HSEM Program staff serves as the chair of the State Emergency Preparedness and Response Committee (EPRC), whose members represent the state agencies that have key emergency responsibility assignments. The Committee is all-hazard in scope. HSEM utilizes the EPRC to help coordinate a variety of State agency emergency preparedness-related tasks. The EPRC also facilitates inter-and-intra-agency cooperation.

Each state agency cited in Executive Order 07-14 designates a member of its staff as its emergency preparedness response contact/coordinator (EPRC/C). The EPRC/C is a point of contact for the Emergency Preparedness and Response Committee (EPRC). The Division of Homeland Security and Emergency Management coordinate the activities of the EPRC to ensure the state responds appropriately and immediately to any type of disaster that occurs in Minnesota and in the nation. Each department is required to have their own emergency plan. The EPRC also reviews overall state plans then recommends the plan to their commissioner for approval. These state plans include the Minnesota Emergency Operations Plan (MEOP) and the Minnesota All Hazard Mitigation Plan (Plan). A contact list and procedures that are used to activate the State Emergency Operations Center (SEOC) are also reviewed by the EPRC. The members of the EPRC usually represent their department in the SEOC when activated to make sure state response activities are coordinated and that information is being shared between departments and the governor. Representatives from state agencies on the committee include:

- Administration
- Agriculture
- Board of Animal Health
- Commerce
- Corrections
- Disability Council
- Education
- Employment and Economic Development (DEED)
- EMS Regulatory Board
- Minnesota Management and Budget
- Health
- Housing Finance
- Human Services
- Judicial Branch
- Labor & Industry
- Metro Transit
- Military Affairs
- Natural Resources
- Pollution Control Agency
- Public Safety- Fire Marshal
- Public Safety- Pipe Line Safety
- Public Safety - State Patrol
- Office of Enterprise Technology
- Revenue
- State Colleges and Universities
- Transportation
- University of Minnesota
- Board of Water & Soil Resources

The EPRC contact list is in Appendix E.

3.3 Program Integration

Requirement §201.4(b): *[The State mitigation planning process* ***should****] be integrated to the extent possible with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives.*

Integration of current planning efforts taking place throughout the state and coordination of these and other local efforts are two keys in creating effective, thorough and accurate plans. Isolated planning efforts can result in redundancies and lost opportunities, not to mention the loss of valuable financial resources. It is important to identify possible areas of overlap between agencies and groups that work directly or indirectly with mitigation. This recognition process can result in partnerships or at the very least, can lay the foundation for ideas to be shared.

Of the 87 counties in Minnesota, 80 counties have FEMA approved plans. The remaining jurisdictions are in various stages of developing multi-jurisdictional all-hazard mitigation plans. These local plans are consistent with and incorporate information from this Plan. Local hazard mitigation plans are encouraged to incorporate other local planning mechanisms, thus providing a unified mitigation strategy throughout all levels and aspects of government within Minnesota. Counties are encouraged to review the state Plan and utilize resources as a starting point for creating their plans.

It is sometimes hard to identify such integrated efforts as outlined here because the concept of mitigation remains an elusive topic for many. An agency may in fact be involved in activities that support mitigation but they may not readily recognize, or place a label on their actions. This is why mitigation planning and outreach is so important: to get these isolated efforts going in the same direction so that combined benefits can be realized through the existing communities and task forces.

The following programs reinforce the idea of integration and coordination in planning for hazard mitigation.

FEMA Public Assistance Section 406 Mitigation

Recently, Public Assistance (PA) Mitigation Section 406 has become a higher priority for the state. For the past three disasters, 406 mitigation data was available:

1. For DR-1830-MN Public Assistance 406 Mitigation, proposed amount is $1,708,412 from 667 projects. The vast majority of protect worksheets were for Category C – Roads and Bridges.
2. Of the 124 mitigation proposals for DR-1900-MN the majority were Category C, 11 project worksheets were for Category D - Water Control Facilities and a few project worksheets were written up for Category G-Parks, Recreational and Other. The total 406-mitigation proposal amount was $3,208,043.
3. DR-1921-MN PA 406 Mitigation proposal funding is $1,463,841 for 56 projects. $1,082,338 is for one utility mitigation project. Further detail regarding 406 mitigation projects is available
4.

State Homeland Security Assessment and Strategy Initiative

Every opportunity is taken by the state to coordinate mitigation ideals with other program processes or initiatives. Such an opportunity came with the recent State Homeland Security Assessment and Strategy Initiative that is designed to get communities to assess their risk to possible terrorist threats. A key component of this effort is an online risk assessment tool. Even though this risk assessment only focused on one hazard—terrorism—communities could conduct a natural hazards risk assessment at the same time they conduct the terrorism risk assessment. Twenty-six counties were solicited to conduct such a process.

Urban Areas Securities Initiatives (UASI)

The 12 metro jurisdictions that fall within the Urban Areas Securities Initiatives recently began work on a holistic risk and capabilities management competency. Utilizing a secure web portal interface, the Twin Cities Urban Area will have an improved understanding of risk, program operations and capabilities. By the end of the first quarter of 2011 a capabilities assessment and gap analysis utilizing detailed hazard analysis and evaluation for critical infrastructure/key resources data will be completed, thus enabling them to apply their lessons learned to a mitigation plan.

Minnesota Emergency Operations Plan (MEOP)

The MEOP is an obvious planning document that shares a similar interest with the State All-Hazard Mitigation Plan. Here, short-term recovery decision-making associated with emergency operations, can lead to implementing mitigation strategies aimed at reducing long-term risk to human life and property.

National Incident Management System (NIMS)

An example of an integrated planning effort is the National Incident Management System. NIMS is designed to integrate local, state and federal resources during a response. This system is used daily in Minnesota to coordinate emergency response between the fire service, law enforcement, and emergency medical services. Incidents and disasters of larger scale may require response from mutual aid organizations and/or more vertical integration of state and federal agencies.

Minnesota Building Codes and Standards

Another planning link can be seen with the Minnesota Department of Labor and Industry, Construction Codes and Licensing Division who administers the Minnesota State Building Code - Statutory Authority (16B.59 - 16B.75) that sets construction standards to assure the health, safety, comfort and security of building occupants.

One important planning document that comes out of this office is the Disaster Preparedness Manual, A Guidebook for Minnesota Building Officials produced by the Disaster Mitigation Committee of the North Star Chapter. Included in this document are creative mitigation measures that surround building code enforcement.

Unfortunately, not all counties have chosen to adopt the state's building code. 422 cities and 20 counties have adopted the building code. Insurance companies do take note of communities that do have an adopted and enforced building code and make insurance rate adjustments accordingly.

Minnesota State Fire Code

The Minnesota State Fire Code is administered by the Department of Public Safety, State Fire Marshal Division. Statutory authority for the code is contained in Minnesota Statutes 299F.011. The code is based on the International Code Council's (ICC) International Fire Code (IFC), as amended for Minnesota. A link to the Minnesota amendments to the IFC, and information about the State Fire Code, can be found at www.fire.state.mn.us. The code contains requirements for fire safety hazard mitigation in new construction, as well as fire safety system maintenance requirements which are in force throughout the life of structures.

The **Minnesota Department of Natural Resources** has many programs that work toward making Minnesotans more disaster resilient. The State has several funding programs available to local jurisdictions to address the state's number one natural hazard – flooding. These funds are primarily from various federal grant programs. Currently, the state uses the HMGP and PDM FEMA programs and the MN DNR Flood Damage Reduction (FDR) Program.

The **Flood Damage Reduction Grant Assistance** Program was created by the Minnesota Legislature in 1987 to provide technical and financial assistance to local government units for reducing the damaging effects of floods. Under this program the state can make cost-share grants to local units of government for up to 50 percent of the total cost of a flood mitigation project. The goal of existing regulations and programs for flood damage reduction is to minimize the threat to life and property from flooding. In addition to property loss, people can be killed or injured fighting flood waters. The efforts of local governments to enforce their zoning ordinances and to sponsor projects and acquire or relocate flood prone buildings have helped to reduce risk to lives and flood damages.

Currently, two different classes of grants are available through the FDR program. Small grants are for projects with a total cost of less than or equal to $300,000 (state share less than $150,000). Small grants are made directly by the DNR from funds appropriated by the Legislature. Large grants are for projects with a total cost greater than $300,000 (state share greater than $150,000). Large grant applications are received and prioritized by the DNR and then presented to the governor and the Legislature for consideration in a capital bonding bill.

Examples are as follows:

Each jurisdiction must enforce its own zoning rules and regulations which includes floodplain management. The State cannot enforce these regulations; it is up to the local jurisdiction.

Each jurisdiction chooses whether or not to adopt building codes and is responsible for enforcing building codes. The State of Minnesota has adopted a statewide building code but there are only a few counties that have adopted them.

The Minnesota Department of Natural Resources Division of Ecological and Water Resources has developed a model ordinance for floodplain management, which provides the minimum requirements an NFIP participating jurisdiction must enforce. This model encourages community development outside of the floodplain and assists in managing the current floodplain.

Note: MN DNR Division of Ecological and Water Resources is the integration of the former Divisions of Waters and Ecological Resources, as of February 2009.

Additional DNR programs that have proven to be successful are illustrated below.

NFIP Coordination in MN

The MN DNR Division of Waters and Ecological Resources is the state coordinating agency for the National Flood Insurance Program (NFIP). State statutes and rules have been adopted that are more restrictive than the federal standards in many respects. DNR Waters works with the zoning authorities around the state to adopt compliant ordinances, and provides training and technical assistance.

There are 533 participating communities, of which 85 are counties and most of the rest are cities. A total of 101 cities have FEMA maps that identify high flood risk areas, but are not participating.

Cooperating Technical Partners (CTP)

The Cooperating Technical Partner (CTP) program allows for more local direction and input during the remapping process, and typically allows for more updated studies or data to be incorporated into the updated maps. The following are CTP with FEMA - State of Minnesota, Washington County, Clay County, Dakota County, Scott County, Sherburne County, and Goodhue County. The following have CTP grants through DNR Waters - Carver, Olmsted, and Meeker. Since 2008 Norman County and the Red Lake River Watershed District have received CTP grants through the DNR.

Risk Mapping, Assessment and Planning - Risk MAP

The vision for Risk MAP is to deliver quality data that increases public awareness and leads to action that reduces risk to life and property. Risk MAP builds on flood hazard data and maps produced during the Flood Map Modernization (Map Mod) program.

The planning process is a very important part of how coordination and integration of mitigation occurs. In the next section, the Minnesota Risk Assessment is conducted. All natural hazards that occur in Minnesota are described, along with past occurrences. Based on the hazard profiles, vulnerability is assessed by jurisdiction.

4. RISK ASSESSMENT: IDENTIFY AND PROFILE HAZARDS

***§201.4(c)(2)**: [The State plan must include a risk assessment] that provides the factual basis for activities proposed in the strategy portion of the mitigation plan. Statewide risk assessments must characterize and analyze natural hazards and risks to provide a statewide overview. This overview will allow the State to compare potential losses throughout the State and to determine their priorities for implementing mitigation measures under the strategy, and to prioritize jurisdictions for receiving technical and financial support in developing more detailed local risk and vulnerability assessments. **201.4(c)2)(i)** – The risk assessment shall include an overview of the type of all natural hazards that can affect the state.*

This section of the Plan is a result of a risk and vulnerability assessment conducted for the State of Minnesota. The risk assessment is part of the State Hazard Mitigation Plan and is intended to support the State's long-term hazard mitigation planning efforts. It was prepared to satisfy the requirements of the Disaster Mitigation Act (DMA) of 2000 and to provide a statewide overview of natural hazards and their risks. This Plan also assesses human-caused hazards such as; fire, hazardous materials spills, and, radiological, critical infrastructure failure, and water supply contamination.

The framework of the risk assessment was developed to provide a basis for activities proposed during the State's mitigation planning effort and should be used by state and local officials to plan and prioritize resource allocations. The risk assessment results should be used to identify and prioritize appropriate mitigation actions to minimize potential losses from hazards identified in this study.

The hazards profiled in the Minnesota Risk Assessment were selected from the comprehensive list of natural hazards FEMA identified in the 1997 publication, *Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy* (MHIRA).

The original risk assessment was based on input from published sources such as the U.S. National Oceanographic and Atmospheric Administration (NOAA), the U.S. Geological Survey (USGS), the U.S. Army Corps of Engineers (USACE), the U.S. Department of Agriculture (USDA), the Minnesota Department of Natural Resources (DNR), and the Minnesota Division of Homeland Security and Emergency Management, among others.

This portion of the Risk Assessment identifies and profiles natural hazards. All 20 hazards that potentially affect the state are described, as is the nature of each hazard, history, location of occurrence, and probability of future occurrence.

The probability ranking and criteria for mitigation potential and hazard identification and disposition are based on data from known reliable sources for all 20 hazards and have not changed for the 2011 Plan update. Flooding, Tornadoes, Straight Line Winds and Wildfire remain the top four natural hazards the state categorizes as having both High Probability Ranking and High Mitigation Potential Ranking.

Criteria for High Probability Ranking:

- The hazard has impacted the State annually, or more frequently The hazard is widespread, generally affecting regions or multiple counties in each event
- There is a reliable methodology for identifying events and locations

Criteria for Mitigation Potential High Ranking:

- Methods for reducing risk from the hazard are technically reliable
- The state or counties have experience in implementing mitigation measures
- Mitigation measures are eligible under federal grant programs
- There are multiple possible mitigation measures for the hazard
- The mitigation measure(s) are known to be cost-effective
- The mitigation measures protect lives and property for a long period of time, or are permanent risk reduction solutions

The 2011 Plan update did not add or withdraw any hazards. Dams were moved from the other hazard section to the natural hazard section due to the impact water has on the environment in the case of a dam or levee failure – flooding.

Based on the above sources, historical data, public perception and technical requirements, the following 20 hazards were considered for analysis:

Natural Hazards

- Flooding
- Wildfire
- Windstorms
- Tornadoes
- Hail
- Lightning
- Coastal Erosion
- Severe Winter Storms
- Landslide
- Sinkholes & Land Subsidence
- Earthquake
- Drought
- Extreme Temperatures
- Dam Failure (moved from Other Hazards)

Other Hazards:

- Water Supply Contamination
- Fire (structural)
- Hazardous Materials
- Nuclear Accidents (uncontrolled releases of radioactive materials)
- Infectious Disease
- Infrastructure Failure

The DMA of 2000 and supporting requirements in the Interim Final Rule (IFR) requires States to first identify hazards that may affect them, perform a comprehensive multi-hazard assessment, which includes a review of detailed information concerning hazard characteristics, past occurrences and probability of future occurrences. The initial hazard identification cataloged potential hazards statewide and determined which have the most chance of significantly affecting the State and its citizens. The hazards include those that have occurred in the past as well as those that may occur in the future. A variety of sources were used in the investigation, as noted earlier.

The following sections provide information on the nature of each hazard that the State of Minnesota is susceptible to, a history of the hazard in the state and the probability of its occurrence in the future.

4.1 Natural Hazards

Requirement §201.4(c)(2)(i): *[The State risk assessment* ***shall*** *include an overview of the] location of all natural hazards that can affect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate.*

The Minnesota Risk Assessment examines natural disasters on a statewide basis and for individual counties. Natural hazards include those caused by climatological, geological, hydrological, or seismic events. Natural hazards are natural events that threaten lives, property, and other assets. Often, natural hazards can be predicted. They tend to occur repeatedly in the same geographical locations because they are related to weather patterns or physical characteristics of an area. Natural hazards such as flood, fire, tornado, and windstorms affect thousands of people each year.

Natural disasters have the potential to affect all of Minnesota, including agricultural producers, farmers and other rural residents. The Department of Agriculture has disaster assistance available for such needs. Agricultural disasters often affect large geographic areas, from multiple counties to multiple states. Many disasters are multiple hazards, such as tornado, high winds, heavy rains and hail. In addition, dates of disaster designation may be effective for months, in the case of drought.

This section will outline the natural hazards identified through the risk assessments. The natural hazards are as follows:

- Flooding
- Wildfire
- Tornadoes
- Windstorms
- Hail
- Coastal Erosion
- Severe Winter Storms
- Dam Failure
- Landslide
- Sinkholes & Land Subsidence
- Earthquake
- Drought
- Extreme Temperatures
- Lightning

Flooding

Flooding is the accumulation of water within a water body (e.g., stream, river, lake, and reservoir) and the overflow of excess water onto adjacent floodplains. Floodplains are lowlands, adjacent to water bodies that are subject to recurring floods. Floods are natural events that are considered hazards only when people and property are affected. Nationwide, hundreds of floods occur each year, making it one of the most common hazards in all 50 states and U.S. territories (FEMA, 1997).

There are a number of categories of floods in the U.S., including the following:

- Riverine flooding, including overflow from a river channel, flash floods, alluvial fan floods, ice-jam floods, and dam break floods
- Local drainage or high groundwater levels
- Fluctuating lake levels
- Coastal flooding, including storm surges
- Debris flow
- Subsidence

The most common type of flooding event is riverine flooding, also known as overbank flooding. Riverine floodplains range from narrow, confined channels in the steep valleys of mountainous and hilly regions, to wide, flat areas in plains and coastal regions. The amount of water in the floodplain is a function of the size and topography of the contributing watershed, the regional and local climate, and land use characteristics. In steep valleys, flooding is usually rapid and deep, but of short duration, while flooding in flat areas is typically slow, relatively shallow, and may last for long periods of time.

The cause of flooding in large rivers is typically prolonged periods of rainfall from weather systems covering large areas. These systems may saturate the ground and overload the rivers and reservoirs in numerous smaller basins that drain into larger rivers. Localized weather systems (i.e., thunderstorms), may cause intense rainfall over smaller areas, leading to flooding in smaller rivers and streams. Annual spring floods, due to the melting of snowpack, may affect both large and small rivers and areas.

While there is no sharp distinction between riverine floods, flash floods, ice jam floods, and dam-break floods, these types of floods are widely recognized and may be helpful in considering the range of flood risk and appropriate responses.

Flash flood is a term in wide use by experts and the general population, but there is no single definition or clear means of distinguishing flash floods from other riverine floods. Flash floods involve a rapid rise in water level, high velocity, and large amounts of debris, which can lead to significant damage that includes the tearing out of trees, undermining of buildings and bridges, and scouring new channels. The intensity of flash flooding is a function of the intensity and duration of rainfall, steepness of the watershed, stream gradients, watershed vegetation, natural and artificial flood storage areas, and configuration of the streambed and floodplain. Dam failure and ice jams may also lead to flash flooding. Urban areas are increasingly subject to flash flooding due to the removal of vegetation, covering of ground cover with impermeable surfaces, and construction of drainage systems. Local flash flooding can be very destructive along the steep bluffs of Lake Superior and the hilly terrain and narrow valleys of southeast Minnesota; however, flash flooding can occur anywhere in Minnesota. Flash flooding occurs on average, three times a year somewhere in the state. Typically, a Flash Flood occurs within six hours of a rain event, or after a dam or levee failure, or following a sudden release of water held by an ice or debris jam, and flash floods can catch people unprepared.

Flash flood definition*: - a rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within six hours of the causative event (e.g., intense rainfall, dam failure, ice jam). However, the actual time threshold may vary in different parts of the country. Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters.*

www.nws.noaa.gov/directives/sym/pd01009050curr.pdf

The definition of a flash flood per the Minnesota Climatology Working Group is "*the occurrence of 6 inches or more rainfall within a 24 hour period*". The size of a flash flood is measured area in square miles over which a 4-inch or more rainfall occurs. The rationale for using this criteria is that a rainfall of six inches in a 24-hour period is near the 100-year return period in Minnesota and, second, a 4-inch and greater rainfall approximates the level at which the newspaper reports indicate increased erosion or other economic damages are associated.

The information at climate.umn.edu/doc/flashflood.htm is a continuation of the book *Sixteen Year Study on Minnesota Flash Floods*. This document was published in January, 1988 by the Minnesota Department of Natural Resources Division of Waters State Climatology Office and the University of Minnesota Soil Science Department. That study looked at sixteen years of flash floods from 1970 to 1985. In addition, flash floods from 1986 to 2008 are included below.

There are a total of 114 flash flood events documented in Minnesota since 1970.

www.nws.noaa.gov/floodsafety/floodsafe.shtml

Ice jam floods are primarily a function of the weather and are most likely to occur where the channel slope naturally decreases, culverts freeze solid, reservoir headwaters, natural channel constructions (e.g., bends and bridges), and along shallows.

A type of flooding that does not result directly from overflowing lakes and streams but must be addressed is flooding that result from inadequate infrastructure, e.g., inadequate storm sewers and storm drainage systems. In Minnesota, floods resulting from inadequate infrastructure are often upstream and away from traditionally delineated floodplain areas that are subject to local land-use regulations. Therefore, this type of flooding has not typically been mapped by NFIP, and NFIP only requires local governments to impose land use regulations in a mapped floodplain. The NFIP standard flood insurance policy, however, often pays claims for flood losses in these areas with inadequate infrastructure.

Local drainage floods may occur outside of recognized drainage channels or delineated floodplains due to a combination of locally heavy precipitation, a lack of infiltration, inadequate facilities for drainage and stormwater conveyance, and increased surface runoff. Such events frequently occur in flat areas, particularly during winter and spring in areas with frozen ground, and also in urbanized areas with large impermeable surfaces. High groundwater flooding - and/or flooding that results from rain falling on nearly saturated or saturated soils, is a seasonal occurrence in some areas, but may occur in other areas after prolonged periods of above-average precipitation. Losses associated with local drainage are most significant when they occur with other hazards described in this document, such as widespread flooding and thunderstorms; therefore, they are not analyzed as a distinct hazard.

Many urban areas that have historically been flood prone have been removed from the floodplain through the application of two construction types: (1) flood control dams, which reduce peak discharges; and, (2) levees, which redirect floods away from areas that would otherwise be inundated.

The third and somewhat less frequent category of floods in Minnesota is slowly rising lake levels. This type of flood is caused by a long-term, above-average precipitation trend in landlocked basins with poor lake outlet. This type of flooding has caused significant localized damages but seldom results in Presidential Disaster Declarations. Water rises slowly over months or years, so the flooding is not caused by a single event.

Minnesota is often referred to as the land of 10,000 lakes; the State has more than 95,000 miles of streams and rivers. These lakes and watercourses are confined within their banks throughout most of the year. On occasion, these water bodies, however, reclaim the low-lying surrounding lands, which results in flooding. Unwise floodplain development exacerbates flooding conditions. The outcome of this includes threat to human and animal health and safety as well as tremendous social and economic losses to individuals, communities, and taxpayers as a whole. In most cases, floods in Minnesota take one of two forms: large-scale flooding and flash flooding. Generally, large-scale floods result from an above normal amount of water in the snowpack (snow water equivalent). This could result from a deep snowpack or if rain on the snowpack causes increased saturation. Other factors that could contribute to a large-scale flood include: frozen soil that prevents infiltration, rapid snowmelt due to an intrusion of an unseasonably warm and moist air mass, and widespread precipitation caused by a broad scale storm system which typically approach the State from the south or west. Flash floods result from powerful, concentrated, slow-moving thunderstorms. Flooding can also occur along Lake Superior. Flooding along Lake Superior occurs most frequently when the lake is at a high level and high winds create waves that inundate low-lying areas.

The aforementioned types of "natural" flooding occur nationally. The Federal Emergency Management Agency (FEMA) and the Minnesota Department of Natural Resources (DNR), Division of Waters through the National Flood Insurance Program (NFIP) usually map them. Regulation of new construction in mapped flood hazard areas is a responsibility of local government.

Flood History in Minnesota

The major 20th century floods in Minnesota took place in 1950, 1965, 1969, 1972, 1987, 1993, and 1997. The 21st century is having its share of floods, in 2001, 2006, 2007, 2008, 2009 and 2010 there has been major flooding in the state. These floods are considered among the most severe in Minnesota's history in terms of stream flow magnitude, extent of lands inundated, loss of life, and property damage. Spring and summer rains caused the 1993 flooding. The floods of 1950, 1965, 1969, 1972, 1997, 2001, 2006, 2009 and 2010 coincided with spring snowmelts, thereby, increasing both the stage and discharge of the snowmelt events. The peak discharges of 1993 only affected a few of the major watersheds. For the southern half of Minnesota, 1965 and 1969 were the years of record peak discharges. Widespread flooding occurred again in the spring of 2000. Then beginning in mid-May and continuing intermittently through July 2001, heavy rain fell over much of Minnesota. In 2007, heavy rains from August 18-20th produced record 24-hour totals in southeast Minnesota and resulted in seven fatalities. Presidential Disaster Declarations for flooding occurred in 2008, 2009 and 2010. Notable floods in Minnesota from 1950-2010 are summarized in Table 2. Descriptions of flash floods in 2007 and 2008 from the State Climatology Office follow.

<u>Flash Floods: 2007</u>

August 18-20, 2007: Southeast Minnesota

The most memorable singular event of 2007 is the southeast Minnesota flood of August 18-20, 2007. A series of thunderstorms moving along a stalled frontal boundary dropped extremely heavy rain on much of southern Minnesota beginning August 18. The most intense precipitation rates occurred during the afternoon and evening hours of Saturday, August 18, and the early morning hours of Sunday, August 19. Over the course of the event, all or portions of 28 counties received at least four inches of rain. Six-inch totals were common across the region, and portions of southeastern Minnesota reported astounding rainfall amounts ranging from 8 to 18 inches. The heaviest rainfall reports came from Winona, Fillmore, and Houston counties, where 36-hour totals exceeded 14 inches. The largest multi-day rainfall total reported was 18.17 inches observed west of La Crescent in northern Houston County. An official National Weather Service climate observer near Hokah in Houston County reported a storm total of 16.27 inches. Of the 16.27 inches, 15.10 inches fell within the observer's 24-hour observation cycle ending at 8:00 AM on Sunday, August 19. This is the largest 24-hour rainfall total ever recorded by an official National Weather Service reporting location in Minnesota. The previous Minnesota record was 10.84 inches, measured at the city of Fort Ripley in Crow Wing County on July 22, 1972.

The deluge produced flooding tied to seven fatalities. Major flood damage occurred in many southeastern Minnesota communities. Hundreds of homes and businesses were impacted. Reports of stream flooding, urban flooding, mud slides, and road closures were numerous throughout southern Minnesota. The combination of huge rainfall totals and a very large geographic extent, make this episode one of the most significant rainfall events in Minnesota's climate history. A six-inch rainfall total for a given location in this region over a 24-hour period is said to be a "100-year" (1% probability) storm. The area receiving six or more inches during a 24-hour period in the midst of this torrent encompassed thousands of square miles. Other heavy rainfall events during this decade of comparable magnitude and spatial coverage include extraordinary rainfalls in northwestern Minnesota on June 9-10, 2002 and in southern Minnesota on September 14-15, 2004.

September 6, 2007: Northeast Minnesota

On September 6, 2007, a strong weather system moving through the Midwest dropped over six inches of rain on portions of St. Louis, Lake, and Cook counties. Rainfall totals surpassed eight inches in central St. Louis County. The deluge led to overtopped and washed out sections of roads and highways. The situation was greatly tempered by the long-term drought conditions that existed prior to the rain event. A storm of this magnitude and intensity would have certainly had a greater impact had the landscape not been so dry. Another heavy rain event also affected portions of the Iron Range on September 18, 2007 when intense precipitation flooded Highway 169 near Grand Rapids.

September 20-21, 2007: Southeast Minnesota

Another heavy rain event of note was one that happened on September 20-21, 2007. Intense rains doused west central and central Minnesota on September 20 and 21. Three to five inches fell along an arc that bisected Minnesota from near Ortonville to Hinckley. The rain drenched portions of Stevens, Pope, Douglas, Todd, Stearns, and Morrison counties; an area that was suffering most intensely from the 2007 drought. The rains fell hard and fast with this event in the Twin Cities. An inch of rain fell in 15 minutes at the Twin Cities International Airport. A 13 year old boy drowned after being swept over a small concrete dam in runoff-swelled Battle Creek in Battle Creek Park.

<u>Flash Floods: 2008</u>

June 7-9, 2008: Southeast Minnesota

The flash flooding came early in the summer season over southeast Minnesota with two events in June 2008. The first was on June 7-9, 2008. Some of the hardest hit areas in Minnesota were Fillmore and Houston Counties. Ground that was already saturated from heavy rains the week before only compounded the problem. Houston County's Board of Commissioners declared a state of emergency on June 9. In Fillmore County, waters from the swollen Root River flooded Preston, and affected from 50 to 75 homes and twelve businesses in the downtown area. The highest two-day total in Minnesota was 10.61 inches about six miles southeast of Caledonia in Houston County. At one point all the roads were closed in Houston County. Some areas hit by this flood fell over the same areas as the historic August 18-20, 2007. flood.

June 11-12, 2008: Southeast Minnesota

More heavy rains fell just a few days later on June 11-12, 2008. The rains were the heaviest over Ortonville in Big Stone County and especially over south eastern Minnesota in the Austin area. The highest 24-hour total ending on the morning of June 12 was 4.25 inches at Lansing in Mower County about five miles north of Austin. Two day totals were between five and six inches over eastern Freeborn and western Mower County.

The heavy rains fell over already saturated ground in southeast Minnesota. By shortly after dark on June 11th, manhole covers were forced up due to the water pressure. Water was over many roads and cars were submerged in Austin. By the wee hours of the morning on June 12, Interstate 90 was closed in Austin due to floodwaters covering the interstate. Later that same day, residents of Austin were sandbagging to protect parts of the town due to rising creeks. One man died early on June 12th when he drove into deep water in a washed out spot on County Road 34 in Freeborn County. One person had to be rescued from a second car that plunged into the water.

July 16-17, 2008: Southeast Minnesota

There was one flood event of note for July 2008. July 16-17, 2008. A small, but intense area of thunderstorms produced torrential downpours over extreme southeastern Minnesota in Winona and Houston County. The La Crosse National Weather Service saw its greatest one day precipitation total for July 16th with 2.50 inches. The highest total found was 5.21 inches at La Crescent in Houston County. Just one mile NNW of La Crescent the rainfall total was 3.92 inches. Many streets were flooded in La Crescent and the intersection of Main and Elm Street was under two feet of water. Mudslides were reported along I-94 near Dresbach in far southeastern Winona County.

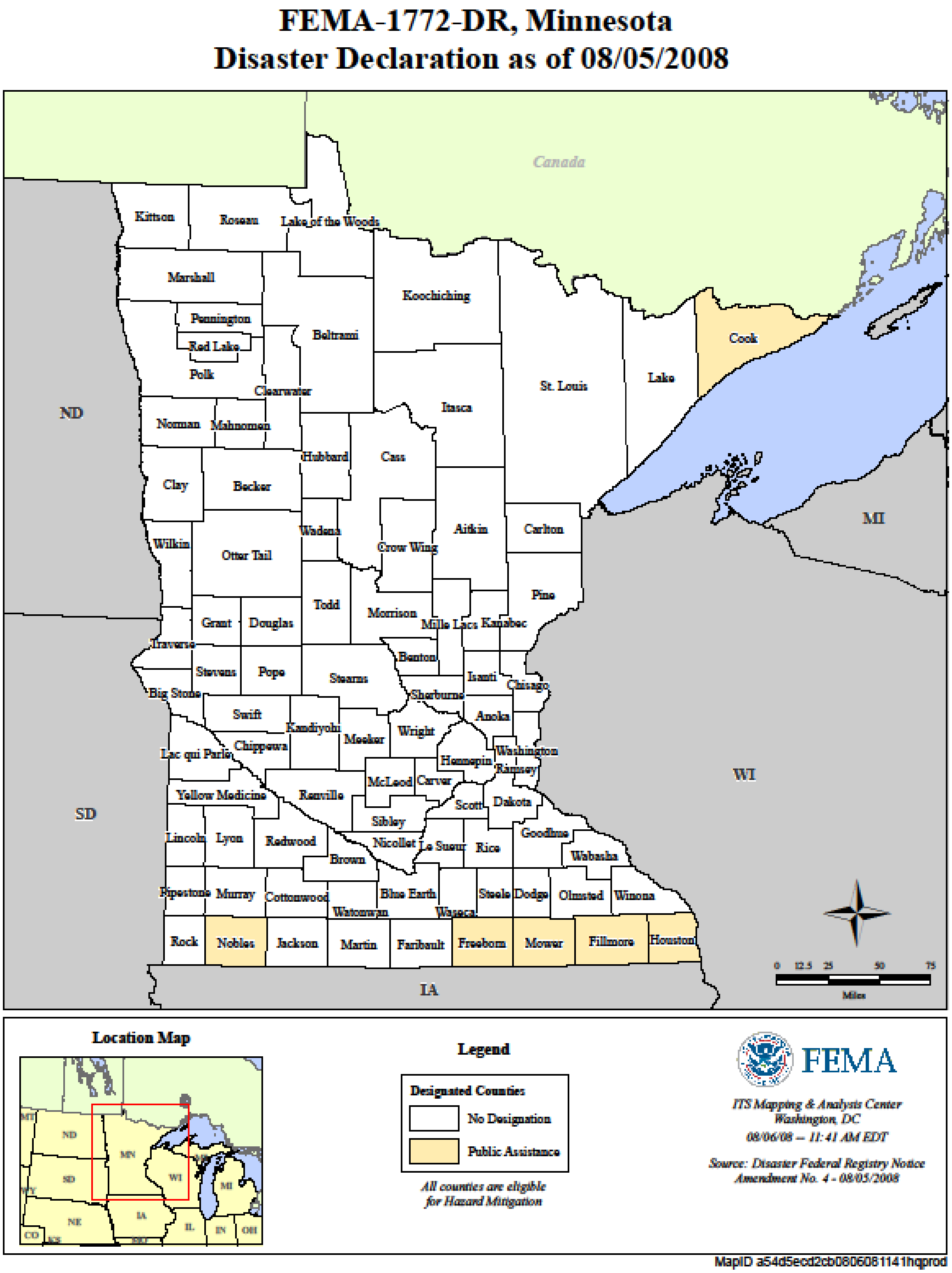
August 11-12, 2008: West Central Minnesota

A line of heavy thunderstorms hit a few areas of west central Minnesota on August 11-12, 2008. The heaviest rain fell in Wilkin, eastern Clay, and western Becker Counties. Street flooding was reported in Wahpeton, North Dakota, just across the border from Breckenridge. 2.75 inches fell in two hours at Wahpeton. Fargo received 3.45 inches for a storm total. Some of the higher rainfall totals found in Minnesota were 4.30 inches in Breckenridge. 2.79 inches at Sabin, 2.70 inches fell at Wheaton and 2.39 inches fell at Detroit Lakes. The heaviest 24 hour total reported was 4.70 inches at the town of Barnesville in southern Clay County.

The following pages provide a description of Presidential Disaster Declarations and the associated declared counties map.

DR-1772-MN The severe storms and flooding June 6 through June 12, 2008 led to disaster declaration for six counties in Minnesota.

FIGURE 6 FEMA-1772-DR MINNESOTA DECLARED COUNTIES



DR-1830-MN In the spring of 2009, a disaster was declared for severe storms and flooding in the Red River Valley. The NCDC description: A stretch of warmer weather occurred from March 14th to 17th, which resulted in high temperatures in the 40s and low 50s. The snow depth in Fargo on the 14th was 15 inches with a melted water equivalent of 3.10 inches. By the 17th, the snow depth in Fargo had dropped to 6 inches. This was followed by a couple of cooler days, which temporarily slowed down any additional snowmelt. A second period of warmer weather began on March 20th and continued through the 24th. During this period, high temperatures again climbed into the 40s and low 50s. Most of the remaining snow in Fargo melted during this stretch of warm weather, with the Fargo snow depth falling from 2 inches to 0. Conditions were about the same in Grand Forks, with the snow depth falling to 0 by the 24th. These two warm-ups resulted in a quick response in river levels, especially across the southern Red River Valley and west central Minnesota. The main stem Red River also showed a response, especially in the southern Red River Valley. With all the runoff moving into the river systems, water covered many roads and resulted in numerous road closures. The water covered entire sections of land as well and threatened many homes. A winter storm event on March 24th and 25th brought more snow to the region, along with a turn to colder temperatures. This resulted in a first crest for many rivers in the southern Red River Valley and west central Minnesota. However, river levels at most points along the main stem Red River continued to stay high. Another winter storm event hit much of the area March 30 to 31st, dropping up to 2 feet of snow in the southern Red River Valley. There was a lot of moisture in this new snow, with snow to liquid ratios of less than 10 to 1. This set the stage for continued flooding into the month of April. Map on following page.

FIGURE 7 FEMA-1830-DR MINNESOTA DECLARED COUNTIES

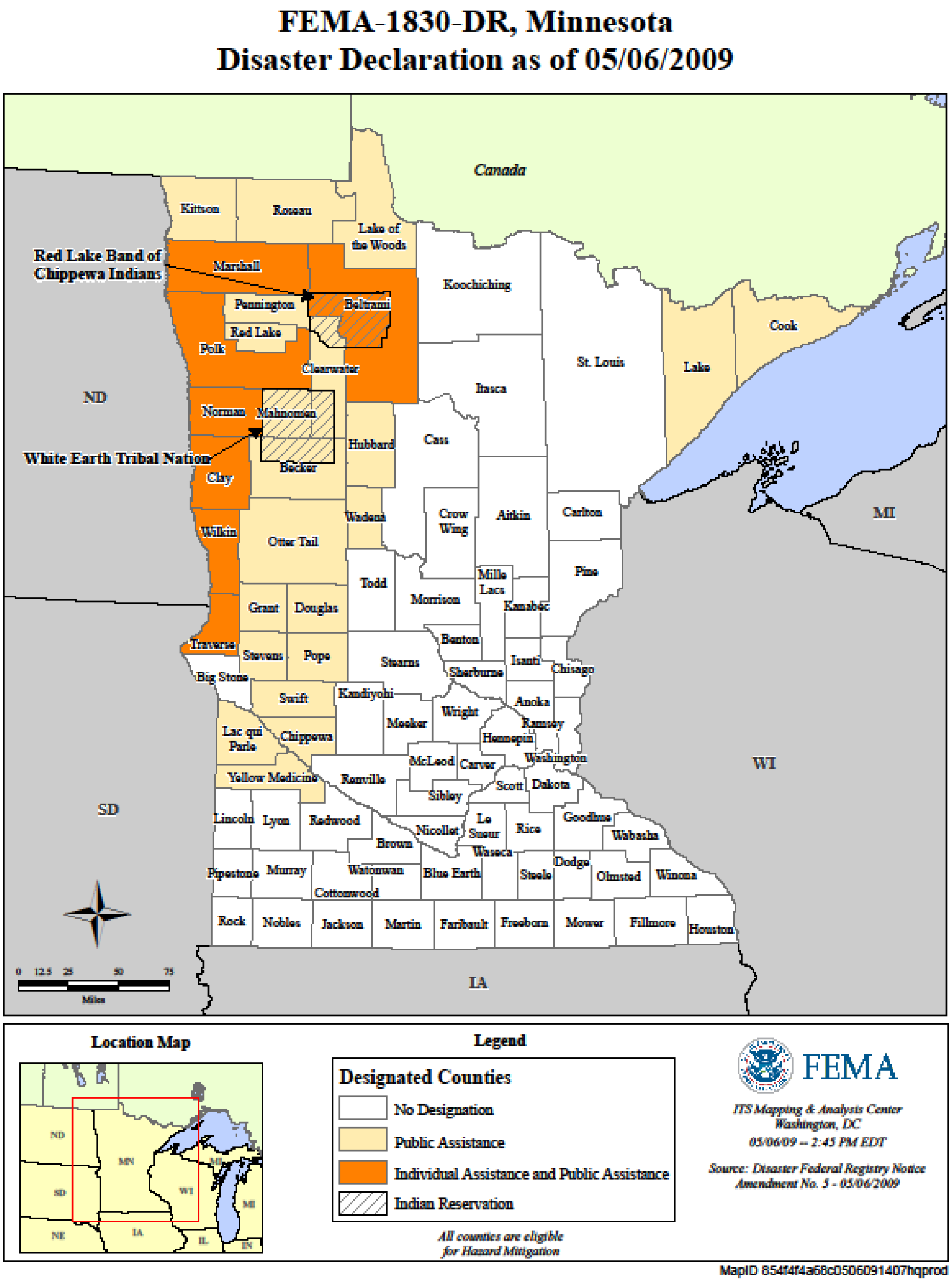
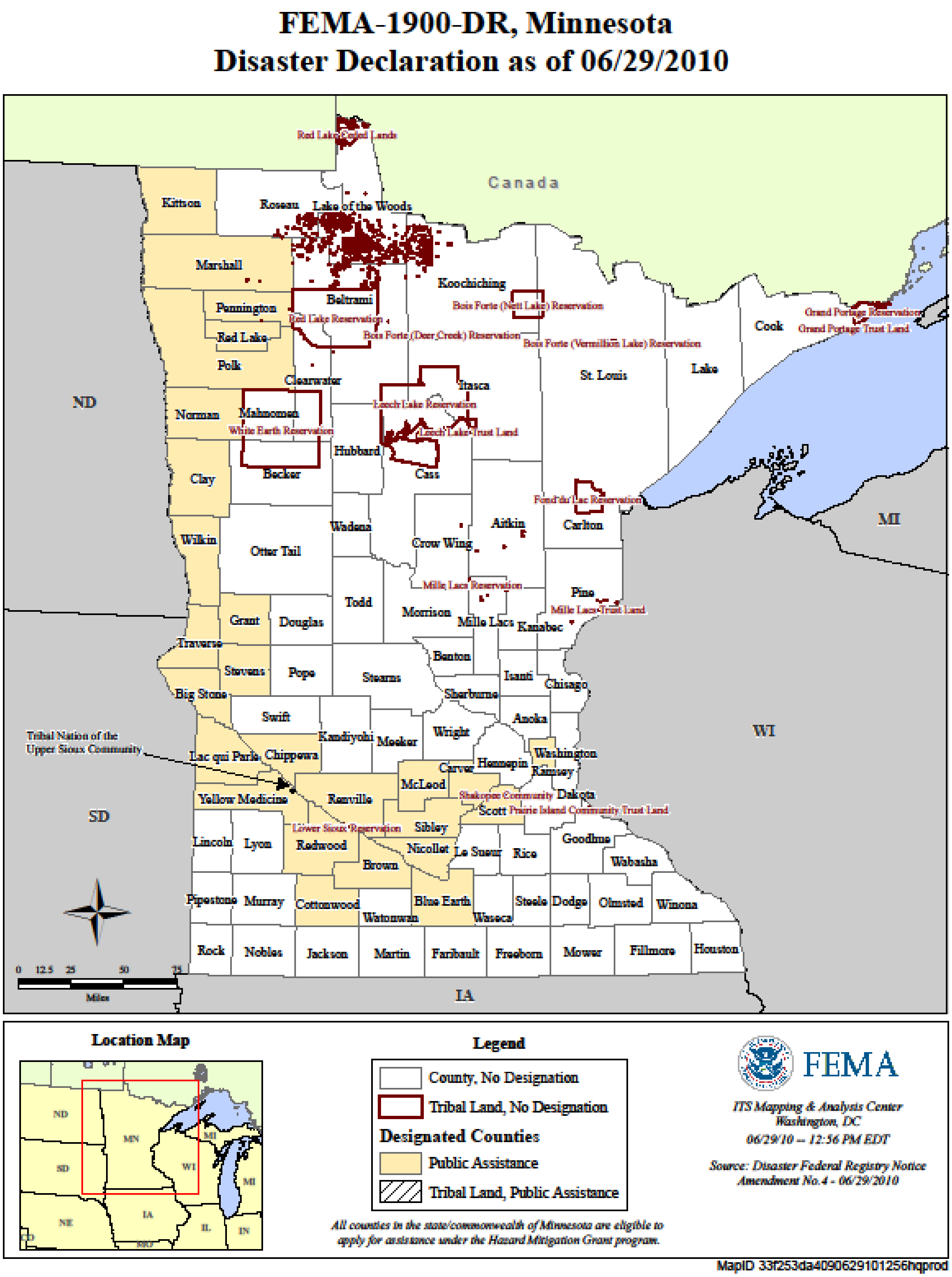


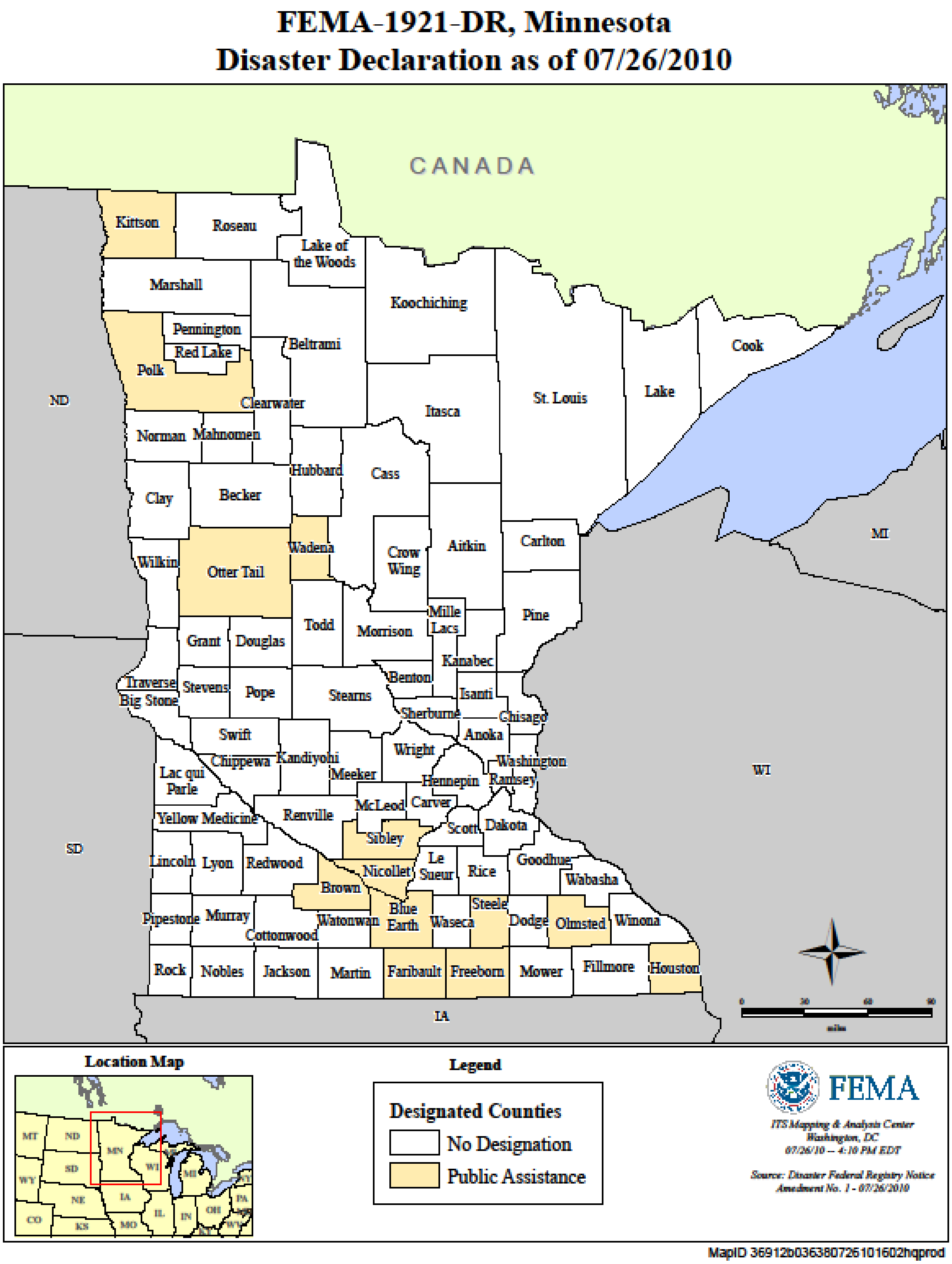
FIGURE 8 FEMA-1900-DR MINNESOTA DECLARED COUNTIES



DR-1900-MN This Presidential Disaster Declaration was issued on April 19, 2010 following an Emergency Declaration for flooding for the Red River Valley. The combination of high-water equivalency snowpack, saturated soils, ice jams, and flat terrain created the potential for near record flooding in several basins throughout Minnesota. Twenty-eight counties were declared for this disaster. Map on previous page.

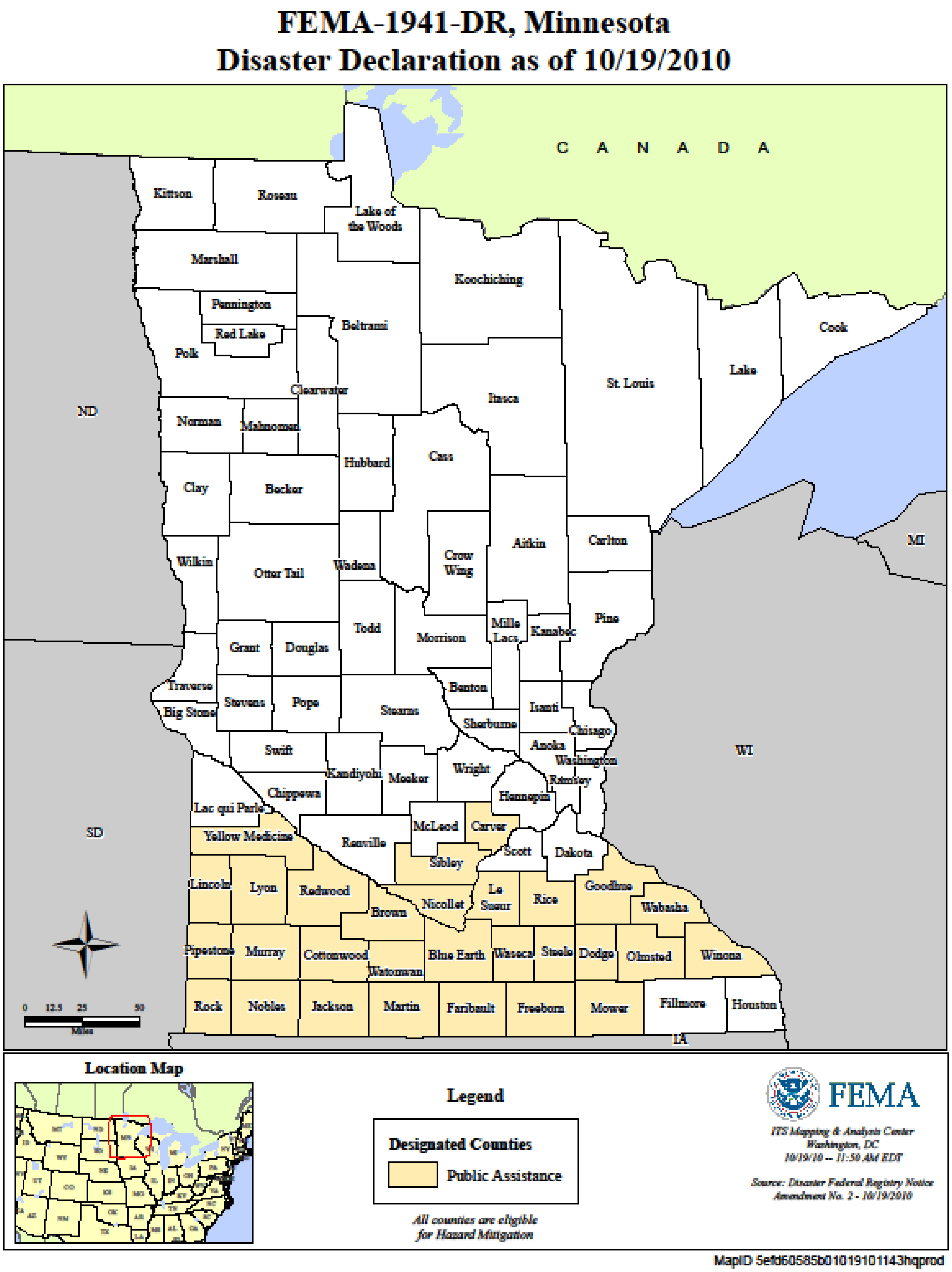
DR-1921-MN Severe weather watches and warnings were issued on the morning of 6/17/10. Shortly after 1300 CDT, super cells built up in the west central part of the State. Other super cells developed in a line stretching from south central to northwest Minnesota. Twenty (20) tornadoes ranging in intensity from EF0 (65-85 mph) to EF4 (166-200 mph) were confirmed. Strong winds, heavy rains and hail affected portions of the State. These storms caused many power outages. Three fatalities have been confirmed and numerous injuries reported. Local emergencies were declared in Faribault, Freeborn, Steele and Wadena Counties and the City of Wadena. A “Severe weather blitz” continued from 6/17/10 through 6/26/10 bringing repeated severe storms, hail, tornadoes and flooding. Map on following page.

FIGURE 9 FEMA-1921-DR MINNESOTA DECLARED COUNTIES



DR-1941-MN On the evening of September 22, 2010, heavy-rain producing thunderstorms developed over southern Minnesota, producing above average amounts of precipitation. An additional low pressure system moved over Minnesota on September 23, 2010, producing more precipitation. At least three inches of rain fell in nearly all southern Minnesota counties, with more than three inches falling in many counties. The State Climatology Office estimates that during the event period (Sept. 22-23), southern counties received rainfall amounts anywhere from 3 to 10 inches. Rainfall continued through September 24, 2010, intensifying the flooding situation already occurring in much of southern Minnesota. Extensive damage occurred in the Zumbro Falls and Hammond areas of Wabasha County. On September 24, 2010, the Zumbro River rose at a rate of 16 inches per hour to a record high of 30.26 feet. The Minnesota River near Henderson reached record flood stage. In addition, hundreds of roads were damaged as a result of flooding brought on by the rainfall. Map on following page.

FIGURE 10 FEMA-1941-DR MINNESOTA DECLARED COUNTIES



The NCDC reports multiple flood events (flood and flash flood) in the state since 2008. Per the date range 1/1/2008 to 8/31/2010, there has been one death, two injuries, nearly $24 million in property damages and over $16 million in crop damage recorded. Since one weather event may be recorded in multiple areas, the total number of events is not listed.

TABLE 2 MAJOR FLOOD EVENTS IN MINNESOTA 1950 – 2010		
Year	Areas Affected	Remarks
2010	Blue Earth County, Brown County, Carver County, Cottonwood County, Dodge County, Faribault County, Freeborn County, Goodhue County, Jackson County, Le Sueur County, Lincoln County, Lyon County, Martin County, Mower County, Murray County, Nicollet County, Nobles County, Olmsted County, Pipestone County, Redwood County, Rice County, Rock County, Sibley County, Steele County, Wabasha County, Waseca County, Watonwan County, Winona County, and Yellow Medicine County	Presidential Disaster Declaration DR-1941-MN was declared due to severe storms and flooding beginning on September 22 through October 14, 2010.
2010	Blue Earth County, Brown County, Faribault County, Freeborn County, Houston County, Kittson County, Nicollet County, Olmsted County, Otter Tail County, Polk County, Sibley County, Steele County, and Wadena County	DR-1921-MN was declared for severe storms, tornadoes and flooding was declared for weather events during June 17-26, 2010.
2010	Big Stone, Blue Earth, Brown, Carver, Chippewa, Clay, Kittson, Lac Qui Parle, Marshall, Norman, Polk, Redwood, Renville, Scott, Sibley, Traverse, Wilkin, and Yellow Medicine counties and the Tribal Nation of the Upper Sioux Community, Cottonwood, McLeod, Pennington, Ramsey, Red Lake and Stevens counties, and Prairie Island Indian Community.	Presidential Disaster Declaration DR-1900-MN was issued on April 19, 2010
2009	Band of Chippewa Indians, Becker, Beltrami, Chippewa, Clay, Clearwater, Cook, Douglas, Grant, Hubbard, Kittson, Lac Qui Parle, Lake, Lake of the Woods, Mahnomen, Marshall, Norman, Otter Tail, Pennington, Polk, Pope, Red Lake, Roseau, Stevens, Swift, Traverse, Wadena, Wilkin and Yellow Medicine Counties.	DR-1830-MN Severe storms and flooding in the Red River Valley
2008	Fillmore, Freeborn, Houston, Mower, Nobles and Cook	DR-1772-MN was declared due to severe storms and flooding.
2007	Winona, Fillmore, Houston, Olmsted, Dodge, Steele and Wabasha	Disaster Declaration Number 1717 was declared on August 23, 2007 for seven southeast Minnesota Counties due to flooding from August 18th to August 20th. An official National Weather Service climate observer near Hokah in

TABLE 2 MAJOR FLOOD EVENTS IN MINNESOTA 1950 – 2010		
Year	Areas Affected	Remarks
		Houston County reported a storm total of 16.27 inches. Of the 16.27 inches, 15.10 inches fell within the observer's 24-hour observation cycle ending at 8:00 AM on Sunday, August 19. This is the largest 24-hour rainfall total ever recorded by an official National Weather Service reporting location in Minnesota. The deluge produced flooding tied to seven fatalities. Major flood damage occurred in many southeastern Minnesota communities. Hundreds of homes and businesses were impacted. Reports of stream flooding, urban flooding, mudslides, and road closures were numerous throughout southern Minnesota.
2006	Becker, Clay, Kittson, Marshall, Norman, Polk, Red Lake, Roseau and Wilkin Counties	Disaster Declaration Number DR-1648-MN was declared on June 5, 2006 for nine northwest Minnesota counties due to flooding from March 30th to May 3rd.
2004	Southern Minnesota: Dodge, Faribault, Freeborn, Mower, and Steele Counties	Presidential Disaster Number DR-1569-MN was declared on October 7, 2004 for five southern Minnesota counties due to severe storms and flooding. Approximately $1.2 million in grants have been approved to assist these counties.
2002	Becker, Beltrami, Clay, Clearwater, Itasca, Kittson, McLeod, Pennington, Polk, Roseau, Goodhue, Hubbard, McLeod and Wright Counties	Flooding occurred on June 14, 2002 resulting in Presidential Disaster Declaration Number DR-1419-MN for 14 counties.
2001	Throughout Minnesota	Flooding, due to heavy rainfall and snow melt in March to July, occurred in 61 counties and 4 Tribal Governments resulting in Presidential Disaster Declaration Number DR-1370-MN. Total of 66 counties approved for some form of disaster assistance.
2000	NW, SE, and Central Minnesota: Chippewa, Clearwater, Dodge, Faribault, Freeborn, Roseau, Winona, Becker, Clay, Dakota, Fillmore, Houston, Mower, Norman, Mahnomen, Yellow Medicine Counties and the White Earth Indian Reservation	Flooding, due to heavy rainfall in May to July, occurred in 17 counties resulting in Presidential Disaster Declaration Number DR-1333-MN. The northwestern, southeastern and central regions of the State were impacted the most.
1999	Northern Minnesota: Kittson, Marshall, Pennington, Polk, Red Lake, and Roseau counties	Flooding occurred in northern Minnesota in March to May 1999 resulting in Presidential Disaster Declaration DR-1288-MN for 6 counties. Damages to personal property, public infrastructure, and businesses totaled at least $11 million. In the spring of 1999, the Red River Valley experienced flooding as a result of snow melt and heavy rains. Roseau County's drainage ditch system sustained an extensive amount of

TABLE 2 MAJOR FLOOD EVENTS IN MINNESOTA 1950 – 2010

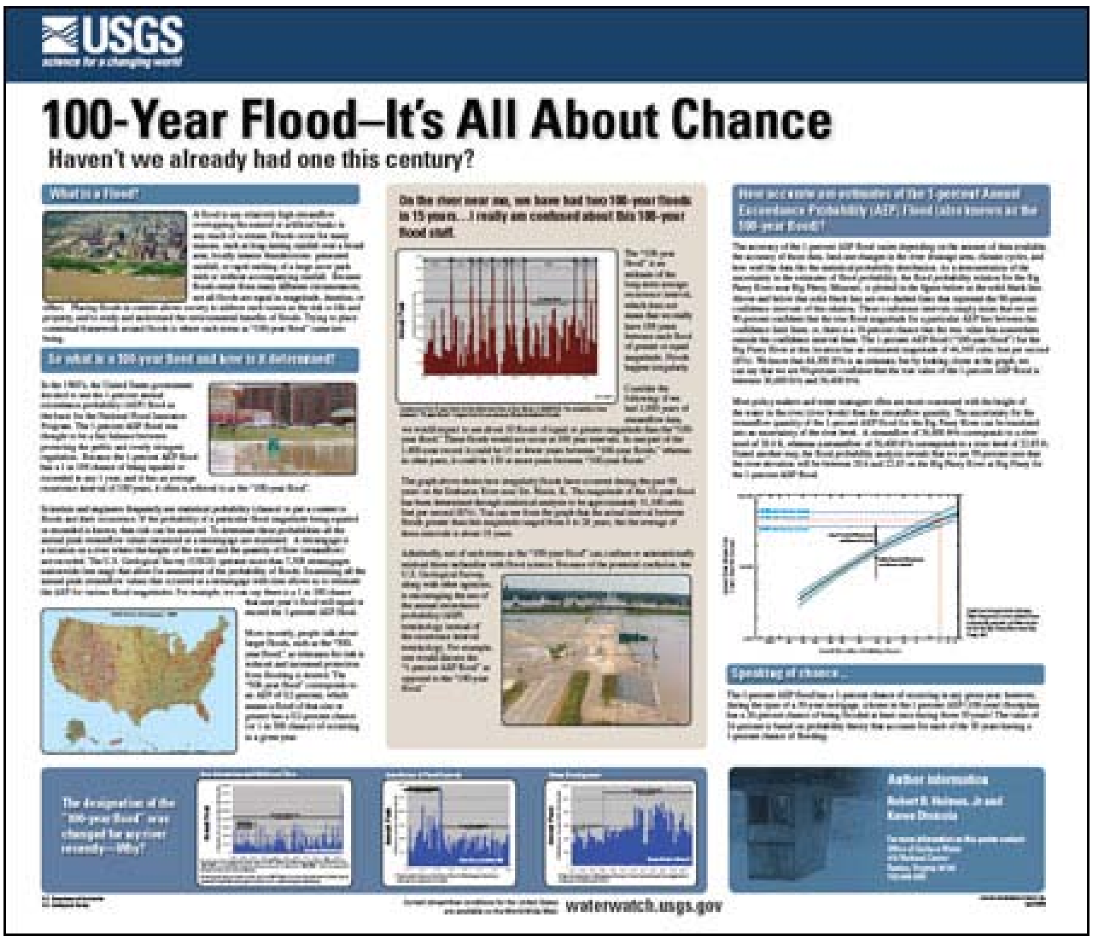
Year	Areas Affected	Remarks
		damage.
1999	Beltrami, Cook, Itasca, Lake, and St. Louis, Aitkin, Cass, Clay, and Hubbard	Disaster Declaration Number DR-1283-MN was issued for nine counties in Northern Minnesota on July 26, 1999. The northeastern part of Minnesota experienced high winds. St. Louis county suffered the most uninsured residential due to heavy rains and flash flooding. Beltrami county experienced high ground water levels that caused a number of serious damages that included wet basements and failed septic systems. The total cost of the disaster was estimated at approximately $52.2 million.
1997	West Central Minnesota	Disaster Declaration Number DR-1187-MN was issued for seven counties on August 5, 1997 for severe storms, high winds, tornadoes and flooding. Flooding and high winds swept through parts of west central Minnesota. Schools in Minneapolis and St. Paul sustained considerable damage, which resulted in more the $2 million in assistance.
1997	Minnesota	Due to the rapid melt of deep snow covering much of Minnesota, serious flooding occurred throughout Minnesota in March to May 1997, with the Red River and the Minnesota River valleys being the hardest hit. Six schools, one medical facility and several other public facilities were so severely damaged that they had to be replaced. An additional late winter storm in early April added to the problem. These floods resulted in a Presidential Disaster Declaration (Disaster Declaration Number DR-1175-MN) for 58 counties in Minnesota. State and federal aid payment totaled at least $386,121,956.
1996	Minnesota	Flash flooding occurred March to May 1996, resulting in a Presidential Disaster Declaration (Disaster Declaration Number DR-1116-MN) for 26 counties throughout Minnesota. State and federal disaster payments totaled $10,904,423.
1993	Southern Minnesota	Serious and repeated flooding occurred throughout the spring and summer of 1993. The southern, southwestern, and western regions of the State were hardest hit. Much of southern Minnesota experienced floods that were commonly greater than a 10-year flood event. The surprising exceptions were the Zumbro, Root, and the Cedar Rivers. Even though there was significant damage along these rivers, the highest recorded discharge during the flood event

TABLE 2 MAJOR FLOOD EVENTS IN MINNESOTA 1950 – 2010		
Year	Areas Affected	Remarks
		fell short of what would be expected in a 10-year flood. The floods of 1993 resulted in a Presidential Disaster Declaration (Disaster Declaration Number DR-993-MN) for 57 counties in the State of Minnesota. State and federal disaster assistance payments totaled $99.3 million. The Minnesota Department of Agriculture estimates that lost production values resulting from this flood totaled $1.5 billion.
1992	Western and southern Minnesota	Disaster declaration issued on June 26, 1992 for eleven counties in western and southern Minnesota for severe storms, tornadoes and flooding. There were heavy rains and flooding and major damage was caused by tornadoes that swept through southwestern Minnesota. The cities of Chandler, Lake Wilson and Clarkfield were the hardest hit.
1987	Anoka, Beltrami, Carver, Dakota, Hennepin, Norman, Polk, Ramsey, Scott, Washington	Severe storms, heavy rain, and tornadoes resulted in major flooding throughout the metropolitan area. Damages exceeded $12 million and resulted in Presidential Disaster Declaration DR-797-MN.
1975	Northwest Minnesota	A flash flood of 3-8 inches fell during a 12 to 15-hour period in Northwest Minnesota. The heavier rains began along the North Dakota border and ended to the southeast of Leach Lake. The heavy rains covered most of Marshall, Beltrami and Pennington Counties, the northern parts of Clearwater, Cass and Hubbard Counties and western Itasca County.
1972	Central Minnesota	In July flooding in central Minnesota (from west of Little Falls east to the border) resulted from the largest 24-hour rainfall recorded in Minnesota. The outcome included a Presidential Disaster Declaration for 18 counties in the State of Minnesota (Disaster Declaration Numbers DR-347-MN and DR-350-MN), the loss of 3 lives, hundreds of road washouts, and damages over $20 million. In late September the third and largest "flash flood" to affect Duluth within that same year resulted in the loss of 2 lives and property damage estimated at $1 million.
1969	Red River, North River, Minnesota River, Des Moines River	Flooding on the Minnesota and Des Moines Rivers and the Red River of the North resulted from snowmelt and rainfall. The outcome included a Presidential Disaster Declaration for 74 counties in the State of Minnesota (Disaster Declaration Numbers DR-255-MN and DR-268-MN), the loss of 9 lives, and property damages

TABLE 2 MAJOR FLOOD EVENTS IN MINNESOTA 1950 – 2010		
Year	Areas Affected	Remarks
		estimated at $150 million. This flood event was the impetus for the State of Minnesota adopting the Comprehensive Floodplain Management Act.
1965	Minnesota River, Mississippi River	Flooding on the Minnesota and Mississippi Rivers resulted from snowmelt and rainfall. The outcome included a Presidential Disaster Declaration for 65 counties in the State of Minnesota (Disaster Declaration Number DR-188-MN), record stages on the Mississippi River, the loss of 16 lives, and property damages estimated at $181 million.
1950	Carlton County, Aitkin County, Clay County, Polk County, St. Louis County	Flooding in the Northern half of the state resulted from snowmelt and rainfall. The outcome included peak discharges approximated at a 100-year recurrence interval on the St. Louis River at Scanlon (Carlton County) and on the Mississippi River at Aitkin (Aitkin County); extensive damages to the communities of Moorhead (Clay County), Crookston, East Grand Forks (Polk County), Floodwood (St. Louis County), and Aitkin (Aitkin County); and property damage losses estimated at $16 million.

The USGS has recently (April 15, 2010) produced a document to accurately describe the meaning of the "100-year flood". In the 1960's, the United States government decided to use the 1-percent annual exceedance probability (AEP) flood as the basis for the National Flood Insurance Program. The 1-percent AEP flood was thought to be a fair balance between protecting the public and overly stringent regulation. Because the 1-percent AEP flood has a 1 in 100 chance of being equaled or exceeded in any 1 year, and it has an average recurrence interval of 100 years, it often is referred to as the "100-year flood". The term "100-year flood" is part of the national lexicon, but is often a source of

FIGURE 11 100-YEAR FLOOD



confusion by those not familiar with flood science and statistics. This poster is an attempt to explain the concept, probabilistic nature, and inherent uncertainties of the "100-year flood" to the layman. The publication is available at http://pubs.usgs.gov/gip/106/.

Statewide Flood Risk Assessment

The statewide flood risk assessment utilized HAZUS-MH (HAZards US - Multi-Hazard), FEMA's methodology for estimating potential losses from disasters. HAZUS is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. HAZUS uses Geographic Information Systems (GIS) technology to estimate physical, economic, and social impacts of disasters. It graphically illustrates the limits of identified high-risk locations due to earthquake, hurricane, and floods. Users can then visualize the spatial relationships between populations and other more permanently fixed geographic assets or resources for the specific hazard being modeled, a crucial function in the pre-disaster planning process.

HAZUS is used for mitigation and recovery as well as preparedness and response. Government planners, GIS specialists, and emergency managers use HAZUS to determine losses and the most beneficial mitigation approaches to take to minimize them. HAZUS can be used in the assessment step in the mitigation planning process, which is the foundation for a community's long term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. Being ready will aid in recovery after a natural disaster.

HAZUS software is a powerful risk assessment methodology for analyzing potential losses from floods. In HAZUS, current scientific and engineering knowledge is coupled with the latest geographic information systems technology to produce estimates of hazard-related damage before, or after, a disaster occurs.

Potential loss estimates analyzed in HAZUS include:

- **Physical damage** to residential and commercial buildings, schools, critical facilities, and infrastructure;
- **Economic loss**, including lost jobs, business interruptions, repair and reconstruction costs; and
- **Social impacts**, including estimates of shelter requirements, displaced households, and population exposed to scenario floods, earthquakes, and hurricanes.

Source: http://www.fema.gov/plan/prevent/hazus/index.shtm

The Minnesota Statewide Flood Risk Assessment Report (Report) is an initial step in identifying and quantifying flood risks throughout the state. The Minnesota Statewide Flood Risk Assessment Report was completed in January of 2011. The Report compiled the results of the county flood risk assessments as a primary update for the 2011 Minnesota State All Hazard Mitigation Plan. The county assessment reports will be distributed to each county emergency director to be included in the local multi-jurisdictional mitigation plans. The statewide Report is contained in Appendix F. County specific data is available to local emergency managers upon request.

Disclaimer - Neither the Minnesota Statewide Flood Risk Assessment Report nor any of the county reports are to be used for National Flood Insurance Program (NFIP) purposes. The information contained in the reports is to be used solely for the purposes of mitigation planning. Using the flood assessment reports for NFIP insurance determinations or mapping revisions will not be admissible by NFIP administrators.

The statewide flood assessment is a step toward identifying and quantifying flood risks for the express purpose of mitigation planning. The risk assessment uses existing available information, including Geographic Information System (GIS) data with HAZUS-MH. This tool enables the State to predict the estimated losses from floods for planning purposes.

The methodology follows the process outlined in “State and Local Mitigation Planning How-To Guide: Understanding Your Risks.” The initial assessment uses existing state level information. The information is compiled in digital formats that enable the future update and enhancement of the assessment to use more detailed local data. As individual community hazard mitigation plans are updated, the statewide flood hazard mitigation risk assessment can be enhanced.

The hazard identification and data inventory tasks were conducted by Minnesota Homeland Security and Emergency Management (HSEM) with assistance from the Geographic Information Sciences Laboratory (GISL) at the University of Minnesota Duluth (UMD) and The Polis Center at Indiana University Purdue University at Indianapolis. The GISL and Polis teams assisted HSEM with developing the flood risk assessment using HAZUS-MH as a risk assessment tool.

The initial task of identifying hazards involved reviewing flood information within the Minnesota Department of Natural Resources county and community hydrologic assessments. The file includes Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) reports, geo-referenced images of scanned FIRM maps, Digital Flood Insurance Rate Maps (DFIRM) vector maps and Q3 vector maps. GISL obtained copies of the available files from MN DNR. County specific flood risk assessments from local hazard mitigation plans were used to identify local historical hazards. These documents were provided by HSEM.

Profile Hazard Events: Following the hazard identification task, staff performed HAZUS-MH 100-year flood return interval analysis for each county using DFIRM or Q3 flood boundaries (DFIRM being preferable) whenever they were available. Prototyping prior to the commencement of the project indicated that the Enhanced Quick Look method available in HAZUS-MH (Release MR4-Patch 1 Aug 2009) provided loss estimates consistent with traditional methods.

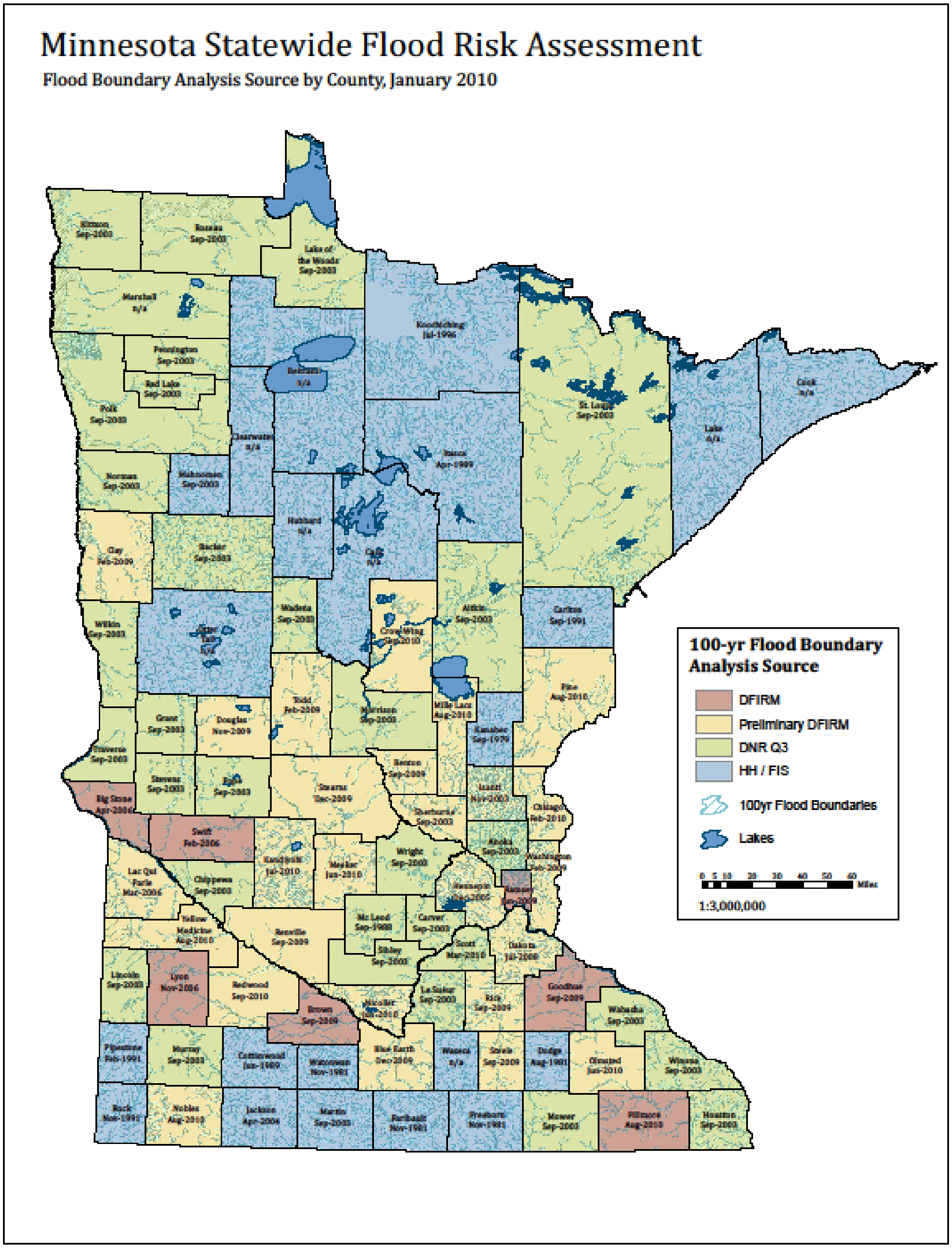
For counties without DFIRM or Q3 boundaries, HAZUS-MH was used to generate new 100-year flood boundaries and flood depth grids. Hydrology and Hydraulic analysis was performed at one square mile intervals on all reaches generated from USGS 30-meter DEMs.

TABLE 3 FLOOD RISK CALCULATION METHODS		
Sources	**Counties**	**Ratio**
DFIRM	33	38%
Q3	32	37%
H&H + FIS Discharge Values	22	25%
Total	**87**	**100%**

Flood Model sources and dates are shown in the following figure. DFIRM and Q3 dates are published dates or date obtained from DNR if data were not through final approval. For counties that did not have a Q3 or DFIRM available, Flood Insurance Study (FIS) dates are given if available (the most recent date is used if there is more than one FIS). See Report for additional data. The following map indicates the data source and floodplain. At this level, it is difficult to see detailed flood boundary, however, HSEM has requested a poster size version of this map, available upon request. In addition, each county has access to their county data and map.

Currently HSEM does not have the resources to place this data online. Future data collection for more in depth (local) risk assessments may take place depending on availability of state resources.

FIGURE 12 STATEWIDE FLOOD RISK ASSESSMENT: FLOOD BOUNDARY ANALYSIS SOURCE



Probability of Occurrence

All portions of the State of Minnesota are subject to flooding. Some locations, however, are more susceptible to severe, repeated flooding than others. As noted by the Minnesota Department of Natural Resources (DNR), Division of Waters, one river that has flooded consistently nearly every other or every third year is the Red River of the North. Repeated flooding at this location is due primarily to two factors: (1) The river flows north, often into areas that have not yet thawed, hence the water backs up; (2) Flat terrain around the river allows flooding above the banks to go on for miles (much further than most rivers in Minnesota).

Flash floods are also of great concern to the State of Minnesota. In a publication entitled, Sixteen Year Study of Minnesota Flash Floods (DNR, State Climatology Office and University of Minnesota Soil Sciences Department, January 1988), it is noted that Minnesota averages five flash floods annually. The earliest flash floods have occurred in May. The monthly distribution of flash floods shows June with the greatest number of events and the flash flood “season” continuing through September. Analysis of Minnesota's flash flood history has revealed that over 50 percent occur in the evening between 6 p.m. and 11 p.m. and 27 percent of flash floods occur from midnight through 7 a.m. The counties of Lyon, Mower, Olmsted, St. Louis, Stearns, and Winona have experienced the greatest number of storm events capable of producing flash flooding, averaging at least one every five years. Olmsted County has experienced the greatest number of events (8) and averages one flash flood every 3.1 years. The National Weather Service (NWS) notes that nearly half of all flash flood fatalities are auto related. They further note that people who are in automobiles when flash floods occur near them are most at risk from flooding in general.

According to Floodplain Management: A Handbook for Local Officials (DNR, Division of Waters, January 1993) the State of Minnesota experiences an average annual direct flood loss of at least $60 - 70 million. Average annual direct flood loss figures of this type have historically included:

- Direct loss to the individual homeowner, business, and agricultural interests (e.g., structural and contents damage, damage to motor vehicles, crop loss, etc.)
- Damage to the community infrastructure (storm sewers, roads, bridges, etc.)
- Costs associated with the flood fight and clean up

There is increased national awareness that the indirect losses due to flooding are very dramatic, affecting individuals living in and out of the floodplain. The indirect losses related to flooding include:

- Lost profits to businesses closed during floods
- Wage losses and unemployment benefits
- Federally subsidized flood insurance payments via the National Flood Insurance Program (NFIP)

- Income tax deductions for flood losses not covered by insurance
- Low-interest disaster relief loans

The taxpayers are burdened with a significant portion of the cost of responding to unwise floodplain development. These indirect costs may, in fact, equal or exceed the direct costs.

The flood risk assessment considers hazards over the entire State of Minnesota, though it does not estimate the probability of occurrence. Flood probability and magnitude are highly location-specific, so it is not possible to characterize these generally across the State in a meaningful way. Statewide, floods are rated High for probability in the qualitative ranking. The Report provides information for each county (and city), based on best available data.

The National Weather Service in coordination with MN DNR have been working to improve flood forecasting. The USGS and DNR have river gages throughout the state that provide real-time information regarding river height. While improvements have been made to forecasting riverine flooding, flash flooding is more difficult to predict. Watches, warnings and advisories for flooding are improving with each flood the state experiences, including regions that have been flooded annually. For example, the Flood Forecast Display Tool is available for the Red River of the North via the Red river Basin Decision Information Network, see http://ffdt.rrbdin.org/.

Sources of Information

Federal Emergency Management Agency (FEMA). 1997. Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy.

Minnesota Department of Natural Resources. Floods. www.dnr.state.mn.us/climate/floods/index.html

National Climatic Data Center, Climate of Minnesota Minnesotacdo.ncdc.noaa.gov/climatenormals/clim60/states/Clim_MN_01.pdf

Minnesota Department of Natural Resources Division of Waters State Climatology Office and the University of Minnesota Soil Science Department. Sixteen Year Study on Minnesota Flash Floods. climate.umn.edu/doc/flashflood.htm

USDA Risk Management Agency. Saint Paul Regional Office

MN DNR Waters, Southeast Minnesota Flood Damage climate.umn.edu/doc/journal/flash_floods/ff070820.htm

Minnesota Statewide Flood Risk Assessment, January 2011

Wildfire

A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed, spread quickly, and are usually signaled by dense smoke that may fill the area for miles around. Wildfires can be human-caused through acts such as arson or campfires, or can be caused by natural events such as lightning. Wildfires can be categorized into three types:

- **Wildland fires** are fueled primarily by natural vegetation in grasslands, brush lands and forests.
- **Firestorms** occur during extreme weather (e.g., high temperatures, low humidity, and high winds) with such intensity that fire suppression is virtually impossible. These events typically burn until the conditions change or the fuel is exhausted.
- **Interface or intermix fires** occur in areas where both vegetation and structures provide fuel. These are also referred to as wildland/urban interface fires.
- **Prescribed fires** and prescribed natural fires are intentionally set or natural fires that are allowed to burn for beneficial purposes.

