

PART THREE: PRIORITY NATURAL HAZARDS

The following hazards have been named to be among the top three potential emergencies caused by natural disaster that could impact any area of Blue Earth County. Cited research has been compiled via the National Climatic Data Center and/or other noted sources.

WINTER STORMS

Definitions and Blue Earth County History

Blue Earth County experiences three basic types of winter storm: blizzards, heavy snow events, and ice storms. (Ice storms include freezing rain, freezing drizzle and sleet.)

Blizzard - Blizzards, the most violent of the winter storms, are characterized by low temperatures, usually below 20 degrees Fahrenheit. These temperatures are accompanied by strong winds in excess of 35 miles per hour with enough snow in the air to create visibilities of one-quarter mile or less for an extended period of time, usually at least three hours or more. While blizzards can occur in Blue Earth County from October through April, they are most common from November through the end of March. There have been six (6) blizzards in Blue Earth County in the past 50 years. Fortunately, these blizzards caused no deaths during this time.

Heavy Snow or Snowstorm - In Minnesota, a heavy snow event is defined by 6 or more inches of snow in a 12-hour period and 8 or more inches of snow in a 24-hour period. Snow is considered heavy when visibilities drop below one-quarter mile regardless of wind speed. In Blue Earth County, there have been 14 occurrences of heavy snow or snowstorm over the last 50 years. Fortunately, these events did not result in any deaths or property damage.

Ice Storms - Freezing rain, probably the most serious of the ice storms, occurs during a precipitation event when warm air aloft exceeds 32 degrees while the surface remains below the freezing point. When precipitation originating as rain or drizzle comes into contact with physical structures ice can form; this creates problems for traffic, utility lines, and tree limbs. During the past 50 years, there have been four (4) ice related (i.e. ice/glaze) storms which resulted in no deaths or property damage. A similar form of ice storm is sleet. Sleet forms when precipitation originating as rain falls through a rather large layer of atmosphere with below-freezing temperatures; the raindrops freeze before reaching the ground. Sleet storms are usually of shorter duration than freezing rain and generally create fewer problems.

Blue Earth County Winter Storm Hazard Risk Assessment

Hazard:	Winter Storm Blizzard, Ice Storm, Heavy Snow, Extreme Cold
Location	Countywide
Historic Events	1997 snowstorm caused 15 foot drifts and closed major highways
Likely to happen now?	Yes
How often?	0-1 storms per year Often below freezing Extreme cold 1-3 days per year
Where would event occur?	Countywide
Severity of event?	Several days per storm, multiple storms in a single winter, limited visibility, high amounts of snow accumulated
When would hazard likely occur?	November-March

What other hazards could occur at the same time?	Damaging winds, traffic accidents, spring flooding due to heavy snow accumulation
Economic impacts	School/business closing, costs of staff and equipment for snow removal, loss of livestock/crops
Loss of life impacts	Could be trapped outside during storm, loss of utilities could endanger those in homes, traffic accidents
Risk Level VH – Very High H – High L – Limited M – Minimal	Citizens/People: M Animals/Livestock: L Housing: L Critical Structures: L Infrastructure: L Total: M/L
Risk Assessment	
Unlikely – 1 Occasional – 2 Likely – 3 Highly Likely – 4	<u>Frequency of Occurrence</u> 2.25
More than 12 hours – 1 6-12 hours – 2 3-6 hours – 3 Minimal-None – 4	<u>Warning Time</u> 1
Limited – 1 Minor – 2 Major – 3 Substantial – 4	<u>Potential Severity</u> 3
Minimal – 1 Limited – 2 High – 3 Very High – 4	<u>Risk Level</u> 1
(Total divided by 4) Very Low – 1 Low – 2 Moderate – 3 High – 4	<u>Overall Priority</u> 2 Low

Statewide History of Winter Storms

Blue Earth County usually experiences at least one occurrence of each type of winter storm annually, often the same type on more than one occasion. There have been 12 winter storms in Blue Earth County in the past 50 years, which no deaths have occurred. Two of the more memorable storms, not just in Blue Earth County history but in Minnesota history as well, were the Armistice Day Blizzard of 1940 and the Halloween Blizzard of 1991, each of which



produced more than a foot and a half of snow in the area. These winter storms are included here due to their particularly vivid examples of the possible effects of such events on Blue Earth County.

Armistice Day Blizzard, 1941

The weather was relatively benign the morning of November 11, 1940. Many people were outdoors, taking advantage of the mild holiday weather. The forecast that morning predicted colder temperatures and a few flurries.

