INTRODUCTION

Natural resources are materials that occur in nature such as water, air, forests, soil, minerals, and geologic features, as well as biological communities comprised of plants and animals. According to the United States Forest Service's Wildland Planning Glossary, natural resources may also be defined as:

- A feature of the natural environment that is of value in serving human needs;
- A feature about which choices must be made;
- Original, basic, or primary aspects of nature, not a manufactured or processed product;
- Commodities such as timber, water, minerals, or amenities such as scenery or scenic viewing points; and/or
- A relative concept depending on the needs and wants of the planning agent, the planning purpose, the technological means of using a feature, and the ability to make use of a feature given social constraints on its use.

This chapter first discusses general natural resource information, including the area's climate, geology, topography, air quality, and soils. Natural features are discussed next, including the Niagara Escarpment, surface waters, groundwater, wetlands, shorelands, floodplains, woodlands, and biological diversity. Following is discussion on threats to the county's natural features, including climate change, long-term decreasing Lake Michigan water levels, shoreline recession and damage, flooding and wetland destruction, non-point source pollution (runoff), Great Lakes water diversion, groundwater quality and quantity, and changing biodiversity. Next is discussion on conservation, protection, and preservation programs at the federal, state, and local levels. Lastly, discussion on non-metallic mineral resources is provided.

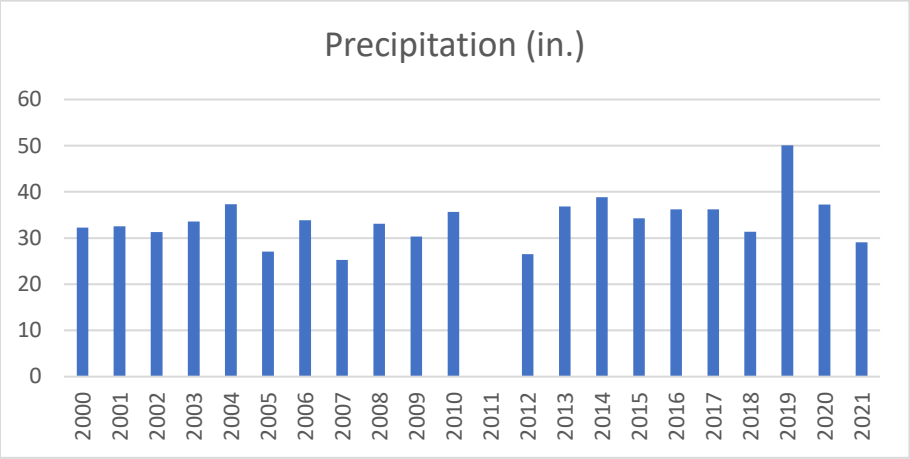
GENERAL NATURAL RESOURCE INFORMATION

CLIMATE

Door County features a humid continental climate with warm summers and cold, snowy winters. The surrounding Green Bay and Lake Michigan temper the climate so there are fewer extremely hot or cold days than is typical for this latitude. Water cooled during the winter delays spring and early summer, while water warmed during the summer delays the first freeze in fall. Mild and pleasant summers are common.

In the past two decades, according to the National Weather Service (NWS) Sturgeon Bay Experimental Farm weather station, Door County experienced the highest levels of precipitation in 2019, at an annual total of 50.11 inches. (See Figure 6.1.) All other years have fallen in the 20- to 40-inch range. Note that the data for 2011 is incomplete and, therefore, annual totals are not available. The average annual precipitation from 2000 to 2021 was 33.76 inches.

Figure 6.1: Annual Precipitation Totals, Door County

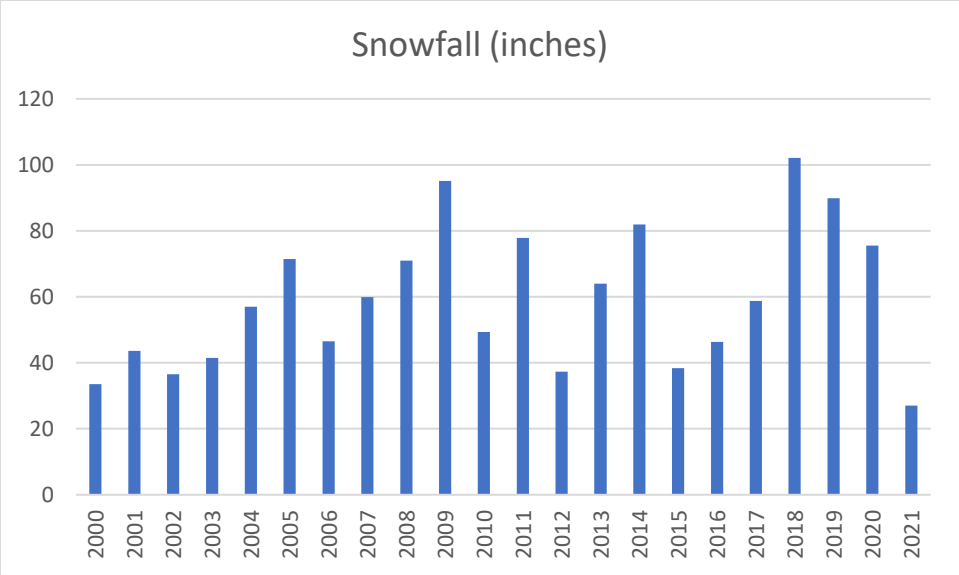


Source: National Weather Service, Sturgeon Bay Experimental Farm, Past Data, NOWData.

Per NWS Sturgeon Bay Experimental Farm data, between 2000 and 2021 the mean annual temperature was 44.5 degrees Fahrenheit. Mean seasonal temperatures during the same time period were 21.2 in the winter, 41.6 in the spring, 66.9 in the summer, and 48.8 in the fall.

From 2000 to 2021, the average annual snowfall was 59.3 inches. The year 2018 had the highest level of snowfall in the past two decades, at 102.1 inches for the year. (See Figure 6.2.)

Figure 6.2: Annual Snowfall Totals, Door County



Source: National Weather Service, Sturgeon Bay Experimental Farm, Past Data, NOWData.

According to the Wisconsin Initiative on Climate Change Impacts (WICCI), Wisconsin's average daily temperature has become 3 degrees Fahrenheit warmer since the 1950s. Additionally, the last two decades have been Wisconsin's warmest on record, and the past decade has been the wettest. Average precipitation has increased by 17% (roughly 5 inches) since 1950, and extreme precipitation events are very likely to increase in the future.

GEOLOGY AND TOPOLOGY

Door County's geology and topography have been largely defined by its Silurian dolostone (dolomite limestone) bedrock. Laid down as sediment on the bottom of a warm shallow sea over 400 million years ago, the rock has been modified by weathering and erosion over long periods of time and by the action of continental glaciers during the last several million years. These glaciers smoothed hilltops, filled in valleys, and left deposits of glacial drift of various types and amounts. The result is a complex landscape of Silurian dolostone, prominently exposed in some areas and thinly or even deeply buried by glacial deposits in others. Silurian dolostone is the bedrock of most of Door County, except for a narrow area along the Green Bay shore in the southwest corner of the county where shale and carbonate rocks of the older Maquoketa Formation are exposed.

This Silurian bedrock forms the extensive physiographic feature or ledge known as the Niagara Escarpment (see photograph below). The Escarpment forms the "backbone" of the Door Peninsula, arcs through Canada for more than 900 miles, and finally forms Niagara Falls at the east end of Lake Erie.

