



Wisconsin Flood Resilience Scorecard

A guided conversation for local officials to improve flood-related health outcomes in their community

Module 1



WISCONSIN DEPARTMENT
of HEALTH SERVICES



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Introduction

Welcome to the Wisconsin Flood Resilience Scorecard (FRS). By completing this guide, local governments will be able to:

- Gather valuable information about flood vulnerability in their community;
- Identify potential sources of vulnerability; and
- Consider recommendations for improvement on a variety of scales.

The FRS can support communities in preparing for flooding events, such as the 2008 flooding experienced in southern Wisconsin. This guide is not designed to address catastrophic events such as a 500-year flood.

This guide is intended for use by Wisconsin public officials in local government. This guide will refer to counties and municipalities collectively as "communities". It is intended to be comprehensive, encompassing three categories of vulnerability:

Module 1: Environmental - Physical and natural landscape characteristics such as soil and slope

Module 2: Institutional - Government and infrastructural capacity and content of existing policies and community plans

Module 3: Social - Cultural and socioeconomic sources of vulnerability and the potential for community partnerships



Public officials benefit from completing all three modules; however, each can be considered independently if only certain portions are of interest. While flooding intensity and the severity of outcomes are influenced by a variety of factors, this guide focuses specifically on reducing the quantity of floodwater.

Ultimately, this guide will help decision makers prioritize projects for improving flood resilience. The benefits of flood resilience are many: limiting the adverse impacts of excess runoff into streams, reducing the financial burden of replacing damaged infrastructure and homes, and limiting negative public health outcomes.

Flooding in Wisconsin

Wisconsin has an abundance of water features, including 15,000 lakes and 84,000 miles of river (Wisconsin Department of Natural Resources, 2020), which provide livelihoods and recreation for its residents. While this water contributes to rich agriculture, fishing and boating, and ample clean drinking water, it also presents a challenge as detrimental flooding events become increasingly common across the state.



According to the Pew Charitable Trusts, flooding is the costliest and most common natural disaster in the United States (The Pew Charitable Trusts, 2019). In 2013 Americans spent approximately \$400 per household in an average year on such extreme weather events but expenses have likely increased with increasing frequency of natural disasters (Weiss & Weidman, 2013). Flooding was a principal cause of damage in 32 of 46 presidential disaster declarations and one of six presidential emergency declarations in Wisconsin from 1971 through June 2016 (Wisconsin Emergency Management & State of Wisconsin Homeland Security Council, 2017).

As an example, unprecedented amounts of rain tore through southern Wisconsin in August 2018, resulting in more than \$200 million of dollars in damage (Kirwan & The Associated Press, 2018), as well as a statewide state of emergency declaration from Governor Scott Walker (Federal Emergency Management Agency, 2018). While average precipitation in the city of Madison for the month of August is 4.27 inches (National Oceanic and Atmospheric Administration, 2010), the storm hitting August 20th -21st of 2018 brought 11 inches in a 24-hour period (National Weather Service & National Oceanic and Atmospheric Administration, 2018b, 2018a). The official all-time Wisconsin 24-hour rainfall record is 11.72 inches from 1946, but during the August 2018 storm unofficial measurements reached up to 15 inches west of Madison in the Cross Plains area (Burt, 2019). Exacerbating these issues are the predictions that these extreme flooding events are only anticipated to increase in the coming years.

Recent climate modeling predicts that high-intensity storms and subsequent flood events are likely to increase throughout the Upper Midwest, including Wisconsin (Wisconsin Initiative on Climate Change Impacts, 2020). While temperatures have been increasing throughout the state over the past century, precipitation patterns are more difficult to predict (Wisconsin Initiative on Climate Change Impacts, 2020). Over the past 70 years, annual precipitation has increased approximately 15%, or on average 4.5 inches throughout the state (Wisconsin Initiative on Climate Change Impacts, 2020). However, these trends are not uniform, with western and south-central Wisconsin seeing the wettest conditions and the north experiencing a drying trend (Wisconsin Initiative on Climate Change Impacts, 2020). Some of Wisconsin's most populous cities can be found in these wettest areas. Wisconsin public officials will need to consider these conditions when creating emergency preparedness, hazard mitigation and management plans, and developing policies.



Creating policies, retrofitting existing structures, and developing green infrastructure solutions comes at a cost, but these steps are essential if communities hope to withstand the natural hazards of the future. Ultimately, investing in solutions earlier will minimize the much greater costs that result from damage after an event has already occurred.

Public Health Effects of Flooding

Not only does flooding damage physical infrastructure, it can contribute to adverse health impacts for some of the state's most vulnerable populations. Flooding is the one of the greatest causes of death associated with natural disasters in the United States (Greenough et al., 2001). This includes both direct and immediate effects as well as indirect, long-term consequences. Direct effects may include drowning, electrical injuries associated with standing water, blunt trauma from objects caught in a storm surge and hypothermia (Greenough et al., 2001). People seeking medical care may also have difficulty accessing care during a flood event (Du et al., 2010), and the effects of flooding can continue to plague individuals for days, months, or even years. Floods can damage critical facilities such as hospitals and nursing homes, which makes routine care for patients with chronic diseases exceedingly difficult. Health facilities, overwhelmed by flood victims and physical damage, may lose medical records or have very limited resources to treat patients while also conducting surveillance on exposures to toxic materials or waterborne diseases (Du et al., 2010).