The storm started with rain that quickly turned to snow. By the 12th, the Twin Cities had received 16.7 inches, Collegeville 26.6 inches, and 20-foot drifts were reported near Willmar. Forty-nine Minnesotans lost their lives in this storm, many of them hunters trapped by the sudden turn of events.

Halloween Blizzard, 1991

The Halloween Blizzard of 1991 was less tragic but equally fierce. Across much of eastern Minnesota, trick-or-treaters donned snowmobile suits as snow began to fall during the afternoon of October 31. After a three-day snowstorm, 28.4 inches of snow were dropped on the Twin Cities, setting a single storm record for the metropolitan area. Duluth received 36.9 inches, the largest single storm total in Minnesota history. Blue Earth County received between 16 and 20 inches of snowfall while other parts of Southern Minnesota, namely Austin and Albert Lea, experienced an ice storm. Extremely cold temperatures followed the storm and hindered highway snow removal and transportation.

Blue Earth County History of Winter Storms

Blue Earth County usually experiences at least one occurrence of each type of winter storm annually, often the same type on more than one occasion. In January of 1997, strong winds of 20 to 35 mph restricted visibilities to zero due to blowing snow. Drifts reached 15 feet in some parts of the county due to previous snowfall and strong winds. Interstate 35 closed temporarily because of multiple vehicle accidents and nearly a dozen highways closed throughout South Central Minnesota.

“The worst storm I remember was on Halloween in 1991. We got two or three feet of snow and snow removal was terrible. No one was prepared for that much snow in such a short amount of time.”

-Scott Anderson, Lake Crystal

Vulnerability to Winter Storms and Blue Earth County Concerns Regarding Winter Storms

The probability of receiving measurable snow (>.1 inch) on any given day is 98.9% in winter, 96.7% in spring, and 85.6% in autumn. Significant snowstorms (5-12 inches in 24 hours) can be expected to occur once annually, and most will result in travel advisories and school and/or road closures. Severe, hazardous snow conditions appear to occur at least once every 10-15 years.

Minor ice storms are expected annually in late winter and early spring. Severe ice storms may be expected to occur once every 25 years, according to historical data. Winds are expected during ice storms in this area as they usually carry the cold air and precipitation that cause the storm.

Cold temperatures are predicted to occur each year, as well, although the 100-year extreme appears to be -38° F. Persistent cold temperatures combined with low precipitation (leading to deep ground frost) appear to occur at least once every 5 years. During years when precipitation is light all winter water main breaks are expected in late winter and early spring as the depth of

ground frost reaches beyond 6 feet, where water mains are laid. This tends to occur once every 10-15 years.

The chance that another winter storm affecting Blue Earth County will occur is highly probable. Communities such as Amboy, Eagle Lake, Good Thunder, Lake Crystal, Mankato, Mapleton, Pemberton, St. Clair, and Vernon Center have expressed concern. Strong winds accompanied with winter storms are a major concern as well. These communities have all identified winter storm events as priority concerns.

Potential Impacts and Cascading Effects

Winter storms have a wide variety of impacts. Poor driving conditions, frigid temperatures, and automobile accidents can lead to loss of life and injuries such as hypothermia and frostbite. Winter storms can also render power equipment inoperable, leading to power outages, and occasional property damage can also occur due to winter storms. In addition, winter storms can have an economic impact as well when businesses and governmental office close, transportation slows down or stops, and people take shelter in their homes.

Winter Storm Gaps and Deficiencies

- Many jurisdictions report that no public outreach is performed to educate citizens about winter weather conditions and health hazards such as frostbite and hypothermia.
- While many jurisdictions report having ‘weather spotters’ capable of alerting police and other city personnel, it is important to see to it that communication and systems of early detection are cohesive throughout Blue Earth County.
- Most power lines within the county are aboveground and as a result subject to damage from ice storms and winter-storm winds causing power outages.
- Local radio and television stations do provide warnings and updates of winter weather conditions, but are effective only if tuned to. Since these broadcast are made nearly entirely in English, language barriers may exist for non-English speaking residents.

ACTIONABLE MITIGATION STEPS:

Actionable Mitigation Steps are more elaborately explained with project, timeframe, responsible jurisdictions/staff, possible funding sources, and priority level in the Action Plan section of this document. Suggested areas of focus are denoted in parentheses.

1. Assure Availability of Information for Non-English Speaking Residents (Countywide) – County and city personnel may want to consider provisions for assuring that language barriers for winter storm events are minimized and that all residents are able to get up-to-date information, regardless of language.
2. Encourage Public to Listen to Local News (Countywide) – County and city staff would provide reminders and encourage local residents through local media that winter storm conditions, warnings, and updates are made available through local radio and television stations.

