MODULE ONE: Assessing Environmental Features of Flood Vulnerability

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 heavily to whether a community will experience recurrent flooding. The physical parameters to be assessed in this portion of the scorecard 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 municipalities not only prepare for current conditions but also predicted future scenarios.

Slope and 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 restrict damage.

Land Use

- 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 consequently 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.

Agricultural Practices

- In areas with intensive agriculture, certain practices can cause soil compaction, leading to less water storage capacity and erosion, which can in turn 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?

Depending on the composition of your staff, 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?

- 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 (BSEs)* 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 by the North Carolina Forest Service 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 damage.

Clay: According to the Soil Science Society of America, clay is 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: As adapted from the Department of Homeland Security, "critical infrastructure" refers to 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. This is the type of FIRM that most users download.

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 ≤ 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.

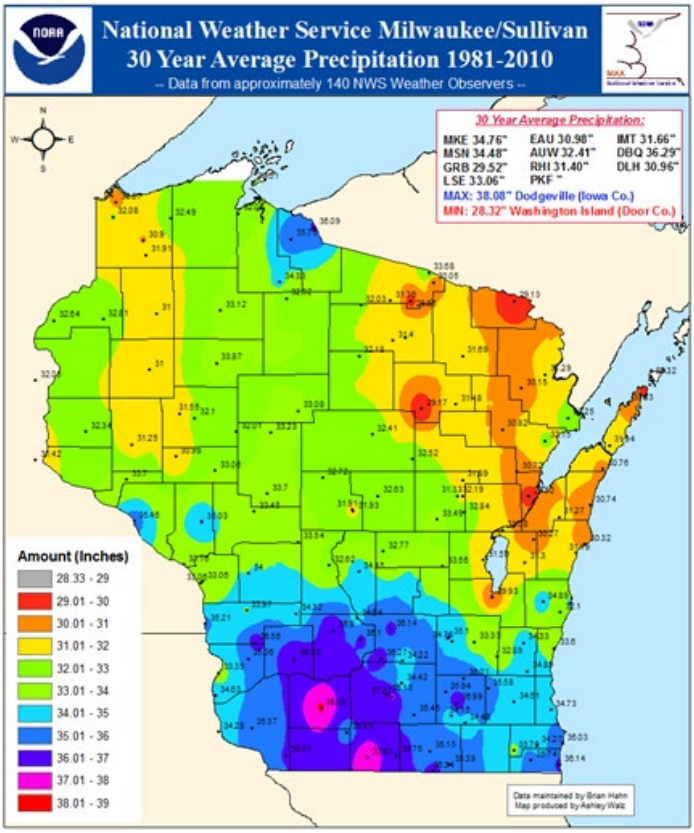
Wetland: A “wetland,” for the purposes of this document, is considered “an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation which has soils indicative of wet conditions” (Wisconsin State Statutes, 2019).

Precipitation Patterns

For this section, you will not need external information. Maps are provided in each section. However, if you would like a more specific evaluation of your precipitation patterns, there may be more local data available. For the purposes of this guide, a broad understanding of precipitation patterns is sufficient.

Historic Annual Precipitation Patterns

Locate your municipality on the map.

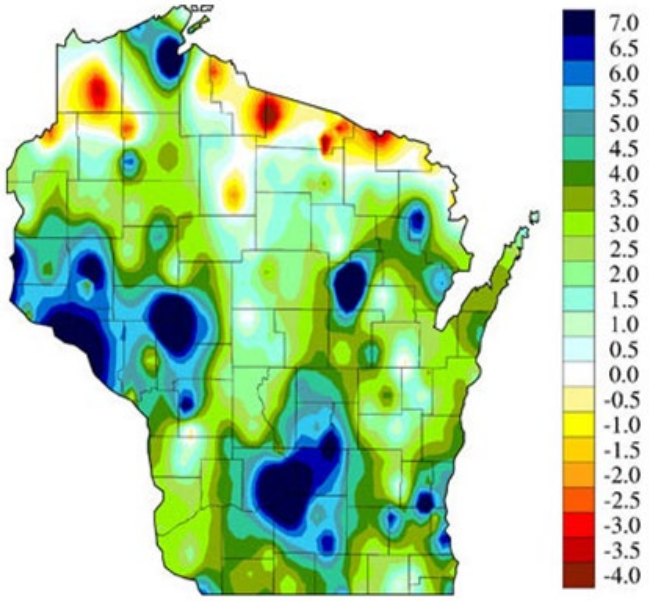


1. Based on historic trends depicted in the map, how much average annual rainfall has your municipality received?

a. 28-31 inches/year
b. 31.01-34 inches/year
c. 34.01-37 inches/year
d. More than 37 inches a year

Change in Average Annual Precipitation

Locate your municipality on the map.

