Adams-Juneau Flood Resiliency Study

December 2018

EDA Project Number: 06-69-06076

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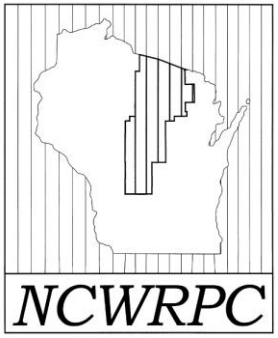

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The North Central Wisconsin Regional Planning Commission (NCWRPC) is a voluntary association of governments, created in 1973 under Wisconsin State Statute 66.945, now 66.0309. Currently, the Commission serves the Counties of Adams, Forest, Juneau, Langlade, Lincoln, Marathon, Oneida, Portage, Vilas and Wood.

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Chapter One

Purpose of the Study

Wisconsin's Adams and Juneau counties are located on the eastern edge of an area that experienced heavy rain and flooding during the period of September 21-22, 2016. As a result of this flooding, a Presidential Disaster was declared for ten affected counties, including Adams and Juneau, in October of 2016. The heavy rains caused widespread flooding throughout the area, negatively impacting business operations.

Flooding closed a portion of County Highway F in Juneau County briefly during Spring 2018. Image source: NCWRPC

This study is in response to impacts suffered resulting from this flood event. The area had rainfall totals of 3 to 7 inches, while some localized areas experienced 9 to 11 inches total. At one Adams County location, a three day of total of 8.2 inches of rainfall was reported. The Wisconsin DNR issued warnings to residents and tourists urging them to avoid contact with flood waters, as well as notification to private property owners to be aware of possible well contamination. In Adams County, several homes were damaged. Additionally, numerous local and county road segments were closed due to water over the roads and culvert washouts, causing damages estimated to exceed $108,000. Reports of flooded parking lots impeded customer access to some businesses. Additionally, the County issued a press release to residents living in low lying areas and those living along the Wisconsin River/Castle Rock and Petenwell Flowages. Conditions above and below dams were considered dangerous, and recreationists and residents were urged to take extra precautionary measures and watch for rapidly rising water. In Juneau County, flooding occurred on the Yellow and Baraboo Rivers. Damages to residential and business properties was scattered throughout those basins. Public sector damages were in excess of $160,000. Several Town and county roads were closed due to high water.

Throughout the ten affected counties, there was 7.2 million dollars in damages to businesses and homes and 14.0 million dollars in damages to public infrastructure, mostly roads and bridges, that support commerce. While floodplain mapping is available for the area, most communities are unaware of the threat to business and commerce from such a significant rainfall event. Efforts to improve flood resiliency are minimal, and communities within the affected area lack a coordinated effort to facilitate flood mitigation, risk reduction, business stability and economic resiliency.

As evidenced by this recent major event, these flood episodes can have a significant impact on local and regional economies. By conducting an analysis of the area encompassed by the Presidential Disaster Declaration (DR-4288), strategic community development plans can be produced that would identify "at-risk" businesses and commercial properties and identify potential infrastructure that could be damaged or destroyed as a result of severe rain and flood conditions.

A flooded portion of County Highway Z in Adams County during Spring 2018. Image source: NCWRPC

The long term potential economic impact of the project is a function of an increased level of community resilience to flooding. The flood event of September 21-22 caused over a quarter-million dollars in damages to public infrastructure alone. Significant private sector damages to homes and businesses were widespread. Most infrastructure damage was caused by roadway, bridge and culvert washouts, leading to community isolation and preventing commuters from reaching their place of work.

A large portion of this flood damage was preventable. The failure of community infrastructure to withstand storm events such as the September 2016 flood, as well as previous floods, is clearly indicative of design and/or construction deficiencies that exist within the region's infrastructure portfolio. Cost savings resulting from the implementation of the proposed project would be realized by a reduction in the direct and indirect losses in a future flood event.

The 2016 September flooding demonstrated that the region was not prepared to respond to historic flooding events. While the flooding damage reported in Adams and Juneau was not as heavy as other affected counties, the event exposed potential risks to emergency travel routes, commerce, public facilities, and housing in Adams and Juneau Counties during future flooding events. Additionally, a number of local and county roads were closed throughout the region until September 30th, which though unreported, undoubtedly affected commerce within the area as well as other community activities. Furthermore, tourism plays a large role in the local economy and with warnings issued by the

Wisconsin Department of Tourism, tourist travel to the area was likely impeded, resulting further lost revenues in an already depressed area of Wisconsin.

While the counties are recovering from the 2016 September flooding events, there is nothing in place at this time to identify, evaluate, and address critical infrastructure in the event of future natural disasters-particularly the economic impact susceptibility related to business commerce, emergency services, transportation, communication, and utilities. Furthermore, there is virtually nothing in place to address community resiliency and business recovery after a major storm event occurs.

The outcome of this effort will demonstrate the potential impacts of historic flood events, pre-identify likely impact areas and assess the economic impacts to communities, businesses and residents. The effort will be incorporated into the county's hazard mitigation plan and serve as a point of reference to guide flood mitigation activities across the counties, which in turn, improves resiliency.[1]

The scope of work for the project will be used to support staff salaries to complete the following activities and deliverables:

- A flood inundation analysis that supports pre-mitigation activities which identify mechanisms that build community economic resiliency.

- Identify vulnerable development and infrastructure within the context of a major storm and flood inundation scenario. Business impacts will be identified and economic losses will be tabulated using local community data.

- Support logistics planning by identifying infrastructure impacts due to flood inundation.

- Publish results of the analysis to the Internet to facilitate local access and use.

- Provide guidance on updating local development strategies, regulations, and long-range planning, including business recovery and hazard mitigation planning.

- Meet with appropriate emergency management and economic development personnel to demonstrate how to use the study results.

[1] Severe flooding in August 2018 proves that the issue of flooding is persistent. See **Appendix E** for information on the 2018 flood event.

Development of this report involved numerous staff level meetings between the counties and the NCWRPC. The final study was presented to the full NCWRPC Board in October and to county board committees in both Adams and Juneau in December of 2018. Following these meetings, copies of the final report were distributed to county departments and appropriate board members and published to the Internet to facilitate local access and use.

The tangible economic benefits of implementation of this posed project will be realized in the reduction in future flood-related losses, a reduction in the direct impacts of flooding on businesses, residences and community facilities and a reduction in indirect losses due to business closure or the inability to conduct commerce due to closed roads impeding access to communities.

Chapter Two

Background

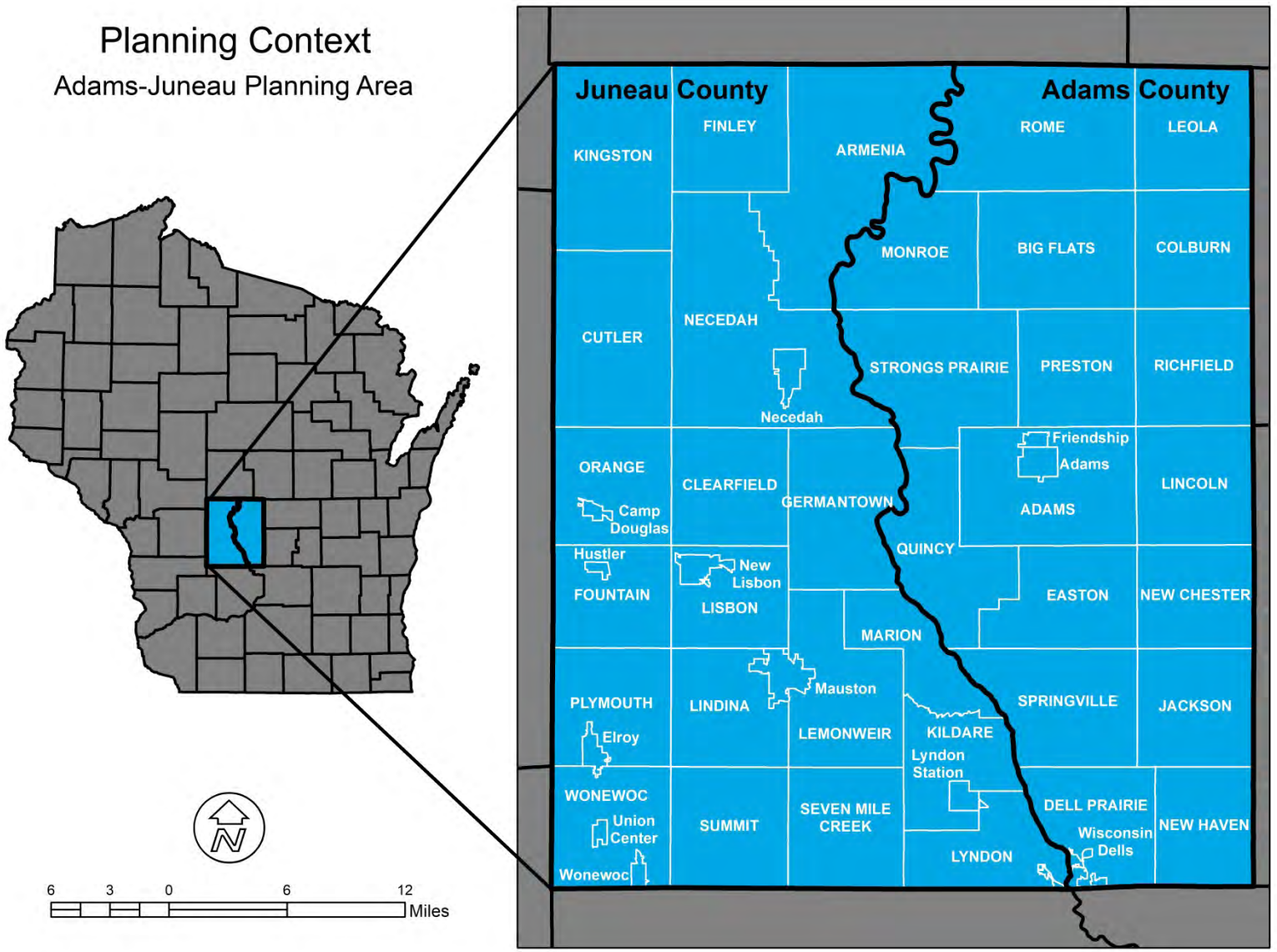
The Adams County-Juneau County Planning Area is located in central Wisconsin. The planning area covers a total surface area of 1,491.76 square miles, of which 5.32% is water, as shown in **Table 1**. The City of Mauston is the largest community located within Juneau County and the City of Adams is the largest community located within Adams County. Combined these two counties have a population of 47,539 residents, and its 891 businesses provide over 13,650 jobs. The planning area is bounded on the north by Wood and Portage Counties, on the east by Waushara and Marquette, on the south by Sauk and Columbia, and on the west by Vernon, Monroe, and Jackson. The planning area lies 150 miles northwest of Milwaukee; 116 miles southwest of Green Bay; 69 miles east of La Crosse, and 78 miles north of Madison. Major metropolitan areas outside of Wisconsin with transportation linkages to the planning area are Chicago, 219 miles southeast; Minneapolis-St. Paul, 195 miles northwest; and Duluth, 254 miles north.

Table 1: Geographical Size

	Area in square miles			% of Total Area	
	Surface Area	Water Area	Land Area	Water	Land
Adams	687.73	42.30	645.43	6.15%	93.85%
Juneau	804.03	37.10	766.93	4.61%	95.39%
Planning Area	1,491.76	79.40	1,412.36	5.32%	94.68%

Source: U.S Census, NCWRPC

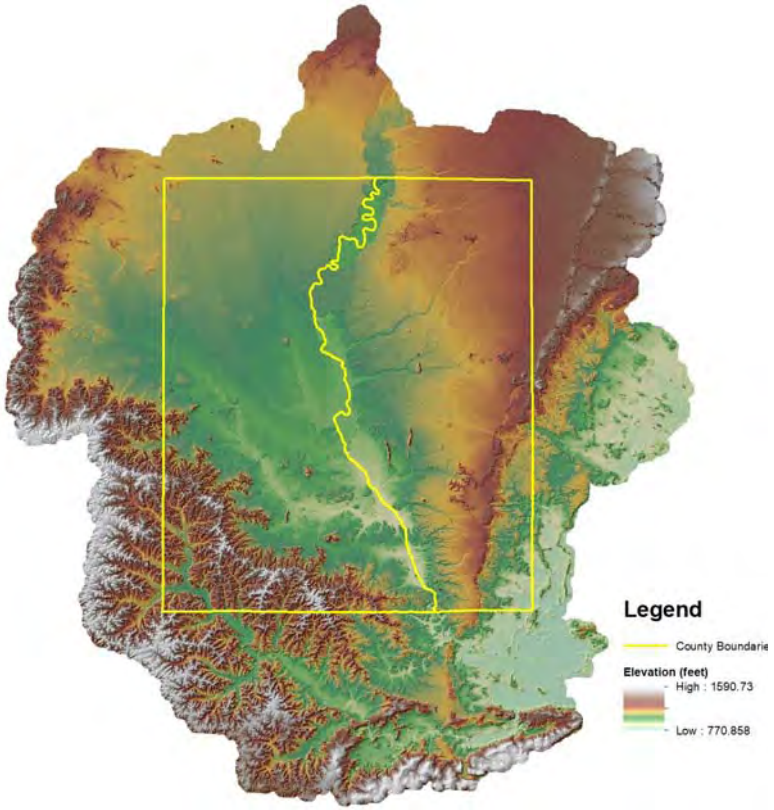
The Wisconsin River forms the border between Adams County and Juneau County.
Image source: NCWRPC


Planning Context
Adams-Juneau Planning Area
Juneau County
Adams County
KINGSTON
FINLEY
ARMENIA
ROME
LEOLA
MONROE
BIG FLATS
COLBURN
CUTLER
NECEDAH
Necedah
STRONGS PRAIRIE
PRESTON
RICHFIELD
ORANGE
Camp Douglas
CLEARFIELD
GERMANTOWN
Friendship
Adams
ADAMS
LINCOLN
QUINCY
Hustler
FOUNTAIN
New Lisbon
LISBON
EASTON
NEW CHESTER
MARION
PLYMOUTH
Elroy
LINDINA
Mauston
LEMONWEIR
KILDARE
Lyndon Station
SPRINGVILLE
JACKSON
WONEWOC
Union Center
Wonewoc
SUMMIT
SEVEN MILE CREEK
LYNDON
DELL PRAIRIE
Wisconsin Dells
NEW HAVEN
6 3 0 6 12
Miles

General Geography

Topography

The planning area is split between the Wisconsin Central Plain and the Western Upland. All of Adams County and about three-quarters of Juneau County are part of the Wisconsin Central Plain, while the southwestern quarter of Juneau County is part of the Western Upland. The Wisconsin Central Plain is characterized by flat or gently undulating topography. Relief is generally low, with extensive wetlands of various types. There are also occasional pinnacles and hills of sandstone such as Sheep Pasture Bluff, Pilot Knob, Rabbit Mound, Friendship Mound, and Roche-A-Cri Mound.



Topography within the Wisconsin Central Plain portion of the planning area is mainly flat, with elevations ranging from 840 feet to 980 feet in the flat portions of the area. This portion of the planning area has extensive areas of wetlands resulting from the flat topography, slowly permeable layers of silt or clay, and a high water table.

Topography in the Western Upland portion of Juneau County consists of unglaciated hilly terrain, with a high elevation of 1,380 feet at Johnson Hill. Soils in the Western Upland portion of the area are well drained. Steep sandstone escarpments mark the northern and eastern boundaries of this area. The hill valleys are typically 200 to 350 feet below the ridgetops and are long and V-shaped with relatively narrow bottoms.

Notable topographical features of note include Roche-A-Cri Mound, Pilot Knob, Rabbit Mound, and Friendship Mound in Adams County, and Sheep Pasture Bluff and Johnson Hill in Juneau County. Principal surface water drainage in the planning area is to the Wisconsin River, while parts of Adams County drain to the Fox River due to divide caused by the Johnson Moraine in the southeastern portion of Adams

County. Major tributaries of the Wisconsin River consist of Little Roche-A-Cri Creek, Big Roche-A-Cri Creek, Fourteen Mile Creek, and the Baraboo, Lemonweir, Little Yellow, and Yellow Rivers. Neenah Creek and Widow Green Creek serve as the main tributaries for the Fox River.

Climate

The planning area has a continental climate that is characterized by long, cold, snowy winters; warm summers; and springs and falls that are often short. From late fall through spring, the weather changes every few days because of air masses that are part of pressure systems moving eastward and northeastward over the northern states.

In winter the average temperature is 19 degrees F., and the average daily minimum temperature is 9 degrees. The lowest temperature on record in the planning area is -43 degrees, which occurred in 1951. In the years 1978 (Juneau County) and 2008 (Adams County), the planning area experienced 57 days at or below 0 degrees. In summer, the average temperature is 69 degrees and the average maximum temperature is 81 degrees. The highest recorded temperature in the planning area is 114 degrees, which occurred in 1936 in Adams County. In 1931, there were 53 days with temperatures exceeding 90 degrees, the greatest number of days at or above 90 degrees in the planning area.

Average total annual precipitation is 33.8 inches. Of this, about 70% usually falls in April through September. The heaviest 1-day rainfall on record was 7.67 inches on August 7, 1980 in Adams County. The heaviest 1-day rainfall on record in Juneau County was 5.22 inches on July 15, 2010. Thunderstorms occur on about 39 days each year. Average seasonal snowfall is 43.65 inches, with 97.4 inches during the winter between 2007 and 2008 being the greatest total on record.

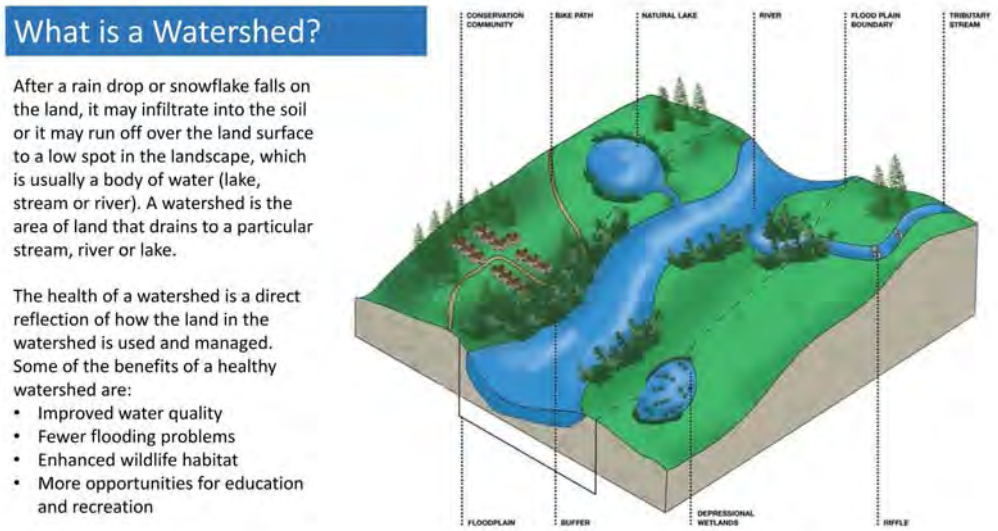


Image source: Coastal Athlete Program

Surface Water

The planning area is located within the Upper Fox River Basin and the Central and Lower Wisconsin River Basins. There are a total of 17 main watersheds within the planning area. **Table 2** lists the main watersheds within the planning area. There are a total of 103 lakes in the planning area, including Petenwell and Castle Rock, the 2nd and 5th largest lakes in the state of Wisconsin. There are 10 rivers within the planning area, the largest of which is the Wisconsin River. The planning area consists of 145 streams spanning 613.5 linear miles. Total surface water area in the area exceeds 52,000 acres, providing an abundant supply of surface water for power generation, irrigation, recreation, and fish & wildlife habitats. There are 187 total dams in the planning area, 78 of which are considered to be large. Juneau County has 124 total dams while Adams County has 63 total dams. See **Map 1: Hydrology**.

Table 2: Watersheds	
Watershed	Basin
Adams County	
Seven Mile & Ten Mile Creeks	Central Wisconsin River
Fourteen Mile Creek	Central Wisconsin River
Big Roche-A-Cri	Central Wisconsin River
Little Roche-A-Cri	Central Wisconsin River
Duck Creek/Plainville Creek	Lower Wisconsin River
Lower Baraboo River	Lower Wisconsin River
Montello River	Upper Fox River
Neenah Creek	Upper Fox River
Juneau County	
Cranberry Creek	Central Wisconsin River
Lower Yellow River	Central Wisconsin River
Wisconsin Rapids	Central Wisconsin River
Beaver Creek	Lower Wisconsin River
Crossman Creek/Little Baraboo River	Lower Wisconsin River
Dell Creek	Lower Wisconsin River
Little Lemonweir River	Lower Wisconsin River
Lower Lemonweir River	Lower Wisconsin River
Seymour Creek/Upper Baraboo River	Lower Wisconsin River

Source: WI DNR

The State Highway 21 Bridge over the Wisconsin River connecting Adams and Juneau Counties.
Image source: NCWRPC

The Yellow River at the Necedah Dam.
Image source: NCWRPC

Flood Susceptible Soils

When examining potential flooding impacts, it is important to consider areas that have higher rates of flood susceptibility. One way to do this is to identify soils that are more likely to flood. By utilizing data from National Resources Conservation Science (NRCS), NCWRPC was able to map soils that are most likely to experience flooding due to their soil properties, such as poor water drainage. Flood susceptible soils are broken down into four groups; very frequent, frequent, occasional, and rare. Within the Adams-Juneau Planning Area, soils that are considered to flood very frequently or frequently are generally located along the Wisconsin, Yellow, Lemonweir, and Baraboo Rivers, as well as the Beaver, Big Roche-A-Cri, and Little Roche-A-Cri Creeks. Overall, Juneau County contains significantly more soils susceptible to flooding than Adams County, as shown in **Map 2: Flood Susceptible Soils**.

Floodplains

Floodplains and wetlands are important subsidiary components to the surface water system as described below:

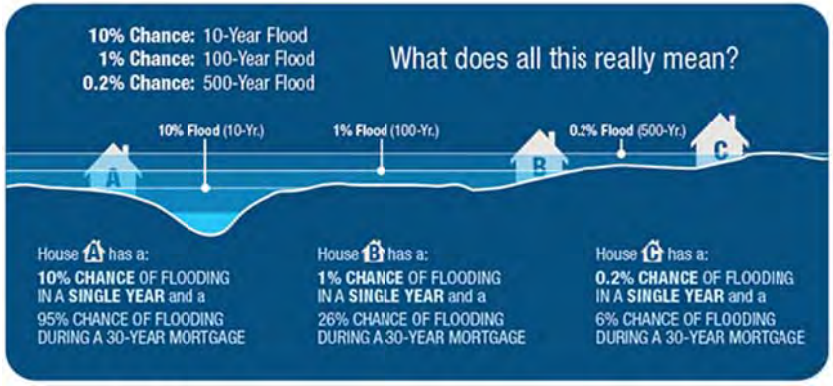


Image source: Project Brays

The primary value of floodplains is their role in natural flood control. Floodplains represent areas where excess water can be accommodated whether through drainage by streams or through storage by wetlands and other natural detention/retention areas. Specific areas that will be inundated will depend upon the amount of water, the distance and speed that water travels, and the topography of the area. If uninterrupted by development, the areas shown on a map as floodplains should be able to handle the severest (regional) flood, i.e. those that have a probability of occurring once every one hundred years.

There is a value in preserving and protecting these natural flood control areas from encroachment. First, by preventing development in the floodplain, the cost of building dikes, levies, or other man-made flood control devices will be saved. Second, for each structure that is constructed in a flood-prone area, that flood-prone area expands, potentially subjecting other structures originally built outside the

delineated flood hazard area to the risk of flooding. Each new structure (or modification to existing) placed in the floodplain puts more life and property in danger.

Floodplain zoning maps identify areas where major floods occur. Regulations prohibit development in the floodway, the most dangerous flood area. In other flood areas, the flood fringe, development that is built above flood levels and otherwise flood-protected is allowed if it is in accordance with local ordinances. For regulatory purposes, a floodplain is generally defined as land where there is a 1% chance of flooding in any year (also known as the 100-year floodplain).

In order to participate in the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP), Adams and Juneau County, along with their incorporated cities and villages, have completed a Flood Insurance Study and a Flood Insurance Rate Map (FIRM) that encompasses the planning area. This FIRM delineates the "A" Zones including the floodway and flood fringe which are those areas inundated by the 100-year flood within the planning area. FEMA has updated the FIRM for both Adams and Juneau County to digital standards. The digital FIRMs are referred to as DFIRM. The NCWRPC downloaded the DFIRM from FEMA's website for use in this plan. Although unofficial, the digital files indicate that there are about 77,905 acres of floodplain, and about 45,352 acres of which are considered as floodway, as shown in **Table 3**.

Table 3: Floodplains

	Acres Floodplain	Acres Floodway
Adams County	19,016.0	6,136.3
Juneau County	58,889.4	39,216.1
Planning Area	77,905.4	45,352.3

Source: FEMA

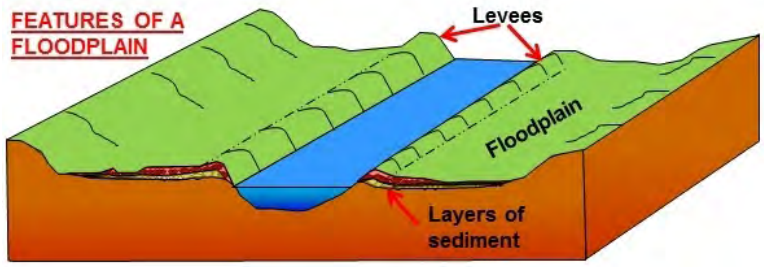


Image source: Quora

Recent housing and DFIRM data indicates that there are 1,486 structures in the planning area that are located within floodplains. According to the most recent All Hazards Mitigation Plan Updates for the two counties, (2013 Adams, 2017 Juneau), only two structures within the planning area are considered repetitive loss structures, meaning they have multiple flood insurance claims, with both structures located in Juneau County.

Wetlands

Wetlands perform many indispensable roles in the function of the hydrologic cycle and local ecological systems. In terms of hazard mitigation, they act as water storage devices in times of high water. Like sponges, wetlands absorb excess water and release it back into the watershed slowly, preventing flooding and minimizing flood damage. As more impermeable surfaces are developed, this excess capacity for water runoff storage becomes increasingly important.

The DNR has also identified the location of wetlands on their WISCLAND database. According to this, the planning area has 148,954.22 acres of wetlands, or 15.6 percent of the total planning area. There are numerous concentrations of wetlands within the planning area, including at the Necedah National Wildlife Refuge, the Leola Marsh Wildlife Area, Colburn Wildlife Area, and the Quincy Bluff and Wetland Natural Area.

Eradication of wetlands can occur through the use of fill material. This can destroy the hydrological function of the site and open the area to improper development. The Wisconsin Department of Natural Resources (DNR) has promulgated minimum standards for managing wetlands.

Flood Causes and Prevention Strategies

Flooding occurs naturally but various factors increase the likelihood of flooding, such as the level of development, impermeable surface area, type of agricultural use and land management practices, wetland loss, ecological characteristics and physiographical makeup. And not all floods are the same. Flooding can occur slowly as upstream floodwaters make their way downstream or quickly, with little or no warning, wrecking infrastructure and property in their path. Such flooding is called flash flooding, with good reason, and is particularly dangerous in the subject region because strong thunder storms are common. When such storms occur they can quickly dump several inches of rain in an area, and when they occur with snow on the ground the rain combined with the snowmelt can exacerbate the problem.

Floods can also be caused by infrastructural failure, sewer or waterway blockage, or an event that drives water quickly downstream. Another such type of surface water flooding is the overflowing of streambanks. Not all floods are caused by surface water; flooding can also happen due to groundwater rising. In this case, pumping is useless because it doesn't help reduce the groundwater-level, as there is no place to drain.

Waterways

The accumulation of floating build up and the resulting blockage of waterways is a primary cause of flooding in both rural and urban areas. Poor agricultural and manufacturing practices can result in large amounts of run-off from fertilizers, organic matter, industrial by-products, manure and soil erosion, which causes waterways to clog and prevents them from being able to absorb excess amounts of water (especially in the case of heavy downpours due to quick changes in climate). Currently in America, there is no clear, centralized system of oversight for the management and prevention of such blockages. It can be very problematic in small and mid-sized streams.

In the case of the Mississippi, runoff is accumulative from all the connected waterways, resulting in a massive clog near the Gulf of Mexico. This end blockage further exacerbates and limits the River's overall "health" by limiting the possibility for water to flow freely throughout. It also dumps non-degrading plastics and other garbage into the oceans. Thus, we are looking at a national issue that demands the appropriate top-down coordination between local, regional and national stakeholders.

Heavy rains in 2017 forced the opening of the Friendship Dam to release pressure on its levee, flooding Friendship Park and causing several road closures in Friendship. Image source: Wisconsin Rapids Tribune

For instance, in the Netherlands, a highly advanced water management system maps and clearly defines responsibilities of the stakeholders involved to clean their respective waterway. It is interesting to note specifically for the exemplary way things are managed between the national and local levels, mitigating potentially hazardous and costly damages that can occur when waterways become blocked.

Impervious Surfaces

Regular inspection and maintenance of dams and other infrastructure can sometimes prevent flash floods from occurring. However, when impervious surfaces such as buildings, parking lots and sidewalks replace natural landscape, the means to absorb floodwaters are limited. In such areas, the intensified velocity of floods can be caused by a lack of distribution and absorption, as well as the potential contamination from fuel, oil and other pollutants that accumulate on these non-porous surfaces. During a flooding event, these contaminants wash into water systems and aquatic

habitats, causing water and ecological pollution.

Development projects have the potential to mitigate the harmful effects of impervious surfaces and flash floods by including plenty of natural landscape and good design. Effective planning methods in such cases would pay particular attention to drainage and to reducing the "flashiness" of the design and would include the addition of shallow depressions that collect rain water (swales) in parking lots; narrowed roadways, minimum size and number of driveways and sidewalks; and the use of porous or pervious paving materials which allows water absorption.

Wetland Restoration

Wetland restoration provides yet another sound flood prevention strategy. According to figures from the U.S. Environmental Protection Agency (EPA), a single acre of wetlands can absorb 1 to 1.5 million gallons of water. In addition, wetlands filter pollutants out of running water, which drop into the sediment. Riparian or riverside habitat also needs protection and restoration. The EPA estimates that bottomland wetlands along the Mississippi River are able to retain floodwaters for 12 days now versus the 60 days it is believed to have once stored. This drop in retention might also be partly due to the above-mentioned issue of clogged waterways.

Floodplain Development

One of the strongest flood prevention strategies is to restrict development in floodplains, along with government buy-outs of homeowners located in such high-risk areas. The Great Flood of 1993 caused catastrophic damage in the Upper Mississippi river floodplain, causing over $20 billion damage. After the flood, the Federal government acknowledged the failure of artificial structures such as dams and levees and some flood victims were relocated. However, in recent years, the lessons of 1993 have faded. Over 85 percent of post-relief money has been used to rebuild in these very same flood-prone areas. Let us quickly revisit some of the lessons from this disaster.

Learning from the Great Flood of 1993

According to a 1995 report by Gerald Galloway, the area drained by the Mississippi and its tributary floodplains provide some of the most productive farmland in the country, which is still the case today. The area offers diverse recreational and economic opportunities and contains important ecological systems. Unfortunately, the Great Flood of 1993 destroyed tens of thousands of homes, flooded hundreds of thousands of acres of prime farmland and disrupted the economic and social fabric of several million people.

Flooding along the Mississippi River in Fountain City, located in Buffalo County, as part of the Great Flood of 1993.
Image source: National Weather Service

The 1993 flood damage estimates pointed out bureaucratic inconsistencies, as no Federal agency was responsible for developing accurate assessments of flood damages, nor was funded to do so. Impacts on businesses, local governments and private property in and out of the basin were difficult to calculate and there was no accurate way to assess tax losses. In addition, a portion of the residential and business damage was caused by basement flooding due to high groundwater and sewer back up in areas outside of the floodplain.

Flood-vulnerable sections of major urban areas, for the most part, were protected by levees and/or reductions in flood stages brought about by upstream impoundments. River towns were protected by urban levees or their location on a bluff. But the enormous rainfalls put considerable amounts of acreage underwater for several months as continuing high water stages prevented the drainage of floodplains.

Businesses sustained significant physical damages, and much of this damage occurred behind levees that failed or were overtopped. In addition to physical damage to buildings and their contents, lost profits and wages from businesses closed by the flood had local and regional impacts.

Agricultural damages from the Great Flood of 1993 had two primary causes: excessive moisture that prevented planting and reduced yields in upland and floodplain areas; and actual flooding that destroyed crops and severely damaged many acres of fertile floodplain cropland. Secondary impacts of agricultural losses to a local economy varied substantially with the dependence of that economy on the agricultural sector. Immediate losses were due to lost sales and unemployment.

In the long run, the assessed value of land that has sustained long-term damage was in some cases reduced, which affected the property tax base of impacted communities. Another secondary effect was a reduction in crop-support payments and crop output, since crop prices are adjusted to the reduced production caused by wet weather.

Long Range Flood Water Management Strategy for Adams County

As a result of the flood of 1993, the NCWRPC worked with the Economic Development Administration (EDA) to provide Flood Recovery services for the region. Through this effort it was determined that a flood management study was needed for Adams County.

EDA provided funding for the project and the NCWRPC completed the work in March of 1996. As a result of this grant, a county-wide study of flooding problems was undertaken. From this study, a set of strategies for flood hazard mitigation was prepared to plot out a plan for long term flood hazard reduction and economic recovery of Adams County. FEMA and WEM, the two agencies primarily charges with reducing damages, emphasize mitigation as the key component in achieving their goal of reducing vulnerability to flood hazard. Pertinent recommendations from that study have been incorporated into this resiliency study.

Floods of 2018

Heavy rainfalls hit Wisconsin in late August of 2018, leading to a State of Emergency being declared for the entire state. During the period of August 27-28, some areas within Adams and Juneau counties received between 5-7 inches of rain overnight. Some areas within the state received over 14 inches of rain during a week-long stretch of rain activity. The heavy rains caused widespread flooding throughout the area, negatively impacting business operations, and led to numerous residents needing to be rescued from their homes via boat.

As a result of the heavy rain, there were road closures throughout Adams and Juneau counties. Major roads that experienced road closures included I-90/94, U.S Highway 12/State Highway 16, State Highway 33, and State Highway 80. Significant flooding of the Baraboo River caused heavy damage in the City of Elroy, Village of Union Center and the Village of Wonewoc. **Appendix E** contains news reports describing damages throughout flood-affected areas.

Chapter Three

Area Context

Demographic and Economic Profile

Population

Estimates from the 2012-2016 American Community Survey show an estimated population of 46,693 residents in the planning area, with 20,294 residents residing in Adams County and 26,399 residents in Juneau County, as shown in **Table 4**. This is a slight decrease (1.8%) in population from the reported 2010 Census population in the area. Since 2000, the population of the planning area has increased by 3,734 residents, or 8.7 percent.

Table 4: Population

	2010 pop.	2016 pop.	# Change	% Change
Adams County	20,875	20,294	-581	-2.8%
Juneau County	26,664	26,399	-265	-1.0%
Planning Area	47,539	46,693	-846	-1.8%

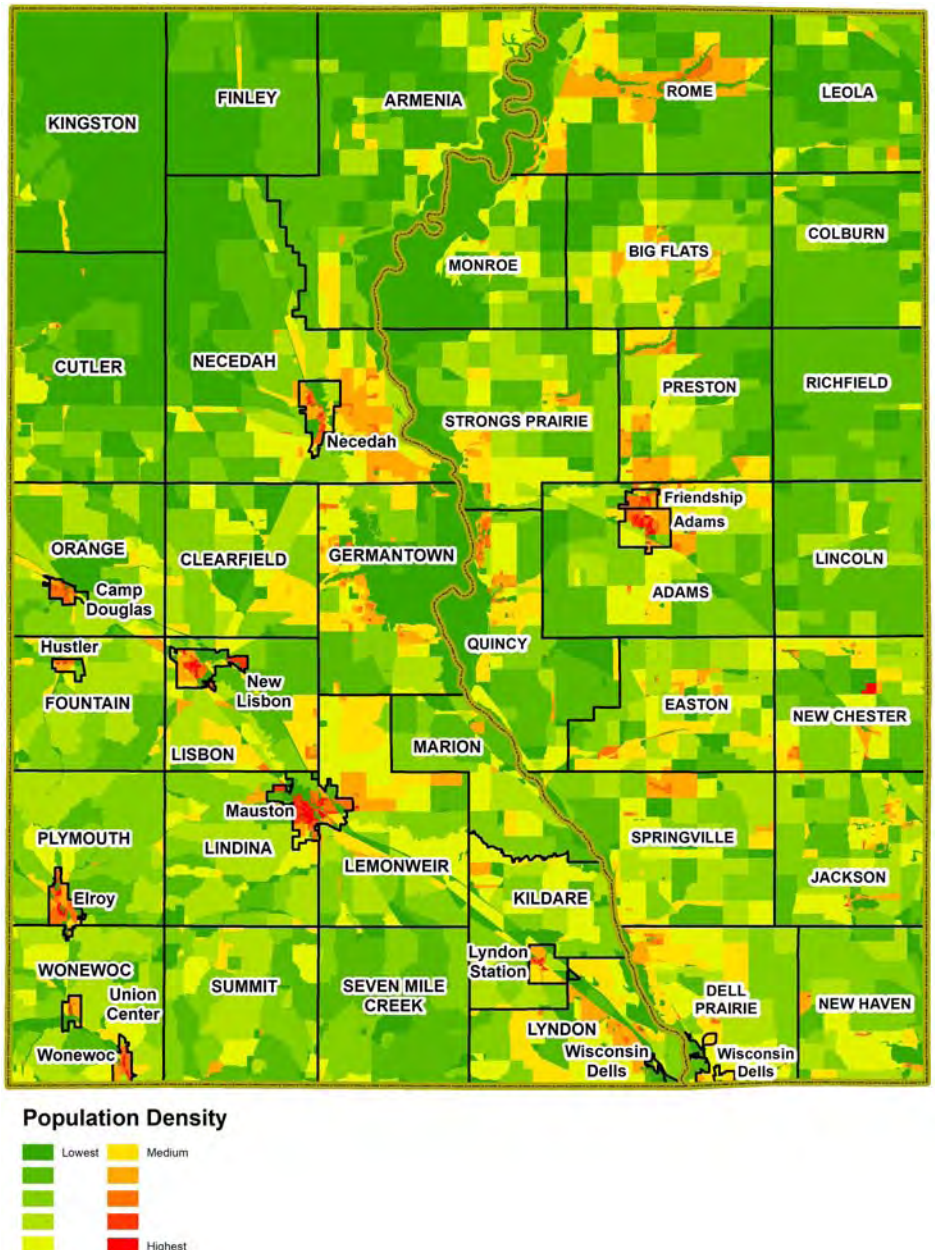
Source: U.S. Census, ACS 2012-2016

Official population projections predict that the planning area will have a population of 52,200 residents in 2025 and a population of 52,780 residents in 2040. **Table 5** shows official population projections in the planning area from the Wisconsin Department of Administration in 5-year increments from 2010-2040.

Table 5: Population Projections

	2010	2015	2020	2025	2030	2035	2040
Adams County	20,875	21,410	22,035	23,120	23,830	23,780	23,315
Juneau County	26,664	27,305	28,130	29,080	29,790	29,805	29,465
Planning Area	47,539	48,715	50,165	52,200	53,620	53,585	52,780

Source: WDOA

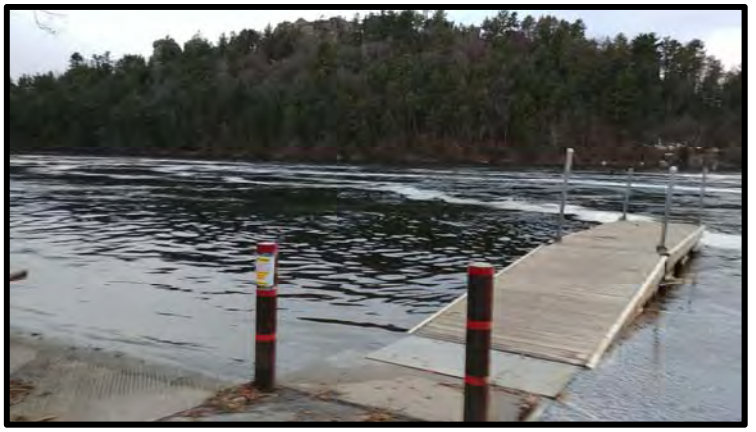


Population concentrations and trends are important when prioritizing hazard mitigation strategies. The City of Mauston is the most densely populated and developed area within the planning area, followed by the City of New Lisbon, the Village of Wonewoc, the City of Elroy, and the Friendship/Adams Area. Other areas of population concentrations include the following communities in Juneau County; Village of Camp Douglas, Village of Hustler, Village of Lyndon Station, Village of Necedah, Village of Union Center, Town of Germantown, Town of Lemonweir, Town of Lyndon and the Town of Necedah, and the following communities in Adams County; Town of Rome, Town of Quincy, Dellwood, Easton, Brooks, Grand Marsh, and Big Flats. Overall population density in the planning area is 31.3 persons-per-square-mile and ranges from a high of 916.25 persons-per-square-mile in the City of Mauston to a low of 1.18 persons-per-square-mile in the Town of Kingston. **Table 6** shows the population density for municipalities in Adams County, while **Table 7** shows the population density for municipalities in Juneau County. The image to the left displays population density by census block for the Adams-Juneau Planning Area.

Table 6: Adams County Population Density, 2016			
	Pop.	Area (sq. mi)	Pop Density
City of Adams	1,659	2.94	564.29
Town of Adams	1,323	50.40	26.25
Town of Big Flats	861	48.05	17.92
Town of Colburn	260	35.87	7.25
Town of Dell Prairie	1,523	32.71	46.56
Town of Easton	958	36.11	26.53
Village of Friendship	721	0.94	767.02
Town of Jackson	1,218	35.64	34.18
Town of Leola	278	37.25	7.46
Town of Lincoln	362	36.10	10.03
Town of Monroe	443	38.43	11.53
Town of New Chester	2,059	31.35	65.68
Town of New Haven	614	30.37	20.22
Town of Preston	1,472	35.82	41.09
Town of Quincy	1,248	39.56	31.55
Town of Richfield	117	35.55	3.29
Town of Rome	2,699	62.22	43.38
Town of Springville	1,328	44.68	29.72
Town of Strongs Prairie	1,098	51.96	21.13
City of Wisconsin Dells	53	1.78	29.78
Adams County	20,294	687.73	29.51

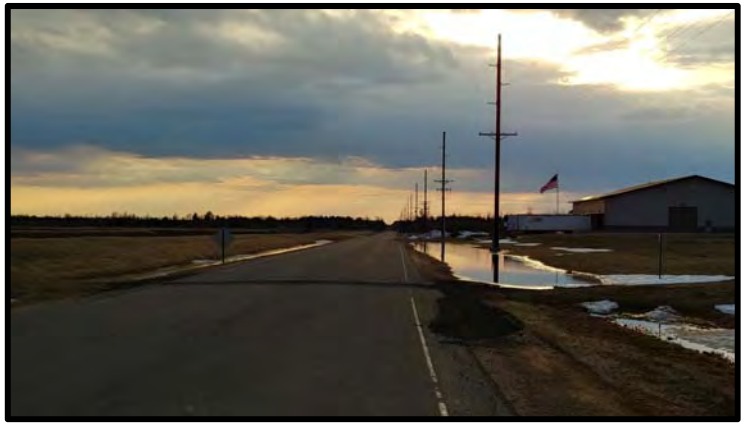
Source: ACS 2012-2016, NCWRPC

Flooding at Friendship Park in 2017.
Image source: FOX6NOW



Wayside Park Boat Landing experienced high water levels during Spring 2018 due to excessive snow-melt.
Image source: NCWRPC

Table 7: Juneau County Population Density, 2016			
	Pop.	Area (sq. mi)	Pop Density
Town of Armenia	630	77.72	8.11
Village of Camp Douglas	621	1.01	614.85
Town of Clearfield	677	35.76	18.93
Town of Cutler	334	54.07	6.18
City of Elroy	1,482	1.98	748.48
Town of Finley	90	38.58	2.33
Town of Fountain	600	30.76	19.51
Town of Germantown	1,478	45.01	32.84
Village of Hustler	186	0.69	269.57
Town of Kildare	556	28.17	19.74
Town of Kingston	67	56.96	1.18
Town of Lemonweir	1,716	42.22	40.64
Town of Lindina	598	32.90	18.18
Town of Lisbon	967	28.22	34.27
Town of Lyndon	1,377	29.21	47.14
Village of Lyndon Station	491	1.99	246.73
Town of Marion	434	24.41	17.78
City of Mauston	4,398	4.80	916.25
Village of Necedah	881	3.10	284.19
Town of Necedah	2,134	82.82	25.77
City of New Lisbon	2,459	2.90	847.93
Town of Orange	621	35.08	17.70
Town of Plymouth	650	34.53	18.82
Town of Seven Mile Creek	323	36.42	8.87
Town of Summit	769	36.93	20.82



Excessive snow-melt flooded the ditch of County Highway F in the Town of Finley in Spring 2018.
Image source: NCWRPC

The Necedah Dam experienced high water levels during Spring 2018.
Image source: NCWRPC

Village of Union Center	165	0.75	220.00
City of Wisconsin Dells	0	0.44	0.00
Village of Wonewoc	902	1.11	812.61
Town of Wonewoc	793	35.47	22.36
Juneau County	26,399	804.03	32.83

Source: ACS 2012-2016, NCWRPC

Seasonal Population

Based on seasonal housing data from the 2012-2016 American Community Survey, the planning area had an estimated seasonal population of 27,775 residents in 2016. **Table 8** shows potential seasonal residents for the planning area. **Appendix C** contains a detailed list of seasonal populations within the planning area. The impact of this seasonal population cannot be overlooked when planning for hazards. Determining when and for how long these seasonal residents will be in the planning area is problematic, but the numbers give some indication of what weekend or other peak period population levels might be.

Table 8: Estimated Seasonal Resident Population, 2016

	Seasonal Housing Units	Estimated Seasonal Population
Adams County	7,939	19,512
Juneau County	3,357	8,263
Planning Area	11,296	27,775

Source: ACS 2012-2016, NCWRPC

Another component of the seasonal population includes short-term accommodations such as campgrounds or hotel-style lodging. The Adams and Juneau County Outdoor Recreation Plans identify 4,950 campsites within the planning area and over 1,000 resort / motel type rooms, including the 620 room Chula Vista Resort in Adams County.

