SEWRPC Community Assistance Planning Report No. 326 (2nd Edition)

WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Chapter 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

In December 2020, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) and the Washington County Office of Emergency Management agreed to cooperatively prepare an update to the 2018 all hazards mitigation plan for Washington County. The plan is designed to be consistent with the guidelines of the Wisconsin Department of Military Affairs, Division of Emergency Management (DMA, DEM), and the Federal Emergency Management Agency (FEMA).[1] As such, the plan aligns with the requirements and procedures defined in the amended Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) of Title 44 Code of Federal Regulations (CFR) Section 201 "Mitigation Planning" and Section 201.6, "Local Mitigation Plans."[2] Additionally, the plan focuses on natural hazard mitigation which the Wisconsin Division of Emergency Management (WEM) and FEMA recommend as an option to single hazard mitigation planning. Natural weather hazard conditions, which include flooding; severe weather conditions, including windstorms, tornadoes, periods of extreme heat or cold, drought, and winter storms were specifically considered for the preparation of this hazard mitigation plan update. While the

[1] *Federal Emergency Management Agency, State and Local Mitigation Planning How-to-Guide, "Understanding Your Risks: Identifying Hazards and Estimating Losses," Publication No. FEMA 386-2, September 3, 2015; Federal Emergency Management Agency, Multi-jurisdictional Mitigation Planning, March 10, 2009; Federal Emergency Management Agency, Local Mitigation Planning Policy Guide, April 2022.*

[2] *On April 19, 2022, FEMA updated the State and Local Mitigation Planning Policy Guides (policies). The policies are the official interpretation of the requirements in the Stafford Act, as amended, specifically Title 44 CFR Section 201.*

plan considered all of the potential hazards, it must be recognized that only limited mitigation actions were feasible for some of these hazards, since they are not site-specific or repetitive in nature.

1.2 OVERVIEW OF STUDY AREA

Washington County is located in southeastern Wisconsin, and is bordered on the east by Ozaukee County, on the south by Waukesha County, on the west by Dodge County, and on the north by Fond du Lac and Sheboygan Counties.

Washington County covers about 436 square miles and contains all or parts of two cities, all, or parts of six villages, and twelve towns as shown on Map 1.1. There are parts of four major watersheds and a total of about 4,500 acres of inland surface waters within the County. The County has a diversified natural resource base, including several inland lakes, as well as major river systems.

The majority of the population resides in three population centers: one in the central portion of the County within the City of West Bend, another in the west-central portion of the County in the City of Hartford and the Village of Slinger, and a third in the southeastern portion of the County in the Villages of Germantown and Richfield. However, population centers are also scattered through the County including the Villages of Jackson, Kewaskum, and Newburg and in the partially urbanized town areas. Much of the land in the County remains in agriculture.

1.3 RELATIONSHIP OF HAZARD MITIGATION PLANNING TO EMERGENCY OPERATIONS PLANNING AND COUNTY REGULATIONS

The focus of this planning effort is natural weather hazard mitigation measures. Such measures generally involve lasting, often permanent, measures designed to reduce the exposure to, probability of, or potential loss from hazardous events. Such measures tend to focus on actions related to where and how to build structures, education to reduce losses or injury, and programs to improve the safety of identified hazard areas. A hazard mitigation plan outlines the strategy for mitigating the hazards potentially impacting a county or community.

Emergency Operations Planning

The mitigation plan should be distinguished from, but compatible with, an emergency operations plan. Such a plan is defined as a plan which describes how people and property will be protected in disaster and

disaster threat situations; details who is responsible for carrying out specific actions; identifies the personnel, equipment, facilities, supplies, and other resources available for use in the disaster; and outlines how all actions will be coordinated. Numerous such emergency operation plans have been developed at the jurisdictional level, and often involve mutual assistance and cooperation agreements between local units of government in adjoining municipalities, both within and outside of Washington County. Plans for mitigating hazards are related to emergency operation activities involving short-term recovery decision-making, since such activities may highlight prospects for implementation of a mitigation strategy aimed at reducing long-term risk to human life and property.

Washington County Comprehensive Emergency Management Plan

Washington County has developed a comprehensive emergency management plan (CEMP) which sets forth an all-hazards action plan. The CEMP provides the framework for the Washington County government and partner entities to respond to public emergencies within the local jurisdiction and regionally. The CEMP establishes a unified command and control structure for emergency response operations to ensure a coordinated and effective response. The CEMP also incorporates the concepts and processes of the National Incident Management System (NIMS) as the standard for emergency response operations.

In addition, many of the local units of government have developed emergency operations plans and/or programs which complement the County CEMP, and which also set forth procedures and actions to deal with a range of situations and events. The CEMP notes that the County is exposed to many hazards that have the potential for disrupting the community, causing damage, and creating casualties. In addition to flooding, the plan recognizes that the County is vulnerable to other natural hazards, including tornadoes and severe weather; technological hazards; accidents involving hazardous materials; terrorism and civil disorder; and utility hazards, such as power failure and water shortages or contamination.

The County CEMP includes procedures and protocols to respond to disasters or large-scale emergencies. The purpose and goal of the County CEMP is to assist the government in protecting lives, property, and the environment from major emergencies through addressing the areas of mitigation, preparedness, response, and recovery. This basic plan is intended as the core of the Washington County emergency operations program. It provides policies for department and agency managers and emergency management professionals to use in planning and actual operations. In response to a disaster or large-scale emergency, all local government forces, including law enforcement, fire, medical, health, public works, and others, are a part of the County's emergency management organization, and will be the first line responders to such an emergency. When the emergency or disaster exceeds the capability of the local governments and the

County to respond, the County will request assistance from the State of Wisconsin on behalf of the County and the affected municipalities. The Federal government will aid the State of Wisconsin when all local and State resources have been exhausted.

Relationship of County Regulations and Programs to Hazard Mitigation Planning

The current ordinances and programs which are most directly related to hazard mitigation and plan implementation include general zoning, floodplain zoning, shoreland and shoreland-wetland zoning regulations, and stormwater management requirements. These ordinances and programs impact how and where development occurs in Washington County and has a significant role in protecting and/or preventing development in potentially hazardous locations. These ordinances and programs are administered by Washington County and the local units of government in the County as indicated in Table 1.1 and described below.

General Zoning

Cities in Wisconsin are granted general, or comprehensive, zoning powers under Section 62.23 of the *Wisconsin Statutes*. The same powers are granted to villages under Section 61.35 of the Wisconsin Statutes. Counties are granted general zoning powers within their unincorporated areas under Section 59.69 of the Wisconsin Statutes. However, a county zoning ordinance becomes effective only in those towns that ratify the county ordinance. Each city, village, and town in Washington County has adopted and enforces its own zoning ordinance. In Washington County, the county shoreland and floodplain zoning ordinances apply to shoreland areas in addition to the town general zoning ordinances.

County Shoreland, Shoreland-Wetland, and Floodplain Zoning Ordinance

Under Section 59.692 of the *Wisconsin Statutes*, counties are responsible for regulating shoreland areas within unincorporated (town) areas. Shorelands are defined as all land lying within 1,000 feet of the ordinary highwater mark (OHWM) of a navigable lake, pond, or flowage; or within 300 feet of the OHWM of a navigable river or stream or to the landward side of the floodplain, whichever distance is greater. Standards for county shoreland zoning ordinances are set forth in Chapter NR 115 of the *Wisconsin Administrative Code*.[3] In addition, Chapter NR 115 requires that counties place all wetlands within the statutory shoreland

[3] Chapter NR 115 sets forth requirements regarding lot sizes and building setbacks; restrictions on cutting of trees and shrubbery; and restrictions on filling, grading, lagooning, dredging, ditching, and excavating that must be incorporated into county shoreland zoning regulations.

zoning jurisdiction area into a wetland conservancy zoning district to ensure their preservation after completion of wetland inventories by the WDNR.

The Washington County Shoreland, Wetland, and Floodplain Zoning Ordinance is set forth in Chapter 275 of the *Washington County Code*. The County's shoreland zoning ordinance applies to shorelands, shoreland-wetlands, and floodplains in all unincorporated (town) areas within the County, generally protecting these areas from intensive development. The ordinance includes restrictions on uses in wetlands located within the shoreland and limits the types of uses that can occur within the 100-year floodplain to prevent damage to structures and property and to protect the floodwater conveyance and storage capacity of floodplains. Most structures must be set back a minimum of 75 feet from the OHWM of navigable rivers, streams, and water bodies. The ordinance was amended in 2016 to comply with recent changes to State law limiting the ability of counties to enforce shoreland zoning regulations that are more restrictive than State standards.

The city and village shoreland regulations generally require a 50-foot building setback from navigable waters on annexed shorelands within the city or village. Where County regulations continue in effect, the city or village is responsible for enforcing the County ordinance. Cities and villages are also required to regulate wetlands within shoreland areas, including those that were in the city or village prior to 1982, under Chapter NR 117 of the *Wisconsin Administrative Code*; and to enforce the minimum floodplain standards set forth in Chapter NR 116 of the *Wisconsin Administrative Code* within all floodplain areas of the city or village.

1.4 SCOPE AND PURPOSE OF PLAN UPDATE

This plan updates the 2018 Washington County hazard mitigation plan.[4] The scope of this plan is countywide, and is intended to set forth the most appropriate, feasible, and effective hazard mitigation strategy for Washington County and the local units of government within the County. The plan complements and refines the *State Hazard Mitigation Plan of Wisconsin*[5] and focuses on local conditions and natural weather hazards likely to occur or be experienced within Washington County and Southeastern Wisconsin. As such, the County and SEWRPC will evaluate, update, and revise existing mitigation strategies as well as develop new local mitigation strategies specific to a community's exposure and impacts from identified natural hazards.

[4] *SEWRPC Community Assistance Planning Report No. 326, Washington County Hazard Mitigation Plan, March 2018.*

[5] *Wisconsin Emergency Management, State Hazard Mitigation Plan of Wisconsin, December 2021.*

The plan is developed as a multi-jurisdictional plan, covering Washington County and all of the municipalities located within the County. The mitigation planning requirements identified in 44 CFR, Section 201.6 "Local Mitigation Plans" requires all jurisdictions participating in a multi-jurisdictional hazard mitigation plan to participate in the planning process. Examples of participation include, but are not limited to, attending planning meetings, contributing research, data, or other information, and commenting and reviewing drafts of the plan.

The municipalities that participated in the development of the Washington County hazard mitigation plan update include:

Cities

Hartford

West Bend

Villages

Germantown

Jackson

Kewaskum

Newburg

Richfield

Slinger

Towns

Barton

Erin

Farmington

Germantown

Hartford

Jackson

Kewaskum

Polk

Trenton

Wayne

West Bend

The plan was prepared by the staffs of the Washington County Emergency Management Office and SEWRPC. In preparing the plan update, the County involved all appropriate County departments as needed. In addition, the planning was coordinated with the related activities of other concerned units and agencies of government. The plan was developed under the guidance of the Washington County Hazard Mitigation Plan Local Planning Team (LPT), which was created by the County specifically for plan update purposes. This team was comprised of elected and appointed officials, agency and business representatives, and citizens from throughout the County knowledgeable in hazard mitigation matters. Table 1.2 summarizes municipal participation in the planning process. For more complete details on the level of participation of local citizens and community groups in the public involvement process, and summary notes for each LPT meeting, see Appendix A.

The original Washington County Hazard Mitigation Plan (2018) was developed and approved as a multi-jurisdictional all hazards mitigation plan under FEMA's previous Pre-Disaster Mitigation grant program. It too was a collective effort of a number of governmental and non-governmental agencies, organizations, and stakeholders under the guidance of an LPT. In addition to formation and active participation of the LPT, the original plan development process included the following steps:

- Collation and review of all pertinent reports relating to the hazard mitigation activities in Washington County
- Inventory mapping and analysis of hazards pertinent to Washington County
- Identification of the facilities and ongoing programs related to hazard mitigation
- Assessment of the vulnerability of County assets to each hazard
- Identification of and prioritization of needed facilities and programs
- Consideration of issues relating to neighboring municipalities and units of government likely to be affected or influenced by natural hazards within Washington County
- Development and evaluation of alternatives to address the identified needs
- The development of plan recommendations and an implementation plan
- Development of a public informational and educational program and program of public consultation to guide the plan development and implementation program, including a prioritization of the recommended plan elements
- Adoption of a strategy for monitoring and refining the plan

This plan update was developed under FEMA's new Building Resilient and Innovative Communities (BRIC) planning grant program.[6] The BRIC program seeks to fund effective and innovative projects that will reduce risk and increase resilience and serve as a catalyst to encourage the whole community to invest in and adopt policies related to mitigation. Additionally, the BRIC program encourages communities to build partnerships with local units of government, business, and other stakeholders that have a shared interest and obligation in protecting and enhancing the safety, resilience, and economic stability of Washington County. The BRIC programs guiding principles are: [7]

1. Support state and local governments, tribes, and territories (SLTT) through capability-and capacity-building to enable them to identify mitigation actions and implement projects that reduce risks posed by natural hazards

2. Encourage and enable innovation while allowing flexibility, consistency, and effectiveness

3. Promote partnerships and enable high-impact investments to reduce risk from natural hazards with a focus on critical services and facilities, public infrastructure, public safety, public health, and communities

4. Provide a significant opportunity to reduce future losses and minimize impacts on the Disaster Relief Fund (ORF)

5. Promote equity, including by helping members of disadvantaged groups and prioritizing 40 percent of the benefits to disadvantaged communities

6. Support the adoption and enforcement of building codes, standards, and policies that will protect the health, safety, and general welfare of the public, considering future conditions, prominently including the effects of climate change, and have long-lasting impacts on community risk reduction, including for critical services and facilities and for future disaster costs

[6] *The Disaster Recovery Reform Act of 2018 (DRRA) amended Section 203 (Pre-Disaster Mitigation program) of the Stafford Act. Through DRRA Section 1234, National Public Infrastructure Pre-Disaster Hazard Mitigation, FEMA discontinued the Pre-Disaster Mitigation grant program and established the Building Resilient Infrastructure and Communities (BRIC) grant program.*

[7] FEMA, *Mitigation Assistance: Building Resilient Infrastructure and Communities FEMA POLICY FP-104-008-05.*

1.5 PLAN MAINTENANCE AND IMPLEMENTATION ACTIVITIES

Outreach Activities

Since the adoption of the initial hazard mitigation plan, local municipalities in Washington County have conducted outreach activities to educate the public about emergency preparedness, including hazard mitigation. The most recent activities are summarized in Table 1.3. The most common methods used by the communities include making information available through posting on the municipality's website and mailing or emailing periodic newsletters to residents. These methods have been used to distribute information on hazard awareness and preparedness related to topics such as flooding, winter weather awareness, tornado awareness, hazardous materials awareness, heat awareness, pandemic influenza, fire safety, and family preparedness. In recent years, some of the local municipalities have also begun reaching the public through social media sites such as Facebook® and Twitter®.

Implementation Activities

Since the adoption of the current hazard mitigation plan (2018), Washington County and the local municipalities have conducted several projects intended to implement recommendations of the plan. These projects are summarized in Table 1.4.

1.6 REVIEW OF PLAN DEVELOPMENT EFFORTS, PROCESS AND ADOPTION

As previously noted, the Washington County hazard mitigation plan was prepared under the guidance of a LPT comprised of representatives of the County and all of the communities within the County, as well as County businesses and agency representatives. The LPT met three times during the plan preparation period to provide input on the types of hazards to be considered, the appropriate mitigation strategies, and to review the draft report chapters. The report chapters were then refined to reflect the comments and recommendations of the Team.

As draft chapters of the plan were completed, copies of the chapters were placed in downloadable form on the SEWRPC website. A webpage was available on this website on which members of the public could ask questions and submit comments on the draft plan update. Following completion of the community profiles and the risk and vulnerability assessments sections of the plan and review by the LPT, a public informational meeting was held to review these sections of the plan with local officials, stakeholders, and citizens and to solicit their input.

After the plan was completed in draft form, an additional public informational meeting was held to review the entire draft plan with local officials, stakeholders, and citizens and solicit their input. In addition, copies of the draft plan were made available at the offices of the Washington County Office of Emergency Management and on the SEWRPC website.

Once FEMA determined that the plan was approvable upon adoption, copies of the plan were sent to each of the local units of government requesting that they adopt the plan in order to retain future eligibility for mitigation funding. Funding to complete this plan was provided by the BRIC planning program administered by WEM. In addition, County and SEWRPC staffs were available to meet with communities on an individual basis to review the plan update and consider adoption and implementation steps. Copies of the adopted resolutions approving the plan by the local units of government are included in Appendix B.

Chapter 1

INTRODUCTION AND BACKGROUND

TABLES

Table 1.1
Regulations and Programs Within Washington County Related to Hazard Mitigation: 2022

Municipality	General Zoning	Floodplain Zoning	Stormwater Management Ordinance or Plan	Shoreland or Shoreland Wetland Zoning	Emergency Operations/Management Ordinance or Plan
Washington County	Adopted	Adopted	County Code	Adopted	Adopted
City of Hartford	Adopted	Adopted	City Code	Adopted	Adopted
City of West Bent	Adopted	Adopted	City Code	Adopted	Adopted
Village of Germantown	Adopted	Adopted	Village Code	Adopted	Adopted
Village of Jackson	Adopted	Adopted	Village Code	Adopted	Adopted
Village of Kewaskum	Adopted	Adopted	Village Code	Adopted	Adopted
Village of Newburg	Adopted	Adopted	Village Code	Adopted	Adopted
Village of Richfield	Adopted	Adopted	Village Code	Adopted	Adopted
Village of Slinger	Adopted	Adopted	Village Code	Adopted	Adopted
Town of Addison	Adopted	County Ordinance	Town Code	County Ordinance	Adopted
Town of Barton	Adopted	County Ordinance	County Code	County Ordinance	Adopted
Town of Erin	Adopted	County Ordinance	County Code	County Ordinance	Adopted
Town of Farmington	Adopted	County Ordinance	Town Code	County Ordinance	Adopted
Town of Germantown	Adopted	County Ordinance	County Code	County Ordinance	Adopted
Town of Hartford	Adopted	County Ordinance	County Code	County Ordinance	Adopted
Town of Jackson	Adopted	County Ordinance	Town Code	County Ordinance	Adopted
Town of Kewaskum	Adopted	County Ordinance	Town Code	County Ordinance	Adopted
Town of Polk	Adopted	County Ordinance	Town Code	County Ordinance	Adopted
Town of Trenton	Adopted	County Ordinance	Town Code	County Ordinance	Adopted
Town of Wayne	Adopted	County Ordinance	Town Ordinance	County Ordinance	Adopted
Town of West Bend	Adopted	County Ordinance	Town Ordinance	County Ordinance	Adopted

Source: Washington County's Municipal Webpages and SEWRPC

Table 1.2
Participation in the Washington County Hazard Mitigation Plan Update Planning Process

Civil Division	Attendance at Local Planning Team Meetings			Provision of Data[a]	Review of Report
	June 7, 2022	February 1, 2023	May 1, 2024		
Cities					
Hartford	--	X	X	X	X
West Bend	X	X	X	X	X
Villages					
Germantown	--	--	--	X	--
Jackson	--	--	--	--	X
Kewaskum	X	--	--	X	X
Newburg	--	--	--	X	--
Richfield	--	X	--	--	--
Slinger	--	--	--	X	--
Towns					
Addison	X	--	--	X	X
Barton	X	--	--	X	--
Erin	--	--	--	X	--
Farmington	X	--	--	X	X
Germantown	X	--	--	--	X
Hartford	X	--	--	--	--
Jackson	--	--	--	X	--
Kewaskum	--	--	--	--	X
Polk	X	X	--	X	--
Trenton	--	--	--	X	--
Wayne	X	--	--	X	X
West Bend	X	X	--	X	X
County					
Washington County	X	X	X	X	X
Other					
Clark Legal Services, LLC	--	X	X	X	X
Ozaukee-Washington Public Health and Emergency Preparedness	--	--	X	--	--

Note: X indicates participation by at least one representative of the municipality or organization.

[a] *Provision of data includes providing information on hazards experienced, projects undertaken, and outreach efforts as well as sharing of relevant plans, reports, and concerns.*

Source: SEWRPC

Table 1.3
Outreach Activities by Community in Washington County
Related or Beneficial to Hazard Mitigation

Community	Activity
Washington County	County website County Facebook page County Twitter account County's Emergency Management Department webpage County Quarterly Newsletter County Newspaper(s) County's Stormwater Management Program Washington-Ozaukee Public Health Department Emergency Preparedness Website and Social Media Outreach County's Annual NWS Severe Weather Spotter/Safety Training Program County's provision of hazard preparedness, information/education distribution, and training material Informational meeting (open house) for the Cedar Creek Watershed HUC 10 Floodplain Study and Map Amendments in Washington County Public Hearing for Chapter 275 (Shoreland-Wetland-Floodplain Zoning) Amendments and Floodplain Map Adoption for the Cedar Creek Floodplain Study
City of Hartford	City website Email and text message information and alert notices (Notify Me) City Facebook page City Twitter account City's Stormwater Management Program City Fire Department Facebook page and webpage that provides additional emergency preparedness resources and information City Police Department Facebook page Hartford Community Development Authority (HCDA) Weatherization Program Housing Rehab Loan Program
City of West Bend	City website City Facebook page City Twitter account City Emergency Government Management Program City Police Department Facebook page City Newspaper "West Bend Daily News" April Severe Weather Awareness and Educational Push via City's Social Media Outlets Citywide Tornado Drills
Village of Germantown	Village website Village Facebook page Email and text message information and alert notices (Notify Me) Village Police Department Facebook page Village Fire Department Facebook page and webpage with FEMA resource link Village Quarterly Newsletter
Village of Jackson	Village website Weekly and Quarterly Newsletters West Bend Daily Newspaper Village Police Department Facebook page
Village of Kewaskum	Village website Village Police Department Facebook page Village Newspaper "The Statesman"
Village of Newburg	Village website Board of Emergency Management Village Monthly Newsletter Fire Department Facebook page Police Department Facebook page

Table continued on next page.

Table 1.3 (Continued)

Community	Activity
Village of Richfield	Village website Planning and Zoning Department webpage provides additional resources related to flood mitigation Village Facebook page Village Twitter account Village Quarterly Newsletter Email and text message information and alert notices (Notify Me)
Village of Slinger	Village website
Town of Addison	Town website
Town of Barton	Town website Town Yearly Newsletter
Town of Erin	Town website Town Newsletter
Town of Farmington	Town website Pamphlets on Storm Safety
Town of Germantown	Town website
Town of Hartford	Town website
Town of Jackson	Town website
Town of Kewaskum	Town website
Town of Polk	Town website
Town of Trenton	Town website Town Bi-Annual Newsletters
Town of Wayne	Town website
Town of West Bend	Town website

Source: Community Websites, Washington County, and SEWRPC

Table 1.4
Hazard Mitigation Activities in Washington County: 2018-2024

Community	Project/Activity	Funding Source	Completion Date
Washington County	Updating Floodplain Studies: • Cedar Creek (Adopted 2022) • Milwaukee River • Upper Rock River • Tributaries of the Menomonee River (ongoing)	WDNR, FEMA	February, 2022
	Installment of LiDAR technology (2015)	None	2015
	Dam Repair on Big and Little Cedar Lake	None	Ongoing
	County Hazard Mitigation Plan update	FEMA	2024
	Conservation farming practices education and outreach	USDA	Ongoing
City of Hartford	WDNR Dam Safety Inspection	None	2024
	Land use zoning code re-write	None	2022
City of West Bend	Tornado Siren Maintenance and Upkeep	None	Ongoing
	Severe Weather Policy Updates, Training, and Drills	NWS	Ongoing
	Main Street reconstruction project (storm sewer upgrades)	None	2023
Village of Germantown	MMSD Greenseams Program Property Purchase	None	2018
	MMSD Greenseams Program Property Purchase	None	2019
	MMSD Greenseams Program Property Purchase	None	2021
	MMSD Greenseams Program Property Purchase	None	2022
Village of Kewaskum	Annual Government Emergency Preparation Table Exercise	None	Ongoing
Village of Newburg	Upgrade to Emergency Siren System Additional Safety Structures in Parks	Village	2024-2025
Village of Richfield	Adoption of new Village Zoning Code	None	2022
Village of Slinger	Upgraded Sewer Pipes	None	2023
	Cleaned and Maintenance Work on Four Village Retention Ponds	None	2023
Town of Barton	MMSD Greenseams Program – Easement Purchase	None	2022
Town of Farmington	MMSD Greenseams Program – OWLT Property Purchase	WDNR Stewardship	2017
	MMSD Greenseams Program – Property Purchase	None	2019
	MMSD Greenseams Program – TCF Property Purchase	WDNR Stewardship	2019
	MMSD Greenseams Program – Easement Property Purchase	None	2020
	MMSD Greenseams Program – OWLT Property Purchase	NAWCA	2021
	MMSD Working Soils Program – Easement Purchase	NRCS	2023
Town of Hartford	Erosion Mitigation Project on Southeast End of Pike Lake	None	2023-2024
Town of Jackson	Replacing Small Double Box Culvert with Full Span Bridge at Cedar Creek Road for Flood Mitigation	None	Ongoing
	MMSD Greenseams Program – Property Purchase	WDNR Stewardship	2019
	MMSD Greenseams Program – Easement Property Purchase	None	2021
	MMSD Greenseams Program – Easement Property Purchase	None	2022
	MMSD Greenseams Program – Easement Property Purchase	None	2022
	Adoption of residential and commercial building code ordinance	None	2022
Town of Polk	Adoption of new Town Zoning Code	None	2024
Town of Trenton	Ditching Along Roadways	None	Ongoing
	Culvert Repair and Maintenance	None	Ongoing

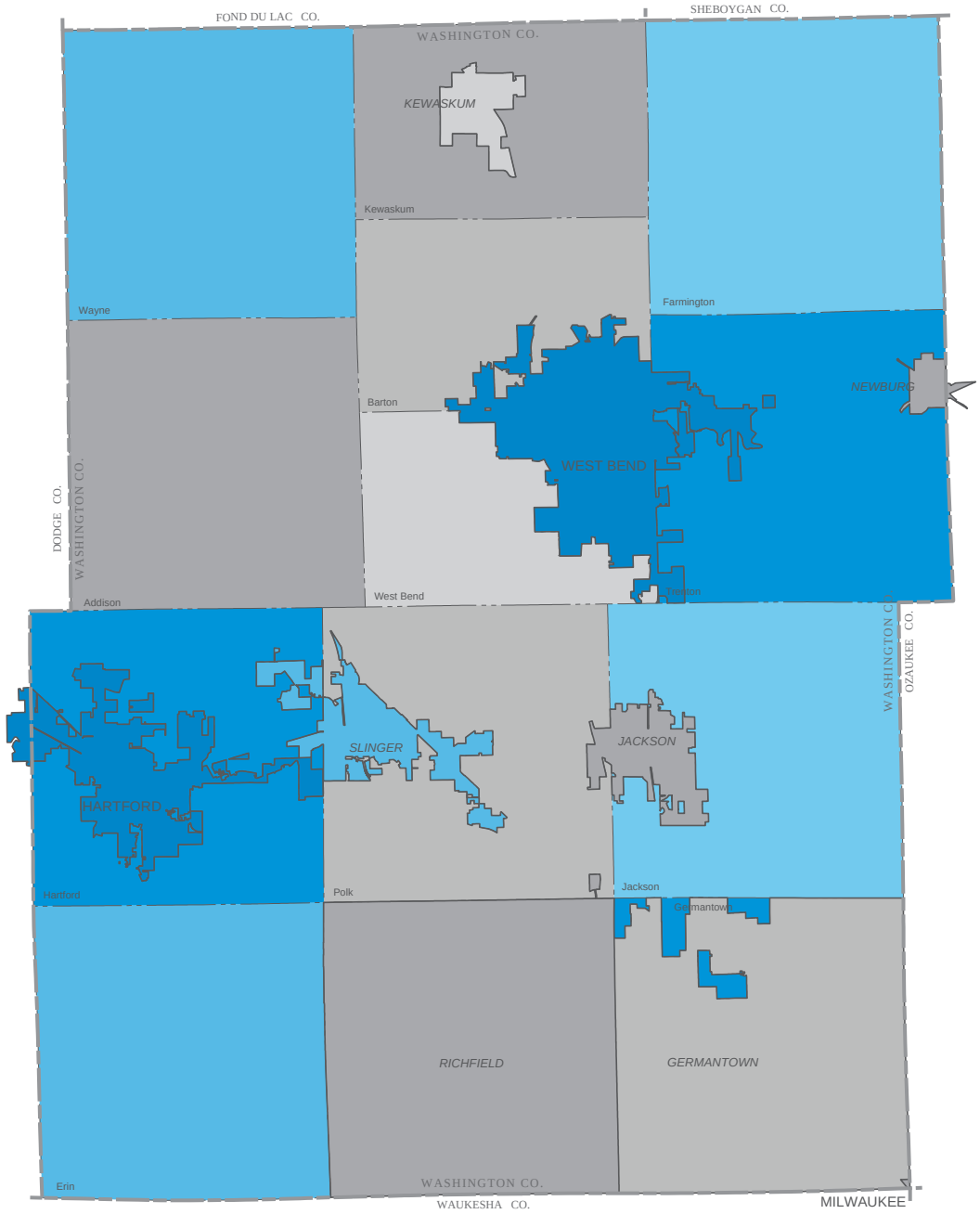
Source: Washington County and SEWRPC

Chapter 1

INTRODUCTION AND BACKGROUND

MAPS

Map 1.1
Civil Division Boundaries in Washington County: 2022



LOCAL GOVERNMENT TYPE

CITY: WEST BEND

VILLAGE: *SLINGER*

TOWN: Polk

N

0 1 2 3 Miles

Source: Washington County and SEWRPC

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Chapter 2

BASIC STUDY AREA INVENTORY AND ANALYSIS

2.1 INTRODUCTION

Information on pertinent natural and built features of the study area is an important consideration in sound hazard mitigation planning. Accordingly, the collection and collation of definitive information regarding basic geographic and demographic characteristics, existing and planned land use, surface water system characteristics, critical facilities, and climate change trends affecting the County constitute important steps in the planning process. The following in-depth information regarding the relevant conditions in the study area is useful in formulating and evaluating sound mitigation approaches.

2.2 CIVIL DIVISIONS

The geographic extent and functional responsibilities of civil divisions and special-purpose units of government are important factors to be considered in hazard mitigation planning, since these local units of government provide the basic structure of the decision-making framework, within which such planning must be addressed. The boundaries of the 20 civil divisions in Washington County are shown on Map 1.1 in Chapter 1 of this report. There are 12 towns in Washington County, including Addison, Barton, Erin, Farmington, Germantown, Hartford, Jackson, Kewaskum, Polk, Trenton, Wayne, and West Bend. In addition, there are six villages including the Villages of Germantown, Jackson, Kewaskum, Newburg, Richfield, and Slinger, as well as two cities including the Cities of Hartford and West Bend, located within the County. The total land area and proportion of the County within each civil division is presented in Table 2.1.

2.3 DEMOGRAPHIC TRENDS AND PROJECTIONS

Information on the size, characteristics, and distribution of population, household, and employment levels (i.e., demographic characteristics) can assist the County in preparing for such projected changes over time. Mitigation measures, such as proper design and development that help reduce impacts from future hazard weather events and promote community resiliency are an essential element in hazard mitigation planning.

It should be noted that the demographic projections for the year 2050 was prepared and developed by SEWRPC in support of the regional land use and transportation plan, which is documented in SEWRPC Planning Report No. 55, *VISION 2050: A Regional Land Use Plan for Southeastern Wisconsin: 2050*.[1]

Population

The area that is now Washington County was first included in the Federal census in 1850. Historical population levels in Washington County are provided in Table 2.2. As of 2020, there were 136,761 individuals residing in the County.

As indicated in Table 2.3, the City of West Bend is the most populous municipality in the County with about 23 percent of the County's population, in 2020. The next most populous communities are the Village of Germantown constituting about 15 percent of the County's population; the City of Hartford with about 11 percent of the County's population; and the Village of Richfield with about 9 percent of the County's population. Based upon 2020 census data, several communities in Washington County experienced a relative population increase from 2010 to 2020. These communities include the City of Hartford, the Village of Slinger, and the Town of Jackson.

The projected population for year 2050 Washington County is 180,500 people (Table 2.2). This is a projected increase of about 32 percent from the 2020 population level.[2] Additionally, Washington County is anticipated to experience the third-highest percentage increase in population within the Region.

[1] *SEWRPC Planning Report No. 55 is available on the SEWRPC website (www.sewrpc.org).*

[2] *Projected levels of population for the Southeastern Wisconsin Region can be found in SEWRPC Planning Report No. 55,* Vision 2050: A Regional Land Use and Transportation Plan for Southeastern Wisconsin, June 2020.

Vulnerable Populations

Every community needs to be able to prepare for and respond to hazardous events, including natural disasters. A number of factors including poverty; lack of access to transportation, technology, and educational resources; age; health; language barriers; insufficient education; and crowded housing can affect a community's ability to reduce or prevent the risks associated with a hazardous event. Such factors, known as social vulnerability, are often associated with populations who have been historically underserved or overlooked. Examination of potential additional vulnerabilities that these populations may face from specific hazard events is a critical consideration for hazard mitigation planning.

The Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR) created a Social Vulnerability Index (SVI) database using U.S. Census data to determine the social vulnerability of every U.S. census tract.[3] The SVI ranks each tract on 16 social factors. These social factors are grouped into four related themes to assess an area's social vulnerability including socioeconomic status, household characteristics, race and ethnic minority status, and type of housing and transportation.[4]

As indicated in Appendix C, the overall SVI for Washington County (using all 16 variables) is primarily considered low. There is a high degree of correlation between the themes, indicating that certain areas of the County have populations who may be especially vulnerable due to multiple factors. As indicated in Figure C.1 of Appendix C, there are higher concentrations of socially vulnerable residents in the more urbanized or densely populated areas, specifically within the Cities of Hartford and West Bend and the Village of Germantown. The overall State and National CDC/ATSDR SVI scores for Washington County are both considered low with the State score being 0.03 and National score being 0.01.

Additionally, FEMA integrates the SVI into its National Risk Index (NRI) dataset and interactive mapping tool. The NRI tool enables public health professionals, emergency planners, and the general public to

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[3] Census tracts are subdivisions of counties for which the Census collects statistical data.

[4] The 16 social factors grouped into four related themes, include: 1). Socioeconomic Status: Populations Below 150% Poverty, Unemployed, Housing Costs a Burden, No High School Diploma, and No Health Insurance; 2). Household Characteristics: Aged 65 and Older, Aged 17 and Younger, Civilian with a Disability, Single-Parent Household and English language proficiency; 3). Race and Ethnic Minority Status: Hispanic or Latino (or any race); Black and African American, two or more races, American Indian and Alaska Native, Native Hawaiian and Other Pacific Islander and other races; and, 4). Housing type/Transportation: Multi-Unit Structures, Manufactured Homes, Crowding, No Vehicle, and Group Quarters (www.atsdr.cdc.gov).

understand their risk to 18 natural hazards.[5] It was designed and built by FEMA in collaboration with various stakeholders and partners including academia; local, state, and federal governments; and private industry. The NRI uses available source data (i.e., the Social Vulnerability Index by CDC and the Baseline Resilience Indicators for Communities from the University of South Carolina) for natural hazard and community risk factors to develop a standard risk measurement for each county and Census tract in the United States. The NRI provides Risk Index scores and rating based on data for Expected Annual Loss due to natural hazards, Social Vulnerability, and Community Resilience. Washington County has a Risk Index rating of 71.27, or "Relatively Low," and a Community Resilience rating of 97.3, or "Very High," when compared to the rest of the U.S. This interactive mapping tool, available through FEMA's website, can be used to support resilience building efforts and ensure that resources go where they are needed most.

Population by Age Distribution

Older adults (65 years or older), as well as infants and young children (nine years or younger), are more sensitive and vulnerable to natural weather hazard events, particularly extreme temperature incidents. According to the most recent age distribution data for Washington County, 26 percent of the total population is aged 65 years or older (13.5 percent) or is under the age of nine (13 percent). In 2050, the projected population of infants and young children is estimated to be about the same, whereas the population of older adults is anticipated to increase (or double) to at least 26 percent. Accordingly, the expected increase in this vulnerable population will progressively need emergency and health services during hazardous weather events. Table 2.4 shows the actual and projected population by age in Washington County from 2010 to 2050.

Households

In addition to total population, the number of households, or occupied housing units, is of importance in land use planning in that it greatly influences the demand for land, as well as the demand for transportation and other public facilities and services. A household includes all persons who occupy a housing unit which is defined by the Census Bureau as a house, apartment, a manufactured home, a group of rooms, or a single room that is occupied, or intended for occupancy, as a separate living quarters.[6]

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[5] *The 18 natural hazards include: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.*

[6] *Separate living quarters are defined as those in which the occupants live separately from any other persons in the building, and which have direct access from the outside of the building or through a common hall.*

Trends in the number of households in the County are shown in Table 2.5. As indicated in the Table, the number of households in the County has generally increased. The County experienced significant gains in the number of new households between 1970 (17,385 households) and 2020 (55,879 households). Since 1970, the rate of increase in the number of households has exceeded the rate of population increase. During this time period, the number of households increased by about 221 percent, compared to a population increase of about 114 percent. With the number of households increasing at a faster rate than the population, the number of persons per household has decreased. The projected number of households in 2050 is expected to increase by about 33 percent (Table 2.5).

Map 2.1 shows the locations of manufactured home parks and individual mobile homes in Washington County. In 2015 there were 706 mobile homes located in the County, most located in six mobile home parks. In addition, there were 18 sites in the County that contained isolated individual mobile homes or small groups of mobile homes. This is important to note because manufactured homes can be particularly vulnerable to natural hazards such as high winds or flooding.

Employment

Trends in job growth are set forth in Table 2.6. The data reflect the number of both full- and part-time jobs within the County. A significant increase in the number of jobs may attract additional residents to the County, thus influencing population growth. As indicated in Table 2.6, employment growth has steadily increased between 1970 and 2020, with an increase in the number of jobs from 24,300 to 72,900, or about 200 percent. By the year 2050, the total number of jobs in the County is projected to increase by about 20 percent (Table 2.6).

Property Value

The value of the real estate and personal property in a community reflects the upper end of the potential for property damage in each community. The equalized value of the real estate and personal property in Washington County and each of the general-purpose units of government in the County as of 2022 is shown in Table 2.7.

2.4 LAND USE

Land use is an important determinant of the potential impact a particular hazard may have, and of the actions which may or should be taken to mitigate the hazard impacts. Accordingly, an understanding of the amount, type, and spatial distribution of urban and rural land uses within the County is an important

consideration in the development of a sound hazard mitigation plan. This section presents a description of the land uses in the County.

Existing Land Uses: 2015

Land uses in Washington County are based on the SEWRPC land use inventory conducted in 2015, as shown on Map 2.2 and summarized in Table 2.8.

Urban land uses occupied about 21 percent of the County in 2015. Residential land comprised the largest urban land use category, encompassing about 11 percent of the County. Commercial land comprised less than 1 percent of the County. Commercial development is concentrated in the County's urban service areas, which include the Cities of Hartford and West Bend, the Villages of Germantown, Jackson, Kewaskum, Newburg, and Slinger, and the Town of Addison. Land used for transportation, utilities, and communications facilities comprised the second largest urban land use of about 16,894 acres, or about 6 percent of the County.

Transportation Systems

Arterial Streets and Highways

The arterial street and highway system serving Washington County is shown on Map 2.3. As shown on Map 2.3, the existing arterial network in the extreme southeastern portion of the County and within the City of West Bend is relatively dense. The major roadways serving the County include U.S. Highway (USH) 45, Wisconsin State Trunk Highways (STH) 28, 33, 60, 83, 144, 145, 164, 167, and 175, and Interstate Highway (IH) 41. USH 45 traverses the entire County in a north-south direction and IH 41/USH 41 spans the entire County in a northwest-southeast direction.

Railway Facilities

As of 2021, railway freight service was being provided within Washington County by two railway companies operating 48 miles of active mainline railway and a 15-mile spur railway line (Map 2.3). The Wisconsin & Southern Railroad Company provides freight service over an approximately 23-mile segment of railway in the southern portion of the County. The Canadian National Railway operates freight service over an approximately 25-mile segment of mainline railway traveling north through the western half of the County. The Canadian National Railway also provides freight service over an approximately 15-mile spur segment of railway in the central portion of the County from the County's southeastern corner to the southern boundary of the City of West Bend.

Airports

Washington County has two publicly-owned airports which serve the public (see Map 2.3): West Bend Municipal Airport and Hartford Municipal Airport. West Bend Municipal Airport is owned and operated by the City of West Bend. It is classified as a general utility-corporate airport which is designed to handle single and twin-engine aircraft as well as corporate jets. The Wisconsin National Guard 832nd Medical Company, an air ambulance unit, has its headquarters at this airport. Hartford Municipal Airport is owned and operated by the City of Hartford and primarily serves general aviation and single-engine aircraft.

Nonurban land uses occupied about 80 percent of the County in 2015. Agricultural land use was the largest component, encompassing about 43 percent of the total area of the County. Cropland is a major component of the agricultural land use category. Other major nonurban land uses in the County include wetlands, woodlands, open lands, and surface water.

Planned Land Uses: 2050

The planned land use element, derived from the County's Multi-Jurisdictional Comprehensive Plan,[7] is presented on Map 2.4. and listed in Table 2.9. The planned land use map suggests where certain types of urban development should be encouraged while preserving agricultural and environmentally significant lands and resources. Map 2.4 is a compilation of planned land use maps prepared by each of the cities, villages, and towns in the County. The land use categories from these local plans were converted to a uniform legend for mapping and analysis purposes. Table 2.9 sets forth the planned number of acres and the percentage of the designated land use category in Washington County for the planned year 2050.

As listed in Table 2.9, planned urban-density areas include suburban, medium, and high-density residential; mixed-use development; commercial development, including office and professional services; industrial development; government and institutional land use; parks and recreational areas; and transportation and utilities. Those urban-density areas are associated with the Cities of Hartford and West Bend; the Villages of Germantown, Jackson, Kewaskum, and Slinger; areas within the Towns of Barton, Hartford, Jackson, Kewaskum, Polk, Trenton, and West Bend adjacent to these Cities and Villages; and the unincorporated settlement of Allenton in the Town of Addison.

The sum of residential land uses encompasses the largest planned urban land use category with about 18 percent of the land within the County. Roadways and highways are also forecasted to comprise a large

[7] *SEWRPC Community Assistance Planning Report No. 287 (Second Edition),* A Multi-Jurisdictional Comprehensive Plan for Washington County: 2050, *April 2019.*

amount land use with nearly 6 percent of the land. The number of acres in agricultural use will likely continue to decline as land is converted from farming to residential or other urban use.

Under VISION 2050, most new development in the County would be contained within urban service areas which are areas that provide basic urban services including public sanitary sewer and water supply services, as well as local parks, schools, and shopping districts. Planned urban service areas generally include existing sewer service areas and additional contiguous lands needed to accommodate anticipated development. Consequently, most of the incremental population, households, and jobs anticipated in the coming decades are allocated to such areas, as shown on Map 2.5.

Surface Water Resources and Flood Hazard Areas

Surface water resources, consisting of streams and lakes, form a particularly important element of the natural resource base. Surface water resources provide recreational opportunities, influence the physical development of the County, and enhance its aesthetic quality. Understanding the protection, enhancement, and proper development of these invaluable resources constitutes a major role in hazard mitigation planning, particularly in flood and drought mitigation.

Wetlands

Wetlands form at the transition between surface water, groundwater, and land resources. As such, these areas are inundated or saturated by surface water or groundwater at a frequency, and with a duration sufficient to support vegetation adapted for life in saturated soils. Wetlands generally occur in depressions and near the bottom of slopes, particularly along lakeshores and streambanks, and on large land areas that are poorly drained. They perform important natural functions that include water quality protection, stabilization of lake levels and streamflow, reduction in stormwater runoff by providing areas for floodwater impoundment and storage, and protection of shorelines from erosion.

The location and extent of wetlands in Washington County are shown on Map 2.6. These wetland areas are based on the WDNR's Wisconsin Wetland Inventory, which was updated to the year 2015 as part of the regional land use inventory. As indicated on Table 2.8, Washington County had approximately 46,638 acres, or about 17 percent of the county's surface area, of wetlands.

Streams

Major streams are defined as those which maintain, at a minimum, a small continuous flow throughout the year except under unusual drought conditions. There are approximately 220 miles of such streams in

Washington County, located within four main watersheds (shown in Map 2.6). The major stream in the **Menomonee River watershed**, which is located in the southeast portion of the County, is the Menomonee River. Major streams in the **Milwaukee River watershed**, which generally includes the area in the eastern half of the County, include the Milwaukee River, the East Branch of the Milwaukee River, the North Branch of the Milwaukee River, Kewaskum Creek, Cedar Creek, Little Cedar Creek, the North Branch of Cedar Creek, Evergreen Creek, Quass Creek, Silver Creek, Stony Creek, and Wallace Creek. Major streams in the **Rock River watershed**, which generally includes the area in the western half of the County, are the East Branch of the Rock River, the Ashippun River, the Coney River, the Kohlsville River, Limestone Creek, Mason Creek, the Oconomowoc River, the Little Oconomowoc River, the Bark River, and the Rubicon River. There are no major streams in the portion of the **Fox River watershed** that is located in Washington County.

Floodplains

Floodplains are the wide, gently sloping areas contiguous to, and usually lying on both sides of, a stream channel. For planning and regulatory purposes, floodplains are normally defined as the areas excluding the stream channel, subject to inundation by the 1-percent-annual-probability (100-year recurrence interval) flood event. There is a 1 percent chance of this event being reached or exceeded in any given year. Floodplain areas are generally not well suited to urban development, not only because of the flood hazard, but also because of the presence of high-water tables and, generally, of soils poorly suited to urban uses. Floodplain areas often contain important natural resources, such as high-value woodlands, wetlands, and wildlife habitat and, therefore, constitute prime locations for parks and open space areas.

FEMA identified floodplains in Washington County are shown on Map 2.6 and described in more detail in chapter 3. Approximately 42,189 acres, not including surface water in lakes and existing stream channels, or about 15 percent of the total area of the County, are located within these 1-percent-annual-probability floodplains.

Lakes

There are 14 major lakes—that is, lakes of 50 acres or more—in Washington County. The major lakes include Bark Lake, Barton Pond, Big Cedar Lake, Druid Lake, Friess Lake, Green Lake, Lake Five, Lake Twelve, Little Cedar Lake, Lucas Lake, Pike Lake, Silver Lake, Smith Lake, and Wallace Lake. Some of the 1-percent-annual probability floodplains in the County are associated with these lakes. In addition, there are at least 39 lakes and ponds smaller than 50 acres located wholly or partially within the County. There are five lake management districts in the County which have responsibilities related to the protection,

rehabilitation, and management of six lakes. These special-purpose units of government are listed in Table 2.10.

Environmental Corridors

SEWRPC has identified and delineated those areas of Washington County having concentrations of natural, recreational, historic, aesthetic, and scenic resources that should be preserved and protected to maintain the overall quality of the environment. Such areas normally include one or more of the following seven integral elements of the natural resource base which are essential to the maintenance of both the ecological balance and the natural beauty of the Region: 1) lakes, rivers, and streams and the associated undeveloped shorelands and floodplains; 2) wetlands; 3) woodlands; 4) prairies; 5) wildlife habitat areas; 6) wet, poorly drained, and organic soils, and 7) rugged terrain and high-relief topography. There are five additional elements that are important considerations in identifying and delineating areas with scenic, recreational, and educational value. These additional elements are: 1) existing outdoor recreation sites; 2) potential outdoor recreation and related open space sites; 3) historic, archaeological, and other cultural sites; 4) significant scenic areas, and 5) natural and scientific areas.

In Southeastern Wisconsin, the delineation of these 12 natural resource and natural resource-related elements on maps result in an essentially linear pattern of relatively narrow, elongated areas which have been termed "environmental corridors" by SEWRPC. Primary environmental corridors include a wide variety of the aforementioned important resource and resource-related elements and are, by definition, at least 400 acres in size, two miles in length, and 200 feet in width. In Washington County in 2015 there were 63,281 acres of primary environmental corridors, or about 23 percent of the land area in the County. These generally lie along rivers and streams and adjacent to lakes, or are associated with woodlands, wetlands, or park and open space sites. In addition, smaller concentrations of natural resource features that have been separated physically from the environmental corridors by intensive urban or agricultural land uses have also been identified. These areas which are at least five acres in size are referred to as "isolated natural resource areas." In Washington County there are 7,476 acres of isolated natural resource areas, or about 3 percent of the land area of the County.

2.5 CRITICAL COMMUNITY FACILITIES

FEMA generally defines a critical facility, infrastructure, or location as resources that are vital to the health and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to emergency shelters, police and fire stations, dispatch centers, hospitals,

nursing homes, daycares, schools, government administration buildings, financial institutions, utility services (i.e., electrical power generation stations, and wastewater or water treatment facilities), transportation resources (i.e., roadways, bridges, railways, and airports), and hazardous materials storage facilities. The type and location of these facilities are an important consideration in hazard mitigation planning because of their potential direct involvement in certain hazard situations and to reduce the potential for additional resources required for emergency response and recovery.

The location of fire, emergency medical rescue services, and police stations are set forth on Map 2.7. The location of these stations in relationship to the floodplain areas will be discussed in Chapter 3.

Fire and Emergency Medical Services

Map 2.7 shows the locations of local fire departments and the fire protection service area of each department in 2022. There were 13 fire departments serving the County in 2022, which are listed on Table 2.11. Many fire department personnel are cross-trained to provide both firefighting, emergency medical, and/ or hazardous materials handling.

A variety of remote fire suppression systems are also present in Washington County. Throughout the County, fire departments, municipalities, and schools have installed devices such as fire suppression cisterns and dry hydrants to aid in firefighting activities.

All of the fire and rescue departments in Washington County participate in a mutual aid agreement with each other and numerous other State of Wisconsin fire and rescue departments, and through a Mutual Aid Box Alarm System (MABAS) agreement. This agreement enables each department to render assistance to, and receive assistance from, other departments in the County as needed to respond to fire and rescue emergencies. Under the agreement, departments render assistance without charge to the extent of available resources not required for the protection of their own service areas. This agreement enables individual departments to significantly supplement their own personnel, apparatus, and equipment with that from other departments in responding to emergencies. Importantly, the agreement allows individual departments to access equipment, such as tankers, aerial trucks, and extrication equipment, which they themselves do not possess and which they may need infrequently.

In addition to the County mutual aid and the MABAS agreements, each fire and rescue department has reciprocal mutual aid agreements with one or more neighboring departments. Some of these are formal, written agreements; others are unwritten. Many departments have indicated that they would respond to

any request for mutual aid, whether or not there is a mutual aid agreement, provided that they are able to do so without jeopardizing their own services.

Fire departments in the County also participate in two special-purpose emergency response teams. The Washington County Hazardous Materials Response Team consists of members from six fire departments in the County. This team is designated as a Type III hazardous materials response team within the State hazardous materials response task force system and is equipped and trained to respond to all known industrial chemical hazards in liquid, aerosol, powder, and solid forms. The second team is the Washington County Dive Team which is comprised of members of the Kewaskum, Richfield, Slinger, and West Bend Fire Departments and Washington County Sheriff's Deputies. It provides a coordinated response to rescue and recovery efforts in waters within the jurisdiction of Washington County, and under a mutual aid request from any jurisdiction outside Washington County. The Dive Team operates under the authority of the Sheriff's Department.

Also shown on Map 2.7 are the emergency medical service stations in Washington County. The City of West Bend and the Village of Slinger independently maintain an emergency medical service. In some areas of the County, the emergency rescue service areas of these departments are different from the fire suppression service area. In addition, in some portions of the County first response service is provided by a different department than the department providing other emergency medical services.

Law Enforcement

Table 2.12 lists the law enforcement stations and locations in Washington County. Six of the 20 municipalities in Washington County provide law enforcement through full-time police departments. The Village of Newburg and the Town of Trenton provide law enforcement through part-time police departments with limited hours and through the Washington County Sheriff's Department. In the remaining municipalities (i.e., townships) primary law enforcement is provided through the Washington County Sheriff's Department. In addition, the Town of West Bend provides limited law enforcement through a Town constable. The location of local law enforcement stations in Washington County is shown on Map 2.7.

The law enforcement agencies within Washington County have several special-purpose units and teams. As previously described, the Washington County Dive Team operates under the authority of the Sheriff's Department. The Sheriff's Department also has accident reconstruction, canine, mobile command post, recreational enforcement, and commercial and private motor vehicle enforcement units. There are two

special weapons and tactics (SWAT)-type teams within the County. The Sheriff's Department's SWAT team is comprised of Sheriff's deputies and officers from the Germantown and Hartford Police Departments and operates under the command of the Washington County Sheriff. In addition, the City of West Bend has a special response team.

Other County Critical Community Facilities

In addition to fire, emergency medical services, and law enforcement stations as described above, other community facilities which are of importance in hazard mitigation planning include schools, government administration buildings, hospitals, major clinics, child daycare centers, and assisted living facilities. Map 2.8 shows the locations of selected types of critical community facilities within Washington County. Because of the need for access to and from these facilities, this plan includes their location and relation to major roadways. The importance of being able to access such facilities, especially during a hazard event, is discussed in detail in Chapter 3. A listing of the critical community facilities and precise locations are included in Appendix D.

Hazardous Material Storage and Use

Public Law 99-499, the Superfund Amendment and Reauthorization Act (SARA/Title III) of 1986, and Wisconsin Act 342 set forth requirements for hazardous material reporting and safety planning. In 2022, there were 161 identified hazardous substances and/or extremely hazardous substances in Washington County. Of these facilities, three were classified as planning facilities, 106 were classified as reporting facilities, and 52 were classified as both planning and reporting facilities. Reporting facilities are any facility that uses, stores, or produces chemicals at or above 10,000 pounds. Reporting facilities include manufacturers, warehouses, and petroleum storage site operators. Planning facilities include a wide range of users of limited amounts of extremely hazardous materials. In addition to industrial materials, the agricultural industry routinely uses materials considered extremely hazardous. These uses range from individual farm use materials to large chemical storage facilities.

The 161 facilities which are noted above as storing or producing hazardous materials are located throughout Washington County. A detailed listing of these facilities and location by address is available at the Washington County Office of Emergency Management.

Historic Sites

Historic sites in Washington County often have important recreational, educational, and cultural value. As such, preserving and protecting these sites are an important consideration in hazard mitigation planning.

In 2022 there were 29 historic places and districts listed on the National Register of Historic Places and the State Register of Historic Places, as shown on Map 2.9 and listed in Appendix E. Reference to these historic places or districts are generally listed on the National Register or the State Register.

2.6 CLIMATE AND CLIMATE CHANGE

Climate, which is the long-term weather conditions in an area, is significant for hazard mitigation planning. Wisconsin's climate continues to change. In the ten years since the initial 2011 Wisconsin Initiative on Climate Change Impacts (WICCI) Assessment Report, new data continues to show increases in warming, rain and snow, and more frequent extreme rainfall events. Statewide temperatures have warmed by about 3°F (Fahrenheit), and precipitation in the south has increased by nearly 20 percent since 1950.[8] For example, Southern Wisconsin has experienced the highest increase in precipitation over the last decade and nearly every region of the state has recently experienced extreme rainfall events that led to flooding of roads, homes, businesses, and farm fields. New analyses reaffirm previous projections indicating that many of these trends will continue with wide ranging consequences throughout Wisconsin's natural and built environments.[9]

The risk posed to Washington County by many of the natural hazards profiled in this plan have been estimated largely upon the historical occurrence of, and impacts attributed to, the hazard within the County. Over longer periods of time, however, climate change may render these risk estimates and impacts less reliable. The following subsections describe the changes that have occurred in Wisconsin's climate since 1950, and the changes that are projected to occur by the middle of the 21st century. For those hazards whose frequency of occurrence or impacts are likely to be affected by the changes in climate, these descriptions will form the basis of evaluating potential long-term changes in hazard conditions.

Historical Climate Change Trends

Average annual temperatures in Wisconsin have increased over the last half of the 20th century and into the 21st century. In the period of 1950 to 2018, the average annual temperature increase in Washington County was about 2°F, as can be seen in Figure 2.1.[10] Much of this increase in temperature can be

[8] *Wisconsin Initiative on Climate Change Impacts, Wisconsin's Changing Climate: Impacts and Adaptation, Nelson Institute for Environmental Studies, University of Wisconsin-Madison and Wisconsin Department of Natural Resources,* 2021.

[9] *Wisconsin Initiative on Climate Change, 2021, op. cit.*

[10] *Wisconsin Initiative on Climate Change website, wicci.wisc.edu.*

attributed to winters warming more rapidly than summers and night-time low temperatures warming faster than day-time high temperatures. It should be noted that Wisconsin's warming trend is not evenly distributed between night-time low temperatures and daytime high temperatures, and from season to season. Around this same time period (1950-2020), the average winter night-time temperatures increased by about 4°F in Washington County.[11]

Average annual precipitation in Wisconsin has also increased over the last half of the 20th century and into the 21st century. Over the period of 1950 through 2018, Washington County experienced an estimated 15 percent increase in precipitation (see Figure 2.2).[12] Most of the increase in average precipitation, in the form of both snow and rainfall, occurred during winter months. In Washington County, and throughout most of the state, average precipitation during winter months increased by about 20 percent during this time period. The same percentage of increases also occurred during the spring and autumn months in the County. Average precipitation during the summer months increased by about 10 percent in Washington County.

Climate Change Projections

The consensus of downscaled results from climate models indicate that average annual temperatures will continue to increase through the 21st century.[13] Depending on location (see Figure 2.3), it is projected that average temperatures in the State of Wisconsin will increase by between 4.0°F and 6.0°F over the period 2041 to 2060. During this time, it is projected that Washington County will experience an increase of about 4.0 to 5.0°F. The greatest changes are projected to occur during winter months, with average winter temperatures being projected to increase by about 5.0 to 6.0°F in Washington County. By contrast, average temperatures in Washington County during the summer are projected to increase by about 4.0°F. Changes in extreme temperatures will accompany these changes in average temperature and the frequency of extreme daily high temperatures is projected to increase. The average number of days per year with daily high temperatures greater than 90°F is currently about 12 in southern Wisconsin.[14] This is likely to triple to about 36 days per year by 2055. In Washington County, the number of extremely hot days per year is projected to increase to about 20 to 30 days.[15] By contrast, the frequency of extreme daily low temperatures is projected to decrease. The average number of days per year with daily low

[11] *Wisconsin Initiative on Climate Change, 2021, op. cit.*

[12] *Wisconsin Initiative on Climate Change, website, wicci.wisc.edu.*

[13] *Wisconsin Initiative on Climate Change Impacts, 2021,* op. cit.

[14] *Wisconsin Initiative on Climate Change Impacts, 2011,* op. ct.

[15] *Wisconsin Initiative on Climate Change Impacts, 2021,* op. cit.

temperatures below 0°F is currently about 15 in southern Wisconsin. This is projected to decrease to about nine days per year by 2055.[16]

The consensus of downscaled results from climate models projects several changes in precipitation through the 21st century.[17] There is a projected increase in annual precipitation in the whole State of Wisconsin by about 5 percent (see Figure 2.4). The projections indicate that the amount of precipitation falling during winter is likely to increase by about 10 percent. Due to the predicted increase in temperatures, it is assumed that a greater amount of precipitation occurring during the winter will fall as rain rather than snow.[18] This will be accompanied by both an increase in the likelihood of freezing rain events and decreases in snow depth and snow cover. Model projections also show that Wisconsin will receive more precipitation and more frequent intense precipitation events during the spring, especially during early spring. As in winter, it will be more likely for early spring precipitation to fall as rain rather than snow.

The total amount of precipitation occurring during the summer is not projected to change much, however the frequency of intense rainfall events will increase. In southern Wisconsin, the frequency of precipitation events in which two or more inches fall in a 24-hour period is expected to increase from about 12 events per decade to 15 events per decade by the middle of the 21st century. These intense rainfall events will be concentrated in the spring and fall. The heaviest rainfall events will also increase in magnitude. The magnitude of a 100-year storm event (five to seven inches of precipitation in a 24-hour period) is expected to increase by about 10 percent in the State of Wisconsin.[19] It should be noted that in the decade from 2010 to 2019, Wisconsin experienced at least 21 extreme rainfall events that exceeded the 100-year event. The shift to more heavy rainfall events, but little change in total summertime precipitation, implies that more dry days will occur in Wisconsin during the summer. More dry days, coupled with higher summer temperatures and the increases in evapotranspiration that are likely to result from higher temperatures, will lead to an increase in the likelihood of summer droughts.

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[16] *Wisconsin Initiative on Climate Change Impacts, 2011,* op. ct.

[17] *Wisconsin Initiative on Climate Change Impacts, 2021, op. cit.*

[18] *Michael Notaro, David J. Lorenz, Daniel Vimont, Stephen Vavrus, Christopher Kucharik, and Kristie Franz, "21st Century Wisconsin Snow Projections Based on an Operational Snow Model Driven by Statistically Downscaled Climate Data,"* International Journal of Climatology, *Volume 31, pages 1615-1633, 2011.*

[19] *Wisconsin Initiative on Climate Change Impacts, 2011,* op. ct.

Chapter 2

BASIC STUDY AREA INVENTORY AND ANALYSIS

TABLES

#262572 – CAPR-326-2 Table 2.1 Civil Divisions in Washington County
500-1149
MAB/mid
1/20/2023; 4/26/2022

Table 2.1
Areal Extent of Civil Divisions in Washington County: 2020

Civil Division	Area		Percent of County Area
	Acres	Square Miles	
Cities			
Hartford	5,415.0	8.46	1.9
Milwaukee	14.0	0.0	0.1
West Bend	10,073.2	15.7	3.6
Villages			
Germantown	22,017.2	34.4	7.9
Jackson	2,484.0	3.9	0.9
Kewaskum	1,465.0	2.3	0.5
Newburg	531.4	0.8	0.2
Richfield	23,332.4	36.4	8.4
Slinger	3,530.6	5.5	1.3
Towns			
Addison	23,060.0	36.0	8.3
Barton	12,353.3	19.3	4.4
Erin	23,123.0	36.1	8.3
Farmington	23,541.8	36.8	8.4
Germantown	1,161.9	1.8	0.4
Hartford	17,390.2	27.2	6.2
Jackson	21,160.5	33.1	7.6
Kewaskum	14,116.0	22.0	5.1
Polk	19,922.0	31.1	7.1
Trenton	20,755.2	32.4	7.4
Wayne	22,902.7	35.8	8.2
West Bend	10,400.7	16.2	3.7
Total	278,750.0	435.3	100.0

Note: This table reflects jurisdictional acreages of the Cities of Hartford and Milwaukee and the Village of Newburg that lie within Washington County only.

Source: SEWRPC

#262578 – CAPR-326-2 Table 2.2 Historical Resident Population Levels in Washington County
500-1149
MAS/mid
4/12/2023; 1/20/2023; 4/26/2022

Table 2.2
Historical Resident Population Levels in Washington County: 1860-2050

Year	Population	Change from Preceding Census	
		Incremental	Percent
1850	19,485	--	--
1860	23,622	4,137	21.2
1870	23,919	297	1.2
1880	23,442	-477	-2.0
1890	22,751	-691	-3.0
1900	23,589	839	3.7
1910	23,784	195	0.8
1920	25,713	1,929	8.1
1930	26,551	838	3.3
1940	28,430	1,879	7.1
1950	33,902	5,472	19.2
1960	46,119	12,217	36.0
1970	63,839	17,720	38.4
1980	84,848	21,009	32.9
1990	95,238	10,480	12.4
2000	117,496	22,168	23.3
2010	131,887	14,391	12.2
2020	136,761	4,874	3.7
2050[a]	180,500	43,739	32.0

[a] *Population based on projections from SEWRPC's* VISION 2050 Plan.

Source: SEWRPC

#265154 – CAPR-326-2 Table 2.3 Population by Civil Divisions in Washington County
500-1149
MAS/mid
4/12/2023; 1/20/2023; 4/26/2022

Table 2.3
Population Change by Civil Divisions in Washington County: 2010-2020

Civil Division	Population		Percent of Change	Percent of County (2020)
	2010	2020		
Cities				
Hartford	14,223	15,617	9.8	11.4
Milwaukee	--	--	--	--
West Bend	31,078	31,752	2.2	23.2
Villages				
Germantown	19,749	20,917	5.9	15.3
Jackson	6,753	7,185	6.4	5.3
Kewaskum	4,004	4,309	7.6	3.2
Newburg	1,157	1,049	-9.3	0.8
Richfield	11,300	11,739	3.9	8.6
Slinger	5,068	5,992	18.2	4.4
Towns				
Addison	3,495	3,464	-0.9	2.5
Barton	2,637	2,743	4.0	2.0
Erin	3,747	3,825	2.1	2.8
Farmington	4,014	3,645	-9.2	2.7
Germantown	254	241	-5.1	0.2
Hartford	3,609	3,400	-5.8	2.5
Jackson	4,134	4,629	12.0	3.4
Kewaskum	1,053	1,118	6.2	0.8
Polk	3,937	3,988	1.3	2.9
Trenton	4,732	4,525	-4.4	3.3
Wayne	2,169	2,182	0.6	1.6
West Bend	4,774	4,441	-7.0	3.2
Total	131,887	136,761	3.7	100.0

Note: This table reflects jurisdictional acreages of the Cities of Hartford and Milwaukee and the Village of Newburg that lie within Washington County only.

Source: U.S. Census Bureau and SEWRPC

#267359 – CAPR-326-2 Table 2.4 Population by Age in Washington County
500-1149
MAS/mid
4/12/2023; 3/8/2023

Table 2.4
Actual and Projected Population by Age in Washington County: 2010-2050

Age Group	Actual Population 2010	Percent of County	Projected Population 2050	Percent of County
Under 5	8,179	6.2	10,533	5.8
5 to 9	9,028	6.8	11,345	6.3
10 to 14	9,487	7.2	11,717	6.5
15 to 19	8,490	6.4	11,341	6.3
20 to 24	5,920	4.5	9,255	5.1
25 to 29	7,128	5.4	8,765	4.9
30 to 34	7,623	5.8	9,266	5.1
35 to 39	8,356	6.3	9,569	5.3
40 to 44	10,206	7.7	10,690	5.9
45 to 49	11,981	9.1	10,913	6.0
50 to 54	10,824	8.2	11,200	6.2
55 to 59	9,207	7.0	10,143	5.6
60 to 64	7,655	5.8	8,207	4.5
65 to 69	5,483	4.2	9,345	5.2
70 to 74	4,013	3.0	8,600	4.8
75 to 79	3,194	2.4	8,279	4.6
80 to 84	2,612	2.0	8,621	4.8
85 and Older	2,501	1.9	12,711	7.0
Total	131,887	100.0	180,500	100.0

Note: The 2020 census population was not yet available by age during this plan update.

Source: U.S. Census Bureau and SEWRPC

#264025 – CAPR-326-2 Table 2.5 Number of Households in Washington County
500-1128
MAS/mid
4/12/2023; 1/20/2023

Table 2.5
Number of Households in Washington County: 1950-2050

Year	Number of Households	Change from Preceding Census	
		Number	Percent
1950	9,396	--	--
1960	12,532	3,136	33.4
1970	17,385	4,853	38.7
1980	26,716	9,331	53.7
1990	32,977	6,261	23.4
2000	43,843	10,866	33.0
2010	51,605	7,762	17.7
2020	55,879	4,274	8.3
2050[a]	74,300	18,421	33.0

[a] *Number of households are projections from SEWRPC's* VISION 2050 Plan.

Source: U. S. Bureau of the Census and SEWRPC

#263940 – CAPR-326-2 Table 2.6 Number of Jobs in Washington County
500-1149
MAS/mid
4/12/2023; 1/20/2023

Table 2.6
Number of Jobs
in Washington County: 1950-2050

Year	Number of Jobs	Change from Previous Time Period	
		Number	Percent
1950	10,200	--	--
1960	15,200	5,000	49.0
1970	24,300	9,100	59.9
1980	35,100	10,800	44.4
1990	45,800	10,700	30.5
2000	60,300	14,500	31.7
2010	63,900	3,600	6.0
2020	72,900	9,000	14.1
2050[a]	87,400	14,500	19.9

[a] *Estimated jobs for the year 2050 as modeled in SEWRPC's* VISION 2050 Plan.

Source: U. S. Bureau of the Census and SEWRPC

#265611 – CAPR-326-2 Table 2.7 Equalized Value of Property
500-1149
MAS/mid
4/12/2023; 1/20/2023; 11/2/2022

Table 2.7
Equalized Value of Property in Washington County by Community: 2015 and 2022

Community	2015 Equalized Value ($)	2022 Equalized Value ($)	Percent Change
Cities			
Hartford	1,068,117,000	1,770,277,100	43.7
Milwaukee	1,209,200	0	--
West Bend	2,418,080,000	3,991,313,500	65.1
Subtotal	3,487,406,200	5,761,540,600	65.2
Villages			
Germantown	2,405,913,400	3,555,243,900	47.8
Jackson	582,082,000	1,069,281,100	83.7
Kewaskum	283,879,900	446,626,200	57.3
Newburg	67,770,800	99,903,400	32.2
Richfield	1,512,204,800	2,257,996,500	49.3
Slinger	466,487,200	871,809,200	86.9
Subtotal	5,318,338,100	8,300,860,300	56.1
Towns			
Addison	318,378,900	453,564,700	42.5
Barton	283,422,700	430,389,300	51.8
Erin	553,768,600	786,883,500	42.1
Farmington	365,349,100	559,674,500	53.2
Germantown	23,248,400	33,872,400	45.7
Hartford	362,148,400	536,004,000	48.0
Jackson	474,369,000	581,671,900	22.6
Kewaskum	123,670,600	178,920,100	44.7
Polk	584,209,100	911,741,800	56.1
Trenton	456,981,800	712,777,100	56.0
Wayne	196,789,500	323,294,900	64.3
West Bend	819,343,600	1,219,500,200	48.8
Subtotal	4,561,679,700	6,728,294,400	47.5
Total	13,367,424,000	20,790,695,300	55.5

Source: Wisconsin Department of Revenue and SEWRPC

Table 2.8
Land Uses in Washington County: 2015

Land Use Category[a]	Acres	Percent of Subtotal	Percent of County
Urban			
Single-Family Residential	29,000.1	48.9	10.4
Multifamily Residential[b]	1,810.4	3.0	0.6
Commercial	1,834.0	3.1	0.7
Industrial	2,053.0	3.5	0.7
Transportation, Communications, and Utilities	16,894.4	28.5	6.1
Governmental and Institutional	1,851.7	3.1	0.7
Recreational	4,057.1	6.8	1.5
Unused Urban	1,836.3	3.1	0.7
Urban Subtotal	59,337.0	100.0	21.4
Nonurban			
Agricultural and Other Open Lands[c]	141,353.5	64.4	50.7
Woodlands	26,263.1	12.0	9.4
Wetlands	46,638.3	21.3	16.7
Surface Water	5,158.2	2.3	1.8
Nonurban Subtotal	219,413.0	100.0	78.6
Total	278,750.0	--	100.0

Note: This table strictly reflects the jurisdictional acreages of the Cities of Hartford and Milwaukee and the Village of Newburg that lie within Washington County only.

