Winona County

Hazard Mitigation Plan

Update

Adoption Date: -- _____2012

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Thanks to Laura Lake, a public administration major at
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Section 1 - Public Planning Process

1.1 Introduction

Officials and leaders in Winona County's communities learned firsthand the importance of hazard mitigation efforts when the area was struck with torrential rains and devastating flash flooding in the fall of 2007. Winona County is committed to the development and implementation of hazard mitigation measures, and will provide on-going support to its cities and townships to do the same.

Hazard mitigation is defined as any sustained action to reduce or eliminate long-term risk to human life and property from hazards. The Federal Emergency Management Agency (FEMA) has made reducing hazards one of its primary goals; hazard mitigation planning and the subsequent implementation of resulting projects, measures, and policies is a primary mechanism in achieving FEMA's goal.

This All Hazard Mitigation Plan (AHMP) is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). The development of a local government plan is required in order to maintain eligibility for certain federal disaster assistance and hazard mitigation funding programs. In order for the National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt an All-Hazard Mitigation Plan (AHMP),

The Winona County Environmental Services, Planning and Emergency Management Departments have joined efforts to develop the county's mitigation plan. The county understands fully that the protection from hazards impacting the county and its residents can contribute to its future community and economic development. The team will continue to work together to develop and implement mitigation initiatives developed as part of this plan.

In recognition of the importance of planning in mitigation activities, FEMA created **Ha**zards **US**A **M**ulti-**H**azard (Hazus-MH), a powerful geographic information system (GIS)-based disaster risk assessment tool. This tool enables communities of all sizes to predict estimated losses from floods, hurricanes, earthquakes, and other related phenomena and to measure the impact of various mitigation practices that might help reduce those losses. We look forward to full utilization of Hazus-MH in the future.

1.2 Planning Authority and Guidance

This plan has been prepared in accordance with the requirements set forth by Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000), Public Law 106-390, codified at 42 USC § 5121 et seq. Hazard Mitigation Planning, 44 CFR Part 201, established criteria for State and local hazard mitigation planning as authorized by DMA 2000.

The Minnesota Department of Homeland Security and Emergency Management (MN HSEM) and the Federal Emergency Management Agency created plan preparation guidance documents, which functioned as instructive resources for establishing the planning process, assessment methods, content, and scope of the all-hazard plan.

1.3 Disaster Declarations

The goal of this plan is to meet the requirements established by the Disaster Mitigation Act of 2000 and to eliminate or reduce vulnerability to repetitive damage from one or more hazards. The following Table 1-1 describes events in which there were known expenditures from 1993 to 2008 in Winona County:

Table 1-1: FEMA-Declared Emergencies in Winona County

Disaster Number	Date of Declaration	Disaster Description	Total FEMA Assistance Amount
993	06/11/1993	Flooding, Severe Storm, Tornadoes	$268,451
1175	04/08/1997	Severe Storms/Flooding	$287,899
1333	06/27/2000	Severe Storms, Flooding and Tornadoes	$159,148
1370	05/16/2001	Flooding	$126,386
1717	08/23/2007	Severe Storms Flooding	$5,436,547

Sources: State of Minnesota All Hazard Mitigation Plan
Federal Emergency Management Agency

1.4 Planning Scope

This plan was prepared as a multi-jurisdictional plan to cover the jurisdiction of Winona County, Minnesota, and the cities located within Winona County. Local units of government within the county were invited to participate in the planning process.

1.5 Planning Process Summary

The Plan was developed as a coordinated effort of the Winona County Emergency Management and Environmental Services Departments along with a 30 member planning committee that assisted with many components of the plan. Planning consisted of the phases described in Table 1-2 below.

Table 1-2: Planning Process Summary

Winona County All-Hazard Mitigation Planning Process	
Phase 1: Planning Process Scope, and Assessment of Community Support	
Task 1	Analyze planning area and process.
Task 2	Determine community interest in mitigation planning - contact Emergency Management staff and local jurisdictions.
Task 3	Work with affected communities to define and formalize process Formalize Committee Members.
Task 4	Committee Meet to discuss All-Hazard Mitigation Plan process and procedures.
Phase II: Assess Risks	

Task 1	Work with Communities and Technical Committee to complete Priority and Hazard identification.
Task 2	Profile Events.
Task 3	Inventory Community Assets.
Task 4	Estimate Losses.
Phase III: Develop a Mitigation Plan	
Task 1	Develop Mitigation Goals and Objectives, with Community and Stakeholder Input.
Task 2	Identify and Prioritize Mitigation Efforts.
Task 3	Prepare an Implementation Strategy.
Task 4	Document the Mitigation Plan.
Task 5	Seek Review and Comments on Draft Plan.
Phase IV: Implement the Mitigation Plan	
Task 1	Adoption of the Plan.
Task 2	Implement Recommendations with Ongoing Public Engagement.
Task 3	Evaluate Planning Results.
Task 4	Revise Plan as Needed.

1.6 Planning Team Information

The Winona County All-Hazard Mitigation Planning Team is headed by Jill Johnson, who is the primary point of contact. Members of the planning team include representatives from the public, private, and governmental sectors. Table 1-3 identifies the planning team and the organizations they represent. Table 1-4 identifies the Winona County Emergency Coordinating Council (WCECC), which functions as the Planning Committee, and the organizations committee members represent. The Disaster Mitigation Act (DMA) planning regulations stress that planning team members must be active participants. Winona County AHMP committee members (Table 1-4) were actively involved in updating the AHMP update. Revisions were made to goals and actions.

Table 1-3: County All-Hazard Mitigation Planning Team

Name	Title	Organization	Jurisdiction
Jill Johnson	Coordinator of Special Projects	County Environmental Services Dept.	Winona County
Anne Morse	Sustainability Coordinator	County Environmental Services Dept.	Winona County
Bob Bilder	Coordinator	County Emergency Management Dept.	Winona County
Nick Meyers	County GIS Analyst	County Planning Dept.	Winona County
Eric Johnson	Zoning Administrator	County Planning Dept.	Winona County
Jeff Kirkey	County Emergency Management Coordinator	County Emergency Management Dept.	Winona County

Table 1-4: Emergency Coordinating Council/Planning Committee

Name	Title	Organization	Jurisdiction
Adam Zimmerman	Chief	Pickwick Fire Department	See Map
Andrea Essar	Security Director	St. Mary's University	Winona
Britt Hendrickson	Assistant Chief	Winona Fire Department	Winona
Carlos Morales	Emergency Dept. Physician	Winona Health	Winona
Chris Humble	Director	Winona Ch American Red Cross	Winona/Winona Co
Dan Wicka	Safety Coordinator	City of Winona	Winona
Dave Belz	Deputy Director	County Emergency Management Department	Winona County
Dave Brand	Sheriff	County Sheriff	Winona County
Deanna Johnson	Administrative Assistant	County Administration	Winona County
Duane Hebert	Administrator	County Administration	Winona County
Ed Krall	Chief	Winona Fire Department	Winona
Jeff Peterson	Health Preparedness Director	County Community Service	Winona County
Jim Multhaup	Assistant Chief	Winona Fire Department	Winona
Jim Pomeroy	Commissioner	County Board	Winona County
Jodi Dansingburg	Principal	Ridgeway Community School	Emergency Management
Joyce Tlougan	Clerk II	County	Winona County
Karla Eppler	Director	Winona Area Ambulance	Operations Manager
Kent Russell	Chief	City of Goodview Police Department	Goodview
Kevin Kearney	Community Liaison Officer	City of Winona Police Department	Winona
Marcia Ward	Commissioner	County Board	Winona County
Michael Peterson	Supervisor	County Dispatch	Winona County
Rachel Nice	Nursing Supervisor	Public Health	Winona County
Rebecca Lamberty	Emergency Service Leader	Winona Health	Winona
Rodney Merchlewitz	Coordinator	Ridgeway First Responders	See Map
Sara Gabrick	Chief Nursing Officer	Winona Health	Winona
Scott Bestul	Assistant Director Security	Winona State University	Winona
Scott Hannon	Superintendent	Winona Area Public Schools	Winona County
Steve Baumgart	Security	City of Goodview	Goodview
Tom van der Linden	Agriculture Produce Educator	University of Mn Extension	Winona County
Walt Kelly	Underground Facilities Damage Prevention Consultant	Emergency Management	Winona County

Specifically, committee members provided input via:

- Review and comment on the draft plans. Two meetings of the planning committee (WCECC) on November 23 and December 28 of 2010 were devoted exclusively to the AHMP update, and extensive input was received.
- Attendance at monthly Emergency Management Coordinating Council (WCECC) meetings throughout the planning process, where feedback on hazard mitigation efforts is regularly received.
- Provision of available GIS data and historical hazard information
- Coordination and participation in the public input process

• Coordination of the formal adoption of the plan by the county

1.7 Public Involvement in Planning Process

Substantial effort was made to solicit public input during the planning process. A public meeting was held with township officials and residents on October 26, 2010 to review the planning process and receive input on risk assessment and the planning process as a whole. Surveys were distributed and responses were incorporated into the individual risk analyses. Survey results are found in Appendix B.

Additionally, AHMP committee members met individually with the city councils throughout 2010 and 2011, meeting agendas for which were publicly noticed, establishing progress to date on previously identified mitigation efforts, soliciting additional risk assessment commentary, and identifying future mitigation goals.

1.8 Review of Technical Resources

The AHMP planning team has identified representatives from key agencies to assist in the planning process. Technical data, reports, and studies were obtained from these agencies. The organizations and their contributions are summarized in Table 1-5.

Table 1-5: Key Agency Resources Provided

Agency Name	Resources Provided
Mn Dept. of Public Safety, Division of Homeland Security and Emergency Management	FEMA Disaster Funding Data; planning assistance
NOAA/National Weather Service LaCrosse, Wisc	Winona County Natural Hazard Assessment
United States Geological Survey (U.S.G.S.)	Data on Natural Resources; Karst
Minnesota Pollution Control Agency	Data on Forest Resources
Minnesota Department of Health	Nitrate probability Study
United States Geological Survey (U.S.G.S.)	General background on Natural Resources
Minnesota Department of Natural Resources	Background on Natural Resources & Flood Response
State Fire Marshall	Historical Fire Data

1.9 Review of Existing Plans

Winona County and its local communities utilized a variety of planning documents to direct community development. These documents include land use plans, comprehensive plans, emergency response plans, municipal ordinances, and building codes. The planning process also incorporated the

existing natural hazard mitigation elements from previous planning efforts. Table 1-6 lists the plans, studies, reports, and ordinances used in the development of the plan.

The planning team met regularly in throughout late 2010 and early 2011, immediately following the monthly planning committee (WCECC) meetings, to review the listed plans and incorporate input from community members. Plans were reviewed and analyzed section by section and revisions and additions were incorporated as appropriate. Most revisions made reflected the challenges and experiences of the 2007 flood event (DR-1717).

The preponderance of the update revisions are found in a greatly expanded Section 4: Risk Assessment, in particular Section 4.4: Hazard Profiles, and in the updating of Section 5: Mitigation Strategy, in particular Section 5.4: Implementation of Mitigation Strategy and Actions.

Table 1-6: Planning Documents Used for AHMP Planning Process

Author(s)	Year	Title	Description	Where Used
Winona County Planning Department	2000	Winona County Comprehensive Land Use Plan	Describes recommended land use	Section 3.6 and Section 3.9
Winona County Planning Department	2011	Winona County Zoning Ordinance	Provides Land Use and Zoning Information	Section 3.9, 5.1.2
Winona County Emergency Management	2008	Winona County Emergency Operations Plan	Information on Fire Departments	Section 5.1
Winona County Planning Department	2011	Winona County Comprehensive Local Water Management Plan	Describes important watershed information	Hydrology Section 3.4 and 4.4.10
Winona Area Ambulance Service	2011	Spring Flooding Response Plan	Describes area emergency response	Section 5.2
Stockon/Rollingstone/Mn City Watershed District	2011	Revised 10 Year Management Plan	Describes specific watershed vulnerabilities	Section 4.4.2
State of Minnesota	2008	All Hazard Mitigation Plan	Declared Emergencies in Winona County and Hazard Analyses	Section 4.1and 4.4
Winona County Environmental Services	2011	Solid Waste Plan	Emergency Removal of Solid and Hazardous Waste	Section 4.4.2

Section 2 - Jurisdiction Participation Information

2.1 Adoption by Local Governing Body

This plan will be considered in effect upon its approval and adoption by the Winona County Board of Commissioners and its approval by the Minnesota Department of Homeland Security and Emergency Management (MN HSEM) and the Federal Emergency Management Agency (FEMA). The final draft of this plan will go to our local units of government for their review. Once the All Hazard Mitigation Plan is approved by "pending adoption", the plan will go back to the Townships Boards and County Board of Commissioners for their adoption.

2.2 Jurisdiction Participation

It is required that each jurisdiction participates in the 2011 Update planning process. Table 2-1lists each jurisdiction's participation and describes its participation in the development of the Update.

Table 2-1: Jurisdiction Participation

Participation			
Jurisdiction Name	**2006 Plan**	**2008 Amendment**	**2011 Plan Update**
City of Altura	Yes	Yes	Yes
City of Dakota	Yes	Yes	Yes
City of Elba	Yes	Yes	Yes
City of Goodview	Yes	No	Yes
City of Lewiston	Yes	Yes	Yes
City of Minneiska	Yes	Yes	Yes
City of Minnesota City	Yes	Yes	Yes
City of Rollingstone	Yes	No	Yes
City of St. Charles	Yes	No	Yes
City of Stockton	Yes	No	Yes
City of Utica	Yes	Yes	Yes
City of Winona	Yes	No	Yes
Winona County	Yes	Yes	Yes

Table 2-2: Staff Representatives

Jurisdiction Name	Participating Member	Participation Description
Altura	Sandra Pasche	Provided information on progress to date and identified future goals
Dakota	Lana Gerlach	Provided information on progress to date and identified future goals
Elba	Pat Haack	Provided information on progress to date and identified future goals
Goodview	Dan Matejka	Provided information on progress to date and identified future goals
Lewiston	Bryan Holtz	Provided information on progress to date and identified future goals
Minneiska	Laura Swartout	Provided information on progress to date and identified future goals
City of Minnesota	Lori Donehower	Provided information on progress to date and identified future goals
Rollingstone	Sharron Behrens	Provided information on progress to date and identified future goals
St. Charles	Nick Koverman	Provided city progress information goals and identified action goals
Stockton	Beth Winchester	Provided information on progress to date and identified future goals
Utica	Cindy Timm	Provided information on progress to date and identified future goals
Winona	Keith Nelson	Provided information on progress to date and identified future goals

Members of the AHMP planning committee were actively involved in attending the AHMP meetings, providing available Geographic Information Systems (GIS) data and historical hazard information, reviewing and providing comments on the draft plans, coordinating and participating in the public input process, and will be coordinating the county's formal adoption of the plan.

Section 3 - Jurisdiction Information

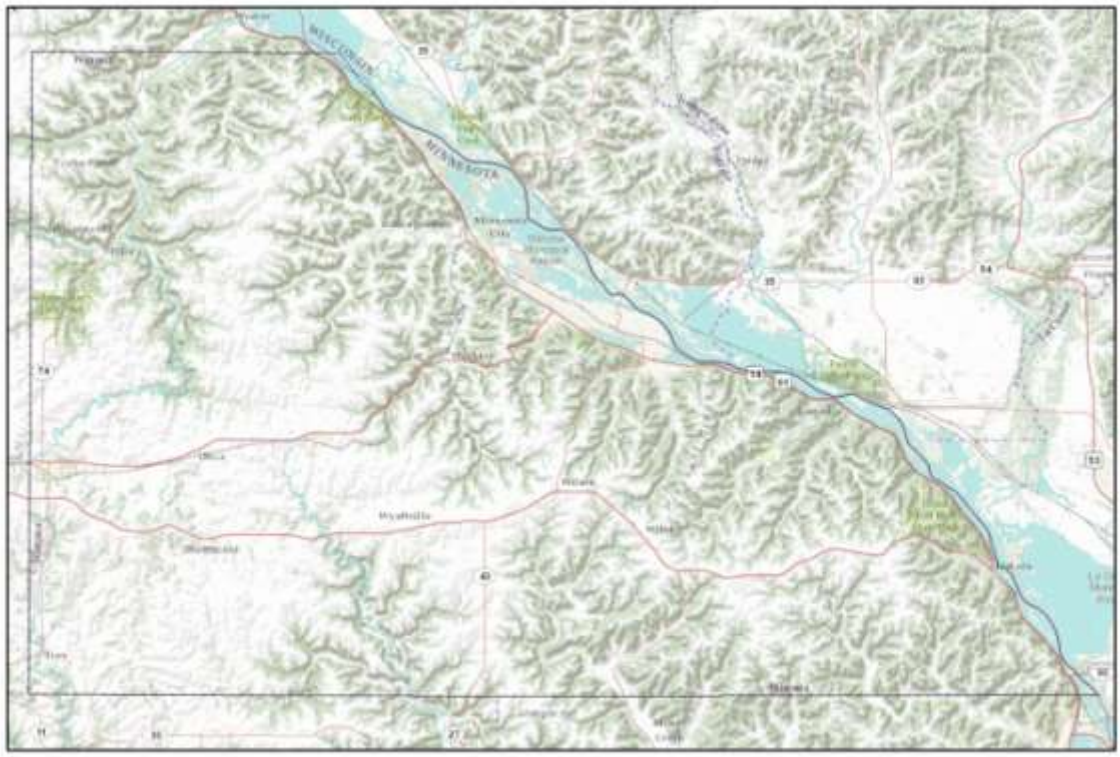
Winona County is located in what is known as the Blufflands of Southeast Minnesota. The County is bounded on the east by the Mississippi River and the State of Wisconsin, on the south by Houston and Fillmore Counties, on the west by Olmsted County and by Wabasha County to the north.

3.1 Topography & Geology

The topography and geology of Winona County contribute to many of the physical hazards addressed in this hazard mitigation plan, including regional and flash flooding, landslides, the potential for transportation related hazardous materials releases, and groundwater contamination. These factors are key to the many of our most significant hazards.

Topography

A dominant physical feature found in much of Winona County's landscape is blufflands. This area is predominated by a series of steep to rolling bluffs, cut by a number of narrow valleys draining surface water to the Mississippi river. Bluffs in Winona County have slopes varying from eighteen to one hundred percent (18%-100%). The highest elevation in the County is found in the western-southwestern portion of the county, at 1,325 feet above sea level. In contrast, the floodplain of the Mississippi River in the East is 600 feet below the western upland plateau.

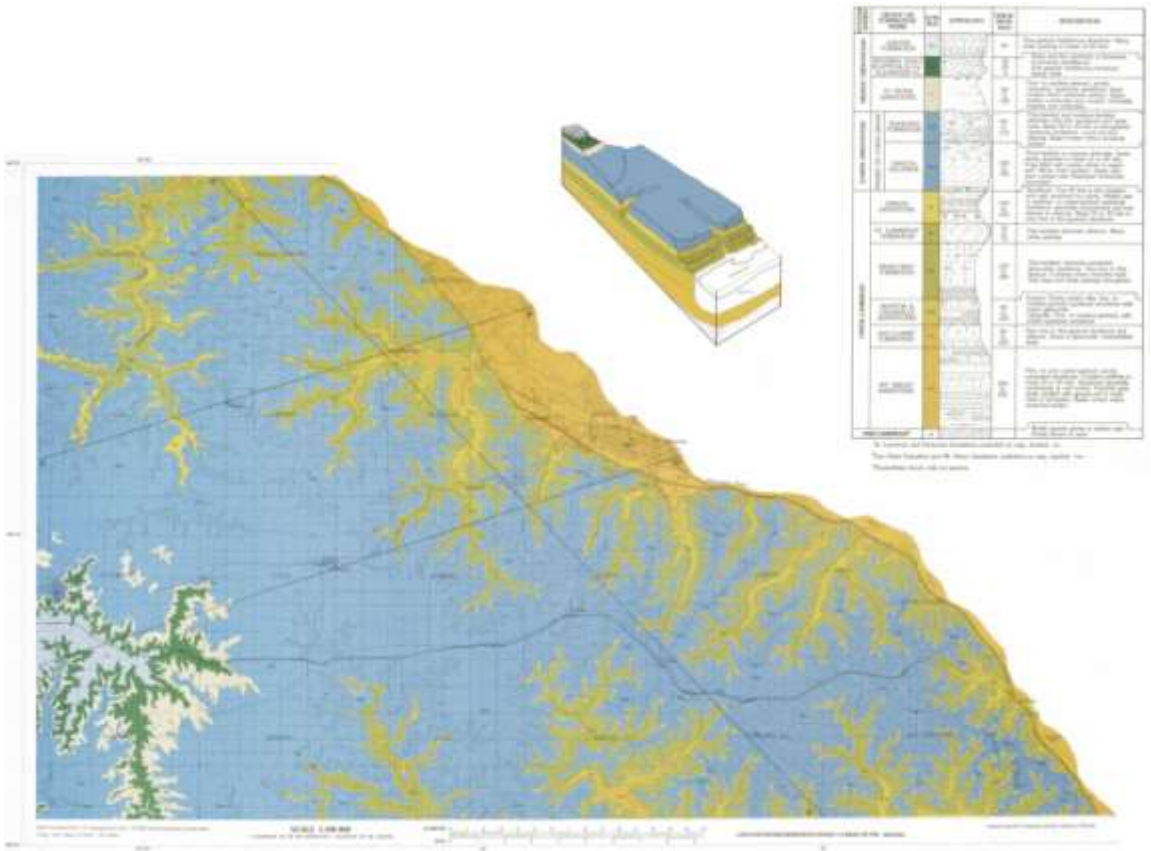


Geology

The southeastern part of Minnesota, including Winona County, did not experience the Wisconsin glaciations, and as a result the landscape has significant exposed bedrock and much thinner soils because it was not blanketed with Wisconsin glacial till. For this reason the region is called the "driftless area". The upper bedrock layer in much of County is the Prairie du Chien group comprised of carbonate rock. Carbonate rock such as dolomite has low porosity and permeability but over time exposed to slightly acidic rainwater, the rock dissolves. Dissolution features such as sinkholes, stream sinks, caves, and blind valleys comprise the visible "karst landscape"(graphic from RI 61).

The bedrock's carbonate components, fine clastic components and coarse clastic components under shallow bedrock conditions (< 200 ft from the land surface) can contain secondary pores such as fractures. The karst system has well-developed secondary porosity and underlying fractures that link the land surface directly to the upper groundwater system. This network also results in groundwater resurfacing as springs and seeps. These springs and seeps are the coldwater source of the county's streams.

Bedrock Geology of Winona County

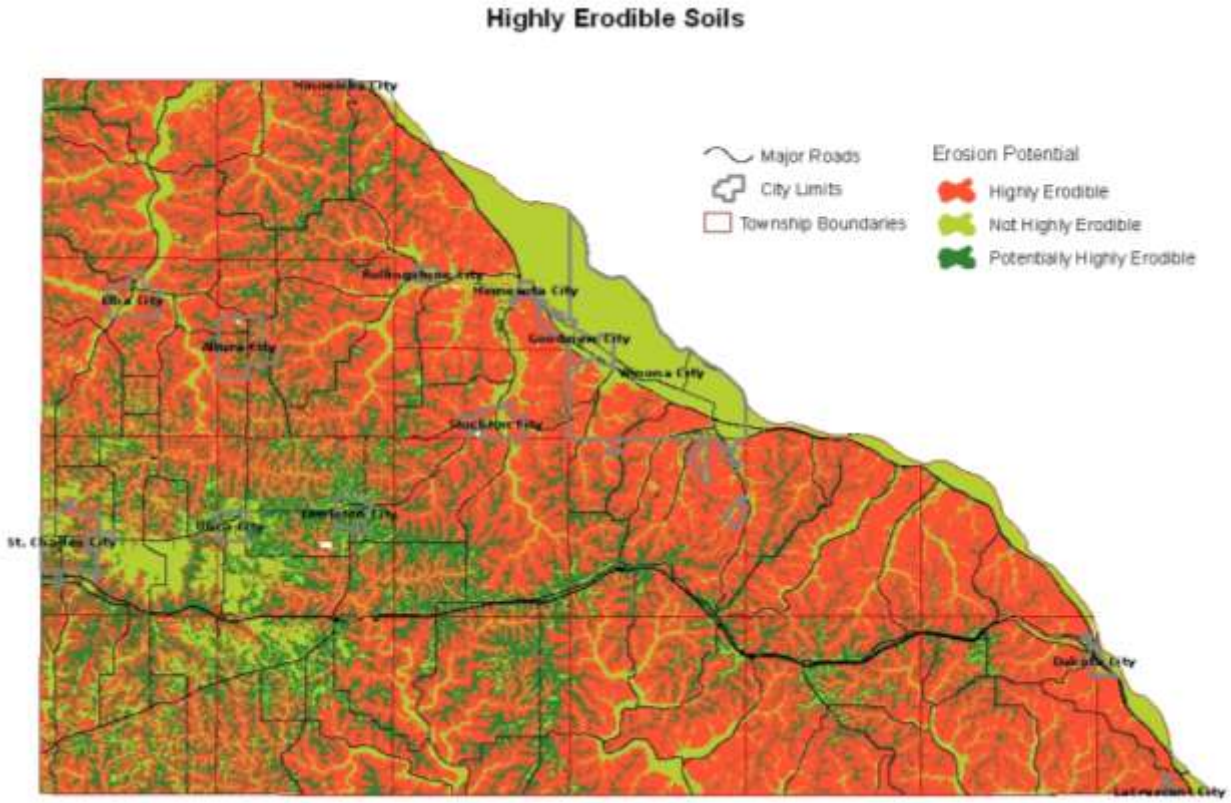


The surficial and bedrock geology of Winona County was described in the 1984 Winona County Geologic Atlas, and is represented in the map above.

3.2 Soils

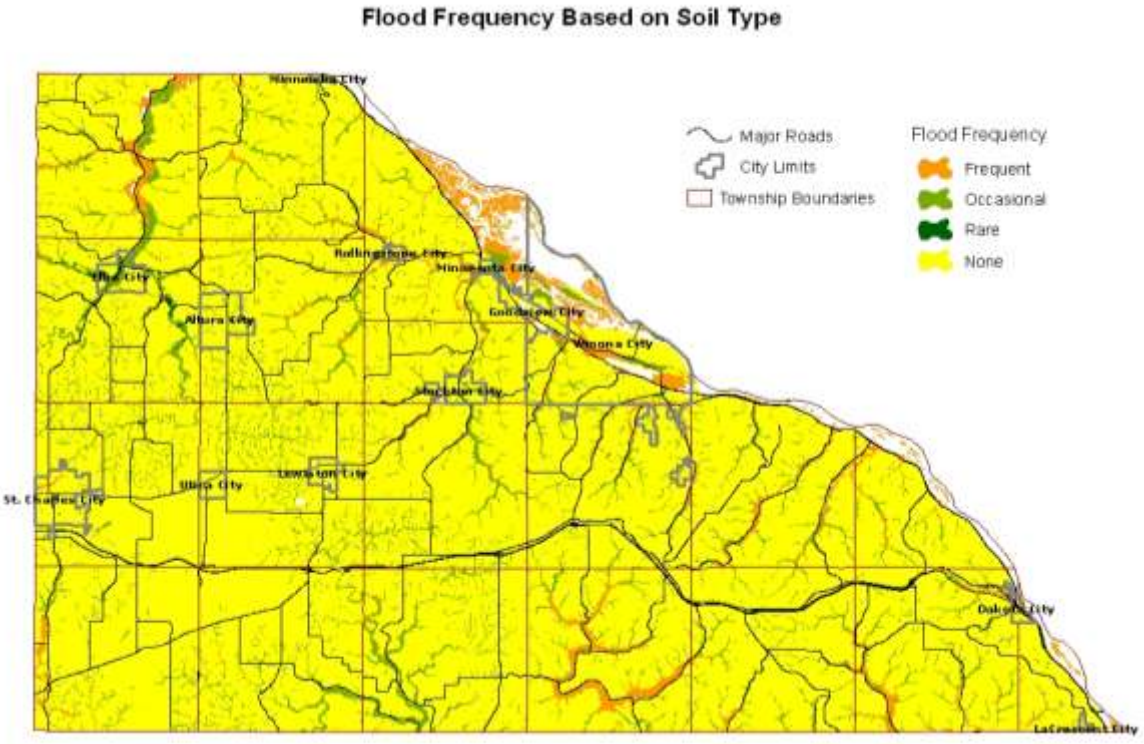
A significant portion of Winona County's soils are classified as "highly erodible" based on their tendencies to erode from wind or water movement. Extra care must be taken in these areas to ensure that proper planting and cover techniques are employed to protect the rich topsoil.

