

## **INTRODUCTION**

Analyzing the hazards in a community is an important and critical step in the mitigation planning process. Before mitigation strategies can be determined, a risk assessment must be made. Part III of Juneau County All-Hazards Mitigation Plan Update will focus on the following:

- Identification of all types of natural hazards that may affect Juneau County; and
- An analysis of the hazards identified as pertinent to Juneau County.

The Hazard Analysis will consist of:

- Background Information;
- History of previous occurrences of hazard events;
- An assessment of the County’s vulnerability to future events; and
- An estimate of future probability and potential losses from the hazard.

## **HAZARD IDENTIFICATION**

The process of identifying those hazards that should be specifically addressed in the Juneau County All-Hazards Mitigation Plan Update was based on consideration of a number of factors. The process included a review of past hazard events to determine the probability of future occurrences and threat to human safety and property damage.

Worksheets from the Wisconsin Guide to All-Hazards Mitigation Planning were used by the Planning Taskforce to evaluate and rank the listing of possible hazards to help identify which hazards should be included in the Plan Update according to threat to human safety and possible damage to property. After review of the hazard scoring exercise results, the Committee decided to move flooding up to number three in rank behind tornado and wildfire because flooding is such a persistent problem in the County although not as potentially devastating as a tornado or wildfire.

The resulting priority ranking of hazards accepted by the Committee is as follows:

1. Tornado
2. Wild Fire
3. Flood / Dam Failure
4. Winter Storms / Extreme Cold
5. Severe Thunderstorms High Wind / Lightning / Hail
6. Drought / Extreme Heat
7. Hazardous Materials Incidents
8. Mass Casualty Incidents (ie: Civil Disorder / Terrorism / Pandemic / accidents & other events)

This Plan Update focuses on natural hazards that have or could cause disasters that can be mitigated on a local level. Technological or manmade hazards include things like pandemic, transportation incidents, civil disturbances, war, terrorism and other mass casualty events. Juneau County already has extensive planning for these types (i.e. "mass casualty") of occurrences, so they are addressed on a more general level in this planning process. Low magnitude earthquakes occur in Wisconsin every few years, but none have exceeded a magnitude of 3.9, which would have vibrations similar to the passing of a semi-truck, therefore, earthquakes are not covered in this plan. Juneau County does not have avalanche, coastal hazard, hurricane, tsunami or volcano issues and conditions for landslide, subsidence or expansive soil problems are not significant in the County.

### **HAZARD ANALYSIS**

The hazard analysis for each hazard included in this Plan Update is broken down into four components, as follows:

**1. Background on Hazard** - The next step after identifying a hazard is to define the hazard and give some general background behind it. This can include occurrence of the hazard within the County or State. This section may also give some indication of the risk to public health and safety and to personal and public property.

**2. History of Hazard** - Past experience of disasters is an indication of the potential for future disasters for which Juneau County would be vulnerable. A review of past occurrences for each identified hazard in Juneau County was completed.

Some disasters have had damages that exceeded the capabilities of local communities and state agencies. Federal assistance is then requested. Federal assistance may be offered through a variety of programs. Assistance may be directed to agricultural producers, individuals and families, businesses, or local governments. There have been 13 natural disasters in Juneau where Presidential Declaration was requested from 1971-2016. They include the following:

1976 - Drought - Presidential Emergency Declared  
1978 - Flooding - Presidential Disaster Declaration  
1990 - Flooding - Presidential Disaster Declaration  
1992 - Flooding - Presidential Disaster Declaration  
1993 - Flooding - Presidential Disaster Declaration  
2000 - Severe Storms/Flooding/Tornado - Presidential Disaster Declaration  
2001 - Severe Storms/Flooding - Presidential Disaster Declaration  
2004 - Severe Storms/Flooding - Presidential Disaster Declaration  
2008 - Flooding - Presidential Disaster Declaration

2009 - Blizzard  
2010 - Flooding - Presidential Disaster Declaration  
2010 - Blizzard  
2016 - Flooding - Presidential Disaster Declaration

It should be noted that this significantly underestimates the number of hazards that have occurred in Juneau County. Almost every year there are significant weather events or disasters that cause thousands of dollars in damage for which no Federal disaster assistance is requested. Major indicators of hazard severity are the deaths, injuries, and economic losses resulting from natural hazards and disasters.

The National Oceanic and Atmospheric Administration (NOAA) publishes the National Weather Service (NWS) data describing recorded weather events and resulting deaths, injuries, and damages. From January 1, 1950 to December 31, 2015, NOAA reported 367 severe weather events for Juneau County.

Note that since the earlier NOAA data is somewhat incomplete, this report focuses on the 10-year period from 2006 to 2015 for hazard analysis purposes. Other sources of data are used to supplement the NOAA data. These sources included other plans and reports, documents from the Juneau County Emergency Management Department, past local newspaper articles, the Wisconsin Department of Natural Resources (DNR), Wisconsin Emergency Management (WEM), and the National Weather Service.

**3. Vulnerability Assessment For Hazard** - For each hazard identified, a summary of the impact that may be felt by the community is given. When possible, existing buildings, infrastructures, and critical facilities located in the hazard areas are identified. Critical facilities are community buildings that are especially important to the health and welfare of the population following hazard events. Examples of such facilities include hospitals, police & fire stations, town halls, and shelters.

Because this is a multi-jurisdictional plan, FEMA requires that the plan assess each jurisdiction's risks where they vary from the risks facing the entire planning area. This section of the plan will identify variations in vulnerability for specific municipalities where they occur.

**4. Future Probability and Potential Dollar Losses from Hazard** - The historic data and vulnerability assessment for each hazard is used to project the potential future probability of that hazard occurring in the County and the potential damages in dollars that might be reasonably expected. This section sets the benchmark to mitigate for each hazard.

**HAZARD ANALYSIS: TORNADOS**

**Background on Tornado Hazard:**

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 tornados may have winds in excess of 300 miles per hour.

A tornado path averages four miles, but may reach up to 300 miles in length. Widths average 300 to 400 yards, but severe tornados have cut swaths a mile or more in width, or have formed groups of two or three funnels traveling together. On average, tornados move between 25 and 45 miles per hour, but speeds over land of up to 70 miles per hour have been recorded. Tornados rarely last more than a couple of minutes in a single location or more than 15 to 20 minutes in a ten-mile area.

<b>Table 11 Tornado Wind and Damage Scale</b>		
<b>Tornado Scale</b>	<b>Wind Speeds</b>	<b>Damage</b>
EF0	65 to 85 MPH	Some damage to chimneys, TV antennas, roof shingles, trees, and windows.
EF1	86 to 110 MPH	Automobiles overturned, carports destroyed, trees uprooted
EF2	111 to 135 MPH	Roofs blown off homes, sheds and outbuildings demolished, mobile homes overturned.
EF3	136 to 165 MPH	Exterior walls and roofs blown off homes. Metal buildings collapsed or are severely damaged. Forests and farmland flattened.
EF4	166 to 200 MPH	Few walls, if any, standing in well-built homes. Large steel and concrete missiles thrown far distances.
EF5	OVER 200 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

*Source: National Weather Service*

Tornados are classified into six intensity categories, EF0-EF5. This scale is an updated or "enhanced" version of the Fujita Tornado Scale (or "F Scale"). The scale estimates wind speeds within tornados based upon the damage done to buildings and structures. It is used by the National Weather Service in investigating tornados and by engineers in correlating building design and construction standards against anticipated damage caused by different wind speeds.

Wisconsin lies along the northern edge of the nation's maximum frequency belt for tornados, known as "Tornado Alley". Tornado Alley extends northeast from Oklahoma into Iowa and then across to Michigan and Ohio. Winter, spring and fall tornados are more likely to occur in southern Wisconsin than in northern counties. Tornados have occurred in Wisconsin every month except February.

**History of Tornados in Juneau County:**

Juneau County has had 2 verified tornados from 2006 to 2015. These tornados are documented along with 23 other historic tornados in Table 12. The most recent was on May 22, 2011 when severe thunderstorms developed along a cold front as it moved through western Wisconsin. These severe thunderstorms produced three confirmed tornadoes. One of these tornadoes was on the ground for almost 65 miles as it tracked from eastern Monroe County, across northern Juneau County, through southern Wood County and into Portage County before dissipating. Total damages were in excess of 6 million dollars.

This tornado entered into Juneau County southwest of Mather and then tracked northeast across the Necedah Wildlife Refuge between Mather and Finley damaging numerous trees. As the tornado approached Finley, it grew in size and was nearly a half mile wide as it crossed County Road F east of Finley. In this area, numerous trees were snapped or blown down with some of them landing on nearby homes. At a cranberry business east of Finley, all of the outbuildings and sheds were demolished and tossed into nearby fields and a loading deck platform and trucks were heavily damaged. Thick wooden power poles in this area were snapped or sheared off over a half mile long stretch. The tornado then weakened as it moved northeast toward the Wood-Juneau County line with damage to trees and some minor roof and siding damage. Total damages across Juneau County from this tornado were estimated to be \$4.4 million.

The other tornado within the study period also occurred in 2011, when a cold front pushed east into Wisconsin during the late afternoon and evening hours of April 10. Severe thunderstorms developed along the cold front and produced very large hail and three tornadoes over portions of western and central Wisconsin. A National Weather Service storm survey team confirmed an EF1 tornado south of Necedah. The tornado first touched down near the intersection of Paradise Lane and 25th Street and produced EF0 damage. Then it briefly produced EF1 damage for about 3/4 of a mile from T Lane through Padre Pio

Drive. A mobile home was rolled over and pine trees were snapped. The tornado continued east-northeast and produced EF0 damage to pine trees around County Road G before ending near the Wisconsin River.