Pictured: Niagara Escarpment, Door County, WI
Source: The Nature Conservancy

The Escarpment in Door County is most prominent – and in many places exposed – along the western side of the county, including the Brussels Hill and the 60 to 200+-foot cliffs along or near the Green Bay shoreline, such as in Potawatomi and Peninsula State Parks.

Dolostone is a sedimentary rock similar to limestone, but is slightly harder and dissolves more slowly than limestone. Geologists from the Wisconsin Geological and Natural History Survey and the University of Wisconsin-Green Bay have found a wide variety of karst features such as sinkholes, enlarged joint openings, and cave systems throughout the bedrock in Door County. These features are the result of small pre-existing fractures in the dolomite bedrock that are slowly enlarged over time by the solution action of slightly acidic groundwater; the Niagara dolomite crevices in Door County have been subjected to considerable dissolution from groundwater activity. The resultant well-developed network of horizontal and vertical crevices provides direct pathways for the effective infiltration of surface water and the rapid flow of groundwater. Furthermore, with surface water able to flow freely into the aquifer due to the presence of surface-level karst features, groundwater in the county has a high chance of becoming contaminated.

Glacial deposits over the land surface of Door County consist of both till and glaciofluvial sediment. Till, or unstratified drift, is a mixture deposited directly by the glacier consisting of an unsorted mixture of clay, sand, gravel, pebbles, and boulders. Till is the surface material of most of the fields and wood lots in the county. Particularly interesting examples of landforms composed of till are drumlins, which are streamlined hills with a blunt nose and a gently sloping tail oriented in the direction of the glacier movement.

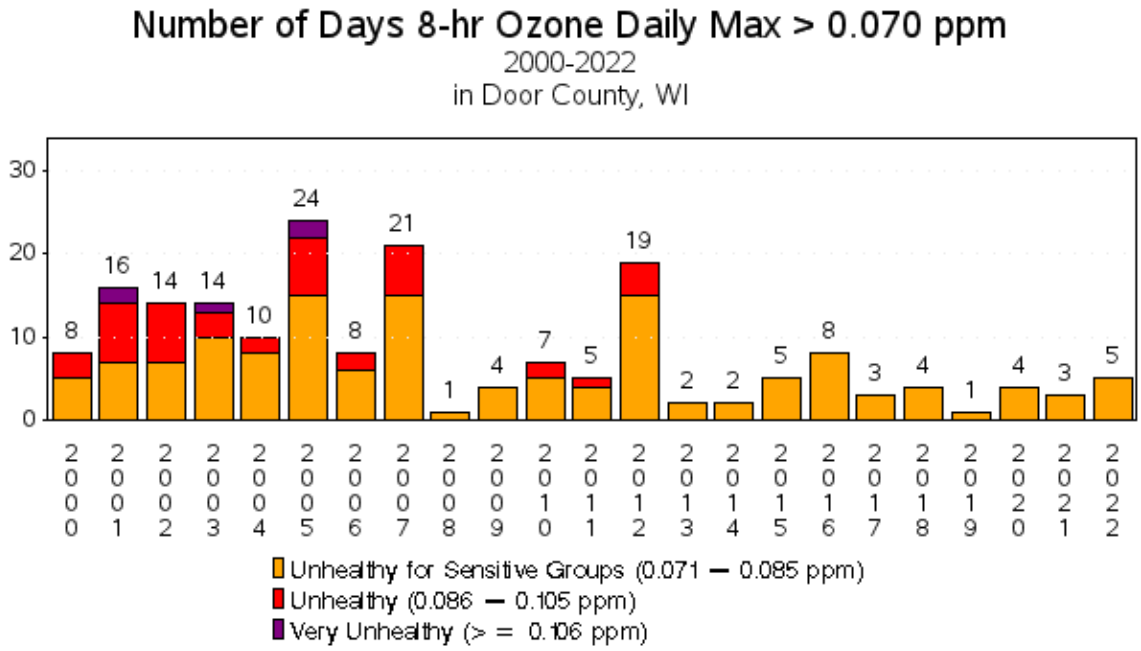
Glaciofluvial sediment is composed of particles moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. These deposits are stratified and occur in the county primarily in the form of kames and small eskers. Kames are small hills or short ridges consisting of layers of sand and gravel deposited by a meltwater stream at the margin of a melting glacier. Eskers are ridges of sand and gravel deposited from meltwater running in tunnels below or inside glaciers. Examples of both can be found in the Kangaroo Lake Moraine which extends westward across the county from Kangaroo Lake. These deposits consist of medium- to coarse-grained sand and gravel with numerous cobbles, boulders, and portions of till.

Other significant topographic features in the county include sand dunes, complexes of beach ridges and swales, and inland lakes. Wetlands of various types and sizes are also scattered throughout the county and are discussed in more detail later in this chapter. In Northern Door, these wetlands primarily drain southeastward into Lake Michigan through small streams. In Southern Door, wetland drainage flows into both Green Bay and Lake Michigan.

AIR QUALITY

The Environmental Protection Agency (EPA) currently monitors air quality in Door County at its Newport State Park station in the Town of Liberty Grove. Door County's main pollutant issues are associated with ozone levels; in 2004, the county was identified by the US Environmental Protection Agency (EPA) as a "non-attainment" zone for exceeding the EPA's 8-hour ozone national air quality standard. Ozone is unhealthy to breathe, especially for children and those with respiratory issues. In 2010, the EPA approved Door and Manitowoc counties for re-designation as "rural transport" attainment areas since the majority of ozone issues in the counties can be attributed to "traveling" pollutants originating from coal-burning power plants, manufacturing plants, and automobiles operating in northwest Indiana, the Chicago area, and southeast Wisconsin. Ozone concentrations in the county generally have decreased over the past two decades, with the last occurrence of "Unhealthy" levels in 2012, and the last occurrence of "Very Unhealthy" levels in 2005. (See Figure 6.3.)

Figure 6.3: Days with Ozone Levels Over 0.07 ppm, Door County



Source: US Environmental Protection Agency, Air Quality Statistics Report, for years cited.

SOILS

The soils in Door County originate from glaciation, bedrock weathering, and fluvial activity. Due to the calcareous nature of the parent material, Door County soils are characteristically alkaline. The majority of the soils came from glacial till laid over the Silurian dolostone and are characteristically reddish brown, heavy loam subsoil over a light brown, permeable loam or sandy loam substratum. A smaller portion of the county's soils come from outwash sand and gravel or lacustrine sediment.

Many of the soils in Door County are very shallow, especially in the northern two-thirds of the county. Across most of the county, soils are less than five feet in depth to bedrock; 22% of the soil is less than 18 inches in depth and another 17% is between 18 to 36 inches in depth. The soils in the northern two-thirds of the county are rough and/or shallow, with much of the land cover remaining in woodland or wetland. The soils in the southern one-third of the county are deeper, smoother, and predominantly farmed. The largest acreage of the county's wetlands is also found in this region.