The potential for excessive soil erosion in the bluff areas and stream valley walls exists through much of the county, due to its areas of extremely steep topography. Careful land use planning and site preparation is required to avoid soil erosion and other hazards. It is essential that residential development, timber harvesting and agricultural production be carefully regulated in these areas.



The Soil Survey of Winona County was issued in 1994 by the US Department of Agriculture's Soil Conservation Service. The survey detailed soils data which predicts soil behavior based on characteristic, grade and condition of soils. There are 10 soil associations that have been identified. The majority of soil acreage in the county is well-drained or moderately well-drained. The exceptions are the poorly-drained floodplain soils of the backwaters of the Mississippi River north of Minnesota City, and the excessively drained soils in the City of Winona due to urban development. According to information compiled by University of Minnesota Department of Soil, Water, and Climate for southeast Minnesota, 95% of Winona County is well drained. Most of the soils in the county are considered to have the potential for significant erosion by water. The University of Minnesota Department of Soil, Water and Climate staff conducted a mapping exercise which determined that the county has the potential for extreme erosion by water. Wind erosion potential, on the other hand, is considered slight to high.

Many other areas are characterized by floodplain soils, along the perennial rivers and streams, and also along intermittent streams and in depressional areas. They may lead to hazardous and costly damages to adjacent structures and safety concerns for people, especially where flooding is relatively frequent.



3.3 Land Cover

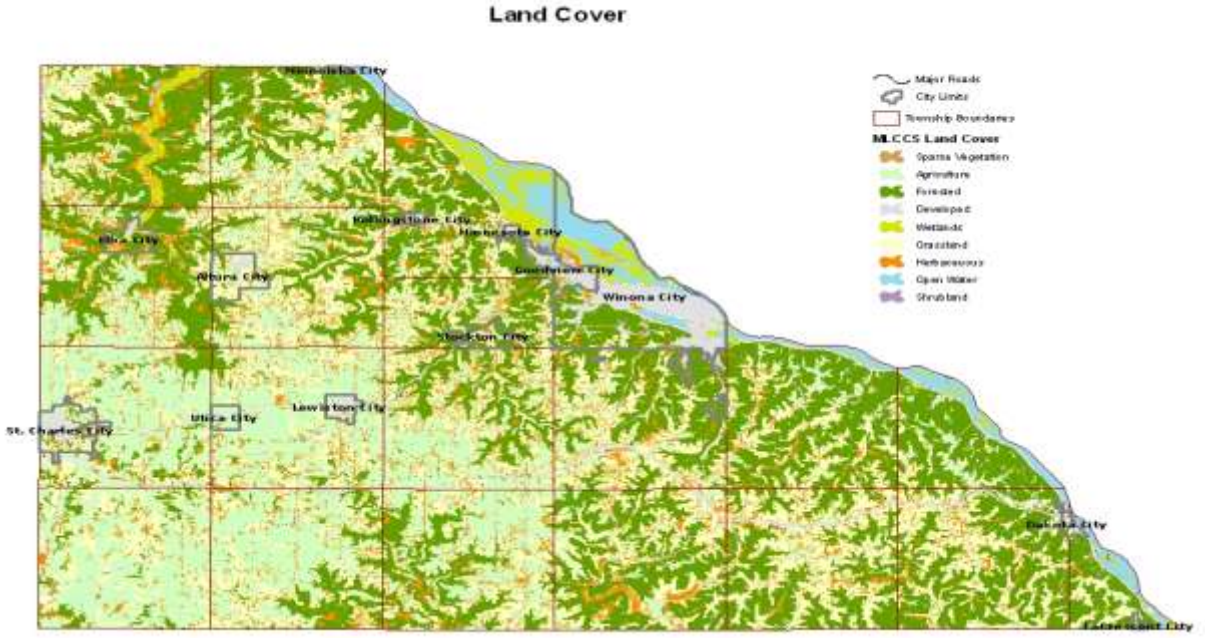
Winona County is unique in that its rural land does not consist exclusively of cultivated crops, but also includes a significant amount of woodlands, pasture and undeveloped steep slopes and bluffs.

The largest single category of land cover is that which is cultivated (44%), followed by forested land, which is 36% of the land cover. Grasslands follow at a distant third at 14%. All other types of land cover are negligible in comparison, as the chart below details.
The Winona County land cover data was derived from the National Land Cover Database 2001 land cover layer and was produced through a cooperative project by the Multi-Resolution

Table 3-1 Winona County Land Cover

Land Cover	Acres	Percent Coverage
Urban and Industrial	7,573.8	1.85
Farmsteads and Rural Residences	5,877.7	1.43
Rural Residential Development Complexes	562.0	0.14
Other Rural Developments	444.6	0.11
Cultivated Land	179,364.7	43.72
Transitional Agriculture Land	40.5	0.01
Grassland	55,710.7	13.58
Grassland-Shrub-tree Complex (Deciduous)	1,201.9	0.29
Deciduous Forest	147,592.0	35.98
Water	10,194.6	2.49
Wetlands	1,086.2	0.26
Gravel Pits and Open Mines	367.8	0.09
Bare Rock	3.4	0.00
Exposed Soil	185.7	0.05
Unlabeled/Unclassified	29.5	0.01
Total	**410,235.1**	**100%**

Characteristics (MRLC) Consortium. Changes to this data can be made as new information is made available.



3.4. Hydrology

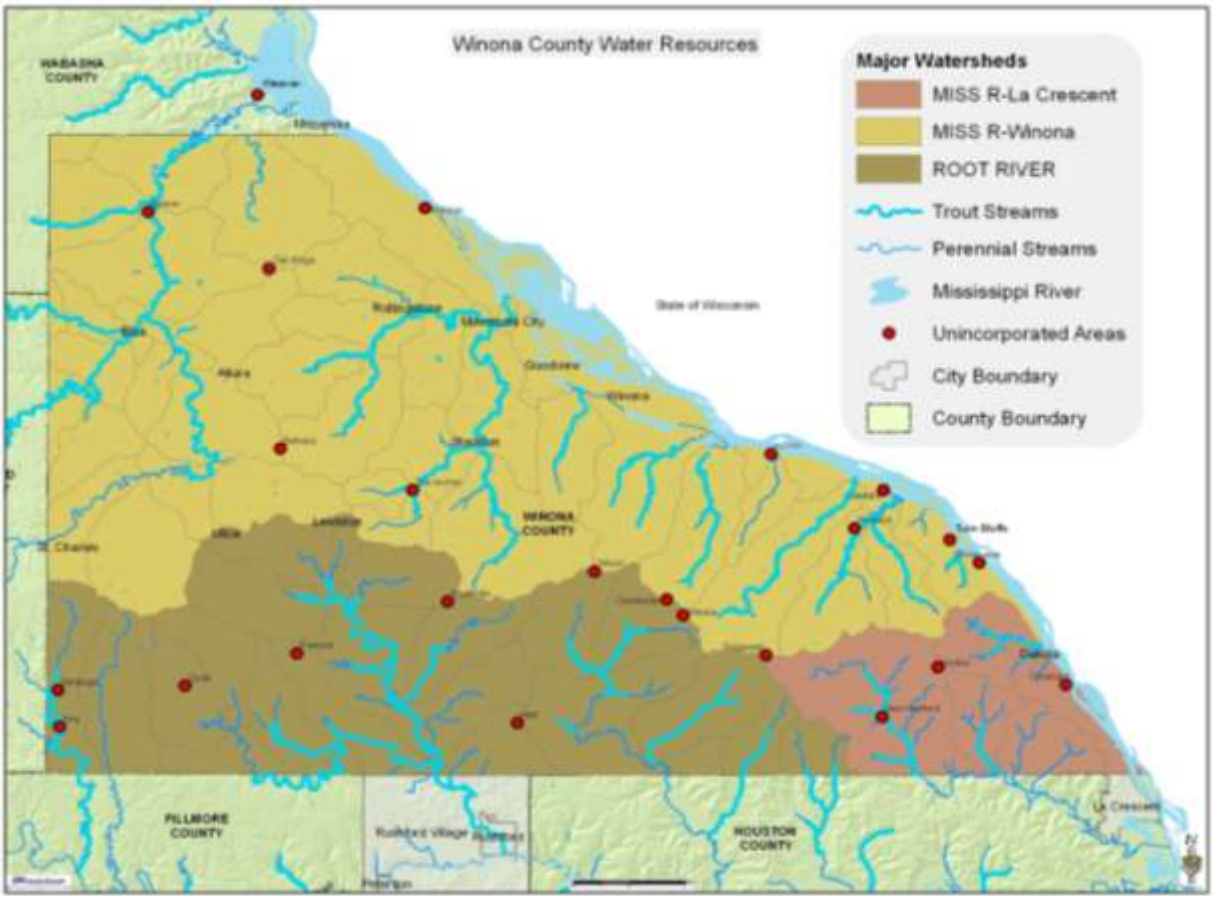
A number of factors contribute to the hydrology of southeast Minnesota and Winona County. Annual moisture, topography, relatively shallow soils over bedrock, relatively well drained soils, lack of lakes and wetlands, geology, stream channel characteristics, and land use and land cover all have an effect on the hydrology in the county in each of the watersheds.

The Winona County Soil Survey (1994) characterizes the county as a mature landscape, dissected by an intricate pattern of deep valleys and ridges as deep as 600 feet in some areas. In the northern and eastern parts of the county ridges are narrow with a dissected low lying plain.

3.4.1 Major Lakes, Rivers, and Watersheds

There are three major watersheds in Winona County, all of which drain to the Mississippi River: the Mississippi River - Winona, Mississippi River – La Crescent, and the Root. The maps below identify these three major watersheds, six minor watersheds and numerous subwatersheds. While there are no natural lakes in Winona County, there are a number of lakes from the backwaters created by the dams along the Mississippi River. In addition, there are a number of former and existing sand/gravel mining operations and city stormwater facilities that have created ponds or small lakes within floodplains or along drainage ways.

Streams throughout the county arise in large part from coldwater springs and seeps. Minnesota DNR has designated 44 stream reaches as trout streams. The largest river in Winona County is the Whitewater River. The only inland lakes in the county are found within Winona and Goodview and were originally backwater wetlands of the Mississippi River or quarries.



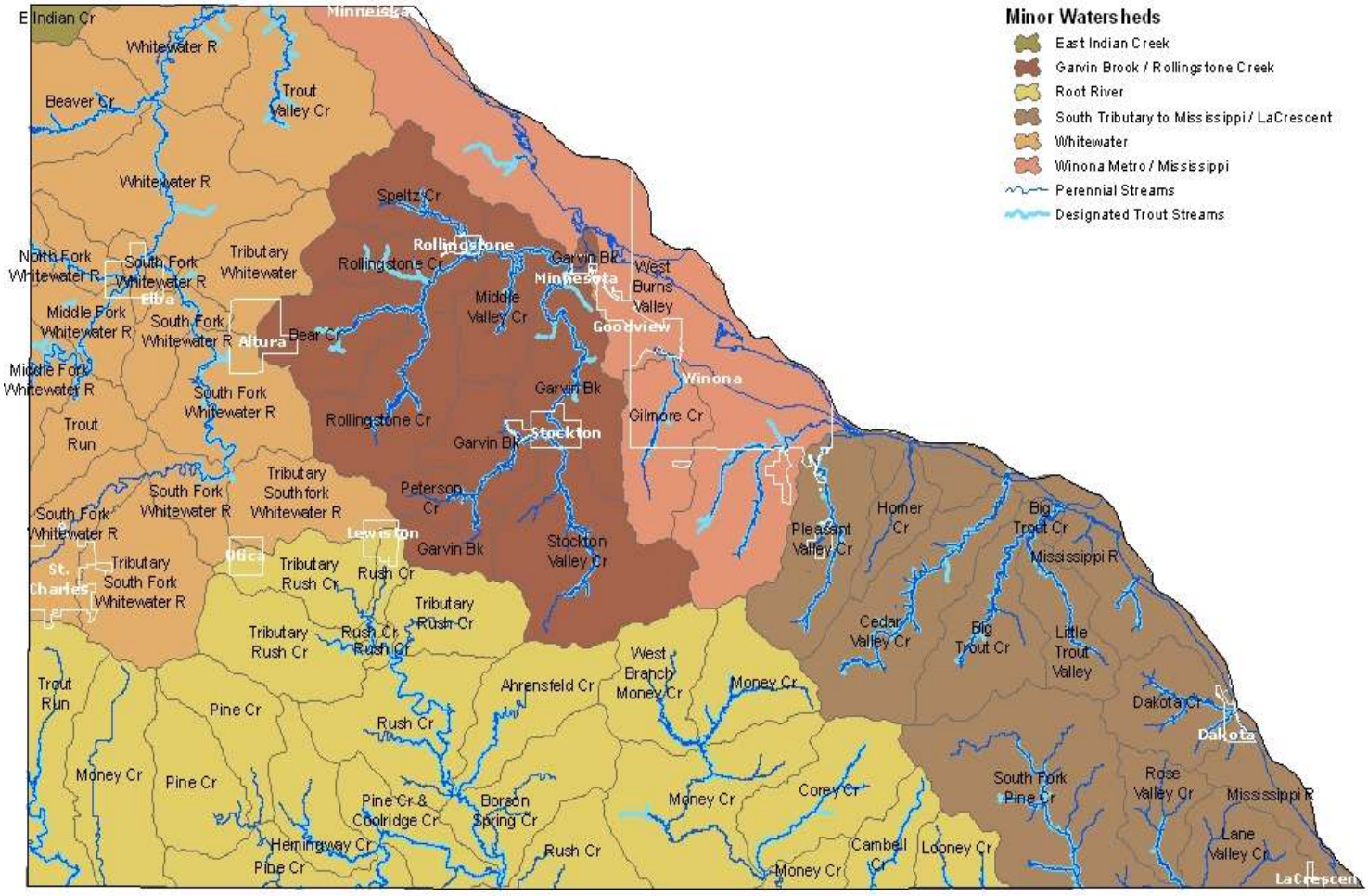


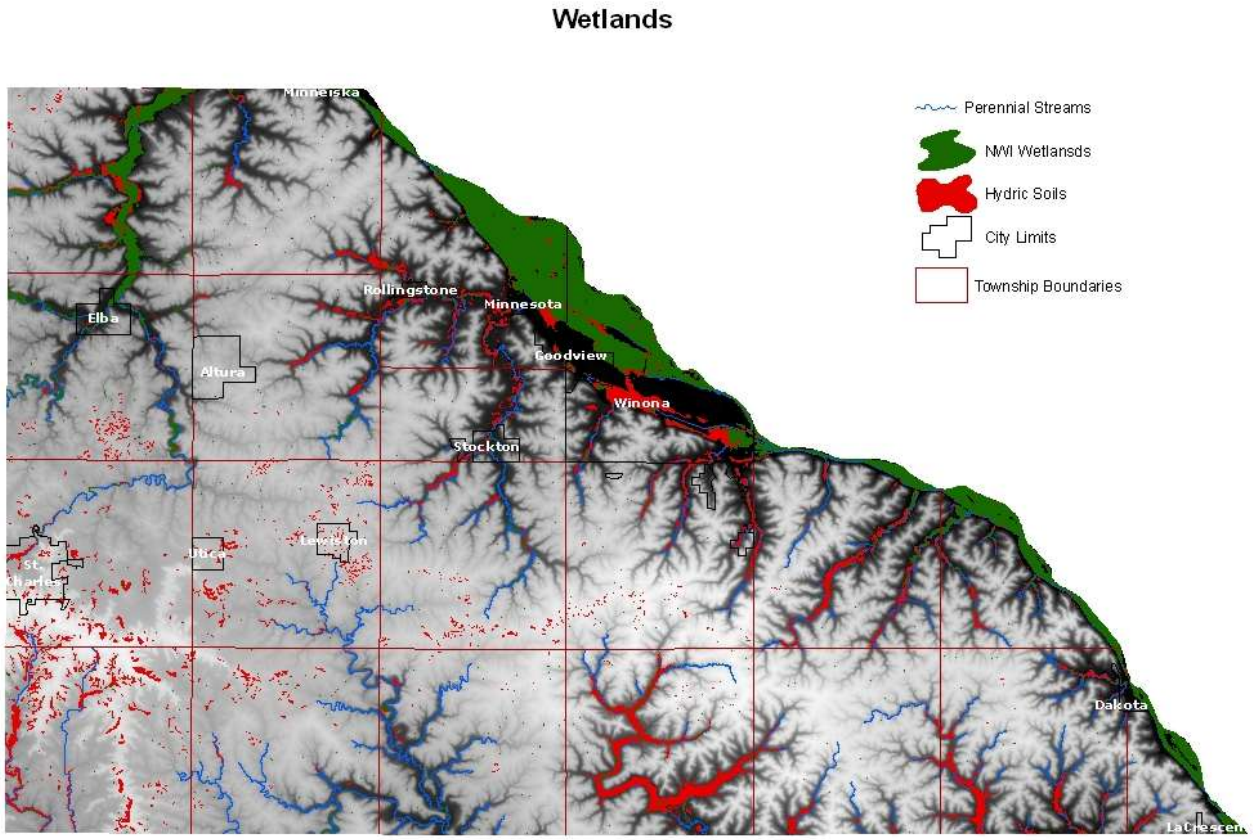
Table 3-2: Watersheds

Watershed Name	HUC Code
Buffalo-Whitewater Watershed	07040003
Whitewater River	070400030310
Garvin Brook	070400030502
Gilmore Creek	
Burns Valley Creek	
Pleasant Valley Creek	070400030607
Cedar Valley Creek	070400030608
Big Trout Creek	070400030609
Miller Valley Creek	
Dakota Creek	
Mississippi River-Winona Watershed	07040003

Gilmore Valley Creek	
Burns Valley Creek	
Root River Watershed	07040008
Trout Run Creek	070400030309
Rush Creek	070400080502
Pine Creek	070400060501
Upper Money Creek	070400080601
Lower Money Creek	070400080602

Mn Department of Natural Resources

3.4.2 Wetlands



northern portion of the county is drained by the Whitewater River that flows directly into the Mississippi River. The northeast and southeast portions of the county are drained by a series of small creeks that flow directly into the Mississippi River. The southern portion of the County drains into tributaries of the Root River, which then flows into the Mississippi River.

According to the Geologic Atlas, the Holocene, or recent epoch of geologic time, has seen a time of leaching, soil formation and slow rates of erosion. However, after European settlement and resulting farming practices, erosion and flooding (severity and frequency) increased dramatically.

Soil conservation practices have reduced the rate of erosion so the excess silty alluvium that has filled the floodplains is now being eroded to former levels. Numerous wetlands, both those identified on the National Wetlands Inventory and potential wetlands based on hydric soil types, are found across the County. Wetlands are associated with depressions in glacial till, floodplain corridors, and in some areas of the county along the hillsides where the Decorah shale outcropping is the first encountered bedrock.

3.5 Climate

This area of Minnesota is classified as warm-summer, temperate continental climate. Warm, humid summers and cold winters characterize this type of climate. Local variations are strongly influenced by topography and greatly affected by the Mississippi River.

Precipitation rates vary month to month with typical yearly rates ranging from twenty-five to thirty-five inches (25" to 35") per year. Typically, over seventy percent (70%) of moisture accumulation occurs between the months of April and September.

The average seasonal snowfall for Winona County is between forty to fifty inches (40" to 50"). Average daily temperature throughout the year varies in Winona County from thirteen to seventy-three degrees Fahrenheit (13° F to 73° F).

During the winter months, minimum temperatures average below ten degrees (10° F). The coldest day on record for Winona County occurred January 30, 1951 with a low of thirty-two degrees below zero (-32° F). In the summer, maximum daily temperatures average in the eighty degree range (80° F to 89° F). The hottest day on record occurred on June 20, 1953 with temperatures of one hundred three degrees (103° F).

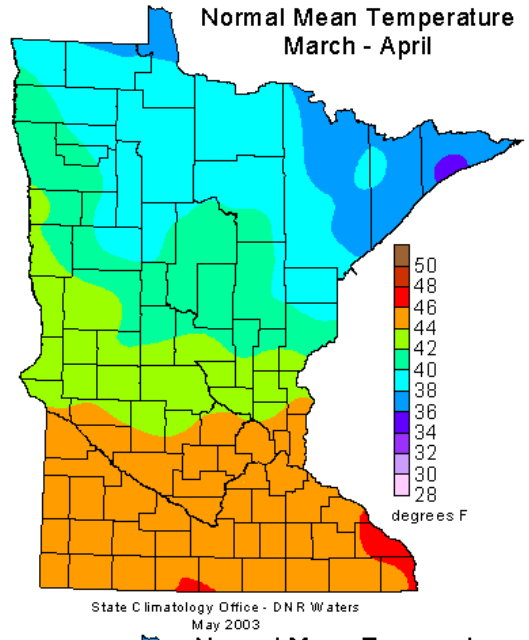
Table 3-3. Average County Precipitation/Snowfall

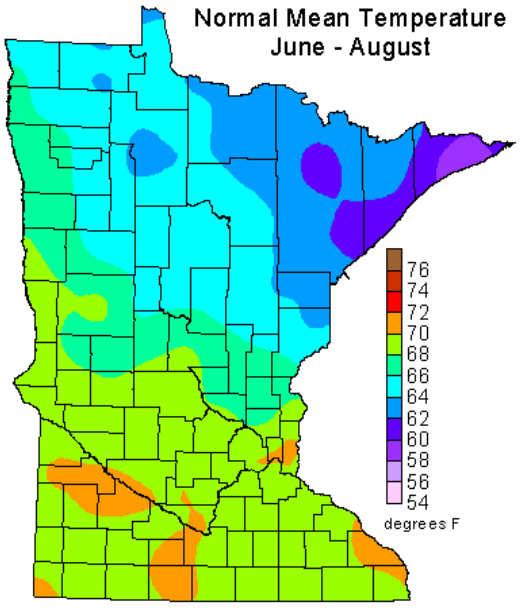
Month	Precipitation in inches	Snowfall in inches
January	1.01	11.4
February	0.86	9.2
March	1.93	11.5
April	3.24	2.7
May	3.92	-
June	4.59	-
July	4.70	-
August	4.70	-
September	3.75	-
October	2.34	0.1
November	2.14	4
December	1.29	8.8

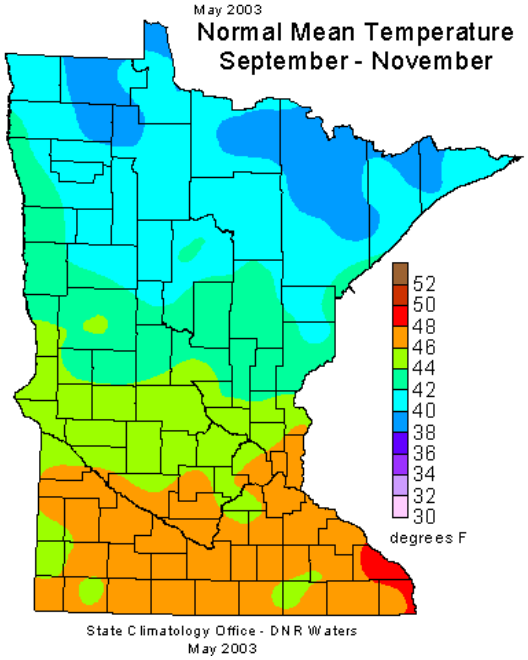
Table 3-4 Average Temperature

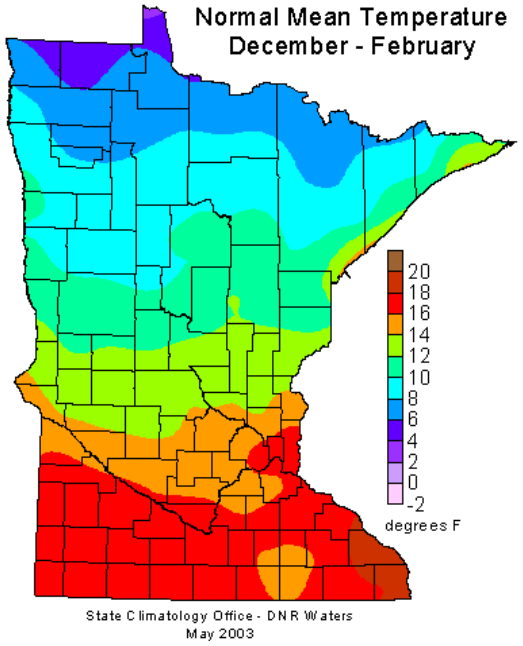
Month	Average Daily Temperatures
January	12.5° F
February	19.5° F
March	31.5° F
April	45.0° F
May	56.5° F
June	66.5° F
July	70.5° F
August	68.0° F
September	59.5° F
October	47.5° F
November	32.5° F
December	18.5° F

The Weather Channel 2010 Monthly Averages for Winona County





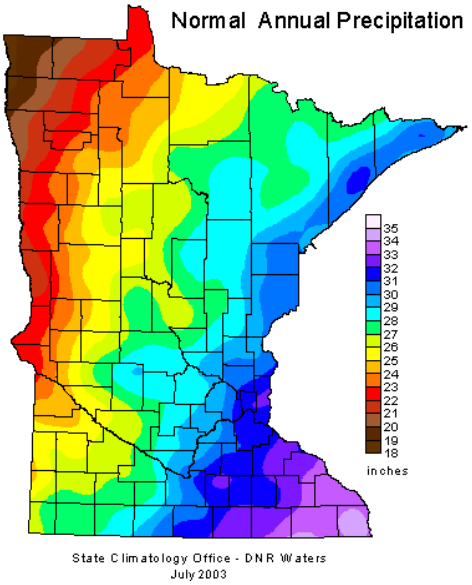




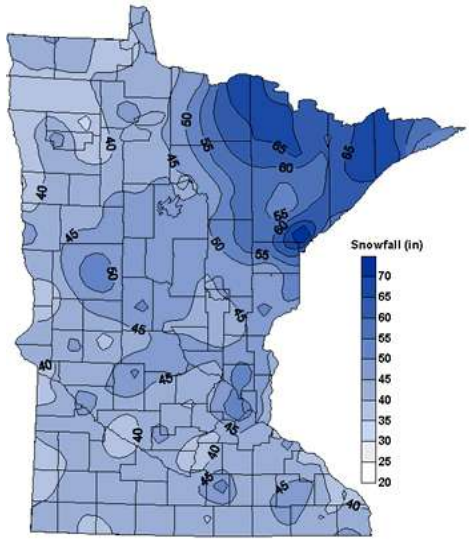
*Department of Natural Resources**

Normal Temperature Maps

A common misconception is that a climate "normal" describes the "typical" state of the atmosphere. "Normal" is simply a 30-year arithmetic mean, computed once per decade. The temperature normals data presented in the maps above summarize the observation Period 1971-2000. These values are benchmarks to be used throughout this decade as a measure of central tendency. Normals data can be useful in placing ongoing weather conditions in historical context. Additionally, normals data offer an excellent tool for describing climate variability across space.