[a] *Parking lots are included with the associated use.*

[b] *Includes manufactured homes and two-family residential homes.*

[c] *Includes agricultural, extractive, and any open lands in rural areas.*

Source: SEWRPC

#263706 – CAPR-326-2 Table 2.9 2050 Washington County Land Use
MAB/mid
500-1149
4/12/2023; 1/20/2023; 06/30/2022

Table 2.9
Planned Land Uses in Washington County: 2050

Land Use Category	Acres	Percent of Total
Urban		
Suburban-Density Residential	35,261.3	12.6
Medium-Density Urban Residential	10,176.0	3.7
High-Density Urban Residential	5,156.7	1.8
Mixed-Use	1,539.1	0.6
General Commercial	4,476.3	1.6
Office/Professional Services	706.5	0.3
Business/Industrial	4,475.0	1.6
Industrial	4,256.0	1.5
Governmental and Institutional	2,861.0	1.0
Park and Recreation	6,240.6	2.2
Street and Highway Rights-of-Way	16,084.4	5.8
Other Transportation and Utilities	1,463.7	0.5
Urban Land Subtotal	92,696.6	33
Undeveloped Land		
Farmland Preservation	7,810.4	2.8
General Agricultural	22,422.1	8.0
Agricultural and Rural Residential	73,373.3	26.3
Extractive	1,778.3	0.6
Former Landfill	31.3	0.0
Primary Environmental Corridor (PEC)	56,794.0	20.4
Isolated Natural Resources Area (INRA)	6,319.4	2.3
Wetlands Outside PEC and INRA	8,764.0	3.1
Other Conservancy Lands to be Protected	3,908.3	1.4
Surface Water	4,852.1	1.7
Nonurban Land Subtotal	186,053.2	67.0
Total	278,750.0	100.0

Source: SEWRPC

#264430 – CAPR-326-2 Table 2.10 Washington County Lake Associations or Districts
500-1149
MAS/mid
4/12/2023; 1/20/2023; 8/22/2022

Table 2.10
Lake Associations and Districts in Washington County

Lake Name	Organization(s)	Municipalities
Big Cedar and Gilbert Lakes	Big Cedar Lake Protection and Rehabilitation District	Towns of West Bend and Polk
Druid Lake	Druid Lake District	Town of Erin
Little Cedar Lake	Little Cedar Lake Preservation and Rehabilitation District	Towns of West Bend and Polk
Pike Lake	Pike Lake Protection District	City and Town of Hartford
Silver Lake	Silver Lake Protection and Rehabilitation District	Town of West Bend

Source: University of Wisconsin-Stevens Point and SEWRPC

#263565 – CAPR-326-2 Table 2.11 Fire and EMS Stations in Washington County
500-1149
MAS/mid
4/12/2023; 1/23/2023; 8/22/2022

Table 2.11
Fire Stations and Emergency Medical Services in Washington County: 2022

Facility Name	Municipality	Address
Allenton Volunteer Fire Department	Town of Addison	431 Railroad Street, Allenton, 53002
Boltonville Fire Department	Town of Farmington	9336 Bolton Drive, Kewaskum 53040
Fillmore Fire Department	Town of Farmington	8485 Trading Post Trail, West Bend, 53090
Germantown Fire Department – Station 2	Village of Germantown	N115 W18752 Edison Drive 53022
Hartford Fire and Rescue	City of Hartford	111 W. Wisconsin Street, 53027
Jackson Fire Department	Village of Jackson	N168 W19851 Main Street, Jackson, 53037
Kewaskum Fire Department	Village of Kewaskum	1106 Fond du Lac Avenue, 53040
Kohlsville Fire Department	Town of Wayne	7678 County Road WW, West Bend, 53090
Lifestar EMS, LLC.	Village of Slinger	123 Weil Drive, 53086
Lifestar EMS, LLC.	City of West Bend	108 W. Decorah Road, 53095
Newburg Fire Department	Village of Newburg	508 Main Street, Newburg, 53060
Richfield Volunteer Fire Department – Station 1	Village of Richfield	2008 Highway 175 Richfield, 53076
Richfield Volunteer Fire Department – Station 2	Village of Richfield	4166 Hubertus Road, Hubertus, 53033
Slinger Fire Department	Village of Slinger	201 Oak Street, 53086
St. Lawrence Volunteer Fire Department	Town of Addison	4955 Highway 175, Hartford, 53027
West Bend Fire Department – Station 1	City of West Bend	325 N. 8th Avenue, 53095
West Bend Fire Department – Station 2	City of West Bend	901 N. River Road, 53095
West Bend Fire Department – Station 3	City of West Bend	2100 S. Main Street, 53095

Source: Washington County Emergency Management and SEWRPC

#264431 – CAPR-326-2 Table 2.12 Police Stations in Washington County
500-1149
MAS/mid
4/12/2023; 1/23/2023; 8/22/2022

Table 2.12
Law Enforcement Stations in Washington County: 2022

Facility Name	Municipality	Address
City of Hartford Police Department	City of Hartford	109 N. Main Street, 53027
City of West Bend Police Department	City of West Bend	350 Vine Street, 53095
Trenton Police Department	Town of Trenton	1071 STH 33, West Bend, 53095
Germantown Police Department	Village of Germantown	N112 W16877 Mequon Road, 53022
Jackson Police Department	Village of Jackson	N168, W19851 Main Street, 53037
Kewaskum Police Department	Village of Kewaskum	204 First Street, 53040
Newburg Police Department	Village of Newburg	614 Main Street, 53060
Village of Slinger Police Department	Village of Slinger	300 Slinger Road, 53086
Washington County Sheriff's Department	Washington County	500 Rolfs Avenue, West Bend, 53095

Source: Washington County Emergency Management and SEWRPC

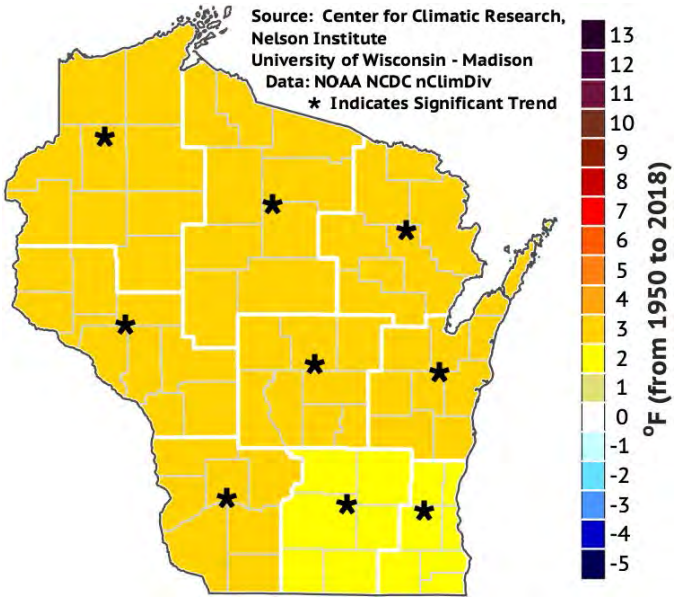
Chapter 2

BASIC STUDY AREA INVENTORY AND ANALYSIS

FIGURES

#264876 – CAPR-326-2 Figure 2.1 Change in Annual Average Temp
500-1149
MAS/mid
1/23/2023; 8/2/2022

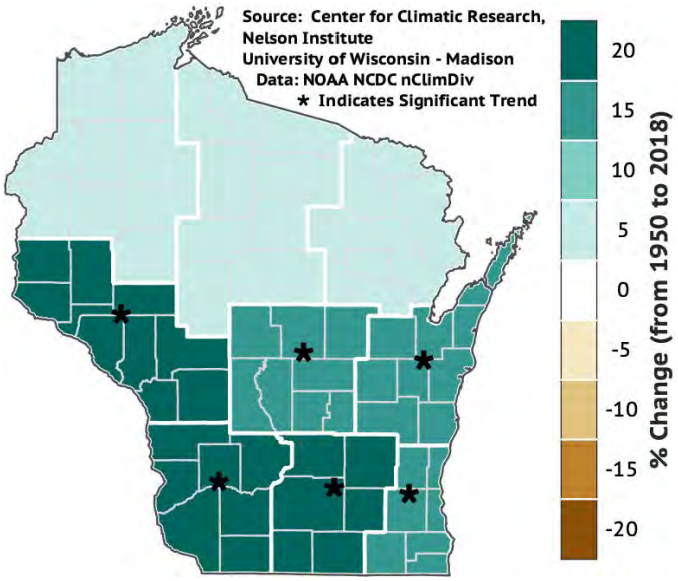
Figure 2.1
Change in Annual Average Temperature from 1950 to 2018



Source: Wisconsin Initiative on Climate Change Impacts, Trends and Projections, wicci.wisc.edu

#264877 – CAPR-326-2 Figure 2.2 Change in Annual Precipitation
500-1149
MAS/mid
1/23/2023; 8/2/2022

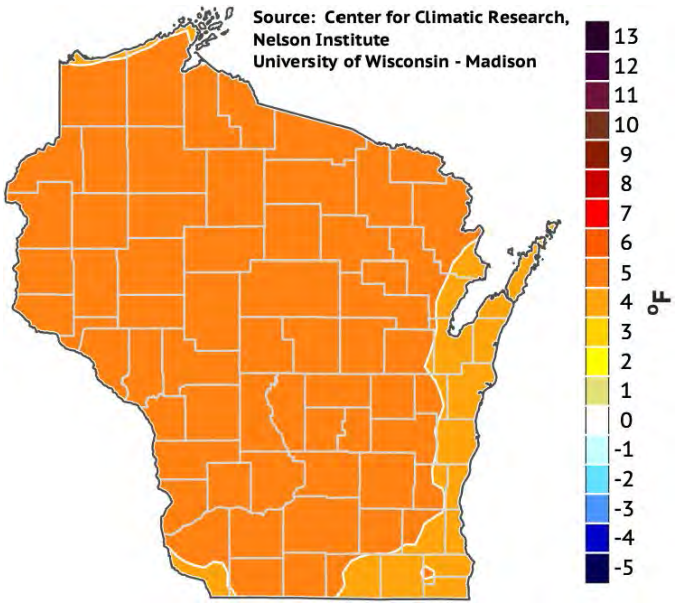
Figure 2.2
Change in Annual Precipitation from 1950 to 2018



Source: Wisconsin Initiative on Climate Change Impacts, Trends and Projections, wicci.wisc.edu

#264878 – CAPR-326-2 Figure 2.3 Projected Change in Annual Average Temp
500-1149
MAS/mid
1/23/2023; 8/2/2022

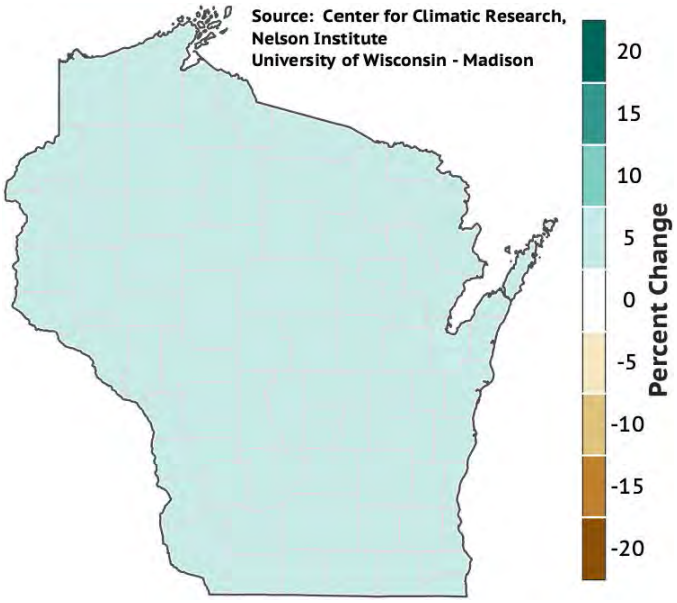
Figure 2.3
Projected Change in Annual Average Temperature from 2041 to 2060



Source: Wisconsin Initiative on Climate Change Impacts, Trends and Projections, wicci.wisc.edu

#264879 – CAPR-326-2 Figure 2.4 Projected Change in Annual Precipitation
500-1149
MAS/mid
1/23/2023; 8/2/2022

Figure 2.4
Projected Change in Annual Precipitation from 2041 to 2060



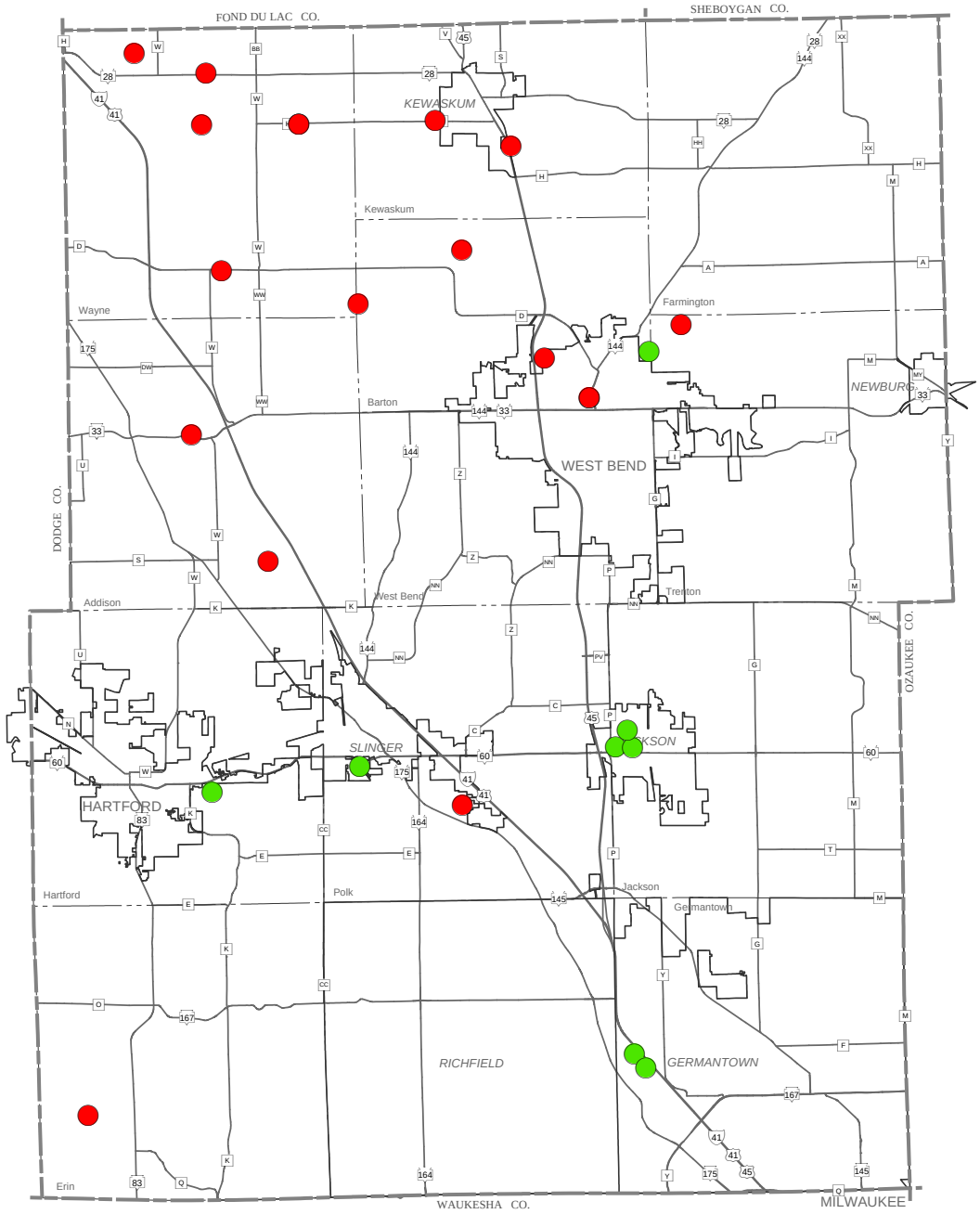
Source: Center for Climatic Research, Statistical Downscaling for Wisconsin, ccr.nelson.wisc.edu

Chapter 2

BASIC STUDY AREA INVENTORY AND ANALYSIS

MAPS

Map 2.1
Manufactured Homes and Parks in Washington County: 2021



MANUFACTURED PARK LOCATION

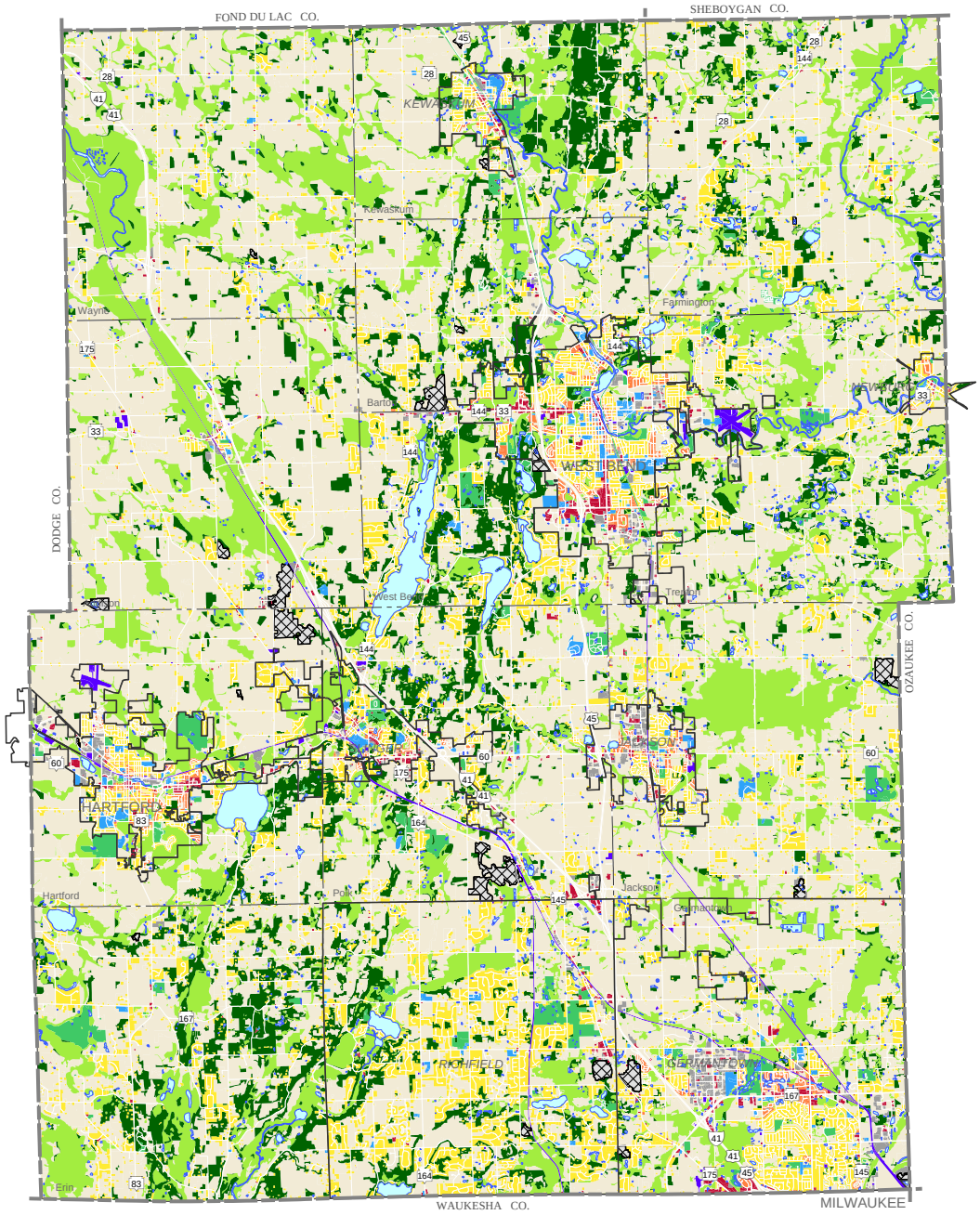
MANUFACTURED HOME LOCATION

N

0 1 2 3 Miles

Source: Wisconsin Department of Safety and Professional Services and SEWRPC

Map 2.2
Existing Land Use in Washington County: 2015



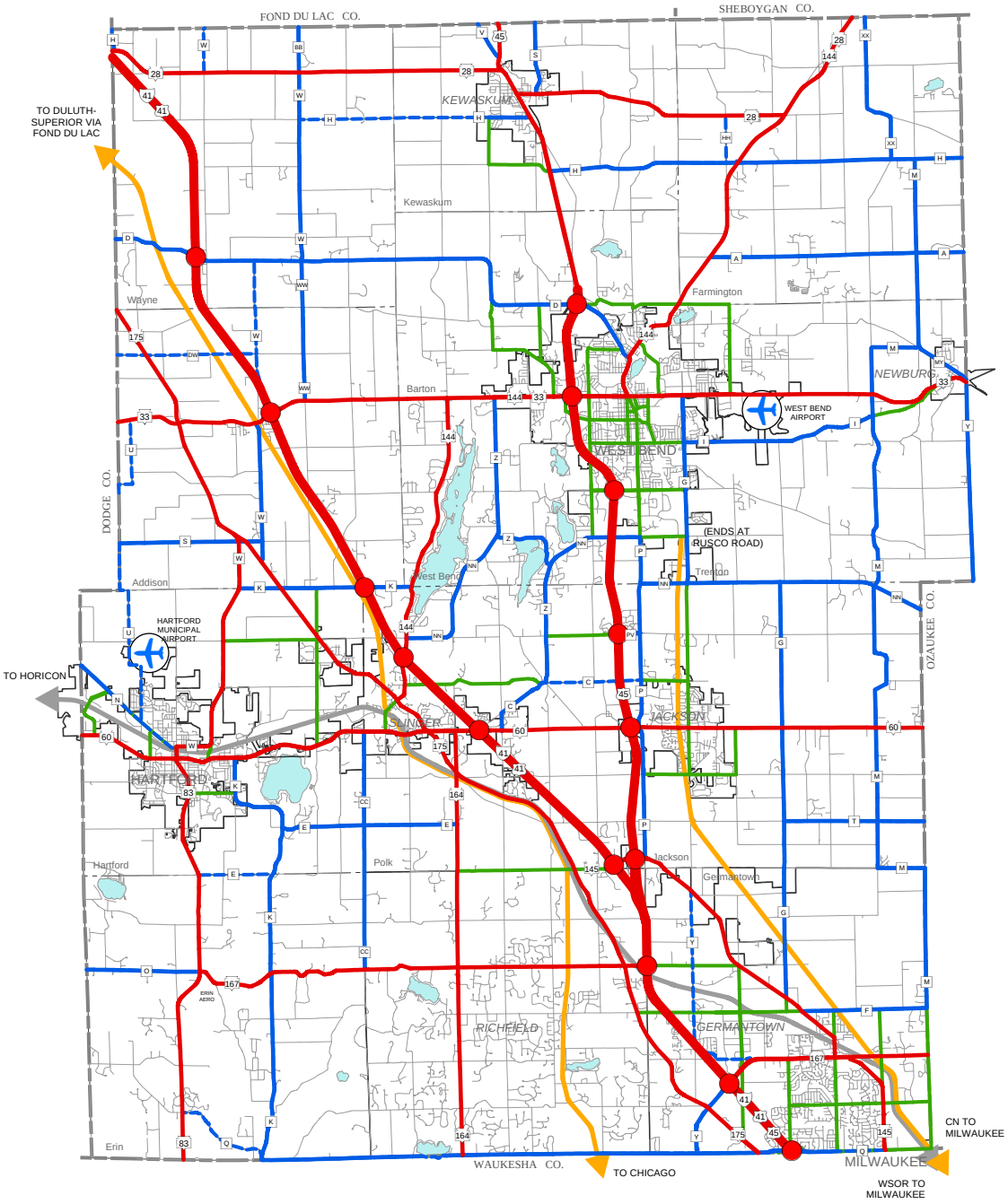
- SINGLE-FAMILY RESIDENTIAL
- MULTIFAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL
- STREETS AND HIGHWAYS
- OTHER TRANSPORTATION, COMMUNICATION, AND UTILITIES
- AGRICULTURAL AND OTHER OPEN LANDS
- WOODLANDS
- WETLANDS
- SURFACE WATER
- EXTRACTIVE OR LANDFILL

N

0 1 2 3 Miles

Source: SEWRPC

Map 2.3
Major Transportation Systems in Washington County: 2023



FREEWAY
- STATE TRUNK HIGHWAY
- INTERCHANGE

STANDARD ARTERIAL
- STATE TRUNK HIGHWAY
- COUNTY TRUNK HIGHWAY
- COUNTY TRUNK HIGHWAY (NON-ARTERIAL)
- LOCAL TRUNK HIGHWAY

RAILWAY
- CANADIAN NATIONAL RAILWAY (CN)
- WISCONSIN AND SOUTHERN RAILROAD COMPANY (WSOR)

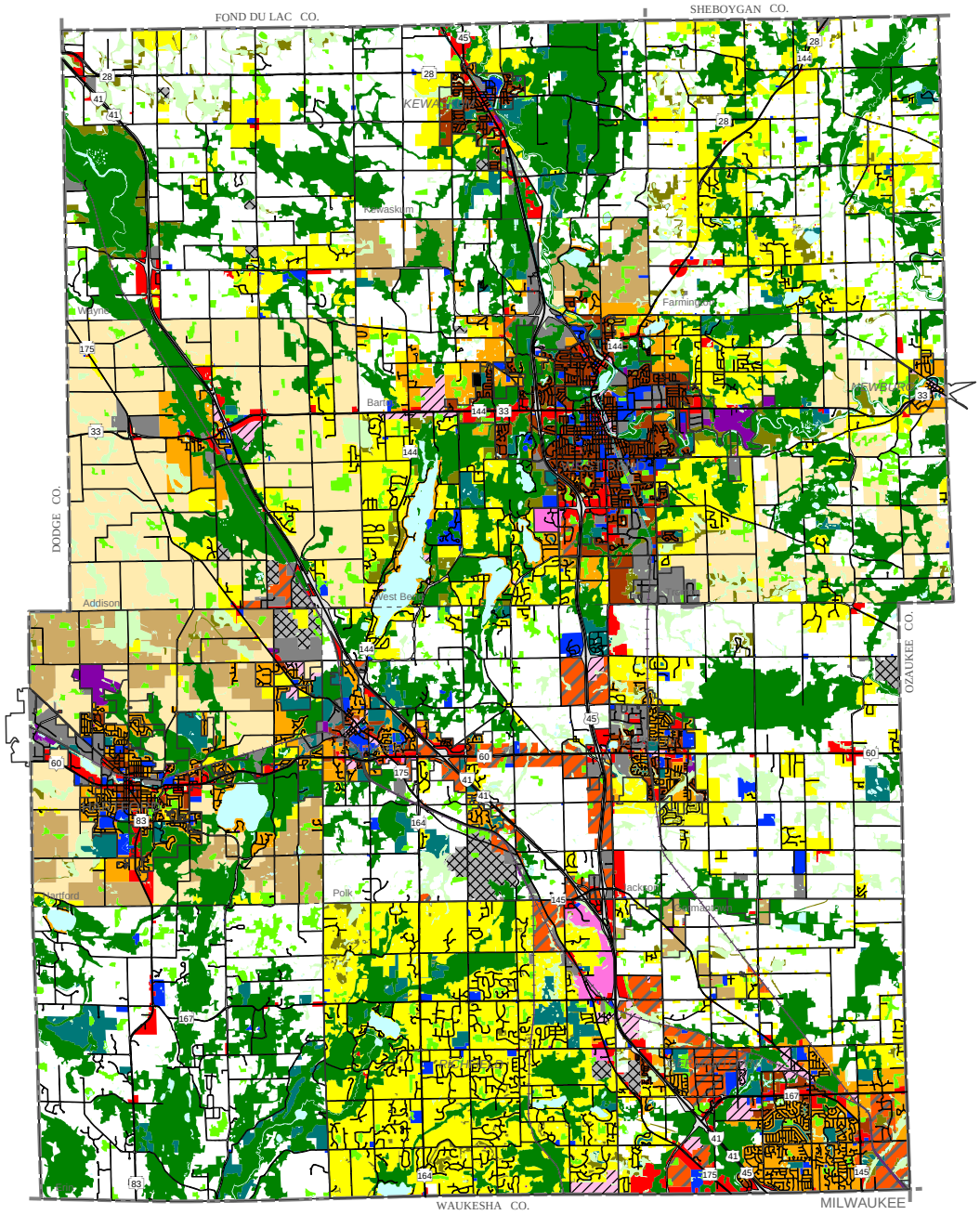
- PUBLIC AIRPORT

N

0 1 2 3 Miles

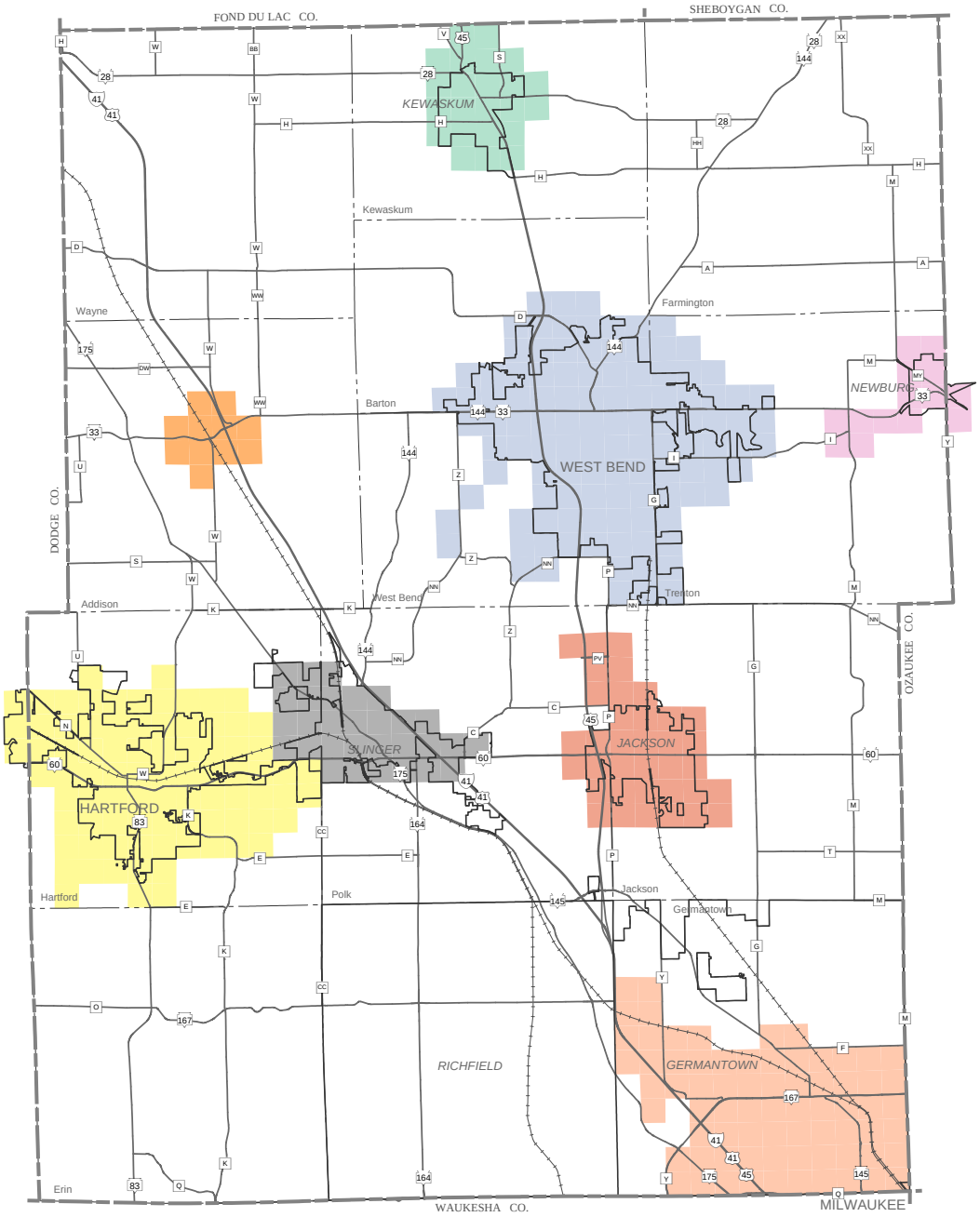
Source: Wisconsin Department of Transportation, Wisconsin Bureau of Aeronautics, Washington County, and SEWRPC

Map 2.4
Washington County Land Use Plan: 2050



Source: Local Governments, Washington County, and SEWRPC

Map 2.5
Generalized Planned Urban Service Areas in Washington County: 2050



VILLAGE OF KEWASKUM

TOWN OF ALLENTON

CITY OF WEST BEND

VILLAGE OF NEWBURG

CITY OF HARTFORD

VILLAGE OF SLINGER

VILLAGE OF JACKSON

VILLAGE OF GERMANTOWN

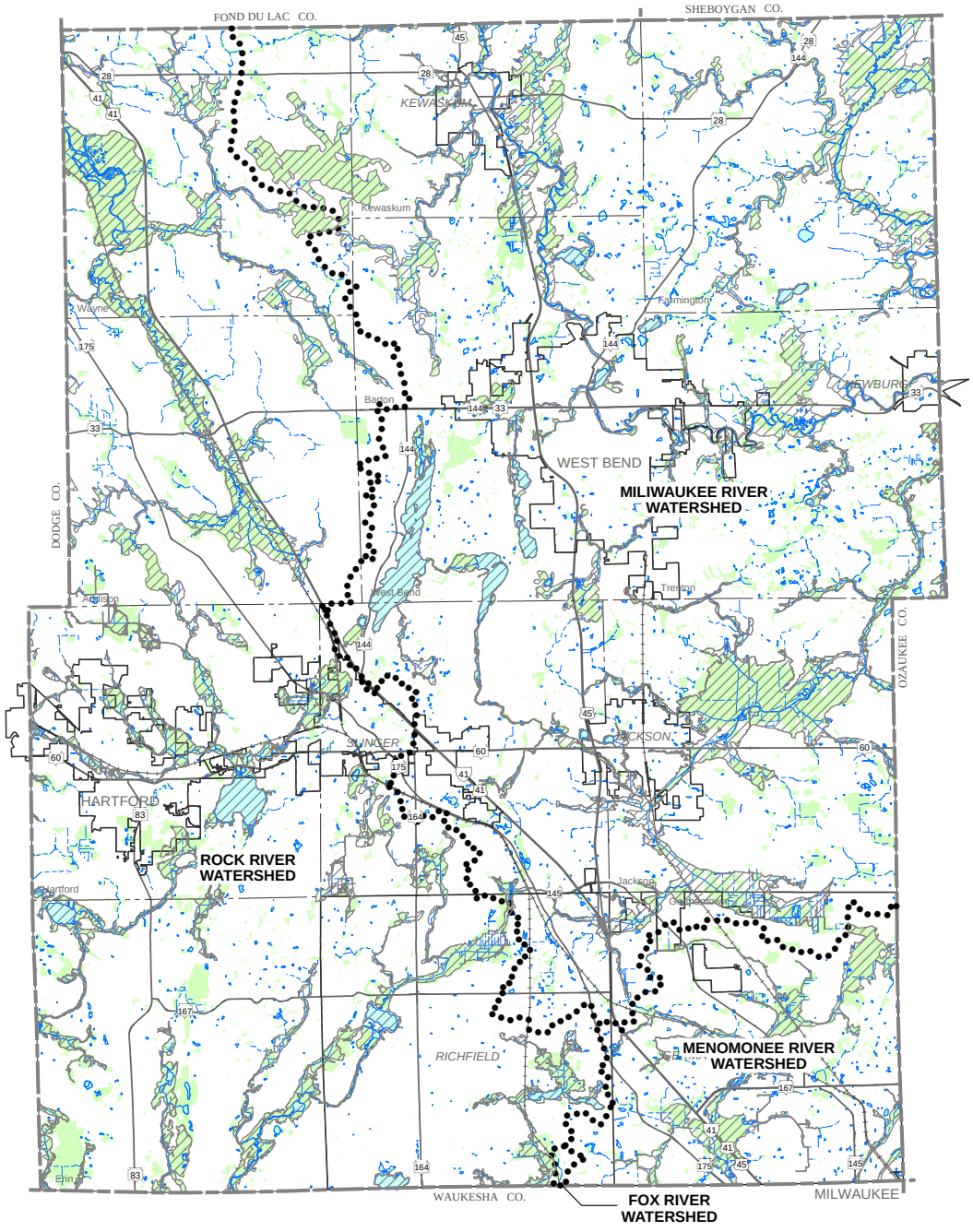
Note: Planned urban service areas generally include existing sewer service areas and additional contiguous lands needed to accommodate anticipated urban development.

N

0 1 2 3 Miles

Source: SEWRPC

Map 2.6
Surface Waters, Wetlands, and Floodplains in Washington County: 2015



ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FLOODPLAINS (FEMA FIS, JANUARY 2022)

MAJOR WATERSHED BOUNDARIES

PERENNIAL STREAM

INTERMITTENT STREAM

WETLANDS

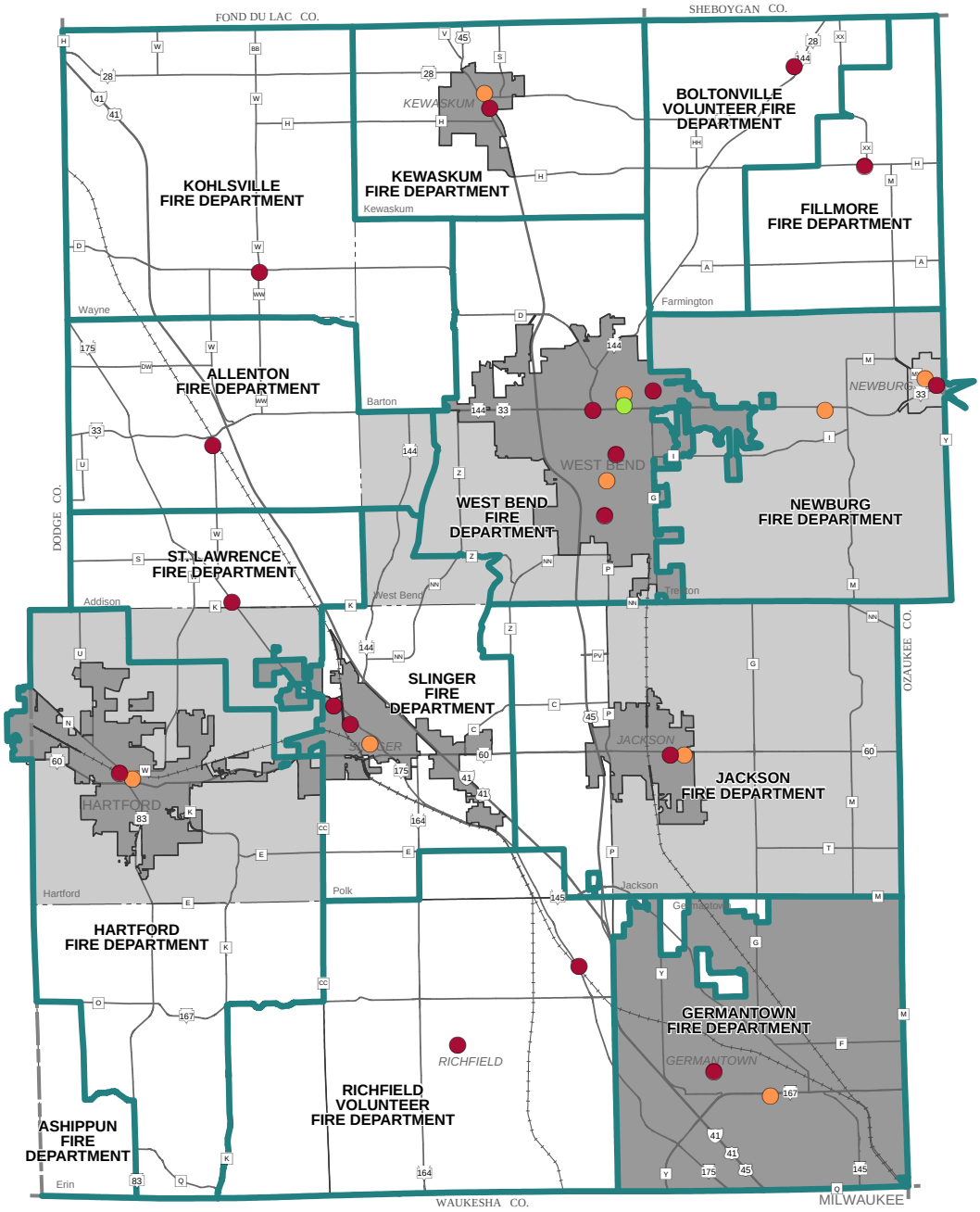
SURFACE WATER

N

0 1 2 3 Miles

Source: Federal Emergency Management Agency and SEWRPC

Map 2.7
Emergency Services in Washington County: 2022



FIRE/EMS STATION

POLICE STATION

COUNTY COURT HOUSE

FIRE DEPARMENT DISTRICTS

AREA SERVED BY A LOCAL POLICE DEPARTMENT

AREA SERVED BY A LOCAL POLICE DEPARTMENT AND BY WASHINGTON COUNTY SHERIFF'S DEPARTMENT

AREA SERVED BY WASHINGTON COUNTY SHERIFF'S DEPARTMENT ONLY

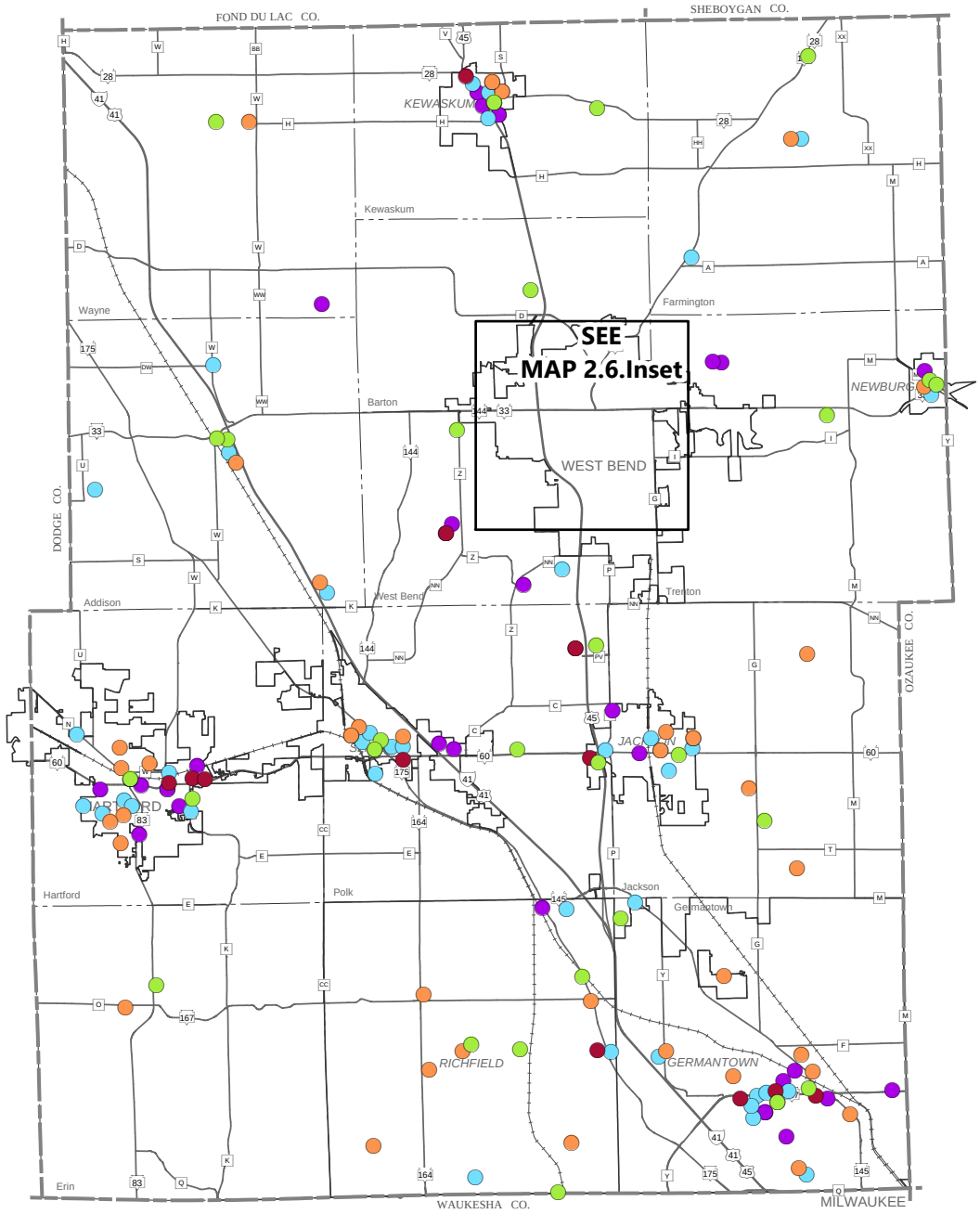
Notes: Fire and EMS personnel are housed within the same structure/station, hence the map shows both within the same building.

N

0 1 2 3 Miles

Source: Wisconsin Department of Justice (WILENET), Washington County Office of Emergency Management Department, Washington County, and SEWRPC

Map 2.8
Critical Community Facilities in Washington County: 2022



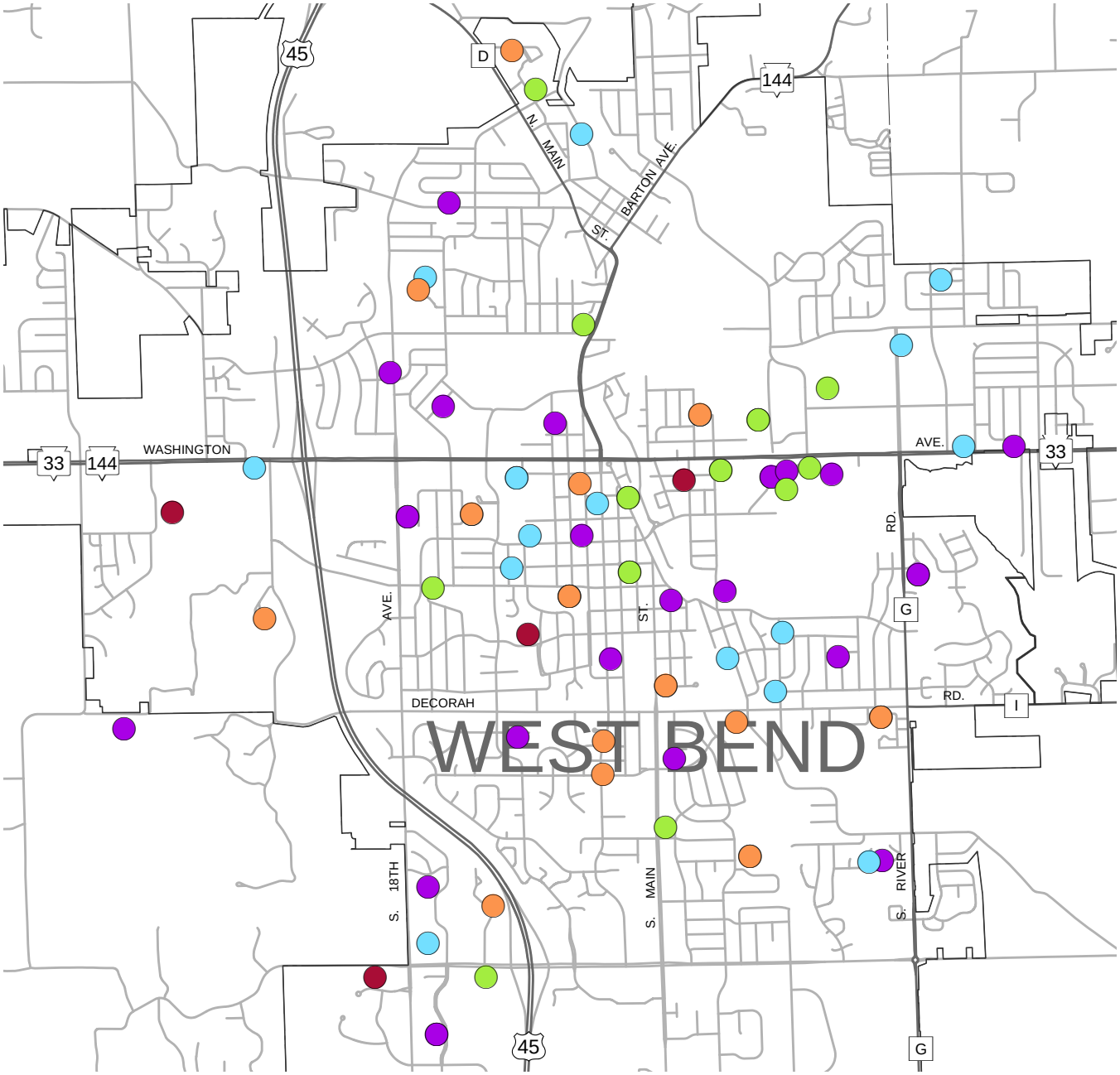
- HOSPITAL/CLINIC
- PUBLIC/PRIVATE SCHOOLS OR COLLEGES
- GOVERNMENT BUILDINGS
- CHILD CARE
- ADULT CARE

N

0 1 2 3 Miles

Source: Wisconsin Department of Children and Families, Wisconsin Department of Health and Social Services, Wisconsin Department of Public Instruction, Washington County, and SEWRPC

Map 2.8.Inset
Critical Community Facilities in Washington County: 2022



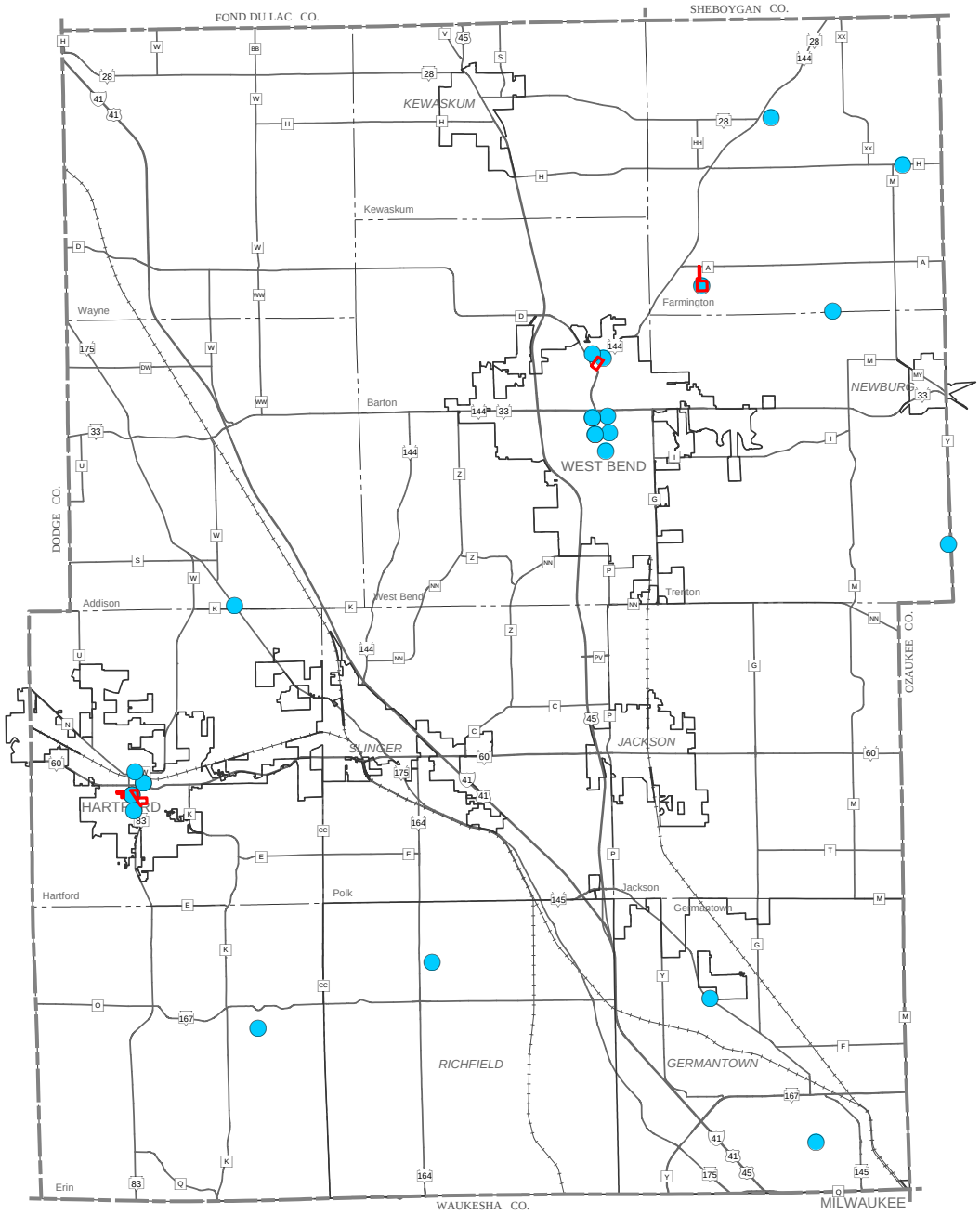
- HOSPITAL/CLINIC
- PUBLIC/PRIVATE SCHOOLS OR COLLEGES
- GOVERNMENT BUILDINGS
- CHILD CARE
- ADULT CARE

N

0 1 2 3 Miles

Source: Wisconsin Department of Children and Families, Wisconsin Department of Health and Social Services, Wisconsin Department of Public Instruction, Washington County, and SEWRPC

Map 2.9
National and State Registers of Historic Sites and Districts in Washington County: 2020



HISTORIC SITE

HISTORIC DISTRICT

N

0 1 2 3 Miles

Source: State Historical Society of Wisconsin, Washington County and SEWRPC

SEWRPC Community Assistance Planning Report No. 326 (2nd Edition)

WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Chapter 3

ANALYSIS OF HAZARD CONDITIONS

To evaluate various potential hazard mitigation alternatives for Washington County and select the most effective and feasible hazard mitigation strategies, the existing potential natural weather hazard problems in the County must first be analyzed and the vulnerability to such hazards documented. Accordingly, this chapter provides the following:

- Identification of the hazards likely to affect Washington County
- Profiles of the extent and severity of recent hazard events which occurred in the County
- Assessment of the vulnerability and risk associated with each type of hazard
- Identification of the potential for changes in hazard severity and risk under future conditions, such as climate change

The vulnerability assessment focuses on the County and community assets described in Chapter 2.

3.1 HAZARD IDENTIFICATION

The process of identifying those natural hazards that should be specifically addressed in the Washington County hazard mitigation plan was based upon consideration of a number of factors. The process included input from the Washington County Hazard Mitigation Local Planning Team (LPT), including a priority

ranking of hazards; review of the hazard identification set forth in the State hazard mitigation plan;[1] review of documentation of past hazard events; and review of related available mapping, plans, and assessments. As part of the updating process, the identification of hazards likely to affect Washington County was reviewed and reevaluated. This reevaluation included additional input from the Washington County Hazard Mitigation LPT. As such, the LPT reevaluated the hazards to be considered using a hazard and vulnerability assessment tool similar to the one used for reviewing hazard identification for the previous plan. However, for this plan update, the assessment was in the form of an online survey tool called "Survey123."[2] In this survey, members of the LPT indicated the likelihood of each hazard occurring in Washington County and evaluated the severity of each hazard on the basis of possible impacts to people, property, and businesses. Finally, the LPT evaluated the relative state of preparedness for each hazard. The ratings given by the LPT for each hazard were used to derive a perceived level of risk posed by each hazard. Following this, the hazards were ranked by perceived level of risk (Table 3.1).

Summary of Hazard Vulnerability and Risk Assessment Survey Results

Methods

The online assessment survey was presented at the June 7, 2022 LPT meeting, with a total of 15 surveys returned and analyzed. For each of the hazards, a risk was computed for each survey using the formula:

Risk (in weighted average) = [(Probability) x (Human impact + Property impact + Business impact - Preparedness)]

Probability (likelihood that an event would occur), Human impact (possibility of death or injury), Property impact (physical losses and damages), Business impact (interruption of services), and Preparedness (mitigation or pre-planning) were each assigned a number from 0 to 3 by LPT members, with 0 indicating "not applicable", 1 indicating low, 2 indicating moderate, and 3 indicating high.

The interpretation of the results returned by this formula is that the perceived threat increases with increasing weighted average risk. For each hazard, an average risk was calculated using the results of all the

[1] *Wisconsin Department of Emergency Management and Military Affairs*, State of Wisconsin Hazard Mitigation Plan*, December 2021*.

[2] ArcGIS "Survey123" is an online tool that collects data through web or mobile devices which can be used to create, share, and analyze surveys.

returned surveys. The hazards were then ranked by average risk, with a rank of 1 indicating the highest perceived risk.

Results

The results from the assessment survey are summarized in Table 3.1. Hazard events are listed in order of highest perceived risk to lowest perceived risk. As listed in Table 3.1, the highest perceived risks of hazards are associated with winter events (i.e., ice storms, blizzards, and heavy snowstorms) and thunderstorm related events (i.e., high winds, lightning, and hail), followed by tornado, drought, extreme temperatures, and flooding events.

Summary and Ranking of Hazards

There are several ways the Washington County hazards can be ranked and summarized to be considered in the County hazard mitigation plan. Current guidance for all hazard mitigation plans promotes comprehensive consideration of all natural hazards. These hazards have been ranked by consideration of their frequency, amount of damage, and death and injuries incurred, as well as by concerns of, and degree of importance assigned by, the collective judgment of the Washington County Hazard Mitigation LPT.

The hazards to be considered in this plan are summarized in Table 3.2[3], along with qualitative information on the hazard severity. As part of the updating process, the hazards considered in the 2018 plan were reevaluated based on data related to the occurrence of hazards since that plan and to the perceived risk associated with each hazard, as summarized in Table 3.1.

Natural hazard severity can be assessed and ranked in a variety of ways. The purpose of ranking hazards is to help set priorities and direct more resources to address those hazards of the greatest severity. However, the kinds of mitigation actions that will be needed and warranted depend on the type of vulnerability to be addressed. Some hazards, such as excessive heat and lightning, are unlikely to cause a disaster, but they can be fatal and, therefore, are serious hazards. Vulnerability to such hazards can best be addressed by preventative measures, such as public information to encourage hazard awareness and personal protection.

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[3] The rankings in Table 3.2 were assigned by combining rankings of the natural hazards listed based upon the number of occurrences, number of damages, numbers of fatalities and injuries reported since 2001, and the perceived risk associated with each hazard as identified by the Local Planning Team and summarized in Table 3.1. It is important to note that some of the natural hazards listed in Table 3.2 represent combinations of hazards listed in Table 3.1. For example, while specific risks associated with thunderstorms, such as hail and lightning are listed separately in Table 3.1, they are combined into one category in Table 3.2.

Other hazards, such as flooding, are pervasive and devastating, and may require a variety of tools—mapping, building codes, zoning laws, insurance, elevation or acquisition of flood-prone structures, and public awareness—to effectively reduce the risk of disaster. However, flooding might not result in more fatalities than a heat wave. In general, ranking hazards by the number of deaths that they cause shifts the focus away from major and largely avoidable disasters, such as floods. Weather hazards that have caused past Washington County disasters are likely the hazards that will cause future disasters. However, the types of natural hazards that result in fatalities remain a public health and safety concern.

The summary listing of natural hazards in Tables 3.1 and 3.2 does include some hazards that have been found to have minimal chance of occurring or offer only limited applicable mitigation options. The hazards listed below will receive less emphasis in the subsequent sections of the report or are incorporated as sub-elements among existing categories, as summarized in Table 3.2.

Fog

Fog is low-level moisture caused by many contributing factors, including ice or snowmelt, moist air from Lake Michigan, or rain evaporation with light winds, which may reduce visibility levels, especially in river valleys and other low spots. Dense fog is often seen with clearing skies the day following a heavy rainstorm. Fog is a widespread natural hazard event that usually covers several counties during an episode. There have been 69 fog events reported in and around Washington County from 2001 through 2021. Although no deaths or injuries were recorded during that period, fog can affect mobility. Dense fog may persist for several hours or days, reducing visibility and leading to vehicle accidents, flight delays, or cancellations at airports. This natural hazard event does not offer significant mitigation alternatives to warrant individual examination. However, it is important to note that the Milwaukee/Sullivan NWS station will issue a dense fog advisory which can help reduce the impacts of fog.

Wildfires

A forest fire is an uncontrolled fire occurring in forest or woodlands outside the limits of incorporated villages or cities. A wildfire is any instance of uncontrolled burning in brush, marshes, grasslands, or field lands. Such incidents are normally responded to by local fire suppression departments in accordance with established response procedures and no specific mitigation actions are deemed warranted. Wildfires in Wisconsin are primarily caused by humans burning yard debris, arson, or campfires, for example. They can also be caused by natural events like lightning. Land use, vegetation, amount of combustible materials present, and weather conditions, such as wind, low humidity, and lack of precipitation, are the chief factors determining the number of fires and acreage burned.

Fortunately, Wisconsin has been in a wet pattern for the last decade, so there have been fewer catastrophic wildfires since 2016. Acres-burned is one way to categorize wildfires, but it should be noted that most wildfires (about 81 percent) are under ten acres and still cause significant damage to land and structures. Although Wisconsin does not have as high of a wildfire risk as other parts of the country, there are wildfires in the state every year. If these are not handled quickly and appropriately, they can turn destructive.

Washington County has over 26,000 acres of woodlands (see Table 2.5) and about 17,000 acres of designated natural areas.[4] Although there are no wildfires reported in the NCEI database for Washington County, the Wisconsin Department of Natural Resources (WDNR) online dashboard for Wisconsin wildfires indicates seven reported events (on private or state-owned lands) in Washington County from the period of 2012 through 2021.[5]

As development into rural and wildland areas continues, the dynamics of fire suppression and control have changed drastically. Wildfire danger grows as more homes and other manmade objects are situated in forests, grasslands, and other areas with highly flammable vegetation, creating what is known as the wildland-urban interface (WUI). According to the U.S. Fire Administration, "the WUI is the zone of transition between unoccupied land and human development. It is the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels." Wisconsin falls in the 15 to 30 percent range of WUI.[6]

Based on guidance from the National Association of State Foresters, the WDNR, in conjunction with its Federal and tribal partners, developed a Statewide assessment of communities at risk from wildfires. None of the communities in Washington County were determined to be at high or very high risk. Considering the low risk and lack of historical significance, forest and wildfire hazards will not be addressed in later chapters.

Dust Storms

There have been no dust storm events reported in Washington County from 2001 through 2021. Natural hazard events that occurred in the past are likely to reoccur in the future, providing the opportunity to plan

[4] *SEWRPC Community Assistance Planning Report No. 287 (Second Edition),* A Multi-Jurisdictional Comprehensive Plan for Washington County: 2050, *April 2019.*

[5] *dnrmaps.wi.gov/WAB.*

[6] *Wisconsin Department of Emergency Management and Military Affairs, State of Wisconsin Hazard Mitigation Plan, December 2021.*

for them. A dust storm event in Washington County would be atypical, therefore, mitigation strategies will not be recommended for this hazard in the current plan.

Land Subsidence

Land subsidence is the lowering of the land-surface elevation from changes that take place underground. Common causes of land subsidence from human activity are pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils (hydrocompaction). Due to the limited threat from physical injury and death incidences from subsidence in Washington County, this aspect will not be considered further in subsequent sections of this report.

Landslide

A landslide is a relatively sudden movement of soil and bedrock downhill in response to gravity. The movement of soil can cause damage to structures by removing the support for the foundation of a building or by falling soil and debris colliding with or covering a structure. Landslides can be triggered by heavy rain, bank or bluff erosion, or other natural causes. In Wisconsin landslides generally are not dramatic. Due to the limited threat from physical injury and death incidences from landslides in Washington County, this hazard will not be considered further in subsequent sections of this report.

Earthquake

An earthquake is a shaking or sometimes violent trembling of the earth that results from the sudden shifting of rock beneath the earth's crust. These sudden shifts release energy in the form of seismic waves or wave-like movement of the land surface. Earthquakes can strike without warning and may range in intensity from slight tremors to great shocks lasting a few seconds or over five minutes. The actual movement of the ground during earthquakes is seldom the direct cause of injury or death. Casualties may result from falling objects and debris, and disruption of communications, electrical power supplies, and gas, sewer, and water lines should be expected from earthquakes. The severity of an earthquake can be measured by comparing the peak acceleration associated with the horizontal shaking it produces to the normal acceleration a falling object experiences due to the force of gravity. This is usually expressed as a percentage of g, the acceleration due to gravity. The level of risk due to earthquake can be expressed as the percentage of g, for which there is a 2 percent probability of being exceeded in a 50-year period. Depending on location, sites in Washington County have a 2 percent probability of experiencing earthquakes in a 50-year period in which the peak

acceleration associated with horizontal shaking exceeds between 4 percent and 8 percent of g.[7] These are low values. While these levels of shaking can be noticeable, they are rarely associated with damage to structures. The earthquake threat to the State and Washington County is considered low, therefore earthquakes will not be considered further in subsequent sections of this report.

Past Hazard Experience

Past experiences with disasters are an indication of the potential for future disasters for which Washington County would be vulnerable. Accordingly, a review was made of the hazards that Washington County has faced in the past and a ranking by risk was made based upon disaster history and emergency management experience. Tables 3.3 and 3.4 detail the history of estimated disaster damages caused by federally declared emergencies, the total number of weather hazard events recorded, and the severe weather history in the County.

As shown in Table 3.3, Washington County had nine presidential disaster declarations, five secretarial disaster designation declarations by the U.S. Department of Agriculture (USDA), and three presidential emergency declarations from 1976 to 2021. In addition, the total documented estimated damages from these 17 events exceeded $50 million (2021 dollars). It should be noted that the reported damage estimates generally underestimate the actual damage that occurred.[8]

Since 2001, Washington County has experienced 572 weather hazards, as summarized in Table 3.4. To illustrate the broader hazard damage potential, Table 3.4 summarizes the damages associated with the 572 natural hazard events. These hazard events were estimated to have caused over $63 million (2021 dollars) in damages. Additionally, the table shows that snow and ice (or winter-related) events are the most frequent weather hazards in the County, followed by thunderstorm and high straight-line winds, hail, and fog. However, flooding is the most damaging weather hazard, followed by hail, tornadoes, and high straight-line winds. Also, there was one injury to note that occurred during a thunderstorm related event.

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[7] U.S. Geological Survey, "2008 United States National Seismic Hazard Maps", USGS Fact Sheet 2008-3018, April 2008.

[8] Major declarations are made by the President, when the President determines, assistance is needed to supplement State and local efforts in providing services such as the protection of lives, property, public health, and safety, and to lessen the threat of a disaster. Agriculture-related disasters and disaster designations are quite common. A Secretarial disaster declaration occurs when the USDA Secretary of Agriculture authorizes a county (or counties) as a disaster area (or "designation") to make available emergency loans for agricultural producers that have suffered severe production losses due to a natural disaster.

The data in Table 3.4 is primarily sourced from the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI), formally known as the National Climatic Data Center (NCDC), which publishes National Weather Service (NWS) data describing recorded weather events and resulting deaths, injuries, and damages in their Storm Events Database. For economic losses resulting from damages to crops, the data from the NCEI can be supplemented with records of crop insurance indemnities from the U.S. Department of Agriculture Risk Management Agency (USDA-RMA).[9]

To illustrate the potential frequency of thunderstorms, tornadoes, and flooding events a review was made of the warnings historically issued by the NWS, as shown in Table 3.5. Over the period of 2001 through 2021, there have been 343 thunderstorm-related watches or warnings, 61 tornado-related watches or warnings, and 24 flash flood and flood warnings.

Improved weather forecasting and warning systems, as well as stronger building codes, help explain why tornado mortality has not been as prevalent in the recent past, although tornadoes remain a very serious threat to human life.

3.2 DESCRIPTION OF ANALYSIS, METHODS, AND PROCEDURES

In the previous section of this Report, the natural hazards considered applicable to Washington County were identified and ranked (Table 3.1). This section of the Report develops a vulnerability assessment for the identified hazards. This vulnerability assessment provides the basis for developing mitigation strategies that address the identified vulnerabilities.

[9] *Note: NCEI relies on damages reported by county, state, and federal emergency management officials, local law enforcement officials, volunteer weather spotters, NWS damage surveys, newspaper articles, the insurance industry, and the general public. Often property damage and crop damage due to weather events will go unreported. Thus, property damages and crop damages discussed clearly represent an underestimate of actual damages that have occurred due to weather events. It is also important to note that weather events are often complex, and damages may occur from multiple hazards, such as when hail, rain, wind, and tornadoes strike during a single storm.*

The procedures utilized in the vulnerability analyses are based upon guidance provided by the Federal Emergency Management Agency (FEMA) and the Wisconsin Department of Military Affairs, Division of Emergency Management (WEM).[10] The analysis includes three components: 1) profile of hazard events, 2) inventory of County and community assets, and 3) estimation of losses. In addition, where applicable, potential changes in vulnerability under future conditions and the variance of vulnerability among the 20 municipalities within Washington County are analyzed. The profiling of hazard events was developed by utilizing the HAZUS methodology, data available on the FEMA and NOAA National Climatic web sites, USDA-RMA, data provided by the WEM, file data available from the Washington County Department of Emergency Management, and SEWRPC.

Data and estimated losses and vulnerability were developed utilizing standard risk assessment methodology as set forth in FEMA and WEM guidelines for hazard mitigation planning where hazards can be estimated spatially and by order of magnitude over a range of events. For hazards which cannot be quantified, alternative approaches have been used relying on qualitative measures. A vulnerability description has been included for each of the applicable hazards listed in Table 3.2.

3.3 HAZARD VULNERABILITY AND RISK ASSESSMENTS

Flooding and Associated Stormwater Drainage Problems

Flooding is the most widespread natural disaster in the United States and is considered a significant hazard in Washington County. Flooding, as defined by the National Flood Insurance Program (NFIP), is "a general and temporary condition where two or more acres of normally dry land, or two or more properties, are inundated by water or mudflow." It is important to note that floods are natural events that provide many environmental benefits and are only considered hazards when development occurs in the floodplain, exposing people and/or property to the risk of flood damages. There are several different types of floods, the most common of which is riverine flooding (or overbank flooding). Wisconsin is also prone to flash floods, ice jam floods, local stormwater drainage floods, and high groundwater floods.[11]

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[10] *Federal Emergency Management Agency, State and Local Mitigation Planning How-to Guide,* "Understanding Your Risks, Identifying Hazards and Estimating Losses," *Publication No. FEMA 386-2, August 2001; Federal Emergency Management Agency,* State Mitigation Planning Policy Guide, *April. 2022; Federal Emergency Management Agency*, Local Mitigation Planning Policy Guide, *April 19, 2022*.

[11] *Wisconsin Department of Emergency Management and Military Affairs, State of Wisconsin Hazard Mitigation Plan, December 2021*.

As described in Chapter 2, there are approximately 220 miles of major streams and 14 major lakes in Washington County that can potentially experience flooding issues. Major watershed boundaries, wetlands, and major streams and lakes within the County are shown on Map 2.6. The land area within the 1-percent-annual-probability floodplain in each community is included in Table 3.6. Approximately 42,189 acres, or 15 percent, of the total area of the County is located within the 1-percent-annual probability flood hazard area (or floodplain).

In addition to flooding, stormwater drainage problems exist on a scattered basis throughout Washington County. The distinction between stormwater drainage, stormwater management, and flood control is not always clear. For the purpose of this report, flood control is defined as the prevention of damage from the overflow of natural streams and watercourses. Drainage is defined as the control of excess stormwater on the land surface before such water has entered stream channels. The term "stormwater management" encompasses both stormwater drainage and nonpoint source pollution control measures. While the focus of this section is on flooding, the related stormwater drainage hazards are also considered because of the interrelationship between those two conditions.

Types of Flooding Problems

Aside from riverine flooding, other types of flooding problems to consider in Washington County are highlighted below:

Dam Failure

A consideration in flood hazard mitigation is the potential for increased flooding due to dam failures. As indicated in Table 3.7 and Map 3.1, there are 57 existing dams identified by WDNR in Washington County. Dams built according to accepted engineering principles at the time of construction and dams built without application of engineering principles can both fail. When a dam fails, or is subject to overtopping, large quantities of water can rush downstream with great destructive force. In the State of Wisconsin, WDNR inspects and assigns hazard ratings to dams.

The WDNR assigns hazard ratings to large dams within the State. Two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified, by law in three categories that identify the potential hazard to life and property.[12]

[12] Wisconsin Administrative Code*, NR 333.06*

- A **low hazard** rating is assigned to those dams that have no development beyond the allowable open space use in the hydraulic shadow where the failure or mis-operation of the dam would result. There would be no probable loss of human life, low economic losses (losses are principally limited to the owner's property), low environmental damage, and no significant disruption of lifeline facilities. Land use controls are placed to restrict future development in the hydraulic shadow.

- A **significant hazard** rating is assigned to those dams that have no existing development in the hydraulic shadow that would be inundated to a depth greater than 2 feet and have land use controls in place to restrict future development in the hydraulic shadow. The potential for loss of human life during failure is unlikely. Failure or mis-operation of the dam would result in no probable loss of human life but may cause economic loss, environmental damage, or disruption of lifeline facilities.

- A **high hazard** rating is assigned to those dams that have existing development in the hydraulic shadow that will be inundated to a depth greater than 2 feet or do not have land use controls in place to restrict future development in the hydraulic shadow. This rating is assigned if loss of human life during failure or mis-operation of the dam is probable.

Of the 57 existing dams in Washington County, all have been assigned a hazard rating by the WDNR. As such, two of the dams (Barton and Lucas Lake Dams) have been assigned a high hazard rating, two have been assigned significant hazard ratings, and the remaining 53 have low hazard ratings. The risk of dam failure is monitored closely by the WDNR.

Flood Hazards Related to Ice Jams

Flows that would normally be conveyed within stream and river channels with little problem can become flood hazards when an ice jam forms downstream. Likewise, ice jams can intensify flooding from streams that are already swollen from large storm events or spring melt. Ice jams occur when chunks of ice clump together to block the flow of a waterway, creating a temporary dam made of ice. The waterway backs up and floods adjacent land—often with swiftly moving water. Ice jams can develop near bends in a river, places where topography flattens, or at bridges. Jams usually occur when there are large temperature swings that cause snow melt to swell a river before the ice has a chance to melt. The volume and speed of water released when an ice jam breaks up can be a highly destructive combination.

Starting in 2017, after the 2012 removal of the Newburg Dam, a portion of the Milwaukee River near the Village of Newburg began experiencing ice jams. The first known major event (2017) caused significant

damage to the nearby Village Park (Fireman's Park) and park structures. The second (2018) known ice jam caused less damage to this area, however in 2019, an ice jam caused major damage to the same Village park and impacted one of the sewer system lift stations which required emergency protective measures.

Agricultural Flood Damages

Historically, flood damages to agricultural land have been significant in Washington County, with crop damages totaling $14.6 million over the period of 2001 to 2021 (Table 3.8). Thus, the average annual reported damages in the County can be approximated at $695,352 per year. With about 6,965 acres of agricultural land located within the identified flood hazard area[13] the average annual flood damage to these lands is about $100 per acre. Because these approximations are only based on reported damages, they are assumed to represent an underestimation of actual flood related agricultural damages. It should be noted that localized crop damage can also be expected during smaller storm events.

Stormwater Drainage Problems

Because of the interrelationship between stormwater management and floodland management, stormwater management actions are an important consideration of the flood vulnerability assessment. Small area stormwater drainage problems are known to exist throughout the urbanized portions of the County. Most of the communities have undertaken stormwater management planning programs or ordinances. Stormwater management plans are typically required by Washington County and the local municipalities for new developments. This practice should minimize the creation of new stormwater related problems. Stormwater management planning in Washington County is described further in the following chapters, and that planning serves as the basis of the assessment of stormwater drainage problem vulnerability. Such problems largely impact community facilities by causing nuisance conditions and are not generally of concern for community health and welfare.

Recent Events (2001-2021)

A total of 11 flood events have been recorded in Washington County between 2001 and 2021. These events are shown in Table 3.8 and are based upon data published by the NCEI. As shown in Table 3.8, these flood events can range from one event per year or up to three events per year, which demonstrates the likelihood and unpredictability of these events. In total, these flood events have resulted in no casualties or injuries, and over $27 million (2021 dollars) in property and crop damages within Washington County. A few examples of some of the more recent flood events are noted below.

[13] *Southeastern Wisconsin Regional Planning Commission's 2015 Land Use Data.*

2004 – From June 1 through June 30, 2004, scattered to widespread heavy rains across south-central and southeast Wisconsin during the period of June 9-12, 2004 kept many rivers and streams at or above flood stage for most of the month. Monthly rainfall totals generally ranged from four to seven inches across south-central and southeast Wisconsin, with some scattered spots picking up between seven and 9.5 inches. Depending on the location, this total was between 50 and 100 percent above normal rainfall for the month. These heavy rains came at a time when reaches of some rivers were still high due to the rains that caused the flood and flash flood events in May. The high-water levels during June kept much of the low bottomland near rivers and streams inundated; closed some major state highways; forced water into basements; damaged corn, soybean, and alfalfa crops; delayed planting of entire fields; washed out gravel road shoulders; and damaged foundations of homes and businesses. Property damages in Washington County resulting from the June 2004 event were estimated at $4.4 million and crop damages were estimated at $8.8 million (2021 dollars). A Presidential disaster declaration was issued for the storms, tornadoes, and flooding that occurred in south-central and southeastern Wisconsin between May 19 and July 3, 2004. Washington County was included in this declaration, making county residents and business owners eligible for Federal disaster aid.

2008 – In June, 2008, severe flooding affected much of southeastern Wisconsin caused by a combination of circumstances, including wet conditions that prevailed through winter 2007-2008 and followed by a wet spring. As a result, soils were highly saturated going into June and had little capacity to accept additional water from precipitation. In addition, June 2008 was one of the wettest Junes on record in southeastern Wisconsin. Because soils were highly saturated, the majority of the precipitation went directly into streams, rivers, and lakes as runoff. This resulted in flooding and flash flooding throughout Washington County. Flooding began in early June and lingered in some areas for several weeks. In some locations, flooding occurred outside of the 1-percent-annual-probability flood hazard area. Examples of the impacts of the June 2008 flooding include the following: rising lake levels caused flood-related problems on several lakes; numerous roads were closed due to flooding or high water; water depths on road surfaces reached or exceeded three feet, resulting in gravel washouts; several roads and bridges sustained damage; shoreline roads along Bark and Friess Lakes were sandbagged; and, sewer backups and flooding of basements were reported in the City of West Bend. About 632 homes were affected and about 50 businesses were affected by the flooding event. The June 2008 flooding was estimated to have caused $6.8 million in property damages and $4.6 million in damages to crops (2021 dollars). Washington County was included in a Presidential disaster declaration that was issued as a result of this event.

2018 – On August 27, 2018, a very warm, moist airmass combined with a series of storm systems which produced multiple rounds of flooding and severe weather across southern Wisconsin. Significant flash flooding took place at times across parts of Washington and Ozaukee Counties. Four to eight inches of rain fell over this area resulting in flash flooding of city streets in Jackson and West Bend and other urban areas of Washington County with up to 18 inches of water depth on some streets in West Bend. Flooding of creeks and lowland areas caused road overtopping damage. The Town of Farmington experienced the greatest impact from the August 2018 flooding. Overall, 24 homes had flood damage with five homes experiencing minor flood damage. This event caused an estimated $649 thousand in property damages and over $5 thousand in crop damages (2021 dollars).

Vulnerability and Community Impact Assessment

To assess the vulnerability of Washington County and its communities to flooding hazards and related stormwater drainage problems, consideration was specifically given to potential structural (including critical and emergency facilities) and roadway flooding impacts, as well as cropland flood damages.

The 1-percent-annual-probability floodplain areas for Washington County, as well as the source of hydrologic and hydraulic data are shown on Map 3.2. As can be seen from the map, these areas are generally located along the major streams and lakes throughout the County. The majority of the floodplains shown on Map 3.2 were developed for FEMA using detailed modeling and GIS techniques to produce the County Flood Insurance Rate Maps (DFIRMs) and were last updated in February 2022.

Damage Estimation Method: Parcel-Based Loss Analysis

SEWRPC staff conducted a parcel-based analysis to estimate the damages that would be sustained by buildings (or structures) as the result of a 1-percent-annual-probability flood event. GIS was used to identify those parcels that are wholly or partially located in the 1-percent-annual-probability floodplain. The parcels were then examined using both 2015 orthophotography and topography to determine whether a principal building, such as a house, a commercial building, or an industrial building was located within the floodplain. For those parcels in which a principal building (structure) was located wholly or partially in the floodplain, the 2022 assessed value of improvements was obtained from Washington County land information GIS portal. The information in the assessment was used to classify each principal building as residential (including manufactured homes), commercial, agricultural, governmental, parks and recreational, industrial, utility, or other. For each principal building, the elevation of the ground at the building was determined from the 2015 one-foot contour topographic maps.

Standard assumptions were made as to the elevation of the first floors of the principal buildings. For a residential building, it was assumed that the first floor was 1.0 foot above the ground elevation. It was also assumed that all residential buildings had a basement. For manufactured homes it was assumed that the first floor was 2.0 feet above ground elevation. For all other building types, it was assumed that the first floor is 0.5 feet above ground elevation.

Flood elevations for the 1-percent-annual-probability flood event were derived from information in the Flood Insurance Study for the County. For those buildings located in floodplains developed using detailed methods (Zone AE on the digital flood insurance rate map (DFIRM)). The flood elevation was based on the location of the structure and adjacent cross sections.

A different methodology was used to determine the flood elevation for those buildings located in floodplains that were developed using approximate methods (Zone A on the DFIRM). A transect was drawn at the building through the mapped floodplain perpendicular to the stream. In most cases, the higher contour elevation at the floodplain edge was used to estimate the flood elevation. In cases where the difference between the elevations at the two edges of the floodplain was greater than 10 feet, the average elevation was used to estimate the flood level.

For each building, the first-floor elevation and flood elevation were compared. The extent of direct damage, such as the costs associated with cleaning, repairing, or replacing the structure, its contents, and the land for each principal building was estimated as a percent of the value of improvements based on standardized flood loss depth-damage curves prepared by FEMA, U.S. Army Corps of Engineers, and SEWRPC. Indirect damages, such as the costs associated with temporary evacuations, relocations, lost wages, lost production and sales, and the incremental costs of traffic detours, were estimated to be a percentage of direct damages for residential, commercial, and industrial buildings.

Impacts of a 1-Percent-Annual-Probability Flood

A review of the community assets described in Chapter 2 indicates the potential for flooding impacts to: 1) a variety of flood-prone residential (including manufactured homes), commercial, and other developed land uses; 2) agricultural, recreational, and lowland areas; 3) roadway systems; and 4) critical community facilities, including two emergency structures and a public works facility. No other significant impacts are expected toward other critical infrastructure or utility systems, or hazardous material storage sites. The analyses estimating the damages that would result from a 1-percent-annual-probability flood were based on the floodplains that were available at the time the analyses were conducted.

Based upon the initial review of the parcel-based analysis, there are currently 1,165 insurable structures estimated to be located within the 1-percent-annual-probability (100-year recurrence interval) flood hazard areas of Washington County (see Table 3.9). The locations of these structures are shown on Map 3.3. There are 923 residential structures (and 103 manufactured homes); 102 commercial structures; 21 agricultural buildings; 12 government buildings, one industrial building; and three other buildings located within the 1-percent floodplain. The specific location of each structure and its relationship to the floodplain is shown on the 2022 FEMA DFIRMs for Washington County.

As of August 2022, four of the 1,165 structures are considered by FEMA to be repetitive- or severe repetitive-loss properties.

- **Repetitive-loss** structures are those that have two or more flood insurance claims of at least $1,000 each.

- **Severe repetitive-loss** properties are those that either have four or more flood insurance claims for damages to building or contents of at least $5,000 each or two or more flood insurance claims for building damages that total more than the existing value of the building.

All four structures are single-family residential, of which two are considered severe repetitive-loss properties. Three of these buildings are located in the Village of Richfield and one is located in the Town of Hartford. WEM has made the acquisition and demolition of repetitive-loss and severe repetitive-loss properties a priority. Acquisition and demolition of such properties are eligible for funding through FEMA's Hazard Mitigation Grant Program (HMPG).

The total market value plus contents for these 1,165 structures are estimated at over $201 million. The estimated damages (Table 3.9) expected during a 1-percent-annual-probability flood event are estimated to be nearly $23.5 million (2022 dollars).

It should be noted that, with a few exceptions, all of these structures were identified as being in the floodplain based upon the best available topographic mapping. Field surveys would be required to determine the precise structure relationship to the floodplain. Some structures may be found to be outside the flood hazard areas based upon detailed field survey data.

Maps 3.4 and 3.5 show the location of selected types of critical community and emergency facilities relative to the 1-percent-annual-probability flood hazard areas in Washington County, including hospitals, nursing homes, clinics, schools, childcare centers, community administration facilities (see Map 3.5), and fire and police stations (see Map 3.4). In addition, Map 3.6 shows the location of historical sites distributed throughout the County along with flood hazard areas, in which one of these sites (West Bend Theatre) is located within the floodplain area.

There are 238 buildings identified as critical community facilities in Washington County. A listing of these facilities can be found in Appendix D. These buildings are geographically distributed throughout the County. Of these critical and emergency facilities, six are estimated to be located within the flood hazard areas. These consist of two historic sites in the City of West Bend; two senior care facilities and fire department located in the Village of Kewaskum; and the Village of Newburg's fire department. It should be noted that other critical facilities appear to be located within the vicinity of flood hazard areas. Because of the need for access to and from these facilities, Maps 3.4 and 3.5 include their location and show the relationship to the flood hazard areas.

As can be seen by review of these Maps, the floodplain intersects a number of arterial and collector streets in the County. In some locations, this may indicate that floodwaters could potentially overtop these roads during a major flood event and potentially cause a washout. This could disrupt portions of the transportation system, including emergency vehicle routes, in the County during flood events. It should be noted that there are two roadway locations along the eastern County border in the Town of Farmington that are known to overtop on a regular basis during heavy rain events. One of these locations is along the Milwaukee River on Riverside Drive and the second is on Jay Road between CTH XX and Camp Awan Road. Mitigation strategies to prevent roadway flooding or washouts, including these two locations, are discussed in more detail in Chapter 5 of this Report.

A review of the extent and severity of flooding conditions within Washington County indicates that there is a significant community impact, in part, as a result of the damages caused by flooding of buildings, primarily basements and the potential disruption of the transportation system during extreme flooding events.

The overall flooding impacts on the transportation system and the need to prepare for major evacuations and other emergency actions are not a significant concern given the isolated nature and the limited severity of the flooding problems on major roadway systems. However, the ongoing coordinated Washington County and local emergency operations planning programs do have provisions for carrying out such actions

if needed. Significant flood-related impacts on the community economy and businesses are of an infrequent and short-term in nature. Likely impacts on County and local government operations involve posting and closure of roadways at locations where floodwaters overtop structures and cause short-term roadway flooding. Another potential impact is the need for emergency and police vehicles to consider the need to utilize alternative transportation routes when providing needed services during periods of flooding. In most of the County this is expected to be a rare occurrence.

Future Changes and Conditions

Changes in land use can have a direct impact on flood flows and stages and, accordingly, can impact flooding problems. The changes in urban land use over the 25-year period from 2015 through 2050 are expected to result in an increase in the amounts of impervious surface in these watersheds. In the absence of mitigative measures, this could lead to increases in future flood flows and stages, especially in downstream areas. As is discussed previously in this report, there are a number of programs in place that are intended to mitigate the potential for such increases in flood flows. Nevertheless, it is important that future condition flood flows and stages be considered as mitigative actions are being determined.

Based upon the above, it may be concluded that the extent and severity of the flooding problem within the County has the potential to become more severe to a limited extent in the near future. This conclusion highlights the importance of carrying out and implementing current floodplain and related ordinances and existing and ongoing stormwater management plans and regulations.

Changes in climate are likely to affect the potential for flooding in Washington County during the 21st century. As previously described in Chapter 2, model projections show Wisconsin receiving more precipitation and more frequent intense precipitation events. These models suggest that by 2050 annual average temperatures in Wisconsin will increase from about 4 to 6°F and the frequency and magnitude of extreme rainfall events (2-5 inches) will be enhanced. By the mid-21st century, Washington County may receive three more precipitation events of two or more inches in 24 hours per decade, roughly a 25 percent increase in the frequency of heavy precipitation events.[14] This is likely to increase the frequency of high flows and high-water levels and potentially increase the frequency and severity of flooding. In particular, the expected increases in the magnitude and frequency of large rainfall events will likely increase flood

[14] *Wisconsin Initiative on Climate Change Impacts,* Wisconsin's Changing Climate: Impacts and Adaptation*, Nelson Institute for Environmental Studies, University of Wisconsin-Madison and Wisconsin Department of Natural Resources, 2011.*

magnitudes in streams and rivers in Wisconsin, although the amount of increase will vary from place to place. The amount of precipitation that falls as rain during winter and early spring months is expected to significantly increase. Winter rain can create stormwater management problems due to icing and runoff over frozen ground which may also lead to an increased risk of flooding.

These climate changes may lead to several flood and stormwater related impacts. Increased rainfall and shifting precipitation patterns that favor more rain during periods of low infiltration and evapotranspiration may lead to more frequent and severe stream and river flooding. Increased precipitation during winter and spring may result in increased occurrence of inland lake flooding. Increased cold-weather precipitation and increased variability in frost conditions may cause a rise in water tables in some areas leading to an increase in groundwater flooding.

The projected increase in the magnitude and frequency of heavy storms could also affect the performance of existing and planned stormwater management and flood mitigation systems. This increase could also expand flood hazard areas, such as the 1-percent-annual-probability flood hazard area, beyond their existing boundaries, potentially encompassing more existing development which could lead to an increase in the risk of flood damages and a future need for larger stormwater management facilities and updated programs.

The magnitudes of potential increases in flooding are unknown, and there is a complex interrelationship between the climatological factors that will be affected by climate change and the features of watersheds that produce runoff. In some cases, climate change-induced changes in certain climatological factors may offset the changes in other factors relative to their effects on flood flows. In other cases, the effects will reinforce one another. Thus, it is very important to continue to improve methods for downscaling climatological data, to expand the climatological parameters for which downscaled data can be developed, and to apply hydrologic and hydraulic simulation models to quantify the potential effects on flooding resulting from climate change.

Multi-Jurisdictional Risk Management

Flooding and associated stormwater drainage problems have been identified as a significant risk in Washington County. As noted earlier and shown on Map 3.3, structures within flood hazard areas have been identified within all general-purpose local units of government in the County. In addition, there are related stormwater drainage problems in selected areas of many communities. Based upon the number of structures potentially impacted (see Map 3.3), the extent of the agricultural flood damage potential, and

the extent of roadway flooding, the entire County is impacted by flooding. A summary of flood impacts by community is listed in Table 3.10.

Severe Weather Events (Thunderstorms, Strong Winds, Hail, and Lightning)

NOAA's National Center for Environmental Information (NCEI) defines severe weather as "destructive storm or weather" that is "usually applied to local, intense, often damaging storms such as thunderstorms, hailstorms, and tornadoes." While this definition can cover a variety of hazards beyond what is listed, thunderstorms, tornadoes, high winds, hail, and lightning are the most prevalent in Wisconsin. Thunderstorms and their related strong or straight-line winds, lightning, hail hazards, and non-thunderstorm high winds are covered within this section. Excessive rains that cause flash flooding and tornadoes are covered separately in other sections.

Thunderstorms

A thunderstorm is defined as a severe and violent form of convection produced when warm, moist air is overrun by dry, cool air. As the warm air rises, thunderheads (cumulonimbus clouds) form. These thunderheads produce the strong winds, lightning, thunder, hail, and heavy rain that are associated with these storm events. The thunderheads may be a towering mass averaging 15 miles in diameter and reach up to 40,000 to 50,000 feet in height. These storm systems may contain as much as 1.5 million tons of water and enormous amounts of energy that often are released in one of several destructive forms, such as high winds, lightning, hail, excessive rains, and tornadoes. The NWS offices serving Wisconsin issue on average 5-10 Severe Thunderstorm Warnings per county per year in the southern counties where thunderstorms are more frequent.

According to the NWS, a typical thunderstorm lasts an average of 30 to 60 minutes and moves at an average velocity that ranges between 30 to 50 miles per hour.[15] Strong frontal systems may produce more than one squall line composed of many individual thunderstorm cells. In Wisconsin, these fronts can often be tracked across the entire State from west to east.[16] As with severe thunderstorms, the peak season for severe thunderstorms is April through August[17]. Thunderstorms may occur individually, form clusters, or as a

[15] *Wisconsin Department of Emergency Management and Military Affairs,* State of Wisconsin Hazard Mitigation Plan*, December 2021.*

[16] *National Weather Service Forecast Office.*

[17] *Wisconsin Department of Emergency Management and Military Affairs,* State of Wisconsin Hazard Mitigation Plan*, December 2021.*

portion of a large line of storms. Therefore, it is possible that several thunderstorms may affect one particular area in the course of a few hours, as well as larger areas of the State or County, within a relatively short period of time.

All thunderstorms are potentially dangerous. However, only about 10 percent of the thunderstorms that occur each year nationwide are classified as severe. Severe thunderstorms can cause injury or death and can also result in substantial property and crop damage. They may cause power outages, disrupt telephone service, and severely affect radio communications, as well as surface and air transportation, which may seriously impair the emergency management capabilities of the impacted areas.