While contact with floodwaters alone may not pose health risks, sewage overflows may contaminate the water with pathogens such as *Escherichia coli*, *Salmonella*, and the hepatitis A virus (Du et al., 2010). Floodwaters can also flow through industrial sites and spread chemicals and other hazardous materials (Du et al., 2010). Overcrowded conditions and lack of sanitary facilities contribute to spread of communicable diseases, and stagnant water allows for the breeding of many disease vectors such as mosquitoes (Du et al., 2010). Finally, if cleanup is not conducted shortly after the flood event (a challenge for financially limited communities), mold is able to grow in damaged buildings. This results in the exacerbation of respiratory conditions such as asthma (Du et al., 2010).

There is also growing interest in the mental health impacts of flooding. Those who experience flood events report higher levels of depression, anxiety, and post-traumatic stress disorder (Waite et al. 2017). If a flooded individual also experiences utility disruptions, their poor mental health outcomes are even greater (Waite et al. 2017). People who are displaced from their homes due to flooding also report higher depression, anxiety, and post-traumatic stress disorder (Munro et al. 2018). French et al. (2019) also found that repeat flood victims may experience slightly higher levels of reported poor mental health. This may be important in considering health equity, as individuals who lack the means to relocate may be more susceptible to repeat flood events.

It is in the best interests of community members, local government and public health officials to minimize these adverse effects by putting preventative measures in place before events occur.

What to Expect from this Guide

Each module of this guide contains the following:

- A “Before you Begin” section explaining why to use this module, who should complete it and what that person or persons will need in order to complete it;
- Definitions and acronyms that will be used throughout the module;
- The module itself;
- A series of recommendations;
- And additional resources.

It is our intention that upon completion of this guide, a community will be able to choose from a variety of solutions and tailor them to be most appropriate for their financial and administrative capacity. The results can also be used to build support from regional partners and to apply for state and federal grant opportunities. Each community may find it appropriate for different staff members to complete the guide — we have provided a partial list of potentially suitable officials at the top of each module. Because this guide was designed to be comprehensive, it is possible that certain portions are not applicable to every community or that certain portions have already been thoroughly examined by a community in the recent past. Each community can customize this guide as is sensible for their needs.

Who Should Participate

The Scorecard was designed for use by public officials and local government staff. It is up to those leading the process to recruit a team of people with the backgrounds and experiences necessary to complete this Scorecard. The Scorecard requires knowledge of the technicalities of infrastructure, zoning, and policy as well as knowledge of community inner workings and relationships. Those on your staff with water resources, engineering, planning, zoning, emergency management and/or community organizing experience are recommended. Other community members, e.g., those who lead health programs and long-time residents, may also be important contributors to this process because of their first-hand experiences living and working in the community.



While every community is encouraged to use the Flood Resilience Scorecard, we recognize some limitations in the usability of the FRS for tribal nations of Wisconsin. Wisconsin has an important population of Indigenous people among 11 federally recognized tribes that have faced severe flood events exacerbated by systemic inequities. The FRS relies on a significant amount of mapping and, in its current form, is tailored for Wisconsin's incorporated municipalities and counties. This inherently leaves some circumstances and institutional conditions of tribal nations unaddressed.

For example, many tribes are geographically dispersed. A reservation can include many other jurisdictions, making it difficult to assess vulnerabilities or makes changes within jurisdictional lines. Similarly, tribal nations have had a historically strained relationship with FEMA, limiting available mapping technologies of floodplains in reservations. Equally important to note is the historical reality of trauma and miscommunication tribes have experienced. Tribal communities' possible mistrust, particularly for government agencies and their work, is levied through centuries of violence, abuse, and mistreatment, often a result of state and federal governments impinging on tribes' sovereignty. While the FRS may not be perfectly applicable, it can still serve as a resource to tribes. One benefit of this tool is how it is rooted in the individual community. By using local knowledge and experts who know your community best, it gives a sense of control and agency in flood resilience.

Tribes are encouraged to participate and can contact Maggie Thelen at Margaret.thelen@dhs.wisconsin.gov if interested in exploring how this document can be adapted to a specific tribe.

Scoring

Questions are equally weighted within the guide. It does not result in a numeric score, instead, if a community does not reach a particular threshold of favorably answered questions, they will be redirected to the appropriate recommendations section. For example, if a community has scored poorly on the “Resource Inventory and Monitoring” section of the Institutional module, the corresponding “Resource Inventory and Monitoring” section of recommendations should be consulted. Some strategies are relatively inexpensive, whereas others require a greater amount of money, staff, and technological capacity. It is possible to increase flood resilience with a variety of tools and strategies.

There are dozens of resources to be found online that can provide more information than is contained in this guide alone. Many of these tools and data, including from the Federal Emergency Management Agency (FEMA), the National Oceanic and Atmospheric Administration (NOAA), the Wisconsin Department of Natural Resources (DNR) and many other authorities can be found in the Recommendations section.

The causes and effects of floods are complex and interconnected; it can be difficult to anticipate where and when flooding will occur and what strategies can ensure community resilience. However, this guide provides a foundation of concepts that are appropriate for communities both unfamiliar and well-versed in flood hazard mitigation.

Flood Resilience Scorecard Data Companion

Many of the questions in this guide request data that is publicly available but often difficult to obtain, analyze or interpret. To make these data more accessible to the users of the Flood Resilience Scorecard, the developers of this guide created the Flood Resilience Scorecard Data Companion.

The Data Companion is a separate document that contains 32 data points that serve as answers to questions in this guide. The Data Companion is specific to your community, with a unique document for all 72 counties and more than 600 cities and villages in the state. If you would like to access your Data Companion, contact Margaret Thelen, Climate and Health Program Coordinator at the Wisconsin Department of Health Services, at Margaret.Thelen@dhs.wisconsin.gov.