Housing

Data from the 2012-2016 American Community Survey shows that the planning area had an estimated total of 32,209 housing units in 2016. The planning area gained 5,716 housing units, a 21.6 percent increase, between 2000 and 2016. The number of households in the planning area slightly increased during this time, only increasing by 1.9 percent, compared to the 21.6 percent increase in housing units. The number of seasonal housing units in the planning area has significantly increased during this time, increasing by 3,616 units, or 47 percent. **Table 9** compares housing data in 2000 to housing data in 2016.

Table 9: Housing, 2016

	Housing Units		Households		Seasonal Units	
	2000	**2016**	**2000**	**2016**	**2000**	**2016**
Adams County	14,123	17,419	7,900	7,950	2,043	7,939
Juneau County	12,370	14,790	9,696	9,978	5,637	3,357
Planning Area	26,493	32,209	17,596	17,928	7,680	11,296

Source: U.S. Census 2000, ACS 2012-2016

Multiple properties in Clearfield experienced flooding in May 2017.
Image source: Juneau County Star-Times

Heavy rains in September 2016 flooded many areas in Juneau County.
Image source: Juneau County Star-Times

Mobile Homes

Mobile homes are extremely vulnerable to hazardous events such as tornadoes and flooding. The 2012-2016 ACS estimates that there were 7,569 mobile homes within the planning area in 2016. Mobile homes make up about 23.5% of the housing stock in the planning area, compared to only 4% in the state as a whole.

Employment

Data from the Wisconsin Department of Workforce Development shows that in 2014, there were a total of 19,159 jobs within the planning area; 7,411 in

Adams County and 11,748 in Juneau County. The Manufacturing Industry was the largest industry in both counties. **Table 10** compares the number of jobs within each industry for both counties in 2016.

Table 10: Employment by Industry, 2016

Industry	Jobs			% of Total Employment
	Adams County	Juneau County	Total	
Ag. Forestry, Fishing, & Hunting	267	552	819	4.3%
Mining, Quarrying & Oil & Gas Extraction	15	17	32	0.2%
Utilities	88	67	155	0.8%
Construction	579	707	1,286	6.7%
Wholesale Trade	164	214	378	2.0%
Information	88	94	182	0.9%
Finance & Insurance	209	307	516	2.7%
Real Estate & Rental & Leasing	134	61	195	1.0%
Professional & Technical Services	171	140	311	1.6%
Management of Companies & Enterprises	2	6	8	0.0%
Admin & Waste Services	229	296	525	2.7%
Educational Services	430	677	1,107	5.8%
Health Care & Social Assistance	900	1,598	2,498	13.0%
Arts, Entertainment, & Recreation	329	346	675	3.5%
Accommodation & Food Services	839	997	1,836	9.6%
Other Services Excluding Public Administration	305	448	753	3.9%
Public Administration	354	783	1,137	5.9%
Manufacturing	1,054	2,348	3,402	17.8%
Retail Trade	842	1,582	2,424	12.7%
Transportation & Warehousing	412	508	920	4.8%
Total	**7,411**	**11,748**	**19,159**	**100.0%**

Source: WI DWD, Bureau of Workforce Training

The top five industries within the planning area were Manufacturing, Health Care & Social Assistance, Retail Trade, Accommodation & Food Services, and Construction. These industries were also the top five industries in both Adams and Juneau counties. These industries accounted for nearly 60 percent of all jobs within the planning area in 2016. The Manufacturing Industry accounted for nearly 18 percent of all jobs within the planning area.

Seasonal employment is much higher in the planning area than in the state as a whole, being significantly influenced by hospitality, tourism, agriculture, and seasonally based manufacturing. The Chula Vista Resort in the Adams County portion of Wisconsin Dells provides a large number of seasonal leisure and hospitality jobs within the planning area. In 2016, there were 1,836 jobs in the Accommodation & Food Services Industry, accounting for 9.6 percent of all jobs within the planning area.

Chula Vista Resort is the prominent employer in Adams County.
Image source: Chula Vista Resort

Due to the high percentage of employers in the region being based in Mauston, Mauston serves as a primary employment and service hub within the planning area. Mauston is home to many of the planning area's top employers including the Mile Bluff Medical Center, Mastermold, and Sand Ridge State Secure Treatment Center. Other communities with major employers within the planning area include New Lisbon, Adams/Friendship, Wisconsin Dells, Necedah, Camp Douglas, and New Chester. **Table 11** lists the prominent employers in Adams County and **Table 12** lists the prominent employers in Juneau County. Prominent employers in the planning area include Chula Vista Resort, Mile Bluff Medical Center, Walker Stainless Equipment Company, Brunner Manufacturing, Oxford Federal Correctional Institution, and the U.S. National Guard at Volk Field.

Table 11: Prominent Employers in Adams County		
Employer Name	Location	Industry
Chula Vista Resort	Wisconsin Dells	Hotels and Motels
Adams-Friendship School District	Adams	Elementary and Secondary Schools
Oxford Federal Correctional Institution	New Chester	Correctional Institutions
County of Adams	Adams	Public Services
Rock Tenn Services	Adams	Corrugated & Solid Fiber Box Mfg
Moundview Hospital and Clinics	Friendship	General Medical & Surgical Hospitals
Heartland Farms Inc.	Various	Potato Farming
Spencer Super AF County Market	Adams	Supermarkets and Grocery Stores
Villa Pines Living Center	Friendship	Nursing Care Facilities
Woodside Sports	Various	Amusement and Theme Parks
Adams-Columbia Electric Co-op	Friendship	Electric Power Distribution
Allied Cooperative	Adams	Fuel Dealers
MSA Professional Service	Friendship	Admin Management Consulting Services
NAPA Auto Parts	Adams	Automotive Parts & Accessories Stores
Terrace Homes	Friendship	New Single-Family Home Construction
Westrock	Adams	Other Paperboard Container Mfg
Wholesale Drug Service	Arkdale	Drug Goods Merchandise Wholesale

Source: WisDWD 2013, WI Worknet 2013, NCWRPC 2016

Table 12: Prominent Employers in Juneau County		
Employer Name	Location	Industry
Mile Bluff Medical Center	Mauston	General Medical & Surgical Hospitals
Walker Stainless Equipment Company	New Lisbon	Plate Work Mfg
Mile Bluff Family Medical	Mauston	All Other Health & Personal Care
Sand Ridge State Secure Treatment	Mauston	Psychiatric & Substance Abuse Hospitals
Necedah Public School	Necedah	Elementary and Secondary Schools
Volk Field - U.S. Army National Guard	Camp Douglas	Legislative Bodies, National Security
Brunner Manufacturing Inc	Mauston	Bolt Nut Screw Rivet & Washer Mfg
Mastermold	Mauston	Plastics Material & Resin Mfg
Leer Inc.	New Lisbon	Electric Appliance Wholesalers
Festival Foods	Mauston	Supermarkets and Grocery Stores
Kwik Trip	Various	Gas Station / Convenience Stores
Freudenberg-Nok	Necedah	Gasket Packing/Sealing Device Mfg
County of Juneau	Mauston	Public Services
Legacy Power Conversion Sales	Necedah	Misc. Electric Equipment Mfg
Mauston School District	Mauston	Elementary and Secondary Schools
New Lisbon School District	New Lisbon	Elementary and Secondary Schools
New Lisbon Correctional Institution - DOC	New Lisbon	Correctional Facility
Parker-Hannifin Refrigeration Specialties	Mauston	AC Refrigeration & Forced Air Heating
Shopko	Mauston	Discount Dept. Stores

Source: WisDWD 2013, WI Worknet 2013, NCWRPC 2016

Economic Impact of Job Loss

To help determine the potential impact of a hazard occurrence on the economy of the County, EMSI economic modeling software was used to estimate the cumulative effects of job losses in some of the top industry sectors of the planning area. A catastrophic, worst case, scenario is examined. Actual impacts would vary by degree of severity of the event. **Appendix B** contains a detailed printout of the analysis, and **Table 13** shows a summary.

Table 13: Economic Impact of Catastrophic Event on Select Industry Sectors			
Sector	**Multiplier**	**Potential Jobs Impacted**	**Earnings Lost**
Crop Production	1.30	-2,205	-$80,429,680
Hotels (except Casino Hotels) and Motels	1.21	-759	-$7,099,494
Gasoline Stations with Convenience Stores	1.18	-560	-$3,889,988
General Medical and Surgical Hospitals	1.25	-766	-$1,747,864

Source: EMSI Economic Modeling Specialists and NCWRPC, 2017.

Critical Facilities

Business & Industrial Parks

Business and industrial parks are areas zoned for the purpose of industrial development. Business and industrial parks usually have good access to transportation, and often provide integrated infrastructure and utilities such as water, gas, electric, and sewer in one location to attract new businesses to the area. This concentration of infrastructure and utilities helps to reduce the operation costs for businesses. There are a total of 14 business and industrial parks located within the planning area, 5 of these parks are located in Adams County, while the other 9 parks are located in Juneau County. As shown in **Tables 14** and **15**, most of the parks within the planning area provide water, sewer, and gas, while the provision of electricity is less common. The largest business/industrial park in Adams County in terms of acreage is the Alpine Village Business Center in the Town of Rome, while the Mauston West Industrial Park is the largest business/industrial park in Juneau County.

Table 14: Adams County Business and Industrial Parks							
Industrial/Business Park	Location	Total Acres	Water	Sewer	Gas	Electric	Rail
City of Adams Industrial Park	City of Adams	38	Y	Y	Y	Y	Y
City of Adams South Industrial Park	City of Adams	40	Y	Y	Y	Y	N
Alpine Village Business Center	Town of Rome	240	Y	N	Y	Y	N
North Industrial Park	Town of Preston	35	N	N	Y	Y	N
South Business Park	Town of Jackson	90	N	N	Y	Y	N

Source: Wisconsin Department of Workforce Development, Bureau of Workforce Information.

Table 15: Juneau County Business and Industrial Parks							
Industrial/Business Park	Location	Total Acres	Water	Sewer	Gas	Electric	Rail
Camp Douglas Industrial Park	Village of Camp Douglas	21	Y	Y	Y	N	Y
Mauston West Industrial Park	City of Mauston	390	Y	Y	Y	N	Y
Mauston East Business Park	City of Mauston	230	Y	Y	Y	Y	N
Elroy Industrial Park	City of Elroy	15	Y	Y	Y	Y	N
New Lisbon Business Park	City of New Lisbon	30	Y	Y	Y	Y	N
New Lisbon Industrial Park	City of New Lisbon	109	Y	Y	Y	N	Y
Lyndon Station Industrial Park	Village of Lyndon Station	60	N	Y	Y	N	Y
Necedah Industrial Park	Village of Necedah	177	Y	Y	Y	N	Y
Wonewoc Industrial Area	Village of Wonewoc	0	N	N	N	N	N

Source: Wisconsin Department of Workforce Development, Bureau of Workforce Information.

Flooding has been an increasing issue in the Town of Clearfield, as evidenced by this road closure due to flooding.
Image source: Juneau County Star-Times

Transportation

The planning area's transportation system provides the basis for movement of goods and people into, out of, through, and within the planning area. An efficient transportation system is essential to the sound social and economic development of the region. When considering the possibility of a disaster event, transportation routes should be thoroughly analyzed.

The principal highways serving the planning area are Interstate 90/94 and U.S. Highway (USH) 12, both in Juneau County. The Interstate connects Wisconsin Dells, Lyndon Station, Mauston, New Lisbon, and Camp Douglas, while USH 12 serves as an alternate route to the Interstate. State Trunk Highway (STH) 13 serves as the principal highway for Adams County and bisects the county through Adams/Friendship. Other highways in the planning area include STHs 16, 21, 23,

33, 58, 71, 73, 80, 82, and 173. These highways link the planning area with neighboring communities and are vital to the manufacturing and tourism sectors of the planning area's economy.

The planning area contains 299 bridges, 32 in Adams County and 267 in Juneau County. There are also 11 airports/landing strips within the planning area, including the Volk Field Air National Guard Base. There are four different rail lines that service the planning area; Union Pacific Railroad, Canadian Pacific Railway, Canadian National, and Amtrak.

Utilities

Utility systems are important in hazard mitigation planning because of the dependency on water, wastewater treatment, gas service, electricity, and communications. Because of this reliance and vulnerability to hazards, utility systems must be identified for this Plan.

The protection of the public water supply facilities from potential contamination from hazards such as flooding is a consideration for hazard mitigation planning. There are 14 water suppliers for domestic and commercial use within the planning area. **Table 16** identifies these water suppliers. Only three of these suppliers currently have a protection plan in place, while as of 2017, Rome Water Utility is currently drafting a protection plan.

Table 16: Inventory of Municipal Water Facilities	
Municipal Water System	Protection Plan
Adams County	
Adams Waterworks	Yes
Oxford Federal Correctional Institute	No
Friendship Waterworks	No
Rome Water Utility	No*
Juneau County	
Camp Douglas Waterworks	No
Elroy Waterworks	Yes
Hustler Waterworks	Yes
Lyndon Station Waterworks	No
Mauston Waterworks	No
Necedah Waterworks	No
New Lisbon Waterworks	No
Union Center Waterworks	No
Wisconsin Air National Guard Volk Field	No
Wonewoc Waterworks	No

Source: WI DNR, USGS
** Plan currently being drafted*

Image source: NCWRPC

The protection of the wastewater facilities is an important consideration for hazard mitigation planning because of its potential to contaminate nearby waterbodies in the event of high water. Also of concern during periods of flooding is the threat of damage to infrastructure and associated facilities. There are currently 15 wastewater treatment centers in the planning area; 11 of which are public and 4 are private. **Table 17** identifies these wastewater treatment facilities. Facilities in **bold** are located within or in close proximity to existing floodplains.

Table 17: Inventory of Wastewater Treatment Plants		
Name	Location	Type
Adams County		
Adams	Adams	Public
Dells Boat Tours	Dell Prairie	Private
Easton	Easton	Private
Juneau County		
Necedah	Necedah	Public
New Lisbon - O'Dell Bay	Germantown	Private
New Lisbon	New Lisbon	Public
New Lisbon - New Plant	New Lisbon	Public
National Guard Volk Field	Orange	Public
Hustler	Fountain	Public
Elroy	Elroy	Public
Union Center	Union Center	Public
Wonewoc	Wonewoc	Public
Lyndon Station	Lyndon Station	Public
Lyndon Station - Crocketts Camping	Kildare	Private
Mauston	Lemonweir	Public

Source: NCWRPC

An aerial view of the Necedah Wastewater Treatment Plant.
Image source: Google Earth

Table 18 is an inventory of utility facilities within the planning area. Industrial parks and non-metallic mines are also included in this table.

Table 18: Inventory of Utility Facilities			
	Adams County	Juneau County	Planning Area
Communication Towers	27	31	58
Dams	63	124	187
Industrial Parks	5	7	12
Landfills	10	2	12
Municipal Water Supply	4	10	14
Non-metallic Mines	8	16	24
Transfer Sites	10	2	12
Wastewater Treatment Plants	3	12	15
Water Towers	4	4	8

Source: NCWRPC

High water at the Necedah Dam in Spring 2018.
Image source: NCWRPC

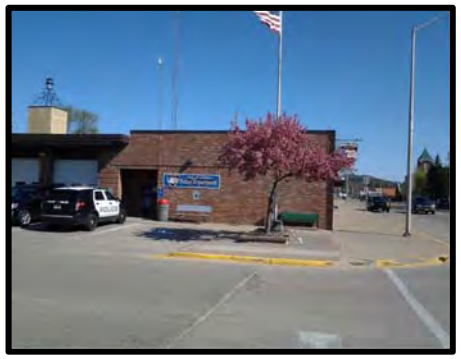
Natural gas within the planning area is mainly provided by WE Energies, Alliant Energy, Wisconsin Gas Company, and Madison Gas & Electric. Electric service in the planning area is mainly provided by Alliant Energy, Adams-Columbia Electric Cooperative, and Oakdale Electric Cooperative. The American Transmission Company owns, maintains, and operates the major transmission facilities within the planning area. Nationwide, cellular telephones account for more than half of all 911 calls. Cell service coverage within the planning area is generally good, but there are numerous "dead zones". Several companies provide telephone service throughout the planning area including Frontier and Charter.

Emergency Services and Facilities

The type and location of public emergency services are an important consideration in hazard mitigation planning because of the potential direct involvement of such facilities in certain hazard situations. **Table 19** is an inventory of emergency service facilities within the planning area. The planning area is served by 20 fire departments; including 19 fire stations, 10 police stations, and 13 ambulance dispatch services.

Table 19: Inventory of Emergency Facilities			
	Adams County	Juneau County	Planning Area
Fire Stations	10	9	19
Fire Departments	12	8	20
Emergency Operations Center	1	1	2
Ambulance Dispatch Centers	6	7	13
Police Departments	2	8	10
Sheriff's Departments	1	1	2

Source: NCWRPC



City of Adams Police Department
Image source: NCWRPC

Other Community Facilities

In addition to emergency service facilities, other community facilities are also important in hazard mitigation planning. Government administration buildings serve as the headquarters that link to resources in helping solve potential problems. Hospitals are very important for knowing where injured residents have to be transported and as to how many people each hospital can handle if a hazard would breakout. **Table 20** is an inventory of critical community facilities within the planning area.

Table 20: Inventory of Critical Facilities			
	Adams County	Juneau County	Planning Area
Hospitals / Clinics	3	6	9
Nursing Homes / Assisted Living	3	10	13
Library	2	6	8
Schools	7	15	22
Town/City/Village Hall	19	28	47
Treatment Facilities	0	2	2

Source: NCWRPC

Flooding near nursing homes like Terrace Heights in Mauston can put citizens in harm's way.
Image source: Mile Bluff Medical Center

Large hospitals in the planning area include the Mile Bluff Medical Center in Mauston and the Moundview Memorial Hospital in Friendship. Primary nursing homes include Villa Pines Living Center in Friendship and Heritage Manor in Elroy.

Parks & Recreational Facilities

Major recreational facilities within the planning area include the Necedah National Wildlife Refuge, Castle Rock Lake, Buckhorn State Park, and Petenwell Lake. There are a total of 60 parks, 42 campgrounds, and 19 state natural areas within the planning area. **Table 21** inventories the various recreational facilities within the planning area.

Table 21: Inventory of Recreational Facilities

	Adams County	Juneau County	Planning Area
Parks	21	39	60
Campgrounds	11	31	42
State Natural Areas	4	15	19
Legacy Areas	0	9	9
Boat Launches	34	26	60

Source: NCWRPC

High water at Wayside Boat Landing in Adams County.
Image source: NCWRPC

Land Use

Land use is an important determinant in the potential impact a particular hazard may have, and in action which may be taken to mitigate the hazard impacts. An understanding of the amount, type, and spatial distribution of urban and rural land uses within the planning area is an important consideration in the development of a sound resiliency plan. Aerial photos were used by the NCWRPC to digitize a land use Geographic Information Systems (GIS) coverage of the planning area. **Table 22** shows the acreage and percent of each classification. For a visual of existing land use within the Adams-Juneau Planning Area, see **Map 3: Existing Land Use**.

Table 18: Generalized Land Use				
Use	Adams Acres	Juneau Acres	Total Acres	% of Area
Agriculture	97,432	106,679	204,112	21.4%
Commercial	1,762	1,722	3,484	0.4%
Cranberry Bog	1,922	2,857	4,779	0.5%
Governmental/Institutional	776	3,949	4,726	0.5%
Industrial	638	785	1,423	0.1%
Mobile Home Park	127	0	127	0.0%
Multi-Family	3	0	3	0.0%
Open Lands	19,398	56,666	76,064	8.0%
Outdoor Recreation	1,739	6,106	7,845	0.8%
Residential	19,313	10,695	30,008	3.1%
Transportation	15,038	14,380	29,418	3.1%
Utility	17	0	17	0.0%
Water	27,934	27,522	55,455	5.8%
Woodlands	253,973	282,918	536,891	56.3%
Total	**440,073**	**514,280**	**954,353**	**100.0%**

Source: NCWRPC, 2015

A flooded woodland area in Juneau County. Image source: Juneau County Star-Times

Forestry and Agriculture

The dominant land uses within the planning area are forestry and agriculture. Land area within the planning area is approximately 56 percent forested, comprised of 536,891 acres of woodland. Agricultural land covers another 21 percent of the planning area's land area. The main agricultural practices within the planning area are dairy farming, complement forage, grain production, and irrigated vegetables. Agriculture is mainly focused in the eastern side of Adams County, along and south of the I-90/94 corridor in Juneau County, and in the Town of Armenia. According to the U.S. Census of Agriculture, Juneau County has only lost 5 percent of its farmland since 1978, while Adams County has actually gained farmland.

Residential Development

Land in residential development makes up about 3 percent of the total planning area. Residential concentrations are scattered throughout the area. Much of the scattered rural development is related to direct recreational demand as various types of housing have clustered along streams and lakes.

Commercial and Industrial Development

Commercial and industrial development makes up only 0.52 percent of the total planning area. Land use for commercial and industrial development is also scattered throughout the area. There are 12 designated industrial parks within the planning area.

Other Land Cover/Uses

Recreational lands including parks and outdoor sports facilities total about 7,845 acres or 0.82 percent of the total planning area. Other lands may have recreational aspects, particularly woodlands. Governmental, public, and institutional lands total about 4,726 acres or 0.50 percent of the total planning area. The transportation category is primarily the roadway travel corridors for federal, state, county, and local highways and roads. Sometimes overlooked, transportation land use can be significant. In the planning area, surface transportation facilities consume about 29,418 acres or 3.08 percent of total land area. Note that this is six times as much land area as is used for commercial and industrial uses within the planning area.

Future Growth and Development

The population of the planning area has increased by 3,734 residents or 8.7 percent since the year 2000. However, between 2010 and 2016, the planning area experienced a slight decrease in population, losing 846 residents during this time. Population within the planning area is projected to rebound however, with population projected to reach levels as high as 53,620 residents in 2030. By 2040, the planning area is expected to grow to a population of 52,780 residents, a gain of 5,241 residents from the total population in 2010.

From a net growth perspective, residential migration into the planning area has been responsible for most of its population growth since the turn of the century, because natural growth has been low (births vs. deaths). This growth pattern is reflective of an aging population and booming seasonal-to-permanent housing markets.

Future residential development is projected to be located along lakeshore and riverfront areas, and in close proximity to communities outside of the planning area, such as Wisconsin Rapids and Wisconsin Dells. More retired persons are expected to migrate into the planning area looking to convert vacation homes into permanent residences. Employment opportunities and accessible amenities are projected to influence future residential growth in a few urban areas. **Table 23** highlights the communities expected to experience future residential growth.

Table 23: Expected Residential Growth

Town	County	Attraction
Armenia	Juneau	Riverfront
Big Flats	Adams	Wisconsin Rapids
Village Camp Douglas	Juneau	Employment
Dell Prairie	Adams	Riverfront
Easton	Adams	Wisconsin Dells
Germantown	Juneau	Riverfront
Jackson	Adams	Wisconsin Dells
Kildare	Juneau	Riverfront
Leola	Adams	Wisconsin Rapids
Lyndon	Juneau	Riverfront
City Mauston	Juneau	Employment
Necedah	Juneau	Riverfront
Village Necedah	Juneau	Employment
New Haven	Adams	Wisconsin Dells
Preston	Adams	Wisconsin Dells
Quincy	Adams	Riverfront
Rome	Adams	Riverfront
Springville	Adams	Riverfront
Strongs Prairie	Adams	Riverfront

Source: UW-Extension, NCWRPC

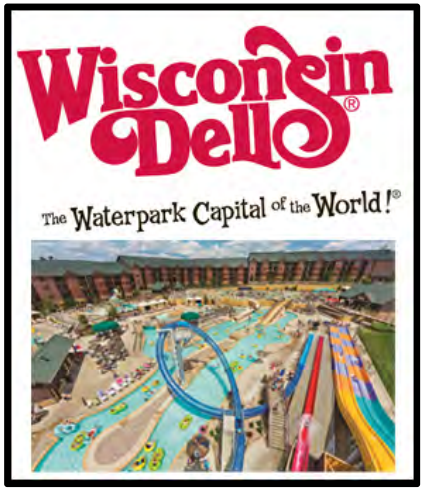
The Wisconsin River is a main source of expected future residential growth in the Adams-Juneau Planning Area.
Image Source: Lake-Link

New commercial and industrial development is expected to be gradual over time, paralleling population growth. The most significant concentrations of commercial and industrial development are likely to occur in the planning areas industrial and business parks, and its incorporated communities. The Mauston West Industrial Park has 120 acres of land ready for development with access to street, sewer, and water. Mauston's East Business Park has over 18 acres of city-owned property available for sale and development with access to street, sewer, and water. **Table 24** displays notable future commercial and industrial developments.

Table 24: Future Commercial & Industrial Growth

Project	Type	Community
Wisconsin Dunes Golf Resort	New Development	Rome
Chula Vista Sports Complex	New Development	Dell Prairie
Highway 82 Corridor	New Development	Adams County
Enbridge Pipeline Expansion	Expansion	Adams County
Mile Bluff Medical Center	Expansion	Mauston
Various Retail Stores & Restaurants	New Development	Mauston
Mastermold	Expansion	Mauston
Brunner Manufacturing	Expansion	Mauston
Gunderson Clinic	New Development	Wonewoc
Small Retail Chain	New Development	Elroy
Brunner Wire	Expansion	Elroy

Source: UW-Extension, NCWRPC



Wisconsin Dells is a major attraction for future commercial development. Image source: TAP into Travel

Tables 25 and **26** list the various industrial/business parks with total acreage available for future development for Adams and Juneau County respectively. There are a combined 743 acres of land available for development in the industrial parks located within these two counties. Alpine Village Business Center in the Town of Rome has the most acres of land available for development in Adams County, while Necedah Industrial Park has the most acres of land available for development in Juneau County.

Table 25: Adams County Industrial Parks	
Industrial/Business Park	Acres Available
Adams County West Industrial Park	12
Adams County South Industrial Park	28
Alpine Village Business Center	140
North Industrial Park	5
South Business Park	75
County Total	**260**

Source: Adams County Economic Development

City of Adams Business Park
Image source: Adams County Chamber of Commerce

Table 26: Juneau County Industrial Parks	
Industrial/Business Park	Acres Available
Camp Douglas Industrial Park	13
Mauston Industrial Park	136
Mauston Business Park	126
Elroy Industrial Park	15
New Lisbon Business Park	6
New Lisbon Industrial Park	0
Lyndon Station Industrial Park	38
Necedah Industrial Park	149
Wonewoc Industrial Area	0
County Total	**483**

Source: Juneau County Economic Development Corporation

Available space at Necedah Industrial Park is in green
Image source: Juneau County Chamber of Commerce

New infrastructure or public facilities will be somewhat minimal, excepting limited replacement of existing facilities. Despite a rebounding economy, local government budgets are expected to remain constrained well into the future. These budget constraints will curtail local governments' ability to develop new facilities and result in a tendency to make do with existing infrastructure and delay expansion plans. Projects that are currently underway in Juneau County include plans for a rehabilitation of the City Hall and the City's Police Department to include a community center and accommodations for an emergency shelter, as well as a new fire department in Mauston. Juneau County is also constructing a new, 2-story office building which will house human services, health department, and the Aging and Disability Resource Center. In New Lisbon, a new wastewater treatment plant and new well are under construction. Elroy is planning to expand their city campground, as well as upgrading their electric utility to include a solar array. Future projects in Adams County include potentially developing a new park in the City of Adams and a potential new Town Hall in the Town of Jackson.

Population within the planning area is generally older. In 2016, Adams County had a median age of 52.2, while Juneau County had a median age of 44.8. This indicates that both counties have older populations than the state as whole, as the state had a median age of 39.1 in 2016. Over the next few decades, the residential base will become even older, aging more quickly than the state as a whole. In fact, the number of residents ages 60 and older will likely exceed the population of residents ages 16 and under by the year 2030. This trend will have implications affecting the demand for emergency services.

Chapter Four

Vulnerability Assessment

A major work effort of this study is the vulnerability assessment. The vulnerability assessment examines potential damages to the region's buildings and infrastructure that may result from flooding. A computer model was utilized to develop a map showing areas at risk for flooding. Within this "at risk" area, the potential impacts from a significant flood event were compiled for municipalities in Adams and Juneau counties. The assessment identifies the numbers and types of population (full time regular and seasonal tourist), critical facilities, and businesses (establishments and employees) impacted as well as estimates of cost in terms of structural damage.

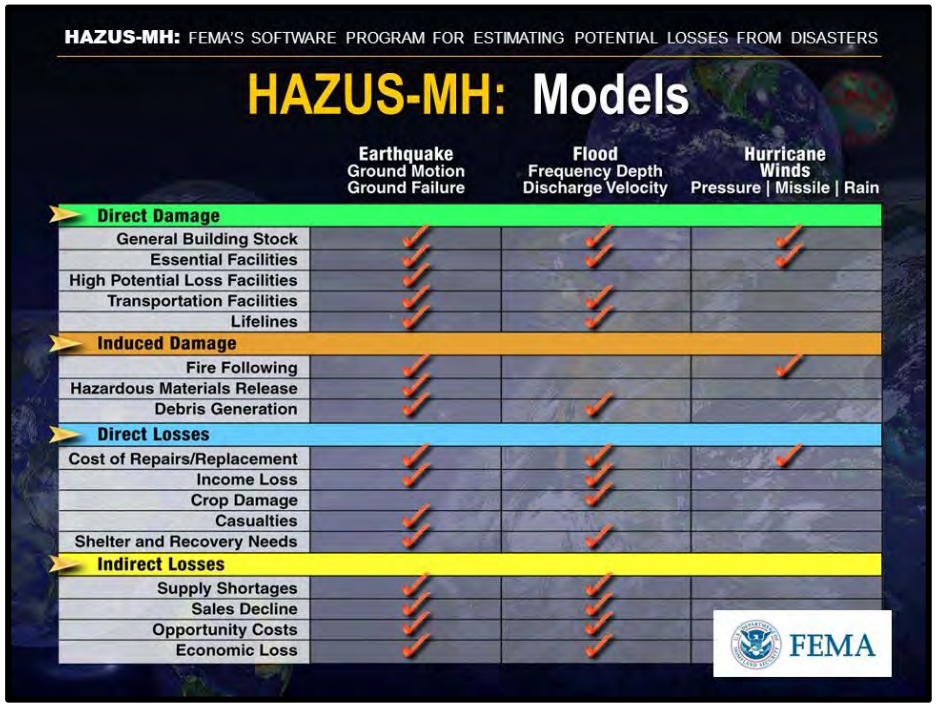
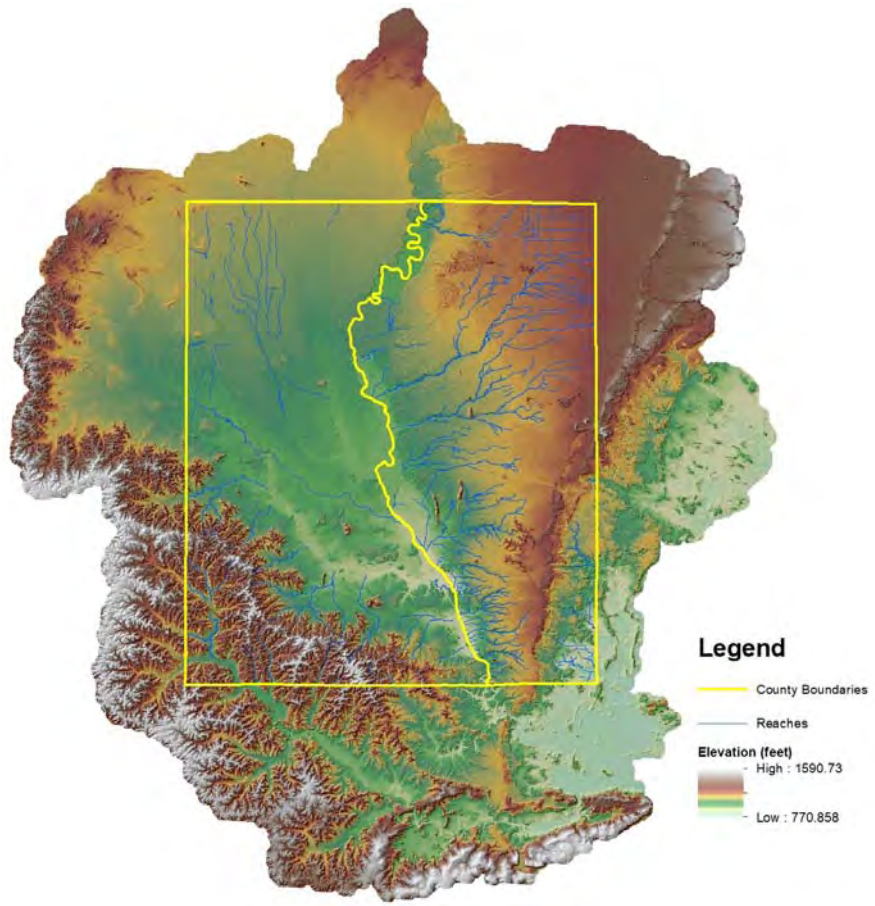


Image source: FEMA

Flood Modeling

In recognition of the importance of planning in mitigation activities, the Federal Emergency Management Agency (FEMA) has created HAZUS-MH (HAZUS US – Multi-Hazard), a powerful geographic information system (GIS)-based disaster mitigation tool that enables communities of all sizes to predict the estimated losses from flood, and other phenomena and to measure the impact of various mitigation practices that might help reduce those losses. Flood hazard analysis consists of three stages: stream delineation, hydrologic analysis to determine stream discharge, and hydraulic analysis to determine flood depth and extent.



Stream Delineation

HAZUS-MH computes a synthetic stream network based on the drainage areas calculated from the Digital Elevation Model (DEM). An input for parameter for the threshold damage area allows the user to define the minimum accumulation area draining to a stream network. The smaller the threshold drainage area, the more detailed the stream network generated in HAZUS. We tested several values in order to identify the optimal damage threshold using a 10-meter DEM in the Adams-Juneau Planning Area. The default value of 10 square miles produced a coarse stream network and required minimal processing time. Conversely, HAZUS was unable to accurately process a threshold drainage area of 1 square mile. Using a 5 square mile drainage threshold value produced a synthetic stream network which very accurately reflected the actual 1:24,000 stream network produced by the Wisconsin Department of Natural Resources. Processing time using a 5 square mile drainage area was less than 24 hours.

Hydrologic Analysis

The objective of hydrologic analysis in HAZUS-MH is to calculate rainfall-runoff characteristics for watersheds and identify discharge values in streams. HAZUS-MH implements hydrologic analysis through built-in regression equations to determine discharge-frequency relationships for each reach and include gage and main stream adjustment. Regression equations within HAZUS-MH include derived variables including catchment area, mean catchment elevation and slope, and channel length; along with default localized parameters including temperature, precipitation, soil type,

forest cover, and snowfall. The HAZUS default database contains stream gage records from across the United States which are used to adjust the regression results based on comparison with other watersheds across the country with similar hydrologic characteristics. Upon completion of the hydrologic analysis, an outpeak discharge table is generated with discharges computed at each reach's upstream and downstream nodes for return periods of 2, 5, 10, 25, 50, 100, and 500 years.

Hydraulic Analysis

HAZUS-MH uses the derived discharge values and stream channel morphology calculated under the hydrologic analysis to compute flood elevations at stream cross-sections. Within HAZUS-MH, the hydraulic analysis is performed using Manning's equation with a friction slope equal to the slope of the reach to estimate flood elevations. Inputs include discharge, cross-section descriptions [channel slope, cross-section geometry, and friction factors for inundated areas], and 2-D flow fields, varying Manning's n, bridge geometries, expansion/contraction coefficients and subcritical/super-critical flow. Outputs include flood elevations at cross-sections, energy head, flood velocity, flood depths and extents. The model is greatly simplified in HAZUS-MH. Inputs include peak discharge, cross-section geometries, 1-D flow field and constant Manning's n for sub-critical flow. Only flood elevations at cross-sections, flood depth and extent grids are generated.

HAZUS estimates the initial floodplain by buffering the reaches [buffer distance = 10 * Q0.5]. Flow centerlines are determined and cross-section lines are placed normal to the flow centerline at intervals of 1,000 feet. Manning's equation determines the flood elevations at the stream cross-sections and HAZUS interpolates elevations between cross-sections to create a flood surface. DEM z (height) values are subtracted from the flood surface elevation to produce a flood depth-grid, which depicts inundation areas and the estimated depth of floodwater along corresponding reaches.

Flood Depth Grids

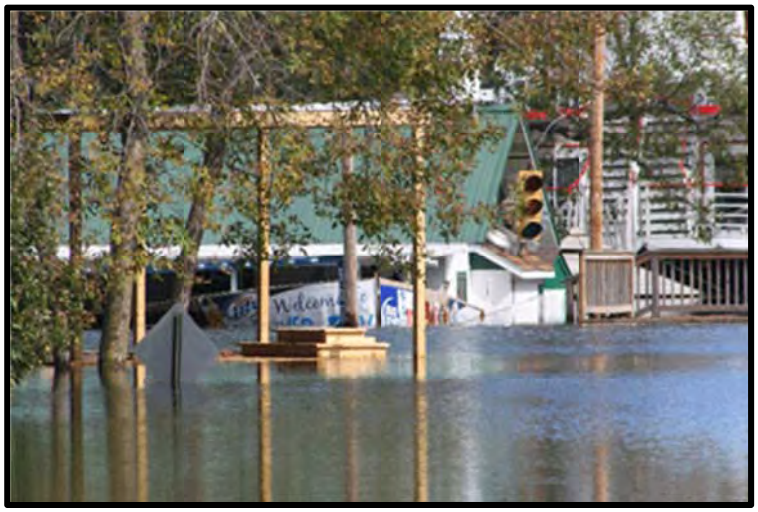
A HAZUS-MH flood depth grid is created by subtracting (cell-by-cell) the ground elevation, contained in the DEM grid, from the flood elevations at cross-sections. This raster data set contains grid cells which depict the depth of water (in feet) within the inundation zone (flood hazard boundary). Estimated flood depths for the Adams-Juneau Planning Area can be found in **Map 4: Modeled Flood Depth**.

NCWRPC At-Risk-Zone

NCWRPC created the At-Risk-Zone used in the vulnerability assessments below by taking existing mapped floodplains in the Adams-Juneau Planning Area, and overlaying them onto the inundation areas that resulted from the HAZUS modeling. Areas added to the inundation area created by the HAZUS modeling are shown in black in **Map 5: Areas At Risk**. The inundation areas created by the HAZUS modeling are shown in red in Map 5. Mapped floodplains outside of the modeled inundation area and the modeled inundation area were then combined to create a single At-Risk-Zone layer.

Resident and Tourist Vulnerability Assessment

To determine potential impacts towards residents and tourists in the Adams-Juneau Planning Area, the NCWRPC conducted a GIS analysis to calculate the number of housing units, campground facilities, mobile homes, trailers, and tourist lodging facilities that are vulnerable to flooding. To be considered vulnerable to flooding, these homes or lodging facilities must be located within the modeled At-Risk-Zone that NCWRPC calculated using HAZUS and GIS. To determine an estimated number of residents impacted, the total number of housing units located within the At-Risk-Zone was multiplied by 2.5. Estimates for the number of visitors were determined by calculating the number of seasonal and trailer homes by 2.5, and by multiplying the number of hotel rooms by the number of guests each room could accommodate.



River Bay Campground in the Town of Lyndon experienced flooding with water levels exceeding 9-feet in 2010
Image source: Wisconsin Dells Events

In Adams County, NCWRPC estimates predict that 5,403 housing units are located in the At-Risk-Zone calculated using HAZUS data for GIS. This estimate predicts that potential flooding could impact up to 13,508 full-time residents in Adams County. The Town of Rome accounts for nearly a third of all housing units, and full-time residents, vulnerable to flooding in Adams County with 1,762 housing units and 4,405 full-time residents considered vulnerable. In terms of vulnerable visitors, the portion of Wisconsin Dells located within Adams County accounts for nearly half of all vulnerable

visitors within Adams County, due to the presence of Chula Vista Resort in the At-Risk-Zone. The Town of Quincy had the most recreational visitors of any municipality in Adams County with an estimated 628 recreational visitors. **Table 27** displays vulnerability estimates for each municipality in Adams County.

Table 27: Flood Vulnerability Estimates, Adams County

Minor Civil Division	Housing Units Vulnerable	Recreational Units	Full-Time Residents	Recreational Visitors	Hotel Visitors	Residents & Visitors Impacted
C. Adams	47	0	118	0	0	118
T. Adams	177	69	443	173	0	615
T. Big Flats	364	105	910	263	0	1,173
T. Colburn	78	0	195	0	0	195
T. Dell Prairie	171	128	428	320	0	748
T. Easton	258	0	645	0	0	645
V. Friendship	70	0	175	0	0	175
T. Jackson	140	0	350	0	0	350
T. Leola	126	44	315	110	0	425
T. Lincoln	24	0	60	0	0	60
T. Monroe	200	136	500	340	0	840
T. New Chester	10	0	25	0	0	25
T. New Haven	151	115	378	288	0	665
T. Preston	436	0	1,090	0	0	1,090
T. Quincy	599	251	1,498	628	0	2,126
T. Richfield	31	0	78	0	0	78
T. Rome	1,762	0	4,405	0	0	4,405
T. Springville	243	61	608	153	0	760
T. Strongs Prairie	334	0	835	0	0	835
C. Wisconsin Dells	182*	0	455	0	2,042	2,497
Adams County	**5,403**	**909**	**13,508**	**2,273**	**2,042**	**17,823**

Source: NCWRPC GIS, HAZUS

**: Value includes Chula Vista Resort Units*

In Juneau County, NCWRPC estimates predict that 3,281 housing units are located within the At-Risk-Zone calculated using HAZUS and GIS. This estimate predicts that potential flooding could impact up to 11,421 full-time residents in Juneau County. The Town of Germantown contains the most flood vulnerable housing units in Juneau County with 585, and the Town of Necedah contains the second-most flood vulnerable housing units with 462. In Juneau County, recreational living quarters account for a large proportion of estimated visitors vulnerable to flooding, with an estimated 3,070 vulnerable visitors staying at recreational sites, compared to 148 visitors staying at hotels. The Town of Lyndon is estimated to have the highest number of flood vulnerable visitors with 818. It is worth noting that the Village of Camp Douglas and the City of Wisconsin Dells did not have any flood vulnerable units that could impact full-time residents or visitors. **Table 28** displays flood vulnerability estimates for each municipality in Juneau County.

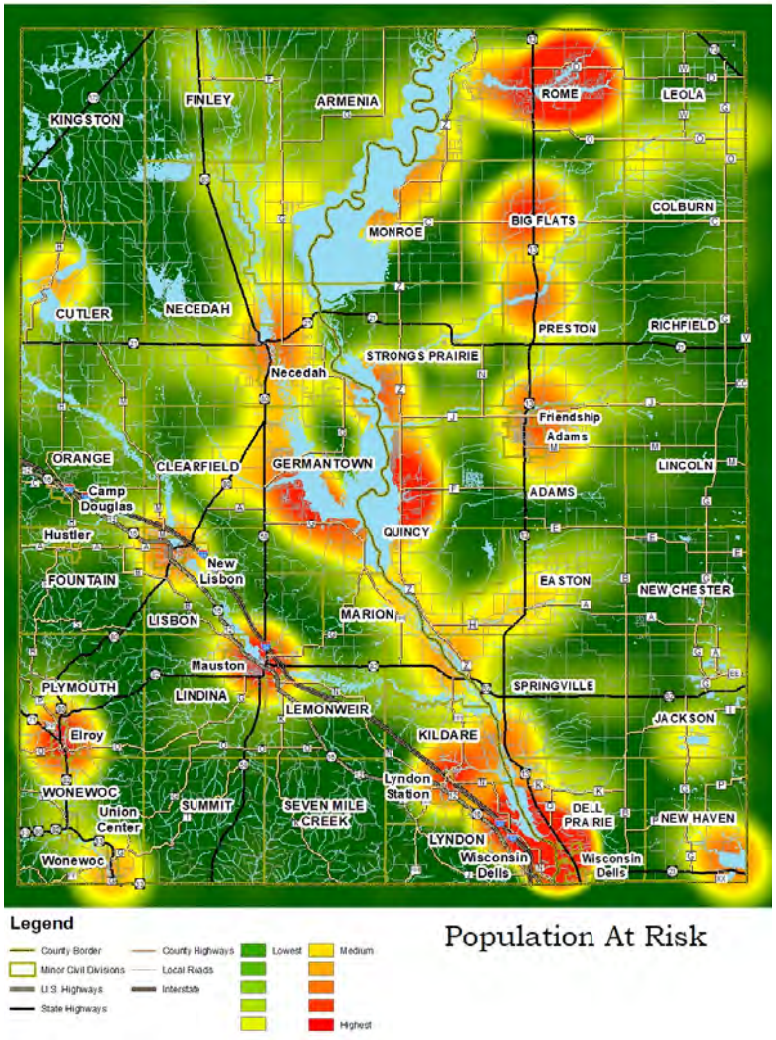
Table 28: Flood Vulnerability Estimates, Juneau County

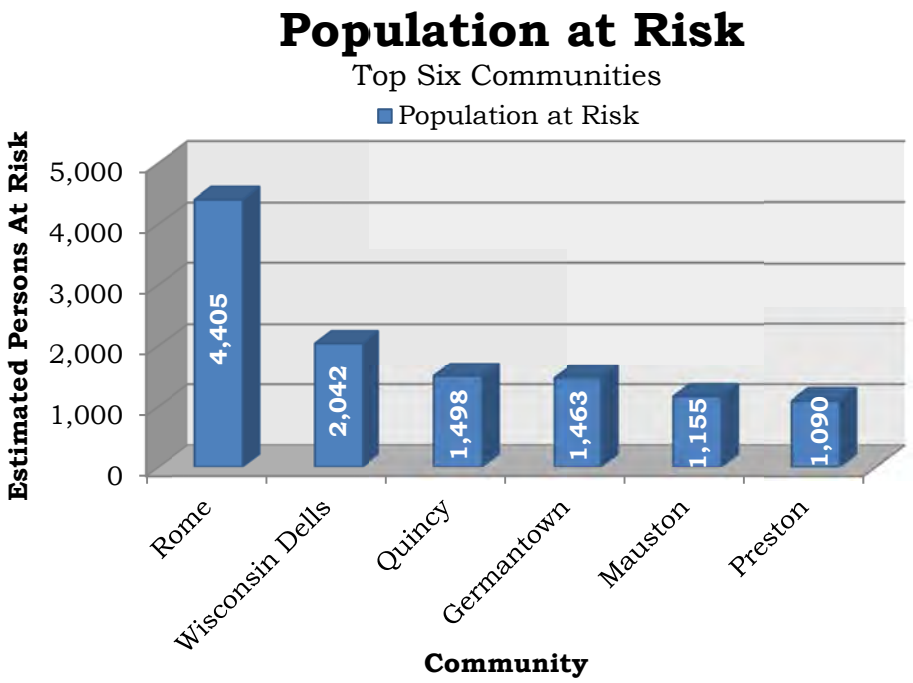
Minor Civil Division	Housing Units Vulnerable	Recreational Units	Full-Time Residents	Recreational Visitors	Hotel Visitors	Residents & Visitors Impacted
T. Armenia	315	0	788	0	0	788
V. Camp Douglas	0	0	0	0	0	0
T. Clearfield	64	66	160	165	0	325
T. Cutler	92	130	230	325	0	555
C. Elroy	270	37	675	93	0	768
T. Finley	103	0	258	0	0	258
T. Fountain	23	0	58	0	0	58
T. Germantown	585	188	1,463	470	84	2,017
V. Hustler	10	0	25	0	0	25
T. Kildare	83	201	208	503	0	710
T. Kingston	1	0	3	0	0	3
T. Lemonweir	82	0	205	0	0	205
T. Lindina	61	0	153	0	0	153
T. Lisbon	58	6	145	15	0	160
T. Lyndon	5	327	13	818	0	830
V. Lyndon Station	80	7	200	18	0	218
T. Marion	108	87	270	218	0	488

C. Mauston	292	45	730	113	48	891
V. Necedah	140	0	350	0	0	350
T. Necedah	462	23	1,155	58	16	1,229
C. New Lisbon	104	111	260	278	0	538
T. Orange	72	0	180	0	0	180
T. Plymouth	49	0	123	0	0	123
T. Seven Mile Creek	1	0	3	0	0	3
T. Summit	9	0	23	0	0	23
V. Union Center	28	0	70	0	0	70
C. Wisconsin Dells	0	0	0	0	0	0
V. Wonewoc	139	0	348	0	0	348
T. Wonewoc	45	0	113	0	0	113
Juneau County	**3,281**	**1,228**	**8,178**	**3,070**	**148**	**11,421**

Source: NCWRPC GIS, HAZUS

In the Adams-Juneau Planning Area, an estimated 32,462 residents and visitors to the area are vulnerable to flooding according to the NCWRPC's modeled At-Risk-Zone. Full-time residents account for 24,929 of those vulnerable to flooding, while visitors account for 7,533 of those vulnerable. There are an estimated 8,674 housing units within the Adams-Juneau Planning area that are vulnerable to flooding, with Adams County accounting for over 62 percent of vulnerable housing units in the area with 5,403 vulnerable housing units. Chula Vista Resort in Adams County accounts for nearly all of the vulnerable hotel visitors within the planning area with up to 2,042 visitors estimated to be vulnerable to flooding there. Juneau County accounts for over 57 percent of all vulnerable campground visitors with 3,070. **Table 29** displays flood vulnerability totals for the Adams-Juneau Planning Area at the county-level.