3. Use of Fire Department Severe Weather Spotters (Eagle Lake, Madison Lake, Good Thunder, Madison Lake, Pemberton, Skyline) - City fire department shall establish and maintain communication procedures for alerting police and personnel in all cities across the county to severe winter weather. This system shall be reviewed periodically during county emergency management meetings to ensure preparedness.
4. Community Education and Drills (Good Thunder, Vernon Center) – City staff (police and fire) would provide educational information to personnel and citizens with the assistance of county emergency management personnel. Information will be provided in 2007-2008 and reassessed annually. Assessment would be done by city staff and county-wide emergency task force. Department (police and fire) will also conduct drills beginning in 207-2008. Blue Earth County emergency management will assist in advising and providing suggestions on improvements. In addition, lessons learned can be shared during annual update sessions.
5. Educate Key Personnel – County hazard mitigation multi-department group shall disperse information with appropriate department, while city fire and police departments shall provide information to personnel and citizens. The county will assist with county wide dissemination of information through means such as county news letter and tax statement mailing. of county emergency management personnel. Information will be provided in 2007-2008 and reassessed annually. Assessment would be done by city staff and county-wide emergency task force.
6. Utilize City Ordinances to Discourage Placement of Trees Near Power Lines (Countywide) - Winter storms, particularly ice storms, can easily down trees. Trees that topple near or on power lines present a serious secondary hazard in addition to the winter storm itself, and can also lead to power outages. Cities should utilize local ordinances to limit the locations of trees nearby to power lines.
7. Bury all Utility and Power Lines to Reduce Power Outages Caused by Winter Storms (Mankato) – If utility lines are buried strong winter winds will not be able to affect them. Since the landscape in Southern Minnesota is very flat, wind speed is always an issue.

SUMMER STORMS

Blue Earth County experiences various summer storms. The main four forms of summer storms, including thunderstorms, tornadoes, hailstorms, and windstorms have frequently occurred within Blue Earth County and will continue to do so in the future.

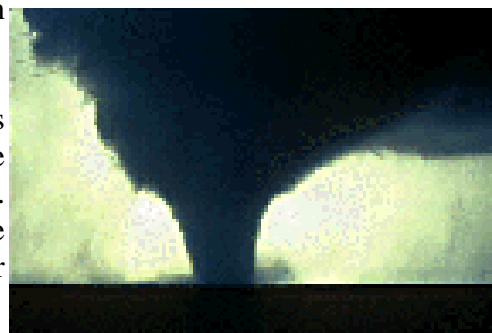


Thunderstorms - 84 of the events reported in Blue Earth County were due to thunderstorm winds. Severe thunderstorms are defined as having one or more of the following: winds in excess of 58 miles per hour, hail of at least 3/4 of an inch in diameter, or a tornado. Thunderstorms are the most common summer storm in Blue Earth County, occurring primarily during the months of May through August with the most severe storms most likely to occur from mid-May through mid-July.

There are four types of thunderstorms, each of which occur in Blue Earth County: Multicell Cluster Storms, Multicell Line Storms, Supercells, and Lightning Storms. One of the reported lightening storms occurred in Lehillier. This property damage was in the amount of \$100,000.

Tornadoes - Tornadoes are the most violent of all storms. The tornado is essentially a rapidly rotating column of air that is spawned by a cumulonimbus cloud. When it drops to the ground it can create significant damage and loss of life. Tornadoes always occur in association with thunderstorms. While somewhat more common in Southern Minnesota they have occurred in all counties in the state.

Tornadoes are most likely to occur during warm humid spells during the months of May, June, July and August, but have occurred as early as March and as late as November in Minnesota. Most tornadoes occur during the warm part of the day – late afternoon or early evening; over 80 percent of tornadoes occur between noon and midnight.



Hailstorms - Hail is a product of a severe thunderstorm. It is formed when strong updrafts within a cumulonimbus cloud carry water droplets above the freezing level or when ice pellets in the cloud collide with water droplets. The water droplets freeze as strong updraft winds toss the pellets and droplets back up into colder regions of the cloud. Both gravity and downdrafts in the cloud pull the pellets down, where they encounter more droplets that attach and freeze as they are tossed once again to higher levels in the cloud. This process continues until the hailstones become too heavy to be supported by the updrafts and fall to the ground as hail.

Most hail in Minnesota ranges from pea-size to golf-ball size. Larger hailstones have been reported but occur much less frequently. Area coverage of individual hailstorms is highly variable and spotty because of the changing nature of the cumulonimbus cloud. Almost all areas

of Southern Minnesota can expect some hail during the summer months, although most hail is not large enough to cause significant crop or property damage.