Date	Time CST	Location	Length (Miles)	Width (Feet)	Deaths	Injuries	F- EF Scale
4/19/57	1530		21.1	300	1	0	F4
5/4/64	2000		7.7	100	0	0	F2
5/4/64	2030		1	27	0	0	F1
5/7/64	1450		3.3	30	0	1	F2
5/8/64	1715		23.5	150	0	0	F2
3/31/67			2	200	0	0	F1
8/9/79	1736		2.7	50	0	0	F2
8/29/79	2000		0	33	0	1	F1
3/30/82	1405	Central Juneau	8	33	0	2	F1
7/3/83	1800	Central Juneau	1	50	0	0	F1
7/3/83	1804	Central Juneau	1	50	0	8	F3
7/3/83	1815	Central Juneau	0.3	10	0	0	F0
7/3/83	1915	Central Juneau	0.3	10	0	0	F0
10/16/84	2030	Southern Juneau	17	100	0	3	F2
8/12/85	1840	New Lisbon	17	880	2	22	F2
5/8/88	1608	Central Juneau	5	73	0	1	F1
5/8/88	1615	Central Juneau	0.7	20	0	0	F1
10/8/92	1430	Southern Juneau	2	100	0	0	F1
6/1/00	1500	NEW LISBON	6.5	100	0	0	F1
6/23/04	1820	NEW LISBON	2	40	0	0	F1
8/18/05	1603	NECEDAH	6	25	0	0	F1
4/10/11	1714	NECEDAH	4.37	150	0	0	EF1
5/22/11	1638	MATHER	19.32	800	0	0	EF2

*Source: NOAA Storm Events Database, 2017 - Injuries and deaths are for entire track.*

Outside the study period, tornado was listed as contributing factor in the Presidential Disaster Declaration that included Juneau County in 2000. On June 1, a tornado touched down just north of New Lisbon and tracked southeast before lifting just north of Mauston. Damage consisted of sheared or blown down trees, barns and sheds demolished, garages heavily damaged, and some light structural damage to homes. There were no reports of injuries or deaths, but damage was estimated at about \$550,000. Hardest hit were homes and farms along 8th Avenue north of New Lisbon, along Meredith Road north of Mauston, and along Highway 58 north of Mauston. There was also downburst (microburst)

wind damage south and west of New Lisbon along Highway 80 and County Roads B and A. Downburst wind damage was also seen along Interstate 90/94 between Camp Douglas and New Lisbon with hundreds of trees blown down or sheared off. Juneau and Monroe County (where a separate tornado touched down) were declared federal disaster areas due to the extensive storm damage.

Another notable tornado occurred on August 12, 1985 when an F-2 hit New Lisbon. Two people were killed and 22 injured. Approximately 35 mobile homes were destroyed and other structures were damaged. Damage was estimated at about \$2.5 million.

While the May 2011 tornado was the most costly in terms of dollars, and the August 1985 tornado was the deadliest, the largest tornado in terms of scale strength was the 1957 F-4 tornado which also had one reported death associated with it. Other tornadoes with injuries associated occurred in 1964 (1), 1979 (1), 1982 (2), 1983 (8), 1984 (3), and 1988 (1).

**Tornado Vulnerability Assessment:**

Though Juneau County is mostly a rural county, there are concentrations of population scattered throughout. Subdivisions, rural unincorporated communities, and the various cities and villages can be regarded as more vulnerable because these areas pose more of a threat to human safety and property damage in more concentrated areas. Map 8 illustrates these areas within the County.

Mobile homes are of significant concern in assessing the hazard risks from tornados. In general, it is much easier for a tornado to damage and destroy a mobile home than standard constructed houses and buildings. Since 21 percent of Juneau County's housing units are mobile homes, vulnerability to health and safety along with property damage is much greater. Research by the NWS shows that between 1985 and 1998, 40 percent of all deaths in the nation from tornados were in mobile homes, compared to 29 percent in permanent homes, and 11 percent in vehicles.

The 2015 figures from the U.S. Census indicate there are 3,114 mobile homes in Juneau County. While mobile homes are scattered throughout the County, many are concentrated in mobile home parks. Map 8 also displays the location of the mobile home parks within the County.

In addition to mobile homes, there are many other areas vulnerable to tornados such as campgrounds. Like mobile homes parks, campgrounds are of concern in the County because often times there is a concentration of people in them and there is little shelter provided. Map 8 also shows the location of campgrounds in the County.

The following is a list of things that may be affected by a tornado. Much of this list can be referenced in Part II.

Insert Map 8 Tornado Vulnerability

To reduce file size for ease of emailing and downloading, the maps are omitted from this draft. To view the maps go to  
<http://www.ncwrpc.org/juneau/hazard/index.html>

- Community facilities – hospitals, schools, "prisons/jails"
- Public Service - police and fire departments
- Utilities - power lines, telephone lines, radio communication
- Transportation – debris clean-up
- Residential – nursing homes, mobile home/parks, garages, trees and limbs, siding, windows
- Businesses – signs, windows, siding, billboards
- Agricultural - buildings, crops, livestock

Based on review of the historic events of tornados, there are no specific areas in the County that have unusual risks. The events are relatively uniform and a countywide concern. However, during the city/village planning meetings for this Plan Update, Elroy, Lyndon Station, Necedah, New Lisbon, Union Center, and Wonewoc identified tornados as a major vulnerability concern due to potential impacts on local electric utilities, shelter concerns (mobile homes/parks in particular), early warning issues, and past experiences.

**Future Probability and Potential Dollar Losses – Tornados:**

Based on the historic data presented here (frequency of past events), Juneau County can expect a tornado about once every 5 years on average. This equates to a probability of 0.2 or about a 20 percent chance in a given year. Table 13 indicates the probability of tornados of a specific magnitude. However, these probabilities are slightly skewed by several instances of multiple tornado events occurring on the same day. The County has not experienced a tornado since 2011.

<b>Table 13 Probability of Intensity for any given Tornado in Juneau County</b>						
<b>Tornado Scale</b>	<b>F/EF0</b>	<b>F/EF1</b>	<b>F/EF2</b>	<b>F/EF3</b>	<b>F/EF4</b>	<b>F/EF5</b>
Number of Reported Tornados*	2	12	7	1	1	0
Probability of Occurrence	9%	52%	30%	4%	4%	<1.0%

*Source: Nat'l Weather Service & NCWRPC – \*Based on historical data from 1957 to 2015.*

Historic data is again used to estimate potential future dollar losses due to tornado. Estimated damages resulting from various tornados in Juneau County range from \$0 to \$4.4 million. On average, Juneau County might expect damages of \$2.2 million per tornado based on the study period of 2006 to 2015. However, going back to 1957, only two of the 23 historic tornados resulted in damages exceeding \$2 million; one was at \$1/2 million, 7 were at \$1/4 million, and the rest were \$100,000 or less. Over the next ten-year period, tornado losses in Juneau County could approach \$4.4 million.

**HAZARD ANALYSIS: WILD FIRE**

**Background on Wild Fire Hazard:**

Wildfire refers to uncontrolled, wild, or running fires occurring on forest, marsh, field, cutover, or other lands or involving farm, city, or village property and improvements incidental to the uncontrolled, wild, or running fires occurring on forest, marsh, field, cutover, or other lands.

Wildfires can occur at any time the ground is not completely snow covered. 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 for fire season length.

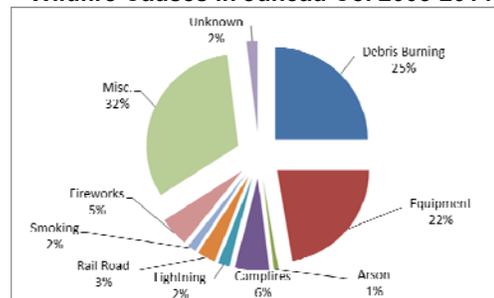
**History of Wildfire in Juneau County:**

The Wisconsin DNR maintains a database of wild fire data. This data represents the most comprehensive source of information for analyzing fire trends in an area such as Juneau County. However, the data is only current through 2014, so the 10-year span from 2005 through 2014 is used for analysis. Between 2005 and 2014, there was an average of 40 fires that have burned 58 acres, annually. The typical fire in Juneau County burns about 1.4 acres.

April is the leading month for fire in Juneau with 27% of the total number of fires between 2005 and 2014. However, fires have occurred in each month of the year in Juneau. The Town of Necedah experienced the most fires between 2005 and 2014 with 82, and led total acres burned with 117. Several communities within the County had no wildfires over the study period and thus no area burned.

The chart below breaks down the causes of wildfire within Juneau County between 2005 and 2014 as classified by the WDNR. The principle cause of wildfire in Juneau County and Wisconsin as a whole is debris burning which resulted in 100 or 25% of wildfires within the County. Equipment is the next leading category at 22% and includes vehicle, motor and other machinery related causes except railroad. Miscellaneous includes a variety of factors such as power lines, structure fires, and improper ash disposal. Arson resulted in less than 1% of wildfires. Lightning, the only natural cause of fire, was responsible for only 8 of the fires or about 2%.

**Wildfire Causes in Juneau Co. 2005-2014**



Source: WDNR

A small central Wisconsin wildfire destroyed six buildings southeast of Necedah on May 2, 2015. Dry conditions across central Wisconsin helped to fuel the fire that started on a warm afternoon. The fire destroyed three houses and three outbuildings. None of the houses were occupied and were only used for storage. The fire burned about 4 acres. Damage estimate was over \$150,000.

An April 13, 2015 wildfire near Necedah burned 336 acres before being extinguished by the Wisconsin DNR and four local fire departments. The fire was likely started by a passing train and then spread quickly by winds that gusted close to 30 mph. Flames from the fire approached a factory, which was evacuated as a precaution. The smoke spread over a residential neighborhood prompting officials to evacuate about 44 homes. No structures were burned, but one fire fighter was treated for smoke inhalation. State Highway 80 south of Necedah was closed due to the fire. Damage estimate was over \$57,000.

Dry conditions were enhanced by windy and unseasonably warm weather during the weekend of April 21 through April 22 of 2007. As a result, a number of wildfires occurred, including near Necedah. The fires were contained within a few hours and did not affect any buildings or homes.

In 2005, Juneau County's next door neighbor, Adams County, experienced one of the largest wildfires in Wisconsin history. Known as the Cottonville Fire, the fire began on May 5 when debris burning in a fire pit got out of control. Approximately 3,410 acres were burned covering an area 1.5 miles wide and 7 miles long. Weather conditions were ideal for fire: warm and windy with very low humidity. Like much of Juneau, Adams County is part of Wisconsin's "sand country" where the dominant vegetation includes grass, pine and scrub oak, which are all known to burn quickly and intensely. Fire spread quickly to the tops of the pine trees.