The following factors contribute significantly to wildfire behavior:

- **Topography**: As slope increases, that is the divergence of the terrain from horizontal, the rate of wildfire spread increases. South facing slopes are also subject to greater solar radiation, making them drier and thereby intensifying wildfire behavior. However, ridgetops may mark the end of wildfire spread, since fire spreads more slowly or may even be unable to spread downhill.
- **Fuel**: Size class, moisture content and volume are the methods of classifying fuel, with volume also referred to as fuel loading (measured in tons of vegetative material per acre). As fuel loading increases, fire intensity (energy released) and flame length increase, making fire suppression more difficult. Fuels with low moisture content ignite easier that wet fuels. The fuel's continuity is also an important factor, both horizontally and vertically.
- **Weather**: The most variable factor affecting wildfire behavior is weather. Important weather variables are temperature, humidity, wind, and lightning. Weather events ranging in scale from localized thunderstorms to large fronts can have major effects on wildfire occurrence and behavior. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildfire activity. By contrast, cooling and higher humidity often signals reduced wildfire occurrence and easier containment.

If not promptly controlled, wildfires may grow into an emergency or disaster. Even small fires can threaten lives, resources, and destroy improved properties. It is also important to note that in addition to affecting people, wildfires may severely affect livestock and pets. Such events may require the emergency watering/feeding, shelter, evacuation, and even burying of animals.

The indirect effects of wildfires can also be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil and waterways. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance siltation of rivers and streams thereby enhancing flood potential, harming aquatic life and degrading water quality. Lands stripped of vegetation are also subject to increased landslide hazards.

Wildfires can occur at any time of day and during any month of the year, however, the greatest wildland fire activity usually occurs from snow melt in March or April, through green up in late May or early June. Careless fire use, arson, equipment use and weather conditions such as wind, low humidity, and lack of precipitation are the chief factors determining the number of fires and acreage burned. Generally, fires are more likely when vegetation is dormant or after extended drought periods.

Wildland fires are capable of causing significant injury, death, and damage to property. A recent inventory showed that 46% of the state (16 million acres) is covered with forests. The potential for property damage from fire increases each year as more recreational properties are developed on wooded land and increased numbers of people use these areas. Fires can extensively impact the economy of an affected area, especially the logging, recreation and tourism industries, upon which many northern counties depend. There can be major direct costs associated with timber salvage and the restoration of the burned area. Burned woodlands and grasslands may need to be replanted quickly to prevent the possibility of widespread soil erosion, landslides, mudflows, and floods which could compound the damage.

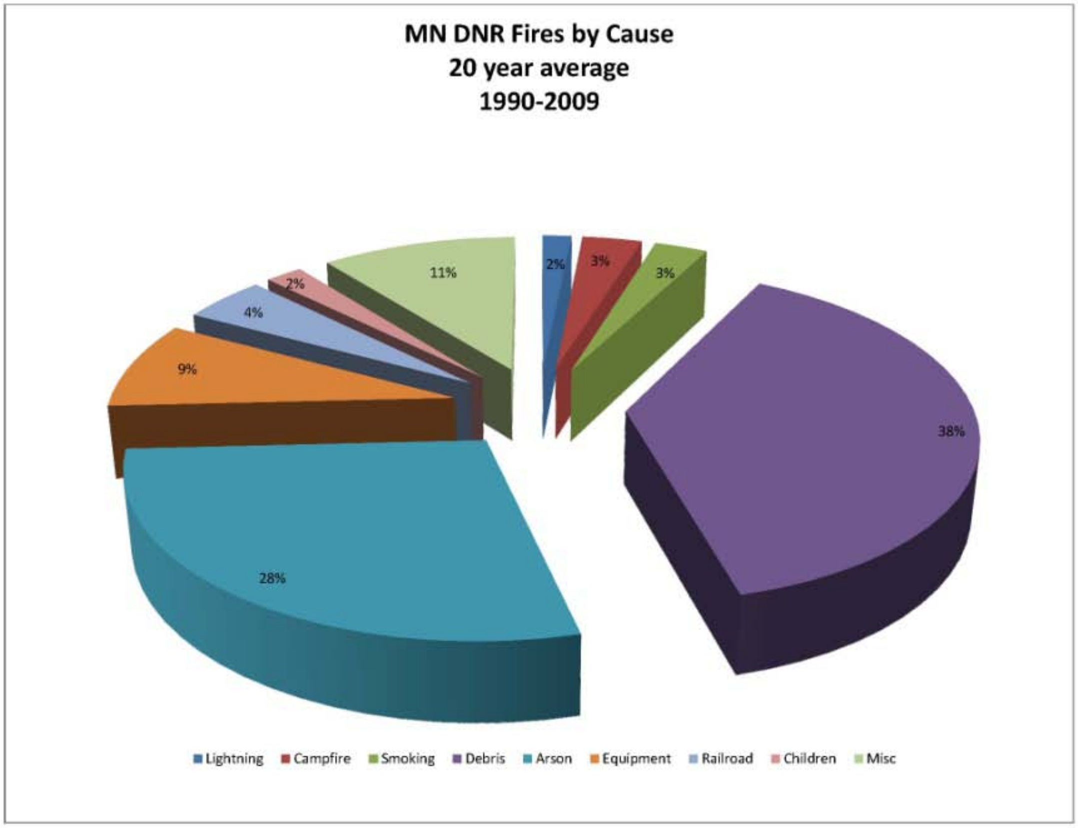
It must be noted that in the residential setting the leading causes of wildland fires are debris burning, arson, and equipment use. However, as the urban-rural interface in Minnesota increases, the fire ignition sources become less clear. Urban fires can result from wildland fires in the wildland urban interface where wildland fires usually result from human rather than natural causes. Only two percent of the Minnesota wildfires are a result of lightning compared to 85 percent that result from human causes. Nationally, lightning causes 16% of the wildland fires.

From 1990 to 2009, the causes were aggregated from the various categories used by the DNR:

- Campfire - Fire caused by campfire
- Debris - Fire caused by piled or running debris, debris from agricultural operations or from a burner
- Equipment - Fire caused by ATV, farm, miscellaneous tools, road maintenance, vehicle or welding/cutting equipment
- Incendiary/Arson - Fire cause by incendiary or arson
- Lightning - Fire caused by lightning
- Miscellaneous - Fire caused by electric fence, fireworks, power line, prescribed fire, structure or other (misc.) cause

- Railroad - Fire caused by railroad brakes, exhaust, maintenance, wheel bearings or other (railroad) cause
- Smoking - Fire caused by smoking

FIGURE 13 MN DNR FIRES BY CAUSE



For outside and other fires, vulnerabilities are dependent upon fuel sources and availability. As for wildfire, one major example of property wildfire vulnerabilities is the area impacted by the July 4, 1999 massive windstorm. This windstorm raked northeastern Minnesota with straight-line winds exceeding 90 miles per hour. In less than 30 minutes, the storm cut an unbroken fuel pathway (10 - 12 miles long and 40 miles wide) through the Boundary Waters Canoe Area Wilderness (BWCAW) in the Superior National Forest, along the Gunflint Trail outside Grand Marais, with an estimated 80 - 120 tons of fuel per acre on over 477,000 acres. Much of this land cannot be legally, cost-effectively, or safely salvaged or cleared. Downed trees and outbreaks of insects and disease previous to the blowdown storm of July 4, 1999 have significantly increased the fire risk in the area. The task of mitigating fire risk and managing any fires that may occur is complicated by: the remoteness and inaccessibility of the area; the number of government entities that have responsibility for land within the area; the extent of the area affected; constraints on the type of activity that can take place within the BWCAW; and the large number of permanent and seasonal residents and tourists that may be affected by a fire in the area.

The size and severity of the “Ham Lake” and “Cavity Lake” fires can be attributed to the unique fuel conditions in that part of the state. Following the 1999 blowdown, several mitigation projects occurred in the affected area including: construction of helipads and safety zones, development of an evacuation plan for the Gunflint Trail, fuel reduction projects, development of the Northeastern Minnesota Wildfire Integrated Response Plan, Community Wildfire Protection Plans, FireWise programs, and defensible space and sprinkler projects around structures.

Wildfire History in Minnesota

The Minnesota Department of Natural Resources (DNR) annually responds to an average of 1,710 fires that burn 44,735 acres. The DNR is the lead state agency for wildland fire prevention and response. However, other agencies also respond to fires in designated protection areas including local fire departments and Federal agencies such as the Bureau of Indian Affairs, Forest Service, Fish and Wildlife Service, and the National Park Service. The following table has information on record fires in Minnesota from 1976-2010.

Table 4 Single Fires of Record

Year	Event
2009	Very dry conditions and strong winds caused a controlled burn to become uncontrollable near Dodge Center in Dodge County on April 8th. The wildfire burned six acres of grass.
2009	Very dry conditions and strong winds caused a grass fire to become out of control and burn two acres on the northeast side of Rochester in Olmsted County on April 9th.
2009	A wildfire caused by very dry conditions and strong winds burned five acres on the southwest side of Rochester in Olmsted County on April 23.
2007	On the morning of May 5 a human caused wildfire started northwest of Ham Lake along the Gunflint Trail in northeastern Minnesota, about 49 miles northwest of Grand Marais. The “Ham Lake fire,” which was in the U.S. Forest Service protection area, was contained to 36,443 acres on the United States side and claimed an additional 39,408 acres in Canada. Firefighting costs for the Superior National Forest’s portion of the fire were approximately $10 million. In Minnesota, 140 structures were destroyed, including 15 year-round residences, 60 seasonal structures and several commercial businesses, valued at $ 10 million. Approximately 759 structures (valued at approximately $42 million) were protected through the efforts of firefighters, FireWise projects and past mitigation projects. Mitigation projects included creation of helipads and safety zones, fuel reduction projects, creating defensible space, and outdoor sprinkler systems for structures. (since this fire was not in MN DNR protection areas, it was not included in the charts that follow.)
2006	Lightning caused a wildfire to breakout two miles south of Seagull Lake on the Gunflint Trail on U.S. Forest Service protected land in the Boundary Water Canoe Area Wilderness (BWCAW). The fire was eventually called the "Cavity Lake Fire" and at the time was the largest fire in the area in one hundred years. The fire spread quickly when 50 mph down drafts from a passing thunderstorm fanned the fire, eventually consumed 31,830 acres. Many entry points and portages in the BWCAW were closed while fire suppression efforts were made. (since this fire was not in MN DNR protection areas, it was not included in the charts that follow.)
2003	A wildfire burned 300 acres of grassland and also burned some small sheds in Windom. The fire came close to five homesteads, burning to less than 20 yards from two of them. One home had smoke damage from the fire. Dry conditions and winds gusting to 40 mph

	allowed the fire to advance rapidly before it was brought under control.
2000	Carlos Edge fire burned 8,000 acres, destroyed over 4 structures, and endangered the towns of Linnwood, Stacy and Wyoming.
1980	Motley fire burned 6,800 acres, destroyed over 20 structures, and endangered the towns of Motley and Philbrook.
1977	Wildland fires destroyed hundreds of thousands of acres of forestland and millions of dollars in homes and improved property. Suppression costs that year totaled around $25 million.
1976	Badoura fire burned 23,000 acres and a dozen buildings in just six hours.
data from noaa's national climatic data center (http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms)	

The following figures indicate the cost and causes, and size and causes of wildfires in the state in 2010 as reported by the DNR.

FIGURE 14 COSTS AND CAUSES OF WILDFIRES IN 2010

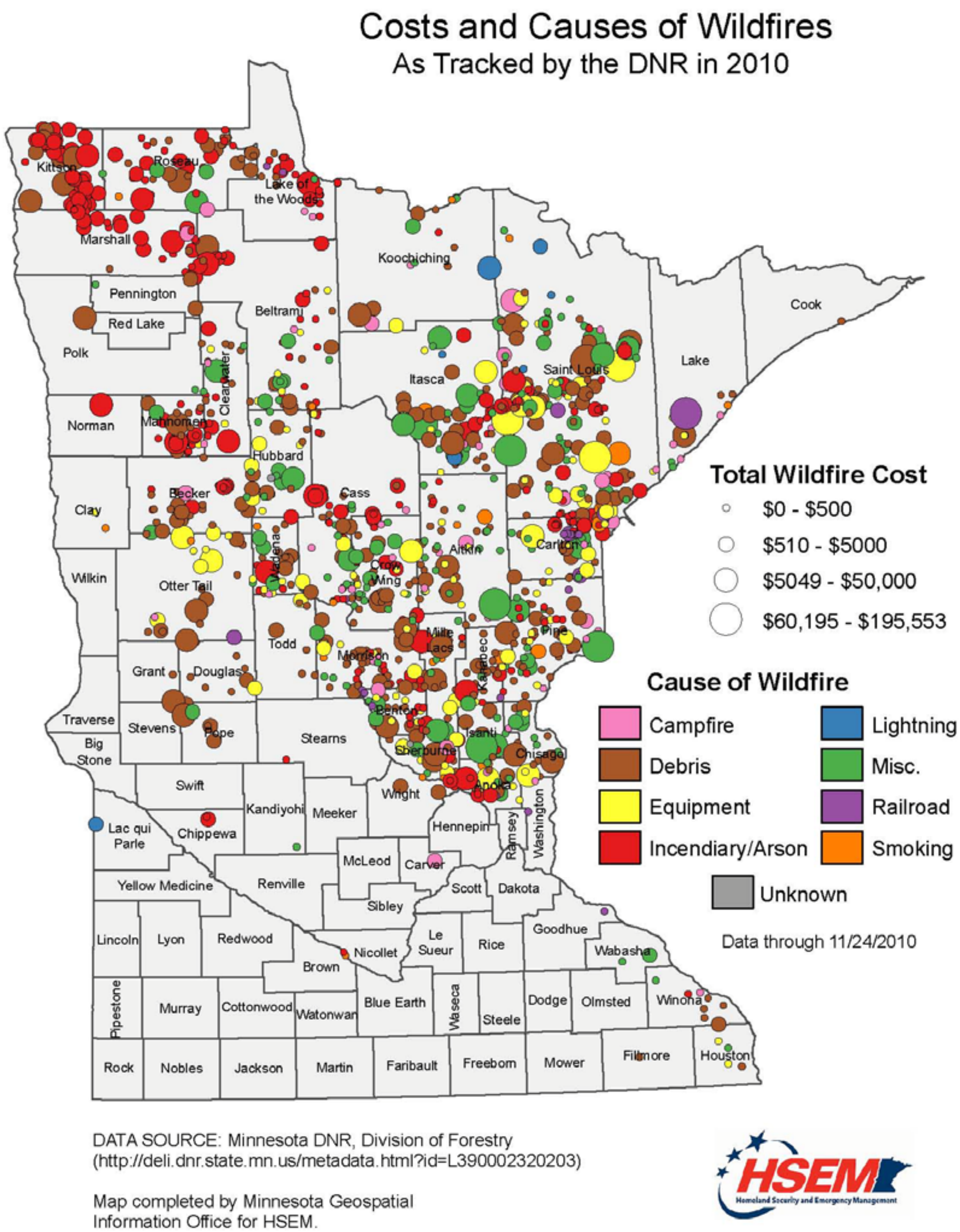
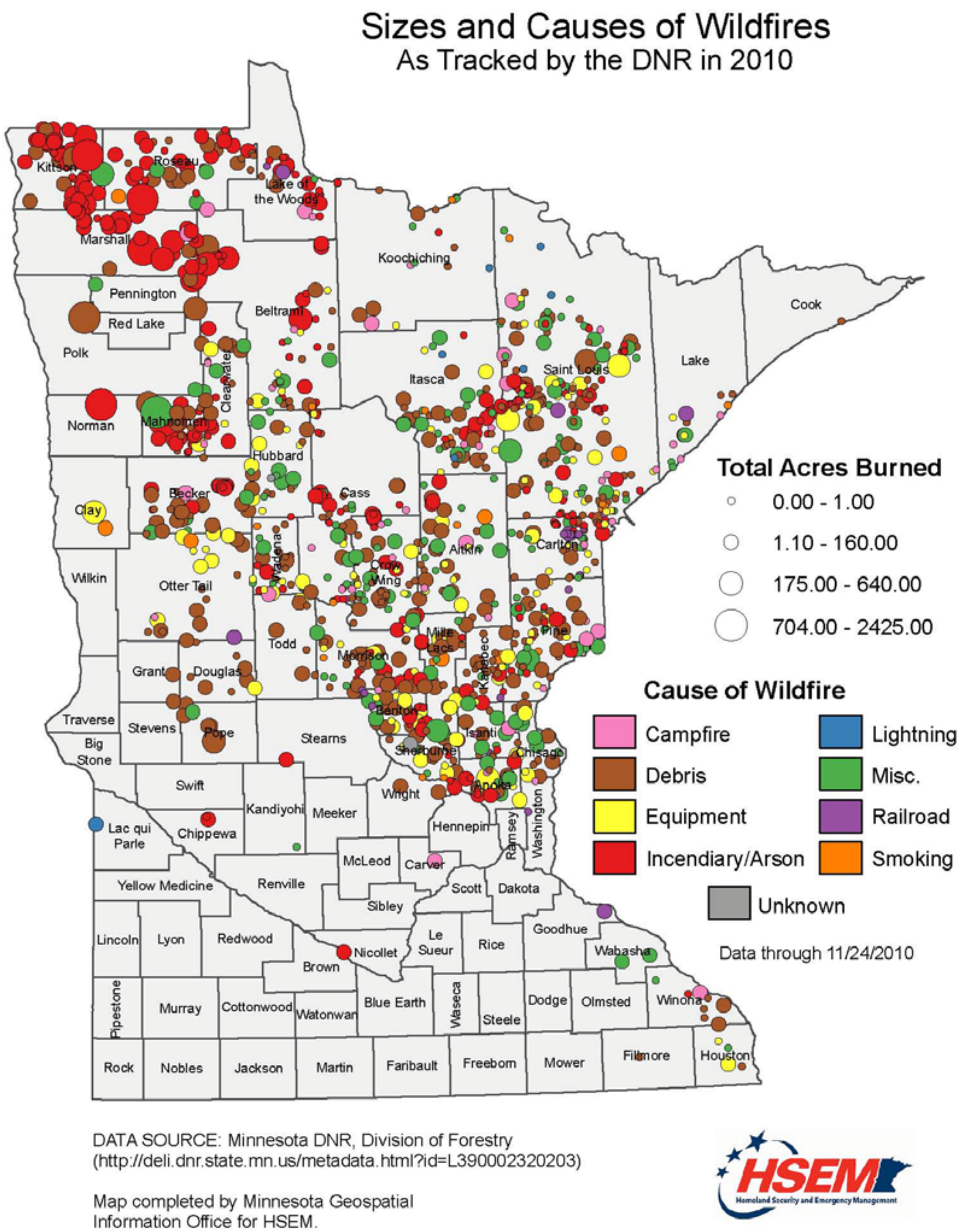


FIGURE 15 SIZES AND CAUSES OF WILDFIRES IN 2010



The following table contains wildfire statistics for the past ten years. For additional wildfire data see Appendix G.

Table 5 Wildfire Statistics 2000-2010					
COUNTY	AVG # FIRES/ YEAR	AVG ACRES/ FIRE	AVG ACRES/ YEAR	AVG COST/ FIRE	TOTAL COST
Aitkin	53	13	683	$ 17,002	$ 9,010,856
Anoka	31	46	1427	$ 10,108	$ 3,163,682
Becker	87	10	888	$ 3,993	$ 3,469,628
Beltrami	68	40	2699	$ 1,387	$ 944,388
Benton	36	4	149	$ 8,998	$ 3,212,129
Big Stone	0	2457	737	$ 75,478	$ 226,435
Blue Earth	2	169	304	$ 1,069	$ 19,234
Brown	1	0	0	$ 381	$ 3,433
Carlton	51	2	88	$ 1,325	$ 679,537
Carver	0	97	39	$ 88,293	$ 353,170
Cass	63	5	336	$ 1,356	$ 859,543
Chippewa	1	472	330	$ 5,006	$ 35,044
Chisago	18	5	84	$ 2,253	$ 401,068
Clay	1	90	54	$ 500,368	$ 3,002,210
Clearwater	38	15	569	$ 459	$ 173,954
Cook	3	17	47	$ 34,287	$ 960,044
Crow Wing	81	4	351	$ 6,871	$ 5,538,095
Dakota	2	88	141	$ 8,329	$ 133,267
Douglas	10	8	83	$ 1,539	$ 155,401
Fillmore	5	5	21	$ 1,429	$ 64,287
Freeborn	0	1	0	$ 500	$ 500
Goodhue	1	8	7	$ 372	$ 3,350
Grant	1	75	83	$ 3,664	$ 40,300
Hennepin	3	9	23	$ 12,350	$ 308,739
Houston	10	4	41	$ 1,346	$ 129,257
Hubbard	29	3	98	$ 1,878	$ 540,989
Isanti	30	4	114	$ 2,066	$ 628,021
Itasca	66	3	214	$ 2,459	$ 1,622,905
Jackson	0	152	15	$ -	$ -
Kanabec	42	5	207	$ 937	$ 392,505

Table 5 Wildfire Statistics 2000-2010

COUNTY	AVG # FIRES/ YEAR	AVG ACRES/ FIRE	AVG ACRES/ YEAR	AVG COST/ FIRE	TOTAL COST
Kandiyohi	1	39	47	$ 254,032	$ 3,048,379
Kittson	36	253	9068	$ 2,077	$ 743,474
Koochiching	23	5	111	$ 3,504	$ 816,512
Lac Qui Parle	1	50	25	$ 5,532	$ 27,662
Lake	17	2	37	$ 1,725	$ 294,910
Lake Of The Woods	23	20	445	$ 1,153	$ 261,769
Le Sueur	0	1	0	$ 500	$ 1,000
Lyon	0	123	25	$ -	$ -
Mahnomen	57	20	1148	$ 415	$ 236,507
Marshall	25	154	3903	$ 1,229	$ 312,061
Martin	0	50	5	$ -	$ -
Meeker	0	75	23	$ 1,460	$ 4,380
Mille Lacs	32	7	237	$ 729	$ 235,520
Morrison	75	19	1382	$ 4,947	$ 3,695,222
Mower	0	9	4	$ 1,283	$ 5,130
Murray	0	10	1	$ -	$ -
Nicollet	1	27	16	$ 333	$ 2,000
Norman	1	516	258	$ 2,100	$ 10,500
Olmsted	0	3	1	$ 343	$ 1,370
Otter Tail	14	18	253	$ 23,240	$ 3,276,849
Pennington	3	278	834	$ 939	$ 28,182
Pine	93	9	866	$ 2,390	$ 2,215,919
Pipestone	0	7	1	$ 500	$ 500
Polk	3	246	688	$ 3,097	$ 86,728
Pope	3	66	198	$ 2,184	$ 65,511
Ramsey	1	12	7	$ 5,275	$ 31,648
Renville	0	52	10	$ 90	$ 179
Rice	1	50	25	$ 100	$ 500
Roseau	40	209	8399	$ 2,021	$ 812,532
Saint Louis	206	4	758	$ 2,022	$ 4,163,400

Table 5 Wildfire Statistics 2000-2010

COUNTY	AVG # FIRES/ YEAR	AVG ACRES/ FIRE	AVG ACRES/ YEAR	AVG COST/ FIRE	TOTAL COST
Scott	1	60	42	$ 797	$ 5,580
Sherburne	39	3	109	$ 12,994	$ 5,106,745
Sibley	0	1	0	$ -	$ -
Stearns	2	23	46	$ 5,987	$ 119,738
Stevens	0	87	35	$ 888	$ 3,550
Swift	0	43	9	$ -	$ -
Todd	21	15	309	$ 15,537	$ 3,278,219
Wabasha	3	6	16	$ 667	$ 16,685
Wadena	29	9	269	$ 1,500	$ 436,633
Waseca	1	1	0	$ 500	$ 2,500
Washington	4	3	11	$ 552	$ 23,201
Wilkin	0	2855	286	$ 17,275	$ 17,275
Winona	11	3	29	$ 657	$ 68,943
Wright	2	20	35	$ 2,822	$ 47,976

The following graphics illustrate data from the Minnesota DNR, Forestry Division. The first graphic indicates the average number of acres burned each month for the past twenty years, with the month of April having the highest average. The following figure shows the average number of wildfires per month with April and May showing the highest incidence of wildfires. The following maps indicate average cost and average acreage of wildfires per county. The last map indicates the total cost of wildfires for the past ten years. From this data, it is possible to develop potential loss estimation, but due to the many variables that lead to wildfires it is not necessarily a useful calculation.

FIGURE 16 AVERAGE ACRES BURNED BY MONTH

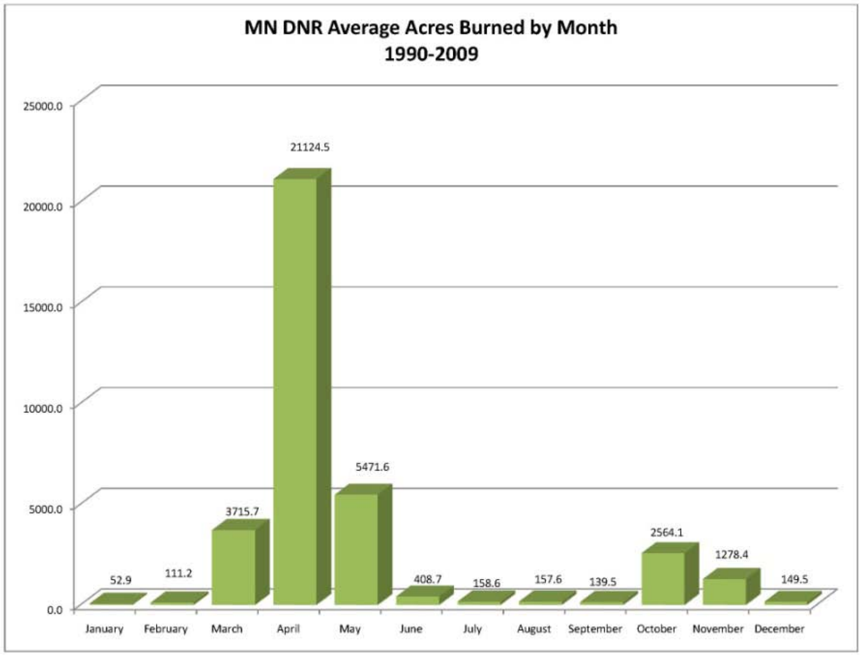


FIGURE 17 AVERAGE WILDFIRES BY MONTH

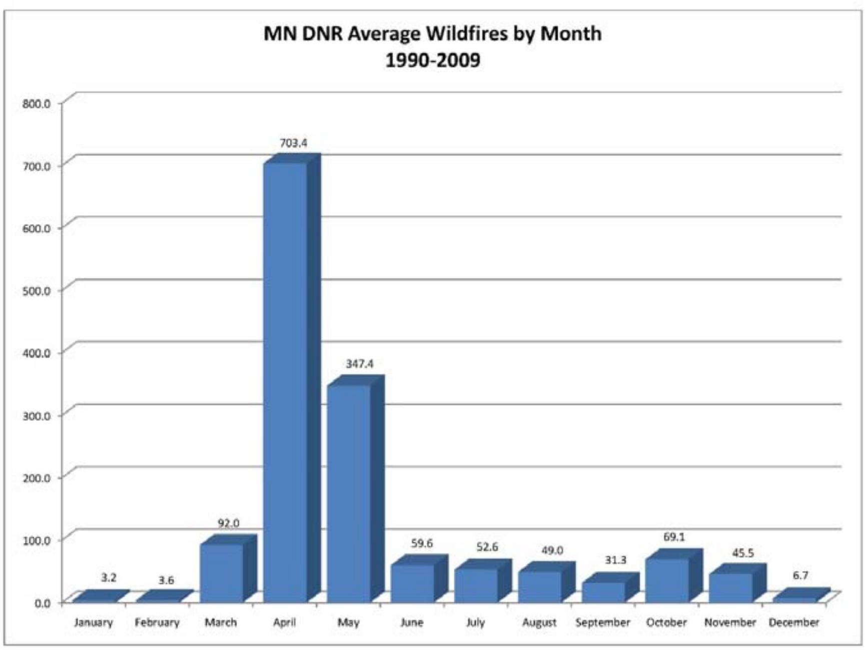


FIGURE 18 AVERAGE ACRES BURNED BY YEAR

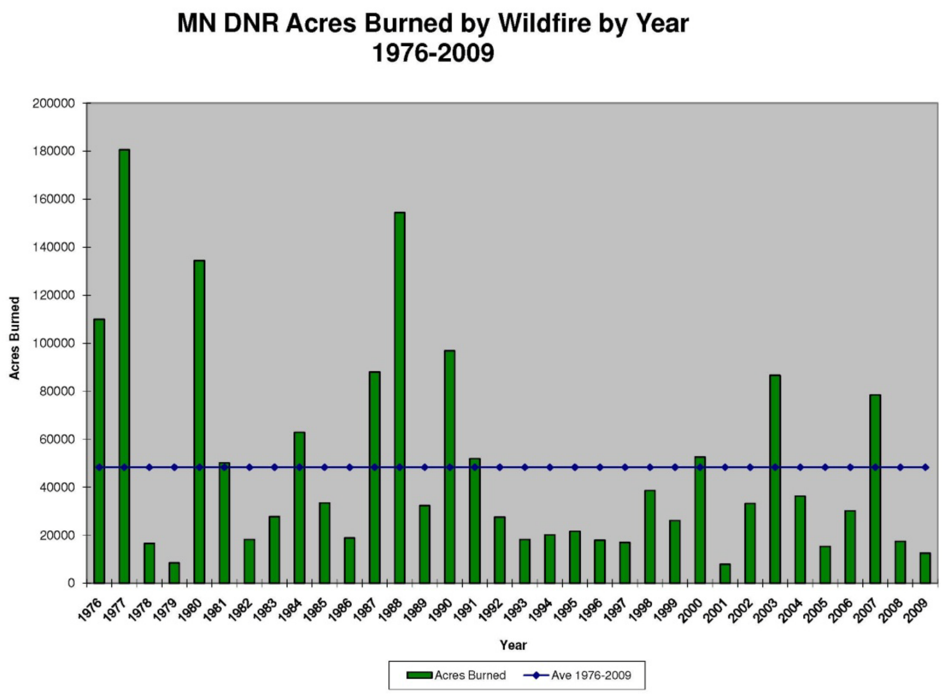


FIGURE 19 NUMBER WILDFIRES BY YEAR

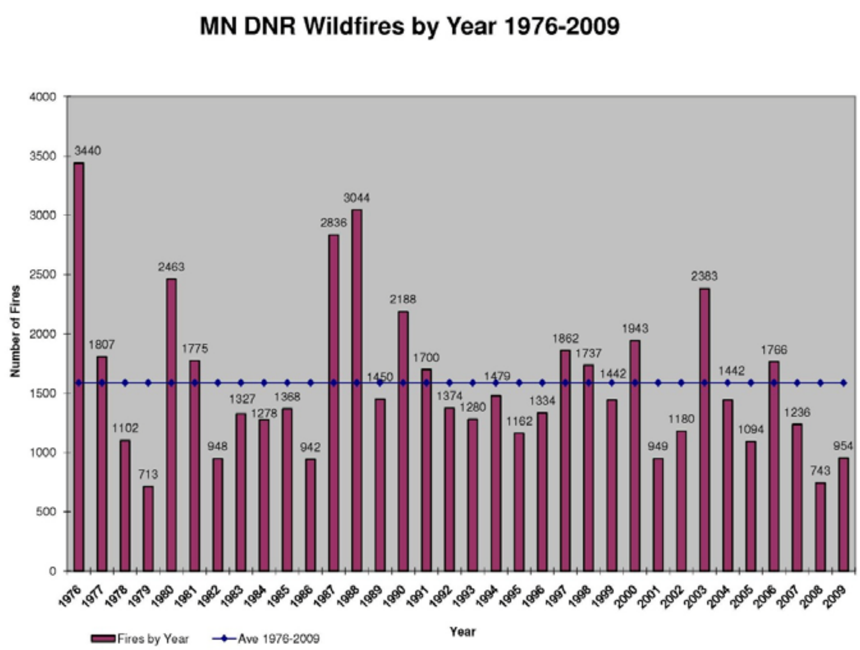


FIGURE 20 AVERAGE COST OF WILDFIRE PER COUNTY

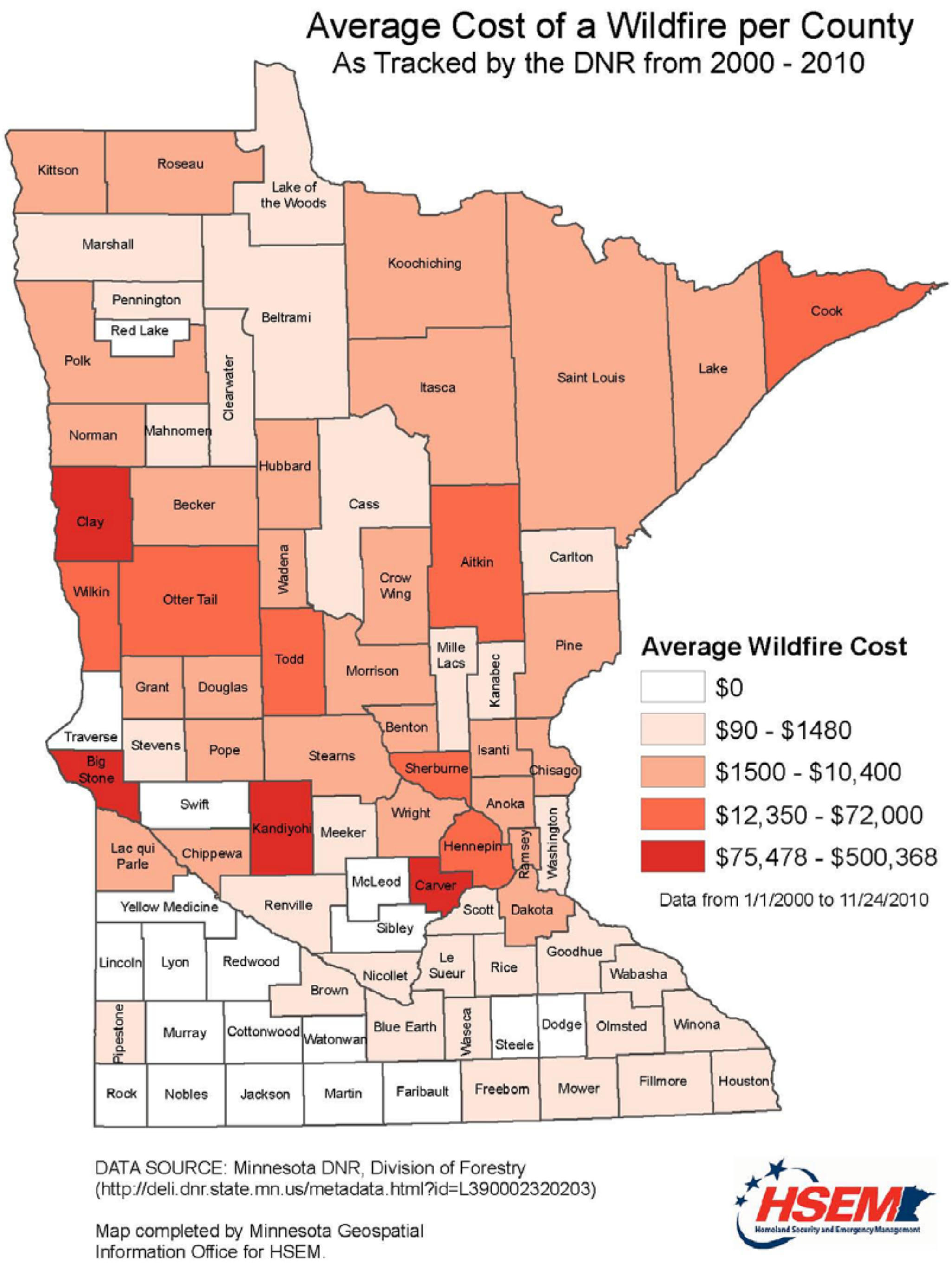


FIGURE 21 AVERAGE SIZE OF WILDFIRE BY COUNTY

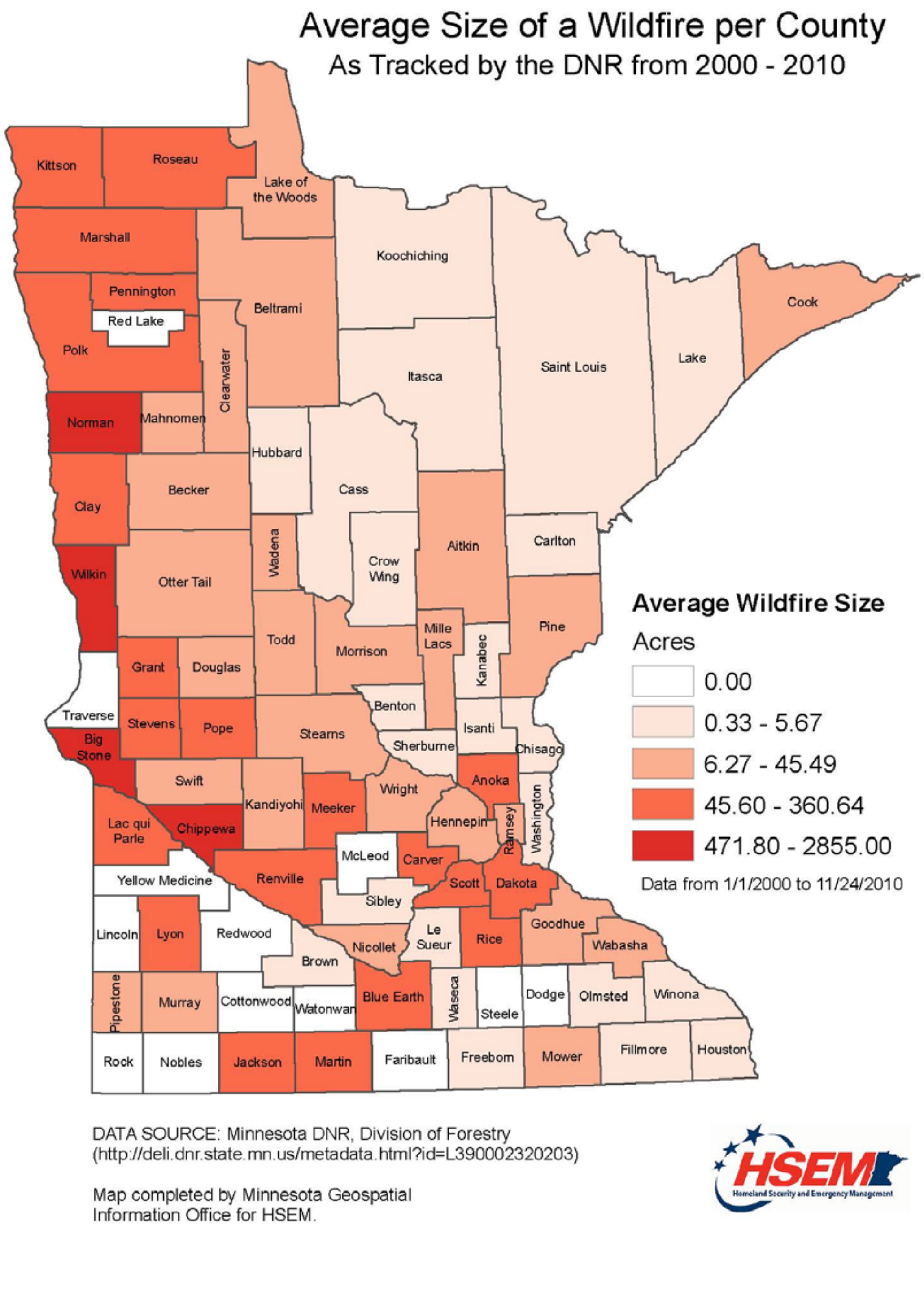
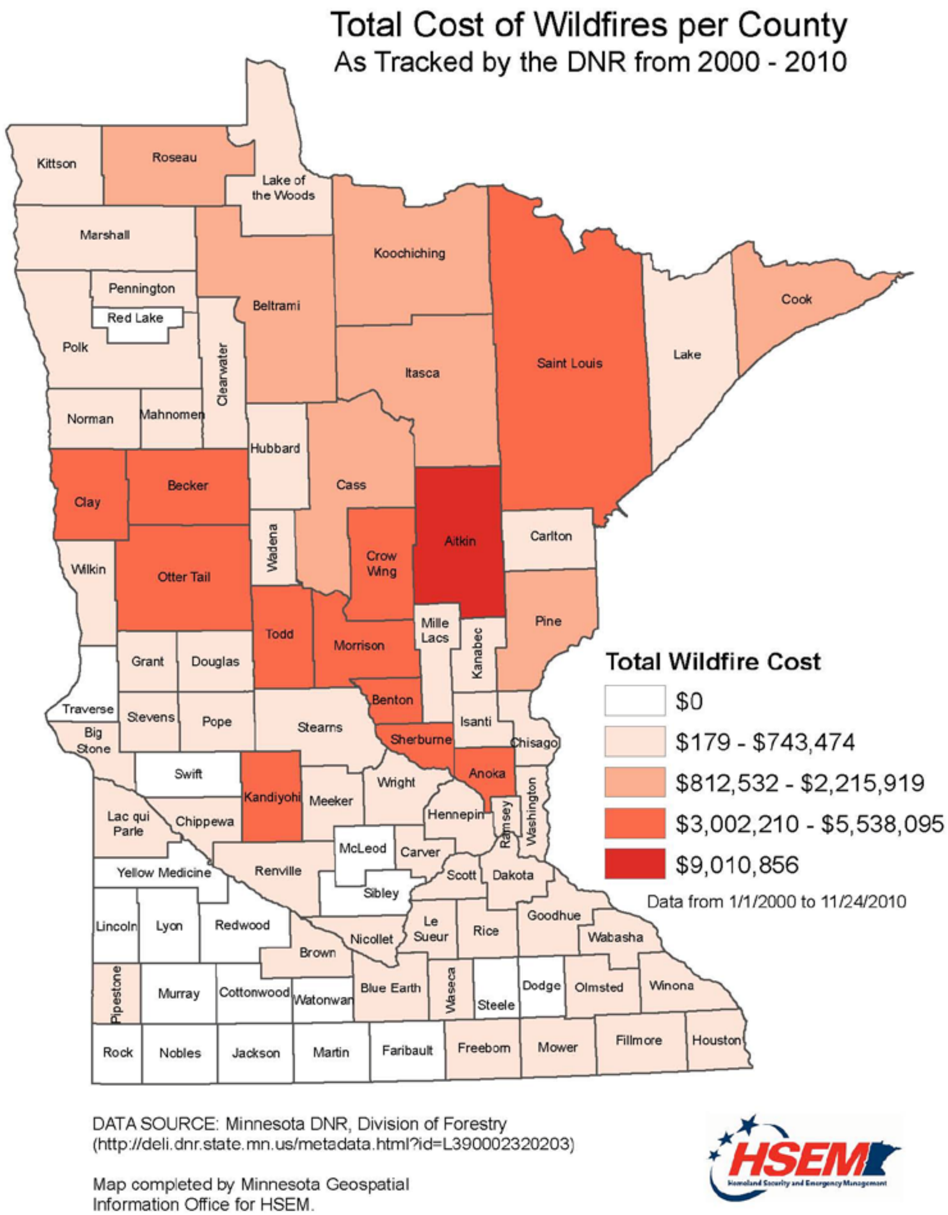


FIGURE 22 COST OF WILDFIRES BY COUNTY



The most costly wildfire was started by "misc. –power line" in Aitkin County and cost $5,002,500. Ten wildfires cost approximately three million dollars each during the period of record 1/1/2000 to 11/24/2010. Approximately 2000 recorded fires with no damage, nearly 9000 wildfires with less than $500 damage, 1500 records with $500-$1000 in damages, 1750 records with $1000-$5000 and 750 over $5000. St. Louis County had the largest number of wildfires at 2059, followed by Pine County with 927, Becker with 869, and Crow Wing with 806.

See www.usfa.fema.gov/nfdc/ for national trends and other general Minnesota information on this hazard. Fires on Federally protected lands and some fires suppressed by fire departments are not included in these statistics.

Probability of Occurrence

Like most weather-related phenomena, wildfire probability cannot be accurately predicted in the short-term. It is reasonable to assume that wildfire incidence will remain stable over the long-term, bearing in mind that weather patterns (in particular periods of drought and very low humidity); fuel load, insect infestations and human behavior can all greatly influence near-term probabilities. The qualitative probability is rated High for the state, although the rating is only intended for general comparison to other hazards that are being considered for this stage of the planning process. The MN DNR Wildfire Information Center provides daily fire weather forecasts, current data on wildfire conditions and burning restrictions throughout the state.

Sources of Information

Data from Wildfires Tracked by Minnesota DNR
(http://deli.dnr.state.mn.us/metadata.html?id=L390002320203)

Minnesota Department of Natural Resources. Wildfire Information Center.
www.dnr.state.mn.us/forestry/fire/index.html

Mitigation Case Studies: Sprinklers and FireWise: A Winning Combination; Ham Lake Fire, Gunflint Trail, Minnesota, May 2007

USFS Ham Lake Fact Sheet, June 26, 2007

Tornado

A tornado is a violently rotating column of air that extends toward the ground from the base of a convective cloud. Tornadoes can form in many environments. Three of these environments include: within intense squall lines, within supercell thunderstorms, and in the right front quadrant of land falling hurricanes. Tornadoes may or may not be visible to the naked eye. The funnel can be transparent or can be hidden by falling rain around it. Often times the only way to determine the presence of a tornado is by the damage it has left behind. A precursor to a tornado is a wall and funnel cloud. Most funnel clouds do not touch the ground, but when the lower tip touches the earth, it the funnel has become a tornado and can cause extensive damage.

Tornado damage severity is measured by the Fujita Tornado Scale, which assigns a numerical value of 0 to 5 based on wind speeds, as shown below. The letters EF may precede the number (e.g., FO, F1, F2) which refers to the enhanced Fujita scale. Most tornadoes last less than 30 minutes, but can exist for more than an hour. The majority of tornadoes are classified in the F0 and F1 category. The path of a tornado can range from a few hundred feet to miles, and tornado widths may range from tens of yards to more than a quarter of a mile.

Table 6 Enhanced Fujita Scale for Tornado Damage

EF Number	3 Second Gust (mph)
0	65-85
1	86-110
2	111-135
3	136-165
4	166-200
5	Over 200

Tornado History

Minnesota lies along the north edge of the region of maximum tornado occurrence in the United States. Tornado Alley, as that part of the central United States has come to be known, reaches across parts of Texas, Oklahoma, Kansas, Missouri, East Nebraska, and West Iowa. In Minnesota, tornadoes have occurred in every month from March through November. The earliest verified tornado in Minnesota occurred on March 18, 1968, north of Truman, and the latest in any year on November 16, 1931, east of Maple Plain.

Despite a higher number of tornadoes reported in recent years, the number of fatalities and injuries due to tornadoes has been decreasing. This is thanks in part to better National Weather Service tools in detecting tornadoes, namely the NEXRAD Doppler radar network installed in the mid 1990's. Also, the ability of alerting the public has improved as well with more National Weather Service radio transmitters and a close relationship with media outlets. An energetic spotter network has also been the key to alerting the public in Minnesota. The increasing number of tornadoes reported may be a direct result of improved communications networks, public awareness, warning systems and training.

Most of the deadly and damaging tornadoes occur in groups of outbreaks that often last from six to 12 hours. One of the worst such outbreak in Minnesota occurred on June 28, 1979, when 16 tornadoes slashed across the state, from northwest to southeast, in a six and one half hour period. Two additional tornadoes occurred in eastern North Dakota with this system. Many such outbreaks have occurred, including the April 30, 1967 cluster in south central and southeast Minnesota.

2010 was a historic year in tornadoes, with 104 tornadoes reported (4 rated EF-4, 4 rated EF-3, 8 rated EF-2, 30 rated EF-1, 58 rated EF-0). There were three deaths, 46 injuries (all were on June 17 except one injury on August 13). This year beat previous records of 74 tornadoes in 2001, 27 in one day on June 16, 1992 (June 17, 2010 had 48 on one day)

Until recently there had been fewer deaths due to tornadoes in Minnesota. Tornadoes in 2010 resulted in three deaths. Prior to 2010 the last tornado to produce multiple deaths (two) was August 9, 1993 in Koochiching County near Littlefork. Since the beginning of NCDC data collection over 1500 tornados have been recorded in the state, 95 people have died, and over 1100 have been injured.

Table 7 Historic Tornado Occurrences in Minnesota

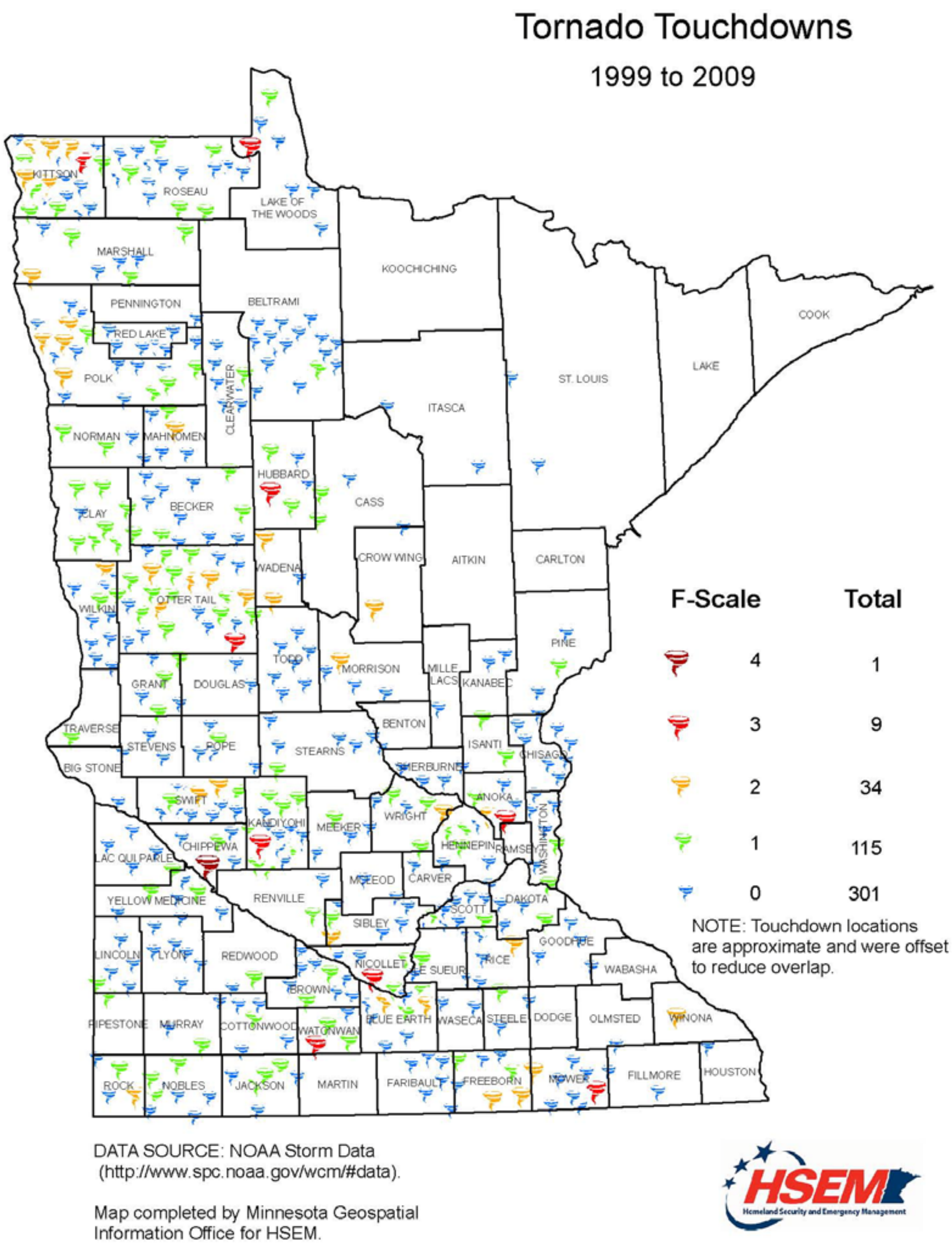
DATE	LOCATION	COMMENT
June 17, 2010	Widely dispersed locations	A major tornado outbreak of 48 tornadoes were reported, with three of these tornadoes reaching EF4 (166-200 mph). Three fatalities. A large number of homes in City of Wadena were damaged or destroyed.
August 19, 2009	Minneapolis	An EF0 tornado tracked through residential South Minneapolis towards Downtown Minneapolis.
May 25, 2008	Hugo	A two-year-old boy died, and seventeen injured
September 16, 2006	Rogers	A 10 year-old-girl died
August 24, 2006	Lake Emily, near Kasota	One dead, 37 injured
June 11, 2004	Mower	F3 category tornado
June 24, 2003	Buffalo Lake	F2 category caused 5 injuries
June 13, 2001	Parkers Prairie	F3 category caused 3 injuries
July 25, 2000	Granite Falls	One death, 15 injured
March 29, 1998	St. Peter and Comfrey	The greatest March tornado outbreak in Minnesota history. Two people died in a family of 13 tornadoes.

Table 7 Historic Tornado Occurrences in Minnesota

DATE	LOCATION	COMMENT
June 14, 1981	Twin Cities from Edina to Roseville	One dead, 83 injured.
August 6, 1969	Outing	Twelve dead and 70 injured.
June 13, 1968	Tracy	Nine dead, 125 injured.
On May 6, 1965	Twin Cities Metro area and South central MN	The most damaging series of tornadoes in Minnesota slashed across west and north sections of the metro killing 14 persons and injuring 685 with damage in excess of $50 million. On this day, eight tornadoes struck south central MN including three that were rated F4. 11 people were killed and 81 were injured. A four block wide swath was cut in the town of Waseca.
June 20, 1957	Moorhead, MN & Fargo, ND	Ten dead and more than 100 injured.
May 10, 1953	Southeast Minnesota	Seven dead and 19 injuries.
August 17, 1946	Mankato, North Mankato, Wells	About an hour apart, tornadoes slashed through the cities, leaving 11 dead and 60 injured (Mankato and North Mankato), and 200 injuries in Wells.
June 18, 1939	Champlin	More than 220 people were injured and 9 killed.
June 22, 1919	Fergus Falls	59 lives lost; second deadliest killer tornado in Minnesota history.
August 21, 1918	Tyler	36 lives lost.
April 14, 1886	St. Cloud and Sauk Rapids	Deadliest tornado in Minnesota history razed parts of St. Cloud and Sauk Rapids, leaving 72 dead and 213 injured.
August 21, 1883	Rochester	31 deaths, numerous injuries.

Source: climate.umn.edu/doc/historical/tornadic.htm

FIGURE 23 TORNADO TOUCHDOWNS



The following table contains data on tornado injuries, deaths and damages for the past ten years.

Table 8 Tornado Injuries, Deaths and Damages 1999-2009

COUNTY	# INJURIES	# INJURIES x $7,500	DEATHS x $3,000,000	PROPERTY LOSS	TOTAL DAMAGES
Anoka	20	$150,000	$3,000,000	$25,000,000	$28,150,000
Blue Earth	0	$0	$0	$2,000,000	$2,000,000
Brown	2	$15,000	$0	$0	$15,000
Cass	1	$7,500	$0	$0	$7,500
Chippewa	15	$112,500	$3,000,000	$20,000,000	$23,112,500
Freeborn	0	$0	$0	$22,000,000	$22,000,000
Hennepin	1	$7,500	$3,000,000	$31,000,000	$34,007,500
Kandiyohi	4	$30,000	$0	$1,000,000	$1,030,000
Mower	0	$0	$0	$2,000,000	$2,000,000
Murray	1	$7,500	$0	$0	$7,500
Nicollet	37	$277,500	$3,000,000	$23,000,000	$26,277,500
Otter Tail	3	$22,500	$0	$5,000,000	$5,022,500
Rice	1	$7,500	$0	$20,000,000	$20,007,500
Roseau	0	$0	$0	$20,000,000	$20,000,000
Sibley	5	$37,500	$0	$15,000,000	$15,037,500
Swift	7	$52,500	$0	$10,000,000	$10,052,500
Wadena	5	$37,500	$0	$10,000,000	$10,037,500
Watonwan	0	$0	$0	$2,000,000	$2,000,000
Winona	2	$15,000	$0	$2,000,000	$2,015,000
Wright	0	$0	$0	$1,000,000	$1,000,000

Note: The death and injury dollar figures used for the current risk assessment were $3 million for death and $7,500 for injury. For the next update of this plan in 2014, the state will use the new FEMA Standard Values for Casualties and Injuries: Dead-Fatal $5.8 million, and three injury amounts –hospitalized ($1,088,000), treat and release ($90,000) and self-treatment ($12,000). They are not used for this analysis because there is currently no way to separate the three different types of injuries.

Some statistics on tornados in Minnesota from 1/1/1950 to 2/28/2010:

- One Year: 104 in 2010, previous record 74 in 2001
- One Month: 71 in June 2010, previous record 38 in June 2001

- One Day: 48 June 2010, previous record 27 on June 16, 1992
- 463 reported tornados on the NCDC resulting in four deaths, 103 injuries, over $233 million in property damages and $7.4 million in crop damages.
- Three F5 tornados in the state, resulting in ten deaths, 185 injuries and nearly $60 million in property damages (Fargo-Moorhead in 1957, Tracy in 1968, and Chandler in 1992)
- 33 F4 tornados in the state, resulting in 41 deaths, 759 injuries and over $413 million in property damages.
- 72 F3 tornados in the state, resulting in 17 deaths, 387 injuries, over $578 million in property damages and $4 million in crop damages.

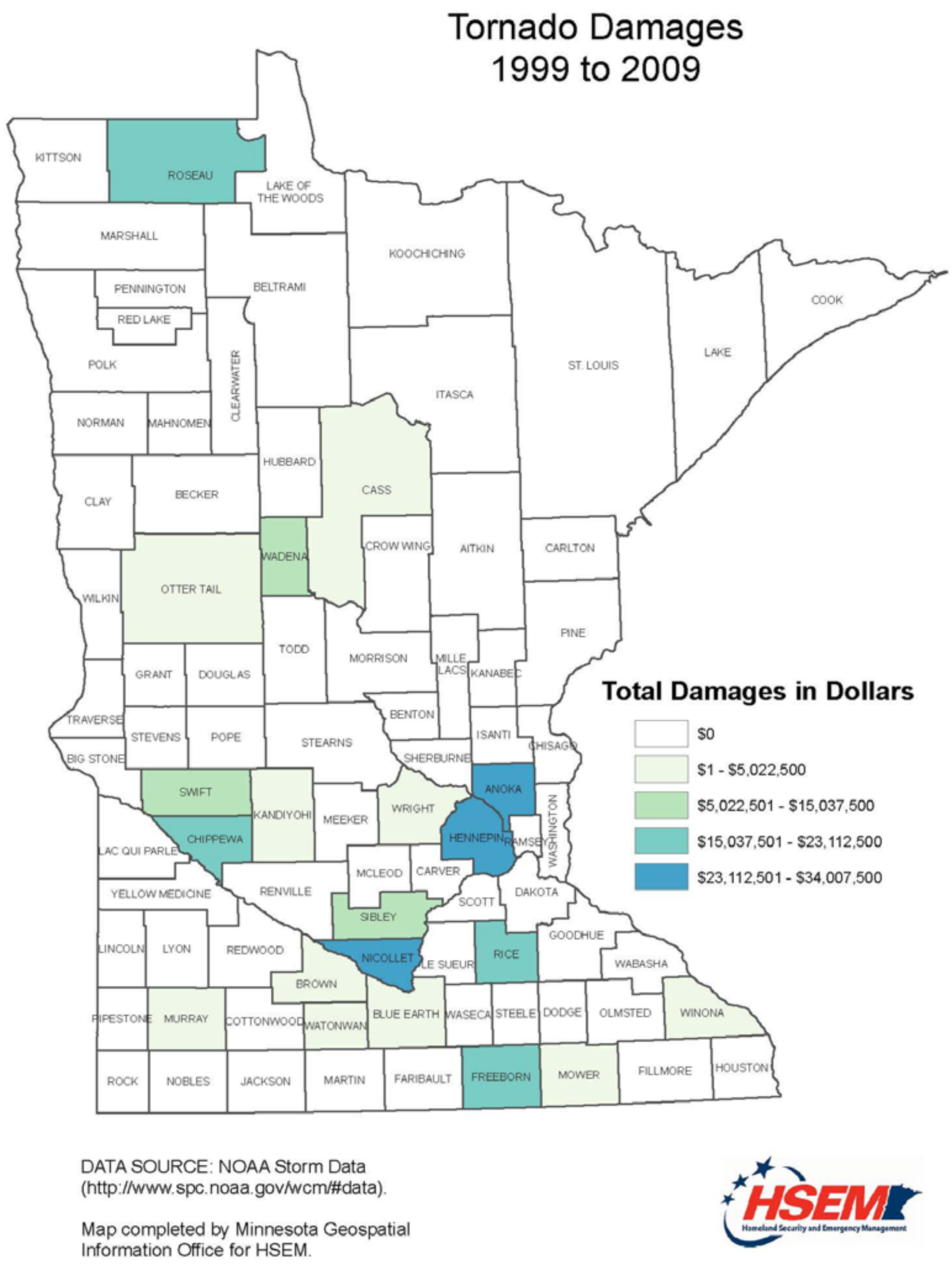
Probability of Occurrence

Tornado risk for each state can be calculated many different ways. The Disaster Center uses a unique formula that not only takes into account the likelihood of a tornado striking a particular state, but also the risks of death, injury and the costs of tornadoes for locations based on the size of the state. Nationally, Minnesota ranks number 17 for frequency of tornadoes, 18 for number of deaths, 19 for injuries and 6 for cost of damages. When these statistics are compared to other States by the frequency per square mile, Minnesota ranks number 29 for frequency of tornadoes, number 22 for fatalities, number 26 for injuries per area, and number 11 for costs per area, based on historic data from 1950 to 1995. This data had not been updated by the Disaster Center the 2011 Plan.

The “tornado month” in the State is June, with July next, and then May. During these three months, over 75 percent of all tornadoes occur; May has about 17 percent, June around 33 percent, and July approximately 28 percent. Tornadoes have never been reported in the State during December, January and February. The southern half of Minnesota has three to four times as many tornadoes as the northern half of the State. The deadliest Minnesota tornado of record was the Saint Cloud-Sauk Rapids tornado on April 14, 1886, when 74 lives were lost. The most damaging tornadoes were those occurring in the northern part of Minneapolis in the late afternoon of May 6, 1965, causing about $280 million (2001 figures) in damage. The most probable danger period in Minnesota is late spring and early summer, between 2 p.m. and 9 p.m.; however, tornadoes can and do occur at any time of the day or night.

Although site-specific tornado probability is impossible to determine, given the relatively long reporting period used in this calculation, it is reasonable to assume that the average annual number will remain relatively constant in the future. It is worth noting, however, the numbers of deaths and injuries can fluctuate drastically depending on the severity of the tornadoes and the locations that they impact. The Risk Assessment section includes a more detailed discussion of tornado risk, and includes calculations of risks to State-owned and operated facilities. Tornadoes are rated High for probability in qualitative ranking.

FIGURE 24 TORNADO DAMAGES



Sources of Information

NOAA, Storm Prediction Center. Tornado Numbers, Deaths, Injuries, and Adjusted Damage, 1950-1994: www.spc.noaa.gov/archive/tornadoes/st-rank.html

Minnesota Tornado History and Statistics: climate.umn.edu/doc/historical/tornadic.htm

National Weather Services' Storm Prediction Center (SPC) Severe Weather Database Files http://www.spc.noaa.gov/wcm/index.html 1950 -2009.

Windstorms

Winds in excess of 58 miles per hour, excluding tornadoes, are windstorms. Windstorms are among the nation's most severe natural hazards in terms of both lives lost and property damaged. The National Weather Service notes the following effects of various wind speeds.

Note: Straight Line Winds and Windstorms are used interchangeably in the Plan. This hazard is treated as a different category than Tornadoes (may also include high winds).

Table 9 Effects of Wind Speed

Wind Speed	Effects
25-31 mph	Large branches in motion, whistling in telephone wires
32-38 mph	Whole trees in motion
39-54 mph	Twigs break off of trees, wind impedes walking
55-72 mph	Damage to chimneys and TV antennas, pushes over shallow rooted trees
73-112 mph	Peels surface off roofs, windows broken, trailer houses overturned
113+ mph	Roofs torn off houses, weak buildings and trailer houses destroyed, large trees uprooted

Severe winds can damage and destroy roofs, toss manufactured homes off their pier foundations, and tear light-framed homes apart. There are several different types of windstorms. A "downburst" is a rather underrated thunderstorm threat defined as a strong downdraft with an out rush of damaging winds on or near the earth's surface. When people experience property damage from a downburst, they often do not believe that "just wind" could have caused the damage, and they assume that they were struck by a tornado. Downbursts may have wind gusts to nearly 130 mph and are capable of the same damage as a medium-sized tornado. A "gust front" is the leading edge of the thunderstorm downdraft air. It is most prominent near the rain-free cloud base and on the leading edge of an approaching thunderstorm and is usually marked by gusty, cool winds, and sometimes by blowing dust. The gust front often precedes the thunderstorm precipitation by several minutes. "Straight-line winds," when associated with a thunderstorm, are most frequently found with the gust front. These winds originate as downdraft air reaches the ground and rapidly spreads out, becoming strong horizontal flow.

Windstorm History in Minnesota

According to the National Climatic Data Center, between 1/1/1950 to 08/31/2010 there have been 116 high wind events (58+mph winds or 50.4 knots) events. This data (the number of events) is misleading because the same storm data may have been reported at multiple locations. Due to these events, there were four deaths and over nine million dollars in property damages. The following table outlines some notable high wind events in Minnesota history from 1975-2010.

Table 10 Windstorms in Minnesota 1975-2010

MONTH/YEAR	LOCATION	REMARKS
June 2006	Hennepin Co.	Numerous trees down in the Lake Calhoun, Lake of the Isles, and Lake Harriet areas, with a few roads blocked. Several small sailboats were tipped over on Lake Calhoun. A large tree fell onto the roof of a home in the 2300 block of Humboldt Ave. South. Two people were injured at Cedar Lake when a tree fell on them. About 30,000 electric customers lost power in the western metro according to Xcel Energy.
September 2005	Ramsey Co.	A severe storm moved out of Anoka County and across northern Ramsey County, knocking down tens of thousands of trees. Numerous roads were blocked. One child was injured in New Brighton from a tree limb crashing down. One person died in Moundsview while clearing their property. Property damage report of $25 Million dollars.
September 2005	Hennepin Co. (countywide)	A large storm swept across most of northern Hennepin County, accompanied by large hail and a brief tornado. The wind and hail were responsible for virtually all damage and a tornado was on the ground only briefly in Brooklyn Park. Tens of thousands of trees were downed and many roads were blocked. Some neighborhoods were without power for more than one week. Property damage report of 130 Million dollars. Perhaps the most severe damage occurred in Brooklyn Park with estimates of at least 10,000 trees downed. Over 90% of the city lost power. A 45 year old man in the north part of Minneapolis died after getting out of his car. He was heading for shelter when a large branch landed on him.
July 2003	Isabella (Lake Co.)	A large tree fell on the tent of a couple who were camping at Jackfish Bay of Basswood Lake. The woman was killed while her 42 year old fiancé was knocked unconscious.
June 2003	Cottonwood	Strong winds caused widespread tree damage, including numerous trees blown down. Falling trees damaged roofs of houses and destroyed the topper of a pickup truck, and severely damaged another pickup. Power lines were blown down, resulting in power outages. A large storage shed was destroyed. The roof of a house was blown off, and other roof damage to structures was reported. Property damage was $1 million.
April 2001	Blue Earth, Brown, Dakota,	A strong surface low pressure system moved out of the

Table 10 Windstorms in Minnesota 1975-2010

MONTH/YEAR	LOCATION	REMARKS
	Faribault, Freeborn, Goodhue, Le Sueur, Martin, Nicollet, Redwood, Rice, Scott, Sibley, Steele, Waseca, Washington, Watonwan	southwestern US and into north central Minnesota by the early afternoon on the 7th. This system produced numerous wind gusts in the 50 to 75 mph range across portions of southern Minnesota. The highest measured wind to be reported was 79 mph at Fairmont (Martin County). Property damage was $8 million.
August 2000	Outing	A 51 year old male was killed when a tree fell on a tent he was in near Lake Washburn
July 1999	Northern Minnesota	"July 4th Blow down." Straight-line winds exceeding 90 mph. Extensive areas of downed trees, shoreline erosion in Superior National Forest and Boundary Waters Canoe Area Wilderness. Disaster Declaration #1283.
May 1998	Burnsville	90+ mph winds blew in a brick wall at retail center. Indoor mall sustained $1 million damages. 2000 trees blown down. Federal/state disaster assistance obligation: $33.8 million. Disaster Declaration #1212.
July 1997	Monticello	Hurricane force straight-line winds. $20 million damages to 200 structures. Total federal/state disaster assistance obligation: $13.5 million.
May 1996	Minneapolis-St. Paul	Straight-line winds. Damages to public infrastructure estimated at $1.45 million.
July 1995	Northern Minnesota	"Great Windstorm of 1995." Intensive and sustained straight-line winds (129 mph for 20-40 minutes). 6.5 million trees blown down, mostly in isolated areas. Federal/state disaster assistance: $6.8 million. Disaster Declaration #1064.
April 1991	Freeborn County	Thunderstorms. Empty tractor-trailer truck flipped over. One fatality.
October 1984	Cass & Otter Tail Counties	Windstorms with 50 mph gusts. Four drown in two separate lake accidents.
June 1984	Hennepin, Blue Earth, & Faribault Counties	Windstorm. One death and several injuries.
April 1984	Southern Minnesota	Snow with strong winds snapped power lines and poles. Extensive power outages, esp. in rural areas.
September 1983	West Central and Central Minnesota	Windstorm. One death and two injuries. Extensive damage to a turkey farm in Kandiyohi County.
July 1983	Minneapolis-St. Paul	Downburst winds. One fatality. $20 million in property damages.
July 1983	Douglas County, Minneapolis-St. Paul	Winds. Power outages to 250,000 customers. Repair expenses to NSP: $2.5 million. 8 injuries.

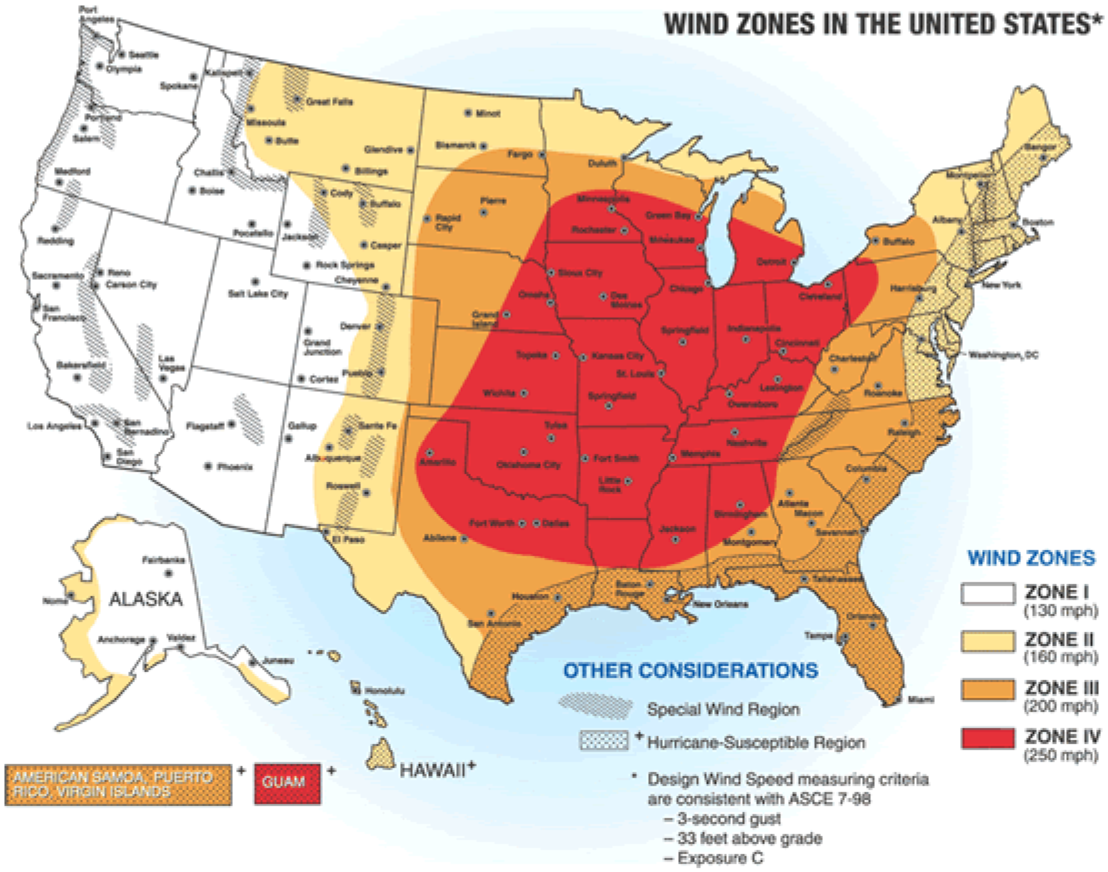
Table 10 Windstorms in Minnesota 1975-2010

MONTH/YEAR	LOCATION	REMARKS
March – April 1982	Houston, Freeborn, and Martin Counties	Windstorms. Two deaths, several injuries, and some property damage.
July 1980	Minneapolis-St. Paul	Downburst with 110 mph winds. One death. Extensive damage to homes and apartments. 100,000 homes without power. Property damages: $43 mil., crops: $1.1 mil.
June 1980	SE Minnesota	Windstorm. Extensive personal property damage est. at $1.4 million and crop damage est. at $4 million. Electric power interrupted for approximately 35,000.
June 1979	Southern Minnesota	Straight-line and downburst winds, occasionally exceeding 100 mph, resulted in severe damages estimated to be at least $35 million.
November 1975	Lake Superior	The ore carrier, "Edmund Fitzgerald," went down as a result of hurricane force winds.

Source: NOAA

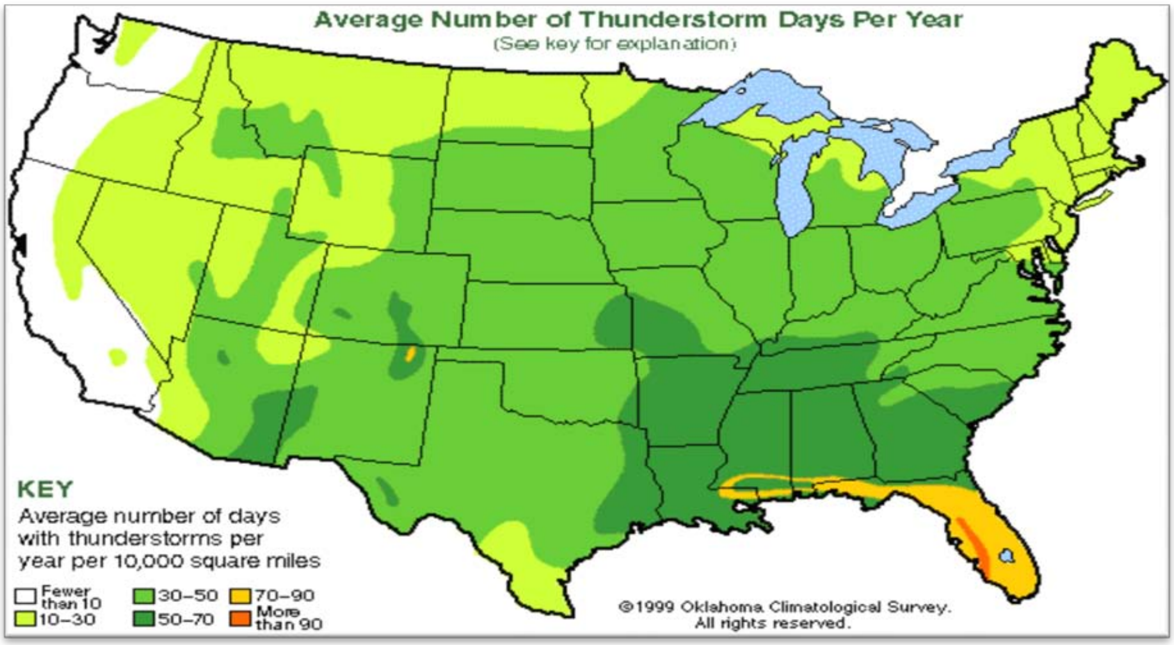
Per the Wind Zones figure, the southern third of the state is in Zone IV, middle third in III and northern third in Zone II.

FIGURE 25 WIND ZONES IN THE UNITED STATES



The following map indicates that the northwest corner of Minnesota averages about 10 to 30 days of thunderstorms per year while the rest of the state averages about 30-50 days with thunderstorms per year, per 10,000 sq. miles.

FIGURE 26 THUNDERSTORM DAYS PER YEAR



There have been no wind events that resulted in damages, since 2006. The location and number of reported events (37) since the last Plan are indicated below.

Table 11 Windstorms > 65 Knots 2008-2009	
County	# of Wind Events
Becker	1
Big Stone	1
Cottonwood	1
Dakota	5
Goodhue	5
Grant	1
Hubbard	2
Kandiyohi	1
Koochiching	1
Lac Qui Parle	4
Lake of the Woods	1
Le Sueur	1
Otter Tail	3
Renville	1
Sherburne	1
Stearns	1
Swift	2
Wilkin	2
Wright	2
Yellow Medicine	1

Data derived from: http://www.spc.noaa.gov/wcm/#gis

The following maps indicate wind speeds greater than 65 knots (and tornado touchdowns) and windstorm damage per county.

FIGURE 27 TORNADO TOUCHDOWNS AND WIND > 65 KNOTS LOCATIONS

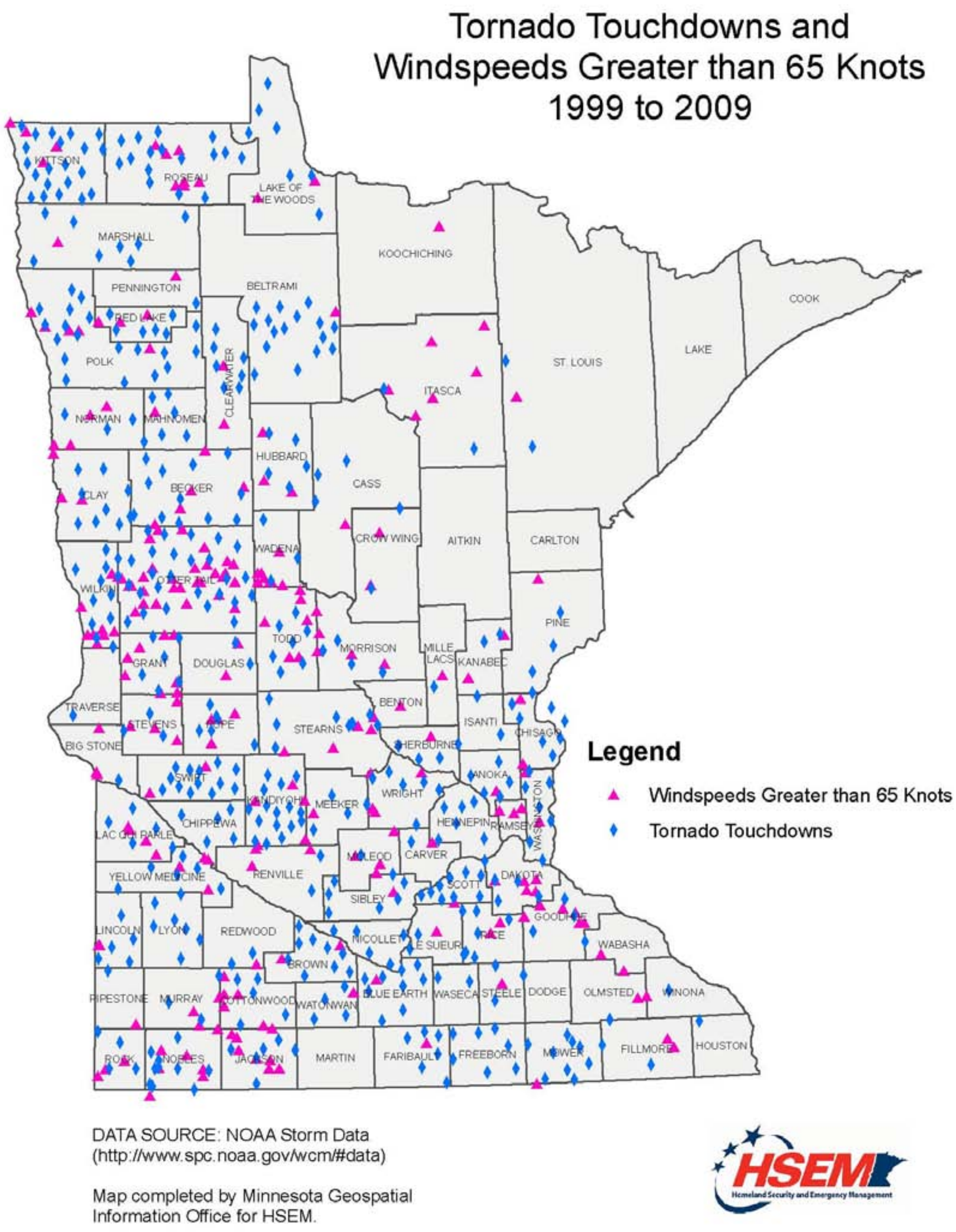
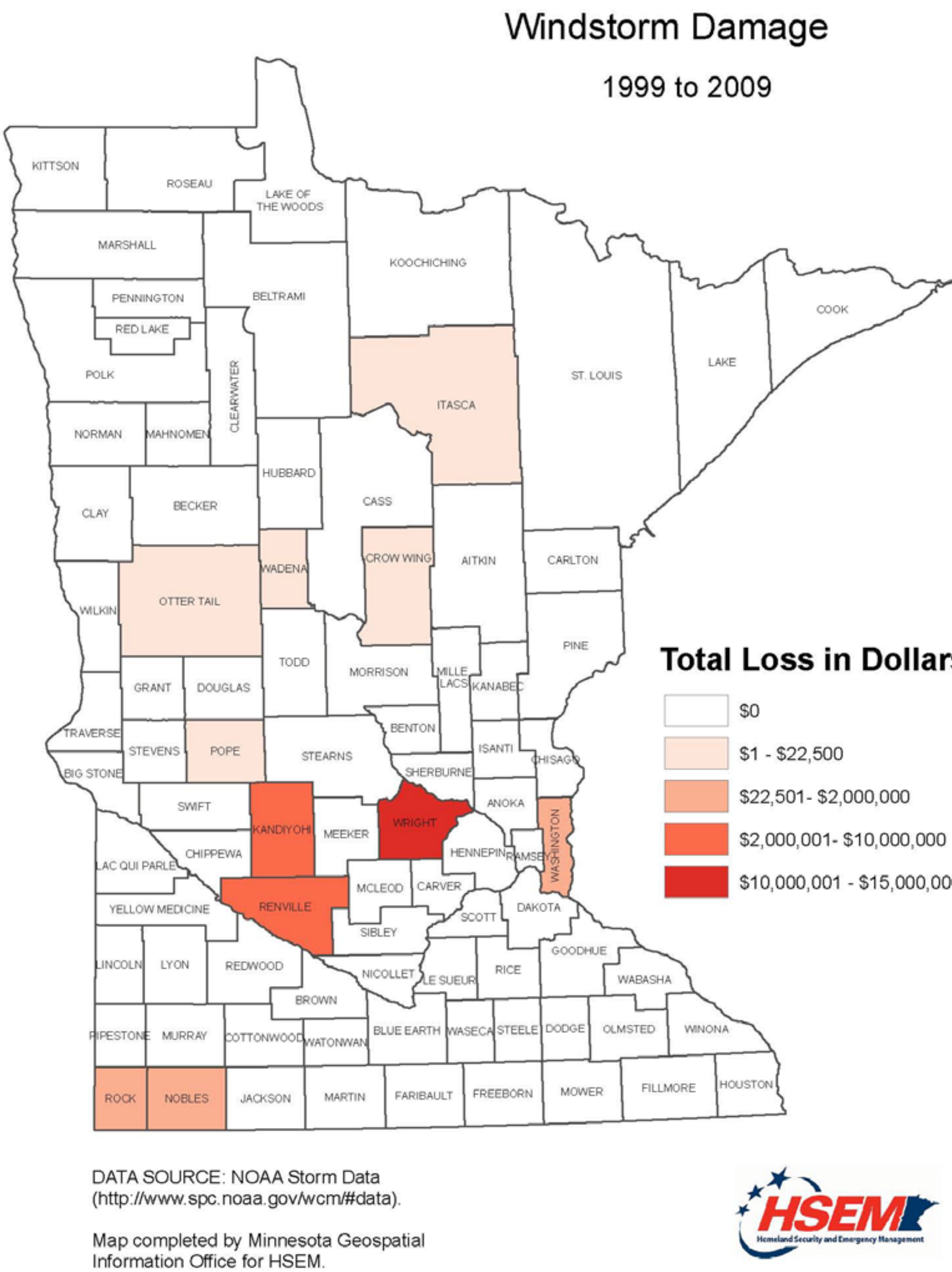


FIGURE 28 WINDSTORM DAMAGES



Probability of Occurrence

Windstorms can occur throughout the State of Minnesota, at any time of year. Most occur during the months of April through September. This recurrence is expected to remain relatively stable, although there will be year-to-year fluctuations. Long-term changes in weather patterns may also influence the number of windstorms that occur. The qualitative rating for windstorms is High.

