

3.0 LA CROSSE COUNTY RISK ASSESSMENT

The following is La Crosse County’s assessment of each of the natural hazards identified as occurring in the State of Wisconsin. Each natural hazard is assessed on the historical occurrence of the hazard, the vulnerability to a given hazard, the probability of the hazard occurring again and a local officials opinion survey. A final risk assessment designation of high, moderate or low is then assigned to each hazard based on a total score from ratings within each of these four assessment factors. Each jurisdiction in the county has the same risk to each hazard with the exception of flooding. The municipalities located along the Mississippi River, La Crosse River and Black River have a higher risk of Riverine or Flash flooding than those not located along these rivers. In addition incorporated communities are susceptible to Stormwater Flooding whereas unincorporated areas without large areas of impervious surfaces are not. See Map 3-6 for flood prone areas.

An overall risk assessment rating of 22 points or greater equates to a “high” risk assessment designation for a given hazard. A risk assessment rating of 15 to 21 points equates to a moderate risk assessment designation and a rating of 14 points or less results in a low risk assessment rating for a given hazard. Table 3-2 provides a summary of the ratings for all the natural hazards.

The following is a description of how the ratings are determined for each assessment and how these ratings result in the final risk assessment designation.

Historical Occurrence Rating Criteria:

Historical occurrence refers to the number of times a particular hazard occurred in the past. Because historical records for the hazards vary greatly each hazard is assessed on occurrences within a 25-year period.

• Less than 4 occurrences in the past 25 years =Low rating, 1-3 points
• 4 to 7 occurrences in the past 25 years = Moderately Low rating, 3-5 points
• 8 to 12 occurrences in the past 25 years = Moderately High rating, 5-7 points
• More than 12 occurrences in the past 25 years = High rating, 7-9 points

Vulnerability Rating Criteria:

Vulnerability is a measure of how people, buildings, structures, personal property, and other things considered important are adversely affected by a given hazard. Some aspects to help measure the magnitude of vulnerability in the county have been quantified in Tables 3-1 and 3-2. These tables show the maximum extent of vulnerability within the county. The vulnerability of a population, buildings, structures, transportation routes ad businesses will vary from one community to another and from one hazard to another.

• Less than 10% of population or property adversely affected =	Negligible rating, 1-3 points
• Ten to less than 25% of population or property adversely affected =	Limited rating, 3-5 points
• Twenty Five to less than 50% of the population or property adversely affected =	Critical rating, 5-7 points
• More than 50% of the population or property adversely affected =	Catastrophic rating, 7-9 points

Probability Rating Criteria:

Probability rating is a measure of the likelihood and frequency of hazard occurring in the future.

• Less than 1% probability in the next 100 years =	Unlikely rating, 1-3 points
• From 1% and 10% probability in the next year or at least one chance in next 100 years =	Possible rating, 3-5 points
• Over 10% to nearly 100% probability in the next year or at least one chance in the next 10 years =	Likely rating, 5-7 points
• Nearly 100% chance in the next year =	Highly Likely rating, 7-9 points

Local Official Hazard Survey Rating Criteria:

In August of 2006 a local officials survey was mailed to village presidents, town chairman, mayors, chiefs of police, the sheriff, and fire department chiefs in the county. Each county official was asked to rank the county’s natural hazards as high, medium, or low regarding their opinion on each hazard’s threat to health and public safety.

<ul style="list-style-type: none"> A majority of local officials were of the opinion that this hazard posed a “low” threat to health and public safety in comparison to the 17 other hazards = 	Low rating, 1-3 points
<ul style="list-style-type: none"> A majority of local officials were of the opinion that this hazard posed a “medium” threat to health and public safety in comparison to the other 17 hazards = 	Medium rating, 3-6 points
<ul style="list-style-type: none"> A majority of local officials were of the opinion that this hazard posed a “high” threat to health and public safety in comparison to the other 17 hazards = 	High rating, 6-9 points

Risk Assessment Designation:

The risk assessment designation is determined by adding the rating points assigned from historical occurrences, vulnerability, probability and the local official survey factors. These summations for each hazard are then assigned a low, moderate, or high threat based on numerical rank.

<ul style="list-style-type: none"> A combined risk factor rating of 11 points or less = 	Low Threat
<ul style="list-style-type: none"> A combined risk factor rating of 12 to 22 points = 	Moderate Threat
<ul style="list-style-type: none"> A combined risk factor rating of 23 points or more = 	High Threat

3.1 La Crosse County, Hailstorm Risk Assessment

Hailstorm Definition: A hailstorm is a weather condition where atmospheric water particles form into rounded or irregular masses of ice that fall to earth. Hail is a product of strong thunderstorms that frequently move across the state. Hail normally falls near the center of the moving storm along with the heaviest rain; however, the strong winds at high altitudes can blow the hailstones away from the storm center, causing unexpected hazards at places that otherwise might not appear threatened.

Hailstorms normally range from the size of a pea to that of a golf ball, but sizes larger than baseballs have occurred with the most severe storms. They form when subfreezing temperatures cause water in thunderstorm clouds to accumulate around an icy core. When strong underlying winds no longer can support their weight, the hailstones fall earthward. Hail tends to fall in swaths that may be 20-115 miles long and 5-30 miles wide. The swath is not normally a large, continuous bombardment of hail, but generally consists of a series of hail strikes that are produced by individual thunderstorm clouds traversing the same general area. Hail strikes are typically one-half mile wide and five miles long. They may partially overlap, but often leave completely undamaged gaps between them.

Hailstorms are considered formidable among the weather and climatic hazards to property and crops of the interior plains of the U.S. because they dent vehicles and structures, break windows, damage roofs and batter crops to the point that significant agricultural losses result. Serious injury and loss of human life, however, are rarely associated with hailstorms.

Hailstorm History and Frequency:

1960's:	11 reported events by NCDC, 4/15/60, 6/12/61, 6/10/62, 7/18/64, 7/4/66, 8/15/66, 4/16/67, 6/20/68, 6/21/68, 8/19/68, 9/8/68, Hail size ranged from 0.75" to 2.75"
1970's:	3 reported events by NCDC, 8/10/71, 7/16/72, 7/29/73, Hail size ranged from 0.75" to 4"
1980's:	13 reported events by NCDC – 7/15/80, 9/20/80, 4/3/81, 4/27/84, 9/24/84, 7/9/85, 4/25/86, 7/30/86, 5/8/88, 4/24/89, 7/8/89, 8/4/89, 10/15/89, Hail size ranged from 0.75" to 3"
1990's:	17 reported events by NCDC – 6/19/90, 6/26/90, 9/9/90, 9/9/91, 5/16/92, 7/19/92, 5/27/93 (C. La Crosse), 5/16/95 (C. Onalaska), 5/18/96, 10/29/96, 10/29/96, 6/5/97 (Holmen), 7/5/97 (Mindoro), 8/23/97, 3/39/98 (Barre Mills), 6/24/98 (Holmen), 8/9/98 (St. Joseph), 7/8/99 (C. Onalaska), 7/8/99 (V. Bangor) Hail sized ranged from 0.75" to 1.00"
2000's:	11 reported events by NCDC – 5/18/00, 4/23/01 (C. Onalaska & Mindoro), 5/10/01 (Newburg Corners), 6/11/01, 6/17/01 (V. Holmen, C. Onalaska & V. West Salem), 6/18/01 (V. Holmen), 4/18/02 (V. Holmen & C. Onalaska), 4/17/04, 7/19/04, 3/30/05 (C. Onalaska), 6/29/05 (C. Onalaska) Hail size ranged from 0.75" to 2.5". 7/04 storm received a Presidential Disaster Declaration.

Wisconsin averages between two to three hail days per year as recorded by National Weather Service stations, although this may not be indicative of the number of hailstorms which occur within a county or larger area during any given hail season. The months of maximum hailstorm frequency are May through September with approximately 85% of hailstorms occurring during this period. Unfortunately, hailstorms are most frequent during the four months of the growing and harvesting seasons for most crops in the state. According to the National Weather Service, about 20% of all severe weather events in Wisconsin are hail events in which hailstones are at least ¾ inch in diameter. Serious hailstorms with hailstones 1.5 inch or larger in diameter are not common.

According to National Weather Service Reports, La Crosse County experienced 68 hailstorms from 1982 through 2003. This was above the average for Wisconsin counties of 30. Neighboring Vernon, Trempealeau and Monroe counties experienced 46, 51 and 66 hail events during this same time period.

Hailstorm Vulnerability Assessment

- **Critical Facilities.** In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns hailstorms a risk factor of 24 indicating this natural hazard is a high risk to the county. Critical facilities vulnerability to hailstorms would be limited primarily to damage to the building's roof and windows and would not interrupt services provided by these facilities except in extreme cases. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- **Business and Industry.** In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. For most businesses and industries hailstorms pose a moderate hazard risk with damage confined to building roofs and windows. Examples of businesses that are particularly vulnerable to hail damage include car and truck dealerships that display vehicles outdoors, greenhouses, and nurseries that store plants and trees outdoors. Auto dealerships can suffer significant losses to their vehicles.
- **Agriculture.** In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Agriculture is a significant part of the county's economy. The overall threat of hailstorm is ranked as high and agricultural crops can sustain significant damage and economic loss from hailstorms. Hailstorms occur most frequently in the county in the months from May through September, which coincide with the planting and harvesting of most crops in the county making those crops vulnerable to hailstorms.
- **Roads and Highways.** Hail damage can occur to any vehicle exposed to elements, whether moving or parked. Hail, although when it is lying on the ground, can cause icing conditions, usually is melted before mitigation action such as sanding, salting, or plowing is done. It can occur in seasons when highway trucks are not setup for snow and ice control.
- **Railroads.** Hail can cause cessation of rail work crews. Hail can cause damage to windshields and headlight covers of locomotives and Maintenance of Way (M of W) equipment. Hail can cause damage to signal lamp covers. Hail can also cause damage to building roofs.
- **Airway.** Hail can cause damage to aircraft skin and control surfaces. Such damage may be critical to the safety and integrity of the aircraft and its control. Hail can cause icing and clogging of engines of small planes in flight. Hail can damage runway lighting fixtures.
- **Waterways.** Hail can damage watercraft windows, lights, instruments and communication devices.
- **Municipal Water.** In the county there are 44 municipal wells and water systems in operation, see Table 3-11. These facilities vulnerability to hailstorms would be limited to damage to the roofs, windows and electrical service, and would not interrupt services provided by these facilities except in extreme cases.
- **Wastewater Treatment Facilities.** There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities vulnerability to hailstorms would be limited to the building roofs, windows and electrical service and would not interrupt services provided by these facilities except in extreme cases.
- **Hazardous Material Sites.** Hazardous material containers in transport can be breached by any accident to the transport mode caused by hail. Hazardous material in storage has no severe impacts caused directly by hail.

Hail Storm Risk Assessment Designation

Hail Storm Historical Occurrence Rating: High - 9
Hailstorm Vulnerability Rating: Negligible - 2
Hailstorm Probability Rating: Highly Likely - 8

Hailstorm Local Official Survey Rating: Medium - 5

Hail Storm Risk Assessment Designation: **High Threat - 24 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Hailstorm Hazard Mitigation Ideas:

- Remove or protect vulnerable attachments such as awnings, antennas and signs on buildings
- Replace vulnerable shingles and siding with hail resistant building materials
- Protect or relocate essential utility and communication equipment
- Provide county residents with public information on hailstorms during severe weather awareness
- Promote the purchase of hail insurance
- Have at least one highway truck at each shop, with a plow and sander that can easily be quickly mounted to respond to emergency situations
- Provide a shed or covered area to store government vehicles if a hail storm is predicted

3.2 La Crosse County, Lightning Storm Risk Assessment

Lightning Storm Definition: Lightning is a sudden and violent discharge of electricity from within a thunderstorm due to a difference in electrical charges and represents a flow of electrical current from cloud-to-cloud or cloud-to-ground. Nationally, lightning causes extensive damage to buildings and structures, kills or injures people and livestock, starts untold numbers of forest fires and wildfires and disrupts electromagnetic transmissions.

To the general public lightning is often perceived as a minor hazard. However, lightning-caused damages, injuries and deaths establish lightning as a significant hazard associated with any thunderstorm in any part of the state. Damage from lightning occurs four ways:

- 1) Electrocution/severe shock of humans and animals;
- 2) Vaporization of materials along the path of the lightning strike;
- 3) Fire caused by the high temperatures associated with lightning (10,000-60,000°F); and
- 4) The sudden power surge that can damage electrical/electronic equipment.

Large outdoor gatherings (sporting events, concerts, campgrounds, etc.) are particularly vulnerable to lightning strikes that could result in injuries and deaths. Early warning of lightning hazards, combined with prudent protective actions, can greatly reduce the likelihood of lightning-related injuries and deaths.

Lightning Storm History and Frequency: La Crosse County experienced 4 lightning events between 1982 and 2006 according to the National Weather Service.

Wisconsin has a high frequency of property losses due to lightning. Insurance statistics show that two out of every 100 farms are struck by lightning or have a fire that may have been lightning-caused each year. According to National Weather Service reports, La Crosse County experienced 4 lightning events between 1982 and 2006 with 1 injury but no deaths recorded.

Lightning Vulnerability Assessment

- **Critical Facilities.** In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns lightning a risk factor of 24 indicating this natural hazard is a high risk to the county. Critical facilities vulnerability to lightning is generally perceived as a minor hazard. The damages caused by lightning to buildings and the potential injuries and deaths resulting from a lightning strike established lightning as a significant hazard associated with any thunderstorm. Lightning can cause electrocution and severe shock in humans, fires in buildings and the sudden power surges resulting from lightning can cause significant damages to a facility's electrical services, and electronic equipment such as computers and motors and communications systems. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- **Business and Industry.** For most business and industries, lightning poses a moderate hazard risk. The damages caused by lightning to buildings and the potential injuries and deaths resulting from a lightning strike established lightning as a significant hazard associated with any thunderstorm. Lightning can cause electrocution and severe shock in humans; fires in buildings and the sudden power surges resulting from lightning can cause significant damages to a business/industries electrical services, and electronic equipment such as computers and motors and communications

systems. The manufacturing industry could experience disruptions caused by lightning strikes to their product processes that could result in the company sustaining economic losses.

- **Agriculture.** The overall hazard risk ranking for lightning for agriculture is high. The damages caused by lightning strikes can be a significant hazard because lightning strikes can cause electrocution or severe shock to humans and farm animals, fire risk to buildings and sudden power surges associated with lightning strikes can cause significant damage to electrical services, motors and milking machinery. Workers in fields and animals in open spaces are particularly vulnerable to lightning strikes. Tree plantations are also susceptible to fires caused by lightning strikes.
- **Roads and Highways.** Severe lightning in Wisconsin is invariably accompanied by heavy rains, which can limit visibility for drivers. Lightning can cause trees, or parts of trees, to suddenly fall across the road. Lightning can be a hazard to people who attempt to leave their vehicle at service plazas, etc.
- **Railroads.** Severe lightning can be hazardous to railway track and other workers. Lightning can cause trees, or parts of trees, to suddenly fall across railroad tracks. Lightning can cause electric signals and remote controlled switches to malfunction. Lightning can cause radio communications outages.
- **Airway.** Lightning can cause malfunction of aircraft communications and navigation devices. Lightning can be hazardous to airport workers and passengers who must access the aircraft by walking across an open field/taxi area.
- **Waterways.** Lightning can be hazardous to workers exposed on decks, or at locks during the storm. Lightning can disrupt electronic devices and communications.
- **Municipal Water.** In the county there are 44 municipal wells and waters systems in operation, see Table 3-11. These facilities vulnerable to lightning would include fire damage to facilities from lightning strikes, damage to a facility's electrical service, electronic equipment and motors. Municipal water service would not be interrupted except in extreme cases.
- **Wastewater Treatment Facilities.** There are 11 wastewater treatment facilities operating in the county, see Table 3-12. These facility's vulnerability to lightning would include fire damage to facilities from lightning strikes, damage to the facilities electrical service, electronic equipment and motors and as a result of power surges, wastewater treatment service would not be interrupted except in extreme cases.
- **Hazardous Material Sites.** The impact of lightning storms on hazardous material is specific to the type of material and its storage or transportation conditions. A lightning strike to a fixed storage building, while having little impact on transportation modes, could start a fire or explosion with the stored hazardous material.

