

**INTRODUCTION**

Part II of the Forest County All Hazards Mitigation Plan Update provides general geographical information, including demographic and economic characteristics. The general development patterns of the county are described in terms of current land use and future development trends.

In addition to developing an understanding of the planning area, this chapter represents the beginning stages of assessing vulnerability by inventorying the numbers, types and values of existing buildings, infrastructure and critical facilities within each participating jurisdiction in the planning area. This overall summary of each jurisdiction's vulnerability to hazards describes the potential impact on the community.

Land use and development trends are analyzed to project the number and type of potential future buildings, infrastructure and critical facilities within each jurisdiction so that mitigation options can be considered in future land use decisions.

The resulting information is an important element of the planning process, since sound alternative mitigation strategies cannot be formulated and evaluated without an in-depth knowledge of the relevant conditions in the study area.

**GENERAL GEOGRAPHY****Location**

Forest County is located in northern Wisconsin (See Map 1). The largest city and county seat is Crandon, in the south-central portion of the county. There are also several unincorporated places dispersed around the county. The county is bounded on the north by Iron County, Michigan on the east by Florence and Marinette Counties, on the south by Oconto and Langlade Counties, and on the west by Oneida and Vilas Counties.

Forest County lies approximately 107 miles northwest of Green Bay; 211 miles northwest of Milwaukee; and 212 miles north of Madison. Major metropolitan areas outside of Wisconsin are Chicago, 296 miles southeast; Minneapolis-St. Paul, 243 miles west; and Duluth, 241 miles northwest.

**Civil Divisions**

There are 15 municipalities (14 towns and 1 city) and 2 American Indian Reservations in the Forest County planning area. These units of government provide the basic structure of the decision-making framework. The county has a total surface area of 1,046.4 square miles, of which 3.1% is water. The area and proportion of the County within each civil division are presented in Table 1.

<b>Table 1 Geographical Size by Municipality</b>				
<b>Municipality</b>	<b>Area in square miles</b>			<b>Area as % of County</b>
	<b>Water area</b>	<b>Land area</b>	<b>Total area</b>	
Alvin town	1.01	114.98	115.99	11.1%
Argonne town	0.07	108.24	108.31	10.4%
Armstrong Creek town	0.65	47.99	48.64	4.6%
Blackwell town	0.37	66.00	66.37	6.3%
Caswell town	0.17	47.74	47.91	4.6%
Crandon town	1.99	33.79	35.78	3.4%
Freedom town	2.03	34.06	36.09	3.4%
Hiles town	9.52	131.44	140.96	13.5%
Laona town	4.15	103.39	107.54	10.3%
Lincoln town	4.80	58.12	62.92	6.0%
Nashville town	5.18	67.17	72.35	6.9%
Popple River town	0.39	50.09	50.48	4.8%
Ross town	0.10	38.49	38.59	3.7%
Wabeno town	0.95	107.34	108.29	10.3%
Crandon city	0.95	5.22	6.17	0.6%
Forest County	32.33	1,014.10	1,046.39	100.0%

Source: U.S. Census

### Topography

Forest County is part of the Northern Highlands geomorphic region, which is characterized by scattered outcroppings of older crystalline rock in a glaciated topography. The terrain, with high local relief occurring, is reminiscent of the northern Scandinavian countries. The landscape generally slopes from northwest to southeast. Elevations vary by more than 300 feet in many places. The fourth highest point in the state, Sugar Bush Hill, with an elevation of 1,939 feet above sea level, is located east of Crandon.

### Climate

Winters in Forest County are very cold, and the short summers are fairly warm. The short frost-free period during the summer limits cropping mainly to forage crops, small grains, and adapted vegetables. Precipitation is fairly well distributed throughout the year but reaches a peak in the summer. Snow covers the ground much of the time from late fall through early spring.

**Insert Map 1: Location Map**

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In winter, the average temperature is 14 degrees F and the average daily minimum temperature is 4 degrees. The lowest temperature on record, which occurred on January 17, 1982, is -39 degrees. In summer, the average temperature is 63 degrees and the average daily maximum temperature is 76 degrees. The highest recorded temperature, which occurred on July 26, 1955, is 100 degrees.

The total annual precipitation is about 30 inches. Of this total, more than 21 inches, or about 70 percent, usually falls between April and September. The growing season for crops falls within this period. In two years out of ten, the rainfall in April through September is less than 18 inches. Thunderstorms occur on about 34 days each year.

The average seasonal snowfall is about 67 inches. The greatest snow depth at any one time during the period of record was 56 inches. On average, 93 days of the year have at least one inch of snow on the ground. The number of such days varies greatly from year to year.

The sun shines 65 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the southwest. Average wind speed of 12 miles per hour occurs in spring.

## **DEMOGRAPHIC AND ECONOMIC PROFILE**

### **Population and Households**

The official 2023 American Community Survey (ACS) population estimate for Forest County shows a population of 9,261 people. This is actually a slight decline from the 2010 ACS reported population of 9,534 people. Since 2010, the population of Forest County has decreased by about 2.9% or by 273 people. The decline is part of an on-going trend, among some counties in northern Wisconsin, since populations generally peaked in the late '90's/early '00's. Since 2010, Forest trails only Langlade County in percentage decline among its neighbor counties, see Table 2. Marinette has also seen this decline. The counties of Florence, Oconto, Oneida, and Vilas saw gains - supported by robust vacation/retirement home markets. If the 13-year trend continues, Forest County will have a population of 8,892 by 2036.

Tribal population in the county includes the Forest County Potawatomi and Sokaogon Chippewa (Mole Lake). The population total for the Potawatomi Reservation was 644 from the 2023 American Community Survey, up nearly 10 percent from 588 in 2010. The Mole Lake Reservation had a population of 450 in 2023, up from 414 in 2010, a 9 percent increase.

<b>TABLE 2 Population of Adjacent Counties</b>				
<b>County</b>	<b>2010</b>	<b>2023</b>	<b># Change</b>	<b>% Change</b>
Forest	9,534	9,261	-273	-2.9%
Florence	4,587	4,617	30	0.7%
Marinette	42,019	41,907	-112	-0.3%
Oconto	37,737	39,329	1,592	4.2%
Langlade	20,218	19,473	-745	-3.7%
Oneida	36,379	38,007	1,628	4.5%
Vilas	21,750	23,410	1,660	7.6%
Wisconsin	5,637,947	5,892,023	254,076	4.5%

Source: American Community Survey and NCWRPC.

Between 2010 and 2023, the majority of the communities (8 of 14) within Forest County experienced an increase in population (refer to Table 3). The largest percentage increase, 59%, between 2010 and 2023, occurred in the Town of Alvin. The greatest amount of actual growth occurred in the Town of Lincoln, adjacent to, which added 207 new residents between 2010 and 2023.

Population concentrations and trends are important when prioritizing hazard mitigation strategies. The City of Crandon is the most densely populated and developed area in the county. Other areas of population concentrations are waterfront development and 11 unincorporated places including Nelma, Alvin, Hiles, Argonne, Cavour, Armstrong Creek, Laona, Blackwell, Mole Lake, Wabeno and Carter. Map 2 (Land Use) shows areas of population concentrations in the County. Overall population density of the county is 8.9 persons per square mile which ranges from a high of 243 in the City of Crandon to lows of 0.83 in the Town of Caswell and 1.5 persons per square mile in Popple River.

The median age in Forest County is about 49.1 years, making it relatively old in comparison to the State's median age of 40.1. The County has been identified as a retirement area resulting from being a vacation spot for many seasonal homeowners. The location of seasonal housing is a strong indicator in terms of retirement location. In Forest County 49% of all housing units have been identified as seasonal/recreational, which is among the highest percentages in the State.

**Insert Map 2: Generalized Land Use**

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<b>Table 3 Population and Households Size of Civil Divisions</b>						
<b>MINOR CIVIL DIVISION</b>	<b>2010 Population</b>	<b>2010 Households</b>	<b>2023 Population</b>	<b>2023 Households</b>	<b>2010 – 2023 % Change in Population</b>	<b>2010 – 2023 % Change in Households</b>
Alvin town	132	78	210	81	59.1%	3.8%
Argonne town	532	238	474	197	-10.9%	-17.2%
Armstrong Creek town	416	174	477	215	14.7%	23.6%
Blackwell town	361	29	320	46	-11.4%	58.6%
Caswell town	71	34	72	35	1.4%	2.9%
Crandon town	745	327	591	243	-20.7%	-25.7%
Freedom town	370	179	441	216	19.2%	20.7%
Hiles town	353	197	428	213	21.2%	8.1%
Laona town	1,215	575	1,215	513	0.0%	-10.8%
Lincoln town	1,067	487	1,274	483	19.4%	-0.8%
Nashville town	1,097	477	1,199	504	9.3%	5.7%
Popple River town	31	20	39	24	25.8%	20.0%
Ross town	143	75	142	62	-0.7%	-17.3%
Wabeno town	1,017	462	880	405	-13.5%	-12.3%
Crandon city	1,984	830	1,499	715	-24.4%	-13.9%
<b>Forest County Total</b>	<b>9,534</b>	<b>4,182</b>	<b>9,261</b>	<b>3,952</b>	<b>-2.9%</b>	<b>-5.5%</b>

Source: U.S. Census

### Seasonal Population

In addition to the full-time population, Forest County has a substantial number of seasonal and temporary residents. This reflects a housing stock which is nearly half seasonal/recreational dwellings (49.4%). The impact of this seasonal population cannot be overlooked when planning for hazards. Table 4 shows an estimate of seasonal residents by municipality, based on average household size multiplied by the number of seasonal units. Determining when and for how long these seasonal residents will be in the county is problematic, but the numbers give some indication of what weekend or other peak period populations might be.

Another component of the seasonal population includes short-term accommodation such as campgrounds or hotel-style lodging. The scope of this plan did not provide for detailed inventory of accommodations, however, the Wisconsin DNR completed a general inventory as part of its statewide comprehensive outdoor recreation plan. That inventory identified 329 hotel/motel beds, 23 bed & breakfast beds, and 82 beds in tourist homes. The DNR also identifies 29 campsites in campgrounds throughout the county, as well as educational/recreational camps with a capacity of 525.

<b>Table 4 Estimated Seasonal Resident Population</b>		
<b>Municipality</b>	<b>2023 Seasonal Housing Units</b>	<b>2023 Seasonal Population</b>
Alvin town	341	883
Argonne town	163	393
Armstrong Creek town	187	385
Blackwell town	102	459
Caswell town	96	198
Crandon town	172	418
Freedom town	337	687
Hiles town	543	1091
Laona town	188	446
Lincoln town	625	1594
Nashville town	775	1845
Popple River town	115	187
Ross town	134	307
Wabeno town	341	740
Crandon city	173	353
<b>County Total</b>	<b>4,292</b>	<b>9,829</b>

Source: U.S. Census and NCWRPC

## Employment

Like seasonal housing, employment facilities represent concentrations of people. In Forest County the Education, health care and social service sector, which includes educational services and nursing and residential care, along with social workers and other human services, accounts for about 20 percent of total employment. The Arts, entertainment, and recreation, and accommodation and food services sector makes up about 13 percent of employment. Manufacturing and Retail Trade each represent about a tenth of the workforce (12% and 10%, respectively), and Construction (9.8%) and Public Administration (9.5%) round out the top six occupations in Forest County.

Table 5 identifies the top employers and their general location in the county. The location of a large employment center is important when prioritizing hazard mitigation strategies.



<b>Table 5 Top Employers in Forest County</b>			
<b>Company</b>	<b>Product or Service</b>	<b>Size</b>	<b>Location</b>
FC Potawatomi Community	Tribal Government	250-499	Towns of Lincoln and Wabeno
Mole Lake Casino and Lodge	Casino	100-249	Town of Nashville
Potawatomi Northern Lights Casino/Bingo	Casino	100-249	Town of Wabeno
Crandon School District	Elementary & Secondary Schools	100-249	Various Locations
Schaefer IGA Enterprises	Supermarkets	100-249	City of Crandon
County of Forest	County Public Employment	100-249	Various Locations
W D Flooring	Floor Materials-Manufacturers	50-99	Laona
Schaefer IGA Enterprises	Supermarkets	100-249	City of Crandon
Wabeno School District	Elementary & Secondary Schools	50-99	Various Locations
Aspirus Crandon Clinic	Clinics	50-99	Crandon
Northern WI Bank Holding	Holding Companies	50-99	Laona

Source: Wisconsin DWD and NCWRPC.

### **LAND USE/COVER AND DEVELOPMENT PATTERNS**

Land use is an important determinant in the potential impact a particular hazard may have, and in actions which may be taken to mitigate the impacts. An understanding of the amount, type, and spatial distribution of urban and rural land uses is an important consideration in the development of a sound hazard mitigation plan.

The North Central Wisconsin Regional Planning Commission (NCWRPC) has categorized land use in Forest County into general classifications using 2015 aerial photography to digitize a land use Geographic Information System (GIS) coverage. Map 2 shows the land use and development patterns in Forest County. Table 6 shows the acreage and percent of each classification.

### Agriculture and Forestry

The dominant land-use in Forest County is forestry. Land area in the county is approximately 92 percent forested, comprised of approximately 612,298 acres of woodland, much of it within the Nicolet National Forest. Agricultural land covers another 12,208 acres or 1.8 percent of the county's land area, which is mostly located on previously forested tracts that were cleared by early settlers. Agricultural production in the county includes cattle & calves, egg chickens, horses & ponies, pheasants, elk, forage crops, corn for silage, oats, potatoes, and cut Christmas trees. A short growing season, irregular topography, and relatively low soil productivity limits most of the agricultural production to the southern portions of the county.

### Commercial, Industrial and Institutional Development

Commercial, industrial, institutional, utility, and quarry development makes up only about 0.2 percent of the total area of the county. Land use for commercial and industrial development is mostly located in the City of Crandon, but pockets are scattered around the county. Most industry is related to processing forest and agricultural products. There is one serviced industrial park in the county, an 18-acre site in Crandon. Government and other institutional facilities are also concentrated in Crandon, however there are a variety of facilities, such as rural schools and town halls, scattered throughout the county. Tribal facilities, including casino developments are located in three areas: Mole Lake in the Town of Nashville, the Potawatomi area in the Town of Lincoln, just east of Crandon and in the Town of Wabeno, at Carter. The U.S.F.S. Civilian Conservation Corps has a major facility on County Highway H in the Town of Blackwell.