Normal Annual Precipitation Map
A common misconception is that a climate "normal" describes the "typical" state of the atmosphere. "Normal" is simply a 30-year arithmetic mean, computed once per decade.
The precipitation normals data presented in the maps below summarize the observation period 1971-2000. These values are benchmarks to be used throughout this decade as a measure of central tendency. Normals data can be useful in placing ongoing weather conditions in historical context. Additionally, normals data offer an excellent tool for describing climate variability across space.



Department of Natural Resources

Mean Annual Snowfall Map
Mean snowfall for the July-June period based on monthly totals from 1971-72 to the 1999-2000 seasons. One gridded map was generated based on the individual station observations using a kriging technique. Means for a given period length were then computed based for each grid point value rather than a per-station basis.

3.6 Demographics

Winona County has a population of 51,461. According to the U.S. Census Bureau, from 2000-2010, Winona County experienced a population increase of 1.02%. The population is spread through twelve cities including Altura, Dakota, Elba, Goodview, Lewiston, Minneiska, Minnesota City, Rollingstone, St. Charles, Stockton, Utica and Winona The largest town in Winona County is Winona, which has a population of approximately 27,592. The breakdown of population by incorporated areas is in Table 3-5 below.

Winona County has seen significant demographic growth in some of its townships, in particular those closest to its population centers of Winona and St. Charles.

Some population growth in the county can be attributed to higher enrollments at Winona State University, Saint Mary's University of Minnesota, and Southeast Technical College. The expanding metropolitan areas of Rochester and La Crosse, in close proximity to Winona County's borders, are also a factor.

Table 3-5: Population by Community

Community	2010 Population	% of County
City of Altura	493	1.0%
City of Dakota	323	.6%
City of Elba	152	.3%
City of Goodview	4,036	7.8%
City of Lewiston	1,620	3.1%
City of Minneiska	50	.1%
City of Minnesota City	204	.4%
City of Rollingstone	664	1.3%
City of St. Charles	3,735	7.3%
City of Stockton	697	1.4%
City of Utica	291	.6%
City of Winona	27,592	53.6%

2010 United States Census, Winona County Data

Table 3-6: City Population

Geographic Area	Total Population 2010	Total Population 2000	Population Increase 2010	Population Decrease 2010	Percent Change %	Total Population Change
Winona County	51,461	49,985	1,476		3%	
Cities						
City of Altura	493	417	76		15%	
City of Dakota	323	329		-6	-2%	
City of Elba	152	214		-62	-29%	
City of Goodview	4,036	3,373	663		16%	
City of Lewiston	1,620	1,484	136		8%	
City of Minneiska	50	60		-10	-17%	
City of Minnesota City	204	235		-31	-13%	
City of Rollingstone	664	697		-35	-5%	
City of St. Charles	3,735	3,295	440		12%	
City of Stockton	697	682	15		2%	
City of Utica	291	230	61		21%	
City of Winona	27,592	27,069	523		2%	
Total			1,914	-142		1.772

2010 United States Census, Winona County Data

3.7 Economy

Nineteen (19) distinct townships make up the County. A diverse and vibrant economy exists throughout Winona County because of its strong agricultural base. The proximity to the Mississippi River, as well as the natural landscape and resources, has influenced Winona County's development and continuing popularity as a regional recreation and economic center.

Table 3-7: Industrial Employment by Sector

Industrial Sector	% of County Workforce
Natural Resource and Mining	1.7%
Construction	2.7%
Manufacturing	24.3%
Trade, Transportation and Utilities	17.9%
Financial Activities	2.9%
Professional and Business Services	8.3%
Education and Health Services	23.4%
Leisure and Hospitality	9.4%
Other Services (minus public administration)	2.6%
Public Administration	4.5%

** Port Authority of Winona**

3.8 Industry

The largest employers in Winona County are located within the City of Winona with the top five being: Benchmark Electronics, Fastenal, Winona State, Winona Health and Winona Area Public Schools. The majority of new commercial growth in the near future will take place in the City of Winona, with the remaining cities receiving smaller amounts of growth.

Table 3-8: Major Employers

Company Name	Location	Employees (number)	Type of Business
Benchmark Electronics	City of Winona	1133	Electronic Component Manufacturing
Fastenal Company	City of Winona	1129	Hardware and Supplies Merchandise
Winona State University	City of Winona	840	Colleges and Universities
Winona Health	City of Winona	814	General Medical and Surgical Hospitals
Winona Public Schools	City of Winona	464	Elementary & Secondary Schools
St. Mary's University of MN	City of Winona	393	Colleges and Universities
TRW Automotive Electronics	City of Winona	373	Industrial Machine Manufacturing (Transportation)
Wincraft	City of Winona	360	Apparel Accessories

** Port Authority of Winona**

3.9 Land Use and Development Trends

Population growth in Winona County has occurred within the cities over the last two decades, with the townships losing population over that time. The county population grew 6.5 percent from 1990 to 2000 and 3% from 2000 to 2010. Table 3.9 below shows the population growth from 1990 to 2010 split by City and Township.

Table 3-9: Urban/Rural Population Growth

	Population 1990	Population 2000	Population 2010
City Population	34,852	38,086	39,858
Township Population	11,931	11,900	11,628
Total Population	46,783	49,986	51,486

2010 United States Census, Winona County Data

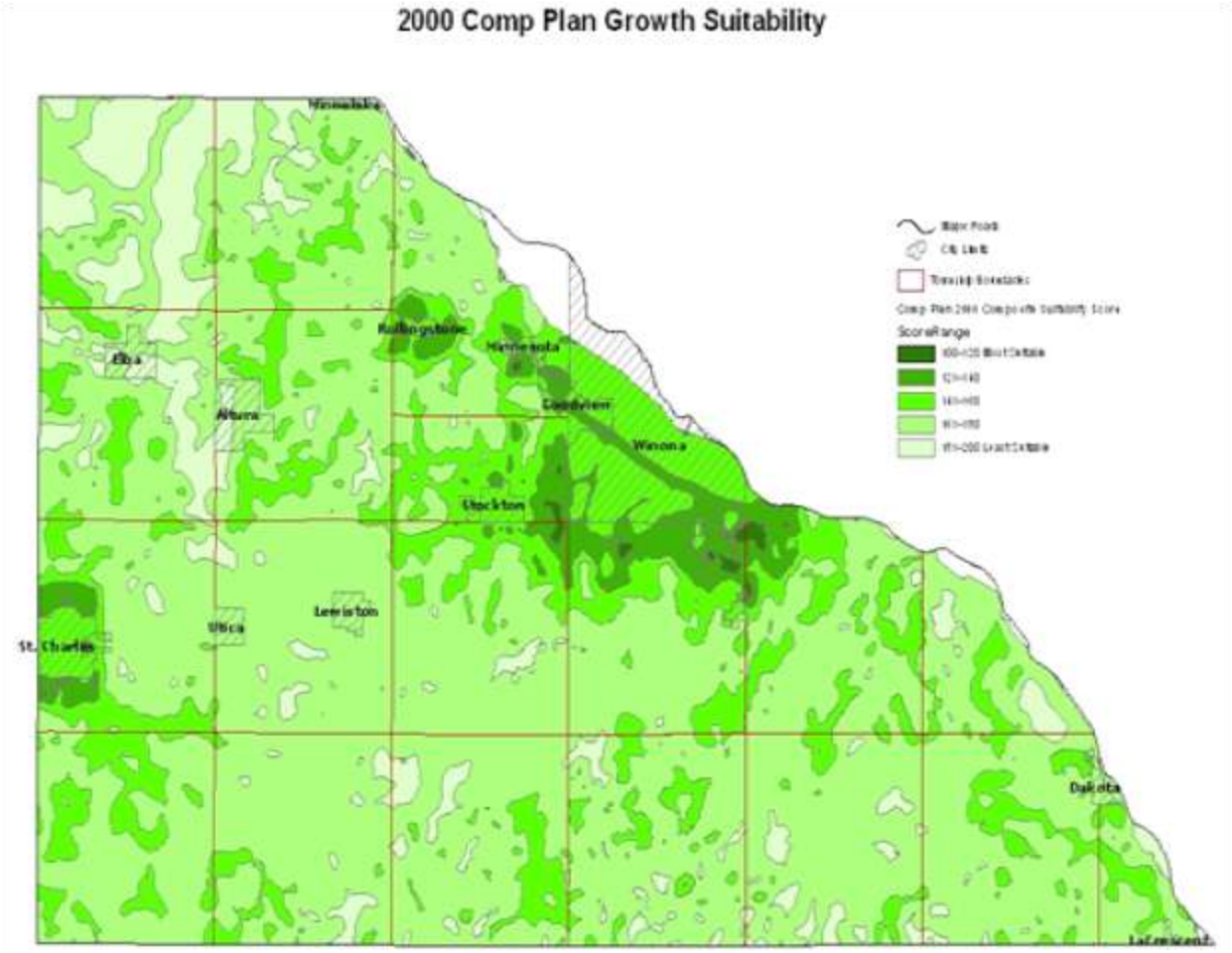
County Ordinances Governing Land Use

The Winona County Zoning Ordinance recognizes Winona County's 2000 Comprehensive Land Use Plan as the policy to regulate land use and development in accordance with the policies and purpose herein set forth. Having completed an update of its Zoning Ordinance in 2010, Winona County is now beginning an update of its Comprehensive Land Use Plan.

Comprehensive Land Use Plan

The current Winona County Comprehensive Plan, adopted in 2000, used GIS to identify areas most suitable for urban expansion by delineating land to meet the County's goals to create an orderly pattern of development near cities. The rating for the delineation was completed by evaluating the future land needs of each municipality, current transportation infrastructure, and identifying known hazards that should discourage development such as floodplains, wetlands, steep slopes, and sinkholes. The composite score was thus derived from an analysis of resource protection, development limitations and service potential.

The final composite of this analysis identified urban expansion areas into two phases, phase I includes 4,207 acres and phase II includes 7,411 acres, with the intent for these phases to accommodate growth until 2020. Below is a map of the composite score that indicates areas most suitable for future development. The final categories correspond to lands best suited for future development, with lower values resulting in better suitability. Areas located in a close proximity to cities and near current services scored higher than other areas.



2010 Winona County Zoning Ordinance

The recently updated County Zoning Ordinance represents a shift in philosophy regarding where development should take place within the county. New standards were established and the conditional use process will be used to steer development away from prime agricultural land and to open more marginal lands, such as wood remnants and abandoned pastures.

The new feature of the 2010 Zoning Ordinance is the creation of Natural Features Overlay Districts, the intent of which is to conserve sensitive and unique environmental areas. The focus of these Overlay Districts includes critical geological and environmental attributes found throughout the county, including shore lands, floodplains, wetlands, steep slopes, blufflands, and karst features.

The goal of the Overlay District is to protect the public from injury and property damage due to flooding, erosion and other natural hazards that may be intensified by developing environmentally sensitive lands. An additional goal of the overlay district is to protecting natural resources for their public benefits. These resources include surface and groundwater, riparian buffer areas and ground water recharge areas.

Another key feature of the county's new Zoning Ordinance is its establishment of performance standards for development within steep slopes and bluffs. Any structures or driveways that occur on

slopes greater than 12% must now submit a site plan created by a licensed engineer, geologist or qualified individual with experience in building, earth work and soil erosion control, which is deemed acceptable to both the Winona County's Planning Department and the Soil and Water Conservation District.

Another feature of our new ordinance is a 100' setback for dwellings, structures and septics from any karst features.

These changes to the county's Zoning Ordinance were a result of much thoughtful and protracted discussion and debate. Together with the changes we will result from the forthcoming update of our comprehensive land use plan, Winona County is working proactively to mitigate risks from natural hazards.

Section 4 - Risk Assessment

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, disruption to local and regional economies, and the expenditure of public and private funds for recovery. Sound mitigation must be based on sound risk assessment. A risk assessment involves quantifying the potential loss resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people. This assessment identifies the characteristics and potential consequences of a disaster, how much of the community could be affected by a disaster, and the impact on community assets. A risk assessment consists of three components—hazard identification, vulnerability analysis, and risk analysis.

The following hazard categories are covered by this plan update: tornados, floods, landslides, drought, earthquakes, thunderstorms, winter storms, hazardous materials storage & transport, fire (structural & wildfire), sinkholes and land subsidence and human-caused hazards. There have been no deletions of hazards identified in the 2005 plan and 2008 amendments, and all were referenced in the earlier plan or amendment.

Hazards not covered in this update include coastal erosion, extreme heat, and dam failure due to their extreme infrequency of occurrence. Nuclear accidents are not incorporated, as Winona County is outside the exclusion zone of the nearest nuclear plant, and infectious disease hazards are addressed within the public health community.

Winona County Natural Hazards Overview

Winona County is in the Upper Mississippi River Valley of the Midwest with terrain ranging from relatively flat farm land in the western half of the county to very steep bluffs and valleys in the eastern half. It is bordered by the Mississippi River to the east.

The area experiences a temperate climate with both warm and cold season extremes.

Winter months can bring occasional heavy snows, intermittent freezing precipitation or ice, and prolonged periods of cloudiness. While true blizzards are rare, winter storms impact the area on average about 3 to 4 times per season. Occasional arctic outbreaks bring extreme cold and dangerous wind chills.

Temperatures between river valleys and surrounding ridges can vary greatly. Typically high temperatures on ridges are 3 to 5F colder than valleys. This can lead to slightly more average snowfall on ridge tops and occasionally a difference in winter precipitation types from ridge to valley.

Thunderstorms occur on average 30 to 50 times a year, mainly in the spring and summer months. The strongest storms can produce associated severe weather like tornadoes, large hail, or damaging wind. Both river flooding and flash flooding can occur, along with urban-related flood problems. The terrain can lead to mud slides and generally increases the flash flood threat. Heat and high humidity is occasionally observed in June, July, or August.

The autumn season usually has the quietest weather. Valley fog is most common in the late summer

and early fall months. On calm nights, colder air settles into valleys leading to colder low temperatures compared to ridge top locations. High wind events can also occur occasionally, usually in the spring or fall.

The variability in weather can be seen in the following graphic, created by a private company (weatherpages.com) that rated each city on variations in temperature, precipitation, and other factors. La Crosse, WI ranked 27th highest and Rochester, MN ranked 3rd highest in variability out of 277 cities.

4.1 Hazard Identification/Profile

4.1.1 Existing Plans

To facilitate the planning process, pre-existing plans were used for this hazard analysis section. These existing plans included the Winona County All Hazard Mitigation Plan (2005) and the Winona County All Hazard Mitigation Plan Amendment (2008).

4.1.2 Major Hazard Summary

Natural and Technological hazards profiled by this plan are listed in Table 4-1.

Table 4-1: Natural and Technological Hazards Profiled

Hazard
Tornadoes
Floods
Landslides
Drought
Earthquakes
Severe Thunderstorms
Winter Storms
Hazardous Material(s) Storage and Transport
Fire (Structural and Wildfire)
Sinkholes and Subsidence
Human-caused Hazard

4.1.3 Hazard Ranking Methodology

The Probability Rating (Low, Medium, High) of each hazard based on the number of events that have occurred in the county within the past 50 years.

- Low = 0-5 events
- Medium = 6-15 events
- High = 16+ events

The Impact Rating (Minimal, Moderate, Significant) was based on the following guidelines

• Minimal =	Few injuries Critical facilities shut down for 24 hours Less than 15% of property damaged
• Moderate =	Multiple injuries Critical facilities shut down for 1-2 weeks At least 30% of property damaged
• Significant =	Multiple deaths Critical facilities shut down for more than one month More than 50% of property damaged

The Hazard Risk (low, elevated, severe) was determined by multiplying probability and impact. It is important to consider both probability and impact when determining risk. For example, if an asteroid were to collide with Earth, the impact would be extreme; but the probability of an asteroid strike (has not happened in billions of years) is so negligibly small that the overall risk is extremely low. There has never been a situation in human history in which a person was killed by a meteor. In contrast, other potentially damaging events like thunderstorms and floods are relatively less severe, but have occurred regularly in many places.

Each hazard addressed within the plan will use sliding scales to represent the probability, impact, and overall risk ratings. The scales will be depicted as follows:

Low	Elevated	Severe

Hazard risk levels are arrived at by considering both the probability of a hazard and it's overall impact overall risk can be either low, elevated or severe. The calculation used is as follows:

Probability (x) Impact (=) Overall Risk

The table below summarizes the hazard risk associated with the nine hazard categories reviewed in the planning process, for each community. More detail of the risk calculation for each community can be found in Appendix A: Community Profiles.

4.1.4 County Hazard Rankings

Table 4-3: Community Hazard Risk Ranking

Hazard Risk Cities	Tornadoes	Floods	Landslides	Drought	Thunder storms	Winter Storms	Hazardous Material(s) Storage and Transport	Fire (Structural and Wildfire)	Sinkholes (Subsidence) "karst"
Altura	Low	Low	Low	Low	Low	Elevated	Low	Low	Severe
Dakota	Low	Elevated	Elevated	Low	Low	Low	Elevated	Low	low
Elba	Low	Severe	Elevated	Low	Low	Low	Low	Low	Low
Goodview	Low	Elevated	Low	Low	Low	Low	Low	Low	Low
Lewiston	Low	Low	Low	Low	Low	Elevated	Low	Low	Severe
Minnieska	Low	Elevated	Elevated	Low	Low	Elevated	Low	Low	Low
Minnesota City	Low	Elevated	Elevated	Low	Low	Low	Low	Low	Low
Rollingstone	Low	Low	Low	Low	Low	Low	Low	Low	Low
St. Charles	Low	Elevated	Low	Low	Low	Elevated	Low	Low	Severe
Stockton	Low	Severe	Elevated	Low	Low	Low	Low	Low	Low
Utica	Low	Low	Low	Low	Low	Elevated	Low	Low	Severe
Winona	Low	Elevated	Elevated	Low	Low	Low	Elevated	Elevated	Low
All County	Low	Elevated	Elevated	Low	Low	Elevated	Elevated	Low	Elevated

4.1.5 GIS and Hazus-MH

A third step in assessment is risk analysis, which quantifies the risk to the population, infrastructure, and economy of the community. Hazards are best quantified using GIS analyses and Hazus-MH. This process reflects a level two approach to analyzing hazards as defined for Hazus-MH. The approach includes substitution of selected default data with local data, thereby improving the accuracy of the model predictions.

Hazus-MH generates a combination of site-specific and aggregated loss estimates depending upon the analysis options that are selected and the input that is provided by the user. Aggregate inventory loss estimates, which include building stock analysis, are based upon the assumption that building stock is evenly distributed across census blocks/tracts. Therefore, it is possible that overestimates of damage will occur in some areas while underestimates will occur in other areas. With this in mind,

total losses tend to be more reliable over larger geographic areas than for individual census blocks/tracts. Hazus-MH is not intended to be a substitute for detailed engineering studies. Rather, it is intended to serve as a planning aid for communities interested in assessing their risk to flood-, earthquake-, and hurricane-related hazards.

Site-specific analysis is based upon loss estimations for individual structures. For flooding, analysis of site-specific structures takes into account the depth of water in relation to the structure. Hazus-MH also takes into account the actual dollar exposure to the structure for the costs of building reconstruction, content, and inventory. However, damages are based upon the assumption that each structure will fall into a structural class, and structures in each class will respond in a similar fashion to a specific depth of flooding or ground shaking. Site-specific analysis is also based upon a point location rather than a polygon, therefore the model does not account for the percentage of a building that is inundated. These assumptions suggest that the loss estimates for site-specific structures as well as for aggregate structural losses need to be viewed as approximations of losses that are subject to considerable variability rather than as exact engineering estimates of losses to individual structures.

The county was not able to utilize GIS and Hazus-MH to complete essential facilities loss analyses in this update due to the incompatibility of our GIS software with the Hazus-MH software. The exception to this is the flood risk analysis included in Section 4.4.2 of the plan, which was produced for us as part of the 2007 flood disaster response. We hope to be able to resolve this challenge in the near future, so that future plans and updates can incorporate a level two analysis.

4.2 Vulnerability Assessment

4.2.1 Asset Inventory

4.2.1.1 Essential Facilities List

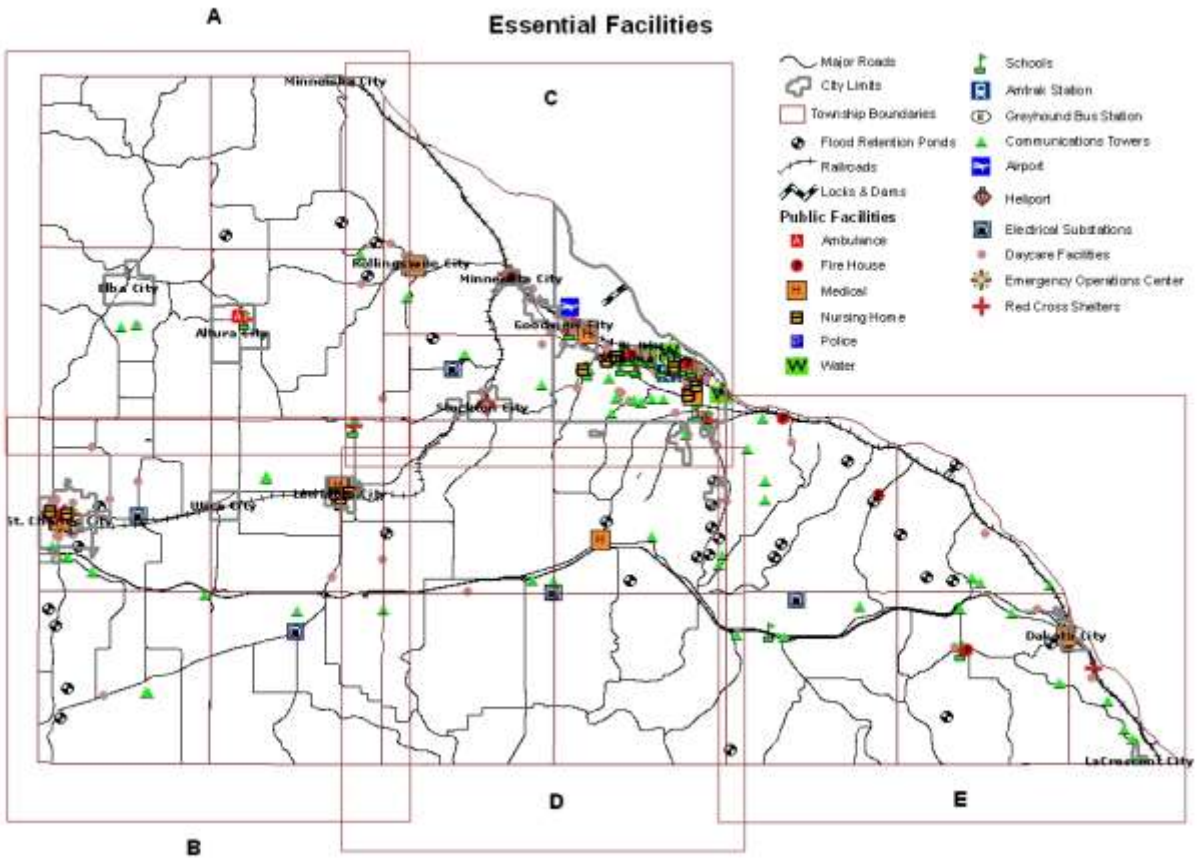
Table 4-4 identifies the essential facilities within the county, exposure for which is determined from County Assessor records. Names, locations and maps of essential facilities are listed in Appendix C.

Table 4-4: Essential Facilities List

Facility	Number of Facilities
Care Facilities	15
Emergency Operations Centers	1
Fire Stations	11
Police Stations	5
Schools	34

** Winona County 2010 Vulnerability Report**

Below is a map of location of these essential facilities within the county. More detailed maps, corresponding to subsets A – E of this map, are provided in Appendix C of this plan update.



4.2.1.2 Facility Replacement Costs

Facility replacement costs and total building exposure are identified in Table 4-5. Data on replacement costs have been updated by local data from the County Assessor.

Table 4-5: Building Exposure

General Occupancy	Facility Replacement Costs
Agricultural	$264,991,900
Commercial	$235,149,400
Education	$367,093,100
Government	$45,661,400
Industrial	$85,234.200
Religious/Non-Profit	$89,220,400
Residential	$752,646,900
Total	$2,848,997,300

** Winona County Assessor's Office**

4.3 Future Development

As the county's population continues to grow, the residential and urban areas will extend further into the county, placing more pressure on existing transportation and utility infrastructure while increasing the rate of farmland conversion; Winona County will address specific mitigation strategies in Section 5 to alleviate such concerns.

Because Winona County is vulnerable to a variety of natural and technological threats, the county government—in partnership with state government—must make a commitment to prepare for the management of these types of events. Winona County is committed to ensuring that county elected and appointed officials become informed leaders regarding community hazards so that they are better prepared to set and direct policies for emergency management and county response.

Restructuring internal to the county has recently brought emergency management personnel and use planning staff together, jointly creating a new Planning and Environmental Services Department. We believe this change will better facilitate communication among staff to allow for improved strategic development and integration of actions to advance mitigation efforts.

When Winona County updates its Comprehensive Land Use Plan in 2013, it will be guided by its recently updated Zoning Ordinance. The current, 2000 Comprehensive Land Use Plan, and in particular Sections 3.9 and 5.1.2 of the Comprehensive Plan will guide development until the update process is complete. In this update process, the risk assessment data developed from this Hazard Mitigation Plan Update will be incorporated into the Comprehensive Plan.

4.4 Hazard Profiles

4.4.1 Tornado Hazard

Hazard Definition for Tornado Hazard

Tornadoes pose a great risk to the state of Minnesota and its citizens. Tornadoes can occur at any time during the day or night. They can also happen during any month of the year. The unpredictability of tornadoes makes them one of Winona's most dangerous hazards. Their extreme winds are violently destructive when they touch down in the region's developed and populated areas. Current estimates place the maximum velocity at about 300 miles per hour, but higher and lower values can occur. A wind velocity of 200 miles per hour will result in a wind pressure of 102.4 pounds per square foot of surface area—a load that exceeds the tolerance limits of most buildings. Considering these factors, it is easy to understand why tornadoes can be so devastating for the communities they hit.