Lightning Storm Risk Assessment Designation

Lightning Storm Historical Occurrence Rating: High - 9

Lightning Storm Vulnerability Rating: Negligible - 2

Lightning Storm Probability Rating: Highly Likely - 7

Lightning Storm Local Official Survey Rating: Medium/High - 6

Lightning Storm Risk Assessment Designation: **High Threat - 24 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Lightning Storm Hazard Mitigation Ideas:

- Communities may use outreach programs to promote awareness of thunderstorm/lightning dangers – for example: consider placing lightning safety tips and/or action plan in game programs, flyers, scorecards etc. and during Severe Weather Awareness Week emphasize issues on weather related disaster preparedness through public education
- Local and state governments can invest in public early warning systems/networks, as well as train people to serve as weather spotters
- Promote establishment of indoor warning systems at all critical facilities and public gathering locations
- When thunder is heard, seek shelter inside the nearest building or enclosed vehicle (e.g., a car, bus or truck). If shelter is not available, avoid trees or tall objects because electricity may be conducted from that object to other nearby objects or persons
- Avoid high ground, water, open spaces and metal objects (golf clubs, umbrellas, fences, tools)
- When indoors, turn off appliances and electronic devices and remain inside until the storm passes
- Surge protection can be installed on critical electronic equipment (*protection devices such as lightning rods and grounding can be installed on critical facilities*)
- Remove taller trees in the vicinity of vulnerable structures
- Specimen trees growing along roadways, or in rest areas or landscaped areas, can be protected by properly installed lightning rods
- Local airports can suspend operations during severe lightning storms
- Major hazardous material storage sites should be protected with properly installed lightning rods

3.3 La Crosse County, Thunderstorm Risk Assessment

Thunderstorm Definition: Thunderstorms are severe and violent forms of convection produced when warm moist air is overrun by dry cool air. As the warm air rises *thunderheads* (cumulo-nimbus clouds) form and cause the strong winds, lightning, thunder, hail, and rain associated with these storms. The National Weather Service definition of a *severe thunderstorm* is a thunderstorm event that produces any of the following: downbursts with winds of 58 miles per hour or greater (often with gusts of 74 miles per hour or greater), hail $\frac{3}{4}$ of an inch in diameter or greater, or a tornado.

The thunderheads formed may be a towering mass six miles or more across and 40,000 to 50,000 feet high. It may contain as much as 1.5 million tons of water and enormous amounts of energy that often are released in the form of high winds, excessive rains and three violently destructive natural elements: lightning, tornadoes, and hail.

On the ground directly beneath the storm system, the mature thunderstorm is initially felt as rain, which is soon joined by a strong downdraft. The downdraft spreads out from the cloud in gusting divergent winds and brings a marked drop in temperature. Even where the rain has not reached the ground, this cold air stream flowing over the earth's surface is a warning that the storm's most violent phase is about to mature.

A thunderstorm often lasts no more than 30 minutes in a given location because an individual thunderstorm cell frequently moves between 30 and 50 miles per hour. However, strong frontal systems may spawn more than one squall line composed of many individual thunderstorm cells. Thunderstorms may occur individually, in clusters or as a portion of a large line of storms that may stretch across the entire state. Thus, it is possible that several thunderstorms may affect an area in the course of a few hours.

Severe thunderstorms can cause injury or death and can also result in substantial property damage. They may cause power outages, disrupt telephone service and severely affect radio communications and surface/air transportation, which may seriously impair the emergency management capabilities of the affected jurisdictions.

Thunderstorm History and Frequency:

1960's	16 reported events by NCDC – 8/3/60, 5/14/61, 6/10/61, 7/30/61, 9/21/61, 5/22/62, 8/29/62, 5/10/63, 6/7/63, 6/8/63, 8/2/63, 5/5/65, 7/10/66, 6/8/67, 8/19/68, 6/26/69 Magnitude of winds for these events ranged from 50kts. to 85 kts.
1970's:	12 reported events by NCDC – 7/18/70, 6/12/71, 6/24/71, 7/18/71, 8/10/71, 6/11/73, 7/29/73, 6/20/74, 6/13/76, 7/14/77, 6/25/78, 6/19/79 Magnitude of winds for these events ranged from 50 kts. to 65 kts.
1980's:	15 reported events by NCDC – 6/5/80, 6/7/80, 6/23/81, 5/17/82, 6/30/83, 7/3/83, 7/19/83, 8/28/83, 4/27/84, 7/10/84, 7/14/84, 7/16/84, 6/7/85, 7/9/85, and 8/12/85. Magnitude of winds for these events ranged from 50 kts. to 109 kts (7/9/85).
1990's:	48 reported events by NCDC – 6/2/90, 8/26/90, 5/29/91, 7/7/91, 9/13/94 (Holmen), 11/18/94 (1 injury, \$10,000 PD), 4/3/95 (2 injuries), 7/27/95 (3 miles East of C. La Crosse, \$200,000 PD), 8/13/95 (Holmen), 5/19/96 (Holmen), 5/19/96 (3 miles East of C. La Crosse), 8/7/96 (3 miles South of C. La Crosse, \$5,000 PD), 8/7/96 (5 miles South of C. La Crosse), 8/7/96 (Holmen), 4/5/97 (3 miles East of C. La Crosse), 6/28/97 (C. La Crosse, \$5,000 PD), 7/13/97 (Bangor, \$2,000 PD), 7/17/97 (Holmen), 8/23/97 (C. Onalaska, \$18,000 PD), 5/15/98 (3 miles East of C. La Crosse), 5/30/98 (La Crosse Municipal Airport, \$20,000 PD), 5/30/98 (C. Onalaska, \$6,000 PD), 3/30/98 (3 miles East of C. La Crosse), 6/18/98 (5 miles South of C. La Crosse, \$15,000 PD), 6/18/98 (3 miles East of C. La Crosse), 6/18/98 (New Amsterdam, \$3,000 PD), 6/18/98 (West Salem, 13 injuries, \$20,000 PD), 6/18/98 (St. Joseph), 6/18/98 (Middle Ridge), 6/18/98 (10 miles North of C. La Crosse, \$6,000 PD), 6/26/98 (Midway), 6/26/98 (Holmen, \$30,000 PD), 6/26/98 (New Amsterdam), 6/26/98 (St. Joseph, \$35,000 PD, \$25,000 CD), 6/27/98 (C. La Crosse, \$200,000 PD, \$75,000 CD, Presidential Disaster Declaration for county), 6/27/98 (2 miles East of C. La Crosse), 6/27/98 (St. Joseph, \$2,000 PD, \$1,000 CD), 6/27/98 (2 miles South of C. La Crosse, \$40,000 PD, \$12,000 CD), 7/20/98 (West Salem, \$14,000 PD), 8/9/98 (Holmen), 8/9/98 (New Amsterdam, \$35,000 PD, \$20,000 CD), 8/9/98 (Holmen, \$1,000 PD), 8/9/98 (C. Onalaska, \$45,000 PD), 8/9/98 (La Crosse Municipal Airport), 8/9/98 (St. Joseph, \$20,000 PD), 6/8/99 (C. La Crosse, \$40,000 PD), 7/8/99 (2 miles East of C. La Crosse, \$85,000 PD), 7/8/99 (Barre Mills, \$150,000 PD, \$40,000 CD). Magnitude of winds for these 48 events ranged from 50 kts. to 81 kts.
2000's:	19 reported events by NCDC – 6/13/00 (C. La Crosse, \$8,000 PD), 8/26/00 (3 miles South of C. La Crosse, \$5,000 PD), 6/11/01 (V. Holmen, \$1,000 PD), 6/11/01 (New Amsterdam, \$1,000 PD), 6/11/01 (Mindoro, \$1,000 PD), 4/17/02 (C. La Crosse), 7/30/02 (C. La Crosse, \$2,000 PD), 7/30/02 (West Salem, \$1,000 PD), 6/24/03 (C. La Crosse), 7/4/03 (6 miles South of C. La Crosse, \$3,000 PD, \$2,000 CD), 7/4/03 (La Crosse Municipal Airport, \$1,000 PD), 7/4/03 (C. La Crosse, \$4,000 PD, \$1,000 CD), 7/4/03 (C. Onalaska, \$1,000 PD, \$2,000 CD), 7/4/03 (West Salem, \$1,000 PD, \$1,000 CD), 7/19/04 (C. La Crosse, \$13,000 PD), 5/26/05 (La Crosse Municipal Airport), 8/9/05 (Barre Mills), 9/12/05 (Holmen, \$1,000 PD), 9/13/05 (New Amsterdam, \$2,000 PD). Magnitude of winds for these 19 events ranged from 50 kts. to 65 kts)

PD = Property Damage and CD = Crop Damage

Thunderstorm frequency is measured in terms of incidence of *thunderstorm days* or days on which thunderstorms are observed. Wisconsin averages between 30 and 50 thunderstorm days per year depending on location, with the southwestern area of the state normally having more thunderstorms than the rest of the state. A given county may experience ten or more thunderstorm days per year.

According to the National Weather Service Publication, *Storm Data*, in the past 30 years, Wisconsin has experienced hurricane force winds of 75 mph or higher on 120 days or about 4 days per year on average. Within the same period there have been 17 days when winds at or above 100 mph have been documented. This means that winds similar to a Category 2 Hurricane are experienced about one day every two years on average in Wisconsin. Thunderstorm winds can be fatal. During the period from 1982 to 2001, 20 fatalities have been attributed to wind from severe thunderstorms.

In Wisconsin, thunderstorms and their associated high winds can occur throughout the state during any month of the year with little or no notice, but their highest frequency is during the period of May through September. They also occur most often between the hours of noon and 10:00 p.m.

As shown in the history above, the National Climatic Data Center (NCDC) reported 110 thunderstorm events in La Crosse County from 1960-2005. The National Weather Service reports that the 72 county average for thunderstorm winds of 75 mph or greater from 1970-2001 was six per county over this 32-year period. La Crosse County had eleven of these events with thunderstorms with hurricane force winds.

Thunderstorm Vulnerability Assessment

- **Critical Facilities.** In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns thunderstorms a risk factor of 25 indicating this natural hazard is a high risk to the county. Thunderstorms can produce heavy rains and downbursts that induce straight-line winds with high wind speeds. Buildings could be damaged by the high winds and temporary flooding could occur in low-lying areas where these facilities are located. Thunderstorms can also produce three violently destructive natural elements, which include lightning, tornadoes, and hailstorms, which are discussed separately in this chapter. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- **Business and Industry.** Thunderstorms can cause damage to buildings by the high winds created by the storms and temporary flooding could occur in low-lying areas where these facilities are located. Thunderstorms can also produce violent destructive natural elements including lightning, tornadoes and hailstorms that can cause severe damage to buildings and can cause injuries and deaths to human.
- **Agriculture.** Thunderstorms can cause significant damage to agricultural crops, buildings and livestock. Heavy rains can cause erosion, wash out seedlings and create standing water in fields. Downspouts and straight-line winds can cause damage to buildings and flatten crops. The other natural elements that are produced by thunderstorms, including lightning, hailstorms and tornadoes can cause severe damage to crops, buildings and livestock.
- **Roads and Highways.** Heavy rains can limit visibility for drivers. Electric traffic signals can malfunction. Washouts and spot flooding can occur. Debris cleanup from roadway is needed soon after the storm.
- **Railroads.** Signals and electric switches can malfunction. Washouts and spot flooding can occur. Debris cleanup from tracks and right-of-way is needed soon after the storm. Damage to freight in poorly fitted cars or covered loads can cause problems, often discovered days or weeks later.
- **Airway.** Flight operations of aircraft, especially small planes, can be disrupted during the storm. Planes from other areas passing over the County may put down at local private airports as "port of refuge". Small aircraft parked on ground at private airports may be damaged.
- **Waterways.** Poor visibility during the storm can cause safety problems to pilots. Dangerous conditions may exist for deck crews and lock crews working outside during the storm. Locking may be aborted. Improperly moored barges could break loose from fleets or terminals.
- **Municipal Water.** In the county there are 44 municipal wells and water systems in operation, see Table 3-11. These facilities vulnerability to thunderstorms would include damage from high winds and heavy rainfall and could pollute underground wells. Other natural elements that are produced by thunderstorms include lightning, hailstorms, and tornadoes and can cause severe damage to municipal water facilities and equipment. Services provided by these facilities would not be interrupted except in extreme cases.

- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. The facilities vulnerability to thunderstorms would include damage to buildings and equipment from high winds. Heavy rainfall could cause holding ponds to overflow and treatment facilities could be inundated with water that could cause system failure. Thunderstorms can also produce lightning, hailstorms and tornadoes that could severely damage the wastewater treatment facilities and equipment. Services provided by these facilities would not be interrupted except in extreme cases.
- Hazardous Material Sites. The impact of thunderstorms on hazardous material is specific to the type of material and its storage or transportation conditions. Material in a state of transportation is more vulnerable than material in storage.

Thunderstorm Risk Assessment Designation

Thunderstorm Historical Occurrence Rating: High - 9

Thunderstorm Vulnerability Rating: Negligible - 2

Thunderstorm Probability Rating: Highly Likely - 8

Thunderstorm Local Official Survey Rating: Medium/High - 6

Thunderstorm Risk Assessment Designation: **High Threat – 25 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Thunderstorm Hazard Mitigation Ideas:

- Communities may use outreach programs to promote awareness of thunderstorm dangers - for example: during Severe Weather Awareness Week emphasize issues on weather related disaster preparedness through public education
- Local and state governments can invest in public early warning systems/networks, as well as train people to serve as weather spotters
- Provide weather radios to critical areas
- Public and private buildings can be designed with structural bracing, shutters, laminated glass in window panes, and hail resistant roof shingles or flashing to minimize damage
- Bury power lines with consideration for maintenance and repair
- Promote indoor warnings at all critical facilities
- Communities may adopt building codes requiring weatherproofing such as wall and roof anchoring, reinforcement of walls, ceilings and floors, etc.
- Cleaning and clearing culverts, drains, and waterways must be kept uppermost as a maintenance practice
- An emergency plan for retrieving and securing run away barges should be developed in cooperation with the barge towing industry and water-based terminals

3.4 La Crosse County, Tornado/High Winds Risk Assessment

Tornado/High Winds Definition: A tornado is a relatively short-lived storm composed of an intense rotating column of air, extending from a thunderstorm cloud system. It is nearly always visible as a funnel, although its lower end does not necessarily touch the ground. Average winds in a tornado, although never accurately measured, are between 100 and 200 miles per hour, but some may have winds exceeding 300 miles per hour. For standardization, the following are National Weather Service definitions of a tornado and associated terms:

- *Tornado* – a violently rotating column of air that is touching the ground
- *Funnel Cloud* – a rapidly rotating column of air that does not touch the ground
- *Downburst* – A strong downdraft, initiated by a thunderstorm, which induces an outburst of straight-line winds on or near the ground. They may last anywhere from a few minutes in small-scale microbursts to periods of up to 20 minutes in large, longer macro-bursts. Wind speeds in downbursts can reach 150 mph, in the range of a tornado.

A tornado path averages four miles, but may reach up to 300 miles in length. Widths average 300-400 yards, but severe tornadoes have cut swaths a mile or more in width, or have formed groups to two or three funnels traveling together. On the average, tornadoes move between 25 and 45 miles per hour, but speeds over land of up to 70 mph have been reported. Tornadoes rarely last more than a couple of minutes over a spot or more than 15-20 minutes in a ten-mile area, but their short periods of existence do not limit their devastation of an area.

The destructive power of a tornado results primarily from its high wind velocities and sudden changes in pressure. Wind and pressure differentials probably account for 90 percent of tornado-caused damage. Since tornadoes are generally associated with severe storm systems, they are usually accompanied by hail, torrential rain and intense lightning. Depending on their intensity, tornadoes can uproot trees, down power lines and destroy buildings. Flying debris can cause serious injury and death.

TORNADO DAMAGE SCALE			
Scale	Wind Speeds	Damage	Frequency
F0	40 to 72 MPH	Some damage to chimneys, TV antennas, roof shingles, trees and windows	29%
F1	73 to 112 MPH	Automobiles overturned, carports destroyed, trees uprooted	40%
F2	113 to 157 MPH	Roofs blown off houses, sheds and outbuildings demolished, mobile homes overturned	24%
F3	158 to 206 MPH	Exterior walls & roofs blown off homes. Metal buildings collapsed or are severely damaged. Forests & farmland flattened.	6%
F4	207 to 260 MPH	Few walls, if any, standing in well-built homes. Large steel and concrete missiles thrown far distances.	2%
F5	261 to 318 MPH	Homes leveled with all debris removed. Schools, motels and other larger structures have considerable damage with exterior walls and roofs gone. Top stories demolished.	Less than 1%

Downbursts are characterized by straight-line winds. Downburst damage is often highly localized and resembles that of tornadoes. There are significant interactions between tornadoes and downbursts and a tornado's path can also be affected by downbursts. Because of this, the path of a tornado can be very unpredictable, including veering right and left or even a U-turn.