### Residential Development

Land in residential development makes up about 1.6 percent of the total county area. Residential concentrations are scattered throughout the county (see "Population and Households" above). Much of the scattered rural development is related to direct recreational demand as various types of housing have clustered along streams and lakes.

There are a number of mobile home parks in the county. According to the U.S. Census, there were 843 mobile homes in 2023. This is about 9.7 percent of housing units for the County compared to about 3.1 percent for the entire state. This is significant due to their vulnerability in natural

Table 6 Land Use in Forest County		
Description	Acres	Percent
Agriculture	12,208	1.8%
Commercial, Industrial, Institutional, Utility, Quarry	1,945	0.2%
Forest/Woodland	612,298	91.5%
Recreation	923	0.1%
Residential	10,434	1.6%
Open Land	3,141	0.5%
Surface Waters	22,736	3.4%
Transportation	5,822	0.9%
Total	669,507	100.0%

Source: NCWRPC

hazards especially tornadoes. Map 11 (Tornado Vulnerability) displays the mobile home concentrations within the county.

**Surface Water**

Forest County is part of three major basins partially containing thirteen watersheds (see Map 3). The Upper Green Bay Basin has eight, the Upper Wisconsin River basin has three and the Wolf River basin has two watersheds within the county. Surface waters comprise about 22,736 acres or 3.4 % of the county area.

The county has 824 lakes and over 317 streams within the watersheds (see Map 3). Six of the lakes exceed 1,000 acres and account for nearly 40 % of total water surface area. The largest is Lake Metonga at 2,157 acres. Many of the lakes are small seepage lakes, particularly on the west side of the county. Major lakes number about 70 with the majority being drainage lakes, but about one-quarter are seepage lakes. Generally, greatest stream flow in the county occurs in late spring and autumn following increased periods of rainfall. Spring flooding is usually most pronounced in the western half of the county. All the streams, like the lakes, are important in the hydrological and ecological regime and should be protected by shoreland zoning and physical protective measures.

Floodplains and wetlands are important contributing components to the surface water system as described below.

**Floodplains**

The primary value of floodplains is their role in natural flood control. Flood plains represent areas where excess water can be accommodated whether through drainage to streams or through storage in 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, levees, 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 flood plain puts more life and property in danger.

Counties, cities, and villages are required to adopt reasonable and effective floodplain zoning ordinances. The requirement is found in section 87.30 of the Wisconsin Statutes and Chapter NR 116 of the Wisconsin Administrative Code.

Floodplain zoning is designed to protect individuals, private property, and public investments from flood damage.

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 one percent chance of flooding in any year (also known as the 100-year floodplain).

A FEMA approved Flood Insurance Rate Map or FIRM, has recently been adopted, allowing the County to participate in the National Flood Insurance Program. The City of Crandon entered the program back in 1987. See Table 7 for summary of NFIP status. The FIRMs delineate the "A" Zones including the floodway and flood fringe, those areas inundated by the 100-year flood within the County.

<b>Table 7 FEMA Community Status Book Report Communities Participating in the National Flood Insurance Program Wisconsin - Forest County</b>				
<b>Community</b>	<b>Initial FHBM</b>	<b>Initial FIRM</b>	<b>Current Map</b>	<b>Program Entry</b>
Forest County	05/08/81	12/16/11	12/16/11	06/24/14
City of Crandon	06/07/74	01/02/87	12/16/11	01/02/87
<i>Source: FEMA.</i>				

The NCWRPC made use of the new digital FIRMs, or DFIRMs, to map floodplains for use in this plan. The digital files indicate approximately **22,000 acres of floodplain in Forest County**. Map 4 shows these approximate flood hazard boundary areas in Forest County. While this might only be 3 percent of total Forest County land, this represents a significant portion of the Town of Alvin and a significant portion of the total available private land.

Currently, there are no repetitive loss structures, those with multiple flood insurance claims in Forest County.

### **Wetlands**

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

The DNR has identified the location of wetlands on their WISCLAND database according to which Forest County has **149,230 acres, or 23 percent** of its total area. There are no main concentrations of wetlands, and Map 3 shows these wetland areas to be scattered throughout the county.

Destruction of wetlands can occur through the use of fill material. This can compromise 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.

**Insert Map 3 Surface Water and Watersheds (with Wetlands)**

**Insert Map 4 Floodplains and Dams**

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**Other Land Cover/Uses**

Recreational lands including parks and outdoor sports facilities total about 923 acres or 0.1 percent of the county land area. Other lands may be used for recreational purposes, particularly woodlands. Open lands represent undeveloped land not wooded or part of a farm such as grassland. 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 Forest County, surface transportation facilities consume about 5,822 acres of land or about 0.9 percent of total land area.

**FUTURE GROWTH AND DEVELOPMENT IN FOREST COUNTY**

After peaking in the late 1990s-early 2000s, the growth trend has largely reversed due to a number of factors. Since 2000, only six of fourteen towns have gained population. Generally, it is the towns with the smallest populations and the most rural locations that have shown the greatest population loss. Although the population in the City of Crandon has also declined notably since 2000, it seems likely whatever growth occurs in the future will be strongest in the area around the city.

Development in Forest County has been historically driven by the agriculture and logging industries. If the trend of the last 23 years holds, by 2046 Forest County will have 8,557 residents. The last decade has been particularly hard on the wood products industry, so a revival of the past growth in the county may be difficult.

Official population projections from 2025 foresee a 1,501-person decrease by 2040. This was based on an assumption of a net, natural loss (births minus deaths) and weak in-migration.

Forest County's population continues to age. The median age is 49.1 in Forest County, nine years higher than the state median, and a quarter of residents are over 65 years of age, seven percent higher than the state, so natural increase is unlikely to turn positive in the foreseeable future. Any growth will be dependent on in-migration.

Most of the in-migration to Forest County in recent decades can be attributed to the conversion of seasonal dwellings to year-round residences. The character of the county's housing stock changed during the 1980s, when seasonal dwellings increased by 589 percent, in a decade that saw a three percent drop in the county's population. During the 1990s while the population increased by 14 percent, the number of seasonal dwellings went up by 7.8 percent. Since 2010, seasonal dwellings have decreased by 3.1 percent.

Although the trend in natural increase is unlikely to change, the increasing rate of construction of seasonal dwellings promises that if the economic factors that may

have slowed the conversion of seasonal to year-round dwellings change then immigration may increase again, and lead to population growth in Forest County. This growth will be concentrated in areas around lakes and near the City of Crandon. Many new residents are likely to be of retirement age.

Tribal/reservation areas within Forest County have had fairly stable populations. The Potawatomi have seen their population grow over the last decade, and continue developing extensive tribal government, including a casino expansion, and residential facilities in the Town of Lincoln. The Mole Lake Reservation's population in the Town of Nashville over the same period has remained flat, but also added new tribal facilities, including a health care center, and has expanded its casino, including a hotel.

Natural features, including lakes and agricultural lands, have largely dictated the county's land use pattern. The Nicolet National Forest takes up a significant portion of the county and is a limiting factor on growth.

The dependence on forestry and agriculture in the county indicates a slow growth dispersed widely across the landscape over time. Although the City of Crandon has seen development of a new small office building and an expansion of Hometown Trolley, commercial development will be minimal around the county and dominated by home-based businesses.

Current public infrastructure projects include the county courthouse renovations, a new town hall and salt shed in the Town of Lincoln, and new recreational facilities in the Town of Wabeno. Moving forward, new infrastructure or public facility projects are expected to be minimal, outside of new tribal developments. However, the Town of Lincoln is planning for a new pavilion and playground, and the Town of Wabeno is planning a new town hall and shop, more recreational facilities, and some infrastructure improvements.

## **PUBLIC FACILITIES AND SERVICES**

### **Transportation**

The transportation system of Forest County provides the basis for movement of goods and people into, out of, through, and within the county. An efficient transportation system is essential to the sound social and economic development of the county and the region. The analysis of transportation routes should be considered in the possible event of a disaster (See Map 5).



**Insert Map 5 Transportation**

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One major U.S. Highway, U.S.H. 8 serves Forest County, running east-west through Crandon and Laona. This highway links the county to Rhinelander, its closest regional service center and to U.S.H. 51.

Six state highways serve the county. Highway 55 is the principle north-south route traversing the entire county from the southern county line to the border with Michigan in the north. Other north-south routes include STHs 101 and 139, both of which link U.S.H. 8 with other highways outside Forest County, and S.T.H. 52 which links to S.T.H. 32 in the south central part of the county. East-west routes, in addition to U.S.H. 8, include S.T.H. 70 across the extreme northern end of the county and S.T.H. 32 which tracks northwest – southeast across the southwest corner of the county through Crandon. These highways link the county with neighboring communities and are vital to the tourism and recreation-based economy.

A network of County trunk highways collects traffic from rural areas. These County highways serve an important role in linking agricultural and timber resources to the county's service centers and major highways. Local roads provide access to local development, farming and forest areas, as well as the county's lakes.

The Wisconsin Department of Transportation maintains 11 bridges on U.S./State highways within the county. Forest County itself owns another 6 bridges on various County highways. The U.S. Forest Service has 17 bridges, primarily on forest roads, but three carry local roads. The various towns are responsible for 13 bridges. There is also one rail-bridge over U.S.H. 8.

The Forest County Commission on Aging coordinates transit services for the elderly and disabled. A mini-bus provides flexible-route service to various areas of the county on a weekly rotation for trips to regional medical centers as well as local service centers for groceries and other needs. The bus is available for dial-a-ride or specially planned trips when not on one of the scheduled routes. The county also has an accessible van for specialized transportation of disabled residents. A volunteer driver network is also available.

The Fox Valley & Lake Superior has a track running east-west through Forest County but service has been suspended for some time, including a spur into Crandon which has been abandoned.

The Crandon Municipal Airport located south of the City of Crandon is the public-use airport serving the area. The airport provides general aviation service for private airplanes and daily airfreight. The Crandon Airport is a basic utility airport, which is designed to accommodate aircraft of less than 6,000 pounds gross weight, with approach speeds below 91 knots and wingspans of less than 49 feet. There are private landing strips located in the county. The nearest commercial passenger service is available in Rhinelander.

**Utilities**

Utility systems are important in hazard mitigation planning because of the community's reliance 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, see Map 6.

The protection of the public water supply facilities from potential contamination from flooding and other threats is a consideration for hazard mitigation planning. The City of Crandon and the Laona and Wabeno Sanitary Districts provide municipal water supplies for domestic and commercial use, while the Blackwell Civilian Conservation Corps Center provides water for its staff and visitors. Both the Potawatomi and the Sokaogon Chippewa have public water systems serving parts of their reservation area. The Potawatomi have two separate systems with one in Lincoln, and another in Wabeno which serves its Carter facilities and residents.

The protection of the wastewater systems is an important consideration for hazard mitigation planning because of its potential to contaminate nearby waterbodies in the event of flooding. Also of concern during periods of high water is the threat of damage to treatment plants. Three municipal wastewater treatment facilities, the City of Crandon and the Laona and Wabeno Sanitary Districts, provide wastewater services. Again the Tribes each have sanitary sewer services in Mole Lake, Lincoln and Carter.

The infrastructure of electric and telephone lines should be considered in the events of high wind, ice storms, tornadoes, flooding, and fire. Wisconsin Public Service provides Forest County with electric service throughout the County. As of 2001, an independent company, American Transmission Company LLC (ATC), owns, maintains, and operates the major transmission facilities located in the State of Wisconsin, including Forest County. The general locations of the major electrical transmission facilities, owned by ATC are shown on Map 6. Multiple providers: AT&T, Verizon, CenturyLink, Bug Tussel Charter/Spectrum Communication, Fast-Air, Northwoods Connect, and Frontier supply internet and/or telephone service in the county.

Nationwide, cellular telephone systems account for about 80 percent of all 911 calls. Service coverage is based upon the handset receiving a direct line-of-sight signal from a system provider's antenna on a tower. Signals generally cannot travel well in dense forest cover, over tall hills, or through thick or multiple cement walls, so limitations for receiving a signal include topography and the thickness & type of building materials. Spotty cell service continues to be an issue in Forest County.

Natural gas transmission across Forest County generally follows USH 8 from the Town of Crandon through the Town of Armstrong Creek. This gas line is tapped by Wisconsin Public Service to provide local delivery in another pipeline that

generally serves the City of Crandon, the downtowns of Laona and Wabeno, and a 32-mile pipeline from Argonne to Hiles. The remainder of the county depends upon bottled gas from local suppliers.

### **Emergency Services and Facilities**

The type and location of public emergency services are important considerations in hazard mitigation planning, because of the crucial role of such facilities in certain hazard situations.

There are eight fire departments within Forest County. These include Crandon, Laona, Wabeno, Alvin, Hiles, Newald, Argonne and Pickerel, see Map 7 for station locations. These departments serve the majority of the county, but some towns receive service from departments in surrounding areas.



*Fire Station B, Town of Hiles*

There are four EMS squads within the County, including: Goodman/Armstrong Rescue, Laona Area Rescue, Pickerel Area Rescue, and Crandon Area Rescue, see Map 7 for station locations. These departments serve the majority of the county, but some towns receive service from squads in surrounding areas.

The Forest County Sheriff's Department provides service to all the towns and the city for law enforcement. The City of Crandon and Town of Laona also have their own police departments. Station locations are shown on Map 7. The Forest County Jail in Crandon is the main correctional facility within the county.

### **Critical 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. In the event of an emergency it is important to know the location of available medical facilities. Nursing homes are vulnerable because of the high

level of assistance required by the residents who live there. Since hundreds of the county's children are there for most of the year schools are important. Map 7 shows the location of selected types of critical community facilities within Forest County. Clinic facilities are located in the City of Crandon, and the Potawatomi (T. Lincoln) and Mole Lake (T. Nashville) reservations.



*Forest County Courthouse, Crandon, WI*

**Insert Map 6: Utilities**

DRAFT

**Insert Map 7: Critical Facilities**

DRAFT

**INVENTORY & VALUE OF STRUCTURES/PROPERTY IN FOREST COUNTY**

The value of the real estate and personal property reflects the upper end of the potential for property damages in each community. The annual equalized value of each municipality represents the Department of Revenue estimate of market value (Agricultural land is included at Use Value) of all taxable property. Property tax levies of jurisdictions are apportioned to each municipality on the basis of equalized value. Table 8 lists each municipality's total equalized values for real estate, personal property, and all property and the percent of the county total each municipality represents.