The NWS monitors severe weather for 20 southern Wisconsin counties, including Washington County, from its Milwaukee/Sullivan office.[18] A thunderstorm watch indicates that conditions are favorable for severe weather, and that persons within the area for which the watches are issued should remain alert for approaching storms. A severe thunderstorm warning indicates that severe weather has been sighted in an area or indicated by weather radar and persons should seek shelter immediately. These severe thunderstorms watch, and warning bulletins and advisories are disseminated over a number of telecommunication channels, including the NOAA Weather Radio, the NOAA Weather Wire, and the State Law Enforcement TIME System. NOAA Weather Radio is available to any individual with a weather alert radio. This system and the other sources are routinely monitored by local media which rebroadcast the weather bulletins over public and private television stations, radio stations, social media outlets, and mobile alert applications on cell phones. In addition, the NWS operates three 24-hour weather radio transmitters that serve all or portions of Washington County. The weather station KEC60, operating at a frequency 162.400 megahertz (MHz), transmits from a location near Delafield in Waukesha County and serves all of Washington County. WWG87, operating at a frequency of 162.500 MHz, transmits from a location near Taycheedah in Fond du Lac County and serves the northern portion of Washington County. WWG91, operating at a frequency of 162.525 MHz, transmits from a location in the Town of Sheboygan in Sheboygan County and serves the northeastern corner of Washington County.

[18] *National Weather Service, Milwaukee/Sullivan Weather Forecast Office.*

To convey the severity and potential impacts from thunderstorms, the NWS recently added a new "damage threat" to Severe Thunderstorm Warnings. The summary of the three damage threat classifications is below:[19]

- **Destructive** damage threat is at least 2.75-inch diameter (baseball sized) hail and/or 80 mph thunderstorm winds. Warnings with this tag will automatically activate a Wireless Emergency Alert (WEA) on smartphones within the warned area.

- **Considerable** damage threat is at least 1.75-inch diameter (golf ball-sized) hail and/or 70 mph thunderstorm winds. This will not activate a WEA.

- **Baseline** or **"base"** severe thunderstorm warning remains unchanged with 1.00-inch (quarter-sized) hail and/or 58 mph thunderstorm winds. This will not activate a WEA.

Types of Thunderstorm-Related Problems

Thunderstorm Winds

High-velocity, straight-line winds that are produced by thunderstorms and widespread non-thunderstorm high winds are the third most destructive natural hazard in Wisconsin and are responsible for most wind-related damages to property. Thunderstorm winds can also be fatal. Damaging winds are classified as those exceeding 50-60 mph. During the period of 2001 to 2021, Washington County experienced three events with hurricane force winds (74 mph or higher) and 95 thunderstorm wind events (greater than 50 mph).

Although distinctly different from tornadoes, straight-line winds produced by thunderstorms can be very powerful, are common, and can cause damage similar to that of a tornado event. Depending upon their intensity, thunderstorm winds can uproot trees and crops, down power lines, and damage or destroy buildings and infrastructure. Flying debris can cause serious injury and death to humans, livestock, and wildlife in their path. Boats, manufactured homes, and airplanes are also extremely vulnerable to damage from thunderstorm winds. During the period from 1982 to 2015, in the State of Wisconsin, 17 fatalities and dozens of injuries were attributed to wind from severe thunderstorms.[20]

[19] *Wisconsin Department of Emergency Management and Military Affairs,* State of Wisconsin Hazard Mitigation Plan*, December 2021*.

[20] *Wisconsin Department of Emergency Management and Military Affairs,* State of Wisconsin Hazard Mitigation Plan*, December 2016*.

Non-Thunderstorm High Winds

High winds are the most common form of severe weather in Wisconsin; thus, there is a high probability of an occurrence each year. Non-thunderstorm high winds tend to be less forceful than thunderstorm winds but are typically more sustained and widespread. These high winds can affect a region for hours, or even several days. Longer lasting windstorms have two main causes: large differences in atmospheric pressure across a region, and strong jet-stream winds overhead. Horizontal pressure differences can accelerate the surface winds substantially as air travels from a region of higher atmospheric pressure to one of lower pressure. Intense winter storms can also cause long-lasting and damaging high winds. Cold fronts associated with intense low-pressure systems can produce high winds both as they pass and for a period afterward as colder air flows overhead. High winds in the winter can produce dangerous wind chills when air temperatures are cold. Severe wind chills are discussed further in the extreme temperature section below.

Like thunderstorm winds, non-thunderstorm high winds can uproot trees and crops, cause widespread power outages, damage buildings, and make travel treacherous. Non-thunderstorm high winds tend to be more sustained and widespread, leading to more damage over a whole region, as compared to thunderstorm winds. During the period of 2001 to 2021, 49 non-thunderstorm high wind events were reported in Washington County.

Hail

From 2001 through 2021, 83 hailstorms were reported in Washington County. In all, NCEI has recorded over $13 million in property damage and nearly $1.6 million in crop insurance indemnities have been paid in Washington County for hail damage.

Wisconsin averages between two to three hail days per year as recorded by NWS stations, although this may not be indicative of the number of hailstorms which occur within a county or larger area during any given hail season. According to the NWS, about 20 percent of all severe weather events in Wisconsin are hail events in which hailstones are at least 0.75 inches in diameter.[21] A hailstorm is a product of strong thunderstorms and unique weather condition where atmospheric water particles form into rounded or irregular masses of ice that fall to earth. Hail normally falls near the center of the moving storm along with the heaviest rain. In some instances, strong winds at high altitudes can blow the hailstones away from the storm center, causing unexpected hazards at places that otherwise might not appear threatened. Hailstones normally range from the size of a pea to the size of a golf ball, but hailstones 1.5 inches or larger in diameter

[21] *Buffalo County, Wisconsin*, Hazard Mitigation Plan*, 2021 (www.buffalocountywi.gov).*

are not uncommon in the State of Wisconsin. Hailstones form when subfreezing temperatures cause water in thunderstorm clouds to accumulate in layers around an icy core. When strong underlying, updraft winds no longer can support their weight, the hailstones fall earthward. Hail tends to fall in swaths that may be 20 or more miles long and five or more miles wide and can fall continuously or sporadically in a series of hail strikes. Hail strikes are typically one-half mile wide and five miles long. Hail strikes may partially overlap, but often leave completely undamaged gaps between them.

Hailstorms are considered formidable among the weather and climatic hazards to property and farm crops because they dent vehicles and structures, break windows, damage roofs, and batter crops to the point that significant agricultural losses result. Falling hailstones can also cause serious injury and loss of human life and livestock, however these occurrences only rarely occur. In addition to impact damage, thick hail combined with heavy rain can clog storm sewers and contribute to stormwater flooding. Hail sufficiently thick to cover a road will pose a traffic hazard. The peak season for hailstorms in Wisconsin is May through September with approximately 85 percent of hailstorms occurring during this period.

Lightning

After floods, lightning kills the most people on average each year. Nationally, lightning has the highest total fatalities since 1940 out of all the severe weather hazards. From 2007 to 2015, Wisconsin reported six fatalities and 11 injuries caused by lightning.[22] However, the State has not reported a fatality caused by lightning since 2017.[23]

Lightning is defined as a sudden and violent discharge of electricity from within a thunderstorm due to a difference in electrical charges and represents a flow of electrical current from cloud to cloud or cloud to ground. Water and ice particles also affect the distribution of the electrical charge. Lightning bolts can travel 20 miles before striking the ground. The air near a lightning bolt can be heated to 50,000 degrees Fahrenheit (°F), which is five times hotter than the surface of the sun. The rapid heating and cooling of the air near the lightning channel causes a shock wave that results in thunder.

[22] *Wisconsin Department of Emergency Management and Military Affairs, State of Wisconsin Hazard Mitigation Plan, December 2016.*

[23] *Wisconsin Department of Emergency Management and Military Affairs, State of Wisconsin Hazard Mitigation Plan, December 2021.*

Lightning is a significant hazard associated with any thunderstorm and can cause extensive damage to buildings and structures, kill or injure people and livestock, start forest fires and wildfires, and damage electrical and electronic equipment. Lightning is a major cause of damage to farm buildings and equipment, responsible for more than 80 percent of all livestock losses, and is the number one cause of farm fires. From 2000 to 2015, Wisconsin had nearly $55 million in property and crop damages from lightning.

According to the NCEI storm events database, Washington County reported 16 lightning events during the period of 2001 to 2021 causing a reported $3.3 million in property damage and $1,130 in crop indemnities. Counties in southern Wisconsin experience a higher number of lightning events than other parts of the State due to higher thunderstorm frequency and more thorough documentation by the local media. Statistics have also shown that 92 percent of lightning-related fatalities occur during May through September, and 73 percent of these events occur during the afternoon and early evening. Approximately 30 percent of persons struck by lightning die and 74 percent of lightning strike survivors have permanent disabilities.

In addition, large outdoor gatherings (i.e., sporting events, concerts, campgrounds, etc.) are particularly vulnerable to lightning strikes that could result in injuries and deaths. Importantly, those who rely on the sound of thunder can oftentimes be misled as lightning can occur 20 miles away from the source thunderstorm. Also, individuals who are deaf or hard of hearing may have trouble identifying when to take shelter. As such, the slogan "Flash, Dash Inside," was created by and for people who are deaf and hard of hearing.[24]

Recent Events (2011-2021)

Based upon data published by NCEI, a total of 127 severe weather events have been recorded in Washington County between 2011 and 2021. This total includes thunderstorm winds, non-thunderstorm high winds, hail, and lightning (see Table 3.11). There have been no reported deaths or injuries due to these events, however there is an estimated $8 million (2021 dollars) in reported property and crop damages. A few examples of these recent events listed in Table 3.11 are noted below.

2012 – A cold front moving into a hot, unstable air mass over southeastern Wisconsin produced scattered strong to severe thunderstorms during the late afternoon hours of August 7, 2012. The thunderstorms

[24] *Wisconsin Department of Emergency Management and Military Affairs,* State of Wisconsin Hazard Mitigation Plan*, December 2021.*

produced large hail up to 1.75 inches in diameter that damaged trees, vehicles, homes, and outdoor equipment in Kewaskum in Washington County. This hailstorm lasted five to eight minutes. Roughly 200 vehicles suffered damage from the hail, as well as many homes, condos, apartments, and outdoor equipment. Property damages resulting from this storm was estimated as being over $2.4 million (2021 dollars).

2013 – The most damaging lightning event in Washington County occurred on August 22, 2013. Lightning struck a dump truck hauling granite along the southbound lanes of IH-41. The lightning blasted a three-foot long, 18-inch-deep hole in the pavement. It also caused the dump truck to lose some of its load. While there were no fatalities or injuries, three vehicles including the dump truck were damaged as a result of this lightning strike. Property damages were estimated at over $2.5 million (2021 dollars) for this event.

2017 – On June 12, 2017, a warm front and shortwave trough triggered a long line of severe thunderstorms that moved across southern Wisconsin. Significant wind damage occurred in some areas, including Washington County, which resulted in an estimated $56,000 (2021 dollars) in reported property damages.

2019 – On June 27, 2019, a warm front and shortwave trough brought a line of severe thunderstorms to southern Wisconsin. Straight-line damaging winds resulted in numerous reports of tree damage and some structural damage. Washington County had a reported $8,679 (2021 dollars) in property damages due to these high winds. To note, this is most likely an underestimate of the actual damages.

Vulnerability and Community Impact Assessment

In order to assess the vulnerability of the Washington County area to these severe weather hazards, a review of the community assets described in Chapter 2 indicate the potential for significant thunderstorm and related hazard impacts to: 1) a variety of residential, commercial, and other developed land uses; 2) agricultural lands; 3) roadway transportation system; 4) utilities; 5) critical community facilities; and 6) historic sites. Significant impacts may also be possible to other infrastructure or utility systems, or hazardous material storage sites. Additionally, manufactured homes can also be particularly vulnerable to damage from high winds associated with severe thunderstorms. The light weight, flat-sided construction, and tenuous foundation connections of mobile and manufactured homes can make them highly vulnerable to wind damage.

On average, historical severe weather events reported a 21-year period from 2001 to 2021 have resulted in about $75,000 of reported property damages and $19,400 of reported crop damages per event or a total

of about $94,400 per event (2021 dollars). However, a few events have been responsible for a large percentage of the total damages. Thus, the average damage cost is considered to be only a very approximate measure of potential damages. On average, there are 12.5 thunderstorm and related storm events per year in Washington County. Over this same period, thunderstorms and related storm hazards have resulted in about $896,600 in property damages and about $231,900 in crop damages per year for average annual total damages of about $1,128,463 (2021 dollars).

Future Changes and Conditions

Based upon recent data from the period 2011-2021 (Table 3.11), Washington County can expect to experience averages of 4 thunderstorm wind events per year, 4 hail events per year, 2 non-thunderstorm high-wind events per year, and 1 lightning event per year somewhere in the County. It should be noted that the historical record shows considerable variation among years in the number of these events that occurred. While it would be expected that in some years the County will experience either fewer events or more events than the average number, the average annual number of events is not expected to change.

The likely effect of climate change on severe weather events is not clear. While projections based upon downscaled climate model results indicate that the magnitude and frequency of heavy precipitation events are likely to increase by the middle of the 21st century, they do not address potential trends in wind, hail, or lightning conditions. Modeling studies utilizing the output of multiple climate models suggest that the number of days per year in which atmospheric environments that are known to support the formation of severe thunderstorms under current climatic conditions will increase between now and the end of the 21st century.[25] It should also be noted that wind strengths over the Great Lakes have increased and are expected to continue increasing in the future.[26] Surface wind speeds above the Great Lakes are increasing by about 5 percent per decade, exceeding trends in wind speed over land.

Changes in land use can have an impact on the potential for damage to occur from severe weather events. Such changes relate to the potential future increase in development within the County. Changing land use patterns within Washington County, as documented in Washington County's Multi-Jurisdictional

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[25] Noah S. Diffenbaugh, Martin Scherer, and Robert J. Trapp, "Robust Increases in Severe Thunderstorm Environments in Response to Greenhouse Forcing," Proceedings of the National Academy of Sciences, Volume 110, pages 16,361-16366, 2013.

[26] Ankur R. Desai, Jay A. Austin, Val Bennington, and Galen A. McKinley, "Stronger Winds Over a Large Lake in Response to Weakening Air-to-Lake Temperature Gradient," Nature Geoscience, Volume 2, pages 855-858, 2009.

Comprehensive Plan and VISION 2050 and summarized in Chapter 2 of this Report, indicate a potential increased risk of thunderstorm-related damage and related losses in the expanding urbanized areas within the County. Because of the mitigation actions that have been taken by the County, local units of government, and individuals, the current vulnerability to thunderstorms and related hazards has decreased in recent years. These ongoing mitigation measures are described further in Chapter 5.

Multi-Jurisdictional Risk Management

Based upon a review of the historic patterns of severe thunderstorms that along with high straight-line wind, hail, and lightning events in Washington County, there are no specific municipalities that have unusual risks. Rather, the events are considered to be relatively uniform and of countywide concern.

Tornadoes

Wisconsin lies along the northern edge of an area of the United States commonly known as "tornado alley." This area extends northeasterly along an axis extending from Oklahoma and Iowa in the west, to Michigan and Ohio in the east. This corridor accounts for one-fourth of the total tornadoes in a given year. The NWS issues, on average, 1 to 2 tornado warnings and about 11 tornado watches in Wisconsin per year.[27] As of 2022, there have been 23 reported tornadoes in Wisconsin.[28]

A tornado is defined as a violently rotating column of air extending from the ground up to the thunderstorm base. It generally lasts for only a short period. The tornado appears as a funnel-shaped column with its lower, narrower end touching the ground and upper, broader end extending into the thunderstorm cloud system. In some cases, the visible condensation cloud may not appear to reach the ground, but meanwhile tornado-force winds may be causing severe destruction (rotating winds can be nearly invisible, except for dust and debris). Similar events, not reaching the land surface, are known as funnel clouds. Funnel clouds may be a precursor to a tornado event. In Wisconsin, tornadoes usually occur in company with thunderstorms formed by eastward-moving cold fronts striking warm moist air streaming up from the south. However, it is not possible to predict tornado activity based upon the occurrence of thunderstorms. But, occasionally, multiple outbreaks of tornadoes occur along the storm frontal boundaries, affecting large areas of the State at one time. Tornadoes generally occur near the trailing edge of a thunderstorm. It is not uncommon to see clear, sunlit skies behind a tornado.

[27] *www.weather.gov.*

[28] *www.ncdc.noaa.gov.*

Historically, tornadoes have been categorized based upon the most intense damage along their paths using the Fujita Scale. Since February 2007, the Fujita Scale has been replaced by the Enhanced Fujita Scale, which retains the same basic design of its predecessor with six tornado strength categories. This scale is shown in Table 3.12. The newer scale reflects more refined assessments of tornado damage surveys, more standardization, and consideration of damage over a wider range of structures.

The destructive power of the tornado results primarily from its high-wind velocities, wind-driven debris, and uplifting force. These characteristics probably account for 90 percent of tornado-caused damage. Since tornadoes are generally associated with severe storm systems, hail, torrential rain, and intense lightning usually accompany tornado events. In addition, tornadoes may be accompanied by downbursts, events which are characterized by strong downdrafts initiated by a thunderstorm that manifest as straight-line winds on or near the ground. These winds can be powerful, with speeds up to 70 to 100 mph. These winds interact with tornadoes and can affect the path of the tornado event in such a manner as to make tornadoes somewhat unpredictable. Depending on their intensity, tornadoes can uproot trees and crops, down power lines, and damage or destroy buildings and infrastructure. Flying debris can cause serious injury and death to humans, livestock, and wildlife in their path. An approaching cloud of debris can mark the location of a tornado, even if the classic funnel cloud is not visible. Before a tornado hits, the wind may die down and the air may become very still.

The NWS monitors severe weather nationwide from its Norman, Oklahoma office. This office is the only entity that can issue a tornado watch. The NWS office in Milwaukee/Sullivan, and the Washington County Office of Emergency Management may issue tornado warnings.[29] A tornado watch means that tornadoes are possible, and that persons within the area for which the watches are issued should remain alert for approaching storms. A tornado warning means that a tornado has been sighted in an area or indicated as likely to have occurred based on weather radar. When tornado warnings are issued for an area, people near and within that designated area are advised to move to a pre-designated place of safety. As discussed previously, Table 3.5 shows the total number of tornado watches and warnings in Washington County from 2001 through 2021.

[29] All outdoor warning sirens in Washington County are owned and operated by the local municipalities with the exception of the siren located the county fairgrounds, in which that one is own and operated by the County.

Recent Events (2011-2021)

In the State of Wisconsin, tornado paths historically have averaged 3.5 miles in length and 50 yards in width, although tornadoes of a mile or more in width and 300 miles in length have been known to occur elsewhere in the United States. On average, tornadoes in Southeastern Wisconsin move across the land surface at speeds of between 25 and 45 miles per hour, although overland speeds of up to 70 mph have been reported. Tornadoes rarely last more than a few minutes over a single spot or more than 15 to 20 minutes in a 10-mile area, but, in those few minutes, significant devastation may occur.

The gravity of any particular tornado event is measured in terms of resulting deaths, injuries, and economic losses. The magnitudes of the tornadoes recorded in Southeastern Wisconsin have been low, primarily EF0 or EF1 events on the Enhanced Fujita Scale (see Table 3.12). Nevertheless, tornadoes are second only to floods as the costliest natural hazards to impact Southeastern Wisconsin.

Notable tornado events that have occurred recently in Washington County are described in the following paragraphs (Table 3.13).

June 23, 2004 – This was the fifth largest tornado outbreak recorded in Wisconsin. Seventeen tornadoes were reported along with damaging straight-line winds and large hail. Two of these tornadoes affected Washington County, with one being responsible for about $14,651 in reported property damages and $73,255 in reported crop damages (both 2021 dollars). The second tornado in this outbreak was a brief F0 tornado. No casualties or damages were reported.

June 18, 2006 – This F1 tornado caused about $5.5 million in property damages (2021 dollars). These damages include the complete destruction of the roof of Lincoln Elementary School and the collapse of a wall and the roof at a local motel. About 147 homes sustained damages, with 12 homes experiencing structural damages and 135 homes experiencing minor damage, mostly to roofs and siding. In addition, there were numerous fallen trees and downed power lines and ten businesses also sustained damages. About 300 We Energies customers lost electric power due to this tornado event. There were no reported casualties, however one person was directly injured and two people were indirectly injured.

Vulnerability and Community Impact Assessment

In order to assess the vulnerability of the Washington County area to tornado hazards, a review of the community assets described in Chapter 2 was made which indicates the potential for significant tornado impacts to: 1) a variety of residential (including manufactured homes), commercial, and other developed

land uses; 2) agricultural lands; 3) roadway transportation system; 4) critical community and public safety facilities; and 5) historic sites. Significant impacts may also be possible to other infrastructure or utility systems, solid waste disposal sites, or hazardous material storage sites.

Based on the NCEI 57-year record history, 19 tornadoes have been reported in Washington County between 1950 and 2021 (see Table 3.13), with about one tornado occurring every 3 years in Southeastern Wisconsin. In total, these 19 tornadoes have resulted in about $83.3 million in reported property damages, $233,500 in reported crop damages, three fatalities, and 57 injuries. It should be noted that most of the property and crop damages, injuries and all of the deaths are a result of only a few of the reported 19 tornadoes. From the distribution of the 19 tornado events, shown on Map 3.7, the tornado locations are widely scattered throughout the County.

During a tornado, homes, businesses, public buildings, and infrastructure may be damaged or destroyed by high winds, rain, and hail. Airborne debris, carried by the tornado and associated high winds, can break windows and doors, allowing winds and rain access to interior spaces. Fixed infrastructure, such as roads and bridges, can also be damaged by exposure to high winds. Although more transportation system damage appears to result from washout associated with flash flooding and debris jams, as opposed to direct damage due to contact with funnel clouds. In an extreme tornado event, such as an F4 event, the force of the wind alone can cause tremendous devastation, uprooting trees, toppling power lines, and inducing the failure of weak structural elements in homes and buildings. Due to the unpredictability of tornado events, all buildings, infrastructure, and critical facilities within the County are considered at risk.

Future Changes and Conditions

Changes in land use can have an impact on the potential for damage due to tornadoes and related hazards to occur. Such changes relate to the potential future increase in development within the County. The changing land use patterns within Washington County, as documented and summarized in Chapter 2, indicate a continuing level of moderate risk of tornado damage and related losses in the County. Because of the mitigation actions that have been taken by the County and local units of government and individuals, the current vulnerability to tornadoes and related hazards has generally decreased in recent years. These ongoing mitigation measures are described further in Chapter 5.

The likely effects of climate change on tornado frequency and severity are not clear. The projections based upon downscaled climate model results do not address potential trends in tornado conditions. A recent study that examined the evolving contributors of risk and vulnerability for tornadoes found that growth in

the human-built environment is projected to dominate the impact of future tornados. An increase in risk and exposure of tornadoes may lead to a significant increase in the magnitude and disaster impact of tornadoes on that built environment from 2010 to 2100.[30] Additionally, high-risk tornado regions may experience increased disaster probability and historically vulnerable regions may be at greater risk of tornado damages due to a combination of factors: increased tornado risk, rapidly amplified exposure, and pre-existing social and physical vulnerabilities.

Multi-Jurisdictional Risk Management

Based upon a review of the historic patterns of tornado events in Washington County, there are no specific municipalities that have unusual risks. Rather, the events are considered to be relatively uniform and of a countywide concern.

Severe Winter Storms

Winter storms can vary in size and strength and include heavy snowstorms, blizzards, freezing rain, sleet, ice storms, and blowing and drifting snow conditions. Extremely cold temperatures accompanied by strong winds can result in wind chills that cause bodily injury, such as frostbite and death. 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**—An occurrence of sustained wind or frequent gusts of 35 mph or higher accompanied by falling or blowing snow, and visibilities of one-quarter mile or less, for three or more hours.

- **Ice Storm**—An occurrence of rain falling from warmer upper layers of the atmosphere to the colder ground, freezing upon contact with the ground and exposed surfaces, resulting in ice accumulations of one-quarter inch or more within 12 hours or less.

- **Freezing Drizzle/Freezing Rain**—The effect of drizzle or rain freezing upon impact on objects that have a temperature of 32°F or below.

[30] *Strader, S. M., Ashley, W. S., Pingel, T. J., & Krmenec, A. J. (2017).* Projected 21st Century Changes in Tornado Exposure, Risk, and Disaster Potential. Climatic Change, *141(2), 301–313. doi.org/10.1007/s10584-017-1905-4.*

- **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.

Much of the snowfall in Wisconsin occurs in small amounts of between one and three inches per occurrence. Heavy snowfalls that produce at least six inches of accumulation in one county happen on average about ten to 12 times per winter statewide.[31] The northwestern portion of Wisconsin receives most of its snow during early and late season storms, while southwestern and southeastern counties receive heavy snows more often in mid-winter. Snowfall amounts in Washington County average 30 and 40 inches per season.

Blizzard-like conditions often can occur during heavy snowstorms when gusty winds cause severe blowing and drifting of snow, even if the conditions did not last long enough to be considered a true blizzard. True blizzards are not common in Wisconsin. However, when they do occur, they tend to affect the eastern counties near Lake Michigan. This is due to less frictional drag over Lake Michigan which allow northwest windstorms to reach higher speeds. Blizzards are more likely to occur in northwestern Wisconsin than in southern portions of the State, even though heavy snowfalls are more frequent in the southeast. Blizzard-like conditions often exist during heavy snowstorms when gusty winds cause severe blowing and drifting of snow. According to NCEI, and shown in Table 3.15, the most recent blizzard event recorded in Washington County occurred on February 1, 2011. Prior to 2011, there have been five other reported blizzards in the County (1996, 1997, 1999, 2007, and 2010).[32]

Freezing rain, ice, and sleet storms can occur at any time from October into April in Wisconsin. In a typical winter season, there are three to five light freezing rain events in the southeastern Wisconsin region. On average, a major ice storm occurs about once every other year somewhere in the State and once every seven years over southeastern Wisconsin. If one-half inch of rain freezes on trees and utility wires, extensive damage can occur, especially if accompanied by high winds that compound the effects of the added weight of the ice. There are also between three and five instances of glazing (less than one-quarter of an inch of

[31] *Wisconsin Department of Emergency Management and Military Affairs,* State of Wisconsin Hazard Mitigation Plan*, December 2021*.

[32] *www.ncdc.noaa.gov*.

ice) throughout the State during a normal winter. The most recent recorded ice storm in Washington County was in 2008.

Recent Events (2011-2021)

Generally, the winter storm season in Wisconsin runs from October through March. Severe winter weather has occurred, however, as early as September and as late as the latter half of April and into May in some locations in the State. The average annual duration of snow cover in Washington County is approximately 85 days. Table 3.15 lists recent winter hazard events that occurred in Washington County from 2011 to 2021. A few examples of recent winter storm events in Washington County are described below.

2011 – During the overnight hours of February 1 to February 2, 2011, a powerful low-pressure center passing south of Wisconsin produced blizzard conditions across much of southern Wisconsin (the Groundhog Day Blizzard of 2011). Snow associated with the system began in the mid-afternoon hours in far southern Wisconsin and pushed northward into the State through the evening. Twenty-four hour snowfall totals were between 20 and 26 inches in southeastern Wisconsin. This was in addition to several inches of snow that had fallen on January 31. Very strong winds were associated with this storm for an extended period of time. Sustained northeast winds of 30 to 40 mph were common throughout the event, with peak wind gusts between 45 and 65 mph. The lakeshore observation site at Sheboygan reported a 55 mph wind gust. The combination of high winds and heavy snow created widespread sustained visibilities of less than one-quarter mile, with frequent whiteout conditions and near zero visibilities. Many locations saw blizzard conditions beginning during the evening of February 1 and continuing through the early morning hours of February 2. Snow drifts of four to 12 feet were common, with reports of some drifts reaching up to 15 feet in open rural areas. Drifting snow closed county highways and roads with many stranded motorists having to be rescued from vehicles buried in the drifting snow. About 100 National Guardsman were mobilized statewide in response to the Governor's emergency declaration for 29 counties. At the height of the storm, We Energies reported 5,200 customers were without power across southeastern Wisconsin. A Presidential disaster declaration was issued for 11 Wisconsin Counties, including Washington County, which received about $395,575 in public assistance under this declaration.

2015 – Intensifying low pressure tracked from the central Great Plains to southeast Indiana the night of January 31st into the evening of February 1st. This resulted in a long duration winter storm and blizzard over portions of southern Wisconsin. Snowfall of 6 to 14 inches accumulated over southern and eastern Wisconsin. Winds gusted from 30 to 40 mph with blizzard conditions, including frequent whiteouts from heavy and blowing snow, in Racine and Kenosha Counties. Vehicle slide-offs and accidents were prevalent.

The Milwaukee County Medical Examiner Office reported the deaths of three men who died after collapsing from shoveling snow.

Vulnerability and Community Impact Assessment

Between 2011 and 2021, 105 winter weather events have affected Washington County. Based on this, it is estimated that Washington County experiences an average of 9.5 winter weather events per year. It should be noted that during this time period there has been considerable variation around this average, with the County experiencing as few as five winter storm events in some years and as many as 17 winter storm events in other years (Table 3.15).

The NCEI database contains no reports of property damages or crop damages for winter storms. For Washington County, records of crop insurance indemnities from the U.S. Department of Agriculture Risk Management Agency show that about $487,084 have been paid out between 2011 and 2021 due to damage caused by winter related weather, such as frost, freeze, or snow. Since 2001, about $39,798 in property damages have been reported as having been caused by winter weather events in Washington County.

Winter storms present a serious threat to the health and safety of affected citizens and can result in significant damage to property. Snow and ice are the major hazards associated with winter storms and are the eighth most destructive natural hazard in Wisconsin. Snow and ice can cause traffic accidents, bring down telephone and power lines, damage trees, impede transportation, burst water pipes, and can tax the public's capabilities for snow removal during heavy storms. A major winter storm can have a serious impact on a community. Loss of heat and mobility are key complications that contribute to winter storm fatalities.

Ice storms and freezing rain are less common than snow but produce road conditions that can make travel hazardous. Even fog or mist on cold roads can produce a glaze of ice that makes travel slippery and dangerous. Accumulated ice can cause the structural collapse of buildings, bring down trees and power lines, causing property damage, loss of power, and isolate people from assistance or services.

Future Changes and Conditions

As previously noted, upon recent data Washington County can expect to experience an average of 9.5 winter storm events per year. It should be noted that the historical record shows considerable variation among years in the numbers of these events that occurred. While it would be expected that in some years the County will experience either fewer events or more events than the average number, over the five-year term of this plan update the average annual number of events is not expected to change.

As discussed in Chapter 2 of the Report, changes in the 20th century and projections based on downscaled results from climate models indicate that there will likely be changes in winter storm conditions affecting Washington County over the 21st century. It is projected that by 2055, the average amount of precipitation that Washington County receives during the winter will increase by about 0.5 to 1.0 inch (measured as water), an increase of about 25 percent.[33] Due to increasing winter temperatures, the amount of precipitation that falls as rain during the winter rather than as snow is projected to increase significantly. It is also projected that freezing rain will be more likely to occur.

Multi-Jurisdictional Risk Management

Based upon a review of the historic patterns of winter storm events in Washington County, there are no specific municipalities that have unusual risks. Rather, the events are of a uniform countywide concern.

Extreme Heat

The Centers for Disease Control and Prevention (CDC) reports that nationwide between 2018 and 2020 a total of 3,066 heat-related deaths occurred.[34] Excessive heat has become the deadliest hazard in Wisconsin. According to the NWS, 22 people have died in Wisconsin directly as a result of heat waves from 2011 to 2021. Temperature data for two selected observation stations in the Cities of Hartford and West Bend in Washington County are shown in Table 3.15. The table shows extreme high and low temperatures and the departure from average temperatures recorded in the period from 2011 through 2021. The average high and low extreme temperatures for this period were 92.4ºF and -18.1ºF for the City of Hartford station and 93.0ºF and -13.9ºF for the City of West Bend station. Prolonged human exposure to either of these temperature extremes could present a significant danger.

Heat and humidity together can create the most severe problems for human health. High humidity makes heat more dangerous because it slows the evaporation of perspiration, which is the body's natural cooling process. The Heat Index (HI) is a measure of discomfort and the level of risk posed to people in high-risk groups by heat and humidity. The HI is expressed in degrees Fahrenheit (ºF) and incorporates an adjustment to the air temperature for relative humidity (RH). For example, if the air temperature is 94ºF and the RH is 55 percent, the HI would equal about 106ºF (see Figure 3.1). Since HI values were devised for shady, light

[33] Wisconsin Initiative on Climate Change Impacts, 2011, op. cit.

[34] Merianne R. Spencer and Matthew F. Garnett., "Quick Stats: Percentage Distribution of Heat-Related Deaths, by Age Group – National Vital Statistics System, United States, 2018-2020". MMWR Morbidity and Mortal Weekly Rep 2022; 71:808. June 17, 2022.

wind conditions, exposure to full sunshine can increase HI values by up to 15ºF. The impact to people in high-risk groups associated with different levels of HI is shown in Table 3.16. The NWS will initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of a heat wave determines whether advisories or warnings are issued. High temperature periods are often also accompanied by the air quality problems related to ground-level ozone which can be harmful, especially to sensitive groups, such as active children and adults with respiratory problems.

The following heat event definitions/criteria are used for the 20 counties in south-central and southeastern Wisconsin served by the Milwaukee/Sullivan Weather Forecast Office:

- **Outlook Statement**—Issued two to seven days prior to the time that minimal Heat Advisory or Excessive Heat Warning conditions are expected. Serves as a long-term "heads-up" message.

- **Excessive Heat Watch**—Issued 24 to 48 hours in advance when Excessive Heat Warning conditions are expected.

- **Heat Advisory**—Issued six to 24 hours in advance of any 24-hour period in which daytime heat indices are expected to be 100° to 104°F, or 95° to 99°F for four or more consecutive days, and nighttime heat indices are greater than or equal to 75°F. Advisories are issued for less serious conditions that cause significant inconvenience and, if caution is not exercised, could lead to situations that may threaten life.

- **Excessive Heat Warning**—Issued six to 24 hours in advance of any 48-hour period in which daytime heat indices are expected to exceed 105°F for three or more hours, and nighttime heat indices are greater than or equal to 75°F. In addition, if Heat Advisory conditions are expected to persist for four or more days, then an Excessive Heat Warning will be issued. Warnings are issued for weather conditions posing a threat to life.

During extended periods of very high temperature, coupled with high humidity levels, individuals can suffer a variety of ailments, including heat cramps (muscular pains and spasms due to heavy exertion). Although heat cramps are the least severe heat-related ailment, they are an early signal that the body is having trouble with the heat. Heat exhaustion typically occurs when people exercise heavily or work in a hot, humid place where body fluids are lost through heavy sweating. Blood flow to the skin increases, causing blood flow to

decrease to the vital organs. This results in a form of mild shock. If not treated, the victim may suffer heat stroke. Heat stroke is life threatening and requires immediate medical attention. The victim's temperature control system, which produces sweat to cool the body, stops working. The body temperature can rise so high that brain damage and death may result if the body is not cooled quickly. Sunstroke is another term for heat stroke. In addition to posing a public health hazard, periods of excessive heat usually result in high electrical consumption for air conditioning, which can cause power outages and brown outs.

Most heat-related deaths occur in cities. Large urban areas often become "heat islands." Brick buildings, asphalt streets, and tar roofs store and radiate heat like a slow burning furnace. Heat builds up in a city during the day and cities are slower than rural areas to cool down at night. The amount of sunshine is an important contributing factor in urban heat waves. In addition, the stagnant atmospheric conditions associated with a heat wave trap ozone and other pollutants in urban areas. The worst heat disasters, in terms of loss of life, happen in large cities when a combination of high daytime temperatures, high humidity, warm nighttime temperatures, and an abundance of sunshine occurs for a period of several days. There are also socioeconomic problems that make some urban populations at greater risk. The elderly, disabled, and debilitated are especially susceptible to heat-related illness and death.

Recent Events (2011-2021)

Extreme heat that affects Washington County are not localized events, as they usually encompass the entire south-central to southeastern portion of the State and may continue for several days or weeks. Table 3.17 lists the recent extreme heat events in Washington County from 2011-2021. As indicated in the table, around $201,290 (2021 dollars) was reported in crop loss during that time period. A few examples of recent events from the table are noted below.

2012 – During the days of July 1-7, 2012, a hot air mass settled over southern Wisconsin, bringing 100-degree heat to many locations for multiple days. Maximum heat indices climbed between 100° and 115°F during the hot spell. Based on news reports, hundreds of people received medical treatment at hospitals or clinics due to heat-related illnesses. Numerous new daily record highs were set as well as record high minimums. The long duration of this excessive heat period likely makes these one of the four most dangerous heat waves to strike southern Wisconsin in recorded history.

2018 – On June 29, 2018, hot and humid conditions produced heat index values ranging from 100° to 110°F. Numerous cooling centers were opened by local communities throughout southern Wisconsin. Some public swimming pools hours were extended due to the heat. The heatwave continued into July 1st.

2019 – On July 19, 2019, the passage of a warm front brought a heat wave to southern Wisconsin with maximum heat index values of 99° to 106°F. The Milwaukee and Madison areas did experience an influx of emergency room visits due to heat exhaustion and/or heat stroke.

Vulnerability and Community Impact Assessment

Heat extremes are primarily a public health concern. The poor, disabled, very young, and elderly are much more susceptible to temperature-related deaths and injury. Education, improved social awareness, and community outreach programs have likely helped to reduce the number of individuals killed or injured by extreme temperature events. Most deaths during a heat wave are the result of heat stroke. Large and highly urbanized cities can create an island of heat that can raise the area temperatures by 3° to 5°F. Therefore, urban communities with substantial populations of elderly, disabled, and debilitated people could face a significant medical emergency during an extended period of excessive heat. Some residents in high crime areas, especially the elderly, are afraid to open windows or go out to cooling shelters. As neighborhoods change, some older residents become isolated because of cultural, ethnic, and language differences.

The Building Resilience Against Climate Effects (BRACE) program in the Wisconsin Department of Health Services has compiled heat vulnerability index maps for the State and each county. The results of the Washington County heat vulnerability index are shown in Figure 3.2. The heat vulnerability index is based on multiple indicators associated with risk for heat-related illnesses and mortality including health factors, demographic and household characteristics, natural and built environment factors, and population density. As indicated in Figure 3.2, areas within Washington County that have the highest vulnerability to an extreme heat event include portions of the Cities of Hartford and West Bend, portions of the Village of Germantown, and portions of the Towns of Hartford and West Bend.

High demands for electricity during extreme heat events can result in blackouts and brown outs. Loss of water pressure can result from opening of fire hydrants in urban areas. Stagnant atmospheric conditions that occur with heat waves are also favorable for trapping ozone and other pollutants in urban areas. Pets and livestock can suffer from prolonged exposure to excessive heat. On average, there are about 1.3 extreme heat events per year in Washington County that can have an impact on people, pets, and other forms of life.

A review of the community assets described in Chapter 2 indicate the potential for extreme heat hazard events to impact: 1) residents at a countywide level, especially the poor, elderly, and sick, 2) agricultural croplands; 3) pets and livestock; 4) municipal water and electric utilities; and 5) natural surface and

groundwater reserves. No specific cost data are estimated for extreme heat events because the nature of such events does not readily permit direct cost analysis.

Future Changes and Conditions

Based upon recent data, Washington County can expect to experience an average of 1.3 extreme heat events per year. It should be noted that the historical record shows variation among years in the numbers of these events that occurred. While it would be expected that in some years the County will experience either fewer events or more events than the average number, the average annual number of events is not expected to change over the five-year term of this plan update.

The projections based on downscaled results from climate models indicate that there will likely be substantial changes in the frequencies of extreme heat events over the 21st century. Extreme heat events are likely to occur more frequently and to be more severe by the middle of the century. As previously described in Chapter 2, average summertime temperatures in Washington County are projected to increase by 4.0°F by year 2060.[35] The number of days per year in which temperatures in southern Wisconsin exceed 90°F is expected to triple by 2055.[36] Given that much of the documented increases in average temperature since 1950 have occurred through increases in night-time low temperatures, it is likely that there will be fewer night-time breaks in the heat during extreme heat events in the future. This could result in some extreme heat events persisting longer. Heat waves have direct impacts on human health, especially among sensitive populations such as the young children and the elderly. In the absence of mitigative measures, the projected increase in the frequency, duration, and severity of heat waves will be likely to cause increases in fatalities and illnesses related to extreme heat.

Multi-Jurisdictional Risk Management

Based upon a review of the historic patterns of extreme heat events in Washington County, there are no specific municipalities that have unusual risks. Rather, the events are of a uniform countywide concern.

Extreme Cold

Like extreme heat, extreme cold is also a deadly hazard. The CDC reports that the death rate of excessive cold as the underlying cause ranges from 1 to 2.5 deaths per million people and over 19,000 people have

[35] *Wisconsin Initiative on Climate Change, website, wicci.wisc.edu.*

[36] *Wisconsin Initiative on Climate Change Impacts, 2011,* op. ct.

died from exposure to cold since 1979.[37] Exposure to extreme cold temperatures can also cause a number of health conditions and can lead to loss of fingers and toes, or cause permanent kidney, pancreas, and liver injury, and even death. These health impacts often result from a combination of cold temperatures, winds, and precipitation. As a result, winter storms can pose substantial risks because they can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. In addition, when deaths and injuries due to cold-related events such as vehicle accidents and fatalities, fires due to dangerous use of heaters, carbon monoxide poisoning due to use of nontraditional sources of heat such as cooking ovens, and other winter weather fatalities are considered, the impact of severe cold periods becomes even greater.

Frostbite and hypothermia are two major health risks associated with severe cold. Frostbite is an injury caused by freezing of the skin and underlying tissues. Frostbite causes a loss of feeling and a white or pale appearance in extremities. Severe frostbite can damage skin and underlying tissues and requires medical attention. Potential complications of severe frostbite include infection and nerve damage. Frostbite is most common on fingers, toes, nose, ears, face, and chin. While exposed skin in cold, windy weather is most vulnerable to frostbite, this injury can also occur on skin covered by gloves or other clothing.

Hypothermia is a condition brought on when the core body temperature drops to less than 95°F. It occurs when the body loses heat more quickly than it is able to produce it. As with frostbite, wind or wetness can contribute to producing hypothermia. Symptoms of moderate to severe hypothermia include lack of coordination, slurred speech, confusion, drowsiness, progressive loss of consciousness, weak pulse, and shallow breathing. Hypothermia may cause lasting kidney, liver, and pancreas problems or death. Members of certain populations are particularly vulnerable to hypothermia. These include older adults, infants, and very young children, the homeless, persons consuming alcohol or other drugs, and persons taking certain medications.

Wind chill is an index used to evaluate the risk posed by the combination of cold temperatures and wind. It is based on temperature and wind speed. Table 3.18 shows the wind chill table used by the National Weather Service. Wind chill is not the actual temperature, but rather a measure of how the combination of wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down body temperature. This combination can strongly affect the risks associated with exposure to extreme cold. For example, a wind chill of -20°F will cause frostbite on exposed skin in just 30 minutes.

[37] *CDC, 2018.*

The NWS issues wind chill advisories when wind chill temperatures are potentially hazardous and wind chill warnings when wind chill temperatures are life threatening. The exact criteria of a wind chill advisory and warning varies from state to state. A wind chill advisory in Wisconsin is issued when wind chill values reach -20°F to -34°F, with wind speeds of 4 mph or more. A wind chill warning in Wisconsin is issued when wind chill values reach -35°F or colder, with wind speeds of at least four mph for three hours or more. In addition, a wind chill watch is issued 12 to 48 hours before these conditions are expected to occur.

What constitutes extreme cold varies in different parts of the country. In the south, near freezing temperatures are considered extremely cold. Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. In the north, extreme cold means temperatures well below zero. Winter residents in Washington County may see heavy snow, strong winds/blizzards, extreme wind chill, lake-effect snow, and ice storms. The public can stay informed by listening to NOAA Weather Radio, commercial radio or television for the latest winter storm warnings and watches.

Recent Events (2011-2021)

Extreme cold that affects Washington County are not localized events, as they usually encompass the entire south-central to southeastern portion of the State and may continue for several days or weeks. Between 2011 and 2021, as shown in Table 3.19, there has been an estimated $73,288 in total crop damages that have affected Washington County as a result of extreme cold temperatures. Several of the extreme cold events listed in Table 3.19 are described below.

2013 – On January 21, 2013, arctic air spread into southern Wisconsin behind deep low pressure that tracked to the north of the state. High winds combined with surface temperatures in the negative single digits to produce wind chills between -20° to -30°F. The frigid wind chills began the morning of January 21 and continued into the morning hours of January 22.

2014 – On January 27, 2014, an arctic cold wave affected southern Wisconsin. West to northwest winds of 10 to 20 mph with the passage of an arctic cold front brought wind chill temperatures of -20° to -38°F beginning in the early morning of January 27. These wind chills did not end until the morning of January 29. The coldest period was the morning of January 28 when wind chills ranged from -30° to -38°F. Widespread school and business closings occurred during this time. The Governor declared a state of emergency due to a propane shortage across the state. Numerous water main breaks and frozen laterals

continued to occur throughout the entire month of January. Two cold weather deaths occurred in the southeastern Wisconsin area.

2019 – On January 29, 2019, during the end of January 2019, a dangerously cold air mass settled across the upper Midwest. It was the coldest air mass since 1996 and it brought three days of sub-zero temperatures with wind chills of -30° to -60° F. At first, schools were closed only due to the snow, but by the middle of the week the Governor declared a state of emergency because of the dangerous cold. Many businesses had to close, and postal services were suspended.

Vulnerability and Community Impact Assessment

Similar to extreme heat, extreme cold is primarily a public health concern, with the impoverished and elderly being much more susceptible to extreme temperature-related deaths and injury. Pets and livestock can also suffer from prolonged exposure to excessive cold. Severe cold temperatures can cause breaks in water mains that can interrupt the water supply. The impacts of a water main break depend on the size and location of the main. Frozen service laterals can also interrupt water supply to individual buildings and be costly to municipalities.

Although no property damages have been reported as a result of extreme cold events, there have been several reported incidents of crop damages between 2011-2021, as previously noted (see Table 3.19). Based on this data, there are about 1.3 extreme cold events per year in Washington County.

A review of the community assets described in Chapter 2 indicate the potential for extreme cold hazard events to impact: 1) residents at a countywide level, especially children, underprivileged, elderly, and sick, 2) agricultural croplands; 3) pets and livestock; 4) municipal water and electric utilities; and 5) natural surface and groundwater reserves. No specific cost data is estimated for extreme cold events because the nature of such events does not readily permit direct cost analysis.

Future Changes and Conditions

As mentioned previously, Washington County can expect to experience an average of 1.3 extreme cold events per year. It should be noted that the historical record shows considerable variation among years in the numbers of these events that occurred. While it would be expected that in some years the County will experience either fewer events or more events than the average number, the average annual number of events is not expected to change over the five-year term of this plan update.

The projections based on downscaled results from climate models indicate that there will likely be substantial changes in the frequencies of extreme cold events over the 21st century.[38] The frequency of extreme cold events may decrease by the middle of the century as projected warming trends are expected to be greatest during the winter. Average winter temperatures in Washington County are projected to increase by about 5.0°-6.0°F. This may result in a reduction of some risks associated with extreme cold.

Multi-Jurisdictional Risk Management

Based upon a review of the historic patterns of extreme temperature events in Washington County, there are no specific municipalities that have unusual risks. Rather, the events are of a uniform countywide concern.

Drought

Drought is the result of a natural decline in the expected precipitation over an extended period of time, and occurs in virtually every climate on the planet, including areas of high and low precipitation. The severity of drought can be aggravated by other climatic factors, such as prolonged high winds, high temperatures, and low relative humidity. Drought is a complex natural hazard which is reflected in the following four definitions commonly used to describe it.

1. Meteorological drought: The degree of dryness, expressed as a departure of actual precipitation from expected average or normal amount, based on monthly, seasonal, or annual time scales

2. Hydrological drought: The effects of precipitation shortfalls on streamflow, reservoir, lake, and groundwater levels

3. Agricultural drought: Soil moisture deficiencies relative to water demands of crop life

4. Socioeconomic drought (or water management drought): Occurs when the demand for water exceeds the water supply, resulting in a water shortage

Drought severity depends on several factors, including its duration, its intensity, its geographic extent, and the demands for water for use by both humans and vegetation.

[38] *Wisconsin Initiative on Climate Change Impacts, 2021, op. cit.*

Drought can be difficult to define in exact terms. This is partly due to its multi-dimensional nature and partly due to the ways it differs from other natural hazards. There is no exact and universally accepted definition of what constitutes a drought. The onset and end of a drought are difficult to determine due to the slow accumulation of its impacts and the lingering effects after its apparent end. The impacts of drought are less obvious than those of some other hazards and may be spread over a larger geographic area. These characteristics have hindered the preparation of drought contingency or mitigation plans by many governments and can make it difficult to perform an accurate risk assessment analysis.

Droughts can have several impacts. They can reduce water levels and flows in surface waterbodies and groundwater. This can cause shortages of water for human and industrial consumption, hydroelectric power, recreation, and navigation. Water quality may also decline, and the number and severity of wildfires may increase during a drought. Severe droughts may result in reduced yields or the loss of agricultural crops and forest products, undernourished wildlife and livestock, and lower land values.

One method to measure the magnitude of a drought is by using the Palmer Drought Severity Index. This method considers factors like temperature, soil moisture, and precipitation, which are entered into an algorithm that returns results between -5 (extreme drought) and 4 (extremely moist) with zero being normal conditions. The U.S. Drought Monitor uses the Palmer Index, along with other indicators, to rate drought conditions into drought categories, as described in Figure 3.3.

The Crop Moisture Index was developed to measure soil moisture over shorter periods, up to four weeks, and has values between -3 (severely dry) and 3 (excessively wet), with zero as normal conditions. The NWS Climate Prediction Center publishes both Palmer Drought Severity and Crop Moisture indices for the country weekly.[39]

Wisconsin is vulnerable to agricultural drought. The State has approximately 14.2 million acres of farmland on 64,100 farms.[40] Even small droughts of limited duration can significantly reduce crop growth and yields, adversely affecting farm incomes and local economies. Droughts significantly increase the risk of forest fires and wildfires. Additionally, the loss of vegetation in the absence of sufficient water can result in flooding, even from average rainfall.

[39] *Wisconsin Department of Emergency Management and Military Affairs,* State of Wisconsin Hazard Mitigation Plan*, December 2021.*

[40] *State of Wisconsin Department of Agriculture, Trade and Consumer Protection, 2022 Wisconsin Agricultural Statistics.*

Estimates of agricultural losses experienced in Washington County due to drought over the period 2011 to 2021 are shown in Table 3.20. Due to the minimal crop damage reporting with NCEI data, these estimates come primarily from records of indemnities paid to agricultural operators by Federal crop insurance programs.[41] The documented loss estimates reflect several factors. First, crop losses often go unreported. Second, Federal crop insurance policies offer coverage to only certain types of crops in any particular year. Third, agricultural operators generally insure only a portion of their crops when purchasing Federal crop insurance. Thus, crop loss estimates are likely to represent underestimates of actual losses. It should be noted that indemnities for drought related losses were paid out in most years. This probably reflects variability in rainfall causing localized crop losses. Based on these sources, it is estimated that Washington County experienced crop damages in excess of $5.5 million between 2011 and 2021. Due to the variability in crop damages paid, an average loss cannot be calculated.

Small droughts of shortened duration have occurred in Wisconsin at an interval of about every 10 years since the 1930s. Extended, widespread droughts have been infrequent in Wisconsin. The most significant droughts, in terms of severity and duration, are 1929-1934, 1948-1950, 1955-1959, 1976-1977, 1987-1989, 1995, and 2012.

The 1929-1934 drought probably was the most significant in Wisconsin history considering its duration, as well as its severity. This drought affected a large majority of the United States and contributed to the Dust Bowl period that greatly damaged agriculture throughout the Country (see Figure 3.4). Wisconsin experienced at least a 75-year recurrence drought interval in most of the State and over 100-year recurrence drought interval in certain areas (see Figure 3.5).[42] The severe economic impact of the Depression compounded the effects of this drought. The drought continued with somewhat decreased effect until the early 1940s in some parts of the State.

Another extremely dangerous drought was the 1987-1989 drought. Many people believed it to be the most severe drought experienced in Wisconsin and much of the Midwest. It was characterized by below normal precipitation, persistent dry air, and above normal temperatures. Heatwaves killed an estimated 5,000 people nationwide and contributed to high livestock loss. Stream flow measuring stations indicated a drought recurrence interval of 75 to 100 years. The effects were most severe in north-central and

[41] *The U.S. Department of Agriculture Risk Management Agency report payments of crop insurance indemnities.*

[42] *Wisconsin Department of Emergency Management and Military Affairs, State of Wisconsin Hazard Mitigation Plan, December 2021.*

northeastern Wisconsin. The drought occurred early in the growing season and resulted in a 30-60 percent crop loss with state agricultural losses estimated at $1.3 billion. State and federal drought assistance programs helped Wisconsin farmers recover a portion of their losses. All Wisconsin counties were designated eligible for this drought assistance.

Recent Events (2011-2021)

The only recent drought event took place in 2012. A lack of rain over south-central and southeastern Wisconsin during June 2012 allowed a drought to slowly develop. The intensity of this drought increased rapidly and by June 26 the drought intensity was rated abnormally dry by the U.S. Drought Monitor. The drought continued through the month of July and by August the conditions were extremely dry across southeastern Wisconsin. Several rainfall and thunderstorm events occurred in August, but annual precipitation amounts were still below normal. The end of August ended with above normal temperatures, increasing the effects on the already stressed crops and water supply. Drought conditions improved by October with above normal precipitation. For many farmers across the region the drought conditions over the summer reduced crop yields. Agricultural operators in Washington County received about $4.8 million in crop insurance indemnities in 2012 due to drought (Table 3.20). This drought also forced sell offs of some dairy and beef cattle herds. Farmers also reported that heat impacts to cows reduced milk production, in some instances by as much as 20 percent. In response to this drought, the Governor declared a drought emergency and authorized the WDNR to expedite permit applications for water withdrawals from lakes and streams for the purpose of watering crops.

Vulnerability and Community Impact Assessment

Washington County is vulnerable to agricultural drought. There are about 126,146 acres of farmland on the 578 farms within Washington County.[43] Even small droughts of limited duration can significantly reduce crop growth and yields, adversely affecting farm income. More substantial events can decimate croplands and result in total loss, hurting the local economy. Due to the importance of agriculture to the Washington County economy and the potential for large crop losses, drought is a major natural hazard threat. There are also 220 miles of major streams, 14 major and numerous smaller lakes, and over 46,600 acres of wetlands in the county which can also be negatively impacted due to drought conditions. In addition, groundwater levels can be affected by drought. This is most important throughout the County as groundwater constitutes the main source of water supply for most uses. Severe droughts may only happen on average every 25 or 50 years, but the 1987 drought proves that, while severe droughts are rare, they can be devastating to

[43] *United States Department of Agriculture, National Agricultural Statistics Service, 2017 Census of Agriculture.*

agriculture, damaging to the local economy, and negatively impact the natural surface water system and groundwater supply system.

In 2017, the most recent year for which data are available, the market value of agricultural products sold by farms in Washington County was about $157 million. This was comprised of about $68 million in crops and $89 million in livestock, poultry, and their products.[44] Based on the current average estimate of $24,700 in crop losses per year, it can be expected that approximately 0.1 percent of the market value of all agricultural products sold by farms in the County will be lost to drought each year.[45] It is also expected that there will be considerable variation among years in the number of losses experienced.

A review of the community assets described in Chapter 2 indicate the potential for drought hazard events to impact: 1) residents at a countywide level, 2) agricultural croplands, 3) livestock, 4) municipal water utilities, and 5) natural surface and groundwater reserves.

Future Changes and Conditions

The future occurrence of a drought is highly unpredictable, it impacts the state occasionally, but not annually. Drought may also be localized, making it difficult to determine probability with any accuracy; however, the NWS and National Integrated Drought Information System (NIDIS) are improving methodologies for accurately forecasting drought conditions. The statewide historical record indicates that severe droughts can be expected to occur at roughly 10-year intervals. As can be seen in Figure 3.5, southeastern Wisconsin regularly experienced drought to at least a moderate level two to three times every ten years from 1895 to 2022.[46] It is not expected that the probability of drought will change during the five-year term of this plan update.

Historical changes over the 20th century and projections based on downscaled results from climate models indicate that there will likely be changes in drought conditions affecting Washington County over the 21st century. By mid-century, average temperatures are projected to rise, leading to longer summers and shorter winters. The temperature increase will also lead to a longer growing season and increased rates of evapotranspiration during summer and early fall months. While the amount of rain during the summer is

[44] U.S. Department of Agriculture National Agricultural Statistics Service op. cit.

[45] Note: the calculated average estimate of crop losses per year during the period of 2011 through 2021 excluded years 2012 and 2013 due to extreme drought events which ultimately caused unusually high monetary losses.

[46] University of Wisconsin-Madison, Atmospheric and Oceanic Sciences, www.aos.wisc.edu.

not projected to change, a greater proportion of precipitation is projected to fall in heavy rainfall events. This will result in a greater number of dry days during the summer. More dry days, coupled with higher summer temperatures and increases in evapotranspiration rates, may increase the likelihood of summer droughts occurring.[47]

Multi-Jurisdictional Risk Management

Based upon a review of the potential impacts of droughts in Washington County, the entities most susceptible to drought conditions are the agricultural communities, the municipalities served by public water supply that use groundwater sources, and those communities that have the largest numbers of private wells. Because all public (municipal water supply systems and non-municipal community water supply systems) as well as self-supplied water systems (i.e., industrial, commercial, institutional, recreational and agricultural uses) and private domestic wells within Washington County utilize groundwater as the primary source of water supply all communities (urban and rural) are vulnerable to the impacts of drought conditions.[48] As such, drought is a uniform countywide concern, especially with those communities with largely agricultural land uses being the most vulnerable to risk.

[47] *Wisconsin Initiative on Climate Change Impacts, 2021, op. cit.*

[48] *SEWRPC Community Assistant Report No. 326,* Washington County Hazard Mitigation Plan*, March 2018.*

Chapter 3

ANALYSIS OF HAZARD CONDITIONS

TABLES

#264982 – CAPR-326-2 Table 3.1 Perceived Risks of Hazards
500-1149
MAS/mid
1/23/2023; 9/19/2022

Table 3.1
Perceived Risks of Hazards as Determined by Hazard Vulnerability and Risk Assessment Survey: 2022

Hazard	Probability[a] *Likelihood this will occur*	Human Impact[a] *Possibility of death or injury*	Property Impact[a] *Physical losses and damages*	Business & Agency Impact[a] *Interruption of services*	Preparedness[a] *Mitigation or pre-planning*	Total Risk[b] *Relative threat*	Rank[c]
Ice Storm	2.533	2.600	2.533	4.733	2.200	19.422	1
High Straight-Lined Winds	2.600	2.267	2.333	2.333	2.067	12.653	2
Lightning	2.733	2.400	2.000	1.867	2.067	11.480	3
Blizzard	2.533	2.467	2.000	2.467	2.600	10.978	4
Heavy Snowstorm	2.600	2.267	2.067	2.533	2.733	10.747	5
Tornado	1.867	2.533	2.600	2.533	2.067	10.453	6
Hail	2.667	2.000	2.000	1.733	2.000	9.956	7
Drought	2.267	2.000	1.733	1.600	1.133	9.520	8
Extreme Cold	2.467	2.267	1.667	2.067	2.333	9.044	9
Extreme Heat	2.267	2.200	1.733	2.000	2.133	8.613	10
Thunderstorm	2.867	1.933	1.733	1.600	2.400	8.218	11
Stormwater Flooding	2.133	1.533	2.133	1.867	2.000	7.538	12
Fog	2.600	1.733	1.267	1.333	1.467	7.453	13
Riverine Flooding	1.933	1.400	2.067	1.533	1.600	6.573	14
Wildfire	1.467	1.600	1.733	1.600	1.733	4.693	15
Inland Lake Flooding	1.533	1.133	1.667	1.333	1.333	4.293	16
Land Subsidence	1.267	1.267	1.467	1.400	1.200	3.716	17
Dam Failure	1.000	1.133	1.333	1.400	1.133	2.733	18
Land Slide	1.000	1.000	1.200	1.133	0.800	2.533	19
Earthquake	0.733	1.200	1.533	1.400	0.867	2.396	20
Dust Storm	0.733	0.867	0.867	0.867	0.667	1.418	21

Note: Value is based on the weighted average of the number of votes received for each score of No Available information (NA), low (1), moderate (2), or high (3).

[a] *Severity = Sum of Impact – Preparedness*

[b] *Total Risk = Probability x Severity*

[c] *Perceived threat/rank is based on Total Risk score.*

Source: SEWRPC

Table 3.2
Summary of Hazards to be Considered in the Washington County Hazard Mitigation Plan: 2022

Hazard	Risk of Occurrence (high, medium, or low)	Damage to Property (high, medium, or low)	Threat to Life Safety (high, medium, or low)	Duration of Impact (long, moderate, or short)	Size of Area Affected (large, medium, or small)
Flooding and Stormwater Drainage Problems	High	High	Medium	Moderate	Large
Thunderstorm, High Winds, Hail, Lightning	High	Medium	Medium	Long	Large
Tornadoes	Low	High	High	Short	Small
Winter Storms	Medium	Low	Medium	Medium	Large
Temperature Extremes	Medium	Low	High	Long	Large
Drought	Medium	Low	Low	Long	Large

Note: Some of the natural hazards listed in this table represent combinations of hazards listed in Table 3.1. For example, while specific risks associated with thunderstorms, such as hail and lightning are listed separately in Table 3.1, here they are combined into one category.

Source: Washington County LPT and SEWRPC

Table 3.3
Summary of Estimated Disaster Damages and Assistance in Washington County for Federally Declared Disaster Emergencies: 1976-2021

Date of Disaster and Event(s)	Estimated Property and Crop Damages ($)	Public Assistance[a] ($)	Individual Assistance[b] ($)	Total Assistance ($)
1976 – Severe Storms, Icing, Wind, Flooding (DR-496)	17,200,000	0	0	0
1976 – Drought (EM-3014)	N/A	0	0	0
1986 – Severe Storms, Flooding (DR-775)	2,750,000	0	0	0
1991 – Hail, Severe Storm (DR-912)	3,163,000	134,731	0	134,731
1997 – Severe Storms, Flooding (DR-1180)	2,700,000	62,241	21,163	83,404
2004 – Severe Storms, Flooding (DR-1526)	9,503,000	0	0	0
2005 – Hurricane Katrina Evacuation (EM-3249)	N/A	0	0	0
2008 – Snow (EM-3285)	N/A	502,335	0	502,335
2008 – Severe Storms, Flooding, Tornadoes (DR-1768)	8,630,000	761,701	503,100	1,264,801
2011 – Severe Winter Storm, Snowstorms (DR-1966)	N/A	461,502	0	461,502
2012 – Drought[c]	4,072,300	0	0	0
2013 – Excessive Rain and Snow, Freeze and Thaw[c]	1,217,265	0	0	0
2017 – Frost, Freeze[c]	129,570	0	0	0
2018 – Flood, Flash Flood, Severe Storm, Wind (DR-4402)[d]	660,898	0	0	0
2019 – Flood, Flash Flood[c]	734,525	0	0	0
2020 – Severe Winter Storm, Flooding (DR-4477)[d]	N/A	0	0	0
2021 – Drought[c]	64,333	0	0	0
Total	50,824,891	1,922,510	524,263	2,447,773

Note: N/A indicates data not available. Also, damage amounts ($) are associated with the year that the event took place.

[a] *Public assistance includes assistance to local units of government and nonprofit organizations.*

[b] *Individual assistance includes disaster assistance through FEMA programs and disaster loans from the U.S. Small Business Administration to individuals, households, and businesses.*

[c] *USDA Secretarial disaster designation issued by the U.S. Secretary of Agriculture.*

[d] *Presidential major disaster declaration issued by the Farm Service Agency (FSA) with FEMA's approval.*

Source: Federal Emergency Management Agency, U.S. Department of Agriculture Farm Service Agency, Wisconsin Emergency Management, and SEWRPC

Table 3.4
Historical Hazard Events Recorded in Washington County (Sorted by Number of Events): 2001-2021

Event	Number of Events	Deaths	Injuries	Property Damages ($)	Crop Damages ($)
Dust Storms	0	0	0	0	0
Wildfires/Forest Fires	0	0	0	0	0
Tornado	9	0	1	6,252,258	73,255
Flood	11	0	0	12,552,281	14,602,386
Lightning	16	0	0	3,306,445	1,130
Drought	18	0	0	0	5,438,873
Temperature Extremes	50	1	0	2,655	319,369
Fog	69	0	0	0	0
Hail	83	0	0	13,550,807	1,589,807
Thunderstorms/High Winds	152	0	0	1,970,767	3,278,770
Winter Storms, Snow, and Ice	164	0	0	39,798	443,699
Total	572	1	1	37,675,011	25,747,289

Note: Dollar Values were adjusted to year 2021 by the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.

Because the one death listed under Extreme Temperatures occurred on March 3, 2010, it is not listed in Table 3.19 due to the time period it occurred in.

Source: National Centers for Environmental Information (NCEI), National Oceanic and Atmospheric Administration (NOAA), and the National Environmental Satellite, Data and Information Service (NESDIS), and the U.S. Department of Agriculture Risk Management Agency

#265765 – CAPR-326-2 Table 3.5 Severe Weather History
500-1149
MAS/mid
1/23/2023; 10/30/2022

Table 3.5
Washington County Severe Weather Warning History: 2001-2021

Year	Flash Flood Warning	Flood Warning	Severe Thunderstorm		Tornado	
			Watch	Warning	Watch	Warning
2001	0	0	9	11	2	2
2002	0	0	5	10	1	0
2003	0	0	7	3	3	2
2004	0	0	12	5	2	2
2005	0	0	12	7	3	0
2006	0	0	19	17	2	1
2007	1	0	4	3	3	1
2008	7	5	9	20	6	1
2009	0	0	5	1	1	1
2010	2	0	5	9	7	3
2011	0	0	12	13	2	2
2012	0	0	7	9	0	0
2013	0	0	5	14	2	1
2014	1	0	7	7	1	1
2015	0	0	6	9	1	0
2016	0	0	9	4	1	0
2017	0	0	6	13	2	0
2018	2	2	4	9	1	2
2019	1	1	4	5	0	0
2020	0	0	5	9	1	1
2021	0	2	5	8	0	0
Total	14	10	157	186	41	20

Source: Iowa State University College of Agriculture – Department of Agronomy, "Iowa Environmental Mesonet"

#266064 – CAPR-326-2 Table 3.6 Areal Extent of Floodplain
500-1149
MAS/mid
1/23/2023; 11/19/2022

Table 3.6
Areal Extent of 1-Percent-Annual-Probability Floodplain by Community in Washington County: 2022

Community	Area (acres)
Cities	
Hartford	624
Milwaukee	--
West Bend	935
Villages	
Germantown	3,298
Jackson	239
Kewaskum	286
Newburg	58
Richfield	2,380
Slinger	321
Towns	
Addison	3,316
Barton	1,543
Erin	2,560
Farmington	4,115
Germantown	358
Hartford	2,287
Jackson	4,873
Kewaskum	2,883
Polk	1,851
Trenton	2,729
Wayne	5,579
West Bend	1,954
Total	42,189

Source: Federal Emergency Management Agency and SEWRPC

Table 3.7
WDNR Dam Inventory for Washington County: 2015

Water Feature	Name		Owner	Size	Structure Height (feet)	Impoundment Surface Area (acres)	Hazard Potential
	Official	Local					
Wallace Creek	Ehne	--	Neil Dinesen	Large	20	18	Low
Milwaukee River	Barton	Gadow Mill	City of West Bend	Large	14	18	**High**
Barton Pond/Milwaukee River	West Bend	--	City of West Bend	Large	13	67	Low
Boltonville Millpond/Stony Creek	Boltonville	--	Boltonville Sportsmen Club	Large	12	9	Low
Lucas Lake/Silver Creek	Lucas Lake	--	Milwaukee Area Girl Scouts-Camp Silverbrook	Large	8	78	**High**
Rubicon River	Pike Lake	--	Hartford Pike Lake Association	Large	12	522	Low
Hartford Millpond/Rubicon River	Hartford	City of Hartford	City of Hartford	Large	13.7	11	Low
Myra Creek	Tillman and Stern	Clyde Wirth SCS Designed	Clyde Wirth	Small	18		Low
Unnamed tributary to Evergreen Creek	Ratzsch	K. A. Raatsch SCS Design	Karl Ratzsch				Low
Tilly Lake	Mayfield	Ivan Knoll	Ivan H. Knoll	Small	14	8	**Significant**
Big Cedar Lake/Cedar Creek	Big Cedar Lake	Cedar Creek Hydraulic Company	Cedar Creek Hydraulic Company	Small	4.4	246	Low
Little Cedar Lake/Cedar Creek	Little Cedar Lake	Washington County Fish and Game Association	Little Cedar Lake Protection Rehabilitation District	Small	15	6	Low
Kohlsville Millpond/Kohlsville River	Kohlsville	Town of Wayne	Town of Wayne	Small	10	5	Low
Milwaukee River	Kewaskum	Village of Kewaskum	Village of Kewaskum	Small	3	52	**Significant**
Wallace Creek	Wallace Lake	--	--	Small	20	3	Low
Wallace Creek	A. W. Johnson-Pond A	G. J. Kahn	A. W. Johnson				Low
Wallace Creek	A. W. Johnson-Pond D	G. J. Kahn	A. W. Johnson	Small	6	118	Low
Silver Creek	Silver Lake	Silver Lake Protective Association	Silver Lake Protective Association		6		Low
Silver Creek	West Bend Carp Pond	City of West Bend	City of West Bend	Small	8	4	Low
Silver Creek	Pick Dam	Washington County Park System Dam	Ridge Run Trust	Small	15	8	Low
Silver Creek	City Park	City of West Bend	City of West Bend		3		Low
Erler Creek	Erler Lake Lower	Leonard Yahr	Leonard Yahr		6		Low
Erler Creek	Erler Lake Upper	Leonard Yahr	Leonard Yahr	Small	6	37	Low
Lent Lake/Cedar Creek	Lent	R. Wacker	--	Small	10	8	Low
Silver Creek	Swimming Pool	City of West Bend	City of West Bend		7		Low
Silver Creek	Ridge Run Trust No. 2	Washington County	Washington County		16		Low
Myra Creek	Oliver H. Baumgartner No. 1	--	Oliver H. Baumgartner	Small	4	1	Low
Myra Creek	Oliver H. Baumgartner No. 2	--	Oliver H. Baumgartner	Small	5	1	Low
Myra Creek	Oliver H. Baumgartner No. 3	--	Oliver H. Baumgartner	Small	2	1	Low
Unnamed Tributary to Quaas Creek	Andrew Gundrum	--	Andrew Gundrum	Small	4	1	Low
Unnamed Tributary to Menomonee River	Edward Linder	Hal Barth	Edward Linder			1	Low
Unnamed Tributary to Wayne Creek	Bernard Timmer	P. H. Schultz	--	Small	11	2	Low

Table continued on next page.

Table 3.7 (Continued)

Water Feature	Name		Owner	Size	Structure Height (feet)	Impoundment Surface Area (acres)	Hazard Potential
	Official	Local					
Unnamed Tributary to Wallace Creek	Washington County	Washington County	Washington County	Small	9	3	Low
Little Cedar Lake/Cedar Creek	Bernard C. Ziegler Dam	--	Bernard C. Ziegler	Small	16	3	Low
Rubicon River	Carl Arkins	--	--				Low
Limestone Creek	Unknown	Main Flowage	WDNR			40	Low
Allenton Creek	Allentown Marsh Pool 1	Wisconsin DNR	WDNR			2	Low
Allenton Creek	Allentown Marsh Pool 2	State of Wisconsin	WDNR			2	Low
Unnamed Tributary to Allenton Creek	Allentown Marsh Pool 3	State of Wisconsin	WDNR			2	Low
Unnamed Tributary to East Branch Rock River	Allentown Marsh Pool 4	State of Wisconsin	WDNR			0.5	Low
Unnamed Tributary to East Branch Rock River	Allentown Marsh Pool 5	State of Wisconsin	WDNR			0.5	Low
Unnamed Tributary to East Branch Rock River	Allentown Marsh Pool 6	State of Wisconsin	WDNR			1	Low
Cedar Creek	Jackson Marsh Wildlife Area Pool 1	Wisconsin DNR	WDNR			8	Low
Cedar Creek	Jackson Marsh Wildlife Area Pool 2	Wisconsin DNR	WDNR			10	Low
Cedar Creek	Jackson Marsh Wildlife Area Pool 3	Wisconsin DNR	WDNR			10	Low
Evergreen Creek	Jackson Marsh Wildlife Area Pool 4	Wisconsin DNR	WDNR			0.5	Low
Schwietzer Pond	Nature's Friends	Peter Hembel	--	Small	15	8	Low
Wallace Creek	Ehne No. 3	Leon C. Fleming	--		3		Low
Wallace Creek	Ehne No. 4	Leon C. Fleming	--		4		Low
Silver Creek	Ridge Run Trust No. 1	Washington County	Washington County	Small	9	8	Low
Kohlsville River	Kohlsville Fire Department	Town of Wayne	Town of Wayne	Small	16	1	Low
Rubicon River	Schaeffer	--	Kent C. Shaffer	Small	5.4	7	Low
Rubicon River	Schaefer	--	Kent C. Shaffer				Low
Wallace Creek	Ehne Uppermost	Shalom Wildlife Sanctuary	Paul Chechvala		9.2	6.5	Low
Cedar Creek	Cedar Creek Dam	Cedar Creek Dam	D. W. Maxon				Low
Coney River	Richfield Dam	Richfield Dam	C. W. Mayer		25		Low
Unnamed Stream	Tennies Pond-Main Pond	--	Village of Slinger	Small	5		Low

Source: Wisconsin Department of Natural Resources and SEWRPC

Table 3.8
Recent Flood Events in Washington County: 2001-2021

Date	Location	Type[a]	Deaths	Injuries	Property Damages ($)	Crop Damages ($)
2/9/2001	County Wide	Flood	0	0	15,778	--
8/22/2001	West Bend	Flood	0	0	--	--
5/21/2004	County Wide	Flood	0	0	517,180	481,545
6/1/2004	County Wide	Flood	0	0	4,395,300	8,790,600
8/22/2007	Hartford	Flash Flood	0	0	132,740	663,700
4/25/2008	Boltonville	Flash Flood	0	0	13,262	--
6/8/2008	Wayne	Flash Flood	0	0	6,803,406	4,658,449
7/22/2010	St. Kilian	Flash Flood	0	0	25,440	2,544
2/20/2018	St. Kilian	Flood	0	0	--	--
8/27/2018	Holy Hill	Flash Flood	0	0	648,065	--
8/27/2018	Holy Hill	Flood	0	0	1,110	5,549
		Total	0	0	12,552,281	14,602,386

Note: Dollar Values were adjusted to year 2021 by the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.

[a] *National Weather Service determines the type of event bason on report narratives from local officials.*

Source: National Centers for Environmental Information, National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of Agriculture Risk Management Agency

Table 3.9
Estimated Flood Damages for a 1-Percent-Annual-Probability Flood in Washington County: 2022

Municipality	Number of Structures in Floodplain	Flood Damages		
		Direct ($)	Indirect ($)	Total ($)
Cities				
Hartford	13	908,070	348,240	1,256,310
Milwaukee	--	0	0	0
West Bend	41	2,964,360	1,156,180	4,120,540
Villages				
Germantown	29	149,550	22,850	172,400
Jackson	133	2,409,610	377,040	2,786,650
Kewaskum	134	1,549,340	287,920	1,837,260
Newburg	4	14,280	4,240	18,520
Richfield	236	4,782,230	729,400	5,511,630
Slinger	--	0	0	0
Towns				
Addison	44	887,920	184,090	1,072,010
Barton	58	670,720	109,110	779,830
Erin	89	1,175,890	176,590	1,352,480
Farmington	60	443,400	76,810	520,210
Germantown	11	95,380	17,710	113,090
Hartford	31	510,210	76,530	586,740
Jackson	47	279,460	41,920	321,380
Kewaskum	19	200,090	30,010	230,100
Polk	24	225,610	39,470	265,080
Trenton	63	687,790	129,530	817,320
Wayne	36	764,120	142,520	906,640
West Bend	93	728,270	109,280	837,550
Total	1,165	19,446,300	4,059,440	23,505,740

Note: Estimated damages are based on assessed improvement values in 2022.

Source: Federal Emergency Management Agency, Wisconsin Department of Natural Resources, Washington County, and SEWRPC

Table 3.10
Communities in Washington County with (or the Potential to Have) Special Flood and Related Stormwater Drainage Considerations

Community	Reason for Consideration
City of Hartford	13 structures are estimated to be located in the flood hazard areas.
City of West Bend	Two historic sites (Gadow's Mill and the West Bend theatre) are located in the flood hazard area. An additional 39 other structures, mainly commercial, are also located within the flood hazard area.
Village of Germantown	29 structures, primarily residential, are located in a flood hazard area.
Village of Jackson	An estimated 167 structures, including 94 manufactured homes, condo buildings, and homes within the same neighborhood are located in a flood hazard area.
Village of Kewaskum	135 structures, including two senior care facilities and the Kewaskum Fire Department, are located within the flood hazard area.
Village of Newburg	Ice jam events on the Milwaukee River impact the nearby "Fireman" Park and a village sewer system lift station. Newburg Fire Department is also located in the flood hazard area. An additional two other residential structures are listed as being in the floodplain.
Village of Richfield	Over 200 residential structures are estimated to be within the flood hazard area, including 3 repetitive-loss structures.
Town of Addison	44 structures are listed as being in the flood hazard area. Although not listed, the Allenton Volunteer Fire Department is located near the shores of the East Branch of the Rock River.
Town of Barton	Areas near the Milwaukee River are subject to flooding, including 58 structures listed in the flood hazard area.
Town of Erin	There are 89 structures estimated to be in the flood hazard area, these include homes along the shoreline of Druid Lake.
Town of Farmington	Two notable roadway overtop locations (portions of Riverside Drive and Jay Road) are regularly impacted from heavy rain events. Additionally, there are an estimated 60 structures located in the flood hazard areas of the town.
Town of Germantown	11 structures estimated to be located in the flood hazard area.
Town of Hartford	31 structures estimated to be located in the flood hazard area including one repetitive-loss structure.
Town of Jackson	47 structures and a number of roadways are susceptible to flooding hazards.
Town of Kewaskum	19 structures estimated to be located in the flood hazard area.
Town of Polk	24 structures estimated to be located in the flood hazard area.
Town of Trenton	63 structures estimated to be located in the flood hazard area.
Town of Wayne	36 structures estimated to be located in the flood hazard area.
Town of West Bend	93 structures estimated to be located in the flood hazard area.

Source: SEWRPC

#264986 – CAPR-326-2 Table 3.11 Severe Thunderstorms Events
500-1149
MAS/mid
1/23/2023; 7/19/2022

Table 3.11
Recent Severe Weather Events in Washington County: 2011-2021

Date	Event Type	Magnitude	Reported Damages			
			Deaths	Injuries	Property Damages ($)	Crop Damages ($)
February 18, 2011	Strong Wind	26 knots	0	0	2,471	335
April 4, 2011	Thunderstorm Wind	70 knots	0	0	--	--
April 15, 2011	Strong Wind	32 knots	0	0	3,706	--
May 15, 2011	Strong Wind	39 knots	0	0	6,177	--
May 22, 2011	Hail	1 inch	0	0	--	--
May 22, 2011	Thunderstorm Wind	56 knots	0	0	12,354	72,649
June 6, 2011	Hail	1.75 inch	0	0	123,540	--
June 8, 2011	Hail	1 inch	0	0	--	--
June 8, 2011	Thunderstorm Wind	56 knots	0	0	--	55,415
June 21, 2011	Thunderstorm Wind	56 knots	0	0	92,655	55,415
August 12, 2011	Thunderstorm Wind	50 knots	0	0	--	2,755
September 3, 2011	Thunderstorm Wind	60 knots	0	0	3,706	--
September 29, 2011	Hail	0.75 inch	0	0	--	--
September 29, 2011	Strong Wind	43 knots	0	0	2,471	--
October 19, 2011	Strong Wind	39 knots	0	0	2,471	--
January 1, 2012	Strong Wind	39 knots	0	0	1,214	--
March 10, 2012	Strong Wind	30 knots	0	0	2,429	--
April 8, 2012	Strong Wind	48 knots	0	0	2,429	--
April 16, 2012	Strong Wind	39 knots	0	0	1,214	--
May 1, 2012	Hail	0.75 inch	0	0	--	--
May 1, 2012	Hail	1.75 inch	0	0	--	--
May 1, 2012	Thunderstorm Wind	61 knots	0	0	3,643	2,888
May 28, 2012	Thunderstorm Wind	61 knots	0	0	12,143	2,888
May 28, 2012	Thunderstorm Wind	56 knots	0	0	12,143	2,888
June 18, 2012	Strong Wind	39 knots	0	0	12,143	--
July 26, 2012	Thunderstorm Wind	52 knots	0	0	--	--
August 7, 2012	Hail	1.75 inch	0	0	2,428,600	--
January 19, 2013	Strong Wind	42 knots	0	0	5,982	--
April 11, 2013	Strong Wind	38 knots	0	0	5,982	--
June 27, 2013	Hail	1 inch	0	0	--	5,858
June 27, 2013	Hail	1 inch	0	0	--	5,858

Table continued on next page.