Tornado/High Winds History and Frequency:

1950's:	2 reported events by NCDC – 4/26/54 (\$3,000 PD, F1 Magnitude), 4/19/57 (No recorded damage, F2 Magnitude)
1960's:	5 reported events by NCDC. 5/14/61 (F2 Magnitude, \$25,000 PD), 5/5/65 (F3 Magnitude, 1 Injury, \$2,500,000 PD), 7/10/66 (F1 Magnitude, \$25,000 PD), 6/15/67 (F0 Magnitude, \$3,000 PD).
1970's:	No events reported.
1980's:	2 reported events by NCDC – 6/5/80 (F2 Magnitude, \$250,000 PD), 6/23/81 (F1 Magnitude, \$250,000 PD).
1990's:	7 reported events (2 tornadoes & 5 high wind) by NCDC – 11/18/94 (High Winds, 1 Injury, \$10,000 PD), 4/3/95 (Microburst, 2 Injuries), 6/28/95 (C. Onalaska, F0 Magnitude), 4/6/97 (Winds of over 70 mph in La Crosse & 4 other counties causing \$45,000 in PD), 5/15/98 (3 miles West of West Salem, F0 Magnitude, 1 Injury, \$40,000 PD), 11/10/98, (Winds of up to 93 mph recorded, affected La Crosse and 12 other counties, \$1.7 million PD/1injury/2deaths), 7/8/99 (High winds 2 miles East of C. La Crosse, \$85,000 PD). 1 reported event reported by Wisconsin Emergency Management – 1998 High Winds and Severe Storms, \$11.1million in Public-Government Property and Facilities Damage and \$36.8 million in Private-Individual Property, Crop and Facilities Damage to La Crosse and 13 other counties, <i>Presidential Disaster Declaration</i> .
2000's:	4 reported events (1 tornado & 3 high winds) by NCDC – 4/7/01 (Winds of 60-70 mph in La Crosse and 9 other counties, \$12,000 PD), 10/25/01 (Winds of 40-50 mph in La Crosse and 12 other counties, no damages recorded), 4/18/04 (Strong Winds, \$1,000 PD), 9/13/05 (3 miles North of Holmen, F1 Magnitude, \$10,000 PD).

PD = Property Damage and CD = Crop Damage

All counties in Wisconsin have recorded at least two tornadoes in the period for 1844-2001. The National Weather Service reported that La Crosse County experienced 20 tornadoes during this period. The National Climatic Data Center also recorded 13 hurricane-force winds events (winds \geq 75 mph) from 1970-2005 in La Crosse County. In 1998, High winds in La Crosse and 13 other counties caused so much damage that the region received a Presidential Disaster Declaration. The history above details tornadoes and high winds in the County from 1954 through 2005.

Tornado/High Winds Vulnerability Assessment

- Critical Facilities.** In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Tornado/High Winds a risk factor of 24 indicating this natural hazard is a high risk to the county. Critical facility's vulnerability to tornadoes and high winds could adversely affect 25 percent of the county's population or property in a single event, see Table 3-2. While tornadoes occur infrequently in the County, 20 occurred in the years 1844-2006. Tornadoes and High winds can cause critical facilities to sustain substantial damage or could be completely destroyed, causing injury and even death. High winds and storms occur more frequently than tornadoes in the county. In 1998, three events were reported in the county. In the events, La Crosse County and thirteen other county critical facilities sustained \$11.1 million in damages to public and government property and the area received a Presidential Disaster Declaration. The services provided by these facilities would not be interrupted except in extreme cases. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.

- Business and Industry. In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. For businesses and industries tornadoes and high winds pose a high hazard risk in the county. Buildings could sustain substantial damage or be completely destroyed causing injuries and even death. High winds occur more frequently and the extent of the damage to buildings is determined by wind speed. The damages could range from damage to chimney, roof shingles and broken windows to exterior wall and roofs blown off buildings or the buildings could collapse. Businesses that are particularly vulnerable to tornadoes and high winds are car and truck dealerships.
- Agriculture. Tornadoes and high winds pose a high hazard threat to agricultural buildings, crops and livestock. Tornadoes and high winds can cause significant damage to buildings and can cause injuries and deaths. These events can flatten crops and forests.
- Roads and Highways. Trailers, especially high profile, empty, or lightly loaded trailers, are susceptible to being blown over, or otherwise adversely impacted, by high winds. As wind speed increases, even sub-tornado speeds can adversely impact vehicle handling, especially on bridges or open areas with long wind sweeps. Gusty winds are particularly dangerous as they occur sporadically and unexpectedly, and can cause unpredicted handling problems. High winds can blow fine soil/sand and other debris across the road and cause visibility problems, or direct damage to vehicles being struck by large blowing debris. Debris blown by high winds, sometimes rather large pieces of wood, tree limbs, or trash barrels, are blown onto highways and can cause safety problems even after the winds have subsided. Vehicles traveling on highways on ridge tops, and oriented in a north-south direction are more subject to high wind damage than are highways in valleys, or running parallel to the predominant wind direction.
- Railroads. High profile and/or lightly loaded cars, especially the “high cube” boxcars typically used to carry auto parts, can be blown over in high winds. Parked individual rail cars that are not properly chocked or brake set can be set in motion by high winds striking the car at a critical angle. Heavy debris striking trains during a high wind episode can cause direct damage to the locomotive or cars. Wind deposited debris on the tracks can cause safety problems after the winds have subsided.
- Airway. Light weight general aviation aircraft are the most prone to wind damage while parked on the ground as these can be blown over by high winds and damaged by flying debris. The larger airplanes and jets are susceptible to flying debris while parked on the ground.
- Waterways. High winds can have the same impact to craft on the Mississippi River as on lakes and oceans, with the wave action across long reaches of water creating potential for separating the barges and towboats. Waterway operations are controlled by the U.S. Coast Guard. Dangerous conditions may exist for deck crews and lock crews working outside during the storm. Locking may be aborted. Improperly moored barges could break loose from fleets or terminals.
- Municipal Water. In the county there are 44 municipal wells and water systems, see Table 3-11. These facilities and equipment could be significantly damaged or destroyed as a result of tornadoes and high winds. The services provided by these facilities would not be interrupted except in extreme cases.
- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities operating in the county, see Table 3-12. These facilities and equipment could be significantly damaged or destroyed as a result of tornadoes and high winds. The services provided by these facilities would not be interrupted except in extreme cases.
- Hazardous Material Sites. Hazardous material in transit is exposed to the same dangers as the mode of transport. Hazardous material in storage is more vulnerable than other material, and storage buildings should be storm reinforced.

Tornado/High Winds Risk Assessment Designation

Tornado/High Winds Historical Occurrence Rating: High - 7

Tornado/High Winds Vulnerability Rating: Critical - 5

Tornado/High Winds Probability Rating: Highly Likely - 6

Tornado/High Winds Local Official Survey Rating: High - 6

Tornado/High Winds Risk Assessment Designation: **High Threat – 24 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Tornado/High Winds Hazard Mitigation Ideas: • Local and state governments can invest in public early warning systems/networks, as well as train people to serve as weather spotters • Provide weather radios to critical areas • Encourage development of storm shelters in each community readily accessible to the public • Strengthen public and private structures by using engineering measures and construction techniques that may include structural bracing, straps

and clips, anchor bolts, laminated or impact-resistant glass, reinforced pedestrian and garage doors, window shutters, waterproof adhesive sealing strips, or interlocking roof shingles • Construct and use concrete safe rooms in homes and shelter areas of mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas • Anchor manufactured homes and exterior attachments such as carports and porches • Communities may adopt building codes requiring weatherproofing such as wall and roof anchoring, reinforcement of walls, ceilings and floors, etc. • Secure loose yard items like yard and patio furniture • Protect temporary debris disposal sites by fencing and/or locating away from populated areas • Require use of special roofing shingles designed to interlock and resist uplift forces • Bury power lines • Designed failure mode to power line design • Provide backup power resources that can enable critical facilities to continue basic services and can be used by businesses to ensure security and protect refrigerated goods • Prune trees near power lines • Promote public education during Severe Weather Awareness Week • Promote preparation of a home tornado plan and assembling a disaster supply kit • Highway agencies need to begin immediate patrols after high winds have swept through an area to clean dangerous debris off the road and shoulder, and insure road signs and traffic signals are visible and functioning • Railroad company maintenance-of-way forces should conduct patrols as soon as possible after a heavy wind event to remove debris on the tracks • An emergency plan for retrieving and securing runaway barges should be developed in cooperation with the barge towing industry and water-based terminals

3.5 La Crosse County, Riverine/Flash Flooding/Storm Water Flooding Risk Assessment

Riverine/Flash Flooding Definition: Flooding occurs when a river, stream, lake or other body of water overflows its banks onto normally dry land or there is an excessive pooling of surface water. These events can be slow to develop or happen very quickly. Flash floods are usually the result of excessive precipitation or rapid snowmelt and can occur suddenly with awesome power. Increased demand for housing along Wisconsin's waterfronts increases flooding vulnerability.

Flood related hazards in Wisconsin arise from a complex set of hydrologic and hydraulic interactions, including excessive precipitation; rapid snowmelt, ice or debris jams in waterway channels and dam or levee failures. These result in river flooding, stream flooding, coastal flooding and erosion, bank slumping, inland lake flooding, flash flooding, flooding from levee and dam failure and storm water runoff and ponding.

The effects of flooding can be devastating and cause extensive property damage. Although the probability of serious injury and loss of life is usually low, flooding increases the likelihood of long-term health hazards from water-borne diseases, mold, mildew, insect infestation and contaminated drinking water. Long-term damage to the environment may also result from flooding of sites containing hazardous materials or waste.

Major floods in Wisconsin tend to occur either in the spring when melting snow adds to runoff from rain or in summer and early fall after intense rainfalls. Flooding which occurs in the spring due to snowmelt and/or prolonged periods of heavy rain is characterized by a slow build-up of flow and velocity in rivers and streams over a period of days. This build-up continues until the river or stream overflows its banks, for as long as a week or two. The water then slowly recedes inch by inch to its original level. The expected occurrence and location of this type of flooding is fairly predictable and normally there is sufficient time for the orderly evacuation of people and property.

Flash flooding, which usually results from surface runoff after intense rains or the failure of water control structures, also poses a threat to all areas of Wisconsin. This is an extremely dangerous form of flooding because it is not very predictable. It can occur very quickly, precluding evacuation to higher ground to prevent loss of life. Small and normally calm rivers and streams will rise very rapidly when surrounding soil and terrain are unable to accommodate intense precipitation. Raging torrents of water can rip through waterways, surging well beyond normal banks and sweeping away everything in their path. Houses, structures, bridges, and boulders can be tossed and rolled by a flash flood. The strength of the water current, carrying debris and surging through an area, can cause serious injuries and death. It can also interrupt power, disable fuel sources, make roads impassable, hamper response efforts and strand people in their homes awaiting rescue.

Riverine/Flash Flooding History and Frequency:

1960's:	2 events: (1) 1965 - Mississippi River Flood of Record, 638.37 MSL, Lock & Dam 8 Tailwater Gage, Genoa, WI- <i>Presidential Disaster Declaration</i> . (2) 1969 – Mississippi River Flood, 635.24 MSL, Lock & Dam 8 Tailwater Gage, Genoa, WI
1970's:	No reported events by the National Data Climatic Center, 3 reported events by Wisconsin Emergency Management: (1) 1971 - Mississippi River Flood. (2) 1975 – Mississippi River Flood, \$633,500-Public Gov't Property and Facilities Damage and \$1.8 million Private-Individual Property, Crop and Facilities Damage to La Crosse and 7 other counties. (3) 1978 – Flooding and Tornadoes, \$11.7 million- Public Gov't Property and Facilities Damage and \$40 million Private-Individual Property, Crop and Facilities Damage - to La Crosse and fifteen other counties, <i>Presidential Disaster Declaration</i> .
1980's	No recorded events by the National Climatic Data Center, 1 reported event by Wisconsin Emergency Management: 1980 – High Winds/Heavy Rains/Tornadoes, \$3.5 million-Public Gov't Property and Facilities Damage and \$6.9 million Private-Individual Property, Crop and Facilities Damage to La Crosse and 10 other counties.
1990's:	4 reported events by NCDC: 4/3/97 (Mississippi River Flood, 3 rd highest on record, \$1 million PD – to La Crosse and five other counties); 8/23/97 (Flash Flood, \$50,000 PD); 6/27/98 (Flash Flood Countywide, \$20,000 PD); 8/9/98 (C. Onalaska); 1 reported event by Wisconsin Emergency Management: (1) 1993 –Flooding, Storms, Tornadoes, Heavy Rain/Mississippi River Flood, \$47 million- Public Gov't Property and Facilities Damage and \$700 million Private-Individual Property, Crop and Facilities Damage - to La Crosse and 46 other counties, <i>Presidential Disaster Declaration</i>
2000's:	4 reported events by NCDC – 5/17/00 (Countywide Urban/small stream flood, \$15,000 PD, \$10,000 CD); 4/10/01 (Mississippi River Flood, \$6.5 million PD – to La Crosse and five other counties); 5/1/01(Mississippi River Flooding, \$7.5 million PD to La Crosse and five other counties); 9/13/05 (Countywide flash flood, \$4,000 PD, \$3,000 CD). 2 reported events by Wisconsin Emergency Management: (1) 2001-Flooding/Storms/Tornado, \$47.7 million- Public Gov't Property and Facilities Damage and \$56.2 million Private-Individual Property, Crop and Facilities Damage - to La Crosse and 31 other counties, <i>Presidential Disaster Declaration</i> . (2) 2004 –Flooding/Severe Storms/Tornado, \$9.9 million- Public Gov't Property and Facilities Damage and \$77.1 million Private-Individual Property, Crop and Facilities Damage - to La Crosse and 43 other counties, <i>Presidential Disaster Declaration</i> .

PD = Property Damage and CD = Crop Damage

The Mississippi River, the largest river in the state, borders La Crosse County making low-lying areas in the county prone to flooding. In addition the Black River and La Crosse Rivers as well as other small rivers and streams in the La Crosse County flood periodically. The history above details flooding events in the county from 1960 to mid 2007. The County has received five Presidential Disaster Declarations since 1973 due to flooding. Wisconsin Emergency Management reports indicate that from 1971 through 2001 the 72 counties in Wisconsin averaged four flood related emergency and disaster events. La Crosse County received 6 events during this time period.

Flood Warning and Evacuation Plans – Mississippi River: Flood events on the Mississippi River are generally predictable and with rare exception even the crest height can be accurately forecast several days to a week or more before the event. There is no history of flash flooding on this part of the Mississippi River. There is usually ample time to prepare for a flood event, and to minimize flood damage by moving property out of lower elevations. This predictability makes the development of a flood warning and evacuation plan a practical concept.

Floodplain Development and Regulation

- County (unincorporated area) Floodplain Management Program: Enforcement and day-to-day administration of the County Floodplain Zoning Ordinance is conducted by the County Zoning Administrator. The Zoning Administrator reviews and issues floodway or flood fringe land use permits based on the permitted uses and prohibited uses outlined in the County Floodplain Zoning Ordinance. Standards for structures and buildings being built are also outlined in the Floodplain Ordinance. Reviewing plans of structures and buildings and then inspecting them is another floodplain management responsibility. Reporting to the DNR on decisions on variances, appeals, amendments, and violations pertaining to floodplain zoning and reporting violations to the County Zoning Agency and County Attorney for prosecution are also an integral part of the County Zoning Administrator's responsibilities. The County Zoning Administrator also frequently advises applicants of the provisions of the Floodplain Zoning Ordinance and assists them in properly preparing permit applications or proceeding with an appeals or amendment request. The existing floodplain

ordinance being currently used is contemporary and understandable therefore no changes are proposed to it at this point in time. This ordinance was updated and adopted in 2006.

Regulating Development. The development that occurs within the unincorporated areas of the County is subject to two ordinances. These are the County Shoreland-Wetland Ordinance and the County Floodplain Zoning Ordinance. The purpose and how the County addresses development with these ordinances is discussed below.

County Floodplain Zoning Ordinance. The State of Wisconsin has delegated responsibility to counties to administer and enforce floodplain zoning in unincorporated areas. This regulatory activity is to be conducted in accordance with Chapter NR 116 of Wisconsin Administrative Code and the standards of the National Flood Insurance Program.

Floodplains are land areas, which have been or may be covered by floodwater during the “regional flood”. The regional flood is a flood determined to be representative of large floods known to have occurred in Wisconsin or which may be expected to occur on a particular lake, river or stream. The regional flood is based upon a statistical analysis of lake level or stream flow records available for the watershed or an analysis of rainfall and runoff characteristics in the watershed or both. In any given year, there is a 1% chance that the regional flood may occur or be exceeded. This regional flood is often referred to as the 100-year flood.

The floodplain is made up of the floodway and flood fringe areas. A floodway is the channel of a river or stream and those portions of the floodplain adjoining the channel required to carry the regional flood discharge. A flood fringe is that portion of the floodplain outside of the floodway, which is covered by floodwater during the regional flood. The term flood fringe is generally associated with standing water rather than flowing water.

Prohibiting new residential construction in the floodway, regulating improvements to existing residential structures in the floodway, requiring dry land access to new development in the flood fringe and requiring a floodplain zoning or shoreland-wetland permit application for all floodplain or shoreland-wetland development are common examples on how the County addresses development and redevelopment in its floodplains and shoreland-wetland areas.