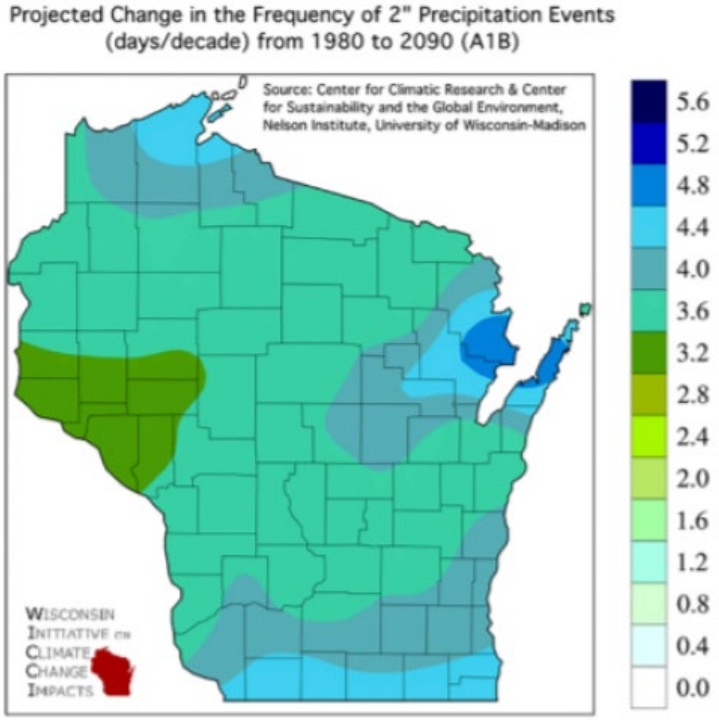


Change in Annual Average Precipitation (inches) from 1950 to 2006

2. How has your annual precipitation changed in the past 50 years?

a. Decreased or no increase
b. Increased no more than 3 inches
c. Increased 3-5 inches
d. Increased more than 5 inches

Projected Change in Frequency of >2" Precipitation Events



3. How is the frequency of heavy precipitation events anticipated to increase in your municipality?

a. No increase predicted
b. 0.4 to 2.0 days/decade
c. 2.4-3.6 days per decade
d. 4.0 or more days/decade

Scoring Precipitation Patterns

Number of “a” answers: _____
Number of “b” answers: _____
Number of “c” answers: _____
Number of “d” answers: _____

If you answered “c” or “d” to two or more questions, please refer to the Precipitation Patterns recommendations section on page 26.

Slope and Elevation

For this section, you should have a **map of your community** with critical infrastructure labeled. You will also need 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 below.

If you have access to GIS: This is the preferred way to conduct your analysis.

To download county GIS data:

1. Visit FEMA's National Flood Hazard Layer (NFHL) Viewer
2. Zoom in to your municipality 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 to download a PDF version of your map

Note: This web interface may be quite slow at times!

Using GIS tools, you can calculate the exact area of the floodplain and what percentage of it overlaps with your municipality. You can also use the "slope tool" found in the "spatial analyst" toolbox to determine maximum change in elevation over a distance (functionally, this is steepest slope). Contact your regional planning commission for assistance if you do not have your own GIS-trained staff. County staff may also have access to elevation maps and topographic data for analysis. Contact your regional planning commission for more information.

If you do not have GIS: The National Flood Hazard Layer (NFHL) Viewer created by FEMA is a great way to view your community's flood maps with an interactive, online interface.

To download PDF versions of your flood maps:

1. Visit FEMA's National Flood Hazard Layer (NFHL) Viewer
2. Zoom in to your municipality 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 a PDF version of your map

If you do not have GIS, you might have to estimate total municipal area within a floodplain instead of providing an exact percentage or try using the Wisconsin DHS Risk Assessment Flood Tool (RAFT). You may consider printing your FIRMs to estimate floodplain area by hand. All FIRM maps are to scale.