<b>Table 8 Equalized Value by Municipality</b>					
<b>Municipality</b>	<b>Improvement Value</b>	<b>Land Value</b>	<b>Personal Property</b>	<b>Total</b>	<b>% of Total</b>
Alvin	\$ 37,700,100	\$19,410,300	\$1,026,700	\$58,137,100	3.7%
Argonne	\$37,423,400	\$14,808,000	\$374,400	\$52,605,800	3.3%
Armstrong Creek	\$37,005,400	\$21,591,400	\$335,900	\$58,932,700	3.7%
Blackwell	\$17,429,300	\$15,812,800	\$161,100	\$33,403,200	2.1%
Caswell	\$10,417,400	\$4,626,900	\$275,900	\$15,346,800	1.0%
Crandon	\$55,676,200	\$27,416,400	\$393,400	\$83,553,300	5.3%
Freedom	\$64,050,600	\$49,810,300	\$84,300	\$113,945,200	7.2%
Hiles	\$120,599,500	\$108,615,500	\$750,600	\$229,965,600	14.6%
Laona	\$105,556,500	\$57,713,200	\$761,300	\$164,243,400	10.4%
Lincoln	\$138,793,700	\$143,733,700	\$876,900	\$283,404,300	18.0%
Nashville	\$170,696,900	\$154,057,400	\$1,791,600	\$326,592,100	20.8%
Popple River	\$7,882,200	\$8,608,100	\$89,600	\$16,579,900	1.1%
Ross	\$13,263,900	\$5,600,500	\$279,400	\$19,240,800	1.2%
Wabeno	\$75,314,900	\$41,386,200	\$688,900	\$117,522,700	7.5%
Crandon	\$103,629,900	\$35,190,000	\$2,089,400	\$140,995,900	9.0%
Forest	\$891,810,000	\$673,190,700	\$7,890,000	\$1,573,472,900	100.0%

Source: WI Department of Revenue, 2024.

The valuation of property in a community reflects the potential for property damages across the community. However, only taxable properties are included in this valuation. Tax exempt government properties are not included. With Forest County owning many critical facilities that are needed in times of disaster the potential for damages to these structures could be devastating for the county. In Table 9a, the County owned critical facilities are listed with its general location and the value of the facilities. Estimates for local government facilities are given in Table 9b/c and Tribal facilities in Table 9d.



<b>Table 9a Value of County Owned Properties</b>		
<b>Name</b>	<b>Value*</b>	<b>Location</b>
Courthouse / Sheriff	\$24,851,257.20	Crandon city
Asphalt Plant	\$106,036.70	Crandon city
Salt Shed	\$136,776.20	Laona town
Salt Shed	\$63,497.50	Alvin town
Fairgrounds	\$323,116.20	Crandon city
Veteran's Memorial Park	\$588,327.30	Crandon city
Highway Department	\$5,610,537.90	Lincoln town
Misc. Other	\$3,650,666.80	Various Locations
<b>Total</b>	<b>\$35,330,215.80</b>	<b>Above Locations</b>

\*=Includes insured buildings, contents, and property in the open. Source: Statement of Values State of Wisconsin Local Government Property Insurance Fund and NCWRPC estimate.

<b>Table 9b Value of City Owned Properties</b>	
<b>Property</b>	<b>Value*</b>
City Hall	\$321,436.50
Police Department	\$217,726.30
Fire Department	\$838,530.00
Street Department	\$190,259.30
Library	\$1,033,349.90
Old Library	\$124,008.50
Water/Sewer Plant	\$3,431,292.70
Well and Pump Houses	\$572,727.10
Water Tower & Reservoir	\$398,275.90
Lift Stations 1 -11	\$1,144,854.70
Booster Station –Hwy 8	\$102,571.70
Storage Buildings	\$228,908.90
Parks and Recreation	\$236,063.30
Airport Building	\$196,927.50
Cemetery	\$84,107.10
<b>Total</b>	<b>\$9,121,039.40</b>
*includes insured building contents. Source: Local Government Property Insurance Statement of Values and NCWRPC estimate.	

Table 9c: Value of Town Owned Properties		
Municipality	Property	Value*
Alvin town	Town Hall	\$400,207.50
	Garage 2	\$80,041.50
	Garage 3 / Salt Shed	\$242,665.50
	Recreation Area & Other	\$81,312.00
Argonne town	Town Hall	\$631,154.70
	Fire Hall	\$488,166.80
Armstrong Creek town	Town Hall / Garage	\$529,798.50
Blackwell town	Town Hall	\$232,755.60
	Recycling Center	\$38,706.80
Caswell town	Town Hall / Buildings	\$433,240.50
Crandon town	Town Hall	\$412,912.50
Freedom town	Town Hall/Garage/Salt Shed	\$395,049.60
Hiles town	Town Hall	\$412,912.50
Laona town	Town/Community Hall	\$430,699.50
	Town Garage/Storage Bldgs	\$308,731.50
	Beach Shelter & Storage	\$107,992.50
	Municipal Building	\$963,039.00
	Cemetary Storage Building	\$149,919.00
	Wellhouse / Shed	\$531,069.00
	Library	\$144,837.00
	Water & Sewer Facility	\$416,724.00
	Multi-purpose Facility	\$543,774.00
	Parks Dept. & Other	\$1,405,173.00
Lincoln town	Town Hall/Garage/Storage	\$588,241.50
	Recycling Center	\$5,082.00
Nashville town	Town Hall (N)	\$412,912.50
	Community Bldg/FD/Garage	\$2,904,000.00
	Salt Shed	\$72,600.00
Popple River town	Town Hall	\$412,912.50
Ross town	Town Hall	\$412,912.50
Wabeno town	Town Hall	\$507,562.00
	Fire Hall	\$684,704.90
	Museum	\$484,264.00
	Library	\$334,249.30
	Town Shop	\$189,844.60
	Recycling Center	\$128,400.80
	Exhibition Facility	\$766,140.10
	Pavilion	\$102,300.00
*includes insured building contents and property in the open Source: Local Government Insurance Policy Declarations and NCWRPC estimate		



*Potawatomi Tribal Wellness Center*

Table 9d-1	Value of Tribal Owned Properties	
Tribe	Property	Value
Potawatomi	Administration Building	\$10,164,000.0
	Convenience Store	\$1,905,750.0
	Accounting Building	\$190,575.0
	Office Building	\$317,625.0
	Casino / Hotel	\$22,566,500.0
	Health Center	\$2,541,000.0
	Head Start / Daycare	\$222,337.5
	Wee Care Daycare	\$158,812.5
	Natural Resources Bldg	\$254,100.0
	Public Works	\$635,250.0
	Aging / Housing	\$635,250.0
	Tribal Hall	\$254,100.0
	Ordinance Office	\$127,050.0
	Language & Culture Office	\$190,575.0
	Museum	\$2,541,000.0
Recreation Center	\$317,625.0	
Source: NCWRPC Estimate.		

Table 9d-2	Value of Tribal Owned Properties	
Tribe	Property	Value
Mole Lake	Casino/Restaurant	\$14,084,056.80
	Hotel Conference Ctr	\$13,517,611.80
	Casino/Hotel Storage	\$676,486.80
	Casino/Hotel Storage	\$177,857.90
	Youth Center	\$1,553,457.40
	Medical Clinic	\$2,557,273.40
	Water Tank	\$372,950.60
	C-Store Gas Station	\$584,138.50
	Historical Home	\$287,004.30
	SFI Office	\$433,180.00
	Old Motel	\$874,989.50
	Storage Bldg	\$158,679.40
	Gazebo	\$13,561.90
	Elder Apartments	\$2,097,051.00
	Day Care Center	\$171,882.70
	EPA Storage Garage	\$103,661.80
	Admin./Environmental	\$4,034,336.90
	Maintenance Bldg	\$461,252.00
	Commodities Dist.	\$196,581.00
	Fish Hatchery	\$226,932.20
	Pump House	\$371,673.50
	Recycling Bldg	\$247,011.60
	Family Services Bldg	\$318,797.60
	Multifamily Apartments	\$1,162,205.00
	Water Tank	\$542,477.10
	Housing Office	\$572,546.70
	Housing Maint. Bldg	\$1,058,387.00
	Randall Apartments	\$522,720.00
	Infrastructure	\$872,605.80
Source: NCWRPC Estimate		



*Mole Lake Community Health Clinic*

**INTRODUCTION**

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

- Identification of all types of natural hazards that can affect Forest County
- An analysis of each hazard identified as pertinent to Forest County

The hazard analysis will consist of:

- Background information
- History of previous occurrences of hazard events
- An analysis of the county's vulnerability to future events
- An estimate of future probability and potential losses from the hazard

**HAZARD IDENTIFICATION**

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

Worksheets from the Wisconsin Guide to All-Hazard Mitigation Planning were used by to re-evaluate and re-rank the list of possible hazards to identify which hazards should be included in the Plan Update based on threat to human safety and possible damage to property. The Plan Update Committee reviewed the results and agreed that the ranking was appropriate and without need of any adjustment. It should be noted that cyber-attack was added as part of a wider effort by the County to address issues that affected the County in the past.

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

1. Winter Storm/Extreme Cold
2. Tornado
3. Thunderstorm/High Wind/Lightning/Hail
4. Flooding/Dam Failure
5. Forest Fire/Wildfire
6. Drought/Extreme Heat
7. Cyber-Attack

This Plan Update focuses primarily on natural hazards that can be mitigated on a local level and have or could cause disasters. Technological or manmade hazards include things like transportation incidents, civil disturbances, hazardous material incidents, mass casualty events, war, and terrorism. Forest County already has action plans for these types of events, so they are not included in this update process, with the exception of

cyber-attack, which is addressed here as indicated. Although of significant concern, human communicable diseases are not addressed in this Plan Update. The Forest County Health Department and area hospitals work with the Wisconsin Department of Health Services and the Center for Disease Control to monitor and plan for those situations.

Low magnitude earthquakes occur in Wisconsin every few years, but none have exceeded a magnitude of 3.9, which would have vibrations similar to the passing of a semi-truck, therefore, earthquakes are not covered in this Plan Update. Forest County does not have coastal hazard issues and conditions for landslide or subsidence problems are not significant in the County.

### **HAZARD ANALYSIS**

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

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

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

Some disasters have had damages that exceeded the capabilities of local communities and state agencies. Federal assistance is then requested, which may be offered through a variety of programs. Assistance may be directed to agricultural producers, individuals and families, businesses, or local governments. A Presidential Declaration was requested for seven natural disasters in Forest County, from 1971 to 2024. They include the following:

- 1975 Army Worm Infestation
- 1976 Drought – Presidential Emergency Declaration
- 1977 High Winds / Hail – Presidential Emergency Declaration
- 2000 Severe Storms/Flooding/Tornado – Presidential Disaster Declaration
- 2010 Severe Storms – State Disaster Fund
- 2019 Tornado/High Winds/Flooding - Presidential Disaster Declaration
- 2020 Covid-19 Pandemic-Presidential Declaration

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

The National Oceanic and Atmospheric Administration (NOAA) and National Climatic Data Center (NCDC) publish the National Weather Service (NWS) data describing recorded weather events and resulting deaths, injuries, and damages. From September 3, 1958, to December 31, 2024, NCDC reported 352 severe weather events for Forest County.

Note that since the NCDC data is somewhat incomplete, this Plan Update focuses on the 10-year period from 2015 to 2024 for hazard analysis purposes. Other sources of data are used to supplement the NCDC data. These sources include Wisconsin Emergency Management, Wisconsin Department of Natural Resources, Forest County Emergency Management, and local news reports.

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

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

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

## **HAZARD ANALYSIS: THUNDERSTORM/HIGH WIND/LIGHTNING/HAIL**

### **Background on Severe Thunderstorm Hazard:**

The National Weather Service definition of a *severe thunderstorm* is a thunderstorm event that produces any of the following: downbursts with winds of 58 miles per hour or greater (often with gusts of 74 miles per hour or greater), hail one inch (recently increased from  $\frac{3}{4}$  of an inch) in diameter or greater, or a tornado. Strong winds, hail, and lightning will be addressed in this section, and tornadoes are discussed as a separate hazard.

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

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

**History of Severe Thunderstorm in Forest County:**

The NCDC database reported 17 severe thunderstorm events for Forest County between 2015 and 2024. These storms typically contain some form of heavy rain, strong winds and lightning. About 11 significant hail events, typically related to a severe thunderstorm, were listed during this time period. No major lightning incident was noted.

The most recent event in Forest County took place on June 17, 2024, when thunderstorms developed along a semi-stationary front during the mid-morning and tracked northeast along the boundary through the late morning on Monday (6/17) across central and north-central Wisconsin. Thunderstorm winds downed trees west of Crandon. The time of this report is an estimate based on radar data.

Another significant event occurred on May 5, 2022, when strong to severe storms developed during the late afternoon and early evening hours on Tuesday (5/10) across north-central and far northeast Wisconsin. Golf ball size hail fell near Mole Lake.

On June 17, 2018, thunderstorms developed across the area as a cold front encountered a very warm and unstable air mass. Some of the storms produced large hail and damaging winds. Thunderstorm winds destroyed some bird pens as the storms passed north of Argonne. NCDC estimated damages at about \$2,500.

On July 8, 2013, severe thunderstorms brought high winds and hail into the Town of Nashville. The storms produced wind damage from a wet microburst, penny to nickel size hail, and heavy rainfall. The microburst, with winds estimated at 75 mph, downed about 30 trees. Numerous locations received more than two inches of rain in a three to four hour period.

On May 20, 2012, a low pressure system that passed through northwest Wisconsin dragged a cold front through the state. Severe thunderstorms developed in a moderately unstable air mass ahead of the front. The storms produced hail up to golf ball size, and downed trees and power lines. In downtown Wabeno, a band stand that was a community landmark for more than 50 years was destroyed. NCDC estimated damages at about \$10,000.

On June 23, 2010, unstable air combined with a surface front and an upper level disturbance to produce severe thunderstorms across northern Wisconsin. High winds from the storms, some estimated as strong as 90 mph, caused considerable damage to trees and power lines as the storms moved through north-central and northeast Wisconsin. Roads across parts of northern Wisconsin were blocked by downed trees.



and power lines, including most of the roads in the Town of Nashville where numerous homes were also damaged. Power was knocked out to more than 15,000 Wisconsin Public Service customers in multiple counties including Forest. Some did not have power restored until late afternoon the following day. NCDRC estimated damages at about \$110,000.