Sources of Information

USDA Risk Management Agency

Storm Prediction Center http://www.spc.noaa.gov/wcm/#data

National Weather Service (NWS) historical records and the National Climatic Data Center; information can be seen on the following web site: www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms.

Hail

A hailstorm is an outgrowth of severe thunderstorms and develops within an unstable air mass. Warm moist air rises rapidly into the upper atmosphere and subsequently cools, leading to the formation of ice crystals. These are bounced about by high velocity updraft (or strong) winds and accumulate into frozen droplets, falling as precipitation after developing enough weight (FEMA, 1997).

The National Weather Service (NWS) defines severe thunderstorms as those with downdraft winds in excess of 58 miles an hour and/or hail 1.0 inch in diameter or greater. While only about 10 percent of thunderstorms are classified as severe, all thunderstorms are dangerous because they produce numerous dangerous conditions, including one or more of the following: hail, strong winds, lightning, tornadoes, and flash flooding (NWS, Flagstaff). The land area affected by individual hail events, an average of 15 miles in diameter around the center of the storm, is similar to the area affected by the parent thunderstorm. Hail risk at a point or over an area is a function of the target at risk (property or crop) and the hail frequency, intensity and size.

Table 12 Estimating Hail Size

Size	Inches in Diameter
Pea	1/4 inch
Marble/mothball	1/2 inch
Dime/Penny	3/4 inch
Nickel	7/8 inch
Quarter	1 inch
Ping-Pong Ball	1 1/2 inch
Golf Ball	1 3/4 inches
Tennis Ball	2 1/2 inches
Baseball	2 3/4 inches
Tea cup	3 inches
Grapefruit	4 inches
Softball	4 1/2 inches
Source: NWS	

The size of hailstones varies and is a direct consequence of the severity of the thunderstorm. The lower the height of the freezing level or where the temperature drops below 32°F above the Earth's surface, the greater the strength of the updrafts, the longer the hailstones are suspended, which generally increases the size of the hailstones. Hailstones vary widely in size, note that hail quarter size (1.0 inch in diameter) or larger is considered severe.

Hailstorms occur most frequently during the late spring and early summer, when the jet stream moves northward across the Great Plains. During this period, extreme temperature changes occur from the surface up to the jet stream, resulting in the strong updrafts required for hail formation.

Hail causes $1 billion in damage to crops and property each year. The costliest hailstorm in the United States was in Denver in July 1990 with reported damage of $625 million. The largest hailstone ever recorded which fell in Aurora, Nebraska on June 22, 2003 measured 7 inch with 18.8 inches in circumference. The heaviest hailstone fell in Coffeyville, Kansas on September 3, 1970, measured over 5.6 inches in diameter and weighed almost 2 pounds (NWS).

Individuals who serve as volunteer "storm spotters" for the NWS are located throughout the State, and are instructed to report any hail. Hailstorms are frequent occurrences across the United States. Since 1988, there have been on average nearly 3,000 individual hail events reported each year. Although they occur in every State on the mainland United States, hailstorms occur most frequently in the Midwestern States, particularly in Texas, Oklahoma, Kansas, and Nebraska. Hailstorms can occur throughout the year; however, most hailstorms occur during the months of April through October. July is the prime month of crop loss produced by hail.

Hail History

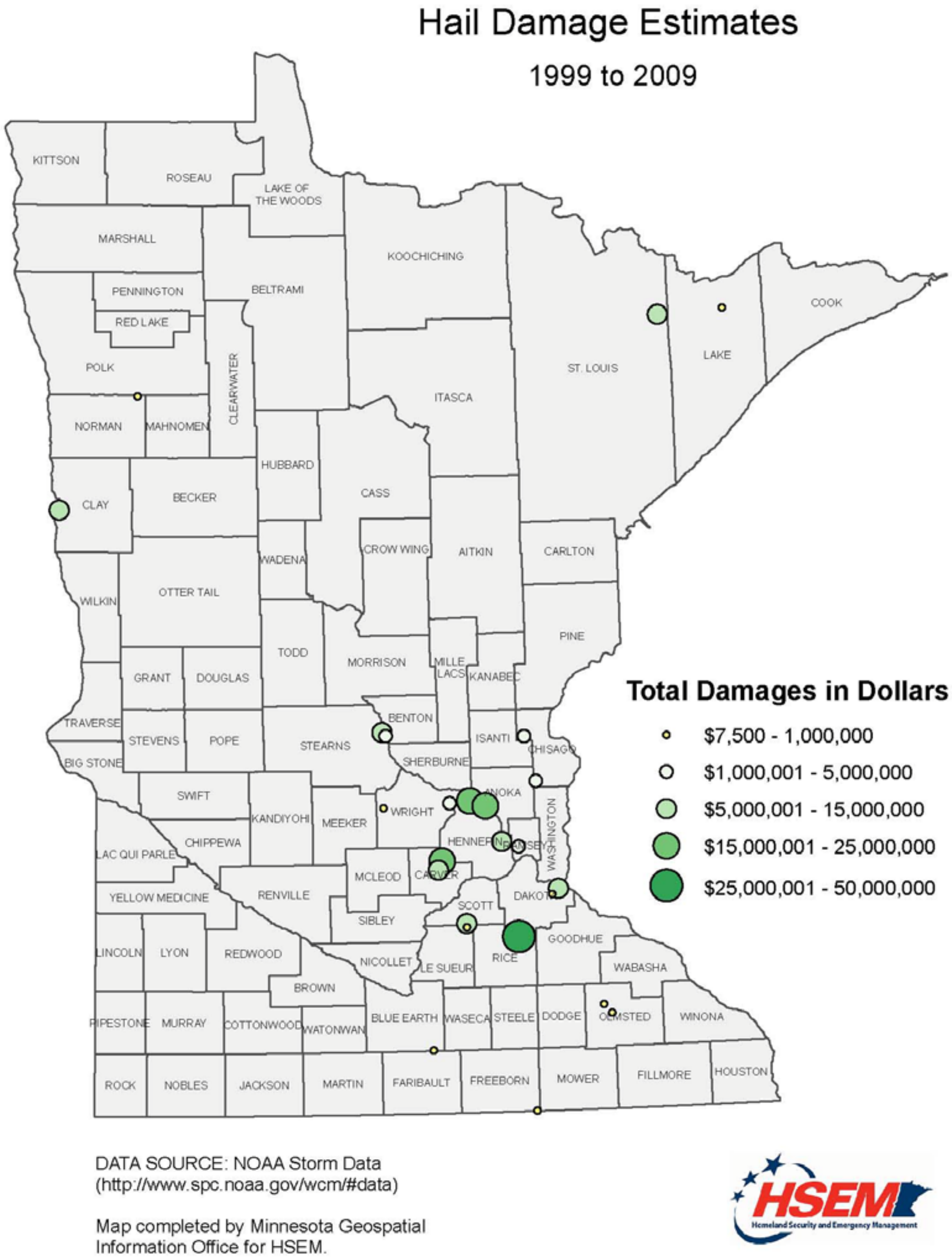
The National Climatic Data Center (NCDC) maintains a list of weather-related disasters in the United States over the past 21 years, in which overall damages and costs reached or exceeded $1 billion. Figures reflect direct and indirect damages, costs, and deaths. One of these billion-dollar disasters is the Minnesota Severe Storms/Hail in May 1998, in which damaging severe thunderstorms with large hail fell over wide areas of Minnesota, resulting in over $1.5 billion damage/costs and 1 death. Each year hail storms result in property and crop damage. In the last three years, 871 hail events were reported.

The NWS reports hail events based on specific geographic areas or distances. Therefore, a single thunderstorm that produces hail over a broad area may be listed as multiple, separate hail events. The following summaries combine a number of hail events occurring during a specific period. In April 1994, two persons were injured and homes were damaged during a severe thunderstorm, which dropped golf ball-size hail. In July 1994, large hail and strong winds destroyed over 270,000 acres of crops, causing more than $35 million in damages. In July 1995, hail wiped out over 640 acres of crops, estimated at $3 million. In May 1996, baseball size hail damaged $500,000 in crops and $2.7 million in property and injured two farmers.

In June 1996, hail destroyed more than 300,000 acres of crops, estimated at more than $9 million, and caused more than $700,000 in property damages. In July 1997, grapefruit size hail damaged more than 30,000 acres of crops, resulting in more than $5 million in crop damage and $200,000 in property damages. In May 1998, hail caused more than $6 million in property damages to an automobile dealership and other structures. In August 1998, hail caused $50 million property damages. In July 2000, large hail destroyed or damaged more than 30,000 acres of crops, causing $4 million in crop damages, and caused more than $100,000 for property damages. In August of 2006, hail damaged or destroyed over 57,000 acres of crops, causing over $7 million in damage and $116 million in property damages. From 2000 to 2006 hail has caused $227 million in property damages and more than $38 million in crop damages. The figures, however, only reflected damages reported to the NCDC. These figures do not include the financial losses related to a significant number of the hail events, as those amounts are undetermined.

Since the 2008 Plan submittal, there have been four additional damaging hail events, with no deaths or injuries. These events had damages totaling $872,000 for property damages and $1.25 million for crop damages.

FIGURE 29 HAIL DAMAGES



The figure above indicates total damages in dollars for hail events for the past ten years.

Insurance data has a number of limitations including the fact that not all farmers have taken insurance coverage (hail insurance is estimated to cover 25 to 30 percent of all crop losses caused by hail). In addition, crop-hail losses shift with time due to the amount of coverage (liability) and the crop value, as well as the temporal variations in hail occurrences, which are large.

Hailstorms cause nearly $1 billion in property, livestock, and crop damage each year. Severe hailstorms cause considerable damage to buildings, automobiles, and airplanes. Significant property damage does not occur until hailstone size reaches about 1.5 inches in diameter. This size will cause damage to cars, windows, and siding. When hailstones get larger and approach three inches in diameter, roofs start to experience major damage.

Damage depends not only on the size of the hail but upon depends on the hardness of the stones, the angle of the impact and wind speed while the hail is in progress. Rapidly increasing hail damages to property have brought average annual losses to $1.2 billion (in 1997-adjusted dollars) during the 1990s.

Hail crop losses in recent years nationally are estimated at $1.3 billion annually, representing between one and two percent of the annual crop value. Hail losses vary considerably regionally, representing, for example, one to two percent of the crop value in the Midwest, five to six percent of the crops produced in the High Plains and much less elsewhere in the nation. Crops are vulnerable to damage especially as peak hailstorm activity coincides with the Midwest's peak agricultural seasons for wheat, corn, barley, oats, rye, tobacco, and fruit. Long-stemmed vegetation is particularly vulnerable to damage by hail impact and accompanying winds. U.S. Department of Agriculture (USDA), Federal Crop Insurance Corporation maintains multi-peril indemnity amounts for crop losses by various hazards including hail.

Probability of Occurrence

Minnesota has experienced an annual average of 548 hail events per year during the period between 2000 and 2010 (5,487 total events/10 year period = 548). During that time there has been over 4.7 million dollars in property damages and 4.25 million in crop damages (for incidents recording over $100K in damages).

The frequency of hail indicates a high of three to four days annually in southwestern Minnesota, decreasing to near two days in the northern portion of the State. The month with the most hail is June, with May next, and then July. During these three months, about 60 percent of the hail occurs; June has 24 percent, May has 20 percent and July has 16 percent. The size of the hail reported is generally in the pea to dime-sized category, with several reports annually of baseball-size and larger.

The annual probability of hail occurring somewhere in the State is clearly quite high. However, the site-specific incidence of hail is considered low because of the localized nature of the hazard.

Sources of Information

Blueprint for Safety (2003). Hail Formation.

www.blueprintforsafety.org/hail/hail01.htm

NCDC list of Billion Dollar U.S. Weather Disasters
www.ncdc.noaa.gov/img/reports/billion/billion2006.pdf

NCDC Storm Events Database www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms

Summary of Natural Hazard Statistics www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms

Stanley A. Changnon, Jr. "Data and Approaches for Determining Hail Risk in the Contiguous United States," Journal of Applied Meteorology, Volume 38, No. 12, pp. 1730-1739.

Stanley A. Changnon, Jr. and David Changnon "Long-Term Fluctuations in Hail Incidences in the United States," Journal of Climate, Volume 13, No. 3, pp. 658-664.

Lightning

Lightning typically occurs as a by-product of a thunderstorm. The action of rising and descending air in a thunderstorm separates positive and negative charges, with lightning the result of the buildup and discharge of energy between positive and negative charge areas. Water and ice particles may also affect the distribution of the electrical charge. In only a few millionths of a second, the air near a lightning strike is heated to 50,000°F, a temperature hotter than the surface of the sun. Thunder is the result of the very rapid heating and cooling of air near the lightning that causes a shock wave.

The hazard posed by lightning is significantly underrated. High winds, rainfall, and a darkening cloud cover are the warning signs for possible cloud-to-ground lightning strikes. While many lightning casualties happen at the beginning of an approaching storm, more than half of lightning deaths occur after a thunderstorm has passed. The lightning threat diminishes after the last sound of thunder, but may persist for more than 30 minutes. When thunderstorms are in the area, but not overhead, the lightning threat can exist when skies are clear. Lightning has been known to strike more than 10 miles from the storm in an area with clear sky above.

According to the National Oceanic and Atmospheric Administration (NOAA), an average of 20 million cloud-to-ground flashes has been detected every year in the continental United States. About half of all flashes have more than one ground strike point, so at least 30 million points on the ground are struck on the average each year. In addition, there are roughly 5 to 10 times as many cloud-to-cloud flashes as there are to cloud-to-ground flashes (NOAA, July 7, 2003).

Lightning is the most dangerous and frequently encountered weather hazard that most people in the United States experience annually. Lightning is the second most frequent killer in the U.S., behind floods and flash floods, with nearly 100 deaths and 500 injuries annually. These numbers are likely to underestimate the actual number of casualties because of the under reporting of suspected lightning deaths and injuries. Cloud-to-ground lightning can kill or injure people by either direct or indirect means. The lightning current can branch off to strike a person from a tree, fence, pole, or other tall object. It is not known if all people are killed who are directly struck by the flash itself. In addition, electrical current may be conducted through the ground to a person after lightning strikes a nearby tree, antenna, or other tall object. The current also may travel through power lines, telephone lines, or plumbing pipes to a person who is in contact with an electric appliance, telephone, or plumbing fixture. Lightning may use similar processes to damage property or cause fires.

Lightning History in Minnesota

From 1/1/1990 to 9/30/2010, there were 183 lightning strikes in Minnesota with 10 fatalities and 70 injuries due to lightning strikes, according to NOAA. Lightning caused over $12.87 million in property damages and $65,000 in crop damages.

During a measured period of years in Minnesota (1959-1992), 31% of lightning deaths occurred in open fields, ball parks and open spaces; 25% occurred under trees; 10% occurred during boating, fishing or other water related activities; 12% occurred near tractors and heavy road equipment; and 2% occurred on golf courses (4% occurred at telephones; and 17% occurred at various other and unknown locations).

During that same time period, 13% of lightning injuries occurred in open fields, ball parks and open spaces; 18% occurred under trees; 6% occurred during boating, fishing or other water related activities; 5% occurred near tractors and heavy road equipment; and 11% occurred on golf courses (10% occurred at telephones; and 36% occurred at various other and unknown locations).

Lightning injuries in Minnesota have occurred during the same months, with the most injuries recorded May through August. Since the 2008 Plan, six additional persons were injured by lightning.

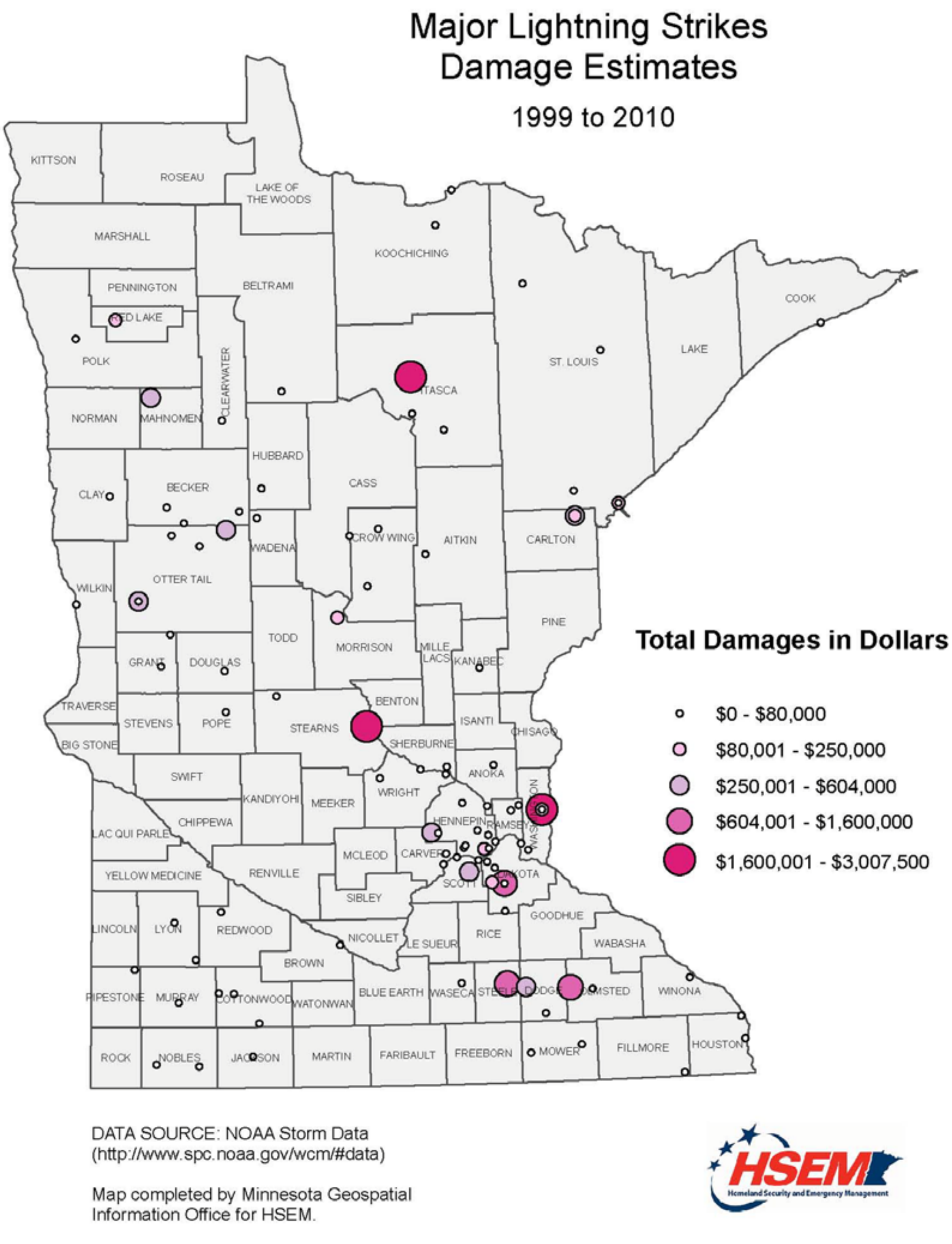
Table 13 Lightning Injuries Reported in Minnesota 2008-2010		
Location or County	Date	Injuries
Minneapolis/St. Paul, Hennepin County	4/22/2008	3
Mora, Kanabec County	6/27/2008	1
Waite Park, Stearns County	5/6/2009	1
Nopeming, St. Louis County	7/27/2010	1

The number of deaths due to lightning strikes from 6/19/1994-8/31/2010 is listed below.

Table 14 Lightning Deaths Reported in Minnesota		
Location or County	Date	Deaths
1 Erskine	6/19/1994	1
2 Newfound Lake	7/13/1995	1
3 Forest Lake	8/11/1995	1
4 Ely	6/28/1996	1
5 Grand Marais	8/6/1996	1
6 Meire Grove	6/26/1998	1
7 White Bear Lake	8/9/1998	1
8 Bowstring , Itasca County	06/08/2007	1
9 Waite Park , Stearns County	05/06/2009	1
10 Stillwater , Washington County	07/21/2009	1
TOTAL		10

Source: NOAA

TABLE 15 MAJOR LIGHTNING STRIKES



Probability of Occurrence

The probability of lightning occurring is high in the State. However, the site-specific incidence of lightning is considered low because of the localized nature of the hazard. The annual incidence of lightning across the State is presumed to remain stable, although year-to-year fluctuations are expected.

Sources of Information

Federal Emergency Management Agency. 1997. Multi-Hazard Identification and Risk Assessment – A Cornerstone of the National Mitigation Strategy. www.fema.gov/fhm/dl_mhira.shtm

National Oceanic and Atmospheric Administration. July 7, 2003. "Lightning." Available from the World Wide Web at: www.noaa.gov/lightning.html

University Corporation for Atmospheric Research (UCAR). 2000. Formation of Lightning. Available from the World Wide Web at: www.windows.ucar.edu/tour/link=/earth/Atmosphere/tstorm/lightning_formation.html.

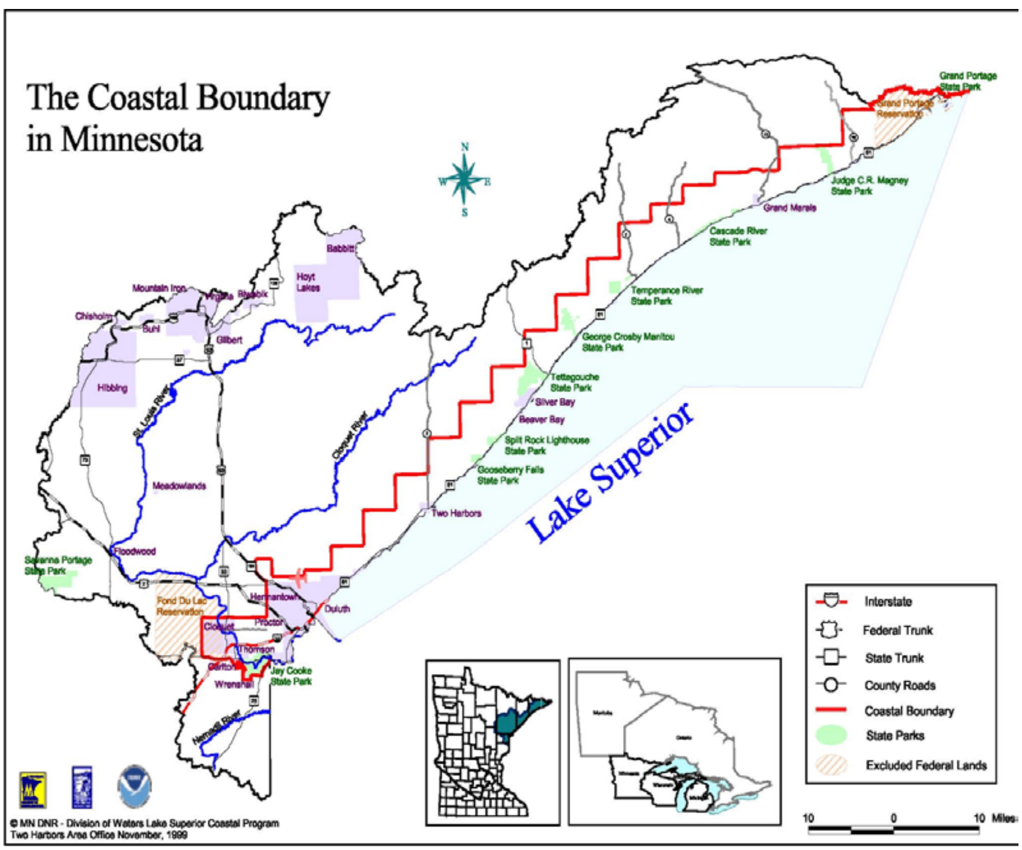
National Weather Service (NWS) historical records and the National Climatic Data Center; information can be seen on the following web site: www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

Coastal Erosion

Coastal erosion is defined as the wearing away of land and the loss of beach, shoreline, or dune material over a period of time as a result of natural coastal processes or human influences. Characteristics such as supply of sand and processes such as sea level change, currents, tides, waves, and wind are natural factors that contribute to the rate of erosion. Human-caused contributors to erosion include dredging tidal entrances, jetty and groin construction, hardening shorelines with seawall, beach nourishment, and construction of harbors and sediment-trapping dams.

As high lake levels increase, bluff recession rates also increase. Increasing assaults by wave action against the base of the bluff cause erosion and beach-building sediments. Navigational improvements and dredge-material disposal practices deplete both tributary and shoreland sources of sediment; removing these sediments from the shore system contributes to erosion. Ice ridges that form and break up each winter along the shoreline cause erosion by trapping sand in floating fragments of ice that are carried offshore into deep water. This continual natural process is one of the principal mechanisms by which sand is lost from the near shore system (USGS, 1992).

FIGURE 30 COASTAL BOUNDARY



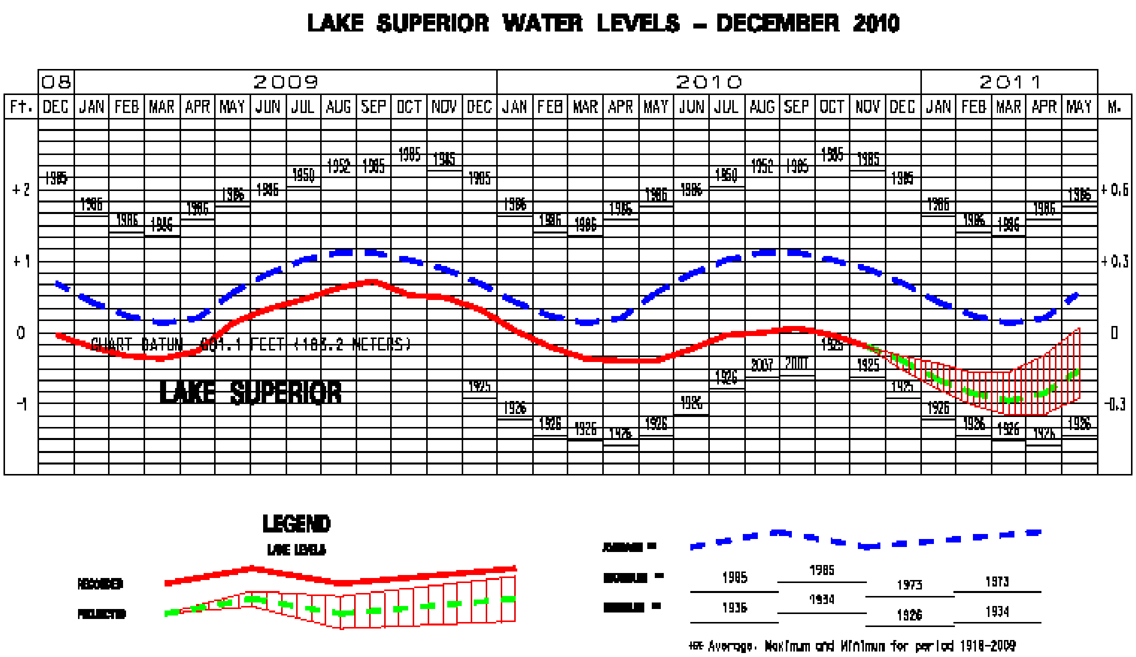
Coastal erosion is usually a gradual process, and sudden incidents prompting emergency action are rare. Such rare events include strong storms with high winds or heavy wave action that can cause sudden failure of bluffs.

Coastal property owners are acutely aware of hazards during periods of high water levels and especially right after a damaging storm or a bluff failure, but this awareness can fade over time if low lake levels slow the erosion rate.

Coastal Erosion history in Minnesota

Northeast Minnesota has 189 miles of Lake Superior shoreline and a coastal population of over 212,000. Erosion along 36 miles of unstable, tall clay shoreline is a particular problem. Typically, shorelines are quite high—often greater than 25 feet—and erosion and bluff instability can harm the aquatic zone near the shore. See Lake Superior water levels through December 2010.

FIGURE 31 LAKE SUPERIOR WATER LEVELS



Minnesota's Department of Natural Resources administers the Lake Superior Coastal Program; it provides pass through grants from the federal government's Coastal Zone Management Program. The coastal waters for Lake Superior include connecting waters, harbors, roadsteads, and estuary-type areas such as bays, shallows, and marshes - and protection zones. The Coastal Program Boundary includes Cook, Lake, St. Louis and Carlton counties. The Lake Superior Basin drainage includes the above counties and parts of Pine, Aitkin and Itasca counties.

Since the 2008 Plan, the North Shore Management Board (NSMB) has published an "Erosion Hazard Area Planning Process Definition" document. The NSMB is responsible for the North Shore Management Plan (NSMP) to address and update the Erosion Hazard Map Area. The Lake Superior shoreline is prone to erosion, due to large fluctuation of water levels and also the wave volume and force that can quickly destroy and relocate shorelines. Erosion continues to be an important topic because it can cause dangerous living conditions, property destruction, and affect values on lakeshore properties. As the North Shore continues to grow in popularity, there continues to be more development focused on the lakeshore.

Continued shoreline development is inevitable and contributes to erosion problems. Erosion rates can accelerate with increases in impervious surfaces, changing and eliminating vegetation cover, and alterations to beach makeup. Serious situations are rare but massive/fast erosion can occur during one storm event leaving houses dangling from cliffs or beginning to slide down hillsides. The effective management of areas with high erosion potential is necessary to protect property owners, and provide measures for reducing erosion.

The NSMP sets standards that are aimed at reducing stormwater runoff, which has a large impact on bluff deterioration. The NSMP advocates for stormwater runoff plans conducted by professionals, vegetation management, and managing soil when performing construction activities. The other way the NSMP protects property owners from the direct affects of erosion is through lake setbacks. The current riparian setback from the permanent vegetation line of Lake Superior is 40 feet or 75 feet from the average water level, whichever is greater. This provides a buffer from the bluffline to protect the structures.

The NSMP also has structure setbacks for erosion hazard areas:

> Structures and soil absorption areas shall be setback the annual erosion rate times 50 plus 25 feet (to allow for structure relocation) from the top edge of the eroding bluff. Where slumping is evident, the setback shall be measured from the uppermost shear zone (point at which the soil separates and slumping begins). In the absence of an established long-term erosion rate, the setback shall be 125 feet.
>
> The structure setback and the location of the soil absorption areas can be modified by variance if the landowner provides technical data proving a different recession rate or that the erosion hazard, although correctly estimated, can be mitigated by structural protection. The setback, however, shall not be reduced to less than the setback standards detailed in the zoning standards portion of this chapter.

To properly plan for erosion along the North Shore, there needs to be a redefinition of the areas. The definition will involve a process for accurately identifying boundaries to the known areas so that they can be more readily utilized through local zoning ordinances. The NSMP is investigating methods and new technologies to provide accurate measurements or shoreline erosion over time including high resolution aerial photographs and Global Positioning System measurements.

Probability of Occurrence

Minnesota's Lake Superior Coastal Program Final Environmental Impact Statement states, "Geologic processes are constantly reworking Lake Superior and its shore. While the processes generally act very slowly to yield almost unperceivable changes, the combination of beach and bluff erosion associated with rising water levels of Lake Superior has, and will continue to cause, considerable changes along the shoreline of Lake Superior."

Coastal erosion for Lake Superior and other lakes in the Great Lakes Basin are caused by many dynamic factors, including the duration of flooding from high water levels (days to months), storm surge (hours to a day) and wave runups (seconds to hours). It is difficult to estimate the annual amount of coastal erosion on Lake Superior. Erosion of dunes and beaches may be as wind and waves build or remove their materials. Erosion of bluffs and banks is by nature irreversible.

The NSMB is in the process of deciding how to map the erosion hazard, since the last map detailing erosion hazard areas was produced in 1988. There are multiple methods and steps involved in developing erosion rates for the erosion hazard mapping project. One method is developing maps to track the shoreline movements over time. The shoreline will need to be measured from the same identifier, whether it is the original high water line, edge of vegetation, or the toe of the slope. In areas where there is significant erosion the erosion reference lines will be spaced further and areas with minimal erosion will have minimal space between the erosion reference lines. This will provide a visual analysis of the shoreline movement over the timeframe. It is a costly endeavor and the group is investigating project partners and funding agents.

In June of 2009, an Erosion Forum was held and a resource guide was published. The complete erosion hazard map is not yet complete. When the resource guide and map are complete, they will provide a useful tool for local governments and their planning efforts.

Sources of Information

Minnesota Department of Natural Resources, Lake Superior Coastal Program,
www.dnr.state.mn.us/waters/lakesuperior/index.html

www.dnr.state.mn.us/waters/lakesuperior/feis/part3.html#A1

University of Wisconsin Sea Grant Institute
seagrant.wisc.edu/coastalhazards/Default.aspx?tabid=438

www.nrri.umn.edu/coastalGIS/DataIndex.html

http://www.lre.usace.army.mil/_kd/Items/actions.cfm?action=Show&item_id=3886&destination=ShowItem

North Shore Management Board, "Erosion Hazard Area Planning Process Definition"
http://www.arrowheadplanning.org/documents/North%20Shore%20Management%20Plan%20Update/ErosionHazardAreaPlanningDefinitionProcess.pdf May 2008

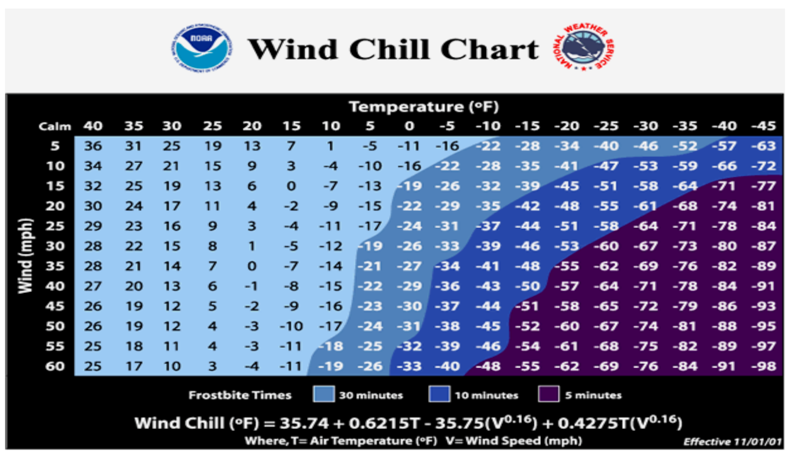
North Shore Management Board, “Erosion Forum Summary and Resource Guide” http://www.arrowheadplanning.org/documents/North%20Shore%20Management%20Plan%20Update/ErosionForumSummaryFINAL.pdf June 2009

Severe Winter Storms

Winter storms vary in size and strength and include heavy snowstorms, blizzards, freezing rain, sleet, ice storms and blowing and drifting snow conditions. Extremely cold temperatures accompanied by strong winds can result in wind chills that cause bodily injury such as frostbite and death. Severe winter and ice storms can cause unusually heavy rain or snowfall, high winds, extreme cold, and ice storms throughout the continental United States.

Winter storm occurrences tend to be very disruptive to transportation and commerce. Trees, cars, roads, and other surfaces develop a coating or glaze of ice, making even small accumulations of ice extremely hazardous to motorists and pedestrians. The most prevalent impacts of heavy accumulations of ice are slippery roads and walkways that lead to vehicle and pedestrian accidents; collapsed roofs from fallen trees and limbs and heavy ice and snow loads; and felled trees, telephone poles and lines, electrical wires, and communication towers. As a result of severe ice storms, telecommunications and power can be disrupted for days. Such storms can also cause exceptionally high rainfall that persists for days, resulting in heavy flooding.

FIGURE 32 WIND CHILL CHART



Wind (mph) \ Temperature (°F)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

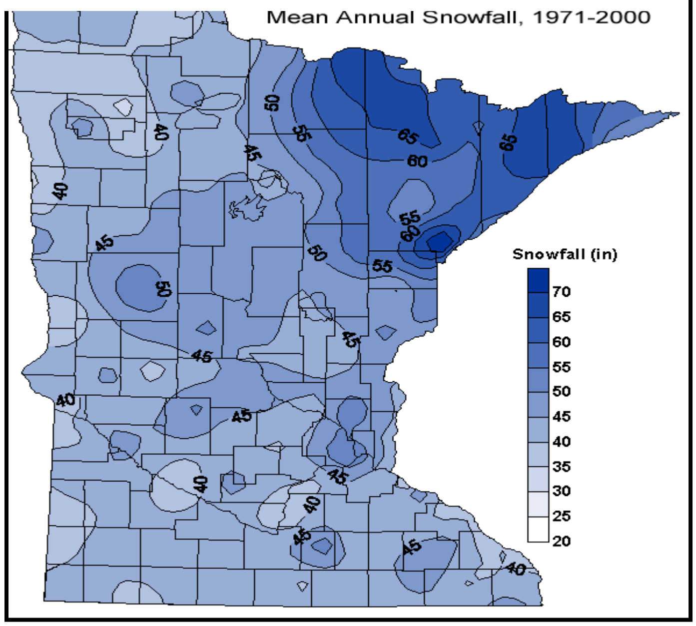
Winter storms present a serious threat to the health and safety of affected citizens and can result in significant damage to property. Heavy snow or accumulated ice can cause the structural collapse of buildings, down power lines or isolate people from assistance or services.

The wind chill temperature is how cold people and animals feel when outside. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature. Therefore, the wind makes it feel much colder. If the temperature is 00 F and the wind is blowing at 15 mph, the wind chill is -19 F. At this wind chill temperature, exposed skin can freeze in 30 minutes.

The NWS issues a Wind Chill Advisory for Minnesota when widespread wind chills of -40 F or lower with winds at least 10 miles per hour (mph) are expected. In some parts of southern Minnesota, the threshold may be -35 F. A Wind Chill Warning is issued when widespread wind chills of -40°F in northern Minnesota and -35°F in southern with winds greater than 10 mph are expected.

Since the last version of the state Plan, two additional persons have died due to exposure.

FIGURE 33 MEAN ANNUAL SNOWFALL



Winter Storm History in Minnesota

The topography, land-use characteristics and winter climate of western and southern Minnesota cause this area to be particularly vulnerable such that blowing and drifting snow is a common occurrence. The number of days with potential problems ranges from 115 in the south to 155 in the north. For an average winter season, taxpayers in Minnesota spend approximately $100 million in snow removal costs, with MnDOT expending $41 million. In the event of a winter season with anomalously high snowfall and exceedingly strong winds, as was the case for much of the state during the winter of 1996-97, the cost of snow removal can soar to $215 million. See Mean Annual Snowfall in the State.

Source: Minnesota Climatology Working Group

Blizzards

The following table shows the history of blizzards in Minnesota, noting significant losses and/or meteorological events. Most notable are the "Armistice Day Blizzard" in November 1940 in which there were 49 deaths; "The Storm of the Century" in January 1975 in which there were 14 deaths; the blizzard in February 1984 in which there were 16 deaths; the "Halloween Monster Storm" of 1991 which did not result in any deaths, but set staggering snowfall records; and the unprecedented series of blizzards in November 1996 through January 1997 which resulted in a Presidential Disaster Declaration (DR-1158-MN). The following is a brief summary of blizzard events in Minnesota during that season.

November 16-17, 1996 Blizzard in NW and WC

December 17-19, 1997 Blizzard in western and southern counties

December 20-21, 1997 Blizzard in NW

December 23, 1997 Blizzard in WC

December 31, 1997 New Year's Eve Blizzard in NW

January 4-5, 1997 Blizzard in western counties

January 9-10, 1997 Blizzard in western and southern counties

January 15-16, 1997 Blizzard in western counties

January 21-22, 1997 Blizzard in western counties

March 4, 1997 Blizzard in WC

April 5-6, 1997 Blizzard in western counties during flood fight

The total seasonal snowfall at Fargo-Moorhead was 117 inches, setting up the record-setting flood of 1997 in the Red River Valley.

More recently, 2010 has had numerous snowfall events. The December 10-11 Blizzard is the 5th largest snowstorm on record for the Twin Cities since 1891. This is largest snowfall for the Twin Cities since the 1991 Halloween Blizzard - 17.1 inches of snow fell. The highest snowfall total found in the state was 23 inches measured at Winona Dam. Three additional inches fell with a lighter snow storm on December 9th at Winona and is not included with the total. December 15-16 an additional 6 inches fell in central and southern Minnesota. The fourth snowstorm for December 20-21, 2010 added to the deepening snowpack across Minnesota.

Table 16 Historic Winter Storms and Blizzards

DATE	LOCATION	REMARKS
12/20-21/2010	Rochester, MN	On December 20th, the official snow observer near Rochester International Airport reported that another 6.1 inches of snow had fallen. This raised the December snowfall total to 37.8 inches. This makes it not only the snowiest December on record, but also the snowiest month ever. The previous snowiest December and month was 35.3 inches back in 2000. Normally, Rochester MN receives 52.7 inches during an entire snow season.
12/10-11/2010	Various	The largest snowfall for the Twin Cities since the 1991 Halloween Blizzard began late Friday night and continued through the day on Saturday. 17.1 inches of snow fell at the Twin Cities International Airport. Not only is this the largest snowstorm on record for December for the Twin Cities, but this storm is the fifth largest snowfall in a single storm to hit the Twin Cities since 1891. Heavy snow with visibilities of a quarter mile or

Table 16 Historic Winter Storms and Blizzards		
DATE	LOCATION	REMARKS
		less was reported at the Twin Cities Airport for eight hours straight from 9am to 4pm December 11. Blizzard warnings were posted on December 11 for all of southern Minnesota, including Carver, Scott and Dakota Counties of the Twin Cities. The Twin Cities International Airport was closed for a time. The Metrodome collapsed under the weight of the snow. For days afterward, cities struggled to remove the snow from streets and sidewalks. School was cancelled for two days for St. Paul and Minneapolis.
12/3-4/2010		A widespread area of snowfall impacted southern and central Minnesota. Widespread reports of 9 to 12 inches of snow, with the maximum observed snowfall being 11.7 inches near Lakeville, MN
11/29-30/2010	Multiple	Portions of the state saw 5 to 10 inches of snow. Totals for the month of November was 9.8 inches in the Twin Cities. This event ensured six measurable days with snowfall in November in the Twin Cities. Redwood County saw 10" of snowfall.
11/13/2010	Multiple	Three days after a record high temperature of 68° in the Twin Cities, the weather turned around quite fiercely with the first winter storm of the season. 8.0" was officially observed at the Minneapolis/St. Paul International Airport. This was the largest pre-Thanksgiving, as well as November snowfall, for the Twin Cities since the "Halloween Blizzard" of October 31-November 2, 1991.
1/25/ 2010	Multiple	Northwest winds gusting to around 50 mph combined with existing heavy and loose snow cover to produce widespread visibilities of a quarter mile or less in blowing snow. Travel was impossible for most of the afternoon and early evening. Schools, businesses, and roads were closed, including Interstate 90.
1/6/2010	Multiple	Snowfall of 4 to 8 inches, previously existing snow cover, and northwest winds gusting to over 40 mph produced widespread blizzard conditions, with visibilities less than a quarter mile. New snowfall included 7.5 inches at Currie. Schools and businesses were closed, and travel became impossible in much of the area. The wind combined with cold temperatures to produce wind

Table 16 Historic Winter Storms and Blizzards

DATE	LOCATION	REMARKS
		chills colder than 35 below zero during the latter part of the storm. This extreme cold continued into the next day, Friday, January 8th.
12/24/2009	Multiple	As the area of low pressure stagnated over Iowa, it deepened and brought stronger north to northeast winds to the Red River Valley portion of northwest Minnesota. The combination of snow and strong winds brought whiteout conditions to this portion of northwest Minnesota. One rarity of the blizzard was the relatively warm temperatures (20s) that held throughout the event. Conditions finally improved on the morning of the 26th, but it took a long time to dig out from all the snow. Interstate 94 was closed for an extended period of time, with travel and all other activities essentially shut down. Many of the larger cities spent thousands of dollars on employee salaries, fuel, and maintenance costs for plowing snow. Storm total snowfall amounts generally ranged from one to two feet, with the most snow reported over the central Red River Valley.
1/12/2009	Multiple	A fast moving, but intense Alberta Clipper system, brought light snowfall across much of southern and portions of west central Minnesota Monday January 12th. However, very strong winds developed as an area of low pressure intensified across central Minnesota. This caused blizzard, or near blizzard conditions across a portion of west central Minnesota Monday morning, with winter storm conditions spreading south and east across the remainder of southern Minnesota during the afternoon and evening of January 12th. A blizzard watch was issued over 36 hours before the event began, with winter storm warnings issued 6 to 12 hours before blizzard conditions were met across west central Minnesota. Several areas along the far western border of Minnesota reported sustained winds of 30 to 40 mph, along with frequent gusts of 45 to 50 mph near Madison, Appleton, and other areas across Lac Qui Parle, western Chippewa, and western Swift counties. Even though not all areas reported three consecutive hours of sustained winds of 30 to 40 mph along with visibilities of 1/4 of a mile or less, numerous communities had several hours of one mile or less in blowing snow, with wind gusts of 30 to 40 mph. Some areas of east central Minnesota did not receive the strong winds, but a few bands of intense snowfall rates caused areas just south of the Twin Cities to

Table 16 Historic Winter Storms and Blizzards		
DATE	LOCATION	REMARKS
		receive between four and six inches of snow. Even after the snow stopped during the evening, strong winds and falling temperatures caused dangerously cold wind chill values. The following are wind chill values obtained during the height of the coldest temperatures and highest wind speeds around the area. Glenwood at -46, Morris at -45, Alexandria at -43, St. Cloud at -43, Benson at -42, Princeton at -42, Albert Lea at -40, and Lakeville at -40.
4/25/2009	Multiple	An unusual late April winter storm hit the Northern Plains and Upper Midwest Friday (25th) and Saturday (26th). A low pressure system pushed northeast across Iowa Friday into Wisconsin Saturday. The storm blanketed much of far southeastern North Dakota and North and West Central Minnesota with more than 8 inches of snow. An area near Wahpeton, ND and Fergus Falls, MN got more than 12 inches. Gusty northerly winds produced blizzard and near blizzard conditions across West Central Minnesota, resulting in the closure of parts of Interstate 94 Saturday morning between Alexandria and Moorhead, MN. Travel was not advised in many other areas as well.
12/13/2008	Multiple	A potent surface low pressure system moved out of Colorado late Saturday (13th) and tracked northeast to the Minneapolis area by noon on Sunday (14th). This created a strong temperature gradient across the northern plains, with Devils Lake (ND) at 15 below zero and the Minneapolis (MN) area around 30 above by noon Sunday. As the system intensified over eastern Minnesota, northwest winds began to gust to around 50 mph with wind chills colder than 40 below zero. Quite a bit of snow also accompanied the wind, which created whiteout conditions for an extended period of time. A blizzard this bad had not been seen since the winter of 1996/97, so the impact on the area was tremendous. Stores closed for portions of the weekend during the busy holiday shopping season. Interstate 94 was closed from Jamestown (ND) to Alexandria (MN). U.S. Highway 10 was closed from Moorhead to Detroit Lakes and U.S. Highway 2 was closed from East Grand Forks to Crookston. No travel was advised across the area. Church services, schools, and many other activities were cancelled or delayed. There were other minor power

Table 16 Historic Winter Storms and Blizzards		
DATE	LOCATION	REMARKS
		outages across the area as well.
4/10/2008	Multiple	Snow, beginning as rain and freezing rain, fell from just after noon on April 10th to the morning of April 11th. The snow accumulated 5 to 8 inches with the 8 inch report 5 miles north of Ivanhoe. The snow was accompanied by north winds averaging around 30 mph and gusting to 45 mph. This produced blizzard conditions, with zero visibilities and drifting snow making travel impossible. Schools and numerous businesses were forced to close. Power outages were reported as power lines fell from the weight of the wet snow and the strong winds.
2/9/2008	Multiple	A cold front moved into Minnesota, along a line from near Baudette to Detroit Lakes. Very little snow fell as the front moved through, as most locations reported an inch or less. However, north to northwest winds gusted from 45 to 55 mph behind the front, causing ground blizzard conditions in open country with wind chills from 25 below to 40 below zero. Snow plows were pulled in many areas, and some school events were cancelled. Interstate 94 was closed from Moorhead to Fergus Falls, U.S. Highway 2 was closed from East Grand Forks to Crookston, and U.S. Highway 75 was closed in Polk County.
1/29/08	multiple	An arctic cold front swept across southeast Minnesota during the morning of January 29. This system was accompanied by snow, with highest accumulations of 2 to 5 inches mainly along and north of a line from Austin (Mower County) to Wabasha (Wabasha County). Strong northwest wind gusts of 40 to 50 mph caused considerable blowing snow. In fact, blizzard conditions were reported in some locations such as Dodge Center (Dodge County), Rochester (Olmsted County) and Austin (Mower County). Conditions became dangerous very quickly as the snow started and winds dramatically increased. In Rochester, the temperature plummeted from 40F at midnight on the 29th to -12F shortly after 11 p.m. in the evening. This 52 degree drop tied a record for the sixth largest temperature change in a calendar day and was the largest temperature change in a calendar day since January 18, 1996. Southbound Interstate 35 was closed from Owatonna to Albert Lea.
2/28/07-	Cook, Lake, St. Louis, Carlton	Blizzard brings over 20 inches of snow and winds exceeding 50 mph to the Duluth area. A week

Table 16 Historic Winter Storms and Blizzards		
DATE	LOCATION	REMARKS
3/2/07		earlier, the Duluth area received over 12 inches of snow in another blizzard event that dumped over two feet of snow on SE Minnesota.
3/2/2007	Big Stone, Traverse	None reported.
3/1/2007	Clay, Wilkin Cottonwood, Jackson, Lincoln, Lyon, Murray, Nobles, Pipestone, Rock, Cook, Lake, St. Louis, Carlton	New snowfall of 12 to 15 inches beginning early morning on March 1st and continuing into the night of March 2nd was accompanied by sustained winds of over 30 mph at times with gusts over 40 mph. Schools and school activities were cancelled and numerous businesses closed. Power outages were reported as the heavy snow and strong winds brought down power lines.
1/24/2006	Clay, Grant, Norman, Becker, Otter Tail, Wilkin, Kittson	A burst of strong northwest winds worked up the Red River Valley, causing a four hour period of ground blizzard conditions. Wind speeds peaked between 50 and 60 mph and occurred with just a little light snow. The Minnesota State Patrol closed Interstate 94 between Moorhead and Fergus Falls. A six vehicle accident occurred on Interstate 94 at exit 54 (in Fergus Falls), which left three people injured.
11/28/2005	Becker, Chippewa, Clay, Clearwater, Grant, Hubbard, Lac Qui Parle, Lincoln, Lyon, Mahnomen, Norman, Otter Tail, Pipestone, Rock, Stevens, Swift, Wadena, Wilkin, Yellow Medicine	Blizzard conditions with no deaths. Visibilities were frequently reduced to near zero and travel was made impossible in many areas. Many schools and businesses were forced to close. There were a few reports of minor damage caused to homes and vehicles by the strong winds. Ice buildup from a period of freezing rain disabled four substations owned by Minnesota Valley Cooperative Light and Power, located near the South Dakota border in Lac Qui Parle County. Power lines were also severed across portions of Chippewa, Lac Qui Parle and Yellow Medicine Counties during the morning hours after sunrise. Numerous automobile and truck accidents were reported across the region.
11/27-11/29/05	Beltrami, Clearwater, Clay, Lake of the Woods, Marshall, Norman, Pennington, Polk, Red Lake, Roseau, Wilkin	A winter storm that caused over $3.9 million in damages. An inverted trough stretched into the Red River Valley, from a low pressure system passing through the central plains. The precipitation began as a mixture of rain and freezing rain, falling quite heavily at times. Thousands of people lost power as several thousand wooden power poles were snapped. Roads were blocked by fallen trees, branches, and power lines. Many vehicle accidents and several injuries were reported due to the treacherous road conditions. Clay, Norman, and Wilkin Counties

Table 16 Historic Winter Storms and Blizzards		
DATE	LOCATION	REMARKS
		received a Presidential Disaster Declaration.
1/22/2005	Dodge, Fillmore, Mower, Olmsted	Wind gusts as high as 40 to 50 mph caused blowing snow to reduce visibility to zero at times. Snow drifts in some areas were 4 to 6 feet deep, which made numerous highways impassable.
1/21/2005	Becker, Big Stone, Blue Earth, Brown, Chippewa, Clay, Douglas, Faribault, Freeborn, Grant, Kandiyohi, Kittson, Lac Qui Parle, Le Sueur, Mahnomen, Marshall, Martin, Mcleod, Meeker, Nicollet, Norman, Otter Tail, Pennington, Polk, Pope, Red Lake, Redwood, Renville, Rice, Roseau, Sibley, Steele, Stevens, Swift, Traverse, Waseca, Watonwan, Wilkin, Yellow Medicine	Blizzard conditions with wind speeds up to 64 MPH. Scattered power outages were reported in Redwood, Brown and Watonwan counties after ice coated power lines were blown down by the high winds. Numerous automobile accidents were also reported region wide during the storm. Hundreds of vehicles were reported in the ditch.
2/11/2003	Blue Earth, Brown, Chippewa, Douglas, Faribault, Freeborn, Kandiyohi, Lac Qui Parle, Le Sueur, Martin, Mcleod, Nicollet, Pope, Redwood, Renville, Sibley, Steele, Stevens, Swift, Waseca, Watonwan, Yellow Medicine	A strong and fast moving cold front plowed out of the Canadian Prairies and into Minnesota, bringing a quick snow that totaled two to three inches. The powdery snow was whipped around by winds frequently gusting over 45 mph producing near-zero visibility. Whiteout conditions were prevalent throughout the open terrain of west central and south central Minnesota.
3/9/2002	Dodge, Fillmore, Houston, Mower, Olmsted, Wabasha, Winona	As a deep low pressure moved into the northern Great Lakes, it produced west winds of 30 to 40 mph, with gusts around 50 mph. Even though only an inch or less of new snow had fallen, the very strong winds produced whiteout conditions, with visibility 1/4 mile or less. The poor visibility combined with falling temperatures caused numerous accidents and 1 fatality and 6 injuries.
3/8/2000	Clay, Clearwater, Mahnomen, Norman, Polk	Blizzard conditions with no deaths reported.
12/19/1999	Kittson	Blizzard conditions with no deaths reported.
3/17/1999	Kittson, Marshall, West Polk	Blizzard conditions with no deaths reported.
2/12/1999	Kittson, Marshall, Norman, Pennington, Red Lake, Roseau, West Polk	Early morning blizzard conditions with peak winds reported to 52 miles per hour (mph). No deaths reported.
12/18/1998	Kittson, Marshall, Norman, West Polk	Blizzard conditions with no deaths reported.
11/10/1998	Northwest region	No deaths reported and no dollar estimates listed.
11/9/1998	Cottonwood, Jackson, Lincoln, Lyon, Murray, Nobles, Pipestone, Rock, Big	No deaths reported; $200,000 in property damage.

Table 16 Historic Winter Storms and Blizzards

DATE	LOCATION	REMARKS
	Stone and Traverse	
3/13/1998	Becker, Clay, Kittson, Mahnomen, Marshall, Norman, Pennington, Polk, Red Lake, Roseau, West Polk	No deaths reported, but $15,000 in property damage was reported.
4/5/1997	Clay, Kittson, Marshall, Norman, West Polk, Wilkin	Blizzard conditions. Three injuries reported. An estimated $25 million in damage, mainly loss of livestock.
4/5/1997	Big Stone, Traverse	Blizzard conditions, no deaths or injuries. North winds blew to 40-60 miles per hour (mph). Wind chills fell to 15 to 30 below. Substantial livestock losses. Damages estimated at $4 million.
3/5/1997	Clay, Kittson, Marshall, Norman, West Polk, Wilkin	Blizzard conditions, but no deaths associated with the storm.
1/22/1997	Western MN	A series of blizzards from mid-November through the end of January resulted in a Presidential Disaster Declaration (DR-1158-MN). Numerous roads, schools, and businesses were closed throughout the extended storm period. A number of deaths occurred in conjunction with these storms, including two resulting from persons leaving their car to walk in blizzard conditions.
Mar-96	West Central and Southwest MN	Blizzard conditions from mid-day on the 24th into the morning of the 25th. Regional school closings were prompted by this storm.
Dec-95	Western and Southern MN	The intensity of this storm prompted statewide closings of schools and many businesses on the 7th.
Dec-91	Southwestern MN	Several schools, businesses, and roads closed; power outages.
Oct-91	Statewide	“Halloween Monster Storm”. 28.4” snow at Twin Cities; 36.9” in Duluth.
Mar-89	Central and Southern MN	1 death. 600 traffic accidents in the Twin Cities metro area.
Jan-89	Northwestern MN	26” of snow at Fargo-Moorhead area; 50 mph winds at Red River Valley.
Nov-88	Southwestern MN	Blizzard stranded or forced thousands of travelers to seek shelter in local SW MN communities.
Mar-85	Statewide	1 death in Renville County; 1 death in Douglas County.
Jan-85	Western and Southern MN	1 death.
Feb-84	Southwestern MN	16 deaths. 1” to 2” snow; 80 mph wind.

Table 16 Historic Winter Storms and Blizzards		
DATE	LOCATION	REMARKS
Nov-83	Southern and Eastern MN	8 deaths. Up to 18" of snow; high winds.
Apr-83	Southeastern MN	17" of snow.
Feb-83	Statewide	12" of snow.
Dec-82	Southern and East Central MN	1 death in Lakeville (Dakota County).
Nov-82	Southwestern and Central MN	1 death in Willmar (Kandiyohi County).
Jan-82	Anoka County	1 death.
Jan-82	Hubbard County	1 death.
Mar-79	Southern MN	3 deaths.
Mar-75	St. Louis County	12" of snow; 100 mph wind; 20' waves at Duluth.
Jan-75	Statewide	"Storm of the Century". 14 deaths. 1-2' of snow; winds up to 80 mph.
Jan-72	Southwestern MN	4"-10" of snow; winds up to 72 mph at Worthington.
Dec-68	Statewide	6 blizzards during 12/68 - 1/69 resulted in serious negative impacts on wildlife due to deep snow.
Jan-67	Statewide	7 deaths.
Mar-66	Northern MN	4-day storm. 23" of snow in Aitkin, 37" in Int'l Falls.
Mar-41	Statewide	32 deaths. High winds up to 75 mph in Duluth.
Nov-40	Statewide	"Armistice Day Blizzard". 49 deaths.

Ice and Ice Storms

The following ice and sleet storms are recorded for the period January 1993 through February 2010, as provided in the table below.

Table 17 Notable Ice and Sleet Storms in Minnesota		
DATE	LOCATION	REMARKS
1/22/2010	Crow Wing, Cass, Southern Aitkin	A complex storm brought a variety of heavy winter precipitation to northeast Minnesota. The storm began as rain and freezing rain, gradually changed over to snow on the evening of the 23rd, and then waffled back between rain, freezing rain, and snow the following day. The wintry mix changed back over to all snow that evening, and it continued to snow all night until finally ending during the day of the 25th. The Brainerd Lakes region received a quarter to as much as three quarters of an inch of icing,

Table 17 Notable Ice and Sleet Storms in Minnesota		
DATE	LOCATION	REMARKS
		though no major problems other than icy roads occurred. Snow amounts ranged from 7 to 12 inches, generally east of a line from International Falls to Duluth to eastern Pine County. The Gunflint Trail and areas just inland from Duluth received as much as 19 inches of snow. Near the Lake Superior shoreline, the precipitation mainly fell as rain.
3/23/2009	Lake, Cook	Warm air surged north ahead of a strong low pressure system, while cold air over Lake Superior was pushed onshore by strong easterly winds. Heavy rain froze on contact and created severe icing conditions along the north shore of Lake Superior from Two Harbors to Grand Marais. Ice accumulated as far west as the Duluth area. The worst of the storm hit Lake and far southeast Cook counties, including the towns of Finland, Silver Bay, Isabella and Lutsen. Ice accumulated to an inch or more in these areas on the 23rd. Tens of thousands of trees were downed by the ice. In some forested areas just inland from Lake Superior, 75 percent or more of the trees were damaged. Lingering temperatures at or below freezing sustained the ice for several days afterward. The Red Cross set up shelters, as many people were without power for several days, and some for up to a week. The ice storm was so damaging that FEMA declared Lake County a federal disaster area, making it eligible for federal aid.
2/8-9/2009	Clay, Kittson, Norman, West Marshall, West Polk, East Marshall, East Polk, Hubbard, Mahnomen, North Beltrami, North Clearwater, Pennington, Red Lake, Roseau, South Beltrami, South Clearwater, West Becker	A Colorado Low tracked from northeast Colorado on the morning of the 9th into west central Minnesota on the morning of the 10th. This system pushed unseasonably warm and moist air into the northern plains, with surface dew point temperatures on the 9th rising into the 30s. As rain fell on the colder ground, surfaces quickly became ice covered. Roughly 0.10 to 0.40 inches of ice was reported, making the morning commute on the 9th extremely treacherous. Hundreds of vehicle accidents were reported from the slick roads. Hospitals also reported many bumps and bruises from people slipping and falling. Many schools were closed on Monday (9th), and then began late on Tuesday. Most areas did not receive their regular mail delivery on Monday.

Table 17 Notable Ice and Sleet Storms in Minnesota		
DATE	LOCATION	REMARKS
12/30/2006	Big Stone, Traverse	None Reported.
11/28/2006	Koochiching, Beltrami, Lake Of The Woods, Marshall, Roseau	A quarter inch of ice was reported in Big Falls and Little Fork. Many vehicle accidents were reported in these areas.
11/27/2005	Big Stone, Traverse	Widespread freezing rain with ice accumulations between 1 and 2 inches. The high winds and heavy ice accumulations caused widespread power outages for some locations for over 10 days. Shelters were set up for those who did not have generator power or another place to go. This was one of the worst ice storms in history.
01/01/2005	Dodge, Fillmore, Houston, Mower, Olmsted, Wabasha, Winona	Freezing rain spread across southeast Minnesota with widespread ice accumulations of 1/4 to 1/2 inch. Numerous accidents were reported by law enforcement officials, but there were no serious injuries
12/30/2004	St. Louis, Koochiching, Aitkin, Cass, Cook, Lake, Itasca, St. Louis, Carlton, Clay, Otter Tail, Grant, Wadena, Wilkin	Freezing rain caused ice up to one-half inch thick to accumulate on roads, sidewalks, trees and power lines. There were many reports of tree damage and sporadic power outages.
11/22/2003	Olmsted, Wabasha	Freezing rain affected much of southeast Minnesota, with ice accumulations up to 1/2 inch thick. Law enforcement officials reported numerous automobile accidents due to icy roads, while there were a few power outages.
11/03/2003	Cottonwood, Jackson, Lincoln, Lyon, Murray, Nobles, Pipestone, Rock	Snowfall of 2 to 4 inches was accompanied by freezing rain and freezing drizzle. Travel was greatly affected by slippery roads, with numerous accidents being reported.
04/16/2003	Aitkin, Cass, Crow Wing, Pine, St. Louis / Carlton	A mixture of sleet and freezing rain fell, causing an icy glaze up to 1/2” to accumulate on roads, trees, and power lines. In addition to the precipitation, the head of the lakes area had very strong winds sustained at 35 to 50 mph. The Aerial Lift Bridge in Duluth reported gusts up to 66 mph. The peak wind at the Duluth Airport was 56 mph. The strong winds closed the port entry of Duluth as the strong east winds packed ice into the ship canal. Numerous trees and power lines were blown down.
12/17/2002	Aitkin, Cass, Cook, Lake, Crow Wing, Itasca, Koochiching, St. Louis, Carlton	Freezing rain, at times mixed with sleet and snow, began late at night and continued through most of the day. One-quarter to one-half inch of ice collected on roads and

Table 17 Notable Ice and Sleet Storms in Minnesota		
DATE	LOCATION	REMARKS
		sidewalks
4/22/2001	Southern Lake, Southern St. Louis / Carlton	An intense low pressure system moved northeast through the western Great Lakes area producing heavy precipitation. Because of the cold temperatures, much of the precipitation fell as freezing rain on the higher elevations away from Lake Superior. Almost an inch of ice coated trees, power lines, and roadways. Tree damage was widespread, downed power lines caused power outages that lasted as long as three days and affected approximately 22,000 homes and businesses. Countless homes and vehicles sustained damage from trees and branches that collapsed under the weight of the ice.
2/24/2001	Dodge, Fillmore, Houston, Mower, Olmsted, Wabasha, Winona	Southeast Minnesota was affected by another in a series of ice storms, which coated much of the area with 1/4 inch of ice. Law enforcement officials reported icy roads contributing to several accidents, none of which were serious.
01/29/2001	Dodge, Fillmore, Houston, Mower, Olmsted, Wabasha, Winona Crow Wing, Northern Aitkin, Pine, Southern Aitkin, Southern Cass, Southern Lake, Southern St. Louis / Carlton	Freezing rain produced ice accumulations of 1/4 to 1/2 inch, prompting schools and several businesses to close.
04/16/2000	Southwest Minnesota	Ice Storm - Freezing rain caused significant ice accumulation on trees, power lines, and other exposed surfaces.
03/08/2000	Northwest and West Central Minnesota	Ice Storm - A thin band of freezing precipitation fell.
04/03-4/1999	Northwest Minnesota	Ice Storm – Significant accumulations of ice brought down power lines and trees, causing hundreds of people to live without power for several days.
04/03-4/1999	Northeast Minnesota	Ice Storm - Ice accumulations up to ¼ of an inch, with a mixture of sleet, snow, and slush on the ground, made travel very hazardous. The weight of ice accumulations brought down trees and power lines and caused extensive damage to an 800-foot television tower.
04/01-2/1999	Northeast Minnesota	Ice Storm - Ice accumulations of ¼ to ½ inch occurred, which caused slippery roads and airport runways as well as widespread electrical outages.

Table 17 Notable Ice and Sleet Storms in Minnesota		
DATE	LOCATION	REMARKS
02/01/1999	Northeast Minnesota	Ice Storm - Freezing rain and freezing drizzle coated the area with as much as ¼ inch of ice.
01/04-5/1998	South Central and Southeast Minnesota	Ice Storm - Freezing rain produced ice accumulations ranging from ¼ to ¾ of an inch. Numerous car accidents were reported, one of which resulted in a fatality.
01/04/1998	Southeast Minnesota	Ice Storm – Widespread ice accumulations of ¼ to ¾ of an inch caused several accidents. One injury was reported.
04/04-6/1997	Northwest Minnesota	Ice Storm – ½ to one inch of ice built up on exposed surfaces. Hundreds of power poles/ lines snapped, which cut power. Estimated damages were $18 million.
03/13/1997	Southwest Minnesota	Ice Storm - Freezing rain caused ice accumulations, which disrupted travel and caused numerous accidents.
01/30/1997	Northwest Minnesota	Ice Storm – ½ inch of freezing rain fell.
01/03-4/1997	Southwest Minnesota	Ice Storm - Freezing rain caused ice accumulation on trees, power lines, and roads.
01/01-2/1997	Northeast Minnesota	Ice Storm - Freezing rain left up to a ¼-inch of ice on area roads. Part of State Highway 61 was closed for several hours.
11/14-18/1996	Southwest Minnesota	Ice Storm - An ice storm with freezing rain caused widespread damage to power lines, poles, and trees. Thousands lost power. Many small farm structures were damaged. A 600-foot radio tower was toppled. Estimated property damages were $13 million.
11/14-15/1996	Southern Minnesota	Ice Storm - ½-inch thick ice was common over the area.
02/22-23/1996	Northwest Minnesota	Ice Storm - Freezing rain forced law enforcement officials to advise no travel.
01/17-18/1996	Southwest Minnesota	Ice Storm - Freezing rain caused severe icing, which resulted in damage to power lines. Damage from a building fire near Mountain Lake was aggravated by the inability of firefighters to respond quickly due to the icy roads. Estimated damages were $350,000.
01/17-18/1996	East Central and Southern Minnesota	Ice Storm - An extended period of rain and freezing rain resulted in significant icing conditions. Up to one-foot thick ice formed on roads. There were significant tree damage and power outages. More than 180,000

Table 17 Notable Ice and Sleet Storms in Minnesota

DATE	LOCATION	REMARKS
		Minneapolis/St. Paul metro residents and the entire town of Lafayette were without power.
01/17-18/1996	Southwest Minnesota	Ice Storm - Freezing rain caused severe icing, which resulted in damage to power lines. Damage from a building fire near Mountain Lake was aggravated by the inability of firefighters to respond quickly due to the icy roads. Estimated damages were $350,000.
01/10/1996	Western Minnesota	Ice Storm -Widespread freezing rain created a thin layer of ice.
12/13/1995	Southern Minnesota	Glaze - Between ¼ and ½ inch of glaze occurred forcing some school closures.
04/11-12/1995	West Central and Southwest Minnesota	Heavy Snow and Ice – A combination of heavy snow and ice resulted in treacherous weather conditions. Widespread power outages prompted the Governor to declare a state of emergency.
04/10-11/1995	Southwest Minnesota	Freezing Rain - Freezing rain and freezing drizzle fell over a three-day period. Thousands of people were without power, some for two days or more. Estimated damages were $200,000.
11/27-28/1994	Southwest, Central, Northeast, and Southeast Minnesota.	Heavy Snow and Ice - The snow closed the Minneapolis-St. Paul International Airport. The storm contributed to at least three fatalities. A buildup of ice and snow, combined with strong winds, resulted in numerous downed power lines.
04/28-29/1994	Entire State	Heavy Snow and Ice - Heavy, wet snow, sleet, and freezing rain occurred.
03/23-24/1994	Northern and Central Minnesota	Heavy Snow And Ice - A late March snowstorm deposited a band of heavy snow, up to 10 inches, as well as a mixture of freezing rain, sleet, and snow, causing extremely slippery road conditions.
11/12-13/1993	All but Southeast Minnesota	Ice Storm and Snow - A wintry mixture of precipitation in the form of freezing rain, sleet, and snow with significant accumulation of ice. Five inches of snow fell on top of the ice making travel hazardous.
01/20/1993	Northern Minnesota	Ice Storm - Freezing rain developed with at least half of an inch of ice coating area roads.

Probability of Occurrence

As shown in the section above, Minnesota experiences a variety of severe winter weather events annually. Although it is impossible to predict probabilities for this type of event over short periods of time, it is anticipated that the long term trend will remain relatively stable, meaning that the State can probably expect one ice and ice/snow storms every year on average and one major blizzard per year.

Sources of Information

2010 Snowfall Events http://www.crh.noaa.gov/mpx/?n=2010snowfall

Federal Emergency Management Agency. 1997. Multi-Hazard Identification and Risk Assessment – A Cornerstone of the National Mitigation Strategy. www.fema.gov/fhm/dl_mhira.shtm

National Oceanographic & Atmospheric Administration - NCDC. Storm Events. www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

Minnesota Climatology Working Group -

climate.umn.edu/snow_fence/Components/SFF/MeanSF/aveannual1971-2000.htm#

climate.umn.edu/doc/historical/winter_storms.htm

National Weather Service www.nws.noaa.gov/om/windchill/index.shtml

Landslide

Landslides are the downward and outward movement of slopes. The term refers to various kinds of events, including mudflows, mudslides, debris flows, rock falls, rockslides, debris avalanches, debris slides, and earth flows. Landslides may include any combination of natural rock, soil, or artificial fill, and are classified by the type of movement and the type of material. The types of movement are slides, flows, lateral spreads, and falls and topples (FEMA, 1997).

Below is a brief discussion of the various types of landslide movements. A combination of two or more landslide movements is referred to as a complex movement.

- **Slides** are downward displacements along one or more failure surfaces of soil or rock. The material may be a single intact mass or a number of pieces. The sliding may be rotational (turning about a point) or translational (movement roughly parallel to the failure surface).
- **Flows** are a form of rapid mass movement by loose soils, rocks, and organic matter, together with air and water that form slurry flowing rapidly downhill. Flows are distinguished from slides by high water content and velocities that resemble those of viscous liquids.
- **Lateral spreads** are large movements of rock, fine-grained soils (i.e., quick clays), or granular soils, distributed laterally. Liquefaction may occur in loose, granular soils, and can occur spontaneously due to changes in pore-water pressure or due to earthquake vibrations.
- **Falls** and **topples** are masses of rocks or material that detach from a steep slope or cliff that free-fall, roll, or bounce. Movements typically are rapid to extremely rapid. Earthquakes commonly trigger rock falls.

Almost any steep or rugged terrain is susceptible to landslides under the right conditions. The most hazardous areas are steep slopes on ridges, hill, and mountains; incised stream channels; and slopes excavated for buildings and roads. Slide potentials are enhanced where slopes are destabilized by construction or river erosion. Road cuts and other altered or excavated areas are particularly susceptible to landslides and debris flows. Rainfall and seismic shaking by earthquakes or blasting can trigger landslides.

Debris flows (also referred to as mudslides) generally occur during intense rainfall on water saturated soil. They usually start on steep hillsides as soil slumps or slides that liquefy and accelerate to speeds as great as 35 miles per hour. Multiple debris flows may merge, gain volume, and travel long distances from their source, making areas down slope particularly hazardous. Surface runoff channels along roadways and below culverts are common sites of debris flows and other landslides (USGS, 2000).

Landslides often occur together with other major natural disasters, such as the following, thereby exacerbating relief and reconstruction efforts:

- Floods and landslides are closely related and both involve precipitation, runoff, and ground saturation that may be the result of severe thunderstorms or tropical storms.

- Earthquakes may cause landslides ranging from rock falls and topples, to massive slides and flows.
- Landslides into a reservoir may indirectly compromise dam safety or a landslide may even affect the dam itself.
- Wildfires may remove vegetation from hillsides, significantly increasing runoff and landslide potential.

Landslide History in Minnesota

The slumping along the Red River and its tributaries in northwestern Minnesota, such as the 2003 incident at Crookston, is—according a report from the Minnesota Geological Survey—"a naturally reoccurring process related to river erosion and the presence of slump-prone clay deposits (11). These conditions are present throughout the Red River Valley from Lake Winnipeg to south of Fargo." The text quoted below comes from "Riverbank Collapse in Northwestern Minnesota: An Overview of Vulnerable Earth Materials," by the University of Minnesota, Minnesota Geological Survey, which can be accessed at

www.geo.umn.edu/mgs/crookston_slump/Slump.pdf

Photo by: Ken Harris, MGS.

Source: http://www.mngs.umn.edu/regionglg.html

FIGURE 34 SEDIMENT SLUMPING IN THE RED RIVER VALLEY

Bank-failure problems are caused by gravity acting on earth materials resting on a slope. In the case of failure, gravitational forces exceed the forces holding the sediment together. Failures can take several forms depending on sediment type, sediment layering, and moisture content. Red River Valley bank failures are typically the result of slumping in which a block of earth moves downward along a curved failure plane, commonly with a backward rotation of the slump block. The fundamental reason why deposits in this area rupture and sag is because they consist of clay rather than sand, silt, or gravel.

Clays are present in northwestern Minnesota because the Red River Valley is the floor of ancient glacial Lake Agassiz, a large lake that formed at the edge of a retreating ice-age glacier (Clayton and Moran, 1982; Fenton and others, 1983). Both glacial and lake sediments were deposited and these clays are exposed along the rivers of the Red River Valley. Riverbanks particularly vulnerable to slumping are those that consist of an upper, relatively competent layer of sediment called the Sherack Formation resting on more easily deformable clays of the Huot and Brenna Formations.

Some of the most recent landslides occurred with the flooding in August 2007 in southeastern Minnesota, where soils were saturated from the prolonged and heavy rains.

Probability of Occurrence

Landslide probability is highly site-specific, and cannot be accurately characterized on a statewide basis, except in the most general sense. The qualitative probability is rated Medium for the state, although the rating is intended only for general comparison to other hazards that are being considered in this stage of the planning process. Conditions that allow slumping will remain in the Red River Valley. Severity of damage, however, can be lessened if more detailed geological maps are created and restrictions on development in hazard-prone areas are observed.

Sources of Information

Federal Emergency Management Agency (FEMA). 1997. Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy.

Harris, K.L. 2003. “Riverbank Collapse in Northwest Minnesota, an Overview of Vulnerable Earth Materials.” University of Minnesota, Minnesota Geological Survey, www.geo.umn.edu/mgs/crookston_slump/Slump.pdf

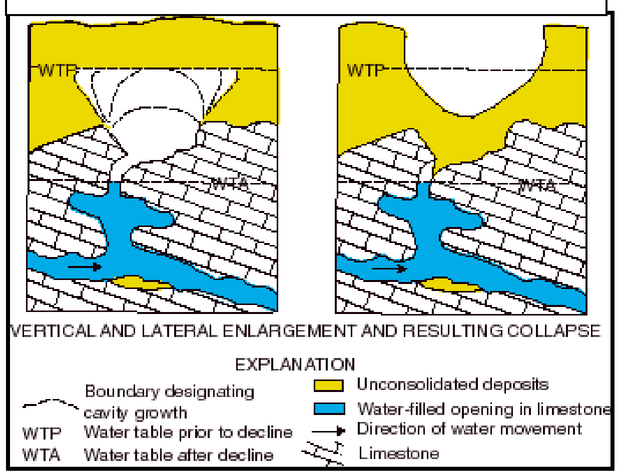
Sinkholes & Land Subsidence

There are three types of potential problems associated with the existence or formation of sinkholes: subsidence, flooding, and pollution. The term subsidence commonly involves a gradual sinking, but it also refers to an instantaneous or catastrophic collapse. In Minnesota, limestone and dolostone underlie the southeastern corner of the state which includes the Minneapolis-St. Paul Metropolitan Area. Similar rocks are also found deep beneath the surface in northwestern Minnesota. In southeastern Minnesota, carbonate rocks from the Cedar Valley Group down through the bottom of the Prairie du Chien Group, contain caves and other karst features. Because most of Minnesota is buried beneath a thick cover of glacial sediments, the karst landscape may not be apparent. In parts of southeastern Minnesota, erosion has removed most of this glacial cover and exposed the carbonate bedrock. Counties known for karst features include parts of Dakota, Rice, Dodge, and Mower, and most of Goodhue, Olmstead, Winona, Wabasha, Houston, and Fillmore. Fillmore County has more caves, sinkholes, and disappearing streams than all other Minnesota counties combined.

The change in the local environment affecting the soil mass causing subsidence and sinkholes collapse is called “triggering mechanism”. Water is the main factor affecting the local environment that causes subsidence. The main triggering mechanisms for subsidence are:

- Water level decline
- Changes in groundwater flow,
- Increased loading, and
- Deterioration (abandoned coalmines)

FIGURE 35 WATER LEVEL DECLINE



Water level decline can happen naturally or be human induced. Main factors in water decline are:

- Pumping of water from wells,
- Localized drainage from construction,
- Dewatering, and
- Drought

Source: Highway Department

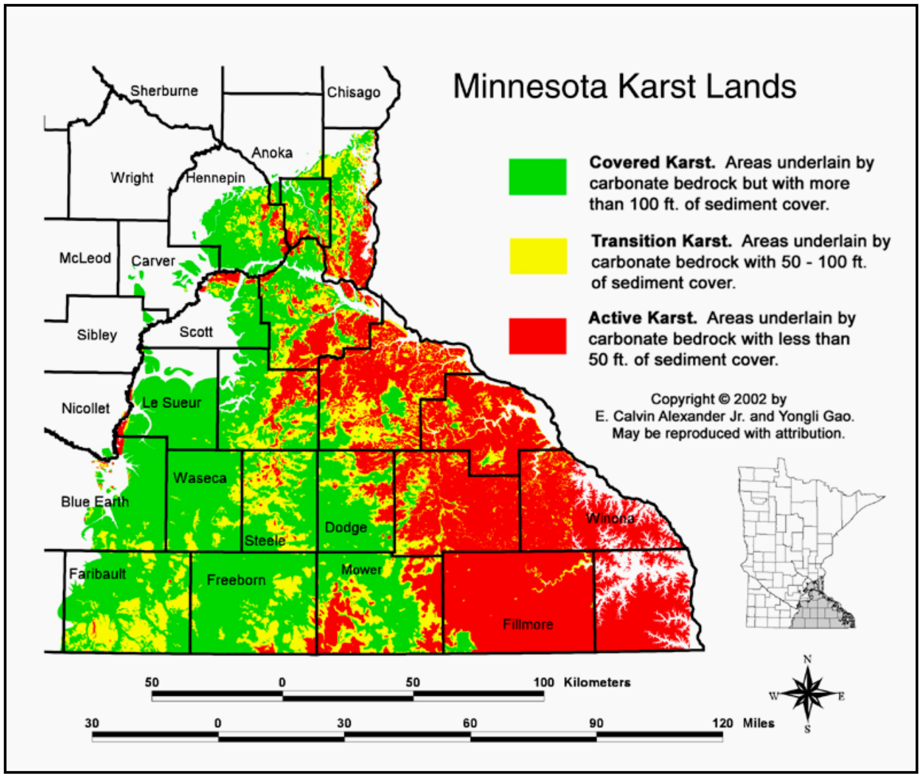
Changes in the groundwater flow include an increase in the velocity of groundwater movement, increase in the frequency of water table fluctuations, and increased or reduced recharge.