County Shoreland-Wetland Ordinance. The State of Wisconsin has delegated responsibility to counties to protect shoreland-wetlands in unincorporated areas. Shoreland wetlands are defined as wetlands of five acres or larger in size, identified on Wisconsin Wetland Inventory Map, and in the Shoreland Zone. The Shoreland Zone is defined as the area located 1,000 feet of the ordinary high water mark of a navigable lake, pond or flowage or within 300 feet of the ordinary high water mark of a navigable stream or to the landward side of the floodplain whichever distance is greater. These regulations are unique in that they regulate additional uses detrimental to shoreland-wetland areas and preserve the shore cover and natural beauty by restricting the removal of natural shoreland cover and controlling shoreland-wetland excavation, filling and other earth moving activity.

City and Village Floodplain Management Programs: The State of Wisconsin has delegated responsibility to cities and villages to administer and enforce floodplain zoning in incorporated areas. This regulatory activity is to be conducted in accordance with Chapter NR 116 of Wisconsin Administrative Code and the standards of the National Flood Insurance Program.

Flooding Vulnerability Assessment

- Floodplain Structures and Assessed Values. La Crosse County has a total of 1,570 parcels on which structures are located within the FEMA 100-year flood boundary. These 1,570 parcels have a total assessed land value of \$61,247,400; an assessed improvements value of \$235,074,129; and a total assessed value of \$296,321,529. The City of La Crosse has the most parcels with 1,290 followed by the Town of Campbell with 172 parcels and the Town of Onalaska with 42 parcels. These three municipalities account for 1,504 parcels or 95.8% of the total number of parcels and a total assessed value of \$283,070,529 or 95.5% of the County’s total. Table 3-3 has a complete listing by municipality of the parcels located within FEMA’s 100-year flood boundary. Map 3-6 shows the location of these properties throughout the floodplain.
- Repetitive Loss Structures. Repetitive Loss Structures are defined as those properties that have had two or more flood insurance claims of at least \$1,000 each. A report titled “State of Wisconsin Repetitive Loss Report” prepared by

Wisconsin Emergency Management and FEMA Region V in April 2004 indicates that there are 5 repetitive loss structures in the county. Two of these structures are located in the City of La Crosse and 3 are located in the unincorporated areas of the County.

- **Flood Risk Assessment.** Determining potential damage to residential and commercial structures is a difficult undertaking without intense survey work. Some of the factors which make it difficult are: not all of the first floor elevations of the structures are the same; even structures adjacent to each other often have different first floor elevations; some areas will receive damage due to wave action or flowing water; some may appear to be flooded and heavily damaged from the outside but in fact have received little damage due to flood proofing techniques; some cannot be observed due to floodwaters inhibiting access; damages are often not reported; and damages that are reported are based on each property owners individual opinion of damage.

Despite these factors an attempt has been made to ascertain the approximate damages a 100-year flood would inflict on residences and businesses in the County. To assist in this damage assessment process the Federal Insurance Administration has prepared a table, which lists the percentage of damage to a structure based upon the amount of water in the first floor. This table can be found in the book titled "Design Manual for Retrofitting Flood-prone Residential Structures" published by FEMA. We used this table when determining the amount of damage to structures. To determine the amount of water in the first floor of structures and the number of structures, which would have water in the first floor, we used Flood Insurance Rate Maps, a City of La Crosse first floor elevation study and local knowledge of the areas. To make flood damage estimates more accurate we divided the County into 12 different areas; these are: 1) Flemming Creek; 2) Black River; 3) Sand Lake Creek; 4) Brice Prairie; 5) City of Onalaska; 6) Town of Campbell; 7) City of La Crosse – North; 8) City of La Crosse - Ebner Coulee and Pammel Creek; 9) City of La Crosse – South; 10) Mississippi River South 11) Mormon Creek; and 12) La Crosse River.

Dividing the County into 12 different geographic areas enables the assignment of different real property values to different areas which is needed because each area is unique in regards to topography, hydrology and development characteristics. This process compensates for the change flood prone property can have across the County in property values from one area to another. By using an average value for each area more realistic flood damage estimates can be generated than if a county wide average value for each structure were used.

During a 100-year flood event the County would have a projected damage total to residential and commercial structures of approximately \$40,813,452. The area totals are as follows: 1) Flemming Creek - \$97,516; 2) Black River - \$6,000; 3) Sand Lake Creek - \$405,910; 4) Brice Prairie - \$365,607; 5) City of Onalaska - \$224,450; 6) Town of Campbell - \$1,474,585; 7) City of La Crosse – North \$29,905,549; 8) City of La Crosse – Ebner Coulee and Pammel Creek \$4,147,974; 9) City of La Crosse – South \$4,911,902; 10) Mississippi River South - \$160,590; 11) Mormon Creek - \$111,369; and 12) La Crosse River - \$2,000. A detailed breakdown of the areas showing total number of structures affected and depth of water in the structures can be seen in Table 3-4.

- **Critical Facilities.** In the county 174-service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Flooding a risk factor of 22 indicating this natural hazard is a high risk to the county.
- **Business and Industry.** In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. Of these businesses 214 are located in the floodplain. These businesses have an assessed value \$116,496,400. Many of these businesses sustain flooding damage and economic losses in lesser flood events. Businesses and industries in the county that do not suffer physical damage often sustain significant income losses as a result of a flood event due to reduction in sales or production problems caused by flood induced customer loss, employee problems and input / output interruptions. Tourism related businesses in particular, such as restaurants, motels, marinas and campgrounds, suffer a loss or revenue because of reduced customers desiring to visit the area. The media publicity generated during a flood event focus on flood related disasters and create a negative mind-set in the public that can persist long after the floodwaters recede.
- **Agriculture.** In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. The Natural Hazard Risk Assessment assigns flooding a high risk factor in the county. The land adjacent to these rivers is mostly agricultural and pasture land that are subject to flooding.

- Roads and Highways. Of all the hazards discussed so far, flooding is the hazard most likely to seriously impact the transportation infrastructure, rather than the vehicles used in transportation, or transportation operations and safety. Periodic flooding of fixed waterways, such as streams and the Mississippi, Black and La Crosse Rivers is a known factor, and the extent of flooding, or potential flooding, has been delineated on maps.

Several roadways in La Crosse County are subject to flooding, either by the predictable, advance notice rising of the Mississippi, Black and La Crosse Rivers, or by the shorter advance warning flash flooding often besetting smaller streams. Other streams and low areas can result in water across the roadway, or at an intersection, even without the event being noted as a major flood event by FEMA.

- Railroads. Periodic flooding of fixed waterways, such the Mississippi is a known factor, and the extent of the flooding, or potential flooding, has been delineated on maps. There are two railroad lines in La Crosse County. The Burlington Northern & Santa Fe Railway's (BNSF) mainline between Chicago and the Twin Cities and the Iowa, Chicago & Eastern Railway lies along the Mississippi River. Stretches of the railroads are reinforced with large boulder and rock riprap as necessary during Mississippi River high water.
- Airway. There are two airports in La Crosse County. Portions of the La Crosse Municipal Airport are located in a floodplain and therefore are subject to flooding. The Holland Air Park is not located in a floodplain and therefore would not be subject to flooding. Aircraft operation would not be possible during times of flooding if the runway was inundated with water.
- Waterways. The Mississippi River is the only commercially navigable waterway in La Crosse County. Each Corps of Engineers Navigation Lock has a water elevation at which point the lock operations are stopped at that lock, and no further operations are conducted. All commercial tows, whether up bound or down bound, seek secure mooring in existing fleeting areas if possible. Some tows may be permitted to pass through the lock to a different pool after closure, if it can be safely done, to allow a tow access to a more secure mooring location. Improperly moored barges could break loose from fleets or terminals. Three dams impact the La Crosse County reach of the Mississippi River. The lock closure river elevation at Trempealeau Lock 6 is 651.5 feet above mean sea level. Lock and Dam 7, located at Dresbach closure elevation is 646.5 feet above mean sea level. Lock & Dam 8, located at the Village of Genoa closure elevation is 635.9.
- Municipal Water. In the county there are 44 municipal wells and water systems, see Table 3-11. These facilities are usually located outside the floodplain, which lessens their vulnerability to flooding. With the volume of water associated with floods and the runoff from the lands and sites that are not usually covered by water, filterization could be accelerated and pollutants could migrate into the water source. Pumping stations in low areas may need to be protected.
- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities can be located in low-lying areas especially gravity type systems making them vulnerable to flooding. Homes and businesses with basement floor drains that empty directly into the wastewater treatment systems can overload wastewater treatment facilities if the buildings are flooded causing the discharge of untreated wastewater. Floodwaters can infiltrate into the piping of the system that could result in the system operating over its capacity. Lift stations may need to be protected.
- Hazardous Material Sites. Hazardous material in transit is subject to the same risk as other material on a given transportation mode. Hazardous material in a storage mode must be protected from floodwaters. Material stored in floodplains should be moved or flood proofed when a prediction of high water is received.

Riverine/Flooding Risk Assessment Designation

Riverine/Flooding Historical Occurrence Rating: High - 8

Riverine/Flooding Vulnerability Rating: Limited - 3

Riverine/Flooding Probability Rating: Likely - 6

Riverine/Flooding Local Official Survey Rating: Medium - 5

Riverine/Flooding Risk Assessment Designation: **High Threat– 22 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Flooding Hazard Mitigation Ideas: • Acquire land in flood prone areas and remove structures and enforce permanent restrictions on development • Relocate structures to less hazardous locations • Elevate structures – mechanically lift so that the lowest floor, including the basement, is raised above the base flood elevation – utilities and other mechanical

devices should also be raised above expected flood levels ● Dry-floodproofing – keep water out by strengthening walls, sealing openings, or by using waterproof compounds or plastic sheeting on walls ● Wet-floodproofing – Use water resistant paints or other materials that can allow for easy cleanup after floodwater exposure in accessory structures or in a garage area below an elevated residential structure. In basement, wet-floodproofing may be preferable to attempting to keep water out completely. ● Adopt zoning ordinances that limit development in the floodplain ● Limit density of developments in the floodplain ● Require that floodplains be kept as open space ● Subdivision design standards can require elevation data collection during the platting phase and lots may be required to have a buildable space above the base flood elevation ● Requirements for building design standards and enforcement include the following possibilities: 1) that a residential structure be elevated; and 2) that a non-residential structure be elevated or floodproofed ● Conservation easements may be used to protect environmentally significant portions of parcels from development – they do not restrict all use of the land, rather they direct development to areas of land that are not environmentally significant ● Purchasing flood insurance does not prevent a flood from occurring, but it does mitigate a property owner’s financial exposure to loss from flood damage ● By taking initiative locally, to more accurately map problem areas with information not already on FEMA maps a community can warn residents about potential risks that may not have been anticipated ● To maintain dry access, roads should be elevated above the base flood elevation. However, if a road creates a barrier it can cause water to pond. Where ponding is problematic, drainage and flow may be addressed by making changes to culvert size and placement. ● Flood warning can alleviate health and safety risk by providing citizens time to escape and possibly remove belongings that could be damaged. NOAA weather radio and EAS broadcasts can be incorporated into a community’s flood warning system ● Local and state governments should have a plan/procedure in place for flood damage control by establishing volunteer teams available for sandbagging etc. and providing for temporary relocation and storage of equipment, furniture etc. ● Communities should develop a post-flood clean up- decontamination, and recovery plan/procedures ● Alternate routes can be determined and marked in advance of the actual flooding ● Movable message portable signs should be posted at locations where motorists can make detour decisions before entering into the flooded road segment ● Cleaning and clearing culverts, drains, and waterways must be kept uppermost as a maintenance practice ● After a flood it is especially important to check and maintain all drainage ways ● Highway agencies need to begin immediate patrols after floods have swept through an area to clean dangerous debris off the road and shoulder, and insure road signs and traffic signal are visible and functioning ● An emergency plan for retrieving and securing run away barges should be developed in cooperation with the barge towing industry and water-based terminals ● Have public relations strategy in place to counteract negative media reports after a flood to maintain community’s tourism base

3.6 La Crosse County, Dam Failure Flooding Risk Assessment

Dam Failure Flooding Definition: A dam failure involves the uncontrolled release of stored water due to the breaching of a water control structure, resulting in rapid downstream flooding. A dam can fail because of excessive rainfall or melted snow, poor construction or maintenance, flood damage, earthquake activity, weakening caused by burrowing animals or vegetation, surface erosion, vandalism or a combination of these factors. Dam failures can result in the loss of life and significant property damage in an extensive area downstream of the dam.

Dams serve many purposes, including agricultural uses, providing recreation areas, electrical power generation, erosion control, water level control and flood control. The federal government has jurisdiction over dams that produce hydro-electricity- approximately 5% of the dams in Wisconsin. Private individuals own approximately 50% of the dams in Wisconsin, the State owns 19%, municipalities such as townships or county governments own 16%, and 15% are owned by various other groups. The Wisconsin Department of Natural Resources regulates all dams on waterways to some degree. However, the majority of dams overall in Wisconsin are small and are not stringently regulated for safety purposes.

Most of the dams that provide a flood control benefit are large hydroelectric dams on major rivers where flood control is a secondary benefit or they are PL 566 dams built through the Watershed Protection and Flood Prevention Act of 1954. The PL 566 dams hold little or no water in their reservoirs under normal conditions. Since these dams only hold significant amounts of waters during floods, they present a special hazard as everyday water related problems such as seepage cannot be readily seen and corrected. When floodwater does arrive, the dam is used to its maximum capacity. La Crosse County has one small hydroelectric dam at Lake Neshonoc but does not have any PL566 dams.

For emergency planning purposes, dam failures are categorized as either *rainy day* or *sunny day failures*. *Rainy day failures* involve periods of excessive precipitation leading to an unusually high runoff. This high runoff increases the reservoir of the dam and if not controlled, the overtopping of the dam or excessive water present can lead to dam failure. Normal storm events can also lead to rainy day failures if water outlets are plugged with debris or otherwise made inoperable. *Sunny day failures* occur due to poor dam maintenance, damage/obstruction of outlet systems or vandalism. This type is the worst case of failure and can be catastrophic because the breach is unexpected and there may not be sufficient time to properly warn downstream residents.

Dam Failure Flooding History and Frequency: There are no reported incidences of dam failure.

- **Critical Facilities.** In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Dam Failure Flooding a risk factor of 8 indicating this natural hazard is a low risk to the county. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- **Business and Industry.** In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. The Natural Hazard Risk Assessment assigns dam failure flooding a low risk factor in the county. No businesses have been identified as lying in the hydraulic shadow of a dam.
- **Agriculture.** In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. The Natural Hazard Risk Assessment assigns dam failure flooding a low risk factor in the county. The land below the dams is mostly agricultural and pastureland that would be subject to flooding in the rare occurrence a dam fails.
- **Roads and Highways.** Dam failure differs from traditional flooding in that flooding, even on a rapidly rising stream such as Pammel Creek happens both with a certain regularity in terms of not being an “if”, but a “when”, and also with a certain advance warning, perhaps weeks for the Mississippi but none-the-less, there is a warning period to take action to close roads, move equipment, or other take other mitigation. A dam break on the other hand could leave little time, even in terms of minutes, to take any mitigation action. Hydraulic shadows of dams in La Crosse County are not known.
- **Railroads** There are two railroad lines in La Crosse County. The Burlington Northern & Santa Fe Railway's (BNSF) lies along the Mississippi River. And the Canadian Pacific (CP) runs East-West within the La Crosse River valley. The risk factor from dam failure to these rail lines is low.
- **Airway.** La Crosse Municipal and Holland Air Park are the two public airports located La Crosse County. Neither of these lie in the hydraulic shadow of a dam.
- **Waterways.** The hazard to commercial navigation on the Mississippi River from dam failures on tributaries is minute. In most cases the initial flush of water from a partial or complete failure of a dam on a tributary would not even reach the Mississippi in a noticeable form. Commercial navigation would be severely affected and possibly halted should one of the Corps. Of Engineers Lock and Dams fail.
- **Municipal Water.** In the county there are 44 municipal wells and water systems, see Table 3-11. These facilities are usually located at higher elevations, which lessens their vulnerability to flooding or damage if a dam would fail. Hydraulic shadows for all dams in La Crosse County are not known.
- **Wastewater Treatment Facilities.** There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities can be located in low-lying areas especially gravity type systems making them vulnerable to flooding in event that a dam fails. Floodwaters could infiltrate into the piping of the system that could result in the system operating over its capacity. Hydraulic shadows of all dams in La Crosse County are not known.
- **Hazardous Material Sites.** While all hydraulic shadows for dams in the County have not been determined, no major hazardous waste disposal or storage sites are located in the hydraulic shadows of dams. Most rural dwellings have fuel oil, bottled gas, gasoline, and other containers of various sizes mounted outdoors or in storage buildings. These containers need to be made secure from winds and flooding.