The 32 data points provided in the Data Companion are coded to align with the question number in this guide. For example, question E-B3 in this guide related to steep slopes can be answered with the information found in the Data Companion listed as E-B3. Questions in this guide that refer to information that can be found in the Data Companion will be noted with the symbol found to the right.

The Data Companion is currently only available for incorporated municipalities (cities and villages) and counties in Wisconsin. Other jurisdictions such as towns or watersheds, are encouraged to use the Flood Resilience Scorecard using the Data Instruction Manual described below.



Flood Resilience Scorecard Data Instruction Manual

Although the Flood Resilience Scorecard Data Companion is only available for municipalities and counties in Wisconsin, other communities and jurisdictions such as towns and watersheds are encouraged to participate. In absence of the Data Companion, we created the Flood Resilience Scorecard Data Instruction Manual.

The Data Instruction Manual details how to access the data required in a step-by-step walkthrough. For each question in this guide that contains the Data Companion logo shown above, you may also use the Data Instruction Manual to access the data for yourself. The Data Instruction Manual is for users both with and without access to Geographic Information Systems (GIS).

Acknowledgments

This Scorecard was initially developed by Haley Briel as a professional project for M.S. completion with the Department of Planning and Landscape Architecture at the University of Wisconsin – Madison. Further development of the guide, including its current iteration, has been completed by the Climate and Health Program at the Wisconsin Department of Health Services (DHS). Editing and professional expertise have been provided by:

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- The Climate and Health Program's Science Advisory Group members; and
- The University of Wisconsin Sea Grant Institute.

Many thanks are in order to these individuals and organizations for their insight in developing this guide. For questions or comments concerning this guide, please contact Margaret Thelen, Climate and Health Program Coordinator, at Margaret.Thelen@dhs.wisconsin.gov.

Module One: Environmental

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Overview

Topographic, climatic and land cover features are key factors in assessing flood vulnerability for a region or municipality. The composition of the landscape itself, in addition to precipitation patterns, contributes to whether a community will experience recurrent flooding. The physical parameters assessed in this module include the following.

Precipitation Patterns

- Precipitation patterns are determined by the volume, distribution, intensity, duration and frequency of rainfall events. They assess the ways in which water is distributed above and below the land surface.
- Rain is most damaging in events where high volumes of water fall over a short time period. These sorts of events are projected to increase in Wisconsin, so it is important that communities prepare for both current conditions and predicted future scenarios.

Slope & Elevation

- Slope refers to the steepness of a land surface, and elevation is height above sea level.
- Flooding can destabilize hillside soils and cause landslides, especially during rain events, so development should be avoided on slopes and low-lying areas at the bottom of slopes to reduce damage.

Land Use & Future Development

- As communities develop, a larger portion of land is covered by impervious surfaces that do not allow water to flow through them and into the ground, leading to increased velocity of stormwater moving downstream and more flooding.
- Solutions such as implementing green infrastructure or requiring developers to create water storage elsewhere to compensate for their impervious surfacing can help reduce harmful floods.

Soils

- Soil can store excess water within pores to mitigate some effects of flooding; soils with larger pore space, like soils with high gravel content, allow floodwater to infiltrate the ground more rapidly.
- Vegetative cover can take in excess water through plant roots and help prevent surface soil erosion and runoff.

Agricultural Practices

- In areas with intensive agriculture, certain practices can cause soil compaction, leading to less water storage capacity and erosion, which can pollute waterways and damage habitat.
- Careful planning of equipment usage and best management practices, such as no-till or minimal till regimes, can help avoid compaction and erosion.

Who Should Complete This Assessment?

One or more of the following individuals may be appropriate to conduct this assessment:

- Floodplain manager
- GIS technician
- Civil or city engineer
- Stormwater utility/public works
- City planner
- Regional planner or natural resources management staff



What Will you Need to Complete This Assessment?

- The Flood Resilience Data Companion for your community
- Maps of your community indicating locations of key infrastructure, such as hospitals, schools and government buildings
- Topographic maps of your community indicating areas of high slope
- Flood Insurance Rate Maps (FIRMs) from FEMA
 - » A FIRM is an official map of a community on which FEMA has delineated both the special hazard areas and the risk premium zones applicable to the community
 - » Full FIRM panels are 36"x25.875," so most users prefer to print a smaller version called a FIRMette which is adapted to print on a standard home printer.
 - » Individual maps can be downloaded from msc.fema.gov by entering an address or place in the search bar. Then, click the "DYNAMIC MAP PRINT MAP/FIRMette" button to download and print your map or maps. Some communities may be small enough that their entire area is contained within one map.
- Land cover data
- Population projections
- Soil maps
- Community agricultural standards, requirements and best management practices

Definitions

1% annual chance flood event: A flood event which has a 1 in 100 probability of being equaled or exceeded in any given year, also referred to as a 100-year flood or base flood.

Zone A: Areas subject to inundation by the 1% annual chance flood event. Detailed hydraulic analyses have not been performed, so no base flood elevations (BFEs) or flood depths are shown.

Zone AE: Areas subject to inundation by the 1% annual chance flood event determined by detailed methods. Base flood elevations (BFEs) are shown.

Base flood elevation (BFE): According to FEMA, “the elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year” (FEMA, 2020a). The BFE is a regulatory requirement for the elevation or floodproofing of structures. In Wisconsin, this may also be referred to as the regional flood elevation. Flood protection elevation is two feet above the regional flood elevation.