Increased loading causes pressure in the soil leading to failure of underground cavities and spaces. Vibrations caused by an earthquake, vibrating machinery and blasting, can cause structural collapse followed by surface settlement.

Sinkholes and subsidence are also common in those areas of the state underlain by old abandoned coal and iron mines. Pillows left for roof support in the mines generally deteriorate over time and eventually collapse, removing roof support. This is particularly a problem where mines underlie more recently developed residential areas and roads.

In Minnesota, the primary natural causes of land subsidence are karst landforms. Karst landforms develop on or in limestone, dolomite, or gypsum by dissolution and are characterized by the presence of features such as sinkholes, underground (or internal) drainage through solution-enlarged fractures (joints), and caves. Karst landforms can be hazardous because of the sinkholes that form there and for the ease with which pollutants can infiltrate into the water supply. Figure 14 illustrates the Karst areas in Minnesota.

FIGURE 36 MINNESOTA KARST



Source: University of Minnesota, Minnesota Geological Survey

Sinkhole and Land Subsidence History in Minnesota

In northeastern Minnesota, sinkholes developed close to the town of Askov's sewage treatment ponds. The sinkholes were discovered when the Minnesota Pollution Control Agency began the review process for upgrading the forty-year old sewage treatment ponds.

Probability of Occurrence

Sinkhole probability is highly site-specific, and cannot be accurately characterized on a statewide basis, except in the most general sense. The qualitative probability is rated

Medium for the state, although the rating is intended only for general comparison to other hazards that are being considered in this stage of the planning process.

Sources of Information

Minnesota Geological Survey, University of Minnesota
www.winona.edu/geology/MRW/MNglance/Mn_Karst.pdf

University of Minnesota, Minnesota Geological Survey.
www.geo.umn.edu/mgs/indx.html#toppg

Minnesota Pollution Control Agency, Karst in Minnesota
www.pca.state.mn.us/index.php/water/water-types-and-programs/groundwater/about-groundwater/karst-in-minnesota.html?menuid=&missing=0&redirect=1

Earthquake

An earthquake is "…a sudden motion or trembling caused by an abrupt release of accumulated strain in the tectonic plates that comprise the earth's crust." These rigid plates, known as tectonic plates, are some 50 to 60 miles in thickness and move slowly and continuously over the earth's interior. The plates meet along their edges, where they move away, past or under each other at rates varying from less than a fraction of an inch up to five inches per year. While this sounds small, at a rate of two inches per year, a distance of 30 miles would be covered in approximately one million years (FEMA, 1997).

The tectonic plates continually bump, slide, catch, and hold as they move past each other which causes stress to accumulate along faults. When this stress exceeds the elastic limit of the rock, an earthquake occurs, immediately causing sudden ground motion and seismic activity. Secondary hazards may also occur, such as surface faulting, sinkholes, and landslides. While the majority of earthquakes occur near the edges of the tectonic plates, earthquakes may also occur at the interior of plates.

The vibration or shaking of the ground during an earthquake is described by ground motion. The severity of ground motion generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. Ground motion causes waves in the earth's interior, also known as seismic waves, and along the earth's surface, known as surface waves. The following are the two kinds of seismic waves:

- **P (primary) waves** are longitudinal or compressional waves similar in character to sound waves that cause back-and-forth oscillation along the direction of travel (vertical motion), with particle motion in the same direction as wave travel. They move through the earth at approximately 15,000 mph.
- **S (secondary)** waves, also known as shear waves, are slower than P waves and cause structures to vibrate from side-to-side (horizontal motion) due to particle motion at right-angles to the direction of wave travel. Unreinforced buildings are more easily damaged by S waves.

There are also two kinds of surface waves, Raleigh waves and Love waves. These waves travel more slowly and typically are significantly less damaging than seismic waves.

Seismic activity is commonly described in terms of magnitude and intensity. Magnitude (M) describes the total energy released and intensity (I) subjectively describes the effects at a particular location. Although an earthquake has only one magnitude, its intensity varies by location. Magnitude is the measure of the amplitude of the seismic wave and is expressed by the Richter scale. The Richter scale is a logarithmic measurement, where an increase in the scale by one whole number represents a tenfold increase in measured amplitude of the earthquake. Intensity is a measure of the strength of the shock at a particular location and is expressed by the Modified Mercalli Intensity (MMI) scale.

Another way of expressing an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. If an object is dropped while standing on the surface of the earth (ignoring wind resistance), it will fall towards earth and accelerate faster and faster until reaching terminal velocity. The acceleration due to gravity is often called "g" and is equal to 9.8 meters per second squared (980 cm/sec/sec). This means that every second something falls towards earth, its velocity increases by 9.8 meters per second. Peak Ground Acceleration (PGA) measures the rate of change of motion relative to the rate of acceleration due to gravity. For example, acceleration of the ground surface of 244 cm/sec/sec equals a PGA of 25.0 percent.

It is possible to approximate the relationship between PGA, the Richter scale, and the MMI, as shown in Table 16. The relationships are, at best, approximate, and also depend upon such specifics as the distance from the epicenter and depth of the epicenter. An earthquake with 10.0 percent PGA would roughly correspond to an MMI intensity of V or VI, described as being felt by everyone, overturning unstable objects, or moving heavy furniture.

Table 18 Earthquake PGA, Magnitude and Intensity Comparison

PGA (%G)	MAGNITUDE (RICHTER)	INTENSITY (MMI)	**DESCRIPTION (MMI)**
<0.17	1.0 - 3.0	I	I. Not felt except by a very few under especially favorable conditions.
0.17 - 1.4	3.0 - 3.9	II – III	II. Felt only by a few persons at rest, especially on upper floors of buildings. III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
1.4 - 9.2	4.0 - 4.9	IV – V	IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rock noticeably. V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
9.2 - 34	5.0 - 5.9	VI – VII	VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable

Table 18 Earthquake PGA, Magnitude and Intensity Comparison

PGA (%G)	MAGNITUDE (RICHTER)	INTENSITY (MMI)	**DESCRIPTION (MMI)**
			damage in poorly built or badly designed structures; some chimneys broken.
34 - 124	6.0 - 6.9	VII – IX	VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
>124	7.0 and higher	VIII or higher	X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent. XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly. XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Source: Wald, Quitoriano, Heaton, and Kanamori, 1999.

Earthquake-related ground failure, due to liquefaction, is a common potential hazard from strong earthquakes in the central and eastern United States. Liquefaction occurs when seismic waves pass through saturated granular soil, distorting its granular structure, and causing some of the empty spaces between granules to collapse. Pore-water pressure may also increase sufficiently to cause the soil to behave like a fluid (rather than a soil) for a brief period and causing deformations. Liquefaction causes lateral spreads (horizontal movement commonly 10-15 feet, but up to 100 feet), flow failures (massive flows of soil, typically hundreds of feet, but up to 12 miles), and loss of bearing strength (soil deformations causing structures to settle or tip). Sands blows were common following major New Madrid earthquakes in the central United States.

Earthquake History in Minnesota

Minnesota has one of the lowest occurrence levels of earthquakes in the United States, but a total of 19 small to moderate earthquakes have been documented since 1860. Minnesota earthquakes, like those elsewhere in the Midwest, are attributed to minor reactivation of ancient faults in response to modern stresses. Although the two earliest earthquakes may have had magnitudes of 4.7 to 5.0, the 1917 Staples and 1975 Morris earthquakes with magnitudes of 4.3 and 4.6 to 4.8, respectively, are the largest that are well documented. The following table shows the history of earthquakes in Minnesota. The strongest earthquake in recent record is a 4.7-magnitude quake that occurred near Morris, Minnesota in 1975.

Table 19 Earthquake History of Minnesota			
Epicenter (nearest town)	Month-Day-Year	Maximum Intensity	Magnitude
Rosholt	10-20-1995	N/¨	3.7
Granite Falls	02-09-1994	V	3.1
Dumont	06-04-1993	V-VI	4.1
Walker	09-27-1982	II	2.0
Cottage Grove	04-24-1981	III-IV	3.6
Nisswa	07-26-1979	III	1.0
Rush City	05-14-1979	N/¨	0.1
Evergreen	04-16-1979	N/¨	3.1
Milaca	03-05-1979	N/¨	1.0
Morris	07-09-1975	VI	4.7
Pipestone	09-28-1964	N/¨	3.4
Alexandria	02-15-1950	V	3.6
Detroit Lakes	01-28-1939	IV	3.9
Bowstring	12-23-1928	IV	3.8
Staples	09-03-1917	VI-VII	4.3
Red Lake	02-06-1917	V	3.8
New Ulm	02-12-1881	VI	3.0-4.0
St. Vincent	12-28-1880	II-IV	3.6
New Prague	12-16-1860	VI	4.7
Long Prairie	(Date unknown) 1860-61	VI-VII	5.0

Source: USGS

On November 15, 1877, two earthquakes 45 minutes apart occurred in eastern Nebraska. The shocks caused damage at North Platte and Columbus, Nebraska and at Sioux City, Iowa. The felt zone encompassed an elliptical area roughly 600 by 300 miles, including the southwestern part of Minnesota.

A strong earthquake centered in Illinois occurred on May 26, 1909, affecting an area of approximately 500,000 square miles, including parts of Minnesota. Intensity VII effects were noted over a considerable area from Bloomington, Illinois to Platteville, Wisconsin. Many chimneys fell at Aurora, Illinois. Although details are lacking, this shock was probably felt at intensity IV or V in southeastern Minnesota.

On September 3, 1917, the shock was felt at Brainerd, about 30 miles east of Staples. Several tremors located outside of Minnesota have been felt within the State's borders.

A strong earthquake on February 28, 1925, centered in the St. Lawrence River region near La Malbaie, Quebec, Canada, was felt widely in the Northeastern United States. The shock was lightly felt at Minneapolis.

Ten years later, on November 1, 1935, another strong earthquake occurred near Timiskaming, Canada and was felt over an area of the United States estimated at one million square miles. This tremor was also lightly felt at Minneapolis.

Although less dramatic than the Staples or Morris events, the 1993 Dumont earthquake and the 1994 Granite Falls earthquake are more typical of those that occur in Minnesota. The magnitude 4.1 Dumont earthquake was felt over 69,600 square kilometers (about 27,000 square miles), and was associated with intensity V-VI near the epicenter. The shaking near the epicenter was accompanied by a loud, explosive noise that alarmed many people, but no injuries or serious damage occurred. In contrast to the Dumont event, the much weaker Granite Falls earthquake (magnitude 3.1) was felt over only about 11,600 square kilometers (about 4,400 square miles), and although intensity V may have occurred locally near the epicenter, most reported intensities were III to IV.

Probability of Occurrence

Probabilistic ground motion maps are typically used to assess the magnitude and frequency of seismic events. These maps measure the probability of exceeding a certain ground motion, expressed as peak ground acceleration (PGA), over a specified period of years. The magnitudes of earthquakes are generally measured using the Richter scale. The severity of earthquakes is site specific, and is influenced by proximity to the earthquake epicenter and soil type, among other factors.

According to the Minnesota Geological Survey (MGS), Minnesota has one of the lowest occurrence levels of earthquakes in the United States; only 19 small to moderate earthquakes have been documented since 1860. MGS further notes that although weak to moderate earthquakes do occur occasionally in Minnesota, a severe earthquake is very unlikely. Average recurrence rates for Minnesota earthquakes have been estimated by MGS (Mooney, 1979) as follows:

Magnitude 4.0 - 10 years

Magnitude 4.5 - 30 years

Magnitude 5.0 - 89 years

Magnitude 5.5 - 266 years

The absence of major earthquakes, together with the infrequency of earthquakes in general, implies a low risk level for Minnesota. (This statement, however, must be tempered in light of the brief span of historical record.) An earthquake history for the state has significant implications for public policy.

For example, the location and design of nuclear power plants must be guided by an assessment of the probability for a damaging earthquake. Minnesota has two nuclear plants in operation, at Prairie Island (near Red Wing) and at Monticello. The Monticello plant lies within the probable felt areas of three Minnesota earthquakes. The Prairie Island plant probably lies within the felt area of one Minnesota earthquake, as well as within the felt areas of several earthquakes with epicenters outside of Minnesota.

Building construction codes present another aspect of public policy dependent upon earthquake history. Certain standards of construction must be met depending upon earthquake zoning classification. The Uniform Building Code of the International Conference of Building Officials assigns every location in the United States to a four-grade Seismic Risk Zone (0 = least risk; 3 = greatest risk); Minnesota rates in Seismic Risk Zone 0. Map 7 shows peak acceleration with 2% probability of exceedance in 50 years.

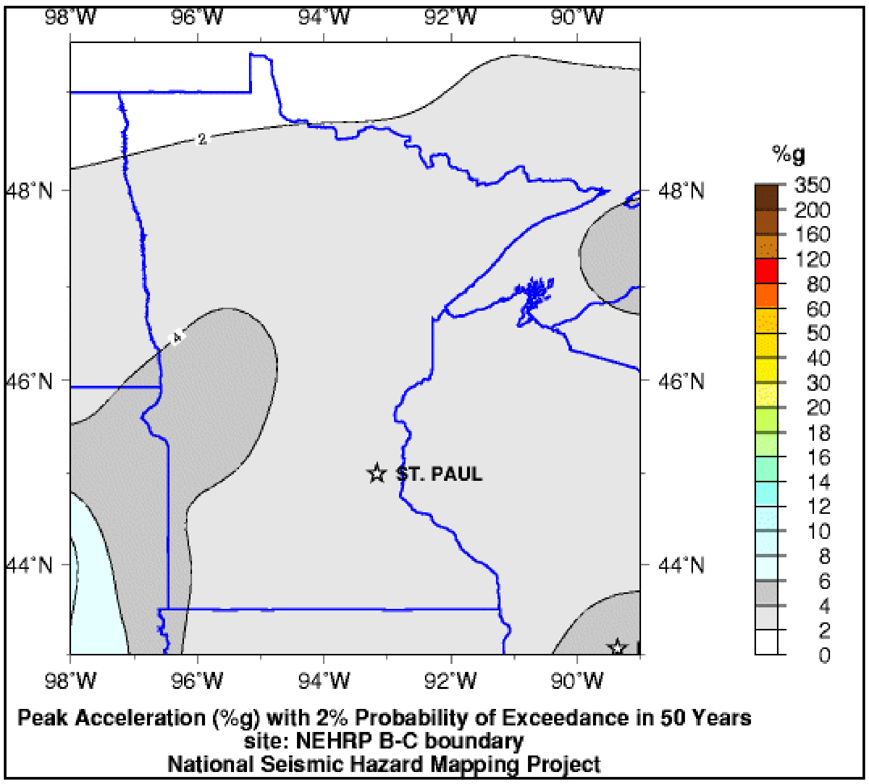


FIGURE 37 PEAK ACCELERATION IN MINNESOTA

Current data and knowledge indicates that, although weak to moderate earthquakes do occur occasionally in Minnesota, a severe earthquake is very unlikely. Although a zero probability of a damaging earthquake occurring in the time span of a human life cannot be assigned, the threat is very small compared to other natural hazards such as flooding and tornadoes.

Sources of Information

University of Memphis Center for Earthquake Information. www.ceri.memphis.edu/index.shtml

USGS. Earthquake Hazards Program: Earthquake History of Minnesota. neic.usgs.gov/neis/states/minnesota/minnesota_history.html

V.W. Chandler. 1994. Minnesota at a Glance: Earthquakes in Minnesota. University of Minnesota. www.winona.msus.edu/geology/MRW/MNglance/Mn_Earthquake.pdf

Drought

Drought is a normal part of virtually every climate on the planet, including areas of both high and low normal rainfall. Drought is the result of a natural decline in the expected precipitation over an extended period of time, typically one or more seasons in length. The severity of drought can be aggravated by other climatic factors, such as prolonged high winds and low relative humidity (FEMA, 1997). Drought is a complex natural hazard which is reflected in the following four definitions commonly used to describe it:

- **Meteorological drought** is defined solely on the degree of dryness, expressed as a departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
- **Hydrological drought** is related to the effects of precipitation shortfalls on streamflows and reservoir, lake, and groundwater levels.
- **Agricultural drought** is defined principally in terms of soil moisture deficiencies relative to water demands of plant life, usually crops.
- **Socioeconomic drought** associates the supply and demand of economic goods or services with elements of meteorological, hydrologic, and agricultural drought. Socioeconomic drought occurs when the demand for water exceeds the supply as a result of weather-related supply shortfall. They may also be called a water management drought.

A drought's severity depends on numerous factors, including duration, intensity, and geographic extent as well as regional water supply demands by humans and vegetation. Due to its multi-dimensional nature, drought is difficult to define in exact terms and also poses difficulties in terms of comprehensive risk assessments.

Drought differs from other natural hazards in three ways. First, the onset and end of a drought are difficult to determine due to the slow accumulation and lingering of effects of an event after its apparent end. Second, the lack of an exact and universally accepted definition adds to the confusion of its existence and severity. Third, in contrast with other natural hazards, the impact of drought is less obvious and may be spread over a larger geographic area. These characteristics have hindered the preparation of drought contingency or mitigation plans by many governments.

Droughts may cause a shortage of water for human and industrial consumption, hydroelectric power, recreation, and navigation. Water quality may also decline and the number and severity of wildfires may increase. Severe droughts may result in the loss of agricultural crops and forest products, undernourished wildlife and livestock, lower land values, and higher unemployment.

Drought History in Minnesota

During the 1987-1989 drought, a State Drought Task Force was convened by the Minnesota Department of Natural Resources (DNR), Director of the Division of Waters. The State Drought Task Force brought together local, state, and federal officials to share information and coordinate drought response strategies.

In addition to the Palmer Drought Severity Index, Division of Waters uses actual precipitation, streamflow, lake level, ground water level, and water use data to assess the status of hydrologic conditions in Minnesota. On a weekly basis, the Division of Waters produces maps of stream flow, precipitation, and seasonal departures from normal.

Table 20 Minnesota Drought History

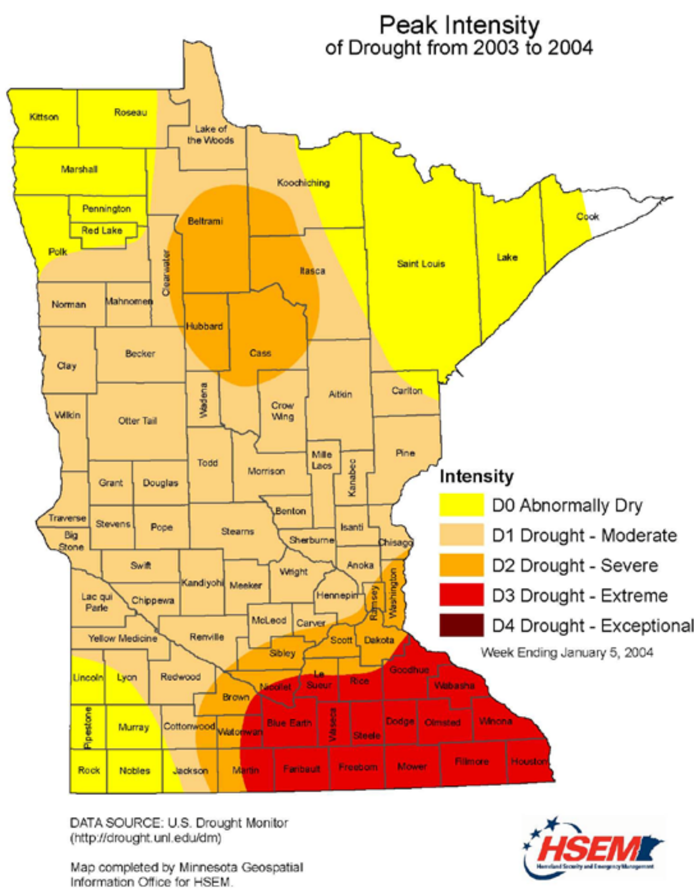
DATES	LOCATION	REMARKS
1-30-Apr-10	Central St. Louis, Northern Cook / Northern Lake, Southern Cook, Southern Lake, Southern St. Louis / Carlton	Very little rain fell across the Arrowhead of Minnesota during the month of April. Precipitation totals were only 10 to 25 percent of normal for the month. This lack of rain allowed for severe (D2) drought conditions to develop by the end of the month across Cook, Lake, and far southeastern St. Louis counties, according to the U.S. Drought Monitor.
1-31-May-10	Northern Cook / Northern Lake, Southern Lake, Southern St. Louis / Carlton	Severe (D3) drought conditions continued through May across the Arrowhead of Minnesota, due to lack of appreciable precipitation. The area covered Cook, Lake, and far southeast St. Louis counties.
1-30-Jun-10	Northern Cook / Northern Lake, Southern Cook, Southern Lake	Severe (D2) drought conditions persisted through August in Lake and Cook counties, according to the U.S. Drought Monitor. Precipitation was near to slightly below normal for the month.
1-31-Jul-10	Central St. Louis, Northern Cook / Northern Lake	Precipitation was slightly below normal for the Arrowhead region of northeast Minnesota, leading to a continuation of Severe (D2) drought conditions in July. Drought conditions expanded further southwest throughout the month to include portions of central St. Louis County, including the Iron Range.
1-31-Aug-10	Northern Cook / Northern Lake, Southern Cook	A lack of appreciable rain led to a continuation of the Severe (D3) drought conditions across parts of the Arrowhead, according to the U.S. Drought Monitor.

Table 20 Minnesota Drought History

DATES	LOCATION	REMARKS
Autumn 2009	Cass, Itasca, Pine	Dry conditions led to portions of the state declared under the severe drought category (D2) according to the U. S. Drought Monitor. The area was in the extreme east, in the St. Croix River valley. By late August the D2 designation was reduced to D1, or moderate drought.
Autumn 2007	Aitkin, Anoka, Benton, Brown, Carlton, Cass, Cook, Crow Wing, Douglas, Hennepin, Hubbard, Itasca, Kanabec, Lake, Mille Lacs, Morrison, Pipestone, Pope, Sherburne, St. Louis, Swift, Todd, Wadena, Wright	USDA designated 24 counties as primary natural disaster areas because of drought that occurred from May 1, 2007 and continuing.
July 2006-September 2007	Roseau, Lake of the Woods, Marshall, Polk, Mahnomen, Becker, Beltrami, Clearwater, Pennington, Red Lake, Hubbard, Kittson, Norman, Otter Tail, Koochiching, Itasca, Carlton, Cass, Clay, Cook, Crow Wing, Aitkin, Lake, Pine, St. Louis, and Wadena Counties	Warmer than normal temperatures and a lack of rain both contributed to a D2 drought designation (per the U.S. Drought Monitor) across portions of northwest and west central Minnesota on July 18th. By July 25th, the designation was upgraded to a D3 (extreme drought). The dry trend started in May, but became much worse by June and July. Drought conditions continue in the fall of 2007.
July-October 2003	Multiple, south central, southeastern and west-central Minnesota	A persistent weather pattern resulted in extremely dry weather across Minnesota. Few widespread rain events moved through the state during the interval, and precipitation totals were less than six inches across much of Minnesota. During this three month period, rainfall totals rank among the lowest on record for many areas of south central and southeastern Minnesota, and a small portion of west central Minnesota.
Nov. 1999-April 2000	Cottonwood, Jackson, Lincoln, Lyon, Murray, Nobles, Pipestone and Rock Counties	Dry weather that began in August 1999 continued through spring 2000. Water levels continued to fall slowly in wetlands, streams and lakes. Above normal temperatures contributed to further drying. One noticeable manifestation of the dry conditions was a number of grass fires. Dry surface and soil conditions remained pronounced.
1987-1989	Statewide	Established new “average low precipitation” and “average high temperature” records. Farmers lost most, if not all, of the year’s crop. Drought also affected power production, the forest products industry, public water supplies and fish and wildlife dependent on adequate surface water. Mississippi River flow levels threatened to drop below the Minneapolis Water Works intake pipes.
1976-1977	Statewide	Began in 1974 in parts of south-central and western MN. Most severely affected areas were the Otter Tail and Lac Qui Parle River basins. Dry

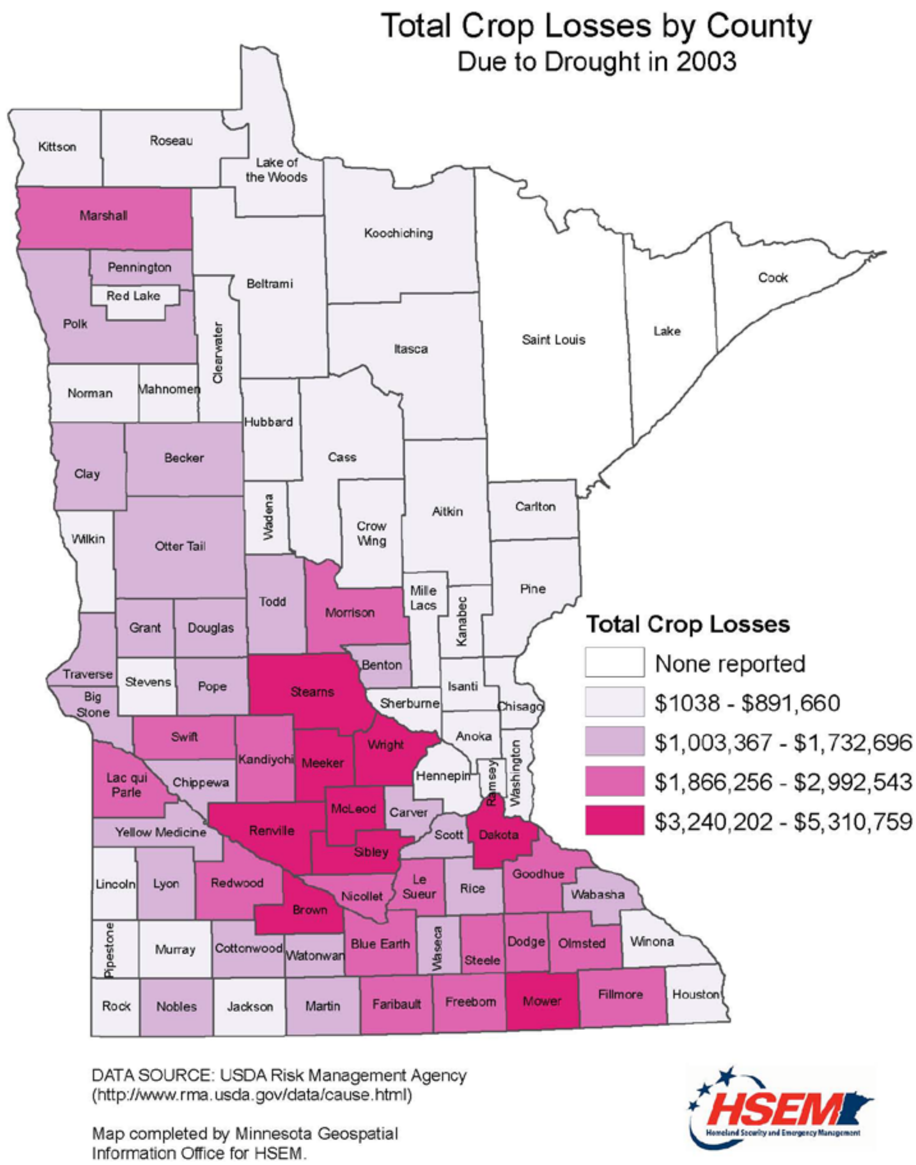
Table 20 Minnesota Drought History		
DATES	LOCATION	REMARKS
		conditions caused lower water levels in wells and caused record low stream flows throughout the state. Late summer forest fires broke out and conflicts arose between domestic well owners and neighboring high capacity well owners.
1954-1961	Extreme NE corner of state	Intensity and duration differed locally
1936	Northwest	Intensity and duration differed locally
1934	Northeast	Intensity and duration differed locally
1931-1942	Statewide	Intensity and duration differed locally
1911-1914	Statewide	Intensity and duration differed locally

FIGURE 38 PEAK DROUGHT INTENSITY 2003-2004



For a three-month period from mid-July through mid-October 2003, a persistent weather pattern resulted in extremely dry weather across Minnesota. Few widespread rain events moved through the state during the interval, and precipitation totals were less than six inches across much of Minnesota. During this three month period, rainfall totals rank among the lowest on record for many areas of south central and southeastern Minnesota, and a small portion of west central Minnesota. The following maps indicate the areas of peak intensity for drought and the crop losses by county for the 2003 drought.

FIGURE 39 CROP LOSS FROM DROUGHT 2003



Drought also occurred in 2006-2007. The following maps indicate ht location of peak intensity and crop losses due to this event.

FIGURE 40 PEAK DROUGHT INTENSITY 2006-2007

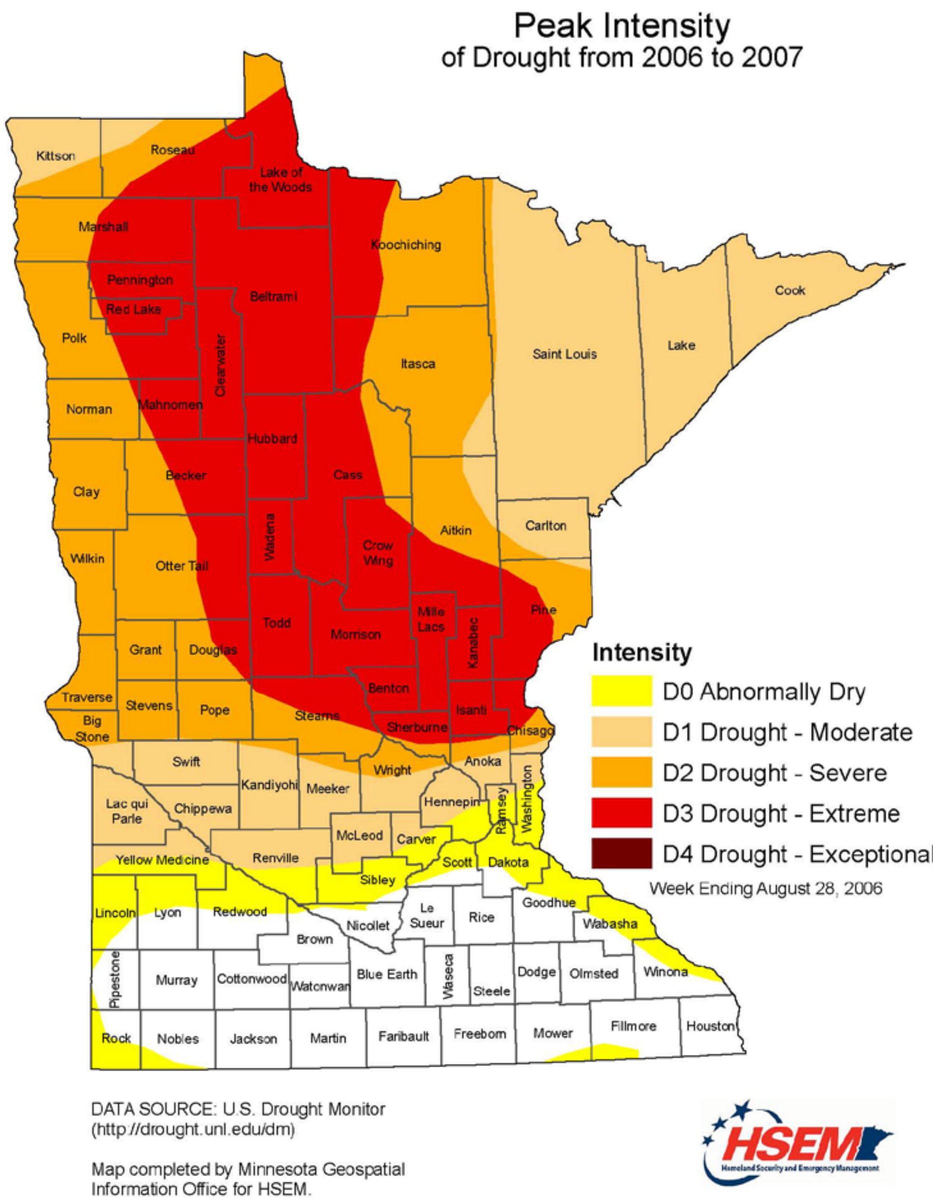
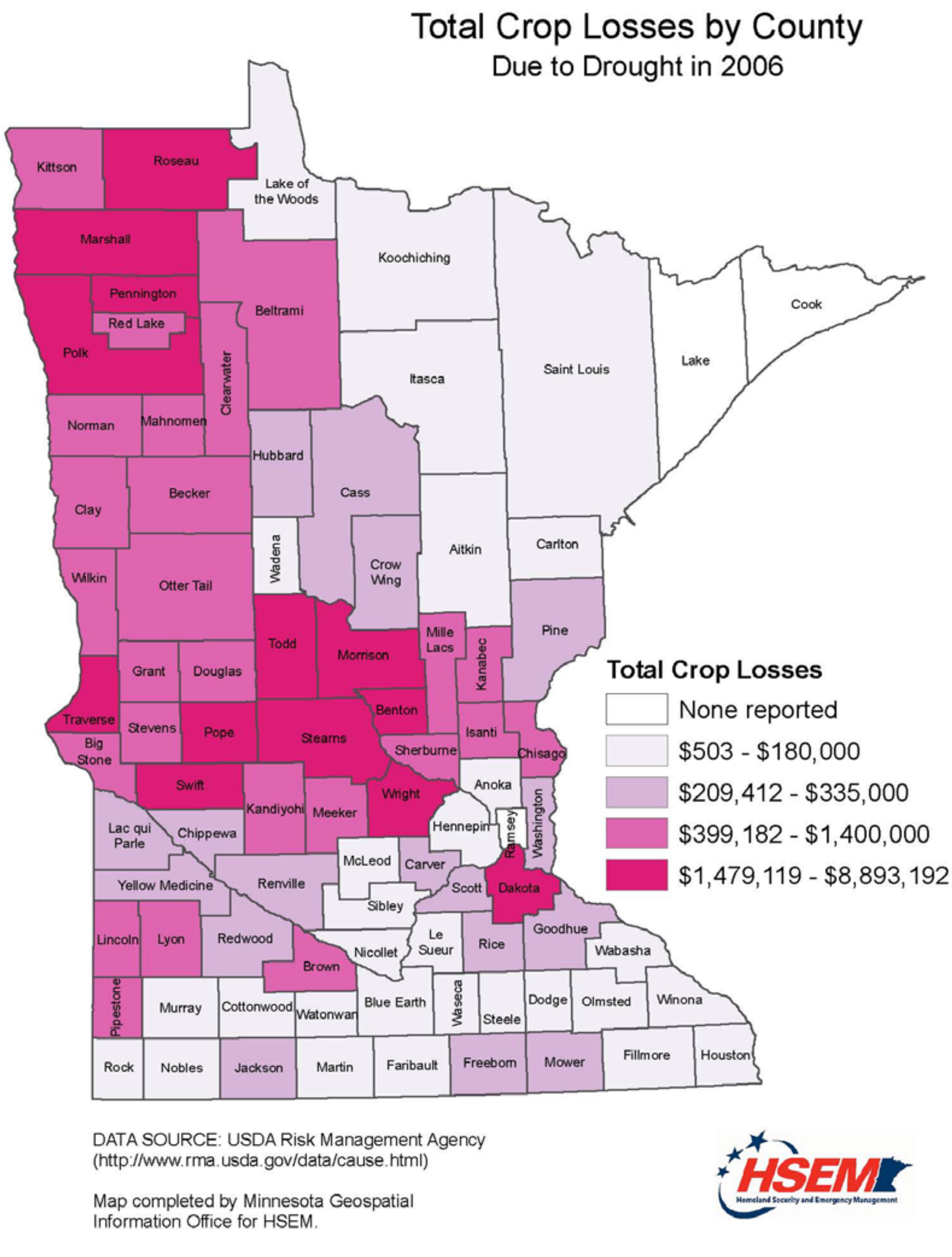


FIGURE 41 CROP LOSS FROM DROUGHT 2006



Update from Minnesota Climatology Working Group as of January 2011 for the drought outlook for the state:

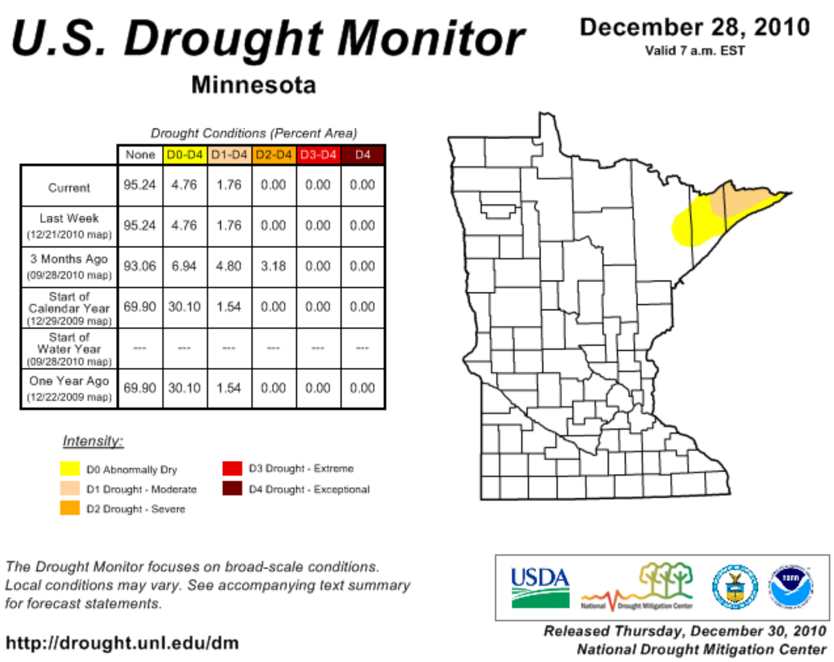
Cook County and portions of Lake County are designated as undergoing Moderate drought (map at right). Precipitation totals since mid-March are less than eighteen inches for sections of northeastern Minnesota, more than four inches short of average (maps below). In many of these areas, mid-March through early November precipitation totals rank below the 10th percentile (one year in ten) when compared with past years over the same seasonal interval.

Other areas in northeastern Minnesota are considered to be Abnormally Dry. Much of this region experienced growing season precipitation shortfalls in 2009 and lower than average snowfall this past winter.

Although the U.S. Drought Monitor no longer indicates drought in east central Minnesota, some hydrologic systems in this area remain impacted by long-term dryness that began in June of 2008. This long-term precipitation anomaly is responsible for low water levels in larger lakes and wetland complexes across Anoka, Ramsey, Chisago, and Washington counties.

The very dry weather has led to stream discharge values in northeastern Minnesota that rank below the 10th percentile when compared with historical data for the date. Lake Superior water level is seven inches below last year's level at this time of year and 13 inches below the historical average.

FIGURE 42 CURRENT DROUGHT MONITOR



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	95.24	4.76	1.76	0.00	0.00	0.00
Last Week (12/21/2010 map)	95.24	4.76	1.76	0.00	0.00	0.00
3 Months Ago (09/28/2010 map)	93.06	6.94	4.80	3.18	0.00	0.00
Start of Calendar Year (12/29/2009 map)	69.90	30.10	1.54	0.00	0.00	0.00
Start of Water Year (09/28/2010 map)	---	---	---	---	---	---
One Year Ago (12/22/2009 map)	69.90	30.10	1.54	0.00	0.00	0.00

Probability of Occurrence

The future incidence of drought is highly unpredictable, and may also be localized, making it difficult to determine probability with any accuracy. Interpreting what is "too dry" or what is "too long" is difficult. What we do know is that when a serious hydrologic imbalance occurs in Minnesota, soil moisture reserves, groundwater supplies, lake levels, and stream flows are negatively influenced. Water-dependent industries including agriculture, public utilities, forestry, and tourism are profoundly affected. Because long-term (months/years) climate variations are unpredictable, drought is largely unpredictable. The probability ranking for drought is High, and is ranked as having Low mitigation potential.

Sources of Information

NOAA, National Climatic Data Center. Storm Events www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storm

http://www.climate.umn.edu/doc/journal/drought_2010.htm

www.drought.noaa.gov/

Academic Climatology - University of Minnesota. climate.umn.edu/climatology.htm

Minnesota Department of Natural Resources. Drought. www.dnr.state.mn.us/climate/drought/index.html

Minnesota Climatology Working Group climate.umn.edu/doc/journal/drought_information_resources.htm

Extreme Temperatures (Heat)

Extreme summer heat is the combination of very high temperatures and exceptionally humid conditions. If such conditions persist for an extended period of time, it is called a heat wave (FEMA, 1997). Heat stress can be indexed by combining the effects of temperature and humidity, as shown in the following table. The index estimates the relationship between dry bulb temperatures (at different humidity) and the skin's resistance to heat and moisture transfer. The higher the temperature or humidity, the higher the apparent temperature. The major human risks associated with extreme heat are as follows:

- **Heatstroke**: Considered a medical emergency, heatstroke is often fatal. It occurs when the body's responses to heat stress are insufficient to prevent a substantial rise in the body's core temperature. While no standard diagnosis exists, a medical heatstroke condition is usually diagnosed when the body's temperature exceeds 105°F due to environmental temperatures. Rapid cooling is necessary to prevent death, with an average fatality rate of 15 percent even with treatment.
- **Heat Exhaustion**: While much less serious than heatstroke, heat exhaustion victims may complain of dizziness, weakness, or fatigue. Body temperatures may be normal or slightly to moderately elevated. The prognosis is usually good with fluid treatment.
- **Heat Syncope**: This refers to sudden loss of consciousness and is typically associated with people exercising who are not acclimated to warm temperatures. Causes little or no harm to the individual.
- **Heat Cramps**: May occur in people unaccustomed to exercising in the heat and generally ceases to be a problem after acclimatization.

In addition to affecting people, severe heat places significant stress on plants and animals. The effects of severe heat on agricultural products, such as cotton, may include reduced yields and even loss of crops (Brown and Zeiher, 1997). Similarly, cows may become overheated, leading to reduced milk production and other problems. (Garcia, September 2002).

Table 21 Heat Index and Disorders

Danger Category		Heat Disorders	Apparent Temperatures (°F)
IV	Extreme Danger	Heatstroke or sunstroke imminent.	>130
III	Danger	Sunstroke, heat cramps, or heat exhaustion likely; heat stroke possible with prolonged exposure and physical activity.	105-130
II	Extreme Caution	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and physical activity.	90-105
I	Caution	Fatigue possible with prolonged exposure and physical activity.	89-90

Source: FEMA, 1997; NWS, 1997.

Extreme Temperatures History in Minnesota

Extreme temperature events (both heat and cold) have caused 19 deaths and $2.5 million in damages in Minnesota from 1995-2011. There were no heat related deaths or injuries from 2008-2011. This section will focus on extreme heat as most of the deaths (15) and property damage in Minnesota have been attributable to extreme heat. In 1995, approximately $2 million in property damage and two deaths were reported from high temperatures. Dewpoints in the 70s to around 80 degrees combined with temperatures in the middle 90s to low 100s to produce heat indices in the 105 to 120 degree range. The following table shows extreme heat events in Minnesota.

Table 22 Extreme Heat History in MN 1976-2010		
YEAR	LOCATION	COMMENT
2010	Dodge County	August 12. The automated weather observing equipment at Dodge Center recorded a maximum apparent temperature of 109 degrees in the afternoon. The temperature was 90 degrees, with a dew point of 81 degrees. The combination of very warm temperatures and high dew points led to extreme apparent temperature values across southeast Minnesota on the 12th. The apparent temperature at Dodge Center (Dodge County) was at or above 105 degrees for three hours in the afternoon.
2006	Anoka, Benton, Blue Earth, Brown, Carver, Chippewa, Chisago, Dakota, Douglas, Faribault, Freeborn, Goodhue, Hennepin, Isanti, Kanabec, Kandiyohi, Lac Qui Parle, Le Sueur, Martin, Mcleod, Meeker, Mille Lacs, Morrison, Nicollet, Pope, Ramsey, Redwood, Renville, Rice, Scott, Sherburne, Sibley, Stearns, Steele, Stevens, Swift, Todd, Waseca, Washington, Watonwan, Wright, Yellow Medicine. Big Stone, Traverse	July 30-31 Temperatures topped out near 100 degrees across much of central and southern Minnesota during the afternoon hours of the 30th and 31st, with maximum heat indices ranging from 105 on the 30th, to 110 on the 31st. No reports of fatalities or injuries were received, but heat advisory criteria were met. July 28-30 Much above normal temperatures and high humidity combined to bring heat indices of 105 to 115 degrees to parts of west central Minnesota. High temperatures were in the upper 90s to around 105 for the three day period.
2005	Hennepin	High temperatures at Minneapolis-St. Paul International Airport remained at or above 90 degrees for 9 consecutive days between July 9th and 17th. This extended period of hot weather set a record for the 3rd longest streak of at or above 90 degree highs since 1891 in the Twin Cities. On July 12th, a laborer putting up a fence in Arden Hills in Ramsey County suffered severe heatstroke. He collapsed at the work site and was rushed to a local hospital. His body temperature reached 108.8 degrees, but miraculously he survived after receiving intensive medical attention

Table 22 Extreme Heat History in MN 1976-2010		
YEAR	LOCATION	COMMENT
2001	St. Louis and Carlton Counties	Five people died in a two-day heat wave, during which high temperatures of 91 degrees and heat indexes of 101 were reached. The victims, all in the Duluth area, included 4 males and 1 female, ranging in age from 47 to 73. All were found in rooms without air conditioning and with poor ventilation. The St. Louis County pathologist determined that the deaths were directly attributable to the heat.
2001	Anoka, Benton, Blue Earth, Brown, Carver, Chippewa, Chisago, Dakota, Douglas, Faribault, Freeborn, Goodhue, Hennepin, Isanti, Kanabec, Kandiyohi, Lac Qui Parle, Le Sueur, Martin, McLeod, Meeker, Mille Lacs, Morrison, Nicollet, Pope, Ramsey, Redwood, Renville, Rice, Scott, Sherburne, Sibley, Stearns, Steele, Stevens, Swift, Todd, Waseca, Washington, Watonwan, Wright, Yellow Medicine	An extensive heat wave persisted for five days (August 4-8) and resulted in five fatalities in Minneapolis and its suburbs. All deaths occurred in Hennepin County and were determined by the county medical examiner.
2001	Anoka, Benton, Blue Earth, Brown, Carver, Chippewa, Chisago, Dakota, Douglas, Faribault, Freeborn, Goodhue, Hennepin, Isanti, Kanabec, Kandiyohi, Lac Qui Parle, Le Sueur, Martin, McLeod, Meeker, Mille Lacs, Morrison, Nicollet, Pope, Ramsey, Redwood, Renville, Rice, Scott, Sherburne, Sibley, Stearns, Steele, Stevens, Swift, Todd, Waseca, Washington, Watonwan	Excessive heat began on July 30 and ended the morning of August 1 when showers and thunderstorms swept through the area, bringing lower temperatures and dewpoints. Until the storms arrived, dewpoints remained in the middle and upper 70s overnight on July 31 into August 1, resulting in nighttime heat index values that never dropped below 80 in many locales, including Minneapolis-St. Paul. One fatality.
1999	Anoka, Benton, Blue Earth, Brown, Carver, Chippewa, Chisago, Dakota, Douglas, Faribault, Freeborn, Goodhue, Hennepin, Isanti, Kanabec, Kandiyohi, Lac Qui Parle, Le Sueur, Martin, McLeod, Meeker, Mille Lacs, Morrison, Nicollet, Pope, Ramsey, Redwood, Renville, Rice, Scott, Sherburne, Sibley, Stearns, Steele, Stevens, Swift, Todd, Waseca, Washington, Watonwan, Wright, Yellow Medicine	A massive upper ridge over the central and eastern U.S. enabled heat to build into Minnesota. Heat indices ranged from 95 to 110 the afternoon of the 23rd, 90 to 105 on the 24th, and climaxed at 95 to 116 on the 25th before a cold front moved in. Indices only dropped into the 70s the mornings of the 24th and 25th. Dewpoints in the middle and upper 70s were common, along with temperatures topping out in the lower and middle 90s. The highest indices noted, all on the 25th, were 116 in Lakeville, 113 in Appleton, and 110 in Faribault, Redwood Falls and Benson. 1 fatality.
1995	Anoka, Benton, Big Stone, Blue Earth, Brown, Carver, Chippewa, Chisago, Cottonwood, Dakota, Dodge, Faribault, Fillmore, Freeborn, Goodhue, Hennepin, Houston, Isanti, Jackson, Kandiyohi, Lac Qui Parle, Le Sueur, Lincoln, Lyon, Martin, McLeod, Meeker, Mower,	Sweltering heat and humidity climaxed on July 12 and July 13. Dewpoints in the 70s to around 80 degrees combined with temperatures in the middle 90s to low 100s to produce heat indices in the 105 to 120 degree range. Two died from a combination of heat exhaustion and

Table 22 Extreme Heat History in MN 1976-2010		
YEAR	LOCATION	COMMENT
	Murray, Nicollet, Nobles, Olmsted, Pipestone, Pope, Ramsey, Redwood, Renville, Rice, Rock, Scott, Sherburne, Sibley, Stearns, Steele, Stevens, Swift, Wabasha, Waseca, Washington, Watonwan, Winona, Wright, Yellow Medicine	dehydration. 2 fatalities.

Source: NOAA NCDC

Probability of Occurrence

The annual probability of extreme temperatures occurring is clearly quite high, although most year-to-year temperature extremes will be within normal statistical bounds.

Sources of Information

Palecki, Michael A. and Changnon, Stanley A. The Nature and Impacts of the July 1999 Heat Wave in the Midwest. Mid-western Climate Center, Illinois State Water Survey, Champaign, IL, August 23, 1999.

National Climatic Data Center (NCDC) www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

Dam Failure

A "dam" is an artificial barrier that has the ability to impound water, wastewater, or any liquid borne material for the purpose of storage or the control of water. Dams can fail for one or a combination of the following reasons:

- Overtopping caused by floods that exceed the capacity of the dam.
- Deliberate acts of sabotage.
- Structural failure of materials used in dam construction.
- Movement and/or failure of the foundation supporting the dam.
- Settlement and cracking of concrete of embankment dams.
- Piping and internal erosion of soil in embankment dams.
- Inadequate maintenance and upkeep.

The hazard classifications for dams are as follows:

- **High** - any loss of life or serious hazard, or damage to health, main highways, high-value industrial or commercial properties, major public utilities, or serious direct or indirect, economic loss to the public;

- **Significant** - possible health hazard or probable loss of high-value property, damage to secondary highways, railroads or other public utilities, or limited direct or indirect economic loss to the public other than that described in Class III; and
- **Low** - property losses restricted mainly to rural buildings and local county and township roads which are an essential part of the rural transportation system serving the area involved.

The Minnesota Dam Safety Program is administered through the Minnesota Department of Natural Resources. Emergency Action Plans (EAP) are required for all High Hazard dams in the state. These plans should be implemented into the County Emergency Operations Plans. DNR is in the process of ensuring all EAPs are up to date and will be contacting emergency managers to ensure that they have EAPs for all High Hazard dams that are in poor or unsatisfactory condition.

FIGURE 43 STATE DAM HAZARD CLASSIFICATION

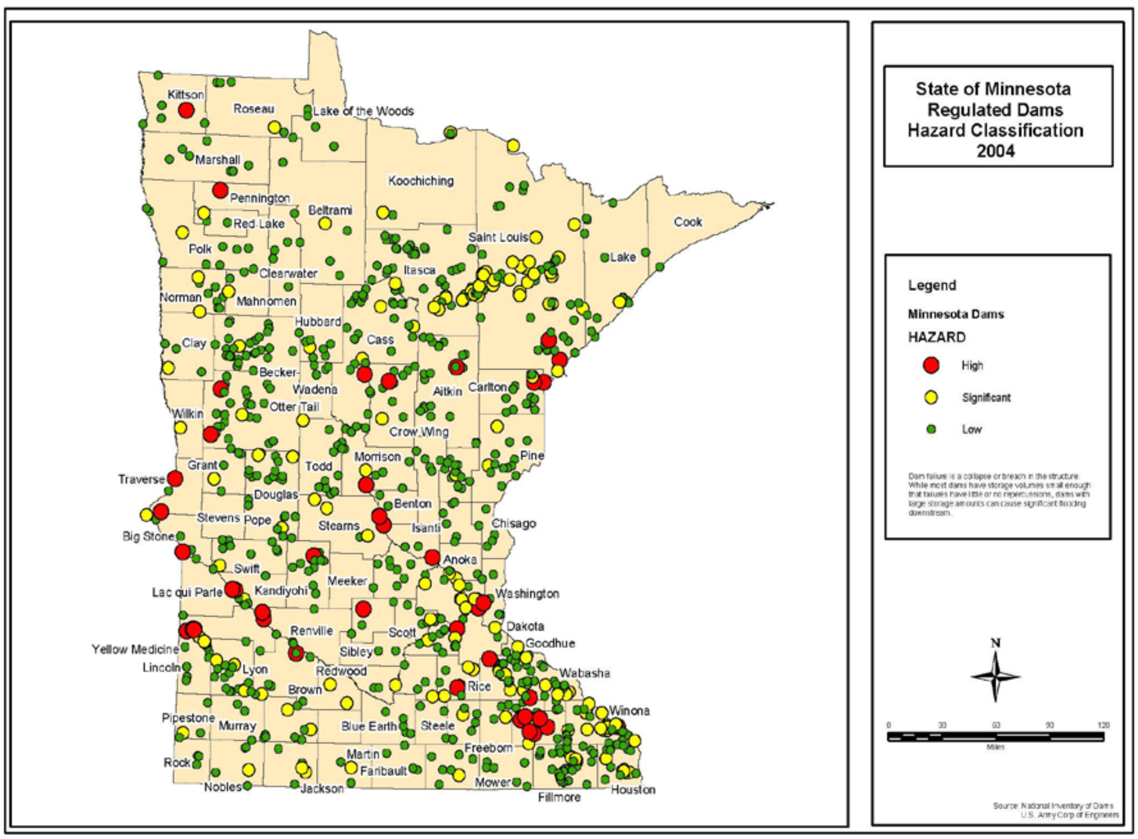
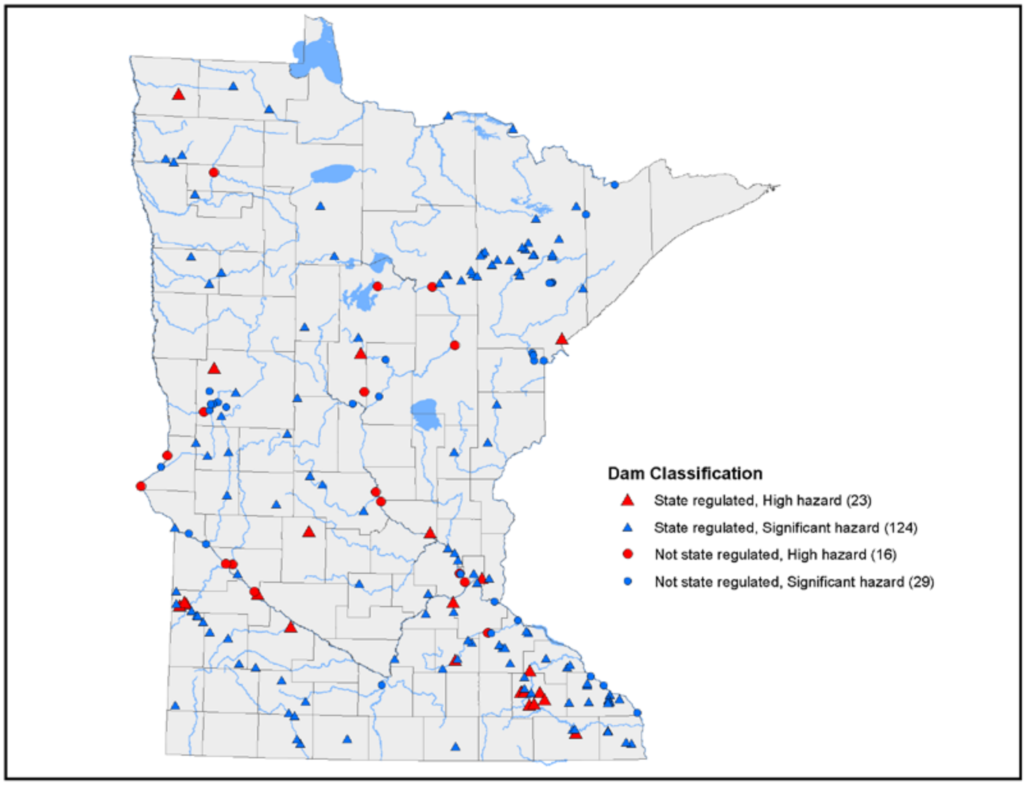


FIGURE 44 STATE DAM REGULATION CLASSIFICATION



Source: Minnesota Dam Safety Program, 2010

The U.S. Army Corp of Engineers (USACE) maintains the lock and dam system on the Mississippi River and other dams used for flood control in the state. USACE also participates with local communities in all phases of flood control that includes dams, levees, or other means of flood control. The Federal Energy Regulatory Commission (FERC) has jurisdiction regarding inspections and Emergency Action Plans of FERC licensed dams used for hydroelectric power generation. The dams that are not regulated by USACE or FERC are regulated by the Minnesota Dam Safety Program. The following statistics are for 2010:

- Number of state-regulated high-hazard potential dams: 23
- Number of state-regulated significant hazard potential dams: 124
- Number of state-regulated high-hazard potential dams: 991

Ownership of dams in Minnesota:

- Private: 31%
- State: 38%
- Federal: 8%
- Local Government: 21%
- Private Utility: 2%

Hazard History

The most notable event due to flood waters overtopping a dam was the 1997 flood in East Grand Forks (DR-1175). A much larger area was impacted throughout the state but the extensive damages were to water cresting over earthen levees. The Red River crested at 54.32 feet. The earthen levees in place were designed to protect to level of a 100-year flood plus three feet of freeboard, or, 52 feet. Three and one half million sandbags plus many cubic yards of clay and gravel were used during the flood fight. The river rise of one inch per hour (two feet per day) overcame the reinforcement efforts.

TABLE 23 NOTABLE DAM INCIDENTS IN MINNESOTA

Date	Location	Remarks
2007	Windom Dam, Cottonwood County	Erosion failure of left abutment.
2007	Rapidan dam, Blue Earth County	Void under spillway, activated Emergency Action Plan for potentially hazardous situation.
2007	Talcot Lake Dam, Cottonwood County	Partial failure of gate.
2006	Lake Breckenridge, Wilkin County	Overtopping failure of left embankment
2002	Wild Rice River, Norman County	Complete failure due to overtopping of saddle dam. About two miles of channel was short circuited. The primary dam and spillway were undamaged.
2000	Byllesby Dam, Dakota County	New flash gates, which were installed the previous year, were secured by machine chain fence links. Some links failed prematurely.
2000	Lake Bronson, Kittson County	Pool elevation restored to normal operating conditions after new relief drains installed in channel bed.
1999	Little Falls, Morrison County	Failure of canal.
1999	Coon Rapids, Anoka County	Bladder leaking air. It was deflated and a partial cofferdam placed when the reservoir was lowered to apply the patch.
1998	Little Cannon River, Goodhue County	Very heavy rainfall, non-overflow area of dam overtopped. Moderate damage to State Highway 19 crossing pool. Significant damage to bridge immediately downstream. Moderate damage to dam. Park property damaged. Several private homes on pool flooded.
1993	Splitrock Lake Dam, Pipestone County	Right abutment failure during a flood.
1987	St. Anthony Falls Lower Dam, Hennepin County	The powerhouse collapsed due to severe undermining caused by piping. The losses included a temporary draw down of the upper pool in the Mississippi River and stranded commercial navigation, a loss of a 10-mw hydro plant facility, construction of temporary cofferdams to raise river

		level to normal navigational elevations, and demolition of remainder of powerhouse. The hydro plant was 204 feet wide and operated at normal head of 20 feet. Plans are underway to reconstruct the failed hydro plant.
1985	Berning Mill Dam, Hennepin and Wright Counties	A 50 to 60 foot section in the middle of the spillway collapsed without warning apparently due to severe deterioration. The remainder of the dam was completely removed from the river by DNR in 1988. The dam was an old timber crib structure built in late 1880's for milling purposes. The spillway was about 7 feet high and 200 feet wide.
1984	Lanesboro Dam, Fillmore County	A portion of the earthen powerhouse canal dike washed out without warning. Work had been done on the dike several months before.
1984	Windom Dam, Cottonwood County	The 60-foot long left earthen embankment washed out during spring floods by floodwaters overtopping the embankment. The dam had an inadequate spillway capacity.
1984	Hanover Dam, Wright County	A 30-foot long portion of the dam's concrete spillway collapsed without warning during normal flow conditions apparently due to severe undermining and deterioration. The remainder of the dam was completely removed from the river by DNR in 1987. This dam was an old milling dam built in early 1900's. The structure was an overflow cemented timber crib spillway about 10 feet high and 250 feet wide.
1983	Odney Flat Dam, Polk County	The earthen emergency spillway washed out during flooding following a heavy rainstorm. This was a newly constructed dam and an erosion resistant vegetative cover had not been established on the emergency spillway. The dam was later repaired and the emergency spillway relocated.
1983	St. Paul Water Treatment Plant Lime Sludge Dam, Ramsey County	A portion of the earthen embankment completely washed out suddenly during normal pool conditions. The failure was due to unstable embankment conditions.
1983	Fishhook River Dam, Cofferdam, Hubbard County	The cofferdam built to control water during reconstruction of the main dam washed out due to structural inadequacy causing damage to the construction site and downstream areas.
1982	Beaver Dam, Washington County	A five-foot high beaver dam, not considered to be an official "dam", washed out in O'Brien State Park resulting in 2 injuries and approximately two million dollars in damage.
1981	Schweiger Dam, St. Louis County	The dam reportedly failed when the owner was attempting to perform repairs on the spillway.
1980	Pickwick Dam, Winona County	The right earthen embankment and a portion of the spillway washed out during a flash flood following a severe rainstorm.

The table lists known incidents relating to dams since 1980. Problems that were identified and repaired that mitigated a failure are also cited along with failures.

Source: Department of Natural Resources, 2010

Future Perspectives

The 100-year flood leads to misunderstanding and is actually a "1% chance flood" in any given year. The 500-year flood works out to be a .2% chance flood. The chance of a dam failing during a flood is reduced by inspection. In regards to overtopping, the National

Weather Service is constantly monitoring conditions to predict flood conditions. The public is protected by use of the Emergency Action Plans for the high risk and significant risk dams. Flood fights occasionally fail and may cause massive damage as seen in East Grand Forks in 1997.

The National Dam Rehabilitation and Repair Act has been introduced into the 111th Congress as HR 1710. This program would provide $200 million over 4 years in federal grant funds to be cost-shared at 65 percent federal to 35 percent state/local for non-federal publicly owned dams. The Minnesota perspective is that it is estimated that the funds needed to repair the high risk dams is $40,255,610 while the proposed funding from HR 1710 is $2,417,144.

Sources of Information

Stanford, 2004. National Performance of Dams Program, Stanford University. 2004. Dam Incident Summary

Department of Natural Resources, 2010. reports reported in Minnesota's component of the national computerized dam inventory NATDAM database.

Federal Emergency Management Agency. 1997. Multi-Hazard Identification and Risk Assessment – A Cornerstone of the National Mitigation Strategy.

Federal Emergency Management Agency, Grand Forks 1997 Flood Recovery. http://wwwlfema.gov/hazard/archive/grandformks/statistics.shtm

Federal Emergency Management Agency, Minnesota Severe Storms/Flooding April 1997. http://www.fema.gov/media/fact_sheets/97mnflood.sthm

Minnesota Public Safety, Homeland Security Emergency Management, 2005. Minnesota State All-Hazard Mitigation Plan.

U.S. Corps of Army Engineers, 2004. State of Minnesota Regulated Dams Hazard Classification, 2004

U.S. Army Corp of Engineers, 2007. Flood Damage and Reduction, Projects and Studies. http.www.mvp.usace.army.mil/fl_damage_reduct/default.asp?pageid=911

4.2 Other Hazards

The Disaster Mitigation Act of 2000 encourages addressing other than natural hazards. This section is identifies other caused hazards with the intent of providing useful information for local planners.

The following other hazards have been identified for this section are:

- Terrorism
- Infectious Disease Outbreak
- Fires (Structure and Vehicles)
- Nuclear Generating Plant Incidents
- Hazardous Material Incidents
- Transportation Incidents
- Ground and Surface Water Supply Contamination

Primary and Secondary Hazards

The hazards that are identified in this section are being discussed as primary hazard or the initiating event. Local planners should look at these hazards as being possible secondary incidents or hazards to disasters initiated by natural hazards in their plans. For instance, flood waters may contaminate a well used for drinking water. The flood is the initiating hazard but contaminating a water supply then becomes another hazard to consider.

Terrorism

To discuss terrorism in the proper context it needs to be defined. The Federal Bureau of Investigation (FBI) categorizes terrorism in the United States as one of two types, i.e., domestic terrorism or international terrorism.

- Domestic terrorism involves groups or individuals whose terrorist activities are directed at elements of our government or population without foreign direction.
- International terrorism involves groups or individuals whose terrorist activities are foreign-based and/or directed by countries or groups outside of the United States or whose activities transcend national boundaries.

The FBI divides terrorist-related activity into three categories:

- A terrorist incident is a violent act or an act dangerous to human life, in violation of the criminal laws of the United States, or of any state, to intimidate or coerce a government, the civilian population, or any segment thereof.
- A suspect terrorist incident is a potential act of terrorism to which responsibility cannot be attributed at the time to known or suspected terrorist group or individual.

- Terrorism prevention is a documented instance in which a violent act by a known or suspected terrorist group or individual with the means and a proven propensity for violence is successfully interdicted through investigative activity.

History of Terrorism in Minnesota

Domestic terrorism: Domestic terrorism is an area of concern within Minnesota. The Minneapolis Office of the Federal Bureau of Investigation in 2006 completed a Domestic Terrorism Threat Assessment for Minnesota and the Dakotas and defined domestic terrorist organizations into four (4) broad categories; special interest, rightwing, leftwing, and lone wolf. While the findings of this report are classified at the Law Enforcement Sensitive (LES) level, it is important to note that this report does indicate that this is an area that warrants attention within Minnesota.

Recent national reporting indicates crime and gang related violence is an increasing trend nationwide. Minnesota is not immune to terrorism. In the mid-1990's, a domestic terrorist militia group known as the Patriots was responsible for manufacturing the deadly toxin ricin for use against federal employees and local law enforcement. Timothy McVey was in Minnesota conducting surveillance on the Whipple Federal Building before he decided to attack the Murrah Federal Building in Oklahoma City. The communities of Ricori (2003) and Red Lake (2005) experienced school shootings that resulted in fatalities and casualties. Numerous nationwide documented cases of drug related thefts that directly impacted infrastructure (copper theft as an example) are also affecting Minnesota.

Minnesota is home to a very diverse national and international population that includes large migrant worker populations, large East African and South East Asian communities, as well as one of the largest settlements of Somalis outside Somalia. Minnesota, as a large agricultural state, draws from a large migrant work force population and there are numerous documented affiliations with this population sub-group and criminal/gang related activity. Crime and gang related activities are both well documented within the state. As recently as January, 2007, the American Nazi Party organized a book burning in Minneapolis and considers Minnesota as its home address.

International Terrorism: Incidents that meet the definition of terrorism have occurred within the state credited to international and domestic terrorist organizations. International terrorism is an area of concern within the state. Specific information related to the threat of international terrorism in Minnesota is located within closed circles. However, there have been two notable cases regarding individuals linked to international terrorist organizations. Zacharius Moussaoui and other high profile international terrorists were arrested within the state. The local FBI Joint Terrorism Task Force (JTTF) is among the most active in the nation, addressing the issue of overseas financial transfers and groups such as Al Qaeda, Hizballah, Hamas, Al-Ittihad al-Islami and Islamic Jihad. These cases provide examples that the threat of terrorism warrants attention and consideration. A major contributing concern regarding international terrorism is the fact that Minnesota shares approximately 700 miles of international border with Canada, more than 150 miles of which is open water along the interior of Lake Superior.

Future Perspectives

Acts of terrorism are random and cannot be predicted with any frequency or scale. Terrorists may see other parts of the country with higher population density and more commerce more attractive to meet their goals. However, Minnesota may not be overlooked since this state offers certain economic strategic value with financial centers, agri-business, transportation, and oil pipelines from Canada.

Integrating the hazard mitigation techniques and strategies found in FEMA 386-7 into the operation and design of facilities may be considered as a future action.

Sources of Information

Federal Bureau of Investigation, Counterterrorism, 2010.

Domestic Terrorism Threat Assessment for Minnesota and the Dakotas, The Minneapolis Office of the Federal Bureau of Investigation, 2006 (classified)

Infectious Disease Outbreak

Infectious diseases have the potential to affect any form of life. Some infectious diseases that were thought to have been eradicated have re-emerged. New strains of some infectious diseases, such as the flu, present seasonal threats to the populace and require continuous monitoring. Widespread epidemics are almost non-existent in the United States. An "epidemic" is defined as a disease that occurs suddenly in numbers clearly in excess of normal expectancy, especially infectious diseases, but is applied also to any disease, injury, or other health-related event occurring in such outbreaks. If an epidemic event were to occur, deaths could be in the many hundreds of thousands across the nation. If the health of the general public is perceived to be threatened on a large scale, riots or states of lawlessness are a possibility.

In the years following World War II, life-threatening bacterial diseases such as tuberculosis and typhoid fever were cured by antibiotics. Dreaded diseases such as polio, whooping cough, and diphtheria could be conquered through vaccination. Thus, it became possible to imagine a world without infectious diseases. We now know that such optimism was premature. New strains of influenza have greater resistance to antibiotics. Many new infectious diseases, such as Acquired Immunodeficiency Syndrome [AIDS], are constantly emerging. In 1997, an avian strain of influenza (H5N1) that had never before attacked humans began to kill previously healthy people in Hong Kong. This crisis raised the specter of an influenza pandemic similar to the one that killed 20 million people in 1918. Although no cases of animal or human illness have been identified in the U.S., the avian H5N1 influenza virus is spreading rapidly in birds and animals in other parts of the world. Such examples remind us that we are barely one step ahead of the microbes and underscore our need for a strong and vigilant public health system.

Infectious disease in domestic livestock has significant impacts to human populations that rely on their animals as a source of food or work. Historically, when a village depended on livestock for food and work, a disease impacting their animals could result in their starvation. People began to coordinate efforts to control diseases in animals to preserve their food supply.

Infectious Disease History in Minnesota

Between the middle of 1918 and the middle of 1919, the worldwide Spanish Influenza pandemic killed at least 21 million human beings -- well over twice the number of combat deaths in World War I. The “Spanish" flu had first appeared in America in spring 1918. All over the world, Spanish Influenza ravaged civilian populations. One-quarter of all Americans suffered bouts of influenza. More than 600,000 Americans died, 10,000 of them were Minnesotans. The city of St. Paul saw more than 1,000 deaths and Minneapolis more than 1,300. In recent years, the State of Minnesota has not had an infectious disease outbreak that reached epidemic proportion.

HIV (human immunodeficiency virus) is the virus that causes AIDS. HIV can spread from person to person during anal, vaginal, or less commonly, during oral sex. HIV can also be spread while sharing needles or reusing equipment to inject drugs, tattoo or body pierce. HIV can also be passed from an infected mother to her baby during pregnancy, childbirth or breastfeeding. Since MDH began tracking AIDS in 1982 and HIV in 1985, a total of 7,824 cases have been reported, including 2,772 that have died. MDH received a new reported HIV case every 29 hours in 2005. There are an estimated 5,233 people who are aware of their HIV status and are currently living in Minnesota.

West Nile Encephalitis is a viral disease transmitted to people and horses through the bite of an infected mosquito. West Nile Virus (WNV) is maintained in a transmission cycle involving one or more species of mosquitoes and birds. Current research is focusing on which mosquitoes and birds are most important in this cycle. WNV is usually found in Africa and southern Europe. The virus was first reported in North America during a 1999 outbreak of encephalitis in New York City.

Since 1999, WNV has moved rapidly to 48 states, the District of Columbia, 7 Canadian Provinces, 24 Mexican States, Dominican Republic, El Salvador, Jamaica, and the Cayman Islands. WNV was first detected in Minnesota July 23rd, 2002. From 1999-2006, 4,261 (956 deaths) human WNV cases were reported in the United States. Of these, 430 (12 deaths) were Minnesota residents.

Government supervision and regulation was a logical outcome of the need and interest to control disease in livestock and the Minnesota legislature created the Live Stock Sanitary Board for this purpose in 1903. This agency was renamed the Board of Animal Health in 1980. Diseases of concern in livestock at the beginning of the 20th century included glanders and equine infectious anemia in horses, anthrax, rabies, and tuberculosis. These diseases often caused illness and death in animals. Where chronic disease occurred, animals were of limited usefulness or not suitable for food. Although science had not yet advanced to identify the causative agents of these diseases, measures were taken to identify affected animals, remove them from the population and control movement of livestock to limit spread of disease. These methods were effective in reducing and often eliminating many diseases. Scientific advances in the early 1900s provided additional tools of testing and vaccination to control disease.

In the mid-1900s the US government selected specific livestock diseases for eradication from the US livestock population. These diseases were selected for eradication because they were transmissible to people and/or had a major impact on animal production, and effective methods were available to detect and control the transmission of the disease. These diseases included brucellosis in cattle and swine, and pseudorabies and hog cholera in swine. The table below summarizes some of the significant diseases in Minnesota livestock and poultry since the early 1900s.

Table 24 Infectious Disease of Livestock and Poultry in Minnesota

Date	Cause	Location	Impact	Containment Method
1800s to 1930	Glanders in horses	Statewide	Disease of respiratory tract and skin. Can be fatal or cause chronic disease in horses which limits horses ability to perform. Transmissible to people.	-Elimination of public watering troughs -Test and euthanize positive animals
1894-1972	Hog cholera in swine	Statewide	Fatal viral disease of swine. Animals die of disease and can't be used as food.	-Swine movement restrictions -vaccination - federal (USDA) / state eradication program
1880s – 1976 Recurred 2005 in NW MN	Tuberculosis in cattle	Statewide	Chronic disease of cattle that is transmissible to people. Cause for condemnation of animal as food at slaughter	-test and slaughter test positives - federal (USDA)/ state eradication program
1800s - 1984	Brucellosis in cattle and swine	Statewide	Chronic disease of cattle and swine that is transmissible to people. Causes abortions in animals	-test and slaughter -vaccination -federal (USDA) / state eradication program
1920s - 1975	Pullorum Disease in poultry	Statewide	A bacterial disease caused by one type of salmonella Causes death especially in young chickens and turkeys	-testing and improved sanitary measures in flocks -test and remove -national poultry improvement plan to classify farms according to disease presence

Preparedness for Infectious Animal Disease

The Board of Animal Health has the responsibility to protect the health of the domestic animals of the state through their authorities in state statute. The Board works with partners such as the Minnesota Department of Agriculture, US Department of Agriculture (USDA), Minnesota Veterinary Diagnostic Laboratory, other local, state and federal agencies, and industry organizations to prepare to respond to an animal disease emergency. Assets available to support an animal disease emergency include:

- A Minnesota agriculture incident management team
- State and federal animal health employees trained as responders in outbreak control
- Minnesota Veterinary Medical Reserve Corps – an organization of veterinary professionals with a subset of their membership trained in animal disease response
- USDA financial support, resources and national regulatory authority for disease response

Current response plans are exercised periodically to provide training for staff and partners. Training workshops for counties are planned for the upcoming year to assist local agencies in developing their plans to support a foreign animal disease response.

Future Perspectives

With our abundant mosquito and bird populations, we expect that WNV will become established in Minnesota. Similar to other mosquito-transmitted diseases already established in this area (LaCrosse encephalitis, Western equine encephalitis, and Eastern equine encephalitis), WNV will likely cause sporadic illness in humans (especially elderly people) and horses. Most people who are infected with West Nile virus have no symptoms or have an infection similar to a mild flu with fever, headache, and fatigue. Most cases of West Nile are treated in humans before the humans develop encephalitis, a serious illness of the brain. The death rate for humans who develop encephalitis ranges from 3 to 15 percent.

According to the U.S. HIV/AIDS Surveillance Report, year-end 2004, Minnesota has 4.3 AIDS cases per 100,000. The overall US rate is 15 cases per 100,000 people. People over 50 years of age and people with compromised immune systems have the highest risk of developing a severe illness from the virus.

Bovine Spongiform Encephalopathy (BSE) occurrences are rare in the US. However, more than 183,000 cases of BSE were confirmed in the UK alone in more than 35,000 herds through the end of November 2003. The risk to human health from BSE in the US is regarded by the Centers for Disease Control and Prevention (CDC) as extremely low.

The US has been free of Foot-and-Mouth Disease (FMD) since 1929, when the last of nine U.S. outbreaks was eradicated. Since FMD spreads widely and rapidly and because it has grave economic as well as clinical consequences, FMD is one of the animal diseases that livestock owners dread most.

Infectious disease is predicted to become increasingly significant as people and goods move more readily around the globe, organisms become resistant to our treatments and control methods, and livestock and people encroach on natural habitat. New diseases are discovered when they move from wildlife populations and impact people and livestock, and diseases are found in new places with the movement of people and goods around the world. In Minnesota as well as the US, there has been a recurrence of bovine tuberculosis (TB) in cattle. Highly infectious diseases of livestock such as foot and mouth disease are found in new parts of the world each year. Minnesota must be prepared to respond to these diseases if they are found in livestock in our state or country.

Sources of Information

http://www.bah.state.mn.us/

http://www.bah.state.mn.us/bah/emergency-planning/

http://www.aphis.usda.gov/animal_health/animal_diseases/

http://www.aphis.usda.gov/animal_health/emergency_management/

MN Department of Health, 2007.

Centers for Disease Control, National Center for Infectious Diseases, 2007

Fires (Structures and Vehicles)

This section addresses fires to property that is not considered a wildfire. The two types of property fires are classified as:

- Structure Fires
  - Residential single family dwellings, apartments, manufactured homes, hotels, motels.
  - Public and mercantile: stores, restaurants, grocery stores, institutions, churches, public facilities, education.
  - Industrial, Manufacturing, Other Buildings: basic industry, manufacturing, storage, residential garages, vacant buildings, unknown.
- Vehicle Fires
  - Mobile Property: aircraft, automobiles, trucks, trains, buses, boats.

Fires have many causes: cooking, heating, open flame and arson are the typical leading causes each year. Other causes include careless smoking, misuse of materials, improper storage, equipment / appliance malfunctions, improper building wiring, industrial mishaps, and instances such as train derailments or transportation collisions.

Fire History in Minnesota

In 2009 there was one fire reported every 34 minutes in Minnesota. One structure fire was reported every 1.3 hours. Rural structure fires occurred every 3.0 hours and metro structure fires occurred every 2.4 hours. One arson fire was reported every 7 hours. Total dollar loss from structure fires exceeded $200 million; approximately $571,000 per day, $23,800 per hour, and $400 per minute.

Table 28 represents the total deaths, injuries, and property loss resulting from fires from 2004 to 2009. In the past 30 years, 2,787 people have died due to fires in Minnesota. In 2009, the per capita death rate due to fire was 0.65 deaths per 100,000 people. Two counties in Minnesota have remained fatality free for 30 years: Norman and Traverse counties.

Year	Classification	Civilian Deaths	Civilian Injuries	Dollar Loss (in millions)
2009	Residential Structure	24 (69%)	105 (88%)	$100.6
	Other	11 (31%)	15 (12%)	$94.4
	Total	35*	120	$195.0
2008	Residential Structure	38 (73%)	114 (79%)	$104.1
	Other	14 (27%)	30 (21%)	$94.6
	Total	52	144	$198.7
2007	Residential Structure	31 (78%)	102 (87%)	$112.0
	Other	9 (22%)	15 (13%)	$46.3
	Total	40	117	$158.3
2006	Residential Structure	37 (80%)	121 (83%	$102.3
	Other	9 (20%	24 (17%)	79,6
	Total	46	145	$181.9
2005	Residential Structure	29 (73%)	125 (84%)	$96.3
	Other	11 (27%)	23 (16%)	$63.9
	Total	40	148	$160.2
2004	Residential Structure	28 (65%	90 (74%)	$83.1
	Other	15 (35%)	30 (26%)	$119.6
	Total	43	121	$202.7

***= Lowest number of fire deaths on record.**

Future Perspectives

Funding for fire suppression and education is available through the federal Assistance to Firefighters Grant (AFG), Staffing for Adequate Fire and Emergency Response (SAFER) Grants, Fire Prevention and Safety (FP&S) Grants, and the Assistance to Firefighters

Station Construction (SCG) Grant programs. Firefighter training grants are available through the Minnesota Board of Firefighter Training and Education.

Secondary Consideration Related to Natural Hazards

Flood, tornado, and high winds may cause structural fires in their aftermath. Downed power lines, natural gas leaks or other sources of ignition initiated by natural hazards may spark fire in structures. Routes to structures may be restricted due to flooding or debris from storms. Blizzards and ice storms may also impair the movement of response vehicles. Operation of critical response facilities located in flood hazard zones may be impaired if they become inundated with flood waters.

Sources of Information

Minnesota Department of Public Safety, State Fire Marshal Office. Fire in Minnesota, 2009.

Nuclear Generating Plant Incidents

Nuclear generating plants use the heat from nuclear fission in a contained environment to convert water to steam, which powers generators to produce electricity. The design, construction, and operation of these facilities are closely monitored by the U.S. Nuclear Regulatory Commission (NRC). In addition, the Minnesota Department of Health performs environmental monitoring as a way of assessing and trending exposure to the public.

The potential danger from an accident at a nuclear generating plant is exposure to radiation. This exposure would most probably come from the release of radioactive material from the plant to the environment. The release may be characterized by a plume (cloud-like formation) of radioactive gasses and particles. The major hazards to the people in the vicinity of the plume are radiation exposure to the body from the cloud and particles deposited on the ground, inhalation of radioactive materials, and ingestion of radioactive materials.