Table 3.11 (Continued)

Date	Event Type	Magnitude	Reported Damages			
			Deaths	Injuries	Property Damages ($)	Crop Damages ($)
June 27, 2013	Hail	0.75 inch	0	0	--	5,858
June 27, 2013	Thunderstorm Wind	50 knots	0	0	1,196	1,320,389
August 22, 2013	Lightning	--	0	0	2,512,230	--
August 30, 2013	Hail	0.88 inch	0	0	--	--
September 19, 2013	Thunderstorm Wind	70 knots	0	0	59,815	111,271
October 3, 2013	Thunderstorm Wind	52 knots	0	0	--	--
November 17, 2013	Thunderstorm Wind	87 knots	0	0	29,908	--
November 17, 2013	Thunderstorm Wind	87 knots	0	0	35,889	--
April 12, 2014	Hail	0.88 inch	0	0	--	--
April 12, 2014	Hail	1 inch	0	0	--	--
April 12, 2014	Hail	0.75 inch	0	0	--	--
April 12, 2014	Hail	1.5 inch	0	0	--	--
May 7, 2014	Hail	0.88 inch	0	0	--	--
May 7, 2014	Hail	1 inch	0	0	--	--
May 7, 2014	Hail	1.25 inch	0	0	--	--
May 8, 2014	Hail	0.75 inch	0	0	--	--
June 17, 2014	Thunderstorm Wind	50 knots	0	0	11,873	117,169
June 30, 2014	Thunderstorm Wind	51 knots	0	0	5,937	117,169
July 13, 2015	Thunderstorm Wind	55 knots	0	0	17,681	--
August 2, 2015	Hail	2.5 inch	0	0	--	--
August 2, 2015	Hail	1.25 inch	0	0	--	--
August 2, 2015	Hail	1.75 inch	0	0	--	--
August 2, 2015	Hail	2 inch	0	0	--	--
August 2, 2015	Hail	1.75 inch	0	0	--	--
August 2, 2015	Hail	0.75 inch	0	0	--	--
August 2, 2015	Hail	0.88 inch	0	0	--	--
August 2, 2015	Hail	1 inch	0	0	--	--
August 2, 2015	Hail	1.75 inch	0	0	--	--
August 2, 2015	Hail	1 inch	0	0	--	--
August 2, 2015	Hail	1 inch	0	0	--	--
August 10, 2015	Hail	1.75 inch	0	0	--	--
August 14, 2015	Thunderstorm Wind	55 knots	0	0	5,894	5,869
December 23, 2015	Strong Wind	42 knots	0	0	1,179	2,302
February 19, 2016	High Wind	52 knots	0	0	28,870	--
March 6, 2016	Lightning	NA	0	0	115,480	--
March 16, 2016	High Wind	50 knots	0	0	8,084	--

Table continued on next page.

Table 3.11 (Continued)

Date	Event Type	Magnitude	Reported Damages			
			Deaths	Injuries	Property Damages ($)	Crop Damages ($)
April 25, 2016	Hail	1 inch	0	0	--	--
April 25, 2016	Hail	1 inch	0	0	--	--
April 25, 2016	Hail	1.75 inch	0	0	--	--
April 25, 2016	Hail	0.75 inch	0	0	--	--
June 15, 2016	Hail	1 inch	0	0	--	116,972
September 21, 2016	Hail	0.75 inch	0	0	--	6,802
February 28, 2017	Hail	1 inch	0	0	--	2,833
March 8, 2017	High Wind	35 knots	0	0	16,964	--
June 12, 2017	Hail	1 inch	0	0	--	--
June 12, 2017	Thunderstorm Wind	70 knots	0	0	28,273	--
June 12, 2017	Thunderstorm Wind	56 knots	0	0	28,273	--
June 12, 2017	Thunderstorm Wind	56 knots	0	0	1,131	--
June 28, 2017	Thunderstorm Wind	52 knots	0	0	11,309	--
June 28, 2017	Thunderstorm Wind	52 knots	0	0	11,309	--
June 28, 2017	Thunderstorm Wind	52 knots	0	0	56,545	--
July 7, 2017	Thunderstorm Wind	61 knots	0	0	5,655	--
July 15, 2017	Thunderstorm Wind	50 knots	0	0	113	--
August 10, 2017	Hail	1.5 inch	0	0	--	--
August 10, 2017	Hail	1 inch	0	0	1,131	--
December 4, 2017	Strong Wind	44 knots	0	0	4,524	--
May 2, 2018	Hail	0.75 inch	0	0	--	--
May 2, 2018	Thunderstorm Wind	52 knots	0	0	--	--
July 1, 2018	Thunderstorm Wind	52 knots	0	0	1,110	--
July 1, 2018	Thunderstorm Wind	50 knots	0	0	3,329	--
August 26, 2018	Thunderstorm Wind	61 knots	0	0	5,549	26,041
August 28, 2018	Thunderstorm Wind	52 knots	0	0	1,110	26,041
October 20, 2018	Strong Wind	39 knots	0	0	1,110	--
February 24, 2019	Strong Wind	45 knots	0	0	1,085	--
May 19, 2019	Thunderstorm Wind	50 knots	0	0	--	--
June 27, 2019	Thunderstorm Wind	50 knots	0	0	8,679	--
June 27, 2019	Thunderstorm Wind	52 knots	0	0	--	--
June 27, 2019	Thunderstorm Wind	50 knots	0	0	1,085	47,564
July 2, 2019	Hail	0.75 knots	0	0	--	8,702
July 2, 2019	Hail	0.75 inch	0	0	--	8,702
July 20, 2019	Thunderstorm Wind	50 knots	0	0	1,085	--
November 27, 2019	Strong Wind	39 knots	0	0	5,425	--

Table continued on next page.

Table 3.11 (Continued)

Date	Event Type	Magnitude	Reported Damages			
			Deaths	Injuries	Property Damages ($)	Crop Damages ($)
April 7, 2020	Hail	1 inch	0	0	--	--
April 7, 2020	Hail	0.75 inch	0	0	--	--
April 7, 2020	Hail	2.5 inch	0	0	--	--
April 7, 2020	Hail	1.75 inch	0	0	--	--
April 7, 2020	Hail	2.5 inch	0	0	--	--
April 20, 2020	Thunderstorm Wind	61 knots	0	0	2,141	--
April 20, 2020	Thunderstorm Wind	50 knots	0	0	2,141	--
June 2, 2020	Thunderstorm Wind	50 knots	0	0	1,070	21,414
June 2, 2020	Thunderstorm Wind	56 knots	0	0	2,141	21,414
June 2, 2020	Thunderstorm Wind	50 knots	0	0	2,141	21,414
July 7, 2020	Hail	0.75 inch	0	0	--	21,414
July 7, 2020	Heavy Rain	NA	0	0	--	21,414
August 28, 2020	Thunderstorm Wind	50 knots	0	0	3,211	1,555
October 12, 2020	Hail	0.75 inch	0	0	--	--
October 12, 2020	Hail	0.75 inch	0	0	--	--
November 10, 2020	Strong Wind	43 knots	0	0	1,070	--
August 8, 2021	Thunderstorm Wind	56 knots	0	0	10,000	8,000
August 10, 2021	Thunderstorm Wind	52 knots	0	0	3,000	1,000
September 7, 2021	Hail	1 inch	0	0	--	605
September 7, 2021	Hail	1 inch	0	0	--	605
September 12, 2021	Hail	0.75 inch	0	0	--	605
September 12, 2021	Hail	1 inch	0	0	--	605
September 12, 2021	Hail	0.75 inch	0	0	--	605
December 15, 2021	High Wind	38 knots	0	0	10,000	--
		Total	0	0	5,803,210	2,278,713

[a] *Deaths, injuries, and property damages reported were based upon a geographic area impacted by the hazard event, which affected Washington County and, in some cases, a larger area of impact than the County itself, generally within the southeast regional area of Wisconsin.*

[b] *Dollar values were adjusted to year 2021 by using the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.*

Source: National Centers for Environmental Information (NCEI), National Oceanic and Atmospheric Administration (NOAA), and the National Environmental Satellite, Data and Information Service (NESDIS), and the U.S. Department of Agriculture Risk Management Agency

Table 3.12
Enhanced Fujita Scale Characteristics

EF-Scale	Wind Speed (miles per hour)[a]	Character of Damage	Relative Frequency (percent)
EF0 (weak)	65-85	Light	53
EF1 (weak)	86-110	Moderate	32
EF2 (strong)	111-135	Considerable	11
EF3 (strong)	136-165	Severe	3
EF4 (violent)	166-200	Devastating	1
EF5 (violent)	>200	Incredible (rare)	<1

[a] *Equivalent wind speeds associated with the Enhanced Fujita Scale represent a three-second gust of wind.*

Source: National Oceanic and Atmospheric Administration

Table 3.13
Tornado Events in Washington County: 1964 Through 2021

Map ID	Date	Magnitude (Fujita)	Deaths	Injuries	Property Damage ($)	Crop Damage ($)
1	July 6, 1964	F1	0	0	--	--
2	July 21, 1968	F2	0	0	196,340	--
3	May 31, 1969	F1	0	0	184,883	--
4	July 27, 1970	F0	0	0	--	--
5	June 5, 1977	F3	0	0	1,122,400	--
6	April 7, 1980	F2	0	2	807,650	--
7	April 4, 1981	F4	3	53	74,150,000	--
8	April 27, 1984	F0	0	0	66,193	--
9	July 1, 1991	F1	0	1	505,450	--
10	June 1, 2000	F0	0	0	--	160,230
11	June 11, 2001	F1	0	0	631,120	--
12	July 6, 2003	F1	0	0	30,256	--
13	June 23, 2004	F1	0	0	14,651	73,255
14	June 23, 2004	F0	0	0	--	--
15	June 18, 2006	F1	0	1	5,526,400	--
16	June 2, 2007	EF0	0	0	--	--
17	June 3, 2007	EF1	0	0	33,185	--
18	August 10, 2015	EF0	0	0	--	--
19	May 9, 2018	EF0	0	0	16,646	--
		Total	3	57	83,285,174	233,485

Note: Dollar Values were adjusted to year 2021 by the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.

Source: National Centers for Environmental Information and U.S. Department of Agriculture Risk Management Agency

Table 3.14
Recent Winter Events in Washington County: 2011-2021

Date	Type[a]	Deaths	Injuries	Property Damages ($)	Crop Damages ($)
January 17, 2011	Winter Weather	0	0	--	--
February 1, 2011	Blizzard	0	0	--	--
February 20, 2011	Winter Storm	0	0	--	--
February 21, 2011	Winter Weather	0	0	--	--
March 9, 2011	Winter Weather	0	0	--	1,529
April 19, 2011	Winter Weather	0	0	--	--
December 29, 2011	Winter Weather	0	0	--	--
January 12, 2012	Winter Weather	0	0	--	1,761
January 17, 2012	Winter Weather	0	0	--	1,761
January 20, 2012	Winter Weather	0	0	--	1,761
January 22, 2012	Winter Weather	0	0	--	1,761
February 23, 2012	Winter Weather	0	0	--	--
March 2, 2012	Winter Storm	0	0	--	2,296
December 9, 2012	Winter Weather	0	0	--	--
December 20, 2012	Winter Storm	0	0	--	--
January 27, 2013	Winter Weather	0	0	--	50,552
January 30, 2013	Winter Weather	0	0	--	47,188
February 7, 2013	Winter Storm	0	0	--	2,022
February 22, 2013	Winter Weather	0	0	--	2,022
February 26, 2013	Winter Storm	0	0	--	2,022
March 5, 2013	Winter Weather	0	0	--	15,313
March 15, 2013	Winter Weather	0	0	--	15,313
March 18, 2013	Winter Weather	0	0	--	15,313
November 25, 2013	Winter Weather	0	0	--	--
December 8, 2013	Winter Weather	0	0	--	--
December 19, 2013	Winter Weather	0	0	--	--
December 22, 2013	Winter Storm	0	0	--	--
January 10, 2014	Winter Weather	0	0	--	76
January 14, 2014	Winter Storm	0	0	--	76
January 24, 2014	Winter Weather	0	0	--	76
January 26, 2014	Winter Weather	0	0	--	76
January 26, 2014	Winter Weather	0	0	--	76
February 13, 2014	Winter Weather	0	0	--	9,732
February 17, 2014	Winter Storm	0	0	--	9,732
November 24, 2014	Winter Weather	0	0	--	--
November 28, 2014	Winter Weather	0	0	--	--
December 8, 2014	Winter Weather	0	0	--	--
December 18, 2014	Winter Weather	0	0	--	--
January 3, 2015	Winter Weather	0	0	--	--
January 8, 2015	Winter Weather	0	0	--	--
February 1, 2015	Winter Weather	0	0	--	--
November 20, 2015	Winter Weather	0	0	--	--
December 28, 2015	Winter Storm	0	0	--	2,302
March 1, 2016	Winter Weather	0	0	--	3,893
March 23, 2016	Winter Weather	0	0	--	3,893
April 2, 2016	Winter Weather	0	0	--	15,327
April 8, 2016	Winter Weather	0	0	--	15,327
December 4, 2016	Winter Weather	0	0	--	--

Table continued on next page.

Table 3.14 (Continued)

Date	Type[a]	Deaths	Injuries	Property Damages ($)	Crop Damages ($)
December 10, 2016	Winter Storm	0	0	--	--
December 16, 2016	Winter Storm	0	0	--	--
December 23, 2016	Winter Weather	0	0	--	--
January 3, 2017	Winter Weather	0	0	--	--
January 10, 2017	Winter Weather	0	0	--	--
January 11, 2017	Winter Weather	0	0	--	--
January 16, 2017	Winter Weather	0	0	--	--
January 24, 2017	Winter Weather	0	0	--	--
February 24, 2017	Winter Weather	0	0	--	2,833
March 1, 2017	Winter Weather	0	0	--	122,080
December 13, 2017	Winter Weather	0	0	--	--
January 14, 2018	Winter Weather	0	0	--	--
February 3, 2018	Winter Weather	0	0	--	893
February 5, 2018	Winter Weather	0	0	--	893
February 8, 2018	Winter Weather	0	0	--	893
February 11, 2018	Winter Weather	0	0	--	893
March 5, 2018	Winter Weather	0	0	--	1,396
April 3, 2018	Winter Weather	0	0	--	17,879
April 14, 2018	Winter Weather	0	0	--	17,879
April 18, 2018	Winter Weather	0	0	--	17,879
December 28, 2018	Winter Weather	0	0	--	--
January 15, 2019	Winter Weather	0	0	--	--
January 18, 2019	Winter Weather	0	0	--	--
January 22, 2019	Winter Weather	0	0	--	--
January 27, 2019	Winter Storm	0	0	--	--
February 5, 2019	Winter Weather	0	0	--	--
February 7, 2019	Winter Weather	0	0	--	--
February 11, 2019	Winter Storm	0	0	--	--
February 17, 2019	Winter Weather	0	0	--	--
February 23, 2019	Winter Weather	0	0	--	--
February 26, 2019	Winter Weather	0	0	--	--
March 9, 2019	Winter Weather	0	0	--	50,806
April 10, 2019	Winter Weather	0	0	--	28,284
October 28, 2019	Winter Weather	0	0	--	--
October 30, 2019	Winter Weather	0	0	--	--
November 6, 2019	Winter Weather	0	0	--	--
December 14, 2019	Winter Weather	0	0	--	62
December 30, 2019	Winter Weather	0	0	--	62
January 10, 2020	Winter Weather	0	0	--	--
January 11, 2020	Winter Weather	0	0	--	--
January 17, 2020	Winter Weather	0	0	--	--
January 31, 2020	Winter Weather	0	0	--	--
February 9, 2020	Winter Weather	0	0	--	--
February 12, 2020	Winter Weather	0	0	--	--
February 17, 2020	Winter Weather	0	0	--	--
November 24, 2020	Winter Weather	0	0	--	--
December 11, 2020	Winter Weather	0	0	--	--
December 29, 2020	Winter Storm	0	0	--	--
January 1, 2021	Winter Weather	0	0	--	--
January 26, 2021	Winter Weather	0	0	--	--
January 30, 2021	Winter Storm	0	0	--	--
February 4, 2021	Winter Weather	0	0	--	1,049
February 11, 2021	Winter Weather	0	0	--	1,049
February 13, 2021	Winter Weather	0	0	--	1,049

Table continued on next page.

Table 3.14 (Continued)

Date	Type[a]	Deaths	Injuries	Property Damages ($)	Crop Damages ($)
April 21, 2021	Winter Weather	0	0	--	--
December 28, 2021	Winter Weather	0	0	--	--
December 31, 2021	Winter Weather	0	0	--	--
	Total	0	0	--	487,084

Note: The data presented in this table only accounts for damages, injuries, and deaths that are directly caused by each winter storm event. Damages, injuries, and deaths that occur indirectly as the result of traffic accidents, slips and falls, or health issues associated with winter storms are not included in this table.

Dollar values were adjusted to year 2021 by the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics

[a] *NWS defines the following types of events as listed in the Table:*

- *Blizzard as a winter storm which produces the following conditions for three consecutive hours or longer: (1) sustained winds or frequent gusts 30 knots (35 mph) or greater, and (2) falling and/or blowing snow reducing visibility frequently to less than 1/4 mile.*
- *Winter Storm is an event that has more than one significant hazard (i.e., heavy snow and blowing snow; snow and ice; snow and sleet; sleet and ice; or snow, sleet and ice) and meets or exceeds locally/regionally defined 12 and/or 24-hour warning criteria for at least one of the precipitation elements.*
- *Winter Weather as an event that causes a death, injury, or a significant impact to commerce or transportation, but does not meet locally/regionally defined warning criteria. Such an event could result from one or more winter precipitation types (snow, or blowing/drifting snow, or freezing rain/drizzle). The Winter Weather event can also be used to document out-of-season and other unusual or rare occurrences of snow, or blowing/drifting snow, or freezing rain/drizzle.*

Source: National Centers for Environmental Information and U.S. Department of Agriculture Risk Management Agency

#264987 – CAPR-326-2 Table 3.15 Extreme Temp & Departure from Average
500-1149
MAS/mid
1/23/2023; 9/22/2022

Table 3.15
Extreme Temperature and Departure from Average Temperature Within Washington County: 2011-2021

	Hartford WWTP Site				West Bend Public Works Site			
Year	Max High Temperature (°F)	Max Low Temperature (°F)	Average Annual Temperature (°F)	Departure from Average Temperature (°F)	Max High Temperature (°F)	Max Low Temperature (°F)	Average Annual Temperature (°F)	Departure from Average Temperature (°F)
2011	95.0	-26.0	43.9	-1.0	95.0	-14.0	46.3	-0.1
2012	101.0	-9.0	47.7	+2.8	103.0	-7.0	49.9	+3.5
2013	94.0	-14.0	42.7	-2.2	92.0	-13.0	44.1	-2.3
2014	89.0	-20.0	41.4	-3.5	89.0	-19.0	42.7	-3.7
2015	89.0	-14.0	45.4	+0.5	90.0	-14.0	46.6	+0.2
2016	90.0	-17.0	47.1	+2.2	91.0	-10.0	48.0	+1.6
2017	92.0	-22.0	45.2	+0.3	92.0	-10.0	47.2	+0.8
2018	94.0	-15.0	44.0	-0.9	94.0	-13.0	45.6	-0.8
2019	91.0	-31.0	44.2	-0.7	91.0	-26.0	44.6	-1.8
2020	90.0	-14.0	45.5	+0.6	93.0	-12.0	47.4	+1.0
2021	91.0	-17.0	46.3	+1.4	93.0	-15.0	48.2	+1.8
Average	92.4	-18.1	44.9	--	93.0	-13.9	46.4	--

Source: National Weather Service and National Oceanic and Atmospheric Administration NOWData

Table 3.16
Level of Risk for Persons in High-Risk Groups Associated with the Heat Index

Heat Index (°F)	Category	Possible Heat Disorders for Persons in High-Risk Groups
80-90	Caution	Fatigue possible with prolonged exposure and/or physical activity
90-105	Extreme Caution	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity
105-129	Danger	Sunstroke, muscle cramps and/or heat exhaustion likely. Heatstroke possible with prolonged exposure and/or physical activity
130 or above	Extreme Danger	Heat stroke or sunstroke likely

Source: National Weather Service

Table 3.17
Recent Extreme Heat Events in Washington County: 2011-2021

Date	Type	Deaths	Injuries[a]	Property Damage ($)	Crop Damage ($)
July 17, 2011	Heat	0	0	--	36
July 17, 2011	Heat	0	0	--	36
July 20, 2011	Heat	0	0	--	36
June 28, 2012	Heat	0	0	--	--
July 3, 2012	Excessive Heat	0	0	--	47,109
July 16, 2012	Heat	0	0	--	47,109
July 23, 2012	Heat	0	0	--	47,109
July 25, 2012	Heat	0	0	--	47,109
July 16, 2013	Heat	0	0	--	--
August 30, 2013	Heat	0	0	--	--
July 21, 2016	Heat	0	0	--	12,748
June 17, 2018	Heat	0	0	--	--
June 29, 2018	Excessive Heat	0	0	--	--
July 4, 2018	Heat	0	0	--	--
July 19, 2019	Heat	0	0	--	--
	Total	0	0	--	201,292

Note: Dollar Values were adjusted to year 2021 by the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.

[a] *No injuries were reported to NCEI or USDA RMA, but injuries may have occurred.*

Source: National Centers for Environmental Information and U.S. Department of Agriculture Risk Management Agency

Table 3.18
Wind Chill Temperatures[a]

Wind (mph)	Temperature (°F)																	
	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	**-22**	**-28**	**-34**	**-40**	**-46**	**-52**	**-57**	**-63**
10	34	27	21	15	9	3	-4	-10	-16	**-22**	**-28**	**-35**	**-41**	**-47**	**-53**	**-59**	**-66**	**-72**
15	32	25	19	13	6	0	-7	-13	**-19**	**-26**	**-32**	**-39**	**-45**	**-51**	**-58**	**-64**	**-71**	**-77**
20	30	24	17	11	4	-2	-9	-15	**-22**	**-29**	**-35**	**-42**	**-48**	**-55**	**-61**	**-68**	**-74**	**-81**
25	29	23	16	9	3	-4	-11	-17	**-24**	**-31**	**-37**	**-44**	**-51**	**-58**	**-64**	**-71**	**-78**	**-84**
30	28	22	15	8	1	-5	-12	**-19**	**-26**	**-33**	**-39**	**-46**	**-53**	**-60**	**-67**	**-73**	**-80**	**-87**
35	28	21	14	7	0	-7	-14	**-21**	**-27**	**-34**	**-41**	**-48**	**-55**	**-62**	**-69**	**-76**	**-82**	**-89**
40	27	20	13	6	-1	-8	-15	**-22**	**-29**	**-36**	**-43**	**-50**	**-57**	**-64**	**-71**	**-78**	**-84**	**-91**
45	26	19	12	5	-2	-9	-16	**-23**	**-30**	**-37**	**-44**	**-51**	**-58**	**-65**	**-72**	**-79**	**-86**	**-93**
50	26	19	12	4	-3	-10	-17	**-24**	**-31**	**-38**	**-45**	**-52**	**-60**	**-67**	**-74**	**-81**	**-88**	**-95**
55	25	18	11	4	-3	-11	**-18**	**-25**	**-32**	**-39**	**-46**	**-54**	**-61**	**-68**	**-75**	**-82**	**-89**	**-97**
60	25	17	10	3	-4	-11	**-19**	**-26**	**-33**	**-40**	**-48**	**-55**	**-62**	**-69**	**-76**	**-84**	**-91**	**-98**

[a] *Wind Chill (°F) = 35.74 + 0.6215T - 35.75($V^{0.16}$) + 0.4275T($V^{0.16}$), where T = air temperature (°F) and V = wind speed (mph). The wind chill temperature is only defined for temperatures at or below 50°F and wind speeds above 3 mph. Bright sunshine may increase wind chill temperature by 10°F to 18°F.*

Frostbite times associated with wind chills:

- 30 minutes
- 10 minutes
- 5 minutes

Source: National Weather Service

Table 3.19
Recent Extreme Cold Events in Washington County: 2011-2021

Date	Type	Deaths[a]	Injuries[a]	Property Damage ($)	Crop Damage ($)
January 21, 2011	Cold/Wind Chill	0	0	--	1,315
January 21, 2013	Cold/Wind Chill	0	0	--	39,965
January 6, 2014	Extreme Cold/Wind Chill	0	0	--	1,559
January 27, 2014	Cold/Wind Chill	0	0	--	1,559
January 7, 2015	Cold/Wind Chill	0	0	--	--
January 9, 2015	Cold/Wind Chill	0	0	--	--
December 14, 2016	Cold/Wind Chill	0	0	--	--
December 18, 2016	Cold/Wind Chill	0	0	--	--
December 25, 2017	Cold/Wind Chill	0	0	--	--
January 1, 2018	Cold/Wind Chill	0	0	--	--
January 29, 2019	Extreme Cold/Wind Chill	0	0	--	194
February 7, 2021	Cold/Wind Chill	0	0	--	14,348
February 13, 2021	Cold/Wind Chill	0	0	--	14,348
	Total	0	0	--	73,288

Note: Dollar Values were adjusted to year 2021 by the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.

[a] *No deaths or injuries were reported to NCEI related to extreme cold or wind chill events for Washington County during this time period.*

Source: National Centers for Environmental Information and U.S. Department of Agriculture Risk Management Agency

#264994 – CAPR-326-2 Table 3.20 Estimates of Crop Losses Due to Drought
500-1149
MAS/mid
4/29/2024; 4/12/2023; 9/23/2022

Table 3.20
Estimates of Crop Losses Due to Drought in Washington County: 2011-2021

Year	Crop Insurance Indemnity Paid (2021 Dollars)
2011	22,424
2012	4,756,557
2013	539,923
2014	56,482
2015	26,732
2016	20,215
2017	--
2018	78,314
2019	--
2020	3,371
2021	64,333
Total	5,568,350

Source: National Centers for Environmental Information and U.S. Department of Agriculture Risk Management Agency and SEWRPC

SEWRPC Community Assistance Planning Report No. 326 (2nd Edition)

WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE:

Chapter 3

ANALYSIS OF HAZARD CONDITIONS

FIGURES

#265328 – CAPR-326-2 Figure 3.1 NWS Heat Index Chart
500-1149
MAS/mid
1/24/2023; 10/19/2022

Figure 3.1
Heat Index Chart

Relative Humidity (%)	Temperature (°F)															
	80	82	84	86	88	90	92	94	96	98	100	102	104	106	180	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

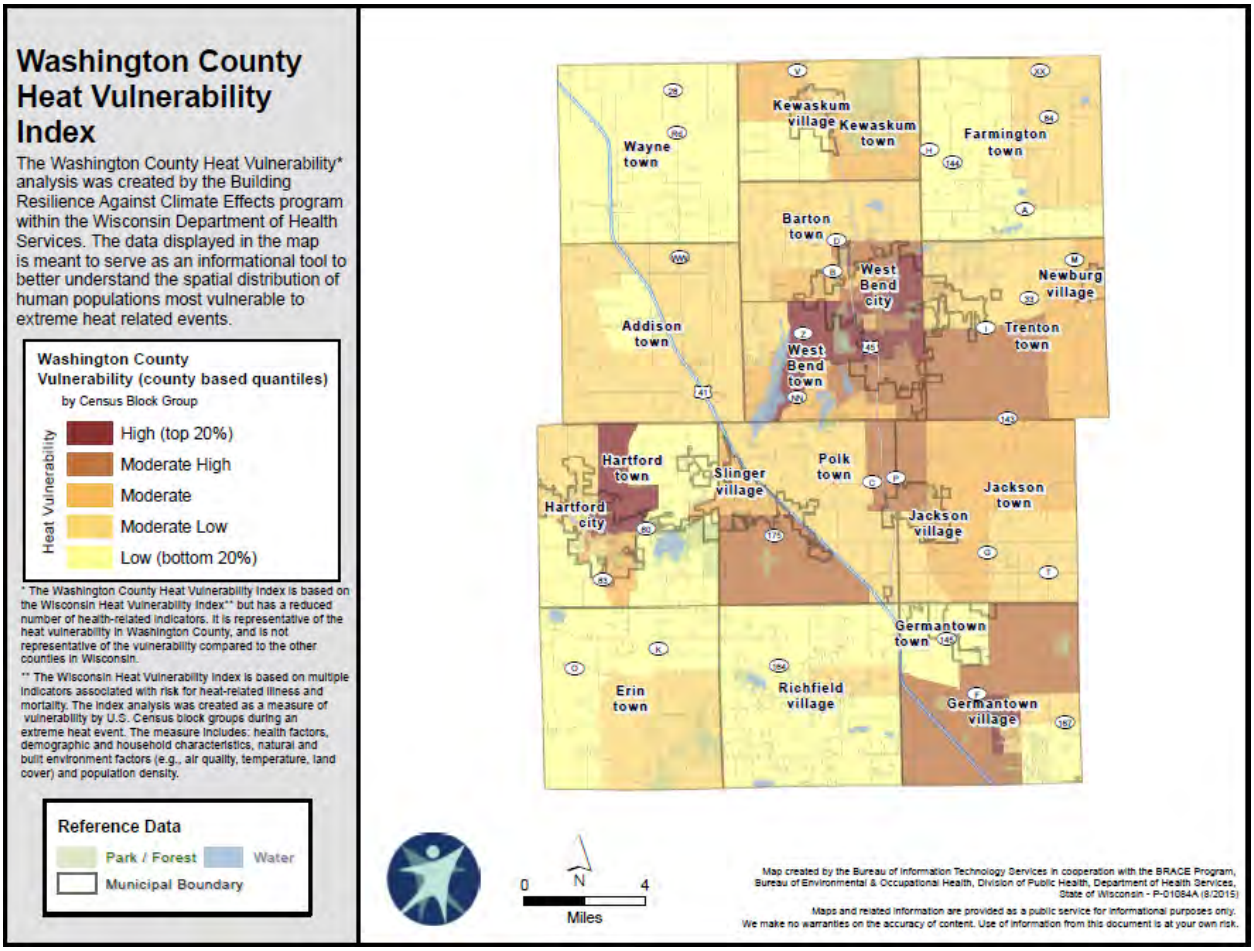
Likelihood of heat disorders with prolonged exposure or strenuous activity:

- Caution
- Extreme Caution
- Danger
- Extreme Danger

Source: National Weather Service and SEWRPC

#266245 – CAPR-326-2 Figure 3.2 BRACE Washington Co. Heat Vulnerability Index
500-1149
MAS/mid
1/24/2023; 10/19/2022

Figure 3.2
Washington County Heat Vulnerability Index Under the BRACE Program



Source: Wisconsin Department of Health Services, Building Resilience Against Climate Effects Program

#265327 – CAPR-326-2 FIGURE 3.3 U.S. Drought Monitor Classifications
500-1149
MAS/mid
1/24/2023; 10/19/2022

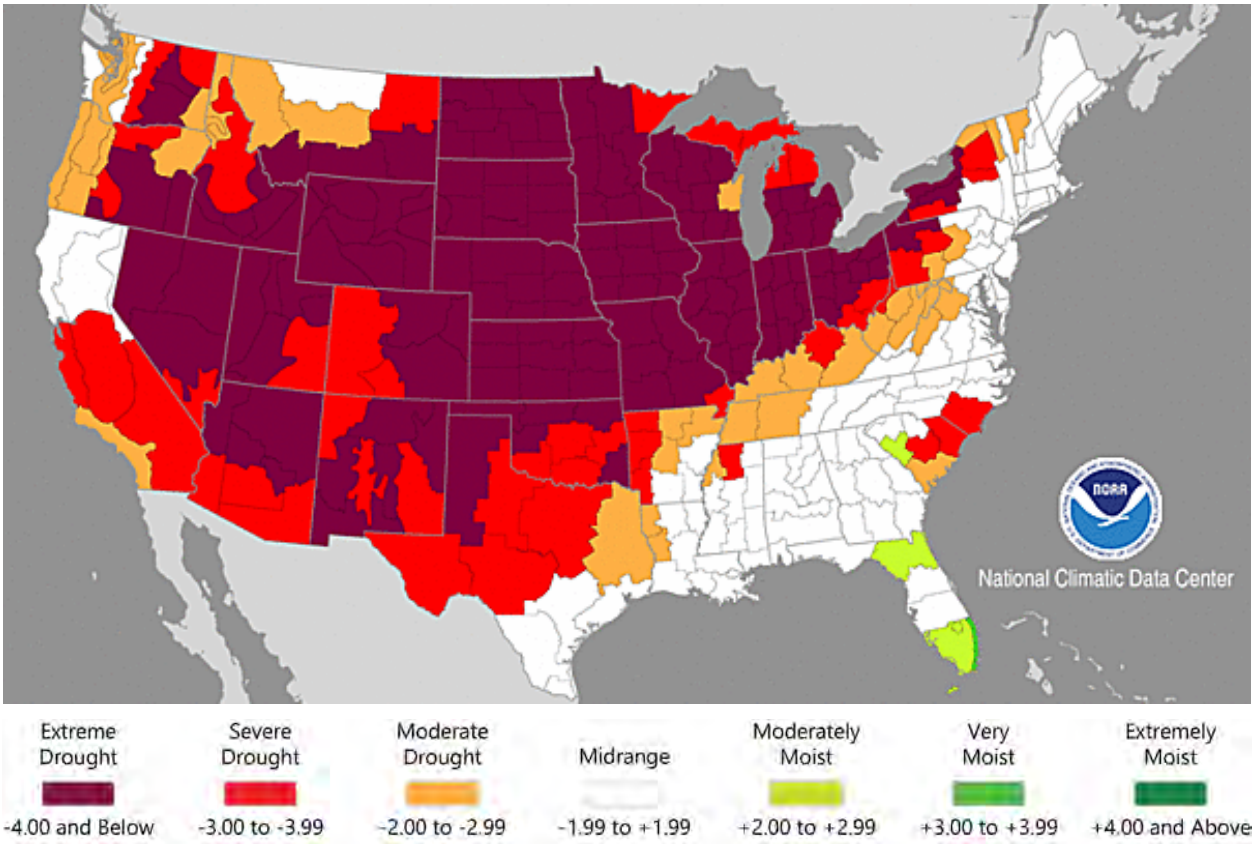
Figure 3.3
U.S. Drought Monitor Classifications

			Ranges				
Category	**Description**	**Possible Impacts**	Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: • short-term dryness slowing planting, growth of crops or pastures Coming out of drought: • some lingering water deficits • pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	• Some damage to crops, pastures • Streams, reservoirs, or wells low, some water shortages developing or imminent • Voluntary water-use restrictions requested	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	• Major crop/pasture losses • Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

Source: U.S. Drought Monitor Drought Classification (droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx)

#265335 – CAPR-326-2 Figure 3.4 July 1934 Palmer Drought Index
500-1149
MAS/mid
1/24/2023; 10/19/2022

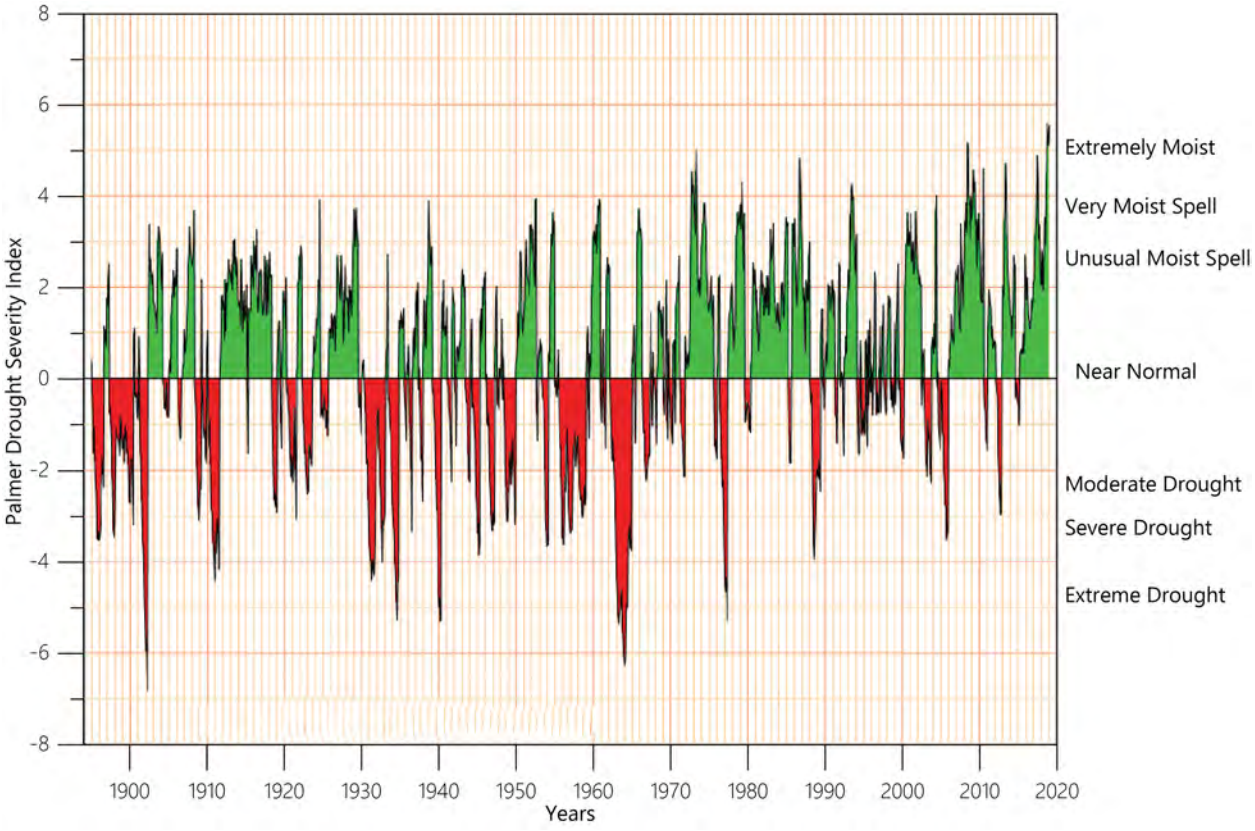
Figure 3.4
Palmer Drought Severity Index for July 1934



Source: National Climatic Data Center

#266132 – CAPR-326-2 Figure 3.5 Palmer Drought Index
500-1149
MAS/mid
1/24/2023; 9/21/2022

Figure 3.5
Palmer Drought Severity Index for Southeastern Wisconsin: 1895-2022



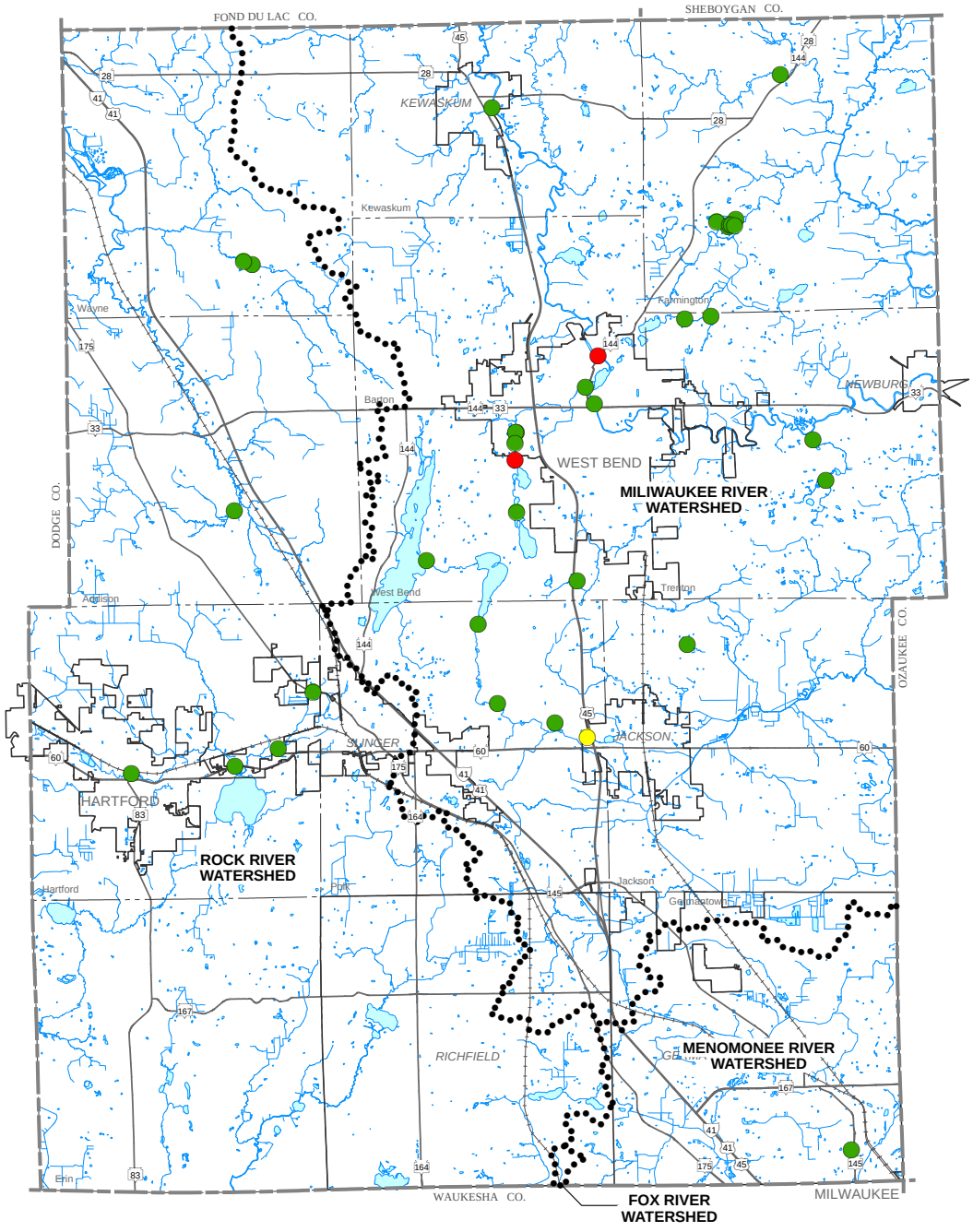
Source: University of Wisconsin Atmospheric and Oceanic Sciences, Wisconsin State Climatology Office

Chapter 3

ANALYSIS OF HAZARD CONDITIONS

MAPS

Map 3.1
Dams Located in Washington County: 2021



HAZARD RATING

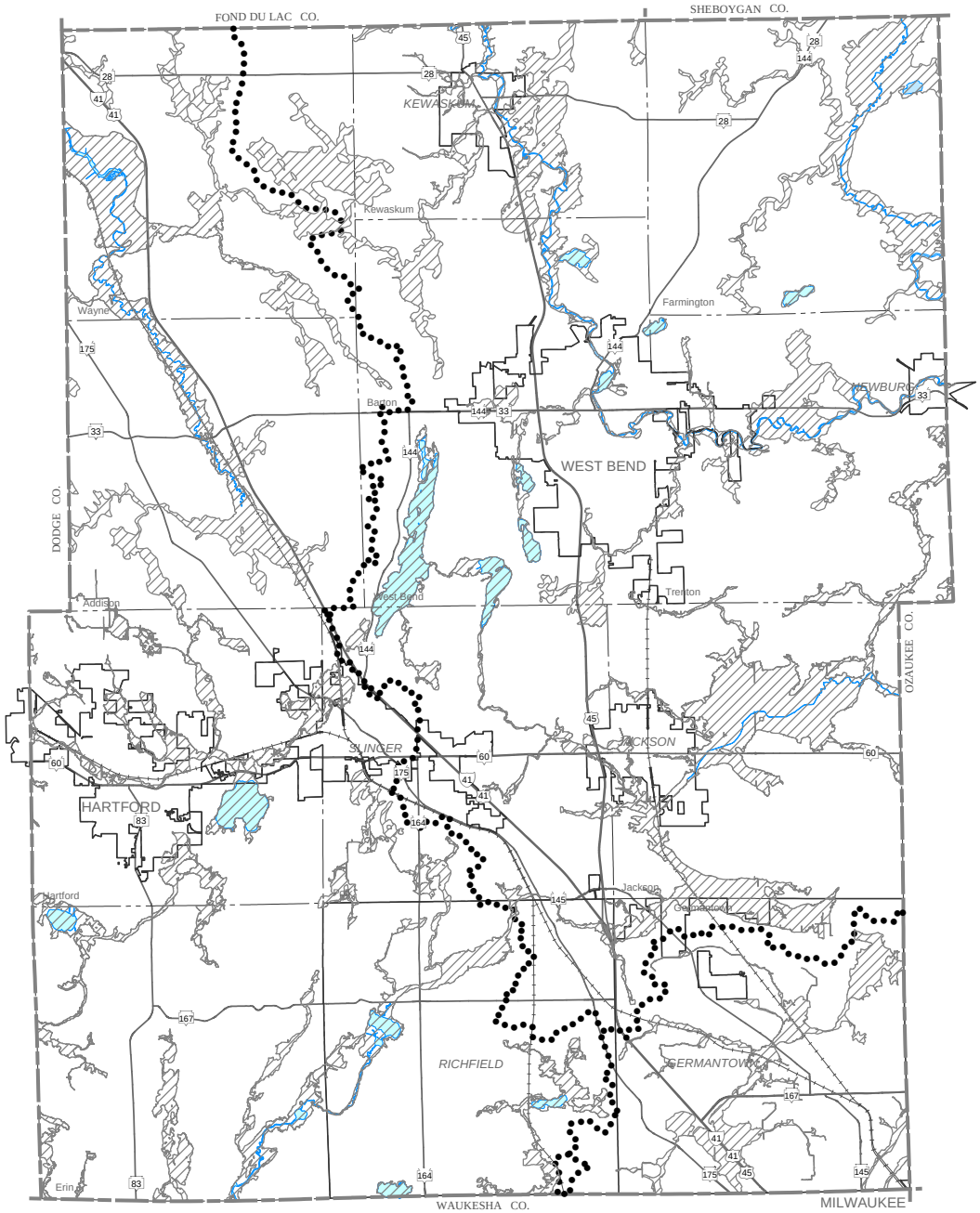
- HIGH
- SIGNIFICANT
- LOW

N

0 1 2 3 Miles

Source: Wisconsin Department of Natural Resources and SEWRPC

Map 3.2
100-Year Floodplains in Washington County: 2022



ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FLOODPLAINS (FEMA FIS, JANUARY 2022)

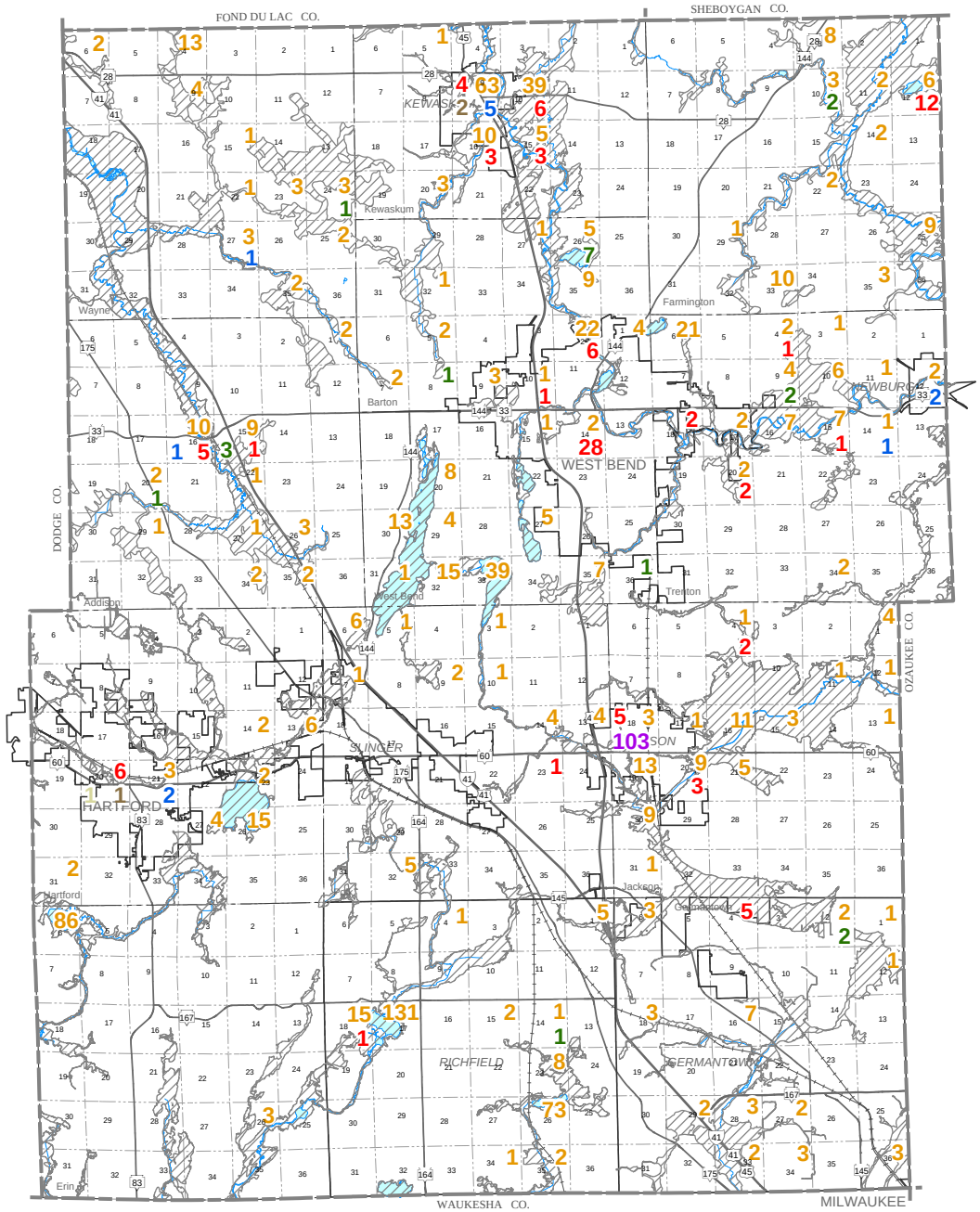
MAJOR LAKES AND RIVERS

N

0 1 2 3 Miles

Source: Federal Emergency Management Agency and SEWRPC

Map 3.3
Structures Located Within the 100-Year Floodplain: 2022



NUMBER OF STRUCTURES WITHIN U.S. PUBLIC LAND SURVEY

- 923 RESIDENTIAL STRUCTURES
- 102 COMMERCIAL STRUCTURES
- 21 AGRICULTURAL STRUCTURES
- 103 MANUFACTURED HOMES
- 12 GOVERNMENT STRUCTURES
- 1 INDUSTRIAL STRUCTURES
- 3 OTHER STRUCTURES

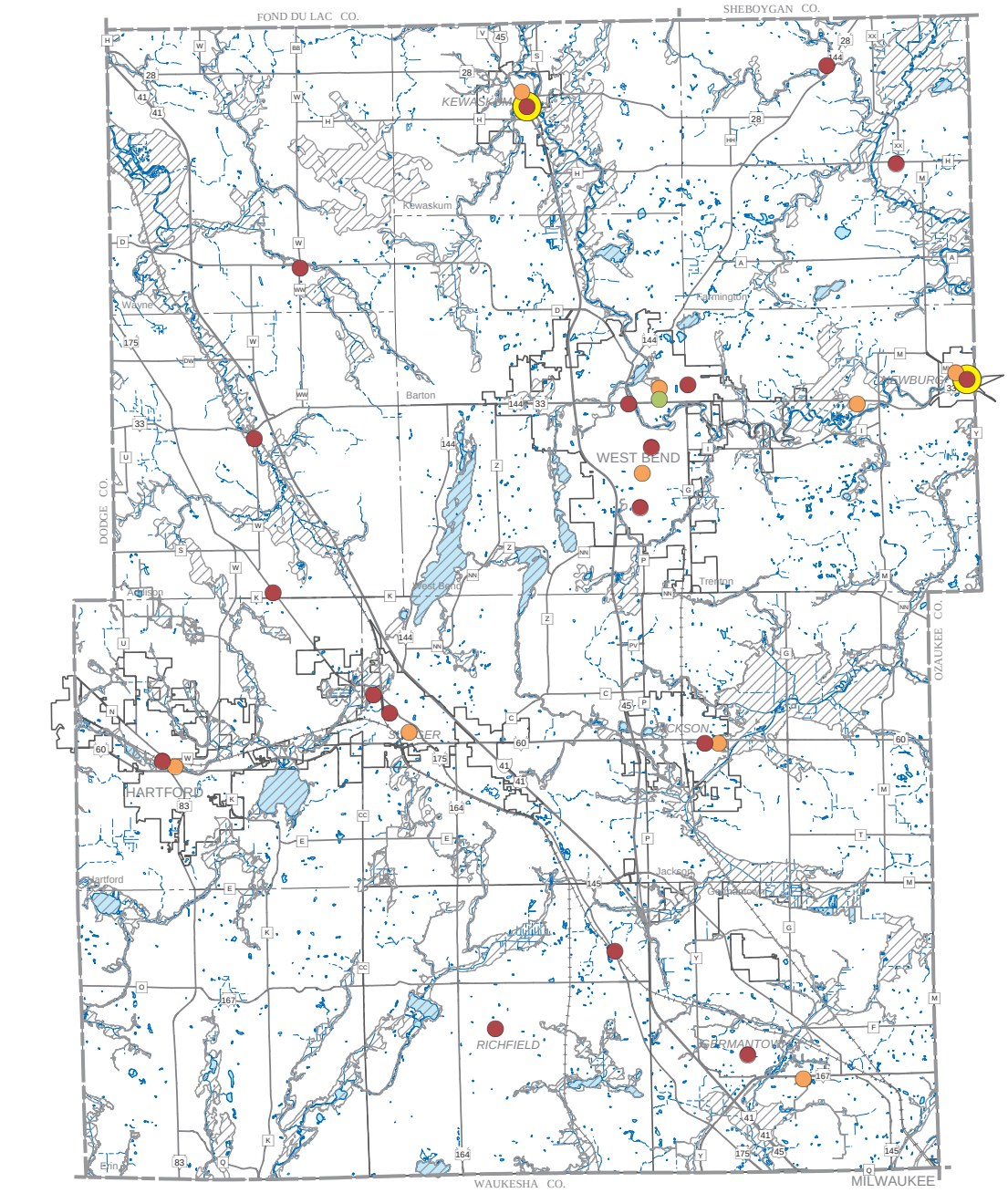
- ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FLOODPLAINS (FEMA FIS, JANUARY 2022)
- PERENNIAL STREAM
- INTERMITTENT STREAM
- SURFACE WATER

N

0 1 2 3 Miles

Source: Federal Emergency Management Agency, Washington County, and SEWRPC

Map 3.4
Emergency Service Structures in Relation to 100-Year Floodplains: 2022



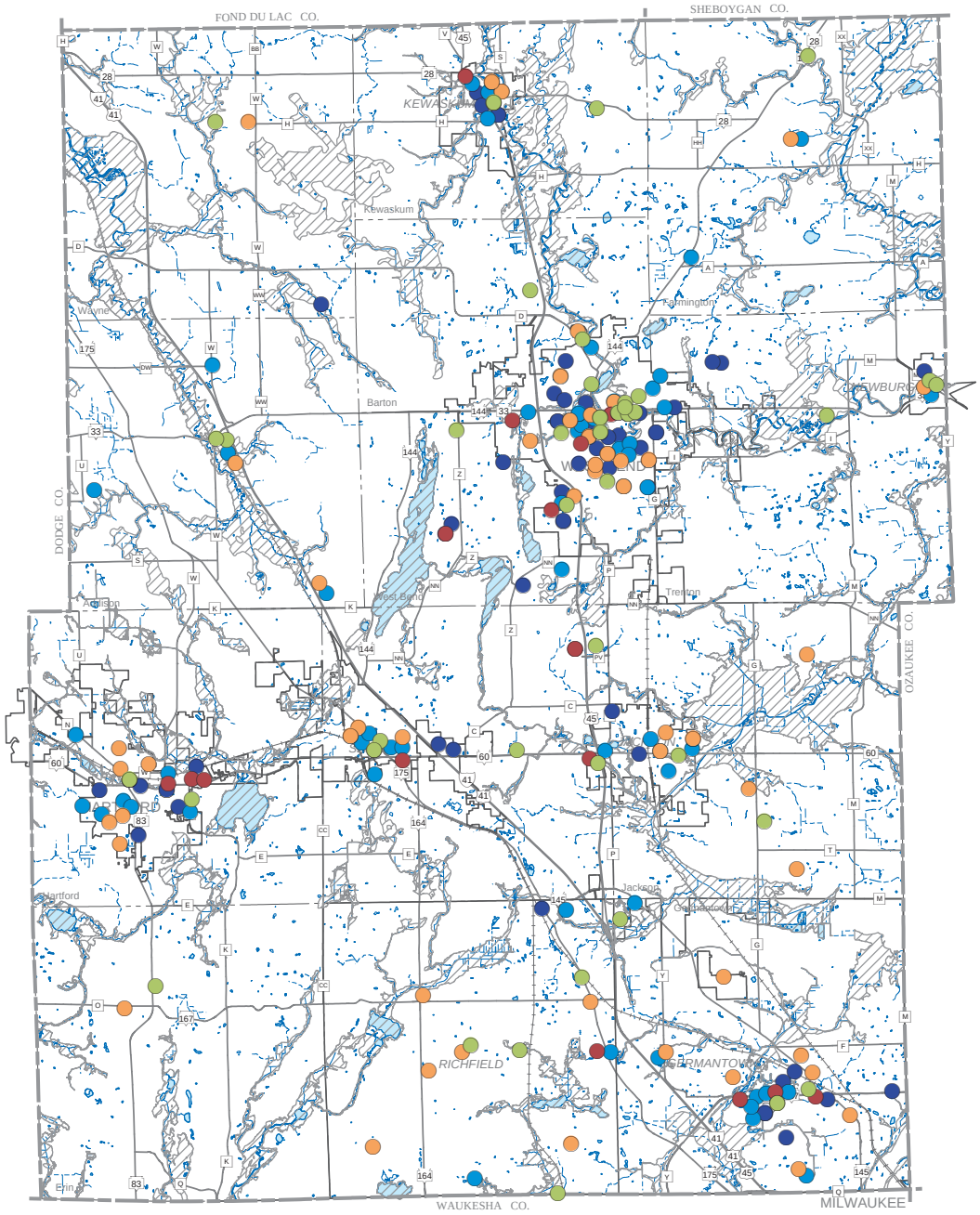
- FIRE/EMS STATION
- POLICE STATION
- COUNTY COURT HOUSE
- FACILITY PARTIALLY OR FULLY WITHIN THE FEMA FLOODPLAIN
- ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FLOODPLAINS (FEMA FIS, JANUARY 2022)
- PERENNIAL STREAM
- INTERMITTENT STREAM
- SURFACE WATER

N

0 1 2 3 Miles

Source: FEMA, Wisconsin Department of Justice (WILENET), Washington County Office of Emergency Management Department, Washington County, and SEWRPC

Map 3.5
Critical Community Facilities in Relation to 100-Year Floodplains: 2022



- HOSPITAL/CLINIC
- PUBLIC/PRIVATE SCHOOLS OR COLLEGES
- GOVERNMENT BUILDINGS
- CHILD CARE
- ADULT CARE

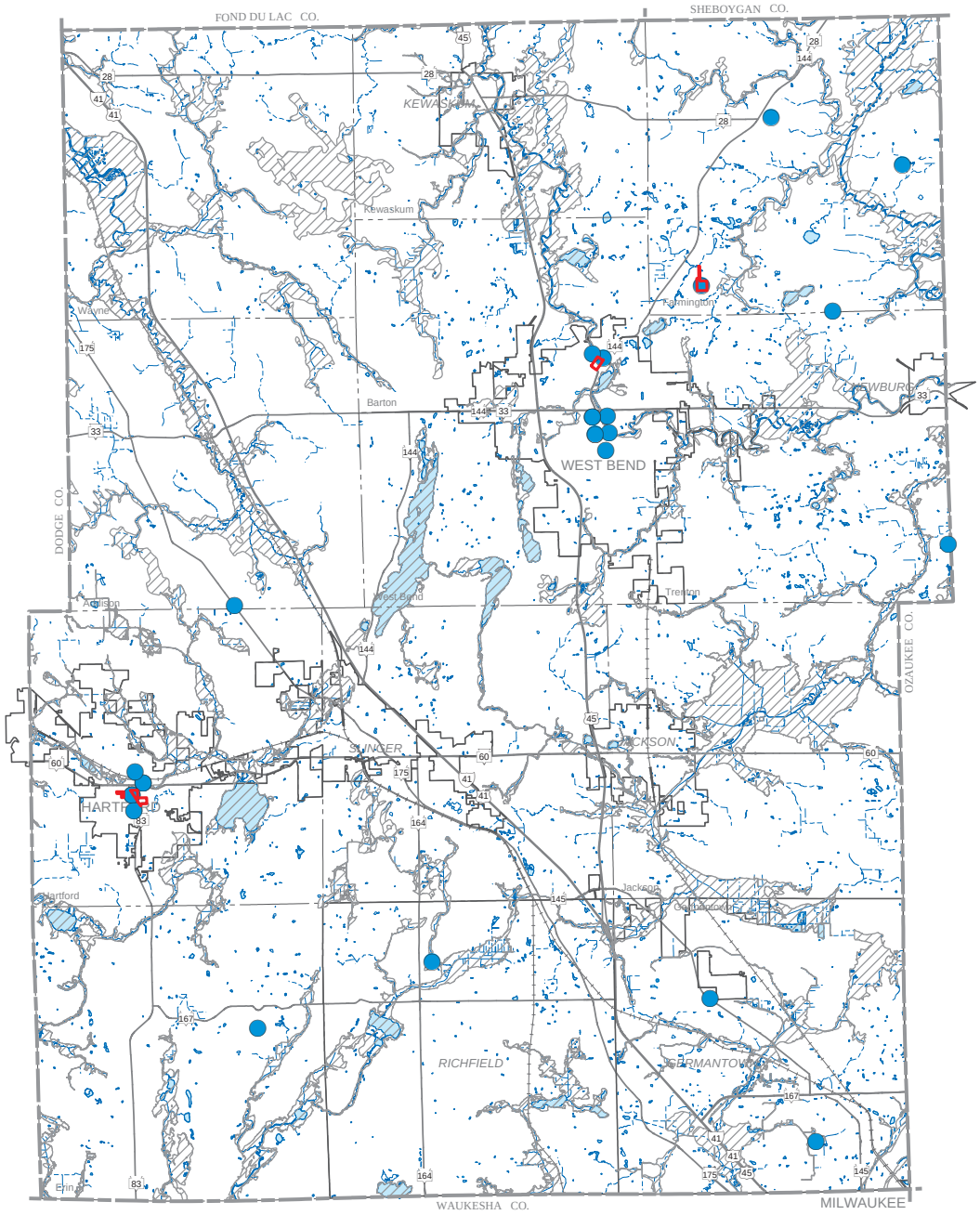
- ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FLOODPLAINS (FEMA FIS, JANUARY 2022)
- PERENNIAL STREAM
- INTERMITTENT STREAM
- SURFACE WATER

N

0 1 2 3 Miles

Source: Wisconsin Department of Children and Families, Wisconsin Department of Health and Social Services, Wisconsin Department of Public Instruction, Washington County, FEMA, and SEWRPC

Map 3.6
National and State Registers of Historic Sites and Districts in Relation to 100-Year Floodplains: 2022



HISTORIC SITE

HISTORIC DISTRICT

ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FLOODPLAINS (FEMA FIS, JANUARY 2022)

PERENNIAL STREAM

INTERMITTENT STREAM

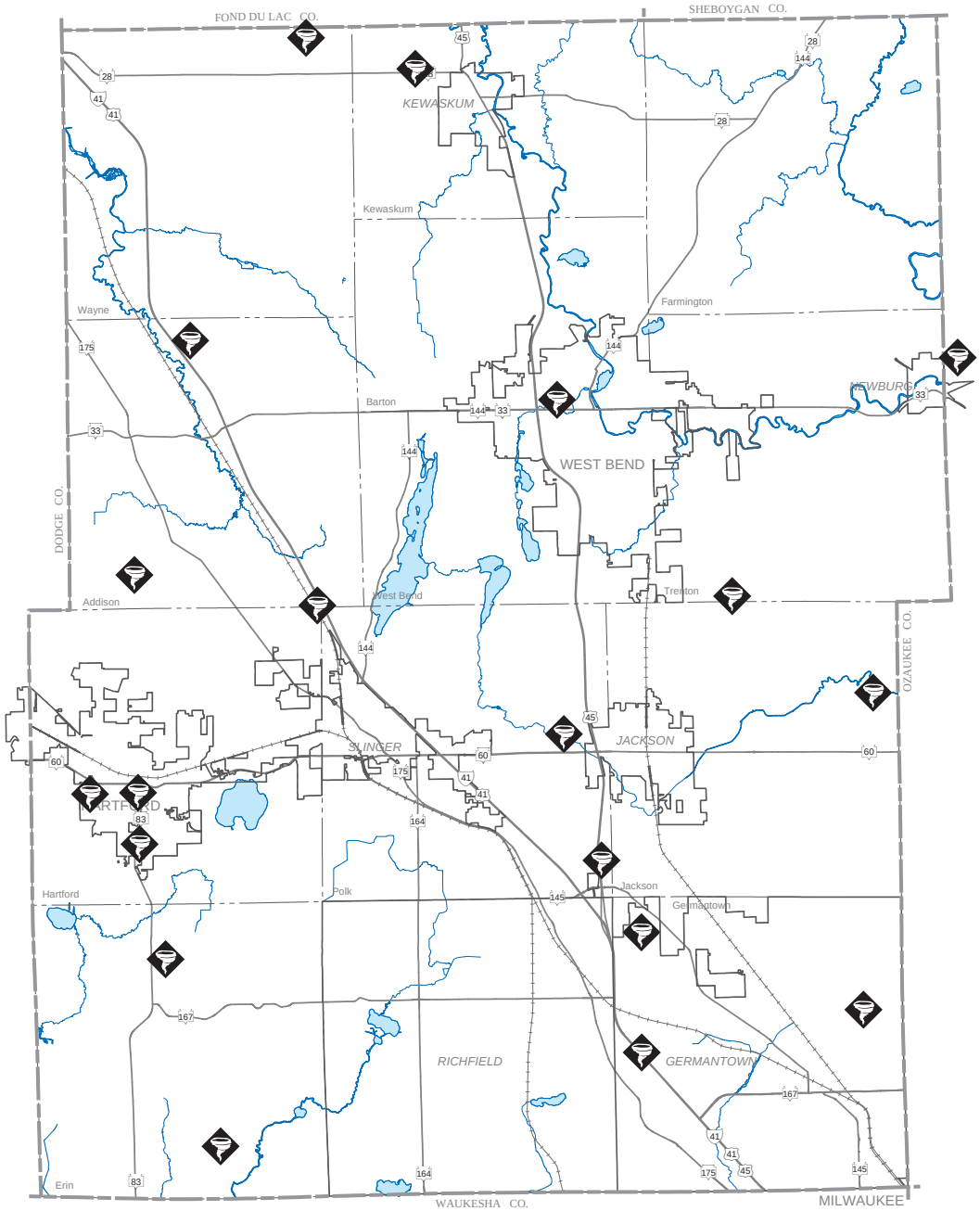
SURFACE WATER

N

0 1 2 3 Miles

Source: FEMA, State Historical Society of Wisconsin, Washington County and SEWRPC

Map 3.7
Tornado Events in Washington County: July 1964 Through May 2018



REPORTED TORNADO SIGHTING

N

0 1 2 3 Miles

Source: National Climatic Data Center and SEWRPC

Community Assistance Planning Report No. 326 (2nd Edition)

WASHINGTON COUNTY HAZARD MITIGATION PLAN

Chapter 4

HAZARD MITIGATION GOALS

Planning is a rational process for formulating and meeting goals and objectives. Consequently, formulating goals and objectives is an essential task that must be undertaken before plans can be prepared. This chapter sets forth hazard mitigation goals and objectives for use in considering alternative hazard mitigation strategies for Washington County and in selecting recommended strategies from among those alternatives. Their differing natures and purposes must be considered when formulating and setting goals and objectives. The Federal Emergency Management Agency (FEMA) defines goals and objectives in this regard. Goals are general guidelines that explain what a community desires to achieve. Based on the selected goals, a community can develop the specific objectives or standards needed to attain the goals. Objectives and standards more narrowly define strategies for meeting the selected goals and are more specific.

4.1 RELATIONSHIP OF HAZARD MITIGATION GOALS AND OBJECTIVES TO OTHER RELEVANT PLANNING EFFORTS

Washington County and several of its local governments have prepared a comprehensive plan that provides a basis for broad-based decision-making on land use-related matters by County and local government officials and will increase the awareness and understanding of County, City, Village, and Town planning goals and objectives by landowners, developers, and other private interests.[1] That plan incorporates and updates elements from other pertinent County and Regional Plans as appropriate. The Village of Kewaskum and the Towns of Addison, Barton, Erin, Farmington, Hartford, Jackson, Kewaskum, Polk, Trenton, and Wayne

[1] *SEWRPC Community Assistance Planning Report No. 287*, A Multi-Jurisdictional Comprehensive Plan for Washington County: 2050 (2nd Edition), *April 2019*.

adopted local comprehensive plans based on the multi-jurisdictional plan. The Town of Germantown adopted the multi-jurisdictional plan document as the Town comprehensive plan. While these local governments prepared their local plans, individually or in partnership, they cooperated in the multi-jurisdictional planning process. The Town of West Bend and the Cities of Hartford and West Bend have adopted their own comprehensive plans.[2]

Additional planning efforts that incorporate and update elements from pertinent Regional, County, and local plans were considered when formulating goals and objectives for the County hazard mitigation program, which include:

Regional Plans

- SEWRPC Planning Report No. 27, *A Regional Park and Open Space Plan for Southeastern Wisconsin: 2000*, November *1977*

- SEWRPC Planning Report No. 30, *A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000*, July 1979

    - SEWRPC Memorandum Report No. 93, *A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report,* Part 1, Part 2, Part 3, March 1995

- SEWRPC Planning Report *No. 50, A Regional Water Quality Plan Update for the Greater Milwaukee Watersheds,* Part One, Chapters 1-12, December 2007 and Part Two, Appendices, December 2007, amended May 2013

- SEWRPC Planning Report No. 42, *Regional Natural Areas Plan*, September 1997, amended 2010

- SEWRPC Planning Report No. 52, *A Regional Water Supply Plan*, Volume One, Chapters 1-12, December 2010 and Volume Two, Appendices, December 2010

- SEWRPC Planning Report No. 55, Vision 2050: *A Regional Land Use and Transportation Plan for Southeastern Wisconsin*, June 2020

[2] *City of Hartford,* City of Hartford 2030 Smart Growth Plan, *n.d. and City of West Bend,* 2020 Comprehensive Plan for the City of West Bend, *April 12, 2004, last amended August 19, 2019.*

County Plans

- SEWRPC Community Assistance Planning Report No. 287, *A Multi-Jurisdictional Comprehensive Plan for Washington County: 2050 (2nd Edition)*, April 2019

    - SEWRPC Community Assistance Planning Report No. 287, *A Multi-Jurisdictional Comprehensive Plan for Washington County: 2035*, April 2008

- Washington County, Wisconsin, *A Park and Open Space Plan for Washington County*, April 2020

- A Farmland Preservation Plan for Washington County, 1981, updated in December 2013 (also located as an amendment in SEWRPC Community Assistance Planning Report No. 287, *A Multi-Jurisdictional Comprehensive Plan for Washington County: 2035*, April 2008 as Appendix T)

- Washington County, Wisconsin, Land & Water Resource Management Plan: 2021-2030, October 2020

- Washington County, Wisconsin, Bikeway & Trail Network Plan, June 2019

Watershed Plans

- SEWRPC Planning Report No. 12, *A Comprehensive Plan for the Fox River Watershed*, Volume One, Inventory Finding and Forecasts, April 1969, and Volume Two, Alternative Plans and Recommended Plan, February 1970

- SEWRPC Planning Report No. 13, *A Comprehensive Plan for the Milwaukee River Watershed*, Volume One, Inventory Finding and Forecasts, December 1970, and Volume Two, Alternative Plans and Recommended Plan, October 1971

- SEWRPC Planning Report No. 26, *A Comprehensive Plan for the Menomonee River Watershed*, Volume One, Inventory Finding and Forecasts, December 1976, and Volume Two, Alternative Plans and Recommended Plan, October 1976

- Quas Creek Watershed Protection Plan, 2004

- The Menomonee River Watershed Updated Implementation Plan: A Comprehensive Watershed Restoration Plan, December 2021

- Total Maximum Daily Loads for Total Phosphorus, Total Suspended Soils, and Fecal Coliform in the Milwaukee River Basin, Wisconsin, March 2018

- Cedar, Pigeon, Ulao, and Mole Creeks Watershed Restoration Plan, June 2020

- Fredonia-Newburg Area Watershed-Based Plan, October 2019

4.2 HAZARD MITIGATION GOALS AND OBJECTIVES

Figure 4.1 presents the goals of the Washington County hazard mitigation planning program. The goals have been established based, in part, upon goals established in the previous edition of the Washington County hazard mitigation plan and related County planning programs, including those listed above. Complementing each of these goals is a set of objectives that can be used to define more specific actions or strategies to achieve the goals.

Chapter 4

HAZARD MITIGATION GOALS

FIGURES

Figure 4.1
Goals and Objectives for the Washington County Hazard Mitigation Plan

➤ **Goal 1: Preserve life and minimize the potential for injuries.**

- **Objective 1.1:** Identify natural hazards that threaten life in Washington County.
- **Objective 1.2:** Identify populations within Washington County that are particularly vulnerable to each identified hazard.
- **Objective 1.3:** Implement programs and projects that help protect the lives of populations vulnerable to each identified hazard.

➤ **Goal 2: Preserve and enhance the quality of life throughout Washington County by identifying potential property and crop damage risks, and recommending appropriate mitigation strategies to minimize potential damages.**

- **Objective 2.1:** Identify locations where property or crop damages are vulnerable to each identified hazard.
- **Objective 2.2:** Improve and update hazard assessment information to make informed recommendations that encourage adaptive and preventative measures for existing development in areas vulnerable to identified hazards and discourage new development in such areas.
- **Objective 2.3:** Protect life and property by implementing and enforcing modern standards, codes, ordinances, and construction procedures.
- **Objective 2.4:** Develop and maintain stormwater and floodplain management systems, and dam safety plans that reduce the exposure of people to drainage- and flooding-related inconvenience and health and safety hazards and that reduce the exposure of real and personal property to damage
- **Objective 2.5:** Continue participating in the National Flood Insurance Program (NFIP) and consider participating in the Community Rating System (CRS) program for all communities within the County.

➤ **Goal 3: Promote Countywide coordination, planning, and training that avoids transferring the risk of hazards from one community to an adjacent community, where appropriate.**

- **Objective 3.1:** Identify and encourage uniformity across municipal boundaries in implementing modern standards, codes, ordinances, and construction procedures that mitigate the impacts of hazards.
- **Objective 3.2:** Identify and encourage cross-jurisdictional and multiple property owner programs and projects that promote cooperation to mitigate the impact of hazards (i.e., stormwater and lake shore structure protection projects).

- **Objective 3.3:** Provide and maintain facilities necessary to maintain high-quality fire and police protection, and emergency medical services (also known as Washington County "Task Force") throughout Washington County.

- **Objective 3.4:** Continue developing and strengthening inter-jurisdictional coordination and cooperation of emergency services.

- **Objective 3.5:** Continue to develop, maintain, and support comprehensive mutual aid agreements.

- **Objective 3.6:** Continue providing Washington County and municipal emergency services with training and equipment to address all identified hazards.

- **Objective 3.7:** Identify and develop programs that complement Washington County and local emergency operation plans to mitigate the potential exposure to health and safety risks and the exposure of property to damage from a broad range of unpredictable and not geographically specific hazards.

- **Objective 3.8:** Develop and maintain backup plans, communications interoperability, and redundancy for emergency response throughout Washington County. Communications interoperability for other crucial public health, public works, dispatch, emergency management, and hospitals should also ensure adequate prevention and response operations.

➤ **Goal 4: Maintain a spatial distribution of the various land uses that preserves and protects the natural resources of Washington County, including its soils, inland lakes and streams, groundwater, wetlands, woodlands, wildlife, floodplains, natural areas, and critical species habitats.**

- **Objective 4.1:** Floodplains should not be allocated to any urban development that would be subject to flood damage or cause flood damage in upstream or downstream areas.

- **Objective 4.2:** No unauthorized structure or fill should be allowed to infringe upon and obstruct the floodway portion of stream channels.

- **Objective 4.3:** The types and distribution of land uses should be developed considering the potential impacts on flood flows, surface water quality, and groundwater quality and quantity. Considerations should be made to limit the amount of impervious surface in new or redeveloped areas.

- **Objective 4.4:** All remaining undeveloped lands within the designated primary environmental corridors in the County should be preserved as natural and open uses.

  Objective 4.5: All remaining undeveloped lands within isolated natural resource areas and wetlands outside the primary environmental corridors and isolated natural resource areas in Washington County should be considered for preservation.

- **Objective 4.6:** All wetlands adjacent to water bodies, within areas having special wildlife or other natural values, and having an area of five acres or greater should not be allocated to any urban development except for limited recreational use, and should not be drained or filled. In addition, Washington County and local government units may choose to preserve all wetlands.

➤ Goal 5: Increase public awareness of hazards threatening life and property.

- **Objective 5.1:** Increase public awareness of existing threats and the means to reduce these threats by conducting educational and outreach programs to various community groups in Washington County.

- **Objective 5.2:** Increase public awareness of populations that are particularly vulnerable to specific hazard threats and inform them of actions they can take, as well as programs available to them, to reduce the risk of injury, death, and property damage.

- **Objective 5.3:** Provide informational items, partnership opportunities, and funding resource information to assist in implementing mitigation activities.

➤ Goal 6: Identify potential funding sources that can assist in implementing mitigation projects and programs.

- **Objective 6.1:** Whenever possible, seek funding for programs that meet the multiple objectives and recommendations made for this hazard mitigation plan, as well as those of other Washington County and local community planning efforts.

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WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Chapter 5

HAZARD MITIGATION STRATEGIES

5.1 EVALUATION OF HAZARD MITIGATION MEASURES

Hazard mitigation planning systematically evaluates the nature and vulnerability of existing hazards and develops continued actions to reduce or eliminate long-term risks from hazards and their effects. Specific purposes of hazard mitigation include eliminating loss of life, lessening danger to human health and safety, minimizing monetary damage to private and public property, reducing the cost of utilities and services, creating community resilience, and minimizing disruption in community affairs. Hazard mitigation also involves avoiding the intensification of existing hazards and the creation of new hazards.

Preparing a hazard mitigation plan for Washington County involves developing and evaluating alternative mitigation measures or actions to reduce risk and selecting the most effective elements of the alternatives to formulate an integrated plan. For planning purposes, the alternative mitigation measures are separated into one of three categories: 1) Non-structural (i.e., nature-based solutions), 2) Structural, and 3) Public Informational and Educational Programming.

The mitigation measures identified in each hazard category were evaluated based on the relative cost and likely benefits (direct and indirect), as indicated in the cost-benefit analysis summary tables at the end of each profiled hazard. Consideration was given to the likelihood of occurrence of each hazard as outlined in the hazard prioritization analysis in Chapter 3. The highest priority is recommended to be given to those mitigation measures that directly or indirectly result in minimized loss of life or injury.

Estimated Cost of Implementation

Where possible, the cost-benefit analysis table for each profiled hazard includes a summary of the estimated capital cost and average annual operation and maintenance cost for each mitigation measure. Many mitigation measures exist, especially for hazards other than flooding and related stormwater drainage problems, where a meaningful direct monetary cost analysis was impossible. Therefore, mitigation measures were also classified as low-, moderate-, and high-cost to categorize the relative expense of implementing the measure. The three categories are generally defined as follows.

- **Low-Cost (less than $100,000)**
  - Educational and informational programming
  - Ongoing enforcement of ordinances
  - Plan development
  - Continued coordination/mutual aid/interagency agreements

- **Moderate-Cost (greater than $100,000 and less than $1,000,000)**
  - Addition of new staff
  - Additional staff hours budgeted
  - Additional equipment
  - New ordinance development
  - New programs/task force

- **High-Cost (greater than $1,000,000)**
  - Major construction
  - New buildings (infrastructure)
  - Capital programs

This cost assessment allows the mitigation measures to be prioritized with particular regard to cost-effectiveness by comparing the estimated low, moderate, and high costs to the number of direct and indirect benefits identified.

Benefits (Direct and Indirect)

The benefits of implementing a mitigation measure can be classified as direct or measurable and as indirect or intangible. Direct benefits were defined as enhanced preparedness/protection of individuals or communities, reduced property damage, reduced injuries, and reduced mortalities. Although the exact

numbers or amounts of such benefits are often unknown, they would directly result from implementing a particular mitigation measure. In contrast, indirect benefits represent a range of potential benefits that may result from implementing specific management actions, such as increased environmental and recreational benefits/ecosystem services and reduced loss of life and injury with associated benefits for economic productivity. For this hazard mitigation plan, direct and indirect benefits are combined into one category within each cost-benefit analysis table for the profiled hazard.

Communities/Jurisdictions Affected

The cost-benefit analysis tables for each profiled hazard also indicate a list of the communities affected by each hazard and corresponding mitigation measures. Some of the mitigative actions described are ongoing or committed actions that do not require evaluating alternative measures but are proposed to be integrated into the mitigation plan as such. In other instances, applicable viable alternatives may be described and evaluated. This Chapter describes the hazard mitigation actions considered to resolve the identified hazard problems within Washington County described in Chapter 3.

In preparing updates to the plan, SEWRPC staff, the Washington County Office of Emergency Management, and the Washington County Hazard Mitigation Plan Local Planning Team reviewed and reevaluated the hazard mitigation goals for the County (see Chapter 4 of this Report). This review considered whether the initial plan's goals were still applicable and whether additional goals should be added. In addition, hazard conditions within the County were reviewed and reevaluated (see Chapter 3 of this Report). This review included reevaluation of the identification of hazards likely to affect the County, updating the data upon which the profiles of the extent and severity of hazard events that occurred in the County were based, reassessment in light of the updated data of the vulnerability and risk associated with each type of hazard, and reevaluation as warranted by the updated assessments of the potential for changes in hazard severity and risk under future conditions.

This review and reevaluation of hazard mitigation goals and hazard conditions, along with consideration of changes in conditions within Washington County since the drafting of the initial plan (see Chapter 2 of this Report), and progress in implementing the initial hazard plan, served as the basis for the review and reevaluation of viable measures to reduce vulnerability to hazards identified in the updated risk assessment and the selection of mitigation actions to address those hazards.