SOIL DESCRIPTIONS

The US Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) is responsible for collecting, storing, maintaining, and distributing soil survey information for privately owned lands in the United States. The *Soil Survey of Door County, Wisconsin*, completed in 1978 by the NRCS, provides detailed soil information and maps for the county. Door County has 75 different soil types, grouped into six general soil associations that have similar patterns of relief and drainage. Map 6.1, General Soil Associations, found at the end of this document, depicts these general soil associations, which typically consist of one or more major soils and some minor soils. Note that the *Soil Survey* is a preliminary reference tool for identifying soil conditions in Door County; actual soil conditions should be

verified in the field with on-site inspection and soil testing. The six major soil associations in Door County, per the *Soil Survey*, are:

- Summerville-Longrie-Omena association: Occupies approximately 40% of the county; found mostly in northern Door County. Shallow to deep, well-drained, nearly level to moderately steep soils that have a sandy loam or loam subsoil over sandy loam, fine sandy loam till, or dolomite bedrock.
- Emmet-Solona-Angelica association: Occupies approximately 23% of the county; found mostly in the southeastern portion of the county. Deep, well-drained to poorly-drained, nearly level to sloping soils that have a loamy sand to silt loam subsoil over sandy loam or loam till.
- Rousseau-Kiva-Markey association: Occupies approximately 6% of the county; mainly found along the eastern coast and in southern Washington Island. Deep, well-drained and moderately well-drained, and gently sloping and sloping soils that have a fine sand or sandy loam subsoil over sand or sand and gravel outwash; and very poorly drained, nearly level organic soils.
- Kewaunee-Kolberg-Manawa association: Occupies approximately 11% of the county; found in Southern Door, primarily in the southwest. Deep and moderately deep, well-drained and somewhat poorly drained, nearly level to moderately steep soils that have a predominantly silty clay subsoil over silty clay till or dolomite bedrock.
- Deford-Yahara Variant-Carbondale association: Occupies approximately 5% of the county; found in the Mink River and northern Baileys Harbor areas and the eastern half of the canal. Deep, poorly drained, nearly level soils that are underlain by find sand outwash or that have a silt loam subsoil over stratified lake sediments; and very poorly drained, nearly level organic soils.
- Carbondale-Cathro associations: Occupies approximately 7% of the county; scattered across the county. Very poorly drained nearly level organic soils (poorly drained mucks).

AGRICULTURAL SOILS

Soils in Door County are predominantly shallow and feature bedrock outcrops that limit production of agricultural crops. Most of the soils used for agriculture were formed from glacial till and are characteristically a reddish-brown heavy loam subsoil over a light brown, permeable loam or sandy loam substratum. Soils generally not suitable for agriculture are formed of silty clay glacial till and are slowly permeable.

The USDA-NRCS classifies soils as to their suitability for agricultural use. Map 6.2, Prime Agricultural Soils, found at the end of this document, depicts soils in Door County that are considered prime farmland, prime farmland if drained, and soils that are not suitable for farming.

NATURAL FEATURES

Residents of Door County highly value the county's natural resources for their contribution to the county's visual character, ecological systems, and human health as well as to the area's recreation, tourism, and residential development industries. Door County's natural features include the Niagara Escarpment, surface waters, groundwater, wetlands, shoreland, floodplains, woodlands, dunes, ridge and swale complexes, and biological diversity. Threats to these natural features and protection efforts at the federal, state, and local levels are also discussed in this chapter.

NIAGARA ESCARPMENT

Door County is defined in many ways by the Niagara Escarpment, a 900-mile long ridge threading through portions of Wisconsin, Michigan, Ontario (Canada), and New York. (See Figure 6.4.) This ridge is the edge of a thick series of hard dolomite layers that resisted erosion and stand up in relief as a prominent line of bluffs. In geological terms, it is called a cuesta, or a sickle-shaped rock feature with a steep face on one side and a gentle on the other. This formation is comprised of layers of shale, limestone, and dolostone rock formed 400 to 500 million years ago, during the Silurian age, under a warm shallow sea. Erosion of adjacent softer rock created the steep bluffs and rock face that is seen along the western side the Door Peninsula. After the cuesta was formed, parts of the ridge were covered by glacial till, making evidence of the escarpment more difficult to identify. Whereas the western side of Door County portrays the cuesta ridge, the eastern side of the county portrays the cuesta slope, evident in the many wetlands and low-lying lands found on that side of the county. Beyond Door County, the cuesta continues to slope downward, underneath Lake Michigan, and reaches a low point in the middle of lower Michigan (called the Michigan Basin).

The Niagara Escarpment is ecologically rich, with rare and endemic species, significant wetland areas, and an abundance of unique eco-systems and natural communities. Cultural resources include archaeological sites, pictographs (rock art), mounds, petroglyphs, maritime structures and wrecks, various lime kilns and caves, and historic farmsteads.

Figure 6.4: Niagara Escarpment

Source: State Cartographer's Office, University of Wisconsin-Madison, 2017.

SURFACE WATERS

Door County's four major watersheds flow into Lake Michigan and many inland waterbodies. The county's economy benefits greatly from surface water features, whether it happens directly through commercial or sport fishing and shipping routes, or indirectly through general tourism and recreation.

WATERSHEDS

The two main management units used by the DNR are basins that are further subdivided into watersheds. Basins and watersheds are interconnected areas of land draining from surrounding ridge tops to a common point such as a lake or stream to their confluence with a neighboring watershed. All lands and waterways can be found in one basin and watershed or another. These watershed units are used in the DNR Priority Watershed Program, as described later in this chapter.

Wisconsin's largest river systems form 24 drainage basins. The Lakeshore Basin, a water-rich area with an assortment of lakes, major rivers, and small streams, and bound by the waters of Green Bay and Lake Michigan, completely encompasses Door County, as well as the counties of Kewaunee and Manitowoc, and parts of Brown and Calumet Counties. Within Door County, there are four major watersheds:

- **Ahnapee River Watershed.** The Ahnapee River Watershed covers 86,772 acres in the areas of northeastern Kewaunee County and south-central Door County. The watershed is dominated by agriculture (71%) and wetlands (17%).
- **Red River and Sturgeon Bay Watershed.** Located primarily in Door County, the Red River and Sturgeon Bay Watershed covers 89,060 acres. The watershed also reaches into parts of Brown and Kewaunee counties. It is mainly agriculture (57%), wetlands (18%), and forest (14%).
- **Stony Creek Watershed.** The Stony Creek Watershed covers 34,558 acres in parts of Central and Southern Door, as well as the northeast tip of Kewaunee County. The watershed is majority agriculture (61%) and wetlands (25%).
- **Upper Door County Watershed.** Covering all of Northern Door and parts of Central Door, the Upper Door County Watershed contains 183,693 acres. It is chiefly forest (34%), agriculture (31%), grassland (14%), and wetlands (13%).

The Kewaunee River Watershed is a minor watershed located in a small portion of Door County. Map 6.3, Watersheds, at the end of this document, displays the location of each. Note that a majority of the county's land area lies in the Upper Door County Watershed.

LAKE MICHIGAN AND INLAND WATERBODIES

The five Great Lakes consist of Lakes Erie, Huron, Michigan, Ontario, and Superior. The Great Lakes Region is comprised of eight states that all border on at least one of the five lakes, including Wisconsin, and one Canadian province. Combined, the Great Lakes contain approximately 21% of the earth's fresh surface water, and 90% of North America's fresh surface water. The US Great Lakes maritime economy supports 311,000 jobs, translating to $8.8 billion in wages.