The effects of radiation exposure depend on the intensity and length in time of exposure to radiation. Low exposure, comparable to chest x-rays, may slightly increase the risk of cancer. Much higher exposures can cause radiation exposure or death.

Nuclear generating plants do not explode like nuclear detonation devices since the fuel is of low enrichment. There is no risk of a nuclear explosion with the associated physical mass destruction.

Nuclear Generating Plant History in Minnesota

The Monticello Nuclear Generating Plant (MNGP) located in Monticello, Minnesota, is owned by Xcel Energy Inc. It is a one-unit, boiling water reactor, rated at 553 megawatt capacity. MNGP is looking to increase their power an additional 71 MW in 2011 upon NRC approval.

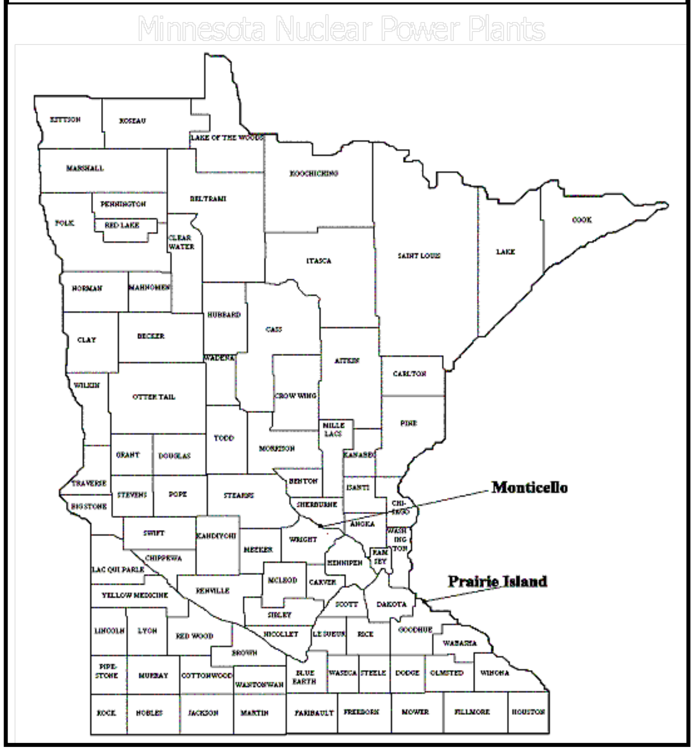
The Monticello plant began commercial operation in June 1971. The plant has been approved to operate through 2030. Currently there are 10 casks of spent fuel being stored in the owner controlled area. The dry casks will be shipped to a depository when one opens.

- Monticello
    - 6 % Power Uprate completed in 1998 (35 MWe)
    - 71 MWe online in 2011
    - Certificate of Need approved by MPUC
    - License amendment filed with Nuclear Regulatory Commission

Prairie Island 1 & 2 Nuclear Generating Plants are located in Red Wing, Minnesota and are owned by Xcel Energy Inc. Both units are pressurized water reactors rated at 538 (550 for a total of 1,100) megawatts electric and began operation in 1973 and 1974. PINGP will be filing a request to the NRC in late 2010 for an additional 82 MWe for each unit (Unit 1 in 2014 and Unit 2 in 2015). Storage of spent nuclear fuel in dry casks began in 1995. Currently there are 27 casks of spent fuel being stored in the owner controlled area.

- PINGP Extended Power Uprate
    - 82 MWe online in 2014 (Unit 1)
    - 82 MWe online in 2015 (Unit 2)
    - Certificate of Need approved MPUC
    - License amendment to be filed with NRC in late 2010

FIGURE 45 NUCLEAR FACILITIES IN MINNESOTA



Source: Radiological Emergency Preparedness

On December 7, 1979, following the March 1979 Three-Mile Island nuclear power plant accident in Pennsylvania, President Carter transferred the Federal lead role in off-site radiological emergency planning and preparedness activities from the NRC to Federal Emergency Management Agency (FEMA). FEMA established the Radiological Emergency Preparedness (REP) Program to [1] ensure that the public health and safety of citizens living around commercial nuclear power plants would be adequately protected in the event of a nuclear power station accident and [2] inform and educate the public about radiological emergency preparedness. FEMA's REP Program responsibilities encompass only "off-site" activities, that is State and local government emergency preparedness activities that take place beyond the nuclear power plant boundaries. Onsite activities continue to be the responsibility of the NRC.

Annual exercises are held so the NRC and FEMA may evaluate the utility, local, and state response organization. In addition, FEMA evaluates the local and state plans and preparation activities annually and issues a letter of certification if the planning for a response to an incident provides reasonable assuredness of safety to the public.

Future Perspectives

Local and state off-site response organizations have not been activated due to an actual incident at one of the nuclear generating plants since the program's inception in 1981. No

General Emergency activations which would start evacuation of the public have ever occurred in the state. The last General Emergency activation in the nation was during the Three Mile Island Accident in 1979.

The NRC has provided increased regulation and oversight to make nuclear reactors safer since 1979. Power plants also have robust security programs mandated by the NRC to deter and repel terrorists.

There are three state critical facilities in the Emergency Planning Zones for each plant. They are:

- Bureau of Corrections: Minnesota Correctional Facility-Red Wing with a replacement cost of $25,688,000.
- Department of Transportation: Truck Station-Monticello with a replacement cost of $871,920.
- Department of Transportation: Truck Station-Red Wing with a replacement cost of $574,200.

Sources of Information

Information supplied by Radiological Emergency Preparedness staff, Division of Homeland Security and Emergency Management, 2010

Hazardous Material Incidents

Approximately 6,000 facilities in Minnesota report their storage of hazardous chemicals to the Minnesota Department of Public Safety's EPCRA Program and their local fire department. Facilities meeting the reporting criteria submit this information annually as required under Section 312 of the federal Emergency Planning and Community Right-to-Know Act (EPCRA). The information is used by emergency planners and responders to plan for and respond to hazardous chemical emergencies.

Over 400 facilities in Minnesota report their routine chemical emissions and on and off-site chemical management activities to the Minnesota Department of Public Safety's EPCRA Program and the U.S. Environmental Protection Agency (EPA). Facilities meeting the reporting criteria submit this information annually as required under Section 313 of the federal EPCRA and is known as the Toxic Release Inventory (TRI). TRI data can be used to prioritize environmental regulatory efforts and promote pollution prevention and waste reduction.

Nearly 600 facilities in Minnesota submit Risk Management Plans (RMP's) to EPA summarizing procedures they have implemented to prevent accidental releases of certain chemicals into the air. Facilities meeting the reporting criteria submit this information every five years as required under Section 112r of the Clean Air Act Amendments of 1990. The information is used by emergency planners and responders to plan for and respond to hazardous chemical emergencies.

The Office of Pipeline Safety oversees pipeline operations throughout the state since 1987. The main office is located in St. Paul, with field offices located in Grand Rapids, Detroit Lakes, and Mankato. The Office of Pipeline Safety is in the Minnesota Department of Public Safety.

Profile of Pipeline Operators in Minnesota

93 Pipeline operators.
Nearly 1.5 million gas meters.
Over 65,000 miles of pipeline.
900 to 1000 inspection days annually.

Hazard History

Hazardous material releases may occur from any of the following:

- Fixed site facilities (e.g., refineries, chemical plants, storage facilities, manufacturing, warehouses, wastewater treatment plants, swimming pools, dry cleaners, automotive sales/repair, gas stations);
- Highway and rail transportation (e.g., tanker trucks, chemical trucks, railroad tankers and intermodal containers);
- Marine transportation (e.g., bulk liquefied gas carriers, oil tankers, tank barges);
- Air transportation (e.g., cargo packages); and
- Pipeline transportation (liquid petroleum, natural gas, other chemicals).

The following table shows significant events in Minnesota for all Hazardous Material modes including pipelines.

Table 26 Sample Minnesota Hazardous Material Incidents 2002-2009

SEVERITY	TYPE OF INCIDENT	INCIDENT SUMMARY DESCRIPTION
MEDIUM	PIPELINE	**July 4, 2002** An underground 34 inch transmission pipeline discharged approximately 50 barrels of crude oil. The pipeline was in a remote swampy area located 0.5 miles from Cohasset. The total spill amount was 6,000 barrels. All of the material was contained n the swampy area. Clean up crews used insitu burning to dispose of the material. There was no threat to any navigable waterways or environmentally sensitive areas.
POTENTIAL MAJOR	FIXED	**February 19, 2003** Fire at an oil storage facility in Barnesville. The entire facility was consumed in fire. The facility contained twenty 4,000 gallon lube oil tanks, three 12,000 gallon lube oil tanks, two 4,000 ethylene glycol tanks, and one tanker trailer with 7,000 gallons of lube oil. In addition, the facility had floor drains which lead to a 2,000 gallon waste tank. The tank, located outside of the facility, overflowed and released material into a ditch but no waterways were impacted. No injuries, fatalities, or evacuations were reported.
MEDIUM	PIPELINE	**November 5, 2003** A pipeline discharge in Brandon Township was reported. The incident resulted from third party damage to a pipeline. A farmer plowing his fields, crossed over a pipeline right-of-way, and damaged an underground gasoline pipe. This caused an estimated 50-

Table 26 Sample Minnesota Hazardous Material Incidents 2002-2009

SEVERITY	TYPE OF INCIDENT	INCIDENT SUMMARY DESCRIPTION
		100 barrels of gasoline to be discharged into soil. The spill occurred below the surface and no waterways were impacted.
MEDIUM	RAILROAD	**October 20, 2004** A storage tank spilled 5,000 gallons of lube oil at a railyard in St. Paul. The tank leaked oil onto the ground and into a nearby water dike. The cause of the leak was equipment failure. No injuries, no community impact, and no water supply contamination resulted.
UNKNOWN	PIPELINE	**December 28, 2004** An explosion leveled a two story building in Ramsey. The cause of the incident was due to a natural gas leak from a faulty connection. Three fatalities and one severe burn injury resulted. MN State Highway 10 was closed in all directions following the blast.
MEDIUM	MOBILE	**August 13, 2005** A 2000 gallon gasoline spill in St. Louis Park occurred. The material was released into Minnehaha Creek which leads to the Mississippi River. The cause of the incident was a stuck valve on the cargo hold of a tanker truck. No fires, fatalities, or evacuations were reported.
MEDIUM	PIPELINE	**May 3, 2006** A pipeline discharge resulted in 30 barrels of crude oil being spilled onto the ground at refinery located in Cottage Grove. The spill was due to a faulty gravitometer. There was no offsite or community impact or injuries.
UNKNOWN	PIPELINE	**November 28, 2007** Two welders were killed when an oil pipeline near Clearbrook exploded. The explosion was due to an oil mist that escaped from a coupling combined with nearby ignition sources.
MAJOR	PIPELINE	**December 4, 2009** 3500 barrels of crude oil containing 58,000 pounds of benzene spilled. The released material was into an excavation site from Line 2 of the Minnesota Pipeline stopple fitting on a main line due to equipment problems. No injuries or fatalities were reported. Most of the oil stayed within the excavation with some entering nearby woods.

Source: Environmental Protection Agency, National Response Center, 2010

WCCO News, 2010.

Future Perspectives

Accidental hazardous material releases, such as an unintended release from a pressure valve or a transportation accident, may cause the release of hazardous materials and complicate response activities. The impact of earthquakes on fixed facilities may be particularly bad due to the impairment of the physical integrity or even failure of containment facilities. The threat of any hazardous material event may be magnified due to restricted access, reduced fire suppression and spill containment, and even complete cut-off of response personnel and equipment. In addition, the risk of terrorism involving hazardous materials is considered a major threat due to the location of hazardous material facilities and transport routes throughout communities and the oftentimes limited anti-terrorism security at these facilities.

Sources of Information

Office of Pipeline Safety, Minnesota Department of Public Safety, 2010.

Transportation Incidents

The areas transportation discussed in this section are:

- Highways
- Railroads
- Commercial Waterways
- Aeronautics

Highways

The primary mode of transportation in Minnesota is highways. Minnesota has the fifth largest highway system in the United States. Minnesota has nearly 132,000 miles of streets and highways and 19,600 bridges. The Minnesota Department of Minnesota (MnDOT) is directly responsible for the trunk highway system and its bridges. The trunk highway system is comprised of 4,668 bridges and the roads are characterized as:

Principal Arterials	5,150 miles
Minor Arterials	5,565 miles
Collectors	1,205 miles
Local	13 miles
Total	11,933 miles

Even though state highways and interstates only make up about nine percent of the total statewide system mileage, they carry about 61 percent of the annual vehicle miles of travel. The remaining roads are under the jurisdiction of local governments.

MnDOT also has jurisdiction over all signs within trunk highway rights-of-way, all billboards along the trunk highways, and all ramp-metering devices in the metro area.

2009 Crash Facts

- 421 traffic deaths — lowest annual death count since 1944 and an 8 percent decrease from the 455 deaths in 2008.
- 141 alcohol related deaths — the lowest annual death count on record, yet alcohol-related crashes accounted for more than one-third of all traffic deaths, matching historical trends.

- 32,756 motorists arrested for DWI — in all, one in seven Minnesota drivers has been arrested for DWI.
- Just 129 of the 302 vehicle occupant deaths were belted; 50 percent of the unbelted deaths were ejected from the vehicle.
- Primary seat belt law helped state reach record-high daytime belt compliance rate of 90 percent (up from 87 percent), and resulted in fewer unbelted deaths.
- 53 motorcyclist deaths — a 26 percent drop from the 72 deaths in 2008, which was a 24-year high.

Source: Office of Traffic Safety, Minnesota Department of Public Safety, 2010.

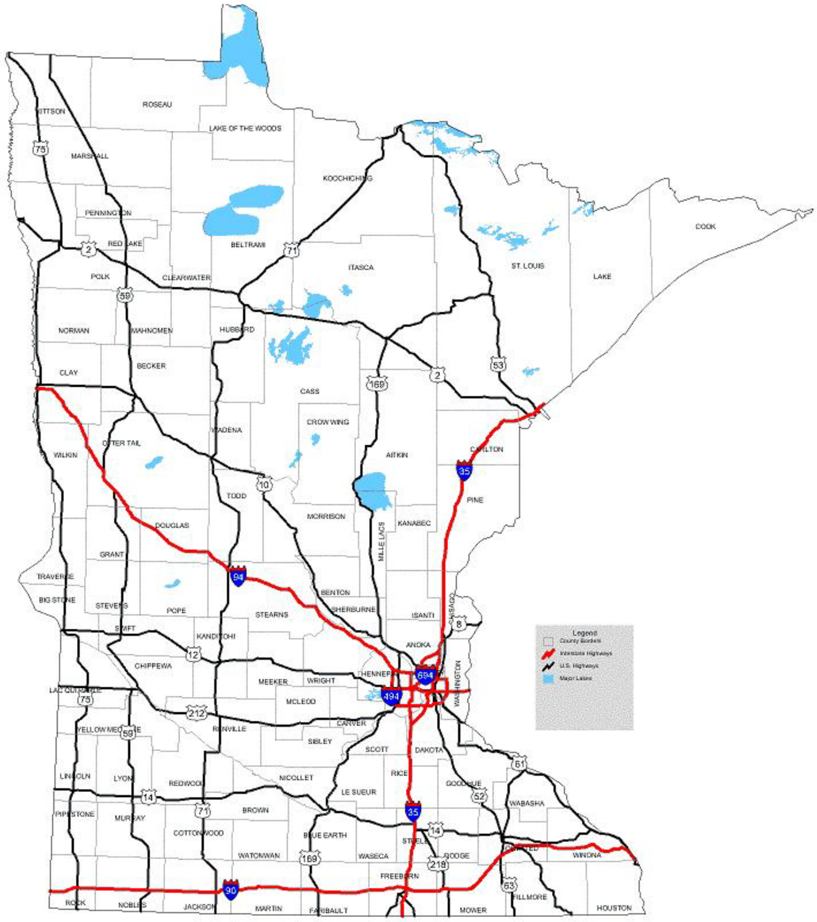
Hazard History

TABLE 27 TRAFFIC SAFETY PERFORMANCE MEASURES FOR MINNESOTA

	2004	2005	2006	2007	2008
Total Traffic Fatalities	567	559	494	510	456
Fatalities Per 100 Million Miles Driven	1.0	0.98	0.87	0.89	0.79
Passenger Vehicle Occupant Fatalities (All seat positions)	453	428	361	392	312
Alcohol Impaired Driving Fatalities (BAC=0.08+)	156	163	149	173	135
Speeding Related Fatalities	144	152	130	111	134
Motorcyclist Fatalities	52	59	67	61	71
Pedestrian Fatalities	37	44	38	33	26

Source: National Highway Traffic Safety Administration, 2010.

FIGURE 46 TRUNK HIGHWAYS IN MINNESOTA



Source: North Star Mapper

http://www.dot.state.mn.us/maps/cadd/highway_system/mnthsys.pdf

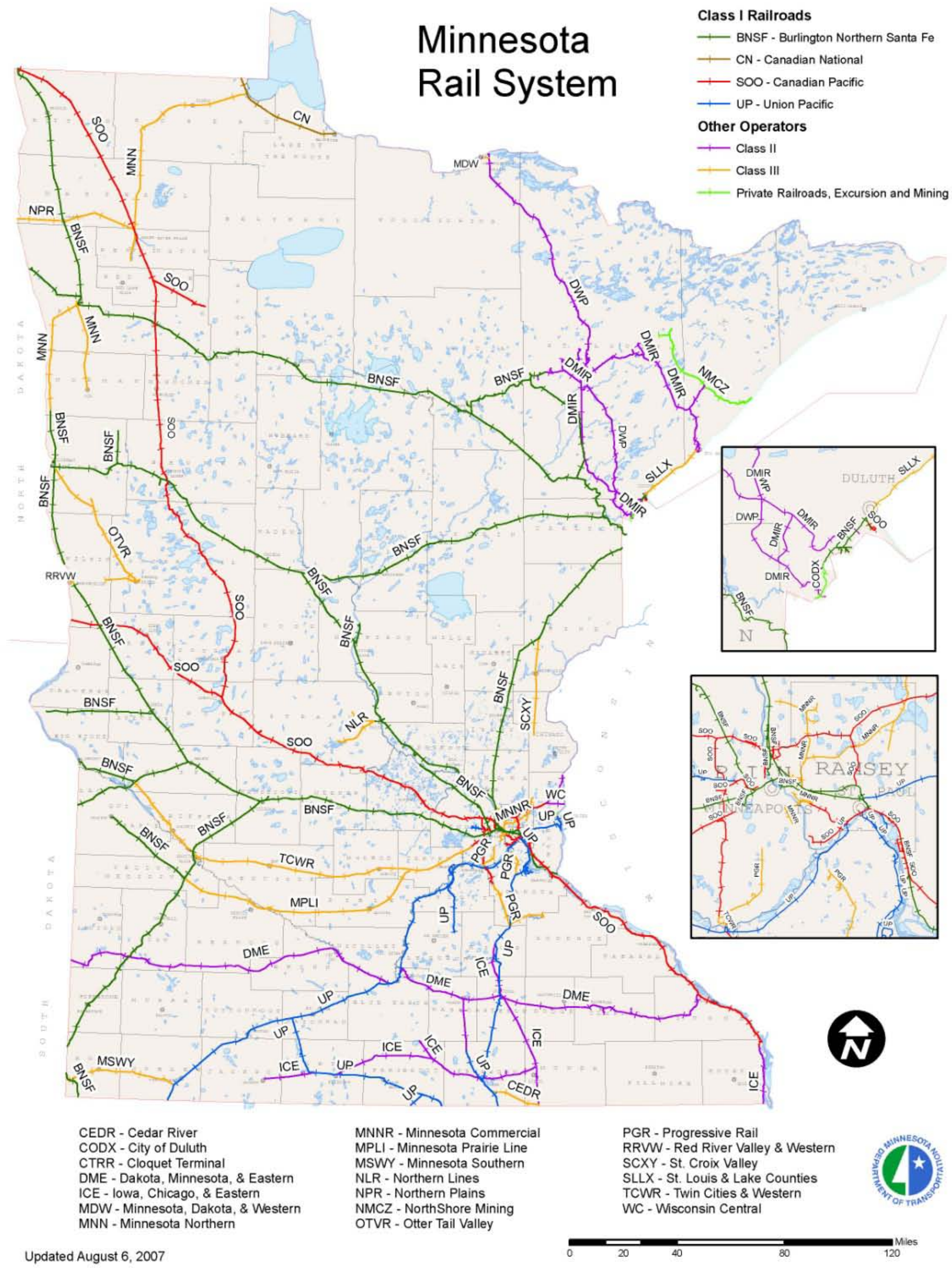
Bridge Inspections

A comprehensive bridge inspection program of 3,875 state owned bridges was initiated to be completed in 2007. Critical findings were found on a combination of fifteen highway bridges, pedestrian bridges, or timber truss bridges. As a result of the findings four bridges were repaired, five bridges had various restriction posted, five were closed, and one bridge was awaiting analysis for a new load rating. An annual bridge inspection program is administered by MnDOT.

Railroads

There are currently 4,711 miles of railway in Minnesota whose use is divided between freight, passenger, and light rail commuter services. Plans for commuter trains and more light rail are in various phases of implementation.

FIGURE 47 MINNESOTA RAIL SYSTEM



Source: Minnesota Department of Transportation, Minnesota Rail System

Goods between Chicago and ports in the northwest are hauled through Minnesota on railroads. Grain and lumber are also transported between the Midwest and the rest of the nation. A growing line of commodities to be hauled by rail are bio fuels. Iron ore and coal are raw materials transported through Minnesota to other parts of the country and the world via rail. Minnesota is sixth in the nation in total tons of commodities originating in the state and eleventh in total tons of commodities terminating in the state.

Rail transportation is subject to the elements and may slow service. An example from DR1717 in 2007 is that several rail bridges were demolished by flood and were rebuilt. Other natural hazards have effects but damage by flood is the most reported. Transportation of hazardous materials is discussed in that section.

Table 28 Minnesota Motor Vehicle/Train Crash Summary

	2004	2005	2006	2007	2008	2009
Total Deaths, All Accidents	19	11	20	12	11	16
Total Train Accidents, excludes highway-rail	72	67	57	62	65	43
Collisions, excludes highway-rail	3	1	1	5	1	
Derailments, excludes highway-rail	57	50	49	49	49	33
Total Highway-Rail Incidents	86	65	61	59	57	40
Total Deaths in Highway-Rail Incidents	15	9	12	5	6	6
Total Injuries in Highway-Rail Incidents	26	28	17	18	20	14
Trespasser Deaths	4	2	6	6	5	9
Trespasser Injuries	2	3	6	11	5	5

Source: Federal Railroad Administration, Office of Safety Analysis, 2010.

Commercial Waterways

The Mississippi River System

The Mississippi River System stretches over 222 miles in Minnesota. The river system supports five port areas whose combined 2009 waterway transported tonnage was 10.8 million net tons.

Minnesota’s largest river tonnage commodities are agricultural products, such as corn, soybeans and wheat. The River accounts for over 60% of Minnesota’s agricultural exports.

River ports also handle other dry cargo commodities such as coal, fertilizer, minerals, salt, cement, steel products, scrap metals and liquid products including petroleum, caustic soda, vegetable oils and molasses

The river navigational system serving Minnesota is maintained by the U.S. Corps of Engineers that dredges the navigation channels and operates the 29 locks on the Upper Mississippi River. The Locks serve both the commercial operators and recreational boaters. The commercial barge operators on the river pay for ½ of the cost of major Federal lock construction with a fuel user tax which is now 20 cents per gallon.

Table 29 Annual Minnesota River Port Tonnage

Port	2005	2006	2007	2008	2009
Minneapolis	1,024,877	1,069,238	795,372	781,155	545,840
St. Paul	5,462,801	5,511,445	5,126,732	3,469,383	5,071,864
Savage	3,018,613	3,214,351	3,201,406	1,705,650	2,777,677
Red Wing	787,883	920,610	851,692	631,870	735,417
Winona	2,008,029	2,204,375	2,099,746	1,573,239	1,672,630
Total	12,302,203	12,920,019	12,074,948	8,160,297	10,803,428

Tonnages will vary due to seasonal flooding, freight rates, and foreign grain demands.

Source: Minnesota Department of Transportation, 2010.

Lake Superior/Great Lakes/St. Lawrence Seaway

Minnesota has four ports on Lake Superior including Taconite Harbor, Silver Bay, Two Harbors and Duluth/Superior. Their combined waterway transported tonnage in 2009 was 41.5 million net tons. Due to the world economy which produced less steel, Minnesota's taconite tonnage dropped from 38 million tons in 2008 to 17.3 million tons in 2009. Normally Minnesota's taconite industry represents 60% of Minnesota's total tonnage transported on Lake Superior. Taconite is mined in north-eastern Minnesota and shipped mainly via the Great Lakes to steel mills in Indiana, Ohio and Pennsylvania.

Western coal is the leading commodity handled in the Duluth/Superior harbor at over 18.3 million net tons in 2009, and has been since 2005.

Other commodities handled by the Port of Duluth/Superior include cement, steel products, limestone, salt and wind generator components. Most of the products transported via the Lake have been on the rise over the last several years, except for 2009.

The U.S. Army Corps of Engineers operates three of the 16 locks on the Great Lakes/St. Lawrence Seaway and maintains a 29 foot deep channel throughout this system. The Canadian government operates and maintains the other 13 locks.

Ships that operate only on the Great Lakes are called "Lakers". Some of the Lakers range in length to over 1000 feet, are 105 feet wide and carry a cargo of 69,000 tons. Ships or Lakers operating on the Great lakes can load to no more that 26'6" draft in normal conditions. Since 1999, lake levels have been so low that they have reduced ship tonnage by as much as 6,000 tons per trip. Less tonnage results in higher freight costs per ton.

Table 30 Annual Minnesota Great Lakes Tonnage					
Port	**2005**	**2006**	**2007**	**2008**	**2009**
Duluth/Superior	45,943,855	47,234,022	47,858,484	45,640,001	31,210,918
Two Harbors	13,216,000	14,447,328	13,736,351	13,302,382	6,222,014
Silver Bay	5,787,772	4,814,261	5,487,958	7,217,823	3,384,622
Taconite Harbor	769,537	939,065	914,022	859,868	709,108
Total	65,717,164	67,434,676	67,996,815	67,056,074	41,526,662

Annual tonnages will vary due to low water, ice conditions and commodity demand.

Source: Minnesota Department of Transportation, 2010.

Aeronautics/Aviation

The National Transport Safety Board makes statistics available on a national basis in regards to flight safety. Minnesota specific information was not available. However, the national data indicates that the level of risk for flying is less than land travel in terms of fatalities per 100,000 miles. The impact of an incident involving a large aircraft may be large and involve an integrated response between Fire, EMS, Law Enforcement plus other agencies. Aircraft parked on the tarmac at airports are vulnerable to damage during high wind or hail storm events.

Ground and Surface Water Supply Contamination

Water is prized resource in Minnesota for many reasons. The “Land of 10,000 Lakes” is a motto that reflects the pride of residing in an area with an abundance of pristine natural water resources. Water resources are also the basis for robust agri-business and a diverse recreational industry. An ample supply of clean water is important in a world where water supply issues are blocking economic development and becoming issues in the international community.

There are many ways water supplies, aquifers, and wells may become contaminated. Examples are:

- Sewage, Partially Treated Waste Water, Sludge
- Leakage from Underground Storage Tanks
- Stormwater Runoff
- Runoff from Construction Sites
- Mines, Tailings, and Spoils

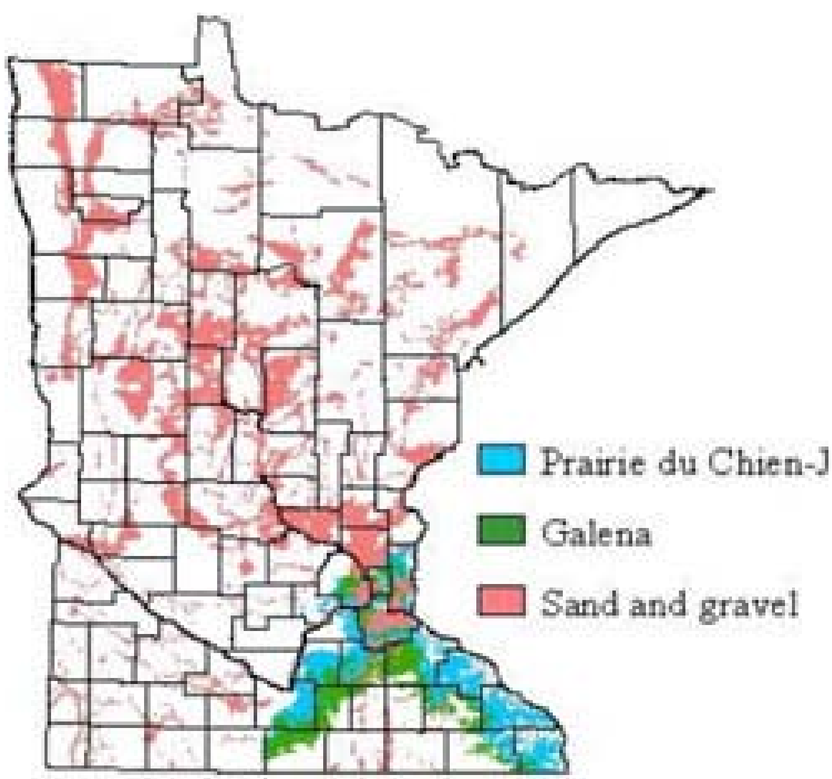
- Landfills and Dumps
- Industrial Effluents and Dumps
- Pesticides
- Animal Production Wastes
- Agricultural Run-Off from Crops

The Minnesota Department of Health, Department of Natural Resources, and the Pollution Control Agency have regulatory responsibility in regards to water pollution through the Board of Water and Soil Resources. The USDA Natural Resources Conservation Service also provides conservations programs that reduce water pollution. Many communities are located in Watershed Districts. Information about the programs these agencies provide may be found through local contacts or their websites.

Some of the secondary impacts due to floods are:

- Contaminated wells
- Inoperable sewage or water treatment plants
- Contaminated water supplies
- Runoff due to scouring of river banks

FIGURE 48 VULNERABLE AQUIFERS IN MINNESOTA



Source: Minnesota Pollution Control Agency 2007c.

History

The federal Clean Water Act requires states to:

- Assess all waters of the state to identify and list impairments
- Conduct Total Maximum Daily Load (TMDL) studies in order to set pollutant reduction goals
- Implement corrective measures to meet TMDLs pollutant reduction goals and restore waters to standards.

On November 4, 2008, Minnesota voters approved the Clean Water, Land and Legacy Amendment to the constitution to: protect drinking water sources; to protect, enhance, and restore wetlands, prairies, forests, and fish, game, and wildlife habitat; to preserve arts and cultural heritage; to support parks and trails; and to protect, enhance, and restore lakes, rivers, streams, and groundwater.

The Amendment increases the sales and use tax rate by three-eighths of one percent on taxable sales, starting July 1, 2009, continuing through 2034. Of those funds, approximately 33 percent is dedicated to the Clean Water Fund to protect, enhance, and restore water quality in lakes, rivers, streams, and groundwater Total funding for the 2009-10 biennium is approximately $150.8M - actual funding is based on collection of sales tax., with at least five percent of the fund targeted to protect drinking water sources.

Protecting Minnesota's waters is a joint effort between seven partner agencies, who collaborate and partner on Minnesota's water resource management activities under the Clean Water Fund:

- Minnesota Pollution Control Agency (MPCA)
- Minnesota Department of Natural Resources
- Minnesota Department of Agriculture
- Minnesota Department of Health
- Minnesota Board of Water and Soil Resources
- Minnesota Public Facilities Authority
- Metropolitan Council

Additionally, these agencies collaborate with the University of Minnesota's Water Resources Center.

Table 31 Clean Water Fund Funding

FY 2010-2011 Clean Water Fund	Outcomes
Monitoring: $16.74 million	Funds will be used to complete 20 percent of the needed statewide assessments of surface water quality and trends. Activities include monitoring lakes and streams in 12 to 16 of the state's major watersheds, sampling at the outlets of the state's major watersheds, and pass-through funding for local assessment monitoring efforts.
Water quality study development: $18.5 million	Funds will be used to develop TMDLs, protection strategies, and implementation plans for waters listed on the United States Environmental Protection Agency approved impaired waters list.
Restoration & Protection: $8.67 million	Administer the Clean Water Partnership and Wastewater Beneficial Reuse Grant program. Prevent impairments and degradation of lakes, rivers, streams and groundwater and civic engagement.
Groundwater assessment and drinking water protection: $7.25 million	2.25M for installation and sampling of at least 30 new shallow monitoring wells, analyze samples from at least 40 shallow monitoring wells each year for endocrine disrupting compounds and complete 4-5 groundwater models for TMDLs and watershed plans. $5M appropriated for groundwater protection or prevention of groundwater degradation activities

http://www.pca.state.mn.us/index.php/water/water-types-and-programs/clean-water-fund/clean-water-fund.html

Non-point source pollutants in public groundwater and/or surface water supplies are being more accurately identified and trended. More water treatment may be needed in the future to emerging characterization of pollution in groundwater and aquifers. An assumption based on the above examples is that water treatment is a growing area of public investment. Water treatment and storm sewers can be damaged by the rush of flood waters. One of the notable impacts to East Grand Forks was that eight wells/water treatment plants were affected. No potable water was available for 13 days and drinking water was not available for 23 days. Another example is damage estimates to water treatment facilities and storm sewers as seen in DR-1717-MN flooding.

Table 32 Community Water Supply Systems in Minnesota	
Public Water System Type	Number of Systems
Municipal	713
Nonmunicipal	241
TOTAL	954

*Does not include wells used for drinking water.

Source: Minnesota Department of Health, 2007b.

Storm drains are susceptible to damage during floods. The hydraulic forces on a system may cause damage. If storage for flow is inadequate, buildings in the area may be flooded.

Table 33 Storm Drainage Failures in Minnesota		
Date/Location:	Type of Failure	Summary of Impacts:
July1999, Minneapolis	Storm Water Overflow	Along highway I-35W in Minneapolis water shot up to heights exceeding 30 feet. A large diameter manhole cover was displaced by the pent-up head of the backed-up storm water in the storm drain.
September 2007, St. Paul	Storm Water Overflow	Five residences were flooded when storm drains overflowed during a rain storm. The city is determining if this was caused by designed restrictions.

Future Perspectives

As the commitment to clean water grows, the investment in treatment facilities and monitoring will also grow. Wastewater treatment plants, storm sewers, water supply/purification/distribution systems, runoff holding ponds and other pollution control devices are susceptible to damage during natural disasters. These systems may also be a source of damage during flooding. An example is storm sewers that do not have the capacity to move water in sufficient quantities thus cause flooding of neighborhoods. There may be treatment plants in floodplains close to a discharge point on a river. It is difficult to determine risk when the location of the facility is not readily available.

Sources of Information

Clean Water Legacy Act, 2007. Clean Water Legacy Act: Restoring and Protecting Minnesota's Waters, Case Studies and Examples; Board of Water and Soil Resources, February 2007

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Minnesota Public Safety Homeland Security Emergency Management, 2005. Minnesota All-Hazard Mitigation Plan.

Minnesota State Demographic Center. 2000 Census SF1 and SF3: Report and Mapping Menu, Summary Report, County at a Glance, or City at a Glance

www.lmic.state.mn.us/datanetweb/php/census2000/c2000_menu.php

http://www.pca.state.mn.us/index.php/water/water-types-and-programs/clean-water-fund/clean-water-fund.html

5. RISK ASSESSMENT: VULNERABILITY ASSESSMENT

Requirement §201.4(c)(2)(ii): *[The State risk assessment **shall** include an] overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments as well as the State risk assessment. The State **shall** describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events. State owned critical or operated facilities located in the identified hazard areas shall also be addressed.*

Requirement §201.4(d): *Plan must be reviewed and revised to reflect changes in development.*

All of the 20 hazards outlined in previous sections pose some risk to Minnesotans. Although the Interim Final Rule (IFR) requires that all natural hazards affecting the State be included in a detailed overview, it is not practical or desirable to perform detailed risk assessments on all of these hazards because many of them have little probability of affecting the State and/or it is difficult to mitigate their effects. It is also important to prioritize the highest risk hazards in order to maximize resources for mitigation efforts. It was determined to reduce the initial list of 20 hazards to those that:

- Have the highest probability of affecting the State, and
- Have the greatest potential for mitigation.

It is important to note that a more in-depth analysis of local risk assessments will become available through the completion of local mitigation plans and the HAZUS run. Mitigation staff will work with FEMA Region V to see if the pilot project for the Local Plan Integration was successful and should continue into the future.

This section provides detailed risk assessments for the four most significant hazards in the State, as identified through a process described previously. The process used to identify the most significant hazards was approved in the previous Plan (2008) and it was deemed not necessary to change the ranking. This qualitative rating is included at the end of each hazard discussed in the present section, as a way to address the issue of probability without undertaking detailed studies for all of the hazards.

5.1 Methodology for Identifying Hazards

The qualitative ranking system rated each of the 20 hazards by its probability and potential for mitigation. This ranking is not intended to supplant detailed risk assessment, but rather to allow time and technical resources to be focused on the most significant hazards.

Defined in the tables below, each hazard was determined to have a high, medium or low ranking for probability and mitigation potential. Each of the ranking levels has several criteria. These criteria were used as general guidelines so in some cases the rankings were weighted toward one or two of the criteria rather than all of them.

Table 34 Probability Ranking and Criteria for Hazard Identification and Disposition

Ranking	Criteria
High	The hazard has impacted the State annually, or more frequently The hazard is widespread, generally affecting regions or multiple counties in each event There is a reliable methodology for identifying events and locations
Medium	The hazard impacts the State occasionally, but not annually The hazard is somewhat localized, affecting only relatively small or isolated areas when it occurs The methodology for identifying events is not well-established, or is not applied across the entire State
Low	The hazard occurs only very infrequently, generally less than every five years on a large scale, although localized events may be more frequent The hazard is generally very localized and on a small scale (i.e. sub-county level) A methodology for identifying event occurrences and/or severities is poorly established in the State, or is available only on a local basis.

Table 35 Mitigation Potential Ranking and Criteria for Hazard Identification and Disposition

Ranking	Criteria
High	Methods for reducing risk from the hazard are technically reliable The State or Counties have experience in implementing mitigation measures Mitigation measures are eligible under Federal grant programs There are multiple possible mitigation measures for the hazard The mitigation measure(s) are known to be cost-effective The mitigation measures protect lives and property for a long period of time, or are permanent risk reduction solutions
Medium	Mitigation methods are established The State or Counties have limited experience with the kinds of measures that may be appropriate to mitigate the hazard Some mitigation measures are eligible for Federal grants There is a limited range of effective mitigation measures for the hazard Mitigation measures are cost-effective only in limited circumstances Mitigation measures are effective for a reasonable period of time
Low	Methods for reducing risk from the hazard are not well-established, are not proven reliable, or are experimental The State or Counties have little or no experience in implementing mitigation measures, and/or no technical knowledge of them Mitigation measures are ineligible under Federal grant programs

	There is a very limited range of mitigation measures for the hazard, usually only one feasible alternative The mitigation measure(s) have not been proven cost effective and are likely to be very expensive compared to the magnitude of the hazard The long-term effectiveness of the measure is not known, or is known to be relatively poor.

For each of the 20 initial hazards the Hazard Identification and Disposition table below lists the name of the hazard, data sources used in assessing it, the relative rankings for probability and mitigation potential, and the disposition of the hazard in this risk assessment. Disposition means how the hazard was addressed, either by performing a basic profile as required by the IFR, or through a more comprehensive risk assessment that provides projections of future losses due from the selected hazards impacting the State and its citizens. Guidance provided by FEMA in the document served as the basis for selecting the natural hazards profiled in the report.

Table 36 Hazard Identification and Disposition

HAZARD	DATA SOURCES	PROBABILITY	MITIGATION POTENTIAL	DISPOSITION
Flooding	FEMA HSEM MN DNR NOAA USDA USGS NWS Minnesota Climatology Working Group	High	High	General profile. HAZUS Risk Assessment for State-owned and –operated facilities
Tornadoes	NWS NOAA FEMA HSEM	High	High	General profile. Risk Assessment at County level. Risk Assessment for State-owned and –operated facilities.
Straight Line Winds	NOAA FEMA HSEM	High	High	General profile. Risk Assessment at County level. Risk Assessment for State-owned and –operated facilities.
Wildfire	MN DNR	High	High	General profile. Risk Assessment at

Table 36 Hazard Identification and Disposition

HAZARD	DATA SOURCES	PROBABILITY	MITIGATION POTENTIAL	DISPOSITION
	USFS HSEM FEMA			County level. Risk Assessment for State-owned and – operated facilities.
Hail	NOAA FEMA HSEM	High	Medium	General profile.
Coastal Erosion	USGS USACE	High	Medium	General profile.
Dam Failure	MN DNR USACE FEMA USACE Association of Dam Safety Officials National Performance of Dams Program HSEM	Medium	Medium	General profile.
Drought	Minnesota Climatology Working Group (MN DNR and U of MN) NOAA National Drought Mitigation Center Climate Prediction Center	High	Low	General profile.
Earthquakes	FEMA University of Memphis Center for Earthquake Information USGS	Low	Low	General profile.
Extreme Heat	FEMA HSEM	High	Low	General profile.
Landslides	FEMA USGS HSEM	Medium	Low	General profile.

Table 36 Hazard Identification and Disposition

HAZARD	DATA SOURCES	PROBABILITY	MITIGATION POTENTIAL	DISPOSITION
Sinkholes & Land Subsidence	FEMA USGS HSEM	Medium	Low	General profile.
Lightning	FEMA NOAA NWS University Corporation for Atmospheric Research (UCAR)	High	Low	General profile.
Winter Storms	FEMA HSEM Department of Military Affairs NOAA	High	Low	General profile.
Fire (Structure and Vehicle)	DPS State Fire Marshal Office	Medium	Low	General profile.
Ground and Surface Water Supply	Board of Water and Soil Resources State Demographic Center PCA MDH	Medium	Medium	Methodology is not applied across the state.
Hazardous Materials	HSEM LMIC US DOT MN DOT Bureau of Transportation Statistics	Medium	Low	General profile.
Nuclear Generating Plants	HSEM NRC Nuclear Energy Institute	Low	Low	General profile.
Infectious Disease Outbreak	MDH BAH HSEM CDC	Low	Low	General profile.

Table 36 Hazard Identification and Disposition

HAZARD	DATA SOURCES	PROBABILITY	MITIGATION POTENTIAL	DISPOSITION
Transportation	MN DOT Minnesota Public Radio	Low	Low	General profile.
Tropical Cyclones	MHIRA indicates that tropical cyclones have a very low chance of occurrence in Minnesota	Low	Low	Not profiled due to low probability and mitigation potential.
Snow Avalanches	MHIRA indicates that snow avalanches have a very low chance of occurrence in Minnesota	Low	Low	Not profiled due to low probability and mitigation potential.
Expansive Soils	MHIRA indicates that expansive soils have a very low chance of occurrence in Minnesota	Low	Low	Not profiled due to low probability and mitigation potential.
Tsunami	MHIRA indicates that tsunamis have a very low chance of occurrence in Minnesota	Low	Low	Not profiled due to low probability and mitigation potential.
Volcanoes	MHIRA indicates that volcanoes have a very low chance of occurrence in Minnesota	Low	Low	Not profiled due to low probability and mitigation potential.

As expected, the classification process provided a clear stratification of the hazards based on these criteria. The state has identified floods, tornadoes, straight-line winds and wildfire as the hazards that present highest risk to the State and the most potential for mitigation based on this limited assessment. In the sections that follow, these hazards are afforded detailed risk assessments in order to identify the areas of the State that are most at risk, and this information is in turn used as the basis for determining appropriate actions to reduce the risks.

As discussed earlier, this ranking system is not intended to supersede more detailed and focused risk assessment procedures. As the State re-evaluates and updates this Plan, it may be appropriate to revisit this ranking methodology and perform full risk assessments for additional hazards.

Because it forms the basis of the State Hazard Mitigation Plan, the state-level risk assessment should be as comprehensive as possible. As discussed elsewhere in this risk assessment, the initial list of 20 hazards was reduced to four for the more detailed vulnerability assessment provided in this section. A HAZUS risk assessment has been done for flooding in the state for the 2011 Plan update. The hazards included in this section are:

- Flooding
- Tornado

- Windstorms (thunderstorms & straight-line winds)
- Wildfire

First, it is important to understand the meanings of several terms that appear in both the Federal hazard mitigation planning rules and this Plan. The terms **risk, probability and vulnerability** appear many times in both places, and those terms and others are defined below and given some context in terms of this plan.

Probability is the likelihood that events of particular severities will occur. The ability to calculate probability varies considerably depending on the hazard in question. In many areas of the country, flood studies of various kinds can provide reasonably accurate estimates of how often water will reach particular places and elevations. On the other hand, tornadoes are notoriously difficult to predict, although general areas of impact can be determined (it is also possible to predict the seasons of the year that are most likely to produce tornadoes.) Probability is a key element of risk because it determines how often the events are likely to happen.

It is important to note that risk is cumulative. This means that although natural hazards may not affect a place in any particular year, the probability of one or more events (in some places multiple events) occurring “adds up” over time. Risk calculations incorporate all expected future events – usually with some limit on the time horizon that is considered – in order to account for both repetitive events and for the probabilities that accumulate over time. So, over time the possibility of the hazard event happening increases.

Severity is the measure of “how bad” a hazard event is. The severity of different hazards is measured in different ways, although most hazards are fairly straightforward to categorize. For example, floods can be measured in terms of depth, velocity, duration, contamination potential, debris flow, and so forth. Tornadoes are measured primarily in terms of wind speed, although their duration on the ground can also be an important factor in their destructiveness.

Vulnerability is the extent to which something is damaged by a hazard.

Value is how much something is worth. Although the concept may generate disagreement, it is possible to assign a value to many community “assets” including physical components such as buildings and infrastructure, functional ones such as government or business operations, and even injuries and casualties.

Risk is often expressed in dollars of future expected losses. It is calculated in this way so that different kinds of losses can be adequately compared. For example, without a common basis for comparison, it would be virtually impossible to determine if the risk of injury from future tornadoes is greater than damage to vehicles in future floods. When the expected losses are converted to and expressed in dollars, the damages can be compared and prioritized. In combination with the concepts discussed above, almost any kind of hazard can be quantified and its risk expressed. The exceptions to this idea are infrequent or highly unpredictable events such as meteors impacting the earth, or manmade hazards such as terrorism. In these cases, the element of probability is virtually impossible to characterize, and the risk calculus cannot be accurate without it.

5.2 Vulnerability Assessment by Jurisdiction

Requirement §201.4(c)(2)(ii): *[The State risk assessment* ***shall*** *include an] overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments as well as the State risk assessment. The State* ***shall*** *describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events…*

The state has continually provided guidance and technical support to the local mitigation plans and has encouraged the sharing of information both between local planning projects and with the state. The state has brought this information directly to the local planning efforts via statewide workshops and planning forums. Additional technical assistance will be provided in the future and will include:

- Providing GIS maps, tables and text necessary to assess risks.
- Compiling statewide dataset of critical facilities.
- County HAZUS-MH reports.

Once local planning data and information is compiled and analyzed in a comprehensive manner, a greater understanding of where the highest risks are across the state will be obtained; with this, the state will be better prepared to decide where and how mitigation resources can be most effective. Data from the statewide flood risk assessment (HAZUS) will be made available to counties and local jurisdictions for their review and incorporation into local hazard mitigation plans, land use planning and mitigation projects. In addition, local jurisdictions may update the critical infrastructure/facilities database for inclusion in a future more detailed HAZUS analysis.

Local Risk Assessments

A local plan integration pilot project was undertaken for the 2011 Plan update and is discussed in depth in Section 7.4. A summary of the local hazard risk assessments for the 16 local jurisdictions reviewed indicates the hazard ranking mirrors the state risk assessment. The local risk assessment included flooding, summers storms* and wildfire is as their top natural hazards. A summary is included in Table 37. All jurisdictions are vulnerable to flooding, summer storms and wildfire (with the exception of the metropolitan Hennepin County). Each jurisdiction had a slightly different risk assessment methodology, but similar rank and risk terminology, all plans ranked hazards as High, Medium and Low – per the state risk

Most plans ranked Risk on a High, Moderate and Low scale, however some counties also included Very High, and Moderate/Low, see legend.

*Summer storms - local plans often categorize hazards differently than the state plan. Since many local plans combine tornadoes and windstorms into a single hazard, these were collapsed into a single category (summer storms).

TABLE 37 LOCAL HAZARD RISK ASSESSMENT

	Summer Storms*		Wildfire		Flooding	
Jurisdiction	**Rank**	**Risk**	**Rank**	**Risk**	**Rank**	**Risk**
Chippewa County	#2	M	#3	ML	#1	M
City of St Paul	#2	H	#3	M	#1	H
Clay County	#2	M	#3	L	#1	H
Cook County	#2	M	#1	VH	#3	L
Hennepin County	#2	M	N/A	N/A	#1	M
Houston County	#2	H	#3	H	#1	H
Itasca County	#1	M	#2	M	#3	L
Mille Lacs County	#3	M	#1	H	#2	M
Mille Lacs Band of Ojibwe	#2	M	#1	H	#3	M
Mower County	#2	M	#3	L	#1	H
Red Lake County	#1	H	#3	M	#2	M
Renville County	#2	M	#3	L	#1	M
Scott County	#2	H	#3	M	#1	H
St. Louis County	#2	M	#1	H	#3	L
Wadena County	#1	H	#3	L	#2	H
Washington County	#1	H	#3	L	#2	H

Legend	
Rank	**Risk**
	VH - Very High
#1 - Highest County Hazard	H - High
#2 - Medium County Hazard	M - Moderate
#3 - Low County Hazard	M/L - Moderate / Low
	L - Low

Each of the 87 county in the state has been included in a Presidential Disaster Declaration. A Chronological History of Minnesota Disasters is located in Appendix H. It contains information on the type of programs - Public Assistance, Individual Assistance, and number of applicants for Individuals and Household Program, Other Needs Assessment, Small Business Administration disaster loan program, state match, if any, and total dollar amounts where available. Minnesota Disaster History 2008-2010 includes disaster information since the previous version of the Plan.

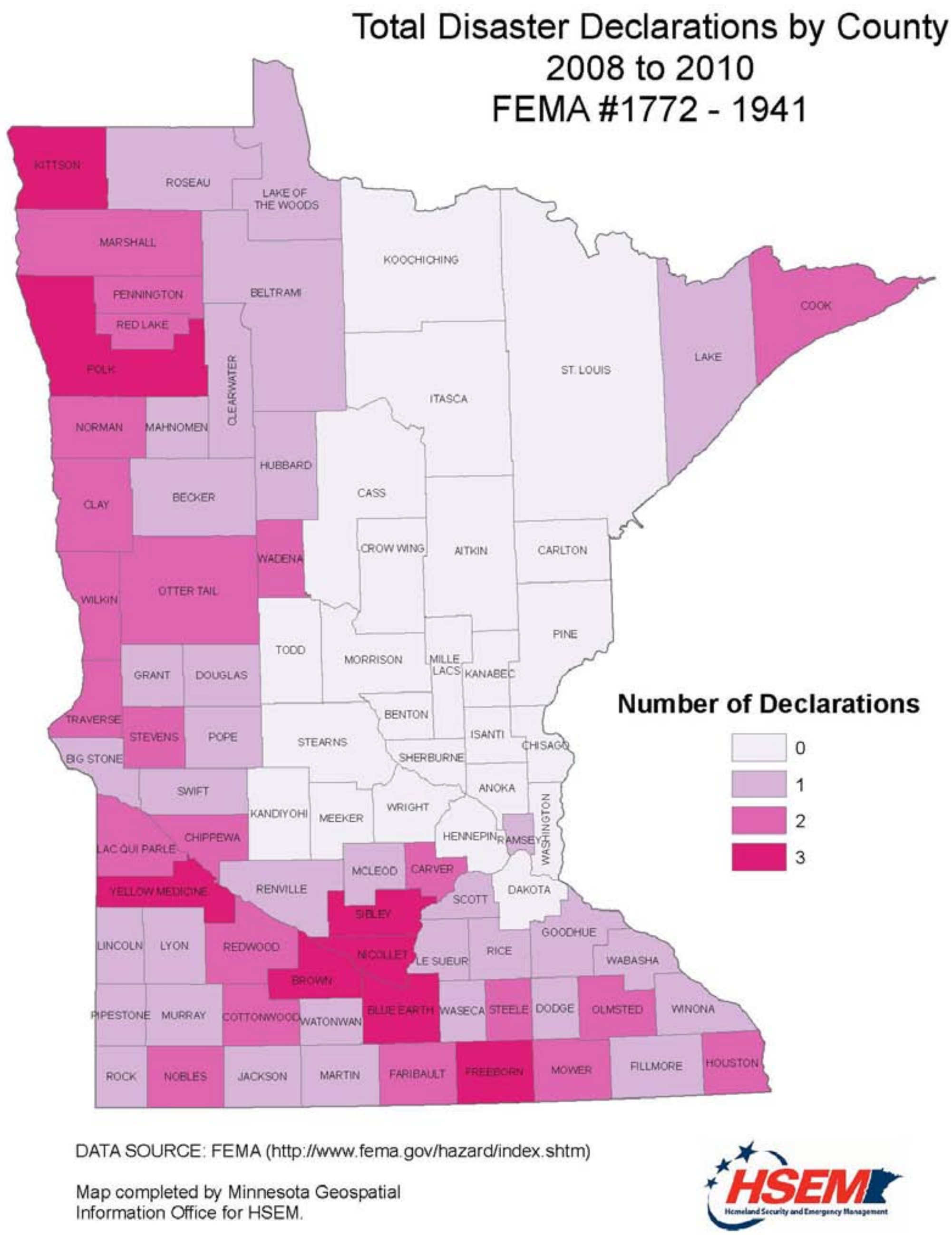
It bears repeating that all jurisdictions in the state are vulnerable to natural hazards, especially flooding and severe storms.

Table 38 Disaster Summary 2008-2010

Year	Disaster Number	Disaster Summary	Program	State Match
2010	1941	Severe Storms and Flooding (Southern Minnesota/Zumbro Falls) Yellow Medicine, Lincoln, Lyon, Pipestone, Rock, Murray, Nobles, Redwood, Cottonwood, Jackson, Faribault, Le Sueur, Waseca, Rice, Brown, Watonwan, Martin, Carver, Sibley, Nicollet, Blue Earth, Freeborn, Steele, Goodhue, Dodge, Mower, Wabasha, Olmsted, Winona Small Business Administration (Primary) Wabasha, Olmsted, Steele, Martin Small Business Administration (Contiguous) Jackson, Watonwan, Blue Earth, Faribault, Rice, Winona, Fillmore, Waseca, Freeborn, Goodhue, Dodge, Mower	PA	25%
2010	1921	Severe Storms, Tornadoes, and Flooding (Wadena Tornado) Faribault, Freeborn, Olmsted, Otter Tail, Polk, Wadena Blue Earth, Brown, Houston, Kittson, Nicollet, Sibley PA 158 applicants/$37,596,586	PA	25%
2010	1900	Flooding (Red, Minnesota, and Mississippi Rivers and Tributaries) Big Stone, Blue Earth, Brown, Carver, Chippewa, Clay, Kittson, Lac qui Parle, Marshall, Norman, Polk, Redwood, Renville, Scott, Sibley, Traverse, Wilkin, Yellow Medicine, Cottonwood, McLeod, Pennington, Ramsey, Red Lake, Stevens, and the Upper Sioux Tribal Community, Prairie Island Tribal Community.	PA	25%
2009	1830	Severe Storms and Flooding (Red River Basin) IHP: 648 Applicants/$2,114,688 ONA: 134 Applicants/$109,409 PA:648 Applicants/$39,321,490 *Traverse, Wilkin, Clay, Norman, Polk, Marshall, Beltrami* Yellow Medicine, Lac Qui Parle, Chippewa, Swift, Pope, Mahnomen, Clearwater, Kittson, Roseau, Lake, Cook Pennington, Red Lake, Lake of the Woods, Becker, Grant, Douglas, Otter Tail, Wadena, Hubbard, Stevens	*IA/PA* PA	25%
2008	1772	Severe Storms and Flooding (SE MN) PA: 114 Applicants/$8,443,444 Houston, Cook, Nobles, Freeborn, Mower, Fillmore	PA	15%

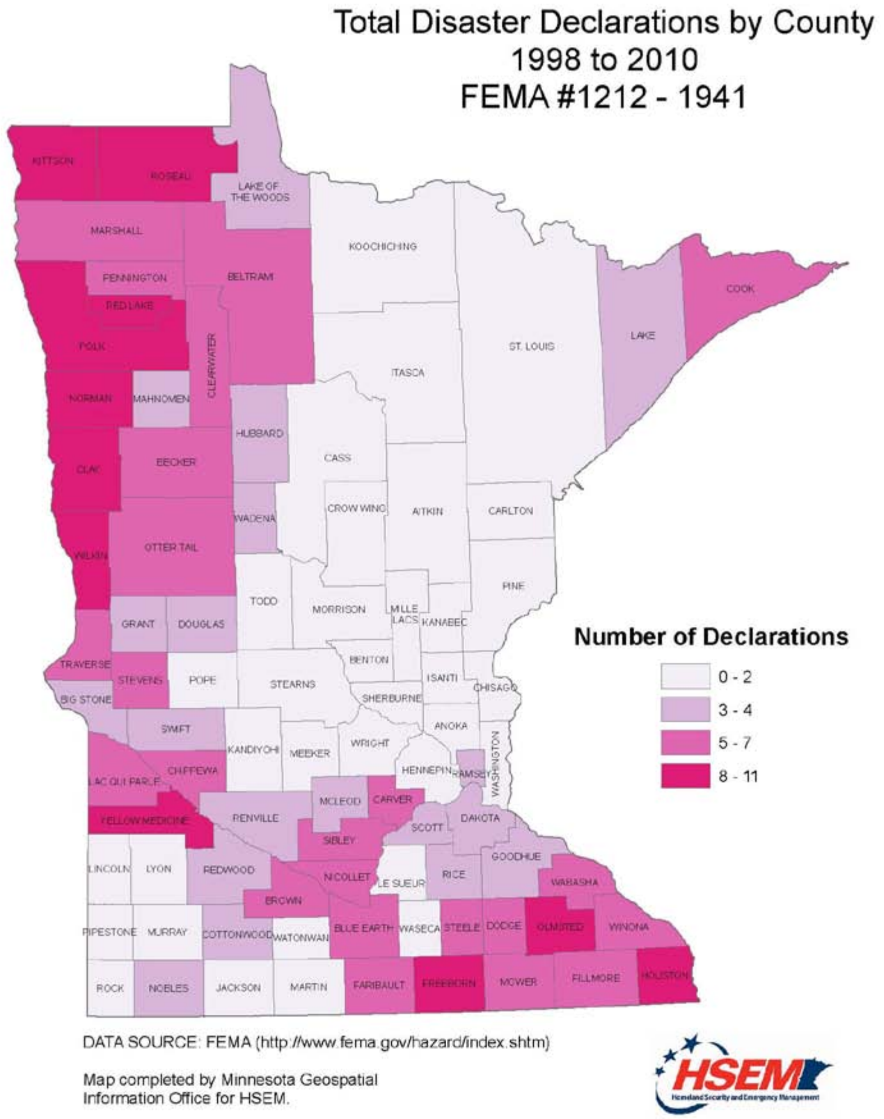
The following map indicates counties included in disaster declarations since approval of the 2008 Plan, per the information in Table 38.

FIGURE 49 DISASTER DECLARATIONS 2008-2010



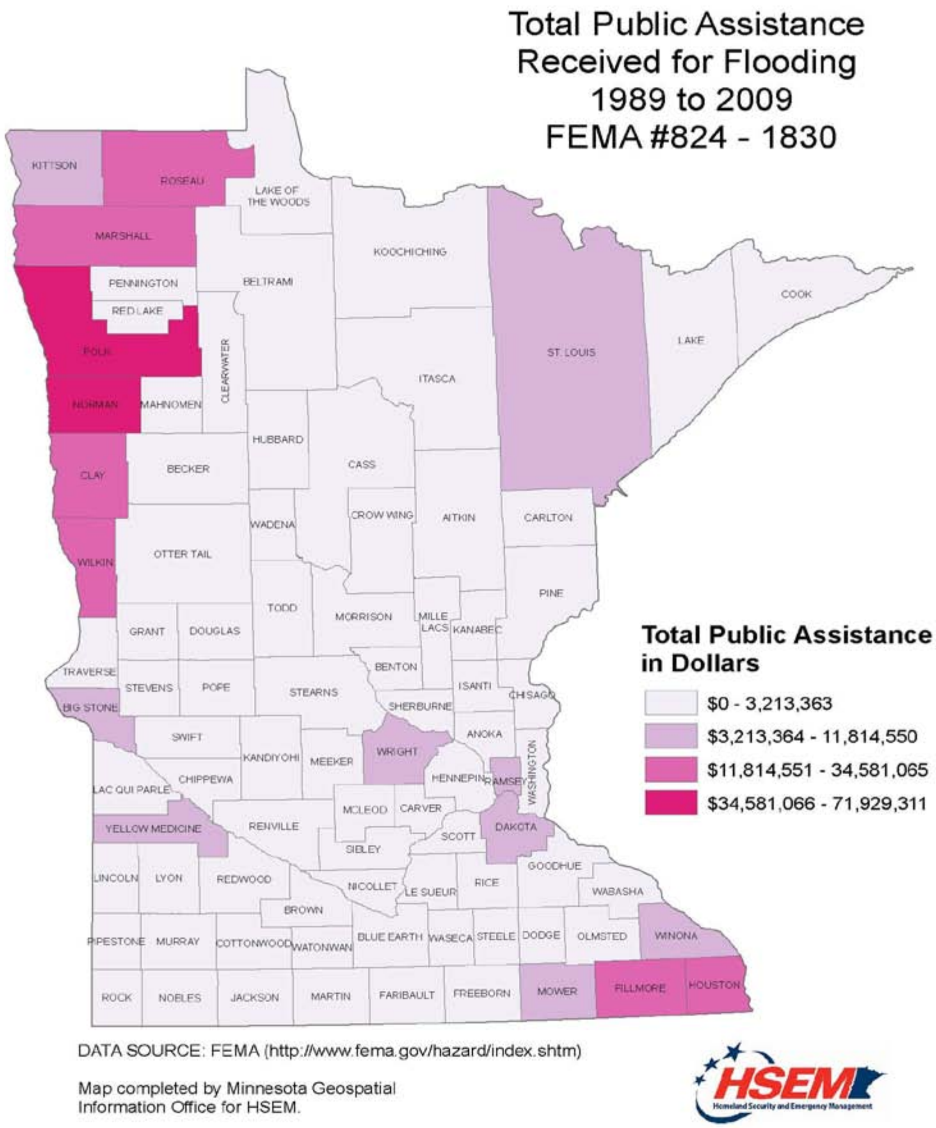
To look further back in Minnesota history, Disaster Declarations by County shows disasters from 1998 through 2010. As the map indicates, the northwest and southeast portions of the state are most prone to disaster, though the west central and Arrowhead region of the state also have been included in disaster declarations.

FIGURE 50 DISASTER DECLARATIONS BY COUNTY



Public Assistance for Flooding Disasters, Figure 51 was created to graphically represent the data from Appendix I, which details federal, state and applicant share for disaster payments to counties from 1989 through 2009. The data includes funding for disasters that included flooding (the majority of disasters in the state). Unfortunately, the spreadsheet does not include data for disasters that did not include flooding, including DR-1622-MN Ice storm, DR-1225-MN for Tornadoes, DR-1158-MN for Blizzard and DR-1151-MN for Snow. It also does not include recent disasters Dr-1900-MN, DR-1921-MN and DR-1941-MN.

FIGURE 51 PUBLIC ASSISTANCE FOR FLOODING DISASTERS



Public Assistance dollars for disasters are a good indicator of vulnerability, as are previous occurrences and damages per NCDC databases. Combining these two data sources with indemnity losses (crop/agriculture insurance dollars) a picture that indicates all counties in the state are vulnerable to natural hazards. The following information reviews hazard specific vulnerability to tornadoes, windstorms and wildfires.

Tornadoes

It is difficult to predict with any accuracy where a tornado will strike. From May to July, over 75 percent of all tornadoes occur in Minnesota. Although site-specific tornado probability is impossible to determine, it is reasonable to assume that the average annual number will remain relatively constant in the future. It is worth noting, however, the numbers of deaths and injuries can fluctuate drastically depending on the severity of the tornadoes and the locations that they impact. As the table below indicates, two metropolitan and highly populated counties (Hennepin, Anoka) rank the highest for property loss, deaths and injuries during the past ten years, though less populated counties are just as vulnerable to major damages, death and injuries from tornadoes.

Table 38 Tornado Damage Frequency from 1999-2009

COUNTY	# TORNADOES	TOTAL DAMAGES	AVG. DAMAGE/EVENT	ANNUAL PROBABILITY
Hennepin	3	$34,007,500	$11,335,833	0.3
Anoka	3	$28,150,000	$9,383,333	0.3
Kandiyohi	3	$1,030,000	$343,333	0.3
Freeborn	2	$22,000,000	$11,000,000	0.2
Wadena	2	$10,037,500	$5,018,750	0.2
Blue Earth	1	$2,000,000	$2,000,000	0.1
Brown	1	$15,000	$15,000	0.1
Cass	1	$7,500	$7,500	0.1
Chippewa	1	$23,112,500	$23,112,500	0.1
Mower	1	$2,000,000	$2,000,000	0.1
Murray	1	$7,500	$7,500	0.1
Nicollet	1	$26,277,500	$26,277,500	0.1
Otter Tail	1	$5,022,500	$5,022,500	0.1
Rice	1	$20,007,500	$20,007,500	0.1
Roseau	1	$20,000,000	$20,000,000	0.1
Sibley	1	$15,037,500	$15,037,500	0.1
Swift	1	$10,052,500	$10,052,500	0.1
Watonwan	1	$2,000,000	$2,000,000	0.1
Winona	1	$2,015,000	$2,015,000	0.1
Wright	1	$1,000,000	$1,000,000	0.1

Data Limitations

The combined dollar amounts for injury, death and property damage change the vulnerability somewhat but mostly for smaller populated counties where death and injury damages can change the total damage figures quite drastically. With better and more warning signals and radios, injury and death numbers should continue to decrease. Thus, the combined numbers (death, injury and property damage) may skew the vulnerability somewhat. Years ago, this might have been the most accurate method of figuring vulnerability but today and especially in the future, the property damage amounts may be a better indicator of vulnerability.

Note: The death and injury dollar figures used for the current risk assessment were $3 million for death and $7,500 for injury. The next update of this plan in 2014, the state will use the new FEMA Standard Values for Casualties and Injuries: Dead-Fatal $5.8 million, and three injury amounts –hospitalized ($1,088,000), treat and release ($90,000) and self-treatment ($12,000). These standard values were not used in this analysis because there currently is no methodology to separate the three different types of injuries. In addition, the relative values of deaths and injury would likely not change the ranking results.

Windstorms

All jurisdictions are vulnerable to windstorms in Minnesota. Estimating vulnerability or annual probability of future damaging events based on past occurrences is only as good as the reporting in each county. The following table lists number of windstorms with reported damages for 1999 to 2009, and the annual probability of future events based on past ten years of record. The highest likelihood that a severe wind event will occur is in Otter Tail County. There were 16 counties that did not report any damaging events, the remaining counties had listed events, but reported no damages.

Damages to crops from windstorms is another dataset that conclusions regarding jurisdictional vulnerability can be drawn from. Indemnity claims from 2000-2009 for wind (wind/excess wind, cyclone) are seen in the table below. Data is from Business with Month of Loss, USDA, Risk Management Agency http://www.rma.usda.gov/data/cause.html. This data indicates agriculture in the west central portion of the state has been vulnerable to windstorms. As in the section on tornadoes, windstorm vulnerability does not always coincide with the annual probability of the event.

Table 39 Probability of Damaging Events due to Windstorm

County	# of Windstorm Events	Total Damages	Annual Probability
Wright	4	$15,000,000	0.4
Kandiyohi	5	$10,000,000	0.5
Renville	3	$6,000,000	0.3
Nobles	7	$2,000,000	0.7
Rock	3	$2,000,000	0.3
Washington	2	$1,000,000	0.2
Crow Wing	3	$22,500	0.3
Pope	4	$15,000	0.4
Itasca	6	$7,500	0.6
Otter Tail	30	$7,500	3
Wadena	9	$7,500	0.9

Wildfire

The Minnesota Department of Natural Resources (DNR) annually responds to an average of 1,580 fires that burn 37,320 acres. The DNR is the lead state agency for wildland fire prevention and response. However, other agencies also respond to fires in designated protection areas including local fire departments and Federal agencies such as the Bureau of Indian Affairs, Forest Service, Fish and Wildlife Service, and the National Park Service. As noted in the risk assessment, the U.S. Fire Administration maintains records of the average numbers of acres burned each year in wildfires, by State.

Total indemnity claims for fire were negligible for the past ten years. Pipestone, Redwood and Wabasha counties were the only three counties to report and damages were $685, $100 and $1,440 respectively, this column was taken out of the table, but is included in the totals. A better picture of vulnerability for agricultural counties can be gleaned from total indemnity claims from all natural hazards.

Table 40 Wildfire Damages > $1M

County	# of Wildfires	Total Damages
Aitkin	530	$ 9,010,856
Crow Wing	806	$ 5,538,095
Sherburne	393	$ 5,106,745
Saint Louis	2059	$ 4,163,400
Morrison	747	$ 3,695,222
Becker	869	$ 3,469,628
Todd	211	$ 3,278,219
Otter Tail	141	$ 3,276,849
Benton	357	$ 3,212,129
Anoka	313	$ 3,163,682
Kandiyohi	12	$ 3,048,379
Clay	6	$ 3,002,210
Pine	927	$ 2,215,919
Itasca	660	$ 1,622,905

Combined Natural Hazards

The total indemnity claims for the 2000-2009 time period was over $33 million. Combined wind damages were over $23.1 million, and flood over $9.6 million. See Appendix K for Crop Loss Data by county. The data file contains total crop losses due to wildfire, flood, tornado and wind for Minnesota counties from 2000 to 2009. The Total Crop Losses by County is a state map of these values.

Table 41 Total Indemnity Claims for Flood, Wildfire, Tornado and Wind on Crops 2000-2009

COUNTY	FLOOD	TORNADO	WIND	TOTAL LOSSES
Lac qui Parle	$52,389		$5,597,290	$5,649,679
Norman	$2,278,570		$311,519	$2,590,089
Marshall	$1,789,473		$430,052	$2,219,525
Chippewa			$1,402,487	$1,402,487
Nobles	$103,793		$1,177,084	$1,280,877
Kittson	$1,116,099		$113,676	$1,229,775
Roseau	$1,128,978	$7,160	$12,328	$1,148,466
Swift	$59,698		$877,228	$936,926
Renville	$42,901		$761,122	$804,023

Table 41 Total Indemnity Claims for Flood, Wildfire, Tornado and Wind on Crops 2000-2009

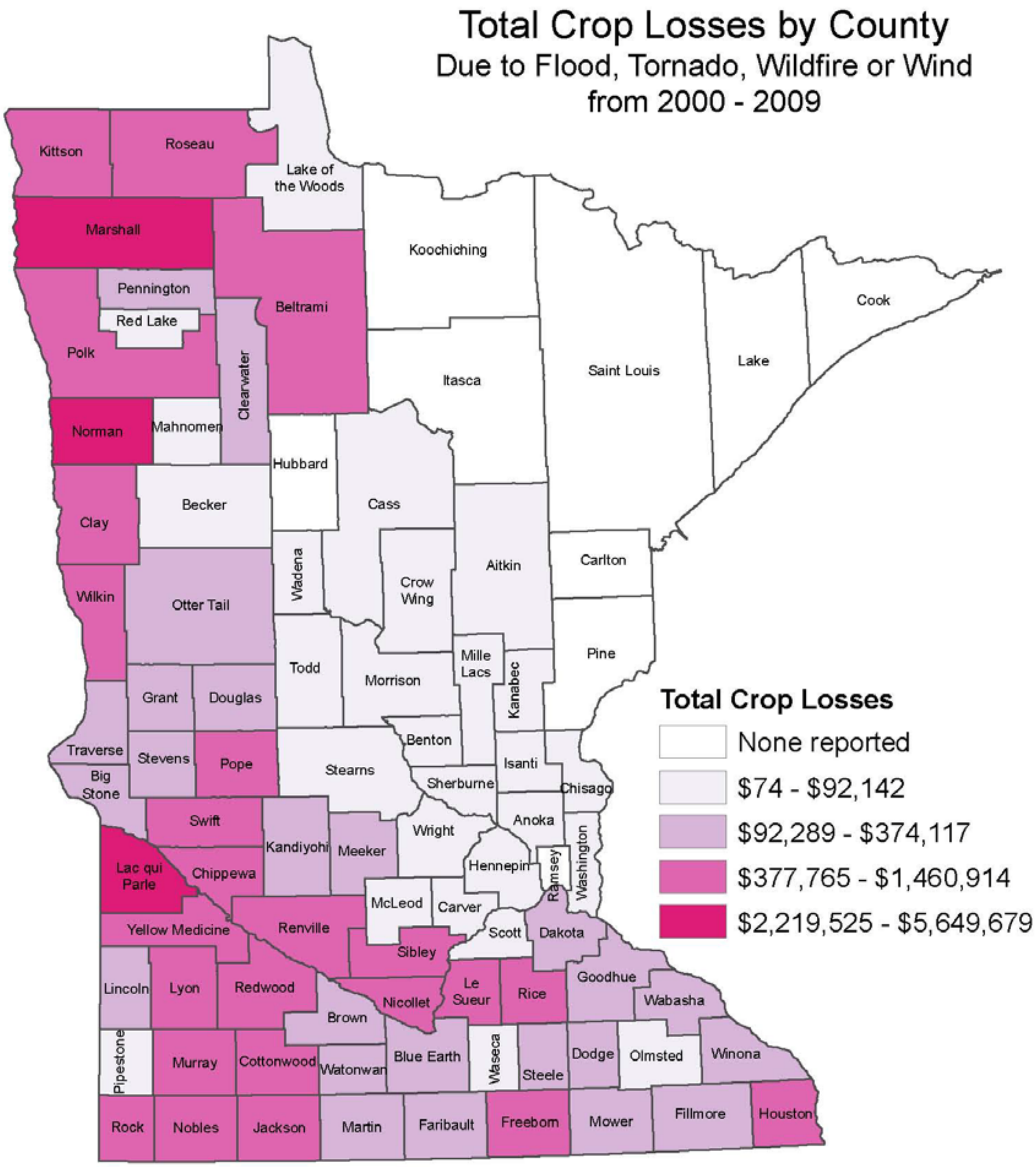
COUNTY	FLOOD	TORNADO	WIND	TOTAL LOSSES
Yellow Medicine	$966		$770,728	$771,694
Clay	$148,279		$579,671	$727,950
Polk	$161,690		$522,696	$684,386
Jackson	$60,840	$1,240	$613,925	$676,005
Rock	$25,537		$642,858	$668,395
Le Sueur	$7,770	$223,871	$436,187	$667,828
Redwood	$22,798		$621,712	$644,610
Freeborn	$580,223	$842	$36,484	$617,549
Pope	$14,479		$538,092	$552,571
Wilkin	$150,617	$10,863	$376,331	$537,811
Lyon	$32,394		$457,468	$489,862
Sibley	$19,930	$17,083	$449,446	$486,459
Beltrami	$4,405		$427,316	$431,721
Rice	$28,976		$400,165	$429,141
Nicollet	$24,286	$13,469	$381,488	$419,243
Cottonwood	$3,719		$399,539	$403,258
Murray	$57,092		$339,733	$396,825
Houston	$301,260		$76,505	$377,765
Martin	$78,615		$253,070	$331,685
Brown	$24,157		$291,819	$315,976
Stevens	$48,130		$250,895	$299,025
Grant	$74,570		$208,563	$283,133
Wabasha	$107,696		$165,884	$275,020
Blue Earth	$104,127		$141,101	$245,228
Big Stone	$27,038		$217,565	$244,603
Fillmore	$139,955		$100,038	$239,993
Dakota	$3,118		$229,101	$232,219
Mower	$112,209		$105,363	$217,572
Dodge	$37,600		$173,312	$210,912
Faribault	$144,630	$1,633	$62,266	$208,529
Kandiyohi	$451	$2,382	$198,606	$201,439
Pennington	$181,771		$18,834	$200,605
Watonwan	$2,967		$194,195	$197,162
Traverse	$13,092		$158,553	$171,645
Clearwater			$170,762	$170,762
Steele	$55,769		$113,409	$169,178
Douglas			$152,125	$152,125

Table 41 Total Indemnity Claims for Flood, Wildfire, Tornado and Wind on Crops 2000-2009

COUNTY	FLOOD	TORNADO	WIND	TOTAL LOSSES
Lincoln	$16,840		$133,468	$150,308
Otter Tail	$8,749		$138,090	$146,839
Meeker	$54,285	$28,578	$25,076	$107,939
Goodhue	$8,560		$85,091	$93,651
Winona	$17,199		$75,090	$92,289
Aitkin			$89,373	$89,373
Olmsted	$53,907		$31,548	$85,455
Pipestone	$452		$81,723	$82,860
Lake of the Woods	$29,575		$42,135	$71,710
McLeod	$17,389		$49,842	$67,231
Becker	$1,517		$61,354	$62,871
Stearns	$5,233		$50,921	$56,154
Waseca	$26,140		$26,676	$52,816
Mahnomen	$17,931		$28,799	$46,730
Scott	$161		$34,841	$35,002
Red Lake	$1,395		$30,691	$32,086
Todd	$7,763		$17,595	$25,358
Wright	$1,891		$22,103	$23,994
Benton	$8,395		$13,868	$22,263
Washington	$3,545		$18,116	$21,661
Morrison	$773		$20,737	$21,510
Carver	$1,488		$16,621	$18,109
Isanti			$15,686	$15,686
Mille Lacs			$13,962	$13,962
Kanabec			$5,306	$5,306
Hennepin			$4,973	$4,973
Anoka	$4,949			$4,949
Sherburne			$4,600	$4,600
Cass			$2,322	$2,322
Chisago			$1,677	$1,677
Crow Wing			$520	$520
Wadena			$74	$74
Totals	$9,661,194	$307,121	$23,101,469	$33,072,009

Source: Cause of loss historical data files: summary of business with month of loss, USDA, Risk Management Agency (http://www.rma.usda.gov/data/cause.html).

FIGURE 52 TOTAL CROP LOSSES BY COUNTY 2000-2009



DATA SOURCE: USDA Risk Management Agency
(http://www.rma.usda.gov/data/cause.html)

Map completed by Minnesota Geospatial
Information Office for HSEM.

5.3 Vulnerability Assessment for State Facilities

44 CFR 201.4(c)(2)(iii) *State owned or operated critical facilities located in the identified hazard areas shall also be addressed.*

State owned and operated facilities are important centers that link the government of the State of Minnesota to the public it serves. These facilities range from the State Capitol building in St. Paul to storage buildings for transportation centers throughout the state. These facilities are hubs for everything from administrative activities to public safety functions and every conceivable role in between. Should these facilities be rendered inoperable by an incident, the public would lose a vital link between them and their government and the services provided.

Critical state owned facilities were identified as those facilities that housed "essential" government services or high profile, culturally significant facilities. Essential services are defined as those services that provide for the immediate health and safety of the public.

The HAZUS-MH analysis was performed using default inventory data contained within the software. HAZUS-MH default inventory data includes the following:

- General building stock
- Essential facilities
- Demographic information
- Transportation lifeline systems
- Utility lifeline systems
- High potential loss facilities
- Hazardous materials facilities

Table 42 Statewide Database Updates

Feature Class	Default Records	Updated Records	Default Exposure X $1,000	Updated Exposure X $1,000
School	3,188	3,850	$17,693,557	$20,927,347
Care	143	557	$1,246,560	$5,387,400
Police	428	531	$671,104	$1,015,260
Fire	709	987	$0	$1,011,000
EOC	46	46	$51,520	$51,520

In addition to the HAZUS-MH supplied data, the state supplied updated essential facilities data. The site-specific inventory (specifically schools, hospitals, fire stations, and police stations) was updated using the best available statewide information.

Sources, assumptions, and processes used to update the site-specific data sets are provided in Report Appendix A. prior to the commencement of the flood analysis. Most of the updates were sourced 2007 from Homeland Security and Information Program (HSIP) Freedom data sets.

Table 42 shows the differences between the default HAZUS data sets for Minnesota and the updated data that was used for the 2010 flood assessment. Table 46 illustrates an important factor of how the updated counts and exposure offers a higher degree of accuracy than the default counts and exposure supplied with HAZUS-MH. The state supplied data is not complete since the Freedom data sets from HSIP are still being updated. It should not be assumed that all critical facilities in the state were modeled as part of this assessment.

The risk assessment process for each county included a visual overlay of flood results with 2008 National Agriculture Imagery Program ortho-photography to identify essential facilities susceptible to damage and find examples where HAZUS-MH building loss damages may be over (or under) estimated.

The State of Minnesota has provided GIS layers for state-owned properties. The risk assessment process overlaid the flood boundaries with the state owned buildings and DNR-managed parks and recreational areas to identify properties at risk.