Tornadoes are defined as violently-rotating columns of air extending from thunderstorms to the ground. Funnel clouds are rotating columns of air not in contact with the ground; however, the

violently-rotating column of air can reach the ground very quickly and become a tornado. If the funnel cloud picks up and blows debris, it has reached the ground and is a tornado.
Tornadoes are classified according to the Enhanced Fujita tornado intensity scale. The tornado scale ranges from low intensity F0 with effective wind speeds of 40 to 70 miles per hour to F5 tornadoes with effective wind speeds of over 260 miles per hour. The Fujita intensity scale is included in Table 4-6.

Table 4-6: Enhanced Fujita Intensity scale

Enhanced Fujita Rating	Estimated Wind Speed (3 second gust)
0 *Gale*	65-85 mph
1 *Weak*	86-110 mph
2 *Strong*	111-135 mph
3 *Severe*	136-165 mph
4 *Devastating*	166-200 mph
5 *Incredible*	Over 200 mph

National Oceanic and Atmospheric Association

Previous Occurrences for Tornado Hazard

Even though Minnesota averages about 24 tornadoes per year, Winona County has only had 13 tornadoes since 1950, averaging about one tornado every 4-5 years.

Most tornadoes are short-lived and small. May and June are the peak months and most occur between 3 and 9 p.m., but they can occur nearly any time of year and at all times of the day.

All recorded tornadoes in Winona County since 1850 are identified in Table 4-7.

Table 4-7: Winona County Tornadoes since 1850

Location	Date	Other Counties Impacted	Winona County Injuries	Winona County Deaths	EF Scale/ Intensity
Lewiston	July 8, 1999	None	2	0	F2
Utica	June 5, 1997	None	0	0	F0
Altura	July 27, 1993	None	0	0	F0
Rollingstone	July 11, 1987	None	0	0	F0
Lewiston	July 10, 1984	None	0	0	F0
Nodine	May 17, 1982	Buffalo, Olmsted,			F2

		Wabasha	0	0	
St. Charles	May 17, 1983	Buffalo	0	0	F2
Lewiston	June 5, 1980	None	0	0	F2
Uncertain	June 20, 1968	No data	0	0	F0
Uncertain	June 15, 1967	No data	?	?	F1
Dakota	May 5, 1965	Houston, LaCrosse	0	0	F3
Fremont	May 5, 1965	None	0	0	F2
St. Charles	May 10, 1953	Olmsted	5	0	F4
Utica	July 27, 1935	Fillmore, Olmsted	8	0	F2
	August 8, 1905	Fillmore			F2
St. Charles	October 3, 1903	Buffalo, Olmsted Trempealeau	30	7	F4
Lewiston	June 17, 1899	Buffalo	0	0	F3
Homer	Sept/ 21, 1894	Trempealeau	3	0	F2
St. Charles & Lewiston	August 21, 1883	None	19	1	F3

Natural Hazard Assessment, Winona County MN

Table 4-8: Winona County Watch and Warnings (2000 – 2009)

Tornado Watches		**Tornado Warnings**	
Year		**Year**	
2009	4	**2009**	1
2008	9	**2008**	1
2007	4	**2007**	0
2006	5	**2006**	0
2005	10	**2005**	0
2004	8	**2004**	0
2003	2	**2003**	0
2002	4	**2002**	0
2001	6	**2001**	1
2000	5	**2000**	0

Natural Hazard Assessment, Winona County MN

Strongest tornadoes: (1850-2008)

- Oct. 3, 1903 (F4) – 30 injured, 7 dead
- May 10, 1953 (F4) – 5 injured. 0 dead
- Aug.21, 1883 (F3) – 19 injured, 1dead
- May 5, 1965 (F3) – - 0 dead, 0 injured
- June 17, 1899 (F3) – 0 dead, 0 injured

Winona County Tornado Facts:

- No F5 or EF5* tornadoes
- Two F4 and three F3 tornadoes
- 8 deaths and 67 injuries since 1850
- Tornadoes have occurred May – Oct.
- Most have occurred in May, June, and July (5)

No tornados have been reported in Winona County between **01/01/2005 – 01/31/2011**

Geographic Location for Tornado Hazard

The entire county is at risk for occurrence of tornadoes. They can occur at any location within the county. As Table 4-7 makes clear, however, St. Charles and Lewiston are at greatest risk for tornados, both in terms of frequency and intensity. Indeed, the county's only F4 tornados have affected St. Charles, and the only F3 tornados have impacted Lewiston and St. Charles.

One of the largest tornadoes to hit Winona County struck in October 1903 devastating St.Charles, MN. Seven people were killed and 30 injured as 50 homes and businesses were damaged or destroyed by the F4. More recently, a tornado passed through Lewiston, MN damaging homes, buildings, and cars along Main Street before moving east of town. Two people were injured by the F2 tornado. The terrain in the county may limit some tornadoes from forming but brief touchdowns and tracks are still possible even through bluffs and valleys.

Risk Identification for Tornado Hazard

Based on historical information, the probability of a tornado is low. Tornadoes with varying magnitudes are expected to occur. The planning team determined that the potential impact of a tornado is moderate; therefore, the overall risk of a tornado hazard for Winona County is low.

Vulnerability Analysis for Tornado Hazard

Tornadoes can occur within any area in the county; therefore, the entire county population and all buildings are vulnerable to tornadoes. To accommodate this risk, this plan will consider all buildings located within the county as vulnerable.

Essential Facilities

All essential facilities are vulnerable to tornadoes. An essential facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts will vary based on the magnitude of the tornado but can include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, and loss of facility functionality (e.g. a damaged police station will no longer be able to serve the community). Table 4-4 lists the types and numbers of all of the essential facilities in the area. Maps identifying essential facilities are located in Appendix C.

Building Inventory

The building exposure in terms of numbers and value for the entire county is listed in Table 4-5. All buildings within the county are potentially at risk, and can expect impacts similar to those discussed for essential facilities. These impacts include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, and loss of building function (e.g. damaged home will no longer be habitable causing residents to seek shelter).

Infrastructure

During a tornado the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a tornado. The impacts to these items include broken, failed, or impassable roadways, broken or failed utility lines (e.g. loss of power or gas to community), and railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

Table 4-9: Tornado Path Widths and Damage Curves

Fujita Scale	Path Width (feet)	Maximum Expected Damage
5	2,400	100%
4	1,800	100%
3	1,200	80%
2	600	50%
1	300	10%
0	150	0%

National Oceanic and Atmospheric Association

Vulnerability to Future Assets/Infrastructure for Tornado Hazard

The entire population and buildings have been identified as at risk because tornadoes can occur anywhere within the state of Minnesota, at any time of the day, and during any month of the year. Furthermore, any future development in terms of new construction within the county will be at risk. The building exposure for Winona County is included in Table 4-5.

All critical facilities in the county and communities within the county should be considered at risk for planning purposes.

Analysis of Community Development Trends

Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures need to be built with more sturdy construction, and those structures already in place need to be hardened to lessen the potential impacts of severe weather. Community warning sirens to provide warnings of approaching storms are also vital to preventing the loss of property and ensuring the safety of Winona County residents.

4.4.2 Flood Hazard

Hazard Definition for Flood Hazard

In accordance with the FEMA definition, a flood is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from an overflow of inland or tidal waters; unusual and rapid accumulation or run of surface waters

from any source; Mudflow; or collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

Upstream floods, also called flash floods, occur in the upper parts of drainage basins and are generally characterized by periods of intense rainfall over a short duration. These floods arise with very little warning and often result in locally intense damage, and sometimes loss of life, due to the high energy of the flowing water. Flood waters can snap trees, topple buildings, and easily move large boulders or other structures. Six inches of rushing water can upend a person; another 18 inches might carry off a car. Generally, upstream floods cause damage over relatively localized areas, but they can be quite severe in the local areas in which they occur. Urban flooding is a type of upstream flood. Urban flooding involves the overflow of storm drain systems and can be the result of inadequate drainage combined with heavy rainfall or rapid snowmelt. Upstream or flash floods can occur at anytime of the year in Minnesota, but they are most common in the spring and summer months.

Downstream floods, sometimes called riverine floods, refer to floods on large rivers at locations with large upstream catchments. Downstream floods are typically associated with precipitation events that are of relatively long duration and occur over large areas. Flooding on small tributary streams may be limited, but the contribution of increased runoff may result in a large flood downstream. The lag time between precipitation and time of the flood peak is much longer for downstream floods than for upstream floods, generally providing ample warning for people to move to safe locations and, to some extent, secure some property against damage. Riverine flooding on the large rivers of Minnesota generally occurs during either the spring or summer.

Flash Flooding

On occasion intense, heavy rain producing thunderstorms or consecutive thunderstorms (“training”) can bring excessive rainfall leading to flash flooding in Winona County. The hilly terrain promotes rapid run-off and enhances the threat. Mudslides can occur in extreme cases. Intense rainfall rates also lead to occasional urban street flooding, especially in/around the city of Winona.

June is the most common month for flash floods, but they can occur from May through September. They are most common in the evening hours, between 8-10 p.m., but can occur at anytime and typically last from 3-6 hours.

Two main rivers impact Winona County – the Mississippi River and the Whitewater River. There are numerous other watersheds or larger creeks throughout the county that can and do flood. The Mississippi River is often the highest in the spring as a result of seasonal snowmelt, but on rare occasions can reach flood stage during the summer or fall from heavy rain patterns. The combination of up-river snowmelt and area rain brought major flooding along the Mississippi river in April 2001, setting the 2nd highest crest levels in many locations. The record crest year remains 1965.

Historical Flood Hazard Overview

Historical flood hazards have been identified in the following community Flood Insurance Study (FIS) reports.

- City of Elba, MN May 1978
- City of St. Charles, MN October 15, 1981
- City of Winona, MN August 19, 1997
- City of Dakota, MN December 15, 1981
- City Minnesota City, MN January 19, 1982
- City of Rollingstone, MN January 19,1982
- City of Stockton February 2, 1982
- City of Winona August 19, 1997
- County of Winona MN Unincorporated Areas July 18, 1983

Winona County has had high costs associated with previous flooding: August 19-23, 2007 severe storms and flooding that occurred resulted in Presidential Disaster Declaration 1717-MN for eight counties in southeast Minnesota, including Winona County. From this event, five people lost their lives in flood related accidents in Winona County and many people were displaced.

A compilation of damage as summarized in the Winona County Flood Recovery Common Community application estimated damages at $77 million. This excludes damages to the City of Winona and Minnesota City. County roads and bridge damages were calculated at $4.5 million. The loss in taxable real property to structures was approximated at $28 million dollars.

FEMA expenditures for DR 1717 totaled $5,436,457. The federal 75% cost share program directed $3,571,974 in disaster relief into sixteen townships and ten cities within Winona County. Funds directed to specific cities are detailed in Appendix A.

Historical Flood Events

In the past, 22 flood events were reported to the National Climatic Data Center (NCDC) for Winona County. The most costly flood event in terms of property and crop damage occurred on August 18, 2007 in multiple areas throughout Winona County. Flash floods hit all the creeks and drainage areas that begin near the Interstate 90 area. Garvin Brook and other creeks that flow into Stockton became terrain-changing flowages and washed out numerous roads, created massive mudslides, took out bridges, damaged railroad tracks, and washed away some homes. Most homes in Stockton had severe water damage as flood waters roared through town. The same event caused all drainage areas leading into communities in eastern Winona County to experience flooding. A section of County Highway 17 was entirely washed out just south of Winona. In addition, more than 300 residents were evacuated from their homes in Goodview due to high water. In Minnesota City a railroad bridge was ripped apart by Garvin Brook and a highway bridge through town suffered major damage on each end. Railroad tracks were warped or pushed clear out of position. Major erosion was seen.

Table 4-10: Winona County Flash Flood Warnings

Flash Flood Warnings	
Year	**#**
2009	1
2008	1
2007	5
2006	0

2005	1
2004	3
2003	0
2003	0
2001	1
2000	2

Natural Hazard Assessment, Winona County MN

Table 4-11: Mississippi at Winona Flood Categories

Flood Category	Height (feet)
Major Flood Stage	18
Moderate Flood Stage	15
Flood Stage	13
Action Stage	11

Natural Hazard Assessment, Winona County MN

Table 4-12: Mississippi at Winona Highest Historical Flood Crests

Date	Height (feet)
4/19/1965	20.77
4/17/2001	20.07
4/19/1969	19.44
4/11/1997	18.27
4/20/1952	17.91

Natural Hazard Assessment, Winona County MN

Table 4-13: Winona Flood Impacts

Height (Feet)	Impact\Action
25	Water levels reach the top of the emergency dike.
24	Water overtops the levees downtown.
22	Water levels reach the designed dike protection level.
20.77	The water reaches the flood of record set in 1965.
20.5	Railroad lines go under water.
17.1	Lock and dam 5 goes out of operation.
17	Some railroad lines may become inoperative.
16.6	Lock and Dam 6 goes out of operation.
16	Lock and Dam 5A goes out of operation.
13	Prairie Island Park begins to flood. Pumping operations are underway by the City of Winona...and dike patrols are started.

At the Winona Dam 5a the flood stage is 655 feet. By 659 feet, the flood stage is moderate, and it becomes a major flood stage at 661 feet. The gauge location is shown in Figure 1, the flood categories are shown in Table 4-14. The historical crests and flood impacts are shown in Table 4-15 and Table 4-16.

Table 4-14: Winona Dam 5a Flood Categories

Flood Category	Height (Feet)
Major Flood Stage	661
Moderate Flood Stage	659
Flood Stage	655
Action Stage	650

Table 4-15: Winona Dam 5a Highest Historical Flood Crests

Date	Height (Feet)
4/19/1965	663.35
4/17/2001	661.95
4/11/1997	661.60
4/19/ 1969	661.37
4/20/1952	659.90

Table 4-16: Winona Flood Impacts

Height (Feet)	Impact\Action
663.74	Water levels reach the flood of record.
663	Lock walls go under water.
660	Lock and dam closes to navigation.

In Minnesota City the flood stage is 660 feet. By 662 feet, the flood stage is moderate, and it becomes a major flood stage at 665 feet. The gauge location is shown in Figure 2, the flood categories are shown in Table 4-17. The historical crests and flood impacts are shown in Table 4-18 and Table 4-19.

Table 4-17: Minnesota City Flood Categories

Flood Category	Height (Feet)
Major Flood Stage	665
Moderate Flood Stage	662
Flood Stage	660
Action Stage	658

Table 4-18: Minnesota City Highest Historical Flood Crests

Date	Height (Feet)
4/19/1965	667.85
4/16/2001	665.70
4/11/1997	665.45
4/18/ 1969	665.10
4/19/1952	663.84

Table 4-19: Minnesota City Flood Impacts

Height (Feet)	Impact\Action
670	Water begins to flow over portions of the protective earthen dike.
668.73	Water levels reach the flood of record.
665	Lock gates and walls go under water.
664.5	The lock and dam is closed to navigation.

Geographic Location for Flood Hazard

Much of the county is at some risk of flooding, but to substantially varying degrees. Those cities located next to the Mississippi and Whitewater Rivers are at highest risk of riverine flooding.

Substantial portions of the county are at risk for flash flooding. These communities, primarily in eastern side of the county, are at substantial risk of flash flooding. These include the communities of St. Charles, Elba, Stockton, Minnesota City, Goodview and Winona.

The heavy rains of 2007 demonstrated that even cities on the ridges can experience flood damage resulting from overwhelmed storm water systems.

Total property damage due to flooding has been extensive since 1997, totaling to $53,947,000 dollars. Crop damage over the same period has totaled $1,457,000 dollars. See Table 4-20 below.

There have been no deaths or injuries related to flooding in Winona County since 2007.

Table 4-20: Winona County Historical Floods (1997-2010)

Location or County	Date	Time	Type	Property Damage	Crop Damage
Houston, Wabasha, Winona	4/3/1997	8:00 PM	Flood	500K	0
Lewiston	7/19/1997	9:30 AM	Urban/small Stream Flood	0	0
Lewiston	7/19/1997	9:42 AM	Flash Flood	50K	30K
Winona	8/23/1997	7:45 PM	Flash Flood	40K	0
Stockton	6/26/1998	11:30 PM	Flash Flood	15K	2K
Stockton	8/9/1998	5:10 PM	Flash Flood	150K	55K
Winona	5/17/2000	3:15 PM	Flash Flood	8K	20K
St Charles	6/1/2000	2:00 PM	Flash Flood	8K	15K
Winona	6/20/2000	9:50 AM	Urban/sml Stream Flood	0	0
Huston, Wabasha, Winona	4/10/2001	10:00 AM	Flood	5.0M	0
Houston, Wabasha, Winona	5/1/2001	12:00 AM	Flood	6.0M	0
Winona	9/15/2004	2:41 AM	Flash Flood	4K	5K
Lewiston	8/18/2007	21:48 PM	Flash Flood	6.0M	250K
Stockton	8/18/2007	21:48 PM	Flash Flood	22.0M	200K
Elba	8/18/2007	22:00 PM	Flood	60K	25K
Lewiston	8/18/2007	22:25 PM	Flash Flood	300K	125K
Winona	8/18/2007	22:35 PM	Flash Flood	12.0M	450K
Winona	8/19/2007	6:00 AM	Flood	1.5M	250K
Lewiston	8/22/2007	16:45 PM	Flash Flood	2K	0K
Winona	6/7/2008	15:38 PM	Flood	50K	20K
Lamoille	6/7/2008	16:30 PM	Flash Flood	250K	10K
Dresbach	7/16/2008	17:38 PM	Flash Flood	10K	0K
			TOTALS:	**$53,947,000**	**$1,457,000**

Winona County 2010 Vulnerability Report

Repetitive Loss

Any property that has received two or more claim payments for damage to buildings of more than $1,000 from the National Flood Insurance Program (NFIP) within any rolling 10-year period for a home or business is considered a Repetitive Loss (RL) structure. *Winona County has two such properties; one is within the City of Winona though outside the dike system and has had two losses with total payments of $14,004.45 and the other is in the county, with two losses and total payments of $28,420.71.*

Risk Identification for Flood Hazard

Probability (x) Impact (=) Overall Risk

Based on historical information, the probability of a Flood event is high in the county. While the planning team determined that the potential impact of a flood is moderate, the overall risk of a flood hazard for Winona County as a whole was deemed elevated.

Vulnerability Analysis for Flood Hazard

Susceptibility to Flooding
The Mississippi River composes the eastern border of Winona County. The communities and residences along the Mississippi annually face the potential of flooding as the Upper Mississippi River Valley Basin collects and drains the snow melt from much of Minnesota and Wisconsin. Large areas of the major population centers of Winona and Goodview lie in the floodplain of the Mississippi River.

After severe flooding events of 1965 and 1969, the Army Corp of Engineers initiated planning for a dike and levee system with construction occurring from 1982-85. The dike system was constructed to protect against a 22 foot flood stage with a 24 foot dike top. The highest crest event occurred in 1965 with the Mississippi River reaching 20.77 feet. The City of Winona maintains pumping stations for a large portion of dike to prevent dike saturation and keeps replacement and portable pumps on hand for use if needed. Maintenance of the dike and levee system remains a priority to prevent a catastrophic dike failure which remains the significant flood hazard for the cities of Winona and Goodview.

A regional flooding hazard also exists along the Whitewater River during spring snow melt for the communities of St. Charles and Elba. Elba lies in the flood plain behind a protective dike. The dike height on the south side of the city was enhanced in 2008 after being topped during a flash flooding event in August 2007.

The topography of Winona County is composed of uplands used for farming cut by deeply incised valleys with densely forested hillsides. The stormwater drainage joins spring fed streams running along the valley floors which are used for farming and residential development. During major precipitation events these streams may be unable to contain the flows introduced into the drainage systems. The majority of the southern half of the county drains to the Root River in Fillmore and Houston Counties, to the Whitewater River in the western part of the county, and to the Mississippi River for the remainder of the county.

Soils in the upland areas are composed of windblown loess deposited during the last glacial retreat. Winona County was part of the driftless area that did not experience glaciations during the last ice age. These loess deposits are composed of very fine clastics with little or no silt or sand content. These soils respond more slowly in accepting and releasing soil moisture and contribute to runoff during heavy precipitation events. The mature dendritic drainage pattern which dominates the Winona County landscape and watersheds combined with the high clay soils provide conditions conducive for dangerous flash flooding.

On August 18 & 19, 2007, large-scale flash flooding occurred in Winona County. Multiple heavy rain events preceding the flash flood saturated the clay soils, resulting in almost complete runoff during the 24 hour rain event that dropped 12 to 17 inches of rain across the entire county. Infrastructure and residences countywide sustained heavy damage. Runoff and erosion were extreme in the communities of St. Charles, Stockton, Minnesota City, Goodview, and localized areas of Winona, and that led to evacuations and rescues. Many roads and bridges were closed or damaged, and five people were killed while driving in the county. Whitewater State Park experienced widespread damage as well, with 500 campers evacuated. The county was declared a federal disaster area with an estimated 45 million dollars in damage.

A strong potential for future flash floods will continue based on these geological factors. Residential buyouts, enhancement and construction of storm water management structures, roadway drainage upgrades, warning systems, and other initiatives have been completed and are ongoing to minimize future damage and injuries resulting from flash flooding events. Winona County will continue to work with its townships and municipalities to plan for and mitigate flash flooding.

HAZUS-MH Hazard Analysis

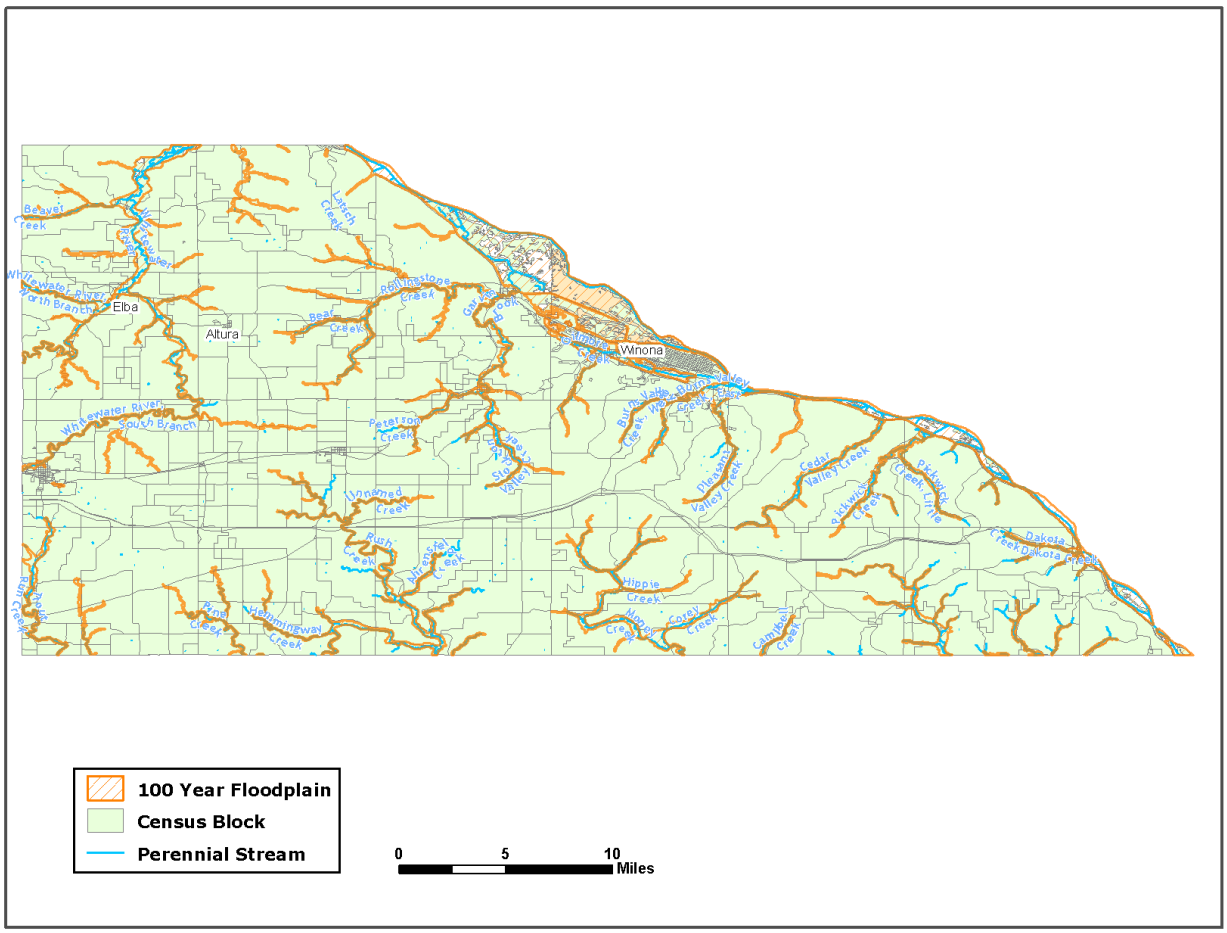
Flood analysis for Winona County was performed using HAZUS-MH MR4 released in August 2009. The bundled aggregated general building stock was updated to Dun & Bradstreet 2006. Building valuations were updated to R.S. Means 2006. Building counts based on census housing unit counts are available for RES1 (single-family dwellings) and RES2 (manufactured housing) instead of calculated building counts.

The site specific inventory (specifically schools, hospitals, fire stations and police stations) was updated using the best available statewide information.

HAZUS-MH was used to generate the flood boundary for a 100-year return period calculated using the USGS 30m DEM and the DNR Q3 boundary.

The map below depicts the flood boundary from the HAZUS-MH analysis.

Winona County HAZUS-MH Analysis (100-Year Flood)



HAZUS-MH Essential Facilities Loss Analysis

A HAZUS-M Essential Facilities loss analysis was undertaken following the 2007 floods and disaster declaration, and released in August 2009. Essential facilities encounter the same impacts as other buildings within the flood boundary: structural failure, extensive water damage to the facility, and loss of facility functionality (i.e. a damaged police station will no longer be able to serve the community).

The HAZUS-MH analysis identified 8 essential facilities that fall within the 100-yr flood boundary*. A list of these essential facilities within Winona County is included in Tables 4-21 and 4-22. Maps of essential facilities potentially at risk to flooding follow Table 4-22.

Table 4-21: Winona County Essential Facility Loss - 100-Year Flood

Class	Building Count	At Least Moderate Damage	At Least Substantial Damage	Loss of Use
Fire Stations	15	1	0	1

Care Facilities	6	0	1	0
Police Stations	5	0	0	0
Schools	40	6	0	0
Total	**66**	**6**	**1**	**1**

Table 4-22: Winona County Damaged Essential Facilities

Facility Type	Facility Name
Care Facilities	Sauer Memorial Home
Fire Stations	Dakota Fire and Rescue Department
School	Hiawatha Valley Ed District
School	Hiawatha Valley Ed District ESY
School	Winona Middle
School	School District Office
School	Bluffview Montessori
School	Winona ESY

* Essential Facilities may be outside of the 100 year flood boundary according to orthophoto interpretation or address verification.

Inundated Essential Facilities in southeast Winona

Inundated Essential Facilities in southwest Winona

Inundated Essential Facilities in central town of Winona.

Essential facility locations were imported from the best available statewide sources. The figures above show the 100 Year flood boundary overlaid with the essential facilities. Some instances have been observed where HAZUS-MH reports a site within the flood plain that cannot be confirmed by the corresponding orthophoto. The essential facility damages reported by HAZUS-MH may be overstated.