Calculations indicate that the Town of Rome has more than twice as many persons potentially at risk than any other community in the Adams-Juneau Planning Area. This is due to a large number of homes being located along Lake Camelot within the Town. The City of Wisconsin Dells in Adams County has the second-highest number of potential persons at risk, with Chula Vista Resort accounting for a vast majority of at-risk persons in Wisconsin Dells.

Table 29: Flood Vulnerability Estimates, Adams-Juneau County Planning Area						
County	Housing Units Vulnerable	Recreational Units	Full-Time Residents	Recreational Visitors	Hotel Visitors	Residents & Visitors Impacted
Adams County	5,403	909	13,508	2,273	2,042	17,823
Juneau County	3,281	1,228	11,421	3,070	148	14,639
Total	8,684	2,137	24,929	5,343	2,190	32,462

Source: NCWRPC GIS, HAZUS

Business Vulnerability Assessment

To determine potential impacts towards businesses in the Adams-Juneau Planning Area, the NCWRPC conducted a GIS analysis to calculate the number of businesses vulnerable to flood damage. For the purpose of this assessment, businesses were placed into one of two groups; Manufacturing and Commercial. Manufacturing businesses include companies that create products, while Commercial businesses include retail, real-estate, public works, and churches. This assessment includes vulnerability estimates for the number of Manufacturing businesses, the number of Commercial businesses, the number of potential employees impacted, and a breakdown of businesses by size. Three size categories were utilized; small (less than 10 employees), medium (10-99 employees), and large (100 employees or more).

Flooding can disrupt or completely stop business operations, such as for this campground and resort. Image source: Rocky Gilner

In Adams County, calculations from NCWRPC estimate that there are 99 businesses vulnerable to flooding. Only two of these businesses are manufacturing based businesses. Estimations show that up to 1,550 employees could be impacted as a result of flooding in Adams County. The City of Wisconsin Dells accounted for nearly half of these employees with an estimated 754 potentially impacted employees, due to Chula Vista Resort and its estimated 750 employees. The City of Adams contains an estimated 320 potentially impacted employees and the Village of Friendship contains an

Chula Vista Resort is a popular tourist attraction in Adams County, and is the largest business in the Adams-Juneau Planning Area located within the modeled At-Risk Zone.
Image source: Chula Vista Resort

estimated 195 potentially impacted employees. No other municipality within Adams County contains over 100 potentially impacted employees.

In terms of business size, Adams County contains 3 large businesses (100 or more employees) vulnerable to flooding; with the City of Adams, Village of Friendship, and City of Wisconsin Dells each containing one large business that is vulnerable to flooding. There are 10 medium sized businesses (10-99 employees) within Adams County that are vulnerable to flooding; with the Town of Rome containing the most such businesses with three. Adams County contains 86 small businesses (less than 10 employees) that are vulnerable to flooding; with the Towns of Rome and Dell Prairie leading the way with 14 and 10 respectively. Overall, the Town of Rome contains the most vulnerable businesses within Adams County with 17 vulnerable businesses. The Towns of Dell Prairie and Quincy also have double-digit businesses vulnerable to flooding with 11 and 10 such businesses respectively. **Table 30** displays the results of the Business Vulnerability to Flooding Assessment for municipalities in Adams County.

Table 30: Flood Vulnerability for Businesses, Adams County							
Minor Civil Division	Commercial Businesses	Manufacturing Businesses	Employees Impacted	Small Businesses	Medium Businesses	Large Businesses	Total Businesses
C. Adams	8	2	320	9	0	1	10
T. Adams	8	0	27	7	1	0	8
T. Big Flats	6	0	19	6	0	0	6
T. Colburn	0	0	0	0	0	0	0
T. Dell Prairie	11	0	44	10	1	0	11
T. Easton	5	0	17	5	0	0	5
V. Friendship	7	0	195	5	1	1	7
T. Jackson	1	0	5	1	0	0	1
T. Leola	1	0	2	1	0	0	1
T. Lincoln	0	0	0	0	0	0	0
T. Monroe	1	0	2	1	0	0	1
T. New Chester	0	0	0	0	0	0	0
T. New Haven	2	0	2	2	0	0	2
T. Preston	3	0	12	2	1	0	3
T. Quincy	10	0	40	8	2	0	10
T. Richfield	0	0	0	0	0	0	0
T. Rome	17	0	80	14	3	0	17
T. Springville	4	0	16	3	1	0	4
T. Strongs Prairie	8	0	15	8	0	0	8
C. Wisconsin Dells	5	0	754	4	0	1	5
Adams County	**97**	**2**	**1,550**	**86**	**10**	**3**	**99**

Source: NCWRPC GIS, HAZUS

Nelson Auto in Necedah experienced flooding with water levels between 3 to 4 feet as a result of a rain event in 2010.
Image source: Juneau County Star-Times

In Juneau County, calculations from NCWRPC estimate that there are 335 businesses vulnerable to flooding. Of these businesses, 15 are manufacturing based and 320 are commercial based. The City of Mauston contains the most commercial based businesses vulnerable to flooding with 90, while the City of Elroy contains the most manufacturing based businesses vulnerable to flooding with 6. Estimations show that up to 2,351 employees could potentially be impacted as a result of flooding in Juneau County. The City of Elroy contains the most potential flood-impacted employees with 796, followed by the Village of Necedah with 550 employees, the City of Mauston with 370 employees, and the Village of Wonewoc with 168 employees. No other municipality within Juneau County has more than 100 employees potentially impacted by flooding.

In terms of business size, Juneau County contains 3 large businesses vulnerable to flooding; with two located in the City of Elroy and the other located in the Village of Necedah. There are 36 medium sized businesses within Juneau County; with the City of Mauston accounting for nearly a third of vulnerable medium sized businesses with 11. Juneau County also contains 296 small businesses; most of which are located in the City of Mauston, Village of Necedah, Village of Wonewoc, or City of Elroy. Overall, the City of Mauston contains the most vulnerable businesses within Juneau County with 91 vulnerable businesses. The Village of Necedah (51), City of Elroy (44), and Village of Wonewoc (42) each contain over 40 vulnerable businesses as well. **Table 31** displays the results of the Business Vulnerability to Flooding Assessment for municipalities in Juneau County.

Table 31: Flood Vulnerability for Businesses, Juneau County

Minor Civil Division	Commercial Businesses	Manufacturing Businesses	Employees Impacted	Small Businesses	Medium Businesses	Large Businesses	Total Businesses
T. Armenia	1	0	2	1	0	0	1
V. Camp Douglas	0	0	0	0	0	0	0
T. Clearfield	0	0	0	0	0	0	0
T. Cutler	1	0	5	1	0	0	1

C. Elroy	38	6	796	37	5	2	44
T. Finley	2	0	4	2	0	0	2
T. Fountain	0	0	0	0	0	0	0
T. Germantown	7	0	14	7	0	0	7
V. Hustler	0	0	0	0	0	0	0
T. Kildare	3	0	3	3	0	0	3
T. Kingston	0	0	0	0	0	0	0
T. Lemonweir	4	0	14	4	0	0	4
T. Lindina	3	0	3	3	0	0	3
T. Lisbon	5	0	31	4	1	0	5
T. Lyndon	3	0	3	3	0	0	3
V. Lyndon Station	12	0	88	10	2	0	12
T. Marion	6	0	15	6	0	0	6
C. Mauston	90	1	370	80	11	0	91
V. Necedah	47	4	550	42	8	1	51
T. Necedah	7	0	45	7	0	0	7
C. New Lisbon	25	0	97	23	2	0	25
T. Orange	1	0	5	1	0	0	1
T. Plymouth	3	1	21	4	0	0	4
T. Seven Mile Creek	0	0	0	0	0	0	0
T. Summit	0	0	0	0	0	0	0
V. Union Center	15	1	78	13	3	0	16
C. Wisconsin Dells	0	0	0	0	0	0	0
V. Wonewoc	40	2	168	39	3	0	42
T. Wonewoc	7	0	39	6	1	0	7
Juneau County	**320**	**15**	**2,351**	**296**	**36**	**3**	**335**

Source: NCWRPC GIS, HAZUS

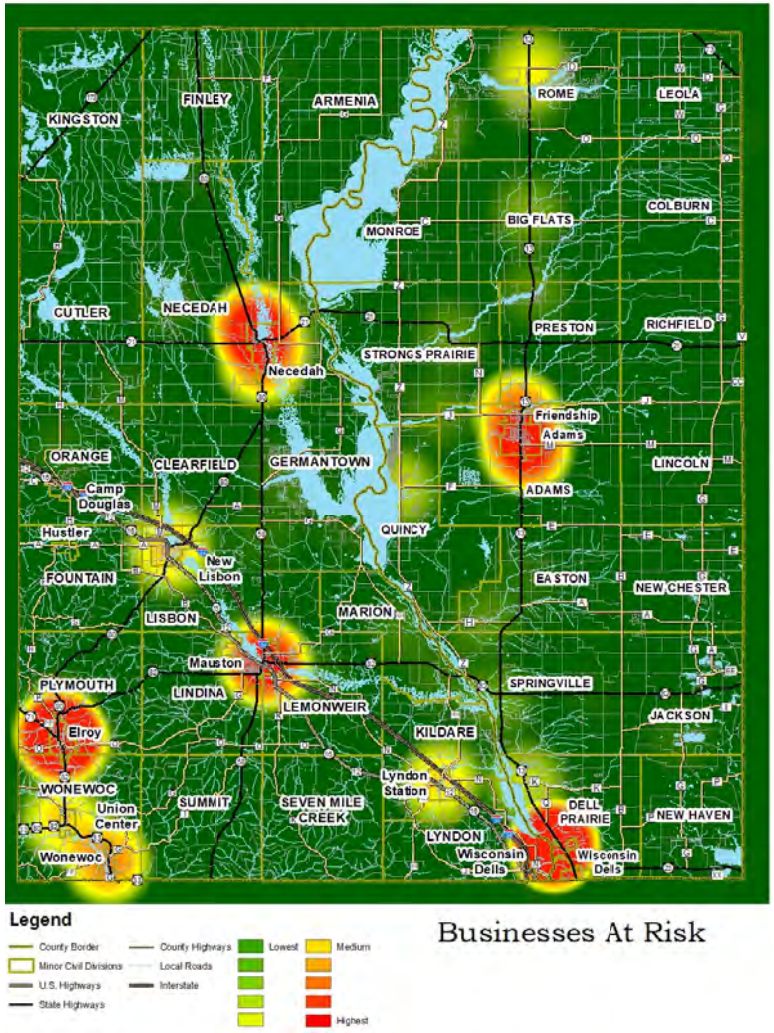
In the Adams-Juneau Planning Area, there are an estimated 434 businesses vulnerable to flooding. Of these, 17 are manufacturing based and 417 are commercial based. Juneau County (335) has substantially more vulnerable businesses than Adams County (99). In terms of employees impacted, the gap between the two counties is smaller as Juneau County has an estimated 2,351 impacted employees compared to Adams County with an estimated 1,550 impacted employees. The narrowing of the gap is mainly due to Chula Vista Resort in Adams County which accounts for nearly half of all of the potentially impacted employees in Adams County.

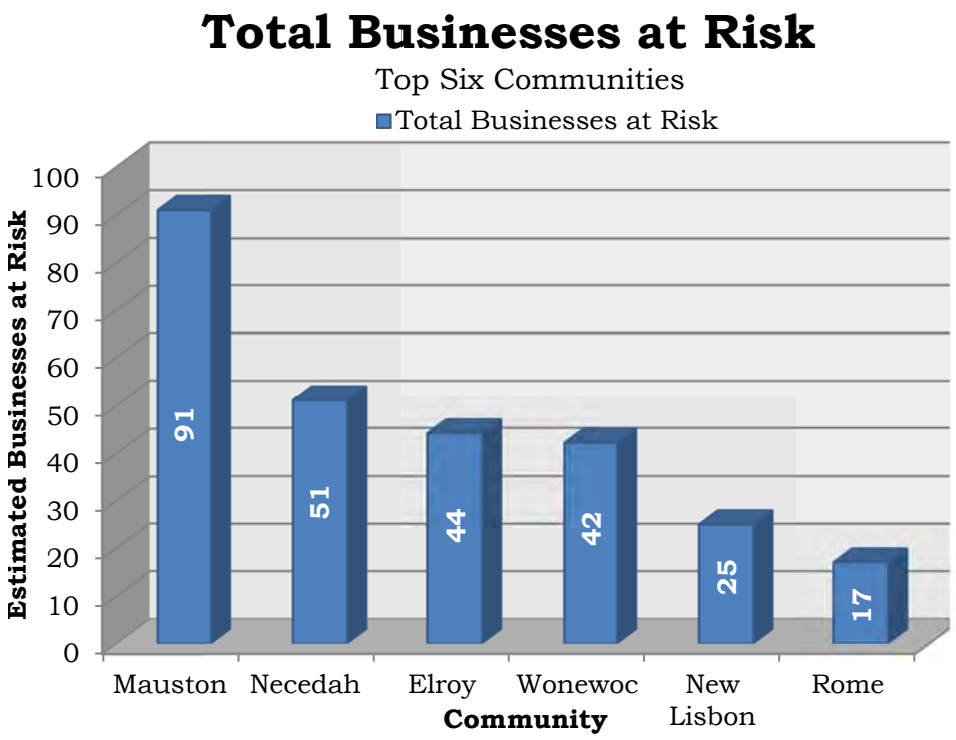
In terms of business size, Adams and Juneau County each contain 3 large businesses that are vulnerable to flooding. Adams County contains 10 medium sized businesses while Juneau County contains 36 medium sized businesses for a total of 46 medium sized businesses in the planning area. There are a combined 382 small businesses in the planning area, 296 in Juneau County and 86 in Adams County. **Table 32** displays the results of the Business Vulnerability to Flooding Assessment for the Adams-Juneau Planning Area. **Map 6: Businesses At Risk** displays the location of vulnerable businesses within the Adams-Juneau Planning Area.

Table 32: Flood Vulnerability for Businesses, Adams-Juneau Planning Area

County	Commercial Businesses	Manufacturing Businesses	Employees Affected	Small Businesses	Medium Businesses	Large Businesses	Total Businesses
Adams County	97	2	1,550	86	10	3	99
Juneau County	320	15	2,351	296	36	3	335
Total	417	17	3,901	382	46	6	434

Source: NCWRPC GIS, HAZUS





Among communities within the Planning Area, the City of Mauston has the most estimated businesses at risk to flooding with 91. Although not among the top six communities in the chart above, the incorporated communities of Adams and Friendship in Adams County combine for 17 businesses at risk, the same as in the Town of Rome. Although the City of Elroy has much less total businesses considered at risk than the City of Mauston, the City of Elroy has more employees potentially impacted due to more large businesses being located in Elroy than in Mauston.

Critical Facilities Flood Vulnerability Assessment

For the purposes of this assessment, critical facilities were categorized into seven groups; municipal services, utility, municipal water treatment, schools, emergency services, dams, and miles of road within the At-Risk-Zone. NCWRPC utilized GIS to calculate the number of critical facilities located within each municipality in the Adams-Juneau Planning Area. Mileage calculations for road segments vulnerable to flooding were calculated using GIS as well.

Critical facilities grouped under Municipal Services include municipal garages, town/village/city halls, courthouses, highway department buildings, and other governmental operational buildings. Critical facilities grouped under Utility include substations and communication towers. The Municipal Water Treatment group includes water towers, treatment facilities, wastewater treatment plants, and municipal water supply wells. Emergency Services critical facilities include hospitals, medical service clinics, police departments, fire stations, and ambulance service stations. Schools and dams make up their own individual groups.

Excessive flooding can disrupt road construction projects, such as the construction project for the State Highway 82 Bridge that connects Adams County and Juneau County.
Image source: Rocky Gilner

In Adams County, an estimated 66 critical facilities are vulnerable to flooding, with more than 551 miles of roadway within the county vulnerable to flooding. Dams account for most of the vulnerable critical structures, accounting for 47 of the 66 vulnerable facilities (71%) in Adams County. Throughout Adams County there are 4 municipal services facilities, 10 utility facilities, 1 municipal water treatment facility, 4 emergency services facilities, and no schools located within the modeled At-Risk-Zone. Among municipalities in Adams County, the Town of Rome contains the most critical facilities vulnerable to flooding with 13, followed by the Town of Leola with 9. **Table 33** provides a breakdown of the number vulnerable critical facilities located in each Adams County municipality.

Table 33: Flood Vulnerability for Critical Facilities, Adams County								
Minor Civil Division	Vulnerable Critical Facilities	Municipal Services	Utility	Municipal Water Treatment	Schools	Emergency Services	Dams	Vulnerable Roads (miles)
C. Adams	1	0	1	0	0	0	0	3.07
T. Adams	5	1	3	0	0	0	1	33.89
T. Big Flats	2	0	2	0	0	0	0	45.46
T. Colburn	1	0	0	0	0	0	1	25.81
T. Dell Prairie	2	0	0	0	0	0	2	18.85
T. Easton	6	0	0	1	0	0	5	44.24
V. Friendship	3	0	1	0	0	1	1	2.94
T. Jackson	3	0	0	0	0	0	3	14.91
T. Leola	9	0	0	0	0	0	9	52.86
T. Lincoln	1	0	0	0	0	0	1	18.00
T. Monroe	0	0	0	0	0	0	0	14.51
T. New Chester	1	0	0	0	0	0	1	4.23
T. New Haven	4	1	0	0	0	0	3	20.15
T. Preston	4	0	0	0	0	0	4	52.67
T. Quincy	2	0	1	0	0	0	1	53.01
T. Richfield	1	0	0	0	0	0	1	20.36
T. Rome	13	1	2	0	0	2	8	66.70
T. Springville	4	1	0	0	0	0	3	33.29
T. Strongs Prairie	4	0	0	0	0	1	3	26.31
C. Wisconsin Dells	0	0	0	0	0	0	0	0.32
Adams County	**66**	**4**	**10**	**1**	**0**	**4**	**47**	**551.58**

Source: NCWRPC GIS, HAZUS

Flooding of the County Highway HH - State Highway 82 intersection in the Town of Kildare.
Image source: Juneau County Star-Times

In Juneau County, an estimated 95 critical facilities are located within the modeled At-Risk-Zone, with more than 779 miles of roadway vulnerable to flooding. Dams account for 61 of the 94 vulnerable critical facilities (64%) in Juneau County. Throughout Juneau County, there are 7 municipal services facilities, 13 utility facilities, 7 municipal water treatment facilities, 4 schools, and 2 emergency services facilities located within the modeled At-Risk-Zone in addition to the previously mentioned 61 dams. Among municipalities in Juneau County, The Town of Kingston contains the most vulnerable critical facilities with 18, followed by the Towns of Armenia and Necedah with 12 each. **Table 34** provides a breakdown of the number vulnerable critical facilities located in each Juneau County municipality.

Table 34: Flood Vulnerability for Critical Facilities, Juneau County

Minor Civil Division	Vulnerable Critical Facilities	Municipal Services	Utility	Municipal Water Treatment	Schools	Emergency Services	Dams	Vulnerable Roads (miles)
T. Armenia	12	2	1	0	0	0	9	97.61
V. Camp Douglas	0	0	0	0	0	0	0	0.00
T. Clearfield	0	0	0	0	0	0	0	23.99
T. Cutler	4	0	2	0	0	0	2	47.99
C. Elroy	2	0	0	1	0	0	1	13.32
T. Finley	8	1	0	0	0	0	7	60.49
T. Fountain	0	0	0	0	0	0	0	9.55
T. Germantown	0	0	0	0	0	0	0	46.79

V. Hustler	0	0	0	0	0	0	0	1.01
T. Kildare	1	0	0	0	0	0	1	25.84
T. Kingston	18	0	1	0	0	0	17	56.61
T. Lemonweir	6	1	0	0	0	1	4	30.79
T. Lindina	1	1	0	0	0	0	0	28.66
T. Lisbon	0	0	0	0	0	0	0	31.11
T. Lyndon	1	0	0	0	0	0	1	12.84
V. Lyndon Station	3	0	2	0	1	0	0	9.19
T. Marion	3	1	1	0	0	0	1	24.05
C. Mauston	3	0	1	0	1	0	1	16.15
V. Necedah	6	0	1	3	0	1	1	10.11
T. Necedah	12	0	4	0	0	0	8	111.08
C. New Lisbon	2	0	0	1	0	0	1	10.13
T. Orange	3	0	0	0	0	0	3	31.88
T. Plymouth	3	1	0	0	0	0	2	25.50
T. Seven Mile Creek	0	0	0	0	0	0	0	12.41
T. Summit	0	0	0	0	0	0	0	15.32
V. Union Center	0	0	0	0	0	0	0	3.52
C. Wisconsin Dells	0	0	0	0	0	0	0	0.00
V. Wonewoc	4	0	0	2	1	0	1	5.52
T. Wonewoc	2	0	0	0	1	0	1	18.12
Juneau County	**94**	**7**	**13**	**7**	**4**	**2**	**61**	**779.58**

Source: NCWRPC GIS, HAZUS

In the Adams-Juneau Planning Area, there are an estimated 160 critical facilities located within the modeled At-Risk-Zone, and about 1,331 miles of roadway that are vulnerable to flooding. Most of the vulnerable critical facilities in the planning area are dams, as dams account for 108 of the 160 vulnerable critical facilities (67%). Throughout the Adams-Juneau Planning Area there are 11 municipal services facilities, 23 utility facilities, 8 municipal water treatment facilities, 4 schools, and 6 emergency services facilities in addition to the 108 dams located within the modeled At-Risk-Zone. **Table 35** provides a breakdown of the number vulnerable critical facilities for both Adams and Juneau Counties.

For a visual representation of vulnerable critical facilities see **Map 7: Critical Facilities At Risk** and **Map 8: Transportation At Risk**.

Table 35: Flood Vulnerability for Critical Facilities, Adams-Juneau Planning Area

County	Vulnerable Critical Facilities	Municipal Services	Utility	Municipal Water Treatment	Schools	Emergency Services	Dams	Vulnerable Roads (miles)
Adams County	66	4	10	1	0	4	47	551.58
Juneau County	94	7	13	7	4	2	61	779.58
Total	160	11	23	8	4	6	108	1,331.16

Source: NCWRPC GIS, HAZUS

Structural Damage Flood Vulnerability Assessment

To put a monetary value on potential damages caused by flooding, all primary structures within the modeled At-Risk-Zone were combined with their respective parcel information. Each primary structure was given their respective parcel's tax roll improvement value. Improvement values were then sorted by municipality. All structures previously examined were used for this assessment, and combined to create a total structures value.

In Adams County, a total of 6,419 structures are located in the modeled At-Risk-Zone. Among municipalities in Adams County, the Town of Rome has the most vulnerable structures with 1,779, while the Town of Quincy has the second-most vulnerable structures with 860.

Estimates show that a flooding event in Adams County could cause up to $526,620,300 in damages throughout the county. The Towns of Rome and Quincy are estimated to be hit the hardest with estimated damages of $197,996,400 in Rome and $51,135,800 in Quincy. Despite having much less vulnerable structures than the Town of Quincy, damages in the City of Wisconsin Dells are estimated to be only slightly lower than in Quincy, mainly due to Chula Vista Resort lying within the modeled At-Risk-Zone. **Table 36** displays estimated structural damages caused by flooding for each municipality in Adams County.

Most of the damages in Adams County are expected to occur to residential buildings, with residential damages in Adams County estimated to cost up to $503,626,100, or about 96% of the total estimated damage cost in Adams County.

Table 36: Potential Structural Damage, Adams County

Minor Civil Division	Total Structures Affected	Residential Value Damage	Commercial Value Damage	Manufacturing Value Damage	Total Value Damage
C. Adams	65	$1,519,600	$2,343,400	$2,727,400	$6,590,400
T. Adams	254	$14,963,800	$681,000	$0	$15,644,800
T. Big Flats	475	$15,032,900	$1,101,700	$0	$16,134,600
T. Colburn	78	$4,089,500	$0	$0	$4,089,500
T. Dell Prairie	310	$18,548,200	$1,120,700	$0	$19,668,900
T. Easton	263	$14,995,300	$334,300	$0	$15,329,600
V. Friendship	77	$4,697,800	$1,174,500	$0	$5,872,300
T. Jackson	141	$14,905,200	$122,400	$0	$15,027,600
T. Leola	171	$9,389,400	$29,100	$0	$9,418,500
T. Lincoln	24	$1,552,100	$0	$0	$1,552,100
T. Monroe	337	$23,059,700	$44,600	$0	$23,104,300
T. New Chester	10	$553,100	$0	$0	$553,100
T. New Haven	268	$12,452,100	$166,800	$0	$12,618,900
T. Preston	439	$35,082,500	$199,900	$0	$35,282,400
T. Quincy	860	$49,764,600	$1,371,200	$0	$51,135,800
T. Richfield	31	$1,837,100	$0	$0	$1,837,100
T. Rome	1, 779	$194,215,100	$3,781,300	$0	$197,996,400
T. Springville	308	$14,511,300	$413,900	$0	$14,925,200
T. Strongs Prairie	342	$31,904,500	$413,700	$0	$32,318,200
C. Wisconsin Dells	187*	$40,552,300	$6,968,300	$0	$47,520,600
Adams County	**6,419**	**$503,626,100**	**$20,266,800**	**$2,727,400**	**$526,620,300**

Source: NCWRPC GIS, HAZUS **: Value includes Chula Vista Resort Units*

Heavy rains caused this property in Clearfield to flood with standing-water levels approaching 2 feet.
Image source: Juneau County Star-Times

In Juneau County, a total of 4,847 structures are located within the modeled At-Risk-Zone. Among municipalities in Juneau County, The Town of Germantown has the most vulnerable structures with 781, followed by the Town of Necedah with 495, and the City of Mauston with 426.

Estimates show that a flooding event in Juneau County could cause up to $358,544,101 in damages throughout the county. The Towns of Germantown and Necedah and the City of Mauston are estimated to see the most monetary damages with estimated damages of $89,115,905 in Germantown, $36,984,300 in Necedah, and $36,712,717 in Mauston. It is worth noting that there are no estimated damages within the Village of Camp Douglas or the portion of the City of Wisconsin Dells located in Juneau County. **Table 37** displays estimated structural damages caused by flooding for each municipality in Juneau County.

Like in Adams County, damages in Juneau County are expected to be highest to residential buildings, with potential residential damage estimated to cost up to $305,554,449 in Juneau County. However, damages to commercial and manufacturing buildings in Juneau County are estimated to account for more damages in Juneau County (15%) than in Adams County (5%).

Table 37: Potential Structural Damage, Juneau County

Minor Civil Division	Total Structures Affected	Residential Value Damage	Commercial Value Damage	Manufacturing Value Damage	Improvement Value Affected
T. Armenia	316	$31,872,800	$37,900	$0	$31,910,700
V. Camp Douglas	0	$0	$0	$0	$0
T. Clearfield	130	$5,040,902	$0	$0	$5,040,902
T. Cutler	223	$10,141,600	$11,700	$0	$10,153,300
C. Elroy	348	$14,473,501	$3,299,209	$4,675,800	$22,448,510
T. Finley	105	$7,286,100	$213,700	$0	$7,499,800
T. Fountain	23	$1,801,001	$0	$0	$1,801,001

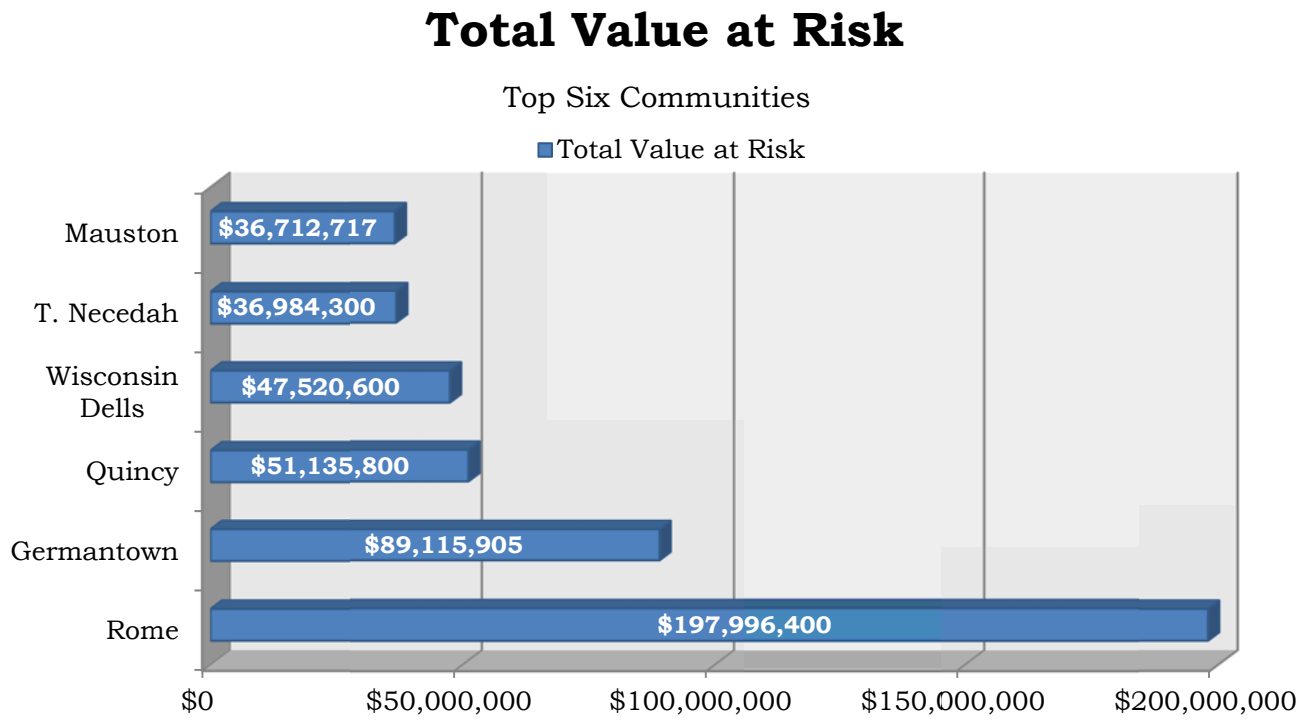
T. Germantown	781	$88,144,604	$971,301	$0	$89,115,905
V. Hustler	10	$1,299,200	$0	$0	$1,299,200
T. Kildare	287	$7,131,905	$699,500	$0	$7,831,405
T. Kingston	1	$24,300	$0	$0	$24,300
T. Lemonweir	88	$9,093,702	$821,800	$0	$9,915,502
T. Lindina	64	$6,075,406	$241,902	$0	$6,317,308
T. Lisbon	70	$3,864,000	$635,200	$0	$4,499,200
T. Lyndon	335	$2,567,800	$95,001	$0	$2,662,801
V. Lyndon Station	99	$6,559,803	$1,914,903	$0	$8,474,706
T. Marion	201	$10,940,107	$474,501	$0	$11,414,608
C. Mauston	426	$19,676,806	$16,828,111	$207,800	$36,712,717
V. Necedah	190	$9,937,501	$6,099,406	$3,538,600	$19,575,507
T. Necedah	495	$35,382,300	$1,602,000	$0	$36,984,300
C. New Lisbon	239	$8,253,000	$3,290,804	$337,900	$11,881,704
T. Orange	73	$6,047,700	$100,000	$0	$6,147,700
T. Plymouth	54	$6,176,001	$286,301	$48,400	$6,510,702
T. Seven Mile Creek	1	$223,300	$0	$0	$223,300
T. Summit	9	$1,001,801	$0	$0	$1,001,801
V. Union Center	44	$1,782,401	$1,243,702	$1,130,000	$4,156,103
C. Wisconsin Dells	0	$0	$0	$0	$0
V. Wonewoc	181	$6,908,002	$2,806,310	$500,600	$10,214,912
T. Wonewoc	54	$3,848,906	$877,301	$0	$4,726,207
Juneau County	**4,847**	**$305,554,449**	**$42,550,552**	**$10,439,100**	**$358,544,101**

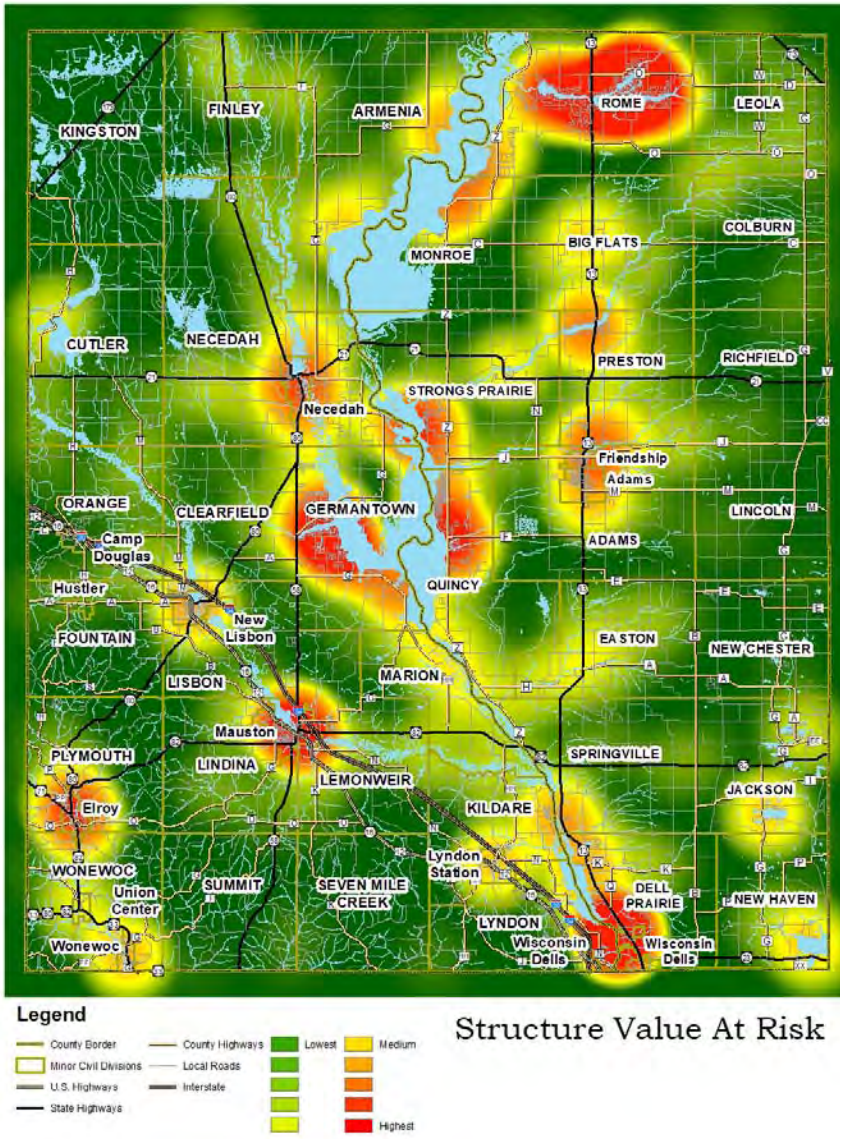
Source: NCWRPC GIS, HAZUS

Across the Adams-Juneau Planning Area, an estimated total of 11,266 structures are located within the modeled At-Risk-Zone. A flood event could cause up to $885,164,401 in damages throughout the planning area, with heavier damage expected in Adams County. While Adams County is expected to see higher total damage costs, damage costs to commercial and manufacturing facilities are estimated to be higher in Juneau County. **Table 38** displays estimated structural damages caused by flooding for the Adams-Juneau Planning Area.

Table 38: Potential Structural Damage, Adams-Juneau Planning Area					
County	Total Structures Affected	Residential Value Damage	Commercial Value Damage	Manufacturing Value Damage	Improvement Value Affected
Adams County	6,419	$503,626,100	$20,266,800	$2,727,400	$526,620,300
Juneau County	4,847	$305,554,449	$42,550,552	$10,439,100	$358,544,101
Total	11,266	$809,180,549	$62,817,352	$13,166,500	$885,164,401

Source: NCWRPC GIS, HAZUS





Residential Damages:

Estimated damages to residential structures are generally higher in the towns rather than the incorporated communities within the planning area, with the Town of Rome leading the way with estimated damages of up to $194,215,100. Other towns with high damage estimates include Germantown, Quincy, Necedah, Preston, Strongs Prairie, and Armenia.

For incorporated communities, the Cities of Wisconsin Dells and Mauston have the highest estimated damage totals, with the presence of Chula Vista Resort being responsible for the high estimated damages in Wisconsin Dells.

Business Damages:

Estimated damages to commercial-business structures are generally highest in the incorporated communities, with the City of Mauston leading the way with $16,828,111 in damages. Other communities with high damage estimates include the Village of Necedah, Cities of New Lisbon and Elroy, and the Town of Rome.

The City of Elroy has the highest estimated damage costs to manufacturing businesses within the Planning Area with an estimated $4,675,800 in damages. Other communities with high damage estimates include the Village of Necedah, City of Adams, and Village of Union Center.

Assessment Summary

After analyzing the results of the various vulnerability assessments, NCWRPC has determined that in terms of total estimated damage costs, future flood-mitigation efforts should focus primarily in the Towns of Rome and Germantown, as well as the Cities of Adams, Elroy, and Mauston, and the Village of Necedah. The Town of Rome led all municipalities in the planning area with $197,996,400 in estimated damages, followed by the Town of Germantown with an estimated $89,115,905 in damages. It is also clear that Chula Vista Resort in the City of Wisconsin Dells should be a priority as well, due to the high number of employees, visitors, and damages estimated to be impacted in a singular venue.

Flood mitigation efforts related to residential housing units should focus on the following towns; Rome, Germantown, Quincy, Preston, Necedah, Strongs Prairie, and Armenia due to the high estimated damage costs in these towns. Among incorporated municipalities, the City of Mauston and City of Elroy are estimated to experience the most damage to residential buildings.

Business-related flood mitigation efforts should be primarily focused on the City of Mauston, City of Elroy, Village of Necedah, and the City of Adams, due to the high estimated damage costs in these areas. The City of New Lisbon and Villages of Wonewoc should be included for the high number of businesses vulnerable to flooding in these areas, while the Village of Friendship should be included for the high numbers of employees vulnerable to flooding impacts.

Appendix A contains maps showing impacted facilities for various communities within the Adams-Juneau Planning Area. These snapshot maps detail the locations of businesses, critical facilities, and residential units that are considered at risk by the HAZUS-modeling process conducted by NCWRPC. Snapshot maps are included to provide a more in-depth analysis of the estimated flood damage to primary structures within the following communities; Mauston, Necedah, Elroy, New Lisbon, Wonewoc, Union Center, Lyndon Station, and the combined Adams-Friendship incorporated area. In addition, a snapshot map detailing the location of At-Risk residential units is provided for the Towns of Rome, Quincy, and Germantown as well.

Chapter Five

Preparedness, Mitigation, Response and Recovery

The purpose of this chapter is to bridge gaps in intergovernmental communication and coordination needed to make economic recovery more efficient in the long run. Bridging these gaps helps improve each jurisdiction's economic resiliency after a flood occurs. Furthermore, this chapter will describe the comprehensive processes involved in disaster mitigation, followed by outlining the theoretical and practical efficiency of Emergency Response Plans (ER-Plans) as they relate to features of economic importance.

First, we have outlined the importance of preparedness, mitigation, and funding followed by an overview of Emergency Management through the use of Emergency Response Plans. Next, we review specific examples of regional ER-Plans, after which we discuss Recovery through Business Continuity Plans.

Image source: World Meteorological Organization

Preparedness and Mitigation

Implementing preparedness and mitigation strategies minimizes the unwanted impacts of disasters. Mitigating economic activities are defined by practices, actions or policies that reduce or eliminate long-term economic risks which result from natural and man-made/technological hazards. An example of mitigation efforts related to economic sustainability is the "implementation of supporting measures to ensure the protection and resilience of Critical Infrastructure and Key Resources (CIKR) designed to ensure business continuity and the economic stability of

communities." (NIMS, 2008) Another popular economic sustainability mitigation activity is the practice of acquiring damaged homes or businesses in flood-prone areas, relocating the structures, and returning the property to open space, wetlands, or recreational uses.

Community Economic Recovery Guidebook

In response to widespread flooding in 2010, the NCWRPC partnered with four other regional planning commissions and EDA to develop the Community Economic Recovery Guidebook. This report is designed to help guide communities to economic stability before, during and after major events such as floods. Each section within the guidebook correlates to a phase in the standard Emergency Management disaster cycle. Tips and insights are provided for each phase throughout the report.

The Community Economic Recovery Guidebook can be found at: https://sites.google.com/a/schoolfactory.org/recovery/home

Finance for Mitigation and Recovery

There are multiple financial resources available that can help fund mitigation and recovery efforts. Some of these resources are highlighted below.

Federal Emergency Management Agency (FEMA)

FEMA can assist financially to help recover from flood impacts. Their funding assistance focuses on temporary housing, repair, replacement or permanent housing construction. Temporary Housing assistance is meant to rent a different place to live or a government provided housing unit when rental properties are not available. Repair assistance is meant to enable homeowners to repair damage from the disaster to their primary residence that is not covered by insurance. The goal is to make the damaged home safe, sanitary, and functional. Replacement assistance is available to homeowners to replace their home destroyed in a disaster that is not covered by insurance. Permanent Housing Construction is meant for direct assistance for the construction of a home. This type of help occurs only in insular areas or remote locations, specified by FEMA, where no other type of housing assistance is possible.

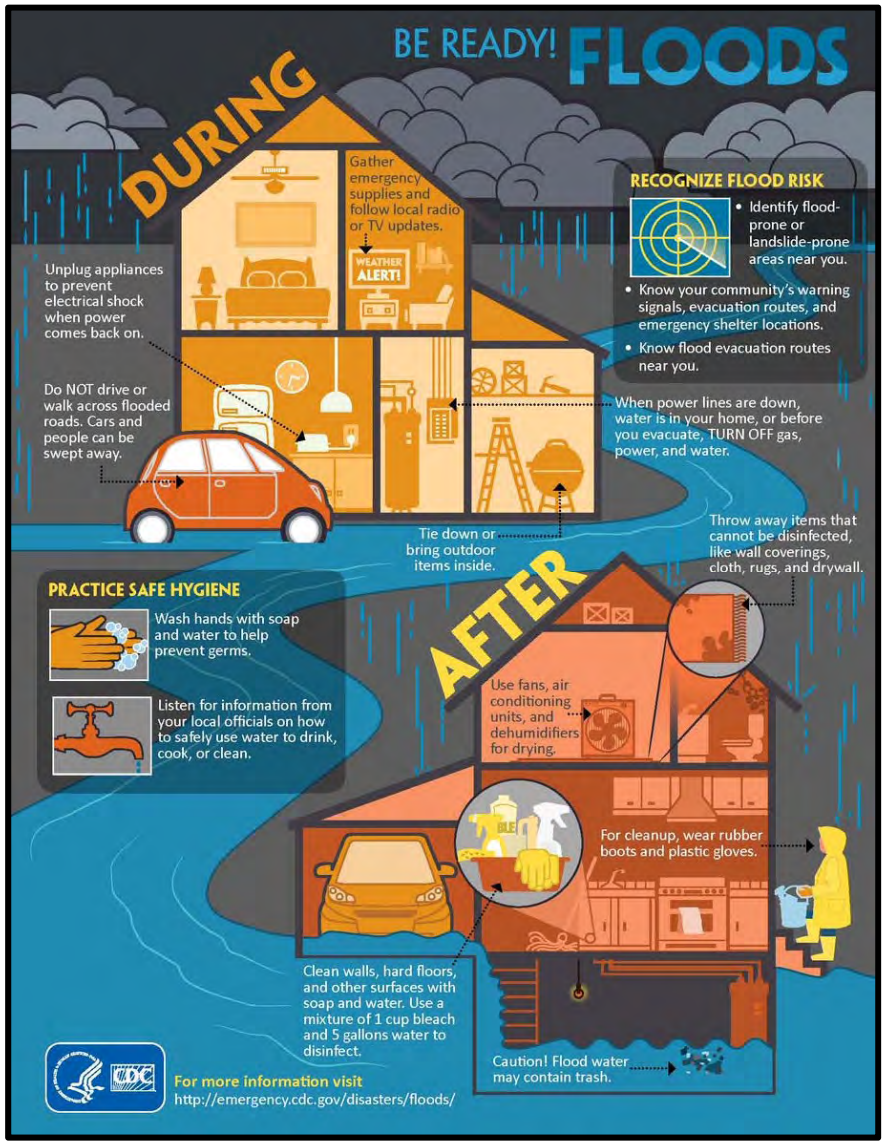


Image source: CDC Emergency

Small Business Administration (SBA)

The Small Business Administration provides financial, business counselling and training, and business advocacy to foster the development and success of small businesses. Financial assistance comes in the form of low interest loans and grant programs to affected businesses that incurred physical or economic injury damages. Such assistance can include; the 7(a) Loan Guarantee, Prequalification Loan, 7 (m) Micro Loan, CDC/504 Loan, CAPlines Program, and 8(a) Business Development Program (Source: www.sba.gov).