Best management practices: Best management practices (BMPs) are defined as “a practice, or combination of practices, that is determined to be an effective and practicable (including technological, economic, and institutional considerations) means” (North Carolina Forest Service, 2006) for meeting goals; for the purpose of this assessment, this goal is reducing flood impacts.

Clay: A very fine-grained soil consisting of particles less than 0.002 mm in diameter (Soil Science Society of America, 2008).

Cover crop: A crop planted primarily to manage soil erosion, fertility, quality, water, and biodiversity within an ecosystem. While they sometimes are harvested for yield, this is not their main function.

Critical infrastructure: Facilities that provide essential services and are necessary for community security, health and safety. This includes emergency shelters, nursing homes, public buildings, schools, hospitals, fire and rescue stations, police stations, water treatment/sewage processing plants, utilities, railroad stations, airports, government facilities and major roadways (Department of Homeland Security, 2020).

Environmental corridor: There are both primary and secondary environmental corridors. Primary environmental corridors are concentrations of significant natural resources at least 400 acres in area, at least two miles in length and at least 200 feet in width. Secondary environmental corridors are concentrations of significant natural resources at least 100 acres in area and at least one mile in length (Southeastern Wisconsin Regional Planning Commission, 2000).

FIRMs, or Flood Insurance Rate Maps: According to the FEMA website, “Official map of a community on which FEMA has delineated the Special Flood Hazard Areas, the Base Flood Elevations and the risk premium zones applicable to the community” (FEMA, 2020b).

FIRMette: A smaller version of a FIRM that is scaled to be printable on a normal home printer.

Flood fringe: A portion of floodplain outside of a floodway including 1% annual chance flood hazard zones and 0.2% annual chance flood hazard zones. Here, lands will likely be inundated in a $\leq 0.2\%$ annual chance flood. Buildings or fill here will replace open land areas that can store waters and may increase flood levels elsewhere.

Floodway: The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. Buildings or fill in this area will increase the BFE. Floodways are often labeled as “Zone A” (meaning 1% annual chance of flooding, no elevation data) or “Zone AE” (meaning 1% annual chance of flooding and elevation data available) on FIRMs.

Impervious surface: According to the Code of Federal Regulations, an “impervious surface” is that which does not permit the absorption of fluids. This largely includes human manufactured materials such as concrete, but may also include natural surfaces such as highly compacted clay soils or bedrock (Department of Agriculture, 2020).

Loam: A soil texture consisting of roughly equal portions of sand, silt and clay. It is considered to be moderately pervious.

Manure management plan: A plan created by facilities that have manure-producing animals or apply manure to crop fields. A manure management plan describes how the facility intends to store and apply manure so that it is used responsibly and cannot pollute nearby waterways.

No-till farming: Also referred to as zero tillage or direct drilling, no-till farming is a type of farming that either has limited or no mechanical agitation of the soil.

Nutrient management plan: A strategy developed by an agricultural producer to obtain maximum return from fertilizer resources in a manner that protects the quality of nearby water resources (University of Wisconsin, 1995).

Riparian buffer zone: Vegetated areas next to water resources that protect the water from nonpoint source pollution and provide bank stabilization and aquatic and wildlife habitat (North Carolina State Extension, 2017).

Rotational grazing: An agricultural practice in which livestock is moved between pastures in order to reduce overgrazing and soil compaction (Brantly, 2013).

Sand: A naturally occurring granular material composed of finely divided rock and mineral particles. It is defined by size, being finer than gravel and coarser than silt.

Silt: A soil texture that is larger than clay, but smaller than sand particles. Silt particles range between 0.0039 and 0.0625 millimeters.

V zones: Velocity zones subject to storm surge and wave action. Buildings here will likely be damaged or demolished in the event of a large storm unless constructed to certain high standards.

Wetland: A “wetland,” for the purposes of this document, is considered “an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation which has soils indicative of wet conditions” (Wisconsin State Statutes, 2019).



E-A) Precipitation Patterns

Information in this section is available in the Flood Resilience Scorecard Data Companion. You may also look for information related to precipitation trends and projections from the Wisconsin Initiative on Climate Change Impacts.

E-A1. Based on historic trends, how much average annual rainfall has your community received?

- A. 28-31 inches/year
- B. 31.01-34 inches/year
- C. 34.01-37 inches/year
- D. More than 37 inches a year



E-A2. What is the percentage increase in precipitation for your community since 1950?

- A. 0%
- B. 5%
- C. 10%
- D. 15% or more



E-A3. How is the frequency of heavy precipitation events anticipated to increase in your community?

- A. No increase predicted
- B. 0.4 to 2.0 days/decade
- C. 2.1-3.9 days per decade
- D. 4.0 or more days/decade



Scoring Precipitation Patterns

Review your responses to the questions in this section and sum the number of times you responded with each letter. Provide that number in the appropriate row to the right.

If you answered “c” or “d” to two or more questions, please refer to the Precipitation Patterns recommendations section on page 72.

Number of “a” answers: _____

Number of “b” answers: _____

Number of “c” answers: _____

Number of “d” answers: _____

E-B) Slope & Elevation

For this section, you should have a map of your community with critical infrastructure labeled. You should also have a topographic map indicating areas of steep slope (where the topographic lines are closest to one another). If this does not exist, a map indicating areas that have been known to erode or have landslides, even through anecdotal evidence, will suffice.

You will also need to download your community's Flood Insurance Rate Maps from FEMA. See directions for this in the box to the right.