HAZUS-MH Aggregate Loss Analysis

HAZUS-MH was used to estimate the damages incurred with a 100-year flood event in Winona County. An estimated 251 buildings may be damaged totaling $96.4 million in building losses and $259.5 million in total economic losses. The total estimated number of damaged buildings, total building losses, and estimated total economic losses are shown in Table 5.

Table 4-23: Winona County Total Economic Loss - 100-Year Flood

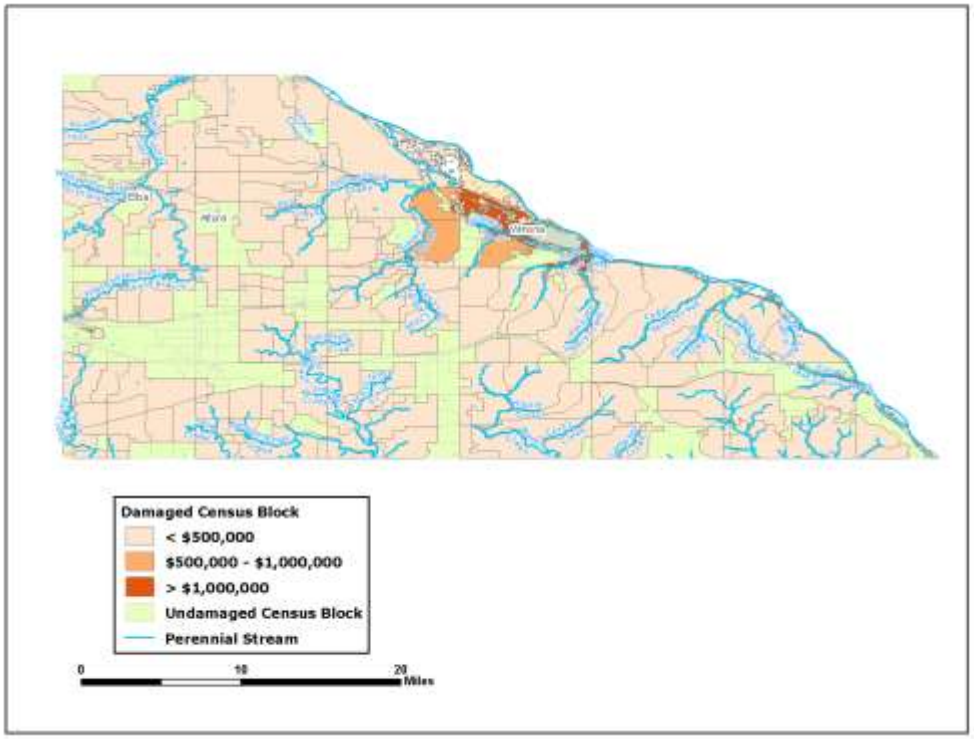
General Occupancy	Estimated Total Buildings	Total Damaged Buildings	Total Building Exposure X 1000	Total Economic Loss X 1000	Building Loss X 1000
Agricultural	75	0	$52,728	$3,090	$1,142
Commercial	1,044	4	$587,959	$57,140	$14,590
Education	41	0	$80,361	$20,628	$2,840
Government	35	0	$20,991	$3,022	$445
Industrial	328	7	$408,993	$62,333	$15,415
Religious/Non-Profit	89	0	$74,595	$6,485	$963

Residential	19,898	240	$2,622,552	$106,805	$60,964
Total	**21,510**	**251**	**$3,848,179**	**$259,503**	**$96,359**

The reported building counts should be interpreted as degrees of loss rather than as exact numbers of buildings exposed to flooding. These numbers were derived from aggregate building inventories which are assumed to be dispersed evenly across census blocks. HAZUS-MH requires that a predetermined amount of square footage of a typical building sustain damage in order to produce a damaged building count. If only a minimal amount of damage to buildings is predicted, it is possible to see zero damaged building counts while also seeing economic losses.

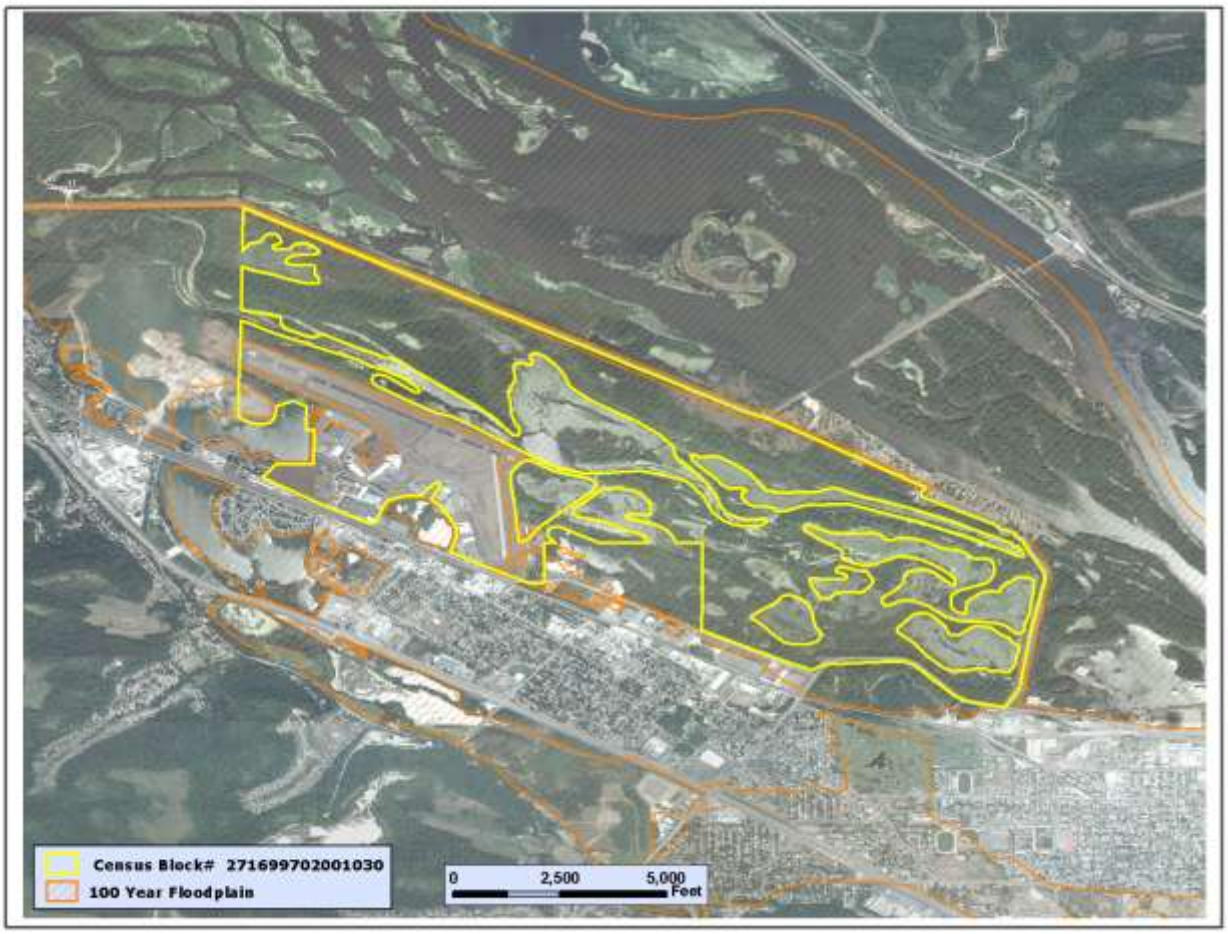
HAZUS-MH estimates 9 census blocks with losses exceeding $1 million. The distribution of losses is shown in Figure below.

Winona County Total Economic Loss - 100-Year Flood



HAZUS-MH aggregate loss analysis is evenly distributed across a census block. Census blocks of concern should be reviewed in more detail to determine the actual percentage of facilities that fall within the flood hazard areas. The aggregate losses reported in this study may be overstated. The figure below is an example of the census block where the highest damage estimates were reported. This figure shows census blocks overlaid with the flood boundary and orthophoto of the City of Winona. Census block 271699702001030 has an estimated building loss of $5.9 million with a total loss of $25.7 million. Although the orthophoto shows significant flooding in this census block the dollar amount may be overestimated. The majority of flooding is in a wetland area and a small percentage of buildings are at risk.

Example of Flood Damage Exposure in northwestern Winona



HAZUS-MH Shelter Requirement Analysis

HAZUS-MH estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS-MH also estimates those displaced people that may require accommodations in temporary public shelters. The model estimates 1,540 households may be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these 3,308 people (out of a total population of 49,985) may seek temporary shelter in public shelters.

HAZUS-MH Debris Generation Analysis

HAZUS estimates the amount of debris that may be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 15,775 tons of debris will be generated. Of the total amount, Finishes comprises 36% of the total, Structure comprises 37% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 631 truckloads (@25 tons/truck) to remove the debris generated by the flood.

HAZUS-MH State Property Loss Analysis

The HAZUS-MH generated flood boundaries were overlaid with the State of Minnesota owned buildings to determine if any structures are at risk to flooding. The site-specific inventory was updated using the best available statewide information. State properties of concern should be reviewed in more detail to determine if the buildings actually fall within the flood hazard areas. Table 8 provides a list of state owned buildings impacted by the flood.

Table 4-24: Winona County State Owned Buildings Flood Inundation

Building Name	Address	Facility/Agency
Whitewater State Park	19041 Highway 74	MN DNR
Crystal Springs Fish Hatchery	Route 2 Box 481	MN DNR
Crystal Springs Fish Hatchery	Route 2 Box 481	MN DNR

The flood boundaries were overlaid with the State of Minnesota state owned buildings identified for this study. Figure below shows an example of the inundated building.

Inundated State Properties 2 miles south of Elba

Vulnerability to Future Assets/Infrastructure for Flood Hazard

While any new development within the county will remain vulnerable to these events, with an effective comprehensive plan to guide thoughtful development, including a recently updated Zoning Ordinance, future risk can be mitigated. Continued monitoring, communication and county support for communities in implementing their mitigation goals will be central to such success.

With the assistance of FEMA's Risk Mapping, Assessment, and Planning, or RiskMAP, the county will be able to better identify, assess and reduce our flood risk. Superior flood maps are expected to be available to Winona County be 2013.

4.4.3 Landslide Hazard

Hazard Definition for Landslide Hazard

Landslides are the movement of slopes that occur through various events including: slides, flows, lateral spreads, falls and topples. Landslides can occur in areas of steep slopes and slopes destabilized by natural

(rainfall, channel erosion and seismic activity) or manmade actions (construction activity or site grading, mining, etc.) Landslides occur often with or after other major disasters such as extreme storm events, flooding, seismic events, and wildfire. Debris flows also may often be a part of the event that causes landslides.

Landslides occurred throughout southeastern Minnesota during the record breaking storm in August, 2007. These landslides occurred along waterways, roads and in developed areas. The constriction of the flow of floodwaters from landslides produced by this high rainfall event greatly increased flood damage. Landslides washed out roads, affecting access and traffic safety, in addition to substantial costs of repair of infrastructure. Indeed, landslides were the cause of two of the three Winona County deaths resulting from the 18 inch rainfall event. Landslides in developed areas can result in significant damage to buildings and property.

Vulnerability Analysis for Landslide Hazard

The deeply incised valleys and soil and colluvium deposits that compose the high slope hillsides in Winona County provide the perfect conditions for mass wasting events. Ongoing erosion of these high slope areas results in periodic releases that can impact roadways and residences constructed along sideslope, footslope, and toeslope areas. When saturated, these hillsides are subject to more large scale releases and accompany flash flooding events. New road construction upgrades are designed to allow these releases without damage to infrastructure or injury to passing motorists. However, conditions remain in place where near vertical 200-400 foot elevation changes in proximity to areas of human activity slow or prevent upgrades due to engineering and financial circumstances. Areas of 200-400 foot elevation change lie mainly along the U.S. Hwy 61 and 14 corridors.

The following map shows areas of steep slopes, and indicates that landslide vulnerability is county-wide. Those communities located immediately below or on our steep slopes are at greatest risk.

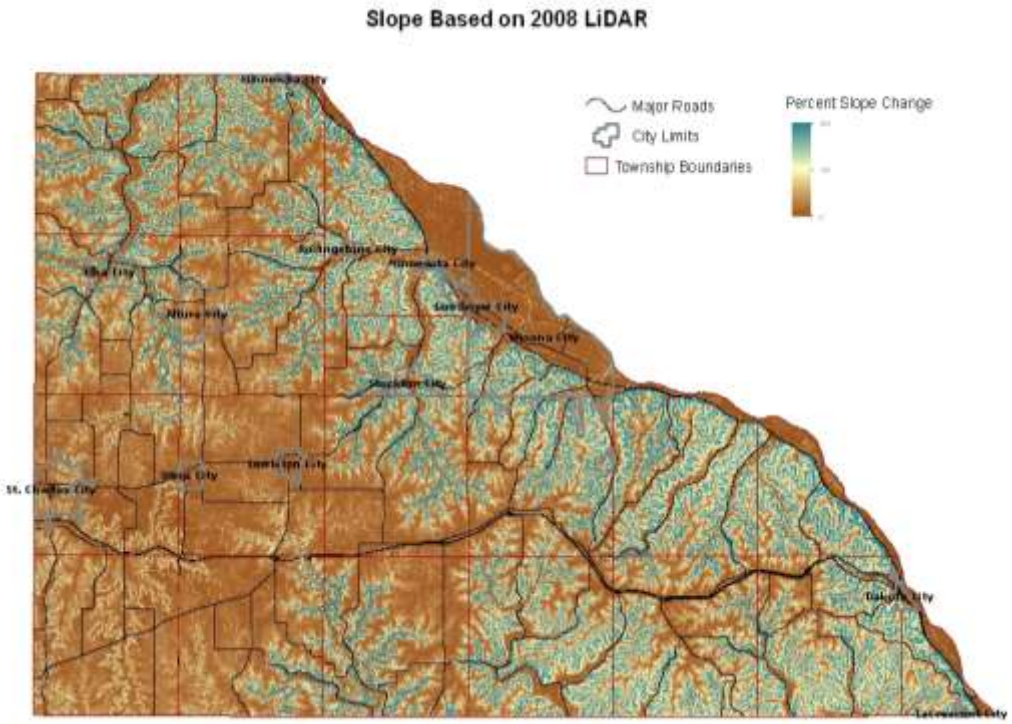


Table 4-25: Landslide Vulnerability

Vulnerability to Landslides	
Frequency	Likely
Impact/damage	Slight to Moderate
Location	Steeper sloping areas primarily along river corridors, and in developing areas graded to steeper, slopes
Geographic Extent	County-wide
Duration	Minutes to years
Seasonal Pattern	Year-round
Warning Time	None-Minimal

Risk Identification for Landslide Hazards

Probability (x) Impact (=) Overall Risk

Based on historical information, the probability of landslides in the county is especially high in the blufflands in the east, and substantially reduced to the west. Overall, however, the probability of landslides is deemed to be high. With an impact is considered moderate, overall hazard risk is deemed elevated.

Infrastructure

The county's transportation infrastructure is most at serious risk from landslides. All too frequently following heavy rain events the roads, highways and interstates that transect the county are closed to

traffic for clean-up of soil, rock and tree debris from washouts. These on-going clean-up costs that fall to township, county and state budgets are significant.

Vulnerability to Future Assets/Infrastructure for Landslide Hazard

The recently adopted steep slope ordinance is expected to have an appreciable impact and reduce future vulnerability to landslides and related loss of infrastructure. Section 11.6 Steep Slopes/Bluffs ordinance includes

1. Proposed Development, including all structures and driveways that occur on slopes greater than twelve (12) percent are required to submit a site plan created by a Licensed Engineer or a Professional Geologist or other qualified individual that has experience in building, earth work, and soil erosion control which is deemed acceptable to Winona County Planning Department and Winona County SWCD.

2. Proposed Development including all structures and driveways that occurs within slopes between eighteen (18) percent and twenty five (25) percent shall be allowed only by a Conditional Use Permit.

3. Developments and other land disturbing activities are prohibited on slopes over twenty five (25) percent. Such slopes shall be preserved in their natural state.

4. Proposed Development including all structures and driveways are prohibited between the toe and the top of the Bluff.
5. A one hundred (100) foot setback shall be observed from the top of the bluff of all bluffs which have a total height of one hundred (100) feet or more as measured from the toe of the bluff to the top of the bluff. This setback shall pertain to all structures and impervious surfaces.

6. Timber Harvesting and selective cutting for approved forest management purposes shall be conducted in accordance with performance standards.

7. Properties containing woodlands shall not disturb more than one (1) acre of the woodlands for altering, regrading, clearing or building except as specifically provided in an approved land disturbance permit.

A Level 2 HAZUS analysis will be particularly helpful in the future in developing credible cost analysis.

4.4.4 Drought Hazard

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, stream flow, 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

On occasion the weather pattern across the upper Midwest favors prolonged heat and humidity, leading to heat waves. June through August are the warmest months with average high temperatures in the 80s and record highs above 100F most days. The warmest temperature on record at Winona is 108F set on July 12, 1936.

In Winona County, there have been 5 heat waves since 1993. During that same time period, there were 15 fatalities directly related to heat in Minnesota.

One of the longest heat waves on record occurred in July 1936 when Winona hit 90F or higher for 15 consecutive days, including 9 days at or above 100F and an all-time record of high of 108F as noted

above. In more recent years, the high temperature hit 90F or warmer 11 consecutive days from July 30th through August 9th in 2001. Other heat waves occurred in 1995 and 1999.

Prolonged dry spells can also lead to drought causing extreme damage to crops. Droughts vary in length and intensity but abnormally dry to moderate drought conditions can occur quite frequently. Severe to extreme droughts occur far less frequently.

Table 4-26: Drought Vulnerability

VULNERABILITY TO DROUGHT	
Frequency	Likely
Impact/damage	Slight to Moderate
Location	County-wide
Geographic Extent	County-wide
Duration	Weeks to months
Seasonal Pattern	Winter and Summer
Warning Time	More than 12 hours

Natural Hazard Assessment, Winona County MN

Dry weather can also lead to a wildfire threat, especially in the spring before foliage has emerged (i.e. before green up) or in the fall after vegetation has started to die off. The driest year recorded for Winona County was 1910 with a total of 16.14" of rainfall.

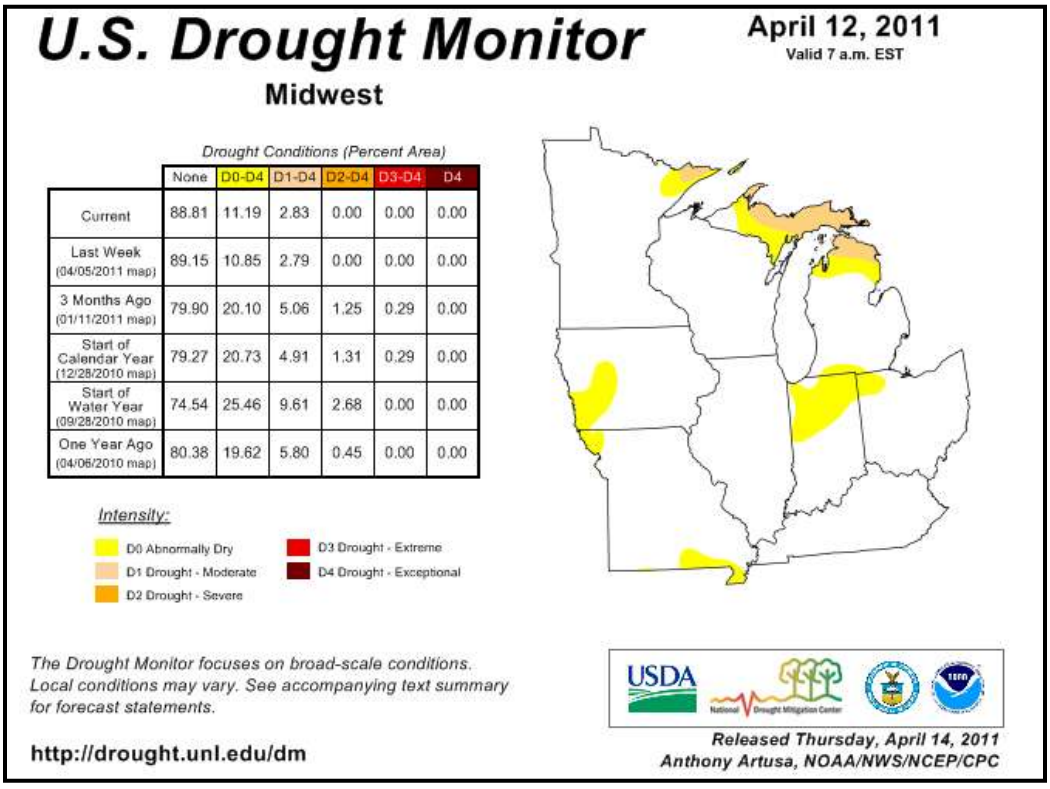
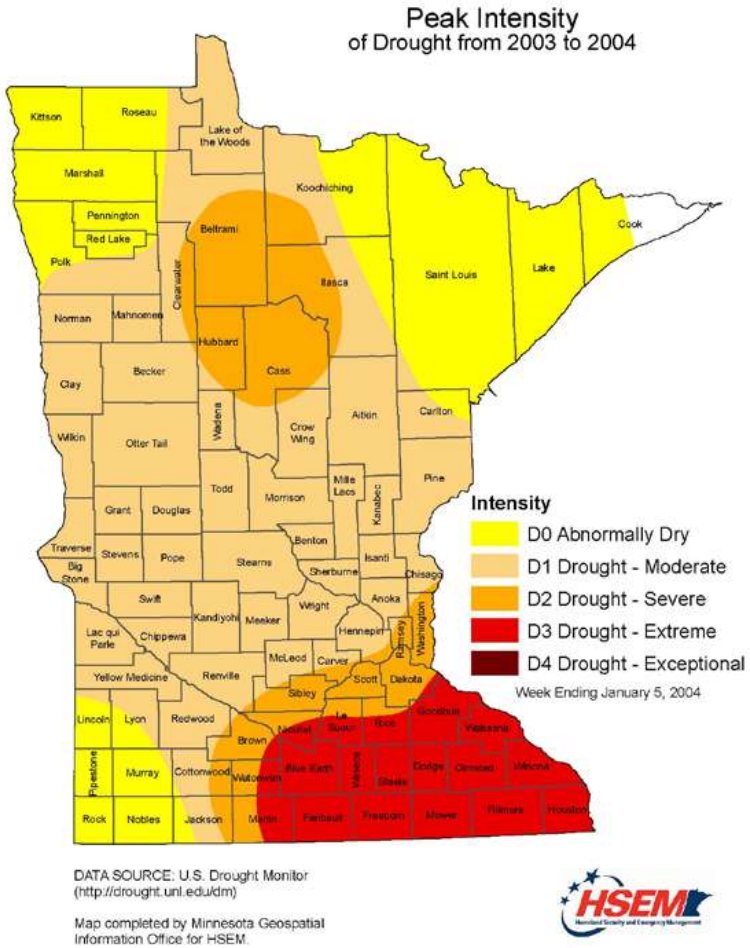


Table 4-27: Minnesota Drought History

DATES	LOCATION	REMARKS
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 southeastern Minnesota.
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. Dry 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.
1931-1942	Statewide	Intensity and duration differed locally
1911-1914	Statewide	Intensity and duration differed locally



*State Climatology Office –DNR waters

Risk Identification for Drought Hazard

Based on historic information, the probability of drought in the county is high. The impact of a drought ranges widely. Because the future incidence of drought is so highly unpredictable, drought is ranked as having a low mitigation potential.

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 so unpredictable, drought is ranked as having a low mitigation potential.

4.4.5 Earthquake Hazard

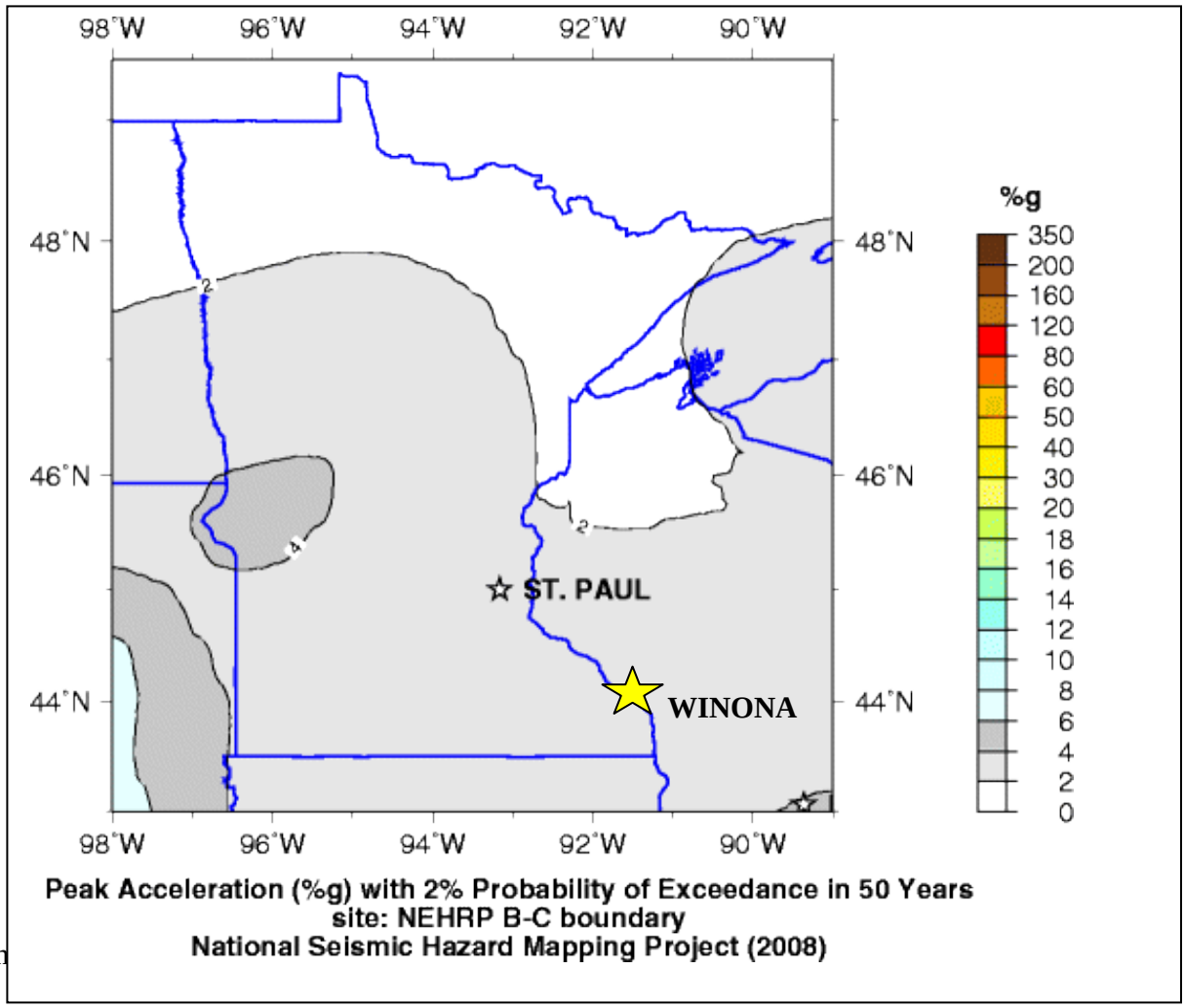
The Minnesota Geological Survey describes an earthquake as a movement of rock in the earth's interior. Most of these occur when solid rock masses move past one another along fracture planes called "faults." While Minnesota is far from any plate margin, the New Madrid seismic zone, located between St. Louis, Missouri and Memphis, Tennessee, has the potential for generating major earthquakes.