On April 10, 2011, thunderstorms produced golf ball to half dollar size hail in the Argonne area and 2-inch diameter hail was reported near Crandon.

Forest County has been fortunate to not experience any lightning events between 2009 and 2018. The last lightning event in Forest County took place in 2000 in the Town of Alvin when lightning struck a house near the intersection of highway 55 and highway 70.



*Forest County Hail*

### **Severe Thunderstorm Vulnerability Assessment:**

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

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

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

Based on review of the historic patterns of thunderstorms associated with high wind, hail, or lightning, there are no specific locations that have unusual risks. The events are spread uniformly across the landscape and are a countywide concern. However, during the City Planning Meeting for this Plan Update, the City of Crandon identified severe thunderstorm winds (high straight line winds) as a major vulnerability concern due to the potential for power outage and resulting impact on municipal services and the population itself (cooling/warming, food and water safety).

### **Future Probability and Potential Dollar Losses – Severe Thunderstorm:**

Based on historical frequency, Forest County can expect 1.7 thunderstorm events per year on average. In other words, the probability is 1.0 or a 100% chance of multiple

storms in a given year. The probability of a thunderstorm with damaging hail in Adams County is also at 1.0 or 100% chance with about 1.1 incidents in a given year. There is not enough data available regarding lightning events to indicate probability.

According to the NCDC, historical thunderstorm events with associated high winds generally reported no property damage per incident, with the exception of one event that recorded \$2,500 in damages. No crop damages were reported. There was insufficient data regarding historic hail and lightning events. **Losses in Forest County associated with severe thunderstorms could approach \$979,992 over the next ten-year period.**

## **HAZARD ANALYSIS: TORNADO**

### **Background on Tornado Hazard:**

A tornado is a relatively short-lived storm composed of an intense rotating column of air, extending from a thunderstorm cloud system. It is nearly always visible as a funnel, although its lower end does not necessarily touch the ground. Average winds in a tornado, although never accurately measured, are between 100 and 200 miles per hour, but some tornados may have winds in excess of 300 miles per hour.

<b>Table 10 Tornado Wind and Damage Scale</b>		
<b>Tornado Scale</b>	<b>Wind Speeds</b>	<b>Damage</b>
EF0	65 to 85 MPH	Some damage to chimneys, TV antennas, roof shingles, trees, and windows.
EF1	86 to 110 MPH	Automobiles overturned, carports destroyed, trees uprooted
EF2	111 to 135 MPH	Roofs blown off homes, sheds and outbuildings demolished, mobile homes overturned.
EF3	136 to 165 MPH	Exterior walls and roofs blown off homes. Metal buildings collapsed or are severely damaged. Forests and farmland flattened.
EF4	166 to 200 MPH	Few walls, if any, standing in well-built homes. Large steel and concrete missiles thrown far distances.
EF5	OVER 200 MPH	Homes leveled with all debris removed. Schools, motels, and other larger structures have considerable damage with exterior walls and roofs gone. Top stories demolished

Source: National Weather Service

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

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

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

#### **History of Tornados in Forest County:**

Forest County has had seven confirmed tornados since 1963, with four occurring prior to 1995. In addition, five funnel clouds have also been reported since 1963. The most recent tornado in Forest County occurred on August 9, 2020, when an upper-level shortwave produced thunderstorms across north-central Wisconsin during the evening hours. A tornado formed at 9:12 PM CDT in a remote forested area in extreme northeast Forest County, east of the town of Alvin. The tornado moved northeast to about 0.3 miles north of Ransdell Lake, then turned east, reaching maximum width before crossing Huff Creek Road. The tornado produced a path of tree damage (DI 27,28, DOD 3,4) before entering Florence County at 9:18 PM CDT. Peak winds were estimated at 105 mph.

The latest funnel cloud in Forest County occurred on September 19, 2012, when a funnel cloud was produced, along with large hail and damaging winds, by a thunderstorm system in the Town of Wabeno. Funnel clouds were also produced in the towns of Argonne and Nashville by a thunderstorm system on July 6, 2012.

The second most-recent tornado in Forest County occurred on April 10, 2011. On that day fifteen tornado were seen in the state, ten in northeast Wisconsin, which is a one-day record. Two twisters were spotted in Forest County that day. Both were spawned by major thunderstorms that developed along and ahead of a cold front as it encountered moist and unstable air across Wisconsin. These storms also produced straight line wind up to 100 miles per hour.



*Tornado Damage, Forest County*

The first tornado developed at 7:30 pm southeast of Argonne and travelled over nine miles to the northeast into Florence County. This was an EF2 storm. It downed hundreds of trees, many of which fell on vacation cabins, and blew the roof off a house east of Argonne. This storm did a reported \$200,000 in damage. A second funnel formed just after 8 pm at Armstrong Creek and travelled for about three miles to the north and west. It damaged two houses and did \$50,000 damage.

In June of 2010, a funnel cloud was observed near County Highway C in the town of Wabeno. This event took place in conjunction with severe thunderstorms and winds up to 90 mph, which damaged trees and power lines across north central Wisconsin, knocking out power for more than 15,000 Wisconsin Public Service customers.

In June of 2005, two supercell storms moved through the southern part of the county causing significant wind damage and producing a funnel cloud three-miles east of Crandon. Three square miles of trees in the Nicolet National Forest were heavily damaged as winds estimated at 90 mph hit the south part of Birch Lake. The roof was torn from a metal building in Laona. Large hail was also associated with this event.

In May of 1994, Forest County experienced a major EF2 tornado that cut a 12-mile path between Crandon and Laona causing \$5 million in property damages and \$50,000 in crop damage. Three mobile homes were destroyed, injuring three people. Another 25 houses were damaged or destroyed and 600 acres of timber were leveled.

The county also experienced EF2 tornadoes in 1972 and 1968. The September 1972 tornado cut a 53-mile long swath with \$250,000 in property damage. The June 1968 tornado had a one-mile path with \$25,000 in damages. In September of 1963, EF1 tornado with a one-mile path caused about \$25,000 in property damages.

**Table 11      Reported Tornadoes/Funnel Clouds in Forest County**

DATE	TIME	LOCATION	LENGTH (miles)	WIDTH (yards)	DEATHS	INJURIES	F-SCALE
08/09/2020	9:12 PM	T. Alvin	2.85	250	0	0	EF1
9/19/2012	6:20 PM	T. Wabeno	n/a	n/a	0	0	n/a
7/6/2012	7:30 PM	T. Argonne T. Nashville	n/a	n/a	0	0	n/a
4/10/2011	7:30 PM	T. Argonne	9	250	0	0	EF2
4/10/2011	8:03 PM	T. Armstrong Cr.	3	150	0	0	EF1
6/23/2010	5:15 PM	T. Wabeno	n/a	n/a	0	0	n/a
6/7/2005	6:04 PM	T. Lincoln	n/a	n/a	0	0	n/a
6/28/1994	5:20 PM	C. Crandon	n/a	n/a	0	0	n/a
5/30/1994	8:50 PM	C. Crandon T. Lincoln T. Laona	12	800	0	3	EF2
9/16/1972	4:05 PM	T. Freedom T. Wabeno	53	200	0	0	EF2
6/30/1968	4:00 AM	T. Caswell	1	200	0	0	EF2
9/19/1963	6:00 PM	T. Laona	1	33	0	0	EF1

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Source: National Climatic Data Center

**Tornado Vulnerability Assessment:**

Though Forest County is primarily rural, concentrations of population are scattered throughout the county. Subdivisions, rural unincorporated communities, and the City of Crandon can be regarded as more vulnerable, because tornados pose a greater threat to human safety and property damage in more concentrated areas, see Map 8.

Mobile homes are of significant concern in assessing the hazard risks from tornados. In general, it is much easier for a tornado to damage and destroy a mobile home than a site-built home. According to the U.S. Census Bureau, in 2020, Forest County had 959 mobile homes, approximately 10.4 percent of all housing units in the county. While mobile homes are scattered throughout the county, many are concentrated in mobile home parks. Map 8 also displays the location of the mobile home parks with approximate number of units.

In addition to mobile homes, campground patrons are vulnerable to tornados because minimal shelter is usually provided. The county is a popular camping destination with campgrounds throughout the Nicolet National Forest, and a number of public and private campgrounds. Refer to Map 8. The Forest Service CCC Camp in Blackwell and the youth camp in Hiles are also notable risk areas for tornados.

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

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

Based on review of the historic events of tornados, there are no specific areas in the county that have unusual risks. The events are a countywide concern. However, during the City Planning Meeting for this Plan Update, the City of Crandon identified tornados as a major vulnerability concern due to the potential for power outage and resulting impact on municipal services and the population itself (cooling/warming, food and water safety). General vulnerability by geographic area (local unit of government) is identified in Map 8.

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

Based on the historic data presented here, between 2015 and 2024 Forest County experienced a tornado event about every 10 years. This equates to a probability of 0.10 or about a 10 percent chance in a given year. While tornadoes are not especially common, funnel cloud sightings occur more often and serve as reminders of the potential threat of a tornado in Forest County. Not enough data exists to indicate the probability of tornados of a specific magnitude.

Historic data is again used to estimate potential future dollar losses due to a tornado. Estimated damages resulting from tornados in Forest County range from zero to \$5 million. On average, Forest County might expect damages of \$780,000 per tornado, however, only one of the six historic tornados resulted in damages exceeding \$250,000. The most recent tornado did not report any damage, while one other did \$250,000, and the rest were \$50,000 or less. Over the next ten-year period, tornado losses in Forest County could approach \$1.8 million.

DRAFT

**Insert Map 8: Tornado Vulnerability**

DRAFT

**HAZARD ANALYSIS: FLOODING/DAM FAILURE****Background on Flood Hazard:**

A variety of classifications are used to describe for flood events including coastal, dam failure, flash, lake, riverine, stormwater, and urban/small stream. Forest County has the potential for all these types of flooding, except coastal. The following descriptions of the types of flooding are compiled from various FEMA and other notable hazard planning sources:

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

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

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

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

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

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

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

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



Flooding problems in Forest County tend to occur in the spring, when melting snow adds to normal runoff, and in summer or early fall, after intense rainfalls. Flooding occurs in the spring due to snowmelt and frozen soil. This build up continues until the river or stream overflows its banks, for as long as a week or two and then slowly recedes inch by inch. The timing and location of this type of flooding is fairly predictable and allows ample time for evacuation of people and protection of property.

Flooding is a potentially significant hazard in Forest County, particularly because of the extensive water features found throughout the County. As described in Part II, there are approximately 317 rivers and streams in Forest County within 13 main watersheds and 3 major drainage basins.

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

There are 25 dams in Forest County (see Map 4), but most do not pose a significant hazard if they fail. According to the DNR, Forest County has eleven large dams, fourteen small dams and the other one was not classified, see Table 12. Most of these dams are the “mill” type, built 50-plus years ago. There are also small dams for watering livestock and various recreational ponds around the County. The Wisconsin DNR regulates all dams on waterways to some degree, however the small dams are not stringently regulated for safety purposes.

A dam can fail for a number of reasons such as excessive rainfall or melting snow. It can also be the result of poor construction or maintenance, flood damage, weakening caused by burrowing animals or vegetation, surface erosion, vandalism, or a combination of these factors. Dam failures can happen with little warning, resulting in the loss of life and significant property damage in an extensive area downstream of the dam.

The WDNR assigns hazard ratings to dams within the state. When assigning hazard ratings, two factors are considered: existing land use and land use controls (zoning) downstream of the dam. Dams are classified into three categories that identify the potential hazard to life and property downstream should the dam fail. A high hazard indicates that a failure would most probably result in the loss of life. A significant hazard indicates a failure that could result in extensive property damage. A low hazard exists where failure would result in only minimal property damage and loss of life is unlikely. In Forest County, none of the dams have a high hazard rating, however, two: Connor's Dam and Hiles Mill Pond, have a rating of significant. Thirteen other dams have a low hazard rating, while nine remain unrated. Four of the dams, Bog Brook, Hay Meadow Creek, Lily Lake and Little Rice Lake, have emergency action plans (EAPs) currently in place.

<b>Name</b>	<b>Size</b>	<b>Hazard Rating</b>	<b>Stream Name</b>	<b>Owner</b>	<b>EAP Date</b>
Adams, Herbert	Small	Low	UNNAMED	Missing	N/A
Alvin Creek	Small	Low	Unnamed	USDA	N/A
Bog Brook	Large	Low	Bog Brook	County	2017
Briss Lake	Large	Low	Unnamed	USDA	N/A
Connor Forest Industries	Small	Significant	Rat River	Private	N/A
Coyote Creek	Large	Low	COYOTE CREEK	USDA	N/A
Davison, Evron E.	Small	Low	TR-LAKE LUCERNE	Private	N/A
Deer Creek	Large	Low	OTTER CREEK TRIB	USDA	N/A
Forester Mueller Lumber Co	Large	Significant	PINE CREEK	Town	2019
Haymeadow	Large	Low	Hay Meadow Creek	USDA	N/A
Klescewski, Leonard No. 1	Small	Low	Armstrong Creek	Private	N/A
Klescewski, Leonard No. 2	Small	Low	Armstrong Creek	Private	N/A
Knowles Creek	Large	Low	Unnamed	USDA	N/A
Lily Lake	Large	Low	LILY RIVER	Town	2007
Little Rice Lake	Large	Low	Wolf River	WIDNR	2023
Metonga Lake	Small	Low	TR SWAMP CREEK	County	N/A
Pichotta, H.A.	Small	Low	NEWMAN CREEK	Private	N/A
Pichotta, Harold A.	Small	Low	NEWMAN CREEK	Private	N/A
Pine Lake Outlet	Small	Low	WOLF	Private	N/A
Roberts Lake	Small	Low	LILY	Private	N/A
Schlafke, Theodore	Small	Low	North Branch Oconto River	Private	N/A
Swamp Creek	Small	Low	Swamp Creek	Tribal	N/A
Vanderloop, Richard	Small	Low	Unnamed	Private	N/A
West Allen Creek	Large	Low	WEST ALLEN CR.	USDA	N/A
Wildcat Creek	Large	Low	WILDCAT CREEK	USDA	N/A

Source: WisDNR

### History of Flooding in Forest County:

Flooding was a principal cause of damage in only one of seven Presidential Disaster Declaration requests in Forest County from 1971 to 2024. This event occurred in 2000, when a nearly stationary front across Wisconsin combined with upper air and abundant moisture to produce a prolonged period of thunderstorms. Flooding from heavy rain caused the



majority of problems, including flooded roads and basements.