Information in this section is available in the Flood Resilience Scorecard Data Companion.

Accessing Your Flood Insurance Rate Map

1. Visit FEMA's [National Flood Hazard Layer \(NFHL\) Viewer](#)
2. Zoom in to your community or type an address into the search bar in the top left
3. Click on the parcel of interest
4. Here you will be given the option to download county GIS data or download a PDF version of your map

E-B1. What portion of your community (total area) is located within a floodplain? This includes all areas zoned A or AE.

- A. We have no floodplain in our community
- B. Less than 10% of the community is within a floodplain
- C. Between 10-50% of the community is within a floodplain
- D. More than half of the community is within a floodplain



E-B2. Do critical structures (meaning hospitals, wastewater treatment centers, police stations and other structures essential to community function) fall within a floodplain?

- A. No critical structures are in a floodplain
- B. One or two critical structures are in a floodplain
- C. Multiple critical structures are in a floodplain



E-B3. What portion of your community (total area) is located on steep slopes (here meaning a slope greater than 10 degrees)?

- A. We have no steep slopes in our community
- B. Less than 10% of the community is on a steep slope
- C. Between 10-50% of the community is on a steep slope
- D. More than half of the community is on a steep slope



E-B4. Do critical structures (meaning hospitals, wastewater treatment centers, police stations and other structures essential to community function) fall on steep slopes (greater than ten degrees)?

- A. No critical structures are on a steep slope
- B. One or two critical structures are on a steep slope
- C. Multiple critical structures are on a steep slope

E-B5. Has your community experienced landslides in the past 50 years?

- A. No, we have not had landslides
- B. Yes, we have had minor landslides a few times
- C. Yes, we have had minor landslides frequently
- D. Yes, we have had at least one major landslide
- E. Yes, we have had major landslides frequently

Scoring Slope & Elevation

Review your responses to the questions in this section and sum the number of times you responded with each letter. Provide that number in the appropriate row to the right.

If you answered "c", "d", or "e" to three or more questions, please refer to the Slope & Elevation recommendations section on page 73.

Number of "a" answers: _____

Number of "b" answers: _____

Number of "c" answers: _____

Number of "d" answers: _____

Number of "e" answers: _____

E-C) Land Use & Future Development

For this section you will need land cover data. Land cover information can be found using the Wisconsin DNR's [Wisconsin Community Canopy Cover](#) look-up tables.

Here, you can either look up all municipalities within a county, or look up your community directly in the drop-down menus. For questions, contact Dan Buckler or a member of the Urban Forestry Team at Wisconsin DNR (Daniel.Buckler@wisconsin.gov).

You also need anecdotal information about population increases or about total development projects approved over the past ten years.

Information in this section is available in the Flood Resilience Scorecard Data Companion.

E-C1. What percentage of your community is listed as impervious surface?

- A. Less than 10 percent
- B. Between 10-25 percent
- C. Between 25-40 percent
- D. Over 40 percent



E-C2. What percentage of your community is listed as tree/shrub or grass/herbaceous?

- A. Over 40 percent
- B. Between 25-40 percent
- C. Between 10-25 percent
- D. Less than 10 percent



E-C3. Does your community have lakes, ponds, wetlands or other natural storage features in your community?

- A. No, we do not have any such features
- B. Yes, we have at least one of these features
- C. Yes, they constitute a sizeable portion (at least 10%) of our community

E-C4. Has the capacity for stormwater retention in these features been established?

- A. Yes, we have had professional engineering studies conducted to determine storage capacity of our water features
- B. Yes, we have had professional engineering studies conducted to determine storage capacity for at least one, but not all of our water features
- C. No, we have not conducted any professional engineering studies to determine storage capacity of our water features

E-C5. Is preservation of existing trees or increasing tree cover encouraged during development and redevelopment in your community?

- A. Yes
- B. Trees are encouraged for future development of new parcels, but not for existing development
- C. Trees are not mentioned in our development guidelines

E-C6. Is preservation or increase of native vegetation encouraged during development and redevelopment in your community?

- A. Yes
- B. Native vegetation is encouraged for future development of new parcels, but not for existing development
- C. Native vegetation is not mentioned in our development guidelines



E-C7. Does your community have any incentive programs for preserving or increasing tree cover and native vegetation?

- A. Yes, our community has a program to provide incentives
- B. No, but we actively use a state or federal incentive program
- C. No, we use no incentives program for this type of development

E-C8. What is the rate of conversion from non-urban (agriculture, conservation, open space, recreation) to urban land uses (commercial, industrial, residential) over the past 10 years in your community?

- A. Little to no conversion
- B. Minimal conversion
- C. Extensive conversion

E-C9. Using population projections and anecdotal evidence, what is the anticipated rate of conversion from non-urban (agriculture, conservation, open space, recreation) to urban land uses (commercial, industrial, residential) over the next 20 years in your community?

- A. Little to no conversion (Less than 5% growth)
- B. Minimal conversion (5 to 10% growth)
- C. Extensive conversion (More than 10% growth)



E-C10. Have areas that are likely to experience development over the next ten years been identified and mapped in your community?

- A. Yes
- B. Some, but not all
- C. No

E-C11. If yes, are these areas within the floodplain?

- A. No
- B. Some
- C. Yes

E-C12. Have environmental corridors been established within your community?

- A. Yes, and more are being developed
- B. Yes, at least one corridor exists
- C. No, no environmental corridors exist

Scoring Land Use & Future Development

Review your responses to the questions in this section and sum the number of times you responded with each letter. Provide that number in the appropriate row to the right.