Community Development Block Grant (CDBG)

Following presidentially-declared disasters, Congress often uses the Community Development Block Grant (CDBG) program to help states and local governments finance recovery efforts. The CDBG program, administered by the Department of Housing and Urban Development (HUD), is the federal government's largest and most widely available source of financial assistance to support state and local government-directed neighborhood revitalization, housing rehabilitation, and economic development activities. CDBG funds are available for short term relief efforts, mitigation actions, and long-term recovery, and have been used to provide housing and business assistance, infrastructure reconstruction, and public services. (Boyd, 2005)
Past disaster relief legislation generally has allowed CDBG funds to fill gaps in FEMA and Small Business Administration (SBA) emergency relief activities. In general, such legislation prohibited CDBG funds from substituting for FEMA or SBA funding, but allowed CDBG funds to be used for activities that are not

reimbursable by FEMA or SBA. Typically, CDBG has been used to finance the removal of debris, the provision of extra security patrols, and the emergency restoration of essential services, such as water, sewer, electrical, and telecommunications.

The third set of activities eligible for CDBG assistance are those associated with long-term recovery and reconstruction efforts. This would include assistance to businesses and residents affected by a presidentially-declared disaster, as well as grants intended to attract new businesses to the area. The forms of assistance may range from business loans to infrastructure improvements.

Again, such activities are intended to lessen the impact of a disaster, and can range from physical measures such as the construction of levees to protect against flooding to buildings designed to withstand earthquakes. Mitigation activities may also involve training exercises and public awareness programs. Less typical is the use of CDBG to compensate businesses and workers for lost wages or revenues. Mitigation may take place at any time – before a disaster occurs, during an emergency, after disaster, or during recovery or reconstruction.

Mitigation activities have involved the use of the CDBG program to fund buyouts of real property in areas prone to a recurrence of the event. For instance, following the Midwest floods of 1993, CDBG and Hazard Mitigation Grants from FEMA were used to acquire privately-held real property within flood plain areas in the nine affected states and to convert the land to public uses, such as recreation, or allowing it to return to its natural state. CDBG funds were also used to construct and repair levees in an effort to reduce the area's vulnerability to future flood losses. Following the Midwest floods of 1997, Congress again appropriated CDBG funds to cover buyouts of privately-held land in flood-prone areas in the affected states.

Construction on the State Highway 82 bridge was delayed in 2018 due to excessive flooding. Image source: Rocky Gilner

Revolving Loan Fund (RLF)

The last source of funding assistance described here is a Revolving Loan Fund (RLF). As part of the EDA's Economic Adjustment Assistance Program, EDA's regional offices award competitive grants to units of local government, state governments, institutions of higher education, public or private non-profit organizations, EDA-approved economic development district organizations, and Indian Tribes to establish RLFs. EDA's RLF recipient, in turn, disburses

money from the RLF to make loans at interest rates that are at or below market rate to small businesses or to businesses that cannot otherwise borrow capital. As the loans are repaid, the grantee uses a portion of interest earned to pay administrative expenses and adds remaining principal and interest repayments to the RLF's capital base to make new loans. A well-managed RLF award actively makes loans to eligible businesses and entities, continues to revolve funds, and does not have a termination date.

Response

A flooding situation can be a busy and chaotic time for business personnel. There are many things that need to be done and many people that need to be coordinated with from outside the organization. As businesses and individuals deal with all of this, it is important to be aware of a few key factors that can help facilitate financial assistance and successful recovery in the long term:

- It is vital that businesses and individuals report their damages. As emergency management is assessing the damage and then asking for federal assistance, knowing the extent of the damage not only to public infrastructure but to private property is critical in determining the type/amount of assistance an area might get. Even if losses seem minor compared to others, it should be reported. This includes taking lots of photos and not discarding any damaged items to the extent possible.
- In the event of a Presidential Disaster Declaration, Federal dollars are made available to assist with public infrastructure replacement and repair. If the damage threshold is high enough for private losses (why reporting is important), there may be assistance for residents that suffered losses. This doesn't happen very often as the threshold for total losses is pretty high to qualify for individual assistance. Community Development block Grant Assistance via the WI Department of Administration (https://doa.wi.gov/Pages/LocalGovtsGrants/Community-Development-Block-Grant-Emergency-Assistance-Program-.aspx) may also be available to individuals that meet low-to-moderate income thresholds of that program.
- Businesses, however, do not qualify for this FEMA Assistance. Instead, with a Presidential Disaster Declaration, Small Business Administration Disaster Recovery Loans (https://disasterloan.sba.gov/ela/Information/Index) will be available to businesses and homeowners.

Additional resources may become available from state and federal sources as a situation unfolds. Taking steps to document impacts of the flooding can speed access to new assistance as it becomes available.

Recovery Through Business Continuity Plans

Before a flood occurs, businesses should be well informed of their community's Mitigation Plan, including specifics such as the rescue response time of their area or where the emergency evacuation routes are located. Additionally, all businesses should have a ***Business Continuity Plan*** in place, and everyone affiliated with the company should be aware of its content. Such a Business Continuity Plan includes all the business continuity arrangements in place to get the company back on its feet after being impacted by a flood. Additionally, the business should have strategies and measurements in place to cope with the risk of losing customers, assets, etc.

The Business Continuity Plan should intersect with the company's management policies and practices to enforce the effectiveness of the plan. Currently, many companies don't have such a plan, so providing a standardized document to provide guidance, irrespective of the size of the organization, needs to occur. When a standardized reference is available, smaller organizations will begin to feel the pressure from major clients to adopt and comply with it.

Business Continuity Plans can help local businesses such as The Rock in Juneau County conduct business during and after a flooding event.
Image source: Rocky Gilner

For many Small and Medium sized Enterprises (SMEs), having a reliable business continuity plan is seen as a luxury that only larger organizations can afford. Smaller companies are the engine of the American economy and have as much right to survive and prosper as their larger counterparts. Paradoxically though, the impact of a disaster is proportionally far greater for a smaller firm than would be the case in a larger organization, as they don't have the number of support staff and redundant infrastructure that can mitigate the impact.

Ideally, a flooded business would immediately implement its business disaster recovery plan. Such a plan should describe all the steps necessary to get the business up and running again and might contain an outline of the businesses support network. This might include the relocation of the business if the current location is too damaged or will take too much time to restore.

Plan, Do, Check, Act Plan Concept

The "Plan, Do, Check, Act" slogan is a formalized program for carrying out business continuity effectively. As written above, an effective Business Continuity Plan requires that a business develop, implement, maintain and improve a

business continuity management system. This short concept helps those involved better understand their responsibilities and how their individual parts contribute to the whole outcome.

Plan includes the establishment of business continuity policy, objectives, targets, controls, processes and procedures. **Do** involves the implementation of the plan – making the necessary connections, establishing the appropriate response and processes. The **Check** step includes monitoring and reviewing the performance against the objectives and policy. **Act** consists of taking preventative and corrective actions to ensure continuous improvement.

It is also important that a business assure itself that its key suppliers and/or outsourced agencies have an effective business continuity plan in place. In this way, the potential effect from a negative economic downturn caused by a disaster will be minimized.

Image source: FEMA

Wisconsin Example of a Business Continuity Plan

Plans guide preparedness activities. They provide a common framework by establishing the desired end state, and the tasks and capabilities required to accomplish it. Pre-disaster planning is an important part of a specific business to be able to continue their practices (both in the short as well as the long term) after a flood or other disaster hit. Such pre-disaster planning needs to be an orderly, analytical, problem-solving process, including plan initiation, analysis of objectives, development and comparison of ways to achieve the objectives, and selection of the best solution.

Emergency planning addresses all hazards. The causes of emergencies can vary greatly, buy many of the effects do not. This means planners can address emergency functions common to all hazards in the basic plan instead of having unique plans for every type of hazard.

Adequate planning must involve all partners. The most realistic and complete plans are prepared by a team of representatives of the government agencies, private sector and nongovernmental organizations (partners) that execute the plan.

Below is the website link to an example template of a Business Continuity Plan for any size business, created by the Local Emergency Planning Committee (LEPC) of Brown County in North Eastern Wisconsin:
www.co.brown.wi.us/i/f/emergency_management/BCLEPC%20Planning%20Template.pdf

Chapter Six

Recommendations

It has taken a number of years for the existing flooding situation within Adams and Juneau counties to have come about. The problems inherent today will not be resolved quickly…there is no quick "fix"! Yet, there are a number of things that both Adams County and Juneau County can do that will enable them to address identified concerns that can be mutually beneficial to County operations, present and future residents, and businesses. The preceding chapters of this report have portrayed, analyzed, and discussed flooding issues, generally and specifically, throughout the Planning Area. A review of those issues suggests a number of actions that need to be undertaken by both counties in order to forestall these situations from becoming worse and begin to provide for long-term resolution of flooding problems in the future.

By analyzing the impact of flooding on the economic sector in the Adams-Juneau Planning Area, NCWRPC has gained a better understanding of the vulnerability to businesses due to flooding. It is unclear whether the affected businesses in this region have continuity plans in place, but their importance should be stressed. Chapter Four exhibited that in terms of type of business; small businesses were the overwhelming majority of organizations affected. Small businesses are the engine driving local economies, thus policy needs to be suited primarily to their needs. Especially, since such businesses often don't have adequate resources to recover.

The coordinated use of a full range of strategies is essential to achieving a significant reduction in flood losses. The following are a combination of non-structural and structural recommendations for both Adams County and Juneau County to consider for their long range stormwater management and flood damage reduction.

An aerial view of flooding near the Adams County – Juneau County border.
Image source: Rocky Gilner

Flooding along the Wisconsin River during Spring 2018.
Image source: Rocky Gilner

Flood Resiliency Strategies

Flooding will occur across the counties to varying degrees. During past events, emergency management, law enforcement, community and business leaders, and economic development professionals have worked together to assist impacted infrastructure, businesses, and residents.

The flooding model has identified areas of concern and damage to property. Working cooperatively amongst all parties is necessary for future actions to occur. The All Hazards Mitigation Plans for Adams and Juneau counties, supported by this flooding model, will guide actions by local, county, and state officials to make the necessary improvements to minimize flood potentials.

Without future action, increased financial costs will be incurred that will have economic impacts detrimental to the economy of Adams and Juneau counties. An initial set of strategies was identified as part of this study. Each strategy was categorized as follows:

- **Data and Analysis:** **Relevant and current data is critical for understanding how to mitigate flood impacts.**
- **Education:** **These measures involve raising awareness of hazard issues and preparing for a hazard before it occurs.**
- **Engineering:** **These measures involve the construction and maintenance of structures to confine, detain or divert floodwaters or to strengthen construction against flood impacts.**

- **Alert and warning:** **These measures involve forecasting and warning systems that are critical in taking action to safeguard lives and property.**

- **Administration and operation:** **These measures involve managing and operating program activities from interdepartmental response to NFIP.**

- **Planning and regulation:** **Land-use planning, zoning and other governmental regulations serve to steer development away from hazard-prone areas or place special conditions on development in high-risk areas.**

Table 39 lists all of the flood resiliency strategies recommended by this plan. Strategies are ordered by their strategy category, starting with the Data and Analysis category. All 29 strategies are discussed following Table 39.

Table 39: Flood Resiliency Strategies	
Strategy #	**Strategy**
Data and Analysis	
1	Adams and Juneau Counties should engage in studies to update their hydrology data.
2	Both Adams County and Juneau County should engage a comprehensive design study to complete an engineered drainage system plan for the flood prone areas identified and future stormwater management.
3	Collect and maintain more accurate flood damage data.
4	Conduct a comprehensive flood study of northern Juneau and southern Wood Counties.
5	Conduct a lake study of Lemonweir Flowage in Mauston.
Education	
6	Respective County Planning and Zoning and Emergency Government for both Counties, in conjunction with County UW-Extension, should expand floodplain management and flood hazard public awareness programs.
7	Educate and inform the public on flood hazards.
8	Educate the public on floodproofing measures.
9	Education on dam function and operation.
10	Educate businesses on various assistance programs.

Engineering	
11	In areas protected by dams and levees, both Adams and Juneau should review and update floodplain maps to more accurately reflect boundaries of areas impacted by potential structural failure.
12	Develop a County-wide culvert maintenance program for both Adams and Juneau Counties.
13	Require stormwater catch basins in areas of new development.
14	Elevate CTH N and improve the bridge near the rail crossing outside Mauston to protect alternate crossing if Highway 58 becomes impassable.
15	Continue installation of detention ponds to alleviate flooding where appropriate.
16	Elevate CTHs FF and G near Wonewoc to alleviate flooding of road and prevent cutting off access to the community.
17	Install floodwall along West Street in the Village of Wonewoc.
18	Install flood walls to protect the waste water treatment plant and electric utility plant in the City of Elroy.
19	Address Friendship Dam maintenance.
Alert and Warning	
20	Provide better warning of impending flood events.
Administration and Operation	
21	Review department responsibilities during a flood event and hold periodic training and exercises.
22	Conduct regular dam and berm inspections.
23	Annually review emergency response procedures.
24	County/City/Village continued compliance in the National Flood Insurance Program (NFIP).
Planning and Regulation	
25	Review County and local stormwater and erosion management plans.
26	Utilize Community Planning and Development Regulation to Manage Development in Flood Prone Areas.
27	Prepare and Inform Public of Evacuation Plans
28	Determine Emergency Shelter Locations and Related Services
29	Plan for Debris Cleanup and Removal

Strategy 1: Adams and Juneau Counties should engage in studies to update their hydrology data.

Existing hydrologic data for the counties is insufficient or out of date, despite the recent FIRM update. Updated hydrology data would provide the counties with detailed background information needed to better define surface water drainage networks and address surface water runoff problems. This would assist the counties in several areas including stormwater management, water quality, dam failure analysis, and amendment/revisions to County Flood Insurance Rate Maps (FIRM).

The United States Geological Survey (USGS) and the Wisconsin Geologic and Natural History Survey (WGNS) cooperate to prepare water resources reports and other hydrologic research on a cost-share basis with local units of government. The U.S. Army Corps of Engineers and the NRCS are other agencies which may conduct studies or be a potential funding source for such a project. FEMA would need to be involved if revisions to the FIRM are proposed.

Strategy 2: Both Adams and Juneau County should engage a comprehensive design study to complete an engineered drainage system plan for the flood prone areas identified, as well as future stormwater management.

This will require aerial topo-mapping, which both counties are scheduled to update in 2020. Selective, site specific topo-mapping of project areas may be sufficient to at least address existing flooding problems. Additional field gathered information would be required. Additionally, the recommended hydrology study could provide useful data for use in the design study.

Strategy 3: Collect and maintain more accurate flood damage data.

Both Adams and Juneau County Emergency Management should continue to collect the various hazard data and damage reports from other departments and municipalities for review and analysis, including photos of local flood events. Hazard areas mapped through this study should be distributed to departments and municipalities with the assistance of the GIS officer for each county.

Lead agencies will be Adams County Emergency Management and Juneau County Emergency Management in coordination with the County Land Information Departments. Participating jurisdictions will include: Adams County, Juneau County, and all municipalities within the Planning Area.

Strategy 4: Conduct a comprehensive flood study of northern Juneau and southern Wood Counties.

A severely flooded ditch located in Armenia.
Image Source: NCWRPC

The northern part of Juneau County and southern part of Wood County annually have a flooding issue every spring as a result of rain events and snow melt coming down from northern Wisconsin. The flooding appears to be worsening over time. This affects both the Yellow and Wisconsin Rivers. The situation is complicated by the dam on the Yellow River and tow tributaries: Cranberry Creek and Hemlock Creek flowing into the Yellow River. Both areas are part of a large drainage/watershed district and flood plain including a federal wildlife refuge, that are affected by silt, downed trees and other debris in the river. Both Cranberry and Hemlock Creeks are affected by water released by the many cranberry growers in the area. There are a number of other potentially contributing factors: increased agricultural use, timber harvesting, road infrastructure changes, defunct drainage districts. The fall of 2016 flooding has affected residents of 10 to 15 municipalities.

The Juneau County Board of Supervisors and area municipalities are calling for a comprehensive study of the flood plain, which will identify these areas and others that can be addressed to alleviate the increasing flooding problem in northern Juneau and southern Wood Counties. Assistance has been requested from the US Army Corps of Engineers.

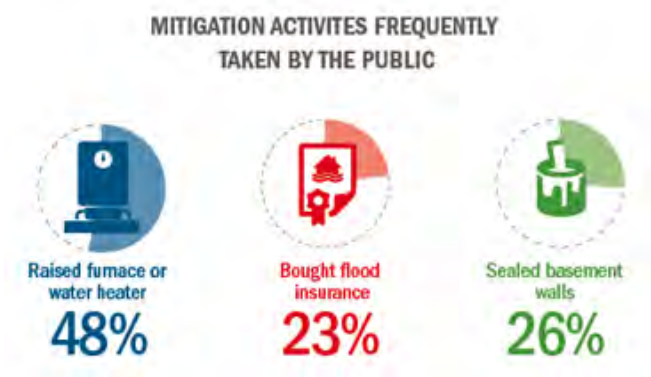
Strategy 5: Conduct a lake study of the Lemonweir Flowage in Mauston.

A lake study of the Lemonweir Flowage adjacent to the City should be conducted to evaluate its influence of on-going flooding issues within the City to determine the feasibility of dredging to clear the channel for increased flood water carrying capacity.

Strategy 6: Respective County Planning and Zoning and Emergency Government for Adams County and Juneau County, in conjunction with County UW-Extension, should expand floodplain management and flood hazard public awareness programs.

Most of the damage suffered in a flood adversely affects private property owners. Typical flood "events" in these counties result in stormwater accumulating in low lying areas and flooding basements. Many of these areas are not identified on floodplain maps because they are not subject to riverine flooding, instead the effects are a result of the high groundwater and soil moisture discussed earlier in this report.

Homeowners often do not realize that their National Flood Insurance Program (NFIP) policies did not cover basement flooding. Coverage is often available only for those with basement sewer backup rider on their homeowners' policies. Homeowners need to be reminded before disaster strikes that NFIP covers damage to basement contents "only if water is lapping at the sides of the building." The causes of basement collapse and how it may be avoided should also be included.



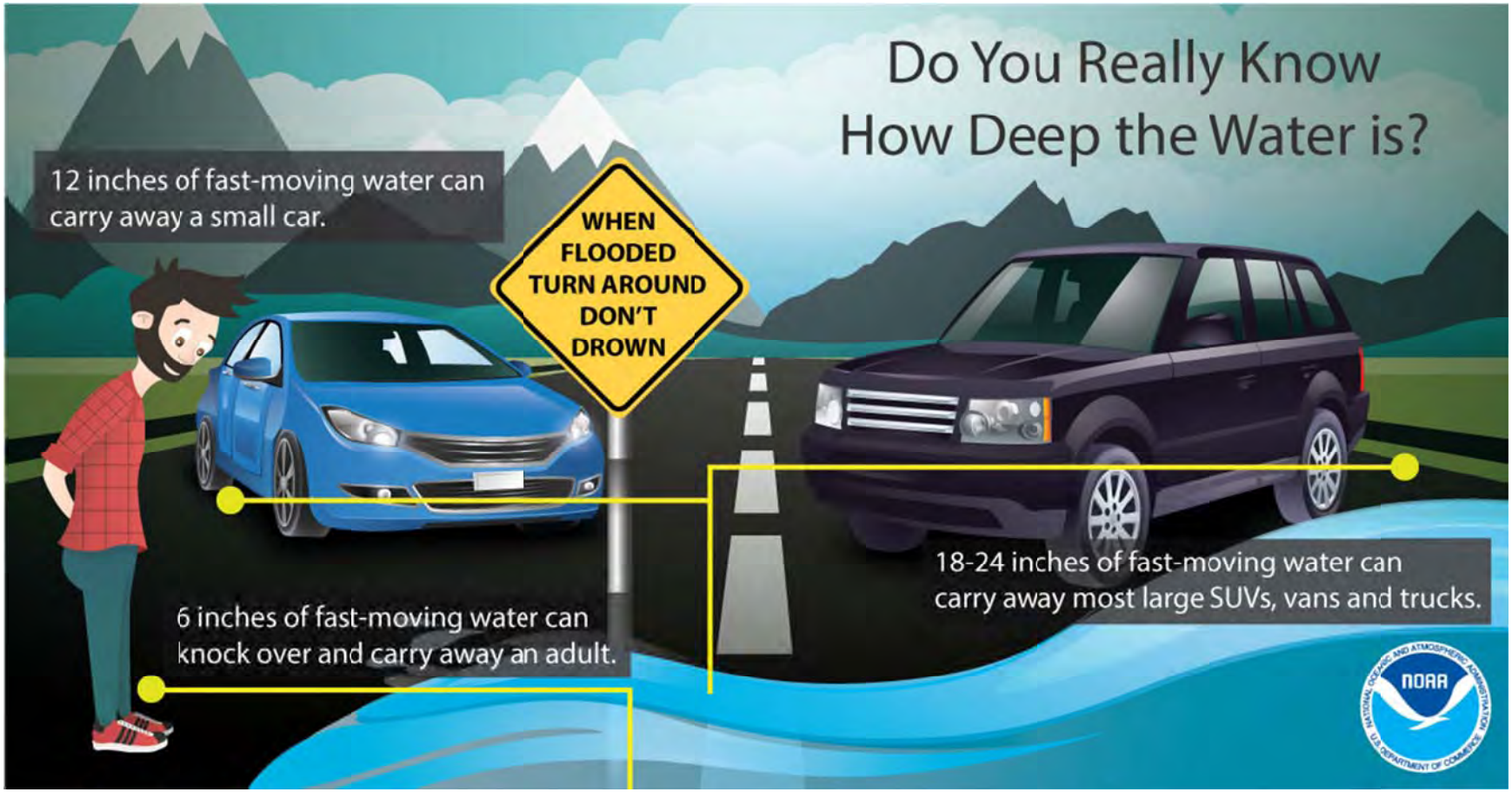
From 2010-2013, FEMA conducted a survey to determine common flood mitigation strategies frequently used by the general population.
Image source: FEMA

An ongoing public information program must advise the public and public officials of the potential for all types of flooding, and what preventative measures they can take to mitigate its effect. Materials such as posters, handbooks, and brochures, coupled with informational workshops, articles in local newspapers, and TV or radio messages, should be effective in accomplishing this goal. Both counties should seek the cooperation of the DNR Bureau of Information and Education, WEM, and FEMA.

Strategy 7: Educate and inform the public on flood hazards.

Due to the intermittent nature of flood events many people continue to be unaware or downplay the potential danger of flood damage. Years may pass without the occurrence of a major flood event and the collective memories of the population fade as people come and go. New development in itself may not cause new flood conditions but may alter

existing drainage patterns adversely. Few people understand how flood warnings and rainfall reports that suggest the potential for a flood event relate to their own property. Juneau County Emergency Management and Adams County Emergency Management should publicize the potential for flooding on an annual basis. Flyers, advertisements and Public Service Announcements should be developed.



Graphics such as the one above can be used to educate and inform the public of the dangers of flooding.
Image Source: National Weather Service

Strategy 8: Educate the public on flood proofing measures

Public awareness of flood proofing measures available is low. Some flood damage is preventable. Much of the flood damage experienced by homeowners during significant flood events in the Planning Area could have been avoided with proper drain tiling, sump pumps, and landscape design. Also, only about 1% of residences in the Planning Area are likely to be covered by flood insurance. Flood insurance is only available through the National Flood Insurance Program. Homeowners are unaware that flooding is often not covered by their insurance policy.

Public education materials and maps should be produced and brought together from Adams and Juneau County Emergency Management, Adams and Juneau County Land Information Service, Wisconsin Department of Natural Resources and other sources, working with municipalities, to form a "library" of flood protection resources. Property owners should be encouraged to act to reduce their vulnerability to flood damage. Perhaps a mitigation grant providing home and business owners at risk of flood damage a low-interest loan to reduce the potential for flood damage could be sought.

Strategy 9: Education on Dam function and operation.

Provide public education and information regarding dam function and operations in the Adams-Juneau Planning Area. Many people do not realize that the dams play a role in stabilizing flow across the overall river system, and water levels may fluctuate and change rapidly posing a potentially hazardous situation for someone caught off-guard in a dam danger zone.

Strategy 10: Educate businesses on various assistance programs.

Provide education and outreach to businesses affected by flooding to help minimize long-term economic impacts. The goal is to keep businesses operational and providing jobs for area residents. There are numerous state and federal programs that can be accessed to help businesses recover. Some of these programs are offered by FEMA and WEDC. County and municipal economic development organizations along with the NCWRPC can provide this assistance.

Strategy 11: In areas protected by dams and levees, both Adams and Juneau should review and update floodplain maps to more accurately reflect boundaries of areas impacted by potential structural failure.

The failure of the small earthen dam or levee at Greenbush Acres subdivision, which caused flooding in several homes, underscores the value of state minimum standards for floodplain development. Older levees, which do not meet the current standard requiring protection three feet above the 100-year flood, should be identified, upgraded, and all areas behind these levees mapped as floodplain. Although this incident was relatively minor, damages would have been much worse with higher flows.

All dams with a high or significant hazard rating should have a dam failure analysis performed and the hydraulic shadow, potential area flooded from dam failure, should be covered by dam failure zoning.

Strategy 12: Develop a County-wide culvert maintenance program for both Adams County and Juneau County.

It appears that inadequate culvert maintenance may be a contributing factor to on-going flooding problems in some portions of the Planning Area. Culverts are generally cleaned on an as-needed basis. Documentation is minimal and probably inadequate. The cost of documentation is negligible, but start-up costs for comprehensive culvert maintenance on a set schedule could be significant. In addition, some towns are skeptical of the need for the extra paperwork, even after the flood of 2008 required replacement of many culverts in the towns and municipalities affected by the flood. Lead agencies will be Adams County Emergency Management and Juneau County Emergency Management in coordination with each counties respective Highway Department. Participating jurisdictions will include: Adams County, Juneau County, and all municipalities within the Planning Area.

Storm catch basins are an effective way to help prevent debris and pollutants from entering a water source. Image source: Benjamin Franklin Plumbing Bay Area

Strategy 13: Require storm water catch basins in areas of new development.

Future development in the county may create problems with storm water drainage and water quality. Storm water catch basins have been shown to have significant benefit in flood control. Several municipalities in the Planning Area have been installing such basins with good results. However, development review and approval within Juneau County is disjointed among a number of diverse entities. Adams County Emergency Management and Juneau County Emergency Management should investigate how storm water catch basin requirements for new or expanding developments can be incorporated into the review and approval process. Both County Zoning and Land Information Departments should assist with this effort.

In addition, Emergency Management should encourage local municipalities to continue to install storm water catch basins where appropriate to help control storm water flooding problems, see Strategy 14. Both counties may be able to provide some assistance in this area by incorporating storm water catch basins into highway projects in areas of new or expanding development.

Strategy 14: Elevate CTH N and improve the bridge near the rail crossing outside Mauston to protect alternate crossing if Highway 58 bridge becomes impassable.

State Highway 58 is the only crossing of the Lemonweir River within the City of Mauston. If this bridge were destroyed or otherwise left unpassable due to flooding or other hazard situation, it would severely hamper emergency response within the City and is a major area of concern for the City. Although circuitous and somewhat lengthy, County Highway N provides an alternate crossing of the Lemonweir River to maintain emergency response. However, County N is also subject to flooding. Elevating the highway and improving the bridge is recommended to ensure the ability to cross the Lemonweir River as needed in an emergency situation.

A more complex alternative recommendation would be to construct a new, second crossing of the Lemonweir River somewhere along Water Street / Roosevelt Street. This would provide a faster route for emergency response, but the cost and environmental considerations with a new river crossing are daunting.

The Mauston – Attewell Detention Pond was developed in 2009.
Image source: Vierbicher

Strategy 15: Continue installation of detention ponds to alleviate flooding where appropriate.

Some communities around the Adams-Juneau Planning Area such as Elroy and Mauston have been putting in storm water detention ponds to collect storm water runoff and reduce flooding. Good results have been reported by these communities, and additional ponds are being planned.

Local municipalities should plan and install storm water catch basins where appropriate to help control storm water flooding problems, see also Action 8. Both counties may be able to provide some assistance in this area by incorporating storm water catch basins into highway projects in areas of new or expanding development.

Lead agencies will be towns and municipalities with at-risk structures, including but not limited to Adams, Elroy, Friendship, Mauston, Necedah, Union Center and Wonewoc. Participating jurisdictions will include: Adams County, Juneau County, the Cities of Adams, Elroy, Mauston & New Lisbon, the Villages of Camp Douglas, Friendship, Hustler, Lyndon Station, Necedah, Union Center & Wonewoc, and all Towns with flood-prone areas.

Strategy 16: Elevate CTHs FF and G near Wonewoc to alleviate flooding of road and prevent cutting off access to the community.

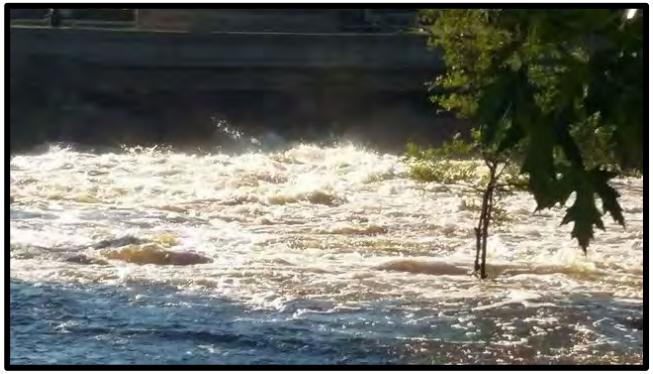
Severe flooding can cut off access to/from the Village of Wonewoc, as happened in 2008 where areas of the community were isolated for several days; hampering emergency services. Overtopping of these and other local roads is an almost annual occurrence. This is a particular concern as the Wonewoc fire and ambulance serve the surrounding town areas. The main concern on 'FF' is adjacent to the bridge on the west side of the Village, while along 'G' there are a number of low lying areas that can become over-topped.

Strategy 17: Install floodwall along West Street in the Village of Wonewoc.

Annual flooding conditions and concern over Hillsboro Dam and other storm surge coming down the Baraboo River have led to this recommendation for the installation of a floodwall along West Street to help protect West Street and the main section of the downtown including police, fire, public works and other village departments from flooding.

Strategy 18: Install flood walls to protect the waste water treatment plant and electric utility substation in the City of Elroy.

The City has had some success installing flood walls to protect public facilities located in the floodplain from flooding, such as its main electrical utility building. Other critical public facilities have been identified as located within the floodplain area such as the water treatment plant and a utility substation. Both of these facilities should be protected by construction of flood walls as well.



Unexpected high water levels led to the Friendship Dam flooding the surrounding area, leading to the temporary closing of State Highway 13.
Image Source: WTMJ-TV

Strategy 19: Address Friendship Dam Maintenance.

Address the Friendship Dam situation and develop emergency action plan. The dam is currently in need of maintenance and has no emergency action plan. Failure of this dam would threaten State Highway 13 – a major north/south highway in the area.

Strategy 20: Provide better warning of impending flood events.

This item was initially brought up by a number of communities during planning meetings for the 2018 update for the Juneau County All-Hazard Mitigation Plan. The Friendship Dam flood-event in 2017 also led to this action item, as there was little warning for that flood. However, the Adams-Juneau Planning Area does not regularly experience rising waters that can be precisely gauged in order to provide adequate warning of an impending flood event. Most flooding within the Planning

Area is caused by runoff. Heavy rains in a short period of time will cause flash flooding. Both Adams and Juneau County rely on The National Weather Service, Wisconsin Emergency Management, and local weather spotters to determine the likelihood of flooding. Areas that typically flood are sometimes isolated to only a few properties within an area. Broad flood warnings are not often alarming to residents that may be affected.

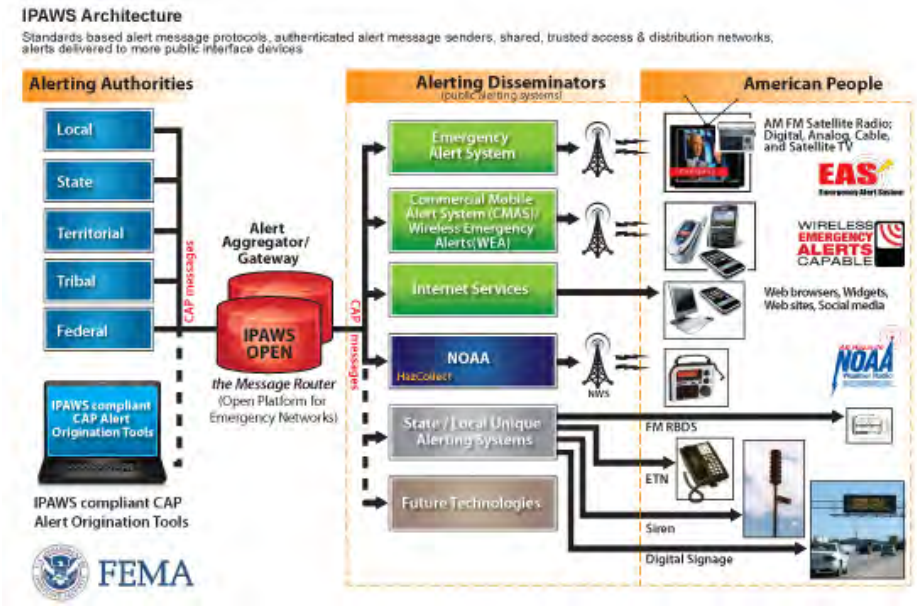


Image Source: FEMA

This recommendation involved continued evaluation and development by Juneau County Emergency Management and Adams County Emergency Management, working with area municipalities, to improve the dissemination of warnings with better means of delivering the message, as well as work to improve the forecast of which areas in the Planning Area are likely to be impacted by a flood event. Part of this effort could include implementing the following:

- Expand the ability to warn people by providing NOAA weather radios to the public at cost. Both Adams and Juneau have initiated a radio distribution program. Initial funding for this project was through a grant from FEMA, and additional grant funding would be needed to continue/expand the program.
- Improve the interoperability of two-way communications within county municipalities. This is an on-going effort.

Strategy 21: Review department responsibilities during a flood event and hold periodic training and exercises.

Departments that have emergency duties need to understand their roles and responsibilities during flood events and other emergencies. Departments may be unprepared if they have not developed and regularly reviewed their emergency action plans. Specifically, they may be inadequately prepared to respond to a flood event.

An annual review of department roles and responsibilities during flood events should be conducted as a part of both the Adams County Emergency Action Plan and the Juneau County Emergency Action Plan, see also Strategy 22. Both Adams and Juneau County Emergency Management will encourage and assist in the implementation of tabletop exercises with various county departments and municipal agencies that have flood response responsibilities.

Dams like the New Lisbon Dam pictured above should be inspected every two years.
Image source: Wisconsin River Trips

Strategy 22: Conduct regular dam and berm inspections.

The Adams-Juneau Planning Area has a number of earthen berms that are used to channel or detain water. These berms are generally quite sound and require little maintenance. They only come under load when the basins they surround are full. Visual inspections are performed but are not fully documented to lessen the liability in the event of a berm failure. A notable exception to this is the inspection program of Wisconsin River Power Company, and their inspection program of the earthen structures adjacent to the two hydroelectric dams on the Wisconsin River.

For example, the 2017 flooding in the Village of Friendship was a result of the Friendship Dam reaching water levels and pressure that were too high which raised concerns whether the dam would be able to stay intact. As a result, the dam was opened to release water from Friendship Lake, which caused flooding downstream of the dam, including at Friendship Park, several roads, and at several residences.

Both Adams and Juneau County Emergency Management should solicit the Wisconsin Department of Natural Resources to begin a regular cycle of berm inspections. Berms should be identified, cataloged and inspected on a two-year cycle. Inspections should also be conducted to any significant flood event for damage. A documentation system should be developed to track inspections.

Strategy 23: Annually review emergency response procedures.

The Adams and Juneau County Sheriff's Departments are the lead response agency during a flood event in their respective County. Each Department has an adequate plan of response to respond to the event, but not all of the officers have had experience or training in responding to a flood event. In addition, the Sheriff's Department emergency response plan includes and a means of coordinating their efforts with other departments and agencies in dealing with a flood event, but training and exercising of these response plans is irregular. This may lead to a lag in response to a flood event. Each Sheriff's Department should review emergency response plans on an annual basis with their road officers and include this review as a part of their annual training.

In addition, both Adams and Juneau County Emergency Management may want to work with other County departments having a role in flood response as well as local municipalities on training and exercising their response and coordinating with the Sheriff's response plan. Some municipalities may need to establish written response procedures and responsibilities, or update existing.

Lead agencies will be Adams County Emergency Management and Juneau County Emergency Management in coordination with the Sheriff's Department in both counties. Participating jurisdictions will include: Adams County, Juneau County, the Cities of Adams, Elroy, Mauston & New Lisbon, the Villages of Camp Douglas, Friendship, Hustler, Lyndon Station, Necedah, Union Center & Wonewoc, and all Towns.

Image source: NFIP

Strategy 24: County/City/Village continued compliance in the National Flood Insurance Program (NFIP).

Communities within Adams and Juneau Counties currently participating in the National Flood Insurance Program (NFIP) should work to ensure continued compliance. Compliance primarily entails adopting and enforcing floodplain management regulations that meet minimum criteria. Adams and Juneau Counties, the Cities of Adams, Elroy, Mauston & New Lisbon, and the Villages of Camp Douglas, Friendship, Hustler, Necedah, Union Center & Wonewoc are in the program. All towns are included under the umbrella of the County through the state mandated county floodplain zoning.

The Village of Lyndon Station is not currently participating in the NFIP. Although the Village has withdrawn from the program, it should reevaluate this situation in the future. It is recommended the Village of Lyndon Station take the necessary steps to come into compliance for participation in the NFIP. By not participating in the program, residents of the Village are not eligible for flood insurance and certain types of disaster aid in the event of a flood event. To enter the program, the Village would have to adopt a compliant floodplain zoning ordinance and the floodplain boundary map from FEMA by resolution and file forms with the Wisconsin DNR. Sample documents are available.

Strategy 25: Review County and local storm water and erosion management plans.

Both the Adams County and Juneau County erosion and storm water management plans should be reviewed annually and updated as necessary to include new development or new storm water management techniques that may be developed. Local municipal ordinances should be reviewed to insure compliance with the county plans.

Strategy 26: Utilize Community Planning and Development Regulation to Manage Development in Flood Prone Areas

The main nonstructural strategy for reducing flood damage is to use of water and land resources more effectively. This goal is achieved through comprehensive planning for and management of these resources throughout a watershed area. Planning and management, as a strategy to reduce flood damage, addresses the critical need to better integrate the natural and man-made environments. This approach to flooding problems is based on the premise that, while floods cannot and should not be totally eliminated, the man-made environment can be safely developed if it respects the natural systems.

Planning and management in practice are based on compiling technical data on topography, drainage, soil composition, and other natural characteristics and analyzing it in light of the physical, social, and economic aspects of the built environment. This analysis is then used to determine appropriate locations for both the encouragement and prohibition of building. Implementation then relies on regulations such as zoning and subdivision ordinances and/or health and building codes.

Widespread flooding occurred along the Wisconsin River as a result of excessive snow-melt in 2018.
Image source: Rocky Gilner

Strategy 26.1: Comprehensive Planning

The main nonstructural strategy for reducing flood damage is to effect better use of water and land resources. This goal is achieved through comprehensive planning for and management of these resources throughout a watershed area. Planning and management, as a strategy to reduce flood damage, addresses resiliency by better integrating the natural and man-made environments. This approach to flooding problems is based on the premise that, while floods cannot and should not be totally eliminated, the man-made environment can be safely developed if it respects the natural systems.

The next step should be the formalization of resiliency concepts in the update of county and local unit comprehensive plans. The legal standing of future land-use decisions can depend on the rationale established in a plan. It is recommended that comprehensive plan updates be developed and implemented to provide a rational basis for the development of land-use policies and controls in order to provide for resilient development and address current and future flooding concerns.

The plan should include analysis of natural resources such as wetlands, floodplains, groundwater, soils, and other environmental features and the man-made influences affecting them in conjunction with a complete socio-economic profile. This analysis is then used to determine appropriate locations for both the encouragement and the prohibition of building. Implementation then relies on regulations such as zoning, land division ordinances, building codes, etc.

The counties and communities then use these plans as a guide and information resource for developers. By providing access to zoning maps and other data, communities can assist builders/developers in identifying and avoiding flood hazards. They can also refer builders to both restrictions and opportunities presented by local planning regulations.

A plan will establish development policies which will guide the community in its land-use decision making. A plan will also identify ways to use zoning and other implementation tools to reduce future flood damage and protect the economic

stability of the community. An essential characteristic of any planning program is that it be ongoing and flexible. Periodic updating of the plan is necessary for continued refinement and course correction in the planning program.

Strategy 26.2: Zoning

It is recommended that county and local zoning ordinances be adopted/updated based on this comprehensive land-use planning process. A zoning ordinance is one of the primary tools used in implementing a land-use plan. Zoning can be used to prohibit and regulate development in designated flood hazard areas.

Adams and Juneau counties both adopted floodplain and shoreland-wetland zoning which gives them regulatory authority over these areas within the counties, and wetlands in general are regulated by state and federal jurisdictions. However, it is recommended that the local units incorporate these areas into a zoning program as informational overlays and reference the appropriate jurisdiction. This will assist local developers with development decisions and can re-enforce flood damage reduction measures. Adams County also has general county zoning but Juneau does not. Cities and Villages have independent zoning. Towns are subject to county shoreland zoning but have the option to come under county general zoning or develop their own zoning programs through statutory procedures, as several towns have done.

The Baraboo River is a major source for potential flooding in Juneau County.
Image source: Wisconsin River Trips

Communities can go beyond the standard flood plain and wetland programs by zoning unregulated intermittent streams, natural drainage-ways, areas of high groundwater, and other identified problem areas as flood hazard areas.

One zoning technique useful for flood prone areas is Planned Unit Development (PUD). This method of cluster development is used predominantly for large-scale residential and/or commercial projects and requires special ordinance provisions. With PUD, part of a given site is built on at a higher density than would otherwise be permitted, thus leaving the remainder of the site as open space. In flood prone areas, the development could be clustered on the part of the site that is safe, leaving the flood prone portion free of buildings but still useable as recreation space or parking.

Strategy 26.3: Land Division Ordinance

Zoning is supplemented by land division regulations, which provide an administrative review to ensure that a project meets specified development standards. Of particular interest in flood hazard reduction is the provision of public facilities, roads (driveways/access points), and utilities in a manner that will not contribute to flooding problems. Communities should develop and adopt land division ordinances to compliment the zoning ordinances. Land division regulations can address many of the issues currently facing the community regarding flood hazard reduction.

Wisconsin law provides a subdividing law loophole. Wisconsin Statute s.236 allows local governments to exempt new lots being created that are over 1.5 acres in size from having to comply with local land division regulations. This exemption normally poses few problems; however, the exemption can act as a loophole. If lots being created are over the 1.5 acre size, the community has no opportunity to regulate them except to accept or reject the public roads being dedicated. No storm water plan gets imposed, and where roads already exist, the community gets no chance to save openings for branch roads to serve undivided parcels to the side or rear.

Land division ordinances should be developed so as to require approval of each and every division of land, regardless of size. Similarly, the land division ordinance should require for any platted lot that (engineered) drainage plans be submitted for approval along with lot and road plans. Said plans must show that the net amount of water runoff from a tract after it is developed will be no greater than before it was developed (by using retention or detention basins within the lot or subdivision), or that storm sewers and swales will be installed in accordance with an overall drainage system plan that will not flood “downstream” land owners.

Single lots that are too small to have a basin or where there is no storm sewer available should be required to make a financial contribution for their share of any future basin created or sewer installed. The community should engage an engineer to review such plans as they are submitted by developers, and a fee charged to the developer to defray the cost of the engineer.

Strategy 26.4: Building Codes

The primary purpose of building codes is to set minimum standards for controlling the design, construction, and quality of materials used in buildings and structures within a given area so that life, health, property, and public welfare are protected. Since it may not be practical to prevent building in all areas subject to flooding, building codes can be used to minimize structural and subsequent damages resulting from inundation. Proper building restrictions/codes can:

- Prevent floatation of buildings from their foundations by specifying adequate anchorage,
- Establish basement elevations and minimum floor elevations consistent with potential flood occurrences,
- Prohibit basements in those areas subject to very shallow, frequent flooding where filling and slab construction would prevent virtually all damage,
- Require building reinforcement to withstand water pressure or high velocity flow and restrict the use of materials which deteriorate rapidly in the presence of water, and
- Prohibit equipment that might be hazardous to life when submerged, including chemical storage, boilers, electrical equipment, etc.

Strategy 27: Prepare and Inform Public of Evacuation Plans

Planned evacuation routes are crucial for safety during a flood event.
Image source: Ready Ohio

Counties should work to develop disaster evacuation plans. Plans need to be in place prior to when an evacuation is necessary. In addition to the plan, counties must make sure their residents know when and where they need to evacuate. Also see Strategy #20. There are a number of methods counties can employ to spread these messages, including posts on local radio stations, social media, email and reverse 911. Reverse 911 gives counties the ability to push emergency messages out to residents by phone; counties generate call lists based on protocols (e.g. internal identification of elderly and special needs residents) and through sign up links (e.g. external self-identification by residents). The most effective means of evacuation, however, is still door-to-door visits by local personnel, typically volunteer firefighters, who can check on residents and spread the message of expected conditions.

Strategy 28: Determine Emergency Shelter Locations and Related Services

In addition to evacuation plans, there needs to be a plan for emergency shelters that provide a safe place for residents during and immediately following a disaster. Counties often partner with national relief organizations, such as the American Red Cross, United Way and the Salvation Army, to develop an emergency shelter system. These organizations also help counties to provide residents with food, supplies, health services and the development of individual recovery plans, including the identification of available recovery resources, during a disaster. Emergency shelters open on a case-by-case basis depending on need in each area of the county, usually due to mass loss of power and flood water safety concerns. It is important that each identified

emergency shelter is equipped to operate in a disaster, with operating generators, etc. Typical emergency shelter locations are community centers and schools.

Strategy 29: Plan for Debris Cleanup and Removal

Debris management plans are critical for efficient post-disaster recovery efforts. Debris is both a health and safety issue and its removal is costly and can take months to complete even with plans in place prior to the event. It is advisable to have a contract for debris removal in place before an emergency. Procuring a qualified contractor can take weeks and time is one thing counties cannot afford to lose during a disaster recovery situation.