*Cottonville Fire (Adams Co.), 2005*

Losses included 9 primary homes, 21 seasonal homes, and 60 outbuildings. Damage was sustained to 15 other homes. Evacuation of 200 residents was required. Firefighting efforts were massive with 5 aircraft (1 from Minnesota DNR), 200 WDNR personnel from across the state, 30 volunteer fire departments and law enforcement from State Patrol, Juneau, LaCrosse and Vernon County Sheriffs and Onalaska Police. The fire took 11 hours to bring under control and several days for mop-up. The courts set restitution at over \$1.4 million indicating the level of damages.

Insert Map 9 Wildfire Vulnerability

To reduce file size for ease of emailing and downloading, the maps are omitted from this draft. To view the maps go to <http://www.ncwrpc.org/juneau/hazard/index.html>

**Wildfire Vulnerability Assessment:**

Juneau County has 282,918 acres of forestland, or 55 percent of the total land area, scattered throughout the County. The potential for property damage from fire increases each year as more recreational and retirement homes are developed on wooded land.

The trend toward introducing more human development into fire prone areas has brought about the term wildland urban interface or WUI. The WUI identifies areas where structures and human development meet or intermingle with undeveloped wildlands. It is within these areas where wildfire poses the greatest risk to human lives and property.

The WDNR has completed a statewide evaluation of fire risk, referred to as the CAR or Communities At Risk assessment, see Map 9. This assessment uses extensive DNR geo-databases to analyze and map hazardous woodland fuel types and the degree of the intermixing of development with wildlands. The maps identify the level of risk for each community on a scale of very high, high, moderate, or low, and also have a community of concern designation. Over half of Juneau County is rated very high (Armenia, Necedah - town and village, Clearfield, Germantown, Marion, Kildare, Lyndon and Lyndon Station) or high (Camp Douglas, Lisbon and Lemonweir). Cutler, Fountain and Lindina are designated as communities of concern.

WDNR reports on the Cottonville Fire indicate that the loss of buildings was due, in part, to a lack of access (long, narrow driveways) and a lack of defensible space (free of fuels that can transmit fire to the structure and allow firefighters to safely operate).

Campgrounds are also a concern because of campfires. Juneau County has a significant number of campgrounds. Locations of the campgrounds are shown on Map 8.

**Future Probability and Potential Dollar Losses – Wildfire:**

Wild fires are relatively common occurrences in Juneau County. Over the 10 year period of analysis, there has been an average of 40 fires per year in the County. In other words, the probability is 1.0 or 100% chance of wildfire each year. However, these fires are typically contained rapidly and remain small, so that each has a minimal impact. The probability of a fire becoming more substantial, like Cottonville, might be estimated at (less than) 10% per year or 0.1.

Because of the relatively small impact of typical individual fires in the County, loss data is not tracked. This makes it difficult to develop an estimate of potential future dollar losses. However, based on the limited damage figures available, it could be estimated that the average cost of a "typical" wildfire in Juneau might be

around \$100,000. Based on this general estimate, over the next ten-year period, wildfire losses in Juneau County could approach \$4 million. With 40 fires per year, the County should expect some fires to "get out of hand" and likely approach or exceed the \$1.4 million in damages of the Cottonville Fire.

### **HAZARD ANALYSIS: FLOODING/DAM FAILURE**

#### **Background on Flood Hazard:**

There are a variety of classifications for flooding including coastal, dam or levee failure, flash, lake, riverine, stormwater and urban/small stream. Juneau County has the potential for all these types except coastal flooding. The following descriptions of the types of flooding are compiled from various FEMA and other notable hazard planning sources:

*Coastal* – Different from other types of flooding which relate to movement of water through a watershed, coastal flooding is due to the effect of severe storm systems on tides resulting in a storm surge. Primarily known as an ocean-based event, the Great Lakes coastal areas can also be affected.

*Dam or levee Failure* – More of a technology related hazard than a natural hazard, various factors can result in the failure of the structural technology that is a dam, thus causing flooding of areas downstream of the dam often similar in effect to flash flooding.

*Flash* – Involves a rapid rise in water level moving at high velocity with large amounts of debris which can lead to damage including tearing out of trees, undermining buildings and bridges, and scouring new channels. Dam failure, ice jams and obstruction of the waterway can also lead to flash flooding. Urban /built-up areas are increasingly subject to flash flooding due to removal of vegetation, covering of ground with impermeable surfaces and construction of drainage systems.

*Lake* – Prolonged wet weather patterns can induce water-level rises that threaten lakeshore areas.

*Riverine* – Also known as overbank flooding, this is the most common type of flooding event. The amount of flooding is a function of the size and topography of the watershed, the regional climate, soil and land use characteristics. In steep valleys, flooding is usually rapid and deep, but of short duration, while flooding in flat areas is typically slow, relatively shallow, and may last for long periods.

The cause of flooding in rivers is typically prolonged periods of rainfall from weather systems covering large areas. These systems may saturate the ground and overload the streams and reservoirs in the smaller sub-basins that drain into larger rivers. Annual spring floods are typically due to the melting of snowpack.

*Stormwater* – Water from storm event that exceeds the capacity of local drainage systems, either man-made or natural, can result in flooding. Inadequate storm sewers and drainage systems are often the primary factor resulting in this type of flooding.

*Urban and Small Stream* – Locally heavy rainfall can lead to flooding in smaller rivers and streams. Streams through urban or built-up areas are more susceptible due to increased surface runoff and constricted stream channels.

Major floods in Juneau County are most common in June; however, they can occur from May through September. Occasionally, intense rainfall or consecutive thunderstorms leads to flash flooding in Juneau County. As most of the county's terrain is relatively flat, ponding of water rather than true flash flooding is more common. While flooding does occur after the snowmelt, these events typically occur in Juneau County after heavy rain patterns.

Flooding is a significant hazard in Juneau County, particularly because it borders the Wisconsin River. As described in Part II, there are approximately 378 miles of streams in Juneau County within ten main watersheds. Four are part of the Central Wisconsin River Basin, while six are a part of the Lower Wisconsin River Basin.

Floodplains exist along the Wisconsin River and the tributaries that feed into it. These floodplains are narrow along tributaries and lakes but extensive throughout the County. Floodplains are described in Part II and shown on Map 4 of this plan. The Federal Emergency Management Agency (FEMA) identifies these floodplains on Digital Flood Insurance Rate Maps (DFIRMs) as downloaded by the NCWRPC from FEMA's website.

There are 118 dams in Juneau County. These dams serve many useful purposes including agricultural uses, providing recreational areas, electrical power generation, erosion control, water level control and flood control. According to the DNR, Juneau County has 48 large dams (including the Petenwell Dam), which have a structural height of over 6 feet and impounds 50 acre-feet or more (See Map 3 and Table 14). The other 69 are regarded as small dams, while one has not been classified. The Wisconsin DNR regulates all dams on waterways to some degree, however the small dams are not stringently regulated for safety purposes. The federal government has jurisdiction over large dams that produce hydroelectricity. Petenwell Dams a major producer of hydroelectricity in Juneau County.

A dam can fail for a number of reasons such as excessive rainfall or melting snow. It can also be the result of poor construction or maintenance, flood damage, weakening caused by burrowing animals or vegetation, surface erosion, vandalism or a combination of these. Dam failure can happen with little warning

resulting in loss of life and significant property damage in an extensive area downstream of the dam.

The WDNR assigns hazard ratings to large dams within the state. When assigning hazard ratings, two factors are considered: existing land use and land use controls (zoning) downstream of the dam. Dams are classified into three categories that identify the potential hazard to life and property downstream should the dam fail. A high hazard indicates that a failure would most probably result in the loss of life. A significant hazard indicates a failure could result in appreciate property damage. A low hazard exists where failure would result in only minimal property damage and loss of life is unlikely. For Juneau County, there are two dams that have a high hazard rating: Mauston and Petenwell. Six dams have a significant rating: Rynearson 1, Ryearson 2, Pool Thirty Three, Sprague Mather Flowage, Potters Flowage, and the Orange Dam while the rest are rated low.

**History of Flooding in Juneau County:**

Flooding was the principal cause of damage in ten of the thirteen Presidential Disaster Declarations in Juneau County from 1976 to 2016. The most recent declaration as of this plan occurred in 2016 and included most of west central Wisconsin. Heavy rain resulted in flooding that caused numerous road and culvert washouts throughout the southern half of the County. Public sector damages exceeded \$108,000, however individual losses were low at an estimated \$8,000. Damage to public infrastructure resulted in a Presidential Disaster Declaration for ten Wisconsin counties, including Juneau.

In 2010, a stationary front set up across central Wisconsin on the evening of September 22nd. As an unusually moist air mass flowed over this boundary, heavy rain developed and fell repeatedly across the area during the evening and overnight hours. Soils were abnormally wet for this time of year, therefore the extreme rainfall amounts that fell caused significant widespread flooding and flash flooding. The Yellow, Lemonweir and Wisconsin Rivers along with their tributaries flooded, which caused road closures, evacuations, and damage to some roads, homes and businesses. People were evacuated from a campground east of Mauston along the Lemonweir River, while a dozen campers, campsites and sheds were ruined. In Necedah, water rose onto the property of several businesses, while homes on the east side of town were evacuated. Five homes and 2 businesses incurred major damage, while 14 homes and 1 business reported minor damage. Some specific road closures included County Roads G and F, and 11th Street, as well as County Roads HH and N near Lyndon Station. There was \$900,000 in estimated property damage.

On June 7, 2008, a warm front extended west to east across the Upper Mississippi River Valley, producing thunderstorms and excessive rainfall. As the storms congealed into a larger scale line of thunderstorms, they continued to move over the same areas, which led to significant flash flooding through the

evening and overnight. Heavy rainfall continued on June 8, enhancing already dangerous flooding conditions across parts of southwest Wisconsin. Many roads were closed due to water over the roadways, mudslides, or partial washouts. Flash flooding hit parts of southern Juneau County hard with water over several roads and some mudslides. Many creeks rose very rapidly as well. Homes along Lincoln, Lake, South Brooklyn, and Franklin streets were evacuated after the river broke its banks on the afternoon of June 8<sup>th</sup> in the City of Mauston. About 16 families were displaced in Wonewoc as well. Mudslides began to occur along Highways 82 and 80. Sections of the Elroy-Sparta State bicycle trail were also damaged and caused a closure. There was concern about high water in Mauston as well, especially along the Lemonweir River.