FIGURE 53 STATE OWNED FACILITIES BUILDING VALUES

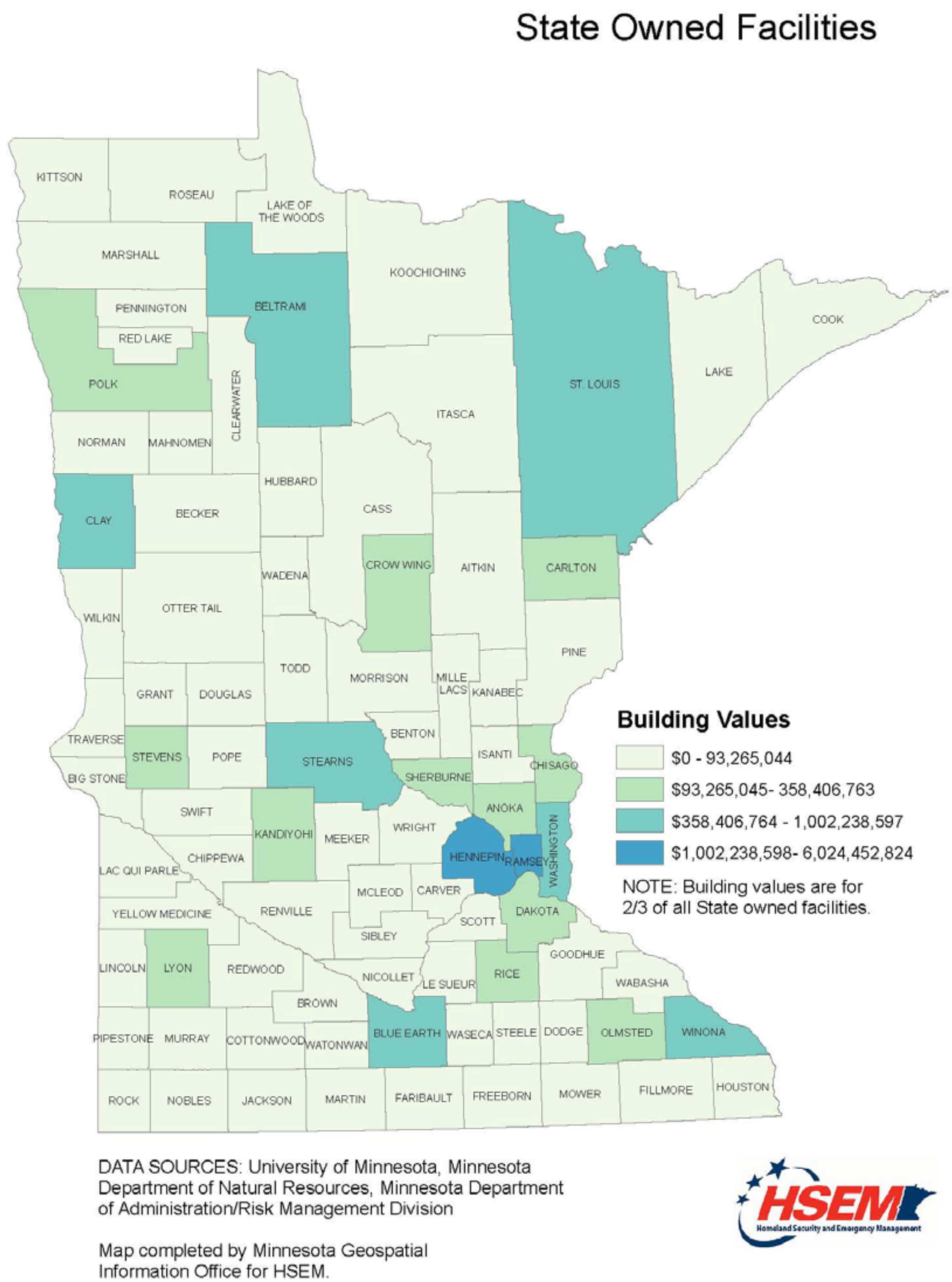
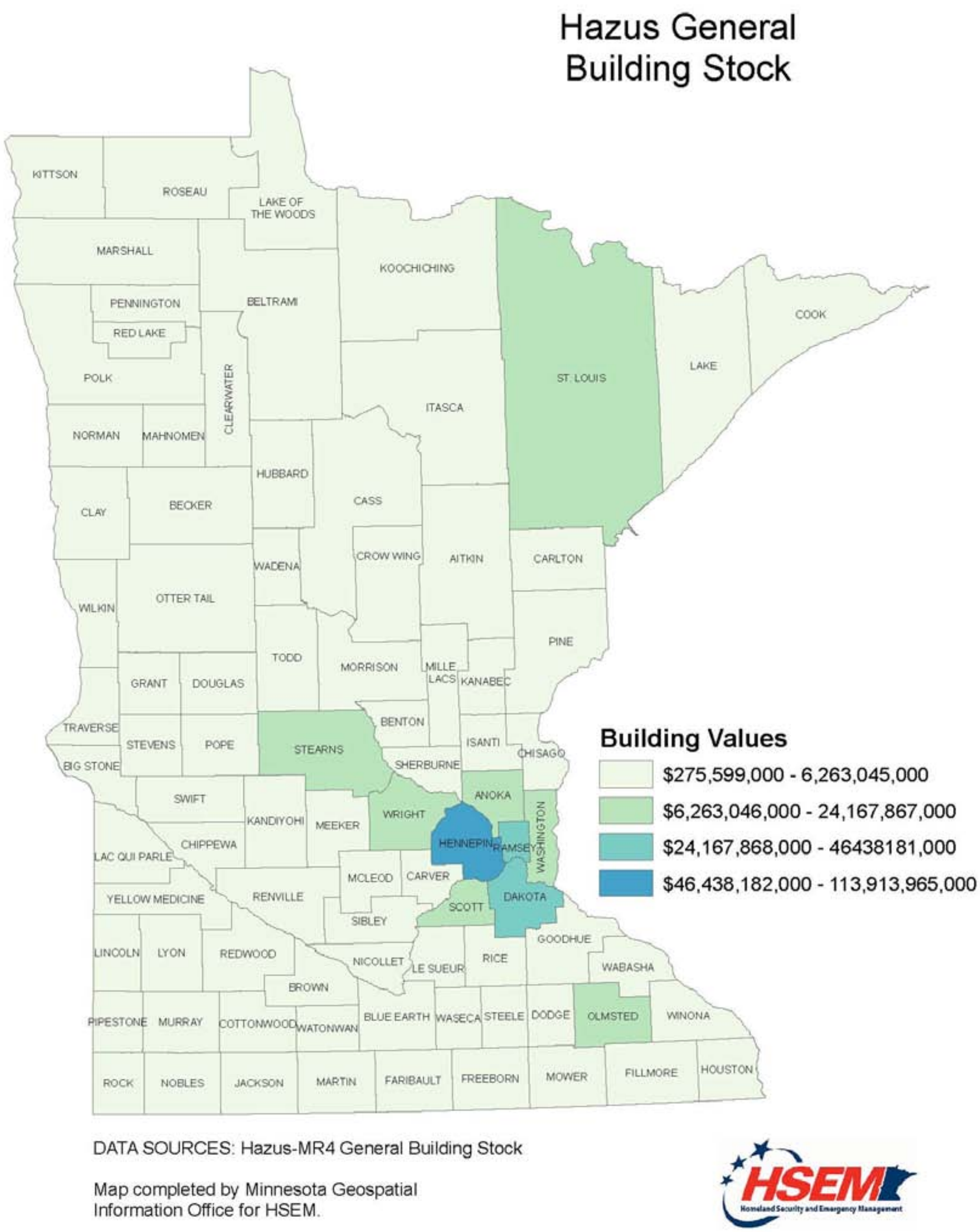


FIGURE 54 HAZUS GENERAL BUILDING STOCK VALUES



5.4 Estimating Potential Losses by Jurisdiction

Requirement §201.4(c)(2)(iii): *[The State risk assessment* ***shall*** *include an] overview and analysis of potential losses to the identified vulnerable structures, based on estimates provided in local risk assessments as well as the State risk assessment. The State* ***shall*** *estimate the potential dollar losses to State owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.*

Statewide Flood Risk Assessment

The loss estimation was performed using HAZUS-MH, a risk mitigation tool developed by FEMA. This process reflects a Level 1+ approach to flood modeling. The Level 1+ approach uses default data while referencing additional data. As indicated above, the loss estimation process used supplementary essential facility information for the purpose of improving the accuracy of the model predictions.

One of the key data sources for HAZUS-MH flood model prediction is terrain data. A USGS provided 30-meter Digital Elevation Model (DEM) was used for the terrain model for each county. Attempts at using higher definition (e.g. 10-meter) DEMs were only successful for 5 counties (Stevens, Sibley, Murray, Steele, and Olmsted). Few counties had seamless 10-meter coverage, and HAZUS-MH processing times could not support the required project timeline.

HAZUS-MH flood modeling was performed one county at a time. A stream network was delineated for every square mile within the county. The HAZUS-MH flood model performs an area weighted assessment of flood damage. The number of grid cells at a given depth is counted and then divided by total number of cells within a census block. The result is used to "weight" damage at that flood depth for each occupancy class. Essential facilities are evaluated by their specific location by default. Buildings are considered a total loss once they reach the 50% damage threshold.

HAZUS-MH analysis was performed within a study region created for each county. Separate study cases within each study region were frequently required:

- Discharge values were input from FIS reports to over-ride the HAZUS calculated 100-year discharge values. Streams that were manually adjusted are included in a separate study case.
- Riverine flood analysis was performed in a separate study case whenever the number of reaches exceeded around 300. This threshold number varied depending on the problems encountered for each study case or study region. For example, Ottertail County has 1318 reaches in the Hydraulic and Hydrological analysis, so resulted in five cases to process all the reaches.

A Global Summary Report is available for each study case. The HAZUS-MH Global Summary Reports included all available options with the exception of Agricultural Impact, User Defined Structures, and What If scenarios.

The analysis includes:

General Building Stock

- Building losses
- By occupancy and by building type
- By full replacement value and depreciated replacement value
- Shelter requirements
- Building, content, and inventory losses

Site-Specific - Essential Facilities

- Building and content losses
- Restoration time to 100% functionality
- Lifeline losses (for selected components)
- Losses to structures and equipment

Site-Specific - State Properties

- Building and content losses

The table below provides estimated building losses for all counties aggregated by occupancy class. These losses are calculated from the General Building Stock inventory. The following figures show building loss by county and ratio of building loss to the total building exposure in each county.

Table 43 Statewide Flood Risk Assessment Results

General Occupancy	Estimated Total Buildings	Total Damaged Buildings	Total Building Exposure X $1000	Total Economic Loss X $1000	Building Loss X $1000
Agricultural	15,479	2	$3,959,612	$144,844	$42,185
Commercial	107,802	165	$71,474,365	$1,791,945	$499,612
Education	3,502	4	$7,668,759	$155,792	$23,227
Government	3,795	52	$3,170,826	$205,154	$29,574
Industrial	34,374	74	$24,260,422	$1,025,829	$278,055
Religious/Non-Profit	8,584	3	$7,650,642	$241,337	$39,522
Residential	1,965,256	10,468	$308,722,398	$3,798,351	$2,421,654
Total	**2,138,792**	**10,768**	**$426,906,003**	**$7,363,252**	**$3,333,829**

County summaries of site-specific losses relative to essential facilities and State Properties are compiled. Counts of the moderately damaged essential facilities and state owned buildings for each county are provided. A table of the State Properties by property type is found in the Report.

FIGURE 55 POTENTIAL BUILDING LOSS ESTIMATES FOR STATE OWNED FACILITIES

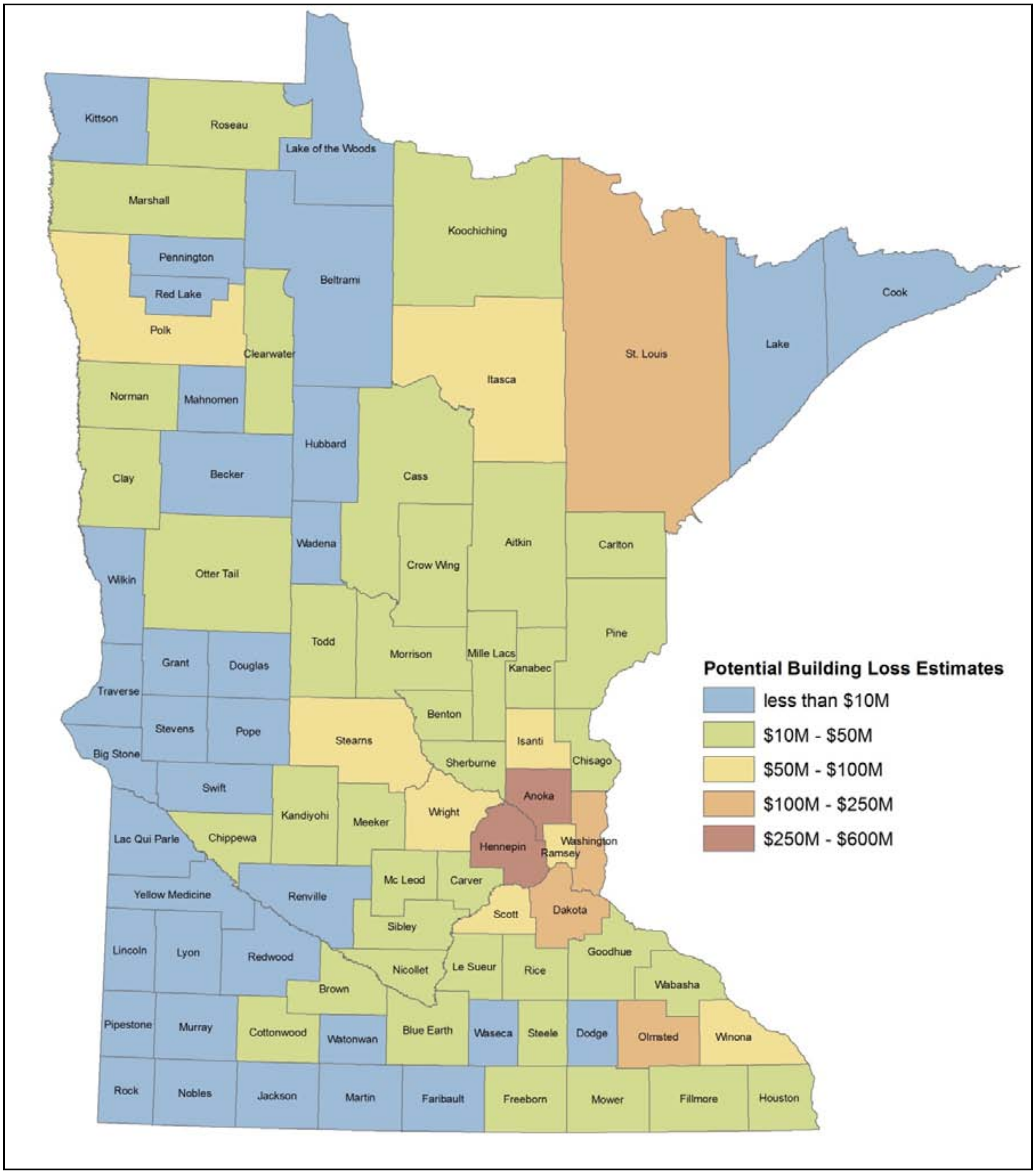
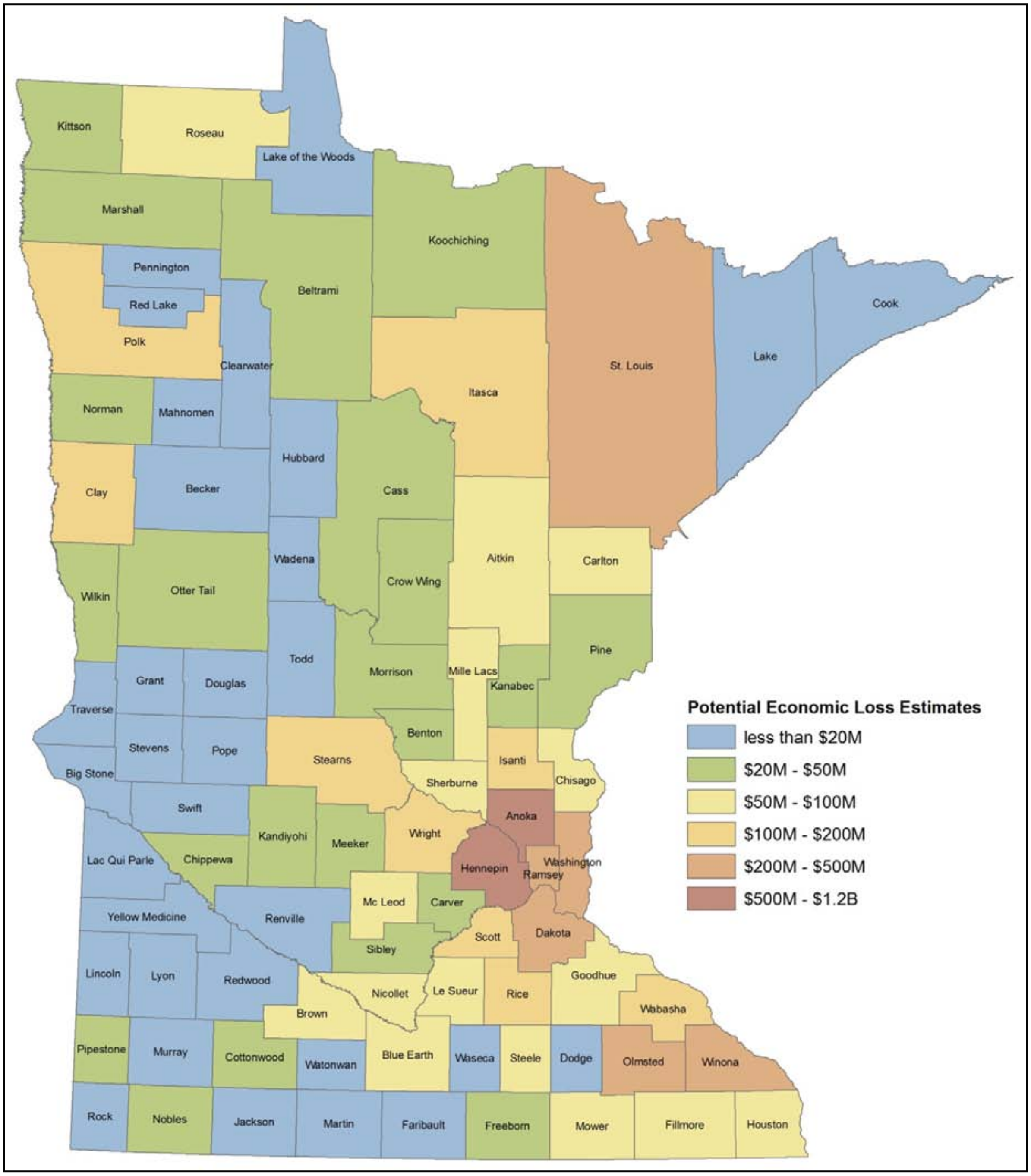
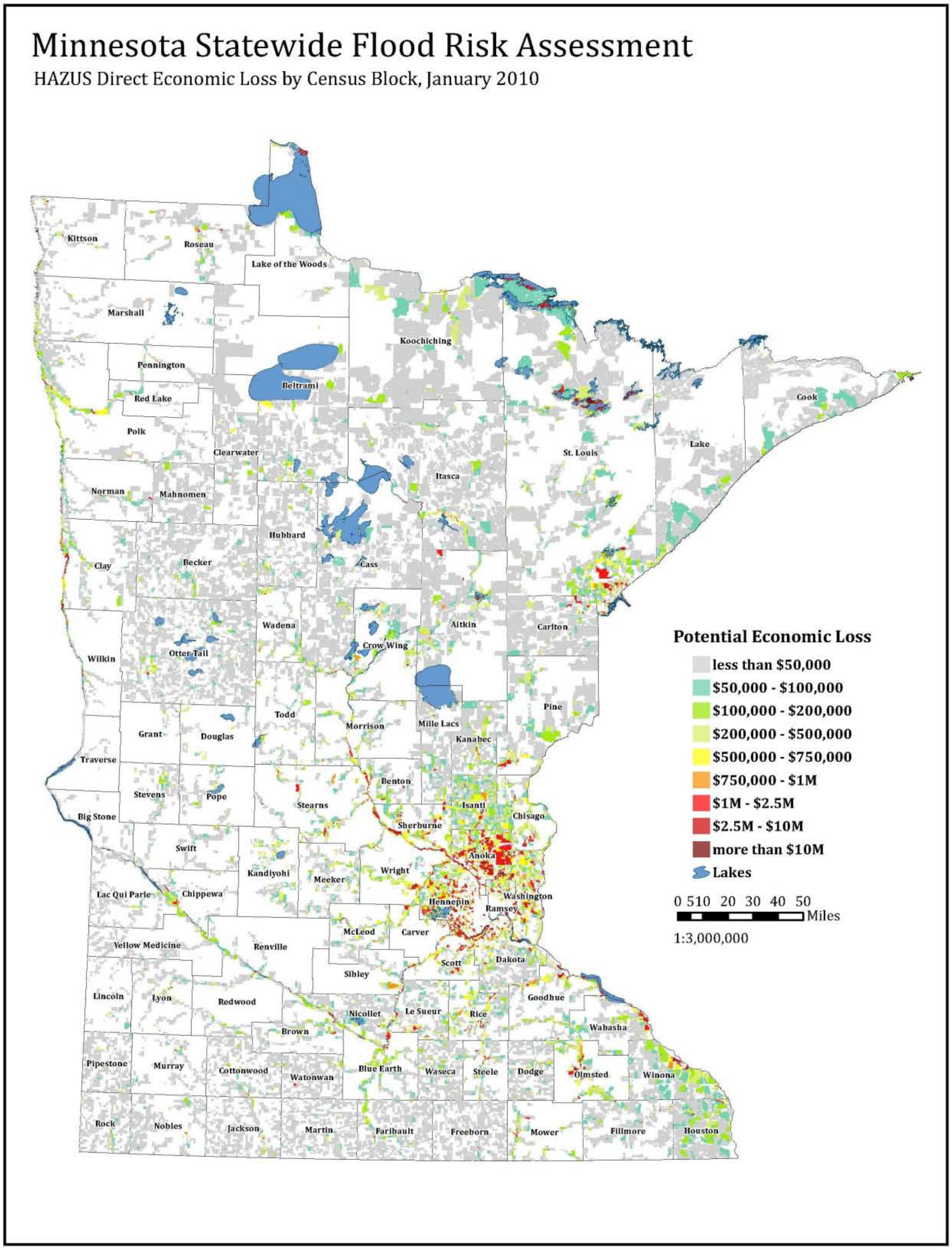


FIGURE 56 POTENTIAL ECONOMIC LOSS ESTIMATES



The Flood Risk Assessment Economic Loss Estimate figure represents the total economic loss estimates by county. The following figure indicates economic loss by census block. This information is available to each county and/or jurisdiction that submits a request to the state. The information can be used to inform decisions related to mitigation project priority.

FIGURE 57 POTENTIAL ECONOMIC LOSS BY CENSUS BLOCK



The following table provides a summary of building loss and economic loss for each county due to flooding. These losses are calculated from the General Building Stock inventory.

Table 48 Flood Risk Assessment Estimates by County

COUNTY	ESTIMATED TOTAL BUILDINGS	TOTAL DAMAGED BUILDINGS	TOTAL BUILDING EXPOSURE X $1000	TOTAL ECONOMIC LOSS X $1000	BUILDING LOSS X $1000
Aitkin	15581	167	$1,650,061	$77,779	$42,056
Anoka	107417	2935	$24,167,867	$1,130,017	$586,056
Becker	20533	2	$2,486,468	$13,953	$5,127
Beltrami	19993	12	$2,549,782	$22,552	$9,341
Benton	13779	71	$2,692,232	$41,223	$19,724
Big Stone	4304	1	$370,709	$1,759	$962
Blue Earth	23631	85	$4,239,055	$59,941	$30,160
Brown	13938	43	$2,296,257	$52,703	$21,419
Carlton	16547	29	$2,367,614	$53,094	$17,767
Carver	28691	26	$6,263,045	$32,473	$15,741
Cass	26619	39	$2,879,718	$32,735	$12,810
Chippewa	7805	72	$852,476	$33,212	$15,612
Chisago	18724	102	$3,053,754	$83,473	$40,175
Clay	21,367	217	$2,999,882	$100,004	$46,501
Clearwater	5100	3	$543,512	$4,902	$19,626
Cook	7308	6	$735,155	$9,086	$3,355
Cottonwood	7058	48	$868,473	$30,378	$11,285
Crow Wing	39989	26	$5,457,342	$37,726	$20,476
Dakota	126068	396	$32,012,831	$353,032	$152,298
Dodge	8633	15	$1,291,386	$17,770	$8,840
Douglas	12447	5	$2,861,924	$5,795	$2,978
Faribault	10670	23	$1,109,127	$14,181	$5,537
Fillmore	11888	94	$1,353,034	$88,188	$34,188
Freeborn	17476	29	$2,569,111	$36,136	$13,010
Goodhue	21210	44	$3,567,229	$85,242	$35,725
Grant	4739	28	$458,674	$6,074	$3,807
Hennepin	382511	1175	$113,913,965	$927,776	$420,842
Houston	10910	69	$1,292,366	$76,082	$34,843
Hubbard	14267	4	$1,579,205	$10,296	$4,722
Isanti	14522	84	$2,710,615	$127,366	$64,068
Itasca	29403	131	$3,713,059	$197,278	$66,224
Jackson	6702	31	$629,412	$13,286	$5,912
Kanabec	8488	45	$1,061,942	$31,015	$14,395

Table 48 Flood Risk Assessment Estimates by County

COUNTY	ESTIMATED TOTAL BUILDINGS	TOTAL DAMAGED BUILDINGS	TOTAL BUILDING EXPOSURE X $1000	TOTAL ECONOMIC LOSS X $1000	BUILDING LOSS X $1000
Kandiyohi	21536	17	$3,245,275	$20,204	$10,137
Kittson	4177	30	$336,073	$20,123	$8,344
Koochiching	9680	17	$1,156,631	$25,170	$13,485
Lac Qui Parle	5346	1	$468,008	$5,426	$2,906
Lake of the Woods	4299	148	$381,700	$14,697	$8,113
Le Sueur	13384	138	$1,921,377	$87,363	$40,168
Lincoln	4499	8	$379,477	$2,102	$1,358
Lyon	11987	14	$1,790,121	$16,840	$5,753
Mahnomen	3623	0	$358,753	$4,475	$1,838
Marshall	7976	34	$583,449	$38,281	$11,793
Martin	11848	4	$1,516,376	$16,210	$4,385
McLeod	16718	45	$3,144,760	$68,731	$26,318
Meeker	12881	29	$1,768,183	$21,897	$10,927
Mille Lacs	12782	60	$1,693,977	$59,862	$24,880
Morrison	17667	79	$2,344,240	$47,190	$22,013
Mower	19794	134	$2,522,554	$98,912	$36,897
Murray	6627	53	$581,843	$10,928	$5,511
Nicollet	12808	32	$2,596,985	$57,540	$21,468
Nobles	11028	26	$1,138,189	$39,916	$8,546
Norman	5799	25	$456,405	$31,211	$10,123
Olmsted	47734	355	$10,224,072	$236,685	$106,039
Otter Tail	40854	20	$4,846,688	$48,217	$19,608
Pennington	7439	3	$1,010,049	$10,673	$4,336
Pine	17210	12	$1,880,697	$46,190	$25,977
Pipestone	6159	13	$609,595	$22,386	$6,809
Polk	17828	314	$2,062,480	$154,662	$72,648
Pope	7758	26	$833,801	$8,548	$4,674
Ramsey	169390	176	$46,438,181	$244,098	$58,554
Red Lake	3290	0	$275,599	$3,268	$1,905
Redwood	11886	9	$1,193,751	$11,192	$5,729
Renville	11334	0	$1,265,786	$8,103	$2,253
Rice	22249	69	$4,621,430	$113,909	$43,304
Rock	5832	10	$547,354	$12,191	$4,779

Table 48 Flood Risk Assessment Estimates by County					
COUNTY	**ESTIMATED TOTAL BUILDINGS**	**TOTAL DAMAGED BUILDINGS**	**TOTAL BUILDING EXPOSURE X $1000**	**TOTAL ECONOMIC LOSS X $1000**	**BUILDING LOSS X $1000**
Roseau	9441	47	$1,070,790	$78,165	$25,868
St. Louis	101776	1101	$17,545,854	$465,710	$245,893
Scott	36365	184	$8,014,343	$192,952	$82,838
Sherburne	25542	147	$5,254,784	$89,268	$48,945
Sibley	8218	52	$1,216,782	$33,649	$19,259
Stearns	55661	171	$10,625,977	$144,480	$66,746
Steele	15497	83	$2,822,446	$53,307	$24,792
Stevens	5541	5	$789,003	$16,442	$7,113
Swift	6609	2	$814,576	$7,253	$2,893
Todd	14361	39	$1,555,337	$19,924	$10,868
Wabasha	11826	212	$1,606,448	$100,255	$49,892
Wadena	7961	2	$1,013,164	$19,310	$7,806
Waseca	9095	11	$1,453,845	$14,951	$5,124
Washington	77175	325	$17,154,765	$258,893	$130,153
Watonwan	6586	7	$815,118	$15,649	$5,054
Wilkin	4450	29	$439,697	$20,473	$8,551
Winona	21510	251	$3,848,179	$259,503	$96,359
Wright	40318	130	$7,981,311	$128,034	$63,410
Yellow Medicine	7204	4	$631,804	$8,558	$3,983
Totals	**2,138,792**	**10,768**	**$426,906,003**	**$7,363,252**	**$3,333,829**

Analyzing the data, Anoka County ranks highest for potential loss based on building loss, second is Hennepin County and third is the largest county in the state - St. Louis County. Three other highly populated counties also have potential building loss greater than one hundred million dollars.

County	Potential Building Loss X $1000
Anoka	$586,056
Hennepin	$420,842
St. Louis	$245,893
Dakota	$152,298
Washington	$130,153
Olmsted	$106,039

Reviewing highest potential economic loss, the same counties rank at the top.

County	Potential Economic Loss X $1000
Anoka	$1,130,017
Hennepin	$927,776
St. Louis	$465,710
Dakota	$353,032
Winona	$259,503
Washington	$258,893
Ramsey	$244,098
Olmsted	$236,685

Hennepin County ranks the highest for total building exposure at over a hundred billion dollars, more than double Ramsey County, ranked second at $46,438,181,000. Dakota ranks third with over $32 billion, Anoka ranks fourth at over $24 billion. Both St. Louis and Washington counties building exposure is estimated at over $17 billion, Olmsted and Stearns both have building values over $10 billion.

5.5 Estimating Potential Losses of State Facilities

Requirement §201.4(c)(2)(iii): *…The State* ***shall*** *estimate the potential dollar losses to State owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.*

An updated statewide asset inventory was conducted for the statewide flood assessment to meet the FEMA 201.4(c)(2)(iii) requirement. The following section and describes the process of updating the HAZUS-MH inventory from more current local data sources. The consultants gathered the best available GIS, community asset, and community riverine hazard data and created a map for hazard event profiling.

A document describing the process used at The Polis Center to update the HAZUS MR4 databases using the most current data sets for the study is available in the Report appendix. To summarize the process, HAZUS-MR4 comes bundled with default modeling data. The HAZUS-MR4 critical facility data set is ten years old, and there are no plans to update it with future HAZUS releases. The HAZUS default data is segregated into geodatabase tables for each State. HAZUS-MR4 provides no data maintenance tools for the State default data. The State default data is the master from which HAZUS Study Regions are extracted. HAZUS performs natural disaster analysis against the Study Region. Typically the Study Regions are extracted by County boundaries. Data changes made to a Study Region cannot be applied to new Study Regions or to the HAZUS default data. HAZUS-MR4 provides limited data maintenance tools within a Study Region. MR4 aggregate data sets have been updated from 2005 Brad and Dunstreet and Census data. The critical facility site specific data sets have not been updated.

The HAZUS-MR4 Comprehensive Data Management System (CDMS) was released in March 2008 and The Polis Center utilizes this module (wherever practical) to manage the updates of any HAZUS data sets. The University of Minnesota at Duluth (UMD) has collected the statewide data sets to be used for the state flood study.

A list of HAZUS site specific facilities is included in the following tables. Facilities indicated with an asterisk were updated from current sources:

Essential Facilities

Care Facilities **	Police Stations **
Emergency Operations Centers	Schools **
Fire Stations **	

Transportation Facilities

Airport Facilities	Port Facilities
Bus Facilities	Rail Facilities
Ferry Facilities	Railway Bridges
Highway Bridges	Runways

Utility Facilities

Communication Facilities	Oil Facilities
Electric Power Facilities	Potable Water Facilities
Natural Gas Facilities	Wastewater Facilities

High Potential Loss Facilities

Dams	Military Facilities
Hazardous Materials Facilities	Nuclear Power Plants

The most recent essential facilities loaded into the Essential Facilities geodatabase for the State of Minnesota includes schools, hospitals, fire stations and police stations. The Polis Center updated the HAZUS default data on a state-wide basis prior to running the county models. The updated state data was used in the analysis. For future higher level analysis, data will be updated using the process detailed in the Report.

Table 44 State Facility Flood Damage Estimates

COUNTY	TOTAL ESSENTIAL FACILITIES	ESSENTIAL FACILITIES FLOODED	TOTAL STATE BLDG	STATE BLDG FLOODED
Aitkin	32	**0**	10	0
Anoka	208	**13**	137	46
Becker	62	**0**	26	1
Beltrami	68	**0**	57	3
Benton	33	**0**	2	0
Big Stone	20	**0**	7	0
Blue Earth	64	**0**	57	0
Brown	49	**0**	17	1
Carlton	69	**1**	55	0
Carver	99	**4**	110	1
Cass	60	**1**	12	0
Chippewa	24	**1**	4	1
Chisago	52	**0**	34	7
Clay	55	**0**	192	1
Clearwater	21	**0**	109	0
Cook	26	**0**	14	1
Cottonwood	31	**2**	16	1
Crow Wing	66	**0**	26	0
Dakota	255	**17**	135	1
Dodge	24	**0**	5	0
Douglas	59	**0**	39	0
Faribault	36	**0**	7	0
Fillmore	50	**2**	14	3
Freeborn	47	**1**	10	0
Goodhue	52	**0**	17	0
Grant	15	**0**	0	0
Hennepin	12	**3**	293	3
Houston	43	**9**	5	1
Hubbard	25	**0**	8	1
Isanti	45	**1**	10	0
Itasca	60	**5**	82	3

Table 44 State Facility Flood Damage Estimates

COUNTY	TOTAL ESSENTIAL FACILITIES	ESSENTIAL FACILITIES FLOODED	TOTAL STATE BLDG	STATE BLDG FLOODED
Jackson	24	**0**	12	0
Kanabec	16	**0**	6	1
Kandiyohi	50	**0**	41	0
Kittson	22	**1**	8	0
Koochiching	31	**1**	20	0
Lac qui Parle	21	**0**	7	1
Lake	12	**0**	36	1
Lake of the Woods	12	**0**	10	0
Le Sueur	35	**3**	12	0
Lincoln	24	**0**	6	0
Lyon	50	**0**	60	0
McLeod	55	**0**	15	0
Mahnomen	19	**0**	2	0
Marshall	30	**8**	8	1
Martin	55	**0**	11	0
Meeker	35	**0**	4	0
Mille Lacs	44	**0**	26	0
Morrison	60	**1**	25	0
Mower	60	**0**	21	1
Murray	24	**0**	14	1
Nicollet	47	**0**	59	1
Nobles	41	**1**	5	0
Norman	26	**10**	5	5
Olmsted	119	**1**	32	1
Otter Tail	92	**5**	32	1
Pennington	22	**0**	7	0
Pine	45	**0**	35	1
Pipestone	27	**1**	17	1
Polk	63	**6**	83	2
Pope	29	**0**	7	0
Ramsey	345	**2**	137	2
Red Lake	15	**0**	0	0
Redwood	53	**0**	9	0
Renville	40	**0**	11	0

Table 44 State Facility Flood Damage Estimates

COUNTY	TOTAL ESSENTIAL FACILITIES	ESSENTIAL FACILITIES FLOODED	TOTAL STATE BLDG	STATE BLDG FLOODED
Rice	67	**0**	79	7
Rock	24	**0**	11	0
Roseau	32	**6**	16	2
St. Louis	301	**5**	199	3
Scott	89	**1**	33	0
Sherburne	64	**0**	29	0
Sibley	38	**1**	2	0
Stearns	161	**0**	76	0
Steele	40	**0**	17	0
Stevens	22	**0**	40	0
Swift	27	**0**	13	1
Todd	40	**0**	8	0
Traverse	16	**2**	6	0
Wabasha	36	**2**	8	3
Wadena	31	**0**	25	0
Waseca	35	**2**	41	0
Washington	158	**0**	115	0
Watonwan	28	**0**	7	0
Wilkin	22	**0**	5	0
Winona	66	**8**	47	3
Wright	116	**0**	13	0
Yellow Medicine	31	**1**	17	0
Totals	**4,849**	**130**	**3,100**	**113**

COUNTY	ESTIMATED ESSENTIAL FACILITIES FLOODED
Dakota	17
Anoka	13
Norman	10
Houston	9
Marshall	8
Winona	8
Polk	6
Roseau	6
Itasca	5
Otter Tail	5
St. Louis	5
Carver	4
Hennepin	3
Le Sueur	3

COUNTY	ESTIMATED STATE BUILDING FLOODED
Anoka	46
Chisago	7
Rice	7
Norman	5
Beltrami	3
Fillmore	3
Hennepin	3
Itasca	3
St. Louis	3
Wabasha	3
Winona	3

Cottonwood, Fillmore, Ramsey, Traverse, Wabasha, and Waseca each have two essential facilities that are expected to be flooded. Polk, Ramsey and Roseau have two state buildings in the floodplain.

Carlton, Cass, Chippewa, Freeborn, Isanti, Kittson, Koochiching, Morrison, Nobles, Olmsted, Pipestone, Scott, Sibley, and Yellow Medicine each has one essential facility that is expected to be flooded.

Becker, Brown, Carver, Chippewa, Clay, Cook, Cottonwood, Dakota, Houston, Hubbard, Kanabec, Lac qui Parle, Lake, Marshall, Mower, Murray, Nicollet, Olmsted, Otter Tail, Pine, Pipestone, and Swift counties each has one state owned building in the floodplain. The remaining 40 counties do not have a state owned building in the Special Flood Hazard Area per the Report.

Data Limitations

There was not sufficient detail in the available existing State Owned Property inventory to report damages based on building value or contents value. The state owned properties data used in the analysis were compiled primarily from Archibus, a facility and property management database system being used by the Mn Department of Administration to track state-owned buildings, MnGeo contributed correctional and historical buildings, Minnesota State Colleges and Universities and the University of Minnesota contributed university and college buildings, and Mn DNR contributed State Parks facilities. Not all State facilities were geocoded, the owned state buildings inventory provided by (MnGeo) includes many missing addresses. In addition, multiple State Park structures in the same park share the same address. Modeling will allow state agencies to determine if mitigation actions are appropriate for exact structures only if individual locations can be distinguished.

The provided records could not be loaded into HAZUS. The files in Excel format files do not contain spatial coordinates. Addresses are provided, but these would need to be geo-coded against local address data. Ideally state owned buildings will be imported as User Defined Facilities as points to be modeled in HAZUS. If the information needed for importing is not available, then overlaying the building locations with the HAZUS generated flood boundaries may be sufficient. User Defined Facilities cannot be imported through Comprehensive Data Management System (CDMS). User Defined Facilities will be imported into HAZUS on a county-by-county basis in the future.

Statewide Flood Risk Assessment Summary

The HAZUS-MH Statewide Flooding Risk Assessment is a first step towards identifying state owned and critical facilities in the floodplain. Data deficiencies and solutions have been identified. The state Report may be useful to other states. The county reports will be shared with the counties for use in mitigation plans. The original plan was to train planners in counties and Regional Development Commissions to perform HAZUS analysis. A trial with one local planner showed that HAZUS was infrequently used. The time investment to keep up to date and to use HAZUS was not cost effective. Sharing the county reports from the state flood reports is cost effective.

County HAZUS reports have been shared with Dakota, Goodhue, Mower, and Nobles county emergency managers and/or to get their feedback. There has been overwhelming support. Nobles County used the state supplied report for the five-year review of their mitigation plan. Dakota is working with the state to complete a Level 2 analysis by integrating county building stock data and using LIDAR* one meter elevation resolutions.

The county HAZUS flood loss estimation reports will be shared with all counties in 2011. Efforts to upgrade the HAZUS reports will be done through mitigation planning grants so that the upgraded county reports can be used in future statewide HAZUS loss estimation reports.

**Note: LIght Detection And Ranging (LIDAR) is a remote sensing system used to collect topographic data. Data is collected with aircraft-mounted lasers capable of recording elevation measurements at a rate of 2,000 to 5,000 pulses per second and have a vertical precision of 15 centimeters (6 inches).*

Potential Loss Estimation on State Facilities due to Tornadoes and Windstorms

An estimated ranking of state facility vulnerability can be established by using annual probability and number of facilities in each county. Based on annual probability and the number of buildings per county (in and out of the floodplain) the following potential loss estimation ranking is listed.

Utilizing the annual windstorm probability and number of state facilities, the jurisdictions with the highest potential for loss are ranked below, along with the total value of the state facilities in that county. Ranking is number of facilities multiplied by the annual probability.

The county with the highest potential loss due to windstorms is Otter Tail County due to the annual probability. The second highest-ranking county is Itasca based on the high number of buildings. As stated before, all jurisdictions in the state are vulnerable to damages by windstorms. This analysis is based on best available data.

Table 45 Potential Loss Estimate Ranking for Windstorms for State Facilities				
County	Annual Probability	Number of Buildings	Facilities value	Ranking
Otter Tail	3	64	$ 83,528,285	192
Itasca	0.6	172	$ 99,706,072	103.2
Kandiyohi	0.5	81	$ 141,067,762	40.5
Washington	0.2	137	$ 564,408,311	27.4
Wadena	0.9	24	$ 101,530,675	21.6
Crow Wing	0.3	70	$ 177,411,177	21
Wright	0.4	40	$ 2,866,607	16
Pope	0.4	37	$ 4,470,254	14.8
Rock	0.3	27	$ 18,882,733	8.1
Nobles	0.7	4	$ 40,531,862	2.8
Renville	0.3	4	$ 1,177,793	1.2
Total			$ 1,235,581,531	

Table 46 Potential Loss Estimate Ranking for Tornadoes for State Facilities				
County	Annual Probability	Number of Buildings	Facilities Value	Ranking
Hennepin	0.3	289	$ 8,158,265,283	86.7
Anoka	0.3	127	$ 360,686,060	38.1
Kandiyohi	0.3	81	$ 141,067,762	24.3
Winona	0.1	113	$ 658,303,404	11.3
Freeborn	0.2	36	$ 50,580,666	7.2
Nicollet	0.1	71	$ 83,167,422	7.1
Rice	0.1	69	$ 249,326,670	6.9
Otter Tail	0.1	64	$ 83,528,285	6.4
Roseau	0.1	52	$ 6,314,015	5.2
Wadena	0.2	24	$ 101,530,675	4.8
Blue Earth	0.1	42	$ 673,659,467	4.2
Wright	0.1	40	$ 2,866,607	4
Brown	0.1	38	$ 9,281,493	3.8
Murray	0.1	35	$ 3,933,902	3.5
Cass	0.1	29	$ 3,805,318	2.9
Mower	0.1	24	$ 123,487,729	2.4
Chippewa	0.1	16	$ 645,525	1.6
Swift	0.1	8	$ 795,556	0.8
Watonwan	0.1	4	$ 2,087,758	0.4
			$ 10,713,333,597	

Utilizing the annual tornado probability and combined number of state owned buildings and essential facilities, the jurisdictions with the highest potential for loss are ranked below, along with the total value of the state facilities in that county. Ranking is number of facilities multiplied by the annual probability.

Hennepin County ranks highest for potential loss due to tornado and Anoka County ranks second. Kandiyohi County ranks third, likely due to the higher probability estimate. This loss estimation is based on best available data.

Data Limitations

There was not sufficient detail in the available existing State Owned Property inventory to report damages based on building value or contents value. The state owned properties data used in the analysis were compiled primarily from Archibus, a facility and property management database system being used by the Mn Department of Administration to track state-owned buildings, MnGeo contributed correctional and historical buildings, Minnesota State Colleges and Universities and the University of Minnesota contributed university and college buildings, and Mn DNR contributed State Parks facilities.

Potential Loss Estimate for Wildfire on State Facilities

Only 74 counties reported damages due to wildfire in the past ten years. Per the wildfire data, there were no damages specifically to state owned facilities. Grant, Martin, Meeker, Norman, Sibley, Waseca and Wilkin counties had reported wildfire but no state facilities per the available data. For the remaining counties (68) the same methodology for tornadoes and windstorms was applied to obtain a ranking for potential damages to state facilities. The annual probability ranking formula is the total number of fires divided by ten years of record. St. Louis County ranks the highest for potential loss for wildfire and Pine County ranks second.

Table 47 Potential Loss Estimate Ranking for Wildfire for State Facilities

COUNTY	VALUE OF FACILITIES	RANKING
St. Louis	$ 1,225,213,342	205.9
Pine	$ 60,702,186	92.7
Becker	$ 57,271,440	86.9
Crow Wing	$ 177,411,177	80.6
Morrison	$ 6,390,525	74.7
Beltrami	$ 489,390,168	68.1
Itasca	$ 99,706,072	66
Cass	$ 3,805,318	63.4
Mahnomen	$ 352,031	57
Aitkin	$ 7,262,672	53
Carlton	$ 174,978,558	51.3

Table 47 Potential Loss Estimate Ranking for Wildfire for State Facilities		
COUNTY	VALUE OF FACILITIES	RANKING
Kanabec	$ 369,480	41.9
Roseau	$ 6,314,015	40.2
Sherburne	$ 161,832,359	39.3
Clearwater	$ 35,256,028	37.9
Kittson	$ 5,042,082	35.8
Benton	$ 625,813	35.7
Mille Lacs	$ 13,526,242	32.3
Anoka	$ 360,686,060	31.3
Isanti	$ 27,718,765	30.4
Wadena	$ 101,530,675	29.1
Hubbard	$ 7,561,742	28.8
Marshall	$ 6,975,799	25.4
Koochiching	$ 31,565,255	23.3
Lake of the Woods	$ 9,277,976	22.7
Todd	$ 1,396,999	21.1
Chisago	$ 128,365,716	17.8
Lake	$ 32,580,867	17.1
Otter Tail	$ 83,528,285	14.1
Winona	$ 658,303,404	10.5
Douglas	$ 127,444,670	10.1
Houston	$ 1,577,127	9.6
Fillmore	$ 12,695,357	4.5
Washington	$ 564,408,311	4.2
Pennington	$ 107,060,484	3
Pope	$ 4,470,254	3
Cook	$ 5,618,061	2.8
Polk	$ 165,177,621	2.8
Hennepin	$ 8,158,265,283	2.5
Wabasha	$ 1,851,976	2.5
Stearns	$ 924,342,407	2
Blue Earth	$ 673,659,467	1.8
Wright	$ 2,866,607	1.7
Dakota	$ 397,693,572	1.6
Kandiyohi	$ 141,067,762	1.2
Brown	$ 9,281,493	1.1
Goodhue	$ 110,655,236	0.9
Chippewa	$ 645,525	0.9

Table 47 Potential Loss Estimate Ranking for Wildfire for State Facilities

COUNTY	VALUE OF FACILITIES	RANKING
Scott	$ 71,701,911	0.7
Clay	$ 480,551,517	0.7
Nicollet	$ 83,167,422	0.6
Ramsey	$ 3,328,477,173	0.6
Lac qui Parle	$ 2,297,808	0.6
Rice	$ 249,326,670	0.5
Carver	$ 50,914,027	0.5
Mower	$ 123,487,729	0.5
Olmsted	$ 209,596,139	0.5
Stevens	$ 206,917,372	0.4
Big Stone	$ 5,656,180	0.4
Le Sueur	$ 4,885,048	0.4
Lyon	$ 428,852,553	0.4
Renville	$ 1,177,793	0.3
Swift	$ 795,556	0.3
Freeborn	$ 50,580,666	0.2
Jackson	$ 30,463,643	0.2
Murray	$ 3,933,902	0.2
Pipestone	$ 25,913,330	0.2

6. MITIGATION STRATEGY

§201.4(c)(3) *[To be effective the plan must include a] Mitigation Strategy that provides the State's blueprint for reducing the losses identified in the risk assessment.*

(i): *[The State mitigation strategy shall include a] description of State goals to guide the selection of activities to mitigate and reduce potential losses.*

(iii): *[The State plans shall include an] identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering and an explanation of how each activity contributes to the overall mitigation strategy. This section should be linked to local plans, where specific local actions and projects are identified.*

201.4(d): *Plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities.*

Hazard mitigation, as defined by the Disaster Mitigation Act of 2000, is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Studies on hazard mitigation show that for each dollar spent on mitigation, society saves an average of four dollars in avoided future losses. (Multihazard Mitigation Council, 2005) Mitigation can take many different forms from construction projects to public education.

The development of a mitigation strategy allows the State of Minnesota to create a vision for preventing future disasters, establish a common set of mitigation goals across state, tribal, and local agencies, prioritize actions, and evaluate the success of such actions. The Minnesota Mitigation Strategy is based on the results of the statewide risk assessment, local and tribal risk assessments and mitigation strategies, and additional recommendations by mitigation stakeholders. The goals are broad, forward-looking statements that outline in general terms what the state would like to accomplish.

Mitigation Goals, Objectives, and Initiatives:

1. Maintain and enhance the State's capacity to continuously make Minnesota less vulnerable to all hazards.

2. Build and support local capacity and commitment to continuously become less vulnerable to natural hazards.

3. Improve coordination and communication with other relevant entities.

4. Increase public understanding, support, and demand for hazard mitigation.

6.1 Update

The Minnesota Department of Public Safety, Division of Homeland Security and Emergency Management Mitigation Division is dedicated to the ongoing implementation of mitigation planning and projects to reduce exposure of the State's population to natural hazards. The Minnesota State All-Hazard Mitigation Plan continues to be the central document to direct the implementation of the mitigation programs statewide. In addition, the Minnesota Silver Jackets

Work Plan for Implementation and Charter will guide multi-agency collaborative mitigation projects and planning.

Goal One (1) has been reviewed and updated by state mitigation staff. Upon review, the majority of strategies and actions for Goal One are inherent in HSEM operations to include state mitigation staff job responsibilities and in the Department of Public Safety and HSEM mission. 'The Goals, Objectives, Strategies and Actions' section has been reviewed and revised and is summarily updated. 'Projected Funding', 'Rational for Action' and 'How Action Contributes to Mitigation Strategy' have been deleted as these are covered elsewhere in the plan as is the progress the state has made in making the state more disaster resistant. Staff shortage and turnover have affected the state hazard mitigation program in its ability to fully follow through with low and some medium priority actions. Priorities for the state have been directed by staff availability and current disaster declarations with disaster declaration related actions taking precedence during the past three years. The timeframe for the majority of actions was and will continue to be ongoing as funding opportunities become available post-disaster or annually.

State Plan goals Two (2), Three (3) and Four (4) were reviewed and updated by the Minnesota Silver Jackets team. These three goals were utilized in the development of the Silver Jackets Charter. These goals guide the multi-agency collaborative mitigation efforts in the state and will be monitored for the 2014 plan update. As the Silver Jackets are the review team for the plan, and are the natural hazard risk management team for the state, the goals will remain state mitigation priorities. Specific actions – including technical and public education focused actions - have been prioritized and are included in the Silver Jackets Work Plan. The Silver Jackets Work Plan for Implementation and Charter are included in the Appendix K.

MN HSEM Vision and Mission: Keeping Minnesota Ready

The mission of HSEM is to help Minnesota prevent, prepare for, respond to and recover from natural and human caused disaster. Our team develops and maintains partnerships; collects and shares information; plan; train and educates; coordinates response resources; and provides technical and financial assistance.

While these goals, objectives and strategies are important and will be updated for this Plan, it is also important to focus on hazard specific mitigation actions. In response to the number and types of disasters during the past three years and the addition of a new State Hazard Mitigation Officer, new hazard-specific goals have been added – a new addition for the 2011 State Plan. The hazard specific actions are linked from the Local Plan Integration pilot project. Ten local all-hazard mitigation plans were reviewed for hazard rankings and mitigation strategies, and are incorporated into the state action plan. The six strategy tools provide guidance for the state and local jurisdictions to develop hazard mitigation plans.

The overriding strategy is to eliminate or significantly reduce loss of life and damages to property from all hazards. Actions in a mitigation strategy may fall under one or more of the following six categories: Prevention, Property Protection, Public Education and Awareness, Natural Resource Protection, Emergency Services and Structural Improvements.

The following six strategy tools provide guidance for the state and local jurisdictions to develop hazard mitigation plans. The strategy and tools were reviewed and updated by the Silver Jackets team and HSEM mitigation staff to include a wide variety of potential mitigation activities. Not all the following types of strategies or tools may be utilized by the state using its current funding sources. Local communities are encouraged to utilize all possible avenues of funding to make their communities more disaster resistant.

Strategy Tools

Prevention – Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include:

- Planning and zoning
- Building codes
- Capital improvement programs
- Open space preservation
- Storm water management regulations
- Hazard mapping
- Subdivision regulations
- Floodplain regulations
- Studies/data collection and analysis to support prevention measures
- Multi-jurisdictional agreements that reduce hazard risks
- Other regulatory measures or processes that reduce hazard risks

Property Protection – Actions that involve the modification of existing buildings or structures to protect them from a hazard area or provide insurance to cover potential losses. Examples include:

- Acquisition, Elevation or Relocation of hazard prone properties
- Structural retrofits
- Storm shutter
- Shatter-resistant glass
- Safe room/storm shelter retrofits
- Security retrofits
- Critical facility protection
- Risk reduction retrofits (modifications) to hazard prone properties
- Studies/data collection and analysis to develop property protection measures
- National Flood Insurance Program (NFIP) participation

Public Education and Awareness – Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Such actions include:

- Education, outreach projects and publications
- Real estate disclosure
- Hazard information centers
- School-age and adult education programs
- Programs to improve awareness of hazard risk
- Programs to improve awareness of hazard risk prevention and reduction

- Education programs directed toward specialized audience, i.e. buildings, developers, and hazard prone neighborhoods
- Utilize new technologies to transmit information about hazard mitigation: Twitter, Facebook and YouTube
-

Natural Resource Protection – Actions that, in addition to minimizing losses, also preserve or restore the functions of natural systems. These actions include:

- Sediment and erosion control
- Stream corridor restoration
- Watershed management
- Forest and vegetation management
- Wetland restoration and preservation

Emergency Services – Actions that protect people and property during and immediately after a disaster or hazard event. Although these measures are not typically considered "mitigation, they significantly minimize the events impact and preserve the community's health and safety. Services include:

- Warning and communication systems
- Emergency response services
- Protection of critical facilities
- Emergency/response facilities and personnel
- Hazard warning systems and equipment
- Health/safety/environmental risk prevention/reduction
- Emergency/response infrastructure
- Emergency/response planning
- Emergency/response training
- Emergency/response vehicles, equipment and protective gear
- Emergency/response services studies and data collection
- Emergency/response communication systems

Structural Improvements - Actions that involve the construction and maintenance of structures and infrastructure to reduce the impact of hazards on people and property. Examples include:

- Dam and reservoir construction/maintenance
- Levee and floodwall construction and maintenance
- Channel modification/maintenance
- Shelter and Safe room construction
- Infrastructure construction and maintenance – roads and bridges
- Infrastructure construction and maintenance – utility systems
- Infrastructure construction and maintenance – urban and rural drainage systems
- Studies and data collection to develop structural projects

6.2 State Plan Goals

Goal 1. Maintain and enhance the State's capacity to continuously make Minnesota less vulnerable to all hazards.

- Institutionalize Hazard Mitigation
- Improve organizational efficiency
- Maximize the utilization of best technology

Goal 2. Build and support local capacity and commitment to continuously become less vulnerable to natural hazards.

- Increase awareness and knowledge of hazard mitigation principles and practice among local public officials.
- Provide direct technical assistance to local public officials and help communities obtain funding for mitigation planning and project activities
- Encourage communities to develop, adopt, and implement local hazard mitigation plans and updates
- Improve compliance with State floodplain regulations and encourage participation in the National Flood Insurance Program (NFIP), and Community Rating System (CRS)
- To assist jurisdictions in developing mitigation projects and identifying funding for cost-beneficial mitigation projects.
- Integrate No Adverse Impact (NAI) principles into hazard mitigation planning and principles.

Goal 3. Improve coordination and communication with other relevant entities.

- Establish and maintain lasting partnerships
- Update policies to eliminate conflicts and duplication of effort
- Incorporate hazard mitigation into the activities of other organizations

Goal 4. Increase public understanding, support, and demand for hazard mitigation.

- Identify hazard-specific issues and needs
- Heighten public awareness of natural hazards
- Publicize and encourage the adoption of appropriate hazard mitigation measures
- Educate the public on the benefits of mitigation measures
- Help educate the public on the benefits of hazard-resistant construction and site planning
- Maximize available post-disaster "windows of opportunity" to implement major mitigation outreach initiatives

The goals and objectives guided development of the mitigation activities in this Plan, and they will provide a vision for hazard mitigation and disaster resistance throughout the State of Minnesota. The state's goals are long-term general guidelines to establish and direct hazard mitigation and loss reduction measures. State hazard mitigation staff and the Silver Jackets team reviewed and updated the following goals. Changes are included in '2008 Updated Goal Tracking in Appendix M.

GOAL 1. Maintain and enhance the State's capacity to continuously make the State of Minnesota less vulnerable to all hazards.

Objective 1.1. Institutionalize Hazard Mitigation.

Strategy 1.1.1. Attract and retain qualified, experienced hazard mitigation professionals. (All State agencies involved in Mitigation)

Action 1.1.1.1. Provide high quality in-house training.

Action 1.1.1.2. Encourage professional development and certification through outside continuing education courses.

Action 1.1.1.3. Allow staff members to travel and attend relevant conferences and workshops.

Action 1.1.1.4. When appropriate, provide membership fees for professional organizations.

Update: A new program administrator/SHMO joined the HSEM mitigation staff in October 2010. The addition of new mitigation staff positions has been added to the strategic plan for the section.

Strategy 1.1.2. Expand Mitigation Opportunities. (HSEM)

Action 1.1.2.1. Publicize program successes through news media or on the web.

Action 1.1.2.2. Promote the Mitigation House as a tool for local use.

Update: A new HSEM website is in development as part of the Minnesota Department of Public Safety website redesign. HSEM has a Twitter account and Facebook page for social outreach.

Strategy 1.1.3. Maintain and implement a State All-Hazard Mitigation Plan that fosters innovation, advances public support, and gains long-term commitments for pre-disaster mitigation from the State of Minnesota. (HSEM)

Action 1.1.3.1. Closely follow FEMA's development of the new rules and regulations for implementing Section 322 of the Disaster Mitigation Act of 2000.

Action 1.1.3.2. Maintain a State All-Hazard Mitigation Plan that remains a functional document to guide all mitigation section activities.

Action 1.1.3.3. Review and incorporate the completed state owned/operated facility inventory list.

Action 1.1.3.4. When local jurisdiction's mitigation plans are approved, incorporate the hazards, risk assessments and projects into the statewide planning initiative.

Action 1.1.3.5. When local jurisdiction's mitigation plans are approved, review their mitigation policies, programs and capabilities.

Action 1.1.3.6. Establish criteria to guide the approval of planning and project grants.

Update: The State mitigation program continues to utilize strategies from the state Plan to make the state more disaster resistant. Local Plan Integration was completed for the 2011 Plan Update. Local projects have been identified. The state owned facility list is still in development.

Objective 1.2. Improve organizational efficiency.

Strategy 1.2.1. Coordinate and communicate with other Sub-Divisions within the Division to support mitigation efforts. (HSEM)

Action 1.2.1.1. Jointly develop procedures with the Public Assistance Section to maximize the use of Section 406 Mitigation Funding following a declared disaster event.

Action 1.2.1.2. Coordinate with the Public Information Officer to publicize success stories.

Action 1.2.1.3. Improve coordination and communication with Regional Program Coordinators by consulting them in the application process and notifying them of grant approval.

Update: Mitigation staff work closely with the State Public Assistance Officer and the Disaster Recovery Coordinator to help identify mitigation needs and provide program information to communities. In addition, staff participates in post disaster applicant briefings as staffing allows and need is identified. HSEM Regional Program Coordinators (RPC) are now advised of grant opportunities and applications that are submitted by their counties. RPCs are updated periodically/quarterly regarding the grant status.

Strategy 1.2.2. Improve Communication with grant applicants and subgrantees. (HSEM)

Action 1.2.2.1. Make regular contact with subgrantees to disseminate policies and provide training as needed.

Action 1.2.2.2. Maintain consistency between policies and procedures, and create an e-mail group to allow for routine dissemination of policies and procedures.

Action 1.2.2.3. Maintain the same Project Manager for consistency.

Action 1.2.2.4. Maintain and update a contact log.

Update: "Task assignment-use a weekly task assignment sheet and help staff prioritize assignments." The sheet was replaced with more frequent meetings.

Maintaining consistency has been challenging due to staff turnover within HSEM. E-mail groups have been established for planning grants and project grants.

Strategy 1.2.3. Streamline Grant Management Process and Procedures. (HSEM)

Action 1.2.3.1. Maintain a uniform 6-part standardized filing system.

Action 1.2.3.2. Assure staff documents all contact, visits, etc. with community in a contact log.

Action 1.2.3.3. An updated POC group will be set up on the e-mail system to facilitate POC's receiving policies promptly. POC's who do not have e-mail will be set up as a group on the fax system and information faxed to them.

Action 1.2.3.4. Minimize paperwork and reporting requirements where possible.

Update: All new files at HSEM follow a standardized format. Files are maintained for each grant where staff can place relevant information. Staff members file emails and electronic documents in electronic project folders project. Email groups have been established for planning and projects.

Strategy 1.2.4. Improve Management. (HSEM)

Strategy 1.2.5. Ensure Timely Process. (HSEM)

Action 1.2.5.1. Complete Local Mitigation Plan reviews within 30 days.

Update: Plans are reviewed in a timely manner.

Objective 1.3. Maximize the utilization of best technology.

Strategy 1.3.1. Incorporate geographic information system (GIS) as a tool in decision making. (HSEM)

Action 1.3.1.1. Continually upgrade statewide spatial data maintained in-house through multiple data sources.

Action 1.3.1.2. Evaluate emerging technologies and upgrade through hardware/software acquisition and training where appropriate and feasible.

Action 1.3.1.3. Maintain capability of GIS specialists and technicians through classroom education and distance learning.

Action 1.3.1.4. Make spatial data with viewing and mapping capability available to all staff in hazard mitigation section, creating a scaled section-wide geographic information system.

Update: HAZUS training was completed in-state for 26 students from various federal, state, and local agencies. HSEM currently relies on other state agencies for the majority of its GIS support.

Strategy 1.3.2. Cooperate and coordinate with partners at all government levels in planning and use of best technology. (HSEM)

Action 1.3.2.1. Develop working relationships with other state agencies for mutual assistance in technologies

Action 1.3.2.2. Work with State and federal agencies to ensure all current risk data bases are utilized (i.e., weather studies and rainfall data).

Action 1.3.2.3. Develop working relationship with federal agencies with interests related to emergency management and hazard mitigation, with technologies from which we can benefit.

Update: The Silver Jackets initiative is a new collaborative group HSEM participates in.

Strategy 1.3.3. Increase the use of best technology in Grants Management. (HSEM)

Action 1.3.3.1. Use GIS for project identification, application development and project implementation.

Update: Progress has been limited due to the lack of access to GIS software for HSEM mitigation staff. A new emphasis will be put in place to better utilize technology to enhance the State's ability to identify, develop and monitor future mitigation activities.

GOAL 2. Build and support local capacity and commitment to continuously become less vulnerable to natural hazards.

Objective 2.1. Increase awareness and knowledge of hazard mitigation principles and practice among local public officials.

Strategy 2.1.1. Conduct mitigation presentations for local public officials. (HSEM)

Action 2.1.1.2. Contact associations for zoning officials to present mitigation ideas to their membership.

Update: Post DR-1921-MN disaster building code outreach was conducted by FEMA and Minnesota Dept. of Commerce.

Strategy 2.1.2. Conduct training courses for local public officials. (HSEM)

Action 2.1.2.1. Conduct interactive "Mitigation Planning Workshops."

Action 2.1.2.2. Educate HSEM Regional Program Coordinators and local coordinators in coordination with the Training Officer.

Update: HM staff strategically targets jurisdictions due for plan update. HSEM has an online training program, available at

https://www.dps.state.mn.us/dhsem/HSEM_Training/hsemIndex.asp

Mitigation staff will continue to routinely conduct individual mitigation training with communities and agencies that either request it or have been identified as experiencing difficulties in their project development or grant management activities.

Strategy 2.1.3. Provide jurisdictions with the necessary resources to evaluate their community building codes highlighting the impact of safe buildings on local residents. (Building Code and Standards)

Action 2.1.3.1. Promote Department of Labor and Industry website that provides informational resources regarding building codes administered in Minnesota. www.dli.mn.gov/ccld/codes.asp

Update: Post DR-1921-MN disaster building code outreach was conducted within the realm of both the Public Assistance Program and the Hazard Mitigation Assistance program. Additional outreach coordination will continue through the Minnesota Dept. of Labor.

Objective 2.2. Provide direct technical assistance to local public officials and help communities obtain funding for mitigation planning and project activities.

Strategy 2.2.1. Provide information on available mitigation funds to jurisdictions. (HSEM and MN DNR)

Action 2.2.1.2. Following any major disaster, inform local communities about mitigation programs.

Action 2.2.1.3. Provide presentations to local jurisdictions explaining all types of mitigation funding sources that are or might become available.

Update: Outreach has been offered to local communities at applicant briefings and targeted stakeholder meetings post disaster. Communities with approved plans are notified of funding availability.

Strategy 2.2.2. Publicize and provide risk assessment products and planning services to assist local officials throughout the local mitigation planning process. (HSEM)

Action 2.2.2.1. Distribute FEMA's mitigation planning documents (State and Local Mitigation Planning how-to guides) to interested jurisdictions.

Update: HSEM staff conducts trainings throughout the year for local emergency managers, consultants and contractors that work with locals on their all-hazard mitigation plans, plan updates, benefit–cost analysis and project applications. Presentations, workshops and trainings held the past three years include:

- Planning workshops for jurisdictions June 2009 in Alexandria and January 2010 in Mankato.
- Benefit Cost Analysis Course 4.5 in Alexandria July 2009

- Integrated Emergency Management Course in State Emergency Operations Center, August 2010
- Mitigation staff lead trainings and workshops annually at the MN HSEM Governor's Conference and the MNAFPM Conference

Objective 2.3. Encourage communities to develop, adopt, and implement local hazard mitigation plans.

Strategy 2.3.1. Continuously demonstrate the importance of pre-disaster mitigation planning to local public officials and promote the availability of Pre-Disaster Mitigation (PDM) resources. (HSEM)

Action 2.3.1.1. Send updated information on the PDM initiative to all eligible municipal and county managers, along with local planners and floodplain administrators.

Action 2.3.1.2. Publicize Section 322 of the Disaster Mitigation Act of 2000 to local public officials in all outreach activities.

Update: The availability of the PDM has been promoted when staff resources are able to support it. Local communities around the state have been awarded grants for this program.

Objective 2.4. Improve compliance with State floodplain regulations and encourage participation in the National Flood Insurance Program (NFIP).

Strategy 2.4.1. Promote NFIP compliance as a prerequisite for all communities with an identified Special Flood Hazard Zone considering hazard mitigation projects. (MN DNR and HSEM)

Action 2.4.1.1. Ensure that Mitigation section staff routinely identify and communicate potential compliance issues.

Action 2.4.1.2. Ensure communities not in good standing with the NFIP understand that they will remain ineligible for any mitigation funding.

Update: HSEM and DNR continue to encourage participation.

Strategy 2.4.2. Encourage communities to adopt strong local floodplain regulations to reduce future flood losses. (MN DNR)

Action 2.4.2.1. Work with HSEM and MN DNR to identify flood prone areas in incorporated municipalities where stronger regulations would be appropriate.

Action 2.4.2.2. Maintain awareness of new incorporations and encourage participation in the NFIP. (MN DNR)

Action 2.4.2.3. Continue to work with MN DNR to conduct floodplain management and flood mitigation workshops. (HSEM)

Update: HSEM and DNR continue to encourage participation.

Strategy 2.4.3. Encourage participation in Community Rating System (CRS) and improve ratings of communities. (MN DNR and HSEM)

Action 2.4.3.1. Identify potential CRS communities and encourage enrollment.

Update: HSEM and DNR continue to encourage participation.

Strategy 2.4.4. Use new technologies such as Map Modernization and digital floodplain mapping (DFIRM) as a tool to increase flood hazard awareness and risk reduction. (MN DNR and HSEM)

Action 2.4.4.1. Use DFIRM data to identify newly mapped flood hazard areas. (MN DNR). Notify communities with new flood risks and encourage them to adopt local floodplain regulations and seek mitigation alternatives. Encourage and assist communities to develop GIS parcel maps and DFIRMs to identify at-risk properties in flood hazard areas.

Action 2.4.4.2. Work with communities, NWS and USGS to identify flood risks and establish flood gages and early warning systems.

Update: DNR utilizes new floodplain mapping and provides information to local communities as part of the mapping process. The Silver Jackets subcommittee has been addressing the locations of stream gages and the need for additional statewide gage location to better predict and warn against flooding events. HSEM has been actively funding stream gages as early warning systems through the Hazard Mitigation Grant Program – 5% Initiative.

Strategy 2.4.5. Support the Minnesota Association of Floodplain Managers (MNAFPM) programs, including education and communication.

Action 2.4.5.1. Support ASFPM administration of the Certified Floodplain Manager (CFM) program. (MN DNR)

Action 2.4.5.2. Coordinate education activities with MNAFPM and support annual conference.

Update: Ongoing

Strategy 2.4.6. Assure minimum flood protection standards are met and promote higher floodplain management standards in all jurisdictions.

(MN DNR and HSEM)

Action 2.4.6.1. Promote and distribute model Floodplain Management Ordinances and Floodplain Management Series Information sheets. (MN DNR)

Ordinances available at:

www.dnr.state.mn.us/waters/watermgmt_section/floodplain/sample_ordinances.html and Flood Information Sheets are available at DNR website.

Action 2.4.6.2. Develop and maintain community floodplain management information database.

Update: Staff is continuing to provide information to the communities on how to establish a local floodplain ordinance and who to contact for assistance.

Objective 2.5. To assist jurisdictions in developing mitigation projects and identifying funding for cost-beneficial mitigation projects.

Strategy 2.5.1. Identify and assess repetitive loss properties for possible projects. (MN DNR and HSEM)

Action 2.5.1.1. Develop statewide tracking system for repetitive loss structures.

Update: Need repetitive loss database that tracks buyouts and retrofits' from all grant funding sources. Acquiring repetitive loss properties is one of the State's highest priorities. A summary of all grant program buyouts will show the positive nature of the success this type of mitigation project has in the state.

Strategy 2.5.2. When available, allocate federal and state grant funding to eligible subgrantees for the purposes of developing local mitigation plans and projects, using adopted plans as guides for projects. (HSEM)

Action 2.5.2.1. Provide federal UHMA Planning and Project Grants to communities willing to provide a (up to) 25% local match, and based upon established criteria.

Update: Funding for plans and projects continues from disaster and non-disaster grant sources.

GOAL 3. Improve coordination and communication with other mitigation oriented entities.

Objective 3.1 Establish and maintain lasting partnerships.

Strategy 3.1.1. Distribute Minnesota publications to State Hazard Mitigation Officers and State Emergency Management Directors. (HSEM)

Action 3.1.1.1. Share new hazard mitigation-related publications with others.

Update: Silver Jackets initiative has started in Minnesota. A public education committee has been formed.

Objective 3.2. Streamline policies to eliminate conflicts and duplication of effort.

Strategy 3.2.1. Coordinate efforts with other agencies to ensure National Environmental Policy Act (NEPA) compliance. (HSEM)

Action 3.2.1.1. Prior to submission of application to FEMA, advising letters will be sent to the consulting agencies.

Action 3.2.1.2. All of the consulting agencies will be called to review all active projects to ensure that they are still in compliance.

Action 3.2.1.3. During 2008, HSEM will review the issue of establishing a single state mitigation fund, and determine whether or not to propose that it be addressed via legislature initiative for the 2009 Legislative Session.

Update: Environmental review process takes place as required by NEPA and FEMA. Compliance checks have not occurred due to low priority and short staffing. A state mitigation fund has not been set up.

Objective 3.3. Incorporate hazard mitigation into the activities of other governmental agencies organizations.

Strategy 3.3.1. Assist other state agencies in identifying structures located in hazardous areas. (HSEM and MNIDNR)

Action 3.3.1.1. Work with SHPO to identify elevations of historic structures in the floodplain.

Action 3.3.1.2. Work with state agencies to identify the elevations of state owned/operated facilities in the floodplain.

Action 3.3.1.3. Partner with former Project Impact participants regarding construction of community shelters.

Update: State owned facilities database is being updated. No progress on SHPO or community shelter database due to low priority and insufficient staffing.

Strategy 3.3.2. Work in coordination with other organizations to acquire and integrate No Adverse Impact principles and connect hazard-prone or environmentally sensitive lands throughout the State. (MN DNR and HSEM)

Action 3.3.2.1 . Use Flood Mitigation Assistance and Severe Repetitive Loss programs funds to acquire flood prone property. Utilize DNR grant funding 50% of local match.

Update: This program is utilized in the state. The DNR allocates funds to acquire flood prone properties. These funds are frequently used to provide the local match. The acquisition of substantially damaged and repetitive loss properties is a State priority. Many jurisdictions would be unable to participate without using these funds for matching funds. The No Adverse Impact movement can save lives and property if utilized in the state.

Strategy 3.3.3. Update building and fire codes with mitigation standards for adoption by local governments.

Action 3.3.2.2. Consult with state agencies, planning associations, and regional development commissions regarding how mitigation standards may be adopted by counties.

Action 3.3.2.3. Develop a plan of action to outreach communities to adopt mitigation related standards.

Action 3.3.2.4. Determine funding for the appropriate agencies to perform outreach to adopt mitigation related standards.

Update: Different organizations have contacts to assist with outreach throughout the state. Volunteer participation may be limited and funding may be needed to support various outreach efforts.

GOAL 4. Increase public understanding, support, and demand for hazard mitigation.

Objective 4.1. Identify hazard-specific issues and needs.

Strategy 4.1.1. Coordinate with key local officials to determine local issues and concerns as well as local, state and federal actions previously taken. (HSEM)

Action 4.1.1.1. Attend and make presentations at the annual MNAFPM conference.

Action 4.1.1.2. Hold meetings with Key Elected Officials, as requested.

Update: HSEM staff participates in MNAFPM conference committee, attend and make presentations at annual conferences as staffing allows. HSEM staff meet with local officials as requested.

Objective 4.2. Heighten public awareness of natural hazards.

Strategy 4.2.1. Launch or participate in awareness campaigns and special events. (HSEM)

Action 4.2.1.1. Participate in Winter Hazard Awareness Week.

Action 4.2.1.2. Participate in Severe Weather Awareness Week.

Action 4.2.1.3. Promote the National Weather Service (NWS) Storm Ready Program.

Action 4.2.1.4. Support and promote the DNR FireWise program.

Update: Awareness campaigns are collaboration between and held in conjunction with HSEM, DNR, NWS and other agencies annually. Counties in the northeastern portion of the state have received sprinkler system grants. Applicants for the sprinklers must meet FireWise requirements.

Strategy 4.2.3. Publicize and encourage the use of warning systems. (NWS and HSEM)

Action 4.2.3.1: Encourage local jurisdictions to establish and maintain a warning systems (e.g., Emergency Alert System (EAS), outdoor warning sirens, and Reverse 911) capable of alerting residents in a timely manner.

Action 4.2.3.2: Work to improve the capability to warn special populations, particularly those with hearing or visual impairments.

Action 4.2.3.3: Promote the use of ARMER interoperable radio and Disaster LAN critical incident software.

Action 4.2.3.4. Promote the advantages of weather radios to the general public.

Action 4.2.3.5. Encourage jurisdictions to keep outdoor warning sirens in good condition.

Action 4.2.3.6. Publicize the use and limitations of outdoor warning sirens.

Action 4.2.3.7. Encourage jurisdictions to warn at-risk population groups of the dangers of extreme temperatures and ways to avoid the danger.

Action 4.2.3.8. Encourage the use of the MDH Health Alert Network to all eligible communities.

Update: The number of jurisdictions with their own Emergency Alert System (EAS) encoders continues to increase. Warning sirens continue to be an issue for several small communities. Reverse 911 is being used in various cities. A consortium of state agencies is meeting with Regional Review Committees to integrate warning of special populations into response plans. ARMER and Disaster LAN systems are used extensively in the metro area and have been used for natural and manmade disasters. The NWS, retail outlets, and media are working together to offer discounts on weather radios. NOAA Weather Radios are promoted during Severe Weather Awareness Week.

Objective 4.3. Publicize and encourage the adoption of appropriate hazard mitigation measures.

Strategy 4.3.1. Provide information on mitigation techniques in the aftermath of disasters. (HSEM)

Action 4.3.1.1. Attend public meetings to discuss mitigation programs.

Action 4.3.1.2. Ensure mitigation is represented in the Joint Field Offices (JFOs).

Action 4.3.1.3. Organize wind-resistant construction and/or safe room workshops in the aftermath of tornadoes.

Action 4.3.1.4. Organize property protection workshops following wildfire incidents.

Action 4.3.1.5. Organize appropriate training workshops for any mitigation issue that arises after a disaster.

Update: Staff works out of JFO and attends public meetings as workload allows. FEMA staff held community safe room workshops and outreach in tornado stricken areas for DR-1921-MN.

Strategy 4.3.2. Increase the public's exposure to hazard mitigation issues. (MN DNR and HSEM)

Action 4.3.2.1. Ensure mitigation is represented at the State Fair.

Action 4.3.2.2. Offer promotional mitigation items to jurisdiction for their local public events and other promotional event opportunities.

Update: No HSEM staff was available for State Fair or other local public events. FEMA provided mitigation information at local county fairs post DR-1921-MN. DNR has an entire building at the State Fair used for outreach.

Objective 4.4. Educate the public on the benefits of mitigation measures.

Strategy 4.4.1. Utilize different methods to deliver the mitigation message to the public. (HSEM)

Action 4.4.1.1. Continue to develop success stories for the FEMA website. Provide a link from the HSEM website.

Action 4.4.1.2. Provide information to any media reporting on past disasters and mitigation in the aftermath of a disaster.

Action 4.4.1.3 Utilize new technologies to promote mitigation, including Twitter, Youtube and Facebook.

Action 4.4.1.3. Distribute mitigation materials to all of the libraries in the State.

Update: FEMA has assisted the State with success stories and loss avoidance studies post disaster. FEMA and MN Dept of Public Safety are using Twitter, Facebook and Youtube to promote mitigation. Public Safety is currently developing a new website.

Objective 4.5. Help educate the public on the benefits of hazard-resistant construction and site planning.

Strategy 4.5.1. Provide the public with information on building codes to enable them to make informed decisions. (HSEM)

Action 4.5.1.1. Provide links on the HSEM mitigation website to sites where individuals can learn more about building codes.

Update: FEMA provided experts for DR-1921-MN hazard-resistant construction education/outreach. Information is also available at http://www.minnesotarecovers.org

Objective 4.6. Maximize available post-disaster "windows of opportunity" to implement major mitigation outreach initiatives.

Strategy 4.6.1. Participate in Preliminary Damage Assessment (PDA) activities immediately following a disaster. (HSEM/FEMA)

Action 4.6.1.1. Assign staff to mitigation outreach teams.

Update: Mitigation staff participated as resources allowed.

Strategy 4.6.2. Document and disseminate information on losses avoided. (HSEM)

Action 4.6.2.1. Coordinate with local officials to collect digital pictures and field reports.

Action 4.6.2.2. Incorporate findings into future volumes of success story documents.

Action 4.6.2.3. Post success story articles on the mitigation website.

Action 4.6.2.4. Present information to the policy makers.

Update: FEMA in coordination with HSEM mitigation staff posted success stories and loss avoidance studies.

Strategy 4.6.3. Maximize available Federal resources. (HSEM)

Action 4.6.3.1. Assist colleges and universities in applying for Pre-Disaster grant funds. (HSEM)

Action 4.6.3.2. Work toward an approved enhanced state mitigation Plan.

Action 4.6.3.3 Acquire software to collect data identified in local mitigation plans for analysis in the state mitigation Plan.

Update: Shortage of HSEM staff resources did not allow the development of an enhanced Plan. HSEM priorities did not allow the assistance of any Disaster Resistant University plan grant application or development. HSEM investigated but did not pursue software for local mitigation plan integration.

6.3 Hazard Mitigation Strategies

The addition of the Natural Hazard Mitigation Goals, Strategies and Objectives section is new to the State of Minnesota All Hazard Mitigation Plan. The following hazard specific mitigation strategies and objectives are intended to further specify what type of mitigation strategies can be utilized to reduce deaths, injuries, property losses and other losses due to natural hazards. Mitigation strategies may be utilized alone or in combination to address natural hazards, depending upon the potential threat and potential for mitigation. The goal is to reduce the deaths, injuries, property loss and economic disruption to natural hazards that impact the state of Minnesota and its' communities. Communities should utilize these strategies and implementation of objectives as a guide to develop their local mitigation plans. The following objectives are examples of successful types of mitigation projects. Communities must weigh the cost-effectiveness, environmental impacts and technological feasibility prior to implementation.

Table 48 Natural Hazard Mitigation Goals, Strategies and Objectives	
FLOODING GOAL: Reduce deaths, injuries, property loss, and economic disruption due to all types of flooding (riverine, flash flooding).	
Mitigation Strategy	**Objectives**
Prevention:	Planning, technical studies, training, adoption of ordinances and legislation, acquisition and use of equipment, establishing shelters, and encouraging participation in NFIP and CRS will be used to prevent or reduce risks to lives and property from flooding.
Property Protection:	Acquisition, repair, or retrofitting of property and acquisition and use of equipment will be used to prevent or reduce risks to property from flooding.
Public Education and Awareness:	Public education and access to information will be used to raise public awareness of risks from flooding in order to prevent or reduce those risks.
Natural Resource Protection:	Stream corridor protection projects and restoration and soil erosion control projects will be used to prevent or reduce risks and increase the protection of natural resources from flooding.
Emergency Services:	Technological improvements, warning systems, responder training, emergency response services, acquisition and use of equipment, and planning will provide emergency services to prevent or reduce the risks to lives and property from flooding.
Structural Improvements:	Construction and maintenance of drains, sewer drainage and separation projects, floodwalls, dams, culverts, levees, roads, bridges, and general flood protection projects will be used to prevent or reduce damages from flooding, loss of services to critical equipment, and the risks they pose to lives, property, and the natural environment.
TORNADO GOAL: Reduce deaths, injuries, property loss, and economic disruption due to tornadoes.	
Mitigation Strategy	**Objectives**
Prevention:	Adoption of ordinances and legislation, acquisition and use of equipment, planning, conducting technical studies, and establishing of shelters will be used to prevent or reduce risks to lives, property, and economic activity from tornadoes.
Property Protection:	Constructing safe rooms and storm shelters, and retrofits will be used to prevent or reduce risks to property from tornadoes.
Public Education and Awareness:	Warning systems, public education, and access to information will be used to raise public awareness of risks from tornadoes in order to prevent or reduce those risks.
Emergency Services:	Warning systems, technological improvements, responder training, planning, emergency response services, and acquisition and use of equipment will provide emergency services to prevent or reduce risks from tornadoes.
Structural Improvements:	Construction of storm shelter and safe rooms and maintenance of other structural projects will be used to prevent or reduce risks from tornadoes.