Lake Michigan is the third largest of the Great Lakes by surface area and the sixth largest fresh waterbody on Earth. Door County, a peninsula surrounded by Lake Michigan and Green Bay, has approximately 300 miles of coastal shoreline, one of the highest amounts of costal shoreline miles of any county in the US. The lake is an environmental and ecological resource for humans and natural

communities, providing habitat to a wide variety of aquatic as well as terrestrial plants and animals. The lake is a resource for humans living in and visiting Door County specifically with regard to its role in the ground/surface water cycle, as a food source, and for the recreational activities it supports. Lake Michigan is an ecosystem that greatly affects our way of life, as well as all aspects of the natural environment, from weather and climate to wildlife and habitat.

Door County has a total of 25 named inland lakes, ponds, and marshes, and 38 named rivers, creeks, and streams draining into Lake Michigan. Table 6.1 lists the county's named rivers, creeks, and streams; Table 6.2 lists the county's named lakes, ponds, and marshes. Map 6.4, Surface Water Features, located at the end of this document, illustrates all the surface water features listed in these tables.

Table 6.1: Rivers, Creeks, and Streams, Door County

Name	Length (miles)
Ahnapee	8.5
Bear	4
Big	13
Ephraim	1.5
Fabry	3.7
Fischer	2
Fish	1.5
Geisel	3.6
Heins	2.9
Hibbard	7.4
Hidden Springs	1
Kayes	9.8
Kolstad	3
Kramer	2
Krueger	2.7
Larson	4
Lily Bay	3.4
Little	--
Logan	5.4
Lost	2.5
Malvitz	2.2
May	5
Mink River	1.4
Peil	2.5
Reieboldt	5.4
Renard	6
Samuelson	1.25
Schuyler	4

Table 6.2: Lakes, Ponds, and Marshes, Door County

Name	Surface Area (acres)
Arbter	16
Bradley	19
Clark	868
Dunes	80
Europe	273
Forestville Millpond	94
Kangaroo	1,123
Krause	4
Little	24
Lost	91
Mackaysee	347
Mink River Lake	101
Mud	155
Schwartz	30
Big (Gunnerson) Marsh	35
Little (Wickman) Marsh	11
Bley Pond	5
Butler Pond	4
Coffee Swamp	2
Pinney	2
Pluff Pond	1
Thorp Pond	7
Upper Lost Lake	1
Voecks Marsh	21
Zoo Lake	2

Table 6.1: Rivers, Creeks, and Streams, Door County (cont'd)	
Shivering Sands	1.1
Silver	2.5
Silver*	5.25
Silver*	2
Stony	13.6
Strawberry	1.6
Sugar	9
Three Springs	2.3
Twin Harbor	2
Whitefish Bay	1.1
Woodard	4.7

Source: Door County Land and Water Resource Management Plan, 2021 – 2030.

GROUNDWATER

Groundwater is water that exists underground in saturated zones beneath the land surface. It is the usable quantity of water in the ground, contained in interconnected pores located below the water table (the underground plane beneath which earth materials, such as soil or rock, are saturated with water). The dominant source of groundwater in Door County is the Silurian dolostone bedrock. The second source of groundwater in Door County is the Ordovician aquifer, which lies beneath the Silurian aquifer in Maquoketa Shale bedrock. Some residents in the southwestern portion of the county draw water from the Ordovician aquifer due to limited access to the Silurian aquifer; such wells are deeper and therefore more expensive than those accessing the Silurian aquifer.

WETLANDS

Wetlands are nurseries for fish and wildlife, purifiers for lakes, rivers, and groundwater, and storage for floodwaters. They also act as playgrounds for birders, hikers, hunters, and paddlers, as well as a storehouse for carbon, a leading greenhouse gas fueling climate change. Wetlands are also commonly known as swamps, bogs, and marshes. Some wetlands also recharge local groundwater aquifers. By slowing water movement, wetlands reduce the likelihood that heavy rainfall or spring snowmelt will cause erosion and flooding. Wetlands also retain soil and hold nutrients that would otherwise promote excessive weed growth and algae blooms in lakes and streams. These nutrients, when held in the wetlands, produce a heavy growth of vegetation that provides nesting sites, food, and cover for waterfowl, small mammals, and many other types of wildlife.

Wetlands located in Door County are shown in Map 6.5, Wetlands, found at the end of this document. An example photograph of an upper Door County wetland is shown in Figure 6.5.

STATE-DESIGNATED SIGNIFICANT COASTAL WETLANDS

Due to the role wetlands play in improving and maintaining the health of Green Bay, Lake Michigan, and the entire Great Lakes ecosystem, the DNR has identified ecologically Significant Coastal Wetlands along Lake Michigan as a way to inform planning efforts. Wetlands located within close proximity to the coast

provide rich habitat for plants and animals, and greatly influence the larger processes of the Great Lakes ecosystem. As transition zones between land and water, coastal wetlands often have rich biodiversity and provide critical habitat for migratory and nesting birds, spawning fish, and rare plants.

Door County has a number of extensive coastal wetland complexes, the majority of which are located on the shoreline of Lake Michigan. Those identified as Significant Coastal Wetlands by the DNR are listed in Table 6.8 at the end of this document.

Figure 6.5: Upper Door County Area Wetlands

Source: Chicago Tribune, 2015.

SHORELANDS

Shorelands serve as valuable environmental resources for humans as well as plants and animals, both aquatic and terrestrial. Since 1968, the State of Wisconsin has required counties and incorporated communities to adopt shoreland zoning regulations to help protect shorelands from issues associated with development. For more information on shoreland and floodplain zoning ordinances in effect in Door County, see Chapter 10, Land Use. For the purposes of shoreland and floodplain zoning regulations, shorelands are defined by the state as land areas within a specified distance from the ordinary high-water mark of navigable waters as follows:

- 1,000 feet from a lake, pond, or flowage; and
- 300 feet from a river or stream or to the landward side of the floodplain, whichever distance is greater.

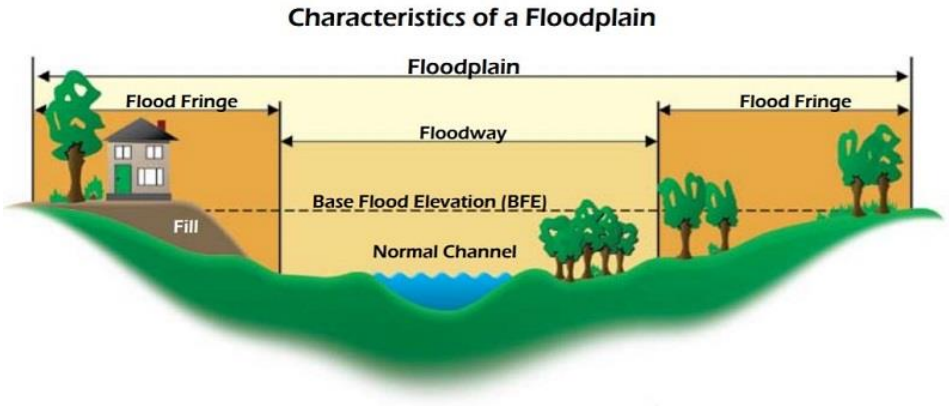
Door County contains approximately 300 miles of Lake Michigan and Green Bay coastal shoreline, as well as over 300 miles of other shorelines along inland lakes, ponds, and streams. Shoreland areas are illustrated on Map 6.6, Shoreland and Floodplain Areas, found at the end of this document.