5.2 HAZARD MITIGATION PLAN COMPONENT FOR MULTIPLE HAZARD TYPES

One of the bedrock principles of emergency management is to approach issues from a multi-hazards perspective. This approach is generally very cost-effective because it accomplishes mitigation goals and preparedness for several types of hazards with *one* resource or strategy. This initial plan component includes mitigation strategies, actions, projects, or programs that benefit multiple identified hazards. This means combining similar mitigation strategies that would otherwise be repeated for several or all of the identified hazards in this Plan update. This section will present current programs, considerations, and mitigation measures applicable to multiple hazards.

Current Programs

Federal and State Programs

FEMA funds several programs that assist state and local governments with hazard mitigation efforts that WEM administers in Wisconsin. Two programs fit best in this "multiple hazards" section because they address various hazard events. These programs include the Hazard Mitigation Grant Program (HMGP) and the BRIC Program (formally the Pre-Disaster Mitigation (PDM) Program). These programs provide funding for pre-disaster planning and on-the-ground projects; they will be discussed in further detail in the hazard mitigation funding sources later in this Chapter. Federal and State agencies also have programs that offer awareness and educational resources and tools to enhance State, local, and Tribal hazard mitigation efforts. FEMA and WEM provide many online resources and social media tool kits to assist the public in hazardous weather preparedness, safety, and recovery. FEMA offers a free mobile application through the Department of Homeland Security's Ready Campaign program that features safety tips on what to do before, during, and after disasters, as well as weather alerts and personal reminders.[1]

NOAA's NWS also has extensive public information and programs to educate people about the dangers of severe weather and how to prevent associated deaths and injuries. The NWS issues warnings, watches, and advisories when there is a threat of severe weather conditions. In conjunction with the NWS and other State and local government agencies, the Wisconsin Department of Health Services provides preparedness and severe weather information to the public.

The Washington County Office of Emergency Management participates in the NOAA Weather-Ready Nation (WRN) Ambassador Initiative but is not actively pursuing NWS StormReady Program designation. The WRN

[1] *Go to Ready.gov to download the mobile app.*

Ambassador initiative helps unify government, non-profits, academia, and private industry efforts toward making the nation more ready, responsive, and resilient against extreme weather hazards. The NWS StormReady Program encourages communities to take a proactive approach to improve local hazardous weather operations by providing emergency managers with guidelines on how to improve their hazardous weather operations.[2]

In addition, Washington County and its municipalities practice and enforce up-to-date State building code regulations and ordinances related to new development and redevelopment. Adopting stronger and more hazard-resistant building codes, including those that improve the ability of structures to withstand severe wind, lightning, or tornadoes can help strengthen community lifelines, reduce community risk, and reduce overall disaster recovery costs.

Local Programs

The Washington County Office of Emergency Management coordinates risk reduction, preparedness, response, and emergency recovery within the County and Southeastern Wisconsin. The County Office of Emergency Management website has several online resources and links related to severe weather safety and other general emergency management-related topics and planning efforts. County and local jurisdictions provide online resources, pamphlets, brochures, and social media content on severe weather preparedness, safety, recovery, and emergency management. Similarly, the Washington-Ozaukee Public Health Department provides the public with many informational and educational resources on emergency and disaster preparedness. The Washington County Office of Emergency Management also participates in State-sponsored severe weather awareness campaigns.

Washington County annually sponsors severe weather spotter training. Depending on availability, training sessions are conducted by the NWS or SKYWARN, a partnership between the NWS and several other organizations. Sessions are targeted toward emergency response personnel and members of the public. In the event of a severe thunderstorm or tornado warning, spotters go to designated locations to monitor weather conditions.

Residents of Washington County may receive weather warnings through NOAA All Hazard Weather Radio. The locations of transmitters serving the County and the frequencies on which they operate are described

[2] *More information on the Weather-Ready Ambassador Initiative and the StormReady Program can be found at www.weather.gov.*

in more detail below. Warnings transmitted via Weather Radio are relayed to other media via the Federal Communication Commission's Early Alert System (EAS), which will also be described below. Federal, State, and local emergency personnel can access the EAS system to disseminate non-weather emergency messages through the National Weather Service's HAZCollect system. Other available modes of communication in which the residents of Washington County can receive severe weather warnings include local television and radio broadcasts, digital mobile alert systems, social media platforms, and even door-to-door notifications in certain situations.

Providing advanced warning systems and public informational and educational programming are some of the most important mitigation actions utilized. Washington County owns and operates one outdoor warning and communication siren system serving the Washington County Fair Park. A total of 43 other outdoor warning and communication siren systems are owned and operated by municipalities in the County, with 15 located within the Village of Germantown, nine within the City of Hartford, eight within the City of West Bend, four within the Village of Kewaskum, three within the Village of Slinger, two within the Village of Jackson, and one each within the Village of Newburg and the Town of Addison. All jurisdictions operating outdoor warning and communication systems use warnings by the NWS to trigger siren activation. In addition, some jurisdictions use other triggering events such as warnings issued by DTN/Meteorlogix—a private weather forecasting service, tornado sightings by weather spotters, and at the direction of the jurisdiction's Chief of Police or his designee.

A detailed description of early public warning and notification systems used by Washington County and communities within the County are described below:

- **The Emergency Alert System (EAS)** allows officials to send emergency information targeted to specific geographical areas. The EAS sends alerts to broadcast media, cable television providers, satellites, pagers, direct broadcast satellites, high-definition television, and video dial tones. This system uses the same digital protocols as NOAA Weather Radio. The NWS generates about 80 percent of EAS activations, primarily for short-duration weather warnings and watches. Federal, State, and local emergency personnel can also access this system to disseminate non-weather emergency messages through the NWS's HazCollect system.

- **Wireless Emergency Alerts (WEA)** is a partnership including local and State public safety agencies, FEMA, the Federal Communications Commission (FCC), the Department of Homeland Security (DHS), and the NWS. Washington County does not currently use WEA. With WEA, authorized County officials

through the State can send emergency messages to mobile devices of those potentially in harm's way without downloading an app or subscribing to a service. WEAs are broadcast from area cell towers to mobile devices only in dangerous areas. These short messages are designed to get the recipient's attention in a critical situation. They will look like a text message showing the alert type and time, any action recipients should take, and the agency issuing the alert. The WEA message will include a special tone and vibration that will be repeated twice. This system can send alerts for extreme weather warnings, local emergencies requiring evacuation or immediate action, AMBER or Silver Alerts, and Presidential alerts during a national emergency.

- **NOAA All Hazard Weather Radio** (**NWR**) is a nationwide network of radio stations broadcasting continuous weather information directly from the nearest NWS office, which is the Milwaukee/Sullivan office for Washington County. Warnings transmitted through NWR are relayed to other media through the FCC's EAS systems.

- **Text Telephone / Teletype Terminal / Teletypewriter / Telecommunication Device for the Deaf (TTY/TTD)** is a device that lets people who are deaf, hard of hearing, or speech-impaired use the telephone to communicate by allowing an individual to type text messages. To communicate, a TTY is required at both ends of the conversation. TTY/TTD can be used with both landlines and cell phones. Unlike text messaging, it is designed for synchronous conversation, like a text version of a phone call. A modern digital cell phone must support a special digital TTY mode to be compatible with a TTY device.

Washington County has developed a Comprehensive Emergency Management Plan (CEMP), which sets forth an all-hazards action plan. In addition, many local government units have developed emergency operations plans and programs that complement the CEMP and set forth procedures and actions to deal with various situations and events. Washington County also maintains plans for mass care and sheltering with the Washington-Ozaukee Public Health Department, Washinton County's Department of Health and Human Services, the American Red Cross, and the Washington County Humane Society.

Multi-Jurisdictional Considerations

The hazards addressed by mitigation measures in this multi-hazard plan component include multiple weather events and non-weather-related hazards. These events can impact all municipalities within Washington County; they may cause damage or loss to various infrastructure (i.e., transmission lines, communication lines, and transportation routes), buildings (i.e., homes, businesses, critical facilities), and

property. Washington County, municipalities, and relevant businesses and organizations should continue coordinating hazard mitigation activities through a cooperative County and local government partnership in countywide hazard mitigation planning and response mechanisms.

Evaluation of Alternatives and Identification of Mitigation Measures

Based upon the preceding evaluation and consideration of risk and review by the Washington County Hazard Mitigation Plan LPT, 24 actions apply to multiple hazards and were determined to be mitigation measures as part of this hazard mitigation plan update. Table 5.1 presents these mitigation measures and a general cost-benefit summary.

5.3 HAZARD MITIGATION PLAN COMPONENT FOR FLOODING AND ASSOCIATED STORMWATER DRAINAGE PROBLEMS

Flooding and related stormwater drainage problems represent one of the most common and damaging hazards affecting Washington County. This section describes alternative and selected strategies to mitigate flooding hazards. As part of the updating process, the Washington County Hazard Mitigation LPT reviewed and reevaluated these strategies, considering the updated hazard conditions and mitigation goals documented in Chapters 3 and 4.

Identification of Alternative Mitigation Strategies

Various non-structural, structural, and educational or informational measures are available for mitigating the impacts of flood and related stormwater drainage problem events in Washington County. Non-structural measures are most effective when the flooded structures are scattered throughout the watershed. In contrast, structural measures typically are most effective where impacted buildings are concentrated, such as urban areas. Educational and informational flood mitigation-related material is effective for communities, homeowners, landowners, businesses, farmers, and local officials who continually experience riverine and stormwater flooding events.

For purposes of organizing this extensive plan component, flood mitigation strategies are grouped into four plan elements:

- Preservation of Floodplains, Open Space, and Environmentally Sensitive Lands

- Floodplain Management

- Stormwater Management

- Public Information and Education Outreach

Preservation of Floodplain, Open Space, and Environmentally Sensitive Lands Plan Element

Floodplain management regulations, open space, and environmentally sensitive land policies are critical in properly implementing flood mitigation efforts. Washington County and its municipalities within the County have several pertinent floodplain management regulations and programs, most notably in zoning regulations and ordinances. In addition, a significant portion of environmentally sensitive lands within the County, including wetlands, woodlands, and floodplains, are under protective ownership and zoning ordinance(s).

Floodplain and Wetland Preservation Regulations

Floodplain management regulations include floodplain zoning ordinances and wetland-shoreland zoning ordinances.[3] The floodplain zoning ordinances are intended to preserve the floodwater conveyance and storage capacity of floodplain areas and to prevent the location of new flood-damage-prone development in flood hazard areas. The wetland preservation zoning ordinance seeks to maintain the stormwater and floodwater storage capacity of wetlands in the County and prohibits certain land uses detrimental to wetland areas.[4] Implementing these ordinances on an ongoing basis is an integral part of the County flood mitigation strategy.

[3] *The 2015-2017 State Budget (Act 55) changed State law relative to shoreland zoning. Under Act 55, a local shoreland zoning ordinance may not regulate a matter more restrictively than a State shoreland-zoning standard regulates it unless the matter is not regulated by a standard in Chapter NR 115, "Wisconsin's Shoreland Protection Program," of the Wisconsin Administrative Code. Examples of unregulated matters may involve wetland setbacks, bluff setbacks, development density, and stormwater standards. In addition, under Act 55, a local shoreland ordinance may not require establishing or expanding a vegetative buffer on already developed land. It may also not set standards for impervious surfaces unless those standards consider a surface to be pervious if its runoff is treated or discharged to an internally drained pervious area.*

[4] *In Wisconsin, wetlands are protected through land use regulations. Local governments are required to establish shoreland-wetland zoning and follow minimum standards promulgated by the Wisconsin Department of Natural Resources. Wisconsin Administrative Code Chapter NR 115 requires counties to protect wetlands mapped on the Wisconsin Wetland Inventory and located in the shoreland zone, which is 1,000 feet from a lake and 300 feet from a river. NR 115 establishes minimum zoning standards such as lot sizes, building setbacks, shoreland setbacks, vegetative buffer requirements, permitted uses, prohibited uses, and other zoning standards.*

Environmentally Sensitive Lands and Open Space Preservation Actions

Protecting environmentally sensitive lands, such as environmental corridors and important natural features on the landscape, can help prevent increased flood flows and associated problems. These areas frequently include significant lowland areas of floodplains and wetlands. Preserving wetlands is particularly important because wetlands often provide storage for floodwater and enhance water quality and wildlife habitat. Furthermore, the intrusion of intensive urban development into environmentally sensitive areas that tend to have high water tables may result in serious and costly problems, such as failing foundations for pavements and structures, wet basements, excessive operation of sump pumps, excessive clear-water infiltration into sanitary sewerage systems, and poor drainage. Similarly, the destruction of vegetative ground cover may result in soil erosion, stream siltation, more rapid stormwater runoff, and increased flooding.

The regional land use plan[5] and park and open space plan carry forward fundamental land use recommendations, including reducing and containing urban sprawl and protecting and preserving environmentally sensitive lands, such as environmental corridors, open space lands, and isolated natural resource areas. This regional land use plan forms the framework for ongoing local land use planning, or plans carried out by local government units, including Washington County. In 2022, Washington County had a total of 521 park and open space sites encompassing 34,086 acres. Of these park and open space sites, 15 were owned and maintained by the County; 38 were owned and maintained by State of Wisconsin departments, including the Wisconsin Department of Natural Resources (WDNR) and the Wisconsin Department of Transportation (WisDOT). Map 5.1 shows the current status of County- and State-owned sites.

Private organizations or conservation easements protect other open spaces and environmentally sensitive sites in Washington County. Conservation easements are voluntary contracts between a private landowner and a land trust or government body that limit or prohibit future parcel development. In 2022, the WDNR, MMSD, and private land trusts and conservancies had conservation easements on 82 sites in Washington County. In total these easements encompass 3,687 acres, with 30 of these sites comprising 40 acres or more. These site locations in the County are shown in Map 5.2. All the conservation easements identified on the map provide permanent protection of resources on private land.

[5] *SEWRPC Planning Report No. 55 (2nd Edition.),* Vision 2050 Volume III: Recommended Regional Land Use and Transportation Plan*, December 2020*.

In addition to the County- and State-owned conservation sites, there were 210 sites owned and maintained by local government units, including cities, villages, towns, school districts, or other public districts. Of those 210 sites, 64 were owned by the Milwaukee Metropolitan Sewerage District (MMSD) under its "Greenseams" and "Working Soils" programs. The Greenseams program is intended to permanently protect significant lands containing water-absorbing soils within watersheds contributing to the MMSD planning area for long-term benefits of floodplain management.[6,7,8] The Working Soils program aims to permanently protect privately held working land in the Milwaukee River watershed floodplain by working with landowners to acquire agricultural easements on priority lands. The landowners retain ownership and the right to work the land.[9] Lands under these programs are shown on Map 5.3. As of 2022, there were 1,777 acres of land within the County in the MMSD Greenseams program and 486 acres of land in the Working Soils program.

A Park and Open Space Plan for Washington County[10] provides for preserving environmental corridors and isolated natural resource areas. That plan's open space preservation and outdoor recreation elements are summarized in Maps 5.4 and 5.5,[11] respectively. Washington County and its municipalities have actively promoted and prepared land use and park and open space plans that are consistent with regional and county objectives for preserving environmentally sensitive lands. This Washington County hazard mitigation plan update incorporates the open space and environmentally sensitive land preservation recommendations of the Washington County park and open space plan. The plan recommends protecting 79,863 acres of open space lands, or about 29 percent of the County, through a combination of public or nonprofit conservation organization ownership,[12] conservation easements, or protective zoning. These

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[6] *The Greenseams program was initiated in 2000 under MMSD's Conservation Plan. The MMSD Conservation Plan identifies land parcels that are recommended to be protected for multiple purposes, including flood reduction potential and stormwater management benefits, as well as wildlife habitat, water quality, and recreational uses.*

[7] *The Conservation Fund; Applied Ecological Services, Inc.; Heart Lake Conservation Associates; Velasco and Associates; and K. Singh and Associates,* Conservation Plan, Technical Report Submitted to the Milwaukee Metropolitan Sewerage District, *October 31, 2001; SEWRPC Memorandum Report No. 152,* A Greenway Connection Plan for the Milwaukee Metropolitan Sewerage District*, December 2002.*

[8] *www.mmsd.com/what-we-do/flood-management/greenseams.*

[9] *www.mmsd.com/what-we-do/flood-management/working-soils.*

[10] Washington County, Wisconsin*, A Park and Open Space Plan for Washington County,* April 2020.

[11] *Map 5.5 is derived from Washington County's current Park and Open Space Plan.*

[12] *Public ownership includes lands owned by a Federal, state, county, or local unit of government, school districts, or other public districts.*

79,863 acres include planned primary environmental corridors, planned isolated natural resource areas, and areas outside corridors but within the Department of Natural Resources project boundaries. All-natural areas and critical species habitat sites recommended to be preserved are contained within the planned primary environmental corridors or isolated natural resource areas. In 2021 dollars, the cost of full implementation of this recommendation is estimated at about $87 million.

Wetland Restoration to Reduce Flood-Related Crop and Property Damages

Wetlands and floodplains can provide natural storage areas for floodwater during heavy rain or snow-melting events. Restoring the natural function of former wetland areas can be an effective strategy to reduce potential flood damage in downstream areas. According to the U.S. Environmental Protection Agency (USEPA), a one-acre wetland can typically store about three acre-feet or about one million gallons of water at any given time. Wetland vegetation can slow the movement of floodwater and can transfer some of this water into the atmosphere through evapotranspiration. Increasing flood storage capacity in Washington County by expanding wetland acreage may also help communities adapt to and reduce the potential impacts of climate change.[13]

As indicated in Table 2.7, Washington County had about 46,640 acres of wetland in 2015; this is most likely a fraction of the wetland area in the County in pre-settlement years. Nearly half of Wisconsin's original 10 million acres of wetlands have been drained or developed. It is important to note that progress has been made in wetland protection and restoration within Washington County in recent decades. The County continually pursues wetland restoration efforts and initiatives. Nevertheless, urbanization and agricultural development have altered the landscape and surface water drainage characteristics in the Southeastern Wisconsin Region, including Washington County. To facilitate the drainage of wetlands and other low-lying areas for cultivation, networks of drainage tile were installed, agricultural drainage ditches were constructed, and some existing streams were channelized. Consequently, channelization has reduced or eliminated the connection between the stream channel and overbank areas during floods. This disconnection of streams from their floodplains reduces floodwater storage in the overbank areas, resulting in higher water levels and larger flood flows downstream.

[13] *Detailed modeling would need to be conducted on a sub-watershed or subbasin level to estimate changes in flood flows resulting from wetland restorations and projected climate change conditions. Such modeling must be based on multiple parameters, including the specific acreages of land converted and the previous land use categories of such sites.*

In addition to providing storage for floodwaters and potentially reducing downstream property damages due to flooding, taking some marginally productive agricultural lands out of production, and returning them to their original wetland condition would reduce annual flood damages to crops. In 2015, approximately 6,965 acres of agricultural land were located within the 1-percent-annual-probability flood hazard area in Washington County, making them susceptible to riverine flooding during large storm events. As noted in Chapter 3, there was over $14.6 million in crop damages from 2001 to 2021. Thus, the average annual crop damages due to flooding is approximately $695,352 annually. It should be noted that these economic losses likely represent an underestimate of the actual damages to crops due to flooding in the County because damages to crops often goes unreported. Therefore, these economic losses represent an underestimate of the actual damages in the County.

The WDNR has developed a digital dataset to identify former wetlands drained and converted to agricultural uses.[14] The WDNR refers to these areas as potentially restorable wetlands. Areas identified as potentially restorable wetlands must have hydric soils, a current land use compatible with wetland restoration techniques, and must not be mapped as a wetland. Washington County has about 13,546 acres of potentially restorable wetlands; however, not all of these are good candidates for restoration. Approximately 3,200 acres of potentially restorable wetland are located within the 1-percent-annual-probability flood hazard area and are currently in agricultural use per the SEWRPC 2015 land use inventory. These areas are shown in Map 5.6.

Agricultural lands are prime candidates for wetland restoration because they are in undeveloped, open space uses and because Federal and State programs are available to support the conversion of certain agricultural lands to wetlands. Agricultural lands could be converted through land purchases, donations, or easements. Some programs provide a percentage of the restoration costs and an annual rental rate. In some instances, farmers may be able to plant a harvestable grass crop for hay. In other instances, land may be purchased or permanently placed into conservation easement by willing landowners, restricting development, and eliminating the chance that these open areas may be placed into more impervious urban land uses.

[14] *Detailed information on WDNR's Potentially Restorable Wetlands mapping methods and metrics can be found in WDNR's Report entitled: "Wisconsin Department of Natural Resources, Mapping Potentially Restorable Wetlands in the Rock River Basin," July 2019.*

Restoring selected potentially restorable wetlands currently in agricultural uses in Washington County is one alternative flood mitigation measure to consider. In addition, some of the areas identified on Map 5.6 may also be recommended to be acquired by a governmental entity or nonprofit conservation organization as part of the environmentally sensitive areas and open space preservation element discussed in the section above.

It can be assumed that most flood-related crop damage reported in the County occurs within the 100-year flood hazard area. If all the areas shown on Map 5.6 were taken out of agricultural production, crop losses due to flooding could potentially be reduced, and additional mitigation of potential downstream property damage is also possible.[15] When opportunities present themselves on a particular tract of agricultural land, wetland restoration should be considered. This alternative would be implemented as a voluntary program, considered at the discretion of each property owner. Wetland restoration projects could have the additional benefits of fish and wildlife habitat improvements, erosion control, water quality improvements, and recreational opportunities.

It should be noted that cost estimates for wetland restoration vary greatly depending upon the type of wetland, the specific restoration techniques employed, local construction costs, and whether restoration costs include the cost of land acquisition. For this recommendation, the estimated wetland restoration per acre cost developed for the Des Plaines River Watershed Plan of $5,700 (2021 dollars) was used.[16] Thus, the estimated cost of restoring all 3,200 acres of potentially restorable wetlands that are located within the 1-percent-annual-probability flood hazard area and are currently in agricultural land uses would be about $16 million.

Floodplain Management Plan Element

Actions to Address Structures Located in High-Risk Areas

The floodplain management element of the Washington County hazard mitigation plan mainly addresses the structures identified in the parcel-based analysis as potentially being in the 1-percent-annual-probability floodplains and structures that experience repetitive flooding issues. This analysis and results were described in detail in Chapter 3. Table 5.2 provides the principal mitigation measures of this element and associated costs.

[15] *Detailed modeling would need to be conducted to determine the amount of flood flow reduction associated with wetland restoration of agricultural land.*

[16] *SEWRPC Planning Report No. 44,* A Comprehensive Plan for the Des Plaines River Watershed*, June 2003*.

FEMA considers four structures to be repetitive- or severe repetitive-loss properties in Washington County. All four structures are single-family residential; two are considered severe repetitive-loss properties. The combined estimated fair market value of these structures is $2.08 million (2022 dollars). All four of these structures were estimated to be located within the 1-percent-annual-probability-floodplain and included in SEWRPC's parcel-based analysis. The damages to these four properties resulting from a 1-percent-annual-probability flood are estimated to be about $1.22 million.

The following mitigation measures are recommended for addressing the 1,165 structures identified as potentially being located in the 1-percent-annual-probability floodplain.

- Floodproofing[17] of up to 139 structures identified in the parcel-based analysis (using geographic information system techniques and color orthophotography) as potentially being in the 1-percent-annual-probability floodplains. These structures consist of all other building types besides residential, including commercial, agricultural, governmental, and other structures. For any nonresidential structure, this recommendation should be implemented following confirmation of the structure's flood hazard status through potential floodplain map updating and conduct of field surveys described in the next section.[18] This plan element is presented as a voluntary option, subject to the preference of the individual property owner. The damages these properties would experience from a 1-percent-annual-probability flood are estimated to be about $6.64 million (2022 dollars). The estimated cost of floodproofing all 139 structures is approximately $8.09 million.

- Acquisition and removal of up to 923 residential structures identified in the parcel-based analysis (using geographic information system techniques and color orthophotography) as potentially being in the 1-percent-annual-probability floodplains.[19] Following the demolition of the structures, the land

[17] Floodproofing is a combination of structural and non-structural changes or adjustments made in the building that reduces or prevents flood damage to the structure and/or its contents. There are two main types of floodproofing: dry floodproofing and wet floodproofing. Dry floodproofing is the practice of making a building watertight or substantially impermeable to floodwaters up to the expected floodwater height. (FEMA, 2008). Wet floodproofing reduces damage from flooding in three ways: allowing floodwater to enter and exit a structure to minimize structural damage, use of flood damage-resistant materials, and elevating important utilities. (FEMA, 2008).

[18] It is anticipated that the results of the floodplain map updating efforts and the field surveys may reduce the number of structures that are confirmed to be in the flood hazard area and that may require floodproofing.

[19] Note that this total and the associated costs do not include the four repetitive loss properties previously described.

should be kept in open space uses. These structures include single-family residential buildings, apartment buildings, condominiums, senior living facilities, and some associated structures. For any structure, this recommendation should be implemented following confirmation of the structure's flood hazard status through potential updating of the floodplain map and conduct of field surveys . This plan element is presented as a voluntary option, subject to the preference of the individual property owner. The damages these properties would experience from a 1-percent-annual-probability flood are estimated to be about $15.02 million (2022 dollars). The estimated cost of acquiring and removing all 923 structures is approximately $222.5 million (see Table 3.9).

- Removal of up to 103 manufactured homes identified in the parcel-based analysis (using geographic information system techniques and color orthophotography) as potentially being located in the 1-percent-annual-probability floodplains and acquisition of the land on which they are located. Following the removal of mobile homes, the land should be kept for open-space use. This recommendation should be implemented following confirmation of the structure's flood hazard status by potential updating the floodplain map and conduct of field surveys. This plan element is presented as a voluntary option, subject to the preference of the individual property owner. The damage these properties would experience from a 1-percent-annual-probability flood is estimated at about $1.84 million (2022 dollars). The estimated cost of acquiring the land and relocating all 103 manufactured homes is about $4.77 million.

In addition to structural flooding, infrastructure such as major roadways and bridges within the County have been reported to experience frequent flooding problems. As shown on Map 3.2, the 100-year recurrence floodplain overtops several arterial and collector streets in Washington County. Raising these roadways and ongoing maintenance to reduce flood damage and flooding concerns related to infrastructure are important considerations for Washington County flood hazard mitigation planning. As noted in Chapter 2, there are two roadway locations in the Town of Farmington that are known to overtop regularly during heavy rain events. Impacts from a flood event can affect people and property by obstructing access to the roadway and severing access to first responders such as police, medical, and fire. Alternatives to improved roadway access during flooding events at known roadway flooding issues, including the two locations in the Town of Farmington, are recommended for this hazard mitigation plan update.

As updated floodplain mapping is completed, for those areas of the County with a large number of flooded structures in close proximity (clustered), instead of a large number of voluntary acquisitions, it may also make sense to investigate a large flood control project. Project types could include levees, diversions,

impoundments, acquisitions, and floodproofing. These projects are not recommended for this plan. Still, if a municipality would like to pursue them further, the first step would be to perform an engineering evaluation to develop feasible alternatives.

Survey of Buildings In and Near the 100-Year Floodplain

The extent of the 1-percent-annual-probability floodplain was delineated on the Washington County large-scale topographic maps for the parcel-based analysis completed for this plan update. That information was taken from the effective FEMA digital flood insurance rate maps (DFIRMs). While the FEMA maps are adequate in detail to identify the extent of flooding for planning and zoning purposes, they can only be considered approximate regarding establishing individual building impacts. Thus, when flood mitigation actions are being considered for a given structure or group of structures, this plan calls for Washington County, or the appropriate municipality, to survey the low-grade elevations adjacent to buildings and the first-floor elevations of buildings that have been identified as being in or near the 1-percent-probability floodplain. Such surveys will provide a more definitive identification of the flood hazard for those properties. The surveys will assist property owners in deciding upon a course of action regarding flood mitigation options.

Participation in the National Flood Insurance Program (NFIP) and Floodplain Map Updating Efforts

FEMA has designated Washington County and all its cities and villages as having flood hazard areas and has taken the steps needed to make residents eligible to participate in the NFIP. Based on a detailed Flood Insurance Study (FIS), FEMA produces Flood Insurance Rate Maps (FIRMs) to identify community areas subject to riverine flooding. A FIS has been completed for Washington County and all municipalities identified by FEMA as having flood hazard areas. This plan calls for the continued participation of Washington County and its municipalities in the NFIP. The plan also calls for the appropriate County or incorporated municipality to request FEMA to revise, as necessary, the FIS to reflect new flood hazard data when such data becomes available. In addition, this plan recommends homeowners in and near flood-prone areas purchase flood insurance to provide some financial relief for flood losses. Finally, as recommended flood control measures are implemented, the plan calls for FEMA to make the necessary revisions to the FIS. Participation in the NFIP by the communities in Washington County is summarized in Table 5.3.

Through FEMA's Map Modernization program,[20] the initial Washington County FIS Report was finalized in November 2013. This Report has since been updated and revised in both October 2015 and again in February 2022 as a part of FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program.[21] Each FIS Report provides floodplain data, which can include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent-annual-probability flood elevations (the 1-percent-annual-probability flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1-percent-annual-probability and 0.2-percent-annual-probability floodplains; and 1-percent-annual-probability floodway. This information is presented on the FIRM and in many components of the FIS Report.[22] Detailed documentation of the Washington County FIS Report and Digital Flood Insurance Rate Maps (DFIRMs) are available on both the FEMA and WDNR[23] website.

Participation in the Community Rating System

The Community Rating System (CRS) is an additional program FEMA offers as part of the NFIP. The CRS recognizes and encourages community floodplain management activities that go beyond the minimum NFIP standards. The program assigns a ranking to communities that participate based on voluntary floodplain management activities and outreach services that the community provides to its residents. A high CRS ranking will offer citizens of that municipality discounts on flood insurance premiums of up to 45 percent. In addition to the benefit of reduced insurance rates, floodplain management and outreach activities associated with CRS aim to enhance public safety further, reduce damages to property and public infrastructure, avoid economic disruption and losses, reduce human suffering, and protect the environment. Participation in the CRS program can incentivize communities to maintain and improve their floodplain

[20] In 2003, FEMA implemented the Map Modernization program. This program was intended to upgrade and distribute FIRMs into a digital format, rather than on paper (i.e., Digital Flood Insurance Rate Maps or "DFIRMs"). This program used state-of-the-art technology and advanced engineering to increase the quality, reliability, and availability of flood hazard maps and data and employed a collaborative process to involve state, regional and local partners in mapping tasks.

[21] Risk Mapping, Assessment, and Planning (Risk MAP) is a FEMA program implemented in 2010 that provides communities with both flood information and tools and some updated DFIRMs that communities can use to make better informed decisions and to take action to reduce risk to life and property.

[22] New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

[23] dnrmaps.wi.gov

management program. Technical assistance for designing and implementing some activities associated with the CRS program is available at no charge.

As of April 2023, no communities in Washington County participate in the CRS program. It is recommended that the County and its municipalities consider participation in the CRS program based on the number of NFIP policies currently in effect in their community. All unincorporated communities would be eligible for premium discounts under Washington County's participation in the CRS. Incorporated communities are required to participate individually.

Lending Institution and Real Estate Agent Policies

This plan calls for lending institutions to continue determining the flood-prone status of properties before mortgage transactions are completed. To that end, these institutions should consult with the appropriate local zoning department to inquire about additional flood hazard studies for areas not identified in the FIS. The plan also calls for real estate brokers and salespersons to continue informing potential property purchasers of any flood hazard at the parcel of interest per the rules of the Wisconsin Department of Safety and Professional Services.

Documentation of the Extent of Future Floods

When flooding occurs in Washington County, the County and affected municipalities are recommended to document the extent of the flood and damages incurred. Several methods could be used to accomplish this, including aerial, satellite, or ground-based photography showing locations of flooded areas, surveying and mapping the elevation of debris lines resulting from floods, or other documentation techniques.

While FIRMs and the associated FIS are based upon the best data available at the time of their development, the inundation patterns depicted on and described in them are not those of actual historical flood events. Instead, they represent estimates of the extent of a hypothetical 1-percent-annual-probability event based on historical events. These estimates are developed using models based on the best available topography, land use, the geometry of, and conditions within, stream channels and adjacent overbank areas, and the presence, configuration, and condition of structures within and adjacent to the stream channel. Actual inundation patterns for actual floods will vary. The flooded areas are affected by several factors, such as local intensity and duration of rainfall, antecedent moisture conditions, blockages of drains and structures, the state of vegetation coverage, and changes that have occurred within the watershed since the development of the FIRM and FIS. It should also be noted that FIRMs only depict flooding related to

waterbodies overflowing their banks and do not depict areas inundated by stormwater runoff as they travel to a receiving stream.

Data developed by documenting the extent of future floods can be used to periodically refine the hydrologic and hydraulic simulation models used to develop the FIRMs and FIS. In addition, such data may also be useful in bridge and culvert design and water quality management planning.

Ice Jams and Mitigation Measures

Ice jams occur when floating river ice accumulates at a natural or man-made structure that impedes the progress of the ice downstream with the river current. Ice jams can significantly block the flow of a river causing upstream flooding. As discussed in Chapter 3, the Village of Newburg has experienced ice jams since 2017. Mitigation measures to prevent future ice jam flood losses are recommended. Such measures include:

- Development and maintenance of an ice jam event database to include:
    - Historical and recent records of ice jam events; and
    - Site-specific ice event data, including freeze-up and ice cover breakup duration.
- Implement the use of the U.S. Army Corps of Engineers (USACE) Cold Regions Research and Engineering Laboratory (CRREL) database.[24]

Stream Channel Maintenance

This plan calls for Washington County, local municipalities, and drainage districts to continue to work together to develop and expand existing programs for regular stream channel maintenance. These programs would include the periodic removal of sediment deposits, selected heavy vegetation, and debris for all watercourses in the County, including bridge openings and culverts, subject to obtaining any necessary local and State permits.

[24] *Department of the Army, U.S. Army Corps of Engineers,* Engineering and Design ICE ENGINEERING, *October 30, 2002*.

Continued Maintenance of Existing U.S. Geological Survey (USGS) Stream Gages on Streams and Rivers of Washington County and Installation of Additional Stream Gage Locations

Washington County has no active USGS stream flow gages within its boundaries. There are five active USGS gages monitoring flows for streams flowing out of the County. This equipment is important for real time stream flow data and flood preparedness as well as to develop a history of flows over time for use in developing recurrence interval flows (such as the 1-percent-annual-probability flows). The gages that are active outside of the County and require continued maintenance include:

- The gage on the Menomonee River in the Village of Menomonee Falls (Waukesha County). USGS operates this gage in cooperation with Waukesha County, the WDNR, and the Southeastern Wisconsin Regional Planning Commission (SEWRPC);

- The gage on the Milwaukee River near the City of Cedarburg (Ozaukee County). USGS operates this gage in cooperation with the MMSD and SEWRPC;

- The gage on Cedar Creek in the City of Cedarburg (Ozaukee County). USGS operates this gage in cooperation with the WDNR;

- The gage on the Rock River at the City of Horicon (Dodge County). USGS operates this gage in cooperation with the WDNR; and

- The gage on the Rock River in the City of Watertown (Jefferson County). USGS operates this gage in cooperation with the WDNR and the U.S. Army Corps of Engineers (USACE).

As part of this plan, it is recommended that Washington County and its communities consider adding USGS stream gages in the County. This equipment would significantly enhance the flow of information for streams in the County. The cost of installing a new USGS stream gage is about $15,000 and then about $10,000 per year in local match is required to maintain the gage. This information is important for real time stream flow data and flood preparedness for communities in the County as well as to develop a history of flows over time for use in developing recurrence interval flows (such as the 1-percent-annual-probability flows). Without updated flow information, it is very unlikely that FEMA regulatory flows will be adjusted in the future, thus it will be difficult to update floodplain maps. Also, without gages upstream of major cities or villages in the County, it will be very difficult to have accurate and timely flood warning. It should be noted

that in previous years the USGS had several stream gage monitoring locations (listed below) within or just outside the County.

- Milwaukee River at Waubeka (Ozaukee County)
- North Branch of the Milwaukee River in Fillmore
- Milwaukee River in Kewaskum
- East Branch Rock River in Slinger
- East Branch Milwaukee River in New Fane (Fond du Lac County)

Actions to Manage the Potential Flood-Related Impacts of Dam Failure

Flooding can also occur as a result of a dam failure. Dam failure flooding may occur when flood flows exceed the hydraulic capacity of the dam spillways, resulting in water overtopping the dam or abutments or when structural failure of the dam occurs. The potential impacts of such failure are related to the dam's size and configuration and the amount, types, and locations of development downstream of the dam.

As discussed in Chapter 3 of this report, there are 57 dams located in Washington County (see Table 3.7 and Map 3.1). Two of these dams (Barton and Lucas Lake Dams) have been assigned a high hazard rating, two have been assigned significant hazard rating, and the remaining 53 have low hazard ratings.

The following mitigation measures are recommended to address the risk of flooding due to dam failure in Washington County:

- All dams in Washington County should be regularly inspected and maintained. Chapter 31, "Regulation of Dams and Bridges Affecting Navigable Waters," of the *Wisconsin Statutes,* requires inspection of dams by a professional engineer with experience in dams at a frequency based upon the dam's hazard rating. High-hazard dams are required to be inspected every two years, significant-hazard dams are required to be inspected every three to four years, and low-hazard dams are required to be inspected every ten years. In addition, it is recommended that owners and operators of dams inspect their dams regularly and following any high-water event.

- Owners or operators of dams should continue to monitor their dams during high-water events.

- Investigate whether the high-hazard potential dam owner is willing to work with the County to abandon and remove the high-hazard potential dam.

- Owners and operators of dams of any hazard rating should consider developing, maintaining, and periodically updating emergency action plans for their dams. Requirements for emergency action plans and guidance and templates for developing such plans are available from the WDNR. Such a plan should include:

    - Procedures to be followed to warn the public if a dam failure is likely to occur

    - Procedures for evacuating areas likely to flood as a result of failure of the dam

    - An identification of road closings and rerouting needed to keep traffic and people out of dangerous areas in the event of flooding due to failure of the dam

- Dam failure analyses should be completed for those dams that are required and have not been done.

Hydraulic shadows from available dam failure analyses should be added to County and local government geographic information system (GIS) map layers. Local government units within the County should regulate and zone the hydraulic shadow areas as floodways unless the shadow area is specifically mapped as a floodway and flood fringe for the dam hazard designation.

Stormwater Management Plan Element

Floodplains provide several beneficial and natural functions, including flood control, erosion control, stormwater management, and water quality enhancement. With increases in urbanization and alterations to the natural landscape, many of the natural functions of floodplains are greatly reduced or even lost, causing large amounts and high velocities of stormwater runoff.[25] Because of this, the relationship between stormwater management and floodplain management is an important consideration within the flood mitigation plan element of this Report.

[25] *Chagrin River Watershed Partners, Inc. and Biohabitats*, Floodplain Restoration and Storm Water Management: Guidance and Case Study, *March 2009*.

Today most communities, including those in Washington County, have stormwater management plans and regulations (i.e., ordinances) designed to minimize the adverse impacts caused by urban development. This element of the plan includes the status of stormwater management planning and related regulations in Washington County.

Stormwater Management Plans and Programs

In *Wisconsin Administrative Code* Chapter NR 216, the State requires certain industrial facilities, construction sites, and municipal separate storm sewer systems (MS4s)[26] to obtain Wisconsin Pollutant Discharge Elimination System (WPDES) stormwater discharge permits[27] to manage the quantity and quality of stormwater runoff before it enters streams and waterbodies.

Designated WPDES entities (i.e., an MS4) are required to address the following application elements to obtain a State stormwater discharge permit:

- Public education and outreach
- Public involvement and participation
- An illicit discharge detection and elimination program
- A construction site pollutant control plan
- A post-construction stormwater management plan
- A pollution prevention plan for the municipal facilities

[26] *What classifies as a Municipal Separate Stormwater Sewer System (MS4) is defined under Wisconsin Administrative Code Chapter NR 216.02. Generally, an MS4 is a conveyance or system of conveyances, including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm sewers designed or used for collecting or conveying untreated stormwater, and is owned or operated by a state, city, town, county, district, association, or other public entity.*

[27] *Individual (i.e., site-specific) WPDES permits are issued to municipal and industrial facilities discharging to surface water and/or groundwater. WPDES general permits are issued by the DNR for specific categories of industrial, municipal, and other wastewater discharges. Under the authority in section 283.35, Wis. Stats., the department may issue WPDES general permits applicable to categories or classes of point source discharges.*

- An annual report of their stormwater management, including:
    - A map of their storm sewer system(s)
    - Installed stormwater best management practices

Communities with approved State stormwater discharge permits include Washington County, the Cities of Hartford, and West Bend; the Villages of Germantown, Jackson, Kewaskum, Richfield, and Slinger; and the Towns of Germantown, Hartford, and West Bend. Washington County, the Cities of Hartford and West Bend and the Villages of Germantown, Kewaskum, Richfield, and Slinger have adopted stormwater management ordinances as part of their discharge permit program. In addition, the Towns of Kewaskum and Trenton have adopted stormwater management ordinances. The County ordinance applies to all unincorporated areas not covered by their own ordinances. In those Towns that also have stormwater management ordinances, it is recommended that the County and the Towns work to ensure that the objectives of each ordinance are met in a coordinated manner. Table 5.4 indicates the communities in Washington County that have adopted a stormwater management-related ordinance or plan.

The remaining urban communities in the County are encouraged to prepare stormwater management plans. In Towns that are anticipated to remain mostly rural under the adopted land use plan, stormwater management planning is only necessary for certain site-specific areas where urbanization is expected or where isolated urban areas already exist, or where stormwater-related problems have developed.

Stormwater-Related Regulations

In 2002, the WDNR issued Chapter NR 151 of the *Wisconsin Administrative Code*, outlining stormwater runoff performance standards from agricultural and non-agricultural lands. Those standards include controls for the quantity and quality of runoff from newly developed and redeveloped lands. The WDNR administers these rules through the Chapter NR 216 stormwater discharge permit system, although local municipalities can adopt their own ordinances consistent with the *Administrative Code*. Chapter NR 152 of the Administrative Code contains model ordinances covering agricultural and non-agricultural operations. Those communities that are required to obtain a WPDES stormwater discharge permit are required to have a stormwater management program that most often results in the adoption of a stormwater management ordinance. As noted above, Table 5.4 lists the stormwater ordinances and/or management plans that Washington County communities have prepared.

Stormwater Management Facilities Maintenance

The effectiveness of stormwater management conveyance and detention facilities and other management measures can be sustained only if proper operation, repair, and maintenance procedures are carefully followed. Important maintenance efforts for stormwater conveyance features include the periodic repair of storm sewers, curbs, and gutters, clearing of sewer obstructions, maintenance of open channel vegetation linings, and clearing of debris and sediment from open channels. Important maintenance efforts for stormwater treatment features include protection of the infiltration capacity of stormwater infiltration facilities, maintenance of detention facility inlets and outlets, maintenance of detention basin vegetative cover, and periodic removal of sediment accumulated in detention basins. This plan calls for these maintenance activities to be carried out continuously to maximize the effectiveness of the stormwater management facilities and protect the capital investment.

Green Infrastructure and Low-Impact Design Integration

Stormwater management continues to evolve and change with continuing development and increased precipitation volumes. Newer stormwater management techniques focus more on imitating natural systems by capturing rainwater where it falls. These types of practices are known as green infrastructure. Green infrastructure systems that enhance infiltration include rain gardens, bio-swales, retention ponds, vegetated rooftops, and permeable pavements. Similarly, low-impact design (LID) practices can greatly reduce runoff volumes by preserving natural areas and vegetation, reducing the extent of impervious surfaces, and integrating stormwater management into the landscape. By reducing stormwater runoff and protecting floodplains, green infrastructure and LID management techniques are recommended to be investigated for new development and redevelopment as mitigation measures to reduce stormwater flooding and enhance water quality and wildlife habitat in Washington County. Furthermore, implementing green infrastructure and LID management techniques, such as detention, retention, or bioretention ponds, into the County's stormwater management regulations can provide the County with CRS credit.

Public Education and Information Element

Public information, education, and participation constitute an integral aspect of Washington County's flood and stormwater mitigation and related efforts. This element includes two sub-element activities to be carried out: public education activities and public information programming and coordination associated with detailed stormwater and floodplain management plans.

Current Federal, State, and Local Educational and Outreach Activities

As discussed in the multiple hazards plan element, FEMA, the National Weather Service (NWS), and WEM provide many online resources and social media toolkits to assist the public with hazardous weather preparedness, safety, and recovery. FEMA's website offers many resources related to flooding hazards, flood insurance, and flood mitigation assistance programs. Currently, FEMA administers the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), and Repetitive Flood Claims (RFC). As previously described, Washington County participates in FEMA's PDM, RiskMAP, and National Flood Insurance Program (NFIP) programming efforts. Continued outreach and educational efforts promoting the importance of obtaining flood insurance through the NFIP to Washington County residents remain an important part of flood hazard mitigation.

FEMA's website also provides flood risk mapping services. The FEMA Flood Map Service Center (MSC) is the official online source for flood hazard information produced under the NFIP. All flood mapping products, such as Flood Insurance Rate Maps (FIRMs), Flood Insurance Studies (FIS), and National Flood Hazard Layer (NFHL) geodatabases, are available to view and download.[28] FEMA has also produced a Flood Risk Report that provides stakeholders with a comprehensive understanding of flood hazard and risk exposure for their community, watershed, or other geographic area. In addition, Ready.gov provides a Flood Safety Social Media Toolkit that contains numerous materials related to flood safety and preparedness.

The WDNR has several grant programs related to flood and stormwater control, including the municipal flood control grant program, municipal dam grant program, and urban nonpoint source stormwater construction grant. The WDNR website also contains informational and educational material and additional resources related to its floodplain management program.

The U. S. Army Corps of Engineers (USACE) website also provides informational and educational resources and links related to flood risk preparedness and management. The USACE National Flood Risk Management program was established to integrate and coordinate USACE flood risk management programs and activities with FEMA and other Federal, state, regional, and local agencies. The USACE flood risk management program maintains and constructs public flood control structures such as dams, reservoirs, levees, floodwalls, and diversion channels. The USACE Disaster Preparedness program includes emergency management organization, planning, training, adequate supplies, tools, equipment, and inspection for non-Federal flood risk management projects.

[28] *msc.fema.gov/portal/resources/productsandtools.*

USACE Cold Regions Research and Engineering Laboratory (CRREL) applies advanced science and engineering skills to study complex environments, materials, and processes such as ice jam events. The CRREL ice jam database provides informational and educational resources as well as known locations and descriptions of historical and current ice jam events.[29]

Over the years, Federal, State, and local governmental agencies have constructed numerous wetland restoration projects covering hundreds of acres of public and private land in Washington County. Their efforts are ongoing, with several additional wetlands appearing on the landscape each year through incentives such as those provided by the Natural Resources Conservation Service (NRCS), United States Fish & Wildlife Service (USFWS), WDNR, and County programs. These programs encourage landowners to remove highly erodible land from agricultural use and restore natural plant communities. Restoration projects such as this help reduce and prevent flooding and stormwater impacts while at the same time improving the ecological, economic, and social well-being of Washington County.

The Wisconsin Department of Health Services has prepared a flooding toolkit for citizens.[30] The toolkit provides general flood information, preparedness tips, and guidelines on cleaning up after a flood. A factsheet prepared by WEM explains the different types of flood watches and warnings. It provides information on what citizens should do if a flood is likely to occur in their area.[31] The Washington County's Emergency Management webpages contain several informational and educational resources related to local, State, and Federal flood protection.

Washington County and the various municipalities should, as needed, collaborate in preparing and distributing various public informational and educational materials, including materials oriented toward property owners and homeowners designed to help them consider and potentially undertake actions to mitigate damages caused by stormwater flooding and sanitary sewer backups. Methods available for distributing information include but are not limited to, print and broadcast media, cable television, pamphlet development, individual seminars, municipal and County online resources, social media, and community speaking engagements.

[29] *www.crrel.usace.army.mil/icejams.*

[30] *The Wisconsin Flood Toolkit is available for download at www.dhs.wisconsin.gov/publications/p0/p00631.pdf.*

[31] *The Ready Wisconsin flood informational handout is available for download at readywisconsin.wi.gov/media/pdf/Flooding.pdf.*

Public Participation Activities and Coordination with Other Agencies and Units of Government

The second sub-element of this mitigation measure involves direct public participation and coordination with other agencies during detailed stormwater and floodplain management plan development. Much of this input has occurred in conjunction with floodplain map updating activities.

Discovery meetings for the Milwaukee River watershed RiskMAP program were held in 2013 and 2014. At the meetings, community members around the watershed, WDNR, and FEMA exchanged information regarding flooding history, development plans, flood risks, floodplain management activities, and study needs. In 2019, the WDNR hosted a RiskMAP update meeting for local planning officials to discuss recent progress on the draft floodplain maps, including areas in Washington County. As described above, work on the RiskMAP effort within the Milwaukee River watershed was completed in 2022. Local knowledge and participation from the public through community representatives during the RiskMAP discovery meetings were essential for a successful program.

With a focus on further informing the public regarding flood mitigation, stormwater and floodplain management, and related issues, this Hazard Mitigation Plan update calls for concerned units and agencies of government, including Washington County and all Cities and Villages within the County, to involve members of the general public and to seek public input in preparing and implementing recommendations regarding such issues.

Multi-Jurisdictional Considerations

As noted in Chapter 3 and shown on Map 3.3, structures within flood hazard areas have been identified within all of the 20 general-purpose local units of government in the County, except for the Village of Slinger. Notable consideration should be given to those communities that have vulnerable populations or community assets, such as critical community facilities, that are deemed to be at a high risk from the impacts of flooding from a 100-year rain fall event. Such communities in Washington County include the Village of Jackson with 94 manufactured homes in the 100-year floodplain and the Villages of Kewaskum and Newburg with fire departments located in the 100-year flood hazard area. In addition, there are related stormwater drainage problems in selected areas of many communities.

Evaluation of Alternatives and Identification of Mitigation Measures

Flood mitigation activities aim to reduce, in a cost-effective manner, the loss of lives and property due to these events. The full range of non-structural and structural approaches were considered in the initial

assessment of potential mitigation measures for flooding and in examining alternative approaches to mitigate the impacts of flooding problems in Washington County.

An important factor in selecting mitigation measures is to consider incorporating recommendations from other related County and local planning efforts (i.e., Washington County's Park and Open Space Plan, Comprehensive Plan, Land and Water Resource Management Plan, and Comprehensive Emergency Management Plan) that may help prevent flooding or act to mitigate the impacts of flooding when it occurs. Including such recommendations in the hazard mitigation plan furthers the goal of integrating the elements of the various plans that seek to guide the County for various issues. Similarly, it was judged important that the mitigation measures incorporate existing programs and efforts that reduce the exposure of people and property to risks posed by flooding or that act to mitigate the impacts of flooding when it occurs. Examples of such programs include floodplain zoning, future participation in the CRS, continued participation in the National Flood Insurance Program (NFIP), updating FIRM maps, stormwater management regulation and planning, and educational and informational outreach programs.

Flooding damages can be mitigated by limiting or restricting how development occurs in high-risk areas. These measures can limit the County's and municipalities' future vulnerability to impacts from flooding and should be a principal element in any flood mitigation effort. Measures to implement this type of mitigation include incorporating recommendations from other related County and local planning efforts and enforcing regulations such as floodplain, wetland, and wetland-shoreland zoning regulations and management. Another important measure to implement this element is preserving open space and environmentally sensitive lands to preserve and restore the flood-mitigating functions of Washington County's natural resources.

Another important flood mitigation component should focus on existing development in high-risk areas. Recurring economic losses and distress from flooding can be reduced by removing structures from the floodplain or modifying them to resist damage from flooding. This element includes acquisition and demolition, floodproofing, and retrofitting structures in high-risk areas. In addition, actions to manage the potential flood-related impacts of dam failure are a key component of this hazard mitigation plan update.

Based upon the preceding evaluation and consideration of risk and review by the Washington County Hazard Mitigation LPT, the flooding and related stormwater drainage problem mitigation plan for Washington County consists of four sub-elements: a preservation of floodplain and environmentally sensitive lands sub-element, a floodplain management sub-element; a stormwater management sub-

element, and a public education and information sub-element. Each sub-element of the plan is an important component of the overall strategy for reducing flood risk and flood damage. Some aspects of the overall plan are already being implemented through existing and ongoing activities by the County and local government units. Table 5.5 presents these mitigation measures and a general cost-benefit summary.

5.4 HAZARD MITIGATION PLAN COMPONENT FOR SEVERE WEATHER (THUNDERSTORM WIND, NON-THUNDERSTORM HIGH-WINDS, HAIL, AND LIGHTNING) HAZARDS

Thunderstorm high-winds, non-thunderstorm high-winds, hail, and lightning are natural hazard events of significant concern to be considered in the Washington County Hazard Mitigation Plan. This section describes alternative and selected strategies to mitigate these hazards. As part of the updating process, the Washington County Hazard Mitigation LPT reviewed and reevaluated these strategies in light of the updated hazard conditions and mitigation goals documented in Chapters 3 and 4.

Identification of Alternative Mitigation Strategies

All thunderstorm-related hazards and non-thunderstorm high-wind events are potentially dangerous and are common within Washington County. Approximately 10 percent of the thunderstorms and related hazard events occurring annually within Southeastern Wisconsin are classified as severe. Severe thunderstorm fronts can often be tracked, providing ample warning for potentially affected areas to take preventive actions. In addition, when severe thunderstorms and related hazard events occur, they generally last for short periods.

While it may not be possible to accurately identify areas with significant risk from thunderstorm-related hazard events or non-thunderstorm high-wind events, measures can be taken to reduce the potential damage caused wherever they may occur in the County. High-wind events associated with windstorms and thunderstorms are similar to tornadoes, except they are more common and usually less powerful.

Hailstorms tend to occur in conjunction with severe thunderstorms. A severe thunderstorm weather advisory or advance warning system may indicate that large or damaging hail is imminent. Personal safety is the priority during a hailstorm, and people should seek shelter and stop driving to avoid accidents. Advance warning systems may allow some actions to reduce hail damage to vehicles and some property, but little can be done to protect structures or crops in the field.

Personal protection is paramount for lightning safety—many people suffer injuries or are killed due to misinformation and inappropriate behavior during lightning storms. A few simple precautions can reduce many of the dangers posed by lightning. The individual is ultimately responsible for their safety and should take appropriate action when threatened by lightning. Little can be done beyond lightning protection systems (lightning rods) to protect property from lightning.

Through review by the Washington County Hazard Mitigation LPT, the following measures to reduce vulnerability to thunderstorm winds, non-thunderstorm high-winds, hail, and lightning have been identified as viable for this update of the County Hazard Mitigation Plan. In addition to the measures listed below, mitigation strategies that were found to address multiple hazard types, including thunderstorm-related and non-thunderstorm high-wind events, were discussed in the Hazard Mitigation Plan component for multiple hazard types earlier in this Chapter. This section will present current programs, considerations, and mitigation measures for thunderstorm winds, non-thunderstorm high-winds, hail, and lightning.

Current Programs

Federal and State Programs

The NWS issues warnings, watches, and advisories when there is a threat of severe weather conditions. Several categories of warnings, watches, and advisories apply to thunderstorms and associated hazards. The NWS Storm Prediction Center in Norman, Oklahoma, will issue a severe thunderstorm watch when conditions are favorable for developing severe thunderstorms in and close to the watch area.

The NWS Milwaukee/Sullivan office will issue a severe thunderstorm warning when:

- A spotter reports a thunderstorm that is producing winds equal to or exceeding 58 miles per hour (mph);
- Hail of one inch or larger in diameter; and/or
- A severe thunderstorm is detected by Doppler radar.

The NWS Milwaukee/Sullivan office will issue a high wind warning when:

- Sustained winds of 40 mph are expected to occur for an hour or more; and/or
- Wind gusts of 58 mph or more are expected to occur.

The NWS Milwaukee/Sullivan office will issue a wind advisory when:

- Sustained winds of 30 mph are expected to occur for an hour or more; and/or

- Wind gusts of 45 mph to 57 mph are expected to occur.

Federal and State programs for thunderstorm events include awareness and education efforts. As the multiple hazards plan mentions, FEMA, NWS, and WEM provide many online resources and social media tool kits to assist the public with hazardous weather preparedness, safety, and recovery. The NWS has an extensive public information program to educate people about the dangers of thunderstorms and related hazards.

The Wisconsin Department of Health Services has developed a severe thunderstorm and tornado tool kit to inform local governments, health departments, and citizens in Wisconsin about preparing for and responding to severe thunderstorms and tornadoes. Similarly, WEM has produced several educational resources regarding thunderstorms and related hazards, including prerecorded radio public service announcements, scripts for radio public service announcements, fliers, and educational materials for children. In addition, numerous other organizations, including the American Red Cross, provide public safety information regarding lightning.

Local Programs

As discussed in detail in the multiple hazards plan component, Washington County uses various methods to warn residents of emergencies, including thunderstorms and thunderstorm-related events. Additionally, on an annual basis, National Weather Service (NWS) meteorologists deliver in-person severe weather awareness/spotter training locally that is free and open to the public. The locations within the county change each year to maximize participation.

Washington County Office of Emergency Management and the Washington-Ozaukee Public Health Department have several online resources, brochures, booklets, and pamphlets on severe weather safety, including thunderstorms and related events, available for the public.

Washington County Office of Emergency Management encourages all special events that are primarily outdoors to register with the National Weather Service for special event preparedness and weather support.

They actively work with the planning board for the Washington County Fair, municipalities, and private festival organizers to develop an all-hazards special event plan to keep attendees safe.

Multi-Jurisdictional Considerations

Thunderstorms and their related hazards can impact all municipalities within the County. In addition, these severe events can cause multiple damages to various infrastructure, including transmission lines, communication lines, and transportation routes, and damage to infrastructure from flooding, hail, and high winds. Hence, Washington County, municipalities, relevant businesses, and other organizations should coordinate thunderstorm related hazard mitigation activities through a cooperative County and local government partnership in countywide disaster planning and response.

Evaluation of Alternatives and Identification of Mitigation Measures

Based upon a review of the above and the risk analysis in Chapter 3, the continuation and refinement of current early warning system programs represent a major component of the planned mitigation action for thunderstorm-related hazards and non-thunderstorm high-wind events. The existing warning systems should continue to rely upon multiple means of communication to alert people to the threat of severe weather. In addition, informing the public of the significance of thunderstorm watches and warnings so that they take thunderstorms and related hazards seriously, know where to seek shelter in emergency situations, and are prepared should such a storm cause a disaster is an important component for minimizing the risks associated with these natural hazards. Community-based informational programs should continue to be conducted by the County in partnership with Federal, State, and local authorities.

Providing adequate safe places for people to seek shelter during severe storms constitutes an additional approach to mitigating the potential impacts of severe storms. The Washington County Office of Emergency Management should continue to provide informational resources on safe rooms at public outdoor facilities such as parks, golf courses, campgrounds, and beaches. In addition to providing informational resources on safe rooms, the County should encourage and promote the construction or upgrade of community safe rooms to provide additional and adequate shelter from severe storms.

Severe storm events can also cause economic losses, especially to agricultural producers, through crop damage. Continuing to provide agricultural producers with information regarding Federal crop insurance programs and encouraging them to purchase crop insurance offers some protection against such losses.

Other feasible mitigation actions include:

- Enforcement of building code regulations that improve the ability of structures to withstand severe wind
- Surge protection for sensitive electronic equipment
- On-site emergency backup power generation for critical infrastructure
- Other precautions that will limit possible injuries, deaths, or property damages due to severe weather events

Most of these measures are currently in place to varying degrees, indicating an emphasis on informational programming and enforcement would take precedence.

Based upon the preceding evaluation and consideration of risk and review by the Washington County Hazard Mitigation LPT (see Appendix A), there are six actions determined to be mitigation measures for this hazard mitigation plan update that are specifically related to thunderstorm winds, non-thunderstorm high-winds, lightning, and hail events.[32] Table 5.6 presents these mitigation measures and a general cost-benefit summary.

5.5 HAZARD MITIGATION PLAN COMPONENT FOR TORNADOES

Tornadoes are a moderate natural hazard to consider in this Washington County Hazard Mitigation Plan update. This section describes alternative and selected strategies to mitigate these hazards. As part of the updating process, the Washington County Hazard Mitigation LPT reviewed and reevaluated these strategies in light of the updated hazard conditions and mitigation goals documented in Chapters 3 and 4.

Identification of Alternative Mitigation Strategies

All tornadoes are potentially dangerous hazards within Washington County, as discussed in Chapter 3. However, tornadoes have been shown to impact Washington County about once every three to four years,

[32] *Mitigation measures that apply to multiple hazard types including thunderstorm winds, non-thunderstorm high winds, lightning, and hail events, are presented in the "Hazard Mitigation Plan Component for Multiple Hazard Types" section in this Chapter.*

and these occurrences are most likely to be an EF1 magnitude or less. In addition, tornadoes, and related hazard events generally last for short periods and impact relatively small areas of the landscape. However, when strong tornadoes do strike, they can cause extensive property damage, injuries, and death.

While it may not be possible to accurately identify areas with significant risk from tornado events or the number or severity of the events, measures can be taken to reduce the potential damage caused by tornadoes and related hazards wherever they occur in the County. Based upon review by the Washington County Hazard Mitigation LPT, the following measures to reduce vulnerability to tornadoes have been identified as viable for this update of the Washington County Hazard Mitigation Plan. In addition to the measures listed below, mitigation strategies that were found to address multiple hazard types, including tornadoes, are discussed in the Hazard Mitigation Plan component for multiple hazard types earlier in this Chapter. This section will present current programs, considerations, and mitigation measures for tornado hazards.

Current Programs

Federal and State Programs

The NWS issues tornado watches when conditions are favorable for the development of thunderstorms that have a strong capability of producing tornadoes, and issues tornado warnings when a tornado has been spotted by a trained observer or Doppler radar has indicated a developing tornado.

Federal and State programs for tornadoes include awareness and education efforts. NOAA's National Severe Storms Laboratory (NSSL) website has educational material on severe weather, including tornadoes. In addition, the NWS has an extensive public information program to educate people about the dangers of tornadoes and related hazards that assist in preventing related deaths and injuries. In conjunction with the NWS and State and local government agencies, WEM provides preparedness information and severe weather information to the public. Similarly, WEM has produced several educational resources regarding tornadoes, including prerecorded radio public service announcements, scripts for radio public service announcements, fliers, and educational materials for children.[33] The Wisconsin Department of Health Services has developed a severe thunderstorm and tornado tool kit to provide information to local governments, health departments, and citizens in Wisconsin about preparing for and responding to severe

[33] *These can be accessed at Wisconsin Emergency Management's ReadyWisconsin website located at: ready.wi.gov/Resources/Manager_Resources.asp.*

thunderstorms and tornadoes.[34] In addition, numerous other organizations, including the American Red Cross, provide public safety information regarding tornadoes.

Local Programs

As discussed in detail in the multiple hazards plan component, Washington County uses various methods to warn residents of emergency situations, including tornado events. Additionally, on an annual basis, National Weather Service (NWS) meteorologists deliver in-person severe weather awareness/spotter training locally that is free and open to the public. The locations within the county change each year to maximize participation.

Washington County owns and operates one outdoor warning and communication siren system, serving the Washington County Fair Park. In addition, local municipalities in the County own and operate 45 other outdoor warning and communication siren systems. The municipalities regularly test warning systems, repairing, and upgrading them as needed.

The Washington County Office of Emergency Management and the Washington-Ozaukee Public Health Department have several online resources, brochures, booklets, and pamphlets available for the public on tornado preparedness and safety and what to do if a tornado warning is issued. Washington County actively promotes tornado safety public information and other summer severe weather public awareness and educational efforts, including applicable links on the County website.

Multi-Jurisdictional Considerations

Tornadoes and their related hazards can impact all municipalities within the County. In addition, these severe events can cause severe damage to various infrastructure, including transmission lines, communication lines, and transportation routes, due to high winds and debris. Public and private buildings can also be destroyed during a tornado event. Washington County, municipalities, relevant businesses, and other organizations should coordinate tornado hazard mitigation activities through a cooperative County and local government partnership in countywide disaster planning and response mechanisms. Such measures are already well underway through the Comprehensive Emergency Management Planning Program involving the Washington County Office of Emergency Management and coordinated local community emergency operations programs and should be continued.

[34] *Wisconsin Department of Health Services,* Wisconsin Severe Thunderstorm and Tornadoes Toolkit*, op. cit.*

Evaluation of Alternatives and Identification of Mitigation Measures

The goal of tornado and high-wind mitigation activities is to reduce, cost-effectively, the loss of lives and property due to these events. An effective warning system is the most important resource for alerting the public to a tornado hazard, which is critical to the main goal of saving lives. Based upon a review of the above and the risk analysis given in Chapter 3, continuation and refinement of the early warning system programs represent a major component of the planned mitigation action concerning tornadoes. The existing warning systems should continue to rely upon multiple means of communication to alert people to the threat of severe weather. In addition, informing the public of the significance of tornado watches and warnings so that they take them seriously and know where to seek shelter in emergency situations, is an important ongoing component for minimizing the risks associated with these natural hazards. Community- and school-based informational programs should continue to be conducted by the County in partnership with Federal, State, and local authorities.

Providing adequate safe places for people to seek shelter when tornadoes may be in the area constitutes an additional approach to mitigating potential injury or death. The best shelters are specifically designed tornado shelters or safe rooms. Lacking such shelters, taking refuge in a basement near supporting walls or pillars and away from windows, or, if there is no basement, taking shelter in smaller interior, windowless rooms, such as hallways or closets, can offer some protection. Cars, manufactured homes, garages, and outbuildings are not safe shelters from tornadoes. Manufactured homes are particularly vulnerable to tornadoes. Washington County has six manufactured home parks in the City of West Bend, Villages of Jackson, Germantown, and Slinger, and the Town of Hartford. Encouraging and promoting the construction of community safe rooms to provide shelter from tornadoes to these vulnerable populations constitutes an important addition to this hazard mitigation plan update.

Finally, other feasible mitigation actions include enforcing building code regulations that improve the ability of structures to withstand severe wind, on-site emergency backup power generation for critical infrastructure, and other precautions that would limit potential injury, death, or property damage. Most of these measures are currently in place to varying degrees, indicating an emphasis on informational programming and enforcement would take precedence.

Based upon the preceding evaluation and consideration of risk by the Washington County Hazard Mitigation LPT (see Appendix A), eight actions were determined to be mitigation measures as part of this

Hazard Mitigation Plan update that are specifically related to tornado events.[35] Table 5.7 presents these mitigation measures and a general cost-benefit summary.

5.6 HAZARD MITIGATION PLAN COMPONENT FOR EXTREME TEMPERATURE

Extreme temperatures are natural hazard events of moderate concern to be considered in the Washington County hazard mitigation plan. Extreme temperatures can disrupt normal activities for the population and even cause the loss of life, particularly among more vulnerable populations. This section describes alternative and selected strategies to mitigate extreme temperature hazards. As part of the updating process, the Washington County Hazard Mitigation Plan LPT reviewed and reevaluated these strategies in light of the updated hazard conditions and mitigation goals documented in Chapters 3 and 4.

Identification of Alternative Mitigation Strategies

Extreme temperature events pose a serious threat to Washington County and should be expected with each summer and winter season. Extreme heat is the deadliest type of severe weather in Wisconsin.[36] Extreme heat and cold events do not typically occur suddenly. They are generally connected to a weather system that can be forecast days in advance, making this a hazard for which plans to mitigate injury, loss of life, and property damage can be activated with sufficient advanced warning. When extreme temperature events occur, they commonly last for extended periods (several days to as much as a week) and impact areas larger than Washington County.

Temperature extremes are difficult for a community to mitigate and may impact the health and safety of citizens, animals, and the viability of crops. While it may not be possible to accurately identify specific areas where there is significant risk from extreme temperature, extreme heat will have the greatest impact in the most urbanized areas of the County where larger amounts of paved areas can cause an urban heat island effect, enhancing the existing hot air mass. Demographically, the elderly, debilitated, mentally ill, poor, and homeless are most vulnerable to both excessive heat and cold. Fatalities are often related to age because excessive heat is stressful to the human body and can overwhelm those weakened due to age or illness. Measures can be taken to reduce the potential injuries and fatalities caused by temperature extremes

[35] *Mitigation measures that apply to multiple hazard types, including tornado events, are presented in the "Hazard Mitigation Plan Component for Multiple Hazard Types" section in this Chapter.*

[36] *Wisconsin Department of Emergency Management and Military Affairs,* State of Wisconsin Hazard Mitigation Plan*, December 2016.*

wherever they occur in the County. Based upon review by the Washington County Hazard Mitigation LPT as part of the updating process, the following measures to reduce the vulnerability to extreme temperature events have been identified as viable for this update of the Washington County hazard mitigation plan. This section will cover programs and mitigation measures related to extreme temperature hazards.

Current Programs

Federal and State Programs

The NWS issues warnings, watches, and advisory statements to media, emergency management, and public health officials when there is a threat of severe weather conditions. Several categories of warnings, watches, and advisories apply to extreme heat and extreme cold conditions and associated hazards. The conditions necessary for each category are presented in detail in Chapter 3 of this report. Heat waves cannot be prevented; therefore, it is important to provide notice of adverse conditions so that the public can anticipate and avoid health-threatening situations. Excessive heat alert thresholds that are specific to major metropolitan centers are determined based on research results that link unusual heat-related deaths to city-specific meteorological conditions. Typical heat alert procedures are as follows.

- Include Heat Index values in city forecasts

- Issue Special Weather Statements and/or Public Information Statements presenting a detailed discussion of 1) the extent of the hazard including, Heat Index values, 2) who is most at risk, and 3) safety guidelines for reducing the risk

- Assist State and local health officials in preparing civil emergency messages during severe heat waves. Meteorological information from Special Weather Statements will be included, as well as medical information, advice, and names and telephone numbers of health officials

- Release all of the above information to the media and over the NOAA Weather Radio

State programs for extreme temperatures include awareness and education efforts. WEM, in conjunction with the National Weather Service and State and local government agencies, provides preparedness and severe weather information to the citizens of Wisconsin. Preparedness information is provided during three severe weather awareness campaigns conducted during the year, each focusing on the prevalent weather hazard. The Wisconsin Department of Health Services (WI DHS) has developed an extreme heat tool kit to

provide information to local governments, health departments, and citizens in Wisconsin about preparing for and responding to extreme heat events.[37]

WI DHS developed a Building Resilience Against Climate Effects (BRACE) Program. The Program conducted a geospatial analysis of heat-related vulnerability in the State. This analysis used existing data related to population density, such as the number of people per square mile; health factors, such as the percentage of the population that visited a hospital emergency department for heat stress; demographic and socioeconomic factors, such as the percentages of young children or persons over 85 years of age and the percentage of households in poverty; and natural and built environment factors, such as surface air temperature during a heat wave, land cover, and air quality; to create a heat vulnerability index (HVI) to identify areas of greatest risk for negative health impacts due to extreme heat. The HVI was calculated for each census block in the County. Based on the HVI, each census block was placed in one of five vulnerability categories based on the level of vulnerability indicated, with each category comprising 20 percent of the census blocks analyzed. It is important to note that the levels of vulnerability shown by the HVI indicate relative levels of risk and do not indicate absolute risks. The results of the Washington County heat vulnerability index are shown in Figure 3.2.

Additionally, WI DHS has developed a winter weather tool kit to provide information about winter weather, including extreme cold.[38] WEM has produced several educational resources regarding extreme heat and winter weather, such as extreme cold, including prerecorded radio public service announcements, scripts for radio public service announcements, fliers, and educational materials for children.[39] In addition, numerous other organizations, such as the American Red Cross, provide extreme temperature public safety information.

Local Programs

The Washington County Office of Emergency Management participates in the statewide public information campaigns for winter and heat awareness weeks each year. It provides links to personal preparedness information on its website. Information on extreme heat and cold safety strategies is available on the Washington-Ozaukee Public Health Department website. The Health Department website also includes

[37] *Wisconsin Department of Health Services,* Wisconsin Extreme Heat Toolkit*, Publication P00632, March 2014.*

[38] *Wisconsin Department of Health Services,* Wisconsin Winter Weather Toolkit*, Publication P00652, April 2014.*

[39] *These can be accessed at Wisconsin Emergency Management's ReadyWisconsin website located at: ready.wi.gov/Resources/Manager_Resources.asp.*

locations, hours of operation, and other information related to designated cooling and warming shelters within both Ozaukee and Washington Counties.

In conjunction with the County, many local government units have developed emergency operations plans and programs that complement the County's CEMP which sets forth procedures and actions for extreme temperature events.

Finally, various methods to warn the residents of Washington County of emergency situations, including extreme temperatures, are described in detail in the "multiple hazards" plan component earlier in this Chapter.

Multi-Jurisdictional Considerations

Extreme temperature events are primarily a public health concern for all communities within the County, and ultimately, prevention should fall to the neighborhood watch groups and local authorities. These events can affect all individuals in the County; however, they are particularly dangerous for the elderly, sick, mentally ill, poor, and homeless, who cannot access shelter with adequate heat or air conditioning or lack access to advisory and educational resources. A coordinated effort involving the Washington County Office of Emergency Management and local community emergency operations programs will be needed to identify and protect individuals vulnerable to temperature-related hazards.

Evaluation of Alternatives and Identification of Mitigation Measures

Extreme temperature mitigation activities aim to reduce injury and the loss of life due to these events. Based upon a review of the above and the risk analysis in Chapter 3, the ongoing informational and educational programs related to extreme temperatures represent a major component of the planned mitigation action. Washington County should continue to promote basic strategies to reduce injuries and fatalities, hazard awareness, and community involvement. Washington County residents experience temperature hazards annually, and the ability to make positive decisions concerning exposure limits will depend on safety awareness. Analysis of the vulnerability of humans, infrastructure, and economic production caused by extreme temperature events demonstrates that providing advanced weather forecasting systems, providing early warning systems to alert the public of extreme temperature situations, availability of adequate shelter from the heat and cold in public buildings, major industrial sites, and other large businesses or complexes, and public informational and educational programming are the most important mitigation actions to be considered. Washington County supports measures presently implemented by the NWS; national, State, and local health organizations; and the media preceding and during excessively hot and cold weather. It is

also important to continue to encourage concern and awareness of neighbors, especially of the elderly, debilitated, and mentally ill. Outreach to poor and homeless populations to inform them of the availability and location of warming and cooling shelters within the County is important to keeping these vulnerable populations safe. Community and school-based informational programs should continue to be conducted by the County in partnership with Federal, State, and local authorities.

Based upon the preceding evaluation and consideration of risk and review by the Washington County Hazard Mitigation LPT (see Appendix A), there are 12 actions determined to be mitigation measures as part of this Hazard Mitigation Plan Update that are specifically related to extreme temperature events.[40] Table 5.8 presents these mitigation measures and a general cost-benefit summary.

5.7 HAZARD MITIGATION PLAN COMPONENT FOR WINTER STORMS

Winter storms are natural hazard events of moderate concern to be considered in the Washington County hazard mitigation plan. This section describes alternative and selected strategies to mitigate this type of hazard. As part of the updating process, the Washington County Hazard Mitigation Plan LPT reviewed and reevaluated these strategies in light of the updated hazard conditions and mitigation goals documented in Chapters 3 and 4.

Identification of Alternative Mitigation Strategies

Severe winter weather can include blizzards, freezing rain, sleet, ice, and dangerous combinations of temperatures and wind. Winter storms may last a few hours or days, completely shutting down businesses and government while isolating residents in their homes.

Impacts of heavy snow and ice accumulations include slippery roads and walkways, collapsed roofs from heavy ice and snow loads, and damaged trees, telephone poles and lines, electrical wires, and communications towers.[41] Additionally, indirect injuries and fatalities can frequently occur from activities associated with winter storms such as heart attacks while shoveling snow, carbon monoxide poisoning,

[40] *Mitigation measures that apply to multiple hazard types, including extreme temperature events, are presented in the "Hazard Mitigation Plan Component for Multiple Hazard Types" section in this Chapter.*

[41] *Wisconsin Department of Emergency Management and Military Affairs,* State of Wisconsin Hazard Mitigation Plan*, December 2016.*

hypothermia, frostbite, automobile accidents, and improper use of space heaters. Severe winter storm fronts can often be tracked, providing ample warning for potentially affected areas to take preventative actions.

While it may not be possible to accurately predict the number or severity of winter storm events, measures can be taken to reduce the potential damage caused by winter storms and their related hazards whenever they occur in the County. High-wind, freezing rain, sleet, ice, and snow may be associated with a winter storm. Reviewed by the Washington County Hazard Mitigation LPT as part of the updating process, the following measures to reduce vulnerability to these dangers have been identified as viable for the Washington County Hazard Mitigation Plan. This section will present current programs, considerations, and mitigation measures for winter storm hazards.

Current Programs

Federal and State Programs

The NWS issues warnings, watches, and advisories when there is a threat of severe weather conditions. Several categories of warnings, watches, and advisories apply to winter weather conditions and associated hazards. The NWS Milwaukee/Sullivan office will issue a winter storm warning when one or more of the following weather events are expected to occur for 12 or fewer hours.

- Snowfall greater than six inches
- Sleet accumulations of two or more inches
- Intermittent blowing snow that reduces visibility below one-half mile with winds of 25 to 34 mph or closes roads
- Less than one-quarter inch of freezing rain accompanied by another winter event

The NWS Milwaukee/Sullivan office will issue a winter weather advisory when one or more of the following weather events are expected to occur over 12 or fewer hours.

- Snowfall of three to six inches
- Sleet accumulations of less than two inches

- Intermittent blowing snow that reduces visibility below one-half mile with winds of less than 25 mph

- Less than one-quarter inch of freezing rain accompanied by another winter event

The NWS office will also issue an advisory or warning for blizzards, ice storms, and lake-effect snow events.

The NWS winter bulletins are distributed over several telecommunication channels, including the NOAA Weather Radio All Hazard radio network, the NOAA All Hazards Weather Wire, the State law enforcement TIME system, and through an emergency e-mailing network. In addition, these bulletins are relayed to other local media via the Federal Communication Commission's Emergency Alert System (EAS), which rebroadcasts the weather bulletins over public and private television and radio stations.

Federal and State winter storm programs include awareness and education activities. The Department of Homeland Security's *Ready.gov* campaign provides online resources on snowstorms, extreme cold awareness, and preparedness.

In November each year, Winter Awareness Week focuses on informing and educating people across the State concerning the hazards of severe winter weather and information on preparedness for extreme weather conditions during winter. The Wisconsin Department of Health Services has developed a weather tool kit to provide information to local governments, health departments, and citizens in Wisconsin about preparing for and responding to winter storm events.[42] Similarly, WEM has produced several educational resources regarding winter weather, including prerecorded radio public service announcements, scripts for radio public service announcements, fliers, and educational materials for children.[43]

The Wisconsin Building Code specifies design requirements to minimize vulnerability to winter storms by setting the load capacity of roofs by region, which is based on likely maximum snowfall. The NWS reports that 70 percent of winter storm fatalities occur in automobiles; therefore, listening to weather advisories and avoiding travel during winter storms would help prevent many fatalities.

[42] *Wisconsin Department of Health Services,* Wisconsin Winter Weather Toolkit*, op. cit.*

[43] *These can be accessed at Wisconsin Emergency Management's ReadyWisconsin website located at ready.wi.gov/Resources/Manager_Resources.asp.*

Local Programs

Winter safety information is prepared and distributed to the media and the public by the Washington County Office of Emergency Management. Preparedness information is also available on the Washington County Office of Emergency Management website. The Washington-Ozaukee Health Department website also provides residents with numerous links and resources about extreme temperature safety, preparedness, and education, including public shelter locations throughout the two counties.

Community strategies for winter storms in Washington County include snow removal, salting and sanding roads, installing snow fences along roadways, maintaining the health of urban trees to minimize damage from ice storms, and promoting sound levels of home insulation. During a storm, the public is advised to monitor local radio, television, and NOAA weather alert radios for up-to-date forecasts. As described in Chapter 2, Washington County has developed a CEMP, which sets forth an all-hazards action plan. The Plan provides for coordinating public safety support agencies such as the American Red Cross and resource acquisitions during winter emergencies. In addition, many local government units have developed emergency operations plans and programs that complement the County CEMP and set forth procedures and actions to deal with various situations and events, including winter storm events.

Various methods are used to warn people in Washington County of emergency situations, including winter storms. These warning systems related to multiple types of hazards are described in an earlier section of this Chapter.

Multi-Jurisdictional Considerations

Winter storms and their related hazards can impact all municipalities within the County. In addition, these severe events can cause multiple damages to various infrastructure, including transmission lines, communication lines, and transportation routes, due to whiteout conditions, snow accumulations, and ice. Washington County, the local units of government, and relevant businesses need to coordinate winter hazard mitigation activities through local government participation in countywide disaster planning and response.

Evaluation of Alternatives and Identification of Mitigation Measures

Analysis of the vulnerability of humans, infrastructure, and economic production to winter storms and related hazard events demonstrates that providing advanced weather forecasts, warning systems, and public informational and educational programming are the most important mitigation actions to be considered. In addition, informing the public of the significance of winter storm watches and warnings so

that they take these events seriously and know where to seek shelter in emergency situations is an important ongoing component of minimizing the risks associated with these natural hazards. Forming a neighborhood outreach program to locate isolated, vulnerable, or special-needs populations likely to be affected by winter storms is an important element in ensuring that these vulnerable population groups are protected during these events and assistance is available to those who need help clearing away snow or ice after winter storm events. The County is currently conducting community and school-based informational programs in partnership with Federal, State, and local authorities.

Based upon the preceding evaluation and consideration of risk and review by the Washington County Hazard Mitigation LPT (see Appendix A), there are ten actions determined by the Washington County Hazard Mitigation LPT to be mitigation measures as part of this Hazard Mitigation Plan update that are specifically related to winter storm events.[44] Table 5.9 presents these mitigation measures, along with a general cost-benefit summary.

5.8 HAZARD MITIGATION PLAN COMPONENT FOR DROUGHT

As described in Chapter 3, droughts are natural hazard events of moderate concern to be considered in the Washington County Hazard Mitigation Plan. This section describes alternative and selected strategies to mitigate drought hazards. As part of the updating process, the Washington County Hazard Mitigation Plan LPT reviewed and reevaluated these strategies in light of the updated hazard conditions and mitigation goals documented in Chapters 3 and 4.