Chapter Seven

Conclusion – How to Use This Study

While floodplain mapping is available for the area, most communities are unaware of the threat to business and commerce from a major rainfall event. Efforts to improve flood resiliency are minimal, and communities within the affected area lack a coordinated effort to facilitate flood mitigation, risk reduction, business stability and economic resiliency.

This project provides flood inundation analysis that supports mitigation activities by identifying likely impact areas and the potential economic impacts to communities, businesses and residents. The effort will be incorporated into both counties mitigation plan and serve as a point of reference to guide flood mitigation activities across the countries, which in turn, improves resiliency. This could include the relocation of businesses and/or infrastructure, retrofitting existing structures to improve storm and flood resiliency or the implementation of flood control devices.

More accurate identification of the at-risk populations, infrastructure and development allows for the support and enhancement of both County's All Hazard Mitigation Plans through the implementation of storm/flood mitigation activities including:

1. Identification of strategies to address community economic resiliency and protect economic development and infrastructure.

2. Support of economic development decisions by allowing hazards to be mitigated before new development occurs.

3. Guidance for counties and local units of government in the update of local development strategies, regulations, and long-range planning, including business recovery planning.

Development of this report involved numerous staff level meetings between the counties and the NCWRPC. The final study was presented to the full NCWRPC Board in October and to county board committees in both Adams and Juneau in December of 2018. Following these meetings, copies of the final report were distributed to county departments and appropriate board members and published to the Internet to facilitate local access and use.

HOW TO USE THIS STUDY

A three step process is recommended to guide the use of this study in reviewing a specific geographic area for potential mitigation actions:

1. Review the model output maps to determine if target area is within a flood zone or the unanticipated area susceptible to flooding identified by the modeling effort.

2. Select potential options to mitigate appropriate for the geography and conditions in question from the list of actions and strategies in this study (See Chapter Six).

    a. Communities: Cross-reference County All Hazard Mitigation Plan and coordinate with Emergency Management on projects as necessary. which can be found here:
        Adams: http://www.ncwrpc.org/adams/adamshzdplan/index.html
        Juneau: http://www.ncwrpc.org/juneau/hazard/index.html

    b. Businesses: Evaluate and select appropriate floodproofing measures (see **Appendix D**) and develop businesses continuity plan (see Chapter Five Recovery Through Business Continuity Plans).

3. Review potential funding options for implementation of actions and strategies. HMGP – Hazard Mitigation Grant Program, PDM – Pre-Disaster Mitigation grants program, and FMA – Flood Mitigation Assistance are the primary programs for these types of projects, but other sources, public and private, may be leveraged.

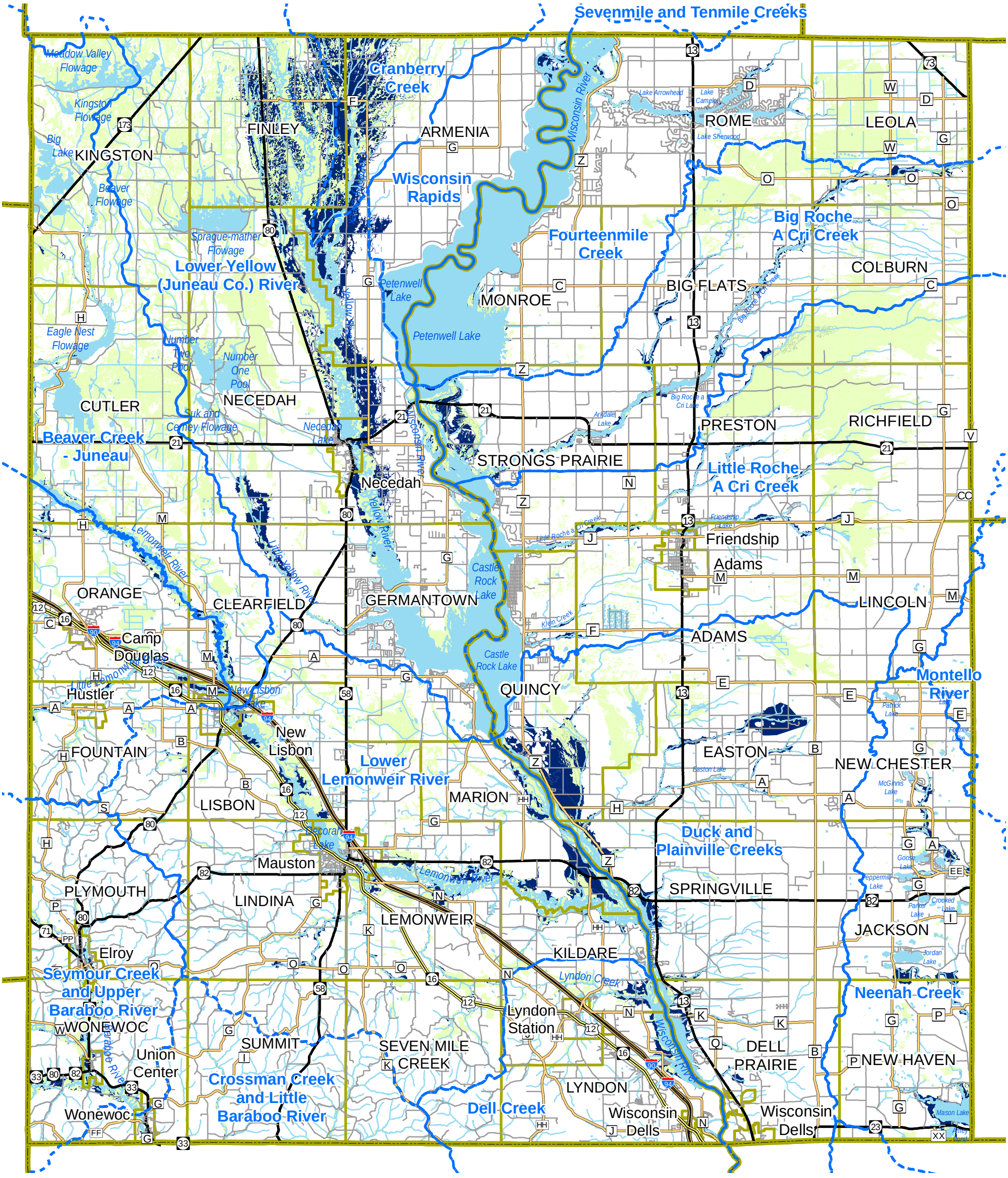
Study Maps

Hydrology

Resiliency Plan For Adams and Juneau Counties

Map 1

Project Number: 06-69-06076



3 1.5 0 3 6 Miles

Source: WI DNR, NCWRPC, FEMA, Adams & Juneau Co.

This map is neither a legally recorded map nor a survey of the actual boundary of any property depicted. This drawing is a compilation of records, information and data used for reference purposes only. NCWRPC is not responsible for any inaccuracies herein contained.

Legend

- County Border
- Minor Civil Divisions
- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate
- Watershed Boundaries
- Wetlands
- Floodplain

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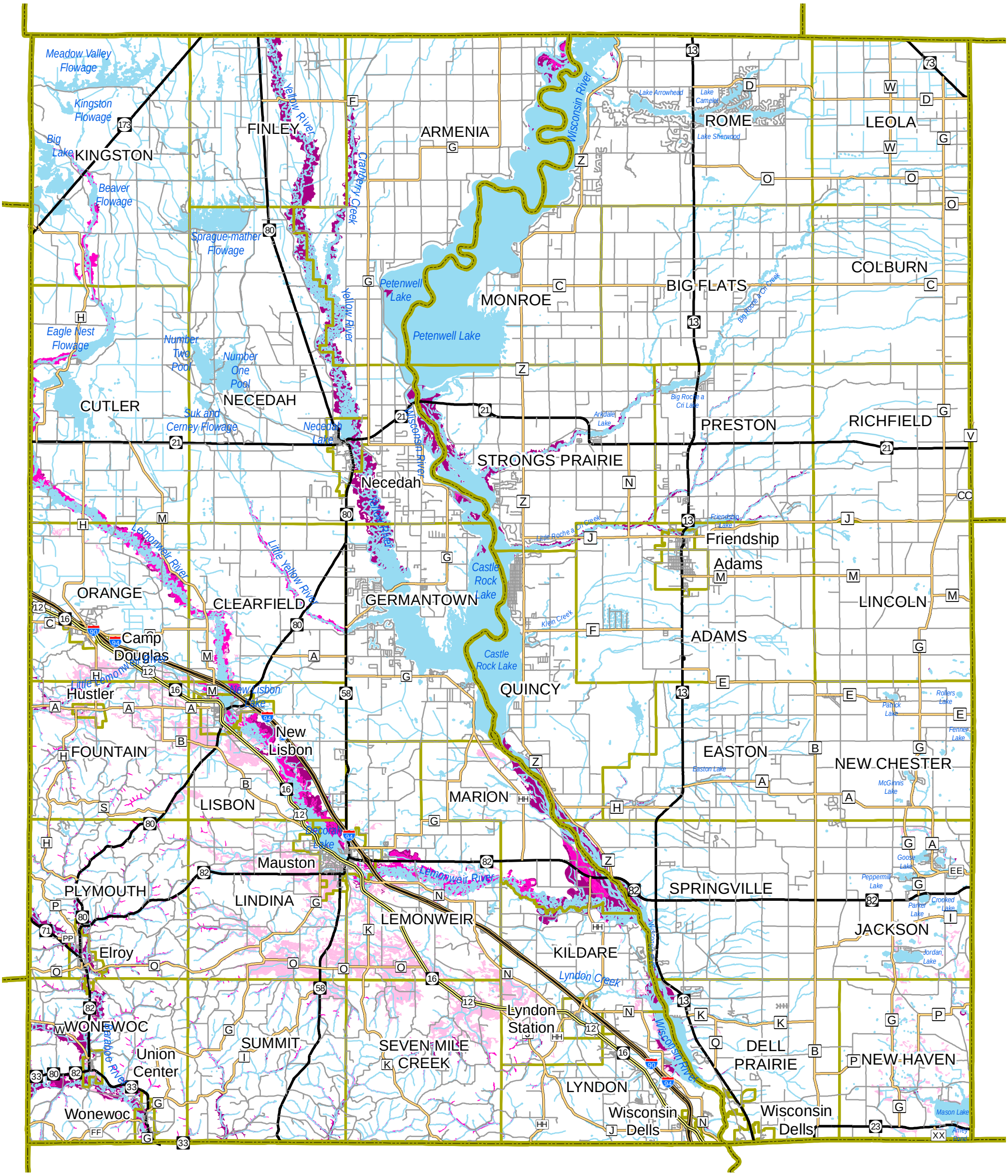

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Legend

- County Border
- Minor Civil Divisions
- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate

Soil Flooding Class

- Very frequent
- Frequent
- Occasional
- Rare

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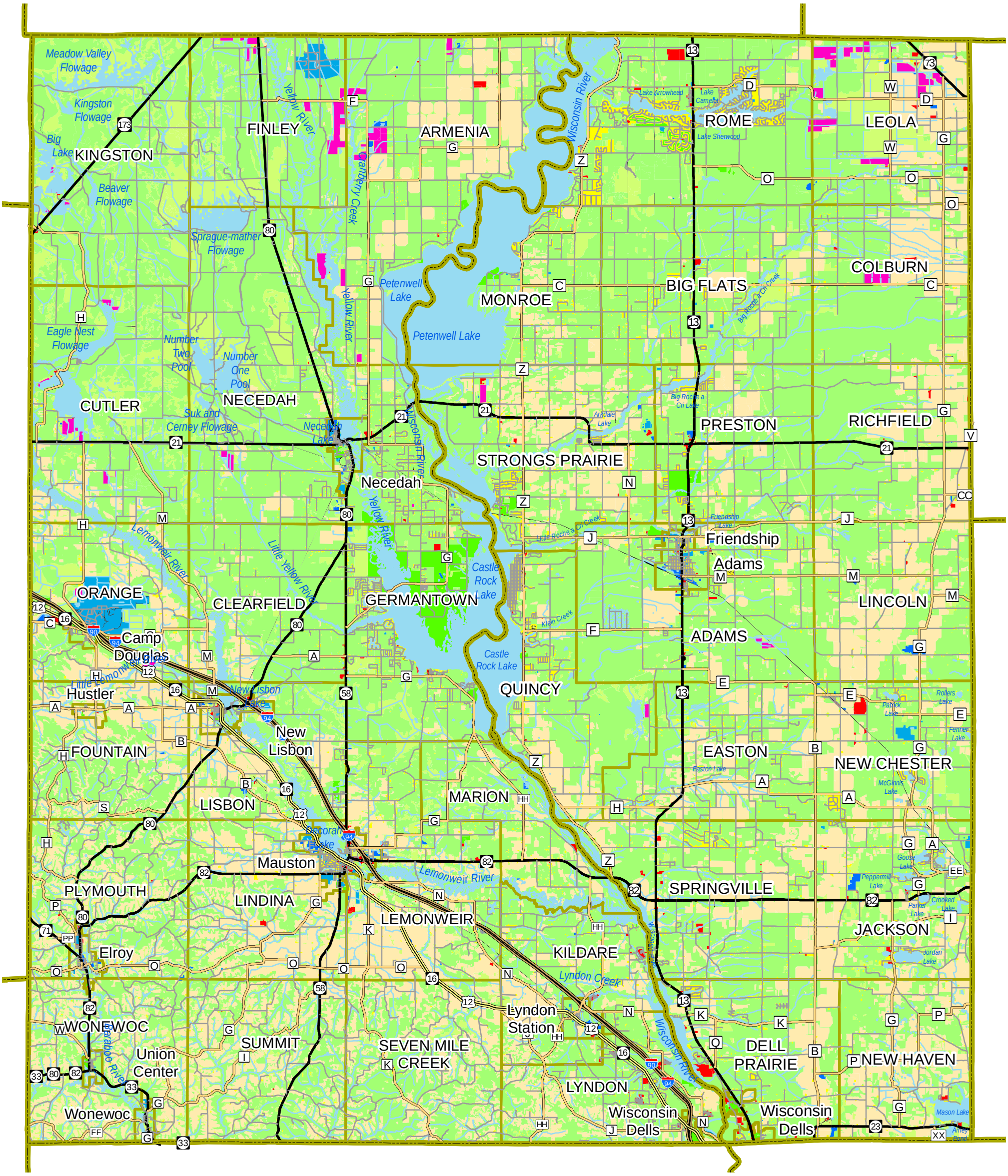
Flood Susceptible Soils Map 2

Resiliency Plan For Adams and Juneau Counties



3 1.5 0 3 6 Miles

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Legend

- County Border
- Minor Civil Divisions
- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate
- Agriculture
- Commercial
- Cranberry Bog
- Governmental
- Industrial
- Mobile Home Park
- Multi-Family
- Open Lands
- Outdoor Recreation
- Quarry
- Residential
- Transportation
- Utility
- Water
- Woodlands

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Existing Land Use

Resiliency Plan For Adams and Juneau Counties

Map 3

Modeled Flood Depth

Map 4

Resiliency Plan For Adams and Juneau Counties

Project Number: 06-69-06076

3 1.5 0 3 6 Miles

Source: WI DNR, NCWRPC, FEMA, Adams & Juneau Co.

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Legend

- County Border
- Minor Civil Divisions
- Interstate
- U.S. Highways
- State Highways
- County Highways
- Local Roads

Water Levels

- High
- Low

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Areas At Risk

Resiliency Plan For Adams and Juneau Counties

Map 5

Legend

- County Border
- Minor Civil Divisions
- Interstate
- U.S. Highways
- State Highways
- County Highways
- Local Roads
- HAZUS Model Areas
- Flood Plain Outside of Modeled Area

3 1.5 0 3 6 Miles

Source: WI DNR, NCWRPC, FEMA, Adams & Juneau Co.

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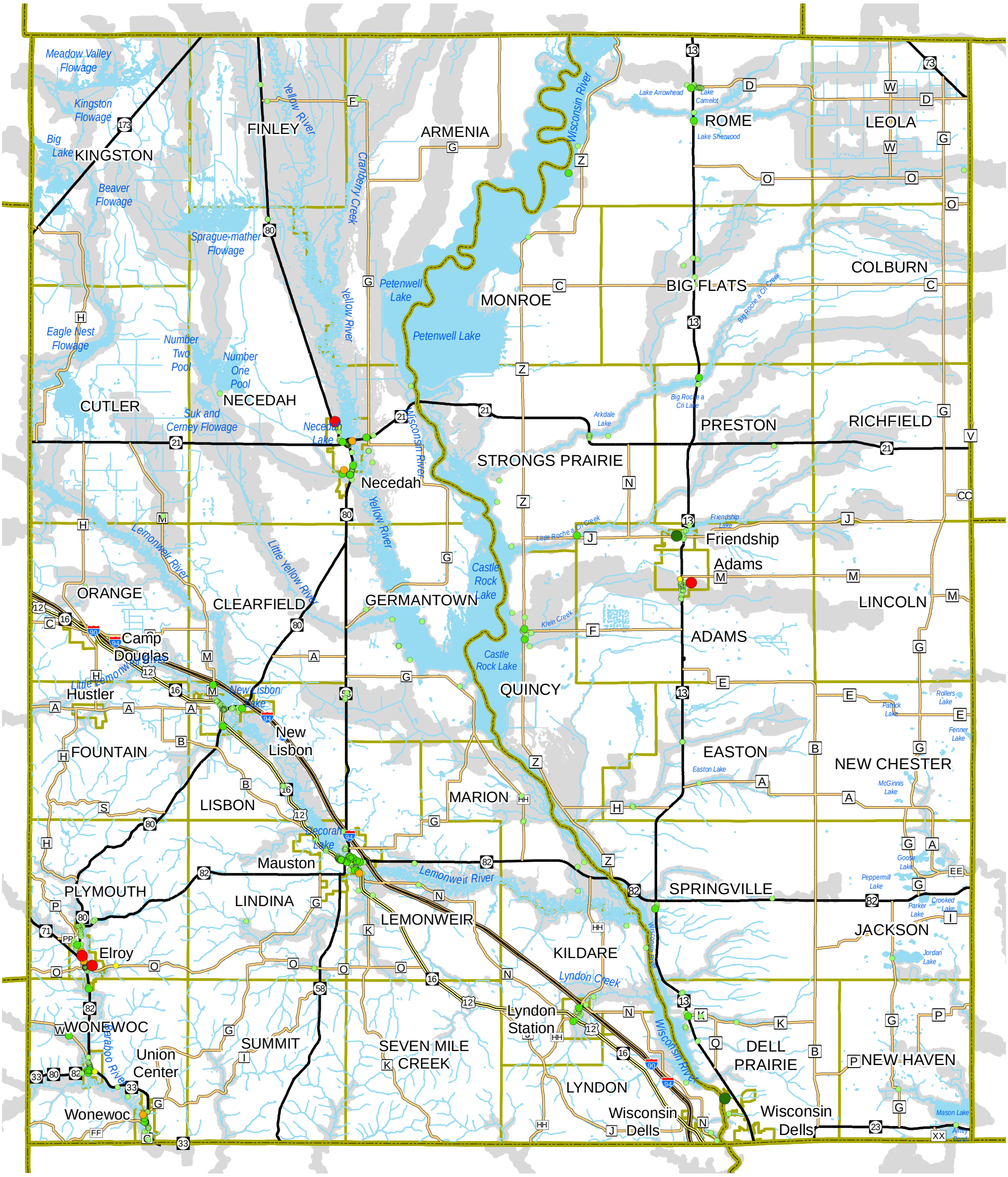

3 1.5 0 3 6 Miles

Source: WI DNR, NCWRPC, FEMA, Adams & Juneau Co.

This map is neither a legally recorded map nor a survey of the actual boundary of any property depicted. This drawing is a compilation of records, information and data used for reference purposes only. NCWRPC is not responsible for any inaccuracies herein contained.

Legend

- County Border
- Minor Civil Divisions
- U.S. Highways
- State Highways
- County Highways
- Interstate
- At Risk Zone

Business Type

- Large Manufacturing
- Medium Manufacturing
- Small Manufacturing
- Large Commercial
- Medium Commercial
- Small Commercial

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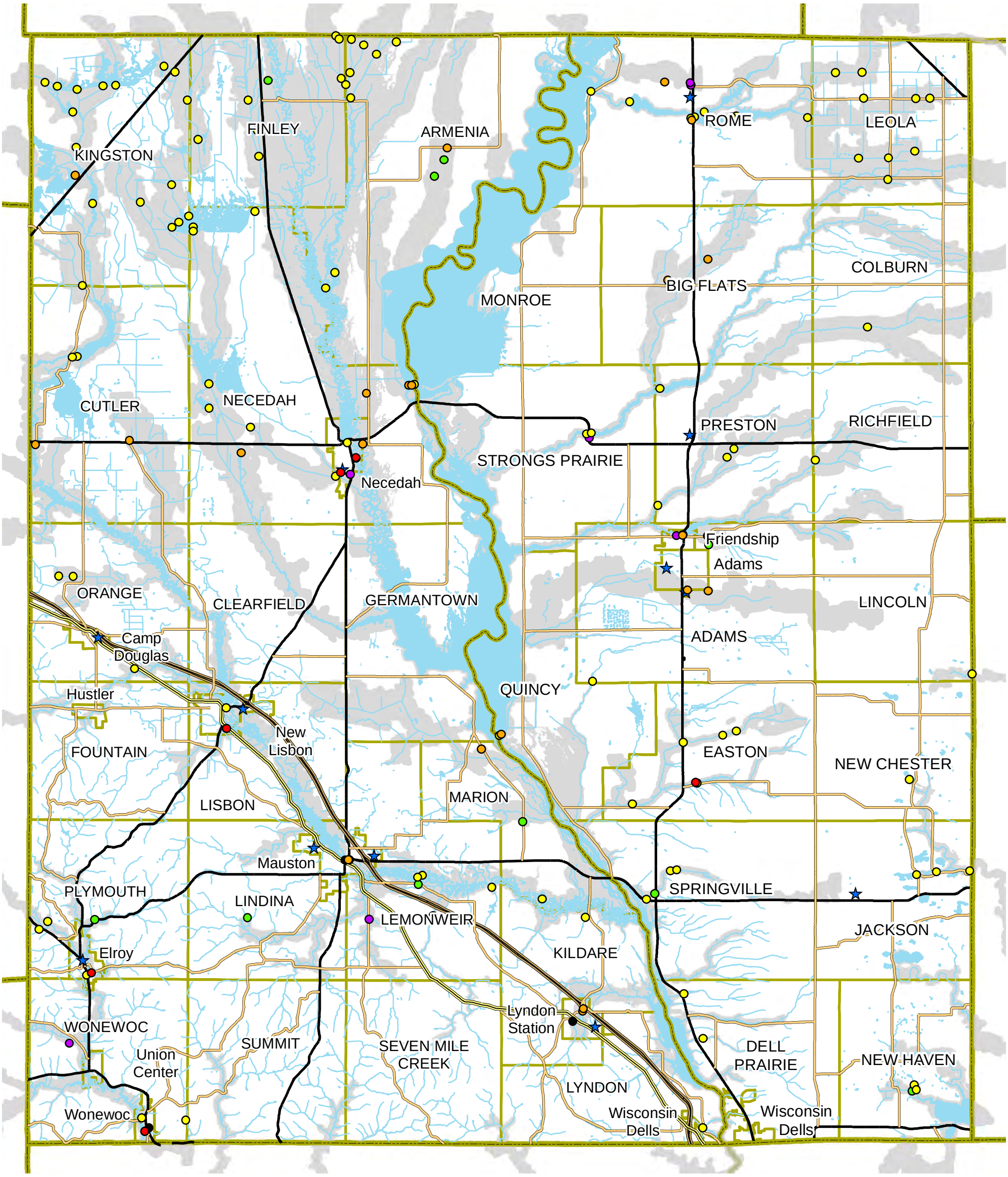
Project Number: 06-69-06076

Business Vulnerability

Map 6

Resiliency Plan For Adams and Juneau Counties



3 1.5 0 3 6 Miles

Source: WI DNR, NCWRPC, FEMA, Adams & Juneau Co.

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Legend

- County Border
- Minor Civil Divisions
- At Risk Zone
- Business/Industrial Parks

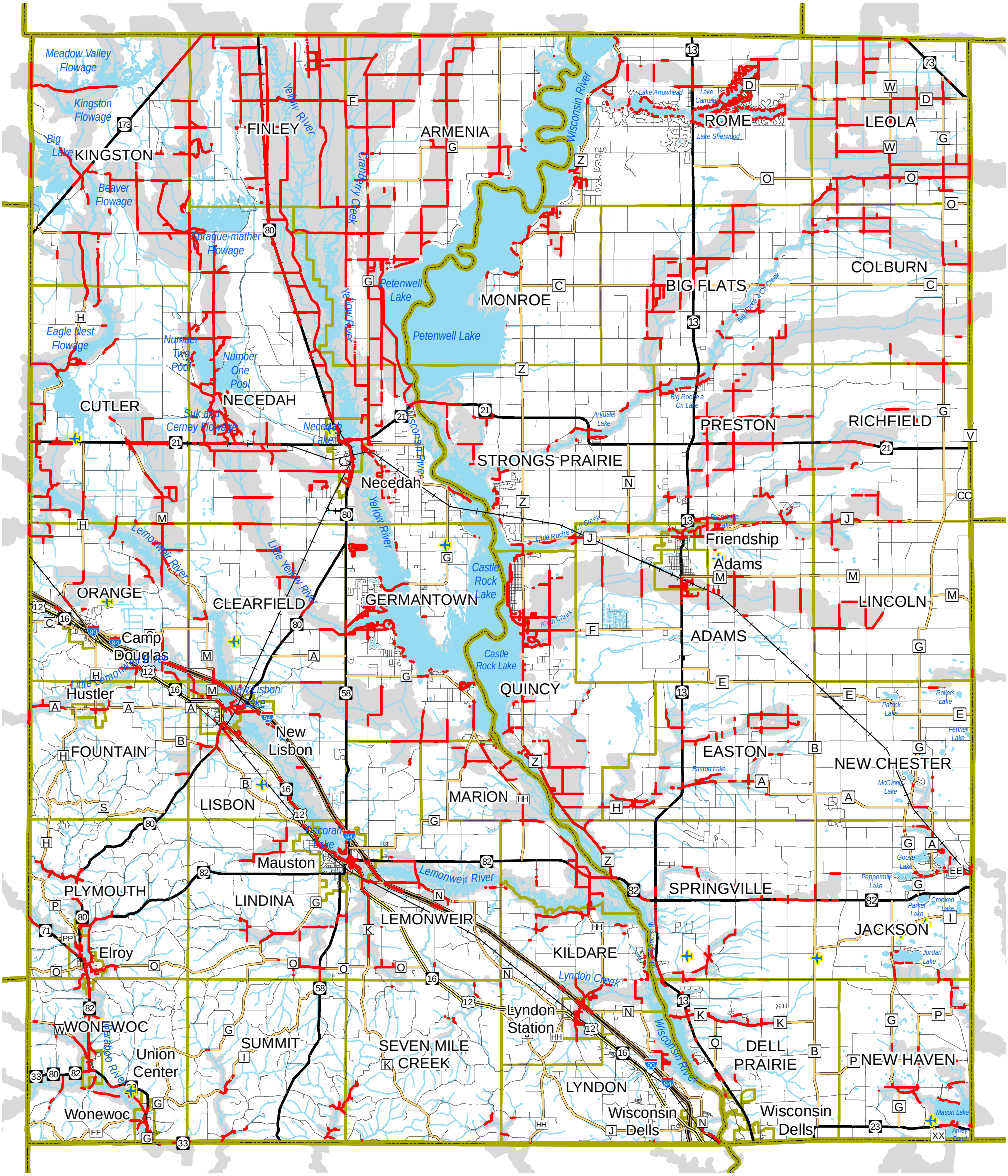
Critical Facility Type

- Emergency Services
- Municipal Services
- Dams
- Utility
- School
- Municipal Water Treatment

Impacted Critical Facilities Map 7

Resiliency Plan For Adams and Juneau Counties

Project Number: 06-69-06076



3 1.5 0 3 6 Miles

Source: WI DNR, NCWRPC, FEMA, Adams & Juneau Co.

This map is neither a legally recorded map nor a survey of the actual boundary of any property depicted. This drawing is a compilation of records, information and data used for reference purposes only. NCWRPC is not responsible for any inaccuracies herein contained.

Legend

- County Border
- Minor Civil Divisions
- Roads at Risk
- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate
- At Risk Zone
- Water

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Project Number: 06-69-06076

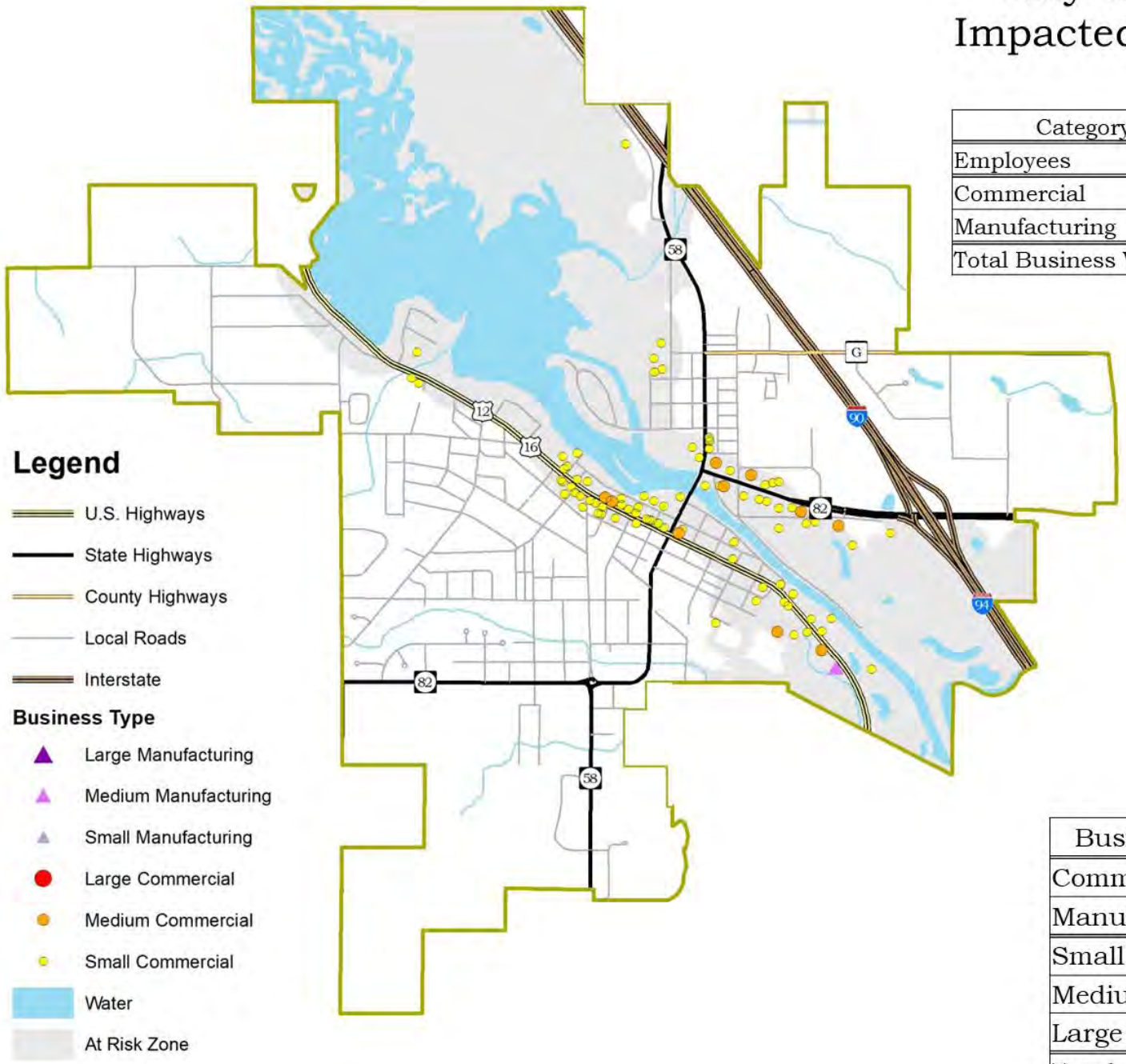
Transportation Vulnerability Map 8

Resiliency Plan For Adams and Juneau Counties

Appendix A

Impacts by Municipality

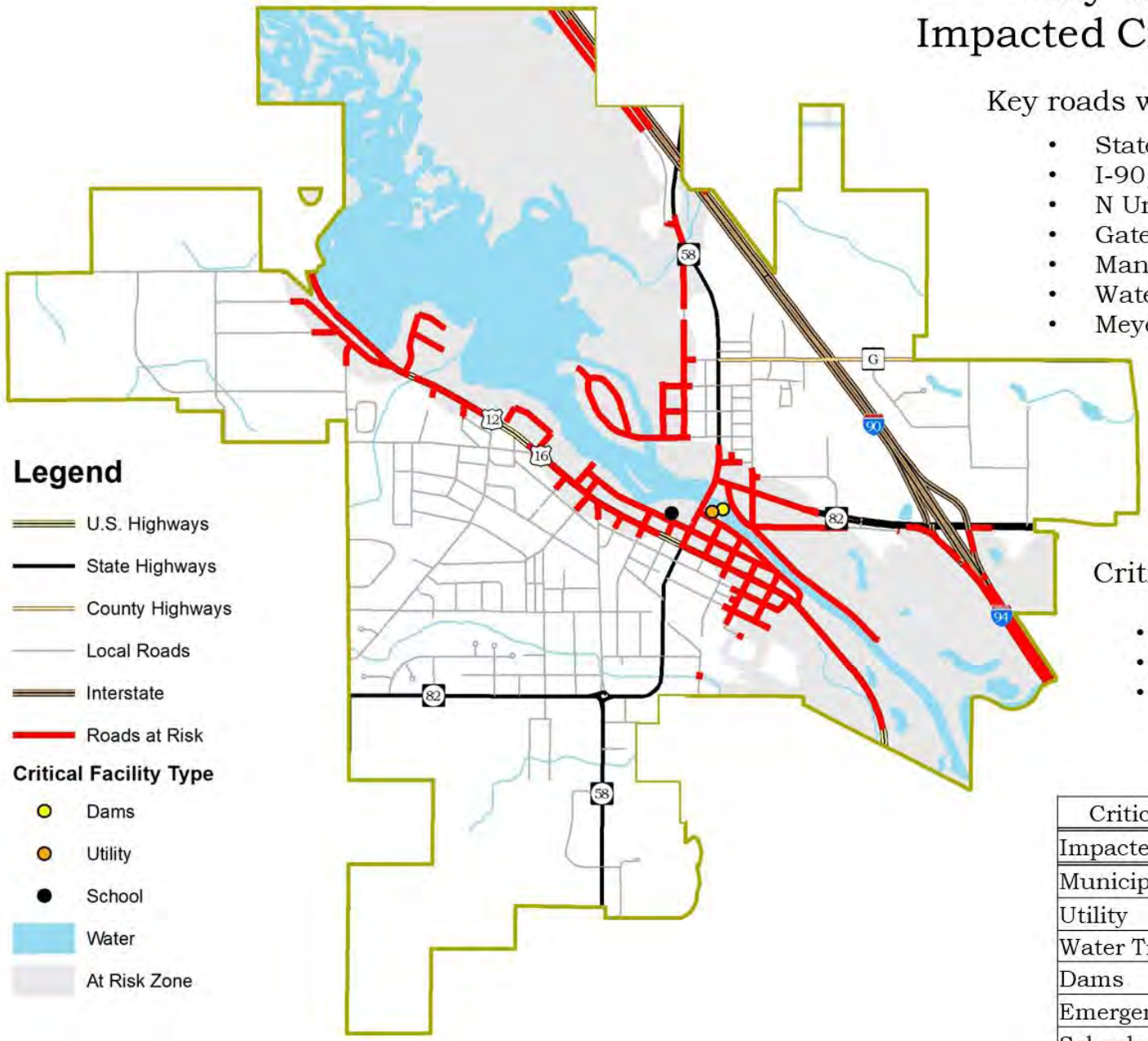
City of Mauston
Impacted Businesses



Category	Impact Value
Employees	370
Commercial	$16,828,111
Manufacturing	$207,800
Total Business Value	$17,035,911

Business Type	Quantity
Commercial	90
Manufacturing	1
Small	80
Medium	11
Large	0
Total	91

City of Mauston
Impacted Critical Facilities



Key roads with segments impacted:

- State St. (U.S. Hwy 12)
- I-90/94
- N Union St. (State Hwy 58)
- Gateway Ave. (State Hwy 82)
- Mansion St.
- Water St.
- Meyer Rd.

Critical facilities impacted:

- St. Patrick's School
- Mauston Dam
- Mauston Substation

Critical Facility Type	Quantity
Impacted Roads (miles)	16.15
Municipal Services	0
Utility	1
Water Treatment	0
Dams	1
Emergency Services	0
Schools	1
Total Facilities	3

Village of Necedah
Impacted Businesses

Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate

Business Type

- Large Manufacturing
- Medium Manufacturing
- Small Manufacturing
- Large Commercial
- Medium Commercial
- Small Commercial
- Water
- At Risk Zone

Category	Impact Value
Employees	550
Commercial	$6,099,406
Manufacturing	$3,538,600
Total Business Value	$9,638,006

Business Type	Quantity
Commercial	47
Manufacturing	4
Small	42
Medium	8
Large	1
Total	51

Village of Necedah
Impacted Critical Facilities

Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate
- Roads at Risk

Critical Facility Type

- Emergency Services
- Dams
- Utility
- Municipal Water Treatment
- Water
- At Risk Zone

Key roads with segments impacted:

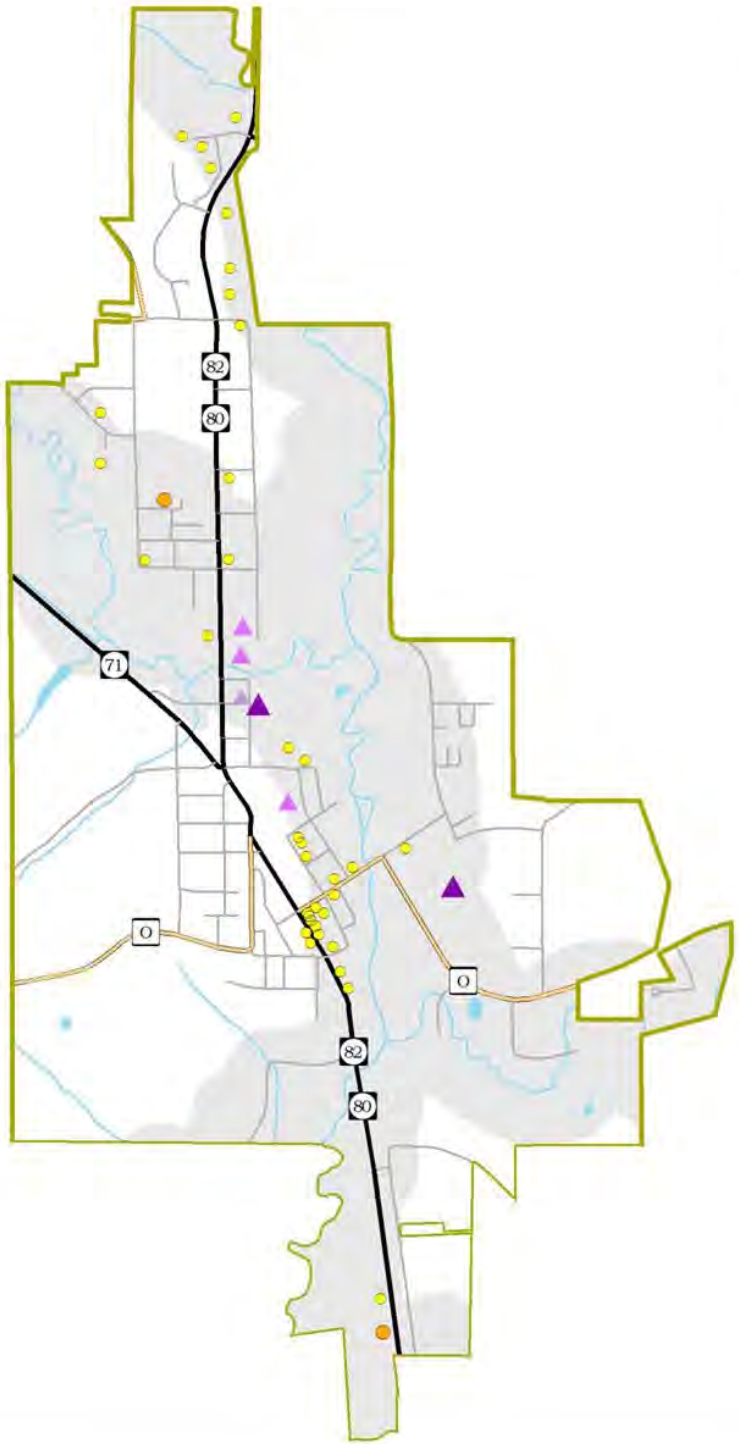
- 3rd St. (State Hwy 21)
- State Highway 80
- 14th St.
- Wheelihan Ave.
- 22nd St.
- High St.
- 2nd St. W
- N Division St.

Critical facilities impacted:

- Necedah Family Medical Center
- Necedah Dam
- Necedah Substation
- Necedah Water Tower
- Necedah Wastewater Treatment Facility

Critical Facility Type	Quantity
Impacted Roads (miles)	10.11
Municipal Services	0
Utility	1
Water Treatment	3
Dams	1
Emergency Services	1
Schools	0
Total Facilities	6

City of Elroy
Impacted Businesses



Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate

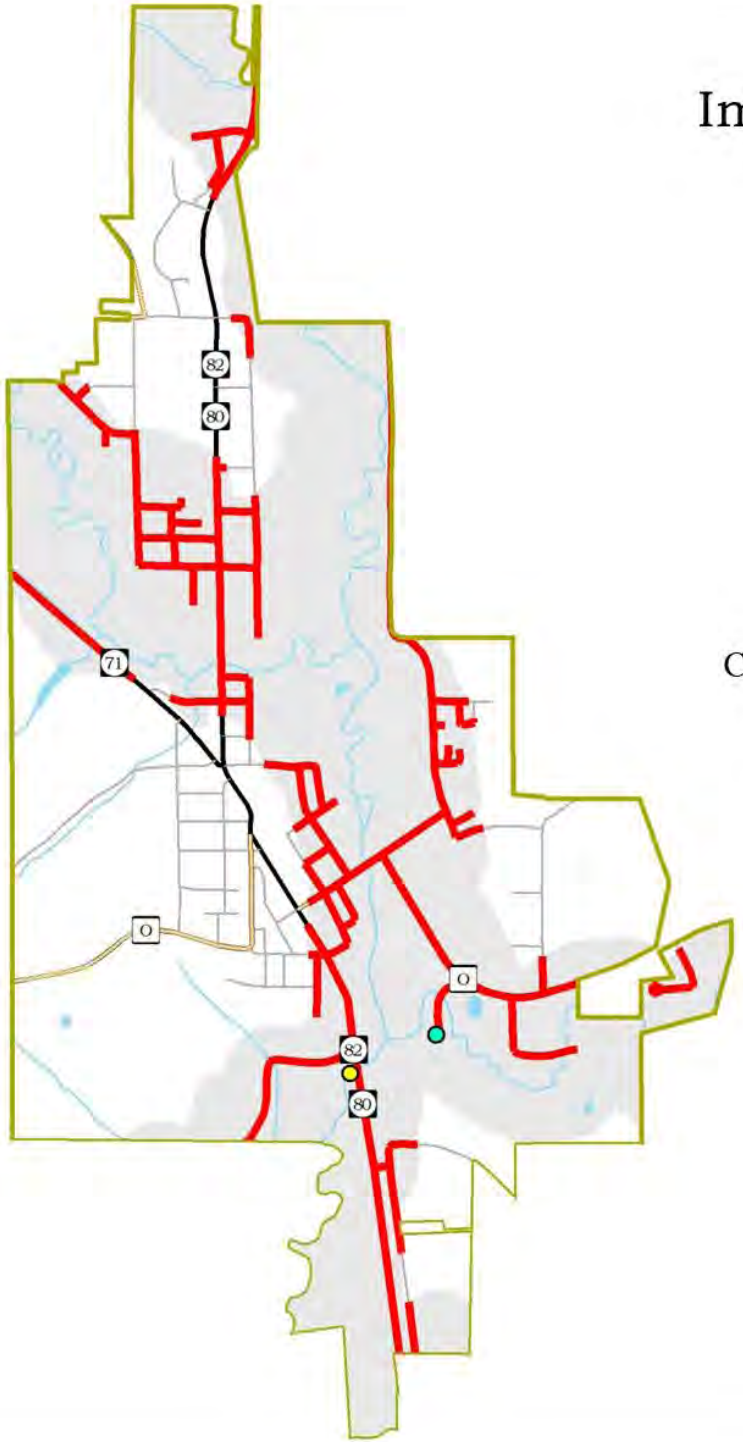
Business Type

- Large Manufacturing
- Medium Manufacturing
- Small Manufacturing
- Large Commercial
- Medium Commercial
- Small Commercial
- Water
- At Risk Zone

Category	Impact Value
Employees	796
Commercial	$3,299,209
Manufacturing	$4,675,800
Total Business Value	$7,975,009

Business Type	Quantity
Commercial	38
Manufacturing	6
Small	37
Medium	5
Large	2
Total	44

City of Elroy
Impacted Critical Facilities



Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate
- Roads at Risk

Critical Facility Type

- Dams
- Municipal Water Treatment
- Water
- At Risk Zone

Key roads with segments impacted:

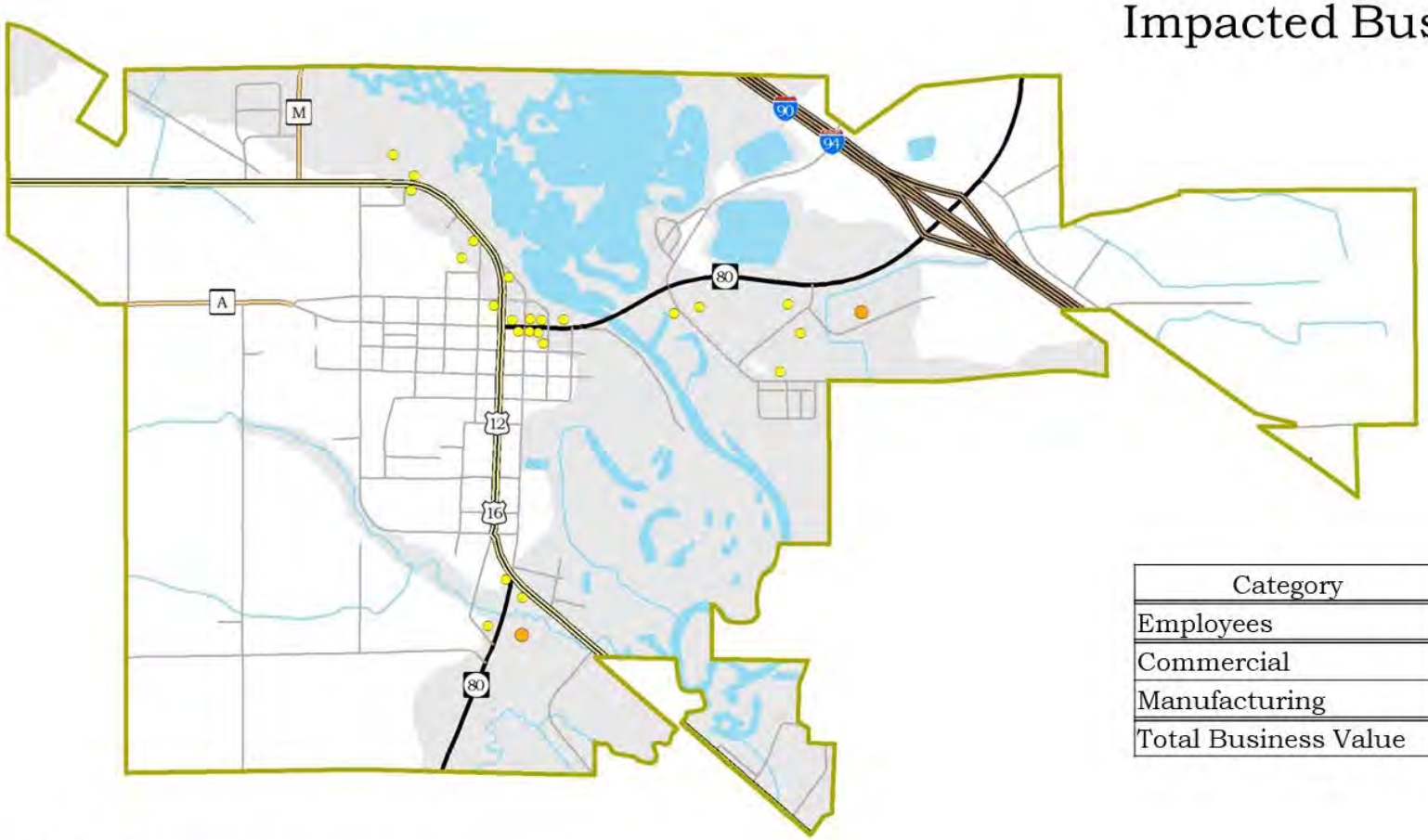
- State Highway 80/82
- State Highway 71
- Franklin St. (County Hwy O)
- Erickson St.
- 2nd Main St.
- Wisconsin St.
- Cedar St.