*Flood Damage. US Hwy 8*

Rainfall totals ranged from 2 to 4 inches in a 24- hour period. Small streams and creeks overflowed their banks and rural areas suffered some crop damage.

The most recent flood event was in April 2002. Significant rainfall and snow melt resulted in flooding of roads and low-lying areas. In 1999, heavy rainfall caused flash flooding in the Town of Alvin. Roads were damaged and some homes and businesses suffered water damage to basements and minimal first floor inundation. In 1996, heavy runoff from spring snowmelt and rain resulted in widespread minor flooding across several northern counties including Forest. Numerous roads and culverts were washed out.

There are no records of significant dam failure within Forest County. Some of the dams have developed holes or other damage but have not caused flooding problems.

#### **Flood Vulnerability Assessment:**

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

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

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

One of the first reports to reference in assessing vulnerability to structures during flooding is the State of Wisconsin Repetitive Loss Report. This Report provides the status of repetitive loss structures by community. FEMA, through the Federal Insurance Administration, classifies a repetitive loss structure “when more than one flood insurance claim of at least \$1,000 is made within a ten-year period.” The information is used as a floodplain management tool and to supplement information provided by communities for flood mitigation grants administered WEM. According to the report, there are no repetitive loss structures in Forest County. Since no structures are listed in the Repetitive Loss Report, structures within floodplains were analyzed. The floodplain boundaries (for watershed boundaries see Map 3) within Forest County are shown on Map 4.

Since no structures are listed in the Repetitive Loss Report, structures within floodplains were analyzed, see *methodology* outlined below. The floodplain boundaries within Forest

County are shown on Map 4. Table 13 shows the number of structures in each municipality identified as "vulnerable to flooding" according to proximity to floodplains. There was a total of 187 structures identified in the designated floodplain boundaries, see Map 9.

<b>Table 13</b>		
<b>Approximate Values of Structures in Floodplains Forest County</b>		
<b>Municipality</b>	<b>Number</b>	<b>Total Value</b>
Alvin town	25	\$1,675,600
Argonne town	9	\$419,000
Armstrong Creek town	1	\$75,100
Blackwell town	12	\$236,900
Caswell town	16	\$450,800
Crandon town	44	\$1,887,900
Freedom town	9	\$517,500
Hiles town	3	\$208,700
Laona town	15	\$772,800
Lincoln town	3	\$84,900
Nashville town	18	\$1,288,200
Popple River town	6	\$82,800
Ross town	4	\$198,500
Wabeno town	10	\$484,800
Crandon city	12	\$816,600
Forest County	187	\$9,200,100

Source: U.S. Census and NCWRPC

#### **Methodology – Structures within Floodplains:**

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

In addition to structural damage from flooding, there may also be significant damage to public roadways, particularly to roadway surfaces, culverts, and bridges. Flooding could inundate or close roadways from a period of a few days up to as much as three months. Such interruptions in the County transportation network would cause travel delays through detours.

The primary impact from damages to roadways is to businesses. The monetary impact is unknown, but past floods have restricted public access and even closed businesses.

Tourism is an important industry in the county and several campgrounds, lodges and restaurants may be affected by flooding.

The agriculture industry is a sector that faces substantial losses, during floods. Flood conditions cause the following economic setbacks for farmers:

- Delayed planting (reduced growing season)
- Prevention of fields from being seeded
- Seed and agricultural chemicals washing out of fields
- Rotting of plants due to excess moisture
- Areas where planted crops are left in the fields due to excessive moisture
- Crops not reaching full maturity or stunted growth
- Requirements of additional soil amendments by farmers causing expenditures of greater amounts of money
- Lower quality (nutritional value) of harvestable crops as a feed source.

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

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

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

The areas considered to have a higher risk for impact from flooding include those communities with structures in floodplains as shown in Map 9. In addition, the City of Crandon identified flooding as a concern during the mitigation planning meeting for this Update. The City has had issues with flooding and drainage.

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

The NCDRC data reported that Forest County had three floods from 1995-2024 (due to the limited number of flood events, a 25 year period is examined). Based on historic data presented here (frequency of past events), Forest County can expect a significant flood event about every six to seven years on average. This equates to a probability of 0.16 or about a 16 percent chance in a given year. The percentage chance of a dam failure is estimated to be less than one percent.

**Insert Map 9 - Flood Vulnerability**

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Historic data on the dollar losses due to flood in Forest County is spotty. NCDC reported losses range from zero to \$154,000. Based on this, Forest County can anticipate at least \$154,000 in property and crop losses, on average, for each significant flood occurrence between the public and private sector. Over the next ten-year period, flood losses in Forest County will likely exceed \$154,000.

Potential losses for structures by jurisdiction are reflected in Table 13. While structures outside mapped floodplains may also be lost or damaged in a flood, structures within flood plains represent the greatest risk from flood damages.

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

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

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

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

*Blizzard* – the occurrence of sustained wind speeds in excess of 35 miles per hour accompanied by heavy snowfall or large amounts of blowing or drifting snow.

*Ice Storm* – an occurrence where rain falls from warmer upper layers of the atmosphere to the colder ground, freezing upon contact with the ground and exposed objects near the ground.

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

*Sleet* – solid grains or pellets of ice formed by the freezing of raindrops or the refreezing of largely melted snowflakes. This ice does not cling to surfaces.

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

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

True blizzards are rare in Wisconsin. They are more likely to occur in the northwestern part of the state than in south-central Wisconsin, even though heavy snowfalls are more frequent in the southeast. However, blizzard-like conditions often exist during heavy

snowstorms when gusty winds cause the severe blowing and drifting of snow. Heavy snow and ice storms are a part of nearly every winter in Forest County.

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

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

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

The NCDC has reported 32 major winter storm events and 4 cold temperature events for Forest County between 2015 and 2024. These storms typically contain some form of heavy snow, blowing snow, ice, freezing rain or drizzle, or glaze.

The latest heavy snow storm in Forest County began on April 2, 2024 when a rapidly intensifying area of low pressure moving across Illinois to southern Lake Michigan on the afternoon of April 2 brought copious amounts of rain and heavy wet snow, damaging winds, and thunderstorms. The storm left over 100,000 people across the state without power during the height of the storm. The highest snowfall total in Forest County was 6 inches near Argonne. The storm caused power outages throughout the county, with over 1,600 without power.

A fierce, late-winter storm produced heavy snow, freezing rain, and high winds across much of central and northern Wisconsin on February 23-24, 2019 as an area of low pressure rapidly deepened across the Great Lakes. At the height of the storm on the 24th, travel was not recommended across parts of central and northern Wisconsin as blizzard conditions made travel nearly impossible. The combination of ice, snow, and strong winds caused power outages and tree damage in many locations. A storm total snowfall of 15.9 inches was measured near Argonne.

Another notable heavy snow in Forest County took place in April 13 of 2018. A low pressure system that moved from the Plains, across Illinois, to the Ohio Valley brought two periods of heavy precipitation and strong northeast winds to the area. The historic late season winter storm pummeled a large section of Wisconsin, including the northeast, from the evening of April 13th through the afternoon of April 15th. The storm brought near-blizzard conditions to much of the area and made roads impassable from time-to-time. Winds of 35 to 50 mph caused sporadic power outages and created waves of 10 to 16 feet on Lake Michigan.



New snowfall records were set at many locations as a large area of 15 to 30 inches of snow fell. Some of the highest recorded snowfall totals included, 31.6 inches in Door County, 30.6 inches in Shawano County and 30.5 inches in Oconto County. The heavy weight of the snow caused several structures to collapse or partially collapse, mainly across east-central Wisconsin. Snowfall totals were the highest ever recorded for an April storm in Rhinelander (18.2 inches). The highest reported snowfall total in Forest County was 14.1 inches near Argonne. This storm came on the heels of another major snow fall across much of the same area with 13.5 inches in Crandon on April 3 and 4.

A complex storm system affected the region November 10-11, 2014, bringing a swath of heavy snow to parts of northern Wisconsin. The main storm hit in two phases. The first phase was in the form of a long west to east band of snow which set up across Minnesota and northern Wisconsin early on November 10th. Low pressure then moved across far southern Wisconsin and produced another round of snow late on November 10th and into the 11th across central and northern Wisconsin.

In addition to the long-duration storm, additional lake effect snow from Lake Superior pushed totals over 20 inches in some locations in the snowbelt. The highest reported snowfall total was 23.7 inches at Lac du Flambeau (Vilas Co.). Some of the highest snow totals outside the snowbelt included 15.2 inches near Alvin.

The most recent extreme cold event took place on January 2-7, 2018. Subzero low temperatures, highs mainly in the single digits, and wind chills in the 20 below to 34 below zero range were common during the first week of January. One person died in the cold after going missing in the woods near Niagara (Florence County).

Between January 6-7, 2014, a bitterly cold arctic air mass, the coldest to impact the region in years, spread across the area following the passage of a cold front. Temperatures fell to lows in the 16 below to 32 below zero range. The cold temperatures, combined with west winds of 10 to 20 mph, produced wind chills in the 40 below to 55 below zero range. The coldest recorded temperature in Forest County was 27 degrees below zero near Laona. Wind chills were as low as 40 below zero.

During an historic event at least 20 record low temperatures were set across Central and Northeast Wisconsin during the early part of February 1996 as a frigid arctic air mass remained entrenched across the area for an extended period. The cold weather resulted in at least one hypothermia-related death outside of Forest County.

Temperatures dropped to colder than 40 degrees below zero in parts of North Central Wisconsin. The coldest reading was 48 below at Lake Thompson in Oneida County. Extreme cold temperatures combined with west winds 10 to 15 mph to produce wind chill readings in the 50 to 70 degree below zero range on February 2nd.

The cold weather was responsible for numerous school closures, stalled vehicles, frozen pipes and broken water lines. Electrical and telephone outages occurred due to snapped

wires and lines. All of the outdoor events of the Badger State games had to be cancelled, and some local ski hills were forced to close for a brief period.

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

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

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

- Infrastructure – operation of emergency services, operation of public facilities and schools
- Utilities – down power and telephone lines
- LP Gas at residences freezing at temperatures below -40
- Septic system freezing
- Transportation – automobile accidents, roadway plowing, salting/sanding
- Residential – roofs
- Businesses –commerce
- Agricultural – livestock

There are no specific areas in the county that have an unusually high risk. Winter storms cover a broad area and are a region-wide concern. The extreme cold weather can affect the entire county. The risk to public health includes the chance of getting frostbite and hypothermia, and motor vehicle accidents. Everyone is at risk for becoming injured in extreme cold weather, either because of frail health or because of travel in a motor vehicle.

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

Based on historical frequency, Forest County can expect 3.2 major winter storms per year on average. In other words the probability is 1.0 or a 100% chance of winter storms in a given year.

For extreme cold temperatures, based on historical frequency, Forest County can expect about one every 3.3 years. Although, because extreme cold temperatures often accompany winter storms, a probability of 100% chance in a given year cannot be ruled out.

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

**HAZARD ANALYSIS: FOREST FIRES/WILDFIRES****Background on Forest Fires/ Wildfires Hazard:**

A forest fire is an uncontrolled fire occurring in a forest or in woodlands outside the limits of an incorporated village or city. A wildfire is any instance of uncontrolled burning in brush, marshes, grasslands or field lands. For the purpose of this analysis, both of these kinds of fires are being considered together.

Forest fires and wildfires can occur at any time whenever the ground is not completely snow covered. The season length and peak months may vary appreciably from year to year. Land use, vegetation, amount of combustible materials present and weather conditions such as wind, low humidity and lack of precipitation are the chief factors for fire season length.

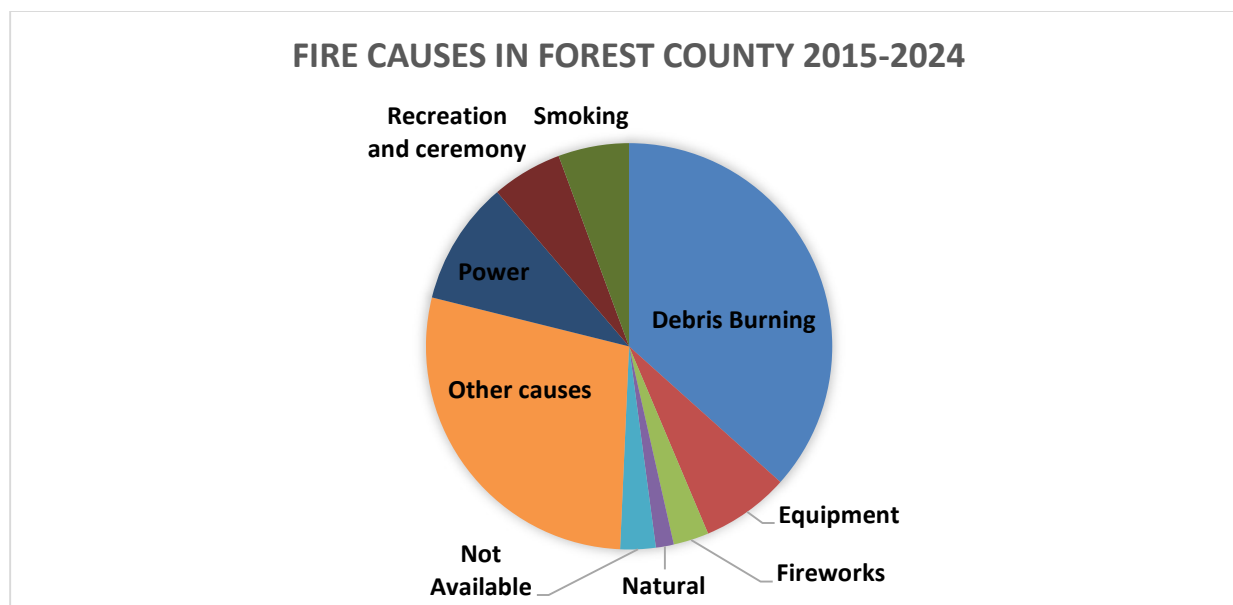
**History of Forest Fires/Wildfires in Forest County:**

The Wisconsin DNR maintains a database of wildfire data. This data represents the most comprehensive source of information for analyzing fire trends in an area such as Forest County. Between 2015 and 2024, 71 fires burned 37.19 acres of land. The typical fire in Forest County burns about 0.52 acres of land.