FLOODPLAINS

Flooding is normal in the typical cycle of streams and lakes. The floodplain is defined by the Wisconsin Department of Natural Resources as “land that has been or may be covered by floodwater during the regional flood.” The “regional flood,” or the “100-year flood,” is somewhat misleading in its name, as the “100-year flood” actually has a 1% chance of occurring in any given year. The floodplain includes the following characteristics, as defined by the DNR (see Figure 6.6):

- **Floodway:** the channel of the river or stream and those portions of the floodplain adjoining the channel required to carry the regional flood discharge – the most dangerous part of the floodplain
- **Flood fringe:** the portion of the floodplain outside the floodway that is covered by flood waters during the regional flood
- **Base Flood Elevation:** the elevation determined by the Federal Emergency Management Agency (FEMA) to which flood water is expected to rise during the regional flood

Figure 6.6: Floodplain Characteristics



Source: FEMA, National Flood Insurance Program Guidebook, 2009; retrieved from Wisconsin DNR.

Natural floodplains, as identified by FEMA, provide flood risk reduction benefits, such as slowing runoff and storing floodwaters. They frequently contain wetlands and other important ecological areas which provide benefits such as fish and wildlife protection; natural flood and erosion control; surface water quality maintenance; groundwater recharge; biological productivity; and higher quality recreational opportunities (fishing, bird watching, boating, etc.). In addition to environmental benefits, natural floodplains also provide considerable economic and social benefits.

Buildings constructed in the floodplain reduce the floodplain's storage capacity. A reduction in the floodplain's storage capacity can cause future flood events to be of higher intensity, allowing flooding outside the historic floodplain. As a way to help protect floodplains, s. 87.30(1), Wis. Stats., and NR116, Wis. Admin. Code, adopted in 1986, require counties, cities, and villages to adopt floodplain zoning ordinances that address problems associated with development in floodplain areas.

Map 6.6, Shoreland and Floodplain Areas, illustrates Door County areas mapped by FEMA as being potentially located in the floodplain. For more information on floodplain ordinances in effect in Door County, see Chapter 10, Land Use.

WOODLANDS

Historic woodlands in Door County included maple-basswood-beech forest, hemlock-hardwood forest, northern white cedar swamp, and hardwood-conifer swamp. Subsequent logging, farming, and development have changed the landscape significantly. Door County currently has approximately 105,949 acres of woodland, covering about 34% of the landmass. These woodlands consist of predominantly maple-basswood, with smaller amounts of lowland hardwoods, oak, aspen-birch, and lowland conifers. All types of woodlands provide aesthetic views, wildlife habitat, and recreation.

Woodlands can also maintain watershed cover, provide shade, serve as a windbreak, help reduce soil erosion, act as a noise barrier, screen development from view, and offset carbon emissions. Map 6.7, Woodlands, found at the end of this document, illustrates the county's woodlands, including naturally grown and planted areas.

Woodlands are managed in Door County through several DNR initiated or administered plans and programs, including the Managed Forest Law Program and State Nursery Program. The Door County Land Use Services Department also administers woodland cutting regulations in some areas of the county through the Door County Comprehensive Zoning Ordinance.

DUNES

Great Lakes coastal dunes are considered the most extensive freshwater dune assemblage in the world. Continental glaciers covering the Great Lakes basin for more than one million years provided the major source of sand for these dunes, most of which were formed over 3,000 years ago. Glacial movement and meltwater transported smaller particles of bedrock from the northernmost regions of North America to the Great Lakes region. Once the glaciers retreated, wind and waves sorted the bedrock particles along the beach, pushing the small-to-medium sized bedrock particles (sand) inland to form the dune systems and leaving the larger cobbles and sand particles near the water.

These dunes are constantly being constructed and reshaped by forces of nature, primarily the wind. There is little to hinder the wind's momentum as it blows across Lake Michigan and hits the shore, picking up and pushing grains of sand inland. This sand is later dropped as the wind moves over land and loses velocity. In time, a pile is formed that gradually grows into a tall sand dune with a gently sloping upwind face and steeply sloping backside. When the wind crests at the top of the dune, it gains momentum again and picks up more grains of sand as it continues blowing further inland. Then, losing speed as it travels over flat land, the wind drops the sand creating smaller dunes behind the foredunes.

There are at least four major zones within a dune complex: beach, foredune, trough/interdunal pond, and backdune. Beaches are areas where water meets land, and the foredune is the first ridge behind the beach. Foredunes are above wave action most of the time, but are still subject to storm waves. Troughs occur behind the foredune, where interdunal wetlands or shallow ponds sometimes form. Backdunes are more stabilized because they are protected from intense wind erosion, allowing vegetation to take hold.

Dune complexes provide for microenvironments that vary in temperature, moisture, and light intensity, creating one of the most diverse ecosystems in the Great Lakes and Door County. Some rare and endangered species, such as the Pitcher's Thistle and Piping plover, rely on the dune environment for their survival. Beach and dune environments are also exceptionally attractive to humans because of their development potential and aesthetics. Dune complexes can be easily damaged and functionally compromised by excessive use, incompatible developments, and the spread of invasive species such as lyme grass and common reed (phragmites). Interdunal wetland communities, which support multiple rare species, are fragile and sometimes short-lived because they can easily be damaged by incompatible uses or hydrological disruption.

RIDGE AND SWALE COMPLEXES

Ridge and swale complexes are rare natural features closely associated with Great Lakes shorelines and sometimes associated with dune complexes. They consist of a series of narrow parallel sandy ridges alternating with low swales. Vegetation on the dry ridges varies and can support open herbaceous or shrub communities on the semi-stabilized dunes closest to the shoreline, dry forests dominated by pines and oaks farther inland, and mixed forests of hardwoods farthest away from the shore. Ridge and swale complexes host unique and diverse habitats for a wide variety of plants, amphibians, reptiles, and breeding and migratory birds.

Swales near the shoreline typically have deeper water and are more open, supporting marsh or sedge meadow communities. Only the deepest swales closest to the shore may be in contact with Great Lakes water. Swales further away receive water via streams or groundwater seepage from areas upslope or support a shrub community. Forested wetlands may be present on swales that are furthest away from the water.

Probably the best-known example of a ridge and swale complex in Door County is located at The Ridges Sanctuary, a preserve occupying just over 1,600 acres along the bay of Baileys Harbor, Lake Michigan, in the northern portion of the Town of Baileys Harbor. The ridges run parallel to the shoreline of Baileys Harbor, and extend inland about one mile. Cooling breezes from Lake Michigan help to sustain a boreal forest, a forest type that is more characteristic of most of Canada.

DRUMLINS

Drumlins are landforms created over 15,000 years ago beneath the moving ice of the glacial Green Bay Lobe. Drumlins are composed of glacial till and are generally teardrop-shaped hills with a blunt nose and a gently sloping tail oriented in the direction of the glacier movement. Drumlins can be found south and east of Ellison Bay, along Highway 42 in Ephraim, northwest of Kangaroo Lake, and between the City of Sturgeon Bay and the Ahnapee River.