In Blue Earth County, there were 68 hail storms reported in the past 50 years which caused approximate \$1,000 in property damage.

Windstorms - Windstorms can and do occur in all months of the year; however, the most severe windstorms usually occur during severe thunderstorms in the warm months. There have been six reported as high winds in Blue Earth County over the past 50 years that range from 40 – 60 miles per hour. These can inflict damage to buildings and in some cases overturn high profile vehicles.

There have been three windstorms reported in Blue Earth County that ranged at higher wind speeds, from 60 – 80 miles per hour. Downburst winds can cause as much damage as a small tornado and the two are frequently confused. As downburst winds spread out they are often referred to as straight-line winds and they can cause major structural and tree damage over a relatively large area.

Blue Earth County Summer Storm Hazard Risk Assessment

Hazard:	Summer Weather Thunderstorm, Lightning, Hail, Wind (excluding tornado)	Tornado
Location	Countywide	Countywide
Historic Events	68 hail events and 84 thunderstorm events between 1950-2006. One fatality due to a storm in 1998.	21 tornadoes in Blue Earth County between 1950 and 2006. Two deaths attributed to one tornado.
Likely to happen now?	Yes	Possible
How often?	High chances of several significant storms per years, extreme heat several days per year	Once every 3-4 years according to current records
Where would event occur?	Countywide	Countywide
Severity of event?	Lightning, damaging winds, extreme heat can be harmful if precautions are not observed	County has already had many tornado events; future events could be more powerful
When would hazard likely occur?	Spring-Fall	Spring-Fall
What other hazards could occur at the same time?	Flooding, traffic accidents, wild and structural fires sparked by lightning	Damage/failure of utilities/infrastructure, fire, exposure to hazardous materials
Economic impacts	Loss of crops/livestock, property damage	Property loss or damage, loss/damage of community infrastructure
Loss of life impacts	Lightning strike, heat stroke/exhaustion, being struck by hailstone or wind-driven object (rare in most cases)	Can be extremely dangerous, particularly stronger tornadoes that can devastate houses down to the foundation where people are taking shelter. Would be especially

		dangerous in more densely populated areas.
Risk Level VH – Very High H – High L – Limited M – Minimal	Citizens/People: H Animals/Livestock: L Housing: H Critical Structures: L Infrastructure: H Total: L/H	Citizens/People: VH Animals/Livestock: H Housing: VH Critical Structures: L Infrastructure: H Total: H/VH
Risk Assessment		
Unlikely – 1 Occasional – 2 Likely – 3 Highly Likely – 4	<u>Frequency of Occurrence</u> 4	<u>Frequency of Occurrence</u> 2
More than 12 hours – 1 6-12 hours – 2 3-6 hours – 3 Minimal-None – 4	<u>Warning Time</u> 3	<u>Warning Time</u> 3
Limited – 1 Minor – 2 Major – 3 Substantial – 4	<u>Potential Severity</u> 3	<u>Potential Severity</u> 4
Minimal – 1 Limited – 2 High – 3 Very High – 4	<u>Risk Level</u> 2	<u>Risk Level</u> 3
(Total divided by 4) Very Low – 1 Low – 2 Moderate – 3 High – 4	<u>Overall Priority</u> 3 Moderate	<u>Overall Priority</u> 3 Moderate

Vulnerability to and History of Summer Storms

Blue Earth County had 84 thunderstorm events, 68 hail events and 21 tornado touchdowns reported between 1950 and 2000. Often these events were produced by the same violent storm event. With 84, 68 and 21 occurrences over 50 years, the likelihood of a thunderstorm, hail event or tornado hitting somewhere in the county is respectively high in any given year. Assuming a storm event affects one square mile, and there are 752 square miles in Blue Earth County, it is likely that various areas of the county will experience various summer storm events, most notably thunderstorms, every year. Blue Earth County is classified as a high tornado risk based on historic wind speeds and the number of tornadoes per 1,000 square miles.

Blue Earth County has experienced all of the summer storms described above. In May of 1998 thunderstorms, wind, hail and tornadoes blew semi-trailers off the road, flattened barns, destroyed machine sheds and garages, damaged outbuildings, downed trees and scattered debris up to one mile.

Straight-line winds and hail have caused significant property damage and loss of life on several occasions during the last 30 years. On May 15, 1998, a line of severe thunderstorms with wind speeds measured at 61 knots resulted in widespread property damage and one fatality.