Dam Failure Flooding Risk Assessment Designation

Dam Failure Flooding Historical Occurrence Rating: Low - 1

Dam Failure Flooding Vulnerability Rating: Negligible - 2

Dam Failure Flooding Probability Rating: Unlikely - 3

Dam Failure Flooding Local Official Survey Rating: Low -2

Dam Failure Flooding Risk Assessment Designation: **Low Threat – 8 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Dam Failure Flooding Hazard Mitigation Ideas: ● Have an inspection, maintenance and enforcement program in place to ensure the continued structural integrity of dams ● Remove unnecessary or old and structurally unsound dams ● Planning for dam breaks can include constructing emergency access roads as well as automating pump and flood gate operation ● Regulate development in a dam's hydraulic shadow, where flooding would occur if there were a severe dam failure ● Develop and coordinate dam failure emergency action plans

3.7 La Crosse County, Forest/Wildland Fire Risk Assessment

Forest/Wildland Fires Definition: A forest fire is an uncontrolled fire occurring in a forest or in woodlands outside the limits of incorporated villages or cities. A wildfire is any instance of uncontrolled burning in brush, marshes, grasslands or field lands. The causes of these fires include lightning, human carelessness and arson.

Forest and wildfires can occur at any time of the day and during any month of the year, but the peak fire season in Wisconsin is normally from March through November. The season length and peak months may vary appreciably from year to year. Land use, vegetation, amount of combustible materials present 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 dry from a winter with little snow and/or a spring and summer with sparse rainfall.

Forest fires and wildfires are capable of causing significant injury, death and damage to property. A recent inventory showed that 46 percent 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. Major direct costs associated with forest fires or wildfires are the salvage and removal of downed timber and debris and the restoration of the burned area. If burned-out woodlands and grasslands are not replanted quickly to prevent widespread soil erosion, then landslides, mudflows and floods could result, compounding the damage.

Forest/Wildland Fires History and Frequency: No major forest fires have occurred in La Crosse County in recent history.

The 1976 drought created the most severe fire danger condition in Wisconsin forests and grasslands since the 1930's. During 1976 a total of 4,144 fires occurred, the greatest number in any one-year since 1971, when detailed record keeping began. The fire season of 1988 is also remembered as one of the driest on record. A total of 3,242 fires occurred that year, but just 9,740 acres burned, an extraordinarily low number considering the severity of the threat. Department of Natural Resource records show that one major forest fires (*fires burning over 500 acres*) have been reported for La Crosse County from 1976 through 2005. This fire occurred at Burr Oak on 4/5/00 and burned approximately 800 acres and caused \$20,000 in property damage, homes were evacuated but none of the structures were damaged as fire fighters contained the blaze.

Forest/Wildland Fires Vulnerability Assessment

- **Critical Facilities.** In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Forest/Wildland Fires a risk factor of 8 indicating this natural hazard is a low risk to the county. Critical facility's vulnerability to Forest/Wildland Fires is very negligible. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- **Business and Industry.** In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. For the majority of urban businesses and industries forest/wildland fires pose a low risk. Businesses and industries located in rural areas or those located adjacent to

forests and grasslands may be at a more significant risk. Examples of businesses that would be more vulnerable to these natural disasters include campgrounds and other recreation facilities.

- Agriculture. The overall hazard risk to agriculture is low. Agricultural buildings, especially out buildings that may be adjacent to forests or grasslands have an increased vulnerability to forest/wildland fires. Crops that have sustained long periods of drought or crops at harvest time could be more susceptible to damage from fires. Agricultural Forests are susceptible to forest/wildland fires. In addition this natural hazard could also endanger livestock.
- Roads and Highways. Smoke from forest fires can adversely affect visibility for motorists, but this is an isolated occurrence. The movement of heavy and specialized fire fighting equipment on public roadways to fire scenes can cause temporary disruption or inconvenience to the motoring public. Following a major forest or wildland fire, sufficient vegetation may have been destroyed so as to warrant consideration of temporary emergence soil erosion control methods. This would especially apply to steep slopes, such as along STH 35.
- Railroads. Smoke from forest fires can adversely affect visibility for train operation, but this is an isolated occurrence and can be mitigated by notification of the railroad dispatcher. A decision to close the railroad temporarily can be made by railroad management. Following a major forest or wildland fire, sufficient vegetation may have been destroyed so as to warrant consideration of temporary emergence soil erosion control methods.
- Airway. Although fires in the hardwood forests of La Crosse County rarely reach the spectacular proportions of fires in the western state mountains, or even in the coniferous forests of northern Wisconsin, aircraft are sometimes used for observation, or water drops. During major fire events the La Crosse Municipal airport or Holland Air Park could become major hubs of air and ground activity. Highway traffic control by local officers in the vicinity of the airports might be needed.
- Waterways. Although there are some historical accounts of navigation by steamboat on the Mississippi River during wildfires on adjacent bluffs, these accounts relate little in the way of direct threat to boats on the river. As with land and air transportation, there could be isolated incidents of smoke drift creating a visibility hazard to river boat pilots, but modern tow boats equipped with radar, are less apt to be impacted by this than are motorists on a highway.
- Municipal Water. In the county there are 44 municipal wells and waters systems in operation, see Table 3-11. These facilities vulnerability to forest/wildland fires would be negligible except if these facilities are located adjacent to forests. The services provided by these facilities would not be interrupted except in extreme cases.
- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities vulnerability to forest/wildland fires would be negligible except if these facilities were located adjacent to forests. The services provided by these facilities would not be interrupted except in extreme cases.
- Hazardous Material Sites. Hazardous material storage areas in the path of forest or wildland fire would have to either receive concentrated protection, at the expense of resources that could otherwise be devoted to the main task of fire suppression, or the material would have to be moved and transported to a pre-designated relocation site if there were sufficient advance warning and accurate prediction of the fire's path. This latter option is not very likely to present itself.

Forest/Wildland Fires Risk Assessment Designation

Forest/Wildland Fires Historical Occurrence Rating: Low - 1

Forest/Wildland Fires Vulnerability Rating: Negligible - 1

Forest/Wildland Fires Probability Rating: Possible - 3

Forest/Wildland Fires Local Official Survey Rating: Medium - 3

Forest/Wildland Fires Risk Assessment Designation: **Low Threat – 8 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Forest/Wildland Fires Hazard Mitigation Ideas: ● Outreach efforts can promote such items as non-combustible roof covering, fire safe construction, and the important of cleaning brush away from buildings ● Promote public education on smoking hazards and the risks of recreational fires ● Zoning can be used to cluster development into defensible areas and keep development away from fire hazards such as steep slopes, where fires are difficult to contain ● Damage potential can be reduced by ensuring that structures are surrounded by defensible space or buffer zones ● Local power companies can help prevent or alleviate wildfires by property maintenance and separation of power lines, as well as efficient response to fallen power lines ● Maintenance of property in or near wildfire prone areas (fuel management techniques, pruning/clearing dead vegetation, selective logging, planting fire-resistant vegetation, creating fire breaks) ● Local governments can require burn permits and restrict campfires and outdoor burning ● Establish or continue to maintain cooperative fire agreements with the Wisconsin Department of Natural Resources ● Smoke from forest fires can adversely affect visibility for motorists,

but can be mitigated by temporary signage or even road closures in a temporary basis • Following a major forest or wildland fire, sufficient vegetation may have been destroyed so as to warrant consideration of temporary emergence soil erosion control methods

3.8 La Crosse County, Heavy Snowstorm Risk Assessment

Heavy Snowstorm Definition: Winter storms can vary in size and strength and include heavy snowstorms. A heavy snowfall is the accumulation of six or more inches of snow in a 12-hour period or eight or more inches in a 24-hour period.

Heavy Snowstorm History and Frequency:

1990's:	13 reported events by NCDC – 1/16/94 (up to 9"), 1/26/94 (6"-12"), 2/22/94 (6"-16"), 2/25/94 (6"-10"), 3/6/95 (7"-10"), 4/9/95 (8"-12"), 11/26/95 (6"-14"), 1/18/96 (6"-10" with blowing and drifting causing drifts of 2'-4'), 11/20/96 (4"-6", \$100,000 PD), 2/4/97 (6"-10"), 3/13/97 (10"-20"), 1/1/99 (8"-13"), 1/24/99(6"-8", 1 death, 20 injuries, \$130,000 PD).
2000's:	12 reported events by NCDC –12/18/00 (4"-8"), 12/28/00 (5"-7"), 3/12/01 (6"-10"), 3/1/02 (6"-10" with 15-25 mph winds), 2/2/03 (3"-7"), 1/26/04 (6"-7"), 2/1/04 (6"-11"), 12/20/04 (6"-9"), 1/21/05 (6"-10"), 2/20/05 (6"-10"), 3/17/05 (8"-16"), 2/15/06 (5"-9").

Much of the snowfall in Wisconsin occurs in small amounts between one and three inches per occurrence. Heavy snowfalls that produce at least eight to ten inches accumulation happen on the average only five times per season. Southwestern Wisconsin receives most of its snow during mid-winter. Snowfall in Wisconsin varies between the seasonal average of approximately 30 inches in the south central area of the state to over 100 inches a year in the extreme northwestern counties.

The National Climatic Data Center records show 13 heavy snowstorm events in La Crosse County during the 1990's and 12 were so far in the 2000's.

Heavy Snowstorm Vulnerability Assessment

- **Critical Facilities.** In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Heavy Snowstorm a risk factor of 30 indicating this natural hazard is a high risk to the county. In fact, this natural hazard received the highest risk assessment of all natural hazards assessed for the county. Heavy snowstorms with large accumulations of snow could cause structural damage to the roofs of these buildings due to inadequate snow load capacity. In extreme cases, operations of these facilities could be limited because employees are unable to get to work. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- **Business and Industry.** In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. Heavy snowstorms with large accumulations of snow could cause structural damages to roofs of these buildings due to inadequate snow load capacity. Businesses and industries vulnerability to heavy snowstorms could include economic loss and disruptions of inputs and outputs in extreme cases.
- **Agriculture.** In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Snow from snowstorms is beneficial to many crops because it provides insulation from freezing and extreme cold. Livestock can be vulnerable to heavy snowstorms and can cause injuries and death. Cropland with significant frost depth can be negatively impacted by heavy snow cover. Spring rains are needed to draw the frost out of the ground; otherwise the water from snow melt will not be absorbed by the soil and can cause severe runoff and flooding.
- **Roads and Highways.** Direct hazard caused by poor visibility and slippery surface. Safety concerns with snowplows. Following a heavy snowfall, visibility problems can persist with blowing snow, and icing following partial melting and refreezing of the runoff water. Blowing snow is more apt to occur on north-south oriented roads such as STH 162. Following a heavy snowfall, children may be outside playing in the snow near the roadway and be oblivious to traffic. Following the snow deposition, lesser-used roads may remain blocked for hours, or even days after the storm is over. This blockage can cause motorist confusion and circuitous detours, as well as hampering access for emergency vehicles. Finding locations to store snow, especially snow removed from large expanses like urban parking lots, can be challenging.

- Railroads. Direct hazard caused by poor visibility. Following a heavy snowfall, visibility problems can persist with blowing snow.
- Airway. Plane operation from the La Crosse Municipal airport or Holland airpark would not be possible during a heavy snowstorm, because of the poor visibility and the physical blockage of the runway and taxiways. Following a heavy snowfall, visibility problems can persist with blowing snow, and icing following partial melting and refreezing of the runoff water. Heavy snow squalls in the vicinity of La Crosse County could cause some light aircraft, possibly flying over the county, to decide to land at La Crosse or Holland until the storms stop.
- Waterways. The Mississippi River is typically closed from about the first week of December to the second week of March. Most heavy snowfalls occur in the winter when the Mississippi River is closed to navigation, and therefore present no challenge. Early heavy snows in early December or mid March could catch an active tow still on the Upper River. The same conditions of poor visibility that affect road and rail travel can impact river pilots as well. Although commercial riverboats are equipped with radar, eyesight visibility is still critical to navigate through locks, and while performing barge transfers. Heavy snow makes conditions dangerous for deck personnel where a slip and fall can be fatal. Lock workers experience the same problem. There is one Corps of Engineers navigation lock, Lock and Dam 7, at the Dresbach.
- Municipal Water. In the county there are 44 municipal wells and water systems in operation, see Table 3-11. These facilities vulnerability to heavy snowstorms is negligible and would not cause interruption of services provided by these facilities.
- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities vulnerability to heavy snowstorms is negligible and would not interrupt services provided by these facilities.
- Hazardous Material Sites. Heavy snow does not have as great an impact on hazardous materials in storage as does some of the other natural hazards, but heavy snow could cause collapse of storage building roofs, as well as restricting the response of emergency crews to the scene.

Heavy Snowstorm Risk Assessment Designation

Heavy Snowstorm Historical Occurrence Rating: High - 9

Heavy Snowstorm Vulnerability Rating: Catastrophic - 7

Heavy Snowstorm Probability Rating: Highly Likely - 8

Heavy Snowstorm Local Official Survey Rating: High - 6

Heavy Snowstorm Risk Assessment Designation: **High Threat – 30 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Heavy Snowstorm Hazard Mitigation Ideas:

- Local and state governments can produce and distribute family and traveler emergency preparedness information relating to severe winter weather hazards
- Safety strategies for severe weather events can be included in driver education classes
- Burying or otherwise protecting electric and other utility lines can prevent utility disruption
- Local governments can impact building/site design through building code enforcement of snow-related ordinances such as snow loads, roof slope, snow removal, and storage
- Establish heating centers or shelters for vulnerable populations
- Local governments need to always plan for and maintain adequate road and debris clearing capabilities
- Use snow fences to limit blowing and drifting of snow over critical roadway segments

3.9 La Crosse County, Ice Storm Risk Assessment

Ice Storm Definition: Winter storms can vary in size and strength and include ice storms. An ice storm is an occurrence where rain falls from warmer upper layers of the atmosphere to the colder ground, freezing upon contact with the ground and exposed objects near the ground.

Freezing drizzle/freezing rain is the effect of drizzle or rain freezing upon impact on objects that have a temperature of 32 degrees Fahrenheit or below. Sleet is solid grains or pellets of ice formed by the freezing of raindrops or the refreezing of largely melted snowflakes. This ice does not cling to surfaces.

Both ice and sleet storms can occur at anytime throughout the winter season from October into early April. Early and late season ice and sleet storms are generally restricted to northern Wisconsin, otherwise the majority of these storms occur in southern Wisconsin. In a typical winter there are 3-5 freezing rain events and a major ice storm occurs on a frequency of about once every other year. If a half inch of rain freezes on trees and utility wires, extensive damage can occur, especially if accompanied by high winds that compound the effects of the added weight of ice. There are also between three and five instances of glazing (less than ¼ inch of ice) throughout the state during a normal winter.

Ice Storm History and Frequency:

1970's:	1 event reported by Wisconsin Emergency Management – 3/76, devastating ice storm, \$8.5 million-Public Gov't Property and Facilities Damage and \$42 million Private-Individual Property, Crop and Facilities Damage to La Crosse and 21 other counties, <i>Presidential Disaster Declaration</i> .
1990's:	4 event s reported by NCDC – 1/26/94 (heavy snow/ice storm); 12/13/95 (glaze); 2/26/96; 1/4/98 (La Crosse & 11 other counties, \$67,000 PD, 14 injuries)
2000's:	2 events reported by NCDC – 2/24/0, 1/1/05

Wisconsin Emergency Management records show that in March of 1976 a devastating ice storm hit La Crosse County along with 21 other counties, causing over \$50 million in property damage warranting a Presidential Disaster Declaration. The National Climatic Data Center reported that La Crosse County experienced four ice storm events in the 1990's and 2 events in 2000's.

Ice Storm Vulnerability Assessment

- Critical Facilities. In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Ice Storm a risk factor of 22 indicating this natural hazard is a high risk to the county. Ice storms can damage the roofs of these facilities by forming “ice dams” and in severe conditions the weight of the ice from these storms can cause roofs to collapse. Ice storms can damage power and communication lines and cut off service to these buildings. Services provided by these facilities would not be interrupted except in extreme cases. See Table 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- Business and Industry. In La Crosse County there were 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. Ice storms can damage the roofs of these buildings by forming “ice dams” and in severe conditions the weight of the ice from these storms could cause roofs to collapse. Ice storms can damage power and communication lines and cut off service to buildings resulting in lost production and revenue from businesses and industries. Agricultural-related businesses and industries could suffer economic losses from crop damages, reduced milk production and loss of livestock due to ice storms.
- Agriculture. In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. The hazard threat from ice storms is high in the county. The agricultural economy can sustain substantial economic losses from these storms. Ice storms can damage and collapse the roofs of buildings and can damage power and communication cutting off service to these buildings. The dairy industry in particular is vulnerable to ice storms because these operations are dependent on electric milking equipment that could result in reduced production and extreme cases milk may have to be dumped. This natural hazard can result in the loss of livestock due to exposure and increase crop damages. Christmas tree farms and fruit tree orchards can suffer damages due to ice-sheared treetops, branches pulled down and destruction of trees. The gathering of sap for maple syrup production can be halted due to ice covering tree spigots and gathering systems during sap runs. Rural areas can be the last to get electrical power restored from downed lines to farms.
- Roads and Highways. Ice is one of the more treacherous hazards to roadway travel. It is not always as plainly obvious on the surface as is snow, and in spotty icing conditions; a vehicle can come upon it unexpectedly on a curve or the bottom of a hill, even though other parts of the highway are clear. Motorists tend to expect icing on bridges. Heavy ice can cause tree limbs or utility lines to fall across the roadway.
- Railroads. The main impact ice storms have on railroad movement is their potential to disrupt wire-based communications if the wires are weighted down and break. Icing can cause obvious productivity and safety hazards to rail crews working on the ground, as in necessary to switch cars at customer sidings or in rail sorting yards.