The most recent earthquake to affect Minnesota occurred on November 9, 1968. Centered in south-central Illinois, the earthquake was felt over approximately 580,000 square miles of the Central United States. Minor damage was reported at Chicago, Illinois; Evansville, Indiana; and St. Louis, Missouri, as well as from a number of cities and towns in the epicentral area. Intensity I-IV effects were noted in Minnesota at Austin, Glencoe, Mankato, Minneapolis, Rochester, and St. Paul.

According to the MGS publication "Earthquakes in Minnesota", Minnesota has one of the lowest occurrence levels of earthquakes in the United States, though 19 small to moderate earthquakes have been documented since 1860. These are attributed to minor reactivation of ancient faults in response to modern day stresses.

Risk Identification for Earthquake Hazard

Based on historical information, the probability of an earthquake is extremely low. As a result, local mitigation efforts associated with earthquakes were been included in the planning process.



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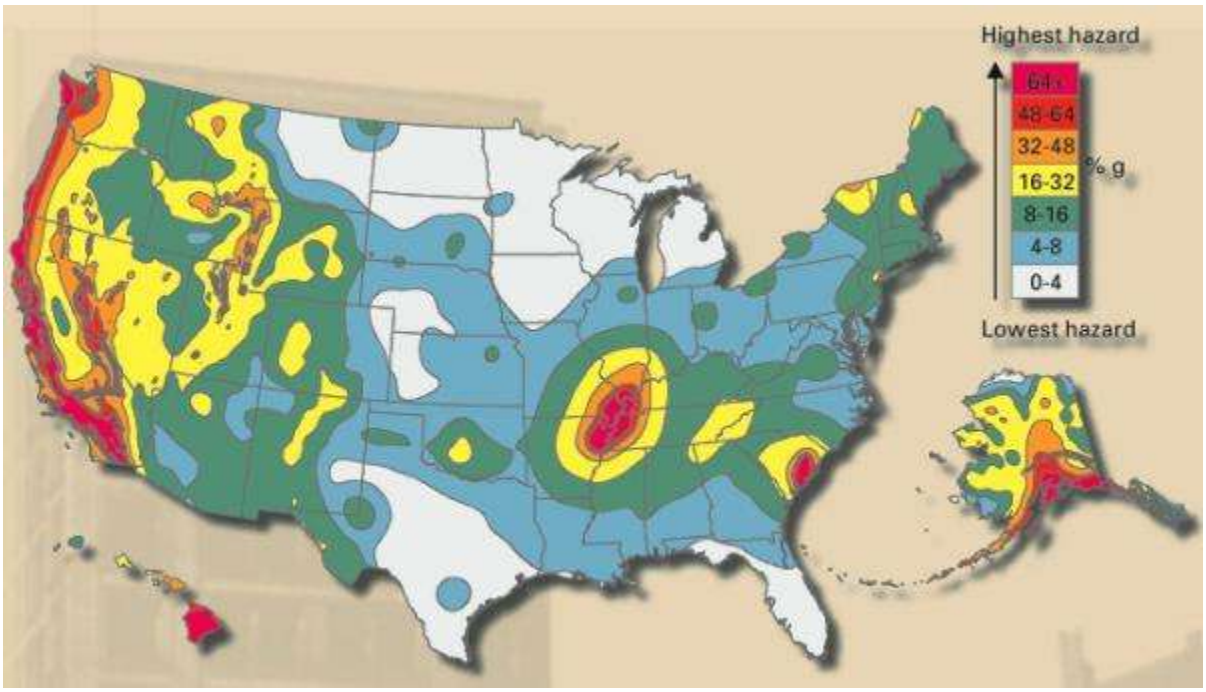
4.4.6 Thunderstorm Hazard

Average Number of Thunderstorm Days per year



Hazard Definition for Thunderstorm Hazard

Severe thunderstorms are defined as thunderstorms with one or more of the following characteristics: strong winds, large damaging hail, or frequent lightning. Severe thunderstorms most frequently occur in Minnesota during the spring and summer months, but can occur any month of the year at any time of day. A severe thunderstorm's impacts can be localized or can be widespread in nature. A thunderstorm is classified as severe when it meets one or more of the following criteria.

- Hail of diameter 0.75 inches or higher
- Frequent and dangerous lightning
- Wind speeds equal to or greater than 58 miles per hour

Winona County averages 39 thunderstorm days per year. The National Weather Service (NWS) considers a thunderstorm severe when it produces wind gusts of 58 mph (50 knots) or higher, 3/4 inch diameter hail or larger, or a tornado.

Hail

Large hail can also occur in a severe thunderstorm. June is the peak month with the most common time between 1 and 9 p.m., but it can occur in other warm season months and at any time of day. Hail is typically crop damaging hazard but can damage roofs, windows, and vehicles if large enough.

Injuries or fatalities are rare for hail, but expenses can be high. In September 2000, hail the size of tennis balls damaged numerous vehicles and hundreds of acres of crops in Lewiston, MN area. In June 2001 hail up to 2" in diameter was reported in the city of Winona. There have been 90 large hail storm reports in the county since 1995.

Lightning

Non-severe thunderstorms still pose a lightning risk. Lightning is a discharge of electricity from a thunderstorm. Lightning is often perceived as a minor hazard, but in reality lightning causes damage to many structures and kills or severely injures numerous people in the United States each year. According to the Vaisala Group, an average of nearly 400,000 cloud-to-ground strikes hit Minnesota each year, based on data from 1996 – 2005. Minnesota ranks 33rd in lightening related fatalities with 8 deaths and 68 injury reports between 1993 and 2008. There was a lightening fatality in Minnesota in 2007 and two in 2009.

Severe Winds

Downdraft winds from a severe thunderstorm can produce local or widespread damage, even tornado-like damage if strong enough. Most severe thunderstorm winds occur in June or July and between the hours of 4 and 8 p.m., but can occur at other times. Most damage involves blown down trees, power lines, and damage to weaker structures (i.e. barns, outbuildings, garages) with occasional related injuries.

In 1998, a large squall line moved through the region with wind gusts in excess of 100 mph knocking down hundreds of trees and damaging buildings. Power was also out in many communities. A thunderstorm wind gust of 101 mph was also recorded in June 1963. There have been roughly 80 damaging wind reports since 1955 and 46 since 1995 in the county.

Table 4-28: Winona County Severe Thunderstorm Watches and Warnings

Severe Thunderstorm Watches		Severe Thunderstorm Warnings	
Year	#	Year	#
2009	5	2009	2
2008	10	2008	7
2007	15	2007	6
2006	14	2006	4
2005	13	2005	4
2004	10	2004	6
2003	8	2003	2
2002	23	2002	4
2001	12	2001	9
2000	13	2000	14

Natural Hazard Assessment, Winona County MN

Geographic Location for Thunderstorm Hazard

The entire county is at similar risk for occurrence of thunderstorms. They can occur at any location within the county.

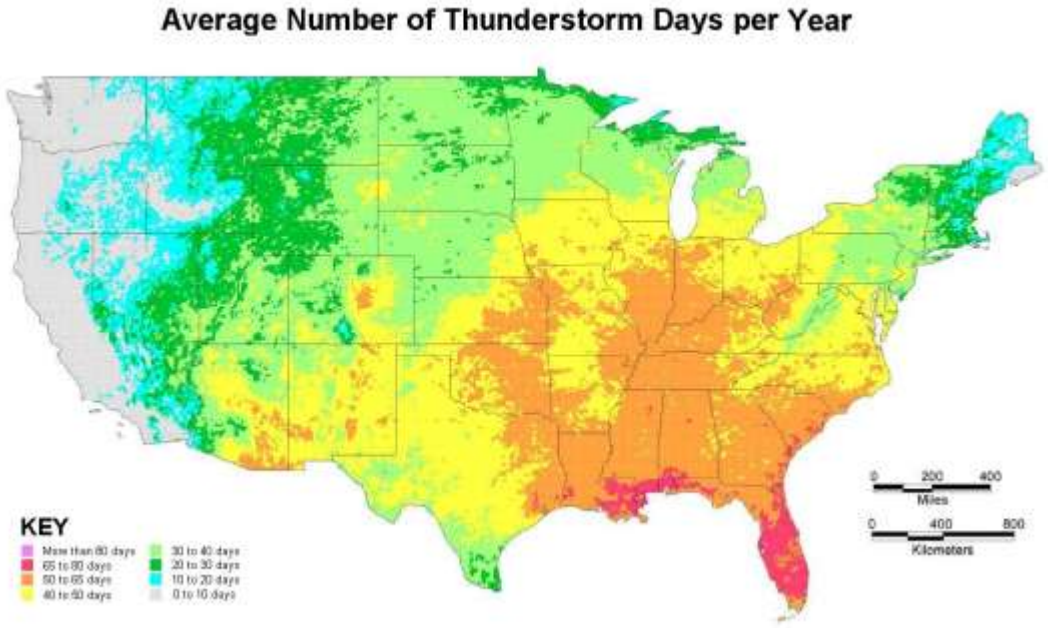
Risk Identification for Thunderstorm Hazards

Probability (x) Impact (=) Overall Risk

Based on historical information, the probability of a thunderstorm with strong winds is medium. The planning team determined that the potential impact of such thunderstorms is minimal; therefore, the overall risk of a thunderstorm hazard for Winona County is low.

Vulnerability Analysis for Thunderstorm Hazard

Severe thunderstorms are an equally distributed threat across the entire jurisdiction; therefore, the entire county's population and all buildings are vulnerable to a severe thunderstorm and can expect the same impacts within the affected area.



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Essential Facilities

All essential facilities are vulnerable to severe thunderstorms. An essential facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality (e.g. a damaged police

station will no longer be able to serve the community). Table 4-4 lists the types and numbers of all of the essential facilities in the area. Maps identifying essential facilities are located in Appendix C.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is provided in Table 4-5. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality (e.g. a damaged home will no longer be habitable causing residents to seek shelter).

Infrastructure

During a severe thunderstorm, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable it is important to emphasize that any number of these items could become damaged during a severe thunderstorm. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); or railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

Vulnerability to Future Assets/Infrastructure for Thunderstorm Hazard

All future development within the county and all communities will remain vulnerable to these events.

Analysis of Community Development Trends

Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures need to be built with more sturdy construction, and those structures already in place need to be hardened to lessen the potential impacts of severe weather. Community warning sirens to provide warning of approaching storms are also vital to preventing the loss of property and ensuring the safety of Winona County residents.

4.4.7 Winter Storm Hazard

Hazard Definition for Winter Storm Hazard

Severe winter weather consists of various forms of precipitation and strong weather conditions. This may include one or more of the following: freezing rain, sleet, heavy snow, blizzards, icy roadways, extreme low temperatures, and strong winds. These conditions can cause human health risks such as frostbite, hypothermia, and death.

Ice (glazing) and Sleet Storms

Ice or sleet, even in the smallest quantities, can result in hazardous driving conditions and can be a significant cause of property damage. Sleet can be easily identified as frozen raindrops. Sleet does not stick to trees and wires.

Ice storms are the result of cold rain that freezes on contact with objects having at temperature below freezing. Precipitation takes the form of freezing rain coating power lines, communication lines, and trees with heavy ice. The winds will then cause the overburdened limbs and cables to snap; leaving large sectors of the population without power, heat, or communication. Falling trees and limbs can also cause building damage during an ice storm. Ice storms can occur but are relatively rare in Winona County with only five occurrences wince 1982.

Snowstorms

Significant snowstorms are characterized by the rapid accumulation of snow, often accompanied by high winds, cold temperatures, and low visibility. A blizzard is categorized as a snowstorm with winds of 35 miles per hour or greater and/or visibility of less than one-quarter mile for three or more hours. The terrain in the eastern parts of the county does limit the number of true blizzards (only three since 1982) but heavy snow, ice, and sleet all occur.

The 30 year average seasonal snowfall for Winona County is 40.7 inches, but nearby ridge tops are typically 3-5 º F cooler and thus average several more inches per year. Blowing snow is more common in western parts of the county and on ridge tops. The bulk of snow falls between December and March.

Table 4-29: Top Snowfalls in Winona County

Top 5 Seasonal Snowfalls in Winona County	
Years	**Snowfall**
1961-62	90.2”
1951-52	88.5”
1950-51	81.2”
1970-71	72.7”
1978-79	66.6”

Natural Hazard Assessment, Winona County MN

Severe Cold

Severe cold is characterized by the ambient air temperature dropping to around 0◦F or below. These extreme temperatures can increase the likelihood of frostbite and hypothermia. High winds during severe cold events can enhance the air temperature’s effects. Fast winds during cold weather events can lower the wind chill factor (how cold the air feels on your skin). Arctic cold outbreaks can occur in the upper Midwest as well. Snow depth can modify these cold temperatures leading to sub-zero readings on average 29 times a winter. Occasionally strong northwest winds will combine with arctic outbreaks to create dangerous wind chill conditions as well. The coldest temperatures are usually January and February with average lows in the single digits and record lows.

Table 4-30: Coldest Lows for Winona County

Coldest Lows for Winona County, MN	
Low	**Date**
-35º F	1/12/1912
-33º F	2/1/1918
-33º F	1/28/1915
-32 º F	1/30/1951
-31 º F	2/4/1996

Natural Hazard Assessment, Winona County MN

Geographic Location for Winter Storm Hazard

Severe winter storms are not limited to any regions in Winona County and occur frequently. These storms can impact all areas throughout the county, and often impact a wide geographic area.

Risk Identification for Winter Storm Hazard

Probability (x) Impact (=) Overall Risk

Based on historical information, the probability of a winter storm is high. The planning team determined that the potential impact of a winter storm is moderate; therefore, the overall risk of a winter storm hazard for Winona County is elevated.

Essential Facilities

All essential facilities are vulnerable to a winter storm. An essential facility will encounter many of the same impacts as other buildings within the jurisdiction. These impacts include loss of gas or electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow. Table 4-4 lists the types and numbers of the essential facilities in the area. Maps identifying essential facilities are located in Appendix C.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is listed in Table 4-5. The impacts to the general buildings within the county are similar to the damages expected to the critical facilities. These include loss of gas or electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow.

Infrastructure

During a winter storm, the types of infrastructure that could be impacted range from transportation infrastructure, including roadways, utility lines/pipes, railroads and bridges, to buildings. Since the county's entire infrastructure is equally vulnerable it is important to emphasize that any number of these items could become damaged during a winter storm. Potential impacts include broken gas and/or electricity lines or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and building collapse from heavy snow loads.

Vulnerability to Future Assets/Infrastructure for Winter Storm Hazard

New development and infrastructure within the county will remain vulnerable to these events.

4.4.8 Hazardous Materials Storage and Transport Hazard

Hazard Definition for Hazardous Materials Storage and Transport Hazard

The state of Minnesota has numerous active transportation lines that run through many of its counties. Active railways transport harmful and volatile substances between our borders every day. The transportation of chemicals and substances along interstate routes is commonplace in Minnesota. The rural areas of Minnesota have considerable agricultural commerce creating a demand for fertilizers, herbicides, and pesticides to be transported along rural roads. Finally, Minnesota is bordered by two major rivers and Lake Superior. Barges transport chemicals and substances along these waterways daily. These factors increase the chance of hazardous material releases and spills throughout the state of Minnesota.

The release or spill of certain substances can cause an explosion. Explosions result from the ignition of volatile products such as petroleum products, natural and other flammable gases, hazardous materials/chemicals, dust, and bombs. An explosion can potentially cause death, injury, and property damage. In addition, a fire routinely follows an explosion which may cause further damage and inhibit emergency response. Emergency response may require fire, safety/law enforcement, search and rescue, and hazardous materials units.

Previous Occurrences for Hazardous Materials Storage and Transport Hazard

Winona County has not experienced a significantly large-scale hazardous material incident at a fixed site or during transport resulting in multiple deaths or serious injuries, although there have been many minor releases that have put local firefighters, hazardous materials teams, emergency management, and local law enforcement into action to try to stabilize these incidents and prevent or lessen harm to Winona County residents.

Geographic Location for Hazardous Materials Storage and Transport Hazard

The hazardous material hazards are countywide and are primarily associated with the transport of materials via highway, railroad, and/or river barge.

Risk Identification for Hazardous Materials Release

Probability (x) Impact (=) Overall Risk

Based on historical information, the probability of a hazmat hazard is medium. The planning team determined that the potential impact of a hazmat release is significant; therefore, the overall risk of a hazmat hazard for Winona County is elevated.

Vulnerability Analysis for Hazardous Materials Storage and Transport Hazard

Hazardous material impacts are an equally distributed threat distributed across the entire jurisdiction, though is tied to transporation and pipeline corridors. Therefore, the entire county is generally vulnerable to a hazardous material release and can expect the same impacts within the affected area. The main concern during a release or spill is the population affected.

Susceptibility to Transportation Related Hazards
Winona County is completely cross cut by several major transportation structures, including Interstate-90 which centrally bisects Winona County from east to west, U.S. Highway 14 and the former DM & E (now Canadian Pacific) railway which both parallel I-90 to the north, and U.S Highway 61 and the Canadian Pacific railway which parallel the Mississippi River along its eastern border. The Canadian Pacific railway which lies along the Mississippi River also serves Amtrak twice daily.

These transportation features move hazardous materials in commerce and present the potential for damage to the environment and injury to the people of Winona County. The geology and geomorphology of Winona County is conducive to the rapid spread of contaminants resulting from spills resulting from accidents, collisions, or similar events.

The bedrock of the upland area of the county is composed mostly of dolomites in the Prairie du Chien Group which have a moderate to high susceptibility to dissolution. These formations, the Shakopee and the Oneota, have a well-developed system of sinkholes and solution cavities known commonly as karst. The region containing the highest level of karst features underlies the Interstate 90, U.S. Highway 14, and former DM & E railway corridors making groundwater contamination resulting from a hazardous materials release along these routes of greater concern. The potential of rapid infiltration is somewhat mitigated by the high clay content of the loess based soils, which, depending on proximity to karst structures, provides some response time to control overland flow from reaching sinkholes or other pathways of rapid migration into the groundwater systems.

Essential Facilities

All critical facilities and communities within the county are somewhat at risk. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural failure due to fire or explosion and loss of function of the facility (e.g. a damaged police station will no longer be able to serve the community). Table 4-4 lists the types and numbers of all essential facilities in the area. Maps identifying critical facilities are located in Appendix C.

Building Inventory

A table of the building exposure in terms of types and value of buildings for the entire county is listed in Table 4-5. The buildings within the county can expect impacts similar to those discussed for critical facilities. These impacts include structural failure due to fire or explosion or debris and loss of function of the building (e.g. a damaged home will no longer be habitable causing residents to seek shelter).

Infrastructure

During a hazardous material release the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available to this plan it is important to emphasize that any number of these items could become damaged in the event of a hazardous material release. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); and railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

The U.S. EPA's ALOHA (Areal Locations of Hazardous Atmospheres) model can be utilized to assess the impact of releases of chemicals. ALOHA is a computer program designed especially for use by people responding to chemical accidents, as well as for emergency planning and training.

Vulnerability to Future Assets/Infrastructure for Hazardous Materials Storage and Transport Hazard

Any new development within the county will be vulnerable to these events, especially development along major roadways.

Analysis of Community Development Trends

Because the hazardous material hazard events may occur anywhere within the county, future development will be impacted. The major transportation routes and the industries located in Winona County pose a threat of dangerous chemicals and hazardous materials release.

4.4.9 Fire Hazard (Wildfires and Structural)

Previous Occurrences for Fire Hazard

In Winona County, there have been few fires, structure or wildfire, with significant numbers of deaths or injuries. Records of fires within the State of Minnesota for the years 1998 – 2010 were reviewed to establish data specific to Winona County. The information was obtained from the Office of the State Fire Marshall, a division of the Minnesota Department of Public Safety. Figure 4-1 details the number of fires for each year records are available, and the associated property loss respectively, categorized by property type. These reports include wildfires and structural fire counts.

Table 4-31: 5 year average (2000-2010) of fire occurrences in Winona County by department

Fire Department	Average Fire Runs	Average Other Runs	Average Dollar Loss
Altura Fire Dept	7	13	$252,500
Dakota City Fire Dept	7	57	$-
Goodview City Fire Dept	6	28	$-
Lewiston City Fire Dept	21	29	$186,880
Minnesota City Fire Dept	4	10	$-
Nodine Fire Dept	8	68	$35,720
Pickwick Volunteer Fire Dept	6	27	$4,700
Rollingstone City Fire Dept	5	10	$67,300
St. Charles Fire Dept	9	24	$9,187,360
Wilson Fire Dept	6	16	$-
Winona City Fire Dept	67	1,920	$102,250
Winona County as a whole	155	1,978	$ 5,198,543

*Source: State Fire Marshal "Fire in Minnesota Annual Report"

Table 4-32: Winona County Fire Occurrences

Year	Total # Fire Runs	Total # Other Runs	Total Dollar Loss	Fire Rate (1 fire/#people)	Average $ Loss/Fire	Fire Deaths
2001	154	1,512	$ 579,300	373	$ 4,323	2
2002	145	2,127	$ 312,450	387	$ 2,422	-
2003	165	1,560	$ 902,705	350	$ 6,313	-
2004	177	1,722	$ 816,250	327	$ 5,442	-
2005	160	1,795	$ 1,231,910	336	$ 8,438	
2006	150	1,898	$ 600,400	361	$ 4,415	-
2007	187	2,296	$ 456,060	290	$ 2,669	-
2008	146	2,358	$ 906,600	430	$ 7,953	-
2009	131	2,160	$45,527,250	430	$ 399,362	-
2010	139	2,356	$ 652,500	399	$ 5,305	
Average	155	1,978	$5,198,543	368	$ 44,664	

*Source: State Fire Marshal "Fire in Minnesota Annual Report"

4.4.9.1 Wildfires

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.

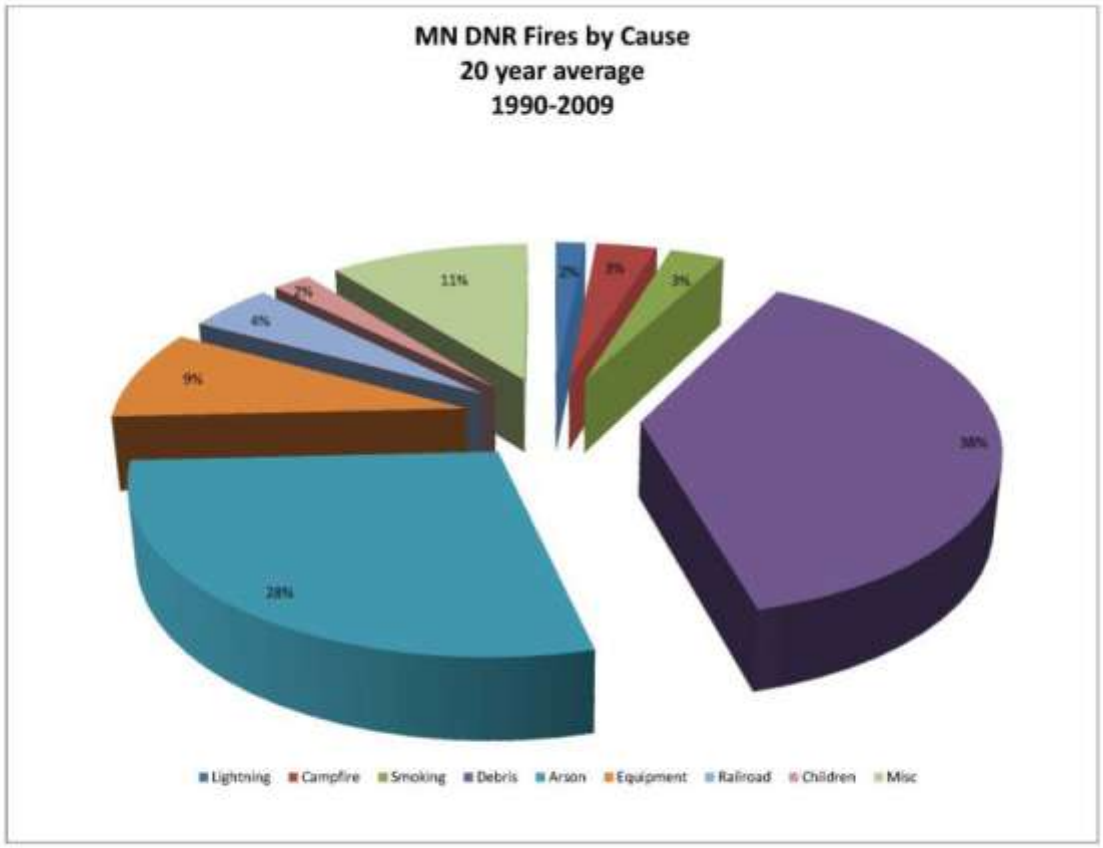
The indirect effects of wildfires can also be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil and waterways. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode 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. For outside and other fires, vulnerabilities are dependent upon fuel sources and availability.

From 1990 to 2009, the causes were aggregated from the various categories used by the DNR and presented below.