If you answered "c" or "d" to six or more questions, please refer to the Land Use & Future Development recommendations section on page 73.

Number of "a" answers: _____

Number of "b" answers: _____

Number of "c" answers: _____

Number of "d" answers: _____

E-D) Soils

Information in this section is available in the Flood Resilience Scorecard Data Companion. If you do not have access to the Flood Resilience Scorecard Data Companion for your community, use the Data Instruction Manual or the USDA's Web Soil Survey to better understand the soils in your community and how they affect flood resilience. The directions to obtain these maps from the USDA's Web Soil Survey are below.

To access the USDA's Web Soil Survey:

1. Go to USDA's [Web Soil Survey](#)
2. Click the green button that says "START WSS."
3. Go to the "Area of Interest (AOI)" tab at the top left.
4. Under "Quick Navigation," click on "Address."
5. Type in the name of your community (ex. Platteville, Wisconsin) and click "View."
6. Click on the icon with a red rectangle and AOI in it in the toolbar under "Area of Interest Interactive Map."
7. Draw a rectangle that encompasses your community. (Note: if this isn't perfect, that is okay. We are hoping to get a broad understanding of soils here.) This will create your area of interest.
8. Click the tab "Soil Map." On the left-hand side of the screen, you will find a full list of soil types and their percentages in your area of interest. Note that this list is very comprehensive; if a soil type is listed as "Palsgrove silt loam, 2 to 6 percent slopes, moderately eroded," for example, just consider it "silt loam."

Soils can be categorized in a variety of ways. More permeable soils generally hold more water, meaning less runoff and greater flood resilience.

Soil Type	Water Permeability
Sand, loamy sand	Rapid/very rapid (>6 inches/hour)
Sandy loam	Moderately rapid (2-6 inches/hour)
Loam, silt loam	Moderate (0.6-2 inches/hour)
Sandy clay loam	Moderately slow (0.2-0.6 inches/hour)
Clay loam, silty clay loam	Moderately slow (0.2-0.6 inches/hour)
Sandy clay	Moderately slow (0.2-0.6 inches/hour)
Silty clay, clay	Very slow and slow (<0.2 inches/hour)

Table adapted from the Missouri Department of Elementary and Secondary Education "Soils Interpretation Help Sheet" (Missouri Department of Elementary and Secondary Education, 2008)

E-D1. What percentage of your community has poorly drained soils?

- A. Less than 5%
- B. Less than 10%
- C. Between 10 and 30%
- D. Between 30 and 50%
- E. More than 50%



E-D2. What percentage of your community has very poorly drained soils?

- A. None (0%)
- B. Less than 5%
- C. Between 5 and 10%
- D. More than 10%



E-D3. What percentage of your community contains soils with low (bottom quartile) available water storage?

- A. Less than 5%
- B. Less than 10%
- C. Between 10 and 30%
- D. Between 30 and 50%
- E. More than 50%



Scoring Soils

Review your responses to the questions in this section and sum the number of times you responded with each letter. Provide that number in the appropriate row to the right.

If you answered "c", "d", or "e" to two or more questions, please refer to the Soils recommendations section on page 74.

Number of "a" answers: _____

Number of "b" answers: _____

Number of "c" answers: _____

Number of "d" answers: _____

Number of "e" answers: _____

E-E) Agricultural Practices

For the section below, you will need to review your community's agricultural standards and requirements. While your community may not have specific regulations, you may fall under the jurisdiction of county-level regulations. You may find this information on your county's website. Contact your county conservation officer or the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) for more information. This section is most relevant for counties, but municipalities may choose to complete it as well.

Information in this section is available in the Flood Resilience Scorecard Data Companion.

E-E1. Does your community have a significant amount (over 10%) of pasture or cropland?

- A. Yes
- B. No

If you answered "No" to this question, skip to Module Two.



E-E2. Are agricultural best management practices (BMPs) promoted or enforced that reduce erosion, limit compaction, and/or promote infiltration?

- A. Financial incentives exist to implement them
- B. Outreach efforts exist to promote them
- C. They are permitted but not promoted
- D. They are not mentioned in any plans

E-E3. Does your community provide resources to producers in order to reduce erosion, limit compaction, and/or promote infiltration? This can include:

- Fund staff time to educate farmers on nonpoint source pollution BMPs and cost-share opportunities funding BMP installation
- Enforce an ordinance regulating manure and biosolids being stored and spread for agricultural purposes
- Provide training on nutrient management plan development and implementation

- A. We do all of the above and more
- B. We do all of the above
- C. We do one of the above, or we do something related but not listed here
- D. We do none of the above

E-E4. How commonly do agricultural producers in and around your community use practices to reduce erosion, limit compaction, and/or promote infiltration? These practices can include:

- No till
- Rotational/Managed Grazing
- Riparian buffer zones
- Contour strip cropping
- Cover crops

- A. Almost all producers implement these practices
- B. Most producers implement these practices
- C. Very few producers implement these practices
- D. These practices are uncommon in our community



E-E5. Does your community provide cost sharing, tax reductions or other incentives to encourage agricultural practices that reduce erosion, limit compaction, and/or promote infiltration?

- A. Yes, these programs are funded enough to meet demand
- B. Yes, we provide some financial support for these programs
- C. No, but we have staff that can provide technical assistance to implement these practices
- D. No, we provide no support for these programs beyond what is provided by state and federal dollars

E-E6. Does your community use any land use regulations or tools to preserve farmland? This can include farmland preservation zoning, transfer of development rights, and conservation easements.