WILDFIRE GOAL: Reduce deaths, injuries, property loss, natural resource and economic disruption due to wildfires.	
Mitigation Strategy	**Objectives**
Prevention:	Enforcement of regulations, adoption of ordinances, technical studies, and planning will be used to prevent or reduce wild land fires and the risks they pose to lives, property, and the natural environment.
Property Protection:	Vegetation management, water treatment measures (for example: sprinklers) will be used to prevent or reduce the risk of wild land fires.
Public Education and Awareness:	Public education and access to information will be used to raise public awareness of risks from wild land fires in order to prevent or reduce those risks, specifically the FireWise program.
Emergency Services:	Planning, responder training, acquisition and use of equipment, evacuations, warning systems, technological improvements, and emergency response services will provide emergency services to prevent or reduce risks to lives and property from wild land fires.
Structural Improvements:	New or retrofit construction utilizing fire resistant building materials and installation and maintenance of sprinkler and warning systems will be used to prevent or reduce the risk of wild land fires.
WINDSTORMS GOAL: Reduce deaths, injuries, property loss, and economic disruption due to windstorms.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, technical studies, acquisition and use of equipment, adoption of ordinances and legislation, and establishing of shelters will be used to prevent or reduce risks from windstorms to lives, property, and economic activity.
Property Protection:	Constructing safe rooms and storm shelters, retrofitting, and vegetation management will be used to prevent or reduce risks to the protection of property from windstorms.
Public Education and Awareness:	Public education, warning systems, and access to information will be used to raise public awareness of risks from windstorms in order to prevent or reduce those risks.
Emergency Services:	Warning systems, responder training, emergency response services, technological improvements, and response and recovery planning will provide emergency services to prevent or reduce risks from windstorms.
Structural Improvements:	Construction of storm shelters and safe rooms and maintenance of other structural projects will be used to prevent or reduce risks from windstorms.
SEVERE WINTER STORMS GOAL: Reduce deaths, injuries, property loss, and economic disruption due to severe winter storms.	
Mitigation	**Objectives**

Strategy	
Prevention:	Acquisition and use of equipment, adoption and enforcement of ordinances and legislation, planning, and technical studies will be used to prevent or reduce risk to the protection of lives, property, and economic activity from the risks from severe winter storms.
Property Protection:	Acquisition and use of equipment and vegetation management will be used to prevent or reduce risks to property from the risks from severe winter storms.
Public Education and Awareness:	Public education, warning systems, access to information, and outreach projects will be used to raise public awareness of the risks from severe winter storms in order to reduce those risks.
Emergency Services:	Acquisition and use of equipment, emergency response services, warning systems, technological improvements, planning, and responder training will provide emergency services to prevent or reduce risks from severe winter storms.
Structural Improvements:	Structural projects will be implemented and maintained to prevent or reduce risks from severe winter storms.
LIGHTNING GOAL: Reduce deaths, injuries, property losses, loss of services, and economic disruption due to lightning.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, technical studies, acquisition and use of equipment, adoption of ordinances and legislation, and establishing shelters will be utilized to prevent or reduce the risks from lightning.
Property Protection:	Retrofits and construction of safe rooms and storm shelters will be used to prevent or reduce the risks to property from lightning.
Public Education and Awareness:	Public education, outreach projects, and access to information will be used to raise public awareness of risks from lightning in order to prevent or reduce those risks.
Emergency Services:	Responder training, warning systems, emergency response services, planning, acquisition and use of equipment, and technological improvements will provide emergency services to prevent or reduce risks to lives and property from lightning.
Structural Improvements:	The construction of safe rooms, shelters, and underground utility lines as well as maintenance of structural projects will be used to prevent or reduce risks from lightning.
HAIL GOAL: Reduce deaths, injuries, property loss, and economic disruption due to hailstorms.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, technical studies, and adoption of ordinances and legislation will be used to prevent or reduce risks to life, property, and economic activity from hailstorms.
Public Education and Awareness:	Public education and access to information will be used to raise awareness of the risks of hailstorms in order to prevent or reduce those risks.
Emergency	Warning systems, responder training, technological improvements, and planning

Services:	will be used to provide emergency services to prevent or reduce the risks from hailstorms.
Structural Improvements:	Construction of shelters and safe rooms and maintenance of existing structures will be used to prevent or reduce the risks from hailstorms.
DAM FAILURE GOAL: Decrease the risks to life and property from dam failure in the State of Minnesota.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, technical studies, inspections, and encouraging participation in NFIP will be used to prevent or reduce risks from dam failures.
Public Education and Awareness:	Public education will be used to raise awareness of risks from dam failures in order to prevent or reduce those risks.
Natural Resource Protection:	Watershed management projects will be used to protect natural resources and prevent or reduce risks from dam failures.
Emergency Services:	Planning, responder training, warning systems, emergency response services, technological improvements, and acquisition and use of equipment will provide emergency services to prevent or reduce risks from dam failures.
Structural Improvements:	Structural projects will be used to prevent or reduce the risks of dam failures.
DROUGHT GOAL: Reduce economic, agricultural and natural resource disruption due to drought.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, acquisition and use of equipment, and technical studies will be used to prevent or reduce risks from drought.
Property Protection:	Water treatment measures will be used to prevent or reduce risks to property from drought.
Public Education and Awareness:	Public education and access to information will be used to raise public awareness of risks from drought in order to prevent or reduce those risks.
Natural Resource Protection:	Planning and implementing watershed plans will be used to prevent or reduce risks from drought.
Structural Improvements:	Technological improvements and acquisition of equipment for structural projects will be used to prevent or reduce risks from drought.
EXTREME TEMPERATURES GOAL: Reduce deaths, injuries, property loss, and economic disruption due to extreme heat.	
Prevention:	Planning and the acquisition and use of equipment will be used to prevent or reduce risks from extreme temperatures.
Property Protection:	Acquisition and use of equipment will be used to prevent or reduce risks to property and economic disruption from extreme temperatures.
Public Education	Public education and access to information will be used to raise public awareness of

and Awareness:	the risks from extreme temperatures in order to prevent or reduce those risks.
Structural Improvements:	Planning, responder training, warning systems, establishing shelters, and technological improvements will provide emergency services to prevent or reduce risks from extreme temperatures.
SINKHOLE (AND LAND SUBSIDENCE) GOALS: Reduce the threat to public health, property loss, damages to structures and infrastructure due to sinkholes and land subsidence.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, technical studies, and building/development regulations will be used to prevent or reduce risks from sinkholes.
Property Protection:	Outreach efforts, public education and access to information will be employed to raise public awareness in order to reduce financial loss and risks to lives and property from sinkholes.
Public Education and Awareness:	Measures to reduce the volume of water passing into a sinkhole will be used in order to reduce financial loss, property damage, and threats to the public health and safety.
COASTAL EROSION GOALS: Limit property damage, economic loss, and disruptions in commercial and industrial activities in Minnesota due to coastal erosion (Lake Superior).	
Prevention:	Planning, technical studies, implementing watershed plans, and adoption of building codes will be used to prevent or reduce risks from coastal erosion.
Public Education and Awareness:	Public education and access to information will be used to raise public awareness of risks from coastal erosion in order to prevent or reduce those risks.
EARTHQUAKE GOALS: Limit property damage, economic loss, and disruptions in commercial and industrial activities in Minnesota due to earthquake.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, building code adoptions and management programs will be used to prevent or reduce risks to property and economic activity from earthquakes.
Property Protection:	Repair and retrofitting of structures will be used to prevent or reduce risks from earthquakes.
Public Education and Awareness:	Public education and access to information will be used to raise awareness of the risks from earthquakes in order to prevent or reduce those risks.
Emergency Services:	Planning, responder training, alert systems, establishing shelters, and technological improvements will provide emergency services to prevent or reduce risks from earthquakes.
LANDSLIDE GOAL: Decrease damage to structures, roads, highways, and bridges from landslides will be decreased.	
Mitigation Strategy	**Objectives**
Prevention:	Planning, technical studies, and adoption of building codes will be used to prevent

	or reduce risks from landslides.
Public Education and Awareness:	Public education and access to information will be used to raise awareness of the risks from landslides in order to prevent or reduce those risks.
Emergency Services:	Planning to implement emergency services will be used to prevent or reduce risks from landslides.

The natural hazard goals, strategies and objectives are broad enough, yet specific enough that local communities can utilize items that are most important to them. Based on local priorities and funding availability the tools above can guide communities to develop an overall mitigation strategy and implement projects to make their communities more disaster resistant.

New state hazard mitigation plan requirements from FEMA have guided the creation of a natural hazard specific action section. Planning in of itself is a beneficial exercise, but the need to impendent mitigation projects to exemplify the effectiveness of planning has become more important. In addition, due to the number and types of disasters in the state of Minnesota the past three years, it was deemed important by HSEM staff and the Silver Jackets to include hazard specific actions. After tornadoes struck Wadena in the summer of 2010 the state Plan was referenced to see what types of project types were included to address the impact of tornadoes. It was found that the Plan lacked hazard specific actions. The previous and following sections aim to address any potential shortfalls and cover any potential hazard specific project gaps. Funding is typically available post-disaster as HMGP funds, or annually with the release of the HMA guidance. Mitigation and other strategic planning documents are typically due for review on a set schedule; state mitigation plans every three years, local hazard mitigation plans every five years, etc. Other planning documents may be created or updated dependent upon funding availability.

6.4 Hazard Mitigation Actions

State Strategy Legend
Prevention = P
Property Protection = PP
Public Education = PE
Natural Resource Protection = NR
Emergency Services = ES
Structural Improvements = SI

The following table indicates what hazard is addressed by action type, what state strategy the action addresses, potential funding sources and timeframe. Primary funding sources are the pre and post-disaster grant programs – the PDM and HMGP explained in detail in the Plan. One potential funding source in the Natural Hazard Mitigation Action table is the Emergency Management Performance Grants (EMPG) program. The EPMG provides resources to assist State and local governments to sustain and enhance all-hazards emergency management capabilities. States have the opportunity to use EMPG funds to further strengthen their ability to support emergency management activities while simultaneously addressing issues of national concern as identified in the National Priorities of the National Preparedness Guidelines. EMPG has a 50 percent Federal and 50 percent State cost-share cash or in-kind match requirement. Other potential funding sources are described in Section 6.5.

Table 49 Natural Hazard Mitigation Actions

HAZARD	STRATEGY	ACTION	POTENTIAL FUNDING SOURCES	TIMEFRAME
All	P, PE, ES	Develop/update/publicize emergency management plans, including preparedness, response, recovery, operations, long-term recovery, and mitigation plans and maintain data inventory	HMGP-Planning, PDM-Planning, EMPG	Ongoing, as required
Flooding	P, PP, NR, ES	Acquire flood prone properties and convert to open space/green space; relocate or elevate to or above base flood elevation.	HMGP, RFC, SRL,FMA, MN DNR, BWSR	Pre and post-disaster
High Winds, Severe Winter Storms, Wildfires	SI	Electrical utility retrofit/hardening	HMGP, PDM	Pre and post-disaster, ongoing
Flooding	SI, NR	Construct, retrofit or maintain drainage systems (pipes, culverts, and channels) to provide adequate and proper functioning systems to include sewage systems and retention and detention systems	HMGP, PDM, USDA-NRCS-FSA, SWCDs, BWSR	Post-disaster, ongoing
Flooding	SI, NR	Replace or retrofit bridges and culverts to meet capacity requirements	HMGP, PDM	Post-disaster, ongoing
Flooding, Landslide, Sinkholes & Land Subsidence	SI, NR	Install soil stabilization, drainage and erosion protection measures	MN DNR, BWSR, USDA-NRCS-FSA, SWCDs, BWSR	Post-disaster, ongoing
Flooding	SI	Construct, retrofit or maintain levees, dams, floodwalls, culverts, and floodgates to ensure adequate capacity and protection levels for property and critical facilities	MN DNR, BWSR, USDA-NRCS-FSA, SWCD	Post-disaster, ongoing

Table 49 Natural Hazard Mitigation Actions

HAZARD	STRATEGY	ACTION	POTENTIAL FUNDING SOURCES	TIMEFRAME
Tornados, Windstorms	SI	Construct public safe rooms for government facilities functions, critical facilities functions, recreational areas, manufactured home parks, schools, and day care centers.	HMGP, PDM	Post-disaster, annually
Flooding	PE, NR	Encourage communities to participate in the National Flood Insurance Program and to complete and adopt the FIRM (Flood Insurance Rate Map)	MN DNR, HMGP-Planning	Pre and post-disaster
All	PE	Develop educational materials for the general public and decision makers, educational projects and information regarding public and private volunteer initiatives as well as information regarding health safety and alternatives to improve the public's awareness of hazard risks and ways to prevent or reduce their impact with a sustainment mechanism to distribute educational materials.	HMGP-5%, NWS, USGS	Ongoing, Pre and post-disaster
All	PE	Promote NOAA (National Oceanic and Atmospheric Administration) weather radio, including citizen purchase of receivers and maintenance of existing NOAA towers	NWS, HMGP-5%	Ongoing
All	P, PP, PE	Develop and promote comprehensive cost-effective recommendations for adoption and enforcement of land use, ordinances and regulations, promote legislation, zoning, and building codes that regulate construction, and decrease risk in	Unknown	ASAP, post-disaster

Table 49 Natural Hazard Mitigation Actions

HAZARD	STRATEGY	ACTION	POTENTIAL FUNDING SOURCES	TIMEFRAME
		areas susceptible to hazards		
Flooding	P, PE	Encourage communities to include severe repetitive loss and repetitive loss strategy in all-hazard mitigation plans and comprehensive plans and educate communities on these properties in their jurisdiction and measures which may be used to reduce future damages	HMGP, PDM, RFC, SRL, MN DNR	ASAP, ongoing
Flooding	P, PE	Complete FIRM (Flood Insurance Rate Maps) and encourage NFIP community and individual participation, and survey of flood prone areas, and river channel studies, and update of existing flood maps and evaluation of the existing Community Rating System	MN DNR	ASAP, Ongoing
Tornado	P, PP, PE	Provide safe room education for builders and developers	HMGP-5%, PDM	Pre and post disaster
Flooding	P, NR	Develop and implement watershed studies and implement watershed plans and conduct hydrology studies and studies of groundwater problems, support of siltation removal projects, and creation of retention basins	MN DNR, MPCA, BWSR, SWCDs, NRCS-FSA	As funding allows
Flooding, Wildfires	P, NR	Establish natural vegetation buffers and removal of dead vegetation next to sensitive lands and forestry improvements/tree planting (sinkholes, floodplains, etc.)	MN DNR, USFS	As funding allows

Flood mitigation measures are the highest priority in the state due to the high occurrence and high mitigation potential. Tornadoes, windstorms and wildfire mitigation measures are also higher risk as demonstrated by the hazard analysis and risk assessment process, and while damages can be reduced, not all damages can be completely mitigated. Depending upon the funding source - disaster or non-disaster - project priority is subject to an evaluation process. The MN Recovers Task Forces natural resources/mitigation subcommittee has its own evaluation process. The HMGP and annual HMA grants project funding priority is subject to a different priority process.

With each project evaluation the benefit-cost ratio, feasibility, and environmental review issues are analyzed. Only projects that meet the criteria - of being cost-beneficial, feasible and pass NEPA review are selected for further review, and implementation. Based on the state's past mitigation successes the following discussion of high priority actions considers and explains how each activity contributes to the overall mitigation strategy of the state.

Based on the state mitigation program history and FEMA requirements, planning measures are a high priority. Generally, public education and various types of hazard or risk reduction training and education measures are also a high priority. In looking at all measures the state has successfully completed, it is obvious that measures such as planning, electrical utility system retrofit/hardening, infrastructure, property acquisitions, and tornado safe-rooms are all high priorities. Disaster specific events and associated disaster response and recovery measures can result in the prioritization of specific mitigation measures that contribute to the disaster recovery process. In Minnesota, this holds true in particular for acquisition and/or relocation of repetitive loss residential and commercial structures as well as flood retrofitting projects for critical facilities and infrastructure. Along with hazard mitigation planning, the acquisition of flood prone homes, electrical utility retrofits, and wildfire sprinklers are a few of the state's high priority actions.

The State of Minnesota has experienced many long-term successes with mitigation from since 2000. More specifically, during the last three years, multiple mitigation measure projects in development coincide with the objectives and goals in the State Hazard Mitigation Plan to prevent and reduce the risks to lives, property, and economic activity from the effects of all hazards. Minnesota communities have benefited and are benefitting from mitigation activities such as local hazard mitigation planning, property acquisition/relocation/elevation, critical facilities protection, infrastructure, drainage, electrical retrofit, safe rooms, NOAA weather radio transmitter installations and through various training, workshops and mitigation related outreach. These mitigation measures are making communities across the state safer and more secure against the negative impacts of natural and human-made hazards. The State of Minnesota continues to effectively implement mitigation programs towards achieving its goals as identified in this Plan.

Since April 2008 the State of Minnesota has received five Presidential Declared Disasters, which emphasized the vulnerabilities and obstacles the state faces in relation to natural hazards such as flooding, tornadoes, and severe storms. The multitude of these disasters has offered opportunities for the state to strengthen their mitigation capabilities through the availability of HMA funding. Federally approved and funded mitigation projects are being administered by the state to include the HMGP and PDM programs. These programs have enabled mitigation projects to address the

State's hazard mitigation goals and objectives meeting the priorities and criteria outlined in the Mitigation Strategy.

In addition to federal programs, several programs at the state level support the goals and objectives outlined and are utilized in advancing mitigation statewide. The State Capability Assessment provides some of the programs and initiatives currently supporting mitigation in Minnesota. Further, the state capability assessment demonstrates the success of the State's mitigation programs administered by both federal and state agencies.

In evaluation of all measures identified and prioritized, it was determined that the 2011 State Hazard Mitigation Plan measures including planning, electrical utility system retrofit/hardening, infrastructure, wildfire retrofit, property acquisitions, and tornado safe rooms are considered high priorities for the State of Minnesota. The action descriptions listed below are the primary actions the state supports for addressing the hazards analyzed in this Plan (not an inclusive list of all actions supported).

State Priority Mitigation Action Descriptions

Mitigation Action: **Develop/update/publicize emergency management plans, including preparedness, response, recovery, operations, long term recovery, and mitigation plans and maintain data inventory**

Planning mitigation measures address multiple objectives in the State Plan that largely impact the state goals for the prevention and reduction of risks to lives, property, and economic activity from the effects of all hazards. Hazard Mitigation Planning is a high priority mitigation measure for implementation in the State of Minnesota. These local plans offer communities the opportunity to identify and evaluate hazards, assess risk, probability, vulnerability, impact, and develop mitigation goals and actions for the prevention and preparation of future hazard events. Of the 87 counties in the state, 80 have approved plans and the remaining seven are in the process of updating. In addition, two cities have local plans. One tribal government submitted their plan to the state for approval, and other tribes opt to submit their plan directly to FEMA.

Mitigation Action: **Acquire flood prone properties and convert to open space/green space; or elevate to or above base flood elevation**

Approximately 1,600 acquisition projects have been completed and are in development following catastrophic flooding in the state. The Hazard Mitigation Grant Program currently provides funding for acquisition/demolition of properties with additional properties being acquired through FDR funding by the Minnesota Department of Natural Resources.

Mitigation measures providing property acquisitions directly address objectives for river and flash flooding and infrastructure failure hazards. Acquisition, repair or retrofitting of property and acquisitions and use of equipment will be used to prevent or reduce risks to property from riverine and flash flooding. Acquisition and improvement of property as well as acquisition, use/or installation of equipment will be used to prevent or reduce risks to property from flash flooding.

Flooding is the highest ranked hazard in this Plan. Acquisition for demolition/relocation/elevation is ranked as a high priority for mitigation measures in this Plan.

Property acquisitions for homes in special flood hazard areas, these projects will directly reduce deaths, injuries, property loss, and economic disruption from river flooding future events. The Montevideo and Moorhead Losses Avoidance Studies demonstrate the impact that mitigation actions for acquiring property and converting to open/green space have on the total losses avoided contributable to previous mitigation actions.

Mitigation Action: **Construct, retrofit or maintain drainage systems (pipes, culverts, and channels) to provide adequate and proper functioning systems to include sewage systems and retention and detention systems**

The state and eligible communities throughout the State have worked in partnership to develop infrastructure mitigation projects. These mitigation projects are broadly defined as drainage and flood control type mitigation. Mitigation projects in development are intended to retrofit existing drainage systems to more effectively handle riverine and overland flooding, protect commercial, residential, and governmental facilities critical to the health, safety and welfare of the populations they serve, and reduce and/or eliminate the long term risk to people and property from natural hazards. These projects involve storm sewer systems, sanitary sewer systems, potable water treatment facilities, wastewater treatment, buildings, equipment and life safety. This mitigation measure is a high priority for this Plan and addresses riverine, flash flooding and sinkholes.

Mitigation Action: **Construct public safe rooms for government facilities functions, critical facilities functions, recreational areas, manufactured home parks, schools and day care centers**

Construction of safe rooms and maintenance of other structure projects will be used to prevent or reduce risks to life and property from the hazards of tornadoes, thunderstorm & lightning, hailstorms, and windstorms. Safe rooms are long-term hazard mitigation measures implemented to reduce the loss of life and property, lessen the impact to local communities due to natural disasters, and enable recovery after a disaster. Overall, safe rooms are ranked high for the prioritized mitigation measures for Minnesota.

Multiple applications are currently under development. Safe rooms address objectives to "Construct public safe rooms for government facilities, critical facilities, recreational areas, manufactured home parks, schools, and day care centers."

Mitigation Action: **Electrical utility retrofit/hardening**

Following windstorms and severe winter weather, including ice storms, the state has worked to develop and fund electrical utility retrofit/hardening projects with rural electric cooperatives. Multiple electrical retrofit projects in development are to upgrade and strengthen conductor, increase pole size, reduce pole spans, convert overhead electrical distribution lines to underground power lines, and ensure a more reliable supply of power to critical facilities. These projects involve hundreds of miles of transmission, distribution, and electrical infrastructure. These projects reduce the future risk of life safety and health, property loss and economic disruption effected by hazards from severe winter storms, wind storms, power failure, tornadoes, and lightning. Electrical utility retrofit/hardening mitigation measures are a high priority for the state. Mitigation measures are evident in these projects by strengthening and improving the reliability of the existing electrical lines or structures which contribute to the overall reduced negative effects of natural hazards.

Mitigation Action: **Mitigate the at-risk structures and associated loss of life from the threat of wildfire through defensible space activities, vegetation management, use of ignition-resistant building materials and external sprinkler systems.**

Wildfire sprinkler systems are a proven mitigation action that has protected numerous structures in the forested northeastern portions of the state of Minnesota. Utilizing sprinkler systems in combination with defensible space activities and other FireWise community wildfire fuel reduction methods is a high priority project type. Success stories have been written on this type of project.

Mitigation Action: **Installation of early warning and communication systems.**

Working with the MN DNR, National Weather Service (NWS) and other agencies installation and replacement of transmitters for flood gauges has been a success in Minnesota. In addition, the installation of NOAA radio towers and transmitters has increased weather radio and EAS communication coverage statewide.

Silver Jackets Work Plan for Implementation

In addition to the mitigation actions listed above, the Silver Jackets have identified priorities for natural hazard risk assessment and reduction. The mitigation actions described above are typically funded through FEMA mitigation grants. Items on the Silver Jackets Work Plan for Implementation are included in the state Plan because they are important for mitigation in Minnesota. However as the Silver Jackets is an unfunded initiative, the goal of the projects identified in the Work Plan are more of a collaborative problem identification and gap analysis with potential solutions and existing fund-matching exercise.

Additional mitigation actions are included in the Silver Jackets 'Work Plan for Implementation'. The development of the work plan was identified as an item for inclusion in this Plan. As a multi-agency collaboration, the identification of priorities further strengthens the ranking of flooding as the State's number one priority. The 2011 State All Hazard Mitigation Plan update has been a priority action for the Silver Jackets team. Other identified projects are the USGS Flood report, spring 2011 flood preparation, High Water Mark Agreement and a report to the legislature on the flooding in the state.

Two subcommittees are currently working on identifying actions for 1) Public Education and 2) Technical issues. Technical Subcommittee projects include stream gage upgrades, FERC gages for the Byllesby dam in Dakota County, the USGS Inundation (real-time) modeling/mapping project and the development of a HAZUS users group. The Public Education subcommittee chair is in the process of obtaining all collaborating agencies point of contact for public information. Once the points of contacts are gathered an information sharing meeting will be held. Other projects include updating the Minnesota Silver Jackets website, or at a minimum linking the site with all collaborating agencies websites. The focus has been on existing initiatives, including Flood Hazard Awareness Week, Summer Storm Awareness Week, National Preparedness Month and Winter Storm Awareness Week. HSEM, DNR and the National Weather Service coordinate these messages, but see the opportunity for improved communication, for a more unified message. The Work Plan for Implementation contains details on timelines, status and responsible entities.

Summary

Funding for the mitigation measures primarily comes from federal and state sources. However, the state continues to pursue additional funding sources. The following sections contain the State and Local Capability Assessment, which provides information on the funding source, description of the type of funding and monetary capabilities. This information was updated by providing the Silver Jackets with the previous version of the mitigation Plan. They updated, removed or added additional funding sources that would reflect the types of projects identified in the Plan.

Mitigation measures identified in local hazard mitigation plans reflect the reliance on federal and state resources to assist with these measures. In Minnesota, a majority of the communities do not have the local resources to fulfill their local mitigation measures match.

6.5 Inventory of Hazard Mitigation Programs, Policies, and Funding

Requirement §201.4(c)(3)(iv): *[The State mitigation strategy* ***shall*** *include an] identification of current and potential sources of Federal, State, local, or private funding to implement mitigation activities.*

In addition to the HMGP and PDM programs, there are additional funding sources available to the state and local jurisdictions for mitigation information, planning and projects. A listing of federal, state and other agencies resources is contained in this section. The site summary and agencies have all-hazard mitigation information and potential funding capabilities.

TABLE 50 FEDERAL AGENCIES AND PROGRAMS
U.S. Department of Homeland Security **Federal Emergency Management Agency (FEMA)** (www.fema.gov/) General information on mitigation planning, hazards, disaster assistance programs, current disasters, etc. *Hazard Mitigation Grant Program (HMGP)* HMGP assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities. http://www.fema.gov/government/grant/hmgp/index.shtm *Pre-Disaster Mitigation (PDM)* PDM provides funds on an annual basis for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The goal of the PDM program is to reduce overall risk to the population and structures, while at the same time, also reducing reliance on Federal funding from actual disaster declarations. http://www.fema.gov/government/grant/pdm/index.shtm *Flood Mitigation Assistance (FMA)*

FMA provides funds on an annual basis so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the National Flood Insurance Program (NFIP).

http://www.fema.gov/government/grant/fma/index.shtm

Repetitive Flood Claims (RFC)

RFC provides funds on an annual basis to reduce the risk of flood damage to individual properties insured under the NFIP that have had one or more claim payments for flood damages. RFC provides up to 100% federal funding for projects in communities that meet the reduced capacity requirements.

http://www.fema.gov/government/grant/rfc/index.shtm

Severe Repetitive Loss (SRL)

SRL provides funds on an annual basis to reduce the risk of flood damage to residential structures insured under the NFIP that are qualified as severe repetitive loss structures. SRL provides up to 90% federal funding for eligible projects.

http://www.fema.gov/government/grant/srl/index.shtm

FEMA, National Flood Insurance Program (NFIP)

Detailed information on the National Flood Insurance Program and other mitigation activities.

www.fema.gov/nfip/

U.S. Coast Guard, National Response Center

Point of contact for reporting all oil, chemical, radiological, biological, and etiological discharges into the environment of the United States.

www.nrc.uscg.mil/index.htm

Provides technical advice on dealing with weapons of mass destruction.

http://www.nrc.uscg.mil/terrorism.html

U.S. Department of Agriculture (USDA) (www.usda.gov)

Natural Resources Conservation Service (NRCS)

To provide leadership in a partnership effort to help conserve, improve, and sustain our natural resources and environment.

www.nrcs.usda.gov/

Emergency Watershed Protection (EWP)

Program is for emergency measures, including the purchase of flood plain easements, for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed.

http://www.nrcs.usda.gov/programs/ewp/

Environmental Quality Incentives Program (EQIP)

Provides technical assistance, cost share payments, and incentive payments to assist crop, livestock, and other agricultural producers with environmental and conservation improvements to their operations.

http://www.mn.nrcs.usda.gov/programs/eqip/index.html

Wetlands Reserve Program Voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. Provides technical and financial support to help landowners. http://www.mn.nrcs.usda.gov/programs/wrp/index.html *Conservation Easements* In cooperation with Minnesota BWSR funding for conservation easements on frequently flooded lands is available. One of many Reinvest in Minnesota (RIM) - NRCS partnerships. *Farm Service Agency (FSA)* www.fsa.usda.gov Disaster Assistance Programs available, includes: Conservation Loans Conservation Reserve Program Emergency Conservation Program Non-Insured Crop Disaster Assistance Program Emergency Farm Loans
U.S. Department of Commerce (DOC) (www.doc.gov) *Economic Development Administration (EDA)* To generate jobs, help retain existing jobs, and stimulate industrial and commercial growth in economically distressed areas of the U.S. http://www.eda.gov/ *U.S. Census Bureau* Profile of Minnesota and each Minnesota county. http://quickfacts.census.gov/qfd/states/27000.html
National Oceanic and Atmospheric Administration (NOAA) *NOAA, Coasts* Provides detailed information on coastal water issues, including the Great Lakes. www.noaa.gov/coasts.html *NOAA, National Climatic Data Center (NCDC)* Current and historical archive of climatic data and information. www.ncdc.noaa.gov/ncdc.html *NOAA, Drought Information Center* www.drought.noaa.gov/ *NOAA, National Severe Storms Laboratory* Comprehensive information on severe weather research. www.nssl.noaa.gov/

NOAA, National Weather Service (NWS)

(www.nws.noaa.gov/)

Provides all available weather information including warning updates.

Advanced Hydrologic Prediction Service (AHPS)

A program designed to provide improved river and flood forecasting and water information. AHPS provides a suite of graphical and numeric products over the Internet to assist community leaders and emergency managers in making better life- and cost-saving decisions about evacuations and movement of property before flooding occurs.

http://water.weather.gov//ahps2/index.php?wfo=mpx

Flood Inundation Mapping

This interactive web page shows the spatial extent of possible or expected flooding in a given area. It can be used to show if roadways and structures will be impacted by floodwaters. At the limited number of forecast locations where inundation maps are currently available, this web page is accessed by clicking on the inundation mapping tab on the hydrograph web page. In collaboration with partners, this product will be expanded to new locations.

Flash Flood Guidance

The North Central River Forecast Centers issues Flash Flood Guidance throughout the day for every county in their area. The river forecast centers determine 1- 3- and 6-hour flash flood guidance values for all counties, and 12- and 24-hour values for parts of the eastern United States. Flash Flood Guidance estimates the average number of inches of rainfall for given durations required to produce flash flooding in the indicated county.

http://www.srh.noaa.gov/rfcshare/ffg.php?duration=3&location=MN

North Central River Forecast Center

Contains a variety of seasonal products including the Spring Hydrologic Outlook

http://www.crh.noaa.gov/ncrfc/

U.S. Department of Defense (DOD) (www.defenselink.mil/)

U.S. Army Corps of Engineers (USACE) (www.usace.army.mil/)

Provides information on assistance available for planning, engineering and design of permanent flood control projects, and assistance to communities during flood emergency operations.

Planning Assistance to States (PAS)

Funded annually by Congress. Federal allotments for each State or Tribe from the nation-wide appropriation are limited to $2,000,0000 annually, but typically are much less. Individual studies, of which there may be more than one per State or Tribe per year, generally cost $25,000 to $75,000. The studies may be phased over several years and cover a wide range of water resource planning activities. PAS studies are cost shared on a 50 percent Federal-50 percent non-Federal basis. The entire local sponsor contribution may be work in kind, and WRDA 2007, Section 2013 provided authority for 100 percent Federal funded PAS studies for hydrologic, economic, and environmental data and analyses.

http://www.mvp.usace.army.mil/fl_damage_reduct/default.asp?pageid=101

Floodplain Management Services

A full range of technical services and planning guidance on flood and floodplain issues is provided upon request. These services are generally made available to other federal, state, and local agencies, but some may also be used by nongovernmental organizations and individuals and are 100 percent Federally funded.

http://www.mvp.usace.army.mil/fl_damage_reduct/default.asp?pageid=49

Regional Flood Risk Management Team

http://www.mvs.usace.army.mil/pm/rfrmt/index1.htm

This Regional Flood Risk Management Team (RFRMT) will integrate pre-flood mitigation with a long-term strategy to plan and implement pre- and post-flood emergency actions, while developing promising nonstructural alternatives and other flood risk mitigation actions recognized to reduce future flood risk within the region.

Cold Regions Research and Engineering Laboratory (CRREL)

www.crrel.usace.army.mil/

Engineering and technology for use in cold regions.

Flood Damage Reduction Studies & Projects http://www.mvp.usace.army.mil/fl_damage_reduct/

Flood damage reduction is one of the primary missions of the U.S. Army Corps of Engineers. As such, the Corps of Engineers may undertake studies and build projects to reduce and/or minimize flood damages. The Corps of Engineers may investigate flooding problems and opportunities in response to directives, called authorizations, from the Congress. Congressional authorizations are contained in public laws and in resolutions of either the House Public Works and Transportation Committee or the Senate Environment and Public Works Committee.

Continuing Authorities Program

Under the Continuing Authorities Program (CAP) legislation authorizes the Corps of Engineers to plan, design, and construct certain types of water resource and ecosystem restoration projects without additional and specific congressional authorization. The purpose is to implement projects of limited scope and complexity. Each authority has specific implementation guidelines, total program and per-project funding limits.

Funding: Studies are cost shared 50/50 during feasibility. Most projects are cost shared 65 percent Federal and 35 percent local during implementation, unless otherwise noted.

http://www.mvp.usace.army.mil/navigation/default.asp?pageid=35

- Small Flood Control Projects authorized by Section 205 of the 1948 Flood Control Act. Per-project: Federal funding limit of $7 million. Designed to implement projects that reduce overland flood damages. Projects must be engineeringly sound, economically justified, and environmentally acceptable.
- Emergency Streambank Protection Projects authorized by Section 14 of the 1946 Flood Control Act. Per-project Federal funding limit of $1.5 million. Designed to protect essential public facilities threatened by flood-induced erosion.
- Aquatic Ecosystem Restoration authorized by Section 206 of the 1996 Water Resources Development Act. Per-project Federal funding limit of $5 million. Designed to develop aquatic ecosystem restoration and protection projects that improve the quality of the environment, are in the public interest, and are cost effective.
- Project Modifications for the Improvement of the Environment authorized by Section 1135 of the

1986 Water Resources Development Act. Federal funding limit of $5 million. Designed to modify existing Corps projects for the purpose of improving environmental quality.

Section 524 of the Water Resources Development Act of 2000: Minnesota Dams

Provides for inventory, inspection, modification and/or rehabilitation of dams originally constructed by the Civilian Conservation Corps, Works Progress Administration, and Works Projects Administration (WPA) in Minnesota. Oversight of 361 of the original 417 WPA dams falls to the Minnesota Department of Natural Resources (DNR) through the office of the State Dam Safety Engineer. The rest are owned and operated by individual counties and the National Park Service.

U.S. Department of Energy (DOE) (www.energy.gov)

Federal Energy Regulatory Commission (FERC)

Regulates the transmission of energy sources interstate commerce and oversees environmental matters.

www.ferc.gov

Agency for Toxic Substances and Disease Registry

Detailed information on toxic substances and disease.

www.atsdr.cdc.gov/

Centers for Disease Control and Prevention – Emergency Preparedness and Response

Provides information about biological agents and other aspects of bioterrorism preparedness and response.

www.bt.cdc.gov/

U.S. Geologic Survey (USGS)(www.usgs.gov/)

Excellent source of natural disaster information (earthquakes, drought, floods, etc.).

Real-Time Data for Minnesota Streamflow

Users can select data from multiple sites using a broad set of filters, such as by State, county, watershed and a latitude/longitude box. This new web service can benefit users with programs that download tab-delimited real-time data from 138 gages.

http://waterdata.usgs.gov/mn/nwis/current/?type=flow

These data are also available in coordination with NWS-AHPS and the Corps of Engineers web sites, although USGS quality assures and maintains the data.

WaterWatch http://waterwatch.usgs.gov/?m=real&r=mn&w=real%2Cmap

Site displays maps, graphs, and tables describing real-time, recent, and past streamflow conditions for the United States. The real-time information generally is updated on an hourly basis. The streamgage-based maps shows conditions for real-time, average daily, and 7-day average streamflow. The real-time streamflow maps highlight flood and high flow conditions. WaterWatch also includes tables of current streamflow information and locations of flooding.

Flood Watch http://mn.water.usgs.gov/flood/

In coordination with USGS's WaterWatch Web site the state map shows the location of streamgages where the water level is above flood or at high flow. High flow conditions are expressed as percentiles that compare the current (i.e., within the past several hours) instantaneous flow value to historical daily

mean flow values for all days of the year. *Water Alert* http://water.usgs.gov/wateralert/ The U.S. Geological Survey WaterAlert service sends e-mail or text messages when certain parameters measured by a USGS data-collection station exceed user-definable thresholds. *StreamStats* http://water.usgs.gov/osw/streamstats/index.html A Web-based Geographic Information System (GIS) that provides users with access to an assortment of analytical tools that are useful for water-resources planning and management, and for engineering design applications. *USGS Programs in Minnesota* http://www.usgs.gov/state/state.asp?State=MN USGS activities in Minnesota. *Earthquake Hazards Program* http://earthquake.usgs.gov/ Up- to-date information on world seismicity.
U.S. Department of Justice (DOJ) (http://www.justice.gov/) *Federal Bureau of Investigation (FBI)* Partnerships and outreach page http://www.fbi.gov/about-us/partnerships_and_outreach/ *Office of Justice Programs, Office for State and Local Domestic Preparedness Support* Assists state and local response agencies throughout the United States prepare for incidents of domestic terrorism. www.ojp.usdoj.gov/osldps
U.S. Department of State (DOS) (www.state.gov) *Office of the Coordinator for Counter Terrorism* Coordinates all U.S. Government efforts to improve counterterrorism cooperation with foreign governments. Provides information on terrorism and national security. http://www.state.gov/s/ct/
U.S. Department of Transportation (DOT) (www.dot.gov) *Federal Highway Administration (FHWA)* Responsible for improving the quality of the Nation's highway systems and its intermodal connections. www.fhwa.dot.gov *National Transportation Safety Board (NTSB)* Information on transportation safety. www.ntsb.gov/ *DOT, Pipeline and Hazardous Material Safety Administration* National safety program for the transportation of hazardous materials by air, rail, highway and water. http://phmsa.dot.gov/hazmat

U.S. Environmental Protection Agency (EPA) (www.epa.gov) *EPA, Office of Solid Waste and Emergency Response* Provides guidance and direction for solid waste and emergency response programs. www.epa.gov/swerrims/
U.S. Nuclear Regulatory Commission (NRC) (www.nrc.gov) Detailed information on nuclear power plants, nuclear waste, and the national Radiological Emergency Preparedness program. www.nrc.gov/
U.S. Small Business Administration (SBA) (www.sba.gov) Provides training and advocacy for small firms. www.sba.gov/

Another valuable resource is the Catalog of Federal Domestic Assistance (CFDA). It provides a full listing of all Federal programs available to State and local governments; federally recognized Indian tribal governments; domestic public, quasi- public, and private profit and nonprofit organizations and institutions; specialized groups; and individuals. More information see: www.cfda.gov.

This section is an inventory of State programs that are important to mitigation efforts statewide. Additional information for agencies with programs that may assist in mitigation efforts are listed with applicable programs and funding the program may offer. The following also lists programs utilized by the state of Minnesota to assist with implementation of mitigation actions. A brief description of each program follows, as does funding information.

The following definitions define the effect on loss reduction programs:

> *Support:* Programs, plans, policies regulations, funding, or practices that directly help the implementation of mitigation actions.
>
> *Facilitate*: Programs, plans, and policies that make implementing mitigation actions easier.

TABLE 50 STATE AGENCIES AND PROGRAMS
Minnesota Board of Animal Health www.bah.state.mn.us/ Information regarding livestock and animal diseases, as well as reporting requirements.
Minnesota Board of Water and Soil Resources www.bwsr.state.mn.us/ To assist local governments to manage and conserve water and soil resources. Program: *Reinvest In Minnesota (RIM)* Funding: Minnesota's premier conservation easement program on privately owned lands

Effect: Support Program: *Reinvest In Minnesota -Wetlands Reserve Program, RIM-WRP* Funding: Administered by the USDA Natural Resources Conservation Service (NRCS). The RIM-WRP partnership is implemented by local Soil and Water Conservation Districts. Conservation easements on frequently flooded lands. http://www.bwsr.state.mn.us/easements/RIM-WRP/index.html Effect: Support
Minnesota Department of Administration www.admin.state.mn.us/ Provides services to government agencies: information technology, facilities and property management, graphic and geographic information systems data and software.
Minnesota Department of Agriculture www.mda.state.mn.us/ Responsible for the regulation of pesticides, fertilizers, food safety and feed including emergency response, state Superfund authority and financial assistance for agricultural entities.
Minnesota Department of Commerce www.commerce.state.mn.us/ The Market Assurance Division in the Department of Commerce regulates insurance companies & agents, banks, and real estate. The Office of Energy Security within the Department of Commerce manages energy assistance funds and provides information and assistance to consumers and businesses on home improvements, financial assistance, renewable technologies, and utility regulations. Program: *Consumer Response Team(CRT)* The Minnesota Department of Commerce Consumer Response Team (CRT) is comprised of investigators who respond to consumer phone calls specifically about insurance. The CRT attempts to resolve disputes between consumers and the insurance industry informally. In the Twin Cities metro area call (651) 296-2488 or statewide toll free at 800-657-3602. http://www.state.mn.us/portal/mn/jsp/content.do?id=-536893703&subchannel=null&sc2=null&sc3=null&contentid=536905284&contenttype=EDITORIAL&programid=536914932&agency=Insurance Effect: Support Program: *Weatherization Assistance Program (WAP)* Assists income eligible households with emergency repair and replacement services. The Weatherization Assistance Program (WAP) uses energy conservation techniques to reduce the cost of home energy. Correcting health and safety hazards and potentially life-threatening conditions is the first consideration in WAP activities. Households where one or more members have received TANF (Temporary Assistance for Needy Families) or SSI (Supplemental Security Income) within the last 12 months. Households at or below 200% of Federal Poverty Income Guidelines are income eligible for WAP. Homeowners and renters may be income eligible for WAP. Priority is given to households with at least one elderly or disabled member and to customers with the highest heating costs.

http://www.state.mn.us/portal/mn/jsp/content.do?subchannel=null&programid=536916220&sc3=null&sc2=null&id=-536893810&agency=Energy Funding: Federally funded through the U.S. Department of Energy and the Department of Health and Human Services. Effect: Support Program: *Energy Assistance Program (EAP)* The Energy Assistance Program (EAP) helps pay home heating costs. Households with the lowest incomes and highest energy costs receive the greatest benefit. Households who are at or below 50 percent of the state median income are eligible Size of grant is based on household size, income, fuel type and energy usage Households with the lowest income and highest fuel costs receive the highest grants Funds are available for renters or homeowners http://www.state.mn.us/portal/mn/jsp/content.do?subchannel=null&programid=536916219&sc3=null&sc2=null&id=-536893810&agency=Energy Funding: Federally funded through the U.S. Federally funded through U.S. Department of Human Services Effect: Support Program: *Office of Energy Security (OES)* The OES works to communicate the preparedness actions of utilities that serve areas affected by disasters. The OES and Public Utilities Commission (PUC) coordinate responses from utilities with regard to restoration activities and typically work through single points of contact at utilities and utility associations. The OES makes information available through its Energy Information Center on energy conservation measures that homeowners may pursue in the event of an emergency that affects the supply or distribution of energy to an area of the state. www.energy.mn.gov Effect: Support
Minnesota Department of Finance www.finance.state.mn.us/ Expedite fiscal management during a state disaster. Assist with funding issues when federal assistance is not provided.
Minnesota Department of Health www.health.state.mn.us/ Detailed information on services and current events affecting the citizens of Minnesota.
Minnesota Department of Human Services www.dhs.state.mn.us/ Provides health care, economic assistance, and other services for those in need.

Minnesota Department of Labor and Industry www.doli.state.mn.us/ Assist with investigations when workers are injured, and detect air contaminants caused by chemical or geological agents, and assessing hazards. Statewide building codes and construction planning and inspection.
Minnesota Department of Military Affairs -National Guard www.dma.state.mn.us Information on the capabilities of the Minnesota National Guard.
Minnesota Department of Natural Resources (MN DNR) www.dnr.state.mn.us/ The Financial Assistance Directory provides summary level information on all of the Department of Natural Resources' financial assistance programs. The department offers a wide variety of financial assistance programs to cities, counties, townships, non-profits, schools, private individuals and others. See www.dnr.state.mn.us/grants/index.html Categories include Aquatic Invasive Species Community Conservation Assistance Education, planning and research Enforcement (snowmobile & OHV safety) Fire Protection Programs Forest management Gifts and donations Habitat improvement Land conservation Recreation (general, trails, and water) Road Improvements Water Wildlife conservation *MN DNR Division of Ecological and Water Resources* http://www.dnr.state.mn.us/waters/index.html The conservation of natural systems and the maintenance of biodiversity. Water education information is available on and discusses floodplain management, flood mitigation, drought/water supply, dam safety, flood warning, climatology, and lake and stream gaging. Program: *Flood Hazard Mitigation Grant Assistance: Flood Damage Reduction (FDR) Program* To provide technical and financial assistance to local governmental units for conducting flood damage reduction studies and for planning and implementing flood damage reduction measures.

www.dnr.stvision of ate.mn.us/waters/watermgmt_section/flood_damage/index.html

Funding: A maximum of 50% of total eligible project costs up to $150,000 with grants more than $150,000 requiring approval by the Legislature.

Effect: Support

Program: *Dam Safety Grants*

To improve the safety and condition of publicly owned dams and water level control structures. *www.dnr.state.mn.us/grants/water/dam_safety.html*

Funding: Reimbursement of costs, up to 50% for repairs, up to 100% for removals. Grants ranged from $25,000 to $1,000,000

Effect: Support

Program: *Wetland Tax Exemption Program*

To provide a financial incentive to maintain wetlands in their natural state and to promote an awareness of wetland values. www.dnr.state.mn.us/grants/water/wetland_tax.html

Funding: Qualifying areas are exempt from property taxes that remain in effect as long as wetland meets the requirements set forth in the statutes.

Effect: Support

Program: *Native Shoreland Buffer Incentives Program*

The grant program is funded through the Minnesota Environment and Natural Resources Trust Fund, as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR). These grants are intended to support local governmental units in their efforts to offer incentives to private landowners who maintain or restore native vegetative buffers along shorelands of lakes, rivers and streams. This is a new opportunity for local entities to receive state funding and technical assistance for the design, implementation and evaluation of a shoreland incentives program of their own design.

www.dnr.state.mn.us/grants/comm_con/shoreland_buffer.html

Funding: A new grant program for three years (July 2008-June 2011) Provides two grants, $75,000 each.

Effect: Support

Program: FireWise in Minnesota

The Minnesota FireWise Project is working with local communities by passing federal Fire Plan funds through to local communities as grants for various "on-the-ground" activities including homeowner, mitigation education, home site assessment, access improvement, and dry hydrants. It involves community groups including fire and emergency services, local schools, city staff (i.e. foresters, planners), and local interest groups. www.dnr.state.mn.us/firewise

Funding: Grant request for 50:50 cost-share funding for assessment & planning, education & mitigation activities. Initial grant request may be for a small amount ($15,000) until FireWise Action Plan is developed. Second grants are available to implement additional actions.

Effect: Support and facilitate.

Program: *Forest Stewardship Program*

To provide technical advice and long-range forest management planning to interested landowners. All aspects of the program are voluntary. Plans are designed to meet landowner goals while maintaining the sustainability of the land. The entire property except active farming

Funding: For the state's cost share program to help defer the costs of implementation of forest management activities. Must enroll forested lands into the Sustainable Forestry Incentive Act or 2c Managed Forest Land to be eligible for property tax relief programs

Effect: Support

Minnesota Department of Public Safety

www.dps.state.mn.us/

State Fire Marshal, Office of Communications, Office of Pipeline Safety Team, State Patrol, Office of Justice Programs, Bureau of Criminal Apprehension, Alcohol and Gambling, Enforcement and Office of Traffic Safety.

Minnesota Homeland Security and Emergency Management

www.hsem.state.mn.us

This site contains information on Emergency Management.

Program: *Minnesota Recovers Task Force: Minnesota's Official Disaster Information Center*

Minnesota Recovers is the state's clearinghouse for all information about floods, tornadoes and other natural disasters that strike Minnesota communities. Information about federal, state and local government disaster-assistance efforts is available on this website. www.minnesotarecovers.org

Funding: Application for community financial assistance is available. Depending upon disaster, different types of funding become available. Flood-Control Grants, Small Cities Development Program and Public Facilities Authority funding information is available here.

Effect: Support and facilitate.

Minnesota Department of Employment and Economic Development (DEED)

www.deed.state.mn.us

To advance the economic vitality of Minnesota through trade and economic development, including the provision of employer and labor market information.

Program: *Public Facilities Authority (PFA)* The authority administers and oversees the financial management of three revolving loan funds and other programs that help local units of government construct facilities for clean water (including wastewater, stormwater and drinking water) and other kinds of essential public infrastructure projects

Funding: Provides municipal financing programs and expertise to help communities build public infrastructure that preserves the environment, protects public health, and promotes economic growth.

Effect: Facilitate

Program: *Small Cities Development Program*

Purpose is to provide decent housing, a suitable living environment and expanding economic opportunities, principally for persons of low-and-moderate income to cities and townships with populations under 50,000 and counties with populations under 200,000.

Funding: Provides federal grants from the U.S. Department of Housing and Urban Development (HUD) to local units of government. State program rules subdivide grant funds into three general categories: Housing Grants, Project Facility Grants, and Comprehensive Grants. Public Facility Grants could include projects involving storm sewer projects and flood control projects.

Effect: Facilitate

Program: *Greater Minnesota Business Development Public Infrastructure Grant Program*

Purpose is to stimulate new economic development, create or retain jobs in Greater Minnesota, through public infrastructure investments.

Funding: Provides grants to cities of up to 50% of the capital costs of the public infrastructure necessary, which expand or retain jobs in the area, increase the tax base, or which expand or create new economic development. Eligible projects include, but not limited to wastewater collection and treatment, drinking water, storm sewers, utility extensions, and streets.

Effect: Facilitate; however, depends on whether or not investments encourage development in flood hazard areas.

Program: *Greater Minnesota Redevelopment Grant Program*

Purpose is to provide grants to assist development authorities with costs related to redeveloping blighted industrial, residential or commercial properties.

Funding: Grants pay up to 50% of eligible redevelopment costs for a qualifying site, with a 50% local match. Grants can pay for land acquisition, demolition, infrastructure improvements, stabilizing unstable soils, ponding, environmental infrastructure, building construction, design and engineering and adaptive reuse of buildings.

Effect: Facilitate; however, depends on whether or not investments encourage redevelopment in flood hazard areas.

Minnesota Department of Transportation

www.dot.state.mn.us/

Comprehensive transportation issues in Minnesota.

Minnesota Emergency Medical Services Regulatory Board

www.emsrb.state.mn.us/

Provides leadership for emergency medical care for the people of Minnesota.

Minnesota Housing Finance Agency

www.mhfa.state.mn.us/

Provides low- and moderate-income housing and resources.

Minnesota Office of the State Archaeologist

http://www.osa.admin.state.mn.us/

Conduct research into the prehistoric and historic archaeology of Minnesota.

Minnesota Pollution Control Agency

www.pca.state.mn.us

Provides pollution control information for Minnesota.

Program: *Stormwater Program*

Minnesota Pollution Control Agency (MPCA) is the delegated permitting authority for Minnesota of the U.S. Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES). Permits are required for most construction activities designed to limit polluted discharges and implement best management practices.

Funding: The Clean Water Revolving Fund, also known as the Clean Water State Revolving Fund or simply SRF, is established under the Federal Clean Water Act and state law to make loans to for both point source (wastewater and stormwater) and nonpoint source water pollution control projects. The PFA prepares an annual Intended Use Plan (IUP) based on a Project Priority List developed by the MPCA. The IUP describes the projects and activities eligible for funding during the state fiscal year.

Effect: Support

Minnesota State Colleges and Universities

www.mnscu.edu

Provide information about Higher education in Minnesota.

Metropolitan Council

www.metrocouncil.org

Provides information on economic development and planning for anticipated growth in the seven county metro area –Anoka, Carver, Dakota, Ramsey, Scott and Washington Counties.

Program: *Livable Communities Grant Program*

The Council awards grants to participating communities in the seven-county area to help them, among other things, create development or redevelopment that demonstrates efficient and cost-effective use of land and infrastructure, a range of housing types and costs, commercial and community uses, walkable neighborhoods and easy access to transit and open space.

Funding: Three different accounts to enable communities through the region to carry out their development plans, and leverage millions of dollars in private and public investment while providing jobs and business growth.

Effect: Facilitate, depending on location of investment and whether or not it is in a flood

The following is a list of associations and organizations that may fund, educate or in some way assist mitigation in the state. The list is a resource for local mitigation planners and has been utilized by the state in the update of this Plan.

Table 51 Other Organizations
American Red Cross www.redcross.org Provide relief to victims of disasters and help people prevent, prepare for, and respond to emergencies.
American Water Works Association http://www.awwa.org/ Information on safe water resources.
Association of State Dam Safety Officials www.damsafety.org/ General Information about dams and dam safety in the US.
Mid-America Earthquake Center (MAE) http://mae.cee.uiuc.edu/ One of three national earthquake engineering research centers established by the National Science Foundation.
Minnesota Geological Survey (MGS) http://www.mngs.umn.edu/index.html The University outreach center for the science and technology of earth resources in Minnesota.
Minnesota Association of Watershed Districts (MAWD) www.mnwatershed.org Provides educational opportunities, information and training for watershed district managers and staff through yearly tours, meetings and quarterly newsletters.
Minnesota Association of Soil and Water Conservation Districts (MASWCD) www.maswcd.org/ Provide voluntary, incentive driven approaches to landowners for better soil and cleaner water. Provide private landowners with technical assistance to implement a wide variety of conservation practices.
Minnesota Independent Insurance Agents www.miia.org See calendar for NFIP training.
National Association of Counties www.naco.org NACo is the only nation-wide organization representing county governments.
Minnesota Natural Resource Conservation Service www.mn.nrcs.usda.gov Locally based NRCS staff work directly with farmers, ranchers, and others, to provide technical and financial

Table 51 Other Organizations
conservation assistance.
National Drought Mitigation Center http://www.drought.unl.edu/ Information on drought preparation and risk management.
National Emergency Management Association www.nemaweb.org/ NEMA is the professional association of state, pacific, and Caribbean insular state emergency management directors.
National Energy Foundation www.getwise.org/ This is site for kids, parents and teachers, with a focus on water conservation in the home.
National Fire Protection Association www.nfpa.org/ Provides scientifically based fire codes and standards, research, training, and education.
National Lightning Safety Institute www.lightningsafety.com/ Independent, non-profit consulting, education and research organization focusing on lightning safety.
Natural Hazards Center at the University of Colorado www.colorado.edu/hazards/ Clearinghouse for natural hazards information. Publishes the Natural Hazards Observer.
WeatherREADY www.weather.com/ready The goal of Weather Ready is to raise national awareness of the need to prepare for severe weather. Sponsored by The Weather Channel
Societal Aspects of Weather-Injury and Damage Statistics http://sciencepolicy.colorado.edu/socasp/toc_text.html Contains societal impact data for weather related disasters.
The Disaster Center www.disastercenter.com/ Provides news and information on current disasters, and the emergency management field.
The Disaster Research Center (University of Delaware) www.udel.edu/DRC/ Research center for the preparation and mitigation of natural and technological disaster for groups, organizations and communities.

Table 51 Other Organizations
National Wildland/Urban Interface Fire Protection Program firewise.org/ Site information to help to become a "FireWise" community.
The Terrorism Research Center www.terrorism.com/ The Terrorism Research Center is dedicated to informing the public of the phenomena of terrorism and information warfare.
The Tornado Project www.tornadoproject.com/ Offers tornado books, posters, and videos. Many links.
United Nations International Strategy for Disaster Reduction www.unisdr.org/ Increase public awareness of hazard and risk issues for the reduction of disasters in modern societies, motivate public administration policies and measures to reduce risks, and improve access of science and technology for risk reduction in local communities.
University of Wisconsin Disaster Management Center http://dmc.engr.wisc.edu/ The center's goal is to help improve the emergency management performance of non-governmental organizations, local and national governments, and international organizations, through a comprehensive professional development program in disaster management.

6.6 State Capability Assessment

Requirement §201.4(c)(3)(ii): *[The State mitigation strategy* ***shall*** *include a] discussion of the State's pre-and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: an evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas [and] a discussion of State funding capabilities for hazard mitigation projects.*

The state of Minnesota has the legal authority to engage in pre- and post-disaster mitigation activities via federal programs. MN HSEM is continually pursuing ways to improve programs, plans and policies for hazard mitigation to become incorporated into other types of planning, programs and policies. The Minnesota Recovers Task Force is an excellent group that is able to expedite prioritization of mitigation funding for projects. Continued coordination and integration of planning and hazard mitigation make the state of Minnesota more disaster resistant. With the new Silver Jackets Initiative, the state is collaborating with federal and state agencies, and in the future with local and other agencies to work towards making Minnesota more disaster resilient.

An evaluation of federal and state programs indicates the successes of mitigation efforts. However, as mitigation is a relatively new field, much more can be done to integrate mitigation into existing planning efforts. The following is an assessment of existing programs, projects and policies that should be pursued to further increase mitigation efforts and results. Contribution to and participation in existing initiatives and coordinated efforts will strengthen mitigation planning at the state and local level and will continue to integrate hazard mitigation planning at all levels.

Enforcement of the National Flood Insurance Program (NFIP) regulations. The Floodplain Management Unit with the MN DNR, Division of Ecological and Water Resources oversees the administration of the state Floodplain Management Program by promoting and ensuring sound land use development in floodplain areas in order to promote the health and safety of the public, minimize loss of life, and reduce economic losses caused by flood damages. This unit also exists to oversee and administer the National Flood Insurance Program (NFIP) for the state of Minnesota. See NFIP Community Status Book at http://www.fema.gov/fema/csb.shtm for a list of communities that participate in the program.

The Community Rating System (CRS) is a voluntary program for NFIP-participating communities. The goals of the CRS are to reduce flood losses, to facilitate accurate insurance rating, and to promote the awareness of flood insurance. The CRS was developed to provide incentives for communities to go beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding. The incentives are in the form of premium discounts.

Currently, state has five communities that participate:

- Austin (class 5)
- Montevideo (class 5)
- Moorhead (class 7)
- Mower County (class 8) and
- Lake St Croix Beach (class 8)

Montevideo and Moorhead are new, effective 5/1/10. An article detailing the process the City of Montevideo, utilized is in the Appendix N entitled “Montevideo Flood Insurance Rating”.

For CRS participating communities, flood insurance premium rates are discounted in increments of 5%; i.e., a Class 1 community would receive a 45% premium discount, while a Class 9 community would receive a 5% discount (a Class 10 is not participating in the CRS and receives no discount). The CRS classes for local communities are based on 18 creditable activities, organized under four categories:

- Public Information,
- Mapping and Regulations,
- Flood Damage Reduction, and
- Flood Preparedness.

The CRS Resource Center is now available.

The table below shows the credit points earned, classification awarded, and premium reductions given for communities in the NFIP CRS.

TABLE 52 NFIP CRS CLASS

Credit Points	Class	Premium Reduction SFHA*	Premium Reduction Non-SFHA**
4,500+	1	45%	10%
4,000 – 4,499	2	40%	10%
3,500 – 3,999	3	35%	10%
3,000 – 3,499	4	30%	10%
2,500 – 2,999	5	25%	10%
2,000 – 2,499	6	20%	10%
1,500 – 1,999	7	15%	5%
1,000 – 1,499	8	10%	5%
500 – 999	9	5%	5%
0 – 499	10	0	0

*Special Flood Hazard Area

**Preferred Risk Policies are available only in B, C, and X Zones for properties that are shown to have a minimal risk of flood damage. The Preferred Risk Policy does not receive premium rate credits under the CRS because it already has a lower premium than other policies. The CRS credit for AR and A99 Zones are based on non-Special Flood Hazard Areas (non-SFHAs) (B, C, and X Zones). Credits are: classes 1-6, 10% and classes 7-9, 5%. Premium reductions are subject to change.

Acquiring substantially damaged structures. Structures that are located in the floodplain of jurisdictions participating in the NFIP that receive damages that exceed 50% of the value of the structure are considered “substantially damaged”. The structure must either be demolished or re-built above the base flood elevation. Rebuilding in the floodway is not allowed in Minnesota. This degree of loss and the potential additional expense of coming into compliance make it an economic disaster for the flood victims. By acquiring the property for pre-flood fair market value, we can ease the economic suffering of the disaster victims. Acquiring substantially damaged structures is a strong program for the state of Minnesota hazard mitigation programs through the federal mitigation assistance and the state FDR program.

Acquiring repetitive loss properties. This works hand in hand with enforcement of the NFIP rules and the acquisition of substantially damaged properties to break the cycle of construction, destruction, reconstruction. Minnesota has been very successful in reducing the number of repetitive loss properties. Using all the different mitigation programs, a significant number of repetitive loss structures have been acquired. The NFIP Repetitive Loss Mitigated (in Appendix P) indicates 183 properties have been acquired. The total for these properties for building payments was over $5.3 million, contents payments were nearly $1 million for a total of $6.3 million in losses.

According to the most current data (October 31, 2010), there are 433 properties on the repetitive loss list for the state. From the 1,086 recorded events, the property losses total nearly $16 million, and contents losses are over $2.5 million. The state will work with the local jurisdictions to acquire these structures. See Repetitive Loss Unmitigated in Appendix P for details.

FEMA's new endeavor, Risk Map is a strategy to integrate mapping, assessment and mitigation planning. The major objectives of **Risk MAP** are to:

- Assess the Nation's flood risk and use this information to increase public awareness of risk. This consistent, quantitative flood risk assessment will be used to track progress toward reducing the nation's flood risk and to target Risk MAP resources to areas that are at greater risk.
- Increase public awareness and understanding of risk from natural hazards and risk management concepts.
- Ensure 80 percent of the nation's flood hazard data are new, have been updated or are deemed still valid. This goal includes:
    - Providing updated flood hazard data for 100 percent of the populated coastal areas in the nation.
    - Evaluating levee status information to ensure the appropriate flood hazards are depicted on Digital Flood Insurance Rate Maps (DFIRM) for counties with levees, including those impacted by expiring Provisionally Accredited Levee status.
- Continue to meet statutory requirements of the National Flood Insurance Program (NFIP) through assessing, on a watershed basis, the need to revise and update all floodplain areas and flood risk zones identified, delineated or established.

FEMA continues to collaborate with local, state, regional, tribal, national and other federal partners in communicating these objectives and implementing Risk MAP. Because FEMA's efforts extend throughout the Nation, implementing Risk MAP helps to maintain the engineering capability in the state and private sectors – sustaining jobs and stimulating the economy.

In Minnesota, FEMA has funded both floodplain mapping for the Wild Rice River, Red Lake River, Root River and Whitewater River watersheds, and Norman, Polk, Houston and Winona Counties. Digital Flood Insurance Rate Maps are being prepared in Norman, Mahnomen, Polk, Kittson and Wilkin County. In addition, the DNR is working with FEMA to assess the validity of the current flood hazard data.

Hazard Mitigation Grant Program Property Acquisition - A Handbook for Minnesota Communities The handbook was created specifically for local community officials looking for ways to minimize the impact of future disasters, using FEMA Publication 317, *Property Acquisition Handbook for Local Communities*, and HMGP Program Guidance. The handbook is a "how to" guide to lead an applicant through one specific hazard mitigation option known as property acquisition (formerly known as "buyout"). The handbook is intended to aid communities in the decision-making process. The handbook also contains information to guide local communities through the grant process as well.

With the addition of the new **Disaster Recovery Coordinator** at HSEM the flow of information between state agencies has improved. The position leads the Minnesota Recovers Task Force, as a long-term recovery committee at the state level. The state offers multiple Disaster Response and Recovery Workshops to local emergency managers and other interested parties.

The updated **Minnesota Disaster Management Handbook** is a tool local jurisdictions are encouraged to utilize in times of disaster. The four phases of emergency management – mitigation, preparedness, response, and recovery – are ongoing, interdependent, and to some degree, overlapping. To ignore the actions required by any one of the four phases jeopardizes the jurisdiction's overall ability to "manage" disasters and emergencies. The purpose of the handbook is to provide a variety of tools to help emergency managers mitigate hazards, prepare for emergencies, and enhance the response and recovery phases of any emergency. The handbook contains damage and impact assessment forms for the state, county and local officials.

Minnesota Disaster Recovery Assistance Framework is another new document developed for local emergency managers to utilize post disaster. The framework is a resource document that provides assistance program information from state, federal, local, and voluntary agency resources following a disaster. The guide is intended to be of assistance to government officials and community leaders involved in managing, organizing, or leading disaster recovery efforts. It provides a comprehensive overview of the roles, responsibilities, and assistance programs that may be available. The Framework describes and highlights assistance that is typically available after disasters.

Minnesota Recovers Task Force To address the state's capabilities during times of disaster, the MRTF is the group that forms to address issues of disaster and a forum to discuss mitigation issues. This group is comprised of federal agencies, state agencies, local agencies, and voluntary organizations. In times of disaster, this group helps develop policy and promote the mitigation policies, best methods and procedures to their respective and related organizations in the state. In Minnesota, this group is a mitigation resource. In post-disaster, MRTF functions not in the initial sense of first responders, but is a planned deliberate response to solve the post-disaster mitigation concerns. The integration of mitigation with recovery efforts has always been and still is a priority in Minnesota. This allows maximum flexibility to provide whatever resources are required. With the addition of the Disaster Recovery Coordinator in 2008 as head of the Task Force, communication between state agencies has improved, relationships have been forged and post-disaster response, recovery and project funding has been streamlined.

The **Minnesota Geospatial Information Office**, known as **MnGeo**, was established in May 2009 as the first state agency with legislatively defined responsibility for coordinating GIS within Minnesota. With the passage of legislation to create MnGeo, LMIC ceased to exist. All of LMIC's functions essential to the new office's coordination responsibilities, along with LMIC's resources, were transferred to MnGeo. MnGeo coordinates the development, implementation, support and use of geospatial technology. They are advised by advisory councils, committees and workgroups representing stakeholders within state government and around the state.

Minnesota Governor's Council on Geographic Information coordinated the development of geographic information technologies statewide between 1991 and 2009. The Council's mission has been taken up by the Statewide Geospatial Advisory Council to MnGeo. The Council was authorized by legislation passed in 2009, advises MnGeo about issues, policies, priorities, and investments needed to improve services statewide through the coordinated, affordable, reliable, and effective use of geospatial technology. The council represents a cross-section of organizations that includes counties, cities, universities, business, nonprofit organizations, federal and state agencies, and other stakeholder groups that benefit from geospatial technology.

The State Government Geospatial Advisory Council focuses on state agency issues.

- Communication and Outreach – They promote active communication among state agencies, between the state and other units of government, and among non-government stakeholders.
- Data Coordination - They guide data investments, develop and promote data standards, and coordinate data management and distribution.
- Technical Coordination - They coordinate the State's technology investments, develop and promote technology standards, facilitate resource sharing, and coordinate and manage enterprise licensing.

The **Emergency Preparedness Committee** (EPC) is Minnesota’s principal organization for promoting, coordinating, and standardizing GIS use across all levels of the state's Emergency Management community. HSEM Director Kris Eide is the Chair of this Committee. Work groups focus on five work plan areas:

- **Outreach**: Promotes awareness of EPC efforts, arranges a quarterly EPC meeting featuring topics appropriate for both the Emergency Management (EM) and GIS communities, and works with local EM entities to develop GIS support for their response plans.
- **Education**: Develops training standards and programs for the Minnesota GIS and EM communities that will promote productive interaction, provides training to those communities, and facilitates state and national training opportunities.
- **Data**: Works to ensure accuracy and appropriateness of Minnesota GIS data needed for EM planning on the local, state and federal levels.
- **Go Team**: Working hand-in-hand with EM agencies, develops suggested GIS standards and enterprise solutions that will facilitate Emergency Operations Center situational awareness and interoperability, stands ready during disasters to augment the GIS capabilities of various city, county and state response organizations, and develops and updates the vision for the Minnesota Common Operating Picture (COP).
- **NG911**: Focusing on developmental issues related to deployment of Next Generation 9-1-1 systems in Minnesota, works to provide GIS training, documentation, guidance and data standardization in support of the state’s 9-1-1 community.

Two recent EPC projects:

  - **Mapping and Geographic Data for the Red River Flood of 2010** (see: http://www.mngeo.state.mn.us/committee/emprep/response_events/red_river_flooding//index.html)

    This site was used for emergency preparedness and response for the flooding in the Red River valley in 2009 and 2010.

- **Minnesota Structures Collaborative (MSC)**

Funded by the Federal Geographic Data Committee (FGDC) via a National Spatial Data Infrastructure Cooperative Agreements Program (CAP) grant in early 2008, the Minnesota Structures Collaborative (MSC) project sought to develop state and local partnerships and the technical capacity for the statewide collection, publication and long term, sustainable maintenance of this data. In partnership with EPC, MnGeo received a grant to improve the availability and quality of geospatial data and maps for four types of structures in Minnesota: Fire stations, hospitals, police stations, public and private schools.

Phase 1 accomplishments include:

•Assessment and standardization of existing structures data (national and state), including minimum attribution, with capacity to add new structures data and integrate with The National Map and other geospatial efforts of national, state and local importance.

•Development of a prototype web-based map interface "MSC Online System" aka GeoMOOSE https://www.sharedgeo.org/MNGEO-ro/public/geomoose.html

•Creation of FGDC and Minnesota compliant metadata records

•Significant effort to build relationships with state and local data contributors and stewards, including publishing a promotional brochure.

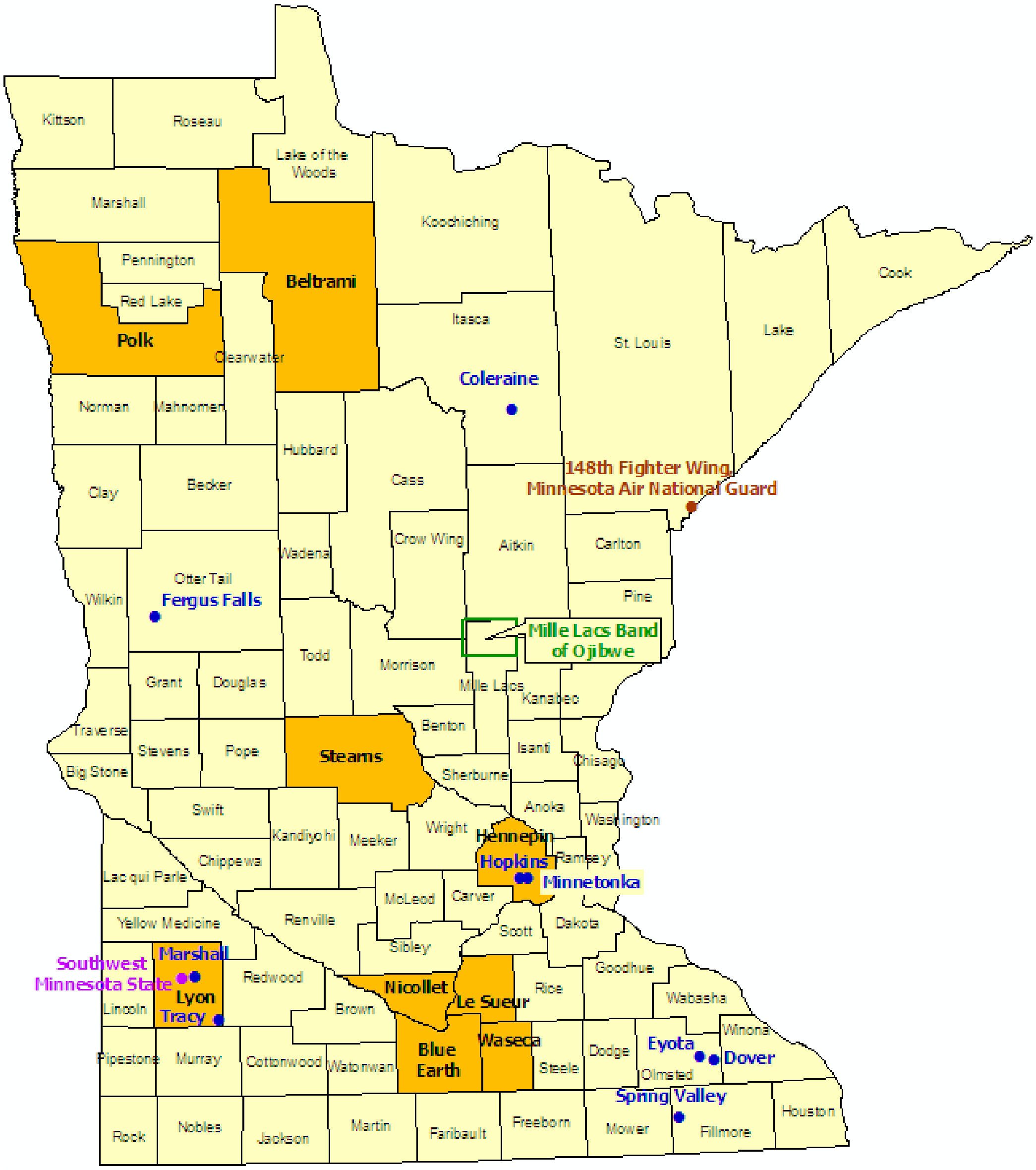
More information on the MSC located at:

http://www.mngeo.state.mn.us/committee/emprep/structures/index.html

The data collected from this project is utilized in the new statewide risk assessment. In Phase 2, MnGeo and EPC members will continue to test and develop the MSC Online System, identify data authorities and custodians, build relationships between federal, state and local governments, and promote integration of structures data that will support The National Map and other important emergency services geospatial efforts such as HAZUS-MH, HSIP and FireWise. During the next phase of implementation, additional expertise from the state's GIS and emergency services sector is being solicited to help steer further development of the prototype online system and its functionality.

StormReady Communities The program is run through the National Weather Service, participation is from NOAA, and other agencies. This type of effective local volunteer education program, like others including FireWise, and SkyWarn, will be encouraged by the state to expand through the federal, state and local grants.

FIGURE 58 STORMREADY COMMUNITIES IN MN



Blue Dot: StormReady Community

- Coleraine
- Dover
- Eyota
- Fergus Falls
- Hopkins
- Marshall
- Minnetonka
- Spring Valley
- Tracy

Purple Dot: StormReady University Southwest Minnesota State

Green Dot: StormReady Indian Band Mille Lacs Band of Ojibwe

Gold Shading: StormReady County

- Beltrami
- Blue Earth
- Hennepin
- Le Sueur
- Lyon
- Nicollet
- Polk
- Stearns
- Waseca

Brown Dot: StormReady Military Site 148th Fighter Wing of the Minnesota Air National Guard

The state can improve upon community education, however staffing and resources are unfortunately scarce at this time. The state does participate and promote Winter Weather Awareness Week, Severe Weather Awareness Week and Preparedness month (September) with partner organizations. These programs are promoted at county fairs, but could use a lot more assistance in terms of staffing. The NWS purchased NOAA radios several years ago, however no program to disseminate and instruct users in communities is available. Code Ready is another program that does not have funding, no staff to promote the program, and as a result year-round community education is lacking in Minnesota.

Monitoring and reducing the impacts of development on water resources is an important goal for the State of Minnesota. Collaboration between research institutions and public policy makers is an important link that exists in Minnesota and must continue to be strengthened to reduce the effects of development on the natural resources of the state.

The **University of Minnesota's Remote Sensing and Geospatial Analysis Laboratory** provides a series of maps and statistics about land cover, impervious surface area and landscape change, derived from satellite imagery in Minnesota from 1986 to the present. Their mission to provide accurate and consistent information about land cover/use is critical for land managers and planners, policy makers, researchers and educators to make better informed decisions about land use in Minnesota.

Minnesota is one of the first states to have multiple dates of land cover and impervious surface, and change data, mapped statewide using satellite imagery. Other surveys have been performed by various means on smaller scales, but none have had the large area coverage as well as the historical depth of information. Quantifying the amount of impervious surface area, an important indicator of environmental quality, is particularly valuable because of its effects on stormwater runoff and lake and stream quality

In addition, the **Water Resources Center** at the University of Minnesota is working in collaboration with Remote Sensing and Geospatial Analysis researchers to create a new satellite based monitoring approach to estimate lake and stream water clarity and map aquatic vegetation at the city, state and regional scales. The collaboration aims to incorporate existing water quality databases and to transfer the technique to state agencies who steward water quality, including the Minnesota Pollution Control Agency and the MN Department of Natural Resources.

http://land.umn.edu/index.html

Red River Basin Decision Information Network (RRBDIN) website http://ffdt.rrbdin.org/index.php has a **Flood Forecast Display Tool** (FFDT) for the public as well as professionals. This a joint effort between the National Weather Service and the International Water Institute for the purpose of applying and evaluating new technologies for better communication of flood risk related information.

Red River Basin Mapping Initiative The goal of this Initiative is to develop a high resolution digital elevation model for the Red River of the North Basin south of the U.S./Canada border using LIght Detection And Ranging (LIDAR).

Minnesota Regional Development Commissions Regional development commissions are multi-county planning and development districts that encourage cooperation between citizens, local government officials, and the private sector. These regional organizations are best equipped to help rural areas because they provide a critical mass of expertise needed at the local level. There are currently 10 regional development commissions serving a majority of the states counties. Rural areas of the state without regional development commissions may benefit from the (re)creation of these commissions to assist not only with all hazard mitigation plans, but all types of planning and development. http://www.mrdo.org/members.asp

Minnesota Environmental Quality Board (EQB) The Minnesota Environmental Quality Board develops policy, creates long-range plans and reviews proposed projects that significantly affects Minnesota's environment. The Environmental Review Program writes the rules for conducting environmental reviews, provides guidance documents, and publishes projects and studies. The Water Program is charged with coordinating state water resource management activities. It is responsible for developing the state water plan, a state water-monitoring plan, biennial water policy and priorities reports, and biennial reports on trends in water quality and availability and research needs. www.eqb.state.mn.us/

State Water Plan The 2010 Minnesota Water Plan was prepared by the EQB Interagency State Water Plan team with help from federal, state and local partners. The plan reviews the past decade's worth of planning efforts, evaluates present issues and identifies strategies for achieving long-range sustainable water resource management. The plan is a 10-year framework for managing Minnesota's waters; it defines a vision of collaboration to ensure clean water and healthy ecosystems for future generations.

http://www.eqb.state.mn.us/documents/2010_Minnesota_Water_Plan.pdf

Sustainable Development Initiative is a collaboration of businesses, government and civic interests that aim to promote policies, institutions and actions that ensure Minnesota's long-term environmental, economic and social well-being. Its goal is to find solutions that benefit people, business and the environment. A guide entitled From Policy to Reality: Model Ordinances for Sustainable Development is available at

www.gda.state.mn.us/pdf/2000/eqb/ModelOrdWhole.pdf. This guide will be brought to the attention of jurisdictions within the state by mitigation staff.

Legislative-Citizen Commission on Minnesota Resources (LCCMR) The function of the LCCMR is to make funding recommendations to the legislature for natural resource projects primarily from the Environment and Natural Resources Trust Fund. These projects are to help protect and enhance Minnesota's natural resources. The final version of the Statewide Conservation and Preservation Plan was presented in July of 2008. The plan was created to chart a long-term course for Minnesota's natural heritage. Recommendations for land use, habitat and energy can be found at: http://www.lccmr.leg.mn/statewideconservationplan/StatewidePlan.htm.

The 2008 Plan indicated future coordination with the group to make recommendations for funding for hazard mitigation related environmental projects. HSEM staff was not available to do this for the Plan update. HSEM mitigation staff will contact the commission to educate them on the importance of integrating hazard mitigation planning, especially in high hazard areas and projected population growth as needed.

Minnesota River Basin Data Center is a center that focuses identifying and acquiring information and data necessary to facilitate natural resource decision making and education within the 37 counties of the Minnesota River Basin. With flooding as the number one hazard in Minnesota all existing water related data and resources should be utilized.

The **Association of Minnesota Counties** is an excellent resource in Minnesota that is available to integrate existing comprehensive planning efforts, hazard mitigation plans, zoning, building codes, and ordinances.

League of Minnesota Cities The League of Minnesota Cities is a membership organization dedicated to promoting excellence in local government. The League serves its more than 800 member cities through advocacy, education and training, policy development, risk management, and other services. Mitigation staff will utilize the league as it is deemed necessary to promote mitigation information. http://www.lmc.org/

In coordination with FEMA, the **Minnesota Statewide Elevation and Imagery Inventory** (SEII) is a community effort designed to gather and share information about high-density elevation and digital aerial photography data in and around the state. In the future the data may be utilized if available to assist in the state and local hazard mitigation plans. http://www.mngeo.state.mn.us/SEII/

Withdrawn: Land Management Information Center and the Local Planning Assistance Center have been deleted from the state capabilities assessment as they are no longer functioning state resources. Unfunded state programs were also deleted from the inventory, including Stream Bank Maintenance, and Wild and Scenic Rivers programs.

Hazard Mitigation Planning Software was not utilized for the 2011 update. HSEM staff did research on this type of software but it was not pursued. Technology exists, specifically software that supports the Stafford Act requirements to assist communities to develop hazard mitigation plans, mapping, risk assessments, and estimating potential losses. The state may revisit pursue the capabilities, ease of use and applicability of this type of software to integrate local plans into the state Plan, and the possibility of local jurisdictions utilizing the software to create/update their plans for state and FEMA review for the 2014 State Plan Update.

Minnesota Association of Floodplain Managers Provides information on floodplain management, flood hazard mitigation, the National Flood Insurance Program, flood preparedness, warning and recovery. HSEM staff participates on the annual conference planning committee, and attends and presents at the annual conference. Opportunities for further collaboration for education, training and information sharing may be pursued.