The principal reason these fires are small is the rapid response of municipal fire departments. This history of small fires is not indicative of the actual risk. There have been some larger fires in the area. In 2003, a single fire burned more than 36 acres in the Town of Nashville. The Duck Lake fire in the Upper Peninsula of Michigan may serve as an example of the potential threat. This fire, in May of 2012, was started by lightning and consumed over 21,000 acres, destroying 136 structures.

April is the leading month for wildfire in Forest County, with 30 percent of the total number of fires between 2015 and 2024 taking place in April. Wildfires have occurred in each month of the year except January, February and December in Forest County. Forest County experienced both the most fires in a year and the most acres burned in a year in 2006, with 15 reported fires that burned a total of 19 acres of land.

The chart below breaks down the causes of wildfire within Forest County between 2015 and 2024, as classified by the WisDNR. The principle cause of wildfire in Wisconsin and in Forest County is debris burning. Of the 71 fires in Forest County during the study period, 26 of them, 37 percent, were caused by debris burning. Other leading causes of wildfire include other causes not named and powerline related.



#### **Forest Fires/Wildfires Vulnerability Assessment:**

Forest County has 612,298 acres of woodlands, or 92 percent of the area of the county. The potential for property damage from fire increases each year as more recreational and retirement homes are developed on wooded land.

Rural buildings may be more vulnerable because of lack of access. Building driveways off main roads are sometimes long and narrow with minimal vertical clearance and no turn around areas large enough for emergency vehicles making it hard to save individual dwellings. These buildings also may not have adequate forest clearance between the structure and the forest.

Campgrounds are also a concern because of campfires. Forest County has federal, state, county, and privately owned campgrounds throughout the County. Locations of the campgrounds are shown on Map 8.

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

The WDNR has completed a statewide evaluation of fire risk, referred to as the CAR or Communities At Risk assessment. This assessment uses extensive DNR geo-databases to analyze and map hazardous woodland fuel types and the degree of the intermixing of development with wildlands. The maps identify the level of risk for each community on a scale of very high, high, moderate, or low, and also have a community of concern designation. Forest County has no Communities at Risk at either Very High or High

levels. However, the Towns Armstrong Creek, Crandon, Hiles, Lincoln, and Nashville are designated as communities-of-concern.

**Future Probability and Potential Dollar Losses – Forest Fires/Wildfires:**

Forest and wildfires are relatively common occurrences in Forest County. In recent years, an average of about 7.1 fires per year in the County has burned, on average, 3.7 acres each year. In other words, the probability is 1.0 or a 100 percent chance of wildfire each year. However, these fires are typically contained rapidly and remain small, so that each has a minimal impact.

Because of the relatively small impact of typical individual fires in the County, loss data is not tracked. This makes it difficult to develop an estimate of potential future dollar losses. However, with over five fires per year, the County should expect some fires to "get out of hand" with the potential to easily meet or exceed the millions in damages of the Duck Lake Fire that occurred in the Upper Peninsula of Michigan in 2012. Annual losses would be maximized if a house was destroyed with each acre ("typical" residential parcel size) burned.



*Fire Watch Tower, Forest Co.*

Insert Map 10 Fire Risk

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

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

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

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

**History of Drought/Extreme Heat in Forest County:**

Drought conditions persisted from summer 2023 through winter 2024, beginning with below-normal rainfall in May and June. This led to Abnormally Dry (D0) and Moderate Drought (D1) conditions, which worsened due to continued dry weather and high temperatures. By late summer, Severe Drought (D2) affected areas south of Highway 10, while D0–D1 conditions remained to the north. In fall, D2 was limited to the southwest third of Forest County, with D1 elsewhere. By November, most of the county was in D1 or D2, and by March, nearly all of Forest County was in D2, except for the far southeast, which remained in D1. Below-normal precipitation persisted into late March.

Below normal rainfall during the latter half of September resulted in Severe Drought (D2) conditions across the entire county at the beginning of October. Warmer than normal temperatures and well below normal rainfall resulted in Severe Drought (D2) continuing through the month. Above normal precipitation from October 29th through November 7th brought an end to the Severe Drought (D2) across much of the county. Severe Drought

(D2) extended across the far western portion of the county on December 1st. Enough precipitation (rain and snow) fell during the past week to bring an end to the Severe Drought (D2) based on the December 5th Drought Monitor.

Previously drought conditions going back to 2005 for Forest County and much of Wisconsin existed, but eased in 2011. Periods of below normal precipitation led to ongoing moisture deficits despite periodic storm events creating breaks in the dry pattern. In 2009 reports from County Agricultural Agents across northern Wisconsin indicated that crops were drought stressed and would have been in worse shape if temps had not been cooler than normal. The report from Langlade County indicated a 20 to 25 % loss of the corn and soybean crop through July of 2009. During this period, the Governor declared a state of emergency to get assistance to the state's agricultural sectors. The extended dry conditions posed serious challenges for farmers from drought stressed crops to issues providing feed for livestock.

NCDC reports indicate drought periods from September to October 2005, August through October 2007, September 2008 through April 2009, July through October 2009 and from April through August 2010. No drought events were recorded by NCDC since 2010 in Forest County.

The drought of 1976-1977, affected an area stretching from north to south across the state. Stream flow measuring stations recorded recurrence intervals from 10 to 30 years. Numerous private and municipal wells went dry due to the lowered groundwater tables and agricultural losses during this drought were set at \$624 million. Forest County was one of 64 counties that were declared federal drought areas and deemed eligible for assistance under the Disaster Relief Act.

Forest County was fortunate to experience no extreme heat waves from 2009 to 2018. The most recent extreme heat wave was in July of 1999 when, for over a week, extreme temperatures and humid weather swept across the state. In some places it was so hot that concrete roads began to buckle. Heat related illness was widespread and three deaths resulted outside Forest County.

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

Droughts can have a dramatic effect on Forest County. The county has about 12,000 acres of farmland. With agriculture being a critical sector of the county's economy, droughts can have serious effects. Even small droughts of limited duration can significantly reduce crop yields, adversely affecting farm income. More substantial events can decimate croplands and result in total loss, hurting the local economy.

Irrigation can negatively impact the water table by drawing water that comes from aquifers and can affect surface water. Drought can exacerbate the problem when high withdrawal rates and little precipitation deplete water bodies and aquifer supplies, thereby decreasing

drinking water supplies, drying streams, and hindering aquatic and terrestrial wildlife. During severe droughts, some wells—mainly private wells—will go dry.

Droughts can trigger other natural and man-made hazards as well. They greatly increase the risk of forest fires and wildfires because of extreme dryness. In addition, the loss of vegetation that results from drought can cause flooding, even from average rainfall.

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

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

The areas most susceptible to drought conditions would be agricultural communities, scattered throughout the south and southeast parts of the county.

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

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

Based on the historic data presented here (frequency of past events) over the past 20 years, Forest County can expect a drought every three years on average, which is a probability of 0.35 or a 35 percent chance in a given year. Significant severe drought is somewhat less common, affecting Wisconsin once about every 10 years.

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

Normally, counties in northern Wisconsin are known for their cold winters, however, extreme heat waves will affect Forest County in the future. Forest County can expect a heat wave once every 20 years or a 5 percent chance in a given year based on historic data.



**HAZARD ANALYSIS: CYBER ATTACK****Background on Cyber Attack Hazard:**

A vast array of networks form the foundation of our means to communicate and travel, power our homes, run our economy, and provide government services. Yet, cyber-attacks have increased dramatically in the United States over the last decade, exposing sensitive personal and business information, disrupting critical operations, and imposing high costs on the economy.

A cyber-attack is the actual or potential disruption of government information systems. Information technology systems are connected in networks or through the Internet, and thus are at risk of cyber-attack. An attack may be a deliberate effort to gain access to the system or processes; or it may be the result of a randomly initiated threat, such as a worm or virus. Unlike physical threats that prompt immediate action, cyber threats are often difficult to identify and comprehend. Among these dangers are viruses erasing entire systems, intruders breaking into systems and altering files, or intruders stealing confidential information.

Cyber-attack may result in the loss of confidence in the government's ability to protect citizens. However, the support services performed in the aftermath of an event can rebuild the reputation of the government's ability to provide services to the people in time of need.

With the extensiveness of information technology (IT) and cyber networks in nearly all parts of society, effectively securing critical infrastructure requires investments in network resiliency as well as cyber infrastructure protection. As all levels of government now rely on cyber networks and assets to provide public safety and economic prosperity, their operations depend on information systems that are maintained, protected, and secured from exploitation and attack.

**History of Cyber Attack in Forest County:**

Cyber-attacks have increased throughout the world and are a major issue due to the increasing reliance on computers and networked technology. The probability of Forest County experiencing cyber-attacks is based on the increase of cyber-attacks throughout the country.

In 2014, the Crypto-locker virus affected Forest County resulting in the loss of about one month's worth of data from the Sheriff's Department file server including documents, pictures, pdf files, etc. One database had to be rebuilt. There was also a denial of service issue about 15 years ago. Denial of Service attacks are designed to overload a network with useless traffic preventing legitimate users access and crashing the system.

**Cyber Attack Vulnerability Assessment:**

The impact of a cyber-attack on property, facilities, and infrastructure is dependent on the type of event and the location in which it occurs. Cyber-attacks, in all probability, will have limited effect on buildings, properties, or infrastructure, but may severely affect the

transportation of goods and services to and from critical facilities. Infrastructure damage or interruption of power to communication services could have a substantial impact; but effects are minimized through thorough planning on the part of the utility and its determination to resume critical services. Economic and financial systems could potentially be significantly impacted, depending on the scope, breadth, and success of the cyber-attack.

All government and personal computers and networks within Forest County are susceptible to cyber-attack. Current approaches to preventing cyber-attack may be inadequate. Attention must be given to security education and awareness so we do not place too much faith in technology's ability to protect data. Inadequate security can facilitate access to critical computer systems, making them vulnerable to attacks.

Cyber-attacks may last from minutes to days depending upon the type of intrusion, disruption, or infection. Generally, no direct effects are felt by the built environment, but secondary effects may occur depending upon the system being attacked.

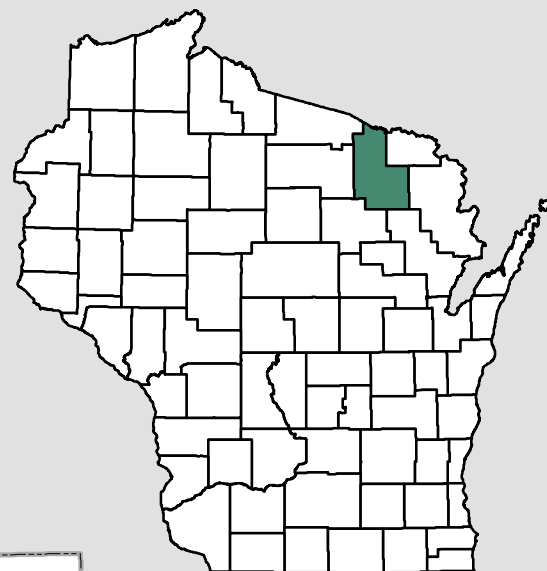
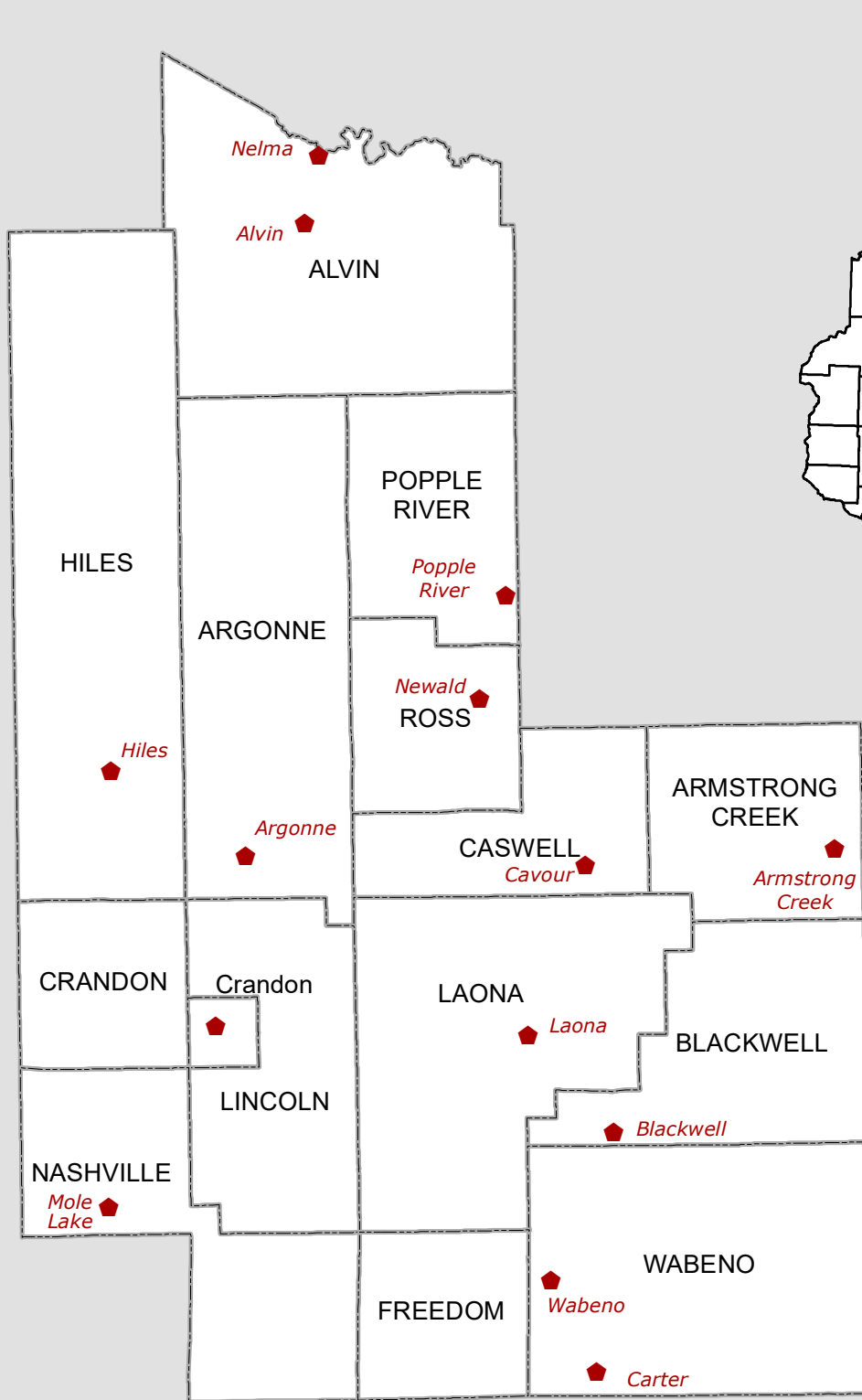
The spectrum of cyber risks is limitless, and serious threats can have wide-ranging effects. Transportation, power, and other services may be disrupted by large scale cyber-attacks. The extent of the disruption is highly uncertain, as it will be determined by many unknown factors such as the target and size of the incident. Vulnerability to data breach and loss increases if a network is compromised. Information about citizens and employees can be at risk. Individually-owned devices such as computers, tablets, and mobile phones that connect to the internet are also vulnerable to intrusion.