BIODIVERSITY

Door County boasts unusual biodiversity, defined by the DNR as the entire spectrum of life forms and the many ecological processes that support them. The DNR Bureau of Endangered Resources maintains Wisconsin's Natural Heritage Inventory (NHI), established in 1985 by the Wisconsin Legislature, a program responsible for maintaining data on the locations and status of rare species, natural communities, and natural features in Wisconsin. A natural community, or wildlife habitat, is an assemblage of different plant and animal species living together in a particular area, at a particular time, in a specific habitat. Species become rare for a variety of reasons, including habitat loss, habitat degradation, highly specialized habitat needs, sensitivity to disturbance, genetic problems, exploitation, persecution, predation, competition, and parasitism.

NATURAL COMMUNITIES

The location and abundance of ecological communities in Wisconsin are determined by environmental factors, such as climate, geology, landform, soils, and hydrology, which interact with natural disturbance events, including windstorms, fires, droughts, floods, and insect infestations. The NHI deems natural communities to be important because of their undisturbed condition, size, what occurs around them, or

for other reasons. Communities may be named for their dominant plant species (for example, pine barrens, sedge meadows, and oak savannas), a prominent environmental feature (Great Lakes Dune, Dry Cliff), or some combination of these factors. Communities range in size from less than one acre to thousands of acres. Communities are also dynamic and always changing. Of the 108 natural communities identified by the NHI as significant in the state, 32, or 30%, are found in Door County. (See Table 6.7 at the end of this document for a list of natural communities located in the county.) The NHI provides lists of natural communities found in each county, and the rare species (discussed below), but it does not identify specific locations in order to protect these rare and sensitive resources.

RARE SPECIES

In addition to the 32 significant natural communities identified in Door County, the NHI also inventoried 145 rare aquatic and terrestrial animals and plants in the county. The NHI list contains species known or suspected to be rare in natural communities native to Wisconsin. It includes species legally designated as endangered or threatened as well as species in the advisory "special concern" category. The list is dynamic and updated as often as new information regarding the biological status of species becomes available. (See Tables 6.6 and 6.7 at the end of this document for lists of rare aquatic and terrestrial plants and animals in Door County.)

A DNR analysis of the distribution of state endangered and threatened species indicates that Door County contains the richest rare species composition per square mile. There are two plant species in Door County that are on both the state and federal endangered species list: the Dwarf Lake Iris and the Pitcher's Thistle (also referred to as dune thistle). The Dwarf Lake Iris is found on partially shaded sandy-gravelly soils along lakeshores and the Pitcher's Thistle is found on stabilized dunes and blowout areas along the Lake Michigan shoreline.

One animal species found in Door County, the Hine's emerald dragonfly, is on both the state and federal lists of endangered species. In 2007, the U.S. Fish and Wildlife Service designated critical habitat for the Hine's emerald dragonfly in Wisconsin, Illinois, and Michigan. There are eleven Hine's emerald dragonfly critical habitat units in Wisconsin; ten of them are in Door County, where the county's coastal springs and wetlands provide rich habitat. Groundwater must remain clean and abundant in order to protect the dragonfly's habitat; note that groundwater discharge to a wetland can originate from nearby or from several miles away. The UW-Extension's Wisconsin Geological and Natural History Survey has mapped the groundwater recharge areas that feed the wetlands where the dragonfly larvae live in Wisconsin. Information and maps pertaining to the Hine's emerald dragonfly critical habitat and the groundwater recharge area study can be found at the websites listed under U.S. Fish and Wildlife Service and the Door County Soil and Water Conservation Department in the Resources and Further Information at the end of this document.

Another animal species found on both the state and federal lists of endangered species is the Piping plover. Piping plovers are tiny shorebirds that inhabit large, isolated beaches with sparse vegetation, preferring the shores of Lakes Michigan and Superior. Plovers have light sandy-gray colored back feathers, white underparts with a white wing stripe, a pale orange, black-tipped bill, and pale orange legs. From the late 1800s to early 1900s, shooting of plovers for sport and the millinery trade contributed to serious population declines throughout North America. Populations began to recover when the Migratory Bird Treaty Act of 1918 made it illegal to hunt them, but humans interfered a second time when increased use of beaches where plovers nest caused populations to decline again. By

1948, only one pair of plovers was known to nest in Wisconsin (in Door County). Between then and 2011, Piping plovers had been absent as nesting birds from the Wisconsin shore of Lake Michigan. Then in 2012, a pair was discovered nesting in northern Door County. In 2019, Plovers were observed nesting in Green Bay, signaling a possible comeback.

THREATS TO NATURAL FEATURES

This section provides an overview of threats to Door County's natural features, beginning with general discussion on climate change, with further examination of climate change effects intertwined in following sub-sections. Discussed in this section are the existing and magnified impacts from these changes, such as lower water levels, shoreline recession and damage, flooding and wetland destruction, runoff, groundwater quality and quantity, and reduced biodiversity. This discussion provides only a broad overview of these complicated issues; a more detailed description can be found in the report *"Wisconsin's Changing Climate: Impacts and Adaptation,"* for which a link is provided in the Resources and Further Information section at the end of this document.

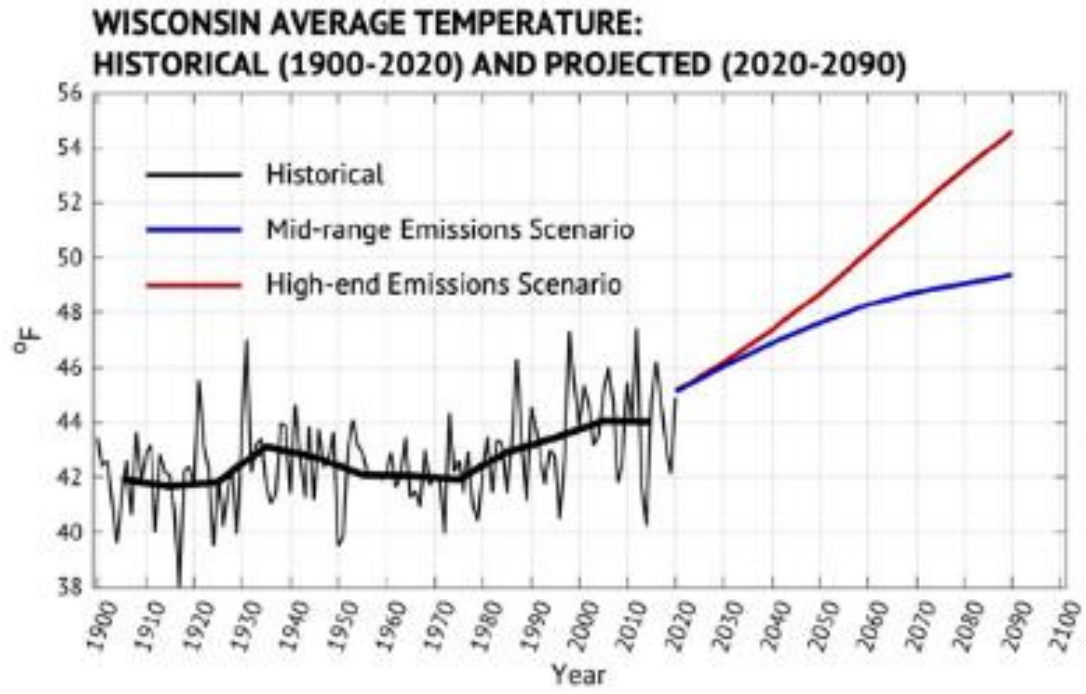
CLIMATE CHANGE

As discussed previously, WICCI reports that Wisconsin's climate has become warmer and wetter since 1950. For coastal regions, such as Door County, temperatures are expected to keep rising, resulting in increased evaporation and transpiration, less ice cover, greater wind strength, and more frequent extreme weather and storms. WICCI is less certain about precipitation, but generally states that rain events, especially in spring, have become more frequent and intense and will continue along that trend. Overall, WICCI predicts more precipitation, but that evaporation will outpace the increased precipitation because of warmer temperatures and reduced ice cover.