- Airway. Icing on wings and elsewhere on the exterior of an aircraft make it impossible to fly. Light planes in flight may have to make emergency landings at La Crosse or Holland if they encounter icing in flight. Aircraft parked in the open on the ground could have their control surfaces damaged by heavy ice storms.
- Waterways. Ice storms can occur earlier and later in the winter season than do severe snow storms, and the most typical time for ice storms is in November and March. Commercial navigation can still be in full operation at the time of an ice storm. Deck surface conditions can be very treacherous for deck hands working on barge tows and for workers at navigation locks and cargo piers.
- Municipal Water. In the county there are 44 municipal wells and water systems in operation, see Table 3-11. These facilities vulnerability to ice storms would be limited to such things as damage to the facilities roofs and loss of electrical service from downed power lines. Services provided by these facilities would not be interrupted except in extreme cases.
- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities in the county, see Table 3-12. These facilities vulnerability to ice storms would be limited to such things as damage to building's roofs and loss of electrical service from downed power lines. Services provided by these facilities would not be interrupted except in extreme cases.
- Hazardous Material Sites. Ice, like snow, is more harmful for the potential peripheral impacts than direct impact. Icy road conditions can make emergency vehicle response difficult.

Ice Storm Risk Assessment Designation

Ice Storm Historical Occurrence Rating: Moderately Low - 4

Ice Storm Vulnerability Rating: Catastrophic - 7

Ice Storm Probability Rating: Likely - 5

Ice Storm Local Official Survey Rating: High - 6

Ice Storm Risk Assessment Designation: **High Threat – 22 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Ice Storm Hazard Mitigation Ideas: • Local and state governments can produce and distribute family and traveler emergency preparedness information relating to severe winter weather hazards • Burying or otherwise protecting electric and other utility lines can prevent utility disruption • Local governments need to always plan for and maintain adequate road and debris clearing capabilities • Home and building maintenance should be encouraged in order to prevent roof and wall damage from “ice dams”

3.10 La Crosse County, Blizzard Risk Assessment

Blizzard Definition: Winter storms can vary in size and strength. A blizzard is the occurrence of sustained wind speeds in excess of 35 miles per hour accompanied by heavy snowfall or large amounts of blowing or drifting snow. True blizzards are rare in Wisconsin, however blizzard-like conditions often exist during heavy snowstorms when gusty winds cause severe blowing and drifting of snow.

Blizzard History and Frequency:

1990's: 1 event reported by NCDC – 11/26/96

One blizzard event was recorded in 1996 by the National Climatic Data Center for La Crosse County.

Blizzard Vulnerability Assessment

- Critical Facilities. In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Blizzard a risk factor of 18 indicating this natural hazard is a moderate threat to the county. Blizzards with heavy snowfalls and strong wind speeds could cause structural damage to roofs of these facilities because of inadequate snow load capacity. Roofing material could be blown off. Electrical service may be interrupted. Operations of these facilities could be limited because employees are unable to get to work. The services of these facilities provided would not be interrupted except in extreme cases. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.

- Business and Industry. In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. Blizzards with heavy snowfalls and strong wind speeds could cause structural damage to buildings because of inadequate snow load capacity. Roofing material could be blown off. Businesses and industries' vulnerability to blizzards could include economic loss and disruption of inputs and outputs.
- Agriculture. In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Snow from blizzards is beneficial to many crops because it provides insulation from freezing and extreme cold. Livestock can be vulnerable to exposure from strong and persistent winds and the heavy snowfall with drifting which can cause injuries and death. The strong winds that accompany blizzards can cause soil erosion of soil especially on ridge tops.
- Roads and Highways. The same problems created by heavy snowfall apply to blizzards as well, except blizzards are characterized by heavy winds in addition to snow. Direct hazards caused by poor visibility and slippery surface are safety concerns with snowplows. Following a heavy snowfall, visibility problems can persist with blowing snow, and icing following partial melting and refreezing of the runoff water. Blowing snow is more apt to occur on north-south oriented roads such as STH 162. Following a heavy snowfall, children may be outside playing in the snow near the roadway and be oblivious to traffic. Following the snow deposition, lesser-used roads may remain blocked for hours, or even days after the storm is over. This blockage can cause motorist confusion and circuitous detours, as well as hampering access for emergency vehicles. Finding locations to store snow, especially snow removed from large expanses like urban parking lots, can be challenging.
- Railroads. Direct hazard caused by poor visibility. Following a heavy snowfall, visibility problems can persist with blowing snow.
- Airway. Plane operation from the La Crosse Municipal Airport and the Holland Airpark would not be possible during a heavy snowstorm, because of the poor visibility and the physical blockage of the runway and taxiways. Following a heavy snowfall, visibility problems can persist with blowing snow, and icing following partial melting and refreezing of the runoff water. Heavy snow squalls in the vicinity of La Crosse County could cause some light aircraft, possibly flying over the county, to decide to land at La Crosse or Holland until the storms stop.
- Waterways. The River is closed to commercial navigation from about the first week of December to the second week of March. Most heavy snowfalls occur in the winter when the Mississippi River is closed to navigation, and therefore present no challenge. Early heavy snows in early December or mid March could catch an active tow still on the Upper River. The same conditions of poor visibility that affect road and rail travel can impact river pilots as well. Although commercial riverboats are equipped with radar, eyesight visibility is still critical to navigate through locks, and while performing barge transfers. Heavy snow makes conditions dangerous for deck personnel where a slip and fall can be fatal. Lock workers experience the same problem. There is one Corps of Engineers navigation lock, Lock and Dam 7 located at the Dresbach.
- Municipal Water. In the county there are 44 municipal wells and water systems in operation, see Table 3-11. These facilities vulnerability to blizzards is negligible and would not be interrupted except in extreme cases.
- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities vulnerability to blizzards is negligible and would not interrupt services provided by these facilities.
- Hazardous Material Sites. Heavy snow does not have as great an impact on hazardous materials in storage as does some of the other natural hazards, but heavy snow could cause collapse of storage building roofs, as well as restricting the response of emergency crews to the scene.

Blizzard Risk Assessment Designation

Blizzard Historical Occurrence Rating: Low - 2

Blizzard Vulnerability Rating: Catastrophic - 7

Blizzard Probability Rating: Possible - 3

Blizzard Local Official Survey Rating: High - 6

Blizzard Risk Assessment Designation: **Moderate Threat – 18 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Blizzard Hazard Mitigation Ideas: • Local and state governments can produce and distribute family and traveler emergency preparedness information relating to severe winter weather hazards • Burying or otherwise protecting electric and other utility lines can prevent utility disruption • Local governments need to always plan for and maintain adequate road and debris clearing capabilities • Use snow fences to limit blowing and drifting of snow over critical roadway segments

3.11 La Crosse County, Extreme Cold Risk Assessment

Extreme Cold Definition: Winters are often accompanied with extremely cold temperatures. Extremely cold temperatures with strong winds can result in wind chills that cause bodily injury such as frostbite and death.

Extreme Cold History and Frequency:

1990's: 5 reported events by NCDC: 12/10/95 (wind chills of 50-70 below zero), 12/9/95 (wind chills of 25 – 50 below zero, 2 deaths and 21 injuries reported statewide), 1/29/96 (wind chills of 20 – 30 below zero), 2/1/96 (wind chills of 30 – 52 below zero), 1/16/97 (wind chills of 30-50 below zero).

The National Climatic Data Center reported that La Crosse County experienced 5 extreme cold events in La Crosse County during the 1990's.

Extreme Cold Vulnerability Assessment

- Critical Facilities. In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Extreme Cold a risk factor of 22 indicating this natural hazard is a high risk to the county. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- Business and Industry. In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. Extreme cold can lead to physical problems for workers (frostbite) and lower productivity. The extreme cold can cause mechanical equipment failures, which could lead to economic loss and disruption of inputs and outputs.
- Agriculture. In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Extreme cold can cause dangerous physical conditions (frostbite) for agricultural workers. Livestock can be vulnerable to exposure from cold temperatures causing more stress on the animal and less production. In addition, extreme cold can cause injuries and death. Equipment failures such as frozen water pipes, fuel lines, etc. can disrupt agricultural production.
- Roads and Highways. Extreme cold impacts highway transportation by creating problems with vehicle starting and operation. Fuels lines and cooling systems can freeze, door latches not work properly, and other mechanical components can fail. The problem of extreme cold is compounded by the fact the roadways usually are already impacted by snow and ice from previous snowstorms. There is a safety hazards to individual motorists if they have any vehicle mechanical problems, or a driving situation that forces them into the ditch or situation where the vehicle is inoperative. Exposure injury, or death, either in or out of the vehicle, can occur quickly. Adverse impact to the road infrastructure can include contraction of bridge joints; contribute to rock face collapse, and pavement cracking.
- Railroads. Extreme cold causes contraction of welded continuous rails, and the imposition of a speed limit by the railroad companies. This speed reduction would impact operations on some railroads. The mechanical components of locomotives, rail cars, and railroad crossing gates can be adversely impacted by extreme cold. The extreme cold can impact railroad operating and maintenance crew's personal safety if they are exposed to the temperatures.
- Airway. Extreme cold can adversely impact all of the mechanical components of an airplane, including the engine and control surfaces. Planes in flight during extreme cold periods can experience engine icing.
- Waterways. Extreme cold events would most likely only occur during periods of the year when commercial navigation on the Mississippi River would be seasonally closed. Recreational boaters in airboats, or recreationists crossing the Mississippi River in snowmobiles could be subject to extreme hazard if they became stranded in an inaccessible area due to mechanical failure or other cause.
- Municipal Water. In the county there are 44 municipal wells and water systems in operation, see Table 3-11. The water systems are at slight risk to extreme cold temperatures as water mains are more susceptible to problems (frozen water lines) but service interruption would be minimal except in extreme cases.
- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities vulnerability to extreme cold is negligible and would not interrupt services provided by these facilities.
- Hazardous Material Sites. Depending upon the type of material involved, there could be problems from the material escape if the containers or piping rupture during extreme cold.

Extreme Cold Risk Assessment Designation

Extreme Cold Historical Occurrence Rating: Moderately Low - 4

Extreme Cold Vulnerability Rating: Catastrophic - 7

Extreme Cold Probability Rating: Likely - 5

Extreme Cold Local Official Survey Rating: Medium/High - 6

Extreme Cold Risk Assessment Designation: **High Threat – 22 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Extreme Cold Hazard Mitigation Ideas: • Local governments can organize outreach to vulnerable populations during periods of extreme temperature • Communities can encourage utility companies to offer special arrangements for paying heating bills • A community can establish heating and/or cooling centers for vulnerable populations

3.12 La Crosse County, Earthquake

Earthquake Definition: An earthquake is a shaking or sometimes violent trembling of the earth that results from the sudden shifting of rock beneath the earth's crust. This sudden shifting releases energy in the form of seismic waves or wave-like movement of the earth's surface. Earthquakes can strike without warning and may range in intensity from slight tremors to great shocks. They can last from a few seconds to over five minutes and they may also occur as a series of tremors over a period of several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties may result from falling objects and debris, because of the shocks, shake, damage or demolish buildings and other structures. Disruption of communications, electrical power supplies and gas, sewer and water lines should be expected. Earthquakes may trigger fires, dam failures, landslides or releases of hazardous material, compounding their disastrous effects.

Earthquakes are measured by two principal methods: seismographs and human judgment. The seismograph measures the magnitude of an earthquake and interprets the amount of energy released on the *Richter scale*, a logarithmic scale with no upper limit. This amount is expressed in Arabic numbers and each unit of increase represents a ten-fold increase in magnitude. An earthquake measuring 6.0 on the Richter scale is ten times more powerful than a 5.0 and one hundred times more powerful than an earthquake, measuring 4.0. This is a measure of the absolute size or strength of an earthquake and does not consider the effect at any specific location. The *Modified Mercalli Intensity Scale* is an intensity scale expressed in Roman numerals, which reports the amount of shaking and effects at a specific location based on expert judgment. The scale has twelve classes and ranges from I (not felt) to XII (total destruction). No occurrence of earthquakes in Wisconsin has been severe. The most serious recorded earthquake registered 5.1 on the Richter scale and had a maximum intensity on the Mercalli Scale of VII.

Earthquake History and Frequency: No major earthquakes have occurred in La Crosse County in recent history.

Earthquake Vulnerability Assessment

- **Critical Facilities.** In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Earthquake a risk factor of 12 indicating this natural hazard is a low threat to the county. Earthquakes can range from nothing felt to total destruction and loss of life. Since no major earthquakes have occurred in Wisconsin or La Crosse County in recent history the risk to these facilities is insignificant. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- **Business and Industry.** In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. Businesses vulnerability to earthquakes can range from nothing felt to total destruction and loss of life. Since not major earthquakes have occurred in Wisconsin or La Crosse County the risk to businesses is insignificant.
- **Agriculture.** In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Agriculture vulnerability to earthquakes is negligible.
- **Roads and Highways.** Earth movement can cause obvious incongruities with the roadway, as well as secondary damage due to related landslides, broken utility lines, and collapsed buildings on the roadway. This secondary damage of landslides would be most severe on roads in rock cuts, or cliffs, or any of the roads leading ridge tops. Broken water

or sewer lines could present the biggest problem in the eleven incorporated communities. Broken gas mains would present the greatest danger of fire and explosion, especially in the vicinity of downed power lines that are creating sparks.

- Railroads. Earth movement can cause obvious incongruities with railroad lines, as well as secondary damage due to landslides along the Mississippi River. Even a slight shift in the earth's surface can cause switches to not properly align, and a slight tremor could cause a parked rail car to move if the brakes were not properly set.
- Airway. Earth movement could cause parked planes to shift position, and in severe, but unlikely, movement, to smash into one another. Underground fuel tanks could rupture. Hangers and other structures could be damaged. Obviously an earthquake would have no direct effect on an airborne aircraft, but runway damage could occur, with rutting or furrowing affecting the unsuspecting pilot upon landing.
- Waterways. An earth tremor could cause wave action, and possibly temporary current reversal on even a large river like the Mississippi. If the event should occur during the active commercial navigation season the problems caused could include, moored barges breaking free, tows running aground, and lock chamber doors becoming jammed and inoperative.
- Municipal Water. In the county there are 44 municipal wells and water systems in operation, see Table 3-11. These facilities vulnerability is negligible and would not interrupt services provided by the facilities except in extreme cases.
- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities vulnerability to earthquakes is negligible and would not interrupt services provided except in extreme cases.
- Hazardous Material Sites. Industrial operations that require the piping of hazardous material to various locations in the storage or manufacturing process are most prone to earth tremor damage in that the pipes could break during the tremors. Material stored in tanks or other containers is always prone to the containers falling or being hit by debris, and breaking, resulting in the release of the material.

Earthquake Risk Assessment Designation

Earthquake Historical Occurrence Rating: Low - 1

Earthquake Vulnerability Rating: Catastrophic - 7

Earthquake Probability Rating: Possible - 3

Earthquake Local Official Survey Rating: Low - 1

Earthquake Risk Assessment Designation: **Low Threat – 12 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Earthquake Hazard Mitigation Ideas: • Information gained from seismic hazard mapping can be used to assess risk • State and local highway departments should review construction plans from all bridges to determine their susceptibility to collapse • Local or state governments can use community outreach activities to foster an awareness of earthquake mitigation activities • Earthquake hazards can be mitigated through land use planning • Encourage local governments to adopt and enforce updated building code provisions is one effective way to reduce earthquake damage risk

3.13 La Crosse County, Extreme Heat Risk Assessment

Extreme Heat Definition: A heat wave is primarily a public health concern. During extended periods of very high temperatures or high temperatures of humidity, individuals can suffer a variety of ailments including heat exhaustion and heat stroke. Heat stroke in particular is a life-threatening condition that requires immediate medical attention. In addition to posing a public health hazard, periods of excessive heat usually result in high electrical consumption for air conditioning, which can cause power outages and brown outs. The majority of deaths during a heat wave are the result of heat stroke. The elderly, disabled and debilitated are especially susceptible to heat stroke.