1. 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. About half of the community is within a floodplain
e. More than half of the community is within a floodplain
f. All or nearly all of the community lies within a floodplain

2. 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
d. All critical structures are in a floodplain

3. 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. About half of the community is on a steep slope
e. More than half of the community is on a steep slope
f. All or nearly all of the community is on a steep slope

4. 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
d. All critical structures are on a steep slope

5. 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 and Elevation

Number of “a” answers: _____
Number of “b” answers: _____
Number of “c” answers: _____
Number of “d” answers: _____
Number of “e” answers: _____
Number of “f” answers: _____

If you answered “c,” “d,” “e” or “f” for three or more questions, please refer to the Slope/Elevation recommendations section on page 27.

Land Use and 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 will also need to determine **projected growth for your community**. You may have anecdotal information about population increases or about total development projects approved over the past ten years. This can be estimated by extrapolating population increases over time from Census data. The Wisconsin Department of Administration (DOA) released a report describing population change from 2010-2040. Some cities have a percent change listed, but for smaller communities a county-level projection is the best available. You can check the DOA's Demographic Services Center or email them at DIR_Demo@wi.gov.

1. 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

2. 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

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

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

4. 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, but we are anecdotally aware of the stormwater that can be accommodated by these features
d. No, we have not conducted any professional engineering studies to determine storage capacity of our water features nor are we are not anecdotally aware of the stormwater that can be accommodated by these features

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

a. Yes
b. Trees are not mentioned either positively or negatively in our development guidelines
c. No, it is discouraged

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

a. Yes
b. Native vegetation is not mentioned in our development guidelines
c. No, it is discouraged

7. Does your community have any incentives programs for preserving or increasing tree cover and native vegetation?

a. Yes, our municipality has a program to provide incentives
b. No, but we take advantage of a state or federal incentive program
c. No, we use no incentives program for this type of development

8. 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 has taken place in the past ten years
b. Minimal conversion has taken place in the past ten years
c. Extensive conversion has taken place in the past ten years

9. 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 10 years in your community?

a. Little to no conversion is expected to take place in the next ten years
b. Minimal conversion is expected to take place in the next ten years
c. Extensive conversion is expected to take place in the next ten years

10. 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

10a. If yes, are these areas within *floodways* or *flood fringe*?

a. Yes
b. Some, but not all
c. No

11. 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 and Future Development

Number of “a” answers: _____
Number of “b” answers: _____
Number of “c” answers: _____
Number of “d” answers: _____

If you answered “c” or “d” for 5 or more questions, please refer to the Land Use recommendations section on page 28.

Soils

For this section you will need **soil maps**. Questions within this section suggest usage of maps from the specified sources, the directions to obtain these maps are below. However, you may have maps delineating soil types in your community within your community plans and choose to use these instead.

Soils can be categorized in a variety of ways. For the purposes of this document, we will use these broad categories:

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)

To learn about your community's soils to answer the following questions, refer to the **USDA's Web Soil Survey**.

1. Click the green button that says "START WSS."
2. Go to the "Area of Interest (AOI)" tab at the top left.
3. Under "Quick Navigation," click on "Address."
4. Type in the name of your municipality (ex. Platteville, Wisconsin) and click "View."
5. Click on the icon with a red rectangle and AOI in it in the toolbar under "Area of Interest Interactive Map."
6. Draw a rectangle that encompasses your municipality. (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.
7. 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."

For question 5, refer to **Soil Explorer**. This tool is much more general and user friendly than the Web Soil Survey.

1. On the right side of the screen, under the icon "Soil Explorer," use the drop-down menu that says "Select a Region" and choose "Wisconsin."
2. Choose the right-side tab that says "Natural Soil Drainage Classes."
3. Zoom in to your municipality. Click on the list icon in the top right corner to see what each color represents.