MN DNR Fires by Cause
20 year average
1990-2009
11%
2%
3%
3%
4%
9%
28%
38%
Lightning
Campfire
Smoking
Debris
Arson
Equipment
Railroad
Children
Misc

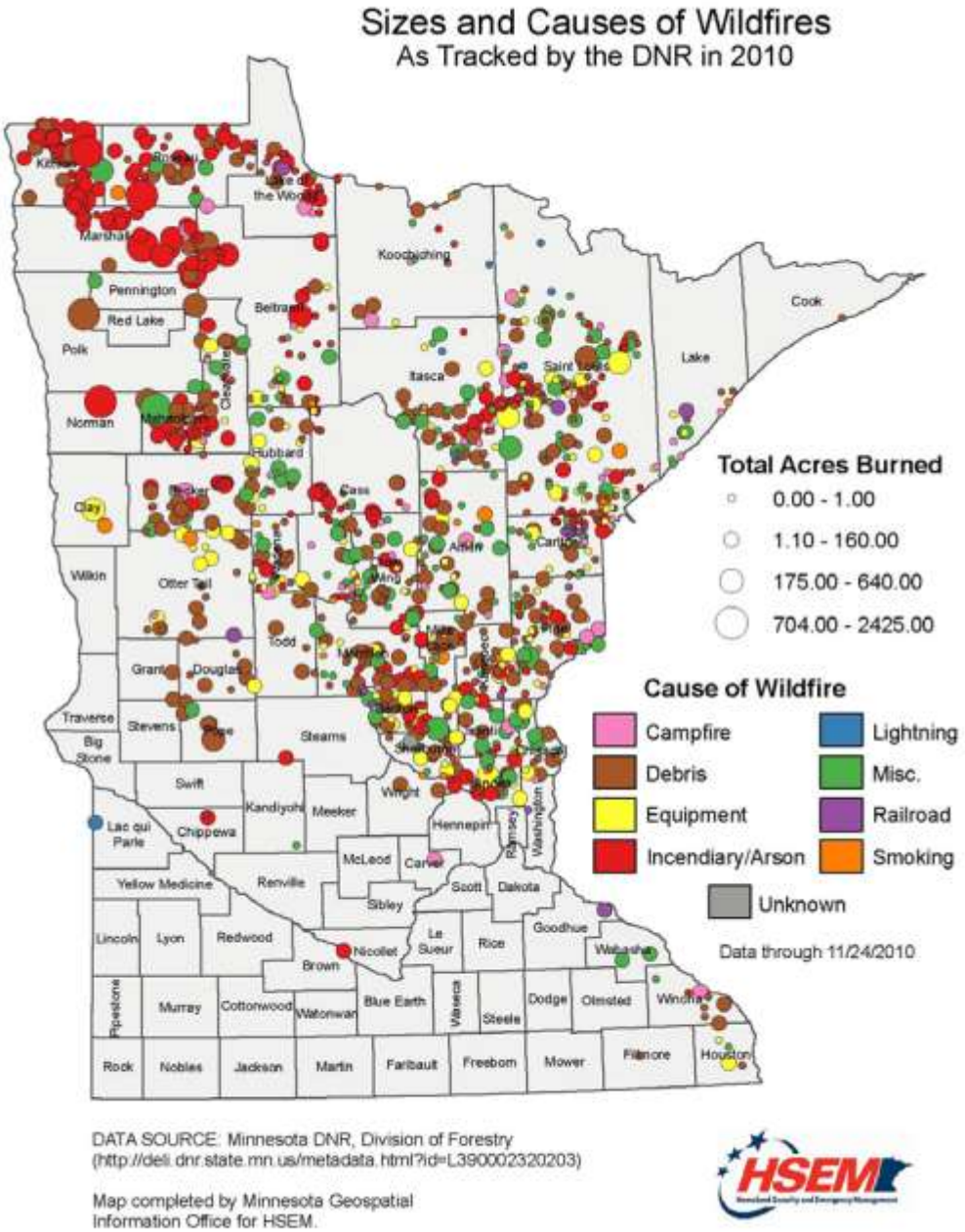

Sizes and Causes of Wildfires
As Tracked by the DNR in 2010
Total Acres Burned
0.00 - 1.00
1.10 - 160.00
175.00 - 640.00
704.00 - 2425.00
Cause of Wildfire
Campfire
Debris
Equipment
Incendiary/Arson
Lightning
Misc.
Railroad
Smoking
Unknown
Data through 11/24/2010
Koochiching
Cook
Lake
Pennington
Red Lake
Polk
Norman
Hubbard
Clay
Wilkin
Otter Tail
Todd
Grant
Douglas
Traverse
Stevens
Big Stone
Swift
Kandiyohi
Meeker
Lac qui Parle
Chippewa
Yellow Medicine
Renville
McLeod
Carver
Scott
Dakota
Sibley
Lincoln
Lyon
Redwood
Brown
Nicollet
Le Sueur
Rice
Goodhue
Pipestone
Murray
Cottonwood
Watonwan
Blue Earth
Waseca
Steele
Dodge
Olmsted
Rock
Nobles
Jackson
Martin
Faribault
Freeborn
Mower
Fillmore
Houston
DATA SOURCE: Minnesota DNR, Division of Forestry
(http://deli.dnr.state.mn.us/metadata.html?id=L390002320203)
Map completed by Minnesota Geospatial
Information Office for HSEM.
HSEM

Table 4-33 Winona County Wildfire Data

Winona County Wildfires (2000-2010)	
Average fires/year	11
Average Acres/fire	3
Average Acres/year	29
Average cost per fire	$657
Total Cost	$68,943

***Minnesota Hazard Mitigation Plan*

Probability of Occurrence Wildfire

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.

4.4.9.2 Structural Fire Hazard

Definition for Structural Fire Hazard

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
- *Public and mercantile*: stores, restaurants, grocery stores, institutions, churches, public facilities, education.
- *Industrial, Manufacturing, Other*: 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.

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.

Geographic Location for Fire Hazard

Structural fire hazards occur countywide and therefore affect the entire county. The heavily forested areas in the east of the county have a higher chance of widespread fire hazard.

Risk Identification for Fire Hazard

Based on historical information, the probability of a fire is low. The planning team determined that the potential impact of a fire is minimal; therefore, the overall risk of a fire hazard for Winona County is low.

Vulnerability Analysis for Fire Hazard

Hazard impacts are distributed across the entire jurisdiction equally. Therefore, the entire population and all buildings within the county are vulnerable to fires and can expect the similar impacts.

Essential Facilities

All critical facilities are vulnerable to fire hazards. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural damage from fire and water damage from efforts extinguishing fire. Table 4-4 lists the types and numbers of essential facilities in the area. Maps identifying essential facilities are included in Appendix C.

Building Inventory

A table of the building exposure in terms of types and value of buildings for the entire county is provided in Table 4-5. Impacts to the general buildings within the county are similar to the damages expected to the critical facilities. Due to the difficulty predicting which communities are at risk, the entire population and all buildings have been identified at risk. These impacts include structural damage from fire and water damage from efforts to extinguish the fire.

Infrastructure

During a fire the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a fire. Potential impacts include structural damage resulting in impassable roadways and power outages.

Vulnerability to Future Assets/Infrastructure for Fire Hazard

Any future development will be vulnerable to these events. Our fire response is considered good, though there is room for improvement. Continuous improvement of building codes will reduce future vulnerability.

4.4.10 Sinkholes and Subsidence (Karst) Hazard

Hazard Definition for Karst

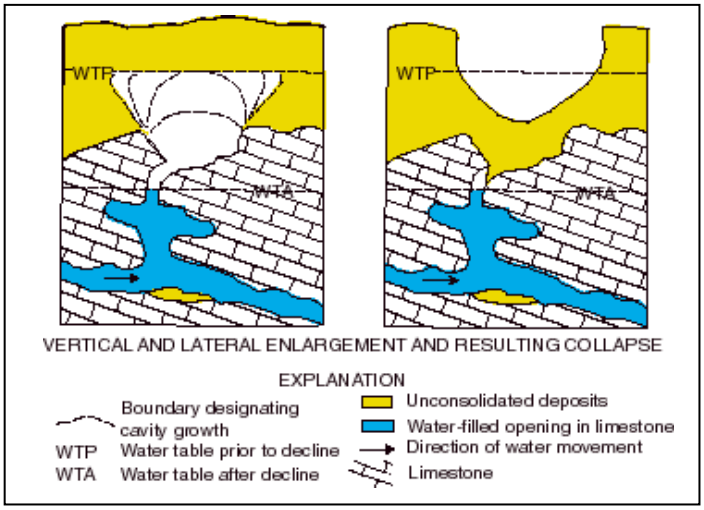
The karst system with its capabilities of rapid flow of water from the land surface and the thin or nonexistent layers of soil in many areas above the bedrock makes the groundwater susceptible to contamination from nonpoint pollution and catastrophic events such as spills. Storage of liquid materials and certain other structures built on this landscape are more susceptible to failure because of the possibility of formation of karst features in the underlying carbonate rock.

The upper bedrock layer in much of Winona County is the Prairie du Chien group comprised of carbonate rock. Carbonate rock such as dolomite has low porosity and permeability but over time exposed to slightly acidic rainwater, the rock dissolves. Dissolution features such as sinkholes, stream sinks, caves, and blind valleys comprise the visible karst landscape.

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.

The main triggering mechanisms for subsidence are:

- Water level decline
- Changes in groundwater flow
- Increased loading, and
- Deterioration



Water level decline can happen naturally or be human induced.

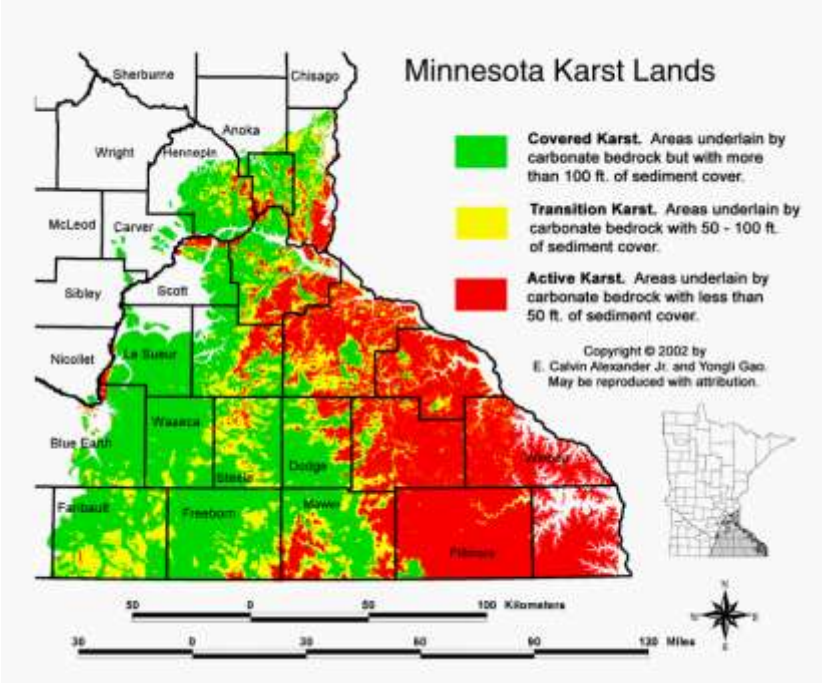
Main factors in water decline are:

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

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.

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.

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. The map below illustrates the karst areas in Minnesota.



Source: University of Minnesota, Minnesota Geological Survey

Previous Occurrences for Karst

Geographic Location for Sinkholes and Subsidence Hazard

Limestone and dolomite underlie the southeastern corner of the state. These 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. Erosion has removed most of this glacial cover and

exposed the carbonate bedrock. Neighboring counties with karst features include Wabasha, Houston, and Fillmore.

In an effort to provide useful information for planning purposes, Minnesota DNR, MGS and U of M track the dynamic attributes of the karst systems through the maintenance of a karst feature database. The existing database mapped reveals the karst features shown on the Karst Features Map for Winona County. Sinkhole distribution and the probability of sinkhole formation in Winona County were specifically studied by Daglesh and Daglesh and Alexander and Magdelene. The findings of their work indicate that sinkholes are found where the Prairie Du Chien group is found. Sinkholes are generally clustered and the best predictor of sinkholes forming is where density of existing sinkholes is the highest.

Sinkhole probability is highly site-specific, and cannot be accurately characterized on a countywide basis, except in the most general sense. The probability is thus rated as high, although the rating is intended only for general comparison to other hazards that are being considered in this stage of the planning process.

Water Supply Contamination

Water is one of the most highly valued resources in the world. The protection and maintenance of the water supply is of the utmost importance to a sustainable community and region. Appropriate measures should be taken to adequately prevent ground water pollution from taking place. The importance of groundwater for rural residences, businesses, industries, and agriculture can be seen throughout the County. Therefore, proper assessment of potential threats should be considered to encourage and promote public and private land use decisions that will provide long-term protection of groundwater resources.

Aquifers, or bodies of saturated rock or sediment through which water can move readily, provide the ground water for Winona County. Residents of Wnona County obtain their water solely from ground water resources. In rural areas, individual wells serve as the source for water. Contaminated surface water can move into groundwater aquifers through improperly sealed wells in the limestone formations characteristic of southeastern Minnesota. The fractured jointed rocks transmit water rapidly, with little or no filtration. Improperly sealed wells allow contact with the various rock strata along the length of the well. Thus, contamination originating in one permeable layer can flow down along the well bore and into another aquifer below. In this way localized contamination can spread unnoticed to distant regions and different aquifers. Contamination sources include sewage effluent, dumps, spills, landfill leachate, urban and agricultural runoff, and private, municipal, and industrial waste. As a result of these processes, many wells in the southern portions of Minnesota contain coliform bacteria or elevated nitrate levels. Furthermore, Rice County reported cases of parasitic diseases such as giardiasis and cryptosporidiosis may be related to contaminated drinking water.

Currently, the Cities of Winona, Goodview, Lewiston and Utica have Wellhead Protection Plans in place, detailing the following information: delineation of the Wellhead Protection Area (WHPA), location of the Drinking Water Supply Management Areas (DWSMA), potential contamination sources within the DWSMA, as well as, goals, objectives, and management strategies to deal with the contamination source of concern. The Cities of Altura and St. Charles are in the process of developing Wellhead Protection Plans.

Risk Identification for Karst

Probability (x) Impact (=) Overall Risk

Based on historical information, the overall probability of hazards resulting from sinkholes and subsidence in the county is high. The planning team determined that the potential impact of karst-related hazards is moderate, and that therefore the risk from sinkholes and subsidence for Winona County is elevated.

Vulnerability Analysis for Karst Hazard

Impacts from karst vary considerably across the entire jurisdiction. The main concern from karst is the damage that can occur, both immediately and over the long term, from contamination of our groundwater, upon which all of the county's residents rely.

As described in previous sections, the geology of Winona County is conducive to the rapid spread of surface contaminants, from accidental spills or general use, of hazardous chemicals. The bedrock of the upland area of the county is composed mostly of dolomites with a moderate to high susceptibility to dissolution. These formations have a well-developed system of sinkholes and solution cavities, which allow rapid migration of surface into the groundwater systems.

Based on surveys of residents, and local government and state agency recommendations, the priority concerns for Winona County's water resources are:

List of Priority Concerns

The following priority concerns were identified through reviewing citizen surveys, responses from local units of government for input, and from recommendations of the state review agencies:

1. Water Quality – Protecting groundwater; addressing Clean Water Act impairments and protecting surface waters; and effectively managing those land areas at the water/land interface such as riparian lands, floodplains, and sensitive groundwater recharge areas in karst settings.

2. Soil Erosion, Sediment Control and Stormwater Management - With the steep topography and extreme soil erosion potential, control of erosion and sediment is a concern on agricultural lands and for residential and urban development. Effective stormwater management includes water retention and infiltration that reduces soil erosion, improves hydrologic processes and reduces flooding.

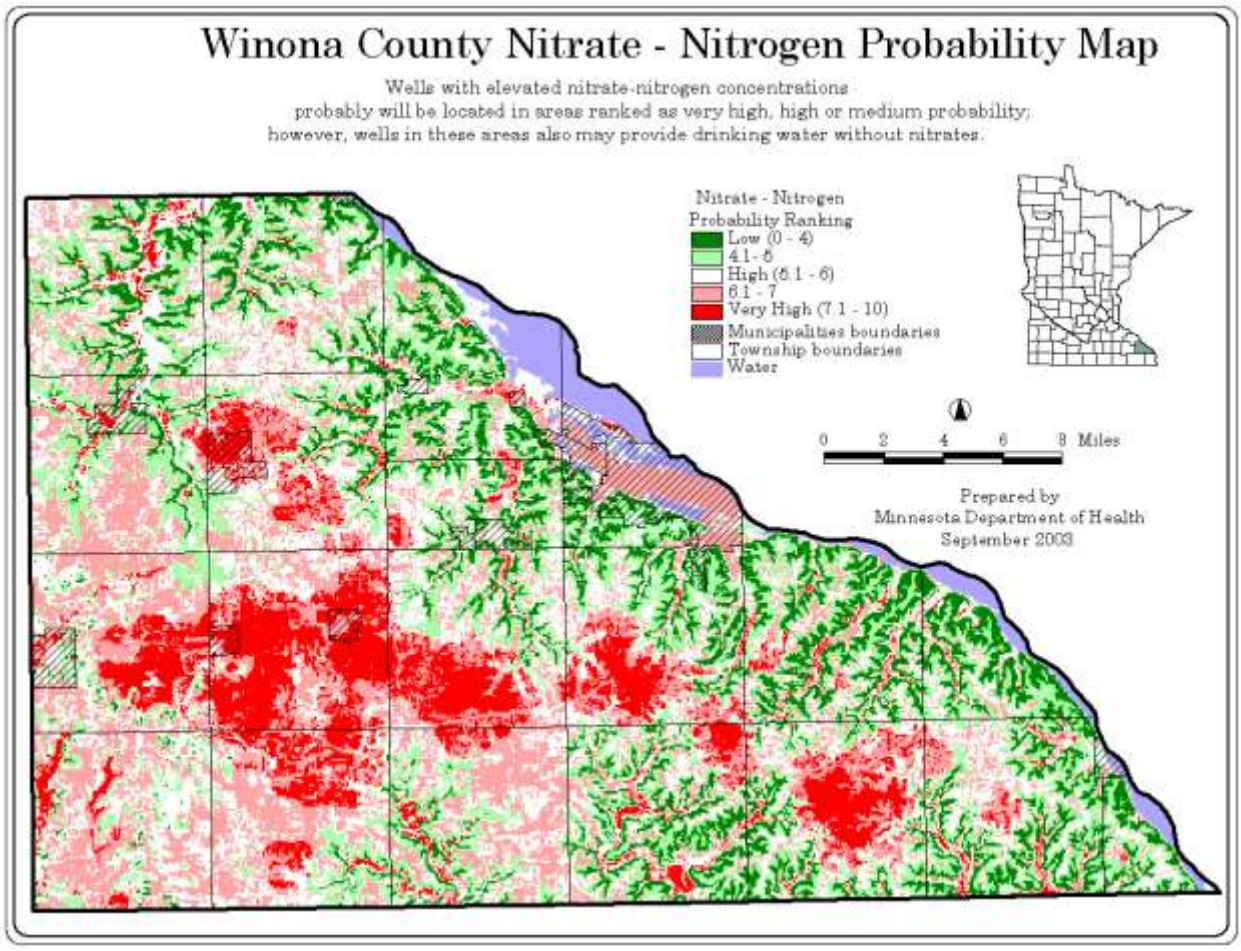
3. Nutrient, Manure and Human Waste Management – Waste generated from feedlots and from septic systems are assumed to contribute to the Clean Water Act recreational impairments as measured by fecal coliform exceedances that occur in several streams in the county. Wastes from feedlots and septic systems as well as from commercial fertilizers can be contributing factors to the high nitrate concentrations found in some wells and streams in the county.

4. Watershed Management Approach – The water plan update is required to address the water resources across the entire county. The priority concerns mentioned above and other concerns that have been previously identified have different impacts in different

watersheds. For example, impacts of residential development are of greater significance in the watersheds that are in and around the City of Winona. A watershed approach provides for a context for integrating programs, and emphasizing and addressing the most significant concerns in any given watershed. In addition, this approach provides a context for collaboration with existing organizations including watershed organizations.

The Minnesota Department of Health (MDH) has developed a nitrate-nitrogen (nitrate) probability map for Winona County, Minnesota, to assist with state and local water quality planning efforts. The probability map identifies areas of the county with relatively very high, high, moderate, and low probability of having elevated nitrate concentrations in groundwater drinking water supplies. Nitrate presence in water is widely used as a marker for likelihood of pesticides in groundwater, testing for which is far more expensive. Funding for this project was provided by the United States Environmental Protection Agency (US EPA) under section 106 of the Federal Clean Water Act for Federal Fiscal Year 2003.

The "Winona County Nitrate-Nitrogen Probability Map" was developed from available information in the data bases that can be illustrated in spatial, Geographical Information System (GIS) formats. The probability rating on the map represents nitrogen input and aquifer sensitivity. Using this criteria, most of Winona County is susceptible to nitrate contamination.



Infrastructure

Experience has shown that ponds, wastewater treatment ponds, manure lagoons are the types of infrastructure most at risk from karst. Several communities have had their wastewater treatment ponds collapse and disappear overnight.

4.4.11 Human-caused Hazard

4.4.11.1 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.

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.

4.4.11.2 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 4-34 Infectious Disease History

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.

Section 5 - Mitigation Strategy

The primary objective of mitigation is to reduce future impacts of hazards, including property damage, disruption to local and regional economies, and the amount of public and private funds spent to assist with recovery. The purpose of the Hazard Mitigation Plan is to determine how to reduce or eliminate the loss of life and property damage resulting from natural and human-caused hazards. Mitigation is an ongoing process adapting over time to accommodate a community's needs. This plan identified nine hazards that have and will affect Winona County. The risks of these hazards and vulnerabilities have been assessed.

From these assessments, hazard mitigation actions have been developed to reduce impacts of specific hazards. Mitigation actions can be organized into eight broad categories of implementation approaches.

- **Prevention** - local government taking steps to minimize the impact of hazards (planning, regulations, and capital improvement programs.
- **Protection of Critical Facilities** – certain public and private facilities are critical for daily activities in communities and for emergency response.
- **Protection of Private Property** – local government and property owners can apply best management practices to reduce the vulnerability of private property.
- **Public Education and Awareness** – an informed public will have the information to take appropriate steps to reduce vulnerability.
- **Natural Resources Protection** – natural resources are important for our economic activities and critical green infrastructure.
- **Emergency Services** – public and private sector capabilities to respond to a disaster.
- **Structural Improvements** –the construction of structures to reduce the impact of a hazard.
- **Coordination/Cooperation** – local governments and private sector taking steps to implement mitigation strategies and strengthen emergency response.

5.1 Community Capability Assessment

The Capability Assessment identifies current activities used to mitigate hazards. This assessment identifies the policies, regulations, procedures, programs, and projects that contribute to the lessening of disaster damages. The assessment also provides an evaluation of these capabilities to determine whether the activities can be improved in order to more effectively reduce the impact of future hazards. The following sections identify existing plans and mitigation capabilities within all of the communities listed in Section 2 of this plan. Additionally, the Community Profiles (Appendix A)

provide detail mitigation actions taken, and future mitigation goals of each of the cities within Winona County.

5.1.1 National Flood Insurance Program (NFIP)

All communities within Winona County participate in the NFIP program, with the exception of Altura and Utica. Table 5-1 provides community participation data.

The county and incorporated areas do not participate in the NFIP'S Community Rating System (CRS). The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS:

1) reduce flood losses;
2) facilitate accurate insurance rating
3) promote the awareness of flood insurance

Winona County has recently identified participation in the CRS as a future action item.

Table 5-1 Community Participation in the NFIP

Community Name	CID Number	FIRM Date	FHBM Date	Current Effective Map Date	Tribunal
Dakota	270526#	06/15/82	08/02/74	06/15/82	No
Elba	270527#	11/01/78	08/09/7	11/01/78	No
Goodview	270528#	06/15/82	05/17/74	06/15/82	No
Lewiston	270914	01/01/50	-	01/01/50	No
Minneiska	270489#	06/20/00	07/11/75	06/20/00	No
Minnesota City	270529#	07/19/82	08/02/74	07/19/82	No
Rollingstone	270530#	07/19/82	08/02/74	07/19/82	No
St. Charles	270531#	04/15/82	05/24/74	04/15/82	No
Stockton	270532#	08/02/82	08/23/74	08/02/82	No
Winona City	275250#	04/21/72	-	08/19/97	No
Winona County	270525#	01/18/84	10/18/74	01/18/84	No

Federal Emergency Management Agency

5.1.2 Plans and Ordinances

Winona County and its incorporated cities have plans and ordinances to regulate storm water management, development and construction, and existing and future land use. Adoption dates of these plans are listed in Table 5-2 below.

As a small county, there is substantial communication across departments and communities. Staff are continuing to cross paths on a daily bases, and as a result, integration of plans is natural and well-facilitated. Regularly monthly meetings of the WCECC are especially well-attended, and reinforce shared outcomes.

Table 5-2: Description of Zoning Plans/Ordinances

Community	Comp Plan	Zoning Ordinance	Storm Water Mgmt
Winona County	2001	2010	n/a
City of Winona	2007	2009	2007
City of Goodview	2008	1979	-
City of St. Charles	2011	2010	2003
City of Lewiston	2011	2009	-

Comprehensive Land Use Plan

The Winona County Comprehensive Plan serves as a guide for the development and conservation of Winona County's land and water resources. The GIS technology that underpins the plan effectively allows local officials across the county to evaluate and guide development proposals and that are consistent, fair and impartial.

The county has begun the process of updating its Comprehensive Plan, and has prioritized the broad engagement and collaboration of county residents in its development, in what is anticipated to be an especially open and transparent process.

Comprehensive Local Water Management Plan

Updated in 2011, the Water Management Plan is an expansive review of the County's water resources and provides detailed guidance on water management.

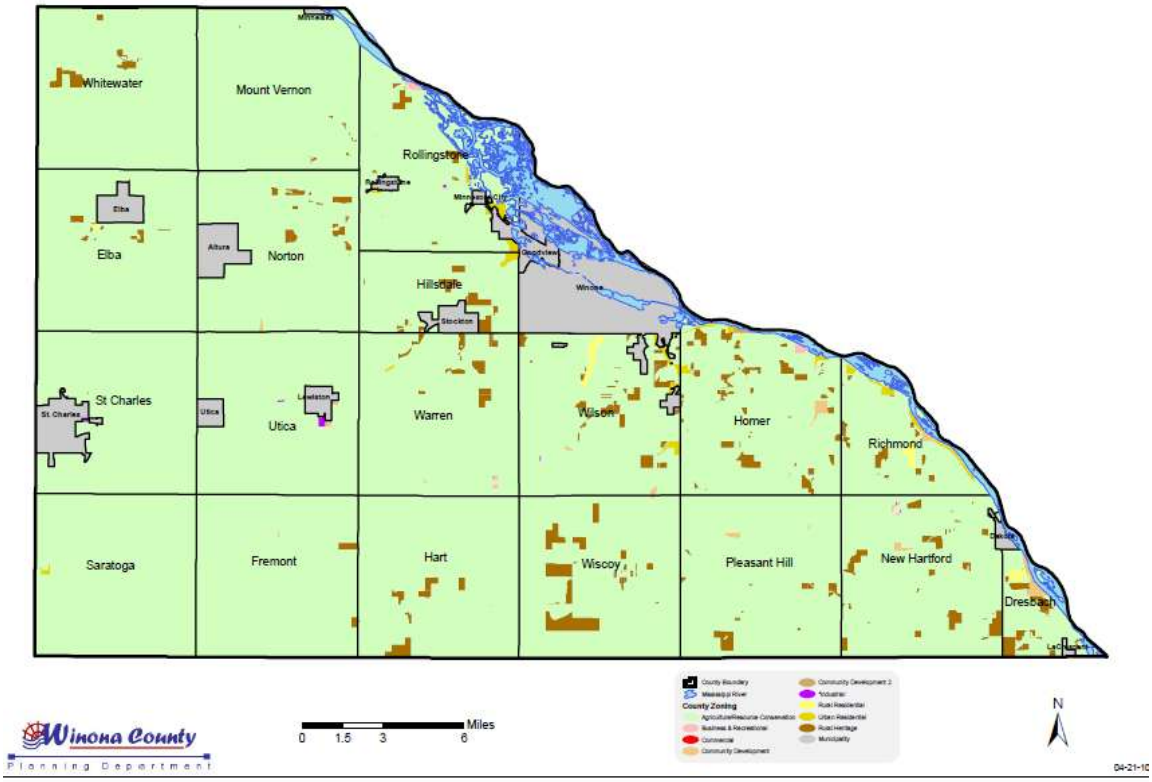
Zoning Ordinance

Adopted in December of 2010, the purpose of the Winona County Zoning Ordinance is to regulate the use of land within the county, the location, size, use and height of buildings; the arrangement of buildings on lots, and the density of population, for purposes of:

- Protecting the public health, safety, order, convenience and general welfare.
- Protecting and preserving agriculture.
- Conserving the natural and scenic beauty of the County.
- Conserving natural resources in the County such as streams, wetlands, groundwater, recharge areas, bluffs, steep slopes, woodlands and soils.
- Minimizing pollution.
- Protecting existing businesses and facilities.
- Conserving energy by allowing solar and earth sheltered housing and wind conversion structures.
- Promoting orderly development and redevelopment of the residential, commercial, industrial, and public areas as well as the preservation of agricultural areas.