Excessive heat in Wisconsin has become the most deadly hazards in Wisconsin in recent times. According to the National Weather Service Milwaukee/Sullivan Office, 111 people have died in Wisconsin directly as a result of heat waves during the 18 years from 1986-2003.

Extreme Heat History and Frequency:

1990's:	5 reported events by NCDC: 7/12/95-7/15/95 (141 deaths directly or indirectly related to heat), 10/12/95, 7/4/99-7/5/99 (heat index value of 105-115 degrees), 7/23/99 (heat index value of 105 – 115 degrees), 7/28/99-7/31/99 (heat index value 110-125 degrees, 12 direct and 8 indirect deaths reported statewide).
2000's:	1 reported event by NCDC: 7/31/01 through first week and a half of August (temperatures over 100 degrees, 10 direct and 5 indirect deaths reported statewide).

The National Climatic Data Center reported that La Crosse County experienced 5 extreme heat events during the 1990's and one event was recorded in 2001. The National Weather Service records show that between 1982 and 2001 La Crosse County experienced 42 heat wave days. Southwestern Wisconsin logged the most heat wave days during this time period.

Extreme Heat Vulnerability Assessment

- Critical Facilities. In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns extreme heat a risk factor of 22 indicating this natural hazard is a moderate risk to the county. See Tables 3-9 through 3-16 and Maps 3-1 through 3-5 for further information and location of these facilities.
- Business and Industry. In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. Extreme heat can lead to physical problems for workers (heat exhaustion) and lower productivity. The extreme heat can cause mechanical equipment failures, which could lead to economic loss and disruption of inputs and outputs.
- Agriculture. In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Extreme heat can cause dangerous physical conditions (heat exhaustion) for agricultural workers. Livestock can be vulnerable to extreme heat causing more stress on the animal and less production. In addition, severe heat can cause injuries and death. Equipment failures due to over heating could disrupt agricultural production.
- Roads and Highways. High heat does not present as direct a threat to transportation in general than do some other natural hazards such as blizzards, or extreme cold, however heat can have many side impacts, such as the safety and comfort of people and livestock having to endure the condition without air conditioning. Motor vehicles may overheat and stall in unsafe locations at highway intersections, fuel stored, illegally, in vehicle trunks or truck beds is more apt to volatilize and cause safety problems. Extreme heat can cause asphalt road surface buckling and rough bumps and cracks. Extreme heat can cause dangerous working conditions for highway maintenance workers outdoors or in poorly ventilated or non-air conditioned shop buildings.
- Railroads. Extreme heat can cause buckling and kinking of welded continuous steel rails. Extreme heat can cause dangerous working conditions for track and other rail maintenance workers outdoors or in poorly ventilated or non-air conditioned shop buildings.
- Airway. Extreme heat can cause volatilization of fuel in aircraft parked outside. Extreme heat can cause changes in atmospheric pressure and in the lift characteristics of small aircraft that a pilot must be aware of and compensate for.
- Waterways. The biggest impact of extreme heat on commercial navigation is apt to be the danger of heat exhaustion to deck crews working outdoors. Hot weather could increase the number of pleasure craft operating on the Mississippi River and result in increased conflict with safe navigation.
- Municipal Water. In the county there are 44 municipal wells and water systems in operation, see Table 3-11. These facilities vulnerability is negligible and would not interrupt services provided by the facilities except in extreme cases. In extreme cases water usage may increase to the point where the water system supply may be stressed.
- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities vulnerability to extreme heat is negligible and would not interrupt services provided except in extreme cases.
- Hazardous Material Sites. Hazardous material of various types could volatilize in extreme heat, especially if safety relief valves were not operating properly.

Extreme Heat Risk Assessment Designation

Extreme Heat Historical Occurrence Rating: Moderately High - 5

Extreme Heat Vulnerability Rating: Catastrophic - 7

Extreme Heat Probability Rating: Possible - 5

Extreme Heat Local Official Survey Rating: Medium - 5

Extreme Heat Risk Assessment Designation: **Moderate Threat - 22 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Extreme Heat Hazard Mitigation Ideas: • Local governments can organize outreach to vulnerable populations during periods of extreme temperature • Communities can encourage utility companies to offer special arrangements for paying utility bills • A community can establish heating and/or cooling centers for vulnerable populations.

3.14 La Crosse County, Agricultural Risk Assessment

Agricultural Definition: Agriculture is the science or art of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation of these products for man's use - *Webster's New Collegiate Dictionary*. For more than 150 years, agriculture has driven the State of Wisconsin's economy. It remains the number one industry in Wisconsin, employing one of every five people. A 2004 U.S. Department of Commerce, Bureau of Economic Analysis report indicates showed that approximately 1.4% of La Crosse County's employed civilian population were employed in the Farming sector.

There are many natural hazards that can affect agricultural production in the State. Droughts reduce crop growth and yields, and can decimate croplands. Extreme temperatures, high winds, hail and other extreme weather conditions can also decimate crop production. Insects can also decimate a crop resulting in a total loss. Animal diseases in farm animals carry the potential of harming not only the animals' health, but also human health in some cases. Agricultural losses from floods include crop loss, soil erosion or property damage to farm structures and equipment. These are just some of the hazards that may affect agriculture.

Agricultural History and Frequency: The history of agricultural losses due to droughts, floods, extreme temperatures, high winds, and hail are detailed under the appropriate natural hazard section.

There are so many natural hazards that can affect agricultural production (droughts, floods, extreme temperatures, high winds, hail, insects etc.) to name a few. Department of Revenue records show that in 2004 La Crosse County had approximately 115,596 acres of agricultural land. Agricultural hazards can occur annually in the county.

Agricultural Vulnerability Assessment

- **Critical Facilities.** In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Agriculture a risk factor of 12 indicating this natural hazard is a low risk to the county. Critical facility's vulnerability to agriculture is not applicable. See Table 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- **Business and Industry.** In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. For most businesses and industries, vulnerability to agriculture production and raising of livestock would be negligible. Businesses and industries that are involved in the growth, production, processing, manufacturing, distribution and wholesale and retail sales of agricultural products and food products can be vulnerable to crop and livestock losses. These businesses and industries can sustain economic losses from reduced production of agricultural commodities due to damages caused by natural hazards.
- **Agriculture.** In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Agriculture production is vulnerable to numerous natural hazards including droughts, floods, extreme temperatures, high winds, hail etc. and are detailed under the appropriate hazard section.
- **Roads and Highways, Railroads, and Waterways.** Unlike the other risks outlined in this section, agricultural risk is not a natural hazard, but rather an economic condition created by the occurrence of natural hazards. If any result would occur from agricultural risk, or crop failure, to impact transportation modes, it would be a reduction in truck, train, and barge traffic due to less grain being produced to haul. Ultimately an import of hay or other livestock feed into the area could result.

- Airway. Agricultural risk is an economic condition, not a natural hazard. There would be not direct threat to the airports or air travel.
- Municipal Water. In the county there are 44 municipal wells and water systems in operation, see Table 3-11. These facilities vulnerability to agriculture is not applicable.
- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities vulnerability to agriculture is not applicable.
- Hazardous Material Sites. If the agricultural risk is brought about because of severe drought, then it is likely natural weather conditions and ground cover condition is also conducive to the danger of wild fire. The same threat caused by fire would be possible. If the agricultural risk is caused by a shift in market conditions, or severe insect or disease infestation, the wildfire threat would not be as high.

Agricultural Risk Assessment Designation

Agricultural Historical Occurrence Rating: Low - 2
 Agricultural Vulnerability Rating: Limited - 3
 Agricultural Probability Rating: Possible - 3
 Agricultural Local Official Survey Rating: Medium - 4
 Agricultural Risk Assessment Designation: **Low Threat – 12 points**
 See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Agricultural Hazard Mitigation Ideas: Agricultural Hazard Mitigation Ideas for droughts, floods, extreme temperatures, high winds, and hail are detailed under the appropriate natural hazard section.

3.15 La Crosse County, Drought Risk Assessment

Drought Definition: A drought is an extended period of unusually dry weather, which may be accompanied by extreme heat (temperatures which are 10 or more degrees above the normal high temperature for the period). There are basically two types of drought in Wisconsin, agricultural and hydrologic. Agricultural drought is a dry period of sufficient length and intensity that markedly reduces crop yields. Hydrologic drought is a dry period of sufficient length and intensity to affect lake and stream levels and the height of the groundwater table. These two types of drought may but do not necessarily, occur at the same time.

Wisconsin is most vulnerable to agriculture drought. In 2005 the state had 15,400,000 acres of farmland on 76,500 farms and was ranked 10th in the country in overall farm receipts (Wisconsin Agricultural Statistics Service). Even small droughts of limited duration can significantly reduce crop growth and yields, adversely affecting farm income. More substantial events can decimate croplands and result in total loss, hurting the local economy. Droughts also greatly increase the risk of forest fires and wildfires because of the extreme dryness. In addition, the loss of vegetation in the absence of sufficient water can result in flooding, even from average rainfall, following drought conditions.

Drought History and Frequency:

1970's:	1 event report by Wisconsin Emergency Management, 1976, \$1 million-Public Gov't Property and Facilities Damage and \$623 million Private-Individual Property, Crop and Facilities Damage to La Crosse and 63 other counties, Presidential Emergency Declaration.
1980's	1 event report by Wisconsin Emergency Management, <i>Hazard Analysis, November 2002</i> - One of the most severe droughts on record for state - 1987-1998 drought that resulted in 52% of the state's 81,000 farms having a crop loss of 50% or more. All Wisconsin counties were designated eligible for drought assistance.

Wisconsin Emergency Management reported one major drought event (1976), which affected La Crosse and 63 other counties in the State. A Presidential Emergency Declaration was made for those counties. According to *Wisconsin Emergency Management's Hazard Analysis, November 2002*, Wisconsin's five most significant droughts in terms of severity and duration are: 1987-1988, 1976-1977, 1955-1959, 1948-1950 and 1929-1934.

Drought Vulnerability Assessment

- Critical Facilities. In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Drought a risk factor of 15 indicating this natural hazard is a moderate

threat to the county. In drought situations, water use may be restricted and affect the operation of these facilities. Hospitals may need water storage systems in emergency situations. Fire stations need adequate water capacity to fight fires. Critical facility's vulnerability to droughts is negligible and won't interrupt services provided by these facilities except in extreme cases. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.

- **Business and Industry.** In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. For most businesses and industries, vulnerability to drought would be negligible. Examples of businesses and industries that are negatively impacted by drought conditions include: agribusinesses, tourism related businesses, boat dealerships and marinas, golf courses, businesses that rely on barge traffic for shipment of raw materials or transporting finished goods and products, and fisheries.
- **Agriculture.** In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Agriculture's vulnerability to drought can be catastrophic. One of the most severe droughts in the state occurred in 1987-1988, which resulted in 52% of the states, 81,000 farms had crop losses of 50% or more. All Wisconsin counties were designated eligible for drought assistance. The costs and losses to agriculture producers can include: reduced yields and crop loss, increased insect infestation and plant disease, increased irrigation, cost of new or supplemental water resource development, wind erosion of top soil, forced reduction of foundation stock, reduced milk production, increased feed costs, high livestock mortality rates, disruption of reproductive cycles, decreased stock weights, reduced productivity of pastureland and loss of farms and dairy herds.
- **Roads and Highways, Railroads, and Waterways.** The impact of drought on transportation modes is much the same as that caused by agricultural failure; a reduction in agriculturally related freight traffic.
- **Airway.** Extended drought could increase the possibility of wildfires. The possible impact of wildfires on the La Crosse Municipal Airport and the Holland Airpark, and on light plane travel has been discussed under that topic.
- **Municipal Water.** In the county there are 44 municipal wells and water systems in operation, see Table 3-11. Municipal water vulnerability to droughts can include decreased supply of water from low water tables and increased pollutant concentrations. Services from these facilities should not be interrupted except in extreme cases.
- **Wastewater Treatment Facilities.** There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities vulnerability to droughts can include decreased water supply and diminished sewage flows. Services from facilities should not be interrupted except in extreme cases.
- **Hazardous Material Sites.** Extended drought could increase the possibility of wildfires. The possible impact of wildfires on hazardous material sites has been discussed under that topic.

Drought Risk Assessment Designation

Drought Historical Occurrence Rating: Low - 2

Drought Vulnerability Rating: Critical - 5

Drought Probability Rating: Possible - 3

Drought Local Official Survey Rating: Medium - 5

Drought Risk Assessment Designation: **Moderate Threat – 15 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Drought Hazard Mitigation Ideas: • Citizens can be encouraged to take water-saving measures, especially when extra water is needed for irrigation and farming • Maintain adequate water storage for human consumption • Communities can pass ordinances to prioritize or control water use, particularly for emergency situations • Contingency plans can be developed to help anticipate needs and actions to take during a drought • Designs or plans for water delivery systems can include consideration of drought events • Crop insurance can preserve economic stability for farmers during a drought

3.16 La Crosse County, Fog Risk Assessment

Fog Definition: Simply, fog is a cloud near the ground. A cloud is an area of condensed water droplets (or ice crystals in the upper atmosphere). The same processes that produce clouds high above the ground can produce clouds near the surface. Therefore, understanding fog requires some basic meteorology. Fog forms when air can no longer hold all of the moisture it contains. This happens when 1) air is cooled to its dew point, which is the temperature at which air is holding as much moisture as

it can (cool air can hold more moisture than warm air) or 2) the amount of moisture in the air increases. Once air has reached its dew point, it condenses onto very small particles forming tiny water droplets that comprise fog.

Fog is a hazard mostly for one very important reason: reduced visibility. Airport delays, automobile accidents, shipwrecks, plane crashes, and many other transportation problems are frequently caused by fog. However, like several other natural hazards, fog can also be beneficial. Several species of plants, including some crops, depend on fog for moisture and cool temperatures from decreased sunlight.

Fog History and Frequency: Not available.

Fog is responsible for an average of over \$1 million in property damage, dozens of injuries, and several deaths every year in the United States. The financial cost of transportation delays caused by fog has not been calculated, but is substantial.

Fog Vulnerability Assessment

- **Critical Facilities.** In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Fog a risk factor of 18 indicating this natural hazard is a moderate threat to the county. Critical facilities vulnerability to fog is negligible and would not interrupt services provided by these facilities. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- **Business and Industry.** In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. Businesses and industries vulnerability to fog would be negligible.
- **Agriculture.** In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Several species of plants, including some crops, depend on fog for moisture. Agriculture's vulnerability to fog is negligible except in extreme cases during prolonged periods of heavy rains, fog may be a contributing factor in some plant diseases.
- **Roads and Highways.** Fogs are most apt to occur in lower elevations blocked by wind flow. STH 35 along the Mississippi River is a good example of fog occurrence. Poor visibility is the major problem with fog, although in the early spring and late fall freezing of the roadway surface can accompany fog and present an additional hazard. Heavy fog can be particularly challenging to pedestrians and bicyclists, even those not directly on the roadway. Heavy fog in parking lots can present security and safety problems for people walking to their cars to and from buildings.
- **Railroads.** The location of railway lines along the Mississippi River requires train engineers to operate more frequently in fog. The same visibility problems confronting the motorist confront the railroad engineer, except the rail operator is more assured other trains will be clear of the right-of-way than a motorist can be assured other vehicles will be clear of the highway. The train engineer still must contend with pedestrians and animals being on the track and not seen in a heavy fog, as well as the possibility of an unseen vehicle at a road grade crossing.
- **Airway.** The La Crosse Municipal airport is a commercial airport and is equipped to handle aircrafts in low visibility situations. The Holland Airpark is not equipped to handle aircraft in conditions other than Visual Flight Rules.
- **Waterways.** Commercial vessels on the Mississippi River are equipped with radar and Coast Guard licensed pilots that know how to use the equipment. Navigation in fog is possible, but the reduced visibility increases the danger. Pleasure craft operated by recreationists pose the biggest threat to safety during foggy periods. Fog makes deck work more dangerous for deck hands on commercial craft.
- **Municipal Water.** In the county there are 44 municipal wells and water systems in operation, see Table 3-11. These facilities vulnerability to fog is negligible and would not interrupt services provided by these facilities.
- **Wastewater Treatment Facilities.** There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities vulnerability to fog is negligible and would not interrupt services provided by these facilities.
- **Hazardous Material Sites.** Fog presents no specific hazard to stored hazardous material. Hazardous material being transported is subject to the same danger as the transportation mode being used.

Fog Risk Assessment Designation

Fog Historical Occurrence Rating: High - 7

Fog Vulnerability Rating: Negligible - 1

Fog Probability Rating: Highly Likely - 7

Fog Local Official Survey Rating: Medium - 3

Fog Risk Assessment Designation: **Moderate Threat – 18 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Fog Hazard Mitigation Ideas:

- Local and State governments can develop automated visibility warning systems that use weather sensors to detect reduced visibility conditions (heavy rains, fog white-out). These systems could trigger a permanent or portable Dynamic Message Sign (DMS) with a message indicating the adverse driving conditions. These same systems could also distribute information on the road hazard to traffic management centers, public safety agencies, or other traffic information systems.
- Educate citizens on weather and road condition resources such as radio, cable TV, Internet etc.