Severe storms again resulted in flooding (and disaster declaration) in 2001 and 2000. Flash flooding was reported near Grand Marsh by the NCDC in 1997 with \$30,000 in damages.

The Flood of 1993 was one of the worst flood events experienced by Juneau County, the state, and entire Midwest. The flooding in Juneau County was a result of several compounding factors including heavy rains and flooding in the fall of 1992. During the winter, Partridge Lake Dam in Juneau County washed out. In the Spring of 1993, the area experienced above average amounts of precipitation. The already saturated ground caused flooding from early June throughout July. Fortunately, before the flood peaks arrived on the Wisconsin River in Juneau County, the Petenwell and Castle Rock Reservoirs were drawn down. This created additional storage capacity that helped ease flow and lowered discharges downstream.

West of the Wisconsin River in the County, there was substantial flooding in a majority of the townships. The City of Mauston, the Village of Wonewoc School District, and numerous homes all experienced flooding and water damage. Standing water plagued the area for months afterward. Juneau County received approximately \$226,934 in disaster disbursements. The major impacts from flooding were to agriculture lands public roadway washouts. In Juneau County, the ASCS provided emergency financial assistance to approximately 200 farmers. Agricultural disaster assistance funded upwards of 1.3 million, while nearly 11 million dollars was estimated in crop losses. High groundwater eroded road bases and caused excessive runoff that washed out culverts and embankments or stripped gravel surfaces off of town roads. In the private sector, the three most common problems were groundwater in basements, failing septic systems, and polluted wells.

Major flooding also occurred in 1973 affecting a large portion of the County with flooding along the entire length of the Mississippi River resulting in a disaster declaration. Flood crest at Wisconsin Dells was 20.7 feet compared to 18.2 feet in 1993. Other notable flooding includes 1967 and 1965 with crests measured at Wisconsin Dells of 19.2 and 19.0 feet respectively.

<b>Official Name</b>	<b>Size</b>	<b>Hazard Rating</b>	<b>EAP Year</b>
Mauston	Large	High	2016
Petenwell	Large	High	2015
Meadow Valley Spillway 6	Large	Low	2012
Meadow Valley Spillway 7	Large	Low	2012
Meadow Valley Spillway 3	Large	Low	2012
Meadow Valley Flowage	Large	Low	2012
Meadow Valley Spillway 5	Large	Low	2012
Meadow Valley Spillway 4	Large	Low	2012
Meadow Valley Flowage	Large	Low	2012
Shuman	Large	Low	2003
Hamm	Large	Low	2002
Partridge Lake	Large	Low	1995
Necedah	Large	Low	1993
Gnirk Family Trust	Large	Low	N/A
Cranberry Creek 2	Large	Low	N/A
Beaver Creek 9	Large	Low	N/A
Little Yellow 18	Large	Low	N/A
New Lisbon	Large	Low	N/A
Necedah Wildlife Refuge 30	Large	Low	N/A
Doyle	Large	Low	N/A
Borge	Large	Low	N/A
Potters Reservoir	Large	Low	N/A
Little Yellow 25	Large	Low	N/A
Necedah Wildlife Refuge 33	Large	Low	N/A
Beaver Creek 4	Large	Low	N/A
Little Yellow 12	Large	Low	N/A
Little Yellow 11	Large	Low	N/A
Beaver Creek 3	Large	Low	N/A
Pawlisch	Large	Low	N/A
Necedah Wildlife Refuge 33	Large	Low	N/A
Little Yellow 19	Large	Low	N/A
Little Yellow 30	Large	Low	N/A
Little Yellow 9	Large	Low	N/A
Little Yellow 13	Large	Low	N/A
Little Yellow 10	Large	Low	N/A
Walsh	Large	Low	N/A
Cusick No.2	Large	Low	N/A
Little Yellow 20	Large	Low	N/A
Trout Lake	Large	Low	N/A
Sarazin	Large	Low	N/A
Beaver Creek 2	Large	Low	N/A
Cusick No.1	Large	Low	N/A
Little Yellow 27	Large	Low	N/A
Rynearson 1	Large	Significant	N/A
Rynearson 2	Large	Significant	N/A
Pool Thirty Three	Large	Significant	N/A
Sprague Mather Flowage	Large	Significant	N/A
Potters Flowage	Large	Significant	N/A

Prior to the construction of the reservoirs at Petenwell and Castle Rock, large-magnitude floods were recorded on the Wisconsin River in September 1911, July 1912, September 1938 and September 1941. A maximum discharge of 72,200

cubic feet per second (cfs) was recorded on September 14, 1938, on the Wisconsin River near Wisconsin Dells just south of the Juneau County line.

Juneau County has not experienced a dam failure with any loss of life or substantial property damage. However, there have been notable incidences of threatened failure in the area. The Town of Rome avoided dam blowouts with the help of many volunteer sandbaggers during the June 2002 flooding when the Lake Camelot dam came within an inch of failure; Lake Arrowhead dam came within seven inches of failure; and Sherwood was about four inches away from failure.

In 2006, the Tri-Lakes dams were again threatening failure. The Kingsway Dam on Upper Lake Camelot is the uppermost dam in a series of dams. Failure of this dam could ultimately lead to failure of 3 other dams downstream and close State Highway 13 as well as various County and local roads. Rapid draw down of the lakes prevented the dam failure and allowed repair of a failing drain system.

**Flood Vulnerability Assessment:**

Flood events in the County have caused substantial property and infrastructure damage in the past and have the potential to cause future damage, since a significant number of structures still exist in the floodplain. Looking at past events, the following have been significantly impacted by flooding:

- Infrastructure – flooded public facilities and schools
- Utilities - down electric lines/poles/transformers, telephone lines, lost radio communication
- Roadways – washouts, inundated roadways, debris clean-up
- Residential structures – flooded basements, damaged septic systems
- Businesses – loss of commerce
- Agriculture - inundated cropland

To assess the vulnerability of the Juneau County area to flooding hazards, basic inventory data described in Part II must be analyzed. For this purpose, consideration should be given to structures (specifically critical facilities), infrastructure, and cropland.

One of the first reports to reference in assessing vulnerability to structures during flooding is the Wisconsin Repetitive Loss Report. The Repetitive Loss Report provides information to the status of repetitive loss properties by community. FEMA classifies a repetitive loss structure “when more than one flood insurance claim of at least \$1,000 is made within a ten-year period”. The information is used as a floodplain management tool and to supplement information provided by communities for flood mitigation grants administered by WEM. According to the report, there are just two repetitive loss structures currently listed with Juneau County, one is in the Village of Lyndon Station and the other is in the Village of

Wonewoc. Both structures are residential. Data is limited to protect the privacy of owners.

Since there are limited repetitive loss structures, structures within floodplains were analyzed to get a more accurate picture of the potential flood vulnerability in the County, see the methodology outlined below. The floodplain boundaries within Juneau County are shown on Map 4. Table 15 shows the number of structures in each municipality identified as "vulnerable to flooding" according to proximity to floodplains. There were a total of 662 structures identified in the designated floodplain boundaries, see Map 10.

*Methodology – Structures within Floodplains:*

- 1. NCWRPC downloaded the new DFIRM floodplain maps from the FEMA website into a GIS coverage for the County.*
- 2. A building point cover was digitized from 2015 digital aerial photography of the floodplain areas.*
- 3. The floodplain coverage was then combined with the building point coverage to identify those structures within the floodplain boundary.*
- 4. Total structures with the floodplain were then tabulated by municipality.*
- 5. Average Values from US Census data were used to determine the total value for the identified vulnerable structures by municipality.*

Flooding in Juneau County is often felt beyond the floodplain boundaries due to factors such as topography and high groundwater. The drainage (surface runoff) network in the County is poorly defined. During periods of extended rainfall and/or snowmelt, a general condition of flooding exists throughout the communities. During this time, basements and roadways suffer considerable damage.

In addition to structural damage from flooding, there would be significant damages to public roadways, particularly to roadway surfaces, culverts and bridges. Flooding would inundate or close roadways due to washouts from a period of a few days up to as much as three months. Such interruptions in the County transportation network cause travel delays through detours. Businesses are often impacted by this restriction in access.

Businesses can be forced to close due to septic system problems and other issues resulting from flooding and the high water table. Tourism is an important industry in the County and several campgrounds, lodges, and restaurants may be affected by flooding.