- A. Yes, we actively use at least one tool to preserve farmland
- B. We have these tools available, but they are not widely used
- C. We encourage preservation but don't have any regulations or incentives to ensure it
- D. No, we don't actively engage in farmland preservation

E-E7. What percentage of cropland acres in your county are under a Nutrient Management Plan?

- A. More than 50%
- B. Between 35 – 50%
- C. Between 10 – 35%
- D. Less than 10%



Scoring Agricultural Practices

Review your responses to the questions in this section and sum the number of times you responded with each letter. Provide that number in the appropriate row to the right.

If you answered "c", "d", "e", or "f" to three or more questions, please refer to the Agricultural Practices recommendations section on page 74.

Number of "a" answers: _____

Number of "b" answers: _____

Number of "c" answers: _____

Number of "d" answers: _____

Number of "e" answers: _____

Number of "f" answers: _____

Recommendations

In this section, you will find recommendations, resources and contacts to learn more about how to improve your community's resilience to flooding. Recommendations are grouped into the same sections as the guide itself. Keep in mind that you may benefit from recommendations in a variety of sections, not just those that you were suggested for you based on your scoring during the assessment. It may be valuable to review all or many suggestions below before choosing the best course of action. Please note that this list of recommendations is not exhaustive and does not represent the full spectrum of possibilities for your community.

Module 1: Environmental

Precipitation Patterns

Flow modeling to properly site stormwater storage features

- Hire engineering consultants or partner with engineering/water resources students at a local university to model stormwater flow.
 - » ArcGIS, the [EPA's Storm Water Management Model](#) (SWMM), and [HydroCAD](#) have tools within it to conduct such an analysis. Price can vary among these products.
- Use models to determine where stormwater storage features would be most beneficial.
 - » There are many stormwater storage features available to you; some can be used as recreational areas in times of low flood risk.
 - » Some guidelines about retention features are provided by the EPA in their [Stormwater Wet Pond and Wetland Management Guidebook](#).
- Contact the National Weather Service to access more detailed local precipitation information.

Enhance and preserve natural habitat with water-storing capacity

- Enforce low-density or open-space development in floodplains (this can also be used as a Community Rating System credit).
- Increase tree cover and vegetation.
 - » The DNR's [Wisconsin Community Tree Map](#) allows you to see which trees are growing in your community and where and calculate the benefits that those trees offer. For more information, contact the [Urban Forestry Program](#) at Wisconsin DNR.
 - » The U.S. Forest Service's [i-Tree Landscape tool](#) can help you identify where and what type of trees could benefit your community. For more information, contact Dan Buckler at Daniel.Buckler@wisconsin.gov.
 - » Many cities provide tax rebates, stormwater fee discounts or stormwater credits for both preserving existing trees and planting new. One report that describes such programs is [Tree Credit Systems and Incentives at the Site Scale](#), prepared for Urban and Community Forestry, Vermont Department of Forests.
- Make efforts to restore wetlands that have previously been developed.

- » The Minnesota Board of Water and Soil Resources has a [Minnesota Wetland Restoration Guide](#) that may serve as a good first step for site evaluation, design and management.
- Identify and preserve remaining wetlands.
 - » The Wisconsin DNR has a [Wetland Identification Program](#) to help individuals locate wetlands that may be on their property.
 - » The Wisconsin DNR provides ideas of conservation activities in [Chapter 11 of their Wetland Restoration Handbook](#).

Slope & Elevation

Site new development out of harm's way or design with hazards in mind

- Avoid development on steep slopes and in the floodplain, particularly for critical infrastructure. For existing structures, retrofit to higher flood standards.
 - » If substantial damage is done (50% or more of the structure's equalized assessed value as listed before the damage occurred is lost), the structure should be rebuilt in a different place or to high flood standards.
 - » The State of Wisconsin has some building design standards for flooding, such as requiring the lowest floor of a building to be situated at 2 feet above base flood elevation. These regulations should be met but also considered the minimum. More information can be found on the [DNR's Floodplain website](#).
 - » [Chapter NR 116](#) of the Wisconsin Administrative Code describes Wisconsin development standards in the floodway and flood fringe. Again, this should be considered the minimum.
- Sequence construction projects in steps to minimize construction disturbance.
- Reinforce unstable hillslopes with deeply rooted grasses.

Map landslide potential using historic and elevation data

- If applicable, gather spatial data about where landslides have historically occurred.
- If applicable, map areas with potential for landslides.
 - » Post visible public signage warning of this danger.
 - » Make landslide potential maps accessible online for the public to view.

Land Use

Map development patterns and predict future land change

- Identify areas likely to develop over the next ten years and delineate floodplain areas and wetlands to be preserved.
 - » If you are located in a county that borders the Great Lakes, you may be able to use the [C-CAP Land Cover Atlas](#) from NOAA to determine percent change of various land use types.

Work with developers to encourage responsible growth

- Require that developers provide detailed flood data about potential impacts of their projects.
- Require developers to create compensatory storage features on site when increasing impervious surfacing.
- Provide educational opportunities for developers to learn smart growth principles or to learn about the benefits of green infrastructure.
- Provide incentives to developers who follow smart growth principles or utilize green infrastructure in their new developments.
- Provide density bonuses to those developers who limit the percentage of impervious surfacing on their property.

Preserve pervious surfacing and open space

- Increase tree and vegetative cover.
 - » U.S. Forest Service's i-Tree Landscape tool can help you identify where and what type of trees could benefit your community. For more information, contact Dan Buckler at Daniel.Buckler@wisconsin.gov.
- Re-evaluate parking needs and, if possible, decrease minimum parking requirements.