Identification of Alternative Mitigation Strategies

A drought is a prolonged period of unusually constant dry weather that persists long enough to cause deficiencies in water supply (surface or groundwater). When drought events do occur, they often impact a relatively large area. The effects of drought are often grouped as economic, environmental, and social. Over time, droughts can severely affect crops, municipal water supplies, recreational resources, human health, and wildlife. If drought conditions extend over several years, the direct and indirect impacts can be significant.[45]

[44] *Mitigation measures that apply to multiple hazard types, including winter storm events, are presented in the "Hazard Mitigation Plan Component for Multiple Hazard Types" section in this Chapter.*

[45] *FEMA,* Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, January 2013*.

Ultimately, drought is about the sufficiency of water, and communities have always depended on water for their economic and physical survival. Stresses on the water resources of Washington County include a growing population, increased competition for available water, loss of groundwater recharge areas due to development, and the potential effects of a changing climate. All of Washington County utilizes groundwater for drinking and irrigation water supply.

Droughts can have the greatest impact on agricultural producers. Washington County has about 126,100 acres of farmland (as shown on Map 2.3).[46] It should be noted that even droughts of limited duration can significantly reduce crop growth and yields, adversely affecting farm income. More substantial drought events can decimate croplands and result in total loss, negatively impacting individual producers and the local economy.

Although nothing can prevent a drought, measures can be taken to reduce the potential loss and impacts caused by droughts wherever they occur in the County. The Washington County Hazard Mitigation Plan LPT reviewed the following measures to reduce vulnerability to drought events as viable for this update of the Washington County Hazard Mitigation Plan. This section will present current programs, considerations, and mitigation measures that apply to drought hazards.

Current Programs

Federal Programs

Interagency/Collaborative Efforts

The NOAA National Integrated Drought Information System (NIDIS) Act was signed into law in 2006. This law is a comprehensive interagency program that coordinates and integrates drought research by building upon existing federal, tribal, State, and local partnerships to create a national drought early warning information system. In addition, the NIDIS website[47] serves as the primary drought portal and clearinghouse for drought-related resources. The NIDIS website provides regional drought early warning systems (DEWS),[48] and links to research and resources for drought planning and preparedness, recovery, education, news about drought, regional webinars, and upcoming drought-related events. In addition, the website has

[46] *United States Department of Agriculture, National Agricultural Statistics Service, 2017 Census of Agriculture.*

[47] *The NIDIS website can be found at www.drought.gov.*

[48] *The Drought Early Warning System (DEWS) utilizes new and existing networks of federal, tribal, State, local, and academic partners to make climate and drought science accessible and useful for decision makers. It also aims to improve the capacity of stakeholders to monitor, forecast, plan for, and cope with the impacts of drought.*

several maps, tools, social media updates, and data related to drought at both the national and regional scales.

The National Drought Resilience Partnership (NDRP)

NDRP is a federal partnership comprised of the U.S. Department of Agriculture (USDA), the U.S. Department of Energy (U.S. DOE), the U.S. Department of the Interior (U.S. DOI), and federal sub-agencies including NOAA, NWS, NIDIS, USGS, National Aeronautics and Space Administration (NASA), the Assistant Secretary of the Army for Civil Works, FEMA, and the U.S Environmental Protection Agency (EPA). The NDRP leverages technical and financial Federal resources, strengthens communication, and supports State, tribal, and local efforts to build, protect, and sustain long-term drought resilience capacity at regional and basin-level scales. The NDRP's responsibilities include the following:

- Strengthening coordination of federal drought policies and programs in support of State, tribal, and community efforts

- Serving as a single federal point of contact on drought resilience

- Leveraging the work of existing federal investments such as the NIDIS, the development of a National Soil Moisture Network, and the Bureau of Reclamation-Natural Resource Conservation Service partnership to improve agricultural water use efficiencies

- Linking information such as monitoring, forecasts, outlooks, and early warnings with long-term drought resilience strategies in critical sectors such as agriculture, municipal water systems, energy, recreation, and manufacturing

University of Nebraska-Lincoln National Drought Mitigation Center

The National Drought Mitigation Center (NDMC), based at the University of Nebraska-Lincoln, helps people, organizations, and institutions build resilience to drought through monitoring and planning. The NDMC serves as the academic partner and web host of the U.S. Drought Monitor map. NDMC's capabilities include climatology, social science, and public engagement. NDMC's services are directed to State, Federal, regional, tribal, and local governments as well as individual ranchers and farmers involved in drought and water supply planning, mitigation, and policy making. NDMC's website offers abundant information on drought research, education, planning, and monitoring.

The U.S. Drought Monitor (USDM)

USDM produces a weekly map product that provides a general summary of current drought conditions. The USDM is a partnership between the NDMC, USDA, and NOAA. Multiple drought indicators are reviewed and synthesized for this weekly product, including various indices, outlooks, field reports, and news accounts. In addition, numerous experts from agencies and offices nationwide are consulted. The drought monitor map uses five drought classifications (D0, D1, D2, D3, and D4) that are described in Chapter 3 of this Report.[49]

U.S. Geological Survey (USGS)

The USGS monitors, assesses, researches, and presents information on various water resource conditions, including streamflow, groundwater, water quality, and water use and availability. Natural interactions of the hydrologic system, both in surface and groundwater, enable resource managers and policy-makers to better prepare for and respond to drought. The USGS National Water Information System (NWIS) is a comprehensive system that supports the long-term storage of water data, including surface water and groundwater level information. The USGS website provides water quality and water level data through several interactive map programs, including USGS's "Drought Watch," "Water Watch," and "Groundwater Watch." In addition, the website offers several additional drought-related resources and links for public information and education.

USGS Groundwater and Streamflow Information Program

The USGS Groundwater and Streamflow Information Program (GWSIP) serves as the national source of impartial, timely, rigorous, and relevant data for short- and long-term water decisions by stakeholders across the United States. In 2018, the USGS began piloting the Nation's next-generation integrated water observing system that provides high-fidelity, real-time water quantity and quality data.

The United States Department of Agriculture (USDA)

The USDA Farm Service Agency (USDA-FSA) provides information about conservation, commodity programs, crop insurance, farm loans, and State and county contacts. It also administers several programs that can provide emergency assistance to agricultural producers in the event of natural disasters such as drought. These programs include the Emergency Conservation Program, the Emergency Forest Restoration Program, the Emergency Loan Program, the Livestock Forage Disaster Program, the Noninsured Crop Disaster Assistance Program, and the Tree Assistance Program. The USDA-FSA's electronic Hay and Grazing

[49] *www.droughtmonitor.unl.edu.*

Net Ad Service (eHayNet) is an internet-based service allowing farmers and ranchers to share "Need Hay" and "Have Hay" ads online. Recently, this service expanded its website to include the option to list a need for grazing or acres available for grazing.

Through its conservation programs, the Natural Resources Conservation Service (NRCS) provides financial and technical assistance to farmers, ranchers, and other private landowners. Conservation programs such as the Environmental Quality Incentives Program, Conservation Stewardship Program, Regional Conservation Partnership Program, Agricultural Conservation Easement Program, the Healthy Forests Reserve Program, and the Conservation Technical Assistance Program help alleviate the effects of drought through proper soil, land, and water best management practices.[50] Additionally, the NRCS website provides a number of informational and educational resources related to drought preparedness.

The National Oceanic and Atmospheric Administration (NOAA)

The NWS, a federal sub-agency under NOAA, provides several informational and educational online resources related to drought and drought monitoring, including the NWS Climate Prediction Center, the National Climatic Data Center Drought Monitoring, and NOAA's experimental drought monitoring and early warning guidance tool known as Evaporative Demand Drought Index.[51]

Additional Federal Programs and Mitigation Resources

FEMA provides drought mitigation assistance through its HMGP and PDM planning program, as well as drought-related informational and educational resources and links on the FEMA website. NASA's Gravity Recovery and Climate Experiment (GRACE) satellite integrates groundwater and soil moisture storage observations with modeling to generate drought indicators based on the cumulative distribution of wetness conditions.[52] In 2013, the American Planning Association (APA), in collaboration with NDMC and NIDIS,

[50] *Detailed information related to NRCS financial and technical assistance programs can be found at www.nrcs.usda.gov/wps/portal/nrcs/main/national/about.*

[51] *Evaporation Demand Drought Index (EDDI) can offer early warning of agricultural drought, hydrologic drought, and fire-weather risk by providing near-real-time information. EDDI can capture signals of water stress at weekly to monthly timescales, which makes it a strong tool for drought preparedness.*

[52] *Drought.gov.*

published a guide to help decision-makers, resource managers, public agencies, landowners, local officials, and policy-makers assist communities for drought preparedness and mitigation.[53]

State Programs

The Wisconsin Geological and Natural History Survey (WGNHS), in collaboration with USGS and WDNR, provides interactive online maps of statewide monitoring wells that include groundwater elevation and conditions.

Farmers in the County who irrigate can also use the Wisconsin Irrigation Scheduling Program (WISP). This research-based computer program provided by the University of Wisconsin-Extension can assist growers in determining the frequency and amounts of irrigation throughout the growing season. Irrigation scheduling provided by this program may be especially helpful during a drought.

The Farmer to Farmer Hay, Forage, and Corn List sponsored by the University of Wisconsin-Extension puts Wisconsin farmers in touch with one another for buying and/or selling corn and forage. The farmer-to-farmer list is free of charge to both buyers and sellers.

The Wisconsin Department of Health Services has developed a drought tool kit to provide information to local governments, health departments, and citizens in Wisconsin about preparing for and responding to drought events.[54] Similarly, the Wisconsin Department of Natural Resources has developed a resource webpage to provide information related to drought in the State.[55] Ready Wisconsin Drought also provides drought-related information and resources to assist individuals and communities before and during a drought.[56]

Chapter NR 852, "Water Conservation and Water Use Efficiency," of the *Wisconsin Administrative Code* establishes mandatory water conservation and efficiency measures for water loss approvals throughout the State. The requirements outlined in this chapter apply to all people within the State applying for withdrawals that will result in a water loss averaging more than 2,000,000 gpd. The chapter establishes three tiers of

[53] *James C. Schwab, American Planning Association-Planning Advisory Service Report No. 574, "*Planning and Drought*", October 2013.*

[54] *Wisconsin Department of Health Services,* Wisconsin Drought Toolkit, *Publication P00884, revised May 2019.*

[55] *dnr.wisconsin.gov/drought.*

[56] *Ready.gov/wisconsin.*

requirements based on the size of the withdrawal and the amount of water not returned to the basin from which it is withdrawn due to diversion or consumptive use. The chapter requires that people applying for a new or increased withdrawal, diversion, or water loss approval submit a water conservation plan meeting specific requirements with their application. In addition, written documentation must accompany the application showing that water conservation and efficiency measures (CEM) that do not require retrofitting have been implemented or completed. The specific CEMs required vary according to the water use sector and tier to which the application is assigned.

Local Programs

Washington County has developed a CEMP that sets forth an all-hazards action plan. In addition, many of the local government units have developed emergency operations plans and/or programs per the County Plan and additional procedures and actions to deal with a range of situations and events, including instances of drought. Many Washington County municipalities have adopted water usage regulations during drought conditions. Still, in general, mitigation strategies for periods of drought include preparing informational releases and plans for farmers and homeowners that can be used if needed during drought conditions. Washington County farmers can contact the Washington County University of Wisconsin-Extension Office and the USDA's Farm Service Agency for information and guidance related to drought.

Multi-Jurisdictional Considerations

Droughts and their related hazards can impact all municipalities within the County; however, those communities that depend on groundwater as a source of water supply and agricultural areas experience the most severe impacts from drought events. Washington County, the local government units, and relevant businesses and agricultural producers need to coordinate hazard mitigation activities through local government participation in countywide disaster planning and response.

Evaluation of Alternatives and Identification of Mitigation Measures

Drought can have economic, environmental, and social impacts. These events can impact agriculture by reducing crop yields or destroying crops. Drought can also reduce local water supplies. Mitigating the potential impacts of drought should be addressed through a multi-faceted approach. Important elements of such an approach include developing plans for responding to drought conditions for local communities and utilities; protecting local water supply sources; water conservation efforts, both in municipal and agricultural settings; and encouraging agricultural producers to take advantage of Federal crop insurance programs.

Based upon the preceding evaluation and consideration of risk and review by the Washington County Hazard Mitigation LPT (see Appendix A), there are 18 actions determined to be mitigation measures for this Hazard Mitigation Plan update that are specifically related to drought events.[57] Table 5.10 presents these mitigation measures and a general cost-benefit summary.

5.9 HAZARD RISK ANALYSIS AND PRIORITIZATION

The hazards identified as potentially affecting Washington County have been ranked by risk to assist in developing this Hazard Mitigation Plan. Additional description of hazards and the vulnerability assessment of Washington County to these hazards have been identified and summarized in Chapter 3 of this report. These priority rankings were based on the number of incidences per year, mortalities, injuries, property damage, and crop damage inventories provided in Chapter 3. Specifically, this prioritization is based upon protecting human life and health and protection from property and crop damage throughout the County. Therefore, the major indicators of hazard severity used to rank these hazards to Washington County are based upon the deaths and injuries versus economic losses, as summarized in Tables 5.11 and 5.12, respectively. It should be noted, however, that economic losses due to fog, wildfires, dust storms, land subsidence, landslides, and earthquakes were not included in this plan.

As identified in the vulnerability assessment of hazards to Washington County in Chapter 3, the magnitude and consequent risk of a particular hazard is dependent upon a number of factors that include, but are not limited to, time (e.g., time of year for thunderstorm events or time in terms of how long an event may last such as drought), size or scale, frequency of occurrence, population size potentially impacted, and amount of urban growth or development potentially impacted. These factors do not indicate that rural areas are any more or less important than urban areas; however, they do indicate that the more urbanized areas have a greater chance of loss in terms of human death, injury, and property damage per hazard event. It is also important to note, as identified in Chapter 3, that many disaster events are compound in nature and not the result of a single event, such as flooding hazards during a severe thunderstorm event. Nonetheless, since the causes of disasters of the past will likely be the best predictor of future disasters, an attempt was made to normalize all of the hazard incidences from 2001-2021 to an annual average to understand the relative potential level of risk each hazard poses to Washington County on an annual basis (see Tables 5.11 and 5.12).

[57] *Mitigation measures that apply to multiple hazard types including drought events, are presented in the "Hazard Mitigation Plan Component for Multiple Hazard Types" section in this Chapter.*

Ranking Severity of Hazards

Death and Injury

Using the data from the various sources summarized in the vulnerability assessment of Chapter 3, the priority hazards identified in Table 3.2 were ranked with respect to their severity in terms of the sum of the number of annual deaths and injuries they caused and then by frequency of occurrence of each type of hazard event as shown in Table 5.11.

Two of the six identified hazards are associated with mortality and injury, as shown in Table 5.11. One of the identified hazards, extreme temperature, resulted in mortality and one of the identified hazards, tornado, was associated with injury with one instance of each occurring in the 20-years. Injuries and deaths are only analyzed if directly caused by the hazard event; therefore, any indirect injury or death caused by a hazard event is not included. Because of the number of injuries and deaths reported during the 20-year period between 2001 and 2021, the ranking of hazards would be insufficient based on available data and variables.

Property Damage

Another way to assess the vulnerability of Washington County to hazards is to examine the resultant property damage. Again, using the data from the various sources summarized in the vulnerability assessment of Chapter 3, hazards in Washington County were ranked with respect to their severity in terms of the annual sum of the property and crop damage caused and is shown in Table 5.12. Annual average property and/or crop damages estimates were determined for all six priority hazards. These hazards include droughts, flooding, temperature extremes, thunderstorm events, tornadoes, and winter storms. Among these hazards, flooding was identified as resulting in the greatest amount of damage to property and crops in Washington County.

Thunderstorms, high winds, hail, and lightning were identified as the second most damaging hazards (when combined) impacting Washington County. These events occur frequently throughout the County and can cause considerable damage to property and crops. All buildings, infrastructure, and critical facilities within the County are considered at risk because of the unpredictability of thunderstorm wind, hail, lightning, and non-thunderstorm high-wind events.

Tornadoes represent the third most damaging hazard impacting Washington County. While most of the historical damages to property and crops caused by tornadoes resulted from one event, the high rank of

this hazard illustrates the impacts that can result from a single catastrophic incident, even when it is restricted to a small portion of the County.

It is expected that for some years the County will experience more events than other years, but the average annual number is not expected to change over the five-year planning period of this Plan. In addition, future changes in climate and land use can adversely impact crops and property damage due to various hazard events.

The Hazard Mitigation Plan described in this report is designed to attain, to the maximum extent practicable, the goals and objectives outlined in Chapter 4. In a practical sense, however, the plan is not complete until the steps to convert the plan into action policies and programs have been specified. This Chapter presents the plan implementation strategies envisioned and Chapter 6 includes information on plan adoptions, maintenance, and revision.

Chapter 5

HAZARD MITIGATION STRATEGIES

TABLES

Table 5.1
Cost-Benefit Analysis for Measures Included in the Washington County Hazard Mitigation Plan: Multi-Hazards

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Nonstructural												
Continue to enforce State building code regulations that aim to improve the ability of structures to withstand hazardous weather conditions.	--[c]	--[c]	X			X	X	X	X			Washington County and all local jurisdictions[d]
Encourage the periodic review and update of and/or explore the need for new municipal and County development regulations, especially in known hazard areas.	--[c]	--[c]	X			X	X	X	X			Washington County and all local jurisdictions[d]
Continue to encourage local municipalities to participate in the National Weather Service's (NWS) StormReady program.	--[c]	--[c]	X			X						Washington County and all local jurisdictions[d]
Continue the integration of hazard mitigation planning into other local planning efforts (i.e., comprehensive and land use planning).	--[c]	--[c]	X			X						Washington County and all local jurisdictions[d]
Create local funding opportunities and mechanisms for hazard mitigation.	--[c]	--[c]		X		X						Washington County and all local jurisdictions[d]
Continue to update a list of potential funding sources associated with hazard mitigation planning.	--[c]	--[c]	X			X						Washington County and all local jurisdictions[d]
Encourage agricultural producers to purchase crop insurance and promote enrollment of agricultural producers into Federal crop insurance programs.	--[c]	--[c]	X			X				X		Washington County and all local jurisdictions[d]

Table continued on next page.

Table 5.1 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Nonstructural (continued)												
Continue to work with local fair/festival organizers to create emergency plans in case of severe weather. Encourage organizers to use National Weather Service outdoor monitoring support.	--[c]	--[c]	X			X						Washington County and all local jurisdictions[d]
Continue coordinating emergency response and operation plans among governmental units and first responders.	--[c]	--[c]	X			X						Washington County and all local jurisdictions[d] and NGOs
Continue working with public health and human services departments, volunteer groups, NGOs, and American Red Cross for natural weather hazards.	--[c]	--[c]	X			X						Washington County
Pursue grant funding for the installation or upgrading of adequate safe rooms in existing manufactured home parks, campgrounds, and public parks and beaches based on community and landowner interest.	--[c]	--[c]	X			X		X	X			Washington County and all local jurisdictions[d]
Structural												
Continue to maintain, update, and upgrade public early warning systems and networks.	--[e]	--[e, f]		X		X						Washington County and all local jurisdictions[d]
Continue using, maintaining, and updating of the County's interoperability communication network systems.	--[e]	--[e]		X		X	X					Washington County[e]
Bury and protect power and utility lines, where feasible and appropriate, to prevent damage from hazardous weather conditions.	--[c]	--[c]			X	X						Washington County and all local jurisdictions[d]

Table continued on next page.

Table 5.1 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Structural (continued)												
Promote emergency on-site back-up power generation at critical facilities, including water treatment and wastewater treatment facilities.	--[c]	--[c]		X		X	X					Washington County and all local jurisdictions[d]
Promote the installation of backup power systems at homes and businesses.	--[c]	--[c]	X			X				X		Washington County and all local jurisdictions[d]
Trim and maintain the health of trees near vulnerable infrastructure.	--[f]	--f		X		X	X					Washington County and all local jurisdictions[d]
Public Informational and Educational Programming												
Continue to promote, update, and add to Washington County Office of Emergency Management and the Washington-Ozaukee Public Health Departments' online resources related to hazardous weather events, preparedness, and post-event management.	--[c]	--[c]	X			X						Washington County
Continue participating in public outreach events that educate County residents, including those considered vulnerable, on planning and preparing for severe weather events.	--[c]	--[c]	X			X						Washington County and all local jurisdictions[d]
Encourage residents to develop a Family Emergency Preparedness Plan and Disaster Supply Kit (Appendix F).	--[c]	--[c]	X			X						Washington County and all local jurisdictions[d]
Encourage and educate the public on the use of severe weather warning applications (apps) on electronic mobile devices (i.e., FEMA's *ready.gov* severe weather warning cellular phone app).	--[c]	--[c]	X			X						Washington County

Table continued on next page.

Table 5.1 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Public Informational and Educational Programming (continued)												
Encourage secure anchoring of mobile and manufactured housing (i.e., tie-downs).	--[c]	--[c]	X			X	X	X				Washington County and all local jurisdictions[d]
Continue distributing and promoting information and educational resources and programs on available home insurance, flood insurance (i.e., NFIP), severe weather insurance, and crop insurance for damages sustained during a natural hazard event.	--[e]	--[e]	X			X						Washington County and all local jurisdictions[d]
Ensure emergency preparedness and educational outreach is accessible to all residents, especially those considered vulnerable.	--[e]	--[e]	X			X		X	X	X		Washington County and all local jurisdictions[d]
Continue to utilize social media as a way to conduct outreach and to inform the public on severe weather hazards.	--[c]	--[c]	X			X				X		Washington County and all local jurisdictions[d]
Encourage the use of adaptive alert systems for vulnerable populations, including people disabilities.	--[e]	--[e]	X			X				X		Washington County and all local jurisdictions[d]

[a] *All cost expressed in 2022 dollars unless otherwise noted.*

[b] *Cost of implementation is allocated among three categories of low (less than $100,000 dollars), moderate (greater than $100,000 and less than $1,000,000), and high (greater than $1,000,000) costs, which are generally defined as:*

Low
- *Educational and informational programming*
- *Ongoing enforcement of ordinances*
- *Plan Development*
- *Continued coordination/mutual aid/interagency agreements*

Moderate
- *Addition of new staff*
- *Additional staff hours budgeted*
- *Additional equipment*
- *New ordinance development*
- *New programs/task force*

High
- *Major construction*
- *New buildings (infrastructure)*
- *Capital programs*

Table continued on next page.

Table 5.1 (Continued)

[c] *Costs covered under ongoing activity.*

[d] *Jurisdictions include general purpose units of government—Cities, Towns, and Villages—and special purpose units of government such as School Districts, Sanitary and Utility Districts, and Agricultural Drainage Districts.*

[e] *Costs are site-specific.*

[f] *Costs to be determined. Partially covered under ongoing programs.*

Source: Washington County Division of Emergency Management and SEWRPC

Table 5.2
Principal Features and Cost of the Recommended Floodplain Management Plan Element for Washington County

Component	Capital Cost[a]		Annual Operation and Maintenance Cost (thousands of dollars)[a]	Implementation Status
	Description	Cost (millions of dollars)[a]		
1. Repetitive loss and severe repetitive loss structures	Remove four structures[b]	2.08	--	Not Implemented
2. Floodplain map updating and refining	Several projects	--[g]	--	Ongoing
3. Surveys of structures identified as being potentially located in flood hazard area	Survey up to 1,165 structures[c]	--[g]	--	Not Implemented
4. Floodproofing structures identified as being potentially located in the flood hazard area	Floodproof up to 139 structures[d]	8.09	--	Not Implemented
5. Acquisition and demolition of structures identified as being potentially located in flood hazard area	Remove up to 9,543,623 structures[e]	222.52	--	Not Implemented
6. Removal of manufactured homes identified as being potentially located in the flood hazard area	Remove up to 103 mobile homes[f]	4.77	--	Not Implemented
	Total	237.46	--	--

[a] *Amounts are shown in 2022 dollars.*

[b] *Structure removal to be carried out at the discretion of property owners.*

[c] *Surveys to be conducted at the discretion of property owners. The number of structures to be surveyed and the associated costs are likely to be lower based upon the results of recommended floodplain map updating and refining. Costs are based upon the costs of field survey. It is likely that the costs of evaluating flood hazard status of structures using LiDAR data would be lower. These surveys should be conducted in conjunction with floodproofing and/or acquisition and demolition projects.*

[d] *Floodproofing to be conducted at the discretion of property owners.*

[e] *Structure removal to be carried out at the discretion of property owners.*

[f] *Manufactured home removal to be carried out at the discretion of property owners.*

[g] *Estimated costs undetermined.*

Source: SEWRPC

Table 5.3
Participation in the National Flood Insurance Program by Washington County Jurisdictions

Community	Participating in Washington County Hazard Mitigation Plan	Participating in National Flood Insurance Program	Date Initial Flood Hazard Boundary Map Identified[b]	Date of Initial Flood Insurance Rate Map (FIRM)	Entry Date into National Flood Insurance Program
Cities					
Hartford	Yes	Yes	01/09/1974	12/04/1984	12/04/1984
West Bend	Yes	Yes	12/28/1973	08/02/1982	08/02/1982
Villages					
Germantown	Yes	Yes	06/28/1974	05/03/1982	05/03/1982
Jackson	Yes	Yes	12/21/1973	08/17/1981	08/17/1981
Kewaskum	Yes	Yes	12/28/1973	01/06/1982	01/06/1982
Newburg	Yes	Yes	--	12/04/2007	11/13/2008
Richfield	Yes	Yes	08/12/1977	09/01/1983	09/30/2008
Slinger	Yes	Yes	10/21/1977	11/20/2013	11/20/2013
Towns					
Addison	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
Barton	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
Erin	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
Farmington	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
Germantown	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
Hartford	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
Jackson	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
Kewaskum	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
Polk	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
Trenton	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
Wayne	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
West Bend	Yes	Yes	08/12/1977[a]	09/01/1983[a]	09/01/1983[a]
County	Yes	Yes	08/12/1977	09/01/1983	09/01/1983

[a] *In Wisconsin, towns are covered under county eligibility in the National Flood Insurance Program.*

[b] *The current effective Washington County FIS is dated February 5, 2022. The effective FEMA floodplain mapping used for this plan update was downloaded on February 25, 2022.*

Source: Federal Emergency Management Agency

Table 5.4
Stormwater Management Ordinances or Plans Prepared for Communities in Washington County

Community	Ordinance or Plan	Prepared By	Year Prepared
Cities			
Hartford	City of Hartford Municipal Code Chapter 20, Erosion Control and Stormwater Management	City of Hartford	--[a]
West Bend	City of West Bend Storm Water Management Program	City of West Bend	2023
	City of West Bend Municipal Code, Chapter 23, Stormwater Management	City of West Bend	2012
Villages			
Germantown	Village of Germantown Code of Ordinances, Chapter 27, Post-Construction Stormwater Management	Village of Germantown	2007
Kewaskum	Village of Kewaskum Code of Ordinances, Chapter 87, Stormwater Management and Erosion Control	Village of Kewaskum	2002
Richfield	Code of the Village of Richfield, Chapter 167, Erosion Control and Stormwater Management	Village of Richfield	2009
Slinger	Village of Slinger Code of Ordinances, Chapter 526, Stormwater Management and Erosion Control	Village of Slinger	2017
Towns			
Kewaskum	Town of Kewaskum Code of Ordinances, Chapter 19, Erosion Control and Stormwater Management	Town of Kewaskum	2017
Trenton	Town of Trenton Code of Ordinances, Chapter 200, Erosion Control and Stormwater Management	Town of Trenton	2016
County	Washington County Code of Ordinances, Chapter 238, Erosion Control and Stormwater Management	Washington County	2016

[a] *No record of preparation date provided to SEWRPC.*

Source: SEWRPC

Table 5.5
Cost-Benefit Analysis for Measures Included in the Washington County Hazard Mitigation Plan: Flood and Associated Stormwater Drainage Problems Hazards

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits[c]						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Floodland and Environmentally Sensitive Land Preservation Sub-Element												
Maintain floodplain and wetland zoning regulations.	--[e]	--[e]	X			X	X	X	X	X	X	Washington County; Cities of Hartford and West Bend; Villages of Germantown, Jackson, Kewaskum, Newburg, Richfield, and Slinger
Continued preservation and maintenance of environmentally sensitive lands and open space areas.[d]	--[f]	--[f]			X	X	X			X	X	Washington County, and all cities, villages, and towns
Wetland restoration to reduce flood-related agricultural and property damage.[g, i]	--[h]	--[h]			X	X	X			X	X	Washington County, and all cities, villages, and towns
Floodplain Management Sub-Element												
Removal of up to 4 repetitive loss structures.[d,]	$2.08 million	--[h]			X	X	X	X	X	X	X	Washington County, and all cities, villages, and towns
Surveys of up to 1,165 structures identified as being potentially located in flood hazard areas.[d]	--[h]	--[h]			X	X	X			X	X	Washington County, and all cities, villages, and towns
Floodproofing 139 structures identified as potentially located in flood hazard area.[d, j]	$8.09 million	--[h]			X	X	X	X	X	X	X	Washington County, and all cities, villages, and towns
Acquisition and removal/demolition of 923 structures identified as being potentially located in flood hazard area.[d, j]	$222.52 million	--[h]			X	X	X	X	X	X	X	Washington County, and all cities, villages, and towns

Table continued on next page.

Table 5.5 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits[c]						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Floodplain Management Sub-Element (continued)												
Removal of up to 103 mobile homes identified as being potentially located in the flood hazard area.	$4.77 million	--[h]			X	X	X	X	X	X	X	Washington County; Village of Jackson
Consider elevating roads above the base flood elevation to maintain dry access. In areas where flood waters tend to wash roads out, construction, reconstruction, or repair can include stabilization or armoring of vulnerable shoulders or embankments, in addition to improving drainage.	--[h]	--[h]			X	X		X		X	X	Washington County, and all cities, villages, and towns
Consider floodproofing and/or relocating critical facilities located within flood-prone areas.	--[h]	--[h]			X	X	X			X		Washington County, and all cities, villages, and towns
Continue participation in FEMA's National Flood Insurance Program and floodplain map updating.[d]	--[e]	--[e]	X			X	X					Washington County and all its cities, villages, and towns
Lending institution and real estate agent policies should continue their practice of determining the floodprone status of properties before mortgage transactions are complete.[d, e]	--[e]	--[e]	X			X	X					Washington County, and all cities, villages, and towns
Enforcement of floodplain regulations.	--[e]	--[e]	X			X	X				X	Washington County, and all cities, villages, and towns
Develop ice jam mitigation measures.	--[e]	--[e]	X			X	X					Village of Newburg
Installation of new USGS stream gages.	$15,000[n]	$10,000[n]	X			X						Washington County, and all cities, villages, and towns
Documentation of extent of future floods.	--[l]	--[l]	X			X						Washington County, and all cities, villages, and towns

Table continued on next page.

Table 5.5 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits[c]						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Floodplain Management Sub-Element (continued)												
Stream channel maintenance.	--[e]	--[e]	X			X	X				X	Washington County, and all cities, villages, and towns
Dam Failure Sub-Element												
Regular inspection and maintenance of dams.	--[l]	--[l]	X			X	X					Washington County, and all cities, villages, and towns
Dam emergency action plans.	--[l]	--[l]	X			X	X					Washington County, and all cities, villages, and towns
Dam failure analysis.	--[m]		X			X	X					Washington County, and all cities, villages, and towns
Investigate interest in abandonment and removal of high hazard potential dams.	--[l]	--[l]	X			X	X				X	City of West Bend
Stormwater Management Sub-Element												
Development and/or continued maintenance of stormwater management plans/programs.[d]	--[e]	--[e]	X			X	X				X	Washington County, and all cities, villages, and towns
Continuation of stormwater-related regulations.[d] including the adoption and enforcement of new stormwater drainage systems that can withstand intense rain fall events.	--[e]	--[e]	X			X	X				X	Washington County, and all cities, villages, and towns
Continuous implementation of stormwater management facility maintenance activities.	--[e]	--[e]	X			X	X					Washington County, and all cities, villages, and towns
Implementation and integration of green infrastructure and low impact design .	--[l]	--[l]	X			X				X	X	Washington County, and all cities, villages, and towns
Public Informational and Educational Sub-Element												
Continue and enhance public education activities related to flood and stormwater management.	--[e]	--[e]	X			X						Washington County, and all cities, villages, and towns

Table continued on next page.

Table 5.5 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits[c]						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Public Informational and Educational Sub-Element (continued)												
Promote and distribute information related to the Federal Flood Insurance Program.	--[e]	--[e]	X			X	X					Washington County, and all cities, villages, and towns
Enhance public participation activities and coordination with other agencies and units of government.	--[e]	--[e]	X			X						Washington County, and all cities, villages, and towns

[a] *All costs are expressed in 2022 dollars unless otherwise noted.*

[b] *Cost of implementation is allocated among three categories of low (less than $100,000 dollars), moderate (greater than $100,000 and less than $1,000,000), and high (greater than $1,000,000) costs, which are generally defined as:*

Low	*Moderate*	*High*
Educational and informational programming	*Addition of new staff*	*Major construction*
Ongoing enforcement of ordinances	*Additional staff hours budgeted*	*New buildings (infrastructure)*
Plan development	*Additional equipment*	*Capital programs*
Continued coordination/mutual aid/interagency agreements	*New ordinance development*	
	New programs/task force	

[c] *The estimated benefits are based upon the reduction in flood damages during a one percent-annual-probability flood event. Damage estimates were developed by the Commission staff based upon structure values, flood stage, and depth of flooding as described in Chapter 3. Note, not all recommendations have a quantifiable benefit for the 100-yr floodplain, hence mitigation measures not having a cost associated to that column.*

[d] *This mitigation is related to, but not essential to, compliance with the requirements of the National Flood Insurance Program.*

[e] *Costs are covered under ongoing or day-to-day activities.*

[f] *Costs were developed under the Ozaukee County Park and Open Space Plan. Unit costs used to estimate acquisition costs were $3,000 per acre of wetlands, $10,000 per acre of woodlands, and $6,000 per acre of other open lands in 2010 dollars. The costs are based on purchasing all recommended land for parks and open spaces. It should be noted that the protection of these areas could also be accomplished through conservation easements, conservation subdivisions, donations, and purchase or transfer of development rights. The acquisition of all land is unlikely to occur before the park and open space plan year 2020 since acquisitions occur only on a willing seller, willing-buyer basis, and only when funds are available. In the past, major land acquisitions by Ozaukee County have been subsidized by State and Federal grants, which are not always available.*

[g] *Wetland restoration to be carried out at discretion of property owners.*

Table continued on next page.

Table 5.5 (Continued)

[h] *Costs are unknown.*

[i] *It is estimated that full implementation of this recommendation would result in an average annual reduction of agricultural damages due to flooding of $225,500.*

[j] *Structure floodproofing, elevation, or removal will be evaluated on a site-by-site basis and be carried out at the discretion of property owners.*

[k] *Costs to be determined. Partially covered under ongoing programs.*

[l] *Costs are site-specific, and additional investigation is needed for countywide estimate.*

[m] *Costs are estimates for installation of one USGS stream gage.*

Source: Washington County Division of Emergency Management and SEWRPC

Table 5.6
Cost-Benefit Analysis for Measures Included in the Washington County Hazard Mitigation Plan: Thunderstorm, Non-Thunderstorm High-Winds, Hail, and Lightning Hazards

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Nonstructural												
Continue to maintain and regularly update local fire department equipment to help detect or mitigate lightning-related fires, such as thermal imaging devices.	--[c]	--[c]		X		X						Washington County and all local jurisdictions[d]
Continue to enforce existing local ordinances requiring adequate electrical grounding in newly constructed buildings.	--[c]	--[c]		X		X	X	X	X			Washington County and all local jurisdictions[d]
Structural												
Promote planting windbreaks for farm crops.	--[c]	--[c]		X		X	X					Washington County and all local jurisdictions[d]
Install lightning grade surge protection devices for critical electronic components used by government, public service, and public safety facilities, such as warning systems, control systems, communications, computers, and data networks.	--[e]	--[e]		X		X	X					Washington County and all local jurisdictions[d]

Table continued on next page.

Table 5.6 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Structural (continued)												
Work with municipalities and businesses to explore installation of community safe rooms and hardening projects for community facilities, businesses, and manufacturers. Priority should be considered for those facilities that are located on a slab-on-grade structure and for those projects that can be completed as part of a newly planned building or building expansion	--[c]	--[c]			X	X		X	X			Washington County and all local jurisdictions[d]
Public Informational and Educational Programming												
Increase public education and awareness of the potential severity of thunderstorm related hazards (i.e., hailstorms and lightning) and non-thunderstorm high-wind hazards and distribute emergency preparedness information related to thunderstorm hazards.	--[c]	--[c]	X			X						Washington County and all local jurisdictions[d]
Provide information and encourage the use of fire-resistant materials and surge protectors on critical electronic equipment.	--[c]	--[c]	X			X	X					Washington County and all local jurisdictions[d]

[a] *All cost expressed in 2022 dollars unless otherwise noted.*

[b] *Cost of implementation is allocated among three categories of low (less than $100,000 dollars), moderate (greater than $100,000 and less than $1,000,000), and high (greater than $1,000,000) costs, which are generally defined as:*

Low
- *Educational and informational programming*
- *Ongoing enforcement of ordinances*
- *Plan Development*
- *Continued coordination/mutual aid/interagency agreements*

Moderate
- *Addition of new staff*
- *Additional staff hours budgeted*
- *Additional equipment*
- *New ordinance development*
- *New programs/task force*

High
- *Major construction*
- *New buildings (infrastructure)*
- *Capital programs*

Table continued on next page.

Table 5.6 (Continued)

[c] *Costs covered under day to day operations.*

[d] *Jurisdictions include general purpose units of government—Cities, Towns, and Villages—and special purpose units of government such as School Districts, Sanitary and Utility Districts, and Agricultural Drainage Districts.*

[e] *Costs are site-specific.*

Source: Washington County Division of Emergency Management and SEWRPC

Table 5.7
Cost-Benefit Analysis for Mitigation Measures Included in the Washington County All-Hazards Mitigation Plan: Tornado Hazards

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Nonstructural												
Require construction regulations for safe rooms in new schools, daycares, and nursing homes, and encourage the establishment of safe rooms for existing structures that do not have basements.	--[f]	--[f]			X	X		X	X			Washington County and all local jurisdictions[d]
Conduct an inventory and inspection of facilities to ensure the quality, quantity, and accessibility of adequate tornado shelters upon request.	--[c]	--[c]	X			X		X	X			Washington County and all local jurisdictions[d]
Structural												
Ensure that maintenance, monitoring, and usage policies/procedures of the County's public outdoor warning systems are up-to-date and reflect the needs of fire and police personnel.	--[f]	--[f]	X			X						Washington County and all local jurisdictions[d]
Work to locally adopt and implement the Wisconsin Outdoor Warning Siren Best Practices.	--[g]	--[g]	X			X	X	X	X			Washington County and all local jurisdictions[d]

Table continued on next page.

Table 5.7 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Structural (continued)												
Work with municipalities and businesses to explore installation or upgrading of community safe rooms and hardening projects for public buildings, community facilities, major industrial and manufacturing sites, large businesses, manufactured home parks, campgrounds, and fairgrounds to ensure adequate shelter from tornadoes.	--[c]	--[c]			X	X		X	X			Washington County and all local jurisdictions[d]
Public Informational and Educational Programming												
Increase public education and awareness of the potential severity of tornadoes and continue to produce and distribute emergency preparedness information related to tornado events especially to those considered vulnerable (i.e., hard of hearing, elderly, disabled, etc.).	--[g]	--[g]	X			X						Washington County and all local jurisdictions[d]
Distribute, and make readily available, information on where to go during severe weather events for campground, park, and beach visitors.	--[e]	--[e]	X			X						Washington County and all local jurisdictions[d]
Produce and distribute information related to what steps should be taken by the public when they hear tornado sirens and other alert notification systems,	--[c]	--[c]	X			X		X	X			Washington County and all local jurisdictions[d]

[a] *All cost expressed in 2021 dollars unless otherwise noted.*

Table continued on next page.

Table 5.7 (Continued)

[b] *Cost of implementation is allocated among three categories of low (less than $100,000 dollars), moderate (greater than $100,000 and less than $1,000,000), and high (greater than $1,000,000) costs, which are generally defined as:*

Low	*Moderate*	*High*
Educational and informational programming	*Addition of new staff*	*Major construction*
Ongoing enforcement of ordinances	*Additional staff hours budgeted*	*New buildings (infrastructure)*
Plan Development	*Additional equipment*	*Capital programs*
Continued coordination/mutual aid/interagency agreements	*New ordinance development*	
	New programs/task force	

[c] *Costs are site-specific.*

[d] *Jurisdictions include general purpose units of government—Cities, Towns, and Villages—and special purpose units of government such as School Districts, Sanitary and Utility Districts, and Agricultural Drainage Districts.*

[e] *Costs to be determined. Partially covered under ongoing programs.*

[f] *Costs are site-specific, and a survey is needed for countywide estimate.*

[g] *Costs covered under ongoing activity.*

Source: Washington County Division of Emergency Management and SEWRPC

Table 5.8
Cost-Benefit Analysis Summary of Measures Included in the Washington County Hazard Mitigation Plan: Extreme Temperature Hazards

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Nonstructural												
Encourage organized neighborhood outreach groups who look after vulnerable populations and promote the availability of shelters during extreme heat and cold.	--[c]	--[c]	X			X			X			Washington County and all local jurisdictions[d]
Continue to provide special arrangements for payment of heating and cooling bills for customers unable to pay due to financial restraints.	--[c]	--[c]	X			X		X		X		Washington County and all local jurisdictions[d]
Designate sites in the County to be used as public cooling/heating shelters during extreme temperature events.	--[e]	--[e]	X			X		X		X		Washington County and all local jurisdictions[d]
Reschedule public events to avoid large outdoor gatherings during periods of extreme heat or cold.	--[e]	--[e]	X			X		X	X	X		Washington County and all local jurisdictions[d]
Encourage employers and school staff to minimize outdoor activity (i.e., exposure to extreme heat) during a heat wave												Washington County and all local jurisdictions[d]
Extend public swimming pools hours during extreme heat events.	--[c]	--[c]		X		X		X		X		Washington County and all local jurisdictions[d]
Establish and promote a donation program of functional window air conditioner units and fans that are no longer in use and distribute these items to vulnerable populations.	--[c]	--[c]	X			X		X	X	X		Washington County and all local jurisdictions[d]

Table continued on next page.

Table 5.8 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Nonstructural (continued)												
Promote and expand winter weather clothing drives (coats, hats, mittens) where people can drop off gently used winter clothing for distribution to vulnerable populations.	--[c]	--[c]		X		X		X	X	X		Washington County and all local jurisdictions[d]
Structural												
Promote measures to reduce heat island effects in urban areas including increasing green space in urban areas; increasing tree plantings around buildings, parking lots, and along public rights-of-way; and encouraging the use of "cool roofing" products made of highly reflective and emissive materials.	--[c]	--[c]	X			X				X	X	Washington County and all local jurisdictions[d]
Maintain and update warming and cooling public shelter sites in Washington County particularly in areas with low-income, elderly, and young populations.	--[e]	--[e]	X			X		X	X	X		Washington County and all local jurisdictions[d]
Implement energy efficiency measures to reduce disruptions of municipal services and stress on electricity systems during heat waves.												Washington County and all local jurisdictions[d]
Public Informational and Educational Programming												
Increase public education and awareness of the potential severity of temperature extreme events and distribute emergency preparedness information related to extreme temperature events.	--[e]	--[e]	X			X						Washington County and all local jurisdictions[d]

Table continued on next page.

Table 5.8 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Public Informational and Educational Programming (continued)												
Promote awareness of public warming and cooling shelters that are available during extreme temperature events through municipal, County, and public health department websites.	--[e]	--[e]	X			X						Washington County and all local jurisdictions[d]
Produce and distribute emergency preparedness information related to the safe operation of generators, space heaters, fireplaces, and wood stoves.	--[c]	--[c]	X			X		X		X		Washington County and all local jurisdictions[d]

[a] *All cost expressed in 2021 dollars unless otherwise noted.*

[b] *Cost of implementation is allocated among three categories of low (less than $100,000 dollars), moderate (greater than $100,000 and less than $1,000,000), and high (greater than $1,000,000) costs, which are generally defined as:*

Low	*Moderate*	*High*
Educational and informational programming	*Addition of new staff*	*Major construction*
Ongoing enforcement of ordinances	*Additional staff hours budgeted*	*New buildings (infrastructure)*
Plan Development	*Additional equipment*	*Capital programs*
Continued coordination/mutual aid/interagency agreements	*New ordinance development*	
	New programs/task force	

[c] *Costs to be determined. Partially covered under ongoing programs.*

[d] *Jurisdictions include general purpose units of government—Cities, Towns, and Villages—and special purpose units of government such as School Districts, Sanitary and Utility Districts, and Agricultural Drainage Districts.*

[e] *Costs covered under ongoing activity.*

Source: Washington County Division of Emergency Management and SEWRPC

Table 5.9
Cost-Benefit Analysis for Measures Included in the Washington County Hazard Mitigation Plan: Winter Storms

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Nonstructural												
Review the energy efficiency and winter readiness of critical facilities and housing in the community.	--[c]	--[c]	X			X				X		Washington County and all local jurisdictions[d]
Continue to work with American Red Cross, or other organizations, to establish a system for short-term sheltering of vulnerable populations.	--[c]	--[c]		X		X		X	X	X		Washington County and all local jurisdictions[d] and NGOs
Pursue additional funding opportunities to assist with budgeting for overtime hours and extra governmental personnel needed during extreme winter events.	--[c]	--[c]		X		X		X	X	X		Washington County and all local jurisdictions[d]
Ensure that the necessary amount of snow removal, anti-icing, and deicing equipment is available and operational.	--[c]	--[c]		X		X				X		Washington County and all local jurisdictions[d]
Structural												
Work with utility companies to assess and improve, as needed, electric service systems dependability.	--[e]	--[e]		X		X				X		Washington County and all local jurisdictions[d]
Continue installing and promote the installation of additional snow fences and planting of windbreaks to protect farm crops and highways.	--[c]	--[c]	X			X	X	X	X			Washington County and all local jurisdictions[d]

Table continued on next page.

Table 5.9 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Public Informational and Educational Programming												
Continue to maintain and promote winter hazard awareness, including home and travel safety measures, such as avoiding travel during winter storms; having a shovel, sand, warm clothing, food, and water in vehicle if travel cannot be avoided; and the value of installing a back-up heating system in at least one room in the home.	--[c]	--[c]	X			X						Washington County
Encourage organized neighborhood outreach groups who look after vulnerable, or special-needs populations during and after winter storms.	--[c]	--[c]	X			X				X		Washington County and all local jurisdictions[d]
Promote the availability of low-income energy assistance programs.	--[e]	--[e]	X			X				X		Washington County and all local jurisdictions[d]
Publicize the availability of emergency shelter sites for those in need of temporary shelter during winter storms.	--[e]	--[e]	X			X				X		Washington County and all local jurisdictions[d]

[a] *All cost expressed in 2021 dollars unless otherwise noted.*

[b] *Cost of implementation is allocated among three categories of low (less than $100,000 dollars), moderate (greater than $100,000 and less than $1,000,000), and high (greater than $1,000,000) costs, which are generally defined as:*

Low
- *Educational and informational programming*
- *Ongoing enforcement of ordinances*
- *Plan Development*
- *Continued coordination/mutual aid/interagency agreements*

Moderate
- *Addition of new staff*
- *Additional staff hours budgeted*
- *Additional equipment*
- *New ordinance development*
- *New programs/task force*

High
- *Major construction*
- *New buildings (infrastructure)*
- *Capital programs*

[c] *Costs are covered under day-to-day operations.*

[d] *Jurisdictions include general purpose units of government—Cities, Towns, and Villages—and special purpose units of government such as School Districts, Sanitary and Utility Districts, and Agricultural Drainage Districts.*

Table 5.9 (Continued)

[e] *Costs to be determined. Partially covered under ongoing programs.*

Source: Washington County Division of Emergency Management and SEWRPC

Table 5.10
Cost-Benefit Analysis for Priority Measures Included in the Washington County Hazard Mitigation Plan: Drought Hazards

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Nonstructural												
Encourage the development and maintenance of drought emergency plans for local utilities and local communities including development of criteria for triggering drought-related actions; development of agreements for secondary water sources; and specification of water use regulations during drought conditions.	--[c]	--[c]	X			X						Washington County and all local jurisdictions[d]
Encourage the development of local water conservation programs.	--[e]	--[e]	X			X						Cities of Hartford and West Bend; Villages of Germantown, Jackson, Kewaskum, and Slinger; Town of Addison
Protect areas of high and very high groundwater recharge potential from inappropriate development (see Map 5.8).	--[f]	--[f]	X			X	X				X	Washington County and all local jurisdictions[d]
Promote regional activities to protect groundwater recharge areas outside of the County boundaries.	--[g]	--[g]	X			X					X	Washington County and all local jurisdictions[d]
Identify areas with potential groundwater level problems and inspect wells in those areas for adequate depth and construction.	--[f]	--[f]		X		X	X				X	Washington County and all local jurisdictions[d]
Promote the use of agricultural methods that reduce evaporation and/or promote infiltration.	--[c]	--[c]	X			X						Washington County and all local jurisdictions[d]

Table continued on next page.

Table 5.10 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Nonstructural (continued)												
Allow and encourage the use of drought-resistant landscaping practices using native plantings.	--[e]	--[e]	X			X	X				X	Washington County and all local jurisdictions[d]
Promote the use of green infrastructure and other stormwater management practices that facilitate aquifer recharge.	--[c]	--[c]	X			X					X	Washington County and all local jurisdictions[d]
Support agricultural programs (i.e., UW-Extension, NRCS, and USDA) that promote soil health, preserve soil moisture, and help to minimize loss of crops and topsoil during drought conditions.	--[c]	--[c]	X			X	X				X	Washington County and all local jurisdictions[d]
Support ordinances to prioritize or control water use during drought conditions.	--[c]	--[c]	X			X				X	X	Washington County and all local jurisdictions[d]
Design and plan for water supply infrastructure systems that are not vulnerable to drought events.	--[h]	--[h]		X		X	X			X		Washington County and all local jurisdictions[d]
Structural												
Consider implementing the recommendations made in the Regional Water Supply Plan[i] for additional water supply facilities and programs to meet forecast water use demands.	--[c]	--[c]	X			X				X	X	Washington County and all local jurisdictions[d]
Consider development of interconnections between adjacent water utilities to ensure provision of water in the event of a loss of water supply due to severe drought.	--[e]	--[e]	X			X				X		City of Hartford and Villages of Germantown and Slinger

Table continued on next page.

Table 5.10 (Continued)

Mitigation Measures	Estimated Cost[a]		Costs of Implementation[b]			Benefits						Community/ Jurisdictions Affected
	Capital	Average Annual Operation and Maintenance	Low	Moderate	High	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Enhanced quality of life/social benefits	Increased Environmental and/or Recreational Benefits/Ecosystems	
Structural (continued)												
Encourage continued federal funding for stream gaging stations and groundwater monitoring wells by the WDNR, USGS, National Weather Service, and U.S. Army Corps of Engineers.	--[c]	--[c]	X			X					X	Washington County
Public Informational and Educational Programming												
Increase public education and awareness of the potential severity of drought events.	--[c]	--[c]	X			X	X	X	X	X	X	Washington County and all local jurisdictions[d]
Promote and distribute emergency preparedness information related to drought.	--[c]	--[c]	X			X				X	X	Washington County and all local jurisdictions[d]
Encourage farmers to report crop and/or livestock losses to appropriate officials.	--[c]	--[c]	X			X						Washington County and all local jurisdictions[d]

[a] *All cost expressed in 2021 dollars unless otherwise noted.*

[b] *Cost of implementation is allocated among three categories of low (less than $100,000 dollars), moderate (greater than $100,000 and less than $1,000,000), and high (greater than $1,000,000) costs, which are generally defined as:*

Low
- *Educational and informational programming*
- *Ongoing enforcement of ordinances*
- *Plan Development*
- *Continued coordination/mutual aid/interagency agreements*

Moderate
- *Addition of new staff*
- *Additional staff hours budgeted*
- *Additional equipment*
- *New ordinance development*
- *New programs/task force*

High
- *Major construction*
- *New buildings (infrastructure)*
- *Capital programs*

[c] *Costs covered under ongoing activity.*

[d] *Jurisdictions include general purpose units of government—Cities, Towns, and Villages—and special purpose units of government such as School Districts, Sanitary and Utility Districts, and Agricultural Drainage Districts.*

[e] *Costs to be determined.*

Table continued on next page.

Table 5.10 (Continued)

[f] *Costs are site-specific.*

[g] *Costs to be determined based on amount of funding allocated for program.*

[h] *Costs are site-specific. Partially covered under ongoing programs.*

[i] *See SEWRPC Planning Report No. 52,* A Regional Water Supply Plan for Southeastern Wisconsin, *2010 for additional information.*

Source: Washington County Division of Emergency Management and SEWRPC

Table 5.11
Priority Ranking of Hazards Affecting Washington County Based Upon Mortality and Injury

Order Based on Local Planning Team[a]	Hazards Identified in the Hazard Vulnerability Assessment Tool	Period of Record	Number of Incidents Per Year (average)	Number of Mortalities Per Year (average)[b]	Number of Injuries Per Year (average)	Sum of Average Mortality and Injury Incidences Per Year
8	Drought	2001-2021	0.9	0.0	0.0	0.0
12, 14	Flood (Stormwater Flooding and Riverine Flooding)	2001-2021	0.6	0.0	0.0	0.0
9, 10	Temperature Extremes (Extreme Cold and Extreme Heat)	2001-2021	2.5	1.0	0.0	1.0
11, 7, 3, 2	Thunderstorms, Hail, Lightning, Strong Winds	2001-2021	12.6	0.0	0.0	0.0
6	Tornado	2001-2021	0.5	0.0	1.0	1.0
5, 1, 4	Winter Storms (Heavy Snow, Ice Storm, and Blizzard)	2001-2021	8.2	0.0	0.0	0.0

[a] *These numbers indicate the ranked order of the hazards assigned by the Washington County Hazard Mitigation Local Planning Team (LPT) through responses given in the Hazard and Vulnerability Assessment Tool (HVA). For more details see the Hazard Identification section in Chapter 3 of this report. Similar hazardous events as listed in the HVA tool (see Table 3.1) are shown in parentheses—hence the multiple rankings given for hazardous events. Similar events listed in the HVA tool were combined into one hazardous event for this hazard mitigation Plan. For example, "heavy snow," "ice storm," and "blizzard" in the HVA tool was combined into "Winter Storms."*

[b] *Deaths that are reported in this table refer only to deaths that are directly caused by the hazard event, while indirectly related deaths are not reported in this table. For example, a death caused by a car accident where fog or snow-covered roads were contributing factors are considered indirectly related deaths and are not reported in this table.*

Source: National Climatic Data Center (NCDC), National Oceanic and Atmospheric Administration (NOAA), National Environmental Satellite, and Data and Information Service (NESDIS) and SEWRPC

Table 5.12
Priority Ranking of Hazards Affecting Washington County Based Upon Crop and Property Damages

Order Based on Local Planning Team[a]	Hazards Identified in the Hazard Vulnerability Assessment Tool[b]	Period of Record	Number of Incidents Per Year (average)	Total Property Damage Per Year (dollars)[c]	Total Crop Damage Per Year (dollars)	Sum of Property and Crop Damages Per Year (dollars)	Priority Ranking Based on Analysis
8	Drought	2001-2021	0.9	0	271,944	271,994	4
12, 14	Flood (Stormwater Flooding and Riverine Flooding)	2001-2021	0.6	627,614	730,119	1,357,733	1
9, 10	Temperature Extremes (Extreme Cold and Extreme Heat)	2001-2021	2.5	133	15,968	16,101	6
11, 7, 3, 2	Thunderstorms, Hail, Lightning, Strong Winds	2001-2021	12.6	941,401	243,485	1,184,886	2
6	Tornado	2001-2021	0.5	312,613	3,663	316,276	3
5, 1, 4	Winter Storms (Heavy Snow, Ice Storm, and Blizzard)	2001-2021	8.2	1,990	22,185	24,175	5

[a] *These numbers indicate the ranked order of the hazards assigned by the Washington County Hazard Mitigation Local Planning Team (LPT) through responses given in the Hazard and Vulnerability Assessment Tool (HVA). For more details see Table 3.1 and the Hazard Identification section in Chapter 3 of this report.*

[b] *Similar hazardous events listed in the HVA tool (see Table 3.1)—as shown in parentheses—were combined into one category of similar nature for this hazard mitigation Plan. For example, "heavy snow," "ice storm," and "blizzard" in the HVA tool was combined into the "Winter Storms" for this hazard mitigation plan.*

[c] *Dollar values were adjusted to year 2022 by using the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.*

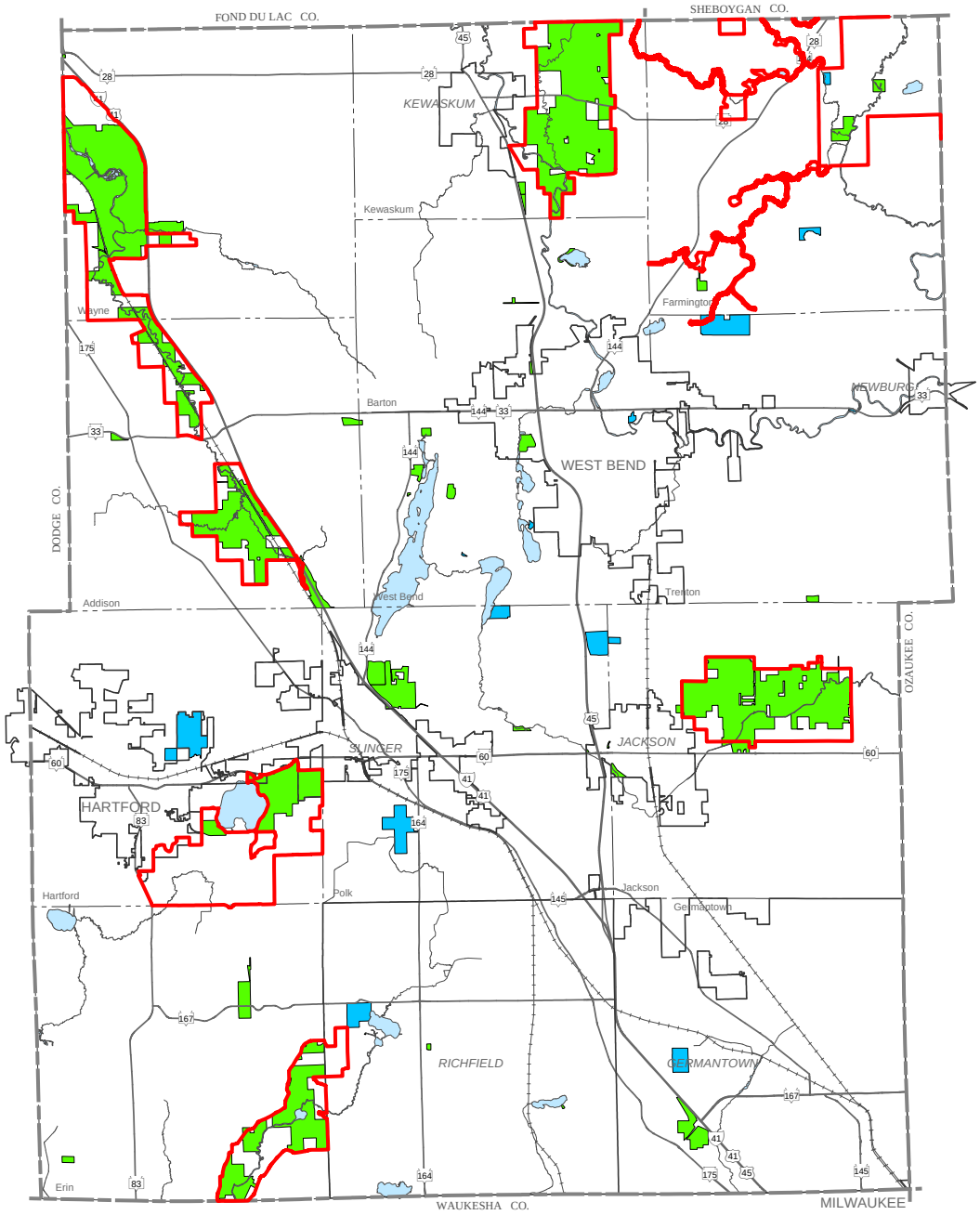
Source: National Climatic Data Center (NCDC), National Oceanic and Atmospheric Administration (NOAA), and National Environmental Satellite, Data and Information Service (NESDIS), and the U.S. Department of Agriculture Risk Management Agency

Chapter 5

HAZARD MITIGATION STRATEGIES

MAPS

Map 5.1
County and State-Owned Park and Open Space Sites in Washington County: 2022



STATE-OWNED SITES

COUNTY-OWNED SITES

WISCONSIN DEPARTMENT OF NATURAL RESOURCES PROJECT BOUNDARIES

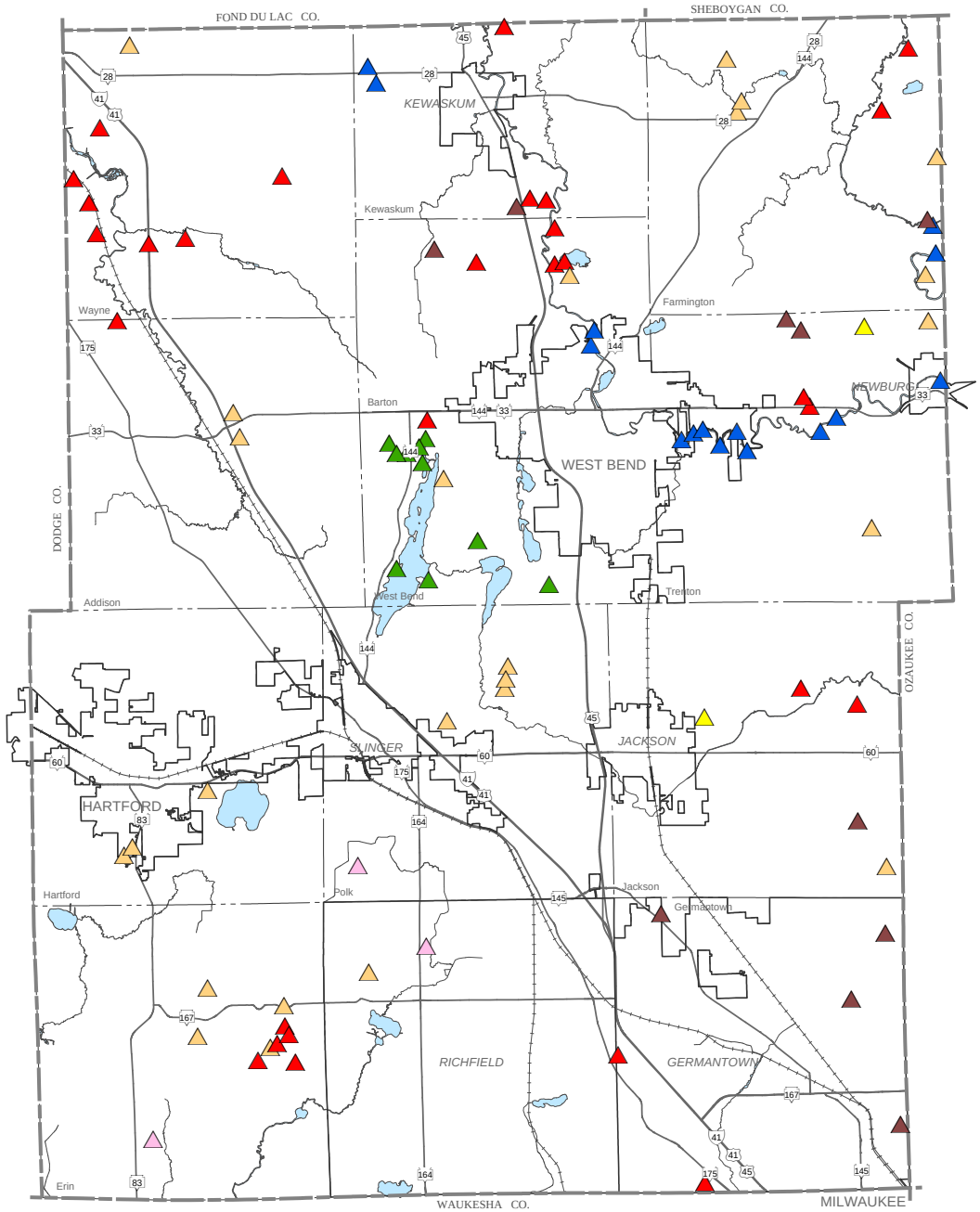
SURFACE WATER

N

0 1 2 3 Miles

Source: Wisconsin Department of Natural Resources and SEWRPC

Map 5.2
State and Nonprofit Organization Conservation Easements in Washington County: 2022



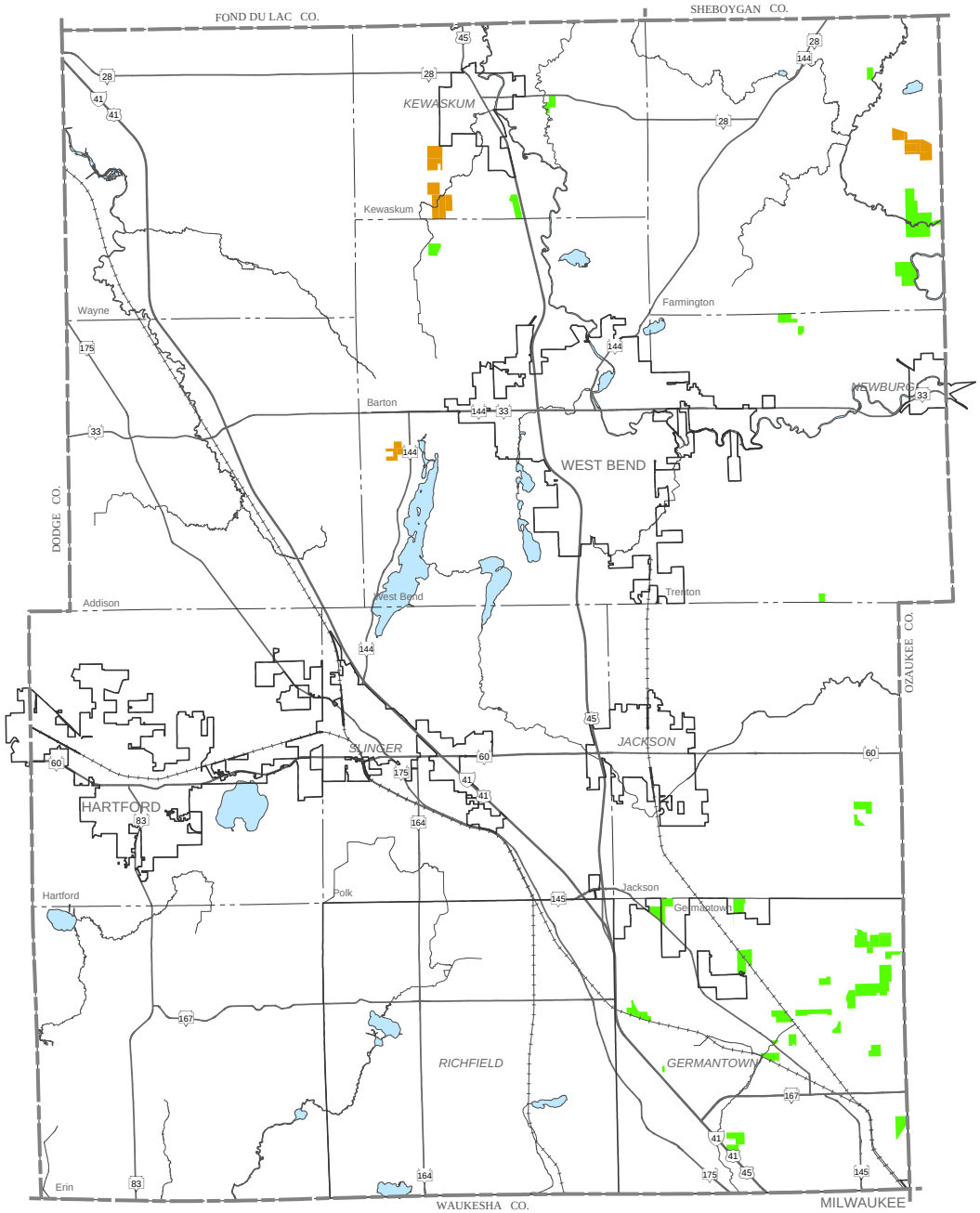
- CONSERVATION RESERVE ENHANCEMENT PROGRAM SITE
- WISCONSIN DEPARTMENT OF NATURAL RESOURCES SITE
- WISCONSIN DEPARTMENT OF NATURAL RESOURCES STREAMBANK EASEMENT SITE
- MILWAUKEE METROPOLITAN SEWERAGE DISTRICT SITE
- CEDAR LAKES CONSERVATION FOUNDATION SITE
- OZAUKEE WASHINGTON LAND TRUST SITE
- TALL PINES LAND CONSERVANCY

N

0 1 2 3 Miles

Source: SEWRPC

Map 5.3
MMSD Greenseams and Working Soils Sites in Washington County: 2022



MILWAUKEE METROPOLITAN SEWERAGE DISTRICT GREENSEAMS SITE

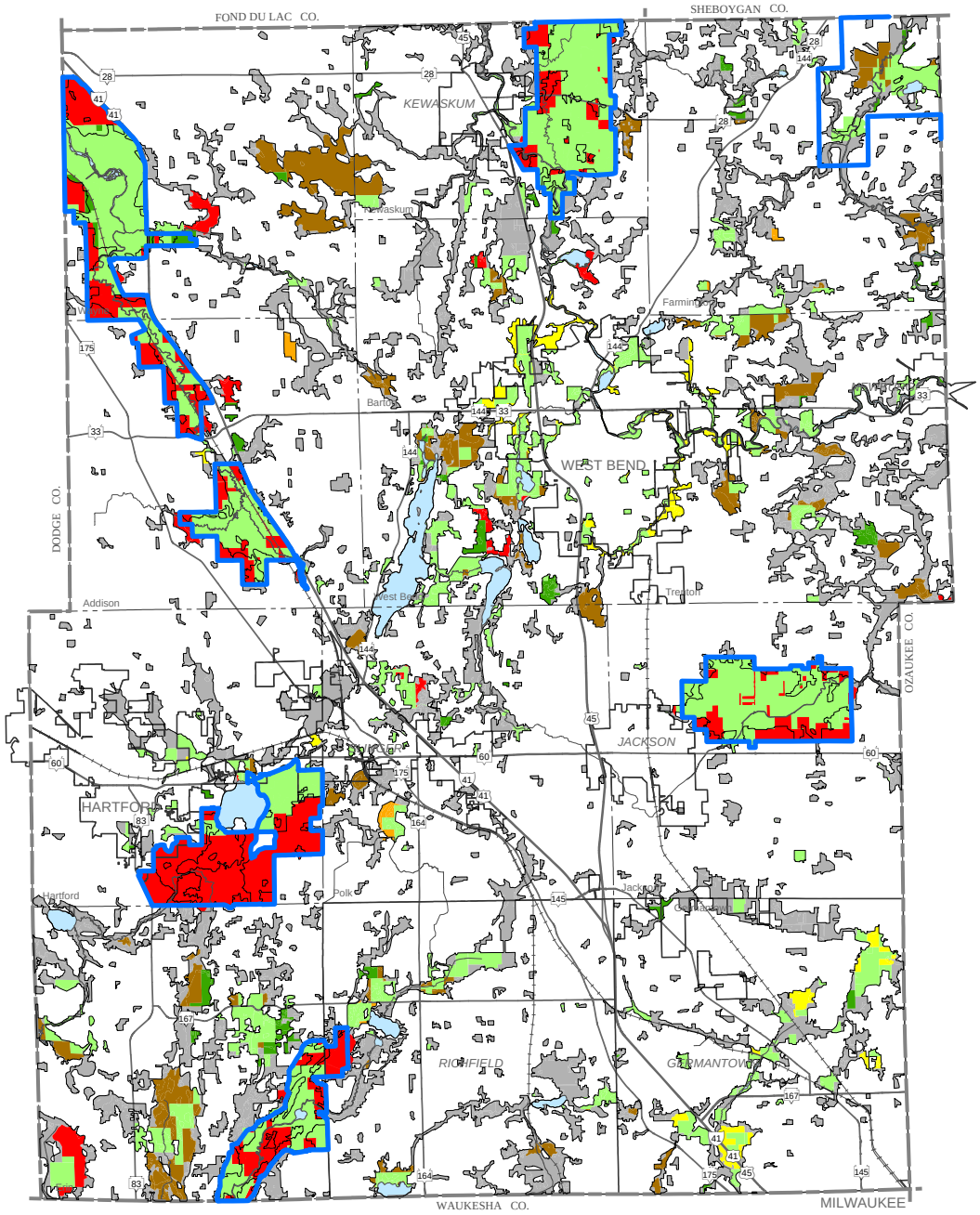
MILWAUKEE METROPOLITAN SEWERAGE DISTRICT WORKING SOILS SITE

N

0 1 2 3 Miles

Source: MMSD and SEWRPC

Map 5.4
Open Space Preservation Element of the Washington County Park and Open Space Plan



Existing Public Interest Ownership of Open Space Lands Within Primary Environmental Corridors and Isolated Natural Resource Areas

- Federal, State, County, Local, NonProfit Conservation Organization, School or Other Public District, or Compatible Private Outdoor Recreation or Open Space Sites
- Lands Under Conservation Easement

Proposed Public Interest Ownership of Open Space Lands Within Primary Environmental Corridors and Isolated Natural Resource Areas

- State
- County
- City, Village, Town, or Special Purpose District
- Nonprofit Conservation Organization
- Open Space Lands to be Protected by Public Land Use Regulation

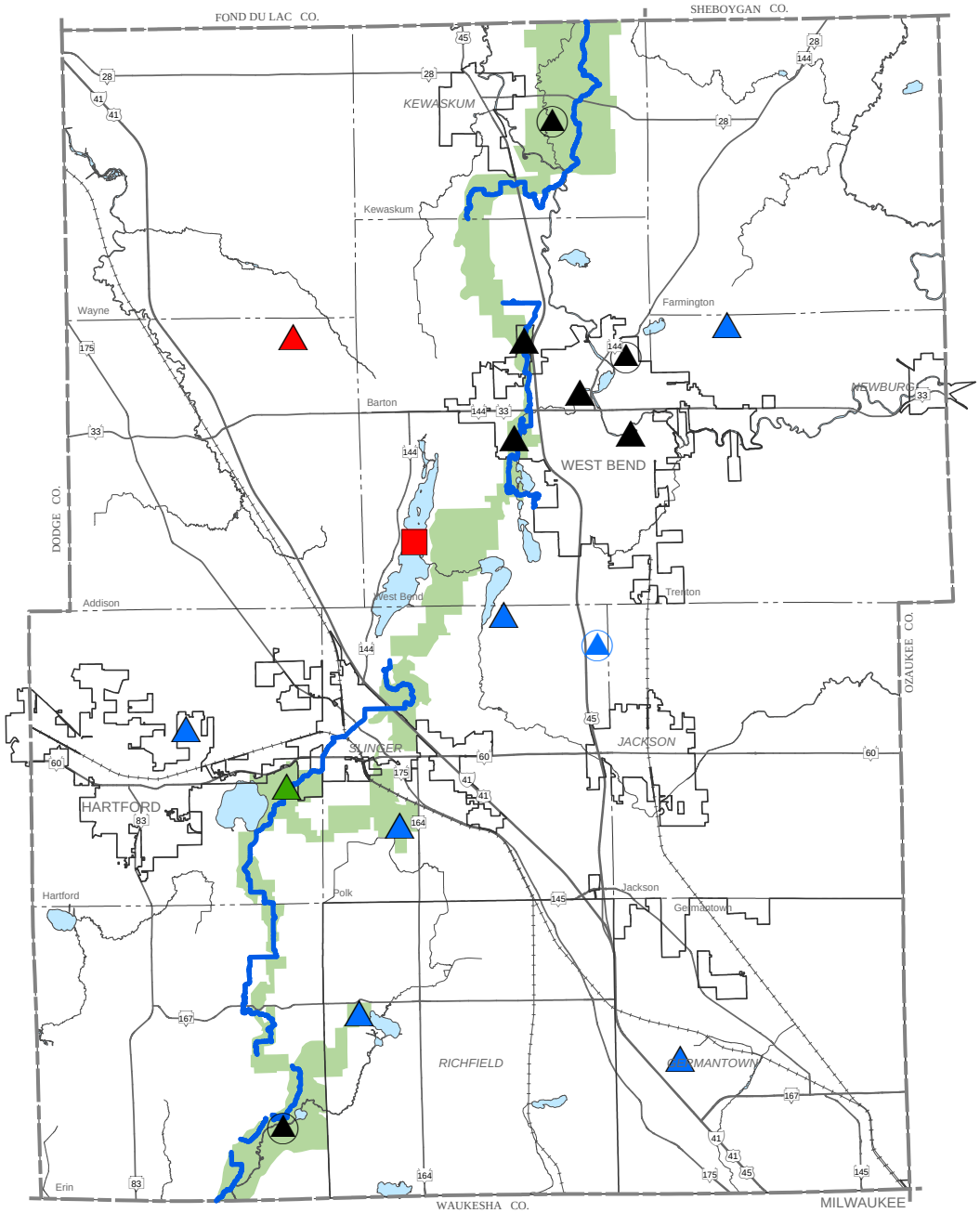
- Primary Environmental Corridors and Isolated Natural Resource Areas
- Surface Water
- Wisconsin Department of Natural Resources Project Area

N

0 1 2 3 Miles

Source: SEWRPC

Map 5.5
Outdoor Recreation Element of the Washington County Park and Open Space: 2035



MAJOR PARKS

- STATE
- COUNTY
- LOCAL
- PROPOSED COUNTY

OTHER PARKS AND OUTDOOR RECREATION SITES

- WASHINGTON COUNTY FAIR PARK
- SPECIAL OUTDOOR RECREATION SITE
- PROPOSED OTHER COUNTY

RECREATION CORRIDORS

- EXISTING ICE AGE TRAIL
- ICE AGE TRAIL CORRIDOR

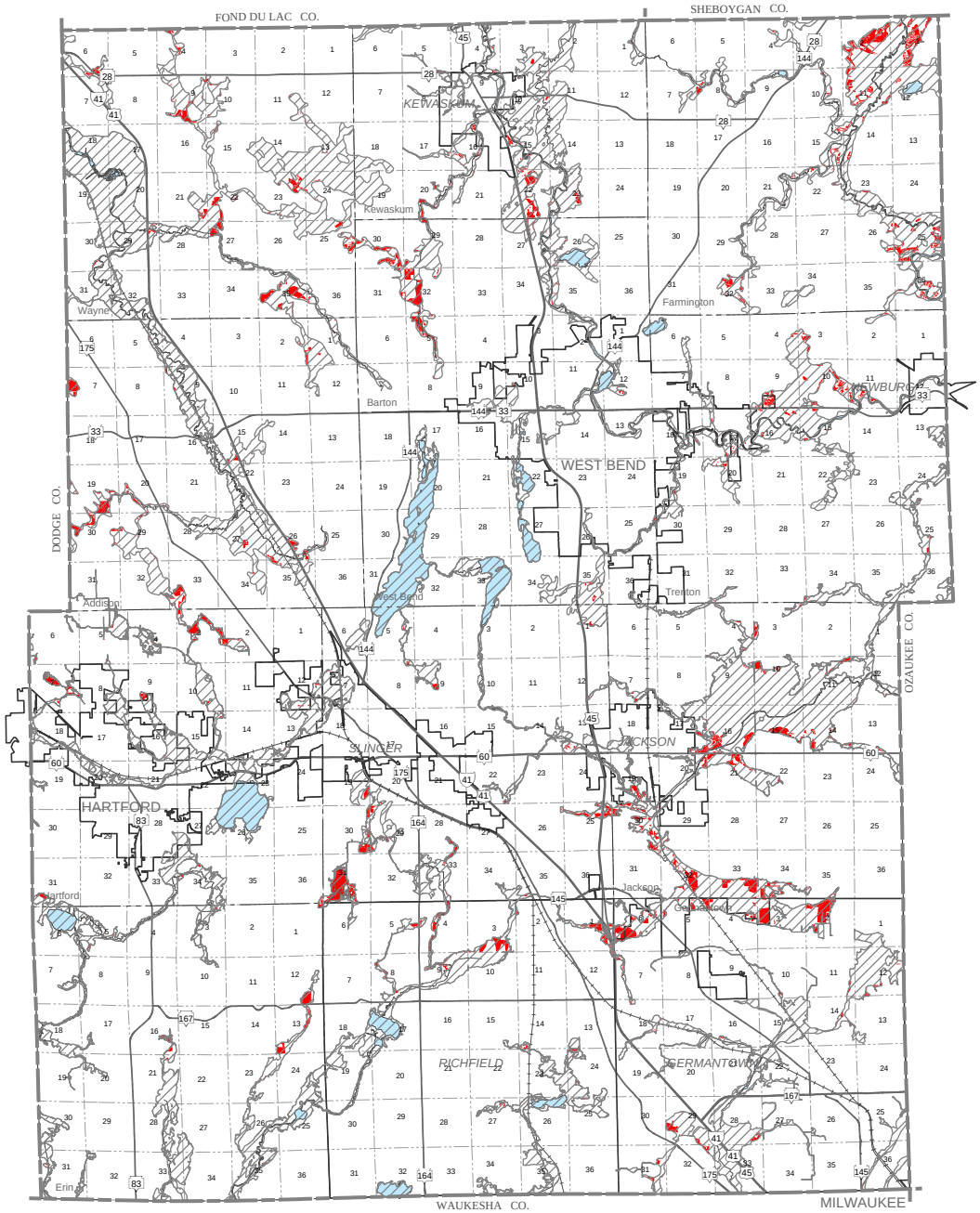
Note: The Ice Age Trai corridor is an area within which the Ice Age Trail may pass in the future, based on a 1995 planning process. Only willing landowners participate in the completetion of the Ice Age Trail.