The agriculture industry is a sector that can face substantial losses during a flood. Flood conditions can leave farmers with the following economic setbacks:

- Delayed planting (reduced growing season)
- Prevention of fields from being seeded

Insert Map 10 Flood Vulnerability

To reduce file size for ease of emailing and downloading, the maps are omitted from this draft. To view the maps go to  
<http://www.ncwrpc.org/juneau/hazard/index.html>

<b>Municipality</b>	<b>Number</b>	<b>Total Value</b>	<b>Average Value</b>
Armenia Town	76	\$ 112,200	\$ 8,527,200
Camp Douglas Village	0	\$ 89,700	\$ -
Clearfield Town	2	\$ 123,800	\$ 247,600
Cutler Town	2	\$ 125,000	\$ 250,000
Elroy City	60	\$ 81,600	\$ 4,896,000
Finley Town	98	\$ 103,100	\$10,103,800
Fountain Town	0	\$ 186,800	\$ -
Germantown Town	0	\$ 117,700	\$ -
Hustler Village	0	\$ 85,000	\$ -
Kildare Town	10	\$ 128,000	\$ 1,280,000
Kingston Town	0	\$ 33,800	\$ -
Lemonweir Town	6	\$ 130,000	\$ 780,000
Lindina Town	1	\$ 149,700	\$ 149,700
Lisbon Town	16	\$ 139,500	\$ 2,232,000
Lyndon Town	3	\$ 140,600	\$ 421,800
Lyndon Station Village	0	\$ 104,200	\$ -
Marion Town	39	\$ 145,000	\$ 5,655,000
Mauston City	38	\$ 99,800	\$ 3,792,400
Necedah Village	25	\$ 95,300	\$ 2,382,500
Necedah Town	229	\$ 119,600	\$27,388,400
New Lisbon City	2	\$ 89,000	\$ 178,000
Lyndon Town	3	\$ 140,600	\$ 421,800
Lyndon Station Village	0	\$ 104,200	\$ -
Marion Town	39	\$ 145,000	\$ 5,655,000
Mauston City	38	\$ 99,800	\$ 3,792,400
Necedah Village	25	\$ 95,300	\$ 2,382,500
Necedah Town	229	\$ 119,600	\$27,388,400
New Lisbon City	2	\$ 89,000	\$ 178,000
Orange Town	1	\$ 159,600	\$ 159,600
Plymouth Town	0	\$ 191,000	\$ -
Seven Mile Creek Town	0	\$ 142,200	\$ -
Summit Town	0	\$ 175,400	\$ -
Union Center Village	13	\$ 86,300	\$ 1,121,900
Wisconsin Dells City	0	N/A	N/A
Wonewoc Village	31	\$ 75,300	\$ 2,334,300
Wonewoc Town	10	\$ 154,800	\$ 1,548,000
Juneau County	662	\$ 120,857	\$73,448,200

Source: US Census 2015 and NCWRPC, 2017

- Seed and agricultural chemicals washing out of fields
- Rotting of plants due to excess moisture
- Areas where planted crops left in the fields due to excessive moisture
- Crops not reaching full maturity or stunted growth
- Requirements by farmers to expend higher amounts of money on additional soil amendments
- Lower quality (nutritional value) of harvestable crops as a feed source.

Reductions in quantity can result in loss of revenues from cash crops and increased expenses for purchasing the needed livestock feed from outside sources. Additionally, reductions in crop quality result in lower prices received for cash crops and increased amounts spent for nutritional supplements to animal feed, which need to be added even in much of the purchased feed.

Economic losses to farmers can generate a ripple effect to the local community as well. Reduction in farm income will curtail the farmers' ability to purchase new equipment and make other improvements. Farmers will have less money to spend at farm dealers, farm supplies, building/hardware suppliers, fertilizer, feed and seed dealers, and other agribusiness and retail establishments. The State itself will have reduced tax revenues. Farmers will have less money to save and invest, and suffer still more increases in debt load.

The forest products industry is affected similarly to agriculture. Forestlands become too wet for logging operations and many water logged tree plantations suffer high mortality rates. Mill inventories become very low, resulting in increased prices for consumers.

The areas considered to have a higher risk for impact from flooding include those communities with structures in floodplains as shown in Map 10.

#### **Future Probability and Potential Dollar Losses – Flood:**

Based on the historic data presented here (frequency of past events), Juneau County can expect a significant flood event about every 4 years on average. This equates to a probability of 0.40 or about a 40 percent chance in a given year.

Due to the significant number of dams and particularly large dams with high hazard ratings, dam failure is an important hazard event to plan for in Juneau County. However, based on past experience, the actual probability of a major dam failure is very low.

Historic data is again used to estimate potential future dollar losses due to flood. On average, Juneau County might expect property and crop losses of \$2.4 million on average, per flood occurrence based on the study period of 2004 to 2013. Over the next ten-year period, flood losses in Juneau County could

approach 9.63 million. However, there is always the chance that a more significant flood will occur like 1993 with greater potential for damage.

### **HAZARD ANALYSIS: WINTER STORMS / EXTREME COLD**

#### **Background on Winter Storms/Extreme Cold Hazard:**

A variety of weather phenomena and conditions can occur during winter storms. For clarification, the following are National Weather Service descriptions of winter storm elements:

*Heavy snowfall* – the accumulation of six or more inches of snow in a 12-hour period or eight or more inches in a 24-hour period.

*Blizzard* – 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.

*Ice Storm* – 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, with accumulations of ¼" or greater.

*Freezing drizzle/freezing rain* – the effect of drizzle or rain freezing upon impact on objects that have a temperature of 32 degrees Fahrenheit or below.

*Sleet* – 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.

*Wind chill* – an apparent temperature that describes the combined effect of wind and low air temperatures on exposed skin.

Winter storms can vary in size and strength and include heavy snowfall, blizzards, ice storms, freezing drizzle/freezing rain, sleet, wind chill, and blowing and drifting snow conditions. Extremely cold temperatures accompanied by strong winds can result in wind chills that cause bodily injury such as frostbite and death.

True blizzards are rare in Wisconsin. They are more likely to occur in the northwestern part of the state than in south-central Wisconsin, even though heavy snowfalls are more frequent in the southeast. However, blizzard-like conditions often exist during heavy snowstorms when gusty winds cause the severe blowing and drifting of snow. Heavy snow and ice storms have been part of nearly every winter in Juneau County.

Dangerously cold conditions can be the result of the combination of cold temperatures and high winds. The combination of cold temperatures and high

wind creates a perceived temperature known as "wind chill". Wind chill is the apparent temperature that describes the combined effect of wind and air temperatures on exposed skin. When wind blows across the skin, it removes the insulating layer of warm air adjacent to the skin. When all factors are the same, the faster the wind blows the greater the heat loss, which results in a colder feeling. As winds increase, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature.

The National Weather Service issues wind chill advisories when wind chill readings of -20 to -34 degrees are expected. Wind chill warnings are issued when wind chill values are expected at or below -35 degrees. Extreme cold events are most likely during the months of January and February.

**History of Winter Storms/Extreme Cold in Juneau County:**

NOAA has reported 34 winter storm events for Juneau County between 2006 and 2015. All of these storms contained some form of snow, sleet, freezing rain, or ice conditions.

Most recently, a winter storm hit western Wisconsin on December 28 - 29, 2015 with heavy snow, sleet and strong winds. As the storm lifted north out of the Southern Plains states, snow moved into western Wisconsin during the late morning of the 28th. For parts of southwest Wisconsin, this snow was mixed with or completely changed over to sleet during the afternoon and early evening of the 28th. The heaviest snow fell during the late afternoon and early evening of the 28th with 1 to 2 inch per hour rates. This caused a rapid deterioration in road conditions causing travel to quickly become dangerous. By the time the snow ended on the 29th, totals across western Wisconsin ranged from 5 to 11 inches. The highest reported total was 11.5 inches near Black River Falls and Warrens (Monroe County). Snow observers reported around 6 inches of snow across Juneau County. The highest reported total was 6 inches in Union Center. Winds gusting into the 30 to 35 mph range created blowing and drifting snow.

Blizzard conditions were reported in Juneau County four times during the study period, including: February 24, 2007, February 17, 2008, December 11, 2010 and December 20, 2012.

In 2012, a strong area of low pressure moved out of the Central Plains into the Great Lakes region on December 19th and 20th. As this storm moved by, it produced a period of blizzard conditions during the morning and afternoon of the 20th as sustained north winds of 25 to 35 mph with higher gusts created poor visibility from falling and blowing snow. Accumulations reached winter storm criteria of 6 inches between midnight and 7 a.m. on the 20th. The Governor issued an executive order declaring a state of emergency before the storm; placing state emergency management, National Guard, State Patrol and other agencies on alert. National Guard troops were used to help rescue stranded

drivers in some areas. The strong winds created blizzard conditions across Juneau County during the morning and afternoon of the 20th. As a result of the blizzard, roads were closed, vehicles became trapped in the snow, some power outages occurred and all schools in the County were closed. The highest reported snow total was 9.0 inches in Mauston (other areas of the state received up to 15 inches).

Minor icing is a common factor with winter storms during the study period, but only one event was classified as a full ice storm during this time. On March 8, 2009, a low pressure system developed and moved into the Central Plains in the afternoon hours and spread a wintry mix of freezing rain, sleet and snow across portions of southwest and central Wisconsin. Ice accumulations of a half of an inch were reported. A National Weather Service observer measured a quarter of an inch of ice accumulation seven miles south of Mauston.

Snow fall totals of 6 to 10 inches were commonly reported with winter storm events over a 2 or more day period from 2006 to 2015. However, the potential for more significant snowfall exists. According to the National Weather Service, the all-time record one-day snow fall is 14.3 inches that occurred at Mauston on March 8, 1946. Between December 11 and 12, 2010, a powerful low pressure system tracked across the Upper Midwest and Great Lakes region. This storm brought heavy snow and blizzard conditions across portions of western and central Wisconsin. Juneau County was within a large area of the state that received about 20 inches of snow. In addition to the heavy snow, sustained wind speeds of 25 to 30 miles per hour with gusts up to 50 miles per hour caused whiteout conditions, widespread road closures, stranded motorists and power outages. Most roads were reported to be impassable and vehicles were stuck on roadways.

Between February 20 and 21, 2011, a winter storm came out of the southwest United States and brought snow, sleet and freezing rain to western Wisconsin. Snowfall amounts of 6 to 8 inches were common across the County by 8 a.m. on the 21<sup>st</sup> and total accumulations ranged from 8 to 10 inches across the southern part of the County up to 15 inches across the north. In addition to the precipitation, strong winds hit the area with sustained winds of 20 to 25 mph and gusts between 30 and 35 mph.

On February 17, 2008, a powerful winter storm moved from Missouri to lower Michigan. This system brought freezing rain initially during the early morning hours with some ice accumulation, but by mid-morning, precipitation changed to all snow and was accompanied by strong northwest winds gusting up to 30 to 35 mph. The combination of heavy snow and strong winds caused blizzard conditions generally along and east of a line from Cassville to Necedah Wisconsin. Parts of Juneau County received snowfall accumulations of around 1 foot.

Arctic cold outbreaks are common in the upper Midwest and sub-zero readings occur 19 times per winter on average depending on snow depth and other factors. Occasionally strong northwest winds will combine with cold outbreaks to create dangerous wind chill conditions. The coldest temperatures are usually in January and February with average lows in the single digits and record lows colder than -25 degrees. The all-time record low in Juneau County is -43 degrees (actual) set in 1951. The NOAA reports 10 extreme cold events between 2006 and 2015.