3.17 La Crosse County, Landslide Risk Assessment

Landslide Definition: A landslide is a relatively sudden movement of soil and bedrock downhill in response to gravity. The movement of the soil can cause damage to structures by removing the support for the foundation of a building or by falling dirt and debris colliding with or covering a structure. Landslides can be triggered by heavy rain, bank or bluff erosion, or other natural causes.

Landslide History and Frequency: Three recent flooding events have caused landslides in the area. During the flooding that occurred 05/31/2000-6/2/2000 a mudslide buried a home under the Mississippi River bluffs in De Soto, Wisconsin. On 07/27/00 flash flooding triggered some mudslides. And flooding between 8/18/2007 – 8/31/2007 caused numerous landslides south of the City of La Crosse.

In Wisconsin landslides generally are not dramatic, however there have been instances of rock fall along the bluffs of the Mississippi River and the collapsing of hillsides during heavy rainfall.

Landslide Vulnerability Assessment

- **Critical Facilities.** In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Landslide a risk factor of 6 indicating this natural hazard is a low risk to the county. Critical facility's vulnerability to landslides is negligible and would not interrupt services provided by these facilities except in extreme cases. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- **Business and Industry.** In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. For most businesses and industries vulnerability to landslides would be negligible except for buildings located next to steep slopes or bluffs.
- **Agriculture.** In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Agriculture's vulnerability to landslides is negligible because this natural hazard is usually an isolated incident and damages would be confined to a limited area.
- **Roads and Highways.** Landslides would be most severe on roads in rock cuts, or cliffs.
- **Railroads.** Landslides can cause obvious damage with railroad lines, especially on lines along the Mississippi River.
- **Airway.** The La Crosse Municipal Airport and the Holland Airpark are both located on flat areas and neither is located near a hill so landslides pose no threats to these facilities.
- **Waterways.** A landslide on a bluff along the Mississippi River could cause wave action on the river or affect boats moored at marinas in extreme cases. The chance that barge traffic would be affected would be negligible.
- **Municipal Water.** In the county there are 44 municipal wells and water systems in operation, see Table 3-11. These facilities vulnerability to landslides is negligible and would not interrupt services provided by the facilities except in extreme cases.
- **Wastewater Treatment Facilities.** There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. These facilities vulnerability to landslides is negligible and would not interrupt services provided except in extreme cases.

- Hazardous Material Sites. Industrial operations that require the piping of hazardous material to various locations in the storage or manufacturing process are most prone to landslide damage in that the pipes could break from a landslide. Material stored in tanks or other containers at the base of hills would be prone to the containers being hit by a landslide, and breaking, resulting in the release of the material.

Landslide Risk Assessment Designation

Landslide Historical Occurrence Rating: Low - 1

Landslide Vulnerability Rating: Negligible - 1

Landslide Probability Rating: Possible - 3

Landslide Local Official Survey Rating: Low - 1

Landslide Risk Assessment Designation: **Low Threat – 6 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Landslide Hazard Mitigation Ideas: • Local governments, developers, and residents can make better decisions using maps • Building codes can set construction standards, including minimum foundation requirements, in landslide-prone areas • Zoning ordinances may be used to create buffers between structures and high-risk areas • A special purpose ordinance for slide-prone areas may be used to limit fill or dumping • Set drainage control regulations to reduce the risk of landslides resulting from saturated soils • Grading ordinances require developers and landowners to obtain permits prior to filling or regrading • Hillside development ordinances are special purpose ordinances that set specific standards for construction on hillsides • Sanitary system codes can reduce the effect of drainage on landslides by limiting the type and location of sanitary systems • Open space designations keep landslide prone areas undeveloped • Structures may be moved to less hazardous locations • Land and structures may be purchased by and titled in the name of a local government body than can remove structures and enforce permanent restrictions on development • Restraining structures may be designed and used to hold soil in place • Grading can be used to increase slope stability • Various types of vegetation increase soil stability • Placing utilities outside of landslide areas decreases risk of service disruption • Restrictive covenants, a legal binding agreement, can be used in a private development to impose restrictions on land use

3.18 La Crosse County, Subsidence Risk Assessment

Subsidence Definition: Sinkholes are a geological phenomena that can pose a hazard to structures and people. A sinkhole is a depression in the ground caused by an evacuation of support from below the soil. Sinkholes can form naturally in areas with karst geology, areas that have limestone or other bedrock that can be dissolved by water. As the limestone rock under the soil dissolves over time from rainfall or flowing groundwater, a hollow area may form underground, into which surface soil can sink. Sinkholes can also be caused by human activity. Areas with karst conditions can be subject to groundwater contaminants from pollutants entering a sinkhole, fissure or other karst features.

Sinkholes have not been a factor in any natural disaster. However, karst features should be identified and considered in a community especially for land use planning, stormwater management and hazardous materials planning to avoid possible damage to structures or contamination of groundwater. Even a well 100 feet deep can be contaminated for surface pollutants entering a sinkhole.

Subsidence History and Frequency: No information was found on major subsidence events in La Crosse County.

Subsidence Vulnerability Assessment

- Critical Facilities. In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. The Natural Hazard Risk Assignment assigns Subsidence a risk factor of 6 indicating this natural hazard is a low risk to the county. Buildings are susceptible to sink holes and can cause a wide range of damage to structures including damage to foundations, partial collapse and/or total destruction of buildings. Sinkholes have not been a factor in any natural disasters in the county. Critical facility’s vulnerability to sinkholes in this area is negligible and would not interrupt services provided by these facilities except in extreme cases. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.

- **Business and Industry.** In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. Buildings are susceptible to sinkholes and can cause a wide range of damages to structures including damage to foundations, partial collapse, and/or total destruction of buildings. Businesses and industries' vulnerability to sinkholes is negligible in this area.
- **Agriculture.** In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Agriculture vulnerability to sinkholes is negligible because this natural hazard is usually an isolated incident and damages would be confined to a limited area.
- **Roads and Highways.** Roads built on areas with karst topography could be subject to subsidence. Sinkholes, when they have occurred in other areas, often happen suddenly, and a vehicle on the highway could literally fall into a hole opening beneath it. The danger of the large subsidence area remains a threat to an unsuspecting motorist, especially at night, until proper barricades can be put up. The threat of subsidence is greater on the ridge top and side hill areas than in the valleys.
- **Railroads.** Subsidence along the railroad tracks could come from direct undermining of the banks by river action.
- **Airway.** The La Crosse Municipal airport and the Holland Airpark are not built in an area prone to subsidence.
- **Waterways.** Soil surface subsidence would have little impact on river navigation.
- **Municipal Water.** In the county there are 44 municipal wells and water systems in operation, see Table 3-11. Sinkholes can cause damage to structures and underground piping that carries the water supply. Wells can be contaminated from surface pollutants entering sinkholes. These facilities vulnerability to sinkholes in this area is negligible and would not interrupt services provided by the facilities except in extreme cases.
- **Wastewater Treatment Facilities.** There are 11 wastewater treatment facilities in operation in the county, see Table 3-12. Sinkholes can cause damage to structures and underground piping that carry wastewater. These facilities vulnerability to sinkholes is negligible and would not interrupt services provided except in extreme cases.
- **Hazardous Material Sites.** Unless a hazardous material storage or disposal site were built in karst topography or on unstable wetland soils, an unlikely possibility, subsidence would not pose a major problem.

Subsidence Risk Assessment Designation

Subsidence Historical Occurrence Rating: Low -1

Subsidence Vulnerability Rating: Negligible - 1

Subsidence Probability Rating: Possible - 3

Subsidence Local Official Survey Rating: Low - 1

Subsidence Risk Assessment Designation: **Low Threat – 6 points**

See Table 3-2 for a detailed analysis to determine the above Risk Assessment Designation.

Subsidence Hazard Mitigation Ideas: • Local governments and state governments can promote community awareness of subsidence risks and effects • Old mining areas or geologically unstable terrain should be identified and mapped so that development can be prevented and limited • Areas susceptible to collapse can be maintained as public open space • Local governments can acquire and title land and enforce permanent restrictions on development • Filling or buttressing subterranean open spaces, as with abandoned mines • Move structures to less hazardous locations • Monitor groundwater levels in subsidence-prone areas

3.19 La Crosse County, Pandemic Flu Risk Assessment

Pandemic Flu Definition: A pandemic is a global disease outbreak. Flu pandemic occurs when a new influenza virus emerges for which people have little or no immunity, and for which there is no vaccine. The disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in very short time.

It is difficult to predict when the next influenza pandemic will occur or how severe it will be. Wherever and whenever a pandemic starts, everyone around the world is at risk. Countries might, through measures such as border closures and travel restrictions, delay arrival of the virus, but cannot stop it. Flu Pandemics are low frequency events, but they have the capability of being extreme impact disasters

The local hospitals have in place a plan to guide their response to a sustained Flu Pandemic. This plan was developed with the help of Gunderson Lutheran Medical Center of La Crosse. In the plan key roles and responsibilities are outlined for each hospital.

Pandemic Flu History and Frequency:

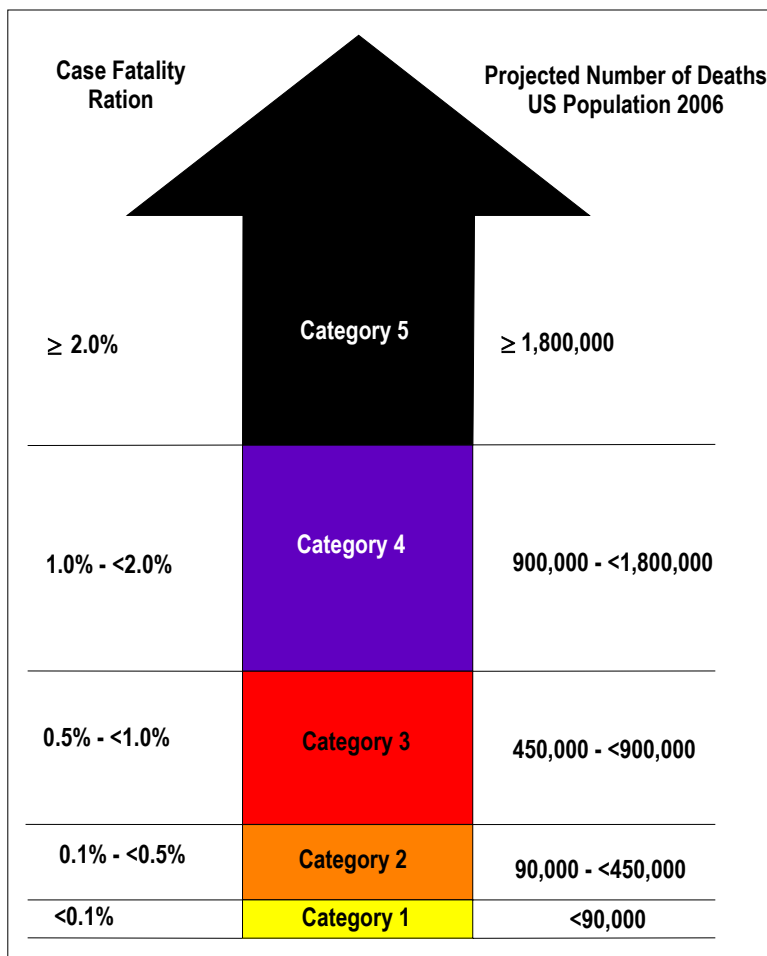
Flu Pandemics are naturally occurring events. Flu pandemics have occurred three times in the last century, in 1918, 1958, and 1967. The 1918 pandemic was the most severe disease outbreak in the history of the world. An estimated 20-40 million people died worldwide. It is not a matter of if another pandemic will occur but when will it occur and how lethal will it be.

Pandemic Flu Vulnerability Assessment

- Critical Facilities. In the county 174 service orientated critical facilities were identified. These include (23) government and military facilities; (16) hospitals, clinics, and residential facilities; (19) police and fire facilities; and (116) schools. These facilities will be severely affected during a pandemic flu. Hospitals and clinics will be inundated with the sick, Residential Care facilities will be closed to visitors and all the services will be severely affected by employees unable to come to work. See Tables 3-7 through 3-10 and Maps 3-1 through 3-4 for further information and location of these facilities.
- Business and Industry. In La Crosse County there are 2,950 businesses and industries that employ 56,616 people, with an annual payroll of approximately \$1.7 billion, see Table 3-6. Businesses and industries will be severely affected by employees unable to come to work due to illness, at-home caring for ill family members, or perhaps a fear of going to work due to the contagious nature of the disease.
- Agriculture. In 2004, county land use statistics indicated that 38.28% or 115,596 acres of county land were classified for agricultural use. Agriculture will be affected by workers unable to tend to crops and animals due to being unable to come to work.
- Roads and Highways. Automobiles and buses carrying affected people are a means of spreading a pandemic flu quickly throughout the U.S. and the world. A way of slowing this spread will be to ask people not to travel. In addition highway crews and maintenance personnel will be affected.
- Railroads. Trains carrying affected people are a means of spreading a pandemic flu quickly throughout the U.S. and the world. A way of slowing this spread will be to stop passenger train services. In addition other train services would be affected due to the lack of operators who would be unable to work due to the flu.
- Airway. Airplanes carrying affected people are a means of spreading a pandemic flu quickly throughout the U.S. and the world. A way of slowing this spread will be to close down airports. A pandemic flu will have a severe impact on airways.
- Waterways. Pandemic Flu presents no specific hazard to waterways.
- Municipal Water. In the County there are 44 municipal wells and water systems in operation, see Table 3-11. These facilities' vulnerability to Pandemic Flu is through the people who would be maintaining and running these facilities. If the operators are affected then the facility will be affected due to lack of operators.
- Wastewater Treatment Facilities. There are 11 wastewater treatment facilities in operation in the County, see Table 3-12. These facilities' vulnerability to Pandemic Flu is through the people who would be maintaining and running these facilities. If the operators are affected then the facility will be affected due to lack of operators.
- Hazardous Material Sites. Pandemic Flu presents no specific hazard to stored hazardous material but could impact persons responsible for monitoring and maintaining these sites.

Pandemic Flu Risk Assessment Designation

The following is a Pandemic Severity Index, this index uses case fatality ratio as the critical driver for categorizing the severity of a pandemic. The index is designed to enable estimation of the severity of a pandemic on a population level to allow better forecasting of the impact of a pandemic.



Source: Interim Pre-Pandemic Planning Guidance: Community Guidance for Pandemic Influenza Mitigation in the United States.

Pandemic Flu Hazard Mitigation Ideas: The pandemic mitigation framework that is proposed is based upon an early, targeted, layered application of multiple partially effective nonpharmaceutical measures. It is recommended that the measures be initiated early before explosive growth of the epidemic and, in the case of severe pandemics, that they be maintained consistently during an epidemic wave in a community. The pandemic mitigation interventions described in this document include:

1. Isolation and treatment (as appropriate) with influenza antiviral medications of all persons with confirmed or probable pandemic influenza. Isolation may occur in the home or healthcare setting, depending on the severity of an individual's illness and/or the current capacity of the healthcare infrastructure.
2. Voluntary home quarantine of members of households with confirmed or probable influenza case(s) and consideration of combining this intervention with the prophylactic use of antiviral medications, providing sufficient quantities of effective medications exist and that a feasible means of distributing them is in place.
3. Dismissal of students from school (including public and private schools as well as colleges and universities) and school-based activities and closure of childcare programs, coupled with protecting children and teenagers through social distancing in the community to achieve reductions of out-of-school social contacts and community mixing.
4. Use of social distancing measures to reduce contact between adults in the community and workplace, including, for example, cancellation of large public gatherings and alteration of workplace environments and schedules to decrease social density and preserve a healthy workplace to the greatest extent possible without disrupting essential services.

Enable institution of workplace leave policies that align incentives and facilitate adherence with the nonpharmaceutical interventions outlined above.

All such community-based strategies should be used in combination with individual infection control measures, such as hand washing and cough etiquette.

Implementing these interventions in a timely and coordinated fashion will require advance planning. Communities must be prepared for the cascading second- and third-order consequences of the interventions, such as increased workplace absenteeism related to child-minding responsibilities if schools dismiss students and childcare programs close.

Decisions about what tools should be used during a pandemic should be based on the observed severity of the event, its impact on specific subpopulations, the expected benefit of the interventions, the feasibility of success in modern society, the direct and indirect costs, and the consequences on critical infrastructure, healthcare delivery, and society. The most controversial elements (e.g., prolonged dismissal of students from schools and closure of childcare programs) are not likely to be needed in less severe pandemics, but these steps may save lives during severe pandemics. Just as communities plan and prepare for mitigating the effect of severe natural disasters (e.g., hurricanes), they should plan and prepare for mitigating the effect of a severe pandemic.