Critical facilities impacted:

- Elroy Dam
- Elroy Wastewater Treatment Plant

Critical Facility Type	Quantity
Impacted Roads (miles)	13.32
Municipal Services	0
Utility	0
Water Treatment	1
Dams	1
Emergency Services	0
Schools	0
Total Facilities	2

City of New Lisbon
Impacted Businesses



Category	Impact Value
Employees	97
Commercial	$3,290,804
Manufacturing	$337,900
Total Business Value	$3,628,704

Legend

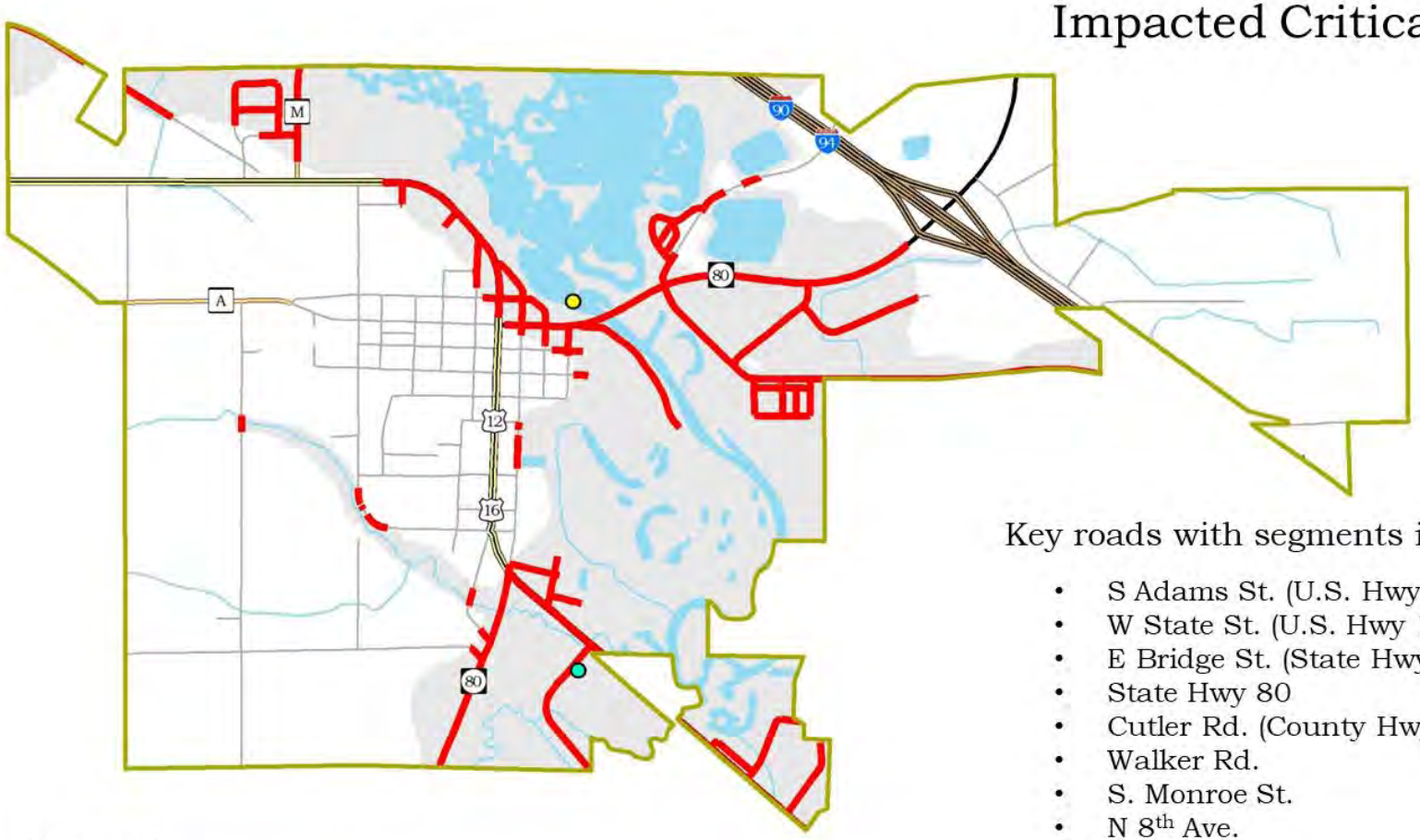
- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate
- Water
- At Risk Zone

Business Type

- Large Manufacturing
- Medium Manufacturing
- Small Manufacturing
- Large Commercial
- Medium Commercial
- Small Commercial

Business Type	Quantity
Commercial	25
Manufacturing	0
Small	23
Medium	2
Large	0
Total	25

City of New Lisbon
Impacted Critical Facilities



Key roads with segments impacted:

- S Adams St. (U.S. Hwy 12)
- W State St. (U.S. Hwy 12)
- E Bridge St. (State Hwy 80)
- State Hwy 80
- Cutler Rd. (County Hwy M)
- Walker Rd.
- S. Monroe St.
- N 8th Ave.
- W Pearl St.

Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate
- Water
- At Risk Zone
- Roads at Risk

Critical Facility Type

- Dams
- Municipal Water Treatment

Critical facilities impacted:

- New Lisbon Dam
- New Lisbon Wastewater Treatment Plant

Critical Facility Type	Quantity
Impacted Roads (miles)	10.13
Municipal Services	0
Utility	0
Water Treatment	1
Dams	1
Emergency Services	0
Schools	0
Total Facilities	2

Village of Wonewoc
Impacted Businesses

Category	Impact Value
Employees	168
Commercial	$2,806,310
Manufacturing	$500,600
Total Business Value	$3,306,910

Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate

Business Type

- Large Manufacturing
- Medium Manufacturing
- Small Manufacturing
- Large Commercial
- Medium Commercial
- Small Commercial
- Water
- At Risk Zone

Business Type	Quantity
Commercial	40
Manufacturing	2
Small	39
Medium	3
Large	0
Total	42

Village of Wonewoc
Impacted Critical Facilities

Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate
- Roads at Risk

Critical Facility Type

- Dams
- School
- Municipal Water Treatment
- Water
- At Risk Zone

Key roads with segments impacted:

- Center St. (State Hwy 33)
- S East St. (State Hwy 33)
- Washington St. (County Hwy FF)
- County Hwy G
- N St. (County Hwy G)
- Church St.
- Railroad St.
- N East St.

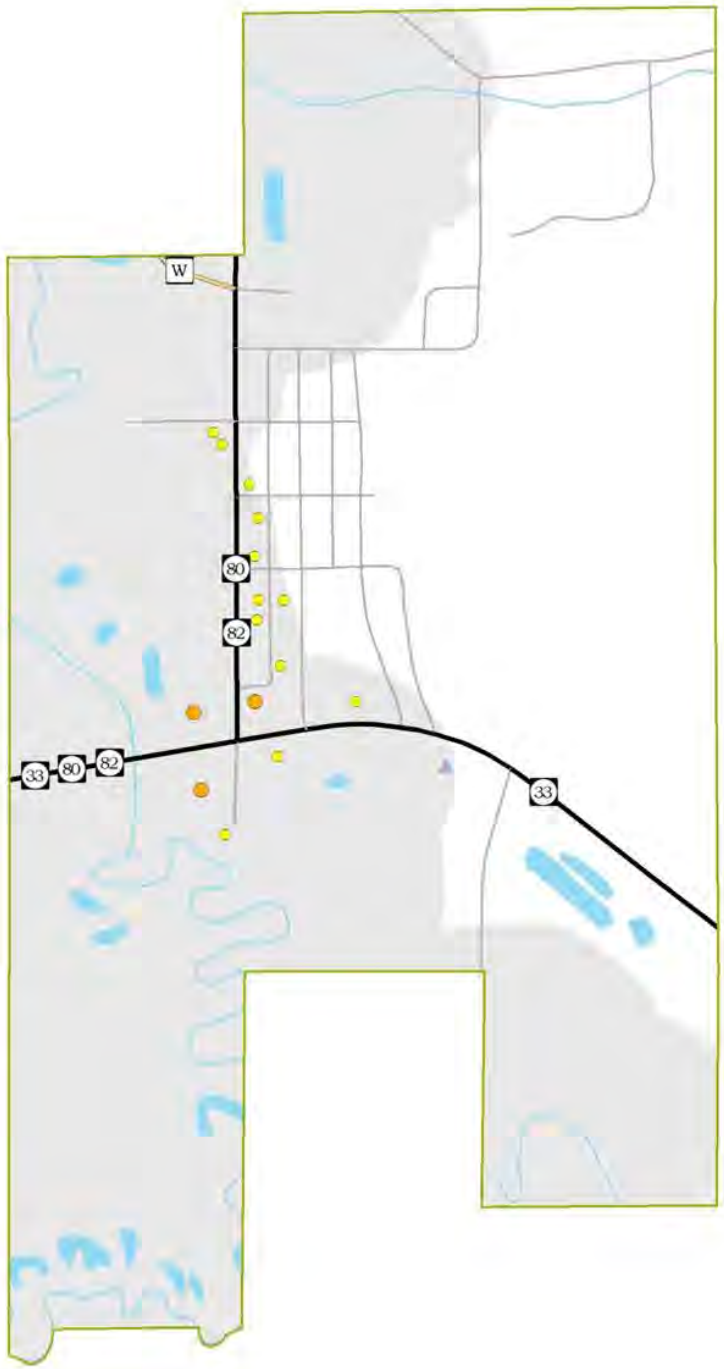
Critical facilities impacted:

- Wonewoc Dam
- Wonewoc Wastewater Treatment Plant (2)
- St. Paul's Lutheran School

Critical Facility Type	Quantity
Impacted Roads (miles)	5.52
Municipal Services	0
Utility	0
Water Treatment	2
Dams	1
Emergency Services	0
Schools	1
Total Facilities	4

Village of Union Center
Impacted Businesses

Category	Impact Value
Employees	78
Commercial	$1,243,702
Manufacturing	$1,130,000
Total Business Value	$2,373,702



Legend

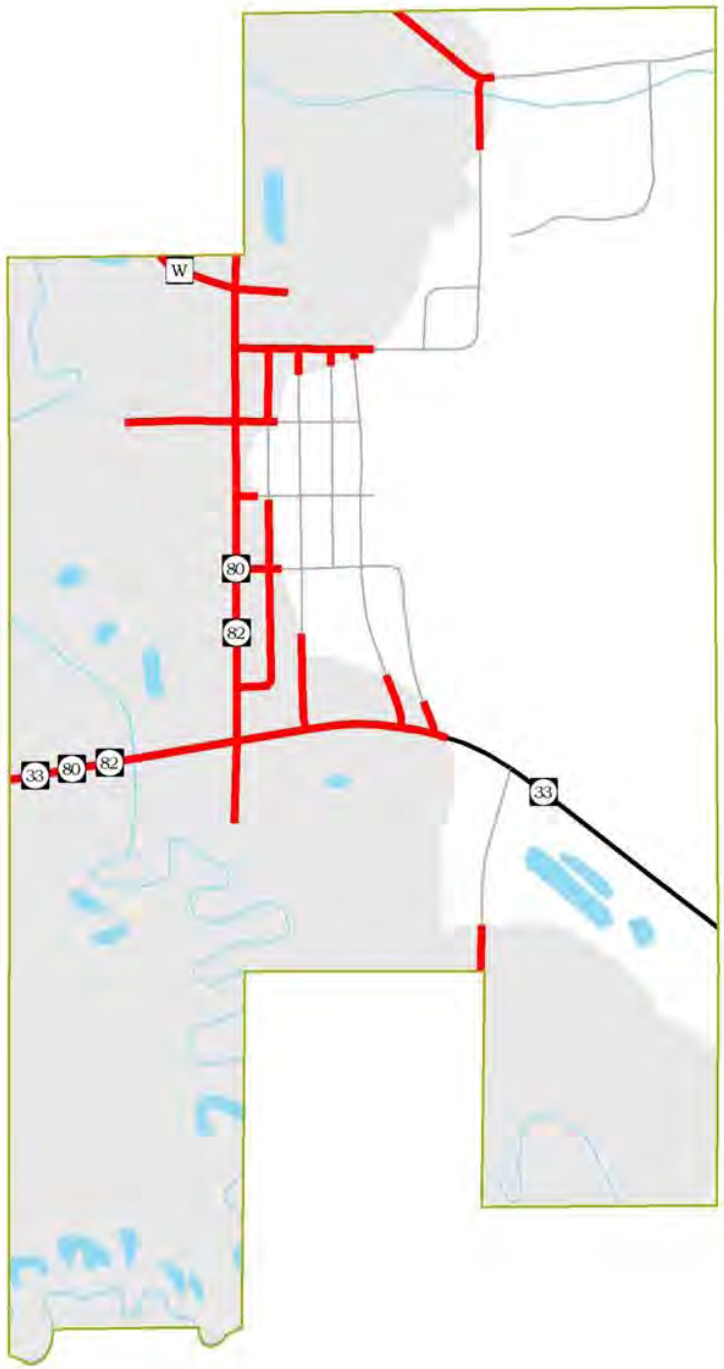
- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate

Business Type

- Large Manufacturing
- Medium Manufacturing
- Small Manufacturing
- Large Commercial
- Medium Commercial
- Small Commercial
- Water
- At Risk Zone

Business Type	Quantity
Commercial	15
Manufacturing	1
Small	13
Medium	3
Large	0
Total	16

Village of Union Center
Impacted Critical Facilities



Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate
- Roads at Risk
- Water
- At Risk Zone

Key roads with segments impacted:

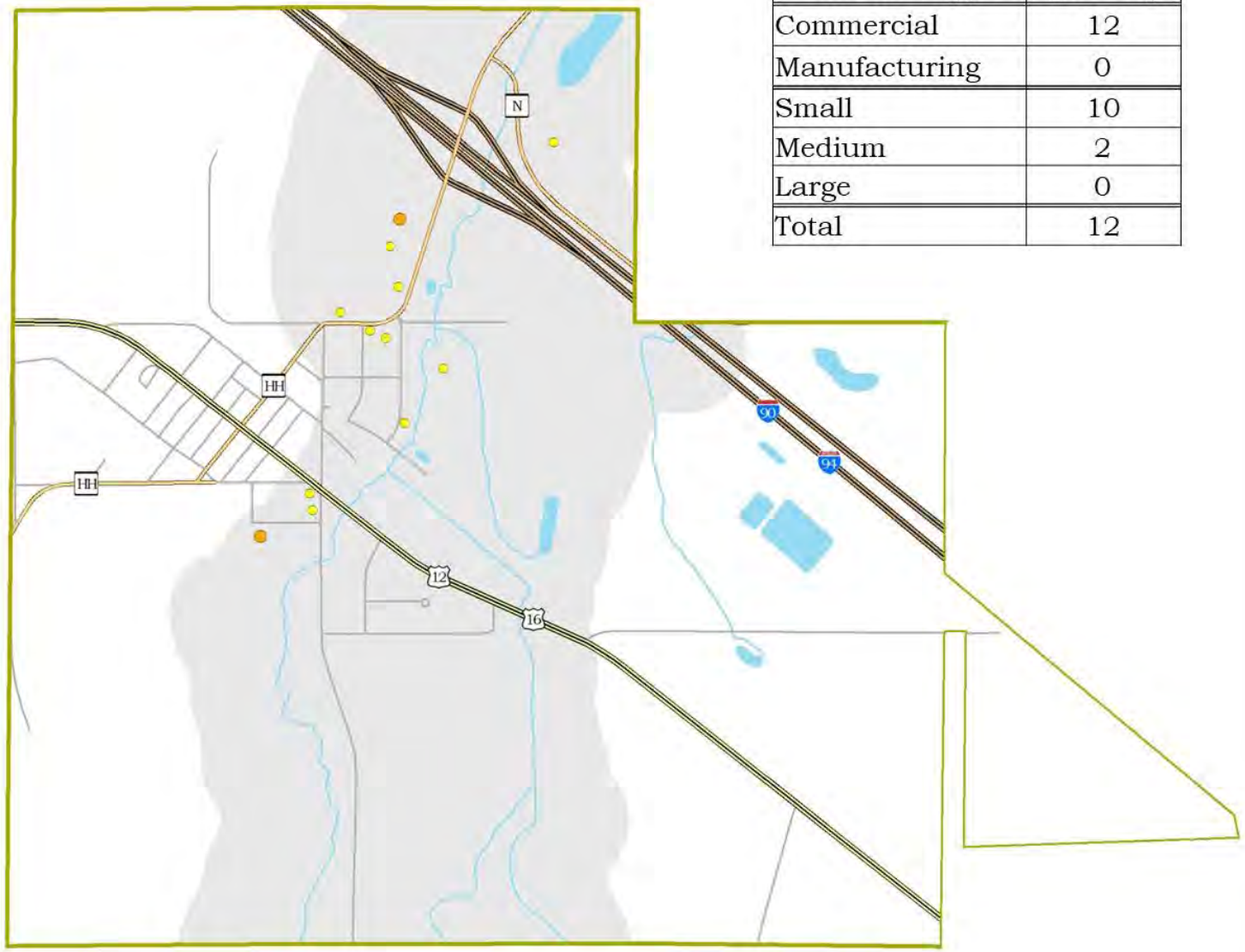
- Bridge St. (State Hwy 33/82)
- State Hwy 82
- Elroy Rd. (County Hwy W)
- Park St.
- Mill St.
- Division St.
- Perry St.
- Main St.
- High St.
- Oak St.

Critical Facility Type	Quantity
Impacted Roads (miles)	3.52
Municipal Services	0
Utility	0
Water Treatment	0
Dams	0
Emergency Services	0
Schools	0
Total Facilities	0

Village of Lyndon Station
Impacted Businesses

Category	Impact Value
Employees	88
Commercial	$1,914,903
Manufacturing	$0
Total Business Value	$1,914,903

Business Type	Quantity
Commercial	12
Manufacturing	0
Small	10
Medium	2
Large	0
Total	12



Village of Lyndon Station Impacted Critical Facilities

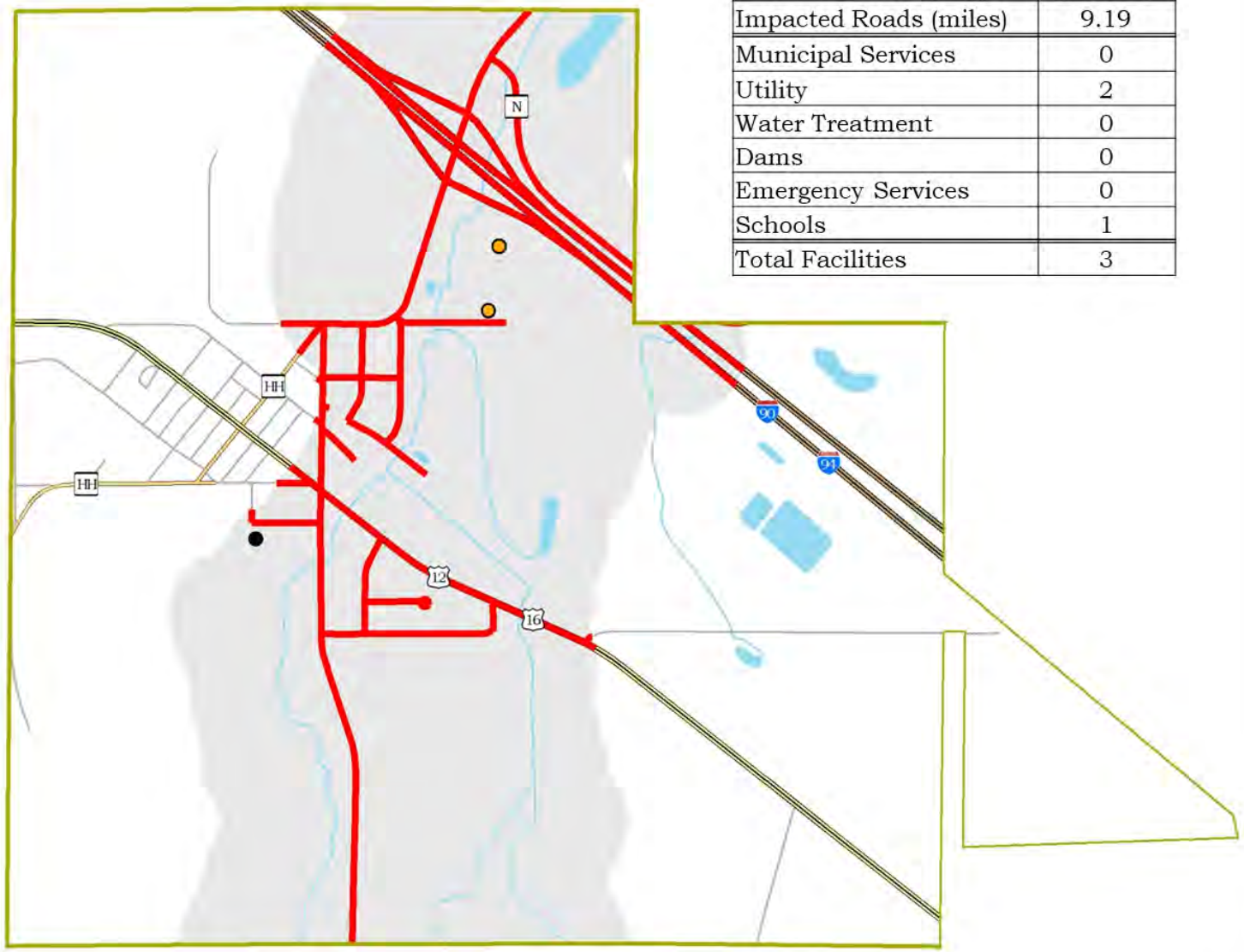
Key roads with segments impacted:

- I-90/94
- Flint St. (U.S. Hwy 12)
- Wright St. (County Hwy HH)
- Prospect St.
- County Hwy N
- N St. (County Hwy G)
- Washington St.
- Roosevelt St.

Critical facilities impacted:

- Lyndon Station Elementary School
- Lyndon Station Substations (2)

Critical Facility Type	Quantity
Impacted Roads (miles)	9.19
Municipal Services	0
Utility	2
Water Treatment	0
Dams	0
Emergency Services	0
Schools	1
Total Facilities	3



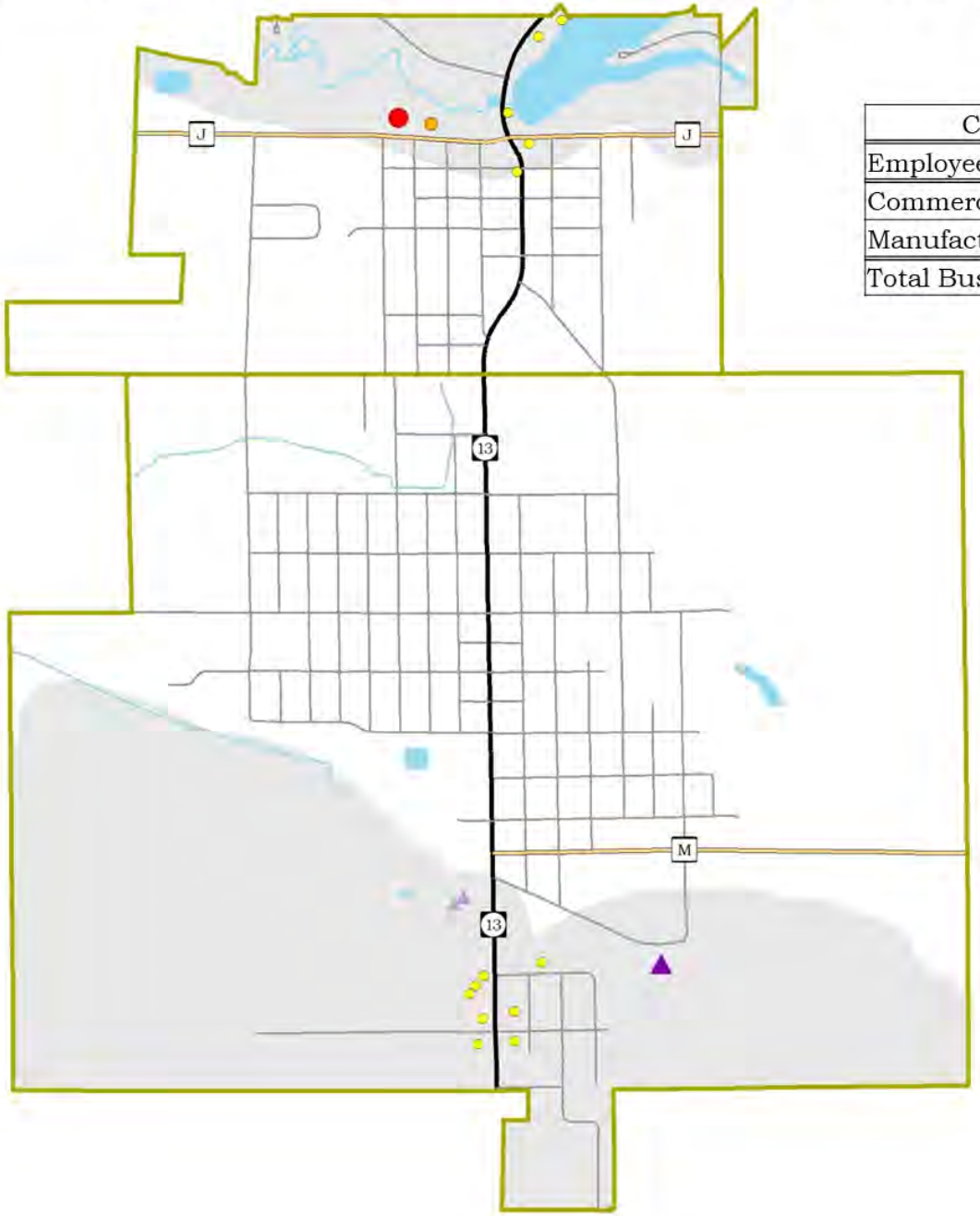
Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate
- Roads at Risk

Critical Facility Type

- Utility
- School
- Water
- At Risk Zone

City of Adams and Village of Friendship Impacted Businesses



Legend

- State Highways
- County Highways
- Local Roads

Business Type

- Large Manufacturing
- Medium Manufacturing
- Small Manufacturing
- Large Commercial
- Medium Commercial
- Small Commercial
- Water
- At Risk Zone

Category	Impact Value
Employees	515
Commercial	$3,517,900
Manufacturing	$2,727,400
Total Business Value	$6,245,300

Combined Statistics.

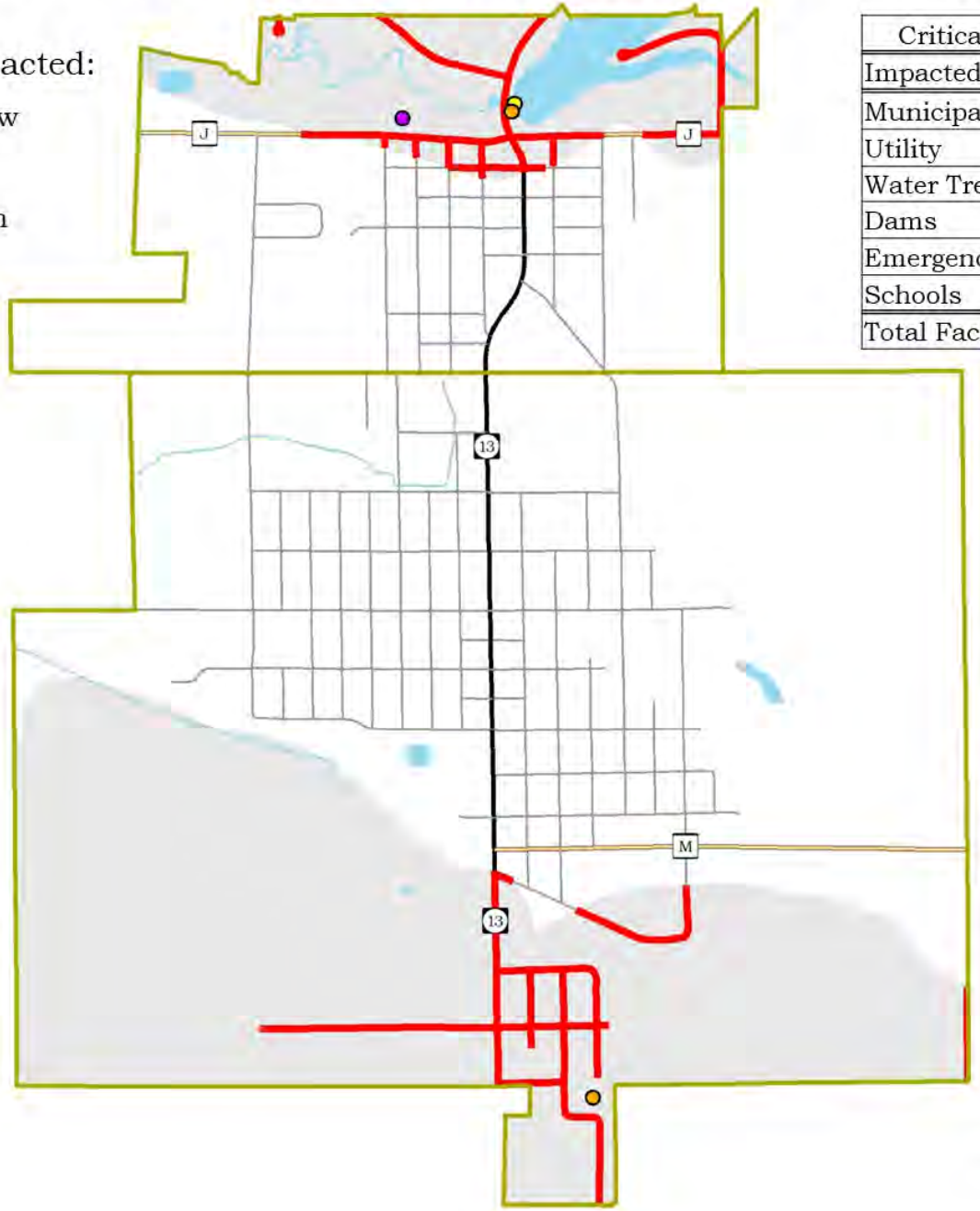
Business Type	Quantity
Commercial	15
Manufacturing	2
Small	14
Medium	1
Large	2
Total	17

Combined Statistics.

City of Adams and Village of Friendship Impacted Critical Facilities

Critical facilities impacted:

- Gundersen Moundview Hospital
- Friendship Dam
- Friendship Substation
- Adams Substation



Critical Facility Type	Quantity
Impacted Roads (miles)	6.01
Municipal Services	0
Utility	2
Water Treatment	0
Dams	1
Emergency Services	1
Schools	0
Total Facilities	4

Combined Statistics.

Legend

- State Highways
- County Highways
- Local Roads
- Roads at Risk

Critical Facility Type

- Emergency Services
- Municipal Services
- Dams
- Utility
- Water
- At Risk Zone

Key roads with segments impacted:

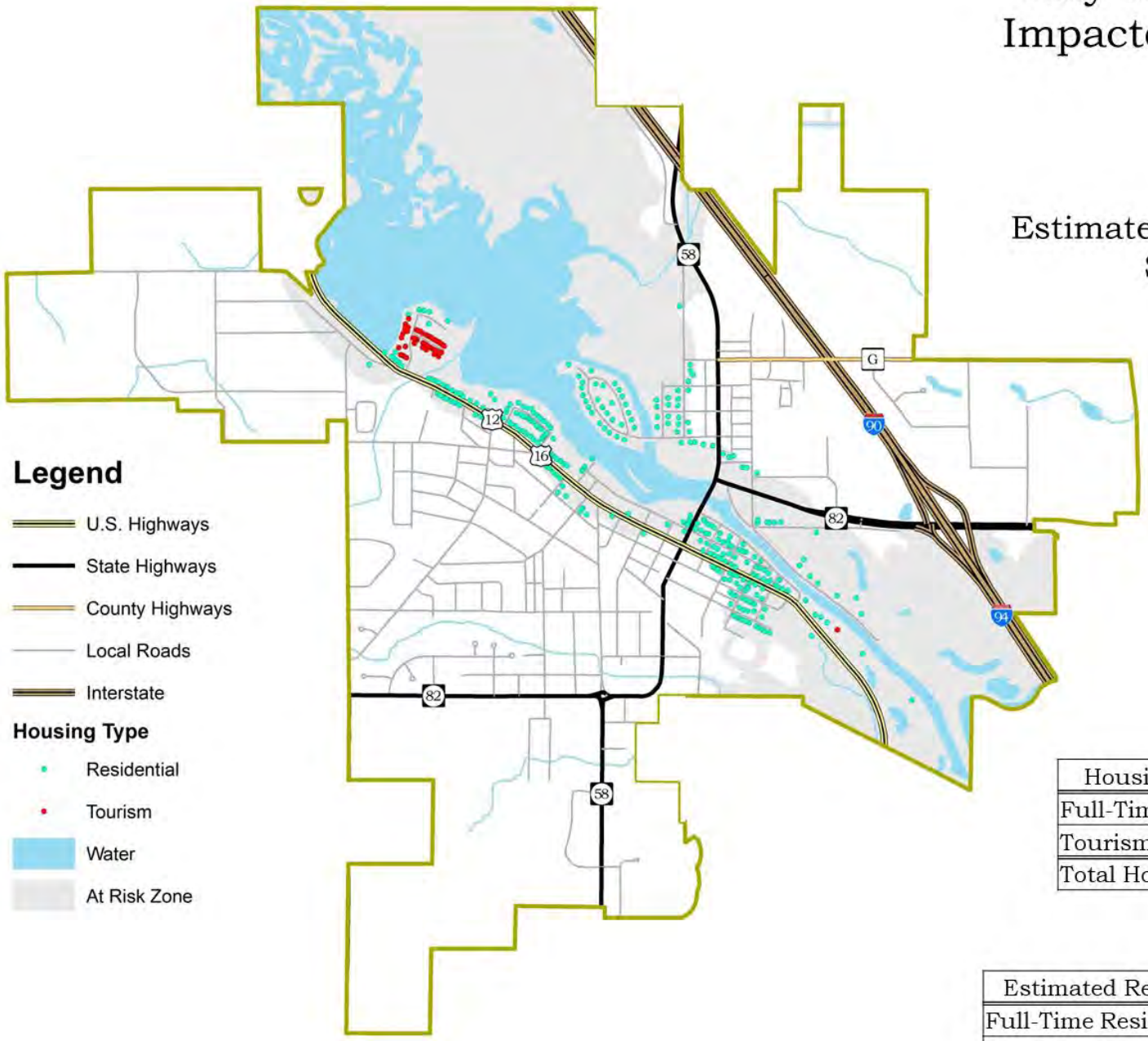
Adams Roads

- Main St. (State Hwy 13)
- Sherman St.
- Railroad St.
- Werner St.
- Linden St.
- Capella St.
- Grant St.

Friendship Roads

- Lake St. (County Hwy J)
- Main St. (State Hwy 13)
- West St.
- 1st St.
- Mound View Dr.
- Adams St.

City of Mauston
Impacted Housing

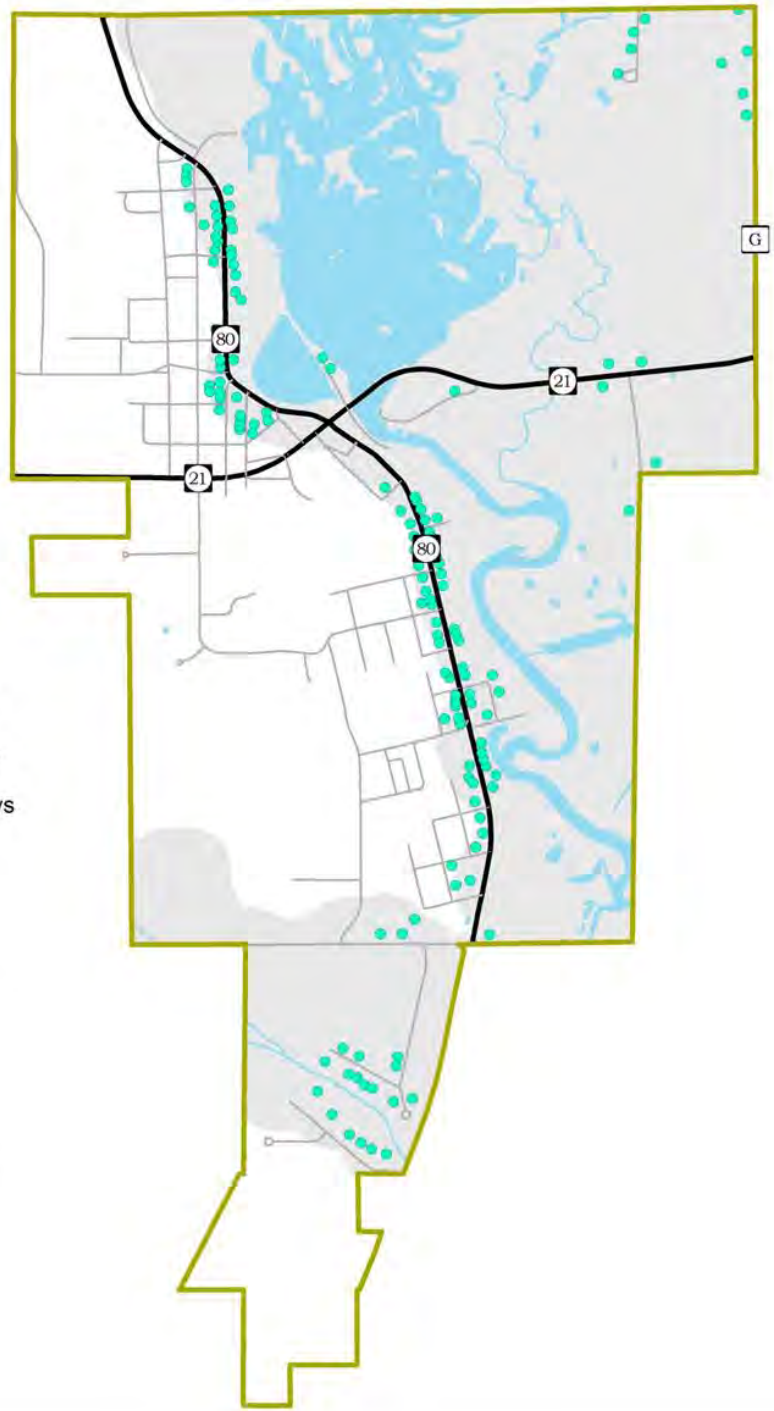


Estimated Housing Damage:
$19,676,806

Housing Facility Type	Quantity
Full-Time Residential	292
Tourism	45
Total Housing Units	337

Estimated Residents Impacted	Quantity
Full-Time Residents	730
Tourists	161
Total	891

Village of Necedah
Impacted Housing



Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate

Housing Type

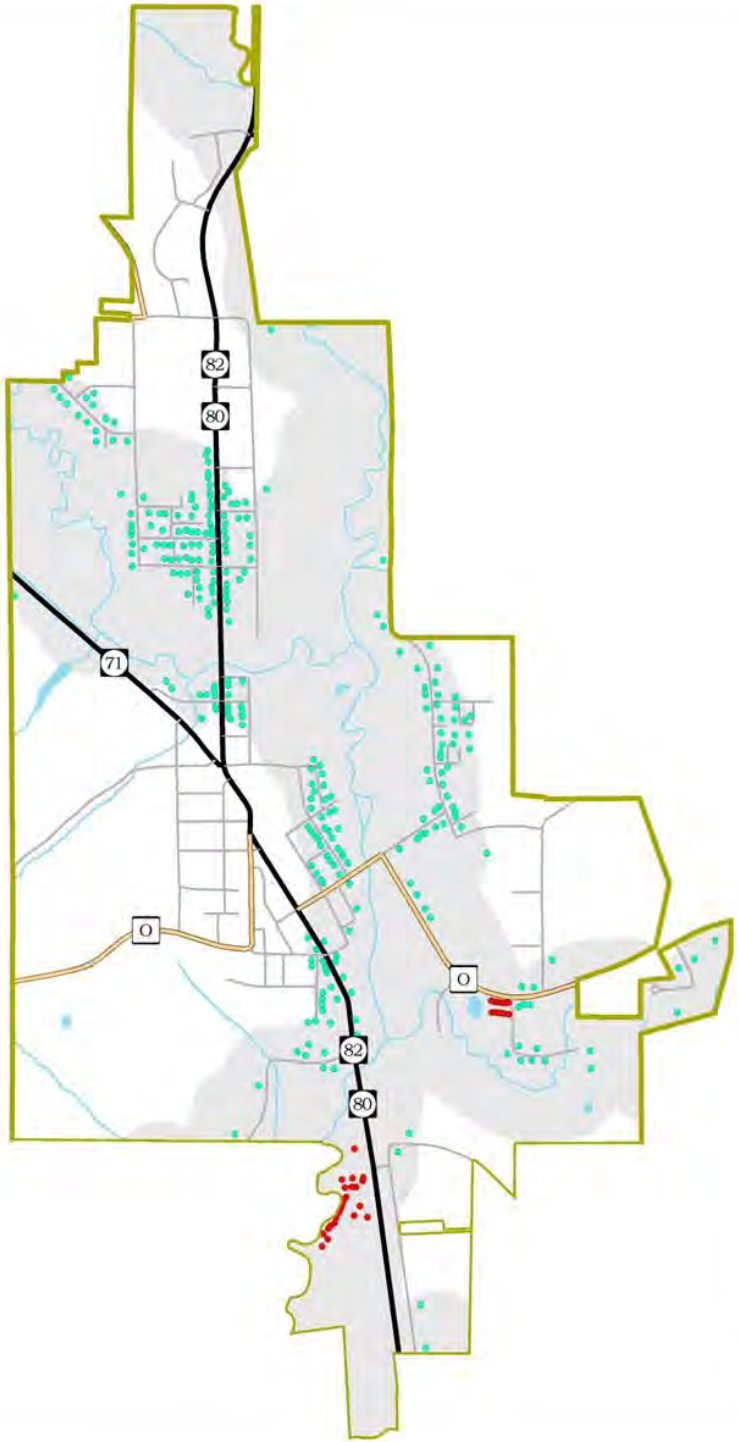
- Residential
- Tourism
- Water
- At Risk Zone

Estimated Housing Damage:
$9,937,501

Housing Facility Type	Quantity
Full-Time Residential	140
Tourism	0
Total Housing Units	140

Estimated Residents Impacted	Quantity
Full-Time Residents	350
Tourists	0
Total	350