Sustainable Development and **Smart Growth** are two relatively new planning tools whose use will be encouraged by all local jurisdictions in all community plans.

Planning and Zoning tools are available for utilization by communities that choose to participate and pass ordinances and regulations based on communities needs. Types of ordinances that can incorporate mitigation include:

1. County Planning Act
2. Shoreland Management
3. Wild and Scenic Rivers
4. Floodplain Regulation
5. Local Water Planning
6. Individual Sewage Treatment Plans
7. Community Based Planning Act, 1997
8. Feedlot Regulation

"No Adverse Impact (NAI) Floodplain Management" is a managing principle that is easy to communicate and, from legal and policy perspectives, tough to challenge. In essence, No Adverse Impact floodplain management takes place when the actions of one property owner are not allowed to adversely affect the rights of other property owners. The adverse effects or impacts can be measured in terms of increased flood peaks, increased flood stages, higher flood velocities, increased erosion and sedimentation, or other impacts the community considers important. The No Adverse impact philosophy can shape the default management criteria: a community develops and adopts a comprehensive plan to manage development that identifies acceptable levels of impact, specifies appropriate measures to mitigate those adverse impacts, and establishes a plan for implementation. No Adverse Impact criteria can be extended to entire watersheds as a means to promote the use of regional retention/detention or other stormwater techniques to mitigate damage from increased runoff from urban areas.

Similar to mitigation strategies, the 'Building Blocks of NAI' are:

- Floodplain Management
- Hazard Identification & Mapping
- Education & Outreach
- Planning
- Regulations & Development Standards
- Mitigation
- Infrastructure
- Emergency Services

This philosophy can guide smart growth and development and assist local communities in remaining flood resistant.

Minnesota Association of Watershed Districts There are 46 watershed districts in Minnesota. Watershed districts are local units of government work to solve and prevent water-related problems. The boundaries of the districts follow those of a natural watershed, and the districts are usually named after that watershed. Because water does not follow political boundaries, it makes sense to manage natural resources on a watershed basis. This type of management allows for an overall, holistic approach to resource conservation. These districts incorporate hazard mitigation into their watershed plans. Plans may include management practices regarding flooding and other water resource protection methods (quality and quantity, surface and ground water) along with other natural resource protection methods. The state believes watershed districts are an underutilized resource for jurisdictions to work on a regional scale to understand ecosystems, and the connection of upstream actions and downstream effects.

Minnesota Geographic Data Clearinghouse contains links to state, regional, local and national mapping and GIS and other data. This resource may be utilized for additional mapping and analysis in future plans. This is one of many GIS resources that was utilized for the 2011 Plan update.

Summary

Local jurisdictions are responsible for pursuing planning and mitigation activities, as all mitigation programs are voluntary. There are many resources available to the state and all jurisdictions located within its boundary. Funding for staff, staff time and technology are needed to obtain and utilize data.. All jurisdictions with a plan, or in the planning process have utilized federal, state and local plans, projects and policies to understand and document the mitigation planning process and its benefits-through projects. Continued communication and integration of existing resources and expanded use of available resources will continue with assistance from the federal government, state and other resources as mitigation planning comes into the forefront of emergency planning.

6.7 Local Capability Assessment

44 CFR 201.4(c)(3)(ii): *[The State mitigation strategy shall include] a general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.*

Local capability assessment for hazard mitigation in Minnesota is included in this Plan by integrating the hazard analysis and risk assessment data from Local Hazard Mitigation Plans as well as the goals, objectives and measures of this Plan as an integral part of the overall planning process. Mitigation measures included in this Plan are a direct integration of the local mitigation policies, programs and capabilities demonstrated and documented through Local Hazard Mitigation Plans.

It is difficult to assess local capabilities because it is not a requirement to meet the standards of a FEMA approved Local Mitigation Plan. Some of the local plans did include a capability assessment. Through the efforts of the HSEM staff working with local governments, the interest in local hazard mitigation planning has risen since the last Minnesota Hazard Mitigation Plan was written.

In the State of Minnesota 86 of the 87 counties have been funded for initial development for FEMA approved local multi-jurisdictional mitigation plans. Thirty counties have been funded for their five-year review. Two cities have been funded for both their initial plan and the five-year update. Also, tribal communities have received funding for mitigation plans throughout the state. One jurisdiction (Sherburne County) is still in the planning process – they have applied for funding for their plan. HSEM continues to encourage communities due for plan update to apply for funding.

TABLE 53 LOCAL CAPABILITY ASSESSMENT			
Policy	Description	Applicability	Effectiveness
Floodplain Management	In 1969, the Minnesota Legislature enacted the State Floodplain Management Act (Minnesota Statutes, Chapter 103F). This Act and sound floodplain management principles stress the need for a comprehensive approach to solving flood problems by emphasizing nonstructural measures, such as floodplain zoning regulations, flood insurance, floodproofing, and flood warning and response planning. By law, Minnesota's flood prone communities are required to: 1) adopt floodplain management regulations when adequate technical information is available to identify floodplain areas; and 2) enroll and maintain eligibility in the National Flood Insurance Program (NFIP) so that the people of Minnesota may insure themselves from future losses through the purchase of flood insurance. In 1987, the Flood Plain Management Act was amended to establish a state cost-sharing grant program to help local government units plan for and implement flood hazard mitigation measures. The Department of Natural Resources (DNR) is the state agency with overall responsibility for implementation of the State Flood Plain Management Act.	At the state level, the DNR has promulgated minimum standards for floodplain management entitled "Statewide Standards and Criteria for Management of Flood Plain Areas of Minnesota" (Minn. Rules 6120.5000 - 6120.6200). These standards have two direct applications: 1) all local floodplain regulations adopted after June 30, 1970 must be compliant with these standards; and 2) all state agencies and local units of government must comply with Minnesota Regulations in the construction of structures, roads, bridges or other facilities located within floodplain areas delineated by local ordinance. Local floodplain regulatory programs, administered by county government, predominately for the unincorporated areas of a county, and by municipal government for the incorporated areas of a county, must be compliant with federal and state floodplain management standards. Both federal and state standards identify the 100-year floodplain as the minimum area necessary for regulation at the local level. These regulations are intended to protect new development and modifications to existing development from flood damages when locating in a flood prone area cannot be avoided.	There are 551 communities participating in the NFIP. There are only five jurisdictions that participate in the Community Rating System.

TABLE 53 LOCAL CAPABILITY ASSESSMENT			
Policy	Description	Applicability	Effectiveness
Building Codes	The Minnesota State Building Code is the minimum construction standard throughout all of Minnesota including all cities, townships and counties. Although it is not enforceable by municipalities unless it is adopted by local ordinance, this law creates a level playing field for the construction industry by establishing the Minnesota State Building Code as the standard for the construction of all buildings in the state. Included are excerpts of the law contained in Minnesota Statute 16B.62 Subdivisions 1a and 1b.	(1a): The state building code is the standard that applies statewide for the construction, reconstruction, alteration, and repair of buildings and other structures of the type governed by the code. The State Building Code supersedes the building code of any municipality. The State Building Code does not apply to agricultural buildings except with respect to state inspections Municipal enforcement (1b): (a) If, as of January 1, 2008, a municipality has in effect an ordinance adopting the State Building Code, that municipality must continue to administer and enforce the State Building Code within its jurisdiction. The municipality is prohibited from repealing its ordinance adopting the State Building Code. This paragraph does not apply to municipalities with a population of less than 2,500 according to the last federal census that are located outside of a metropolitan county, as defined in section 473.121, subdivision 4. (b) If a municipality is not required by paragraph (a) to administer and enforce the State Building Code, the municipality may choose to administer and enforce the State Building Code within its jurisdiction by adopting the code by ordinance [appointing a certified building official, and establishing a fee schedule]	State law required city and county ordinances be deposited with their local county law library. The most recent state building code map (7-2008) indicates 502 municipalities administer the code with a designated building official. 422 cities, 65 townships, 20 counties (includes five counties where city building officials administer the code). Minnesota state building code is the standard for construction statewide; however the code is enforced by certain cities and townships.

TABLE 53 LOCAL CAPABILITY ASSESSMENT			
Policy	Description	Applicability	Effectiveness
Zoning	The authority to establish and implement zoning regulations rests with local governments. Zoning authority is delegated to the cities and provides broad discretion to separate incompatible land uses and direct future development.	Zoning provides communities with the opportunity to establish land use patterns that are logical, orderly, attractive, and convenient. They may be used to keep inappropriate development out of hazard-prone areas and can designate certain areas for such things as conservation, public use, or agriculture.	Cities are free to choose whether to have zoning. Cities that adopt zoning may structure their local zoning ordinances to meet local needs. All larger cities within the state and many of Minnesota's smaller communities have adopted zoning ordinances. The level of zoning varies widely depending on the size and capabilities of the community. Many of Minnesota's smaller communities that have adopted zoning have only residential, commercial, and agriculture zones.

6.8 Severe Repetitive Loss Strategy

Requirement §201.4(c)(3)(v): *A State may request the reduced cost share authorized under §79.4(c)(2) of this chapter for the FMA and SRL programs, if it has an approved State Mitigation Plan … that also identifies specific actions the State has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties), and specifies how the State intends to reduce the number of such repetitive loss properties.*

Requirement §201.4(c)(3(v): *In addition, the plan must describe the strategy the State has to ensure that local jurisdictions with severe repetitive loss properties take actions to reduce the number of these properties, including the development of local mitigation plans.*

Severe Repetitive Loss

The Severe Repetitive Loss (SRL) grant program was authorized by Section 1361A of the National Flood Insurance Act of 1968, U.S.C. 41002a, as amended by the Flood Insurance Reform Act (FIRA) 2004, Public Law 108-254, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss (SRL) Structures insured under the National Flood Insurance Program.

The Final Rule implementing regulations for both Severe Repetitive Loss and Flood Mitigation Assistance programs based on the 2004 Flood Insurance Reform Act became effective October 16, 2009. Section 79.6 clarifies that demolition and relocation of structures are eligible for funding only when the acquired flood-prone property is converted to open space.

SRL Properties are residential properties that have at least four NFIP claim payments over $5,000 each, when at least two such claims have occurred within any ten-year period (must be greater than 10 days apart), and the cumulative amount of such claims payments exceeds

$20,000; or for which at least two separate claims payments have been made with the cumulative amount of the building portion of such claims exceeding the value of the property, when two such claims have occurred within any ten-year period.

To ensure repetitive loss properties remains a high priority for receipt of mitigation program grant funds, the State of Minnesota Homeland Security and Emergency Management Division will implement a Severe Repetitive Loss Strategy designed to eliminate or reduce the damage to property and the disruption of life caused by repeated flooding of the same properties. This program will be implemented as funds become available.

The key elements of the Minnesota SRL will include a combination of technical assistance, education, and implementation of mitigation measures. Specific mitigation actions include:

- Establishing SRL as a funding priority for mitigation grants in order to implement mitigation measures such as acquisition, demolition, relocation, and elevation to reduce the number of severe repetitive loss properties
- Providing educational materials and assistance to the public, community leaders, planners, and other interested parties regarding severe repetitive loss properties in the community and mitigation measures/strategies which may be used to reduce damages to these properties.
- Encouraging planners and communities to include severe repetitive loss strategies in all-hazard mitigation plans and in other community planning documents such as comprehensive plans.

As of June 10, 2010 two properties have been identified in the state as Severe Repetitive Loss properties. Both are in Mower County, and one is in the City of Austin proper. Mower County has a FEMA approved All Hazard Mitigation Plan, dated November 30, 2010. The city of Austin and Mower County have completed many acquisitions utilizing all federal and state funding programs. In the case of a SRL buyout the city/county would have the capabilities to implement the project. The Mower County Emergency Manager and City of Austin City Engineer/Director of Public Works have contacted the homeowners and informed them of FEMA funding options for property acquisition. The Greatest Savings to The Fund (GSTF) value are less than the value of the property. While the city has the capabilities to design, implement, and monitor the project, the cost-benefit assessment does not qualify the homes for the SRL program.

TABLE 54 SEVERE REPETITIVE LOSS DATA FOR MINNESOTA

Property	Losses	Property Value	Cumulative Loss and Loss Adjustment Expenses Paid	Replacement Cost	Savings to the Fund Value	SRL Indicator
1	4	$315,600	$128,972	$330,000	$60,799	Validated Uninsured
2	7	$259,990	$90,001	$0	$67,327	Validated

Repetitive Loss

The City of Warren (Marshall County) has the most properties on the list, with 74 properties, the City of Austin (Mower County) has 62 un-mitigated properties, followed by Clay County with 25, and the City of Granite Falls (Chippewa County) has 15 properties. There are 114 jurisdictions (city and county) are on the repetitive loss list, 65 jurisdictions have only one property on the list, thirty-eight jurisdictions has less than ten properties on the list, five communities have ten or more properties on the repetitive loss list as of 10-31-2010.

Sorting by jurisdictions with ten or more properties on the list Norman County, Marshall County and the City of Lakeland (Washington County) are included. The following table sorts the data by the ten highest total payments for repetitive loss properties. The full list of non-mitigated repetitive losses is contained in Appendix P.

Table 55 Repetitive Loss County Un-mitigated: Top Ten Total Payments

County Name	Community Name	Total Payments	Losses	Properties
Mower	Austin, City Of	3,907,142.43	179	62
Clay	Clay County	1,310,796.54	61	25
Marshall	Warren, City Of	1,104,079.35	196	74
Dakota	Lilydale, City Of	687,314.96	5	2
Clay	Moorhead, City Of	654,658.21	32	11
Chippewa	Granite Falls, City Of	654,405.21	31	15
Stearns	Waite Park, City Of	591,789.26	10	4
Sibley	Sibley County	456,697.53	4	1
Wilkin	Breckenridge, City of	425,500.91	18	8
Scott	Shakopee, City of	401,465.40	8	3

Table 56 Repetitive Loss County Summary: Mitigated Records

COUNTY NAME	COMMUNITY NAME	BUILDING PAYMENTS	CONTENTS PAYMENTS	PAYMENTS	LOSSES	PROPERTIES
CARVER COUNTY	Carver, City Of	$ 49,703	$ 2,589	$ 52,292	5	2
CHIPPEWA COUNTY	Montevideo, City Of	$ 74,873	$ 15,333	$ 90,206	8	4
CHISAGO COUNTY	Chisago County *	$ 8,660	$ -	$ 8,660	2	1
CLAY COUNTY	Clay County *	$ 182,267	$ 20,275	$ 202,542	11	4
	Georgetown, City Of	$ 24,256	$ 1,946	$ 26,202	4	2
	Moorhead, City Of	$ 782,632	$ 60,699	$ 843,331	40	13

Table 56 Repetitive Loss County Summary: Mitigated Records

COUNTY NAME	COMMUNITY NAME	BUILDING PAYMENTS	CONTENTS PAYMENTS	PAYMENTS	LOSSES	PROPERTIES
GOODHUE COUNTY	Cannon Falls, City Of	$ 179,066	$ 67,830	$ 246,896	7	3
	Goodhue County *	$ 56,895	$ 19,631	$ 76,525	2	1
HENNEPIN COUNTY	Golden Valley, City Of	$ 106,687	$ 32,781	$ 139,468	17	8
	Minneapolis, City Of	$ 82,578	$ 6,555	$ 89,134	11	5
HOUSTON COUNTY	La Crescent, City Of	$ 81,433	$ -	$ 81,433	2	1
KITTSON COUNTY	Kittson County *	$ 54,814	$ -	$ 54,814	6	3
LAC QUI PARLE COUNTY	Dawson, City Of	$ 8,906	$ 983	$ 9,889	2	1
LE SUEUR COUNTY	Le Sueur County *	$ 8,364	$ -	$ 8,364	2	1
LYON COUNTY	Marshall, City Of	$ 3,323	$ -	$ 3,323	2	1
MARSHALL COUNTY	Marshall County*	$ 393,046	$ 44,666	$ 437,712	20	9
	Stephen, City Of	$ 87,416	$ 74,992	$ 162,408	2	1
	Warren, City Of	$ 121,999	$ 10,297	$ 132,296	21	8
MOWER COUNTY	Austin, City Of	$ 1,168,587	$ 231,917	$ 1,400,504	151	62
	Mower County *	$ 280,595	$ 113,142	$ 393,737	13	4
NOBLES COUNTY	Adrian, City Of	$ -	$ 3,221	$ 3,221	2	1
NORMAN COUNTY	Norman County*	$ 95,567	$ -	$ 95,567	7	2
OLMSTED COUNTY	Rochester, City Of	$ 91,266	$ 22,569	$ 113,835	14	7
POLK COUNTY	East Grand Forks, City Of	$ 241,184	$ 12,220	$ 253,405	11	5
	Polk County *	$ 283,663	$ 43,525	$ 327,187	12	5
RAMSEY COUNTY	St. Paul, City Of	$ -	$ 112,009	$ 112,009	2	1
SCOTT COUNTY	Prior Lake, City Of	$ 46,363	$ 8,027	$ 54,390	2	1
ST. LOUIS COUNTY	Proctor, City Of	$ 10,717	$ 10,000	$ 20,717	2	1
STEARNS COUNTY	Cold Spring, City Of	$ 10,163	$ 1,717	$ 11,880	2	1
STEELE	Owatonna, City	$ 9,254	$ 9,882	$ 19,135	2	1

Table 56 Repetitive Loss County Summary: Mitigated Records

COUNTY NAME	COMMUNITY NAME	BUILDING PAYMENTS	CONTENTS PAYMENTS	PAYMENTS	LOSSES	PROPERTIES
COUNTY	Of					
TRAVERSE COUNTY	Browns Valley, City Of	$ 21,902	$ 8,331	$ 30,233	4	2
	Traverse County*	$ 8,824	$ -	$ 8,824	2	1
WASHINGTON COUNTY	Lake Elmo, City Of	$ 84,763	$ -	$ 84,763	11	5
	Lake St. Croix Beach, City Of	$ 21,359	$ -	$ 21,359	2	1
WILKIN COUNTY	Breckenridge, City Of	$ 222,305	$ 16,131	$ 238,436	12	6
WRIGHT COUNTY	Buffalo, City Of	$ 327,260	$ 20,817	$ 348,077	12	6
	Wright County *	$ 103,345	$ 635	$ 103,980	5	2
TOTAL		**$ 5,334,035**	**$ 972,718**	**$ 6,306,753**	**432**	**182**

The City of Austin, Mower County has the most mitigated properties (62) with the repetitive losses in the state. The City of Moorhead has had 13 properties mitigated per this list. Per the FEMA NFIP Community Status Book Report dated 11/17/2010, there are 551 communities participating in the National Flood Program. As stated in the goals section additional participation in the federal program will be promoted, as will participation in the CRS. See Figure 60, below for a listing.

Minnesota has been very successful in reducing the number of repetitive loss properties and will continue to utilize all available funding programs to acquire homes in the floodplain. The NFIP Repetitive Loss Mitigated report indicates 183 properties have been acquired. The total for these properties for building payments was over $5.3 million, contents payments were nearly $1 million for a total of $6.3 million in losses.

Table 57 Summary of Communities Participating in NFIP	
Total In Flood Program	551
Total In Emergency Program	34
Total In the Regular Program	517
Total In Regular Program with No Special Flood Hazard	91
Total In Regular Program But Minimally Flood Prone	69

Table 58 Summary of Communities NOT Participating in NFIP	
Total Not in Flood Program	94

Total Suspended from Emergency Program	0
Total Suspended from Regular Program	1
Total Withdrawn Communities Not In Program	1
Total Not In Program With Hazard Area Identified	94
Total Not In Program With Hazard Area Identified < 1 Year	4

Minnesota's Flood Damage Reduction (FDR) grant program has partially funded acquisition and removal of approximately 100 flood prone structures a year since 1988. The repetitive loss properties have been a priority for acquisition, and are expected to continue to be a higher priority. Since 1987, over $340 million has been allocated through the FDR grant program.

According to the most current data (October 31, 2010), there are 433 properties on the repetitive loss list for the state. From the 1,086 recorded events, the property losses total nearly $16 million, and contents losses are over $2.5 million. The state will continue to work with the local jurisdictions to acquire these structures.

Community Rating System (CRS) participation data as of October 1, 2010. There are only a few communities that participate in the state.

FIGURE 59 COMMUNITY RATING SYSTEM PARTICIPATION IN MN

COMMUNITY NUMBER	COMMUNITY NAME	CRS ENTRY DATE	CURRENT EFFECTIVE DATE	CURRENT CLASS	% DISCOUNT FOR SFHA[1]	% DISCOUNT FOR NON-SFHA[2]	STATUS[3]
	Minnesota						
275228	Austin, City of	10/1/91	05/1/08	5	25	10	C
275236	East Grand Forks, City of	10/1/91	10/1/98	10	0	0	R
275240	Lake St. Croix Beach, City of	10/1/95	10/1/00	8	10	5	C
275243	Montevideo, City of	05/1/10	05/1/10	5	25	10	C
275244	Moorhead, City of	05/1/10	05/1/10	7	15	5	C
270307	Mower County	10/1/95	04/1/00	8	10	5	C
275246	Rochester, City of	10/1/91	10/1/96	10	0	0	R
270729	West St. Paul, City of	10/1/91	10/1/96	10	0	0	R

C=Current, R=Rescinded

State mitigation planners will continue to encourage local communities to update their mitigation plans, and prioritize mitigation actions according to jurisdictions risks. HSEM will continue to promote participation in the NFIP, CRS and identify funding for the local share for acquisitions of repetitively damaged homes.

7. COORDINATING LOCAL MITIGATION PLANNING

7.1 Local Funding and Technical Assistance

Requirement §201.4(c)(4)(i): *[The section on the Coordination of Local Mitigation Planning* ***must*** *include a] description of the State process to support, through funding and technical assistance, the development of local mitigation plans.*

Funding for local hazard mitigation programs and technical assistance is available through federal, state, government and other agencies, as listed in this Plan. The PDM and HMGP are two grant programs available to assist locals in their hazard mitigation plan development. PDM grant funding provides funds to states, territories, Indian Tribal governments, and communities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. The PDM is a competitive grant program that is ranked via a national ranking process. Under the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 it is the responsibility of the state to identify and select hazard mitigation projects to be recommended to the Federal Emergency Management Agency for final approval and funding of the Hazard Mitigation Grant Program.

Local all-hazard mitigation plans are consistent with and incorporate information from the state Plan. Local hazard mitigation plans are encouraged to incorporate other local planning mechanisms, thus providing a unified mitigation strategy throughout all levels and aspects of government within Minnesota. The state has continually provided guidance and technical support to the local mitigation plans and has encouraged the sharing of information both between local planning projects and with the state.

This section summarizes the funding and technical assistance given to local jurisdictions for the purpose of mitigation planning. Since the approval of the State Plan in April of 2008, approximately 40 planning applications have been submitted to FEMA and FEMA V has successfully approved 54 plans.

Mitigation Plan Tracking

Mitigation plan status is tracked on a spreadsheet to give mitigation staff a one stop synopsis of all local and multijurisdictional mitigation plans. The spreadsheet includes the jurisdiction of the plan and its funding source with the grant approval date and ending date. Tracking for various stages of the review include when the state receives the plan for review, when it was sent to FEMA, local adoption, and plan approval date. The five-year review is listed so that data may be used to determine when planning applications need to be developed. The jurisdiction is also assigned a mitigation staff planner who follows plan development and review. This spreadsheet is the basis to communicate milestones to local mitigation planners. HSEM also requests tracking spreadsheets from FEMA Region V to verify state data in addition to tracking local plan adoption.

Mitigation Planning Workshops

In the autumn of 2008, mitigation staff met with Regional Development Commission (RDC) staff for a three hour meeting at the University of Minnesota at Crookston. By legislation, RDCs have been established to assist in economic development throughout Minnesota. There are eleven region districts of which seven support mitigation planning to counties and tribal communities. Five RDCs were represented at this meeting. The first part of the meeting discussed the June 2008 planning requirements and how they were to be implemented. An overview of HAZUS-MH was given with the goal of discussing resources and ideas of how to use HAZUS for mitigation plans.

In June 2009, mitigation staff attended a two-day workshop, "Mitigation Planning Workshop for Local Governments (G318)" in Bismarck, North Dakota to prepare for the workshop being given later in the month. Materials developed jointly by FEMA Region V and HSEM were compared to the workshops materials and presentations. Minor revisions were made to the FEMA V/HSEM materials.

The Mitigation Plan Workshop, held June 24, 2009, was located in Alexandria to be closer to the affected areas of DR-1830-MN. Fifty participants attended from across the state. HSEM Regional Program Coordinators attended to increase their knowledge of mitigation planning. FEMA Region V and HSEM mitigation staff co-developed this workshop. The intent was to discuss how to meet planning requirements while having a useful plan. Of the 40 participants, roughly half were emergency directors and half planning staff. Focus was on utilizing more community groups since mitigation plans are community oriented. The new requirements relating to NFIP were covered in detail. Universal problem areas such as how to document community participation and how maps support the planning process were also addressed. Discussion took place about applications to fund five-year reviews and following the Plan Maintenance section of current plans for periodic reviews and post-disaster update.

In January 2010, two HSEM mitigation staff held a workshop in Mankato. This workshop targeted the southern region due to the volume of mitigation plans coming due in 2011 and 2012. There were 30 participants from the region and mitigation planners from across the state starting the five year review process.

HSEM sponsors the annual Governor's Conference on Homeland Security and Emergency Management. During the 2010 conference, mitigation staff presented two, three-hour breakout sessions. Approximately an hour and a half was allocated for mitigation plan highlights based on the Mitigation Plan Workshops. Fifty emergency directors and planners attended these breakout sessions.

HSEM Regional Meetings

During the first and second quarter of 2010, mitigation updates were sent to HSEM Regional Program Coordinator meetings with the intent of keeping county emergency directors up to date on mitigation planning. Each RPC was briefed on the items and related them to the directors. County mitigation plan five year review dates was given for participants to keep up to date with periodic reviews and to request funding. HSEM continues to contact local emergency managers to develop their applications and mitigation plans.

Individualized Support

Mitigation staff planners keep in contact with plan developers in several ways. Staff planners review the quarterly reports to determine the progress on a mitigation plan development. This review is based on the plan development portion of the approved application and the estimated budget. The subgrantee reports on the progress of a plan by section in the quarterly report and sends an expenditure report with supporting documentation. A conversation about the plan requirements often start due to a quarterly review. The staff planner may see a problem and call to resolve it, or, a developer may see that they are behind schedule or have a problem meeting a requirement and contact the staff mitigation planner.

Mitigation plans sent for state review also initiate dialogue between mitigation staff and plan developers. Differences in the plan and planning requirements are often remediated by use of the phone and e-mail. However, larger issues may require meetings to discuss issues.

Application development for mitigation plans is another opportunity for mitigation staff to communicate with local planners. HSEM developed a customized application to meet HMA requirements for PDM and HMGP. PDM subapplicants are supported to use eGrants for PDM applications by using developed materials to obtain a username/password and use on-line eGrants training. Distinctions about eligible items are made, especially for ineligible work related to routine plan maintenance.

Mitigation applications and planning tools have been placed on the HSEM website. The goal of these items is to assist in local mitigation applications and planning. Mitigation staff often sends material on request or directs planners to the HSEM website. The URL is:

http://www.hsem.state.mn.us/Hsem_Subcategory_Home.asp?scatid=114&catid=10

Mitigation staff also meets with local planners and emergency management directors. Frequently this is due to is a new emergency management director working on a plan or education intervention is required. In addition, mitigation staff meets with potential subapplicants. There are an average of two individual meetings per year for mitigation plan development and three for application development.

HAZUS-MH Support

An effort to integrate HAZUS loss estimates for due to floods began in 2008. The main effort was to supply a statewide estimate plus estimate of losses for state facilities for the 2011 Minnesota State All-Hazard Mitigation Plan. As the project plan developed, HSEM determined that a HAZUS analysis would be done for each county and that the county report could be shared with the counties for use in mitigation plans. The original plan was to train planners in counties and Regional Development Commissions to perform HAZUS analysis. A trial with one local planner showed that HAZUS was infrequently used. The time investment to keep up to date and to use HAZUS was not cost effective. Sharing the county reports from the state flood reports is cost effective.

County HAZUS reports were shared with Dakota, Goodhue, Mower, and Nobles county emergency manager and/or to get their feedback. There was overwhelming support. Nobles County used the state supplied report for the five year review of their mitigation plan. Dakota is working with the state to complete a Level 2 analysis by integrating county building stock data and using LIDAR one meter elevation resolutions.

The county HAZUS flood loss estimation reports will be shared with all counties in 2011. Efforts to upgrade the HAZUS reports will be done through mitigation planning grants so that the upgraded county reports can be used in future statewide HAZUS loss estimation reports.

Future Local Mitigation Plan Support

Support for local mitigation planning is a high priority. The program benchmarks activities in other states to learn how to better support the local planning effort and how to make the plans living, useful tools. Advice from FEMA V is both sought and considered with the goal of better supporting communities. Many of the same activities listed above will be used either routinely or when needed.

7.2 Local Mitigation Plan Update(s)

Up to 7% of the HMGP funds may be used for planning for the State All Hazard Mitigation Plan or local, multi-jurisdictional mitigation plans. Planning grant funding from HMGP and PDM has met the need up until recently. As jurisdictions are due to update their plans every five years, the state has identified potential funding sources.

The counties in the state have been encouraged to develop multi-jurisdictional plans since the beginning of the mitigation plan requirement. Two cities have opted to develop their own local mitigation plans. Several tribal communities have developed or are in the process of developing tribal state/local plans.

Of the 87 counties in Minnesota, 80 counties, two cities and two tribal governments have FEMA approved plans. Six of the seven remaining county initial plans have been funded and the seventh jurisdiction has applied for funding for their initial multi-jurisdictional All-Hazard Mitigation Plan. Many local plans are coming due for to the five-year review and update date. Technical assistance and funding for updates are provided through both pre and post-disaster mitigation grants.

The Planning Grant Status (Appendix C) spreadsheet lists all jurisdictions (counties, cities and tribes) plan status. The document is revised as plans are funded, submitted for review, approved pending adoption or are formally approved.

The following section summarizes the actual and projected funding for mitigation planning in the state. Mitigation planning is voluntary on the part of the jurisdiction. HSEM supports mitigation planning by communicating plan due dates with jurisdictions and offering available HMA funding. County emergency directors also know that it is the responsibility of the jurisdiction to complete plans prior to their review dates to be eligible for HMA funding.

PDM funding combined with available HMGP funding is used to support mitigation plan development for initial plans, support for required three-year review for state plans and five year reviews for local plans. The following summary is current as of December 30, 2010. The period of this summary covers 2010 thru 2013.

Current Initial Plan Funding	# of Plans
Initial County Multi-jurisdictional Plans – PDM-2011 Application	1
County Multi-jurisdictional Plan - Funded	8
Tribal State/Local Plan - Funded	1

Three Year Review Funding	# of Plans
Tribal State/Local Plan Review - Funded	1

Funding for Plan Reviews Due in 2010	# of Plans
County Multi-jurisdictional Plans - Not Funded	1
County Multi-jurisdictional Plan - Funded	7
Local Jurisdiction Plan - Funded	1

Funding Projection for Plan Reviews Due in 2011	# of Plans
County Multi-jurisdictional Plans - Not Funded	2
County Multi-jurisdictional Plan - Funded	5

Funding Projection for Plan Reviews Due in 2012	# of Plans
County Multi-jurisdictional Plans - Not Funded	7
County Multi-jurisdictional Plans – PDM-2011 Application	5
County Multi-jurisdictional Plan - Funded	5
Local Jurisdiction Plan - Funded	1

Funding Projection for Plan Reviews Due in 2013	# of Plans
County Multi-jurisdictional Plans - Not Funded	26
County Multi-jurisdictional Plans – PDM-2011 Application	1
County Multi-jurisdictional Plan - Funded	7

The state will be submitting an application for PDM–2012 for the Minnesota State All-Hazard Mitigation Plan due in 2014.

7.3 Mitigation Success Stories in Minnesota

Success stories illustrate how mitigation projects have worked to reduce damages to people and property, and keep Minnesota and its population safe. Utilizing existing programs, funding mitigation programs, and coordinating with other planning efforts, losses can be even further reduced. Promoting how mitigation is successful in our local communities is important to the state mitigation program. Publicizing success stories via press releases in the local media, posting on the FEMA website and other methods of transmitting the message of how mitigation helps locals is a priority for the state. In addition to written success stories, best practices, and case studies, FEMA has assisted the state in producing loss avoidance studies and a video. Since the 2008 plan, mitigation publications include:

What is Mitigation? video on YouTube made by External Affairs during a Community Education & Outreach event at the Wadena Co. Fair for DR-1921-MN.

Ramsey Park Swayback Bridge Video

In response to the flooding of spring 2010, (DR-1900-MN), the FEMA Environmental and Historical Preservation Team developed a video on the restoration of the historic Ramsey Park Swayback Bridge in Redwood Falls, Redwood County, Minnesota. As a WPA project built in 1938, it was placed on the Historic Register in 1980. Over the Redwood River, the unique bridge was built to allow flow over it during high flow seasons, but it was damaged due to ice chunks and tree debris. See video at: http://www.fema.gov/medialibrary/media_records/2866

FEMA Loss Avoidance Studies (LAS) provide a quantitative approach to assess performance of mitigation measures, in this case, property acquisitions. Working with the state and local jurisdictions, data is collected for the study and multiple analyses are conducted to determine if there were measurable avoided losses since the projects' completion. The reports contain project descriptive information and the impacts of those projects. Damage estimates were based on actual storm events and the potential losses that may have occurred had the mitigation project not taken place. FEMA's HAZUS –MH-MR4 modeling software was used to model a flood event and information from that model was applied to certain number of historical crests since the acquisitions were completed. The third phase of analysis is the Loss Estimation Analysis. This analysis calculated the dollar amount from physical damage and loss of function from pre and post mitigation. Return on Investment (ROI) = Losses Avoided (LA) divided by Property Investment (PI) or acquisition cost x 100. The ROI will only increase as more flooding events occur, making property acquisition an effective and permanent mitigation tool.

- Evaluating Losses Avoided Through Acquisition Projects: Montevideo, MN December 2010

  City of Montevideo, MN was selected for their acquisition (with Federal and State assistance) of 48 repetitive-loss properties. The total losses avoided were estimated at $8,394,030. The total project investment for the project was $1,123,145. As a result, the collective return on investment for the ten flood events was 747 percent. Using the ten storm events to determine possible damage that *would* have occurred to the properties had they not been acquired, yields significant returns on investments. Full report in Appendix R.

- Evaluating Losses Avoided Through Acquisition Projects: Moorhead, MN December 2010

  City of Moorhead, MN was selected for their acquisition (with Federal and State assistance) of 27 repetitive-loss properties. The total losses avoided were estimated at $9,443,150. The total project investment for the project was $2,966,850. As a result, the collective return on investment for the five flood events was 318 percent. Report in Appendix S.

- Let a Tree Fall, We'll Have Power to Hear It: Lake County Converts Power Lines.

Only July 4, 1999, a strong thunderstorm caused severe tree blowdown and power outages resulting in a disaster declaration. The Cooperative Light and Power Association of Lake County – which is over 90 percent forested - received two HMGP grants to convert overhead power lines to underground cables. This has proven valuable to the customers as in March of 2009 during the worst ice storm in 20 years, over two inches of ice fell breaking trees, branches and power lines. If no mitigation had occurred, the power outages for the 3,000 customers would have been extended by several days. It would have taken much longer to clear the lines and rebuild them, leaving people in the cold all the while. As Steve Wattnem, General Manager of CLP, explains, "These projects are truly long-term mitigation. They reduce our costs of maintenance and repair as well as get power to our customers faster. The FEMA grant has paid for itself over and over; we should see a return of our taxpayer's investment for years to come!" http://www.fema.gov/mitigationbp/bestPracticeDetail.do?mitssId=6751

- Mitigation Plays Strategic Role in Local Land Use Planning.

  East Grand Forks, Polk County. After the 1997 flood, during which 90 percent of the city was impacted, the city utilized HMGP to acquire 370 flood-damaged properties. Through comprehensive land use planning – the flood provided impetus for the 2035 Land Use Plan - and deed restrictions required by HMGP, the land adjacent the Red and Red Lake Rivers was converted to green space. The green space serves as flood protection and has become a model for sustainable floodplain management. The successful combination of land use planning and flood mitigation has shown how a city can protect itself from floods while attracting visitors. The area experienced subsequent flooding in 2001, 2002, 2006 and 2009. Each year the city has benefited from the success of their planning effort: each flood event was a non-event. No major damages occurred, and the city watched the water rise and fall without much disruption. By focusing on flood protection for the city, the planning effort has effectively and realistically protected its citizens from future floods while assuring a high quality of life. A city planner is states "The city has accomplished the challenging task of becoming flood resistant while maintaining and growing their economic development opportunities; it's a great triumph." The city's successful planning efforts give the city new life and its residents a new reason to be proud of their town and its future. For the full story see: www.fema.gov/mitigationbp/bestPracticeDetail.do?mitssId=6769

- Mitigation Prevents Disaster Declaration for Montevideo, Minnesota

  Located in Chippewa County, the city of Montevideo has utilized four HMGP grants to acquire 131 properties. The City had a three-tiered goal: 1) eliminating health and safety issues associated with flood damaged structures, 2) eliminating problems with flooded sanitary sewer systems, and 3) permanently eliminating the need for costly disaster interventions. That goal came to fruition during the 2009 flood. The sixth highest flood proved to be simply a minor inconvenience to the City and its residents. There was no health and safety issue, no flooded sanitary sewer systems, and no costly disaster intervention. The water simply came and went without much concern. www.fema.gov/mitigationbp/brief.do?mitssId=6750

- Austin Pre-Disaster Mitigation Saves Homes

  This best practice article was posted to the FEMA Mitigation Best Practices website/library October 6, 2008. The city of Austin utilized Pre-Disaster Mitigation grant funds to acquire 15 homes in the Wildwood Park neighborhood along the Cedar River. This area had flooded six times between 1978 and 2004, and in June of 2008 the area was flooded, but no properties were damaged.

  http://www.fema.gov/mitigationbp/brief.do?mitssId=6149

- Mitigation Case Study Sprinklers and FireWise: A Winning Combination. Ham Lake Fire, Gunflint Trail, Minnesota, May 2007 is in the final stages and should be available for public consumption early in 2011. The story details how the combination of sprinklers and utilization of FireWise practices, including defensible space, prevented a widespread wildfire from burning down homes in its wake.

In addition to publishing success stories, the state has managed to track the spending on projects and plans since the start of the mitigation program. As identified in the 2008 Plan, HSEM staff created/updated a database to track all projects. An Excel database was created to track disaster and non-disaster grant funding, see Appendix T Federal Share Allocations for details.

For the next update of this Plan in 2014, it is a goal to develop a searchable database, to include all pertinent information regarding disaster declaration, contacts, timelines for projects and plans, budgets, payments and closeout status in order to assist HSEM staff to query information and provide reports as needed.

7.4 Funding Update

The following is a summary of mitigation grants (obligated or expended) by type and 75% federal funding expended through December 2010. The majority of funding for these projects falls under HMGP and PDM grants. These totals do not take into account the most current funds that became available for three disasters (DR-1900-MN, DR-1921-MN and DR-1941-MN) in 2010 as applications are in review and have not been obligated.

Post-disaster funding in the state from DR-929-MN (1991) through DR-1830-MN (2009) has resulted in the following federal HMGP expenditures and obligations for:

- Acquisition projects over $42 million
- Electric Distribution over $19 million
- Mitigation Planning over $2 million
- Drainage projects nearly $12 million
- Wildfire projects over $2 million
-

Table 59 Hazard Mitigation Grant Program (HMGP) Funding Summary

DISASTER/ PROJECT TYPE	PROPERTY ACQUISITION	ELECTRIC DISTRIBUTION	MITIGATION PLANS	DRAINAGE	WILDFIRE	5% INITIATIVE
DR-929	$0	$440,638	$0	$0	$0	$97,000
DR-993	$7,370,000	$157,500	$0	$3,684,655	$0	$640,238
DR-1078	$0	$557,695	$0	$0	$0	$0
DR-1116	$96,750	$249,497		$330,512		$608,412
DR-1151	$0	$1,637,745	$0	$0	$186,499	$45,000
DR-1175	$23,267,887	$3,864,370	$0	$690,568	$0	$1,297,831
DR-1187	$1,269,775	$501,750	$0	$0	$0	$69,361
DR-1212	$0	$2,406,392	$0	$1,870,223	$0	$160,928
DR-1225	$211,865	$2,551,039	$0	$600,206	$0	$85,578
DR-1283	$50,301	$1,171,957	$0	$286,945	$943,736	$120,721
DR-1288	$0	$1,233,787	$0	$0	$0	$0
DR-1333	$1,867,396	$2,048,990	$0	$230,668	$0	$237,375
DR-1370	$4,116,662	$437,540	$410,183	$0	$0	$33,942
DR-1419	$309,451	$712,082	$408,633	$3,568,997	$0	$75,000
DR-1569	$0	$434,400	$42,000	$0	$0	$0
DR-1648	$346,125	$0	$22,500	$0	$0	$0
DR-1717	$1,983,460	$374,501	$696,480	$591,263	$1,171,500	$206,501
DR-1772	$0	$438,750	$45,225	$0	$0	$30,000
DR-1830	$1,961,021	$0	$438,150	$0	$0	$0
	$42,850,693	**$19,218,633**	**$2,063,171**	**$11,854,037**	**$2,301,735**	**$3,707,887**

From 2002 through 2010, the State of Minnesota received over $25 million through the Pre-Disaster Mitigation program, both through the annual competitive program and Congressional Earmarks for the following:

- Acquisition projects over $14 million
- Mitigation Planning over $1.5 million
- Drainage projects over $2.75 million
- Wildfire projects nearly $6.4 million

Table 60 Pre-Disaster Mitigation (PDM) Grant Program Funding Summary

Grant	Property Acquisition	Mitigation Planning	Drainage	Wildfire
PDM-2002	$0	$274,445	$0	$0
PDM-2003	$0	$284,361	$0	$0
PDM-2005	$14,440,837	$74,250	$0	$0
PDM-2007	$0	$139,650	$0	$0
PDM-2008	$0	$0	$0	$5,944,365
LPDM-2008	$0	$0	$51,828	$450,000
PDM-2009	$0	$453,056	$0	$0
PDM-2010	$0	$305,892	$2,701,119	$0
Totals	**$14,440,837**	**$1,531,654**	**$2,752,947**	**$6,394,365**

Additional Technical Assistance and Public Education

While mitigation funding data is not available for the disasters that took place in 2010, education outreach and technical assistance for local units of governments took place in the state. The following information is from Hazard Mitigation Strategy documents put together by FEMA Region V, Joint Field Office and state mitigation staff. The document is created as a strategy or action plan to guide FEMA staff while they are 'in town' in response to a presidential disaster declaration. A strategy document was not created for DR-1772-MN. The document summarizes mitigation activities that took place post-disaster. It documents activities at the local level specifically public education, outreach and training. In addition it highlights NFIP outreach and education led by experts in the field.

DR-1941-MN

Hazard Mitigation Grants and Planning

Hazard Mitigation Assistance (HMA) Programs

- General information on Hazardous Mitigation Assistance (HMA) Programs 404 and 406 presented at all applicant briefings.
- Technical assistance made available as requested.

Section 404 Hazard Mitigation Grant Program (HMGP)

- In order to provide technical assistance on HMGP for state and local officials using the FY2011 Unified HMA Guidance, HSEM prepared a handbook and reference CD entitled "HMGP Property Acquisition for Minnesota Communities." FEMA assisted in printing 150 copies for the State.

Mitigation Planning

- Providing planning technical assistance to communities for the update of their multi-jurisdictional Hazard Mitigation Plan has been ongoing by HSEM.
- FEMA provided outreach planning technical assistance to Leach Lake band of Ojibwa and Pine Island.

Floodplain Management and Insurance

- Limited FEMA staff attended the Town Hall meeting in the city of Mazeppa and answered questions raised.
- Technical assistance was provided regarding Substantial Damage determinations and requirements to Zumbro Falls, Hammond and Wabasha County. 117 inspections were done resulting in 31 substantial damage determinations. A copy of the final inspection results were supplied to State DNR, HSEM, Region V and local community building inspector.
- The 11 most highly impacted counties targeted and 208 NFIP agent visits were completed.
- A draft of general information for a "quickbook" for officials for future disasters was completed. The state will prepare MN specific information and the project will be completed in conjunction with the next declaration.
- A "Retrofitting Flood-prone Residential Buildings" course held November 30, 2010 with 14 participants.

Hazards and Performance Analysis

- 406 Mitigation assistance has been provided as applicable.
- Quantitative Best Practice (QBP) studies were conducted for Moorhead and Montevideo.

DR-1921-MN

Hazard Mitigation Grants and Planning

Hazard Mitigation Assistance (HMA) Programs

- MN HSEM has included information in the PA packets distributed at the applicant's briefings.

Section 404 Hazard Mitigation Grant Program (HMGP)

- As a result of FEMA-1900-DR-MN, the administrative plan requires minor updates for approval under DR-1921. Submitted to FEMA for review within 60 days of declaration.

Community Education and Outreach

Hazard Mitigation Best Practices

- Opportunities were provided for community members to learn more about wind resistant building techniques through outreach venues at East Otter Tail fair 7/22/2010 to 7/25/2010, Home Depot/Albert Lea 7/21/2010 to 7/25/2010, Wadena Fair 7/29/2010 to 7/31/2010 and Lowe's/Owatonna 7/28/2010 to 8/1/2010.

DR-1900-MN

Hazard Mitigation Grants and Planning

Hazard Mitigation Assistance (HMA) Programs

- 12 briefings were held May 4 to May 12, 2010 to present information on HMA programs and the application process.
- Information on project development presented during application briefings.

Section 404 Hazard Mitigation Grant Program (HMGP)

- Information on the HMGP for state and local officials using the FY2009 Unified HMA Guidance presented at 12 briefings.

Mitigation Planning

- A Disaster Administrative Plan by the State submitted, reviewed and approved by May 4, 2010.
- Information from the flooding event collected for inclusion in the State All-Hazard Mitigation Plan update.
- The Upper Sioux Tribe has contracted with Regional Development Commission to update the expired Tribal Multi-Hazard Mitigation Plan.

Community Education and Outreach

Hazard Mitigation Best Practices

- A Best Practice location identified in the city of Delano.
- Five field sites visited and documented and three articles were written and ready to be submitted to FEMA Best Practices.

Hazards and Performance Analysis

Information on the type and cost of Benefit Cost Training for FEMA and State PA staff that is available forwarded to JFO Training Officer for implementation upon approval

DR-1830-MN

Hazard Mitigation Grants and Planning

Hazard Mitigation Assistance (HMA) Programs

- Information on HMA programs and the application process was presented at applicant briefings for 27 counties and 2 Tribal Nations.
- Officials met with five local communities (the city of Moorhead, Clay County, Norman County, Marshall County, Polk County and Kittson) who expressed interest in the HMA programs.

Section 404 Hazard Mitigation Grant Program (HMGP)

- Thirty people attended an in-service conducted for a disaster area in Norman County on July 23, 2009.

Mitigation Planning

- The Administrative Plan submitted by the State received approval from FEMA Region V on June 1, 2009.

- Two meetings were conducted by MN HSEM with the White Earth and Fond du Lac Tribal Governments to discuss mitigation planning information.
- The MN HSEM conducted two meetings with the MN Valley Regional Development Commission and the Mid-Minnesota Regional Development Commission regarding county plans they are working on.
- The Region V staff and MN HSEM conducted one planning workshop in Alexandria, MN on June 24, 2009.

Community Education and Outreach

- Three Best Practice articles were completed and posted on the FEMA.gov website.
- Outreach completed in nine different home improvement stores in three different counties.

Floodplain Management and Insurance

- Nine Press releases regarding NFIP or mitigation issued during the disaster.
- One on one meetings were held with a total of 67 agents and information was distributed to an additional 14 agents covering 36 communities and 7 counties.

National Flood Insurance Program Delivery

- Contacts and information regarding substantially damaged structures delivered to an additional 12 counties and 16 cities.
- Officials from the city of Kent and the city of Wolverton met with to present information on joining the NFIP.
- RSDE training as well as follow up technical support regarding any potential appeals to their determinations was provided to the city of Moorhead and Clay County officials.
- DRCs were supported in Ada, Bemidji, Breckenridge, Crookston, Hendrum, Moorhead and Oslo.

7.4 Local Plan Integration

Requirement §201.4(c)(4)(ii): *[The section on the Coordination of Local Mitigation Planning* ***must*** *include a] description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan.*

A local plan integration pilot project was conducted for this 2011 state Plan update. HSEM contracted with Minnesota Geospatial Information Office (MnGeo) to complete a Local Integration Pilot Project. The purpose of this project was to address the FEMA local plan integration requirement. MnGeo staff reviewed 16 local plans for hazard ranking, prioritization and project implementation. A matrix was developed for local plan review. The goal was to have a matrix that local plan data would be incorporated into as it was reviewed by the state, and for inclusion for the 2014 state Plan update. Another goal for the project was to have a method to identifying potential projects when funds become available for mitigation activities.

Plans were chosen to include communities with current All-Hazard Mitigation Plan. Four were plan updates, plans were selected from a variety of geographic locations throughout the state and HSEM Regions. One city plan and one Tribal plan were also included.

Table 61 Local All Hazard Mitigation Pilot Project Jurisdictions

#	Jurisdiction / County	5 Year Review
1	City of St. Paul	3/22/2012
2	Chippewa (Update)	7/12/2015
3	Clay	11/5/2012
4	Cook (Update)	9/1/2015
5	Hennepin (Update)	8/31/2015
6	Houston	6/30/2014
7	Itasca	5/25/2011
8	Mille Lacs	1/15/2014
9	Mille Lacs Band of Ojibwe	2/12/2012
10	Mower (Update)	8/31/2015
11	Red Lake	5/6/2013
12	Renville	12/15/2013
13	Scott	5/12/2015
14	St. Louis	3/1/2012
15	Wadena	5/6/2013
16	Washington	4/5/2012

A total of 16 local Hazard Mitigation Plans by county, city and tribal governments were reviewed. Local plans may include hazards which are not natural in cause, the pilot project focused only on natural hazards. A matrix was created for summarizing and ranking the top natural hazards for the local governments. Plans varied widely in format due in part to the FEMA requirements at time of plan submission. Populated fields included: county name, population, plan date, the top hazard for the county, its rank and risk within the county, goals, objectives, state strategy, action, lead agency, priority, time line, and dollar amounts for the action items. Focus was on risk assessment and mitigation issues for each local plan. Because each county's plans varied significantly in form and format, this information was often spread across multiple sections of the plans. While most of the information for the fields could be pulled directly from the plans, several key items were not. Rank, risk factors and state strategies for a county's natural hazards were often not clearly identified in their plan. Plans were reviewed for several aspects of each mitigation plan to determine them. Factors taken into account included how many times a hazard occurred, repetitiveness of the hazard in the same area, other historical data, how the county prioritized its hazards, community profile, terrain, soil, environment, geography, physical characteristics, surface waters/wetlands, the counties vulnerability assessment, demographics, and agriculture.

Since many local plans combined tornadoes and windstorms into a single hazard, these were collapsed into a single category (summer storms-tornadoes).

The state strategy field was used to link each of the objectives found in the local plans to the current state strategy list: Prevention (P), Property Protection (PP), Public Education and Awareness (PE), Natural Resource Protection (NR), Emergency Services (ES) and Structural Improvement (SI). Strategies that seemed most appropriate for each goal/objective were categorized.

Local Natural Hazard Ranking and Mitigation Strategy Summaries

The ranking for the hazards was done on a county level, though each jurisdiction within the county may have a different ranking: The ranking was: 1 Highest Hazard, 2 Medium Hazard and 3 Low Hazard. The Risk was also assumed for the entire county, though each jurisdiction may have varied risk. Risk ranking is: Very High = VH, High = H, Moderate = M, Moderate / Low = ML, and Low = L.

The following summary indicates the rank and risk for flood hazard for the 16 reviewed local plans. Half of the jurisdictions in the study rank flooding their number one hazard.

Flood Hazard: Local Ranking and Mitigation Strategy								
County	**Rank**	**Risk**	**P**	**PP**	**PE**	**NR**	**ES**	**SI**
Chippewa	#1	M	Y	Y	N	N	N	Y
City of St Paul	#1	H	Y	Y	Y	N	Y	Y
Clay	#1	H	Y	N	N	Y	N	Y
Cook	#3	L	Y	Y	N	N	Y	N
Hennepin	#1	M	Y	Y	Y	N	Y	Y
Houston	#1	H	Y	Y	N	N	N	Y
Itasca	#3	L	Y	Y	N	Y	Y	N
Mille Lacs	#2	M	N	Y	N	N	Y	N
Mille Lacs Band of Ojibwe	#3	M	Y	Y	N	N	N	N
Mower	#1	H	Y	Y	Y	Y	N	N
Red Lake	#2	M	Y	N	N	Y	N	N
Renville	#1	M	Y	Y	Y	N	Y	Y
Scott	#1	H	Y	Y	Y	Y	Y	Y
St. Louis	#3	L	Y	Y	Y	Y	Y	Y
Wadena	#2	H	Y	Y	Y	N	Y	Y
Washington	#2	H	Y	Y	N	Y	Y	Y

Wildfire ranking is highest for jurisdictions in the northeast portion of the state.

Wildfire Hazard: Local Ranking and Mitigation Strategy									
County	**Rank**	**Risk**	**P**	**PP**	**PE**	**NR**	**ES**	**SI**
Chippewa	#3	ML	Y	N	Y	N	Y	N
City of St Paul	#3	M	Y	N	N	N	Y	N
Clay	#3	L	Y	Y	Y	N	Y	N
Cook	#1	VH	Y	Y	Y	Y	N	Y
Hennepin	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Houston	#3	H	Y	Y	Y	N	Y	N
Itasca	#2	M	Y	Y	Y	N	Y	N
Mille Lacs	#1	H	Y	Y	Y	N	N	N
Mille Lacs Band of Ojibwe	#1	H	Y	Y	N	Y	Y	N
Mower	#3	L	N	N	Y	N	N	N
Red Lake	#3	M	Y	N	Y	N	N	N
Renville	#3	L	Y	Y	Y	N	Y	N
Scott	#3	M	Y	Y	Y	Y	Y	N
St. Louis	#1	H	Y	Y	Y	N	Y	N
Wadena	#3	L	N	N	Y	Y	Y	N
Washington	#3	L	N	N	N	N	Y	N

Only four of the jurisdictions reviewed ranked summer storms (tornadoes and windstorms) high. The majority of jurisdictions ranked summer storms as their #2 hazard. Actions for jurisdictions that rank this hazard as high use all but natural resource protection strategies.

Summer Storms Hazard: Local Ranking and Mitigation Strategy								
County	**Rank**	**Risk**	**P**	**PP**	**PE**	**NR**	**ES**	**SI**
Chippewa	#2	M	Y	N	Y	N	Y	Y
City of St Paul	#2	H	N	N	Y	N	Y	Y
Clay	#2	M	Y	N	Y	N	N	Y
Cook	#2	M	Y	N	Y	N	Y	N
Hennepin	#2	M	Y	Y	Y	N	Y	N
Houston	#2	H	Y	Y	Y	N	Y	Y
Itasca	#1	M	Y	Y	Y	N	N	N
Mille Lacs	#3	M	Y	N	Y	N	Y	Y
Mille Lacs Band of Ojibwe	#2	M	Y	N	Y	N	Y	N
Mower	#2	M	Y	Y	N	N	Y	N
Red Lake	#1	H	Y	N	Y	N	N	N
Renville	#2	M	N	N	Y	N	Y	Y
Scott	#2	H	Y	Y	Y	N	Y	Y
St. Louis	#2	M	Y	N	Y	N	Y	Y
Wadena	#1	H	N	N	Y	N	Y	Y
Washington	#1	H	Y	Y	Y	N	Y	Y

The Local Plan Review Summary contains the ranking, goals, strategies and actions to address the top natural hazards for each of the 16 reviewed plans. Each plan reviewed utilized a variety of strategies to address their top natural hazards. Each plan was reviewed for mitigation actions in regards to the jurisdictions top natural hazards. The document is a 16 page Excel spreadsheet included in Appendix U Local Plan Review Summary.

The goal of this pilot project was to have all local jurisdictions mitigation actions in one document. In reviewing this process, it is extremely time intensive, as there is no one standard format; jurisdictions have different ways of categorizing, ranking and summarizing their risk assessments. The project attempted to categorize each jurisdictions actions, lead agency, priority, time line and potential funding and/or cost. While the goal of having single reference document was attained, it does not seem to be as user friendly as anticipated. It appears that the new SHMO's method and strategy to administer the hazard mitigation program, with tracking 'Notice of Interest" (NOI) for mitigation funding will be a superior method and will be utilized instead of updating the pilot project spreadsheet. It is easier to access a specific county's plan on the shared mitigation drive and review a jurisdictions plan and priorities than to access a separate document. In addition, the priorities of the state must be taken into account when a funding request is reviewed, and local jurisdictions priorities may have changed with the passage of time and severe weather and other events. In attempting to summarize a local multi- jurisdictional (county) plan, details and even more specific local jurisdictions (city) priorities are not made apparent. One goal of local plans is to ensure each local jurisdiction participated in order to ensure its 'uniqueness' if any is brought to light. Summarizing goals, strategies and objective is appropriate for the state and countywide plans, but each jurisdiction has its own priorities. Local hazard mitigation is better served through the new NOI process and applicable grant prioritization process. Information on prioritization of local assistance is contained in the following section.

Another goal for the pilot project was to gather a database of completed projects. The Updated Local Plan Completed Tasks database is in Appendix V, and lists projects completed by Chippewa, Hennepin and Cook Counties. As updating projects identified in previous plans is a requirement for updating local hazard mitigation plans, and as funding for mitigation projects is tracked by the state, this database will not be continued or updated. The Local Planning and Technical Assistance section provides an update on these activities.

7.5 Prioritizing Local Assistance

Requirement §201.4(c)(4)(iii): *[The section on the Coordination of Local Mitigation Planning must include] criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs, which should include consideration for communities with the highest risks, repetitive loss properties, and most intense development pressures.*

Further, that for non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost benefit review of proposed projects and their associated costs.

The application process, project review, ranking and selection criteria for mitigation planning and projects is described below. PDM grant applications are evaluated at the regional and national level once approved by the state for application. All other HMA grant program funds are evaluated first by state mitigation staff, then forwarded to regional FEMA staff for review. The Hazard Mitigation Assistance Unified Guidance is available at FEMA's website.

As part of a Presidential Disaster Declaration, the State is required to submit an Administrative Plan. This document details how the State will administer the Hazard Mitigation Grant funds made available by the disaster declaration. The state's FEMA approved HMGP Administrative Plan describes the organization, staffing, and procedures to be used when implementing the Section 404 Hazard Mitigation Grant Program in both the post and pre-disaster mitigation environment.

Applicant eligibility criteria will be in accord with federal statutes and regulations. Specifically, potentially eligible applicants will include: state agencies, local governments, private non-profit organizations (or institutions that own or operate a private non-profit facility as defined in 44 CFR 206.2211(e), and Indian tribes. Any questions regarding the eligibility of an applicant will be resolved by the SHMO, or, if necessary, by the Governor's Authorized Representative or his/her designee.

Projects may be of any nature that will result in the reduction or elimination of potential natural hazards and the protection of life and property. Specific types of eligible projects include, but are not limited to:

- *Flood reduction and flood control projects;*
- *Tornado Safe Room Construction or Retrofit projects;*
- *Retrofitting of facilities, including burying or retrofitting of power lines;*
- *Acquisition, elevation, or relocation of floodplain properties; and*
- *Development of comprehensive multi-hazard/multi-jurisdictional hazard mitigation plans.*

Non-Duplication of Programs – HMGP funds cannot be used as a substitute or replacement to fund projects or programs that are available under other federal authorities, except under limited circumstances in which there are extraordinary threat to life, public health, safety or improved property. Other federal program authorities that should be looked into before requesting use of HMGP monies are, for example: Section 406 of the Stafford Act, Federal Insurance Administration Programs, the U.S. Army Corps of Engineers, the Small Business Administration, and the Natural Resources Conservation Service.

Project criteria: projects must be in conformance with the State Hazard Mitigation Plan developed as a requirement of Section 409 of the Stafford Act and Section 322 of the Disaster Mitigation Act of 2000. Projects must have a beneficial impact upon the designated disaster area. Projects do not have to be located in the designated disaster area, funding is made available statewide. Projects must be in conformance with 44 CFR Part 9, Floodplain Management and Protection of Wetlands, and 44 CFR Part 10, Environmental Considerations. Projects must solve a problem independently or constitute a functional portion of a solution where there is assurance that the project as a whole will be completed. Projects that merely identify or analyze hazards or problems are not eligible.

Projects must be cost-effective and substantially reduce the risk of future damage, hardship, loss, or suffering resulting from a major disaster. The sub-grantee must demonstrate this by documenting that the project:

a) Addresses a problem that has been repetitive or a problem that poses a significant risk if left unsolved.

b) Will not cost more than the anticipated value of the reduction in both direct damages and subsequent negative impacts to the area if future disasters were to occur. Both costs and benefits will be computed on a net present value basis.

c) Has been determined to be the most practical, effective, and environmentally sound alternative after consideration of a range of options.

d) Contributes, to the extent practicable, to a long-term solution to the problem it is intended to address.

e) Considers long-term changes to the areas and entities it protects and has manageable future maintenance and modification requirements.

Environmental Considerations: Projects funded under the HMGP must comply with all appropriate environmental requirements. These include the National Environmental Policy Act (NEPA), P.L. 91-190, as amended; Executive Order 11988, Floodplain Management; Executive Order 12898, Environmental Justice in Minority and Low-Income Populations, and Executive Order 11990, Protection of Wetlands. (Minnesota is a NEPA - compliant state.). The SHMO will ensure through coordination that all required environmental review is performed. The extent of such review will depend upon (1) the nature of a project, (2) environmental contractor assistance, if any, made available by FEMA or funded by the state, and/or (3) the environmental requirements imposed by other agencies participating in a project (if any). Approval to initiate a project will not be granted, nor will any HMGP monies be expended prior to the completion and satisfactory outcome of a required environmental review.

Information acquired during the Preliminary Damage Assessment (PDA) process may be used if completed by Mitigation in identifying potential projects. In the event of an expedited presidential declaration request, mitigation may not be included in the PDA. The SHMO will review the existing State Mitigation Plan for identification of potential statewide projects for HMGP funding. Following a presidential disaster declaration but prior to the establishment of a JFO, the SHMO will confer with the federal HMO on a number of issues. Among these will be early indications of potential HMGP applicants. The Public Assistance Project Worksheet teams may also discover potential hazard mitigation projects. Projects that include the acquisition of properties that have repetitive flood-insurance claims will be of high priority.

Shortly following submission of the Governor's request for a presidential declaration, the state PA Program Officer and the SHMO will jointly meet with the affected county emergency management directors to briefly review both the PA Program and the HMGP if possible. In the event of an expedited presidential declaration, the SHMO will schedule meetings with each individual county emergency management director when it is deemed an appropriate time by both the SHMO and the county.

During Applicant Briefing(s) and individual meetings, potential applicants will be given directions as to how pre-applications for potential hazard mitigation projects can be submitted to the SHMO. At the discretion of the SHMO and in coordination with the federal HMO, press release(s) describing the program may be developed and issued. Such press release(s) would include a point of contact for obtaining additional program information. The release could also include an announcement of HMGP briefings or meetings to be held in the area, should the SHMO decide to hold such briefings. At the discretion of the SHMO and in coordination with the federal HMO, mitigation information describing the program may be disseminated to communities and the public through Disaster Recovery Centers (DRC's) and/or public meetings held by local officials of the disaster-impacted area.

Shortly after the presidential declaration of disaster, the SHMO determines if a separate HMGP briefing (in addition to that given at the Applicant Briefing) would be beneficial, and if so, could be scheduled. Depending on the scope of a disaster, the Minnesota Recovers Task Force (MRTF) may hold a consolidated, multi-agency applicant briefing. Such briefing(s) would include the following: general program overview; eligibility; application process; and technical assistance.

The SHMO is responsible for ensuring that HMGP application forms and other informational documents are made available to potential applicants. Depending on the magnitude of a disaster and the number of agencies participating in the recovery/mitigation process, a preliminary HMGP application form may be utilized and/or a multi-agency, multi-program application form may be developed. (Refer to Attachment B for a sample HMGP Preliminary Application Form and a sample Application Form.) Such forms may be disseminated at the Applicant's Briefing(s), and/or at a special HMGP briefing, if such a briefing is held.

In Minnesota, applicants for HMGP funds will be required to submit a completed application form (or preliminary application form) within a time frame established by the SHMO. If an applicant is unable to submit a fully completed application form within the required time period, it will need to notify the SHMO. The deadline to submit applications to FEMA is 12 months from the date of declaration with a possibility for two-three month time extensions totaling up to an additional six months.

The SHMO will make an initial review of all application forms to determine if the minimum required project information and eligibility criteria have been met. If they have not, the applicant(s) will be notified of the need to provide additional information.

HSEM may request state management costs from FEMA to fund one or more staff positions. The principal responsibility of the positions would be to facilitate the timely development and submission of project applications.

Once an application or Notice of Interest is received by HSEM, it is brought to the attention of the MRTF (assuming it is activated). At this time, a consensus is obtained as to which agency represented on the MRTF, if any, can/should fund the project.

For projects being considered for HMGP funding, the SHMO will perform an initial review of submitted application forms and determine if: all questions on the form have been adequately addressed, FEMA's minimum project criteria and any additional state criteria have been met and if all relevant information about the project has been provided.

If more project information is needed, the SHMO will obtain it in one or both of the following ways: by requesting the appropriate staff person to ask local officials for it, or by contacting applicants directly and asking for the additional project information.

HSEM staff will perform a benefit-cost analysis for the project or assist the sub-applicant in doing so. When necessary, HSEM staff will request that the State Historic Preservation Office (SHPO) perform a review for historical concerns. HSEM staff will work with the Minnesota Department of Natural Resources (DNR) and FEMA to ensure that the community in which a project is located is compliant with the National Flood Insurance Program (NFIP) and local floodplain ordinances if applicable.

HSEM/FEMA staff will determine the level of environmental review necessary. When needed and as required, the SHMO will request the Minnesota DNR or FEMA to conduct an environmental and floodplain management review relative to specific proposed hazard mitigation projects. When necessary, HSEM staff will initiate consultation with both the U.S. Army Corps of Engineers (USACE) and the Minnesota Department of Transportation (MN DOT) for project review and concurrence if no future agency projects are scheduled in the project action area.

Review of the application forms by the SHMO may reveal that several eligible projects are competing for insufficient hazard mitigation funding. Should this be the case, projects will be prioritized or ranked in accord with FEMA and state criteria. These criteria are as follows:

1. Measures that best fit within an overall plan for development and/or hazard mitigation in the community, disaster area, or state.

2. Measures that, if not taken, will have a severe detrimental impact on the applicant such as potential loss of life, loss of essential services, damage to critical facilities, or economic hardship on the community.

3. Measures that have the greatest potential impact on reducing future disaster losses.

4. Measures that are designed to accomplish multiple objectives, including damage reduction, environmental enhancement, and economic recovery.

5. Measures that are in accordance with any overall hazard mitigation project priorities established by the State Mitigation Plan.

6. Additional state criteria that may be considered

   a) Geographic distribution of projects

   b) Projected cost of proposed project

   c) Relative cost-effectiveness of projects

   d) Conformity of project with existing local hazard mitigation plans and land use/building regulations in the communities. Sub-grantees who do not have a plan will be required to develop an all-hazard mitigation plan.

   e) Applicant's level of interest and demonstrated degree of commitment to hazard mitigation actions and programs.

Following the review, and if necessary, prioritization of potential hazard mitigation projects, the SHMO will decide: which projects should be selected, the level of funding for each project selected, and the order in which projects should be funded (i.e., a ranking of the projects by priority).

The SHMO will notify all applicants of the decision made by the state relative to their proposed projects. For those projects that have been selected, the SHMO will determine if the applicant still intends to carry out the project, and if it would carry out the project with the level of state funding tentatively approved.

Following notification of the applicants of the (state) action taken on their application, the SHMO will submit the state's HMGP applications to the FEMA Region V HMO. All submissions will be made within the time-frame of 12 months, as established by FEMA.

The application materials that the SHMO will forward to FEMA include the following:

1) Name of the sub-grantee
2) State or local contact for the project
3) Written location of the project including geo-coding of structures and map.
4) Description of the project
5) Cost estimate and budget and letter of funds commitment for the project
6) Analysis of the project's cost-effectiveness and substantial risk reduction consistent with Section 206.434 (b) of Federal 404 Regulations
7) Work schedule
8) Justification for selection
9) Alternatives considered
10) Environmental information consistent with 44 CFR Part 9, Floodplain Management and Protection of Wetlands, and 44 CFR Part 10, Environmental Considerations
11) Historical importance information

Once HSEM has been notified by FEMA of the action that it has taken on the state's applications for HMGP funds, the staff will notify individual applicants. For projects that FEMA has approved, the SHMO will determine if the applicant still intends to carry out the project. For each project that has been approved by the state and by FEMA, a State of Minnesota HMGP grant contract (see Attachment x) will be completed. The appropriate state and local government representatives will sign the contract. Along with a copy of the completed agreement, sub-grantees will also be provided with the HSEM document, Sub-grantee’s Handbook for the Section 404 Hazard Mitigation Grant Program (available upon request). The handbook contains program requirement information and forms.

In regards to prioritizing technical assistance, the Administrative Plan states; as a general rule, applicants for HMGP funds will be responsible for obtaining any technical assistance they may need in order to develop or carry out a hazard mitigation project. In some instances, however, certain state agencies may be in a position to provide technical assistance. FEMA may also have assistance available, particularly with regard to benefit/cost analysis and environmental review. Applicants who want such assistance may place a request with the SHMO. The SHMO will then work to obtain the needed assistance.

Process for Integrating State and Local Mitigation Measures

Identification of proposed mitigation measures within each local jurisdiction are the responsibility of the local community. The process of identification should take place during the local hazard mitigation planning process, but it may take place post disaster. The transition between identifying potential mitigation projects and submitting applications for funding of those projects is accomplished through the following process;

- The State notifies potential applicants of Hazard Mitigation Assistance (HMA) program funding availability and program requirements.
- Following notification, applicants will submit a Notice of Interest (NOI) declaring their intent to apply to HSEM by the established deadline. At a minimum, the NOI will include the name of the applicant, a brief description of the proposed project(s) including time frames for completion, title of Local Hazard Mitigation Plan and date of FEMA plan approval, mitigation measure from the approved plan that corresponds with the proposed project, approximate cost of the proposed project, and its precise location.
- HSEM mitigation staff review NOI's to determine initial eligibility and whether the sub-applicant will be invited to complete a full HMA application. The review will consider the level of funding available under the grant; how the proposed project fits within an overall plan for development and/or hazard mitigation in the community and how the project addresses the State's priorities.
- All NOI's received by HSEM are tracked in the General Project Tracking Spreadsheet and are utilized for current and future funding opportunities. The NOI's are tracked by project type and include the sub-grantee, county, project type, total cost, and other pertinent information for the sub-grantee. A tracking sheet is maintained for acquisitions, planning, and all other projects.

If all eligibility requirements are met and funding is available then a formal invitation to apply for FEMA funding will be sent to the sub-applicant.

Each project lead is responsible for coordinating and tracking all project activities with the sub-applicant. The project lead will make reports on the weekly mitigation report outlining all relevant activities relating to the projects being submitted to the State. The SHMO sends these reports to HSEM management, appropriate FEMA staff, and other stakeholders in an effort to keep all parties informed of significant mitigation project developments.

State project leads and project officers will provide technical assistance and guidance throughout project and application development.

Upon application completion, the sub-applicant will submit the application to the State for review, approval, and submittal to FEMA.

All activities specific to the submitted project application are tracked by the project lead using the Project Officer Report. This report tracks such items as total applications submitted, total project cost and application submittal dates.

The State has several Hazard Mitigation funding opportunities available. The following is a list of programs that have provided FEMA funding for hazard mitigation projects to complete proposed mitigation measures since the last update period.

- The Hazard Mitigation Grant Program (HMGP) has been available and open over the last three years due to multiple Presidential Disaster Declarations.
- The Pre Disaster Mitigation Program (PDM) has an annual funding stream which guarantees a minimum amount of funding to each state.

8. PLAN MAINTENANCE PROCESS

The state will submit the Plan to the FEMA Region V office for review and approval before a formal adoption process is pursued. Once approved, the Plan will be adopted via signature: director of HSEM, Governor, state agency commissioners involved with mitigation activities, and from those with shared interests in the Plan.

Once the Plan has been approved, an official notice announcing the approval will be posted in the State Register and on HSEM website. This step will inform stakeholders of the Plans' success and encourage the implementation of mitigation strategies in the community and it will welcome ongoing feedback on the Plan.

8.1 Monitoring, Evaluating, and Updating the Plan

Requirement §201.4(c)(5)(i): *[The Standard State Plan Maintenance Process* ***must*** *include an] established method and schedule for monitoring, evaluating, and updating the plan.*

Provisions for monitoring, evaluating, and updating the Plan are located in the Code of Federal Regulations (44 CFR). The 44 CFR regulations require that the state "must review and revise its Plan to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities, and resubmit it for approval to the appropriate Regional Director every three (3) years."

HSEM serves as the lead agency for preparation of the State Plan and serves as lead agency for monitoring, evaluating, and updating the Plan. The State Hazard Mitigation Officer (SHMO) is responsible for coordinating Plan updates and maintenance. This position is located within HSEM and also serves as the lead coordinator of the State Hazard Mitigation Team (SHMT). Significant input into all phases of the planning process is derived from the SHMT, State Stakeholders, and the Silver Jackets Team.

Projecting into the future, the SHMT will be regularly involved in monitoring, evaluating, and updating of the Plan over the next three (3) years during each quarter beginning with the first quarter following approval of this Plan as indicated in the table below. Triggers for Plan updates include, but are not limited to:

- If a disaster requires HSEM to reassess its goals and objectives
- If a reassessment indicates that some adjustments are needed on goals and objectives, the SHMT will coordinate that process
- If changes in federal or state laws require revisions, the SHMT and appropriate State Stakeholder Agencies will be consulted for advice on how to conform to new legislation

Table 62 Plan Monitoring, Evaluating and Updating Matrix

Monitoring, Evaluating, and Updating Activity	Responsibility	Quarterly	Annual	3-Years
Review and update the Hazard Analysis and Risk Assessment	HSEM, SHMT			●
Evaluate progress on mitigation actions and projects	SHMT		●	
Agency Report to SHMT	State Agencies	●		
Identification of implementation issues	HSEM, SHMT	●		
Evaluate participation by stakeholders in mitigation planning	HSEM		●	
Provide briefings on updates	SHMT	●		
State Capability Assessment Updates	SHMT		●	
Plan review and approval	SHMT, State Agencies,			●
Plan Adoption by State of Minnesota	HSEM			●
Plan Approval by FEMA	HSEM, FEMA			●

As part of the monitoring, evaluating and updating component, the update evaluation will use the following criteria:

- Do the goals and objectives still address current and expected conditions?
- What were the nature and the magnitude of problems encountered and changes that have occurred?
- Were the current resources appropriate for implementing the Plan?
- What implementation problems occurred, as technical, political, legal, or coordination issues?
- Were the outcomes as expected?
- Did the agencies participate as originally proposed?

This process will require the SHMT to participate in updating all parts of the Plan. Approval of the updated Plan will be required by all State Agency Administrators and the Governor.

Multiple activities will be addressed differently for future monitoring, evaluating, and updating efforts for the state mitigation Plan. More frequent (quarterly) review of implementation issues, stakeholder participation, and the capability assessment will assist Minnesota in keeping its mitigation planning on track and ensure measures and capabilities are in-line with needs. Reviews of the hazards, Risk Assessment and associated mitigation actions and projects will also keep Minnesota's efforts on track. Addressing the above items in a regular and consistent manner will allow for enhanced adaptability to new federal and state guidance and Plan adoption.

For the next update the update process will be further refined and simplified to allow for a more efficient process for the collection and update of hazard specific information, local data integration, and agency specific capabilities and mitigation measures.

8.2 Monitoring Progress of Mitigation Activities

Requirement §201.4(c)(5)(ii): *[The Standard State Plan Maintenance Process* ***must*** *include a] system for monitoring implementation of mitigation measures and project closeouts.* ***§201.4(c)(5)(iii):*** *system for reviewing progress on achieving goals as well as activities and projects in the Mitigation Strategy.*

The Plan is a living document and requires regular monitoring, review, and evaluation. Also, the Federal Hazard Mitigation Planning regulations require the Plan to be updated and submitted for approval to the Regional Director of FEMA every three years. The Plan will be reviewed annually by the Silver Jackets as described below. Mitigation staff will initiate planning to update the Plan 18 months before FEMA approval is required to integrate input from federal, state, local agencies and the public.

The Silver Jackets will meet formally on an annual basis (approximately 12 months following Plan approval) to conduct a review of the Plan. If political or hazard events change and dictate an earlier review, then the members will be solicited via telephone or e-mail contact for their input to these changes. Then the Silver Jackets will:

- Review the goals and action items to determine their relevance to changing situations in the state.
- Review the Risk Assessment as necessary to incorporate current information, including updated hazard profiles and any new data on vulnerable state facilities.
- Monitor progress on mitigation actions and projects in the Plan by reviewing quarterly progress reports. The database of all local plans and local action items will be reviewed as part of the process.
- Evaluate mitigation actions and projects in the Plan by reviewing the final quarterly progress report.
- Identify implementation problems (technical, political, legal and financial) based on quarterly progress reports and input by the public and partners.
- Evaluate the effectiveness of the planning effort by using FEMA Worksheet #2: Evaluate Your Planning Team.
- Consider recommendations by the Silver Jackets members to increase hazard mitigation involvement by federal agency representatives, state agencies and local jurisdictions.
- Discuss changes in policies, priorities, programs and funding that alter the Plan’s goals and objectives, projects and timelines.

Should the mitigation staff determine during the annual meeting that the Plan should be updated; a meeting will be scheduled for updating the Plan. A list of recommendations or enhancements compiled during the annual meeting will be used to update the Plan. The State will update its Plan as necessary to reflect:

- Hazards addressed in the Plan – All of the natural and human-caused hazards that have been identified as posing a threat to the state of Minnesota have been included in the Plan. As situations change or new information becomes available 1) the hazards currently included in the Plan will be updated and 2) new hazards identified as a threat will be added to the Plan.
- State owned structures – A state owned and other Critical Facilities Database is still a priority , though funding is lacking. This database inventories all state owned structures and will be maintained, as necessary.
- County and City owned structures – funding for geocoding county and city critical facilities was not completed for the 2011 Plan due to funding issues. A database will be pursued as funds become available.
- HAZUS Analysis – HSEM will attempt to utilize a HAZUS Level 2 analysis for the next three-year update.
- New mitigation actions and projects – Additional actions and projects may be identified during the Plan evaluation.
- Problem identification and resolution – Recommendations developed to overcome problems (technical, political, legal and financial) may affect the mitigation strategy.
- Review and update will involve all of the original participants in the planning process and others identified as important for the Plan update. This process will occur, as needed, or at a minimum every three years. The Plan will be resubmitted to FEMA for their review as required by the federal DMA 2000 planning guidelines.
- The State Hazard Mitigation Officer (SHMO) has the overall authority and responsibility for maintenance of the Plan. The updated Plan will be submitted to FEMA for review. Once FEMA has determined the Plan is approved- pending adoption, the updated Plan must be submitted for approval by the Governor no later than three months after the conclusion of the Plan update meeting.

Disasters provide an opportunity to evaluate the effects of the disaster, to improve resistance to the hazard, review the accuracy of hazard specific sections and to determine if the planning efforts affected damage reduction. In the case of a disaster declaration in the State, the Plan can be updated if HSEM believes this necessary. A post-disaster review may replace an annual review depending upon the severity of the disaster event.

The Mitigation Section of HSEM is responsible for reviewing all Local Mitigation Plans based on the criteria established in 44 CRF 201.6 within 30 days of the arrival date and either certify or supply comments, as needed.

Plan Distribution

The Plan, and any changes to it, will be available in an electronic format on the HSEM website. Revised portions of the Plan will be annotated with the date of the revision. Digital and/or hard copies of the Plan will be distributed to State and Federal agencies as requested. HSEM will maintain a distribution list for hard copies provided to such agencies to facilitate the distribution of Plan revisions.

Acronyms and Abbreviations

BAH	(Minnesota) Board of Animal Health
BCA	Benefit Cost Analysis
BWCAW	Boundary Waters Canoe Area Wilderness
BWSR	Board of Water and Soil Resources
CDMS	Comprehensive Data Management System
CFM	Certified Flood Manager
CRS	Community Rating System
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
DMA	Disaster Mitigation Act
DOT	Department of Transportation
DPS	Department of Public Safety
EAS	Emergency Alert System
EMPG	Emergency Management Grant Program
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
FDR	Flood Damage Reduction
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Act
FSA	Farm Services Administration
GIS	Geographic Information System

Acronyms and Abbreviations

HAZUS-MH	HAZards US - Multi-Hazard
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HSEM	Homeland Security and Emergency Management
HSIP	Homeland Security and Information Program
IFR	Interim Final Rule
JFO	Joint Field Office
LCCMR	Legislative-Citizen Commission on Minnesota Resources
LIDAR	LIght Detection And Ranging
MDH	Minnesota Department of Health
MEOP	Minnesota Emergency Operations Plan
MGS	Minnesota Geological Survey
MHIRA	Multi-Hazard Identification and Risk Assessment
MMI	Modern Mercalli Intensity Scale
MN DOT	Minnesota Department of Transportation
MN DNR	Minnesota Department of Natural Resources
MNAFPM	Minnesota Association of Floodplain Managers
MRTF	Minnesota Recovers Task Force
NAI	No Adverse Impact
NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NOAA	National Oceanographic and Atmospheric Administration
NOI	Notice of Interest
NRCS	Natural Resource Conservation Service
NSMB	North Shore Management Board
NSMP	North Shore Management Plan

Acronyms and Abbreviations

NWS	National Weather Service
PDM	Pre-Disaster Mitigation
PGA	Peak Ground Acceleration
RFC	Repetitive Flood Claims
RPC	Regional Program Coordinators
SEII	(Minnesota) Statewide Elevation and Imagery Inventory
SEOC	State Emergency Operation Center
SHMO	State Hazard Mitigation Officer
SRL	Severe Repetitive Loss
SWCD	Soil and Water Conservation Districts
TRI	Toxic Release Inventory
UMD	University of Minnesota at Duluth
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USDOT	U.S. Department of Transportation
USFS	United States Forest Service
USGS	U.S. Geological Survey