RISING TEMPERATURES

According to the Wisconsin Initiative on Climate Change impacts (WICCI), Wisconsin's average temperature is projected to increase another 3 to 5 degrees Fahrenheit by 2050. (See Figure 6.7.)

Figure 6.7: Wisconsin Historical and Projected Average Temperatures



Source: Wisconsin Initiative on Climate Change Impacts, 2021 Assessment Report.

According to the National Weather Service (NWS) and the National Oceanic & Atmospheric Administration (NOAA), for both low and high emissions forecasts, the average daily maximum and average daily minimum temperatures are projected to increase in Door County over the next 70+ years. (See Figures 6.8 & 6.9.) This follows the trend of more extreme global temperatures.

Figures 6.8: Projected Maximum Annual Average Temperature, Door County

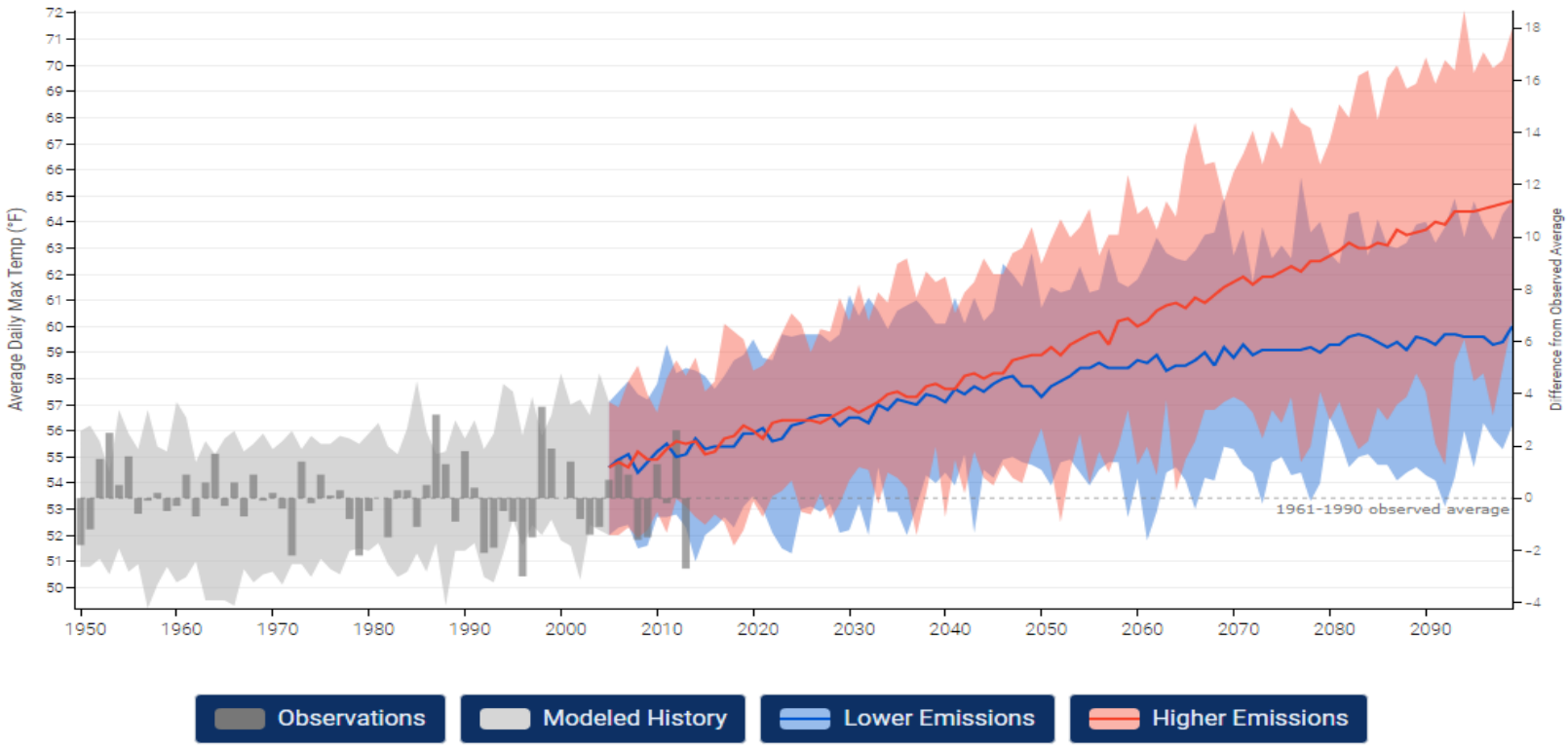
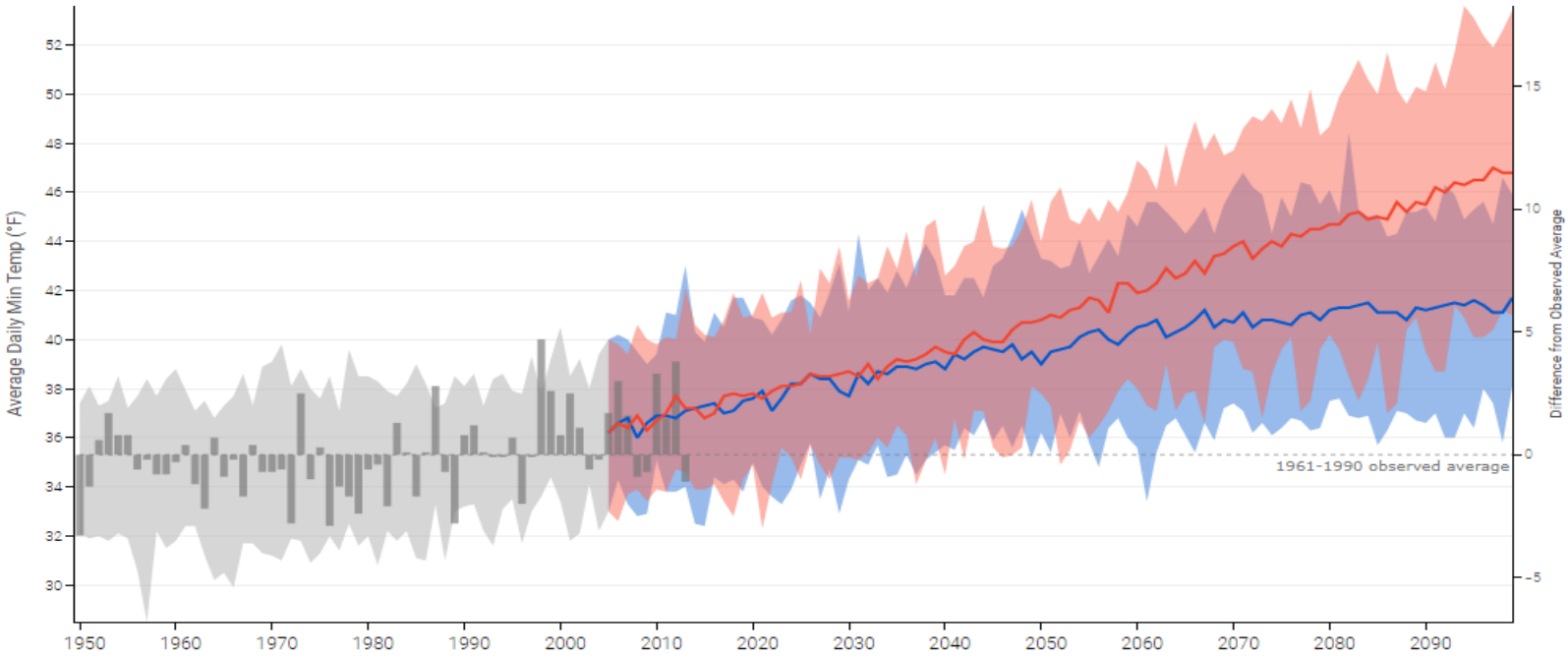