Most recently, wind chills of 35 to 45 below were common across western Wisconsin from January 27 to 28, 2014. These dangerous wind chills occurred behind a strong cold front that moved across the region on January 26. As temperatures fell behind the front, strong northwest winds started pushing the wind chills to 35 below or colder during the early morning of the 27th. Most locations then had wind chills of 35 below or colder into the morning of the 28th, which was when warmer air started to spread back across the area. All the schools across western Wisconsin were closed on both January 27th and 28th. Wind chills of 35 below or colder occurred across Juneau County from the morning of January 27th into the morning of the 28th. The lowest recorded wind chill was 38 below from the automated weather observing equipment at Volk Field.

In 2009, an arctic cold front over southern Canada moved southeast into the Ohio River valley in the evening hours of January 14th. This brought bitterly cold temperatures and wind chills across portions of southwest and central Wisconsin in the evening hours of January 14th through the morning hours of January 16th. Unofficial lowest wind chill values ranged from -37F at Necedah to -42F at Volk Field in the morning hours of January 15th.

**Winter Storms / Extreme Cold Vulnerability Assessment:**

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

The following is a list of things that may be adversely affected by a winter storm. Much of these community assets can be referenced in Part II.

- Infrastructure – operation of emergency services, operation of public facilities and schools
- Utilities – down power and telephone lines
- Transportation – automobile accidents, roadway plowing, salting/sanding
- Residential – roofs
- Businesses – commerce
- Agricultural - livestock

Based on review of the historic events of winter storms and extreme cold, there are no specific areas in the County that have unusual risks. Winter storms cover a broad area and are a region-wide concern. However, during the city/village planning meetings for this Plan Update, Hustler, Mauston and New Lisbon identified winter storm and/or extreme cold as a major vulnerability concern due to snow and ice removal demands and issues related to providing adequate warming shelter for residents in a major snow or ice storm where power may be out, possibly for extended periods.

The extreme cold weather can affect the entire County. The risk to public health includes the chance of getting frostbite and hypothermia, and motor vehicle accidents. Everyone is at risk for becoming injured in extreme cold weather, either because of a frail body or because of travel in a motor vehicle.

**Future Probability & Potential Dollar Losses – Winter Storms/Extreme Cold:**

Based on historical frequency, Juneau County can expect 3.4 significant winter storms per year on average. In other words the probability is 1.0 or a 100 % chance in a given year. For extreme cold temperatures, based on historical frequency, Juneau County can expect an occurrence every year on average. So again, the probability is 1.0 or a 100 % chance in a given year.

Estimating potential future losses for winter storms is difficult. Damages and losses are typically widespread. Auto accidents and additional snow removal time are typical impacts of winter storms, and such claims are not aggregated or tracked for monetary damage. Winter storms do have the potential to be extremely destructive, particularly in the case of ice storms. Potential future losses per incident might range from \$5,000 to \$2 million based on experiences from other counties.

**HAZARD ANALYSIS: SEVERE THUNDERSTORM / HIGH WIND / LIGHTNING / HAIL****Background on Severe Thunderstorm Hazard:**

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 1 inch (recently increased from  $\frac{3}{4}$  inch) in diameter or greater or a tornado. Strong winds, hail, and lightning will be addressed in this section, however tornados will be referenced as a separate hazard.

Lightning results from discharge of energy between positive and negative areas separated by rising and falling air within a thunderstorm. This discharge heats the surrounding air to 50,000 degrees. Hail results as the warm rising air cools, forming ice crystals which are held by the updrafts until accumulating enough weight to fall. The hail size depends on strength of the updrafts keeping it up.

Thunderstorms 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. A given county may experience ten or more thunderstorm days per year. The southwestern area of the state normally has more thunderstorms than the rest of the state.

**History of Severe Thunderstorms in Juneau County:**

The NOAA database has reported 41 severe storm events for Juneau County between 2006 and 2015. These storms typically contain some form of heavy rain, strong winds, and lightning. About 19 significant hail events, typically related to a severe thunderstorm, were listed during this time period. There were also three notable lightning incidents identified.

Most recently, a complex of thunderstorms developed over Minnesota during the evening hours of July 12, 2015. As these storms move southeast during the early morning hours of the 13th, they strengthened over central Wisconsin and started producing damaging winds. A reporting station near Necedah measured a 62 mph wind gust and trees were blown down.

On September 2, 2011, severe thunderstorms produced damaging winds during the morning hours across portions of southwest and central Wisconsin. Numerous trees and power lines were down across the area, and over 10,000 residents lost power and schools were either delayed for two hours or closed in these areas. Several trees were blown down near Sandstone Estates with one falling on trailer. NOAA reported damage estimate was \$26,000

On May 22, 2011, severe thunderstorms that produced 3 damaging tornadoes across southwestern Wisconsin also generated baseball size hail just east of Mauston. Hail damage estimate was about \$25,000.

On October 26, 2010, a low pressure system deepened over northern Minnesota and set the Wisconsin state record for the lowest recorded barometric pressure. This system was responsible for high winds across portions of southwest and central Wisconsin in the morning hours of October 26th and the daytime hours of the 27th. Numerous trees blown were blown down; some power lines also came down causing power outages across western and central Wisconsin. Sporadic damage to roofs and buildings also occurred. Several trees were reported down across the A peak gust of 61 mph was reported near Necedah and Volk Field had a gust of 56 mph.

On September 22, 2010, a stationary front set up across central Wisconsin in the evening. As an unusually moist air mass flowed over this boundary, heavy rain developed and fell repeatedly across the area during the evening and overnight hours. Soils were abnormally wet for this time of year, therefore the extreme

rainfall amounts that fell caused significant widespread flooding and flash flooding. Buffalo, Trempealeau, Jackson, Taylor, Clark, and Juneau counties were included in a federal disaster declaration as a result. The storm total rainfall at Volk Field was 3.26 inches, while 2.90 inches fell near Necedah.

In June 2010, thunderstorms developed along a cold front and moved over central Wisconsin in the evening hours of June 12th. Lightning from the thunderstorms struck an oak tree and killed a dozen cows on a farm near County Highway N.

In June 2008, a warm front extending east to west across the Upper Mississippi River Valley was the focus for a significant severe weather event on June 7. The event produced four tornadoes, numerous reports of wind damage and large hail. On Sunday, June 8, the warm front was lingering across the region, but a cold front was quickly tracking east out of the northern Plains. Showers and storms redeveloped during the day in the vicinity of the warm front, while a line of storms developed out ahead of the cold front, with these tracking across the region Sunday night. The severe weather activity, aside from heavy rain, was not as widespread compared to Saturday, June 7. Two individuals were struck by lightning in the Town of Germantown. One of the victims did require treatment for the minor injuries.

On August 23 and 24, 2006, Hail as large as baseballs, along with thunderstorm wind gusts as high as 75 mph, were reported across southwest Wisconsin. Waves of hail repeatedly moved over the same areas, especially along the Interstate 94 corridor. There was substantial damage to corn and soybean fields, as well as cranberry plants. Cranberry crop loss was projected at 50 percent in some areas. The hail also shattered windshields of numerous vehicles, broke windows and damaged roofs and siding of homes. Total crop damage totaled close to 14 million dollars, with damage to vehicles and homes totaling nearly 3 million dollars. Within Juneau County, NOAA damage estimates totaled \$235,000 in property damage and \$365,000 in crop damage.

**Severe Thunderstorm Vulnerability Assessment:**

The National Weather Service can forecast and track a line of thunderstorms that may be likely to produce severe high winds, hail, and lightning but where these related hazards form or touch down and how powerful they might be, remains unpredictable. The distribution of thunderstorms and related hazard events have been widely scattered throughout the County.

Many thunderstorm events (without tornados) have caused substantial property and infrastructure damage, and have the potential to cause future damage. In order to assess the vulnerability of the Juneau County area to thunderstorms and related storm hazards, a review of the past events indicate significant impacts to:

- Infrastructure – hospitals, schools, street signs, police and fire departments
- Utilities - electric lines/poles/transformers, telephone lines, radio communication
- Transportation – debris clean-up
- Residential - mobile homes, garages, trees and limbs, siding, windows
- Businesses – signs, windows, siding, billboards
- Agricultural - buildings, crops, livestock
- Vehicles – campers, boats, windshields, body, paint

Based on review of the historic patterns of thunderstorms associated with high wind, hail, or lightening, there are no specific municipalities that have unusual risks. The events are relatively uniform and a countywide concern. However, during the city/village planning meetings for this Plan Update, Hustler, Necedah and New Lisbon identified severe thunderstorm as a major vulnerability concern due to potential damages from high winds including impact on local electric utilities.

**Future Probability and Potential Dollar Losses - Severe Thunderstorms:**

Based on historical frequency, Juneau County can expect 4.1 thunderstorm events per year on average. In other words, the probability is 1.0 or a 100% chance of multiple storms in a given year. The probability of a thunderstorm with damaging hail in Juneau County is also at 1.0 or 100% chance with about 1.9 incidents in a given year. There is not enough data available regarding lightning events to indicate probability.

According to the NCDC, historic thunderstorm events with associated high wind and reported damages averaged \$4,779 in property damage per incident and \$1,000 in reported crop damage. Historic thunderstorm events with associated hail that reported property damage averaged \$39,114 and \$52,142 in reported crop damage. Historic thunderstorm events with associated lightening that reported property damage averaged \$10,750. Losses in Juneau County associated with severe thunderstorms could approach \$1.9 million over the next ten-year period.

**HAZARD ANALYSIS: DROUGHT / EXTREME HEAT****Background on Drought / Extreme Heat Hazard:**

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.

Droughts, both agricultural and hydrologic, are relatively common in the state. Small droughts of shortened duration have occurred at an interval of about every ten years since the 1930's.