- Providing for the compatibility of different land uses and the most appropriate use of land throughout the County.
- Encouraging cooperation among governmental agencies to help achieve land use policy goals.
- Fair and efficient enforcement of land development regulations including the discontinuance of existing uses.
- Promoting in a financially responsible manner orderly development of the community to insure adequate levels of service in areas of public safety, utilities, transportation and administration.
- Ensuring the fair and non-discriminatory administration of this Ordinance by allowing administrative decisions rendered by the Planning Department to be appealed through a recognized process.
- The Winona County Zoning Ordinance requires a 50-foot, permanent vegetative buffer adjacent to protected waters in agricultural areas unless the landowner has an approved Resource Management System.

Winona County Zoning Map



5.1.3 Fire Insurance Rating

Fire Insurance Rating Programs/ Policy

Table 5-3: Winona County Fire Department Ratings

Department	Fire Insurance Rating	Number of Firefighters
Altura		
Dakota	ISO 8	18 full-time volunteers
Goodview	ISO 6	28 full-time volunteers
Hidden Valley	ISO 8	12 full-time volunteers
Lewiston		
Minnesota City	ISO 9	19 full-time volunteers
Nodine		13 full-time volunteers
Pickwick		
Ridgeway		
Rollingstone		
St. Charles	ISO 5	28 full-time volunteers
Wilson		
Winona	ISO 3	21 full-time and 24 paid on-call

5.2 Mitigation Goals

In Section 4 of this plan, the risk assessment reviewed nine hazard categories that impact Winona County. The AHMP planning team members understand that although hazards cannot be eliminated altogether, Winona County can work toward building disaster-resistant communities.

The following four goals identified by our communities. These goals represent long-term, broad visions of the overall vision the county would like to achieve for mitigation.

Goal #1 Maintain and enhance the County's capacity to continuously make Winona County less vulnerable to all hazards.

Objectives

- *Prevent injury and death*
- *reduce economic losses for residences, business, industry, government and schools through activities which protect life and property and prevent repetitive damage and loss.*

- *utilize all opportunities to design and upgrade/modify critical facilities, integrating and coordinating natural hazard mitigation activities with emergency operations plans and procedures, where appropriate.*

- *improve hazard mitigation information so that effective prevention activities and measures can be produced and implemented.*

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

Objectives

- *protect life, property and environment through natural resource management and land use planning i.e. flooding, karst geology, wildfire and environmental health.*

- *projects to ensure the protection of critical facilities, services and infrastructure.*

- *preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.*

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

Objectives

- *strengthen collaboration and coordination among public agencies, non-profit organizations, business and industry emphasizing the following three areas:*

  a. Location of facilities and personnel for response
  b. Identification of response areas (jurisdictional concerns)
  c. Review of mutual aid agreements

- *provide support to communities and jurisdictions to facilitate implementation of relevant plans.*

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

Objectives

- *Host public meetings during planning processes that encourage public participation and informs the public of the risks associated with hazards and their role in hazard mitigation.*

- *Stimulate interest and awareness of hazard prevention/mitigation through a public education campaign using all forms of media and by attending other people's meetings i.e. Chamber, service groups and community organizations (short-term).*

- *Develop and implement an education and outreach program that increases public awareness of the risks associated with natural hazards with an emphasis on the*

importance of environmental health and public health to the prevention of and response to disasters (long-term).

5.3 Mitigation Action Analysis

Upon completion of the risk assessment and development of the goals for the 2005 plan and 2008 plan amendment, the planning committee and cities in Winona County established a set of mitigation action steps. The list of actions adopted in this process are comprised Table 5-4 below. Although there are many action steps yet to be fully implemented, as Table 5-4 shows, with few exceptions, the action steps remained consistent with those developed in earlier planning processes.

Appendix A includes a detailed, community-by-community review of progress on actions to date.

Priority County Action Steps

The County will give especially high to the following mitigation efforts in the future:

1. Work with Mn DNR and FEMA to develop Risk Map, utilizing Level 2 Hazus analysis
2. Fully utilize GIS system for emergency management
3. Work closely with our cities and townships to support them in the meeting their goals. In particular, provide them with educational materials they can disseminate to their residents.
4. Review and evaluate the opportunity for implementation of the Community Rating System
5. Expand the local awareness and utility of the National Grid

5.4 Implementation Strategy

Implementation of the mitigation plan is critical to the success of the planning process. The first step is to identify and prioritize actions. In order to establish priorities, an analysis and prioritization of the actions is important. Some actions may occur before the top priority due to financial, engineering, environmental, permitting, and site control issues. Public awareness and input of these mitigation actions can lead to increased grant funding opportunities.

For each mitigation action related to infrastructure, new and existing infrastructure was considered. Additionally, the mitigation strategies address continued compliance with the NFIP. The respective city councils, in collaboration with the All-Hazard Mitigation Planning Team, reviewed community actions, while the thirty-member Planning Committee (WCECC) reviewed the county-wide goals and actions. Most importantly, planning committee and planning team members met individually with each community in 2010 and 2001, with staff as well as city council meetings, to establish priorities and review progress to date. Hazard risk, projected benefits and estimated costs, including local budgets and grant opportunities, were considered and incorporated into the prioritization process. A list of the meetings where the goals and actions were reviewed is located in Appendix D.

In coming years, availability of Level 2 HAZUS analysis data will make this prioritization process stronger. Table 5-4 below presents an overall summary of progress to date on the mitigation action steps and projects developed and implemented by the broadly representative Planning Committee (WCECC).

Mitigation actions are listed in the following table by hazard category and are described by priority, mitigation action, implementing jurisdiction including the lead agency or person, state strategy, resource availability, year adopted, progress, and action completed.

The priority column is based on several factors that, in part, are an identification of the feasibility of the strategy. The costs for each strategy are not a part of this plan but must be developed at the time that the strategy is considered for implementation. The feasibility of each strategy is based on several factors that will need to be updated at the time the strategy is reviewed for implementation. Those factors considered were:

- Legality of the strategy based on state law/rules as well as mandates;
- Resource availability – staff, funding, ongoing program or activity, capabilities of the community;
- Cost of strategy;
- Effectiveness of the strategy; and
- Capacity for implementation – community understanding and acceptance.

The designations in each column of the table are classified as follows:

Priority

Low (L)
Medium (M)
High (H)

Resource availability

Not funded (NF)
Partially funded (PF)
Currently funded (CF)

The lead agency on implementation of the actions yet to be completed is identified in bold type in the column entitled "Implementing Jurisdiction and Lead".

Table 5-4: Comprehensive All Hazard Mitigation Actions

Priority	All Hazard Mitigation Action	Implementing Jurisdiction & Lead	State Strategy	Resource availability	Year Adopted	Progress	Action Complete
H	Compatible communication technology (radios) among emergency response staff.	Winona County and all participating jurisdictions	Emergency Services		2008	Fully implemented in 2012	✓
H	GIS Parcel Mapping	Winona County Planning Office	Structural Improvement		2005	Completed Sept. 2006	✓
H	Communications Plan	Sheriff's Dept./WCECC	Emergency Services	Currently funded (CF)	2005	Completed; is the state 800 mhz system	✓

H	Fire Depts. & Emergency Management Services Mutual Aid and Hazardous Materials Services Agreements	WCECC/**Emergency Manager**	Emergency Services	Currently Funded (CF)	2005	Many in place; continue to develop more	2015
M-H	GIS Analysis of Emergency Services Response Times to Determine Response Areas	Winona County Planning & Environmental Services Department with **Cities and Townships**	Emergency Services	Currently funded (CF)	2005	Progress; have capability for routing analysis	2015
H	Public Awareness and Education Program on Hazard Mitigation Activities for All Hazards	WCECC/**Emergency Manager**	Emergency Services	Currently Funded (CF)	2005	Have shared information with cities; on-going	On-going
M	Critical Facilities Hardening	Winona County Emergency Manager, Cities	Emergency Services	CF for assessment; NF for actual hardening	2005	Full identification of critical facilities still in progress via HSEM directed THIRA	On-going
H	GPS Critical Facilities	**Winona County Planning & Environmental Services Department**	Structural Improvement	Currently Funded with existing staff	2005	Will complete subsequent to final list of facilities	2014
H	Assessment of need for additional emergency operation centers in Winona County.	St. Charles	Emergency Services	CF with existing staff	2008	Assessment completed	✓
H	Update of outdoor warning sirens to be compatible with 2013 federal requirements.	Winona, Altura, Dakota, Elba, Stockton	Emergency Services	Funded with current staff	2008	Completed By 2010	✓
H	Private water supply protection including well sealing, well hardening and repair to meet well code.	**Winona County**	Structural Improvement	NF; funded through grants	2008	Will continue; is an on-going effort	On-going
H	Private water supply protection through decontamination/disinfection of wells.	**Winona County**	Emergency Services	Currently funded; kits sold at cost to residents	2008	Provides water test kits to residents	On-going
H	Public water supply protection.	Elba, Lewiston, Stockton and all cities	Structural Improvement		2008	Targetted projects completed; but really on-going	✓
H	Assessment and development of all-hazard shelters.	Winona County and **all participating jurisdictions**	Emergency Services	CF with existing staff	2008	Completed by some though not all	2014
H	Assessment of hazard damaged septic systems and grants/loans for pumping, inspections, new installation and repair	**Winona County** (Rollingstone Township), Elba, Minnesota City	Structural Improvement	CF unless disaster; then grants needed	2008	Targets finished by 2011; but is on-going	✓
L	Adoption of building code and inspection program.	**Winona County**	Prevention	NF; no staff available for inspections	2008	Opposition at local level stalled progress in 2009	Uncertain

H	Development of GIS decision support system that would include updating spatial and non-spatial data (such as Karst features and landslide vulnerabilities), modeling, project cost benefit evaluation, and hazard event record storage including substantial damaged structure information.	**Winona County**, Utica	Prevention and Public Education	PF; can implement w/existing staff, but any potential costs of software not secured	2008	Have identified karst features, slopes; set with data & infrastructure; HAZUS software incompatibility has prevented completion	2014
H	Backup generators for protection of public services.	Altura, Dakota, Lewiston, **Utica**	Emergency Services	NF; likely reason not entirely completed	2008	Completed by all but Utica	2014
H	Review and evaluate opportunity for implementation of the Community Rating System	**Winona County Planning Department**	Prevention	CF	2010	Have begun	2014
H	Expand the local awareness and utility of the National Grid	**Winona County Planning Departmen**t	Public Education and Awareness	CF	2010	Yet to begin	On-going
H	Work closely cities and townships to support achievement of their mitigation goals	**Winona County Emergency Services** and Planning Departments	Emergency Services	CF	2010	Progress made	On-going
H	Bury overhead power lines, updating and improving electrical grid reliability and support technologies and infrastructure	All Participating Jurisdictions	Structural Improvement	Grant funds and local budgets	2013	Is an on-going effort	Ongoing
M-H	Improve/repair aging storm drainage ditches and easements to adequately control storm water runoff	Winona County and All Participating Jurisdictions	Structural Improvement	Grant funds and local budgets	2013	Is an on-going effort	Ongoing
H	Update of Communication and alert system for community/region	All Participating Jurisdictions	Structural Improvement	Grant funds and local budgets	2013	Is an on-going effort	Ongoing
Priority	**Flood Mitigation Actions**	**Implementing Jurisdiction**	**State Strategy**	**Resource Availability**		**Progress**	**Action Complete**
M-H	Development of multiple methods for warning residents of hazards including countywide AM/FM radio station, distribution of NOAA Weather Radios, and cell phone coverage in areas with no present coverage. Warning sirens additions, and education/outreach	Winona County and **all participating jurisdictions**	Emergency Services	Partially funded (PF)	2008	Much progress made; esp. in areas with worst reception improved	On-going
H	Minor road, bridge and culvert repair including clean out of structures.	Winona County and all participating jurisdictions	Structural Improvement	PF; local budgets not sufficient	2009	Flood targets completed; but need is on-going	✓
M	Technical assistance and administration to survey, design agricultural conservation/water retention structures	Winona County & **SWCD**	Structural Improvement	NF; sufficient staffing not available	2008	On-going	2016
H	Update floodplain management ordinances to ensure consistency with FEMA and MN DNR requirements.	Winona County and all **participating jurisdictions**	Prevention	PF; may be challenging for some small cities	2008	Will be completed subsequent to availability of new maps	2015
H	Acquisition of substantial and repetitive damaged structures and parcels/lots for open space use.	Winona County, Elba, St. Charles, Stockton	Property Protection	NF; FEMA grants funded	2008	Flood targets completed; ongoing	✓
H	Acquisition of substantial and repetitive damaged structures and	Winona County, Elba, St. Charles,	Property Protection	NF; FEMA grants	2008	Completed as recommended;	✓

	parcels/lots in the 100 year floodplain for open space use.	Stockton		funded		on-going	
H	Acquisition of substantial and repetitive damaged structures in the 100 year floodplain with the lot remaining for rebuilding in compliance with current floodplain regulation.	Winona County, Elba, St. Charles, Stockton	Property Protection	Not funded; grants needed	2008	Flood targets completed; on-going as needed	✓
H	Elevation of existing substantial damaged structures in the 100 year floodplain with approved elevation methods including surveys required	Winona County, Elba, St. Charles, Stockton	Property Protection	Funded with FEMA grants	2008	Completed as recommended; on-going as needed	✓
H	Acquisition of substantial and repetitive damaged structures and parcels/lots in the contiguous areas where there are identified secondary areas of flooding (i.e. 500 year floodplain).	Winona County, Elba, St. Charles, Stockton	Property Protection	Funded with FEMA grants	2008	Completed as recommended; ongoing as need	✓
H	Rain and stream gage triggered flood warning systems in targeted watersheds.	Winona County, Elba, Minnesota City, Stockton	Emergency Services	Funded through MN DNR	2008	Have been installed on the Whitewater; ongoing need	✓
H	Repair of dikes and levees.	Winona, Elba	Structural Improvement	Funded with FEMA grants	2008	Completed as recommended; ongoing	✓
H	Planning and technical assistance for flood control structures in select watersheds.	Winona County, Stockton, Elba and Goodview	Structural Improvement	PF; local staff not sufficient	2008	NRCS & SWCD assisting landowners in planning and construction; on-going	✓
H	Planning and technical assistance for storm water management.	Winona County, Altura, Elba, Lewiston, St. Charles, Stockton, Utica, **all jurisdictions**	Structural Improvement	NF; current staffing levels generally not adequate	2008	Much completed, but more to do on this topic for all jurisdictions	✓
M	Hydraulic/Hydrological Studies in select watersheds.	**Winona County Watershed Districts**, Stockton, Elba, Goodview and Winona	Structural Improvement	CF; with current staffing and grants	2008	Many studies of watersheds completed; ongoing	✓
H	Land acquisition for floodplain and/or flood control management.	Winona County, Elba	Structural Improvement	NF; financed with FEMA grants	2008	Flood targets completed; ongoing	✓
H	Extension of centralized water and sewage to replace structurally damaged (water/wastewater) on-site systems.	Winona County, Goodview	Structural Improvement	Financed with FEMA grants	2008	Flood targets completed	✓
M	In stream and near stream debris removal and floodplain vegetation management.	Winona County (Rollingstone, Hillsdale, Warren, Wilson, Homer, Elba townships), Minnesota City, St. Charles, Stockton	Land use planning and Natural Systems	PF	2009	Flood targets met; but additional response limited due to lack of staff; on-going	✓
M	Inventory of water retention structures throughout the county.	Winona County, **Winona County SWCD,** Stockton	Structural Improvement	Funded by SWCD	2008	Completed via aerial photo analysis	✓
M	Adoption of Storm water and Erosion Control Ordinances	Winona County Planning Office, Cities and Townships	Structural Improvement	PF; partially funded	2005	In process	2015

M	Repair of new water retention structures in agricultural areas.	Winona County SWCD	Structural Improvement	NF; staff is limited	2008	Some progress made	2016
H	Adoption of National Flood Insurance Program by all jurisdictions not currently participating	**Altura, Lewiston, Minneiska** (working with Wabasha County)	Prevention	PF; due to limited staff in small cities	2008	Nearly completed as recommended	2014
H	Update of FIRM (floodplain) maps in critical flood hazard areas.	Winona County	Prevention	CF	2008	In progress by MN DNR	2014
H	Public education about floodplain management ordinances, risks associated with living in the floodplain and benefits of purchasing flood insurance	Winona County and **all participating jurisdictions**	Public Education and Awareness	CF; currently funded with existing staff	2008	Progress made but much more to do	On-going
Priority	**Wildfire/Structural Fire Mitigation Actions**	**Implementing Jurisdiction**	**State Strategy**	**Resource Availability**		**Progress Toward Goal**	**Action Complete**
M-H	Assessment/purchase of water storage/access for refilling fire trucks.	Winona County, **Stockton** (suggested by Lewiston), **Minneiska**	Emergency Services	PF; city funding capacity varies	2008	Under discussion	2014
L	Identify structural/retrofit/vegetation management projects	**Winona County**	Prevention/ Structural Improvement	NF; sufficient staffing not available	2008	DNR Forest Stewardship Planning in process; will address	2014
L	Implement Fire wise Program	Winona County Planning Office with **Cities and Townships**	Prevention/Structural Improvement	CF	2008	Some progress by local fire departments	Uncertain
Priority	**Karst**	**Implementing Jurisdiction**	**State Strategy**	**Resource Availability**		**Progress Toward Goal**	**Action Complete**
H	Steep slope Ordinance	Winona County Planning Office	Natural Resource Protection	PF; staffing limited for enforcing	2008	Completed 2010	✓
H	Public Information on Groundwater Protection, including buffers	All participating jurisdictions	Natural Resource Protection	CF	2010	Much activity, including work with watershed Districts	On-going
Priority	**Invasive and Exotic Species**	**Implementing Jurisdiction**	**State Strategy**	**Resource Availability**		**Progress Toward Goal**	**Actions Complete**
H	Develop effective government response to burgeoning challenge of invasive species within the county; EAB, OB and many others	**Winona County Planning Department**	Prevention/ Structural	CF; Currently Funded	2010	Established state's first regional, multi-agency invasive workgroup.	✓
H	Public Information and Training Workshop on Invasive and Exotic Species*	**Winona County Planning & Environmental Services,** with DNR, MDA and MNDOT	Natural Resource Protection	CF; Currently Funded	2010	Developed state's first regional workgroup	✓
Priority	**Technological**	**Implementing Jurisdiction**	**State Strategy**	**Resource Availability**		**Progress Toward Goal**	**Actions Complete**
L	Formation of a Public/Private Committee for Protection of Utility Infrastructure*****	WCECC/Emergency Manager	Emergency Services	PF; staffing insufficient	2008	No action to date	In progress

For the action steps and projects identified above that have yet to be completed, the jurisdictions will work to complete them in the coming years. Some completed actions are assumed to be on-going, and will enacted as needed in emergencies. Winona County Emergency Management staff will be the local champions for the mitigation actions. County Commissioners, city council members and township boards will be an integral part of the implementation process. Federal and state assistance will be necessary for a number of the identified actions.

5.5 Multi-Jurisdictional Mitigation Strategy

As a part of the multi-hazard mitigation planning requirements, at least two identifiable mitigation action items have been addressed for each hazard listed in the risk assessment and for each jurisdiction covered under this plan.

Each of the incorporated communities within Winona County was invited to participate in brainstorming sessions in which goals, objectives, and strategies were discussed and prioritized. Each participant in these sessions was armed with possible mitigation goals and strategies provided by FEMA, as well as information about mitigation projects discussed in neighboring communities and counties. All potential strategies and goals that arose through this process are included in this plan. The county planning team used FEMA's evaluation criteria to gauge the priority of all items. A final draft of the disaster mitigation plan was presented to all members to allow for final edits and approval of the priorities.

Section 6 - Plan Maintenance

Plan maintenance is a critical component of any plan. A formal procedure for plan maintenance ensures that the Winona County Hazard Mitigation Plan is utilized, kept up-to-date, and analyzed for effectiveness. The monitoring and evaluation of the Plan includes a schedule of annual review culminating in the preparation of plan revisions every five years. The plan review and revision processes incorporate public participation as a key component. This section also includes discussion of how mitigation strategies or actions can be incorporated into existing plans.

Plan Adoption

The Winona County Board of Commissions is responsible for adoption of the Winona County Hazard Mitigation Plan. Prior to adoption, the County Emergency Manager is responsible for submitting the plan to the State Hazard Mitigation Administrator at the Minnesota Division of Homeland Security & Emergency Management. The State Hazard Mitigation Administrator will then submit the plan to the Federal Emergency Management Agency (FEMA) for their review. Once any FEMA required revisions are made, the County will proceed with adoption and will become eligible for Hazard Mitigation Grant Program funds.

Facilitator

The Emergency Manager is responsible for convening the WCECC meetings, providing an agenda, and producing notes of the meetings.

6.1 Monitoring, Evaluating, and Updating the Plan

Throughout the five-year planning cycle, the Winona County Emergency Management staff will reconvene the AHMP planning committee to monitor, evaluate, and update the plan on an annual basis. Additionally, a meeting will be held during July 2015 to address the five-year update of this plan. Members of the planning committee are readily available to engage in email correspondence between annual meetings. If the need for a special meeting, due to new developments or a declared disaster occurs in the county, the team will meet to update mitigation strategies. Depending on grant opportunities and fiscal resources, mitigation projects may be implemented independently by individual communities or through local partnerships.

The committee will review the county goals and objectives to determine their relevance to changing situations in the county. In addition, state and federal policies will be reviewed to ensure they are addressing current and expected conditions. The committee will also review the risk assessment portion of the plan to determine if this information should be updated or modified. The parties responsible for the various implementation actions will report on the status of their projects, and will include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies should be revised.

Updates or modifications to the AHMP during the five-year planning process will require a public notice and a meeting prior to submitting revisions to the individual jurisdictions for approval. The plan will be updated via written changes, submissions as the committee deems appropriate and necessary, and as approved by the county commissioners.

The GIS data used to prepare the plan was obtained from existing county GIS data as well as data collected as part of the planning process. As new data becomes available, the updated data will be used for future risk assessments and vulnerability analyses.

6.2 Implementation through Existing Programs

The results of this plan will be incorporated into ongoing planning efforts since many of the mitigation projects identified as part of this planning process are ongoing. Winona County and its incorporated jurisdictions will update the zoning plans and ordinances listed in Table 5-2 as necessary, and as part of regularly scheduled updates. The mitigation plan will be used to help guide building code changes and land use planning. Each community will be responsible for updating its own plans and ordinances.

Some of the townships and most of the cities within the County have adopted their own land use plans, zoning ordinances and capital improvement programs. The County will need to coordinate with these local units of government to share the maps, data and information generated through the planning process. The County has not adopted Uniform Building Code.

The WCECC will encourage each of the local units of government and participating organizations to incorporate mitigation activities into their CIP's, land use and water plans, and ordinances. The WCECC will rely heavily upon the County Planning Staff and Emergency Manager to begin integration of the mitigation strategies into county planning documents, policies and procedures. The WCECC has added the County GIS Administrator to its membership which will serve to link the Planning Staff, Emergency Manager, and WCECC.

6.3 Continued Public Involvement

Winona County emphasizes citizen involvement in all its planning processes. In keeping with this dedication to open public process, the WCECC will notify the public annually of updates or revisions that are being considered for the Hazard Mitigation Plan and provide opportunities for the public to comment and share ideas or concerns. The WCECC will use official notices and public service announcements to all media sources to publicize public meetings and/or comment periods. Copies of the Plan will be made available at the public libraries in the County. In addition, each of the participating organizations as well as appropriate County departments will make available copies for public purview. The Winona County Planning Office will be the official depository of the Plan. The County Planning Office will be responsible for keeping track of public comments.

The Plan will be available for viewing on the County website. We will also post proposed changes and allow the public to provide feedback. Communication with the public on hazard mitigation activities will be on-going. Many of the action items have a public education and promotion component. Education of the public to their individual responsibility and opportunity to ensure their own safety, others' safety and prevent or reduce property damage is a theme of the plan.

Continued public involvement is critical to the successful implementation of the AHMP. Comments from the public on the AHMP will be received by the EMA director and forwarded to the AHMP planning committee for discussion. The public will be notified of periodic planning meetings through notices in the local newspaper. Once adopted, a copy of this plan will be maintained in each jurisdiction and in the County Emergency Management office.

Section 7 – A Success to Celebrate

Too Close for Comfort: The Demonstrated Value of Land Use Regulation in Mitigating Disasters

Rare are the opportunities for those who work in the world of hazard mitigation to have the value of their efforts demonstrated for all to see. The hypothetical world of crises and disasters *averted* is, after all, entirely intangible. For planners and regulators in southeast Minnesota's Winona County, however, the historic rains of August 2007, and the devastating flash floods that followed, provided an excellent example of the importance of such work. This is a story of what didn't come to pass as a result of good ordinances, and county commissioners willing to stand behind them.

So Close in Time and So Precisely in Place

Had you viewed the isolated, narrow valley off of Headwater's Drive in Winona County's Wiscoy Township before the record-breaking 17" of rain that fell over 24 hours, you might have thought it the perfect spot for a weekend music fest. Steep valley walls provided privacy and containment of what would be huge sound, and the lengthy, flat floodplain was a perfect spot for erecting stages, pitching tents and parking cars. Perfect, that is, unless you happened to be an event and land use planner.

What Winona County Environmental Services and Planning staff observed in the summer of 2007 when they visited the site to determine its feasibility as the location for the proposed Fat Fest, was one narrow gravel road that led into a very narrow valley - through the floodplain – from the south, and a frighteningly steep road out of the valley to the north. Staff was unanimous in their agreement that the site was entirely inappropriate for the proposed mass gathering, and that permits for such an event should not be granted.

As is often the case in such circumstances, however, fest advocates took their frustration with the permit denial to County Commissioners, lobbying them to overrule staff recommendations and grant the permits. And, as is also common, some commissioners did challenge the staff recommendations, expressing opposition to enforcement of the ordinances. In the end, however, a majority of commissioners stood by their ordinances and refused the requested permits.

Fast forward two months, to August 18th, 2007. The sight of that same valley after the historic flash flooding that hit Winona County left no doubt in anyone's mind that had the festival been held in that spot, on that weekend, numerous fatalities would surely have resulted. Those who would have tried to wait out the rain would have seen their routes of escape closed off entirely. The township road that ran through the narrow valley was blocked to the south by the flooding Money Creek, which rose by more than 12 feet, and to the north by a mudslide of shocking proportions. A section of steep hillside measuring over 100 ft. in height and 40 ft. in length simply slid down over the roadway, rendering it impassable.

The ordinances that prevented the gathering from being held in this beautiful, remote valley were the county's Zoning and Large Assembly ordinances. Enforcement of the ordinances, which required multiple routes of ingress and egress and other safety and health precautions, meant that festival organizers had to find another location. But had the event been allowed to go forward at that location, and been scheduled a mere six weeks later, Winona County would have suffered a far more devastating disaster than ultimately befell the county by the floods of '07.