N

0 1 2 3 Miles

Source: Ice Age Trail Alliance, Washington County and SEWRPC

Map 5.6
Agricultural Land to be Considered for Wetland Restoration: 2019



AGRICULTURAL LAND TO BE CONSIDERED FOR WETLAND RESTORATION
(These areas indicate agricultural land that is located within the 100-Year Floodplain and considered by WDNR to be Potentially Restorable Wetland)

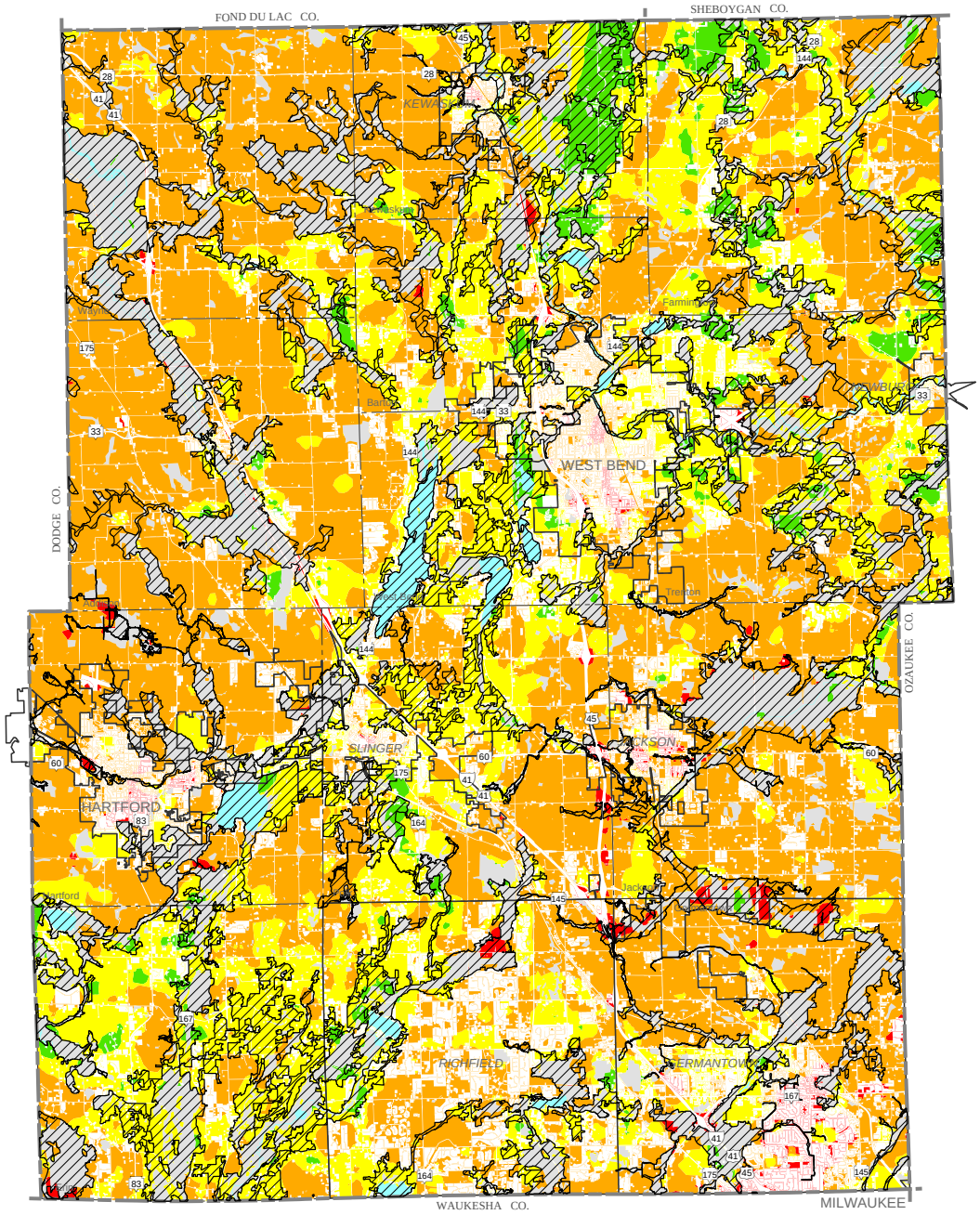
ONE-PERCENT-ANNUAL-PROBABILITY
(100-YEAR RECURRENCE INTERVAL)
FLOODPLAINS (FEMA FIS, JANUARY 2022)

N

0 1 2 3 Miles

Source: FEMA, Wisconsin Department of Natural Resources and SEWRPC

Map 5.7
Groundwater Recharge Potential in Washington County: 2015



VERY HIGH

HIGH

MODERATE

LOW

UNDETERMINED

EXISTING URBAN DEVELOPMENT (2015)

PRIMARY ENVIRONMENTAL CORRIDORS (2015) AND ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FLOODPLAINS (FEMA FIS, JANUARY 2022)

SURFACE WATER

Note: No soil survey data is available for areas shown as undetermined. These areas are largely comprised of wetlands.

N

0 1 2 3 Miles

Source: Wisconsin Geological and Natural History Survey, Federal Emergency Management Agency, and SEWRPC

SEWRPC Community Assistance Planning Report No. 326 (2nd Edition)

WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Chapter 6

PLAN ADOPTION, IMPLEMENTATION, MAINTENANCE, AND REVISION

The Hazard Mitigation Plan described in this report is designed to attain the goals and objectives outlined in Chapter 4, to the maximum extent practicable. However, the plan is not complete until the steps to convert the plan into actions, policies, and programs have been specified. This Chapter presents the Plan implementation strategies envisioned and includes information on plan adoption, maintenance, and revision.

6.1 PLAN REFINEMENT, REVIEW, AND ADOPTION

As described in Chapter 1, Washington County initiated its hazard mitigation planning program in 2015. The plan set forth in this report began in 2020 and was conducted pursuant to the mitigation planning requirements of 44 *Code of Federal Regulations*, Section 201.6(d) (44 CFR 201.6(d)), which call for local hazard mitigation plans to be reviewed; updated to reflect changes in development, progress in local mitigation efforts, and changes in priorities; and reapproved every five years for local jurisdictions to be able to receive hazard mitigation funding. In 2002, the Federal Emergency Management Agency (FEMA) published rules for hazard mitigation planning in response to the Disaster Mitigation Act of 2000. These rules address State and local mitigation planning and are important for the Washington County Hazard Mitigation Program in the following manner:

- The Wisconsin Department of Military Affairs, Division of Emergency Management (WEM), is directly involved in a partnership role for all-hazard mitigation planning. That agency is responsible for

preparing and periodically updating a State all-hazard mitigation plan, providing technical assistance and guidance for local all-hazard planning, and administering planning grant programs for FEMA.

- The rules outline State and local mitigation planning guidelines for accessing hazard mitigation grant funds. For disasters declared after November 1, 2004, local government units must have a FEMA-approved mitigation plan to receive project grants from the Hazard Mitigation Grant Program (HMGP) and the Building Resilient Infrastructure and Communities (BRIC) Program. This element is important because it requires local adoption of a hazard mitigation plan to remain eligible for grants from specific mitigation funds. Communities can formally adopt the County Plan or create and adopt their own plan.

- The rules and related guidance provide more specificity and detail on the hazard mitigation plan content than did the previous rules. The Washington County Hazard Mitigation Plan has been structured to meet the 2002 guidance.

This Washington County Hazard Mitigation Plan was prepared under the guidance of the Washington County Hazard Mitigation Local Planning Team (LPT), comprised of representatives of all of the communities within the County, as well as elected and appointed officials; agency, non-profit representatives, and citizens from throughout the County knowledgeable in hazard mitigation matters. The LPT met three times during the plan preparation period to provide input on the types of hazards to be considered, the appropriate mitigation strategies, and to review and refine the draft report chapters to reflect the comments and recommendations of the LPT. The activities of the LPT are documented in Appendix A.

Each community has unique capabilities available to mitigate and reduce long-term vulnerability to natural hazard events. These capabilities include authorities, policies, programs, staff, technical knowledge, and funding. The Washington County LPT participated in an online Community Capabilities Assessment. By gathering this input, communities will be able to better identify the capabilities currently effective in reducing disaster impacts and identify areas where increased capacity may improve their ability to reduce risk. A copy of the survey assessment provided to LPT members, as well as the results from the survey, are documented in Appendix H.

During the drafting of the Plan, public informational meetings were held to review the Plan with local officials, stakeholders, and citizens, following completion of the first three chapters and after completion of the Plan in draft form. In addition, as draft chapters of the updated Plan were completed, copies were placed

in downloadable form on the website of the Southeastern Wisconsin Regional Planning Commission (SEWRPC) and a webpage was available on the SEWRPC website on which members of the public could ask questions and submit comments on the draft plan update.

Additionally, consideration of the input and needs of underserved and vulnerable populations was incorporated throughout the planning process. Public feedback on the draft plan was solicited online through the websites of both the Washington County Office of Emergency Management and SEWRPC, and public participation was encouraged through social media posts. Physical copies of the draft Plan were available to be printed on behalf of the public through the Washington County Office of Emergency Management. An opportunity for in-person public comment was provided at public informational meetings, held in the evening to accommodate people who could not attend during normal business hours. Meeting notices were provided via local print, internet (i.e., email notifications), printed flyers, and social media. Note, public meeting flyers were distributed throughout the County at locations accessible to general public, including those populations considered vulnerable (elderly, disabled, low-income, etc.)

Following Plan finalization, the Plan was presented for consideration and adoption to the Washington County Board of Supervisors on [INSERT DATE]. A copy of the signed Plan adoption resolution is included in Appendix B. Copies of the Plan were also sent to each of the local units of government in the County advising them of the need for adoption in order to retain future eligibility for mitigation funding from the FEMA HMGP and the BRIC Program administered by WEM. In addition, County and SEWRPC staff have been made available to meet with communities on an individual basis to review the Plan and consider adoption and implementation steps. The Washington County Department of Emergency Management maintains a status report on Plan adoption by the County and local government units.

6.2 PLAN IMPLEMENTATION STRATEGIES

An important first step in implementing the updated Hazard Mitigation Plan for Washington County is its formal adoption by the County, the Cities of Hartford and West Bend, and the Villages of Germantown, Jackson, Kewaskum, Newburg, Richfield, and Slinger. The Towns are covered by the County adoption but may adopt this Plan update individually as well. Upon formal adoption, the Plan becomes an important guide to hazard mitigation and related management decisions for the County and participating local units of government. Such adoption serves to signify agreement with and official support of the Plan recommendations and enables government officials and staff to begin integrating the Plan

recommendations into the other ongoing County and municipal programs, such as land use and public works development planning and programming.

Realization of the Plan will require a long-term commitment to the objectives of the Plan and a high degree of coordination and cooperation among County officials and staff and various County and community departments and other bodies, including the Hazard Mitigation Local Planning Team; intergovernmental task forces or other committees that may be created in the future to help address common hazard mitigation issues; other concerned units and agencies of government and their respective officials and staffs; area developers and lending institutions; businesses, industry, and institutions; and concerned private citizens in undertaking the substantial investments and series of actions needed to implement the Plan. Close cooperation with WEM and FEMA is also essential.

A summary of the Plan elements and selected implementation strategy information, including current status, general priority assignments, designated management agencies, and schedules is included in Table 6.1. It is recommended that the County and local units of government incorporate the analyses performed and mitigation strategies recommended into other local planning efforts, such as those related to stormwater management, stream and river protection, land and water conservation, and comprehensive planning, where appropriate.

6.3 HAZARD MITIGATION FUNDING SOURCES

The ability of each participant in this Hazard Mitigation Plan to implement the measures proposed is most often limited by their ability to finance the projects and dedicate sufficient staffing time toward implementing projects while still providing other essential services. Financing of the construction, operation, and maintenance of hazard mitigation measures may be accomplished through a number of means, including: establishing a stormwater utility; tax incremental financing (TIF) districts; local property taxes; reserve funds; general obligation bonds; private-developer contributions, including fees applied to construction of regional stormwater management facilities in lieu of providing onsite facilities; State grants or loans; and certain Federal and State programs.

Identifying potential funding sources, including sources other than solely local-level sources, is an integral part of implementing a successful mitigation plan and serves as one way for participants in this Plan to expand on and improve their capability to mitigate the impacts of hazard events in their communities. Successfully pursuing and receiving grant funding takes a considerable amount of time and effort and the

lack of available staff time to pursue funding opportunities is often a major barrier to successful plan implementation. Having sufficient staff time dedicated to pursuing grant funding opportunities represents a way to expand a community's capability to implement the hazard mitigation measures recommended in this Plan, particularly with increasing funding becoming available through the Bipartisan Infrastructure Law.[1]

The following description of funding sources includes those that appear to be applicable for the County and local units of government as of 2023. However, because funding programs and opportunities are constantly changing, the involved staff of County and local units of government will need to monitor the potential funding sources and programs. Some of the programs described in this Chapter may not be available under all envisioned conditions in the County or to its residents and/or property owners for a variety of reasons, including, for example, eligibility requirements or lack of funds at a given time in Federal and/or State budgets. Nonetheless, the list of sources and programs set forth in this Chapter should provide a starting point for identifying possible funding for implementing the Hazard Mitigation Plan recommended in this report (see also Appendix G).

U.S. Federal Emergency Management Agency (FEMA) Programs

FEMA funds several programs in the State of Wisconsin that are administered through WEM. These programs include the HMGP, Flood Mitigation Assistance (FMA), BRIC, and Public Assistance (PA) Program. These programs are described below. For these FEMA programs, the projects must be cost-effective (benefits outweigh the costs), environmentally sound, address a repetitive problem, and be a long-term solution.

Building Resilient Infrastructure and Communities (BRIC)

As detailed in Chapter 1, BRIC is a new FEMA pre-disaster hazard mitigation program that replaced the Pre-Disaster Mitigation program. The BRIC program assists states, local communities, tribes, and territories participating in hazard mitigation projects that reduce the risks faced by disasters and natural hazards including capability- and capacity-building, encouraging, and enabling innovation, promoting partnerships, enabling large projects, maintaining flexibility, and providing consistency. Projects eligible under BRIC must:

- Be cost-effective
- Reduce or eliminate risk and damage from future natural hazards

[1] *U.S. Public Law No. 117-58 (2021),* Infrastructure Investment and Jobs Act, www.govinfo.gov/app/details/PLAW-117publ58.

- Meet either of the two latest International Building Codes (i.e., 2015 or 2018)

- Align with the applicable hazard mitigation plan

- Meet all environmental and historic preservation (EHP) requirements

Eligible applicants include states, territories, and Tribal governments. These entities can submit applications on behalf of sub-applicants such as local units of government and state and tribal agencies. BRIC grants require a non-federal share of 25 percent of the project costs.

Hazard Mitigation Grant Program

The HMGP can provide up to 75 percent of the costs of certain natural hazard mitigation projects. In the case of flood mitigation, projects can include floodproofing, acquisition and relocation, or demolition of flood-prone properties, elevation of structures in compliance with NFIP standards, and other flood control measures, where identified as cost-effective. To be eligible for mitigation activities with FEMA funding, structures must be insured under the NFIP. The HMGP requires a non-federal match of 25 percent of project costs. In Wisconsin half of this match is provided by the WEM HMGP funds that become available only after a Presidential disaster declaration has been issued within the State. Applications must be submitted to WEM within 60 days of the declaration. Eligible projects must be included as part of the grantee's all-hazard mitigation plan and must meet cost-benefit criteria established by FEMA. HMGP funds can be used on private property for eligible projects. The HMGP gives priority to properties identified by FEMA as repetitive-loss properties.

Flood Mitigation Assistance Program

The FMA program can provide up to 75 percent of the costs attendant to acquiring, relocating, elevating, and floodproofing structures in compliance with NFIP standards. Properties included in a project sub-application for FMA funding must be NFIP-insured at the time of the application submittal and prior to the period of availability or application start date. Flood insurance must be maintained through completion of the mitigation activity and for the life of the structure. In addition to participating in the NFIP, eligible program applicants must meet cost-benefit criteria established by FEMA. Mitigating repetitive-loss properties is given a high priority under this program. Increased cost of compliance (ICC) coverage under the NFIP may provide a funding source for bringing noncompliant structures into compliance after a flood loss.

Public Assistance Program

FEMA's PA program can provide some limited assistance with respect to structure elevation and relocation. For example, if entire portions of a community were to be relocated outside of a floodplain, this program can assist in rebuilding the necessary infrastructure in the new location. Funding under this program is provided for repair of infrastructure damaged during a flood that results in a Presidential disaster declaration. In making repairs to the infrastructure, cost-effective mitigation activities may be included. If a community determines that a badly damaged facility is not to be repaired, the estimated damage amount may be used to fund an alternate project. Funding provided under the PA program may pay for cost-effective hazard mitigation measures for facilities damaged by the incident. In addition, funding from the PA program may be combined with funding from the HMGP, FMA, and/or PDM programs to implement mitigation measures in the same facility; however, they cannot be combined to pay for the same work.

U.S. Department of Agriculture Farm Service Agency (USDA-FSA)

The USDA-FSA oversees several voluntary conservation-related programs that provide direct and indirect hazard mitigation benefits. These programs work to address a large number of farming- and ranching-related issues, including drinking water protection, reducing soil erosion, preserving wildlife habitat, preserving and restoring forests and wetlands, and aiding farmers whose farms have been damaged by natural disasters (see also Appendix G).

U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS)

The USDA-NRCS provides farmers and ranchers with financial and technical assistance to voluntarily install conservation measures to concurrently help the environment and agricultural operations. Many of these programs may serve as potential funding sources for flood mitigation efforts by the County and local communities (see Appendix G).

U.S. Army Corps of Engineers (USACE)

The U.S. Army Corps of Engineers programs are potential sources of funding for implementing the floodplain management recommendations of this Plan. In order to be eligible for funding, the plan components must meet specific Corps economic feasibility and other criteria. The programs that may be applicable include the following:

- Section 22—Water resources planning assistance (50 percent Federal, 50 percent local cost share)

- Section 103—Hurricane and Storm Damage Reduction Program. Maximum $5.0 million per project (65 percent Federal, 35 percent local cost share)

- Section 205—Flood damage reduction projects. Maximum Federal cost for planning, design, and construction is $10.0 million per project (65 percent Federal, 35 percent local cost share)

- Section 208—Clearing debris and sediment from channels for flood prevention. Maximum $500,000 per project (65 percent Federal, 35 percent local cost share)

- Section 14—Emergency streambank and shoreline protection. Maximum $1.5 million per project (65 percent Federal, 35 percent local cost share)

Wisconsin Department of Natural Resources (WDNR)

The WDNR operates programs that may serve as potential funding sources for flood mitigation efforts by the County and local communities (see Appendix G). Three of these programs are described below.

Municipal Flood Control Program

This program provides grants for the mitigation of flood-prone property, the restoration of riparian areas, and the construction of flood control projects. Under Chapter NR 199, "Municipal Flood Control Grants," of the Wisconsin Administrative Code, municipalities, including cities, towns, and villages, as well as metropolitan sewerage districts, are eligible for cost-sharing grants from the State for projects such as acquisition and removal of structures; floodproofing and elevation of structures; riparian restoration projects; acquisition of vacant land, or purchase of easements, to provide additional flood storage or to facilitate natural or more efficient flood flows; construction of facilities for the collection, detention, retention, storage, and transmission of stormwater and groundwater for flood control and riparian restoration projects; and preparation of flood mapping projects.

Municipal Dam Grant Program

The 2021 biennial budget provided $10 million to fund eligible engineering and construction costs associated with the maintenance, repair, modification, or abandonment and removal of municipally owned dams. The program will cover 50 percent of the first $1,000,000 of eligible project costs and 25 percent of the next $2,000,000 of dam repair, reconstruction, or modification project costs. The program will cover 100 percent of the first $1,000,000 for dam abandonment and removal projects. Cities, towns, villages, counties,

tribes, and public inland lake protection and rehabilitation districts may apply for funds through this program.

Dam Removal Grant Program

The Dam Removal Grant Program provides reimbursement for 100 percent of eligible project costs up to a maximum of $50,000 for any owner who wishes to remove a dam. Eligible costs include labor, materials, and equipment directly related to planning the actual removal, the dam removal itself, and the restoration of the impoundment. Counties, cities, villages, towns, tribes, public inland lake protection and rehabilitation districts, and private dam owners may apply for grant funds through this program.

Other Potential Funding Sources

A variety of other potential funding sources exist which may provide funds for implementation of elements of the recommended Hazard Mitigation Plan. These are listed in Appendix G.

6.4 PLAN MONITORING AND REEVALUATION STRATEGIES

For a hazard mitigation plan to be successful it must not only be implemented but also monitored. Plan monitoring is best accomplished through a formal, periodic process designed to measure and assess progress in implementation, changes in outside circumstances that may affect the plan and efforts to implement it, and changes to the plan or the implementation process. The plan should also be reviewed following each hazard event to assess its continued viability and the need for revisions.

Plan Monitoring

Review

To ensure successful monitoring of the Hazard Mitigation Plan, it is recommended that the Washington County All Hazards Mitigation Plan LPT meet periodically to review the Plan and the status of its implementation with a view toward enhancing and improving response to natural hazard events. Plan review meetings will be held following any disasters that affect the County and at the discretion of the Director of the County Office of Emergency Management. These meetings will provide the opportunity to develop and recommend any necessary revisions of the Plan to the Washington County Board of Supervisors, as well as to the local units of government involved. The revisions would be proposed, considered, and adopted in the form of formal amendments to the Hazard Mitigation Plan. This review process will be coordinated and conducted by the County Office of Emergency Management, with input from, coordination with, and participation by all concerned County officials and staff, all units and agencies of government involved in

plan implementation, and concerned private parties. The LPT, in its review process, will periodically examine the Plan and the efforts to implement it with respect to the following:

1. Whether any hazards affecting the County and local units of government have changed, and if so, how they have changed

2. Whether any hazard mitigation goals and objectives have changed or need to be changed

3. The degree and extent of progress made in implementing previously identified hazard mitigation actions

4. Whether the plan elements and their priorities should remain unchanged or need modification

5. Whether any new plan elements are needed

6. Whether applicable funding programs and levels have changed

As an integral part of its review process, it is recommended that the County Office of Emergency Management, with review and guidance of the LPT, submit a written report to the Local Emergency Planning Committee and the County Board that sets forth the status of plan implementation efforts, details plan implementation actions taken over the past year, prioritizes mitigation goals and activities for the next year and sets forth any recommended revisions to the plan. It is also recommended that the County Office of Emergency Management oversee the development and maintenance of a tracking and archiving system for all future detailed hazard mitigation studies undertaken by or for the County or the local units of government concerned. Such studies should be evaluated using policies established either by the LPT or the County Board.

The meetings of the LPT will continue to be publicly noticed, and salient decisions will be recorded in the County Office of Emergency Management files and, where appropriate, on the County website and in press releases, among others. Meetings of the LPT are considered public meetings under Wisconsin Law and are open to all interested parties. County Office of Emergency Management staff will also continue to organize community-level events to increase public awareness, participation, and preparedness. The staff will ensure that appropriate notices, agendas, and other documentation are provided to interested people and LPT members in a timely manner. The venue and timing of these events shall be varied to ensure the widest

possible participation and geographic spread across the County. Through these community-level events, staff will gain an understanding of issues of concern, encourage public involvement, and maintain hazard awareness and preparedness at a high level. The County Office of Emergency Management will be responsible on a day-to-day basis for creating and implementing a common monitoring system. This will require close cooperation and coordination with other units of government and agencies involved. This review will form part of the agenda for the aforementioned annual meeting of the LPT.

Post-Disaster Review

The plan monitoring and refinement strategy will include a post-disaster component whereby the Plan is reviewed and evaluated after any future major hazard event. Based upon this review, the Hazard Mitigation Plan will be updated or revised as needed based on the experiences, circumstances, and consequences of the hazard. In this regard, the post-disaster review effort will be coordinated with the emergency operations program administered by the County Office of Emergency Management in partnership with the local units of government. The experiences of emergency operations may indicate a need for refined mitigation actions that would then be incorporated into the plan. Any Plan updating found to be needed will be incorporated into the annual plan update noted above.

Reevaluation Strategy

As a condition of eligibility for receiving project grant funding from its mitigation grant programs, FEMA requires that hazard mitigation plans be reviewed, revised, and resubmitted for approval every five years. The updated Plan should document changes that have occurred since the development of the Plan, such as implementing recommended mitigation measures, changes in development, occurrences of hazard events, and changes in local priorities. In addition, it should update the risk analysis. This should include both determining whether the risks posed by specific hazards have changed and reevaluating the identified hazards to determine whether any changes need to be made in the set of hazards addressed by the Plan. Finally, the updated Plan should evaluate the relevance of the Plan's goals, objectives, and recommended strategies and update them as appropriate.

To meet these requirements, it is recommended that the Hazard Mitigation Plan be updated at a minimum of five-year intervals. The Director of the Washington County Office of Emergency Management should lead updating efforts in partnership with other appropriate County departments. Reevaluation, updating, and revision of this plan should be initiated approximately 24 months prior to its expiration. As part of the updating process, the Director will reconstitute the Hazard Mitigation LPT to oversee the development of the updated Plan. The team should include representatives of all of the municipalities that are covered

under the Plan. The meetings of the LPT will be publicly noticed. In addition, at appropriate times during the updating process, members of the public and adjacent communities will be provided with opportunities to review and submit questions and comment on the Plan update. Plan updating will be conducted according to relevant guidance available from FEMA and WEM. Following completion of the updated Plan in draft form, it will be submitted to WEM and FEMA for review and approval. Following approval by FEMA, the updated Plan will need to be adopted by the Washington County Board and by the governing bodies of the incorporated municipalities in the County.

Incorporating Existing Planning Mechanisms

The Hazard Mitigation LPT will meet on an annual basis to provide a mechanism for ensuring that the actions identified in the Plan are incorporated into ongoing County planning activities. Washington County currently utilizes comprehensive land use planning, land use regulations, neighborhood planning, and building codes to guide and control development in the County. These existing mechanisms will have hazard mitigation strategies integrated into them where applicable. In addition, the County will require participating local municipalities to address hazards in their comprehensive plans and land use regulations. Specifically, one of the goals in the Plan promotes the spatial distribution of land uses to minimize hazards and dangers to the health, welfare, and safety of County residents from natural and man-made hazards. The County Community Development Department will conduct periodic reviews of the County's comprehensive plan and land use policies, analyze any plan amendments, and provide technical assistance to other local municipalities in implementing these requirements.

Chapter 6

PLAN ADOPTION, IMPLEMENTATION, MAINTENANCE, AND REVISION

TABLES

Table 6.1
Summary of Mitigation Measures and Funding Sources

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Multi-Hazards					
Continue to enforce State building code regulations that aim to improve the ability of structures to withstand hazardous weather conditions.	Implemented	High	Ongoing	Wisconsin Department of Safety and Professional Services, Municipal Building Inspector and/or Engineer	3, 6, 7, 8, 33, 36, 64
Encourage the periodic review of and/or explore the need for new municipal and County development regulations, especially in known hazard areas.	Partially Implemented	Medium	Ongoing	SEWRPC, WCB, WCEM, WCPD	
Continue to encourage local municipalities to participate in the National Weather Service's (NWS) StormReady program.	Not Implemented	Low	As funding and opportunities become available	NWS, WCEM	
Continue the integration of hazard mitigation planning into other local planning efforts (i.e., comprehensive and land use planning).	Implemented	High	Ongoing	FEMA, WEM, SEWRPC, WCEM, WCLC	
Create local funding opportunities and mechanisms for hazard mitigation.	Partially Implemented	Low	As funding and opportunities become available	WCB, WCEM	
Continue to update a list of potential funding sources associated with hazard mitigation planning.	Implemented	Medium	Ongoing	SEWRPC, WCEM	
Encourage agricultural producers to purchase crop insurance and promote enrollment of agricultural producers into Federal crop insurance programs.	Partially Implemented	Low	Ongoing	USDA-FSA, WCLC	
Continue coordinating emergency response and operation plans among governmental units and first responders.	Implemented	High	Ongoing	FEMA, WEM, SEWRPC, WCEM, WCLC, WCPD	
Continue to work with local fair/festival organizers to create emergency plans in case of severe weather.	Implemented	High	Ongoing	WCEM, WCPSC, WCPWC, WCSO	
Continue working with public health and human services departments, volunteer groups, NGOs, and American Red Cross.	Implemented	High	Ongoing	American Red Cross, WOPHD, WCHHD, WCSO, Municipal EMS, Fire, and Police Departments	

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Table 6.1 (Continued)

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Multi-Hazards (continued)					
Pursue grant funding for the installation or upgrading of adequate safe rooms in existing manufactured home parks, campgrounds, and public parks and beaches based on community and landowner interest.	Not Implemented	High	As funding and opportunities become available	WNDR, WCEM, Municipal Planning and/or Community Development Commissions	3, 6, 7, 8, 33, 36, 64
Maintain, update, and upgrade public early warning systems and networks.	Implemented	High	As needed	NOAA, WCEM, WCSO	
Continue using, maintaining, and updating of the County's interoperability communication network systems.	Implemented	High	As needed	WCEM, WCSO, Municipal Fire and Police Departments	
Bury and protect power and utility lines, where feasible and appropriate, to prevent damage from hazardous weather conditions.	Partially Implemented	Medium	Ongoing	We Energies, WCEM, Municipal Public Works and/or Utility Departments	
Promote emergency on-site back-up power generation at critical facilities, including water treatment and wastewater treatment facilities.	Partially Implemented	High	Ongoing	WCEM, Municipal Water Supply and Wastewater Utilities	
Promote the installation of backup power systems at homes and businesses.	Partially Implemented	Medium	Ongoing	WCEM	
Trim and maintain the health of trees near vulnerable infrastructure.	Partially Implemented	Low	As funding and opportunities become available	WDNR, UW-Extension, WCLC, We Energies, WCPWC	
Continue to promote, update, and add to Washington County Office of Emergency Management and the Washington-Ozaukee Public Health Departments' online resources related to hazardous weather events, preparedness, and post-event management.	Implemented	Medium	Ongoing	WCEM, WOPHD	
Continue participating in public outreach events that educate County residents on planning and preparing for severe weather events.	Implemented	Low	Ongoing	WCEM	
Encourage residents to develop a Family Emergency Preparedness Plan and Disaster Supply Kit.	Implemented	Medium	Ongoing	FEMA, WEM, WCEM, WOPHD	
Promote inclusion of safety strategies for severe weather events into driver educational classes and materials.	Partially Implemented	Low	Ongoing	WCEM, WisDOT	

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Table 6.1 (Continued)

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Multi-Hazards (continued)					
Encourage and educate the public on the use of severe weather warning applications (apps) on electronic mobile devices (i.e., FEMA's *ready.gov* severe weather warning cellular phone app).	Implemented	Low	Ongoing	FEMA, NOAA, NWS, WCEM, City and Village Boards	3, 6, 7, 8, 33, 36, 64
Routinely inspect mobile and manufactured housing to ensure they are securely anchored (i.e., tie-downs).	Not Implemented	Medium	Ongoing	WCEM, County and Municipal inspectors	
Continue distributing and promoting information and educational resources and programs on available home insurance, flood insurance (i.e., NFIP), and crop insurance for damages sustained during severe weather.	Implemented	High	Ongoing	FEMA, WCEM, WCLC	
Organize outreach to vulnerable populations to help protect them from severe weather hazards.	Not Implemented	Medium	Ongoing	WCEM, City and Village Boards	
Utilize social media as a way to conduct outreach and to inform the public on severe weather hazards.	Partially Implemented	Medium	Ongoing	WCEM, City and Village Boards	
Flooding and Associated Stormwater Drainage Problems					
Floodplain and Environmentally Sensitive Land Preservation Element					
Maintain floodplain and wetland zoning regulations.	Implemented	High	Ongoing	WDNR, WCLC, WCPT, Municipal Engineering, Planning, and/or Zoning Departments	3, 4, 5, 6, 7, 14, 16, 18, 21, 23, 24, 26, 27, 28, 29, 32, 33, 36, 43, 44, 47, 49, 52, 65
Continued preservation and maintenance of environmentally sensitive lands and open space areas.	Partially Implemented	High	As funding and opportunities become available	WDNR, OWLT, WCLRD, WCPT, MMSD, CLLF, Tall Pines Conservancy, Municipal-Council/Board; Parks, Open Space, and/or Recreational Departments; and Planning Departments	
Continue wetland restoration to reduce flood-related agricultural and property damage.	Not Implemented	Medium	As funding and opportunities become available	USFWS, NRCS, WDNR, OWLT, WCLRD, WCPT, MMSD, CLLF, Tall Pines Conservancy, Municipal Engineering, Planning, and/or Zoning Departments	

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Table 6.1 (Continued)

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Flooding and Associated Stormwater Drainage Problems (continued)					
Floodplain Management Plan Element					
Remove up to 4 repetitive loss structures[a]	Not Implemented	High	As funding and opportunities become available	FEMA, WEM, WCEM, WCLRD, Property Owners, Municipal-Council/Board; Engineering, Planning, and/or Zoning Departments	3, 4, 5, 7, 15, 16, 17, 18, 21, 29, 33, 36
Surveys of up to 1,165 structures identified as being potentially located in flood hazard areas.	Not Implemented	High	Implement after updating floodplain maps	WCEM, WCLRD, Property owners, Municipal Engineering Departments	
Floodproofing 139 structures identified as potentially located in flood hazard area.[a]	Not Implemented	Medium	Implement after updating floodplain maps and surveys of structures	WEM, WCEM, WCLRD, Property Owners, Municipal Planning, Engineering, and/or Zoning Commissions	
Acquisition and removal/demolition of up to 923 structures identified as being potentially located in flood hazard area.[a]	Not Implemented	Medium	Implement after updating floodplain maps and surveys of structures	FEMA, WEM, WCEM, WCLRD, Property Owners, Municipal-Council/Board; Engineering, Planning, and/or Zoning Departments	
Removal of up to 103 manufactured homes identified as being potentially located in the flood hazard area.[a]	Not Implemented	Medium	Implement after updating floodplain maps and surveys of structures	FEMA, WEM, WCEM, WCLRD, WCPT, Property Owners, Municipal-Council/Board; Engineering, Planning, and/or Zoning Departments	
Consider elevating roads above the base flood elevation to maintain dry access. In areas where flood waters tend to wash roads out, construction, reconstruction, or repair can include stabilization or armoring of vulnerable shoulders or embankments, in addition to improving drainage.	Not Implemented	High	As needed and ongoing	WEM, WCEM, WCLRD, Municipal-Council/Board; Engineering, Planning, and/or Zoning Departments	
Consider floodproofing and/or relocating critical facilities located within flood-prone areas.[a]	Not Implemented	Medium	As needed	WEM, WCEM, WCLRD, Municipal-Council/Board; Engineering, Planning, and/or Zoning Departments	
Continue participation in FEMA's National Flood Insurance Program and floodplain map updating.	Partially Implemented	High	Ongoing	FEMA, WDNR, WCLC, Municipal-County/Board; Engineering, Planning, and/or Zoning Departments	

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Table 6.1 (Continued)

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Flooding and Associated Stormwater Drainage Problems (continued)					
Floodplain Management Plan Element (continued)					
Lending institution and real estate agent policies should continue their practice of determining the flood prone status of properties before mortgage transactions are complete.	Partially Implemented	High	Ongoing	Lending Institutions, Real Estate Brokers	3, 4, 5, 7, 15, 16, 17, 18, 21, 29, 33, 36
Enforcement of floodplain regulations.	Partially Implemented	High	Ongoing	WCPD, All Municipalities	
Develop ice jam mitigation measures.				WEM, WCEM, WCPWC, Municipal-Council Board; Engineering, Planning, and/or Zoning Departments	
Installation of new and maintenance of existing USGS stream gages.	Partially Implemented	High	Ongoing	USGS, WDNR, SEWRPC, WCLRD	
Documentation of extent of future floods.	Not Implemented	High	As future flooding occurs	WCLRD	
Stream channel maintenance.	Partially Implemented	Medium	Ongoing as funding and opportunities become available	WDNR, WCLRD, WCPT, Municipal Public Works Departments	
Dam Failure Sub-Element					
Regular inspection and maintenance of dams.	Partially Implemented	High	At a minimum, as required by WDNR[b]	WDNR, Municipal Public Works Department, WCDH, Private and Public Dam Owners	33
Continue to update and adopt dam emergency action plans.	Partially Implemented	High	Ongoing	WDNR, WCEM, Private and Public Dam Owners	
Dam failure analysis.	Partially Implemented	High	As needed	WDNR, WCEM, Private and Public Dam Owners	
Investigate interest in abandonment and removal of high hazard potential dams.	Not Implemented	Medium	As dam failure analyses are completed	WDNR, City of West Bend	
Stormwater Management Plan Element					
Development and/or continued maintenance of stormwater management plans/programs.	Partially Implemented	High	Ongoing	WCLRD, WCPT, Municipal Public Works Departments	7, 18, 29, 61
Continuation of stormwater-related regulations, including the adoption and enforcement of up-to-date stormwater drainage systems.	Partially Implemented	High	Ongoing	WCLRD, WDNR	
Continuous implementation of stormwater management facilities maintenance activities.	Partially Implemented	High	Ongoing	WCLRD, WDNR	

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Table 6.1 (Continued)

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Flooding and Associated Stormwater Drainage Problems (continued)					
Stormwater Management Plan Element (continued)					
Implementation and integration of green infrastructure and low impact design.	Partially Implemented	Medium	As funding and opportunities become available	FEMA, WDNR, WCLRD, WCPT, Municipal- Board/Council, Planning Commission, Public Works Departments	7, 18, 29, 61
Public Informational and Educational Element					
Continue and enhance public education activities related to flood and stormwater management.	Partially Implemented	High	Ongoing	UW-Extension, WCLRD, WCEM, WDNR, Municipal Public Works Departments	7
Promote and distribute information related to Federal Flood Insurance Program.	Partially Implemented	Medium	Ongoing	FEMA, WCEM, WCLRD, Municipal Planning Commissions	
Enhance public participation activities and coordination with other agencies and units of government on flooding events and impacts.	Partially Implemented	High	Ongoing	UW-Extension, WDNR, WCEM, WCLRD, WCPT	
Thunderstorm Wind, Non-Thunderstorm High-Wind, Hail, and Lightning					
Maintain and regularly update local fire department equipment to help detect or mitigate lightning-related fires, such as thermal imaging devices.	Implemented	Medium	As needed	Municipal Fire Departments	3, 7, 10, 16, 33, 64
Enforce existing local ordinances requiring adequate electrical grounding in newly constructed buildings.	Implemented	High	As needed	Wisconsin Department of Safety and Professional Services, Municipal Building Inspector and/or Engineer	
Promote planting windbreaks for farm crops.	Implemented	Low	Ongoing	UW-Extension, WCEM, SEWRPC, WCLC, WCPD	
Install lightning grade surge protection devices for critical electronic components used by government, public service, and public safety facilities, such as warning systems, control systems, communications, computers, and data networks.	Partially Implemented	High	As needed	WCEM, Municipal Council/Boards	
Explore installation of community safe rooms and hardening projects for community facilities, businesses, and manufacturers, especially slab-on-grade buildings.	Partially Implemented	High	As needed	WCEM, Municipal Council/Boards	

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Table 6.1 (Continued)

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Thunderstorm Wind, Non-Thunderstorm High-Wind, Hail, and Lightning (continued)					
Increase public education and awareness of the potential severity of thunderstorm related hazards and non-thunderstorm high-wind hazards and distribute accessible emergency preparedness information related to thunderstorm hazards.	Partially Implemented	Low	Ongoing	UW-Extension, WEM, WCEM	3, 7, 10, 16, 33, 64
Provide information and encourage the use of fire-resistant materials and surge protectors on critical electronic equipment.	Partially Implemented	Low	Ongoing	We Energies, WCEM	
Tornadoes					
Require construction regulations for safe rooms in new schools, daycares, and nursing homes, and encourage the establishment of safe rooms for existing structures that do not have basements.	Not Implemented	High	As funding and opportunities become available	WCEM, Municipal Council/Boards	3, 7, 33, 64
Conduct an inventory and inspection of facilities to ensure the quality, quantity, and accessibility of adequate tornado shelters.	Not Implemented	Medium	As funding and opportunities become available	WCEM, Municipal Council/Boards, Engineering, Planning, Community Development, and/or Zoning Departments	
Ensure that maintenance, monitoring, and usage policies/procedures of the County's public outdoor warning systems are up-to-date and reflect the needs of fire and police personnel.	Implemented	High	Ongoing	WCEM, WCSO, Municipal Fire and Policies Departments	
Work to locally adopt and implement the Wisconsin Outdoor Warning Siren Best Practices.		Low		WCEM, WCSO	
Work with municipalities and businesses to explore installation or upgrading of community safe rooms and hardening projects for public buildings, community facilities, major industrial and manufacturing sites, large businesses, manufactured home parks, campgrounds, and fairgrounds to ensure adequate shelter from tornadoes.	Partially Implemented	Medium	As needed	WCPT, WCEM, Municipal Council/Boards, Engineering, Planning, Community Development, and/or Zoning Departments	

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Table 6.1 (Continued)

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Tornadoes (continued)					
Increase public education and awareness of the potential severity of tornadoes and continue to produce and distribute accessible emergency preparedness information related to tornado events.	Implemented	Medium	Ongoing	UW-Extension, WEM, WCEM	3, 7, 33, 64
Distribute, and make readily available, information on where to go during severe weather events for campground, park, and beach visitors.	Not Implemented	Low	As funding and opportunities become available	WDNR, WCEM, WCPT	
Produce and distribute information related to what steps should be taken by the public when they hear tornado sirens.	Not Implemented	Low	As funding and opportunities become available	WDNR, WCEM, WCPT	
Extreme Temperatures					
Organize neighborhood outreach groups who look after vulnerable populations and promote the availability of shelters during extreme heat and cold.	Partially Implemented	High	Ongoing	WCEM, WOPHD	33
Continue to provide special arrangements for payment of heating and cooling bills for customers unable to pay due to financial restraints.	Implemented	Medium	As needed	WCHHD, WOPHD	
Designate sites in the County to be used as public cooling/heating shelters during extreme temperature events.	Implemented	High	Ongoing	American Red Cross, WOPHD, WCEM	
Reschedule outdoor activities (i.e., public events, sporting practices, outdoor work) during periods of extreme heat or cold.	Implemented	High	As needed	WOPHD, WCB, WCEM, Municipal Council/Boards	
Extend public swimming pools hours during extreme heat events.	Implemented	Low	As needed	WOPHD, WCB, WCPT, WCEM, Municipal Council/Boards	
Establish and promote a donation program of functional window air conditioner units and fans that are no longer in use and distribute these items to vulnerable populations.	Not Implemented	Medium	As needed	WOPHD, WCB, WCHHD, WCEM, Municipal Council/Boards	
Promote and expand winter weather clothing drives (coats, hats, mittens) where people can drop off gently used winter clothing for distribution to vulnerable populations.	Not Implemented	Medium	As needed	WOPHD, WCB, WCHHD, WCEM, Municipal Council/Boards	

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Table 6.1 (Continued)

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Extreme Temperatures					
Promote measures to reduce heat island effects in urban areas including increasing green space in urban areas; increasing tree plantings around buildings, parking lots, and along public rights-of-way; and encouraging the use of "cool roofing" products made of highly reflective and emissive materials.	Not Implemented	Low	As needed and as funding and opportunities become available	WCPT, Municipal Planning Commissions, and Parks and Recreational Departments	33
Maintain and update warming and cooling public shelter sites in Washington County.	Implemented	Medium	As needed	WOPHD	
Increase public education and awareness of the potential severity of temperature extreme events and distribute emergency preparedness information related to extreme temperature events.	Implemented	Medium	Ongoing	UW-Extension, WOPHD, WEM, WCEM	
Promote awareness that is accessible to all citizens of public warming and cooling shelters that are available during extreme temperature events through print media, door-to-door, and municipal, County, and public health department websites.	Partially Implemented	High	Ongoing	American Red Cross, WOPHD, WCHHD, WCEM	
Produce and distribute emergency preparedness information related to the safe operation of generators, space heaters, fireplaces, and wood stoves.	Implemented	High	Ongoing	WCEM, WDHS, Ready Wisconsin	
Winter Storms					
Review the energy efficiency and winter readiness of critical facilities and housing in the community.	Partially Implemented	High	Ongoing	WCPWC, WCEM, WOPHD	3, 7
Continue to work with American Red Cross, or other organizations, to establish a system for short-term sheltering of vulnerable populations.	Implemented	High	Ongoing	American Red Cross, WCEM, WOPHD	
Pursue additional funding opportunities to assist with budgeting for overtime hours and extra governmental personnel needed during extreme winter events.	Implemented	Medium	As needed	WCEM, WCB, Municipal Council/Boards	
Ensure that the necessary amount of snow removal, anti-icing, and deicing equipment is available and operational.	Partially Implemented	Medium	Ongoing	WCPWC, WCHD, Municipal Public Works Departments	

Table continued on next page.

Table 6.1 (Continued)

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Winter Storms (continued)					
Work with utility companies to assess and improve, as needed, electric service systems dependability.	Partially Implemented	High	As needed	We Energies, WCPWC, Municipal Public Works and/or Utility Departments	3, 7
Continue installing and promote the installation of additional snow fences and planting of windbreaks to protect farm crops and highways.	Partially Implemented	Low	As needed	WCHD, Property Owners	
Continue to maintain and promote winter hazard awareness, including home and travel safety measures, such as avoiding travel during winter storms; having a shovel, sand, warm clothing, food, and water in vehicle if travel cannot be avoided; and installing a back-up heating system in at least one room in the home.	Implemented	Medium	Ongoing	WEM, UW-Extension, WOPHD, WCEM	
Organize neighborhood outreach groups who look after vulnerable or special-needs populations, during and after winter storms.	Not Implemented	High	Ongoing	WOPHD, WCHHD, WCEM	
Promote the availability of low-income energy assistance programs.	Partially Implemented	Medium	As needed	We Energies, WCB, Municipal Public Works and/or Utility Departments	
Publicize the availability of emergency shelter sites for those in need of temporary shelter during winter storms.	Implemented	High	Ongoing	American Red Cross, WOPHD, WCHHD, WCEM	
Drought					
Encourage the development and maintenance of drought emergency plans for local utilities and local communities including development of criteria for triggering drought-related actions; development of agreements for secondary water sources; and specification of water use regulations during drought conditions.	Partially Implemented	High	Ongoing	Municipal Water Supply Utilities and Planning Departments	28, 44, 60, 61, 64
Encourage the development of local water conservation programs.	Partially Implemented	Medium	Ongoing	NRCS, UW-Extension, WCLRD, Municipal Water Supply Utilities and Planning Departments	
Protect areas of high and very high groundwater recharge potential from inappropriate development.	Partially Implemented	High	Incorporated into the Regional Land Use Plan and Ongoing	WCLRD, WCPT, SEWRPC, Municipal Planning Commissions	

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Table 6.1 (Continued)

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Drought (continued)					
Promote regional activities to protect groundwater recharge areas outside of the County boundaries.	Not Implemented	Low	As needed	WCLRD, WCPT, SEWRPC	28, 44, 60, 61, 64
Identify areas with potential groundwater level problems and inspect wells in those areas for adequate depth and construction.	Partially implemented	High	Ongoing	USGS, WDNR, WCLRD, Property Owners	
Promote the use of agricultural methods that reduce evaporation and/or promote infiltration.	Partially Implemented	Medium	Ongoing	USDA, NRCS, UW-Extension, WCLRD, SEWRPC	
Allow and encourage the use of drought-resistant landscaping practices using native plantings.	Partially Implemented	Low	Ongoing	USDA, NRCS, UW-Extension, WCLRD	
Promote the use of green infrastructure and other stormwater management practices that facilitate aquifer recharge.	Partially Implemented	Medium	Ongoing	USDA, NRCS, UW-Extension, WCLRD, SEWRPC, Municipal Planning Commissions	
Support agricultural programs that promote soil health, preserve soil moisture, and help to minimize loss of crops and topsoil during drought conditions.	Implemented	Medium	Ongoing	USDA, NRCS, UW-Extension, WCLRD	
Support ordinances to prioritize or control water use during drought conditions.	Implemented	High	In place and ongoing	WDNR, WCLRD, Municipal Water Supply Utilities and Planning Commissions	
Design and plan for water supply infrastructure systems that are not vulnerable to drought events.	Not Implemented	Low	Ongoing	Municipal Water Supply Utilities and Planning Commissions	
Consider implementing the recommendations made in SEWRPC's regional water supply plan for additional water supply facilities and programs to meet forecast water use demands.	Not Implemented	Medium	Ongoing	WCLRD, WCLC, Municipal Water Supply Utilities and Planning Commissions	
Consider development of interconnections between adjacent water utilities to ensure provision of water in the event of a loss of water supply due to severe drought.	Not Implemented	Medium	Ongoing	WCLRD, WCLC, Municipal Water Supply Utilities and Planning Commissions	
Continue operation and monitoring of stream gaging stations and groundwater monitoring wells by the WDNR, USGS, NWS, and USACE.	Partially Implemented	Low	Ongoing	USACE, USGS, WDNR, WCLRD, WCPT	

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Table 6.1 (Continued)

Mitigation Measures	Status	Priority	Implementation Timetable	Designated Department, Management Agency, or Personnel	Potential Funding Programs (see Appendix G)
Drought (continued)					
Increase public education and awareness of the potential severity of drought events.	Not Implemented	High	Ongoing	WEM, USDA, NRCS, UW-Extension, WCLRD, WCEM	28, 44, 60, 61, 64
Promote and distribute emergency preparedness information related to drought.	Not Implemented	High	Ongoing	USDA, NRCS, UW-Extension, WCLRD, WCEM, WEM	
Encourage farmers to report crop and/or livestock losses to appropriate officials including the Washington County Office of Emergency Management.	Not Implemented	High	Ongoing	USDA, NRCS, UW-Extension, WCLRD, WCEM	

Note: The following abbreviations are used for designated management agencies or departments:

ATC= American Transmission Company
FEMA= Federal Emergency Management Agency
NOAA= National Oceanic and Atmospheric Administration
NRCS= Natural Resources Conservation Service
NWS= National Weather Service
OWLT= Ozaukee-Washington Land Trust
PHMSA= Pipeline and Hazardous Materials Safety Administration
PSC= Public Service Commission
USACE= U.S. Army Corps of Engineers
USDA-FSA= U.S. Department of Agriculture – Farm Service Agency
USGS= U.S. Geological Survey
WCB = Washington County Board
WCEM= Washington County Emergency Management
WCHD= Washington County Highway Department
WCHHD= Washington County Human Services Department
WCLC = Washington County Land and Water Conservation Division
WCLRD = Washington County Land Resources Division
WCMP= Wisconsin Coastal Management Program
WCPD = Washington County Planning and Land Use Department
WCPSC = Washington County Public Safety Committee
WCPT = Washington County Parks and Trails
WCPWC = Washington County Public Works Committee
WCSO= Washington County Sheriff's Office
WDNR= Wisconsin Department of Natural Resources
WEM= Wisconsin Emergency Management
WisDOT= Wisconsin Department of Transportation
WOPHD= Washington-Ozaukee Public Health Department
CLCF = Cedar Lake Conservation Foundation
MMSD = Milwaukee Metropolitan Sewerage District

[a] *Land acquisition, demolition of structures, and removal of structures to be done on a willing buyer, willing seller basis.*

[b] *As required in Chapter 31, "Regulation of Dams and Bridges Affecting Navigable Waters," of the Wisconsin Statutes, high hazard dams are required to be inspected every two years; significant hazard dams are required to be inspected every three to four years; and low hazard dams are required to be inspected every 10 years. Owners and operators of dams should inspect their dams both on a regular basis and following high water events.*

Source: SEWRPC

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WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Appendix A

WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE LOCAL PLANNING TEAM MEMBERS, MEETING AGENDAS, MEETING SUMMARY NOTES, AND PUBLIC MEETING NOTICES

Figure A.1
Members of the Washington County Hazard Mitigation Local Planning Team

Brad Bautz	Director of Emergency Management, Town of Erin
Tom Becker	Ozaukee-Washington Public Health and Emergency Preparedness
Tom Bishop	Chief of Police, Village of Kewaskum Police Department
Rochelle Brien	Senior Planner, Southeastern Wisconsin Regional Planning Commission
Adam Christensen	Planner, Washington County Community Development Department
Jeffrey Clark	Volunteer Member, Washington County Local Emergency Planning Committee
Eric Damkot	GIS Manager, Washington County
Tim Dehring	Chief of Police, City of West Bend Police Department
Ed Doerr	Supervisor, Town of Trenton
Bob Eichner	Clerk, Town of Jackson
Ron Eickstedt	Highway Superintendent, Town of Jackson
Josh Glass	Assistant Highway Commissioner, Washington County
Walt Grotelueschen	Director of Emergency Management, Village of Newburg
John Hanan	Emergency Preparedness Coordinator, Washington Ozaukee Health Department
Robert Hartwig	Town Board Chairman, Town of Jackson
Jim Healy	Village Administrator & Planning and Zoning Administrator, Village of Richfield
Laura Herrick	Chief Environmental Engineer, Southeastern Wisconsin Regional Planning Commission
Ed Ihlenfeld	Department of Public Works, Town of West Bend
Hannah Keckeisen	Planner, Washington County Community Development Department
Pamela Konrath	District #14 Supervisor, Washington County
Chris Marks	Emergency Manager, Village of Richfield
Paul Metz	Town Chair, Town of Germantown
Miranda Page	Planner, Southeastern Wisconsin Regional Planning Commission
Jeremy Pfeifer	Building Inspector, Towns of Addison, Barton, Hartford, and Wayne
Darryl Pree	Planning Commission Secretary, Town of Farmington
Dennis Roethle	Director, Town of West Bend Department of Public Works
Matthew Rohlinger	Police Lieutenant, City of West Bend Police Department
Kurt Rusch	Assistant, Washington County Emergency Management
Rob Schmid	Emergency Management Manager, Washington County Emergency Management
Dean Schmidt	Chief of Police, Village of Slinger Police Department
Scott Schmidt	Chief of Public Works Officer, Washington County
Albert Schulteis	Town Board Chairman, Town of Polk
Paul Sebo	Conservation & Zoning Manager, Washington County Land and Water Conservation Department
Megan Shedivy	Planner, Southeastern Wisconsin Regional Planning Commission
Mike Snow	Chief of Police, Village of Germantown Police Department
Paul Stephans	Fire Chief, City of Hartford Fire Department
Daniel Stoffel	Town Treasurer, Town of Kewaskum
Aaron Swaney	Fire Chief, Village of Jackson Fire Department
Mike VanderSanden	GIS Coordinator, Washington County Land Use Division
Troy Zagel	Supervisor, Town of West Bend

Figure A.2
Agenda and Summary Notes for Local Planning Team Meeting: June 7, 2022

Washington County Emergency Management Office
Southeastern Wisconsin Regional Planning Commission

Notice of Meeting and Agenda

WASHINGTON COUNTY HAZARD MITIGATION PLAN LOCAL PLANNING TEAM

DATE: June 7, 2022

TIME: 2:00 to 3:30 p.m.

PLACE: Washington County Sheriff's Office
500 Rolfs Ave.
West Bend, Wisconsin 53095

AGENDA:

1. Welcome and introductions: Mr. Rob Schmid, Washington County Emergency Management Coordinator
2. Overview of hazard mitigation and planning process: Megan Shedivy, SEWRPC
    a. Different hazard mitigation measures
3. Background on the original Washington County Hazard Mitigation Plan: Megan Shedivy, SEWRPC
    a. Overview of previous plan (Pre-Disaster Mitigation grant program)
    b. Main components to be reviewed and revised
    c. Schedule for the plan update (Attachment 1)
    d. Local Planning Team role
4. Review hazard mitigation goals from original hazard plan (Attachment 2): Megan Shedivy
5. Hazard and vulnerability assessment exercise- provided online and in-person (https://arcg.is/1XmyjG1 and Attachment 3): Megan Shedivy
6. Adjourn

Megan A. Shedivy
Secretary

Enclosures

Attachment 1

WORK SCHEDULE AND DIVISION OF RESPONSIBILITIES FOR UPDATING THE WASHINGTON COUNTY HAZARD MITIGATION PLAN

Task	Estimated Completion Timeframe	Responsible Agency
Start of Project Update	March, 2022	Washington County
Update Planning Team Membership	April, 2022	Washington County
Kickoff Meeting	June, 2022	SEWRPC and Washington County
Public Participation and Outreach	December, 2024	SEWRPC and Washington County
Review and Update Community Profile	August, 2022	SEWRPC
Chapter 1 "Introduction"	End of May, 2022	SEWRPC
Chapter 2 "Study Area Inventory"	End of August, 2022	SEWRPC
Chapter 3 "Analysis of Hazard Conditions"	End of October, 2022	SEWRPC
Planning Team Meeting (Review Chapters 1 through 3)	November, 2022	SEWRPC and Washington County
Public Meeting to Review Partial Draft Plan	End of November, 2022	SEWRPC
Revise Draft Plan Based on LPT & Public Comments	December, 2022	SEWRPC
Chapter 4 "Hazard Mitigation Goals"	January, 2023	SEWRPC
Chapter 5 "Mitigation Actions/Strategies"	May, 2023	SEWRPC
Chapter 6 "Plan Adoption, Maintenance, Implementation"	June, 2023	SEWRPC
Planning Team Meeting (Review Chapters 4 through 6)	July, 2023	SEWRPC
Public Meeting to Review Draft Plan	August, 2023	SEWRPC and Washington County
Submit Draft Plan Update to WEM for Review	September, 2023	SEWRPC
Formal Adoption and Approval by WEM/FEMA	November, 2023	Washington County and SEWRPC
End of Grant Period	December, 2024	--

Source: SEWRPC

Attachment 2

GOALS FROM PREVIOUS WASHINGTON COUNTY HAZARD MITIGATION PLAN

The following goals were established from the original Washington County hazard mitigation planning program.[1] The goals have been established based, in part, upon goals previously established in watershed, park and open space, and land use planning programs.

1. A spatial distribution of the various land uses that minimizes hazards and dangers to health, welfare, and safety as well as further enhancing the economic base of the County and will result in a compatible arrangement of land uses properly related to the existing and proposed supporting transportation, utility, public safety systems, and public facility systems.

2. A spatial distribution of the various land uses that maintains connectivity among and that will result in the protection and wise use of the natural resources of the County, including its soils, inland lakes and streams, groundwater, wetlands, woodlands, wildlife, and natural areas and critical species habitats.

3. An integrated transportation system that, through its location, capacity, and design, will safely, economically, and effectively serve the existing and proposed land use pattern and promote the implementation of the land use plan, meeting the current and anticipated travel demand and minimizing the potential for accidents and the associated toll on life and property damage.

4. The provision of facilities necessary to maintain a high quality of fire and police protection and emergency medical services throughout the County.

5. The development of a stormwater and floodplain management system that reduces the exposure of people to drainage- and flooding-related inconvenience and to health and safety hazards and that reduces the exposure of real and personal property to damage through inundation resulting from flooding and inadequate stormwater drainage.

6. The identification and development of programs that complement County and local emergency operations plans to mitigate the potential exposure to health and safety and the exposure of real and personal property resulting from a broad range of hazards that are unpredictable and not geographically specific in nature.

[1] SEWRPC Community Assistance Planning Report No. 326, Washington County Hazard Mitigation Plan: 2015-2022, March 2018.

Attachment 3

HAZARD AND VULNERABILITY ASSESSMENT SURVEY
WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Link and QR Code to Survey:
https://arcg.is/1XmyjG1

Washington County Hazard Ranking Assessment

INSTRUCTIONS

To Local Planning Team Members:
Washington County is conducting a study to better understand the preparedness needs and risk perceptions of its Hazard Mitigation Local Planning Team Members as part of the County's Hazard Mitigation Plan update process.

To do so, a questionnaire has been distributed to the Local Planning Team Members. Your feedback is needed and greatly appreciated!

The questionnaire should only take about 5-7 minutes to complete. Responses will be utilized to inform the Natural Hazard Identification and Risk Assessment portion of the Hazard Mitigation Plan update.

Your input will serve as part of your jurisdiction's participation in the Hazard Mitigation Plan update, which is required under federal guidelines to maintain eligibility for FEMA hazard mitigation funding.

DEADLINE: Please complete the survey by July 7, 2022.

Thank you for your participation!
If you have any questions, please contact Megan Shedivy, Southeastern Wisconsin Regional Planning Commission, at 262.953.4286 or mshedivy@sewrpc.org.

Please indicate which jurisdiction you are representing:

PROBABILITY

Please indicate what you consider to be the likelihood that this hazard will occur.

- Low - Occurs very little or not at all (every 51-100 years)
- Moderate - Occurs somewhat or rarely (every 26-50 years)
- High - Occurs often or frequently (every 1-25 years)
- Not Applicable - does not apply to your area/jurisdiction

Issues to consider for Probability include:

- Known risk
- Historical data and experience
- Local government or agency experience

	Low	Moderate	High	Not Applicable
Riverine flooding	○	○	○	○
Stormwater flooding	○	○	○	○
Inland lake flooding	○	○	○	○
Tornado	○	○	○	○
Thunderstorm	○	○	○	○
High straight-line wind	○	○	○	○
Lightning	○	○	○	○
Hail	○	○	○	○
Heavy snowstorm	○	○	○	○
Blizzard	○	○	○	○
Ice storm	○	○	○	○

Extreme cold	○	○	○	○
Extreme heat	○	○	○	○
Drought	○	○	○	○
Fog	○	○	○	○
Dust storm	○	○	○	○
Earthquake	○	○	○	○
Wildfire	○	○	○	○
Dam failure	○	○	○	○
Landslide	○	○	○	○
Land subsidence	○	○	○	○

PROBABILITY: Other (please specify below)

If you would like to rank another natural hazard not already listed, please do so here.

HUMAN IMPACT

Please indicate what you consider to be the likely level of impacts to human life if the hazard occurs.

- Low - Minimal or minor impact on people
- Moderate - Somewhat significant impact on people
- High - Severe impact on people
- Not Applicable - does not apply to your area/jurisdiction

Issues to consider for Human Impact include:

- Potential to cause death
- Potential to cause injury requiring medical treatment

	Low	Moderate	High	Not Applicable
Riverine flooding	○	○	○	○
Stormwater flooding	○	○	○	○
Inland lake flooding	○	○	○	○
Tornado	○	○	○	○
Thunderstorm	○	○	○	○
High straight-line wind	○	○	○	○
Lightning	○	○	○	○
Hail	○	○	○	○
Heavy snowstorm	○	○	○	○
Blizzard	○	○	○	○
Ice storm	○	○	○	○
Extreme cold	○	○	○	○

Extreme heat	○	○	○	○
Drought	○	○	○	○
Fog	○	○	○	○
Dust storm	○	○	○	○
Earthquake	○	○	○	○
Wildfire	○	○	○	○
Dam failure	○	○	○	○
Landslide	○	○	○	○
Land subsidence	○	○	○	○

HUMAN IMPACT: Other (please specify below)

If you would like to rank another natural hazard not already listed, please do so here.

PROPERTY IMPACT

Please indicate what you consider to be the likely level of physical losses and damages to property if the hazard occurs.

- Low - Minimal or minor impact on properties
- Moderate - Somewhat significant impact on properties
- High - Severe impact on properties
- Not Applicable - does not apply to your area/jurisdiction

Issues to consider for Property Impact include:

- The potential to cause damage to property or crops
- The cost to replace damaged property
- The cost to set up a temporary replacement for damaged property
- The cost to repair damaged property
- The time to recover from the property damage

	Low	Moderate	High	Not Applicable
Riverine flooding	○	○	○	○
Stormwater flooding	○	○	○	○
Inland lake flooding	○	○	○	○
Tornado	○	○	○	○
Thunderstorm	○	○	○	○
High straight-line wind	○	○	○	○
Lightning	○	○	○	○
Hail	○	○	○	○
Heavy snowstorm	○	○	○	○
Blizzard	○	○	○	○
Ice storm	○	○	○	○
Extreme cold	○	○	○	○

PROPERTY IMPACT: Other (please specify below)

If you would like to rank another natural hazard not already listed, please do so here.

BUSINESS & GOVERNMENT AGENCY IMPACT

Please indicate what you consider to be the likely level of impact to the operations of businesses and government agencies if the hazard occurs.

- Low - Minimal or minor impact on operations
- Moderate - Somewhat significant impact on operations
- High - Severe impact on operations
- Not Applicable - does not apply to your area/jurisdiction

Issues to consider for Business & Gov. Agency Impact include:

- Business or agency interruption
- Employees unable to report to work
- Customers or clients unable to reach facility
- Company or agency in violation of contractual agreements
- Imposition of fines and penalties or legal costs
- Interruption of access to critical supplies
- Interruption of product or service distribution
- Financial impact or burden
- Interruption of critical care and emergency services

	Low	Moderate	High	Not Applicable
Riverine flooding	○	○	○	○
Stormwater flooding	○	○	○	○
Inland lake flooding	○	○	○	○
Tornado	○	○	○	○
Thunderstorm	○	○	○	○
High straight-line wind	○	○	○	○
Lightning	○	○	○	○
Hail	○	○	○	○
Heavy snowstorm	○	○	○	○
Blizzard	○	○	○	○
Ice storm	○	○	○	○
Extreme cold	○	○	○	○

Extreme heat	○	○	○	○
Drought	○	○	○	○
Fog	○	○	○	○
Dust storm	○	○	○	○
Earthquake	○	○	○	○
Wildfire	○	○	○	○
Dam failure	○	○	○	○
Landslide	○	○	○	○
Land subsidence	○	○	○	○

BUSINESS & GOV. AGENCY: Other (please specify below)

If you would like to rank another natural hazard not already listed, please do so here.

PREPAREDNESS

Please indicate what you consider to be the current level of preparedness for dealing with the hazard and its impacts if the hazard occurs.

- Low - Low level of preparedness, or not prepared
- Moderate - Medium level of preparedness
- High - High level of preparedness
- Not Applicable - Does not apply to your area/jurisdiction

Issues to consider for Preparedness include:

- The status of current plans that address the hazard
- The frequency of drills that address the hazard
- The status of training related to the hazard and its impacts
- Insurance
- The availability of back-up systems
- The availability of community resources

	Low	Moderate	High	Not Applicable
Riverine flooding	○	○	○	○
Stormwater flooding	○	○	○	○
Inland lake flooding	○	○	○	○
Tornado	○	○	○	○
Thunderstorm	○	○	○	○
High straight-line wind	○	○	○	○
Lightning	○	○	○	○
Hail	○	○	○	○
Heavy snowstorm	○	○	○	○
Blizzard	○	○	○	○
Ice storm	○	○	○	○
Extreme cold	○	○	○	○

Extreme heat	○	○	○	○
Drought	○	○	○	○
Fog	○	○	○	○
Dust storm	○	○	○	○
Earthquake	○	○	○	○
Wildfire	○	○	○	○
Dam failure	○	○	○	○
Landslide	○	○	○	○
Land subsidence	○	○	○	○

PREPAREDNESS: Other (please specify below)

If you would like to rank another natural hazard not already listed, please do so here.

What specific areas in your jurisdiction are heavily impacted by natural hazard events?

Please list these known areas and be specific.

Please provide a list of the hazard mitigation activities/projects your jurisdiction has initiated and/or completed since 2018. Examples include: flooded structure buyouts, stormwater management efforts, tornado shelters, etc.

Are any of the hazard mitigation projects listed in the above question considered nature-based, such as green infrastructure, bioengineering, etc.?

Please provide a list of weather hazard related outreach activities your jurisdiction/local communities have initiated and/or completed since 2018.

Additional Comments

If you have any questions, comments, concerns, or would like to rank another natural hazard not already listed, please do so here.

SUMMARY NOTES OF THE JUNE 7, 2022 MEETING OF THE WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE LOCAL PLANNING TEAM

INTRODUCTION

The June 7, 2022, meeting of the Washington County Hazard Mitigation Plan Update for the Local Planning Team (LPT) was convened at the Washington County Sheriff's Department at 2:10 p.m. The meeting was called to order by Megan Shedivy, Planner for the Southeastern Wisconsin Regional Planning Commission (SEWRPC). Attendance was taken by a sign-in sheet.

In attendance at the meeting were the following individuals:

Local Planning Team Members	
Megan Shedivy, Secretary	Planner, SEWRPC
Tom Bishop	Chief of Police, Village of Kewaskum
Rochelle Brien	Senior Planner, SEWRPC
Jeffrey Clark	Attorney, Washington County (excused absence)
Tim Derhing	Chief of Police, City of West Bend
Laura Herrick	Chief Environmental Engineer, SEWRPC
Ed Ihlenfeld	Department of Public Works, Town of West Bend
Hannah Keckeisen	Community Development Planner, Washington County
Jeremy Pfeifer	Zoning and Building Inspector, Towns of Addison, Barton, Hartford, and Wayne
Darryl Pree	Emergency Director, Town of Farmington
Dennis Roethle	Director, Department of Public Works, Town of West Bend
Kurt Rusch	Emergency Management Assistant, Washington County
Rob Schmid	Manager, Department of Emergency Management, Washington County (excused absence)
Albert Schulteis	Chair, Town of Polk
Paul Sebo	Conservation and Zoning Manager, Washington County
Mike Snow	Chief of Police, Village of Germantown
Mike VanderSanden	GIS Coordinator, Washington County Land Use Division
Troy Zagel	Supervisor, Town of West Bend

Ms. Megan Shedivy welcomed the attendees to the meeting, thanked them for their participation, then introduced fellow SEWPRC attendees, Ms. Herrick, and Ms. Brien.

OVERVIEW OF HAZARD MITIGATION AND HAZARD MITIGATION PLANNING PROCESS

Ms. Shedivy presented an overview of hazard mitigation, why it is important, and examples of hazard mitigation measures. There were no questions or comments regarding this discussion. Ms. Shedivy then went on to explain local hazard mitigation planning and the requirements needed in local plans in order to be approved in order to receive funding from the Federal Emergency Management Agency (FEMA) for mitigation projects. Again, no questions or comments were given during this discussion.

BACKGROUND ON DEVELOPMENT OF THE HAZARD MITIGATION PLAN UPDATE

Ms. Shedivy presented a brief background on the county's initial hazard mitigation plan (2018), its main components, and the planning process that took place before it was approved. Ms. Shedivy then introduced material related to the hazard mitigation plan update. She mentioned FEMA's new Building Resilient Infrastructure and Communities ("BRIC") funding program that this plan is being developed under, the natural weather hazards that will be addressed, the plan components and chapters, and the role of the LPT during the plan updating process. No comments or questions were presented about the initial hazard mitigation plan or the plan update components or process.

Ms. Herrick reiterated that this plan update will be for natural weather hazards only. Again, no questions or comments were given from attendees during the meeting.

[Secretary's Note: A copy of the presentation can be found on the SEWRPC website at: www.sewrpc.org/SEWRPC/communityassistance/Hazard-Mitigation-Planning under "Washington County Hazard Mitigation Plan Update"]

HAZARD AND VULNERABILITY ASSESSMENT EXERCISE

Ms. Shedivy stated that as part of the hazard and vulnerability analysis for the plan update, it will be necessary to determine which natural weather hazards to continue to include in the plan. She noted that a hardcopy of the hazard and vulnerability assessment exercise and instructions were included as "Attachment 3" with the agenda. Ms. Shedivy also noted that the survey is available online or by using a QR code for mobile phone devices. The online link and QR code were also provided in the handout. She pointed out that the deadline for submitting the survey is July 7, 2022, and to please provide recent hazard mitigation-related projects, by jurisdiction, which have been completed or in the process of being completed since the previous plan was finalized.

[Secretary's Note: A copy of the hazard and vulnerability assessment tool are attached herein as Exhibit A.]

Ms. Shedivy explained that the results of this exercise would help reassess the natural hazards and their impacts that occur within the county and communities, which are to be addressed in the hazard mitigation plan update.

ADJOURNMENT

There being no further business, the meeting was adjourned at 2:45 p.m.

AFTER MEETING DISCUSSIONS

After the meeting, Ms. Keckeisen notified Ms. Herrick that the link provided in the handout was not working when typed into the internet browser. It was then determined that the link worked when copied and pasted into the internet browser.

After the meeting, Mr. Rusch indicated to Ms. Herrick that there would be a potential mitigation project in the Village of Newburg at Fireman's Park due to ice damming on the Milwaukee River. He stated that every couple of years repairs have been required in the park. Ms. Herrick responded we would look into this area of concern and appreciated his input for a potential mitigation project.

[Secretary's Note: After looking at the river configuration at the park, it appears that the location of the ice damming on the Milwaukee River is downstream of the former Newburg dam and that the bend in the river and floodplain vegetation may be the issue.]

Figure A.3
Agenda and Summary Notes for Local Planning Team Meeting: February 1, 2023

Washington County Emergency Management Office
Southeastern Wisconsin Regional Planning Commission

Notice of Meeting and Agenda

WASHINGTION COUNTY HAZARD MITIGATION PLAN LOCAL PLANNING TEAM

DATE: Wednesday February 1, 2023

TIME: 2:00 to 3:30 p.m.

PLACE: Washington County Sheriff's Office
500 Rolfs Ave.
West Bend, Wisconsin 53095

AGENDA:

1. Roll Call
2. Consideration of Summary Notes of June 7, 2022, Local Planning Team meeting (a copy of the draft summary notes is available for download from the SEWRPC website at: **http://www.sewrpc.org/HMP**
3. Consideration of Chapter 1, "Introduction and Background," of SEWRPC Community Assistance Planning Report No. 326 (2nd Edition), *Washington County Hazard Mitigation Plan* (CAPR 326) (a copy of all the draft chapters will be available for download from the SEWRPC website one week prior to the meeting at: **http://www.sewrpc.org/HMP**
    a. Highlight the importance of community participation during the planning process as part of FEMA's new Local Mitigation Planning Policy Guide
    b. Discuss recent projects within the County related to hazard mitigation
    c. Note the change in community adoption guidelines
4. Consideration of Chapter 2, "Basic Study Area Inventory and Analysis," of SEWRPC CAPR 326 (2nd Edition)
5. Consideration of Chapter 3, "Analysis of Hazard Conditions," of SEWRPC CAPR 326 (2nd Edition)
    a. Review of results from the online hazard and vulnerability assessment exercise
6. Discussion of upcoming public meeting
7. Adjourn

Megan A. Shedivy
Secretary

SUMMARY NOTES OF THE FEBRUARY 1, 2023 MEETING OF THE WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE LOCAL PLANNING TEAM

INTRODUCTION

The February 1, 2023, Local Planning Team (LPT) meeting for the Washington County Hazard Mitigation Plan Update was convened at the Washington County Sheriff's Department at 2:05 p.m. The Washington County Department of Emergency Management Manager, Mr. Rob Schmid, gave a brief introduction and then turned the meeting over to Ms. Megan Shedivy, Planner for the Southeastern Wisconsin Regional Planning Commission (SEWRPC). Attendance was taken by a sign-in sheet.

In attendance at the meeting were the following individuals:

Local Planning Team Members	
Megan Shedivy, Secretary	Planner, SEWRPC
Jeffrey Clark	Attorney, Washington County
Tim Derhing	Chief of Police, City of West Bend
Josh Glass	Assistant Highway Commissioner, Washington County
Laura Herrick	Chief Environmental Engineer, SEWRPC
Chris Marks	Emergency Manager, Village of Richfield
Kurt Rusch	Emergency Management Assistant, Washington County
Rob Schmid	Manager, Department of Emergency Management, Washington County
Albert Schulteis	Chair, Town of Polk
Paul Stephans	Fire Chief, Hartford Fire Department
Troy Zagel	Supervisor, Town of West Bend

Ms. Shedivy welcomed the attendees to the meeting and thanked them for their participation. She briefly reviewed the meeting agenda and the summary notes from the June 7, 2022, LPT kick off meeting. There were no comments on the summary notes from the LPT.

CHAPTER 1 "INTRODUCTION AND BACKGROUND"

Ms. Shedivy began her presentation with an overview of draft Chapter 1. She gave a brief description of the study area (Washington County) as well as the relationship of hazard mitigation planning to other County efforts. Ms. Shedivy indicated that Table 1.2 lists the plan participation efforts in which all villages and cities need to participate in the planning process (i.e., attend meetings, comment on draft chapters, or provide data) in order for the plan to be approved. There were no questions or comments related to this material.

Ms. Shedivy continued with a short discussion on plan adoption. Mr. Clark asked what the incentive for communities was to adopt the plan. Mr. Schmid answered that communities would then be eligible for FEMA funding on projects related to hazard mitigation. Ms. Herrick also mentioned that adoption does not require a financial commitment from communities.

No additional comments or questions were given from the LPT for draft Chapter 1.

CHAPTER 2, "BASIC STUDY AREA INVENTORY AND ANALYSIS"

Ms. Shedivy continued with a brief overview of draft Chapter 2. She noted that a table for the critical community facilities in Washington County has been created and this appendix will be posted on the SEWRPC website after the meeting.

Ms. Shedivy briefly described the inventory data that was collected and analyzed, including the County's current and projected demographic trends; civil divisions and projected development; and current and planned land use characteristics. Ms. Shedivy emphasized that the background or inventory information for the County is an important element of the planning process.

While discussing critical community facilities, Mr. Schmid pointed to Map 2.7 noting that downtown West Bend was recently designated as a historical district.

[Secretary's Note: After the meeting, Ms. Shedivy looked on the Wisconsin Historical Society website to verify. According to the State Historical Society's listings, that specific location, or district has not yet been listed officially as a historical district so this will not be added to this plan update.]

Ms. Shedivy then presented Maps 1.1 and 2.2 to illustrate projected urban development areas within the County. She also gave an overview of the demographic characteristics including trends and projections related to population, household, and employment data. Through graphs and tables, Ms. Shedivy was able to demonstrate that the County continues to show an increase in its demographic trends and land use development. It was noted that planned year 2050 data was provided by SEWRPC's *VISION 2050: A Regional Land Use and Transportation Plan*.

Concluding Chapter 2, Ms. Shedivy gave a general overview on climate change and its relative importance with hazard mitigation planning. She also emphasized that FEMA now considers this information essential and necessary for hazard mitigation. The source of climate change data and how it is presented throughout the Plan was explained to the LPT attendees. Ms. Shedivy stated that Figures 2.1 through 2.4 illustrate temperature and precipitation trends and projections.

After the climate discussion, Mr. Clark asked if the climate change data in the Plan was specific to Wisconsin. Ms. Herrick responded that the data used came from climate global circulation models downscaled to the State level as used in the Wisconsin Initiative on Climate Change Impacts (WICCI) reports. Mr. Rusch then asked if the projected increase in the average temperature of Wisconsin (about 5 degrees Fahrenheit) stated in the Plan was correct. Ms. Shedivy replied that the data is based off Figure 2.3, which comes from the WICCI Report.

There were no further questions or comments on draft Chapter 2.

CHAPTER 3, "ANALYSIS OF HAZARD CONDITIONS"

Ms. Shedivy began with a general overview of draft Chapter 3 and its main components. She gave a brief discussion on the hazard identification and ranking process; the risk analysis portion; and how each hazard was profiled. She then presented and explained the hazards considered for this Plan update (Table 3.2). Ms. Herrick mentioned that the rankings in Table 3.2 are qualitative and subjective and asked that the LPT review the table to provide additional input.

With no questions or comments related to the layout of draft Chapter 3, Ms. Shedivy continued to the profiled hazards analyzed in the Plan, starting with flooding and stormwater drainage. A brief background on the existing hydrological features within the County was presented with Map 3.1 showing the major streams, lakes, and watersheds as well as the 1-percent-annual-probability (100-year event) floodplains.

Ms. Shedivy then reviewed the different types of flooding concerns (i.e., dam failure, ice jams, agricultural, and stormwater drainage); recently reported flood events; and different County assets vulnerable to flooding impacts, including agriculture, transportation, and structural damages.

For structural impacts caused by flooding, Ms. Shedivy described the parcel-based loss analysis used to estimate potential damages caused by a 100-year flood event. Map 3.3 was presented to illustrate and explain the results of the analysis. Ms. Shedivy clarified that the different colored numbers represent different building types (residential, commercial, agricultural, government, industrial, and other) and the amounts indicate the number of structures estimated to be located within the 100-year floodplain per USPLSS Section Number.

Ms. Shedivy noted that Table 3.9 shows the results of the parcel-based analysis. Municipalities with a large number of structures estimated to be within the 100-year floodplain were noted along with the estimated direct and indirect structural flood damages.

An overview of the County's critical and emergency community facilities and their relative location to the 100-year floodplain was also presented with Maps 3.4 and 3.5. Ms. Shedivy cited the two emergency facilities and six critical community facilities estimated to be located in the 100-year floodplain.

Mr. Schmid asked if the total amount of structures (1,200) from the parcel-based analysis have experienced flooding impacts in the past. Ms. Herrick answered that this number is based on FEMA floodplain mapping and not actual flood experience.

Ms. Shedivy continued the draft Chapter 3 discussion with an overview of the remaining profiled hazards, including severe weather (i.e., thunderstorm-related events), tornadoes, winter storms, extreme temperatures, and drought hazard events in Washington County.

During the winter storm hazard discussion, Mr. Glass asked if snow squall was included as a winter storm category. Ms. Shedivy responded that because snow squalls are not listed as an event type on the National Weather Service storm event database it was not included in the Plan. Mr. Schmid commented that with the increase in reported or experienced winter squall events these most likely will be included in future plan updates.

Mr. Glass also asked if fog was evaluated as a hazard event. Ms. Shedivy replied that because fog, along with several other natural hazards have been found to have either a minimal chance of occurring or offer only limited mitigation options, they were not fully profiled as a hazardous event, however, are still acknowledged and briefly described at the beginning of Chapter 3. Ms. Herrick noted the main impact related to fog is primarily associated with transportation accidents and that warnings related to fog hazards will be mentioned in Chapter 5 under severe weather hazard mitigation alternatives.

Mr. Glass then inquired if the County airports were included in the Plan as critical community facilities, to which Ms. Shedivy replied that they are not in the draft. In response, he and Mr. Clark suggested that the two public airports be added as critical facilities, particularly because the National Guard often utilizes the airports to support disaster response throughout the State.

> [Secretary's Note: After the meeting, Ms. Shedivy included the two public airports to the Critical Community Facilities table located in the Appendix of the Plan.]

Additionally, Mr. Glass asked if public works facilities, such as highway departments, were considered critical community facilities. He added that because the facility he works at stores and utilizes supplies needed during hazardous events (i.e., sandbags and road salt) such structures should be considered critical. Mr. Sebo agreed with Mr. Glass's suggestion.

> [Secretary's Note: After the meeting, Ms. Shedivy examined the location of public works facilities throughout Washington County. Based upon her review, she found one facility

estimated to be within the 100-year floodplain, which is the Village of Jackson's public works building, in which it is already included in the parcel-based loss analysis structure count.]

Mr. Schmid mentioned that the structural flood damages during the 2008 flood was predominantly due to high lake levels. Ms. Shedivy will add language to the Plan specifically related to high lake levels and structural impacts in Washington County.