#### **Future Probability and Potential Dollar Losses – Cyber Attack:**

Although there is currently insufficient data to determine an accurate probability, the data suggests that the percentage chance of a serious cyber-attack on Forest County in any given year is estimated to be about 15 percent.

The threat of cyber-attack has been identified as a significant and growing threat to Forest County. The level of success or damage will vary greatly. Intrusion detection systems log attack attempts every month. There are constant probes by individuals and groups with intent to cause anything from total system shutdown to simply "seeing if they can do it."

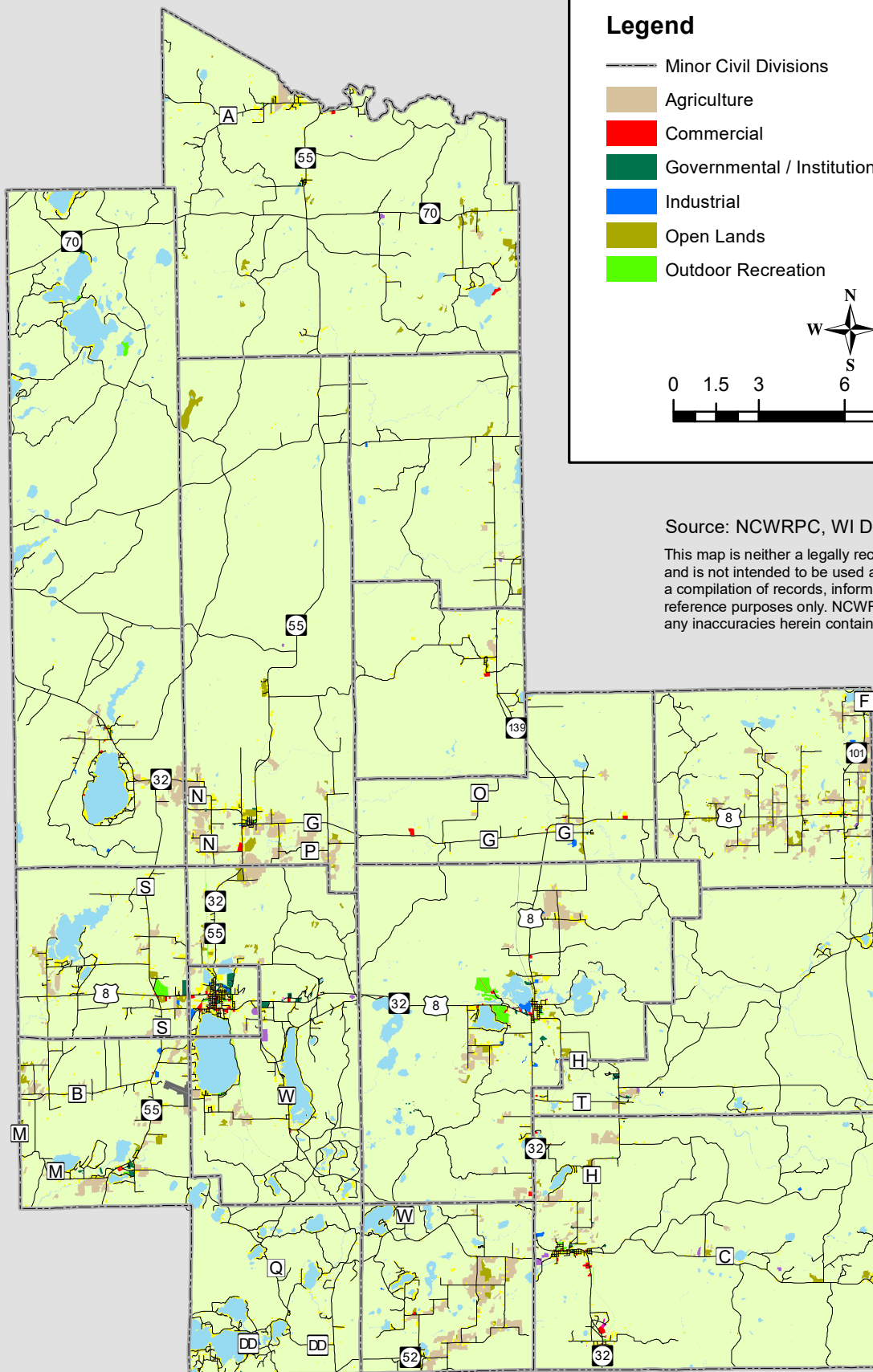
No accurate method of estimating potential losses related to cyber-attack is available at this time for Forest County; however the County has established a Committee of the County Board to monitor and address this issue.



Source: NCWRPC, Forest County

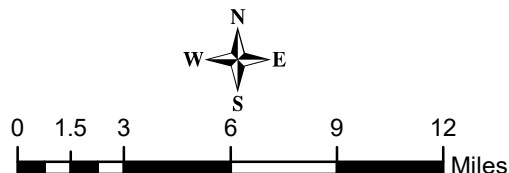
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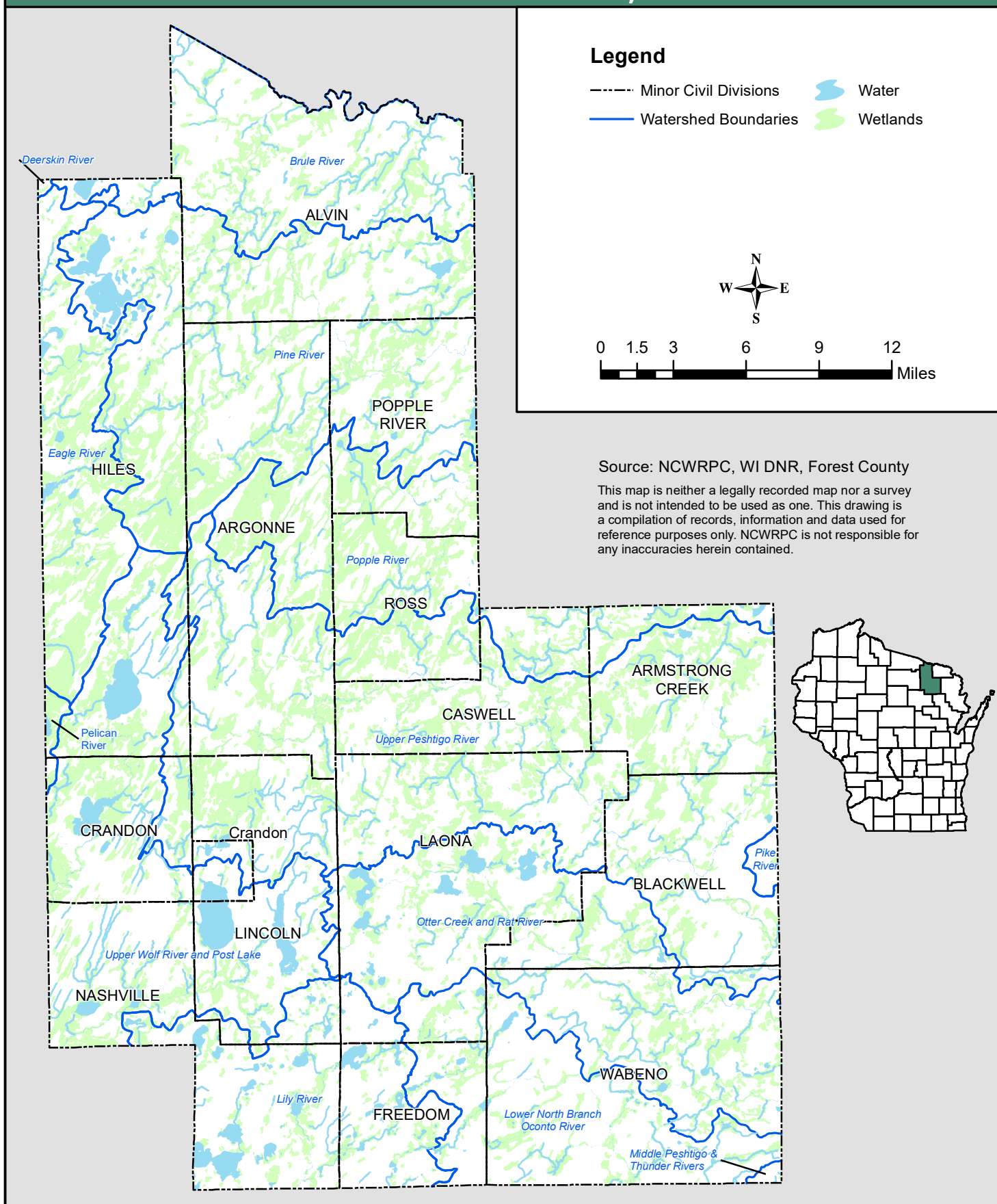
- |                              |                |
|------------------------------|----------------|
| — Minor Civil Divisions      | Quarry         |
| Agriculture                  | Residential    |
| Commercial                   | Transportation |
| Governmental / Institutional | Utility        |
| Industrial                   | Water          |
| Open Lands                   | Woodlands      |
| Outdoor Recreation           |                |



Source: NCWRPC, WI DNR, Forest County

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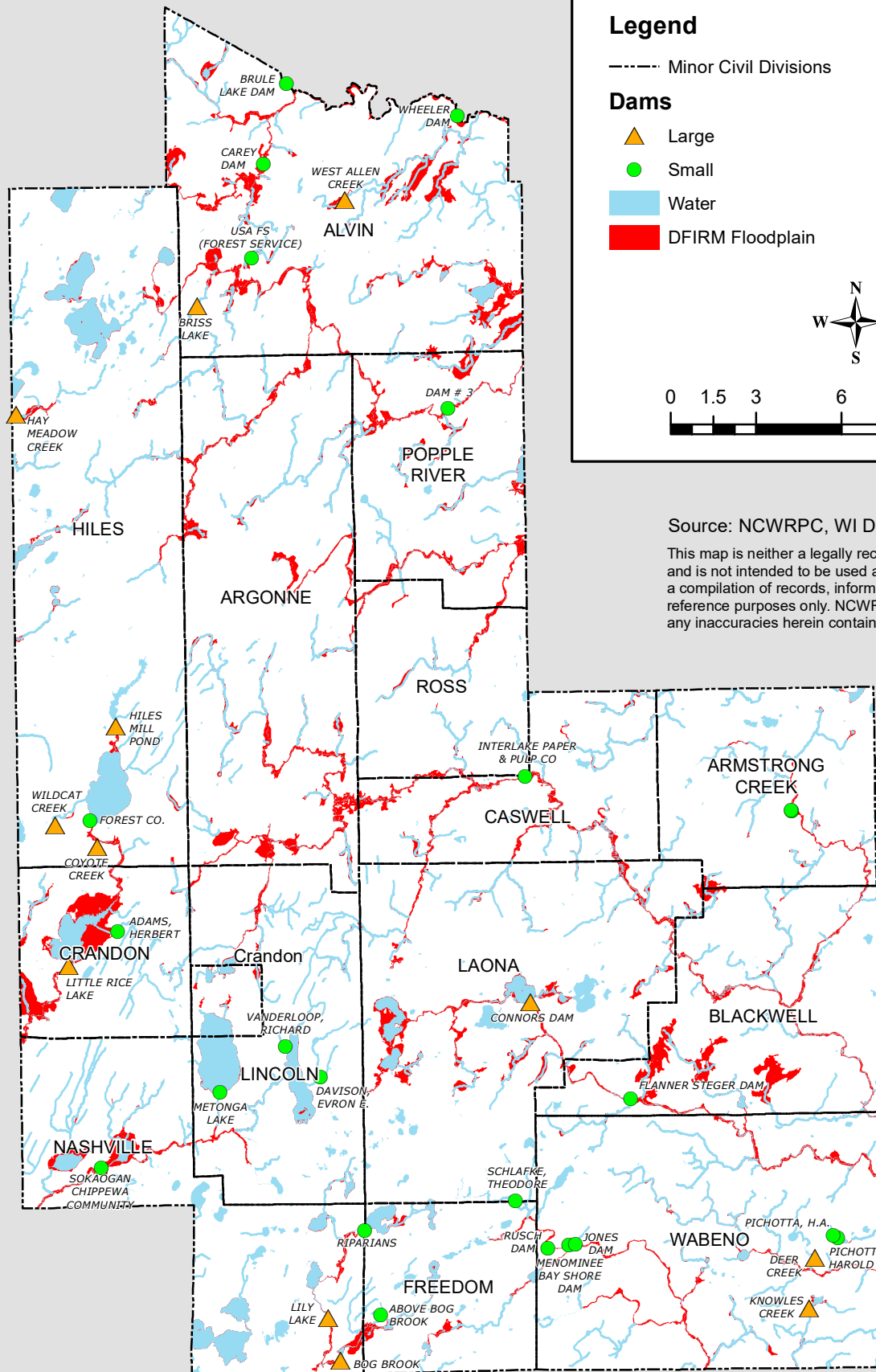