1. How much of the land area in your community is categorized as either *sand* or *loamy sand* (high drainage)?

a. All or nearly all
b. Between 60 and 80%
c. Between 30 and 60%
d. Between 10 and 30%
e. Less than 10%

2. How much of the land area in your community is categorized as *sandy loam*, *loam* or *silt loam* (moderately high to moderate drainage)?

a. All or nearly all
b. Between 60 and 80%
c. Between 30 and 60%
d. Between 10 and 30%
e. Less than 10%

3. How much of the land area in your community is categorized as *sandy clay loam*, *clay loam*, *silty clay loam* or *sandy clay* (moderately low drainage)?

a. Less than 10%
b. Between 10 and 30%
c. Between 30 and 60%
d. Between 60 and 80%
e. All or nearly all

4. How much of your land area is categorized as *silty clay* or *clay* (low drainage)?

a. Less than 10%
b. Between 10 and 30%
c. Between 30 and 60%
d. Between 60 and 80%
e. All or nearly all

5. Using the Soil Explorer, what soil drainage class is predominant in your municipality?

a. Excessively drained or somewhat excessively drained
b. Well drained or moderately well drained
c. Somewhat poorly drained or poorly drained
d. Very poorly drained

Scoring Soils

Number of “a” answers: _____
Number of “b” answers: _____
Number of “c” answers: _____
Number of “d” answers: _____
Number of “e” answers: _____

If you answered “c,” “d” or “e” for three or more questions, please refer to the Soils recommendations section on page 28.

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.

1. Does your community have a significant amount (over 10%) of pasture or *cropland*?

a. No
b. No, but we have other intensive land uses that need to be managed to minimize erosion and/or compaction
c. Yes

2. Are agricultural *best management practices* (BMPs) promoted or enforced that reduce erosion?

a. Financial incentives exist to promote them
b. Outreach efforts exist to promote them
c. They are required
d. They are permitted but not promoted
e. They are not permitted
f. They are not explicitly permitted or prohibited in any formal municipal plan

3. Are agricultural *BMPs* promoted or enforced that reduce compaction?

a. They are required
b. Financial incentives and outreach efforts exist to promote them
c. Either financial incentives or outreach efforts exist to promote them
d. They are permitted but not promoted
e. They are not explicitly permitted or prohibited in any formal municipal plan
f. They are not permitted

4. Do any of the following practices occur in your community to limit soil compaction or erosion due to agricultural activities?

- Fund staff time from municipal sources 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
- Host an agricultural clean sweep program at least biennially

a. We do all of the above and more
b. We do all of the above
c. We do at least two of the above
d. We do one of the above, or we do something related but not listed here
e. We do none of the above

5. Does your community provide cost sharing, tax reductions or other incentives to encourage agricultural practices that reduce erosion and compaction?

a. Yes, we provide ample financial support for these programs
b. Yes, we provide some financial support for these programs
c. No, we provide no support for these programs beyond what is provided by state and federal dollars.

6. Does your community use any land use regulations or tools to preserve farmland?

a. Yes, we use conservation easements, transfer of development rights and/or other programs to preserve farmland
b. Yes, we use one tool to preserve farmland
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

7. Does your community provide workshops or trainings for farmers to encourage *BMPs*?

a. Yes, we provide regular workshops/trainings for farmers
b. No, but we publicize and promote workshops/trainings provided by other organizations or at a county level
c. No, we have had workshops in the past but none recently
d. No, we have never hosted or promoted such an event

Best Management Practices

Complete the following table:

	a. Required	b. Encouraged	c. Neither Encouraged nor Prohibited	d. Prohibited	e. N/A
8. *No till*					
9. *Riparian buffer zones*					
10. *Cover crops*					
11. *Manure management plan*					
12. *Rotational grazing*					
13. *Nutrient management plan*					

Scoring Agricultural Practices

Number of “a” answers: _____
Number of “b” answers: _____
Number of “c” answers: _____
Number of “d” answers: _____
Number of “e” answers: _____
Number of “f” answers: _____

If you answered “c,” “d,” “e” or “f” for six or more questions, please refer to the Agricultural Practices recommendations section on page 29.

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 One

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.
        - Information about SWMM can be found on the EPA's website
- 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 regional planning agencies 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 Wisconsin DNR at DNRUrbanForestryAssessment@wisconsin.gov.
    - 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 provides resources 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 website under floodplains.
        - 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 each construction project 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.
    - U.S. Forest Service' 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.

Work with farmers to encourage responsible management practices

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

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.