[Secretary's Note: After the meeting, Ms. Shedivy re-examined the parcel-based loss analysis for structures estimated to be impacted by high water events along lake shore properties. She found a number of structures listed and will add text within the flooding hazard section of the Plan describing the potential high lake level impacts in Washington County.]

With no more questions or comments, Ms. Shedivy concluded the review of draft Chapters 1 through 3.

LOCAL PLANNING TEAM INPUT ON POTENTIAL HAZARD MITIGATION PROJECTS

Before the meeting was adjourned, Ms. Shedivy asked the LPT for additional input on hazard mitigation projects recently completed or planned to be completed during the lifespan of this Plan. She presented a list of project examples and reminded the LPT that projects added to the Plan can facilitate federal funding opportunities to help communities complete the project.

Mr. Sebo suggested looking into the Sugar River Soil Health study at the Wisconsin Department of Natural Resources (WDNR). He explained why the study could be useful for the Plan and how it can be used as a template for potential flood mitigation projects in Washington County. Both Ms. Herrick and Ms. Shedivy agreed, and this study will be incorporated into Chapter 5.

Mr. Sebo also suggested including Milwaukee Metropolitan Sewerage District (MMSD) Greenseams properties as potential project(s) related to flood mitigation.

[Secretary's Note: An updated map and information on MMSD's Greenseams projects will be included in Chapter 5 of the Plan. Recently purchased properties will also be added to Table 1.4.]

There being no further business, Ms. Shedivy thanked the participating LPT members for their attendance and any additional contribution to the draft plan. The meeting was adjourned at 3:17 p.m.

POST MEETING PROJECT DISCUSSIONS

Mr. Zagel suggested including a Cedar Creek cleanout project downstream of Little Cedar Lake. He mentioned that the Town of West Bend and Lake PRD are investigating a potential study with SEWRPC. Mr. Zagel noted that the Creek is full of sediment from adjacent farms which is impeding stream flow and backing up water to Little Cedar Lake during high flow times.

Ms. Herrick also suggested adding streamflow gage(s) to the Milwaukee River as a potential flood hazard mitigation alternative. Mr. Schmid agreed this would be helpful for future flood events and floodplain map updates. This potential project will be included in Chapter 5 of the Plan.

Figure A.4
Agenda and Summary Notes for Local Planning Team Meeting: May 1, 2024

Washington County Emergency Management Office
Southeastern Wisconsin Regional Planning Commission

Notice of Meeting and Agenda

WASHINGTION COUNTY HAZARD MITIGATION PLAN LOCAL PLANNING TEAM

DATE: Wednesday, May 1, 2024

TIME: 3:30 to 4:30 p.m.

PLACE: Washington County Public Agency Center
333 E Washington St., Room 1113A
West Bend, Wisconsin 53095

AGENDA:

1. Roll Call
2. Consideration of the Summary Notes of the February 1, 2023, Local Planning Team meeting.
3. Consideration of draft Chapter 4, *Hazard Mitigation Goals*
4. Consideration of draft Chapter 5, *Hazard Mitigation Strategies*
5. Consideration of draft Chapter 6, *Plan Adoption, Implementation, Maintenance, and Revision*
6. Discuss the Community Capability Assessment
7. Discussion of public meeting immediately after the LPT meeting
8. Adjourn

Megan A. Shedivy
Secretary

NOTE: A copy of the summary notes and draft chapters will be available for download from the SEWRPC website two weeks prior to the meeting at: **http://www.sewrpc.org/HMP.**

SUMMARY NOTES OF THE MAY 1, 2024 MEETING OF THE WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE LOCAL PLANNING TEAM

INTRODUCTION

The May 1, 2024, the Local Planning Team (LPT) meeting for the Washington County Hazard Mitigation Plan Update was convened at the Washington County Public Agency Center at 3:30 p.m. The Washington County Department of Emergency Management Manager, Mr. Rob Schmid, gave a brief introduction and then turned the meeting over to Ms. Megan Shedivy and Ms. Miranda Page, Planners for the Southeastern Wisconsin Regional Planning Commission (SEWRPC). Attendance was taken by a sign-in sheet.

In attendance at the meeting were the following individuals:

Local Planning Team Members	
Megan Shedivy, Secretary	Planner, SEWRPC
Tom Becker	Ozaukee-Washington Public Health and Emergency Preparedness
Adam Christensen	Community Development Planner, Washington County
Jeffrey Clark	Attorney, Washington County
Eric Damkot	Director of GIS, Washington County
Laura Herrick	Chief Environmental Engineer, SEWRPC
Miranda Page	Planner, SEWRPC
Matthew Rohlinger	Police Lieutenant, City of West Bend
Kurt Rusch	Emergency Management Assistant, Washington County
Rob Schmid	Manager, Department of Emergency Management, Washington County
Scott Schmidt, PE, PLS	Chief of Public Works Officer, Washington County
Paul Stephans	Fire Chief, Hartford Fire Department

Ms. Shedivy welcomed the attendees to the meeting and thanked them for their participation. She briefly went over the summary notes from the February 1, 2023, LPT meeting. She summarized the major comments and edits taken from those notes. This included an update regarding downtown West Bend as a Historical District, to which Ms. Shedivy noted was still not listed as such on the Wisconsin Historical Society's website, thus no changes were made to the Plan. She continued that the County airports and major public works facilities have now been added as critical facilities in Chapter 2 per comments from the LPT. She also noted that the LPT suggested Cedar Creek cleanout project is not in the Plan as no information was found related to the work being done.

With no comments or questions on the February 1, 2023, summary notes, Ms. Shedivy moved onto the review of draft Chapters 4-6 for the Washington County hazard mitigation plan update.

CHAPTER 4 "HAZARD MITIGATION GOALS"

Ms. Shedivy began her presentation with an overview of draft Chapter 4. She gave a brief explanation on how the chapter is formulated and how it fits into the planning process. Ms. Shedivy reviewed the related planning efforts and Figure 4.1, "Goals and Objectives for the Milwaukee County Hazard Mitigation Plan Update." Figure 4.1 lists six goals and the objectives for each goal. Mr. Schmid had a question related to the second goal, on whether the County or any of its communities participate in FEMA's Community Rating System (CRS) program. Ms. Shedivy responded that neither the County nor its communities currently participate in the CRS program.

No additional comments or questions were given from the LPT for draft Chapter 4.

CHAPTER 5, "HAZARD MITIGATION STRATEGIES"

Ms. Shedivy continued with an overview of draft Chapter 5. She noted that because this particular chapter is comprehensive in nature, examples of hazard mitigation strategies from only two of the profiled hazards will be presented. A background and outline of the chapter was presented to the meeting attendees, including how the mitigation strategies are categorized (i.e., structural, nonstructural, and educational outreach). Ms. Shedivy then gave an overview of the hazard mitigation strategies and cost-benefit analysis tables. Ms. Shedivy also noted why the chapter contains a "multi-hazard" strategies subsection. With no LPT questions, Ms. Shedivy continued with mitigation strategy examples for flooding and severe thunderstorm and thunderstorm related hazards.

Mr. Clark inquired if the Washington County communities are coordinating with the Wisconsin Department of Natural Resources (WDNR) on flooding issues. Ms. Herrick responded that communities do coordinate riverine flooding issues/efforts with the WDNR and FEMA where floodplain mapping exists, but stormwater flooding is regulated at the local level. Mr. Schmid agreed that each community has its own protocol on how to regulate stormwater flooding.

Mr. Christenson questioned if the mitigation strategies listed in Tables 5.5 through and 5.10 came from previous hazard plans, land-use plans, and/or community comprehensive plans. Ms. Shedivy indicated that yes, most strategies came from related planning efforts, however some were formulated using other sources such as updated county, state, or federal resources.

Mr. Stephans asked if the Storm Ready program is still being promoted by the National Weather Service (NWS). Mr. Schmid said that this program still exists, but the NWS has been focusing on promoting other outreach efforts, including Weather Ambassadors. Mr. Stephans also asked who should be notified when public siren, warning, alerting systems are upgraded in the County. Mr. Schmid responded that he is in fact the one responsible for keeping this inventory. He then reiterated that any investments in emergency infrastructure are considered a hazard mitigation project and should be included in this plan.

With no further questions or comments on draft Chapter 5, Ms. Shedivy handed the presentation over to Ms. Page for the remainder of the draft Plan review and next steps.

CHAPTER 6, "PLAN ADOPTION, IMPLEMENATION, MAINTENANCE, AND REVISION"

Ms. Page began with a general overview of draft Chapter 6 and its main components. She gave a brief summary on the plan adoption and monitoring process and plan implementation, including an overview of Table 6.1, "Summary of Mitigation Measures and Funding Sources." Ms. Page presented the table layout and the information that it includes. She also noted that Table 6.1 coordinates with Appendix G, which is a list of funding sources related to mitigation projects. There were no comments or questions for draft Chapter 6.

Ms. Page stated that after FEMA approves the draft plan, the County will need to adopt the Plan before the grant ends in December 2024. She noted that County communities (cities and villages) have a year after FEMA approval to also adopt the plan to remain eligible for Federal hazard mitigation funding opportunities.

DRAFT PLAN APPENDICES OVERVIEW

Ms. Page continued with an overview of the Plan Appendices. She noted which appendices will not be complete until the Plan is finalized. Ms. Page highlighted Appendix G and that it contains an extensive table of potential funding sources and reiterated that it corresponds with Table 6.1. She also noted that Appendix H, "Communities Capabilities Assessment," is a new requirement by FEMA and requested that LPT members complete a hard copy assessment survey before leaving the LPT meeting. Mr. Clark asked if for the Capacity Assessment survey it would make sense to get a list of the communities that have yet to respond and to reach out to those specific communities directly. Mr. Schmid indicated that he has sent out multiple requests via email to the communities but has received a minimal response. Mr. Christensen mentioned that he will share planning, engineering, and public works staff

contact information to help get the survey out to the communities that have yet to participate. Ms. Page noted she will also reopen the online survey until mid-May to allow for more participation.

[Secretary's Note: After the meeting, Mr. Christensen emailed Ms. Page and Ms. Shedivy contact information for community staff officials best suited to participate in the Community Assessment survey. Ms. Page sent out survey reminders to the list of staff members provided.]

With no further questions or comments, Ms. Page concluded the draft plan review presentation with a reminder of where the text is available (www.sewrp.org/hmp) and to send any comments or questions related to the Plan chapters via the SEWRPC online comment screen or to Ms. Shedivy at mshedivy@sewrpc.org.

CHAPTER 1- "INTRODUCTION AND BACKGROUND"

To best complete the plan update, Ms. Shedivy reminded the LPT members to review Table 1.4, "Hazard Mitigation Projects/Activities by Community: 2018-2024" and to fill out any information that could be added, especially for those communities that do not have any projects or activities listed. Mr. Schmid reminded the Planning Team the projects listed in the Table do not need to be specifically from the previous hazard mitigation plan or from a FEMA funded project. He added that any project that relates to hazard mitigation indicates to FEMA that a community is proactive in creating a more resilient community.

Mr. Christensen asked if the Milwaukee Metropolitan Sewerage District's (MMSD) Working Soils program should be added to Map 5.3, "MMSD Greenseams and Working Soils Sites in Washington County: 2022," in which Ms. Shedivy replied that those sites were indeed added and that the Map was updated prior to the meeting. Ms. Shedivy will also add this program to Table 1.4 and Chapter 5 text.

[Secretary's Note: After the meeting, Ms. Shedivy incorporated the MMSD's Working Soils program content into Table 1.4 and Chapter 5 text.]

Mr. Schmid also noted that the Town of Polk recently purchased a 138-acre parcel of land from Cedar Lakes Conservation Fund and that the Town is updating their ordinances. Ms. Herrick responded that more recent efforts like this will need to be added to the next plan update.

Mr. Clark asked if all tornado shelters have been identified in the plan. Mr. Schmid replied that he helps public buildings designate tornado shelter spaces, (i.e., schools). He added that the Plan does not identify all tornado shelters as that would be difficult to do.

Mr. Christensen inquired if cover-crops and no-till agriculture practices could be considered as a hazard mitigation activity. Ms. Shedivy acknowledged that such practices could be added to the plan, and Mr. Christensen responded that he would provide the information to Ms. Shedivy on this after the meeting.

[Secretary's Note: On May 7, 2024, Mr. Christensen emailed Ms. Shedivy additional hazard mitigation projects/activities to potentially add to Table 1.4. Ms. Shedivy added the suggested projects to the Table.]

ADJOURNMENT

There being no further business, the LPT meeting was adjourned at 4:25 p.m.

POST MEETING DISCUSSION

After the meeting was adjourned, Mr. Christensen presented Ms. Page and Ms. Shedivy his handwritten edits and comments on a printed version of draft Chapters 4-6. Ms. Page indicated that she would go over his comments and incorporate them into the Plan content.

[Secretary's Note: Ms. Page updated draft Chapters 4-6 to include Mr. Christensen's additional comments and edits.]

Figure A.5
Notice Materials for Public Meeting #1: March 2, 2023

County to provide update on hazard mitigation plan

WEST BEND — Washington County officials announced on Tuesday that they will be holding a public information meeting to discuss the purpose and progress of updating the county's plan to mitigate impacts from natural hazards.

The meeting will be from 6 to 8 p.m. March 2 at the Washington County Public Agency Center.

"This session will provide an opportunity to learn more about, and to comment on, the findings and recommendations documented in the preliminary draft of the first three chapters of Southeastern Wisconsin Regional Planning Commission (SEWRPC) Community Assistance Planning Report No. 326 of the Washington County Hazard Mitigation Plan Update," said the notice.

"The plan includes recommendations related to the mitigation of impacts from hazards such as flooding and related stormwater drainage problems; weather-related hazards such as tornadoes, winter storms, extreme temperatures, drought, and severe thunderstorms in Washington County," the notice said.

The first three report chapters can be viewed online at www.sewrpc.org/HMP.

The initial hazard mitigation plan was adopted in 2018 by the county. According to the notice, the new plan is being updated to maintain eligibility for hazard mitigation funding through the Federal Emergency Management Agency.

According to the notice, the session will start out in an open-house format for the first hour so that members of the public can engage with representatives from the county and SEWRPC to learn more about mitigation plan and submit comments on it.

Following the open house, the SEWRPC will give a presentation starting at 7 p.m.

The public are encouraged to provide comments during the meeting, but if you cannot attend, written comments may be submitted by email to mshedivy@sewrpc.org or by comment screen on the commission's website, www.sewrpc.org/SEWRPC/HMP.

The meeting will be held in Room #1113 A&B of the Washington County Public Agency Center, 333 E. Washington St. in West Bend.

Source: "County to provide update on hazard mitigation plan." Daily News, *February 22, 2023.*

Public information meeting scheduled on hazard mitigation plan update for Washington County

Citizens are invited to a public information meeting related to the mitigation of impacts from natural hazards in Washington County, Wisconsin. This session will provide an opportunity to learn more about, and to comment on, the findings and recommendations documented in the preliminary draft of the first three chapters of Southeastern Wisconsin Regional Planning Commission (SEWRPC) Community Assistance Planning Report No. 326 of the Washington County Hazard Mitigation Plan Update. The plan includes recom?mendations related to the mitigation of impacts from hazards such as flooding and related stormwater drainage problems; weather-related hazards such as tornadoes, winter storms, extreme temperatures, drought, and severe thunderstorms in Washington County. This plan constitutes an update of the initial hazard mitigation plan which was adopted by the County in 2018 and is being completed in order for the County to maintain eligibility for hazard mitigation funding through the Federal Emergency Management Agency. This meeting will discuss the purpose of the plan and review the work completed to date.

Copies of the first three report chapters, including the risk and vulnerability analysis chapter, are now available for review on the SEWRPC web site at: http://www.sewrpc.org/HMP

The plan is being prepared by SEWRPC, in cooperation with the County's Department of Emergency Management. Preparation of the plan was guided by a Hazard Mitigation Local Planning Team consisting of local officials, including representatives of City and Village departments, such as the fire, police, city development, and public works departments; County departments and agencies, including the County emergency management office and the health care community.

The meeting will be held from 6:00-8:30 p.m. on Thursday, March 2, 2023 at the Washington County Public Agency Center, Room #1113 A&B, 333 E, Washington Street, West Bend, Wisconsin, 53095.

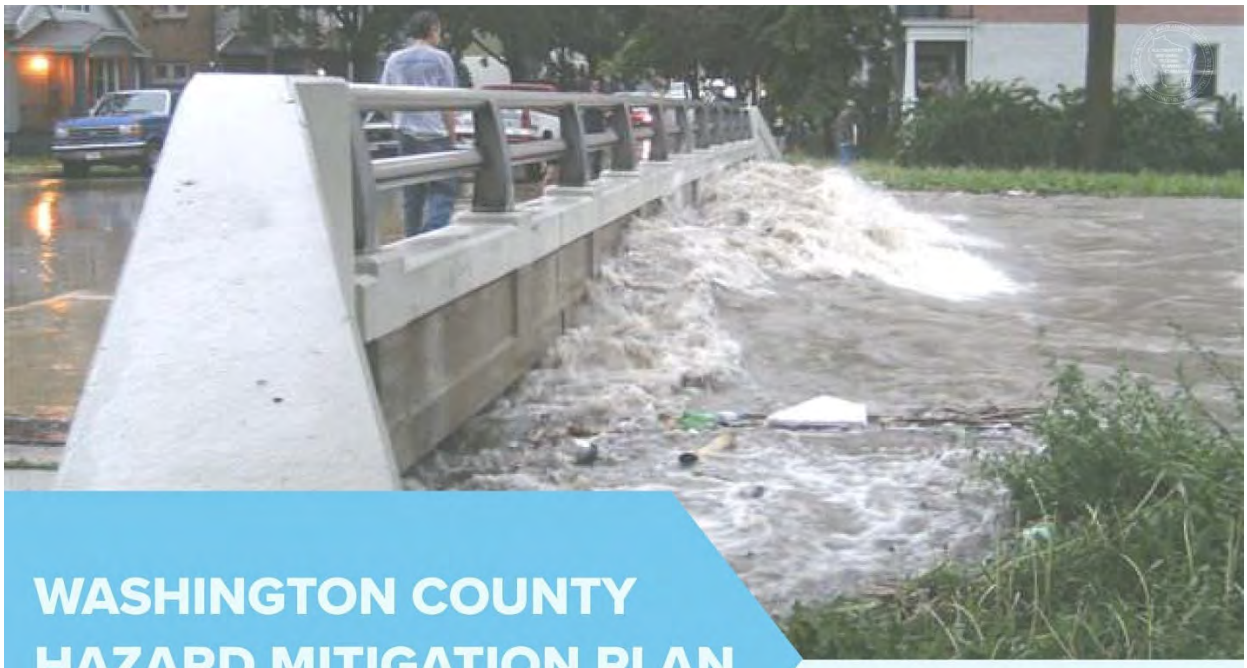
The sessions will begin with a meeting in "open house" format for the first hour and, which will provide an opportunity to meet one-on-one with the Commission and County staff to receive information, ask questions, and provide written comment. A presentation will be made by the Commission staff starting at 7:00 p.m.

In addition to providing comments at the public meeting, written comments may also be submitted by email (mshedivy@sewrpc.org) or by comment screen on the Commission's website. This comment screen may be found at: http://www.sewrpc.org/SEWRPC/HMP

To ask questions or to submit written comments on the Hazard Mitigation Plan Update, please contact:

Southeastern Wisconsin Regional Planning Commission: Megan A. Shedivy, Planner, W239 N1812 Rockwood Drive. P.O. Box 1607, Waukesha, Wisconsin 53187-1607, Phone: 262-547-6721, Fax: 262-547-1103, e-mail: mshedivy@sewrpc.org

Source: "Public information meeting scheduled on hazard mitigation plan update for Washington County." Daily News, *February 25, 2023.*



WASHINGTON COUNTY HAZARD MITIGATION PLAN PUBLIC MEETING

Washington County residents are invited to an informational meeting related to the mitigation (or lessening) of impacts from natural hazards such as flooding, tornadoes, drought, extreme temperature events, and severe winter storms.

March 2nd

6:00-8:00pm

Washington County
Public Agency Center
Room 1113 A&B
333 E. Washington St.
West Bend, WI

Figure A.6
Notice Materials for Public Meeting #2: May 1, 2024

County holding public meeting May 1 for feedback on Hazard Mitigation Plan

WEST BEND — Washington County will be holding a public meeting to provide county residents the chance to learn about and comment on the draft plan of the Washington County Hazard Mitigation Plan in Room 1113 A&B of the Washington County Public Agency Center, 333 E. Washington St., from 5 to 6 p.m. on May 1.

According to the release, county residents are invited to learn about plans to lessen the impacts from natural hazards, which include flooding, tornadoes, drought, extreme temperature events and severe winter storms, as well as comment on them before they are submitted to be finalized.

The county must create a Hazard Mitigation Plan, per Federal Emergency Management Agency (FEMA) guidelines, to receive federal funding for mitigation projects that help communities reduce the loss of life and property from disasters.

"Hazard mitigation planning helps prevent/minimize future damages, promotes disaster-resilient communities, and reduces response and recovery resource requirements," said the release. "Adopting the plan also allows municipalities and counties the opportunity to apply for mitigation project grant funds through FEMA. Hazard Mitigation Plans must be reviewed and updated on a regular basis to remain eligible for federal grants."

The last Washington County Hazard Mitigation Plan was adopted by the County Board and all cities, villages and townships in the county in 2018.

Source: "County holding public meeting May 1 for feedback on Hazard Mitigation Plan." Daily News*, April 11, 2024.*

JOIN US!

at a public meeting for the 2024-2029 Update of the Washington County Hazard Mitigation Plan

Wednesday, May 1, 2024
5:00 p.m. to 6:00 p.m.
Washington County
Public Agency Center
333 E. Washington Street
Room 1113A
West Bend, WI 53095

Public Meeting Information

- Review draft plan, including study area inventory and analysis, analysis of hazard conditions, hazard mitigation goals, recommended hazard mitigation measures, and plan adoption, implementation, and maintenance
- Open discussion to answer questions and take comments on plan update
- Visit **www.sewrpc.org/hmp** to view draft plan chapters and provide written feedback. Written comments may be provided through May 16th

The Washington County Hazard Mitigation Plan identifies areas of risk, assesses the magnitude of the risk, and develops strategies for reducing the risk that natural hazards post throughout the County. Completion and approval of the plan will maintain the eligibility of Washington County and its communities to apply for FEMA mitigation project funds to implement mitigation strategies.

WASHINGTON COUNTY

Appendix B

WASHINGTON COUNTY BOARD OF SUPERVISORS RESOLUTION TO ADOPT THE WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

[Content will be prepared at a later date]

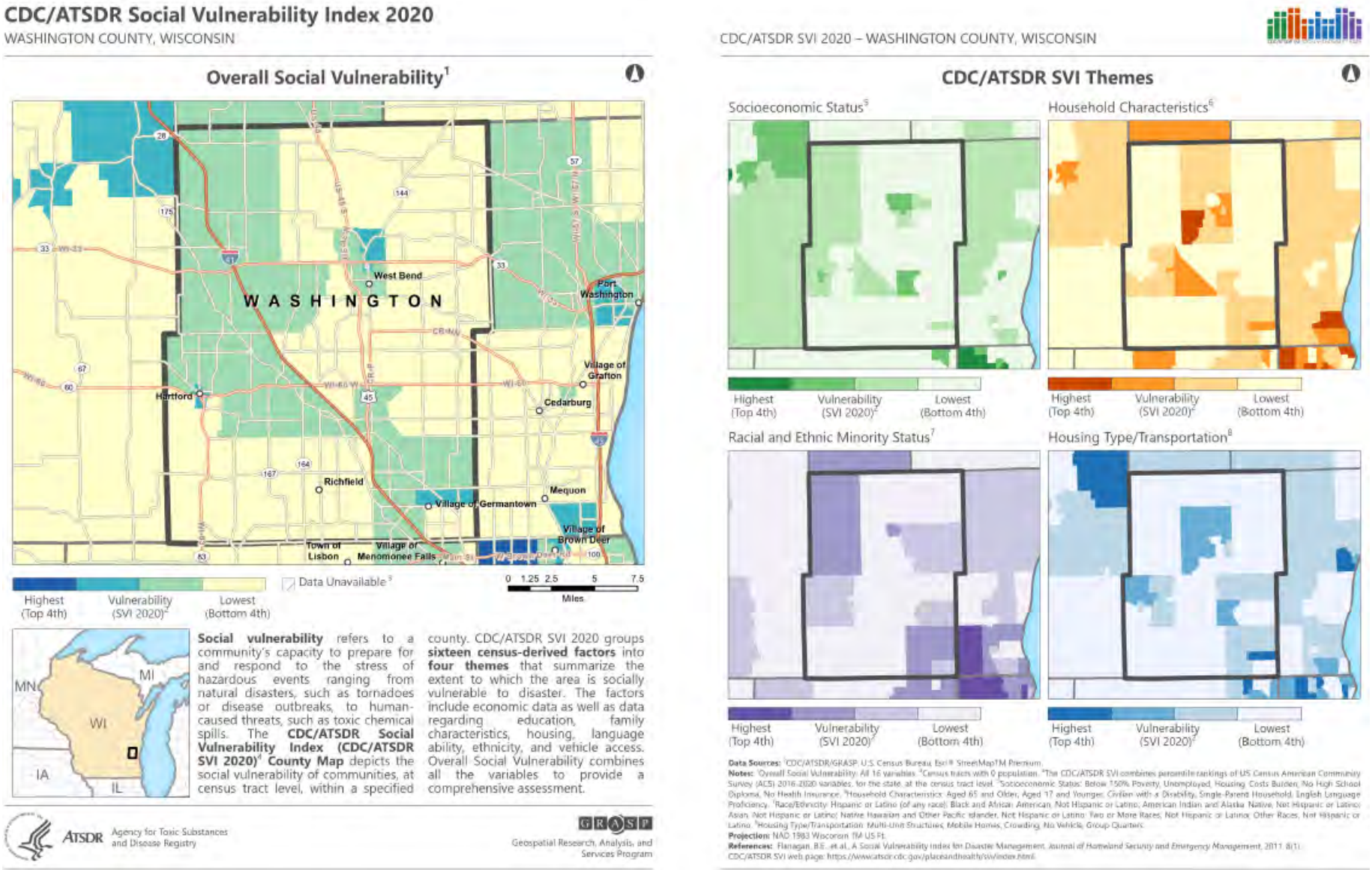
SEWRPC Community Assistance Planning Report No. 326 (2nd Edition)

WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Appendix C

SOCIAL VULNERABILITY INDEX

Figure C.1
CDC Social Vulnerability Index for Washington County: 2020



Source: CDC/ATSDR Social Vulnerability Index, 2020, Washington County, Wisconsin, svi.cdc.gov/Documents/CountyMaps/2020/Wisconsin/Wisconsin2020_Washington.pdf

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SEWRPC Community Assistance Planning Report No. 326 (2nd Edition)

WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Appendix D

CRITICAL COMMUNITY AND PUBLIC SAFETY FACILITIES AND SERVICES WITHIN THE WASHINGTON COUNTY PLANNING AREA

Table D.1
Selected Critical Community Facilities Within the Washington County Planning Area: 2015

Name	Community	Address
Governmental Buildings		
Social Security Administration	City West Bend	1145 Vern Street, West Bend
Washington Justice Center	City West Bend	432 E. Washington Street, West Bend
Washington County Public Agency Center	City West Bend	333 E. Washington Street, West Bend
Washington County Fair Park	Town of Polk	3000 CTH PV, West Bend
Washington County Historical Museum	City West Bend	320 S. Fifth Street, West Bend
Washington County Law Enforcement/Corrections Building	City West Bend	500 N. Schmidt Road, West Bend
Samaritan Health Center	City West Bend	531 E. Washington Street, West Bend
Washington County Vehicle Maintenance and Storage Facility	City West Bend	900 Lang Street, West Bend
Youth Treatment Center	City West Bend	801 E. Washington Street, West Bend
Wisconsin Department of Corrections Division of Community Corrections	City West Bend	273 S. 17th Avenue, West Bend
Wisconsin Department of Transportation Division of Motor Vehicles	City West Bend	1516 Paradise Drive, West Bend
Office of State Public Defender	City West Bend	155 N. Main Street, West Bend
Workforce Development Center	City West Bend	2200 Green Tree Road, West Bend
U.S. Department of Agriculture	City West Bend	333 E. Washington Street
Wisconsin National Guard Armory	City of Hartford	880 W. State Street
Wisconsin National Guard Armory	City West Bend	125 Chopper Drive
Addison Town Hall	Town of Addison	127 1st Street, Allenton
Barton Town Hall	Town of Barton	3482 Town Hall Road, Kewaskum
Erin Town Hall	Town of Erin	1846 STH 83, Hartford
Farmington Town Hall	Town of Farmington	9422 STH 144, Kewaskum
Germantown Town Office	Town of Germantown	N128 W17714 Holy Hill Road, Germantown
Germantown Village Hall	Village of Germantown	N112 W17001 Mequon Road, Germantown
Hartford City Hall	City of Hartford	109 N. Main Street, Hartford
Hartford Town Hall	Town of Hartford	3360 CTH K, Hartford
Jackson Town Hall	Town of Jackson	3146 Division Road, Jackson
Jackson Village Hall	Village of Jackson	N168 W20733 Main Street, Jackson
Kewaskum Town Hall	Town of Kewaskum	9019 Kettle Moraine Drive, Kewaskum
Kewaskum Village Hall	Village of Kewaskum	204 S, 1st Street, Kewaskum
Newburg Village Hall	Village of Newburg	614 Main Street, Newburg
Polk Town Hall	Town of Polk	3680 STH 60, Slinger
Richfield Village Hall	Village of Richfield	4128 Hubertus Road, Hubertus
Slinger Village Hall	Village of Slinger	300 Slinger Road, Slinger
Trenton Town Hall	Town of Trenton	1071 STH 33E, West Bend

Table continued on next page.

Table D.1 (Continued)

Name	Community	Address
Governmental Buildings (continued)		
Wayne Town Hall	Town of Wayne	6030 Mohawk Road, Campbellsport
West Bend City Hall	City of West Bend	1115 S. Main Street, West Bend
West Bend Town Hall	Town of West Bend	6355 CTH Z, West Bend
Hospitals		
Aurora Medical Center of Washington County	City of Hartford	1032 E. Sumner Street, Hartford
Froedtert West Bend	Town of Polk	3200 Pleasant Valley Road, West Bend
Clinics		
Albrecht Free Clinic of Washington County	City of West Bend	1110 Oak Street, West Bend
Aurora Advanced Healthcare—Germantown	Village of Germantown	N112 W17975 Mequon Road, Germantown
Aurora Advanced Healthcare--Hartford	City of Hartford	1640 E. Sumner Street, Hartford
Aurora Advanced Healthcare—Hubertus	Village of Richfield	3055 Hubertus Road, Hubertus
Aurora Advanced Healthcare—Slinger	Village of Slinger	1061 E. Commerce Boulevard, Slinger
Aurora Advanced Healthcare—West Bend	City of West Bend	205 Valley Avenue, West Bend
Aurora Advanced Healthcare—West Bend	Town of West Bend	5595 CTH Z, West Bend
Columbia St. Mary's—Germantown Express Care	Village of Germantown	N112 W15415 Mequon Road, Germantown
Froedtert Health Medical Group—Germantown Health Center	Village of Germantown	W168 N11237 Western Avenue
Froedtert Health Medical Group—Hartford Health Center	City of Hartford	110 Loan Oak Lane, Hartford
Froedtert Health Medical Group—Jackson Health Center	Village of Jackson	W225 N16711 Cedar Park Court, Jackson
Froedtert Health Medical Group—Kewaskum Health Center	Village of Kewaskum	1701 Fond du Lac Avenue, Kewaskum
Froedtert Health Medical Group—St. Joseph's Health Center	Town of Polk	3200 Pleasant Valley Road, West Bend
Froedtert Health Medical Group—West Bend Health Center	City of West Bend	1700 W. Paradise Drive, West Bend
Washington County Health Department	City of West Bend	333E. Washington Street, West Bend
Public Schools		
Addison Elementary School	City of Hartford	5050 Indian Drive
Allenton Elementary School	Allenton	228 Weis Street
Amy Belle Elementary School	Colgate	3294 Willow Creek Rd
Badger Middle School	West Bend	727 S. 6th Avenue
Central Middle School	Hartford	1100 Cedar Street
County Line Elementary School	Germantown	W159 N9939 Butternut Road
Decorah Elementary School	West Bend	1225 Sylvan Way
Erin Elementary School	Hartford	6901 CTH O
Fair Park Elementary School	West Bend	519 N. Indiana Ave
Farmington Elementary School	Kewaskum	8736 Boltonville Road
Friess Lake School	Hubertus	1750 STH 164
Germantown High School	Germantown	W180 N11501 River Lane
Green Tree Elementary School	West Bend	1330 Green Tree Road

Table continued on next page.

Table D.1 (Continued)

Name	Community	Address
Public Schools (continued)		
Hartford Union High School	Hartford	805 Cedar Street
Jackson Elementary School	Jackson	W204 N16850 Jackson Drive
Kennedy Middle School	Germantown	W160 N11836 Crusader Court
Kewaskum Elementary School	Kewaskum	1415 Bilgo Lane
Kewaskum High School	Kewaskum	1510 Bilgo Lane
Kewaskum Middle School	Kewaskum	1676 Reigle Drive
Lincoln Elementary School	Hartford	755 South Rural Street
MacArthur Elementary School	Germantown	W154 N11492 Fond du Lac Avenue
McLane Elementary School	West Bend	833 Chestnut Street
Richfield Elementary School	Richfield	3117 STH 167
Rockfield Elementary School	Germantown	N132 W18473 Rockfield Road
Rolf's Early Childhood Center	West Bend	737 S. 3rd Ave
Rossman Elementary School	Hartford	600 Highland Avenue
Silverbrook Middle School	West Bend	120 N. Silverbrook Drive
Slinger Elementary School	Slinger	203 E. Polk Street
Slinger High School	Slinger	209 E. Polk Street
Slinger Middle School	Slinger	521 Olympic Drive
Washington Street School	West Bend	500 N Schmidt Road
i4Learning Community School	Campbellsport	5760 Mohawk Road
West Bend East High School	West Bend	1305 E. Decorah Road
West Bend West High School	West Bend	1305 E. Decorah Road
Private Schools		
Bethlehem Evangelical Lutheran Elementary School	Germantown	N108 W14290 Bel Aire Lane
Crown of Life Evangelical Lutheran School	Hubertus	1282 Tally Ho Trail
David's Star Lutheran Elementary School	Germantown	2750 David's Star Drive
Good Shepherd Lutheran Elementary School	West Bend	777 Indiana Avenue
Holy Angels Elementary School	West Bend	230 North 8th Avenue
Holy Trinity Catholic Elementary School	Kewaskum	305 Main St
Kettle Moraine Lutheran High School	Jackson	3399 Division Road
Living Word Child Development Center	Jackson	2240 Living Word Lane
Living Word Lutheran High School	Jackson	2230 Living Word Lane
Montessori Children House West School	West Bend	1701 Vogt Drive
Morning Star Lutheran School	Jackson	N171 W20131 Highland Rd
Peace Lutheran Elementary School	Hartford	1025 Peace Lutheran Drive
St. Augustine School, inc.	Colgate	4908 Monches Road
St. Boniface Elementary School	Germantown	W204 N11968 Goldendale Road

Table continued on next page.

Table D.1 (Continued)

Name	Community	Address
Private Schools (continued)		
St. Frances Cabrini Elementary School	West Bend	529 West Hawthorne Drive
St. Gabriel Elementary School	Hubertus	1200 Saint Gabriel Way
St. John Lutheran Elementary School	West Bend	899 South 6th Avenue
St. John Lutheran Elementary School	Newburg	623 Congress Street
St. Kilian Elementary School	Hartford	245 High St
St. Peter Catholic Elementary School	Slinger	206 E. STH 175
Trinity Lutheran Elementary School	West Bend	1268 Pleasant Valley
Higher Educational Facilities		
Moraine Park Technical College - West Bend	West Bend	2151 N. Main Street
U.W. Washington County	West Bend	400 University Drive
Assisted Living Facilities for People with Disabilities		
Adult Family Homes		
17th Avenue Adult Family Home	West Bend	233 S. 17th Avenue
Bobolink Home	West Bend	834 Bobolink Lane
Brywen, LLC	West Bend	6799 Diane Drive
Dennis Path Adult Family Home	West Bend	6874 Dennis Path
Ellenbecker Adult Family Home	West Bend	7463 Brookhaven Drive
HIL Carrie Lane	West Bend	1628 Carrie Lane
HIL Magellan House	West Bend	212 S. 16th Avenue
Home Care Solutions at Home	Hartford	1190 Western Drive
Home of Devotion Assisted Living, LLC	West Bend	6881 Beck Lane
Jackson Manor, LLC	Jackson	N168 W21041 Main Street
Key House	Kewaskum	1146 Fond Du Lac Drive
Meadowbrook Home	West Bend	818 Meadowbrook Drive
Next Step in Residential Services 7th Avenue Home	West Bend	2425 State Road 175
People Serve, LLC	West Bend	1017 Hillcrest Street
Regner Home	West Bend	523 N. 10th Avenue
REM Polaris	West Bend	618 Polaris Street
REM Wisconsin II Judith Court	West Bend	706 Judith Court
REM Wisconsin II, Inc. - Germantown	Germantown	N116 W16105 Main Street
Richfield Adult Family Home	Richfield	2425 State Road 175
Sherman Way House	West Bend	733 Sherman Way
South Hartford Adult Family Home	Hartford	3088 State Highway 83
Washington Home	West Bend	2030 E. Washington Street
Wink Home, LLC	Hartford	1354 – 1356 Patton Drive

Table continued on next page.

Table D.1 (Continued)

Name	Community	Address
Assisted Living Facilities for People with Disabilities (continued)		
Community-Based Residential Facilities		
Arbor Point	West Bend	230 Arbor Point Avenue
Calm Harbor	West Bend	141 S. 8th Avenue
Chestnut Community Facility	West Bend	346 S. Main Street
Exodus Transitional Living Facility	Kewaskum	1421 Fond Du Lac Avenue
Germantown Home	Germantown	W164 N10502 Timberline Court
HIL Columbus House	West Bend	5096 Valley Trail
Nursing Homes		
Cedar Lake Health and Rehabilitation Center	West Bend	5595 County Road Z
Pavilion at Glacier Valley	Slinger	1900 American Eagle Drive
Samaritan Health Center	West Bend	531 E. Washington Street
Virginia Highlands Health and Rehab Center	Germantown	W173 N10915 Bernies Way
Assisted Living Facilities		
Adult Day Care		
Just Like Home Adult Day Care Center	Jackson	W218 N17483 Delaney Court
Community-Based Residential Facilities		
Cottages at Cedar Run	West Bend	6090 Scenic Drive
Countryview Group Home	Germantown	N112 W12850 West Mequon Road
Ellen's Home Germantown	Germantown	N113 W16358 Sylvan Circle
Ellen's Home South	Germantown	W150 N11127 Fond du Lac Avenue
Fields of Washington County	West Bend	531 E. Washington Street
Harvest Home at Arbor Point	West Bend	330 Arbor Point Avenue
Hawthorn Manor	West Bend	321 Hawthorn Drive
Ivy Manor of West Bend	West Bend	350-370 S. Forest Avenue
Kettle Moraine Gardens	Kewaskum	1038-1042 Fond du Lac Avenue
Majestic Heights Assisted Living	Hartford	63-85 S. Wacker Drive
Matter Haus	Germantown	N109 W17000 Ava Circle
New Perspective - West Bend	West Bend	2130 Continental Drive
Serenity Villa	Slinger	1600-1727 American Eagle Way
Waterford at Hartford	Hartford	1025 Bell Avenue
Waterford at West Bend	West Bend	831 E. Washington Street
Wellington Place of Hartford	Hartford	615 Hilldale Drive
Nursing Homes		
Cedar Lake Health and Rehabilitation Center	West Bend	5595 CTH Z
Pavilion at Glacier Valley	Slinger	1900 American Eagle Way
Samaritan Health Center	West Bend	531 East Washington Street

Table continued on next page.

Table D.1 (Continued)

Name	Community	Address
Assisted Living Facilities (continued)		
Residential Care Apartments		
Cedar Bay West	West Bend	5555 Cedar Bay Drive
Fields of Washington County	West Bend	675 E. Washington Street
Kettle Moraine Gardens	Kewaskum	1038 Fond du Lac Avenue
New Perspective - West Bend	West Bend	2130 Continental Drive
Waterford at Hartford	Hartford	1025 Bell Avenue
Transportation Facilities		
Hartford Municipal Airport	Hartford	4200 CTH U
West Bend Municipal Airport	West Bend	330 Earl Stier Drive

Source: Washington County and SEWRPC

SEWRPC Community Assistance Planning Report No. 326 (2nd Edition)

WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Appendix E

HISTORICAL AND STATE HISTORICAL SITES AND DISTRICTS WITHIN THE WASHINGTON COUNTY PLANNING AREA

Table E.1
National and State Historic Sites and Districts in Washington County: 2023

Map Number (See Map 3.6)	Site Name	Location by Address	Civil Division	Year Listed
1	Barton Historic District	Roughly bounded by Harrison and Jefferson Streets, Barton Avenue, Salisbury Road, Monroe Street, and the Milwaukee River	City of West Bend	1992
2	Kissel's Addition Historic District	Rural Street and W. Root Avenue	City of Hartford	1988
3	Kissel's Wheelock Addition Historic District	Roughly bounded by Church Street, Wheelock and Linden Avenues, Branch Street, and Teddy Avenue	City of Hartford	1988
4	Washington County "Island" Effigy Mound District	--	City of West Bend	1996
5	Amity Leather Products Company Factory	723-735 S. Main Street	City of West Bend	2002
6	Barton Elementary School	614 School Place	City of West Bend	2018
7	Christ Evangelical Church	W188 N12808 Fond du Lac Avenue	Village of Germantown	1983
8	Gadow's Mill	1784 Barton Avenue	City of West Bend	1974
9	George A. Kissel House	215 E. Sumner	City of Hartford	1988
10	Holy Hill	1525 Carmel Road	Town of Erin	1992
11	Jacob Schunk Farmhouse	Donges Bay Road	Village of Germantown	1983
12	Leander F. Frisby House	304 S. Main Street	City of West Bend	1985
13	Lizard Mound State Park	2121 County Highway A	Town of Farmington	1970
14	Louis Kissel House	407 E. Sumner	City of Hartford	1988
15	Messer-Mayer Mill	4399 Pleasant Hill Road	Village of Richfield	2007
16	Otto P. Kissel House	124 South Street	City of Hartford	1988
17	Ritger Wagonmaking and Blacksmith Shop	4928 WI 175	City of Hartford	1982
18	Saxonia House	421 WI H	Farmington	2006
19	Schwartz Ballroom	150 Jefferson Avenue	City of Hartford	1998
20	Schwartz Family House	220 Union Street	City of Hartford	2018
21	St. Agnes Convent and School	1386 Fond du Lac Street	City of West Bend	2010
22	St. Augustine Catholic Church and Cemetery	Co. Hwy. Y 3 miles south of the junction of Co. Hwy. Y and SR 33	Town of Trenton	1990
23	St. John of God Roman Catholic Church, Convent, and School	East of Kewaskum at 1488 Highland Drive	Village of Kewaskum	1979
24	St. Peter's Church	1010 Newark Drive	City of West Bend	1983
25	Washington County Courthouse and Jail	320 S. 5th Avenue	City of West Bend	1982
26	West Bend Chicago and Northwestern Depot	Veterans Avenue at Willow Lane	City of West Bend	2008
27	West Bend Post Office	607 Elm Street	City of West Bend	2000
28	West Bend Theatre	125 North Main Street	City of West Bend	2020
29	William L. Kissel House	67 South Street	City of Hartford	1988
30	Lizard Mound Boundary Increase	2121 County Highway A	Town of Farmington	2023
31	Wilhelm Tischer Blacksmith Shop	1125 Western Avenue	Village of Jackson	2023
32	West Bend Downtown Historic District	102-337 North Main, 101-162 South Main, 508 and 519 Hickory, 607 and 623-627 Elm, 623-629 Cedar Streets, 108-112 5th, 100-228 6th Avenues	City of West Bend	2023

Source: National Register of Historic Places, State Historical Society of Wisconsin, Washington County, and SEWRPC

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WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Appendix F

HAZARD MITIGATION MATERIAL AND RELATED RESOURCES

Additional Items to Consider Adding to an Emergency Supply Kit:

- ❑ Prescription medications and glasses
- ❑ Infant formula and diapers
- ❑ Pet food, water and supplies for your pet
- ❑ Important family documents such as copies of insurance policies, identification and bank account records in a portable waterproof container
- ❑ Cash and change
- ❑ Emergency reference material such as a first aid book or information from www.ready.gov
- ❑ Sleeping bag or warm blanket for each person. Consider additional bedding if you live in a cold-weather climate.
- ❑ Complete change of clothing including a long sleeved shirt, long pants and sturdy shoes. Consider additional clothing if you live in a cold-weather climate.
- ❑ Fire Extinguisher
- ❑ Matches in a waterproof container
- ❑ Feminine supplies, personal hygiene items and hand sanitizer
- ❑ Mess kits, Paper cups, plates and disposable utensils, paper towels
- ❑ Paper and pencil
- ❑ Books, games, puzzles or other activities for children

Ready

Prepare. Plan. Stay Informed.®

Emergency Supply List

FEMA

www.ready.gov

Recommended Items to Include in a Basic Emergency Supply Kit:

- ❑ Water and non-perishable food for several days
- ❑ Extra cell phone battery or charger
- ❑ Battery-powered or hand crank radio that can receive NOAA Weather Radio tone alerts and extra batteries
- ❑ Flashlight and extra batteries
- ❑ First aid kit
- ❑ Whistle to signal for help
- ❑ Dust mask, to help filter contaminated air and plastic sheeting and duct tape to shelter-in-place
- ❑ Moist towelettes, garbage bags and plastic ties for personal sanitation
- ❑ Non-sparking wrench or pliers to turn off utilities
- ❑ Can opener (if kit contains canned food)
- ❑ Local maps

FEMA's Ready Campaign

educates and empowers Americans to take some simple steps to prepare for and respond to potential emergencies, including those from natural hazards and man-made disasters. Ready asks individuals to do three key things: get an emergency supply kit, make a family emergency plan, and be informed about the different types of emergencies that could occur and appropriate responses. Everyone should have some basic supplies on hand in order to survive several days if an emergency occurs. This list of emergency supply kit items is only a starting point. It is important that individuals review this list and consider the unique needs of their family, including pets, for items to include. Individuals should also consider having at least two emergency supply kits, one full kit at home and smaller portable kits in their workplace, vehicle or other places they spend time.

Ready. FEMA

Federal Emergency Management Agency
Washington, DC 20472

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11/08/2023; 04/01/24; 04/05/2024

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WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Appendix G

POTENTIAL FUNDING PROGRAMS TO IMPLEMENT PLAN RECOMMENDATIONS WITHIN WASHINGTON COUNTY

Table G.1
Potential Funding Programs to Implement Plan Recommendations

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided
1	U.S. Economic Development Administration (EDA)	Disaster Supplemental Funding	Municipalities impacted by a Presidentially declared disaster	To plan and implement community resilience projects against future disasters	Varies, based on the circumstances of proposed projects; In general, 80 percent Federal cost-share; 20 percent local match
2	EDA	Public Works (PW) and Economic Adjustment Assistance (EAA) Programs	States, municipalities, tribal governments, higher education institutions, economic development districts, and nonprofit organizations	1. The PW supports the construction, expansion, or upgrade of public infrastructure and facilities 2. EAA supports the design and implementation of strategies to help communities that have experienced or are under the threat of serious damage to their underlying economic base	$150,000 to $1 million for EAA awards, with an average award of $650,000; $600,000 to $3 million for PW awards, with an average award of $1.4 million; Cost-share: 50 percent federal; 50 percent local
3	U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA)	Hazard Mitigation Grant Program	State agencies and participating National Flood Insurance Program (NFIP) communities; federally recognized tribes, tribal agencies, private nonprofits, and local government/communities	1. Floodproofing 2. Relocation of structures 3. Elevation of structures 4. Property acquisition 5. Conformity with approved state and local mitigation plan 6. Plan preparation 7. Safe room construction 8. Construction or modification of dikes, levees, floodwalls, seawalls, groins, jetties, breakwaters, and stabilized sand dunes	75 percent Federal cost-share assistance; 12.5 percent State match and 12.5 percent local match required[a]
4	FEMA	Flood Mitigation Assistance Grant Program	State agencies and participating NFIP communities; federally recognized tribes, tribal agencies, local governments/communities	1. Elevation, relocation, or demolition of insured structures 2. Acquisition 3. Dry floodproofing 4. Minor structural projects 5. Beach nourishment activities 6. Projects must be consistent with the goals and objectives identified in the State, tribal, or local mitigation plans	Funding is appropriated by Congress;[b] 75 percent Federal cost-share assistance; 25 percent local match required; two types of grants: Planning grant and project grant[c]

Table continued on next page.

Table G.1 (Continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided
5	FEMA	Public Assistance Grant Program	State, tribal, territorial, and local governments; certain types of private nonprofit organizations	1. Rebuilding infrastructure damaged during a flood 2. Building infrastructure for portions of a community that are to be relocated outside of floodplains 3. Limited assistance with structural elevation and relocation	75 percent Federal cost-share assistance; the State determines the local match
6	FEMA	National Training and Education Division	State and local first responders; private sector and tribal entities	1. Provides preparedness training and exercise support to first responders in the event of a manmade or natural catastrophic event 2. Provides educational services in 18 professional disciplines	Provides over 150 training courses for first responders
7	FEMA	Building Resilient Infrastructure and Communities Program	Applicants: States, Territories, and Tribal governments Sub-applicants: Local and Tribal governments and State and Tribal agencies	1. Capability- and capacity-building activities 2. Hazard mitigation projects 3. Management costs	Funding is appropriated by Congress;[b] 75 percent Federal cost-share assistance provided (small, impoverished communities may be eligible for up to 90 percent federal cost-share); 25 percent State or local match is required
8	FEMA	Assistance to Firefighters Grant Program	City, County, Village, Tribal, and Township Fire Departments; nonaffiliated emergency medical services (EMS) organizations, State Fire Training Academies (SFTA)	1. Firefighter and EMT training 2. Firefighting and EMS equipment 3. Firefighter personal protective equipment	Cost-share matching fund requirements dependent upon size of population served by Fire Department
9	FEMA	Staffing for Adequate Fire and Emergency Response Grants (SAFER)	City, County, Village, Tribal, and Township Fire Departments (volunteer, combination, and career fire departments)	1. Hiring of new, additional firefighters to improve staffing levels 2. Recruitment and retention of volunteer firefighters involved with or trained in the operations of firefighting and emergency response	Salary and associated benefits for new firefighters and volunteer firefighters; Recipients of SAFER Recruitment and Retention of Volunteer Firefighters Activity grants are not required to contribute matching funds; Firefighters Activity grant recipients are required to contribute non-federal funds subject to a Position Cost Limit and a Cost Share (see program guidance)

Table continued on next page.

Table G.1 (Continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided
10	U.S. Army Corps of Engineers (USACE)	Continuing Authorities Program—Snagging and Clearing for Flood Risk Management Program	State and local units of government	1. Removal of obstructions that restrict flood flows of navigable waters 2. Projects must be designed and constructed by the Corps	Federal share cannot exceed $500,000 for a given project; cost-share program with local match of 35 percent for design and preparation; construction cost varies between 30 percent and 65 percent federal share
11	USACE	Continuing Authorities Program—Emergency Streambank and Shore Protection Program	Local governments	Bank protection of highways, highway bridges, essential public works, churches, hospitals, schools, and other nonprofit public services from flood induced erosion	Federal share cannot exceed $5,000,000 for a given project; cost-share program with local match of 35 percent for design and construction required
12	USACE	Small Hurricane and Storm Damage Reduction Program	State agencies and local units of government	1. Beach nourishment 2. Floodproofing 3. Other structural and nonstructural storm damage reduction projects	Federal share cannot exceed $5,000,000 for a given project; cost-share program with local contribution of 35 percent for design and construction required
13	USACE	Water Resources Development and Flood Control Acts	Local governments	1. Water resources planning assistance 2. Emergency streambank and shoreline protection	50 percent for studies and 65 percent for project implementation of Federal cost-share assistance; 35 to 50 percent local match is required
14	USACE	Continuing Authorities Program—Flood Risk Management Program	Local governments and special authorities	Assistance for planning, design, and construction of structural and non-structural flood control projects. Projects are not limited to any particular type of improvement.	Feasibility study is 100 percent federally funded up to $100,000; 50 percent local match required for any costs exceeding $100,000; 65 percent federal cost share for project implementation with 35 percent local match required
15	USACE	Floodplain Management Services Program	State, regional, and local governments; federally recognized Native American Tribes; other non-federal public agencies	1. Floodplain delineation 2. Flood hazard evaluation 3. Dam break analysis 4. Stormwater management 5. Flood risk reduction	100 percent federal cost-share assistance provided; entities may provide voluntary contributions
16	USACE	Flood Damage Reduction Program	State and local units of government	1. Projects designed to reduce the impact of flood events 2. Projects must be designed and constructed by the Corps	50 to 65 percent Federal cost-share assistance above $100,000 and cannot exceed $10 million; 35 to 50 percent local match is required

Table continued on next page.

Table G.1 (Continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided
17	U.S. Department of Agriculture, Farm Services Agency (USDA-FSA)	Conservation Reserve Program	Individual landowners in a 10- or 15-year contract	1. Riparian buffers 2. Trees 3. Windbreaks 4. Grassed waterways 5. Farmer must have owned or operated the land for at least 12 months prior to the previous program sign-up period	50 percent Federal cost-share assistance; 50 percent local match from individual; an annual rental payment for the length of the contract is also provided
18	USDA-FSA	Emergency Conservation Program	Individual landowners	1. Grading and shaping farmland 2. Restoring conservation structures 3. Redistribution of eroded soil 4. Debris removal 5. Projects must be in response to a natural disaster	Up to 75 percent Federal cost-share assistance, the remaining is determined by the committee reviewing the application
19	USDA-FSA	Emergency Forest Restoration Program	Individual non-industrial private forest landowners	Restore privately owned forests damaged by natural disasters	Funding and technical assistance provided under a 10-15 year contract
20	USDA-FSA	Noninsured Disaster Assistance Program	Landowners or tenants that experienced direct damaging weather or adverse natural occurrence to crops during the eligible crop coverage period before or during harvest	Protecting non-insurable crops against natural disasters, including drought, freeze, hail, excessive moisture, or excessive wind, flood, and excessive heat, or insect infestation.	NAP provides basic coverage equivalent to the catastrophic level risk protection plan of insurance coverage, which is based on the amount of loss that exceeds 50 percent of expected production at 55 percent of the average market price for the crop.
21	USDA-FSA	Farmable Wetland Program	Individual agricultural landowners in 10- or 15- year contracts	Restore currently farmed wetland	One-time $100 per acre Federal signing incentive; up to 50 percent Federal cost share assistance for installation of practices plus one-time incentive payment of 40 percent of practice installation cost; annual rental payments based on the weighted average dryland cash rate
22	U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (USDA-NRCS)	Agricultural Conservation Easement Program-*Wetlands Reserve Easements*	Local government and individual landowners	1. Purchase agricultural land easements that protect the conservation values of eligible land 2. Wetland protection, restoration, and enhancement	Permanent easement: NRCS pays 100 percent of easement value and 75 to 100 percent of restoration cost 30-year easement: NRCS pays 50 to 75 percent of easement value and 50 to 75 percent of restoration cost

Table continued on next page.

Table G.1 (Continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided
23	USDA-NRCS	Conservation Stewardship Program	Individual landowners in a five-year contract	1. Filter strips 2. Riparian Buffers 3. Wildlife corridors 4. Stream habitat improvement	Payments for maintaining and/or enhancing natural resources not to exceed $40,000 per year or $200,000 over a five-year period
24	USDA-NRCS	Watershed Protection and Flood Prevention Program	State and local units of government; tribal governments	1. Watershed protection 2. Flood prevention measures 3. Benefits that are directly related to agriculture must be at least 20 percent of the total project benefits 4. Watersheds can be no larger than 250,000 acres	Cost-share rates vary depending on the type of measure and the purpose to which the cost is allocated; total average annual monetary benefits equal $2.2 billion
25	USDA-NRCS	Emergency Watershed Protection Program – *Floodplain Easement Option*	Individual landowners provided they have a local sponsor such as a local unit of government	1. Sale of agricultural flood prone lands to NRCS for floodplain easements 2. Land must have a history of repeated flooding (at least twice in the past 10 years) 3. Landowner retains most of the rights as before the sale 4. NRCS has authority to restore the floodplain function and value	The USDA pays the landowner the lowest of three options: a geographic rate, the fair market value of the land, or an offer made by the landowner; 75 percent Federal cost-share assistance; 25 percent local match is required[d]
26	USDA-NRCS	Emergency Watershed Protection Program - *Recovery Assistance*	Individual landowners provided they have a local sponsor such as a local unit of government	1. Debris removal 2. Reshaping and protection of eroded streambanks 3. Repair levees and structures 4. Repair damaged drainage facilities	Up to 75 percent Federal cost-share assistance; 25 percent local match is required
27	USDA-NRCS	Environmental Quality Incentives Program(EQIP)	Agricultural producers, owners of non-industrial private forestland, Indian Tribes, and those with an interest in the agricultural or forestry operations	1. Animal waste management practices 2. Soil erosion and sediment control practices 3. Nutrient management 4. Groundwater protection 5. Habitat improvement	Up to 75 percent Federal cost-share assistance; 25 percent local match is required
28	USDA- Risk Management Agency	Federal Crop Insurance	Agricultural producers	1. Insurance of selected crops against losses due to natural hazards 2. USDA Risk Management Agency administers this program; however, producers purchase Federal crop insurance through private insurance agents	Insurance of selected crops against losses due to natural hazards

Table continued on next page.

Table G.1 (Continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided
29	U.S. Fish and Wildlife Service (USFWS)	North American Wetlands Conservation Grants Program	Private or public organizations	1. Land acquisition 2. Restoration, management, and enhancement of wetland ecosystems and other habitat for migratory birds and other fish and wildlife	Applicants must match their grant request at no less than a 1-to-1 ratio; requests for small grants may not exceed $100,000
30	USFWS	Partners for Fish and Wildlife Habitat Restoration Program	Private landowners for a 10-year-minimum contract	Restoration of degraded wetlands, native grasslands, stream and riparian corridors, and other habitat areas	Full cost-share and technical assistance; individual projects cannot exceed $25,000
31	U.S. Department of Housing and Urban Development (HUD)	Community Development Block Grant Programs	Local governments	1. Public Facilities Grants to fund tornado shelters and safe houses 2. Housing Grants to fund the rehabilitation of housing to meet current building codes 3. Funds continuous training course for the building code authority	No matching requirements; Amounts awarded vary based on assessed community needs
32	U.S. Small Business Administration	Disaster Loan Program	Homeowners, renters, and businesses	1. Property repair 2. Property replacement 3. Meeting building code requirements 4. Involuntary relocations out of a special flood hazard area	Low interest loans
33	U.S. Environmental Protection Agency (USEPA)	Environmental Education Local Grants	Local or State education agencies, colleges, and nonprofit organizations; State environmental agencies, tribal education agencies, and noncommercial educational broadcasting agencies	1. Improving environmental education teaching skills 2. Educating teachers, students, or the public about human health problems 3. Building capacity for environmental education programs 4. Education communities 5. Educating the public through print, broadcast, or other media	$3 million available nationally,[b] grants range from $50,000 to $100,000; up to 75 percent federal cost share assistance, 25 percent local match is required
34	USEPA	Clean Water State Revolving Fund	States and municipalities for construction and technical assistance on publicly owned treatment works or nonpoint source pollution management systems	Projects that support decentralized wastewater treatment systems; stormwater management; water conservation; watershed pilot projects; and water reuse	Most assistance that municipalities is for loans that need to be repaid 100 percent to the CWSRF
35	USEPA	Drinking Water State Revolving Fund	States and municipalities	Construction of drinking water infrastructure projects, including modifications to ensure system capacity during flooding, and planning for flooding events	Individual states allocate funds to prioritized projects. Most assistance is for loans that have to be repaid 100 percent to the DWSRF

Table continued on next page.

Table G.1 (Continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided
36	U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA)	Surface Transportation Block Grant Program	State and local units of government	Provides funding assistance for smaller-scale transportation projects and activities such as improvements to pedestrian and bicycle facilities and recreational trails; provides assistance for community improvements such as historic preservation and vegetation management, and environmental mitigation related to stormwater and habitat connectivity	80 percent Federal cost-share assistance; 20 percent local match is required
37	USDOT	Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Transportation Grants	State, local, and tribal governments	Construction, design, and/or planning projects that will have a significant impact on roads, bridges, transit, rail, ports, or intermodal transportation systems.	Greater than $10 million; A match is required.
38	Wisconsin Department of Administration (DOA)	Community Development Block Grant Program-*Emergency Assistance Program*	Local governments that have low to moderate income populations	1. Repair of disaster relate damage to dwellings 2. Assist to purchase replacement dwellings 3. Repair and restore public facilities and infrastructure	1. For public facilities/infrastructure, funds are awarded as a grant, requiring a 25 percent local match for the total project expense 2. For housing, funds are awarded as a grant 3. For business assistance, funds may be awarded as a loan or a grant
39	Wisconsin DOA	Community Development Block Grant Program-*Public Facility Program*	Local governments that have low to moderate income populations	1. Improvements and repairs to public infrastructure 2. Construction or expansion of or improvement to, community facilities	No matching requirements; Amounts awarded vary based on assessed community needs
40	Wisconsin DOA	Community Development Block Grant Program-*Flexible Facilities Program*	Local governments	Construction, repair, or expansion of community facilities with the purchase and/or instillation of digital technology infrastructure for remote high speed internet access that will directly assist in response to COVID-19	Maximum Award Amount per Project: $4,250,000

Table continued on next page.

Table G.1 (Continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided
41	Wisconsin DOA	Non-State Grant Program	Non-state organizations that can show: 1. Proof of not-for-profit status 2. Proof of grantee match of at least 50 percent of the total project cost 3. Proof of plans and specifications by an architecture/engineering firm of record	Funding to non-state organizations for construction projects that benefit the public	Up to 50 percent of total project cost
42	Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP)	Producer-Led Watershed Protection Grants	1. At least five farmers within the same watershed 2. At least one collaborator: county land conservation, UW-Extension; WDNR; or nonprofit organization	1. On-farm demonstration and research projects 2. Education and outreach efforts on conservation systems 3. Innovative practices to improve water quality	Max award of $40,000 per group
43	DATCP	Soil and Water Resource Management Program	Individual landowners	1. Wetland restoration 2. Filter strip, riparian buffers 3. Subsurface drainage 4. Well abandonment	Program funds 70 percent of the cost of conservation project
44	Wisconsin Department of Natural Resources (WDNR)	Municipal Flood Control Grants	Cities, villages, towns, metropolitan sewerage districts	1. Acquisition and removal of structures 2. Flood proofing and elevation of structures 3. Riparian restoration projects 4. Acquisition of vacant land or purchase of easements 5. Construction of stormwater and groundwater facilities related to flood control and riparian restoration projects 6. Flood mapping	50 percent State cost-share assistance; 50 percent local match
45	WDNR	Knowles-Nelson Stewardship Grant Program	Local government and nonprofit conservation organizations	1. Streambank protection projects 2. Land acquisition of stream corridors for water quality improvement	50 percent State cost-share assistance; 50 percent local match is required
46	WDNR	Dam Removal Grant Program	Counties, cities, villages, towns, lake districts, and private dam owners	1. Dam removal planning 2. Dam removal 3. Restoration of impoundment	State covers 100 percent of project costs up to $50,000

Table continued on next page.

Table G.1 (Continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided
47	WDNR	Municipal Dam Grant Program	Counties, cities, villages, tribes, inland lake protection and rehabilitation districts	1. Dam repair, reconstruction, or modification to improve safety 2. Dam abandonment and removal	For repair, reconstruction, or modification projects grant awards cover 50 percent of the first $400,000 and 25 percent of the next $800,000 of eligible project costs For abandonment and removal projects, grant awards will cover 100 percent of the first $400,000 of eligible project costs
48	WDNR	Land and Water Conservation Fund Program	State agencies and local units of government	1. Planning for acquisition of parks 2. Land acquisition for parks and open space 3. Supporting facilities that enhance recreational opportunities	50 percent cost-share assistance provided
49	WDNR	Urban Nonpoint Source and Stormwater Grants Program	Local units of government, tribal governments, regional planning commissions, and special purpose lake, sewerage, and sanitary districts	1. Planning 2. Educational and information activities 3. Ordinance development and enforcement 4. Land acquisition and easement purchase 5. Storm water detention ponds 6. Streambank and shoreline stabilization	70 percent State cost-share assistance for projects not involving construction, requiring a 30 percent local match; 50 percent State cost-share assistance for projects involving construction, requiring a 50 percent local match
50	WDNR	Surface Water Grant Program	Counties, cities, local units of government, lake associations, natural resource agencies, and town sanitary districts	1. Habitat protection 2. Reduce runoff 3. Best management projects 4. Comprehensive planning 5. Education and outreach	Cost-share, DNR provides 67 percent cost-share for planning grants and 75 percent for management grants
51	WDNR	Urban Forestry Grant and Urban Forestry Catastrophic Grants	Cities, villages, towns, counties, tribes and 501(c)(3) nonprofit organizations	1. Depends based on whether Regular Grant, Startup Grant, or Catastrophic Storm Grant. 2. Community tree management, maintenance or education within Wisconsin cities, villages or other areas of concentrated development	Competitive cost-share grants of up to $25,000
52	WDNR	Wisconsin Forest Landowner Grant Program	Individual landowners with a Forest Stewardship Plan prepared by a forester	1. Stream buffer establishment 2. Streambank stabilization 3. Wetland restoration	Up to 50 percent cost-share assistance; 50 percent local match is required

Table continued on next page.

Table G.1 (Continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided
53	Wisconsin Department of Transportation (WisDOT)	Disaster Damage Aids	Local governments. Road must be closed or rendered impassable due to the disaster damage or damaged caused by government emergency response units	1. Road repair and maintenance to any highway that is not on the State Trunk Highway System	1. For claims with final costs, applicant receives 75 percent of replacement costs plus 50 percent of improvement costs 2. For claims ≤ $15,000, applicant may accept payment equal to 75 percent of WisDOT's estimate for all repairs (replacement and improvement), which may include final costs if available. 3. For claims submitted for damage by any governmental unit in response to the disaster, applicant receives 70 percent of replacement. 4. 4. If Federal-aid is granted for damage reimbursement, it shall be in lieu of aid otherwise available under DDA.
54	WisDOT	Emergency Relief Program	Roadway or roadway structure damage on Federal-Aid highways (Major collectors and above) resulting from a natural disaster. Governor's State of Emergency Declaration required	1. Repair physical damage 2. Debris removal 3. Traffic control and detour signing	Emergency repairs are 100 percent covered if done within 180 days of the event, otherwise paid on prorated basis. Permanent restorations projects are 90/10 (Interstate) or 80/20 (non-Interstate).
55	WisDOT	Local Bridge Improvement Assistance	Counties, cities, villages, and towns are eligible for rehabilitation funding on bridges with sufficiency ratings of 80 or less, and replacement funding on bridges with sufficiency ratings less than 50.	Rehabilitate and replace very deficient existing local bridges on Wisconsin's local highway systems	Both federal and state funds are allocated by formula to each county based on the statewide proportional share of bridge replacement costs
56	WisDOT	Local Roads Improvement Program	Local governments	1. Road construction 2. Road maintenance 3. Snow plowing 4. Shoulder grading 5. Pavement marking 6. Curb and gutter repairs	Reimbursement cannot exceed 50 percent of the total eligible project costs
57	WisDOT	Surface Transportation Program- *Rural Roads*	State governments	Projects to improve roads and streets in rural areas classified as principal arterial, minor arterial, or major collector	Program funding depends on state biennial budget and federal reauthorization

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Table G.1 (Continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided
58	WisDOT	Surface Transportation Program- *Local Roads*	Outside urban areas with a population less than 50,000	Projects aimed to improve roads and streets classified as rural minor collector and local streets	For federal funds projects cannot exceed $500,000 or be less than $250,000 Final funding availability will be determined based on upcoming congressional and state legislative action
59	Wisconsin Emergency Management (WEM)	Wisconsin Homeland Security Grant Program	State and local government units that must comply with HSPD-5	1. NIMS and ICS training courses 2. Funds purchase of equipment	Statewide $3,980,000 will be available
60	Wisconsin Public Service Commission	Telecommunications, Water, Energy Divisions	Local governments	Incorporate disaster resilience into regulation development, land use practices and environmental impacts of public utilities	General Utility Assistance
61	National Fish and Wildlife Foundation (NFWF)	Wal-Mart Stores, Inc. Acres for America Program	State and local units of government, nonprofit organizations, Indian Tribes, educational institutions	Acquisition of permanent easement for conservation of habitat	$3.5 million available nationally annually; minimum 1:1 match ratio required; higher local match preferred
62	NFWF	Five-star and Urban Waters Restoration Grant Program	Nonprofit organizations, local governments, municipal governments, Indian tribes, educational institutions	1. Wetland restoration projects 2. Riparian restoration projects 3. Coastal and forest restoration projects 4. Projects must be part of a larger watershed project 5. Projects must have at least five contributing parties	$2,000,000 available nationally annually; project awards range from $20,000 to $50,000, average award $30,000; 1:1 non-federal match ratio required; higher local match preferred
63	Ozaukee/Washington Land Trust	Stewardship Grant Program, Urban Green Space Program	Land trusts, local units of government, and nonprofit organizations	1. Land acquisition for greenway space in urban areas 2. Protection of scenic or ecological features 3. Wildlife habitat improvement	Funding depends on specific projects
64	State Farm	State Farm Community Grants	Government entities, educational institutions, 501(c)(3) nonprofit organizations, 501(c)(4) volunteer fire companies, 501(c)(6) chambers of commerce	1. Auto and road safety 2. Teen driver education 3. Home safety and fire prevention 4. Disaster preparedness and recovery	Grants of $5,000 or more

Note: Cost-share and local match requirements reported in this table can vary depending on specific details for individual projects.

[a] *The non-Federal share is 25 percent. In Wisconsin, the State Division of Emergency Management pays 12.5 percent, and the local community pays 12.5 percent.*

[b] *Funding available on an annual basis.*

[c] *Municipalities must have a flood mitigation plan to be eligible for a project grant.*

[d] *In kind services are allowed as a part of the local cost-share assistance.*

Source: FEMA, Department of Homeland Security, U.S. Environmental Protection Agency, Wisconsin Department of Natural Resources, U.S. Department of Justice, Wisconsin Emergency Management, the State of Wisconsin and SEWRPC

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SEWRPC Community Assistance Planning Report No. 326 (2nd Edition)

WASHINGTON COUNTY HAZARD MITIGATION PLAN UPDATE

Appendix H

WASHINGTON COUNTY COMMUNITY CAPABILITY ASSESSMENT

Each Community has a unique set of capabilities available to them to accomplish mitigation and reduce long-term vulnerability to natural hazard events. These capabilities include authorities, policies, programs, staff, technical knowledge, and funding, among others. Reviewing existing capabilities allows for identifying areas where increased capacity may improve a community's ability to reduce risk. As a part of this Hazard Mitigation Plan Update, Local Planning Team members were asked to participate in an online Community Capability Assessment. The questions asked within that assessment are provided below.

1. Please indicate which community you are representing (include municipality and department/jurisdiction).

2. **Planning:** What planning capabilities does your community have to implement hazard mitigation strategies?

	Yes	No	Unsure
Comprehensive Plan or Community Master Plan			
Capital Improvement Plan			
Economic Development Plan			
Local Emergency Operations Plan			
Continuity of Operations Plan			
Transportation Plan			
Stormwater Management Plan			
Disaster Recovery Plan			
Watershed Restoration Plan			
Other			

3. **Ordinances/Zoning:** What ordinances/zoning capabilities does your community have to implement hazard mitigation strategies?

	Yes	No	Unsure
General Zoning Ordinances			
Building Code			
Floodplain Zoning			
Shoreland or Shoreland/Wetland Zoning			
Farmland Preservation Programs			
Other			

4. **Personnel/Technical:** What personnel/technical capabilities does your community have to implement hazard mitigation strategies?

	Yes	No	Unsure
Designated Emergency Management Manager			
Planner/Engineer with land development knowledge			
Engineer/other professional with building and infrastructure cost training			
Planner/Engineer with understanding of natural hazards			
Public Works			
Building Inspector or Official			
Floodplain Manager or Administrator			
Grant writing			
GIS analysis			
Hazard data and information			
Warning systems/services			
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)			
Mutual aid agreements			
Other			

5. **Financial/Funding:** What financial/funding capabilities does your community have to implement hazard mitigation strategies?

	Yes	No	Unsure
Capital Improvements Project Funding			
Authority to levy taxes for special purposes			
Stormwater Utility Fee			
Community Development Block Grant			
Fees for water, sewer, gas, or electrical services			
Impact fees for new development			
Other			

6. **Outreach/Engagement:** What outreach/engagement capabilities does your community have to implement hazard mitigation strategies?

	Yes	No	Unsure
Staff with knowledge in natural hazards to attend community gatherings			
Ongoing public education or informational programs (e.g., household preparedness, fire safety)			
Local citizen or nonprofit groups focused on vulnerable populations			
Local citizen or nonprofit groups focused on environmental protection			
Local citizen or nonprofit groups focused on emergency preparedness			
Municipal newsletter			
Emergency notification apps			
Other			

7. **Community Capacity:** Considering the five categories of community capabilities, rate the capacity of your community to implement hazard mitigation projects and strategies.

	Low	Moderate	High
Planning			
Ordinances/Zoning			
Personnel/Technical			
Financial/Funding			
Outreach/Engagement			

8. **Planning:** List specific planning capabilities that, if improved upon, would advance your community's ability to implement hazard mitigation projects or strategies.

9. **Ordinances/Zoning:** List specific ordinances/zoning capabilities that, if improved upon, would advance your community's ability to implement hazard mitigation projects or strategies.

10. **Personnel/Technical:** List specific personnel/technical capabilities that, if improved upon, would advance your community's ability to implement hazard mitigation projects or strategies.

11. **Financial/Funding:** List specific financial/funding capabilities that, if improved upon, would advance your community's ability to implement hazard mitigation projects or strategies.

12. **Outreach/Engagement:** List specific outreach/engagement capabilities that, if improved upon, would advance your community's ability to implement hazard mitigation projects or strategies.

13. **Greatest Needs:** What do you consider the top three needs to improve your community's capacity to implement hazard mitigation projects and strategies?

Summary of Washington County Community Capability Assessment Results

There was a total of twelve participants in the Washington County Community Capability Assessment. In the responses below, boxes highlighted yellow indicate the majority of the communities feel this item is needed to enhance hazard mitigation implementation.

1. Please indicate which community you are representing (include municipality and department/jurisdiction).

   The following communities and agencies participated in the Community Capability Assessment:

   - Washington County Highway Department
   - Washington County Emergency Management (2)
   - Washington County Community Development Department
   - Volunteer member of the Washington County Local Emergency Planning Committee (LEPC)
   - City of West Bend
   - City of Hartford
   - Village of Slinger
   - Village of Newburg
   - Village of Kewaskum
   - Village of Germantown
   - Town of Polk

2. **Planning:** What planning capabilities does your community have to implement hazard mitigation strategies?

	Responses		
	Yes	No	Unsure
Comprehensive Plan or Community Master Plan	11	1	0
Capital Improvement Plan	10	1	1
Economic Development Plan	4	4	4
Local Emergency Operations Plan	10	2	0
Continuity of Operations Plan	8	3	1
Transportation Plan	6	5	1
Stormwater Management Plan	8	2	2
Disaster Recovery Plan	6	3	3
Watershed Restoration Plan	4	4	4
Other (see below)	1	0	11

Other: Land and Water Resource Management Plan

3. **Ordinances/Zoning:** What ordinances/zoning capabilities does your community have to implement hazard mitigation strategies?

	Responses		
	Yes	No	Unsure
General Zoning Ordinances	9	1	2
Building Code	10	0	2
Floodplain Zoning	11	0	1
Shoreland or Shoreland/Wetland Zoning	9	2	1
Farmland Preservation Programs	1	8	3
Other	0	2	10

4. **Personnel/Technical:** What personnel/technical capabilities does your community have to implement hazard mitigation strategies?

	Responses		
	Yes	No	Unsure
Designated Emergency Management Manager	11	0	1
Planner/Engineer with land development knowledge	12	0	0
Engineer/other professional with building and infrastructure cost training	11	0	1
Planner/Engineer with understanding of natural hazards	7	2	3
Public Works	11	0	1
Building Inspector or Official	8	3	1
Floodplain Manager or Administrator	5	2	5
Grant writing	8	2	2
GIS analysis	9	3	0
Hazard data and information	5	2	5
Warning systems/services	12	0	0
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	12	0	0
Mutual aid agreements	11	0	1
Other (see below)	0	1	11

Other: Town of Polk is in partnership with the Washington County GIS services

5. **Financial/Funding:** What financial/funding capabilities does your community have to implement hazard mitigation strategies?

	Responses		
	Yes	No	Unsure
Capital Improvements Project Funding	11	0	1
Authority to levy taxes for special purposes	7	1	4
Stormwater Utility Fee	6	5	1
Community Development Block Grant	2	4	6
Fees for water, sewer, gas, or electrical services	6	5	1
Impact fees for new development	6	2	4
Other	0	2	10

6. **Outreach/Engagement:** What outreach/engagement capabilities does your community have to implement hazard mitigation strategies?

	Responses		
	Yes	No	Unsure
Staff with knowledge in natural hazards to attend community gatherings	10	1	1
Ongoing public education or informational programs (e.g., household preparedness, fire safety)	7	2	3
Local citizen or nonprofit groups focused on vulnerable populations	6	2	4
Local citizen or nonprofit groups focused on environmental protection	5	2	5
Local citizen or nonprofit groups focused on emergency preparedness	7	2	3
Municipal newsletter	11	0	1
Emergency notification apps	3	5	4
Other	0	2	10

Other: Town of Polk Municipal Newsletter will be resurrected in 2024

7. **Community Capacity:** Considering the five categories of community capabilities, rate the capacity of your community to implement hazard mitigation projects and strategies.

	Responses		
	Low	Moderate	High
Planning	3	7	2
Ordinances/Zoning	2	5	5
Personnel/Technical	2	7	3
Financial/Funding	3	8	1
Outreach/Engagement	3	6	3

8. **Planning:** List specific planning capabilities that, if improved upon, would advance your community's ability to implement hazard mitigation projects or strategies.

Responses:

- Village of Slinger is looking at the possibility of expanding planning operations

- Increased communication between the Emergency Management Office, County Engineers, and the Community Development Department on hazard mitigation projects, outreach efforts, and research on funding opportunities/grant writing

- Town of Polk working in conjunction with Washington County

9. **Ordinances/Zoning:** List specific ordinances/zoning capabilities that, if improved upon, would advance your community's ability to implement hazard mitigation projects or strategies.

   Responses:

   - Town of Polk update of ordinances to be completed by August 2024
   - Towns amending their zoning ordinances to create farmland preservation zoning districts
   - Improve floodplain zoning in Village of Newburg
   - An individual in Village of Kewaskum just focused on municipal zoning/ordinances which is currently shared between Police Chief and Village Administrator

10. **Personnel/Technical:** List specific personnel/technical capabilities that, if improved upon, would advance your community's ability to implement hazard mitigation projects or strategies.

    Responses:

    - Town of Polk working in partnership with Washington County
    - Village of Newburg floodplain manager and a dedicated emergency services director
    - Municipal fire department vs the contracted private fire company
    - Additional emergency management personnel
    - Provide shared planning/engineer professionals that Washington County municipalities could utilize for project specific work such as updating their zoning ordinance or creating stormwater management plans

11. **Financial/Funding:** List specific financial/funding capabilities that, if improved upon, would advance your community's ability to implement hazard mitigation projects or strategies.

    Responses:

    - Town of Polk will need a referendum to increase

    - Village of Newburg stormwater utility program

12. **Outreach/Engagement:** List specific outreach/engagement capabilities that, if improved upon, would advance your community's ability to implement hazard mitigation projects or strategies.

    Responses:

    - Greater coordination between local hazard preparation/mitigation non-profits and the Emergency Management Office

    - Continued community communication

    - Aging population group and at-risk mental health population

13. **Greatest Needs:** What do you consider the top three needs to improve your community's capacity to implement hazard mitigation projects and strategies?

    Responses:

    - Washington County Highway Department
        1) Coordination with DNR for spills
        2) Follow-up from DNR on spills

    - Washington County Emergency Management
        1) Better "buy in" from local municipalities – most are unable to afford and/or justify project grant match amounts
        2) Public awareness of long term deferred projects
        3) Increased stress on environment from development, future risk without mitigation projects related to flooding and individual destructive events

- Washington County Community Development Department
  1) Coordination within County Departments and coordination between the County and municipalities
  2) Applying for grants/funding jointly when able or providing letters of support for Washington County municipalities (if applicable)
  3) Hire additional emergency management staff

- Volunteer Member of the Washington County LEPC
  1) Need enhanced collaboration, cooperation, and communication between and among Washington County and its multiple municipal jurisdictions
  2) "Collaboration is a force multiplier" – the late General Colin Powell, former Chairman of the Joint Chiefs of Staff and U.S. Secretary of State

- City of West Bend
  1) Unsure

- City of Hartford
  1) Need assistance with updating the City's Emergency Operations Plan
  2) Need guidance on how to utilize zoning for emergency preparedness
  3) Could use financial assistance to mitigate vulnerable property and populations

- Village of Slinger
  1) Training for staff to become more familiar with hazard mitigation methods
  2) Information on outreach possibilities and programs
  3) Funding for both of the above

- Village of Newburg
  1) Staffing
  2) Volunteer groups

- Village of Kewaskum
  1) Time
  2) Personnel
  3) Funding

- Village of Germantown
    1) Unsure

- Town of Polk
    1) Funding for fire and EMS services

All of the responses and input provided by the participating Local Planning Team members in this assessment provided more context and information to the staff preparing this Washington County Hazard Mitigation Plan Update.