City of Elroy
Impacted Housing



Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate

Housing Type

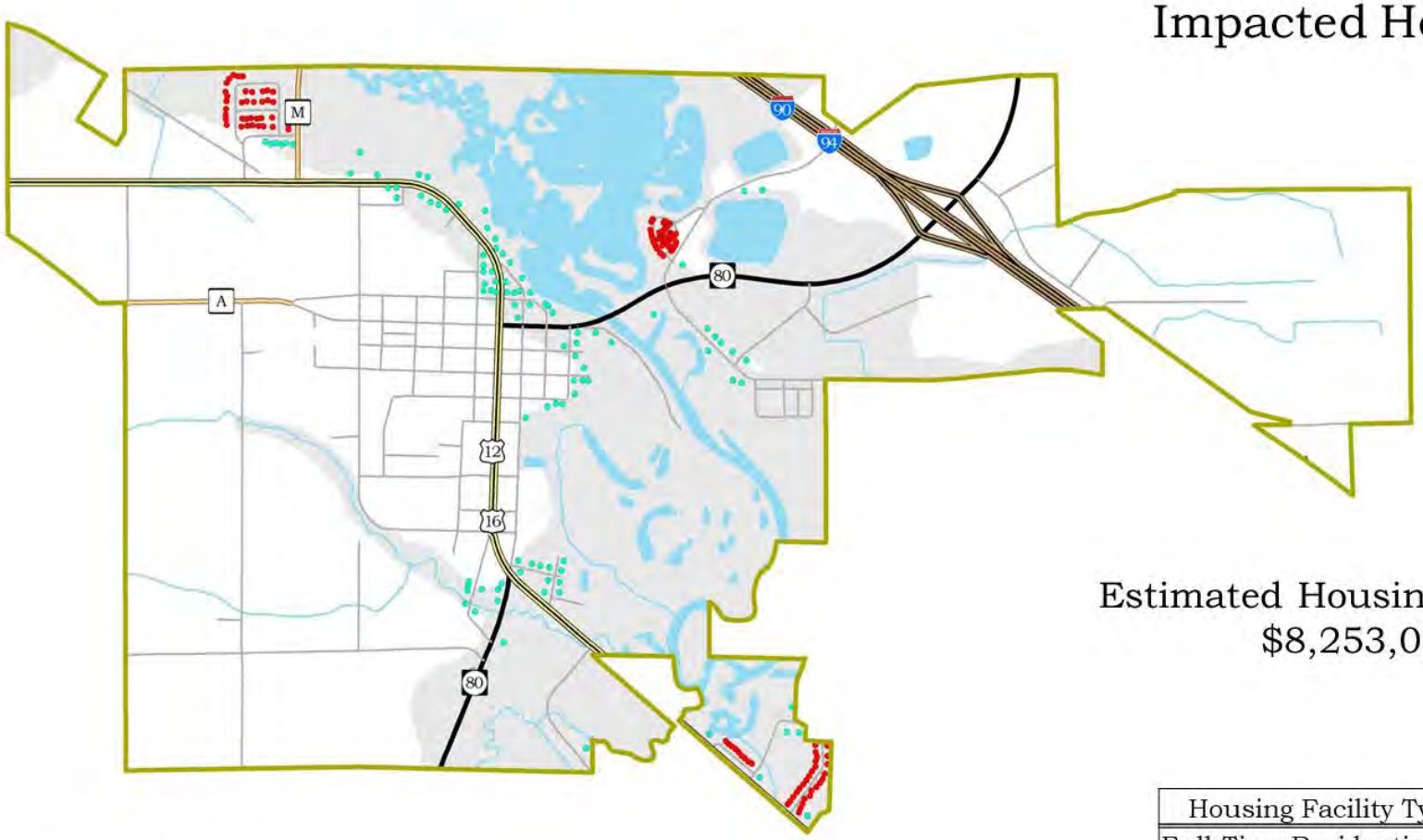
- Residential
- Tourism
- Water
- At Risk Zone

Estimated Housing Damage:
$14,473,501

Housing Facility Type	Quantity
Full-Time Residential	270
Tourism	37
Total Housing Units	307

Estimated Residents Impacted	Quantity
Full-Time Residents	675
Tourists	93
Total	768

City of New Lisbon
Impacted Housing



Estimated Housing Damage:
$8,253,000

Housing Facility Type	Quantity
Full-Time Residential	104
Tourism	111
Total Housing Units	215

Estimated Residents Impacted	Quantity
Full-Time Residents	260
Tourists	278
Total	538

Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate
- Water
- At Risk Zone

Housing Type

- Residential
- Tourism

Village of Wonewoc
Impacted Housing

Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate

Housing Type

- Residential
- Tourism
- Water
- At Risk Zone

Estimated Housing Damage:
$6,908,002

Housing Facility Type	Quantity
Full-Time Residential	139
Tourism	0
Total Housing Units	139

Estimated Residents Impacted	Quantity
Full-Time Residents	348
Tourists	0
Total	348

Village of Union Center
Impacted Housing

Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate

Housing Type

- Residential
- Tourism
- Water
- At Risk Zone

Estimated Housing Damage:
$1,782,401

Housing Facility Type	Quantity
Full-Time Residential	28
Tourism	0
Total Housing Units	28

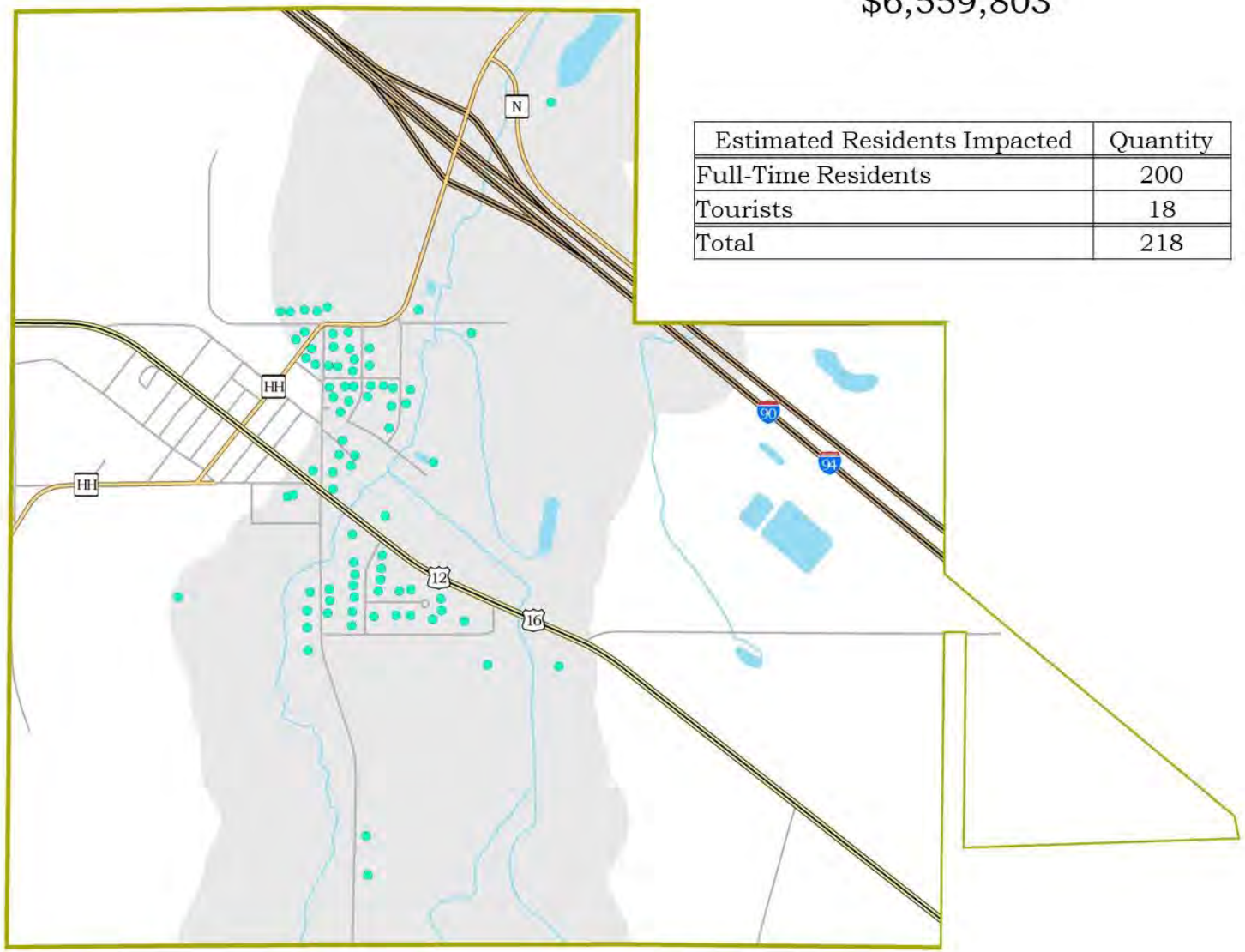
Estimated Residents Impacted	Quantity
Full-Time Residents	70
Tourists	0
Total	70

Village of Lyndon Station Impacted Housing

Housing Facility Type	Quantity
Full-Time Residential	80
Tourism	7
Total Housing Units	87

Estimated Housing Damage:
$6,559,803

Estimated Residents Impacted	Quantity
Full-Time Residents	200
Tourists	18
Total	218



Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate

Housing Type

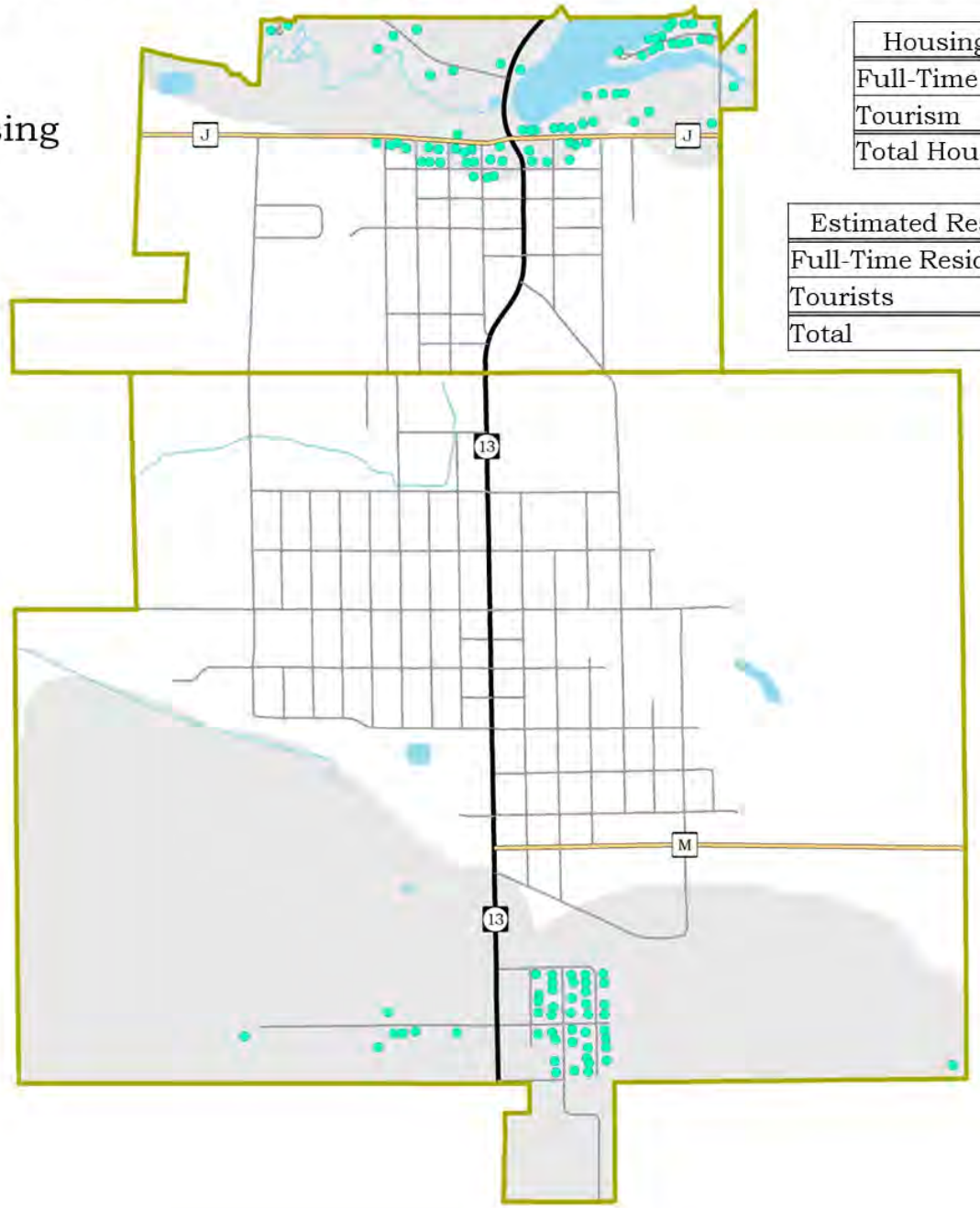
- Residential
- Tourism
- Water
- At Risk Zone

City of Adams and Village of Friendship Impacted Housing

Estimated Housing Damage: $6,217,400

Housing Facility Type	Quantity
Full-Time Residential	117
Tourism	0
Total Housing Units	117

Estimated Residents Impacted	Quantity
Full-Time Residents	293
Tourists	0
Total	293

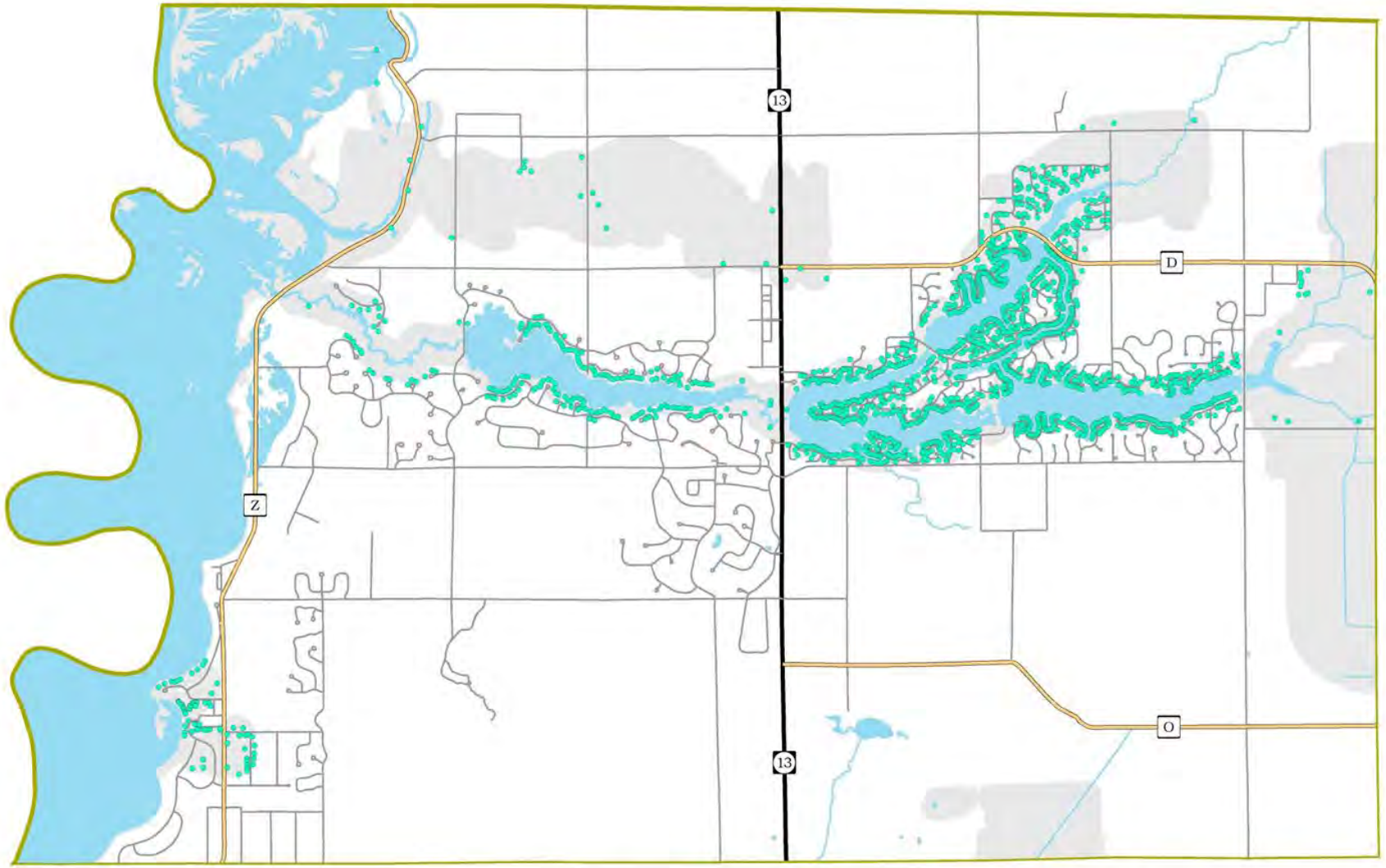


Legend

- State Highways
- County Highways
- Local Roads

Housing Type

- Residential
- Tourism
- Water
- At Risk Zone



Legend

- State Highways
- County Highways
- Local Roads
- Water
- At Risk Zone

Housing Type

- Residential
- Tourism

Town of Rome Impacted Housing

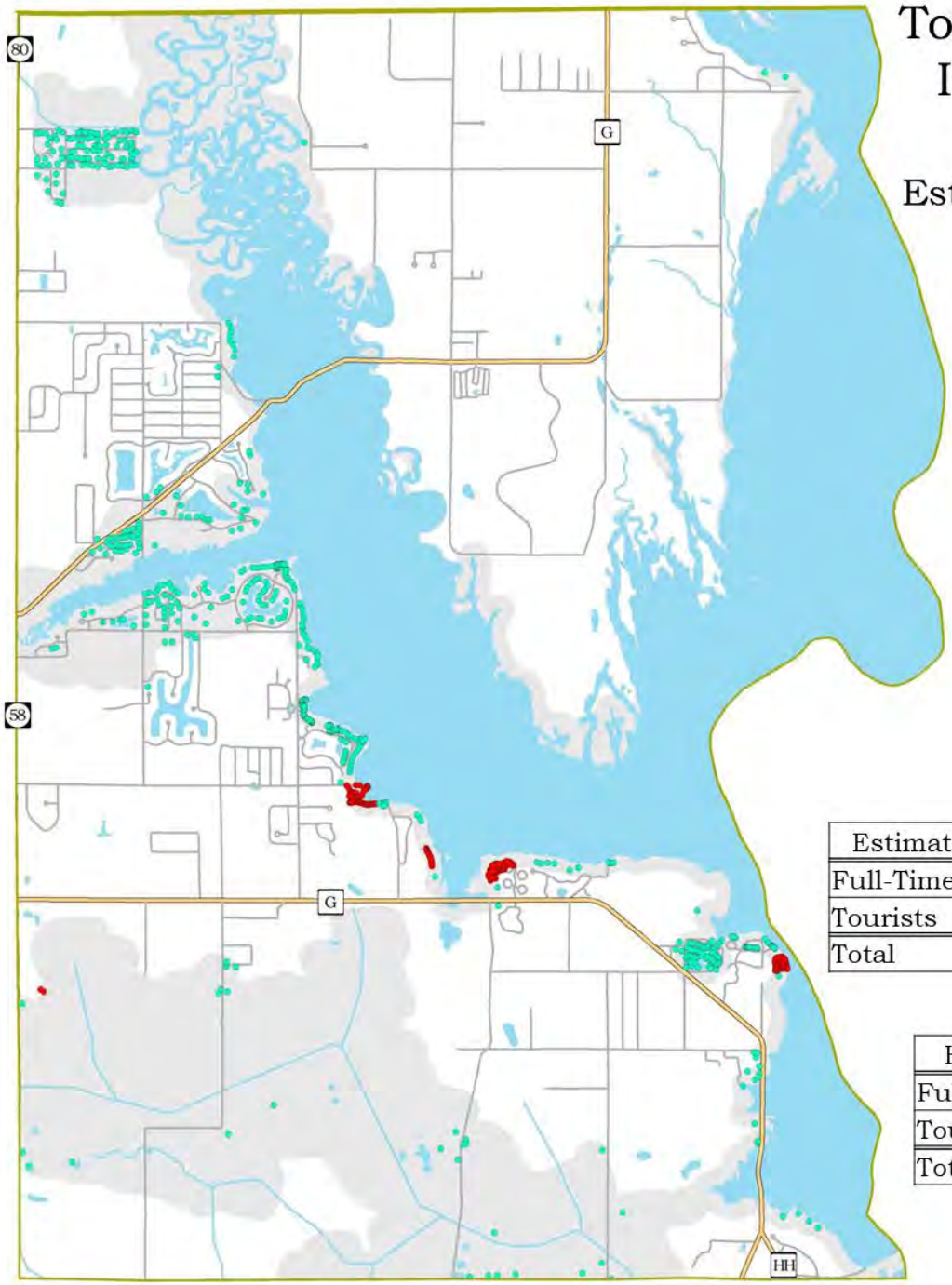
Housing Facility Type	Quantity
Full-Time Residential	1,762
Tourism	0
Total Housing Units	1,762

Estimated Residents Impacted	Quantity
Full-Time Residents	4,405
Tourists	0
Total	4,405

Estimated Housing Damage: $194,215,100

Town of Germantown Impacted Housing

Estimated Housing Damage:
$89,115,905



Legend

- U.S. Highways
- State Highways
- County Highways
- Local Roads
- Interstate

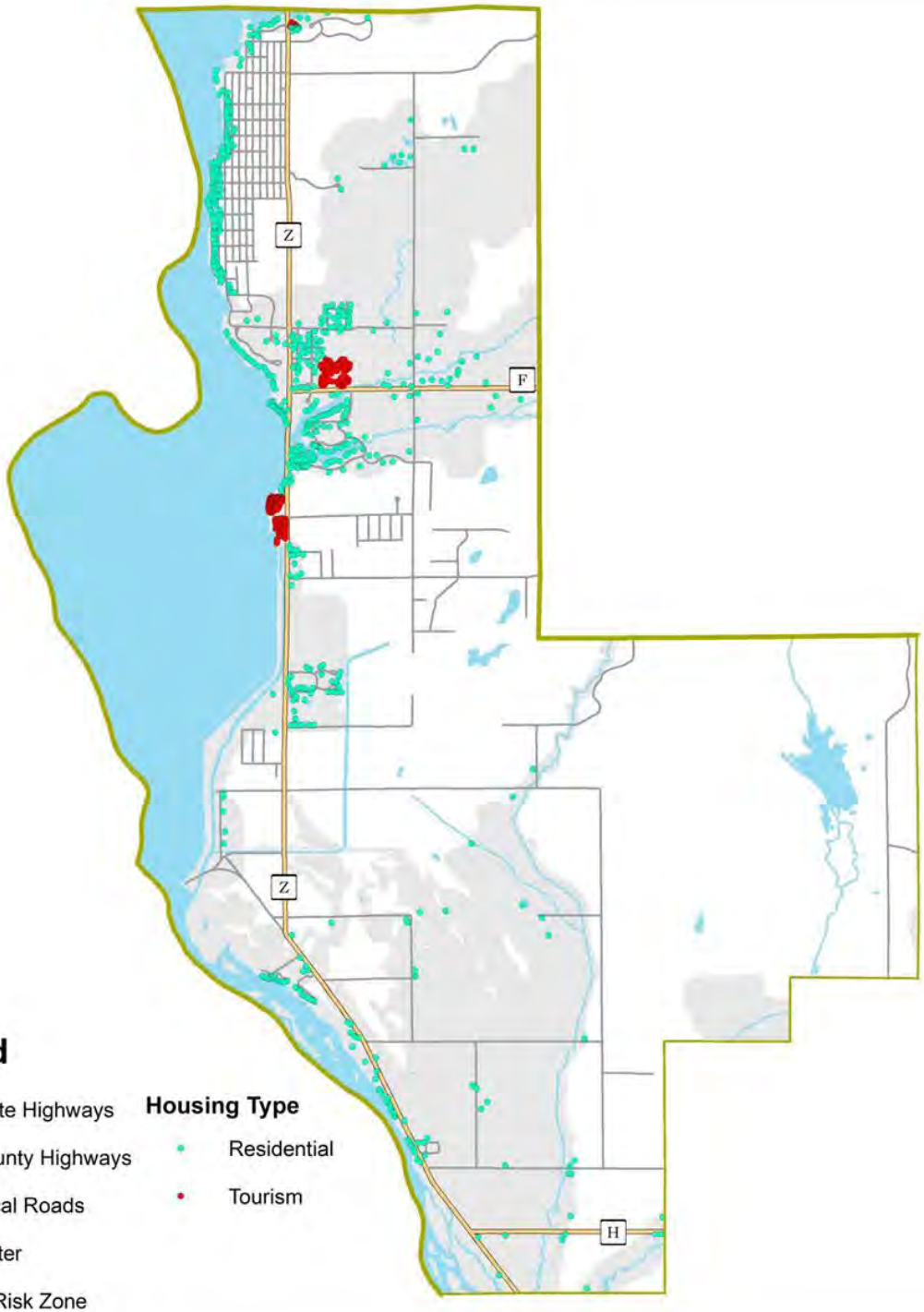
Housing Type

- Residential
- Tourism
- Water
- At Risk Zone

Estimated Residents Impacted	Quantity
Full-Time Residents	1,463
Tourists	554
Total	2,017

Housing Facility Type	Quantity
Full-Time Residential	585
Tourism	188
Total Housing Units	773

Town of Quincy
Impacted Housing



Estimated Housing Damage:
$51,135,800

Housing Facility Type	Quantity
Full-Time Residential	599
Tourism	251
Total Housing Units	850

Estimated Residents Impacted	Quantity
Full-Time Residents	1,498
Tourists	628
Total	2,126

Appendix B

Economic Impact Analysis

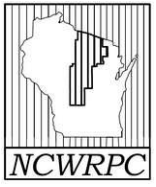
Impact Scenario

Crop Production in 2 Wisconsin Counties

Emsi Q4 2017 Data Set

December 2017

North Central Wisconsin Regional Planning Commission



210 McClellan Street, Suite 210
Wausau, Wisconsin 54403

Parameters

Regions

Code	Description
55001	Adams County, WI
55057	Juneau County, WI

Industry Scenario

Code	Description	Change Type	Change Value
111000	Crop Production	Jobs	-1,695

Input-Output Year

2016

Changes to Crop Production

$-80,429,680	-2,205	$-7,987,473
Change in Earnings	**Change in Jobs**	**Change in Taxes on Production and Imports (TPI)**
1.28 Multiplier	1.30 Multiplier	

Scenario Results - Industry

NAICS	Industry	Change in Jobs
11	Agriculture, Forestry, Fishing and Hunting	-1,902
21	Mining, Quarrying, and Oil and Gas Extraction	-3
22	Utilities	-3
23	Construction	-25
31	Manufacturing	-4
42	Wholesale Trade	-14
44	Retail Trade	-13
48	Transportation and Warehousing	-31
51	Information	-1
52	Finance and Insurance	-28
53	Real Estate and Rental and Leasing	-40
54	Professional, Scientific, and Technical Services	-9
55	Management of Companies and Enterprises	0
56	Administrative and Support and Waste Management and Remediation Services	-20
61	Educational Services	-1
62	Health Care and Social Assistance	-32
71	Arts, Entertainment, and Recreation	-6
72	Accommodation and Food Services	-22
81	Other Services (except Public Administration)	-23
90	Government	-29

Scenario Results - Occupation

SOC	Occupation	Change in Jobs
11-0000	Management Occupations	-1,109
13-0000	Business and Financial Operations Occupations	-28
15-0000	Computer and Mathematical Occupations	-6
17-0000	Architecture and Engineering Occupations	-2
19-0000	Life, Physical, and Social Science Occupations	-9
21-0000	Community and Social Service Occupations	-3
23-0000	Legal Occupations	-1
25-0000	Education, Training, and Library Occupations	-13
27-0000	Arts, Design, Entertainment, Sports, and Media Occupations	-12
29-0000	Healthcare Practitioners and Technical Occupations	-13
31-0000	Healthcare Support Occupations	-6
33-0000	Protective Service Occupations	-6
35-0000	Food Preparation and Serving Related Occupations	-26
37-0000	Building and Grounds Cleaning and Maintenance Occupations	-48
39-0000	Personal Care and Service Occupations	-49
41-0000	Sales and Related Occupations	-69
43-0000	Office and Administrative Support Occupations	-101
45-0000	Farming, Fishing, and Forestry Occupations	-524
47-0000	Construction and Extraction Occupations	-33
49-0000	Installation, Maintenance, and Repair Occupations	-32

51-0000	Production Occupations	-23
53-0000	Transportation and Material Moving Occupations	-92
55-0000	Military occupations	0
99-0000	Unclassified Occupation	0

Scenario Results - Demographics

Demographics	Change in Jobs
Female 14-18	-15
Male 14-18	-35
Female 19-21	-9
Male 19-21	-43
Female 22-24	-17
Male 22-24	-60
Female 25-34	-46
Male 25-34	-209
Female 35-44	-91
Male 35-44	-320
Female 45-54	-94
Male 45-54	-299
Female 55-64	-107
Male 55-64	-501
Female 65-99	-44
Male 65-99	-315

Crop Production - Data Sources and Calculations

Input-Output Data

The input-output model in this report is Emsi's gravitational flows multi-regional social account matrix model (MR-SAM). It is based on data from the Census Bureau's Current Population Survey and American Community Survey; as well as the Bureau of Economic Analysis' National Income and Product Accounts, Input-Output Make and Use Tables, and Gross State Product data. In addition, several Emsi in-house data sets are used, as well as data from Oak Ridge National Labs on the cost of transportation between counties.

State Data Sources

This report uses state data from the following agencies: Wisconsin Department of Workforce Development, Bureau of Workforce Information

Impact Scenario

Hotels (except Casino Hotels) and Motels in 2 Wisconsin Counties

Emsi Q4 2017 Data Set

December 2017

North Central Wisconsin Regional Planning Commission

210 McClellan Street, Suite 210
Wausau, Wisconsin 54403

Parameters

Regions

Code	Description
55001	Adams County, WI
55057	Juneau County, WI

Industry Scenario

Code	Description	Change Type	Change Value
721110	Hotels (except Casino Hotels) and Motels	Jobs	-636

Input-Output Year

2016

Changes to Hotels (except Casino Hotels) and Motels

$-21,012,609	-759	$-7,099,494
Change in Earnings	**Change in Jobs**	**Change in Taxes on Production and Imports (TPI)**
1.23 Multiplier	1.19 Multiplier	

Scenario Results - Industry

NAICS	Industry	Change in Jobs
11	Agriculture, Forestry, Fishing and Hunting	-1
21	Mining, Quarrying, and Oil and Gas Extraction	0
22	Utilities	-1
23	Construction	-7
31	Manufacturing	-1
42	Wholesale Trade	-1
44	Retail Trade	-5
48	Transportation and Warehousing	-2
51	Information	-1
52	Finance and Insurance	-2
53	Real Estate and Rental and Leasing	-17
54	Professional, Scientific, and Technical Services	-6
55	Management of Companies and Enterprises	0
56	Administrative and Support and Waste Management and Remediation Services	-14
61	Educational Services	0
62	Health Care and Social Assistance	-11
71	Arts, Entertainment, and Recreation	-4
72	Accommodation and Food Services	-651
81	Other Services (except Public Administration)	-9
90	Government	-25

Scenario Results - Occupation

SOC	Occupation	Change in Jobs
11-0000	Management Occupations	-51
13-0000	Business and Financial Operations Occupations	-13
15-0000	Computer and Mathematical Occupations	-1
17-0000	Architecture and Engineering Occupations	-1
19-0000	Life, Physical, and Social Science Occupations	0
21-0000	Community and Social Service Occupations	-2
23-0000	Legal Occupations	0
25-0000	Education, Training, and Library Occupations	-9
27-0000	Arts, Design, Entertainment, Sports, and Media Occupations	-7
29-0000	Healthcare Practitioners and Technical Occupations	-4
31-0000	Healthcare Support Occupations	-6
33-0000	Protective Service Occupations	-10
35-0000	Food Preparation and Serving Related Occupations	-191
37-0000	Building and Grounds Cleaning and Maintenance Occupations	-215
39-0000	Personal Care and Service Occupations	-21
41-0000	Sales and Related Occupations	-30
43-0000	Office and Administrative Support Occupations	-133
45-0000	Farming, Fishing, and Forestry Occupations	-1
47-0000	Construction and Extraction Occupations	-8
49-0000	Installation, Maintenance, and Repair Occupations	-34

51-0000	Production Occupations	-12
53-0000	Transportation and Material Moving Occupations	-12
55-0000	Military occupations	0
99-0000	Unclassified Occupation	0

Scenario Results - Demographics

Demographics	Change in Jobs
Female 14-18	-33
Male 14-18	-25
Female 19-21	-43
Male 19-21	-19
Female 22-24	-41
Male 22-24	-18
Female 25-34	-94
Male 25-34	-73
Female 35-44	-64
Male 35-44	-63
Female 45-54	-60
Male 45-54	-65
Female 55-64	-52
Male 55-64	-51
Female 65-99	-28
Male 65-99	-29

Hotels - Data Sources and Calculations

Input-Output Data

The input-output model in this report is Emsi's gravitational flows multi-regional social account matrix model (MR-SAM). It is based on data from the Census Bureau's Current Population Survey and American Community Survey; as well as the Bureau of Economic Analysis' National Income and Product Accounts, Input-Output Make and Use Tables, and Gross State Product data. In addition, several Emsi in-house data sets are used, as well as data from Oak Ridge National Labs on the cost of transportation between counties.

State Data Sources

This report uses state data from the following agencies: Wisconsin Department of Workforce Development, Bureau of Workforce Information

Impact Scenario

Gasoline Stations with Convenience Stores in 2 Wisconsin Counties

Emsi Q4 2017 Data Set

December 2017

North Central Wisconsin Regional Planning Commission

210 McClellan Street, Suite 210
Wausau, Wisconsin 54403

Parameters

Regions

Code	Description
55001	Adams County, WI
55057	Juneau County, WI

Industry Scenario

Code	Description	Change Type	Change Value
447110	Gasoline Stations with Convenience Stores	Jobs	-493

Input-Output Year

2016

Changes to Gasoline Stations with Convenience Stores

$-12,658,645	-560	$-3,889,988
Change in Earnings	**Change in Jobs**	**Change in Taxes on Production and Imports (TPI)**
1.21 Multiplier	1.14 Multiplier	

Scenario Results - Industry

NAICS	Industry	Change in Jobs
11	Agriculture, Forestry, Fishing and Hunting	0
21	Mining, Quarrying, and Oil and Gas Extraction	0
22	Utilities	0
23	Construction	-2
31	Manufacturing	0
42	Wholesale Trade	-1
44	Retail Trade	-495
48	Transportation and Warehousing	-4
51	Information	-1
52	Finance and Insurance	-2
53	Real Estate and Rental and Leasing	-15
54	Professional, Scientific, and Technical Services	-5
55	Management of Companies and Enterprises	0
56	Administrative and Support and Waste Management and Remediation Services	-6
61	Educational Services	-1
62	Health Care and Social Assistance	-5
71	Arts, Entertainment, and Recreation	-1
72	Accommodation and Food Services	-4
81	Other Services (except Public Administration)	-4
90	Government	-14

Scenario Results - Occupation

SOC	Occupation	Change in Jobs
11-0000	Management Occupations	-13
13-0000	Business and Financial Operations Occupations	-4
15-0000	Computer and Mathematical Occupations	0
17-0000	Architecture and Engineering Occupations	0
19-0000	Life, Physical, and Social Science Occupations	0
21-0000	Community and Social Service Occupations	-1
23-0000	Legal Occupations	0
25-0000	Education, Training, and Library Occupations	-5
27-0000	Arts, Design, Entertainment, Sports, and Media Occupations	-3
29-0000	Healthcare Practitioners and Technical Occupations	-2
31-0000	Healthcare Support Occupations	-1
33-0000	Protective Service Occupations	-2
35-0000	Food Preparation and Serving Related Occupations	-77
37-0000	Building and Grounds Cleaning and Maintenance Occupations	-8
39-0000	Personal Care and Service Occupations	-3
41-0000	Sales and Related Occupations	-370
43-0000	Office and Administrative Support Occupations	-26
45-0000	Farming, Fishing, and Forestry Occupations	0
47-0000	Construction and Extraction Occupations	-2
49-0000	Installation, Maintenance, and Repair Occupations	-16

51-0000	Production Occupations	-2
53-0000	Transportation and Material Moving Occupations	-24
55-0000	Military occupations	0
99-0000	Unclassified Occupation	0

Scenario Results - Demographics

Demographics	Change in Jobs
Female 14-18	-42
Male 14-18	-19
Female 19-21	-45
Male 19-21	-16
Female 22-24	-29
Male 22-24	-12
Female 25-34	-54
Male 25-34	-31
Female 35-44	-45
Male 35-44	-31
Female 45-54	-62
Male 45-54	-35
Female 55-64	-59
Male 55-64	-46
Female 65-99	-22
Male 65-99	-12

Gasoline Stations - Data Sources and Calculations

Input-Output Data

The input-output model in this report is Emsi's gravitational flows multi-regional social account matrix model (MR-SAM). It is based on data from the Census Bureau's Current Population Survey and American Community Survey; as well as the Bureau of Economic Analysis' National Income and Product Accounts, Input-Output Make and Use Tables, and Gross State Product data. In addition, several Emsi in-house data sets are used, as well as data from Oak Ridge National Labs on the cost of transportation between counties.

State Data Sources

This report uses state data from the following agencies: Wisconsin Department of Workforce Development, Bureau of Workforce Information

Impact Scenario

General Medical and Surgical Hospitals in 2 Wisconsin Counties

Emsi Q4 2017 Data Set

December 2017

North Central Wisconsin Regional Planning Commission

210 McClellan Street, Suite 210
Wausau, Wisconsin 54403

Parameters

Regions

Code	Description
55001	Adams County, WI
55057	Juneau County, WI

Industry Scenario

Code	Description	Change Type	Change Value
622110	General Medical and Surgical Hospitals	Jobs	-574

Input-Output Year

2016

Changes to General Medical and Surgical Hospitals

$-43,757,840	-766	$-1,747,864
Change in Earnings	**Change in Jobs**	**Change in Taxes on Production and Imports (TPI)**
1.15 Multiplier	1.34 Multiplier	

Scenario Results - Industry

NAICS	Industry	Change in Jobs
11	Agriculture, Forestry, Fishing and Hunting	-1
21	Mining, Quarrying, and Oil and Gas Extraction	0
22	Utilities	-1
23	Construction	-4
31	Manufacturing	-2
42	Wholesale Trade	-3
44	Retail Trade	-8
48	Transportation and Warehousing	-4
51	Information	-1
52	Finance and Insurance	-7
53	Real Estate and Rental and Leasing	-25
54	Professional, Scientific, and Technical Services	-17
55	Management of Companies and Enterprises	0
56	Administrative and Support and Waste Management and Remediation Services	-24
61	Educational Services	-1
62	Health Care and Social Assistance	-608
71	Arts, Entertainment, and Recreation	-5
72	Accommodation and Food Services	-23
81	Other Services (except Public Administration)	-24
90	Government	-8

Scenario Results - Occupation

SOC	Occupation	Change in Jobs
11-0000	Management Occupations	-37
13-0000	Business and Financial Operations Occupations	-21
15-0000	Computer and Mathematical Occupations	-7
17-0000	Architecture and Engineering Occupations	-1
19-0000	Life, Physical, and Social Science Occupations	-3
21-0000	Community and Social Service Occupations	-17
23-0000	Legal Occupations	-2
25-0000	Education, Training, and Library Occupations	-5
27-0000	Arts, Design, Entertainment, Sports, and Media Occupations	-8
29-0000	Healthcare Practitioners and Technical Occupations	-320
31-0000	Healthcare Support Occupations	-89
33-0000	Protective Service Occupations	-4
35-0000	Food Preparation and Serving Related Occupations	-42
37-0000	Building and Grounds Cleaning and Maintenance Occupations	-37
39-0000	Personal Care and Service Occupations	-13
41-0000	Sales and Related Occupations	-33
43-0000	Office and Administrative Support Occupations	-82
45-0000	Farming, Fishing, and Forestry Occupations	-1
47-0000	Construction and Extraction Occupations	-5
49-0000	Installation, Maintenance, and Repair Occupations	-18

51-0000	Production Occupations	-8
53-0000	Transportation and Material Moving Occupations	-12
55-0000	Military occupations	0
99-0000	Unclassified Occupation	0

Scenario Results - Demographics

Demographics	Change in Jobs
Female 14-18	-6
Male 14-18	-3
Female 19-21	-12
Male 19-21	-3
Female 22-24	-23
Male 22-24	-4
Female 25-34	-108
Male 25-34	-30
Female 35-44	-121
Male 35-44	-41
Female 45-54	-136
Male 45-54	-47
Female 55-64	-128
Male 55-64	-56
Female 65-99	-24
Male 65-99	-24

General Medical and Surgical Hospitals - Data Sources and Calculations

Input-Output Data

The input-output model in this report is Emsi's gravitational flows multi-regional social account matrix model (MR-SAM). It is based on data from the Census Bureau's Current Population Survey and American Community Survey; as well as the Bureau of Economic Analysis' National Income and Product Accounts, Input-Output Make and Use Tables, and Gross State Product data. In addition, several Emsi in-house data sets are used, as well as data from Oak Ridge National Labs on the cost of transportation between counties.

State Data Sources

This report uses state data from the following agencies: Wisconsin Department of Workforce Development, Bureau of Workforce Information

Appendix C

Seasonal Population Tables

Adams County Seasonal Population, 2016		
	Seasonal Housing Units	Estimated Seasonal Pop.
Adams County	**7,939**	**19,512**
City of Adams	32	70
Town of Adams	242	590
Town of Big Flats	657	1,421
Town of Colburn	95	225
Town of Dell Prairie	393	1,028
Town of Easton	291	699
Village of Friendship	19	64
Town of Jackson	542	1,356
Town of Leola	81	227
Town of Lincoln	105	279
Town of Monroe	346	782
Town of New Chester	285	1,617
Town of New Haven	91	216
Town of Preston	413	1,124
Town of Quincy	1,026	2,303
Town of Richfield	62	127
Town of Rome	1,999	4,383
Town of Springville	437	1,140
Town of Strongs Prairie	799	1,734
City of Wisconsin Dells	24	127

Juneau County Seasonal Population, 2016		
	Seasonal Housing Units	Estimated Seasonal Pop.
Juneau County	**3,357**	**8,263**
Town of Armenia	304	696
Village of Camp Douglas	15	41
Town of Clearfield	134	359
Town of Cutler	138	366
City of Elroy	10	26
Town of Finley	72	158
Town of Fountain	39	92
Town of Germantown	986	2,211
Village of Hustler	0	0
Town of Kildare	193	495
Town of Kingston	26	60
Town of Lemonweir	104	264
Town of Lindina	20	44
Town of Lisbon	33	87
Town of Lyndon	134	374
Village of Lyndon Station	43	110
Town of Marion	85	187
City of Mauston	68	184
Village of Necedah	22	56
Town of Necedah	628	1,597
City of New Lisbon	21	84
Town of Orange	87	278
Town of Plymouth	70	182
Town of Seven Mile Creek	69	170
Town of Summit	34	85
Village of Union Center	5	10
City of Wisconsin Dells	0	0
Village of Wonewoc	8	19
Town of Wonewoc	9	25

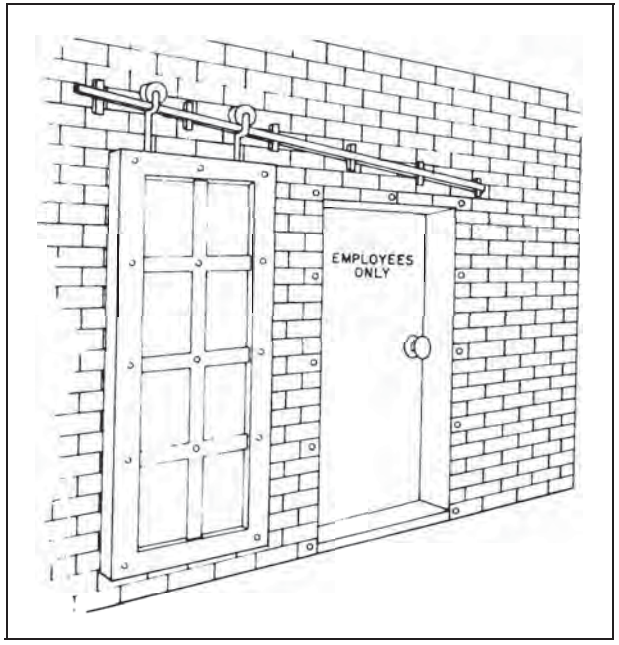
Appendix D

Non-Residential Floodproofing Measures

Technical Bulletin 3-93

Non-Residential Floodproofing — Requirements and Certification

for Buildings Located in Special Flood Hazard Areas
in accordance with the
National Flood Insurance Program



FEDERAL EMERGENCY MANAGEMENT AGENCY
FEDERAL INSURANCE ADMINISRTATION

FIA-TB-3
4/93

Key Word/Subject index:

This index allows the user to quickly locate key words and subjects in this Technical Bulletin. The Technical Bulletin User's Guide (printed separately) provides references to key words and subjects throughout the Technical Bulletins. For definitions of selected terms, refer to the Glossary at the end of this bulletin.

Any comments on the Technical Bulletins should be directed to:

FEMA/FIA
Office of Loss Reduction
Technical Standards Division
500 C St., SW, Room 417
Washington, D.C. 20472

Technical Bulletin 3-93 replaces Technical Bulletin 90-3 (draft) "Non-Residential Floodproofing Certification Requirements."

Graphic design based on the Japanese print The *Great Wave Off Kanagawa,* by Katsushika Hokusai (1760-1849), Asiatic collection, Museum of Fine Arts, Boston.

TECHNICAL BULLETIN 3-93

Non-Residential Floodproofing — Requirements and Certification for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program

Introduction

This bulletin describes design, construction, and planning requirements for the floodproofing of non-residential buildings under the 'National Flood Insurance Program (NFIP) regulations and how to correctly complete the NFIP's Floodproofing Certificate for Non-Residential Structures form. For the purposes of this bulletin, floodproofing means making a building watertight, substantially impermeable to floodwaters.

Before a floodproofed building is designed, numerous planning considerations, including flood warning time, uses of the building, mode of entry to and exit from the building and the site in general, floodwater velocities, flood depths, debris impact potential, and flood frequency, must be addressed to ensure that dry floodproofing will be a viable floodplain management tool. These critical considerations are discussed within this bulletin.

In the FEMA publication "Floodproofing of Non-Residential Structures," floodproofing is described as a combination of adjustments and/or additions of features to buildings that eliminate or reduce the potential for flood damage. Examples of such adjustments and additions include anchoring of the building to resist flotation, collapse, and lateral movement; installation of watertight closures for doors and windows; reinforcement of walls to withstand floodwater pressures and impact forces generated by floating debris; use of membranes and other sealants to reduce seepage of floodwater through walls and wall penetrations; installation of pumps to control interior water levels; installation of check valves to prevent the entrance of floodwater or sewage flows through utilities; and the location of electrical, mechanical, utility, and other valuable damageable equipment and contents above the expected flood level.

Floodproofing components for an individual building may also include floodwalls, small localized levees, or berms around buildings. However, such components, because they are not part of the building itself, are generally not credited for the flood insurance rating of a building under the NFIP and are therefore not detailed within this bulletin.

The NFIP allows a new or substantially improved non-residential building in an A zone (Zone A, AE, A 1-A30, AR, AO, or AH) to have a lowest floor below the base flood elevation (BFE), provided that the building has been designed, constructed, and certified to be floodproofed and to meet established criteria. Floodproofing of areas below the BFE in residential buildings is not permitted under the NFIP. In a Coastal High Hazard Area (Zone V, VE, or V 1 -V30), construction or substantial improvement of a building with a lowest floor elevation below the BFE is not allowed, regardless of any floodproofing techniques employed.

A Floodproofing Certificate for Non-Residential Structures (FEMA Form 81 -65) has been developed by FEMA for use in the certification of non-residential floodproofing designs. Because of the increased potential for significant building damage due to the failure of the floodproofing system, the NFIP requires a design certification for all floodproofed buildings. In

accordance with Section 60.3(c)(4), communities shall require a correctly completed certificate (or its equivalent) for every floodproofed building within a Special Flood Hazard Area (SFHA) and shall maintain the completed certificates on file.