In Blue Earth County, two of the reported tornadoes in the past 50 years were responsible for \$11.2 million in property damage, 9 personal injuries and two deaths. Reports identified Blue Earth County as the general location where most of the tornadoes occurred. The chart below depicts summer storm related concerns from communities throughout Blue Earth County.

Jurisdiction	Assessed Risk (Probability)	Assessed Impact	Top Three Priority?
Amboy	High	Medium	No
Eagle Lake	High	High	Yes
Good Thunder	High	Medium	Yes
Lake Crystal	Medium	Medium	Yes
Madison Lake	High	High	Yes
Mankato	Medium	Medium	Yes
Mapleton	Medium	Medium	No
Pemberton	High	High	Yes
Skyline	Medium	Medium	Yes
St. Clair	High	Medium	Yes
Vernon Center	Medium	Medium	Yes
Blue Earth County	Medium to High	Medium to High	Yes

Probability: High – Annually to 2yrs, Medium - 5yrs, Low – 10yrs

Impact: High – Loss of life and \$500,000 plus property damage, Medium – bodily injuries and \$250,000 property damage, and Low – bodily discomfort and less than \$100,000 in property damage

Potential Impacts and Cascading Effects

Potential impacts of summer storms can be extremely varied. The most significant potential impacts include the loss of life or physical injuries sustained, varying degrees of property and infrastructure damage (ranging from mild damage to total loss), interruptions of city services, and utility failures such as interruption of communications and power outages which can range from several hours to many days. The economic impact of summer storm damage is also very significant, as lost or damaged businesses are forced to shut down while repairs are made, and some may never open again due to the financial hardships caused by the storm damages. This lost business is in turn felt throughout the local economy. Storm repair efforts can also strain city resources, including staff and equipment. Economic impacts can also occur through damage or loss of agricultural crops or livestock. Lightning strikes may ignite both structural and wildfires.

Summer Storm Gaps and Deficiencies

- Mankato reported that power lines should be buried in areas where it is economically feasible; power outages are one of the primary impacts of a tornado. It should be noted, however, that burying power lines is not an absolute solution.
- Power outages are a concern for some Blue Earth County communities. The leading cause of power failures is weather-related events ranging from seasonal flooding, tornadoes to winter storms and wildfires. Power grids, generating plants, transformer stations, and power poles and even buried cable are vulnerable. Fewer instances of power failures are due to system failures, human error, accidents and sabotage. Extreme heat or extreme cold and lack of power can be a dangerous mix, particularly for elderly people, young children, and those with medical challenges.

- Some rural Blue Earth County residents may be outside the effective range of city severe weather warning system sirens. Additionally, not all communities have warning system sirens.
- Local television and radio stations provide summer storm warning information and updates but are effective only if tuned and paid attention to. Since broadcasts are nearly entirely in English, language barriers may also exist for non-English speaking residents.
- The City of Eagle Lake does not have the facilities to deal with the people who are left without shelter.

ACTIONABLE MITIGATION STEPS:

Actionable Mitigation Steps are more elaborately explained with project, timeframe, responsible jurisdictions/staff, possible funding sources, and priority level in the Action Plan section of this document. Suggested areas of focus are denoted in parentheses.

1. Designate Shelters for the Public (Good Thunder, St. Clair, Countywide) – City administration working with fire, police, public works and external partners will identify appropriate and safe shelter space.
2. Encourage Residents to Listen to Local News (Countywide) – County and city staff would provide reminders and encourage local residents through local media that winter storm conditions, warnings, and updates are made available through local radio and television stations
3. Guarantee Maintenance on Early Warning Systems (Mankato, Vernon Center) – City public works department will work to maintain the early city warning systems. Staff will also maintain communication with emergency responders.
4. Assure Availability of Information for Non-English Speaking Residents (Countywide) – County and city personnel may want to consider provisions for assuring that language barriers for winter storm events are minimized and that all residents are able to get up-to-date information, regardless of language.
5. Fire Department Severe Weather Spotters (Eagle Lake, Good Thunder, Madison Lake, Pemberton, St. Clair) – City fire departments shall utilize designated weather spotters to alert police and city personnel. Updated communication lists shall be maintained.
6. Provide Public Outreach and Education (Countywide) - City staff (police, administration, and fire) would provide educational information to personnel and citizens with the assistance of county emergency management personnel. Information could be provided in 2007-2008 and reassessed annually. Assessment would be done by city staff and county-wide emergency task force.
7. Bury Power Lines (Mankato) – The city public works department will work with the local utility companies to bury power lines when possible. This shall be incorporated into the update of the city’s comprehensive plan and related ordinances