Extended periods of warm, humid weather can create significant risks for people, particularly the elderly who may lack air conditioning or proper insulation or ventilation in their homes. Animals are also at risk during extended periods of heat and humidity. The National Weather Service issues a Heat Advisory when the Heat Index ranges from 105 to 114 degrees daytime and remains at or above 80 degrees at night, during a 24-hour period. The heat index combines the effects of heat and humidity to better reflect the risk of warm weather to people and animals. When heat and humidity combine to reduce the amount of evaporation of sweat from the body, outdoor activity becomes dangerous even for those in good shape. The index measures the apparent temperature in the shade. People exposed to the sun would experience an even higher apparent temperature. A heat index of 105 is considered dangerous and prolonged exposure can result in heat stroke, exhaustion and cramps. People should be reminded to use extreme caution when the heat index is between 95 and 105. A heat index of 95 occurs when the temperature is 90 degrees and the relative humidity is 50 percent.

#### **History of Drought / Extreme Heat in Juneau County:**

NOAA reports indicate that much of Wisconsin including Juneau County was under drought conditions between 2004 and 2013. At one point, the Governor had declared a state of emergency to get assistance to the state's agricultural sectors. The extended dry conditions posed serious challenges for farmers from drought stressed crops to issues providing feed for livestock.

Beginning in 2013, improved rainfall across the Midwest gradually relieved the drought in Wisconsin. Nationally, however, what is being tagged as the 2012-2015 North American Drought has affected over 80% of the U.S. as well as parts of Canada and Mexico, and drought continues to affect parts of the country. This drought is on track to exceed the 1988-89 drought, which also affected Wisconsin/Juneau County, as the costliest natural disaster in U.S. history.

Juneau County experienced the 1988-1989 drought with the rest of the Midwest. It was characterized not only by below level precipitation, but also persistent dry air and above normal temperatures. Stream flow measuring stations in the state indicated a recurrence interval of between 75 and 100 years. The drought occurred early in the growing season and resulted in a 30-60% crop loss, with agricultural losses set at \$1.3 billion for the state. No statistics were available for the amount of crops lost in Juneau County, but 52 percent of the state's 81,000 farms were estimated to have losses of 50 percent or more, with 14 percent

estimated having losses of 70 percent or more. Some rural wells went dry, and water conservation was instituted in the rural areas

The drought of 1976-1977 was most severe in a wide band stretching from north to south across the state. Stream flow measuring stations recorded recurrence intervals from 10 to 30 years. Agricultural losses during this drought were set at \$624 million. Juneau County was one of 64 counties that were declared federal drought areas and deemed eligible for assistance under the Disaster Relief Act.

According to the National Weather Service, Juneau County has been affected by a number of heat waves over the years (16 since 1982 with 3 documented fatalities). The warmest temperature (actual) on record in Juneau County was 107 degrees F set on August 24, 1948.

The NOAA database has two recent listings for extreme heat events. The most recent was in 2012 when a hot air mass settled over Wisconsin in early July, bringing highs of 100 degrees or hotter to central Wisconsin from July 2 through July 9. Relative humidity was low, but heat indices still managed to reach the 100 to 110 range. Volk Field recorded a peak heat index of 113 on July 5th. One person died from heat related causes during the evening of July 9th. The person lived in a house which did not have air conditioning and was taking a medication that did not allow the body to sweat. An average of 3 to 4 people a day were treated for heat related illnesses.

In 2011, warm and humid air invaded western Wisconsin on July 17th and remained in place for the next three days. A number of people were treated for heat related illnesses. Afternoon heat indices routinely topped out between 110 and 120. Within Juneau, the highest recorded heat index was 114 at Volk Field on the 18th with a dew point of 85. Little relief occurred at night, as overnight lows remained above 75 degrees. Most of the counties across western Wisconsin opened cooling centers.

#### **Drought / Extreme Heat Vulnerability Assessment:**

Droughts can have a dramatic effect on Juneau County. The County has nearly 107,000 acres of farmland or 21% of its land area dedicated to farming. With agriculture being a critical sector of the County's economy, droughts have disastrous effects. 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.

Irrigation can draw water that otherwise would naturally go to aquifers or surface waters. Drought can exacerbate the problem when high withdrawal rates versus little precipitation deplete waterbodies and aquifer supplies, therefore decreasing drinking water supplies, drying streams, and hindering aquatic and terrestrial wildlife. During severe droughts, some wells - mainly private wells - will go dry.

Another significant area of impact from drought includes the tourism sector of the economy. Campgrounds and other outdoor/recreational operations report a downturn in business as potential patrons remain at home.

Droughts can trigger other natural and man-made hazards as well. They greatly increase the risk of wildfires because of 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.

The following is a list of things that may be adversely affected by a drought. Much of these community assets can be referenced in Part II.

- Infrastructure – municipal water supplies
- Surface water –groundwater reserves, recreation, and wildlife
- Forests
- Agricultural - crops, livestock

The areas most susceptible to drought conditions would be agricultural towns. Agricultural land is scattered throughout the County but largely the Towns of Armenia, Orange, Fountain, Plymouth, Wonewoc, Lisbon, Lindina, Summit, Lemonweir, Seven Mile Creek, Kildare and Lyndon.

According to the Wisconsin Emergency Management, excessive heat has become the most deadly hazard in Wisconsin in recent times. Extreme heat can happen anywhere within Juneau County affecting everyone, however the elderly and young are the ones with the highest risk of getting heat related injuries, which can lead to death. Ways to prevent injuries include wearing light-colored clothing, drinking plenty of water, slowing down, and not staying in the sun for too long.

#### **Future Probability and Potential Dollar Losses – Drought/Extreme Heat:**

Based on the historic data presented here (frequency of past events), Juneau County can expect a drought every ten years on average, which is a probability of 0.10 or a 10 percent chance in a given year. Significant severe drought is somewhat less common, affecting Wisconsin once about every 15 years.

Drought is another hazard lacking good loss figures at the county level. However, a look at aggregate data for two major droughts can give some indication of potential impact. The two major droughts in Wisconsin resulted in losses of \$9.6 million (1976-77) to \$18 million (1987-88) per county on average.

Normally, central Wisconsin is known for its cold winters, however, extreme heat waves will affect Juneau County in the future. Juneau County can expect a heat wave once every 5 years or a 20 percent chance in a given year based on the historic data presented.

**HAZARD ANALYSIS: HAZARDOUS MATERIALS INCIDENTS****Background on Hazardous Materials Incidents Hazard:**

This type of hazard occurs with the uncontrolled release or threatened release of hazardous materials from a fixed site or during transport that may impact public health and safety and/or the environment.

Under the Emergency Planning and Community Right to Know Act (EPCRA), a hazardous material is defined as any chemical that is a physical hazard or health hazard [defined at 29 CFR 1910.1200(c)] for which the Occupational Health and Safety Administration (OSHA) requires a facility to maintain a Material Safety Data Sheet (MSDS). Under EPCRA there is no specific list of hazardous materials. An extremely hazardous substance (EHS) is defined as one of 356 substances on the United States Environmental Protection Agency list of extremely hazardous substances, identified at 40 CFR Part 355.

EPCRA of 1986 also known as SARA Title III, brings industry, government and the general public together to address emergency planning for accidental chemical releases. The emergency planning aspect requires communities to prepare for hazardous chemical releases through emergency planning. This provides essential information for emergency responders. The community right-to-know aspect increases public awareness of chemical hazards in their community and allows the public and local governments to obtain information about these chemical hazards.

Counties in Wisconsin, including Juneau County have a Local Emergency Planning Committee (LEPC) that is set up in accordance with the federal legislation and is responsible for implementation of EPCRA at the county level. The County Emergency Management Director is a member of the LEPC to ensure continuity and coordination of emergency response planning.

To meet the requirements of Title III of EPCRA, the LEPC developed the County Hazardous Materials Response Plan. This plan establishes policies and procedures for responding to hazardous material incidents. The LEPC is required to review, test, and update the plan every two years. Methods for notification and reporting an incident are outlined in the plan. This plan also works in conjunction of the County Emergency Response Plan (ERP) where alert to the public, communications, and response procedures are outlined. The plan is tested through tabletop, functional and full-scale exercises and actual response situations.

To provide a high level of hazardous materials response capabilities to local communities, Wisconsin Emergency Management contracts with 22 Regional Hazardous Materials Response Teams. The teams are divided into Task Forces: Northeast Task Force, Northwest Task Force, Southeast Task Force, and the Southwest Task Force. These Task Forces are then divided into Type I, Type II,

and Type III teams, all with complimentary capabilities and training requirements. Juneau County is located in the Southwest Taskforce area. A Regional Response Team may be activated for an incident involving a hazardous materials spill, leak, explosion, injury or the potential of immediate threat to life, the environment, or property. The Regional Teams respond to the most serious of spills and releases requiring the highest level of skin and respiratory protective gear. This includes all chemical, biological, or radiological emergencies.

#### **History of Hazardous Materials Incidents in Juneau County:**

Juneau County hazardous materials response incidents since 2006 are shown in Table 16. These have been primarily small, low hazard spills. In most cases these incidents were quickly resolved by the County team.

<b>Table 16</b>	
<b>Juneau County Hazardous Materials Incidents</b>	
<b>Date</b>	<b>Description</b>
05/05/08	New Lisbon: Crop Duster Crash - 600 lbs aviation fuel
08/22/09	Armenia: Crop Duster Crash - 150 gallons insecticide
09/03/09	Camp Douglas: Possible Reptile Poison - regional team called in to test substance before clean-up.
12/18/09	CTH K & St. Clair Rd: LPG Truck Roll Over - standby
01/23/11	Mauston: WI River Coop Tank Leak - 26,000 lbs liquid feed
10/23/11	Necedah: Car Accident - leaking mineral oil
04/25/13	Seven Mile Creek: Truck Rollover - 2 tons dry fertilizer road cleared and ditch pumped out
<i>Source: Juneau County Emergency Management, 2017</i>	

#### **Hazardous Materials Incidents Vulnerability Assessment:**

In 2013, the Juneau County LEPC sponsored a detailed Hazardous Materials Commodity Flow Study. This Study inventoried the risk factors that make hazardous materials incidents a keen concern in Juneau County, which are reviewed below:

##### Fixed Facilities

The Commodity Flow Study identified 38 facilities within the County meeting reporting the requirements for one or more hazardous chemicals. These are sites that have hazardous substances present at any one time in amount equal to or exceeding the chemical-specific threshold planning quantity (TPQ).