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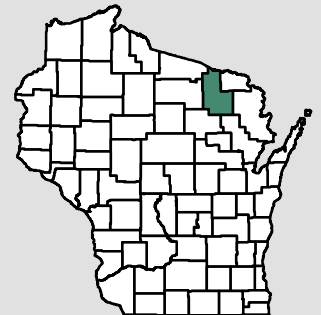
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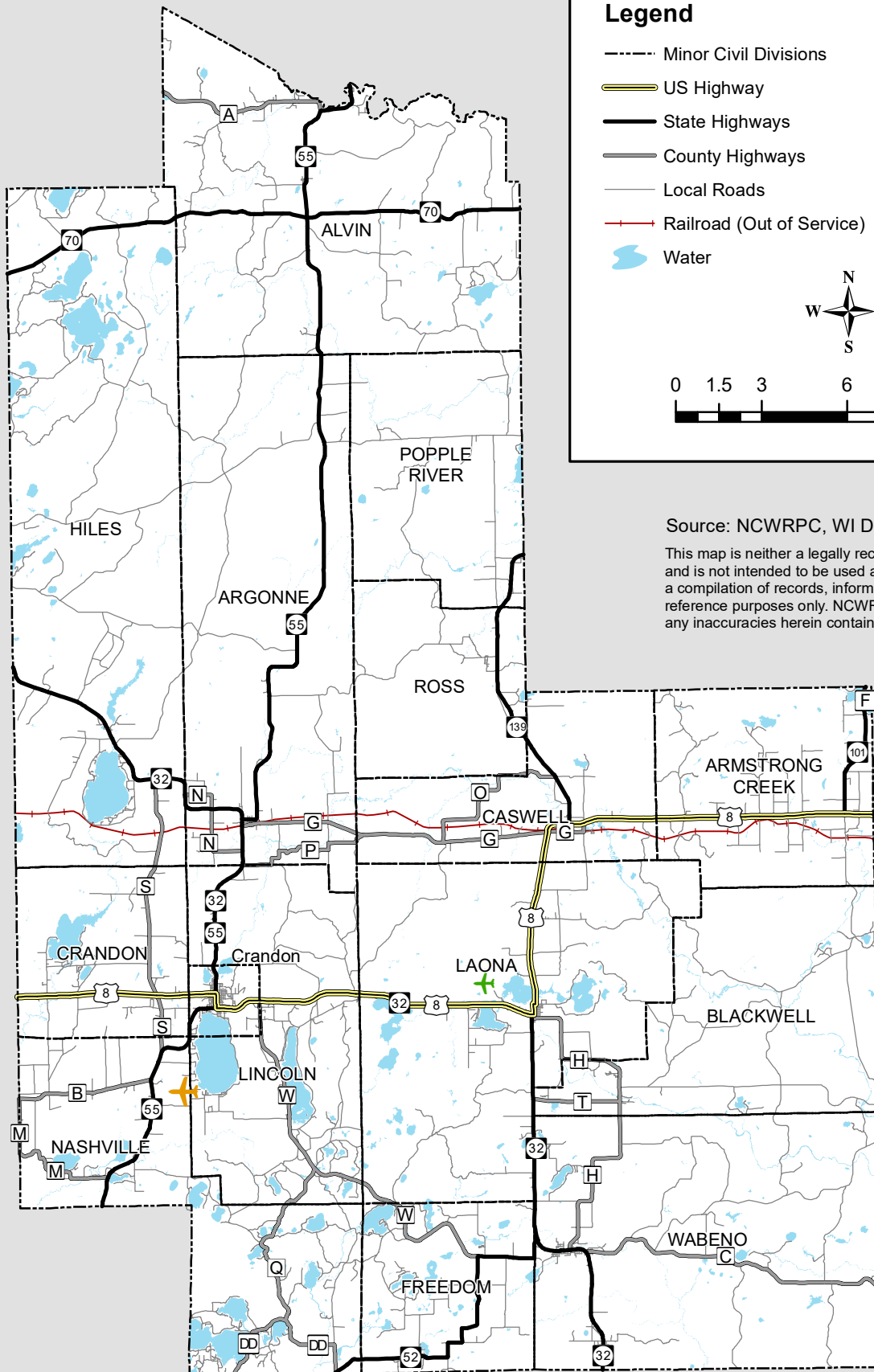




Source: NCWRPC, WI DNR, Forest County

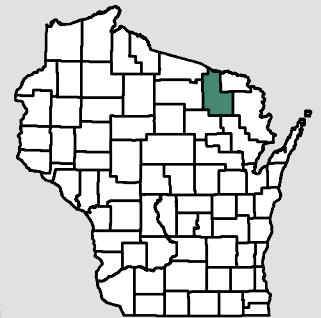
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Source: NCWRPC, WI DNR, Forest County

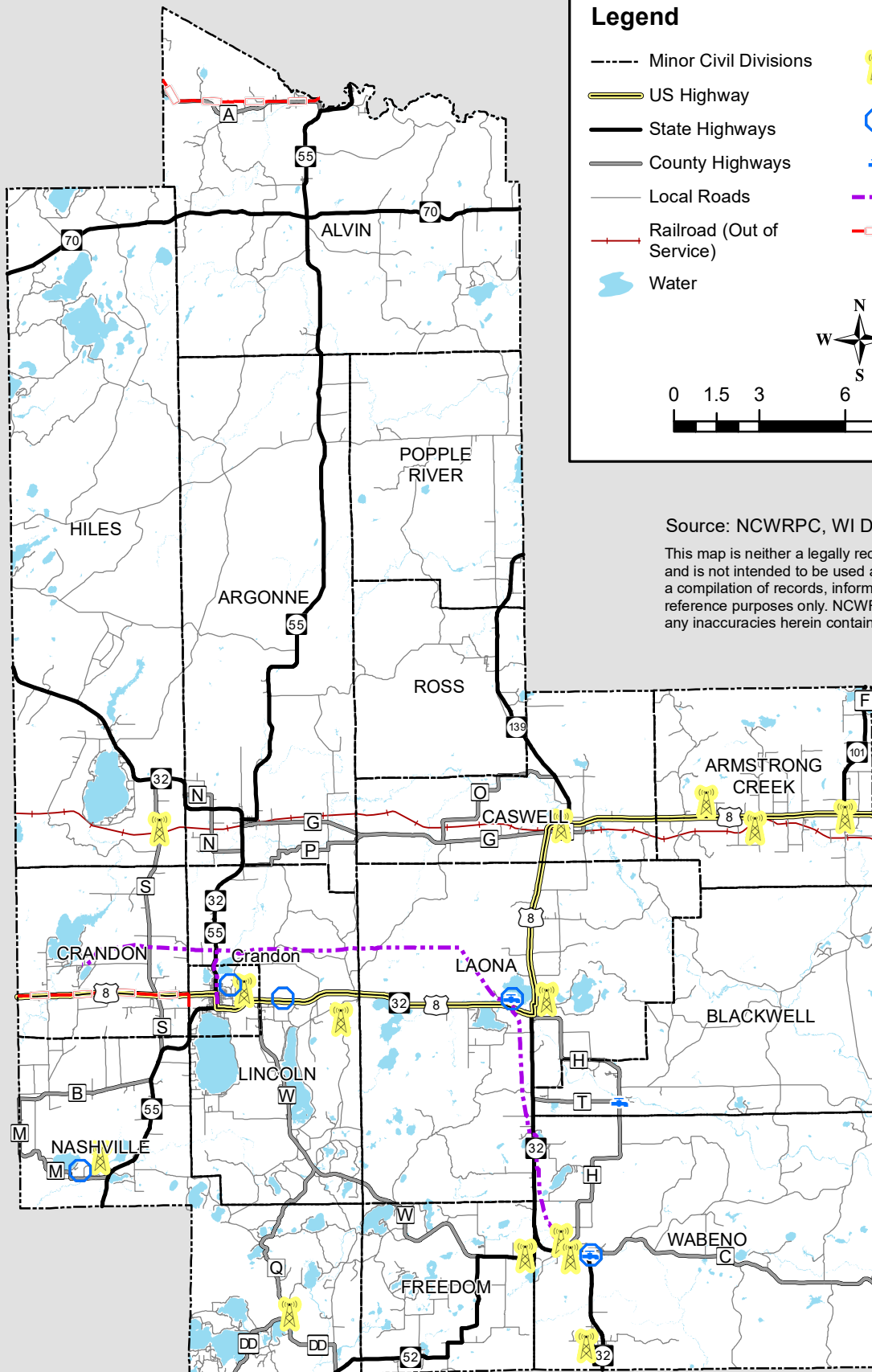
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### Legend

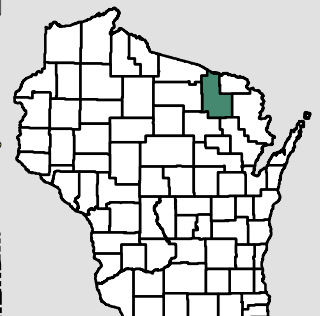
- Minor Civil Divisions
- == US Highway
- == State Highways
- == County Highways
- == Local Roads
- Railroad (Out of Service)
- Water
- Celltowers
- Waste Water Treatment Plant
- Public Water Supply
- Pipeline
- High Voltage Powerline



0 1.5 3 6 9 12 Miles

Source: NCWRPC, WI DNR, Forest County

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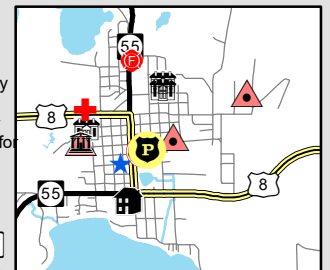
- |                             |                                   |
|-----------------------------|-----------------------------------|
| --- Minor Civil Divisions   | Court House                       |
| US Highway                  | Emergency Operations Center       |
| State Highways              | Emergency Operations Center (Alt) |
| County Highways             | Schools                           |
| Local Roads                 | Emergency Shelter                 |
| Railroad (Out of Service)   | Health Services                   |
| Water                       | Nursing Home                      |
| Fire Station                | Ranger Station                    |
| City Police                 | Senior Housing                    |
| Sheriff Department          | Town Halls                        |
| Town Hall / Fire Department | Tribal Administration             |
| Saint Mary's Clinic         |                                   |
| City Hall                   |                                   |

0 1.5 3 6 9 12 Miles

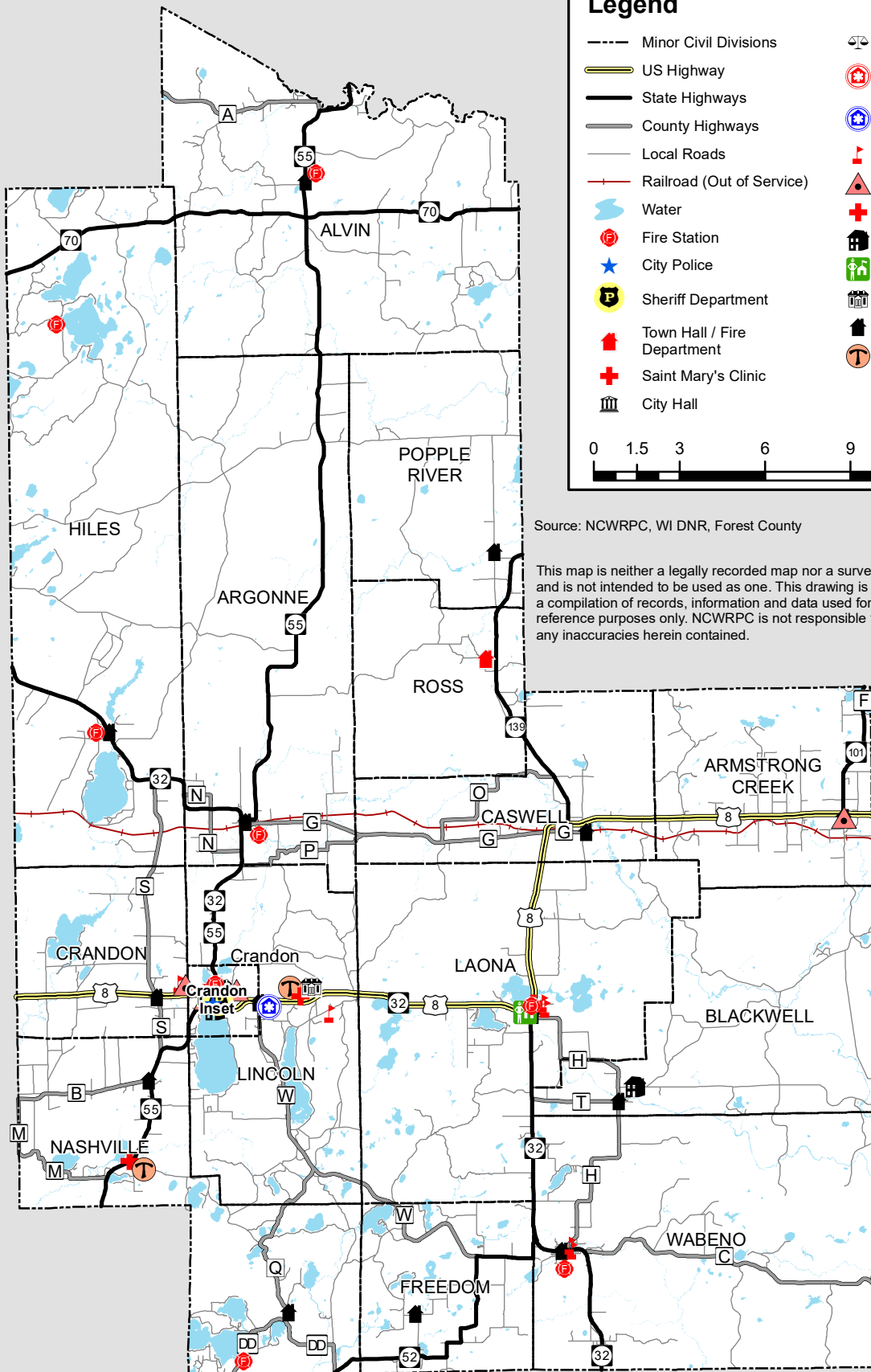
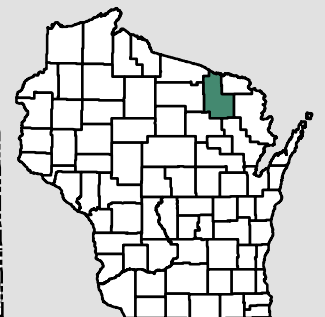


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**City of Crandon Inset**



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