Soils

Encourage vegetation to prevent erosion

- Plant native deeply rooted grasses and other vegetation on slopes and at shorelines to reduce runoff.

Work with farmers to encourage best management practices

- Encourage agricultural best management practices that minimize soil compaction. Please refer to the "Agricultural Practices" recommendations section for more.

Assess soils prior to site selection for new development or critical structures

- Use the USDA's [Web Soil Survey](#) to find the location of different soil types in your community.

Agricultural Practices

Provide opportunities for farmers to learn about best management practices from the municipality and from each other

- Host educational workshops for farmers to learn about best management practices to manage nutrients and avoid soil compaction or erosion.
 - » The Wisconsin [Department of Agriculture, Trade, and Consumer Protection](#) (DATCP) provides farmer education grants to local organizations to teach farmers how to develop their own nutrient management plans.
 - » The Wisconsin DNR provides information about [agricultural standards](#), with links for more information.
 - » Another potential partner is the [Wisconsin Land and Water Conservation Association](#).
- Find farmers who are utilizing best management practices and enlist them as partners.
 - » Provide incentives to farmers who participate in a mentorship program.

Monitor progress and reward farmers who adhere to best management practices

- Enact a regular schedule to monitor if farmers are meeting Total Maximum Daily Load (TMDL) requirements and provide incentives to those who meet these standards.
 - » Also refer to the Department of Natural Resources Administrative Code ([Ch. NR 151](#)) for more information.



Funding Resources

Federal

Federal Emergency Management Agency (FEMA)

Hazard Mitigation Assistance Grants: Provides funding for eligible mitigation measures that reduce disaster losses.

Flood Mitigation Assistance Grants: Funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program.

Building Resilient Infrastructure And Community (BRIC): Support states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards.

Department of Housing and Urban Development (HUD)

Community Development Block Grants (CDBG): Provides grants to states, cities, and counties to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons.

National Park Service (NPS)

Land and Water Conservation Fund: This grant program helps urban communities address outdoor recreation deficits by supporting projects in cities and urbanized areas that create new outdoor recreation spaces, reinvigorate already existing parks, and form connections between people and the outdoors.

Rivers, Trails And Conservation Assistance Program: Partners with community groups, nonprofits, tribes, and state and local governments to design trails and parks, conserve and improve access to rivers, protect special places, and create recreation opportunities.

Department of Agriculture (USDA)

Community Facilities Direct Loan & Grant Program: Provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area.

Water And Waste Disposal Loan And Grant Program: Provides funding for clean and reliable drinking water systems, sanitary sewage disposal, sanitary solid waste disposal, and storm water drainage to households and businesses in eligible rural areas.

Conservation Innovation Grants (CIG): Supports the development of new tools, approaches, practices, and technologies to further natural resource conservation on private lands. CIG partners work to address our nation's water quality, air quality, soil health and wildlife habitat challenges, all while improving agricultural operations.

Special Evaluation Assistance For Rural Communities And Households (SEARCH): Helps very small, financially distressed rural communities with predevelopment feasibility studies, design and technical assistance on proposed water and waste disposal projects.

Environmental Protection Agency (EPA)

Recreation Economy For Rural Communities: Planning assistance program to help communities develop strategies and an action plan to revitalize their Main Streets through outdoor recreation.

Urban Waters Small Grants Program: Help local residents and their organizations, particularly those in underserved communities, restore their urban waters in ways that also benefit community and economic revitalization.

Greening America's Communities: Help cities and towns develop an implementable vision of environmentally friendly neighborhoods that incorporate innovative green infrastructure and other sustainable design strategies.

Environmental Justice Collaborative Problem-Solving Cooperative Agreement Program: Provides financial assistance to eligible organizations working on or planning to work on projects to address local environmental and/or public health issues in their communities.

Economic Development Administration (EDA)

Public Works And Economic Adjustment Assistance Program: Support work in Opportunity Zones by leading to the creation and retention of jobs and increased private investment, advancing innovation, enhancing the manufacturing capacities of regions, providing workforce development opportunities, and growing ecosystems that attract foreign direct investment.

Fish and Wildlife Service

North American Wetlands Standard/Small Grant: Supports public-private partnerships carrying out projects in the United States that further the goals of the North American Wetlands Conservation Act. These projects must involve long-term protection, restoration, and/or enhancement of wetlands and associated uplands habitats for the benefit of all wetlands-associated migratory birds.

National Urban And Community Forestry Challenge Cost-Share Grant Program: Supports critical management of existing and future urban and community forests to promote disaster risk reduction and community resilience and better prepare communities for the increasingly destructive impacts of climate change.

State

Municipal Flood Control Grant Program (DNR): Assists cities, villages, towns and metropolitan sewerage districts concerned with municipal flood control management.

Clean Water Fund Program (DNR): Provides affordable financial assistance to municipalities for publicly-owned wastewater and water-quality-related storm water infrastructure projects that are needed to achieve or maintain compliance with federal and state regulations.

Safe Drinking Water Loan Program (DNR): provides affordable financial assistance to municipalities for publicly-owned drinking water infrastructure projects that are needed to protect public health and achieve or maintain compliance with federal and state regulations relating to water supply.

Urban Forestry Grants (DNR): Provides regular, startup, or catastrophic storm grants that support the creation or further development of urban forestry programs and help recover from storms.

Producer-Led Watershed Protection Grants (DATCP): Provides funding to producer-led groups that focus on nonpoint source pollution abatement activities.

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