##### Highway

Trucks carry the bulk of hazardous materials to and through the County. Regular shipments of gasoline, propane, acid and other substances are delivered across Wisconsin. Every roadway in the County is a potential route for hazardous material transport, but major transportation routes are Interstate 90/94, US12/16, and State Highways 21, 58, 80, 82 and 173 (see Map 5).

The Commodity Flow Study monitored traffic at key locations and counted trucks with Hazardous Warning Placards. The locations of the intersections and the total number of trucks with hazardous materials are seen in Table 16a.

<b>Intersection</b>	<b># of Trucks</b>
State Hwys. 21 & 80	53
State Hwy. 82 & I90/94	39
US Hwy 12/16 & North Road	4
State Hwys 80/82 & 71	18
State Hwys 80/82 & 33	16
Interstate 90/90 (various points)	295

*Source: Juneau Co. Commodity Flow Study, 2013.*

### Railroad

Three major freight railroads operate in Juneau County, including Canadian National (CN), Canadian Pacific (CP) and Union Pacific (UP). Track routing can be seen on Map 5. Rail stations and junctions include: New Lisbon Junction, Marquis Energy Spur (Necedah), CN-UP Junction Loop (Necedah), Camp Douglas Junction, and Volk Field Siding. All three railroads transport a wide range of hazardous materials through the County, see Table 16b. Although trucks transport most of the hazardous materials in the state and the U.S., rail can carry significantly larger loads of hazardous materials.

<b>Material</b>	<b>CN</b>	<b>CP</b>	<b>UP</b>
Petroleum Crude Oil		X	
Alcohols		X	
Environmentally Hazardous Substances (Liquid)		X	
Molten Sulfur		X	X
Hot Asphalt		X	X
Potassium Hydroxide	X		
Chlorine	X		
Sodium Hydroxide	X		
Hydrochloric Acid	X		X
Ethanol-Gasoline	X		
Sulfuric Acid			X
Ferric Chloride Acid			X

*Source: Juneau Co. Commodity Flow Study, 2013.*

Obtaining detailed information for emergency planning from the railroads can be difficult, but the study cited 4,000 rail car loads of hazardous materials moving through the County annually from one carrier and "significantly more than that" on another. Carloads were not mentioned for the third carrier.

### Pipeline

No major pipelines directly traverse Juneau County, but the Enbridge Petroleum Pipeline comes in close proximity, particularly at the northeast corner, as it runs through neighboring Adams County. Approximately 1.5 million barrels per day move through this pipeline. There have been significant incidents with this pipeline at varying points along its track through Wisconsin, including a leak of 176,000 gallons of crude oil in Rusk County in 2007. Groundwater contamination was the primary consequence of that spill.

A high capacity natural gas main owned by Northern Natural Gas enters the County from the south and branches out to the distribution network at Elroy, Mauston, New Lisbon, Union Center and Wonewoc. A variety of gas utilities use this network to service customers. According to the Commodities Flow Study, natural gas pipelines while not common are not rare either and can be very dangerous. Large amounts of explosive gas can escape quickly from a breach.

A hazardous materials incident can have far reaching impacts, however, those communities which are traversed by major highways, rail or pipeline are susceptible to a higher risk, refer to Maps 5 and 6.

### **Future Probability & Potential Dollar Loss – Hazardous Materials Incidents:**

Based on the historic data presented here (frequency of past events), Juneau County can expect about a minor hazardous material release about every 1.4 years on average, which is a probability of 0.7 or a 70 percent chance in a given year.

There is insufficient data to determine the probability of a major incident. However, with the number of verified trucks carrying hazardous materials and major freight rail lines moving through the County, the chances appear to be significant for a catastrophic hazardous materials incident occurring at some point in Juneau County.

As with the probability, there is limited historic data to base an estimate of potential dollar losses from HazMat incidents. However, based on occurrences statewide, damages range from \$100 to \$10.5 million per incident. The higher end of the range is not impossible in Juneau County.



*HAZMAT Exercise*

**HAZARD ANALYSIS: MASS CASUALTY INCIDENTS****Background on Mass Casualty Incidents Hazard:**

A mass casualty incident is any situation in which emergency medical personnel and the scene are overwhelmed by the number and severity of fatalities and/or injuries. Juneau County Emergency Management defines a mass casualty incident as one involving upwards of 35 victims requiring transport by emergency medical services.

For purposes of this study, the Mass Casualty Incidents section will focus on the following situations that are likely to result in mass casualties should they occur:

- *Civil Disorder*
- *Terrorism*
- *Pandemic*
- *Transportation Accidents*
- *Other Unanticipated Events (such as building collapse)*

It is important to note that any of the hazards addressed in this plan could lead to a mass casualty incident.

Civil disorder, also known as civil unrest or civil strife, is a broad term that used by law enforcement to describe one or more forms of disturbance caused by a group of people. Civil disturbance is typically a symptom of, and a form of protest against, major socio-political problems; the severity of the action coincides with public expression(s) of displeasure. Examples of civil disorder include, but are not necessarily limited to: illegal parades; sit-ins and other forms of obstructions; riots; sabotage; and other forms of crime. They can be planned or spontaneous demonstration to the public and the government, but can escalate into general chaos.

Terrorism is typically a preplanned targeting of an armed assault or a biological, chemical or explosive (potential WMD, Weapon of Mass Destruction) attack on a high value site or population concentration where a group or individual can maximize the number of human casualties or the amount of damage to a facility or organization. Juneau County has a number of potential targets.

Pandemic disease or illness, be it natural or man-caused, is a real concern for emergency managers and health care professionals. Though many of the illnesses that historically created major problems in Juneau County can now be successfully prevented or treated, others continue to pose a serious threat, such as H1N1 aka swine flu.

A transportation accident or incident involves the crash or malfunction of a vehicle or system, such as airplane/airliner, railroad train, bus (school or coach) which may involve loss of life, serious injury, property damage, fire and/or

explosion, and/or release of hazardous substances (See also: *Hazardous Materials Incidents* earlier in this section.)

**History of Mass Casualty Incidents in Juneau County:**

Mass casualty incidents are extremely infrequent in Juneau County. Historically, the closest thing to a mass casualty event in Juneau County has been confined to incidents such as public health emergencies and school bus crashes. For example, in 1992 a school bus with over 30 students slide off the road and overturned down a steep embankment. One person was injured, but the remainder had to be transported to the hospital to be checked. In 2006, 13 participants of a bicycle rally contracted a serious viral illness, nearly overwhelming Mile Bluff Medical Center.

Civil unrest or terrorist incident has no historical precedence in Juneau County, however, there have been a few suspicious or false alarm incidents that have involved some form of response. In 1995, a bomb scare led to the evacuation of the Juneau County Courthouse. The Fort McCoy bomb squad was called in to detonate a suspicious package. In 2001, another bomb threat lead to evacuation of the Courthouse and search of County facilities. In 2002, reports of mail containing white powdery substance led to HAZMAT screening for anthrax. There have also been instances of bomb threats at area schools (and one hotel) which were managed by county and local law enforcement agencies.

Although Juneau County Health Department has developed a management plan for addressing a pandemic disease outbreak, some strains can be highly contagious and a particular threat to certain groups such as pregnant women or people with health conditions. Major global influenza outbreaks have occurred four times in the last century: 1918, 1957, 1968 and 2009. The greatest loss occurred in 1918 when the Spanish Flu (H1N1) killed 20 to 40 million people (550,000 in the US) between 1918 and 1919. Approximately 8,400 died in Wisconsin, with 72 of those occurring in Juneau County. The 2009 "Swine Flu" was a new variant of that H1N1 virus.

**Mass Casualty Incidents Vulnerability Assessment:**

Although unprecedented in Juneau County, a mass casualty incident could result in a serious threat to life or property and could lead to economic, health or psychological affects that could last for years. A mass casualty incident can occur anywhere in the county. The likelihood of such an event is greater near transportation routes, such as major highways, railroad corridors and airports (specifically Volk Field), or population centers (cities and villages).

Citizens not directly involved in a mass casualty event may have their lives significantly disrupted. Their ability to work, enjoy recreation and in some cases, obtain necessities may be jeopardized. Disruption of infrastructure may occur during very severe events. Public utilities such as water, fuel and electricity may be temporarily unavailable, as well as public infrastructure for communication.

Civil disorder or a terrorist act may occur anywhere in the County. The Wisconsin Air National Guard Base at Volk Field outside Camp Douglas is a high-value military target, while other potential targets for terrorism include the two hydroelectric dams operated by the Wisconsin River Power Company on the Wisconsin River, fuel oil, gasoline and propane storage facilities, municipal utility infrastructure and various schools and churches.

Small pockets of groups with anti-government or anti-tax political leanings have been in Juneau County for decades. These groups have been quiet for many years, but these antigovernment political views quietly persist just below the surface of civil society. Quiet antiabortion and anti-family planning protests sponsored by a local church in Mauston have occurred for years, and occasionally anti-war protests have occurred outside the Volk Field Airbase.

Juneau County has significant potential exposure to a transportation-related mass casualty incident. The County is located under a major air corridor (between Chicago and Minneapolis), and is bisected by a number of major state, federal and Interstate highways and several railroads. Tens of thousands of people pass over and through Juneau County daily.

During the city/village planning meetings for this Plan Update, Camp Douglas, Hustler, Lyndon Station, Mauston and Necedah all some form of mass casualty event as a major vulnerability concern due to proximity to Volk Field, potential contamination of water supply, train derailment, or interstate crash.

**Future Probability & Potential Dollar Loss – Mass Casualty Incidents:**

There is insufficient data to determine the probability of future mass casualty incidents in Juneau County. However, historically such events have been extremely rare. Although rare events, the potential risk to life and property is very high, so it is important to mitigate against these risks and to be prepared to respond should they occur.

As with the probability, there is limited historic data to base an estimate of potential dollar losses from mass casualty incidents. Associated costs/damages would include emergency services, medical treatment, and restoration/reconstruction. Significant economic disruption could occur due to loss of business revenue, loss of work time and costs of treating injuries or illness.