A Floodproofing Certificate for Non-Residential Structures is required for the following types of buildings (in A zones only):

- Floodproofed non-residential buildings (no residential uses).
- Floodproofed mixed-use buildings that are professionally designed with all residential uses located above the floodproofing design elevation.

NFIP Regulations

The NFIP regulations that specifically apply to the design of floodproofing for non-residential buildings are within Section 60.3(c)(3), which states that the community shall:

> ***"Require that all new construction and substantial improvements of non-residential structures within Zones A1 -A30, AE, and AH on the community's FIRM (i) have the lowest floor (including basement) elevated to or above the base flood level, or (ii) together with attendant utility and sanitary facilities, be designed so that below the base flood level the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. "***

Section 60.3(c)(8) further states that the community shall:

> ***"Require within any AO zone on the community's FIRM that all new construction or substantial improvements of non-residential structures (i) have the lowest floor (including basement) elevated above the highest adjacent grade at least as high as the depth number specified in feet on the community's FIRM (at least two feet if no depth number is specified), or (ii) together with attendant utility and sanitary facilities, be completely floodproofed to that (base flood) level to meet the floodproofing standard specified in paragraph 60.3(c)(3)(ii)."***

Additionally, Section 60.3(c)(4) requires that any floodproofing design be certified in the following manner:

> ***"Provide that where a non-residential structure is intended to be made watertight below the base flood level, (i) a registered professional engineer or architect shall develop and/or review structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction are in accordance with the accepted standards of practice for meeting the applicable provisions of paragraphs (c)(3)(ii) or (c)(8)(ii) of this section, and (ii) a record of such certificates which includes the specific elevation (in relation to mean sea level) to which such structures are floodproofed shall be maintained with the official designated by the community... "***

It should be noted that Technical Bulletins provide guidance on the minimum requirements of the NFIP regulations. Community or State requirements that exceed those of the NFIP take precedence. Design professionals should contact the community to determine whether more restrictive local or State regulations apply to the building or site in question. All applicable standards of the State or local building code must also be met for any building in a flood hazard area.

Planning Considerations

A review of the following factors for the site in question will assist the design professional in determining whether floodproofing is appropriate. For example, if a site will be surrounded by rapidly rising, high-velocity floodwaters during a flood, and the available warning time is short, then the site is unsuitable for a floodproofed building.

Warning Time

The rate-of-rise of floodwaters for the site in question, the established flood warning system (if any), the flood warning time available, and the reliability of the flood warning must be reviewed to determine appropriate floodproof design elements. The rate-of-rise or the flood warning time available through an existing reliable (community-based or regionally based) flood warning system must be adequate to provide sufficient lead time to evacuate a floodprone building when flooding threatens. In addition, sufficient warning time must exist to successfully place floodproofing components, such as removable flood shields or gates, if such components are to be included in the floodproofing design. Other examples of floodproofing techniques that can require human intervention are operating sump pumps and closing valves. The amount of time necessary to put human intervention floodproofing components in place will depend upon the number of components, their complexity, and the availability of personnel to place them. Floodproofed buildings are not appropriate for any site in a flash flood area, because of the potentially short warning time.

Safety and Access

Safe access to a floodproofed building is a critical factor in the determination of whether floodproofing is an appropriate design alternative. In 1987, Colorado State University conducted a study of human stability in flood flow conditions based on the product number of depth of flow multiplied by the floodwater velocity. Results of this study indicated that any floodplain location with a product number of 4 or greater represents a significant hazard to individuals. Floodplain sites with a base flood product number number of 4 or greater (depth in feet multiplied by velocity in feet per second) will create a hazard for anyone attempting to escape from or gain access to the site. Such sites are not generally acceptable for floodproofed buildings, unless modifications are made to the site to reduce the flood hazard.

For any floodproofed building, all roads to be used as evacuation routes must remain passable as the floodwaters rise. In addition, all roads that provide access to buildings whose dry-floodproofing components require human intervention must remain passable long enough for the floodproofing components to be installed and for all personnel to safely evacuate the site. For sites with an acceptably low hazard (product number less than 4) that are contiguous to land above the BFE, evacuation and access during times of flooding are generally not critical considerations.

Flood Velocities, Flood Depths, and Debris

For sites with flood velocities in excess of 5 feet per second or base flood depths in excess of 3 feet, the cost of dry-floodproofed construction may be prohibitive. Part 3 of the section of this bulletin titled "Minimum Engineering Considerations" describes the flood forces that a floodproofed building must be able to resist. Flood-borne debris can generate impact forces that may make a dry-floodproofed design technically infeasible and therefore inappropriate. A level of safety above the BFE, referred to as freeboard, is recommended, as discussed under "Minimum Engineering Considerations. "

Note: While buildings need only be protected to the BFE for floodplain management purposes, freeboard is considered for flood insurance rating purposes. Because of the additional risk associated with any floodproofed building, 1 foot is subtracted from the elevation to which a building has been floodproofed, for insurance rating (if the building is floodproofed at least to the BFE). Therefore, to receive an insurance rating based on 100-year flood protection, the building must be floodproofed to an elevation at least 1 foot above the BFE. Insurance premiums will be lower if floodproofing exceeds this requirement.

Flood Frequency

A site that has been flooded frequently may not be appropriate for a dry-floodproofed building. The cumulative wear-and-tear on a building's external components as a result of recurring inundation may render a dry floodproofing strategy infeasible. The cost of repeated business interruption and of frequent cleanup activities, as well as the effects of having to repeatedly implement a flood emergency plan, must be assessed.

If the evaluation of each of the aforementioned factors indicates that dry floodproofing is a viable floodplain management alternative, then a floodproofing design is developed. For all floodproofed buildings, the design professional must then produce both a Flood Emergency Operation Plan and an Inspection and Maintenance Plan for the building.

Flood Emergency Operation Plan

A Flood Emergency Operation Plan is an integral part of any building's floodproofing design and is critical when the floodproofing requires human intervention such as the installation of flood gates or flood shields. A Flood Emergency Operation Plan is necessary for any floodproofed building to ensure that the floodproofing components will operate properly under all conditions, including power failures. A continuous source of electricity to operate any necessary floodproofing components, such as pumps, will be needed for any floodproofing design that

includes such components. The design professional must produce the plan. An adequate plan must include the following:

1. An established chain of command and responsibility with leadership responsibilities clearly defined for all aspects of the plan.
2. A procedure for notification of necessary parties when flooding threatens and flood warnings are issued. Personnel required to be at the building should have a planned and safe means of ingress and should have no other emergency response duties during a flood event. Alternates should be assigned in the event that the primary persons responsible are unable to complete their assigned duties under the plan.
3. A list of specific duties assigned to ensure that all responsibilities are addressed expeditiously. The locations of materials necessary to properly install all floodproofing components must be included in the list.
4. An evacuation plan for all personnel—those without duties for the flood emergency as well as those with duties for implementing the plan. All possible ingress and egress routes must be identified.
5. A periodic training and exercise program to keep personnel aware of their duties and responsibilities. Training drills should be held at least once a year and should be coordinated with community officials. Flood safety precautions should be repeated during each training drill.

Inspection and Maintenance Plan

Every floodproofing design requires some degree of periodic maintenance and inspection to ensure that all components will operate properly under flood conditions. The necessary inspection and maintenance activities, including inspection intervals and repair requirements, must be described in the Inspection and Maintenance Plan. Components that should be inspected as part of an annual (as a minimum) maintenance and inspection program include the following:

1. Mechanical equipment such as sump pumps and generators.
2. Flood shields and closures, to ensure that they fit properly and that the gaskets and seals are in good working order, properly labeled, and stored as indicated in the Flood Emergency Operation Plan.
3. Walls and wall penetrations, for cracks and potential leaks.
4. Levees and berms, for excessive vegetative growth, cracks, or leaks.

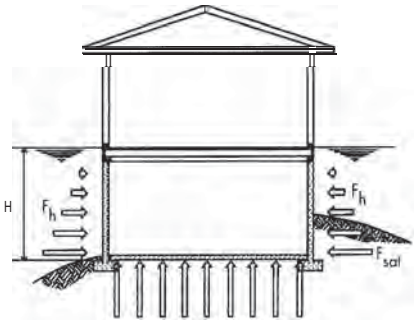
Both the Flood Emergency Operation Plan and the Inspection and Maintenance Plan are necessary at the time that the Non-Residential Floodproofing Certificate is submitted to the community. Before issuing a building permit, the community should require that the property owner sign an agreement stating that the plan will be adhered to. The community should also be assured that the inspection and maintenance activities required by the plan will continue regardless of changes in the ownership of the floodproofed building. This assurance should be accomplished by appropriate deed restrictions. Any lease agreement should also contain clear language stating the leaseholder's responsibilities for the floodproofed building.

Minimum Engineering Considerations

The design professional, a registered professional engineer or architect, must certify that the following requirements have been met by the building's design, specifications, and plans:

1. The building must be watertight (i.e., floodwaters must not enter the building envelope):
   a. The building must be watertight to the floodproof design elevation, which is further defined as being at least the BFE. As previously noted, floodproofing to any elevation less than 1 foot above the BFE will have a serious negative impact on the flood insurance rating for the building. Generally a minimum of 1 foot of freeboard is recommended. Additional freeboard is warranted for sites where predicted flood depths may be inaccurate, such as sites within large drainage areas and rapidly urbanizing areas.
   b. The building's walls must be "substantially impermeable to the passage of water." FEMA has adopted the U.S. Army Corps of Engineers (COE) definition of substantially impermeable from the COE publication "Flood Proofing Regulations." This document states that a substantially impermeable wall "shall not permit the accumulation of more than 4 inches of water depth during a 24-hour period if there were no devices provided for its removal. However, sump pumps shall be required to control this seepage." Flood-resistant materials, described in Technical Bulletin 2, "Flood-Resistant Materials Requirements," must be used in all areas where such seepage is likely to occur.
2. The building's utilities and sanitary facilities, including heating, air conditioning, electrical, water supply, and sanitary sewage services, must be located above the BFE, completely enclosed within the building's watertight walls, or made watertight and capable of resisting damage during flood conditions.
3. All of the building's structural components must be capable of resisting specific flood-related forces. These are the forces that would be exerted upon the building as a result of floodwaters reaching the BFE (at a minimum) or floodproofing design level, and include the following:
   a. Hydrostatic Flood Force—This is the force that water at rest exerts on any submerged object. For a floodproofed building design, the calculations of hydrostatic flood forces must include saturated soil pressure on any portion of the building that is below grade (see Figure 1). Guidelines for determining hydrostatic pressure are provided on the following page.

HYDROSTATIC PRESSURES BY WATER DEPTH	
HEIGHT (H) (WATER DEPTH)	Ph (LBS/SQ.FT.)
1	62.4
2	124.8
3	187.2
4	249.6
5	312.0
6	374.4
7	436.8
8	499.2
9	561.6
10	624.0



Buoyancy Force

Figure 1. Hydrostatic Pressure Diagram

Resultant Lateral Force Due to Hydrostatic Pressure from Freestanding Water:

$F_h = \frac{1}{2}wH^2$

where: F_h is the lateral force from freestanding water (in pounds per linear foot of surface)

w is the specific weight of water (62.4 pounds per cubic foot)

H is the height of the standing water (to the floodproof design level)

If any portion of the building is below grade, then calculate the Resultant Cumulative Lateral Force Due to Hydrostatic Pressure from Saturated Soil:

$F_{sat} = \frac{1}{2}SD^2 + F_h$

where: F_{sat} is the lateral force from saturated soil

S is the equivalent fluid weight of saturated soil (in pounds per cubic foot)

D is the depth of saturated soil (in feet)

F_h is the lateral force from freestanding water

Note: See Appendix C of the FEMA "Design Manual for Retrofitting Flood-Prone Residential Structures" for further information.

b. Buoyancy-This is the vertical force associated with the building's tendency to float when inundated or surrounded by floodwaters. This force can be calculated as shown below.

Buoyancy Force:

$F_b = wAH$

where: F_b is the force due to buoyancy

w is the specific weight of water (62.4 pounds per cubic foot)

A is the area of horizontal surface (floor or slab) being acted upon (in square feet)

H is the depth of building below the floodproofing design level (in feet)

Note: See Appendix C of the FEMA "Design Manual for Retrofitting Ftood-Prone Residential Structures" for further information.

c. Hydrodynamic Force—This is the force exerted on vertical surfaces exposed to moving floodwaters. The determination of hydrodynamic force is based on the expected velocity of the floodwaters with depths to the floodproofing design level (BFE or higher). The projected average base flood velocity within the floodway may be obtained using FEMA Flood Insurance Studies (FISS) where a floodway has been identified. It should be noted that velocities in the flood fringe will generally be less than the floodway velocities presented in the FIS. Where no FIS velocity data exist, velocities should be determined using Manning's equation, as found in most hydraulic reference and text books.

Hydrodynamic Force:

$F_d = C_d m \frac{1}{2}(V)^2 A$

where: F_d is the lateral force due to hydrodynamic pressure

C_d is the drag coefficient

m is the mass density of water (1.94 slugs per cubic foot)

V is the velocity of the water (in feet per second)

A is the area of the wall affected (in square feet)

Note: See Appendix C of the FEMA "Design Manual for Retrofitting Ftood-Prone Residential Structures" for further information.

d. Debris Impact Force—This is the force associated with flood-borne debris striking the side of a building. This force presents the greatest unknown to the designer, but a value must be estimated to develop an effective floodproofing design. Unless more detailed information is available, such as historical debris flow data, the formula shown below should be used. This formula assumes a 1-second duration of impact. The weight of the object is generally estimated at 1,000 pounds but can be reduced to 500 pounds for areas subject to minor debris flow potential. Any areas subject to severe debris (such as mountainous regions or areas subject to ice floes) are not appropriate sites for floodproofed buildings unless the designer takes these forces into account in designing and armouring the building. Armouring often results in designs that are not cost-effective.

Debris Impact Force:

$$F_i = \frac{WV}{gt}$$

where: F_i is the Impact Force

w is the weight of the object (in pounds)

v is the velocity of the object (in feet per second)

g is the acceleration due to gravity (32.2 feet per second^2)

t is the duration of impact (in seconds)

Note: See Appendix C of the FEMA "Design Manual for Retrofitting Flood-Prone Residential Structures" for further information.

4. Like all construction that falls under the NFIP regulations, the building must meet the requirements of all applicable portions of local and State building codes, including the provisions of the Americans with Disabilities Act; life-safety codes for ingress, egress, and clearing; and venting and combustion air requirements.

Preparation of the Floodproofing Certificate for Non-Residential Buildings

The Floodproofing Certificate is required for all non-residential buildings to be floodproofed and is to be completed by the design professional. The first part of the Certificate contains information concerning the location and ownership of the building.

FEDERAL EMERGENCY MANAGEMENT AGENCY
NATIONAL FLOOD INSURANCE PROGRAM

O.M.B. No. 3067-007

FLOODPROOFING CERTIFICATE

FOR NON-RESIDENTIAL STRUCTURES

The floodproofing of non-residential buildings maybe permitted as an alternative to elevating to or above the Base Flood Elevation; however, a floodproofing design certification is required. This form is to be used for that certification. Floodproofing of a residential building does not alter a cummunity's floodplain management elevation requirements or affect the insurance rating unless the community has been issued an exception by FEMA to allow floodproofed residential basements. The permitting of a floodproofed residential basement requires a separate certification specifying that the design complies with the local floodplain management ordinance.

	FOR INSURANCE COMPANY USE
BUILDING OWNER'S NAME	POLICY NUMBER
STREET ADDRESS (including Apt., Unit, Suite and/or Bldg. Number) OR P.O ROUTE AND BOX NUMBER	COMPANY NAIC NUMBER
OTHER DESCRIPTION (Lot and Block Numbers, etc.)	
CITY	STATE ZIP CODE

Building location and Ownership information

Section I of the Certificate is the Flood Insurance Rate Map (FIRM) information, including the BFE used in designing the floodproofing system. Copies of the FIRM should be available through the community's floodplain administrator.

SECTION I FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

Provide the following from the proper FIRM:

COMMUNITY NUMBER	PANEL NUMBER	SUFFIX	DATE OF FIRM INDEX	FIRM ZONE	BASE FLOOD ELEVATION (in AO Zones use depth)

Section I

Section II requests information regarding the floodproofing design. The first item is the elevation, referenced to the datum of the FIRM (generally the National Geodetic Vertical Datum of 1929), to which the building is floodproofed. This elevation must be equal to or greater than the BFE. It is important to note that for insurance rating purposes, the floodproofing design must provide protection to 1 foot above the BFE to receive rating credit. If the building is floodproofed only to the BFE, then the building's insurance rating will result in a higher premium. Before a decision is made to floodproof to less than 1 foot above the BFE, insurance implications should be carefully considered.

The second item is the height of the floodproofing above the lowest adjacent grade. This information is intended to be used by community building officials, FEMA, and NFIP insurance underwriters to analyze the level of safety that the floodproofing design will provide. Since floodwaters exert greater pressure on the floodproofed building as the height of the flooding increases (see Figure 1), floodproofing that exceeds 3 feet in height represents a greater risk and may result in insurance rates that reflect this increased risk.

SECTION II FLOODPROOFING INFORMATION (By a Registered Professional Engineer or Architect)

Floodproofing Design Elevation Information:

Building is floodproofed to an elevation of __.__ feet NGVD. (Elevation datum used must be the same as that on the FIRM.)

Height of floodproofing on the building above the lowest adjacent grade is feet.

(NOTE: for insurance rating purposes, the building's floodproofed design elevation must be at least one foot above the Base Flood Elevation to receive rating credit. If the building is floodproofed only to the Base Flood Elevation, then the building's insurance rating will result in a higher premium.)

Section II

Section III is the actual certification of the floodproofing design as required in Section 60.3(c)(4) of the NFIP regulations. It is important to note that design professionals signing this form are certifying that they have developed and/or reviewed the design plans and specifications and find them in compliance with accepted standards of practice for dry floodproofing. This certification is based on the floodproofing design, not the as-built condition of the building. The person signing this form must be a registered professional engineer or architect within the state or territory where the building will be constructed or substantially improved.

SECTION III CERTIFICATION (By a Registered Professional Engineer or Architect)

Non-Residential Floodproofed Construction Certification:

I certify that based upon development and/or review of structural design, specifications, and plans for construction that the design and methods of construction are in accordance with accepted standards of practice for meeting the following provisions:

The structure, together with attendant utilities and sanitary facilities, is watertight to the floodproofed design elevation indicated above, with walls that are substantially impermeable to the passage of water.

All structural components are capable of resisting hydrostatic and hydrodynamic flood forces, including the effects of buoyancy, and anticipated debris impact forces.

I certify that the information on this certificate represents my best effort to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.

CERTIFIER'S NAME	LICENSE NUMBER (or Affix Seal)		
TITLE	COMPANY NAME		
ADDRESS	CITY	STATE	ZIP
SIGNATURE	DATE	PHONE	

Copies should be made of this certificate for: 1) community official, 2) insurance agent/company, 3) building owner.

FEMA Form 81-65

Section III

The NFIP

The NFIP was created by Congress in 1968 to provide federally backed flood insurance coverage, because flood insurance was generally unavailable from private insurance companies. The NFIP is also intended to reduce future flood losses by identifying floodprone areas and ensuring that new development in these areas is adequately protected from flood damage. The NFIP is based on an agreement between the federal government and participating communities that have been identified as being floodprone. FEMA, through the Federal Insurance Administration (FIA), makes flood insurance available to the residents of a participating community provided that the community adopts and enforces adequate floodplain management regulations that meet the minimum NFIP requirements. The NFIP encourages communities to adopt floodplain management ordinances that exceed the minimum NFIP criteria. Included in the NFIP requirements, found under Title 44 of the U.S. Code of Federal Regulations, are minimum building design and

construction standards for buildings located in SFHAs. Through their floodplain management ordinances, communities adopt the NFIP design performance standards for new and substantially improved buildings located in floodprone areas identified on FIA's FIRMs.

Technical Bulletins

This is one of a series of Technical Bulletins FEMA has produced to provide guidance concerning the building performance standards of the NFIP. These standards are contained in Title 44 of the U.S. Code of Federal Regulations at Section 60.3. The bulletins are intended for use primarily by State and local officials responsible for interpreting and enforcing NFIP regulations and by members of the development community, such as design professionals and builders. New bulletins, as well as updates of existing bulletins, are issued periodically, as necessary. The bulletins do not create regulations; rather they provide specific guidance for complying with the minimum requirements of existing NFIP regulations. Users of the Technical Bulletins who need additional guidance concerning NFIP regulatory requirements should contact the Natural Hazards Branch of the appropriate FEMA regional office. The "User's Guide to Technical Bulletins" lists the bulletins issued to date and provides a key word/subject index for the entire series.

Ordering Information

Copies of the Technical Bulletins can be obtained from the appropriate FEMA regional office. Technical Bulletins can also be ordered from the FEMA publications warehouse. Use of FEMA Form 60-8 will result in a more timely delivery from the warehouse — the form can be obtained from FEMA regional offices and your state's Office of Emergency Management. Send publication requests to FEMA Publications, P.O. Box 70274, Washington, D.C. 20024.

Further Information

The following publications provide further information concerning non-residential floodproofing:

1. "Answers to Questions About Substantially Damaged Buildings," FEMA, May 1991, FEMA-213.
2. "Block and Brick Wall Integrity Against Water Heights and Systems and Materials to Prevent Flood Waters From Entering Buildings," Carl E. Pace, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi, 1984.
3. "Commercial-Industrial Flood Audit," New England District, U.S. Army Corps of Engineers, n.d.
4. "Cooperative Flood Loss Reduction, A Technical Manual for Communities and Industries," Flood Loss Reduction Associates, 1981.
5. "Design Manual for Retrofitting Flood-Prone Residential Structures," FEMA, September 1986, FEMA-1 14.
6. "Floodproofing Non-Residential Structures," FEMA, May 1986, FEMA- 102.

7. "Flood Proofing Regulations," U.S. Army Corps of Engineers, March 1992, EP 1165-2-314.
8. "Human Stability in a High Flood Hazard Zone," S.R. Abt, R.J. Whittlen, A. Taylor, and D.J. Love, Water Resource Bulletin, August 1989.
9. "Sealants, Part 1," John P. Cook, Progressive Architecture, December 1974.
10. "Sealants, Part 2," John P. Cook, Progressive Architecture, February 1975.
11. "Systems and Materials to Prevent Flood Waters from Entering Buildings," U.S. Army Corps of Engineers, 1984.
12. "Tests of Brick-Veneer Walls and Enclosures for Resistance to Flood Waters," Carl E. Pace, U.S. Army Corps of Engineers, Lower Mississippi Division, Vicksburg, Mississippi, 1978.

Glossary

Base flood — The flood that has a 1-percent probability of being equaled or exceeded in any given year (also referred to as the 100-year flood).

Base Flood Elevation (BFE) — The height of the base flood, usually in feet, in relation to the National Geodetic Vertical Datum of 1929 or other datum as specified.

Basement — Any area of a building having its floor subgrade (below ground level) on all sides.

Coastal High Hazard Area — An area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high-velocity wave action from storms or seismic sources.

Federal Emergency Management Agency (FEMA) — The independent federal agency that, in addition to carrying out other activities, oversees the administration of the National Flood Insurance Program.

Federal Insurance Administration (FIA) — The component of FEMA directly responsible for administering the National Flood Insurance Program.

Flood Insurance Rate Map (FIRM) — The insurance and floodplain management map issued by FEMA that identifies, on the basis of detailed or approximate analyses, areas of 100-year flood hazard in a community.

Floodprone area — Any land area susceptible to being inundated by floodwater from any source.

Lowest floor — The lowest floor of the lowest enclosed area of a building, including a basement. Any NFIP-compliant unfinished or flood-resistant enclosure useable solely for parking of vehicles, building access, or storage (in an area other than a basement) is @ considered a building's lowest floor.

Special Flood Hazard Area (SFHA) — Area delineated on a Flood Insurance Rate Map as being subject to inundation by the base flood and designated as Zone A, AE, A1-A30, AR, AO, AH, V, VE, or V1-V30.

Substantial damage — Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

Substantial improvement – Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the "start of construction" of the improvement. This term includes structures that have incurred "substantial damage," regardless of the actual repair work performed.

Appendix E

August 2018 Flood Event News Reports

Interstate 90/94 closed in both directions near Mauston

By NBC15 Staff | Posted: Tue 1:38 PM, Aug 28, 2018 | Updated: Wed 10:35 AM, Aug 29, 2018

JUNEAU COUNTY, Wis. (WMTV)--- The eastbound and westbound lanes of I-90/94 near Mauston in Juneau County are closed Tuesday afternoon because of flooding.

Michael Bie, a spokesperson with the Wisconsin Department of Transportation, said eastbound traffic is being detoured from New Libson east on Wisconsin Highway 80 to Necedah, east on Wisconsin Highway 21 to Coloma and south on I-39 to Portage.

Bie said westbound I-90/94 is being detoured at Portage via I-39, Wisconsin Highway 21 in Coloma to Tomah.

Bie said motorists are urged to use the designated route as many state, county and local roads are experiencing flooding.

Standing Water on Interstate 90-94 caused a portion of the Interstate between Mauston and New Lisbon to close.
Image source: NBC15

Evacuations underway in Elroy following heavy overnight rain

Posted: Aug 28, 2018 10:35 AM CDT
Updated: Aug 28, 2018 10:35 AM CDT

UPDATE (WKOW) -- First responders rescued people from about 30 homes in Elroy Tuesday. Between 12 and 15 of those were by boat.

There are reports of homes with collapsed foundations and side roads washed out. The Elroy Fire Department says people should stay off the road if you can to help first responders rescue people.

****

ELROY (WKOW) -- Residents of several neighborhoods in the Juneau County city of Elroy have been evacuated because of flooding caused by heavy overnight rain.

Numerous streets are under water, according to a WKOW news crew now on the scene.

A shelter has been opened at Royall Elementary School for evacuees.

The storms that swept through central Wisconsin late Monday night and into Tuesday morning dropped significant rain in some areas and left damage in their wake.

The Sauk County Sheriff's Office told 27 News there were trees down near Lake Redstone and flooding reported near the iHop on Highway 13 in Wisconsin Dells.

The National Weather Service also received these reports after the storms moved through:

Trees and power lines down -- 1 mile ENE of Wisconsin Dells
3 inches of rain in Montello
50 mile per hour wind gust -- 1 mile E of Princeton
Trees down along Highway 12 in West Baraboo

These storms also dropped inches of rain in some places. Here are some of those radar-estimated amounts:

Mauston: 5-7"
Wisconsin Dells: 4-5"
Portage: 2-4"

The City of Elroy was one of the hardest hit communities by the August 2018 flood event.
Image source: Channel 3000

WKOW.COM
WE'VE GOT YOU COVERED

Heavy rain, flooding in Juneau County after strong overnight storms

Posted: Aug 28, 2018 1:04 AM CDT
Updated: Aug 28, 2018 1:04 AM CDT

UPDATE (WKOW) -- Residents along the Baraboo River watershed can expect high water coming their way.

Heavy overnight rain in Vernon and Juneau Counties where the Baraboo and West Baraboo rivers flow caused flooding in Hillsboro, according to Adam Sonntag, city administrator.

Sonntag says all four gates of the dam just west of town were opened for a while to alleviate the water height out of the West Branch of the Baraboo River accumulating in a nearby lake, according to Sonntag.

Water in Hillsboro is going down this morning but it is too early to asses any damage.

That water is now flowing toward Union Center where the West Branch meets the Baraboo River, according to Sonntag.

From there, the Baraboo continues on to Wonewoc, LaValle, Reedsburg and into Baraboo.

Flooding has been reported in Elroy, Wonewoc and LaValle.

WKOW has news crews in the area and will have reports soon.

In Adams County, HY G in the Town of New Haven is the only road closed due to flooding, according to Adams County Sheriff Terry Fahrenkrug.

****

UPDATE (WKOW) -- The Sauk County Sheriff's Office recommends drivers use caution Tuesday morning.

Officials say water remains over some roadways.

More rain is forecast for later Tuesday and they say conditions can change quickly.

Highway H has been closed due to a culvert washout and Highway F is closed due to a bridge being out.

****

MADISON (WKOW) -- The storms that swept through southern Wisconsin late Monday night and into Tuesday morning dropped a lot of rain in some areas and left damage in their wake.

The Sauk County Sheriff's Office told 27 News there were trees down near Lake Redstone and flooding reported near the iHop on Highway 13 in Wisconsin Dells.

The National Weather Service also received these reports after the storms moved through:

- Couple trees and power lines down -- 1 mile ENE of Wisconsin Dells
- 3 inches of rain in Montello
- 50 mile per hour wind gust -- 1 mile E of Princeton
- Trees down along Highway 12 in West Baraboo

These storms also dropped inches of rain in some places. Here are some of those radar-estimated amounts:

- Mauston: 5-7"
- Wisconsin Dells: 4-5"
- Portage: 2-4"

Heavy rains forced County Highway FF in Wonewoc to close as part of the flood event of August 2018.
Image source: Channel 3000

Sandbagging flurry in flood-ravaged Wisconsin counties; I-90/94 near Mauston partially open

From the Stories, photos and videos: Devastating floods hit La Crosse area; more rain forecast for Friday series

BILL NOVAK bnovak@madison.com 23 hrs ago

8/30/2018 Sandbagging flurry in flood-ravaged Wisconsin counties; I-90/94 near Mauston partially open | Wisconsin | lacrossetribune.com

Sandbagging efforts are of prime importance Wednesday in Wisconsin counties hard hit by torrential rains on Tuesday, mainly because of rivers rising so quickly and overflowing banks.

Dozens of roads remain closed because of flooding, but one main highway, Interstate 90/94 near Mauston in Juneau County is partially open.

The westbound lanes are open from Portage to Mauston, but a detour remains in place for the eastbound lanes, with motorists getting off at New Lisbon.

"Motorists are encouraged to use the designated detour route, as many state, county and local roads are experiencing flooding," the Wisconsin Department of Transportation said.

Highway 49 near Pole Road in Dodge County is closed, because a large power line fell across the highway. Detours have been set up.

"This highway may be closed up to 24 hours as power lines are being repaired," said Sheriff Dale Schmidt.

In south-central Wisconsin, Sauk, Richland and Rock counties are preparing sandbags for communities expected to be hardest hit by floodwaters.

In Reedsburg in Sauk County, Police Chief Tim Becker said residents who were flooded in 2008 can expect similar flooding over the next day or so, because of water flowing over the Hillsboro dam.

"Sandbagging is recommended for homes on the west side of Reedsburg," Becker said. Materials are at Reedsburg Area High School and the RACA building, so Becker is encouraging those unaffected by the flooding to volunteer to help fill sandbags.
The Baraboo River is expected to rise 10 feet because of the rains, so inmates from the Sauk County Jail are helping fill sandbags at the highway facility in West Baraboo.
"The water continues to rise in LaValle and will down the Baraboo River," said Sauk County Emergency Management Director Jeff Jelinek. "If you are in a low-lying area or are prone to flooding, now is the time to prepare."

In Richland County, Viola is feeling the flooding stress from the Kickapoo River, and Yuba and Hub City are getting hit with floodwaters in the Pine River.

Rockbridge, Richland Center and parts to the south will also be affected by rising water.

"All those down river of these floodways are encouraged to take necessary precautions, and some residents have been encouraged to evacuate," the Richland County Emergency Management office said.

In Rock County, sand and sandbags are available at the Town of Rock town hall in Afton, the Newville Park and Ride, the North River Road boat landing, in Janesville at 900 N. Parker Drive and in Beloit at 2351 Springbrook Court.

In Dane County, several roads that had been closed by flooding are now open or will reopen later Wednesday.

Highway KP from Black Earth west to Highway F is open, and Highway G from Highway J to Marsh View Road is expected to open.

Highway W from Highway B to East Church Street remains closed, and Highway 14 in Black Earth will be closed for months because two bridges need to be replaced.

There are plenty of closed highways throughout the region, and a complete list of closures as well as highways that have reopened can be found on the state highway travel map at 511wi.gov.

In Madison, heavy rain didn't materialize as forecast, so there was less chance of flash flooding in the Isthmus, but high water in Lake Mendota is still going to be released through the Tenney Dam, which could affect city streets.

Gov. Scott Walker declared a state of emergency for Fond du Lac, Juneau, La Crosse, Monroe, Vernon and Washington counties, because of the damage caused by severe storms blowing through the region Tuesday afternoon.

Numerous flood warnings for rivers in the region have been issued by the National Weather Service.

The warnings include:

- The Wisconsin River at Portage in Columbia County, expected to reach flood stage by Thursday morning.
- The Crawfish River at Milford in Jefferson County, expected to reach flood stage Thursday morning.

The Baraboo River at Rock Springs, La Valle, Reedsburg and near Baraboo, with flooding beginning Wednesday afternoon at Rock Springs and cresting Friday morning; water flooding downtown La Valle already with the river five feet above flood stage; minor flooding in Reedsburg; and flooding starting Wednesday evening near Baraboo and cresting Sunday morning.

Flooding closed portions of State Highway 80/82 in the Village of Wonewoc.
Image source: Channel 3000

INCIDENT REPORT

Wisconsin Emergency Operations Center

Department of Military Affairs | 2400 Wright Street | Madison, WI 53707

Incident Report #8 – August Wisconsin Flooding
August 29, 2018
Contact: State Emergency Operations Center Phone: 608-888-5328

Recovery efforts continue in communities across Wisconsin, following recent storms that have caused widespread flooding in many parts of the state and generated at least two tornadoes on Tuesday evening. The tornadoes, which touched down in southwest Fond du Lac County near Brandon and north of Kiel near the Calumet and Manitowoc County lines, downed trees and power lines, while also damaging multiple buildings. No injuries were reported.

Governor Scott Walker on Wednesday declared a State of Emergency for all of Wisconsin, which directs state agencies to assist local governments in their response to the flooding and allows the Wisconsin National Guard to be called to active duty by the adjutant general if requested. The governor on Wednesday viewed storm damage in western Wisconsin, taking an aerial tour of the region and visiting several communities hit by flooding.

Several parts of the state have experienced torrential rainfalls in the past two weeks with some areas receiving more than 14 inches of rain. This has caused lake levels to rise in Dane County and pushed portions of the Kickapoo and Baraboo rivers to record levels. An additional half inch of rain could fall on parts of the state late Thursday night.

Private property owners should report flood and storm damage by calling 2-1-1 or 877-947-2211. Make sure to document damage by taking pictures and speak with your insurance agent. Multiple resources designed to help residents with their recovery efforts is being posted online at http://readywisconsin.wi.gov/flooding/AUG2018.asp

Several roads throughout the state remain closed due to standing water or because of damage caused by flooding. Drivers are urged to check 511wi.gov for current road closure information. If drivers encounter a closed route or standing water on a roadway, turn around and find another route. Do not drive around barricades or through water.

Adams County
Multiple roads are closed in the southern portion of Adams County, mainly in the Town of New Haven, due to heavy rains and flooding. Approximately 1,900 customers were without power in the county. A State of Emergency has been declared in the county.

Bayfield County
Trees were reported down in several areas throughout the county, with branches and leaves visible on many roadways. No road closures are currently reported.

Brown County
Heavy rainfall on Tuesday caused street flooding in Green Bay.

Calumet County
Nearly a dozen homes near the City of New Holstein received damage during Tuesday's storm. Calumet County and the City of New Holestein have both declared a state of emergency.

Dane County
Multiple residences have been evacuated and several roads remain closed in the county. A shelter is open at Madison West High School. A State of Emergency has been declared in the county, and the Dane County Emergency Operations Center was activated. There has been one confirmed fatality of a missing person. Officials continue to monitor lake levels.

Dunn County
Downed trees are being removed and power lines are being repaired in an area south of State Highway 170.

Fond du Lac County
Approximately 6,650 customers in the county were without power. There is also localized flooding on some streets in the city of Fond du Lac. Two barns in the county collapsed, killing approximately 100 cattle. A shelter is open at Brandon Elementary School in the village of Brandon. The National Weather Service has concluded a probable EF-1 tornado touched down near the village of Brandon late Tuesday. A State of Emergency has been declared in the county, and the Fond du Lac County Emergency Operations Center was activated.

Green Lake County
Minor damage to a barn and some silos have been reported from a tornado touchdown. Approximately 420 customers in the county were without power.

Iron County
Multiple reports of trees down and water over roadways in the northern half of the county.

Jackson County
Strong winds damaged multiple residences and knocked down trees in the town of Cleveland.

Jefferson County
Approximately 130 residences were without power and several trees are down in the area.

Juneau County
Multiple roads in the county are closed due to flooding. A shelter is open at Elroy Elementary School. A State of Emergency has been declared in the county.

Heavy rains in late August forced numerous roads in Adams and Juneau counties to close.
Image source: NBC15

8/30/2018 UPDATE: Current road closures in southern Wisconsin - WKOW 27: Madison, WI Breaking News, Weather and Sports

UPDATE: Current road closures in southern Wisconsin

Posted: Aug 28, 2018 12:55 PM CDT
Updated: Aug 28, 2018 12:55 PM CDT
1:15 p.m. Wednesday

Crawford County

- US 61 closed from WIS 171 to US 14 (Readstown in Vernon County). No posted detour.
- WIS 131 closed between WIS 171 and US 61. No posted detour.
- WIS 171 closed from WIS 27 (Mount Sterling) to US 61 (Rolling Ground). No posted detour.

Dane County

- US 14 closed between Cross Plains and Black Earth; traffic detoured via WIS 78 and US 12.

Dodge County

- WIS 49 closed from County Y to WIS 175 for power lines over the roadway. No posted detour.

Juneau County

- I-90/94 eastbound closed from mile marker 69 near Mauston to mile marker 79 at Lyndon Station
- Eastbound traffic detoured at New Lisbon via WIS 80 (Necedah), WIS 21 (Coloma) and I-39 (Portage)
- Westbound is open to traffic
- US 12 closed between Mauston and Lyndon Station. No posted detour.
- WIS 33 closed between WIS 82 and Wonewoc. No posted detour.
- WIS 80/82 closed between Union Center and Elroy. No posted detour.

La Crosse County

- WIS 35 is open to one lane with flagging operations between County K and US 14
- WIS 162 closed between US 14/61 (Vernon County) and WIS 33 (Middle Ridge). No posted detour.

Marquette County

- WIS 23 closed at Neenah Creek bridge two miles east of Briggsville. High water at the bridge. No posted detour.
- WIS 22 closed at Main Street Bridge over the Montello River in Montello. High water at the bridge. No posted detour.

Monroe County

- WIS 33 closed between Cashton and WIS 131 (Ontario). No posted detour.
- WIS 131 closed between Wilton and Ontario. No posted detour.

Richland County

- WIS 131 closed between WIS 56 and WIS 82. No posted detour.
- WIS 56 closed from WIS 131 (Viola) to County G. No posted detour.

- WIS 80 closed at County D (just north of Rockbridge). No posted detour.

Sauk County

- WIS 23 closed at Albert Street in Reedsburg. No posted detour.
- WIS 33 closed between Wonewoc and WIS 58. No posted detour.
- WIS 33 closed from WIS 58 (LaValle) to WIS 23 (Reedsburg). No posted detour.
- WIS 58 closed between County G (Ironton) and WIS 33 (LaValle). No posted detour.

Sheboygan County

- WIS 42 between County Road FF and Orchard Road is closed for downed powerlines. Expected to reopen this evening. Traffic detoured via I-43 and County Road XX.

Vernon County

- US 14/61 closed between US 14/WIS 27/82 (Viroqua) to High Point Road (Richland County Line). No posted detour.
- WIS 33/131 intersection closed in Ontario. No posted detour.
- WIS 56 closed between Viroqua and Viola. No posted detour.
- WIS 82 closed between Slayback Road and South Mill Street (LaFarge). No posted detour.
- WIS 131 closed between Ontario and Rockton. No posted detour.
- WIS 131 closed between WIS 82 and West Adams Street (LaFarge). No posted detour.
- WIS 162 closed between Chaseburg (Depot Street) to US 14. No posted detour.
- WIS 162 closed between US 14/61 (Coon Valley) and WIS 33 (Middle Ridge, La Crosse County). No posted detour.

****

UPDATE (WKOW) -- Westbound I90/94 is now open, according to the Juneau County Sheriff's Office.
Crews are working on repairs to the road Eastbound near Mauston and that remains closed. US 12 is still flooded between Mauston and Lyndon Station so that is not a viable alternate route.

****

UPDATE (WKOW) -- All eastbound and westbound lanes of I-90/94 between Mauston and Lyndon Station are closed because of water on the highway, according to the Wisconsin State Patrol.
The total closure began about 4:30 p.m. Tuesday.
Westbound I-90/94 is detoured at Portage via I-39 north, then west on WIS 21 in Coloma to Tomah to return to the interstate.
Eastbound I-90/94 is detoured at New Lisbon via WIS 80 to Necedah, WIS 21 to Coloma, and I-39 south to Portage to rejoin I-90/94 eastbound.

****

UPDATE (WKOW) -- As of 2:30 p.m., eastbound traffic on I-90 in Juneau County between Mauston and Lyndon Station is still shut down due to flooding and motorists are being diverted off at New Lisbon, according to a press release from the Wisconsin State Patrol.
Eastbound motorists exiting at New Lisbon are advised to take WIS 80 east to Necedah, then east on WIS 21 to Coloma, then south in I-39 to Portage to meet I-90.

Water is flowing over the eastbound lane of I-90 near mile marker 72.
The State Patrol is monitoring the westbound lane of I-90 in that area for potential flooding problems.
****
UPDATE (WKOW) -- The Wisconsin State Patrol says there is a possibility I-90 might be shut down in both directions if flood waters continue to rise between Mauston and Lyndon Station, according to the Wisconsin State Patrol.
As of 1:30 p.m., the eastbound lanes of the interstate are still shut down because flood water is flowing over the eastbound lanes near mile-marker 72.
Eastbound traffic is being diverted at Mauston.
However, the water is beginning to fill in the median ditch between the east and westbound lanes, according to the State Patrol.
If this situation continues and water rises high enough to start flowing over to the westbound lanes, that whole section of the interstate could be shut down.
As of now, the westbound lanes of I-90 remain open.
WKOW will continue to monitor the situation and provide updates as they develop.

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MAUSTON (WKOW) -- Flood water running over the eastbound lane of I-39/I-90 has shut down a portion of that highway between Mauston and Lyndon Station.
The Wisconsin State Patrol ordered the shutdown around 12:30 this afternoon.
Eastbound traffic is being turned around near the 72-mile marker using the median cross-over, according to the State Patrol .
So far, westbound traffic is not affected by floodwater but slowdowns are expected as the turn-around traffic from the eastbound lane merges with westbound traffic.
Eastbound traffic is being diverted off the Interstate at Mauston, then onto HY 12 east to Lyndon Station where traffic can get back onto I-39/I-90 eastbound.

Flooding in an area located southeast of Mauston.
Image source: Channel 3000

Wisconsin's severe thunderstorms move on; rain and risk of flooding continue

D. Kwas and James B. Nelson, Milwaukee Journal Sentinel Published 3:21 a.m. CT Aug. 28, 2018 | **Updated 11:00 p.m. CT Aug. 28, 2018**

Rain will continue along with some isolated thunderstorms into early Wednesday morning across southern Wisconsin, according to the National Weather Service in Sullivan.

The risk of flooding remains across the state, with a flash flood watch for southeastern Wisconsin in effect until 6:45 a.m., the weather service said

The band of severe thunderstorms that battered the state Tuesday moved south into northern Illinois late in the evening and was expected to head out over Lake Michigan overnight.

Rain was expected to taper off overnight in western and central Wisconsin, but significant flooding was expected to continue, the weather service said.

Gov. Scott Walker on Tuesday evening declared **a state of emergency for Fond du Lac, Juneau, La Crosse, Monroe, Vernon and Washington counties** because of the storms. The six counties were added to Walker's executive order issued last week for Dane County.

The storms knocked out power around the state. We Energies reported at 10 p.m. that more than 22,000 customers were without power in the southeastern part of the state.

A tornado touched down near Oakfield in Fond du Lac County at 4:10 p.m., according to the weather service. Tornado warnings were issued in multiple counties as the storm moved across the Fox Valley and east-central Wisconsin and continued on toward the lakeshore.

The City of Waupun declared a state of emergency at 10 p.m. The city, which straddles Dodge and Fond du Lac counties, was hit by strong thunderstorms and a tornado warning about 4 p.m., causing a significant number of downed trees and power lines.

Brownsville in Dodge County reported significant wind damage that caused many fallen trees, downed power lines and property damage.

The weather service Tuesday night warned of a record-setting flood along the Kickapoo River near Readstown. At 8 p.m., the river had risen to 17.98 feet, well above its 11-foot flood stage. The weather service warned residents south of Readstown to be prepared for rapid rising of water along the river.

Flooding closed I-90-94 in both directions at Mauston, causing huge backups. The interstate remained closed late Tuesday night.

In southeastern Wisconsin, the Milwaukee River near Cedarburg was 11.8 feet deep as of 8 p.m. Tuesday. Flood stage for the river is 11 feet. The weather service warned that another 1 to 2 inches of rain overnight would raise the river to 14.5 feet.

Residents and businesses along the River were preparing for the worst. Located just feet from the river bank, Fiddleheads Coffee in Thiensville was surrounded by sandbags, sump pumps at the ready.

A cold front following Tuesday night's storms will finally provide some needed time for the ground to absorb the multiple rounds of rain. The temperature had fallen into the 60s by late Tuesday evening after a daytime high of 86.

Residents in southwestern Wisconsin awoke Tuesday morning to a deluge. Hit hardest Monday night were the Wisconsin counties of La Crosse, Vernon and Monroe, where the weather service said from 5 to 11 inches of rain had fallen. Westby in Vernon County reported 10 inches.

Adams County in south-central Wisconsin, according to the weather service, was also hit hard Monday night with up to 7 inches of rain in some areas.

As the storm system moved across Wisconsin, it brought flooding to the Fox Valley and then sagged into the area hit hardest by the Sunday and Monday storms, Ozaukee and Washington counties.

The flooding had closed or affected 15 roads in Vernon County, the weather service said.

Heavy overnight rains cause flooding around Wisconsin

8/30/2018 Wisconsin weather: Rain, risk of flooding continue

Ontario in Vernon County was also hit hard.

La Crosse reported heavy rain for more than seven straight hours.

In Fond du Lac, there were reports of 3 feet of water across some intersections.

The only good news from the Monday's and Tuesday's storms: They appeared to have largely missed Madison, which is still recovering from last week's record storm and flooding.

The Monday night storm was the fourth in 11 days to bring multiple inches of rain to parts of southern Wisconsin.

National Weather Service meteorologist Ben Miller said that the cold front that entered the state Tuesday night would deliver temperatures in southern Wisconsin in the low 70s on Wednesday, with much lower humidity,

"It'll feel a little like fall," he said. "It's going to be a pleasant three days, for sure."

Jeff Rumage, Trent Tetzlaff and the USA TODAY NETWORK-Wisconsin contributed to this report.