Figure 6.9: Projected Minimum Annual Average Temperature, Door County

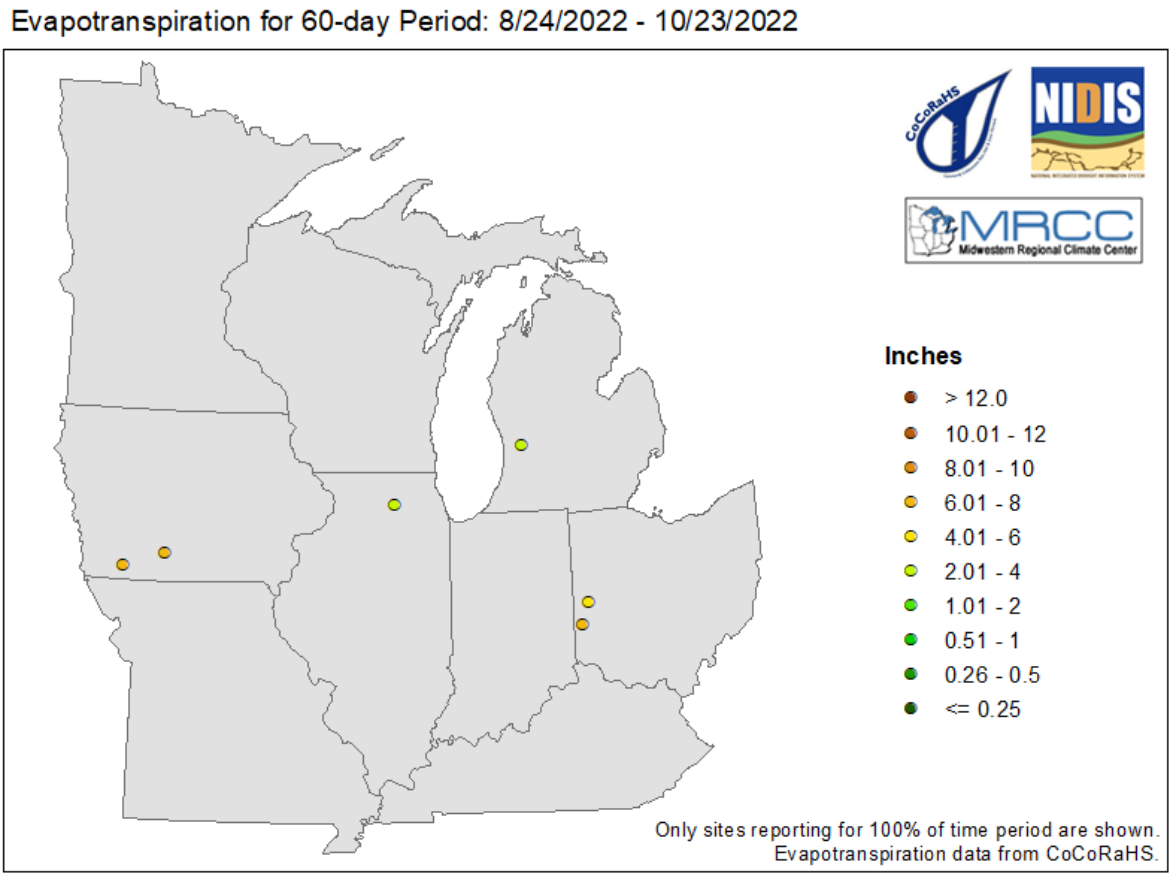


Source: National Weather Service & National Oceanic & Atmospheric Administration, The Climate Explorer.

Evaporation

Rising temperatures, in turn, increase the rate of evaporation from the soil, enhancing the probability of agricultural and ecological droughts. The Midwestern Regional Climate Center (MRCC) tracks evapotranspiration across the region for various timeframes, ranging from one to sixty days. The U.S. Geological Survey defines evapotranspiration as the "sum of all processes by which water moves from the land surface to the atmosphere via evaporation and transpiration," where evaporation refers to the soil releasing water vapor into the atmosphere, and transpiration refers to plants releasing water vapor into the air. The MRCC reports that over the course of sixty days in 2022, evapotranspiration across the region varied from two to eight inches, with lower amounts occurring further north near Door County. (See Figure 6.10 below.)

Figure 6.10: Evapotranspiration, Midwest



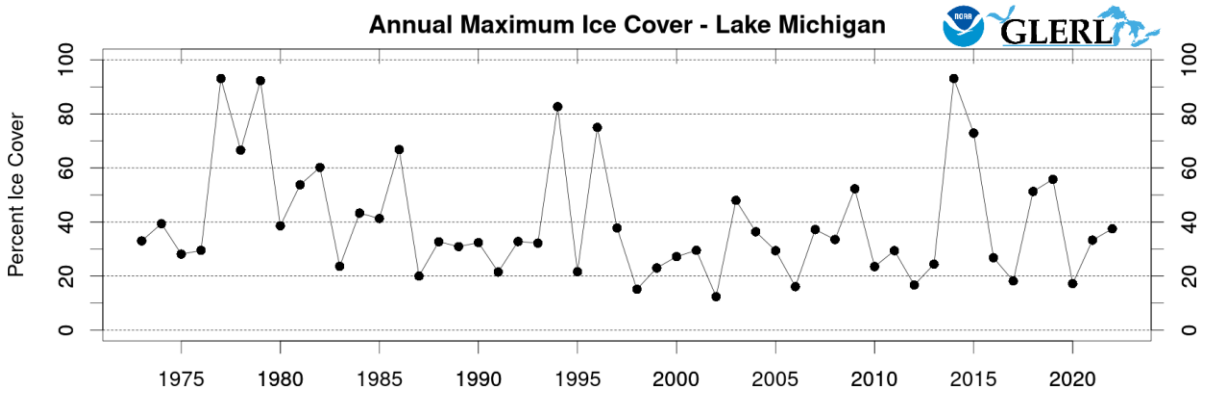
Source: Midwestern Regional Climate Center.

Ice Cover

Lake Michigan's maximum ice cover has varied over the past fifty years, ranging from less than 20% in some winters to over 90% during others. (See Figure 6.11.) According to the National Oceanic and Atmospheric Administration's (NOAA) Great Lakes Environmental Research Laboratory (GLERL), the areas of Lake Michigan surrounding Door County have seen a 5% to 20% reduction in ice cover since

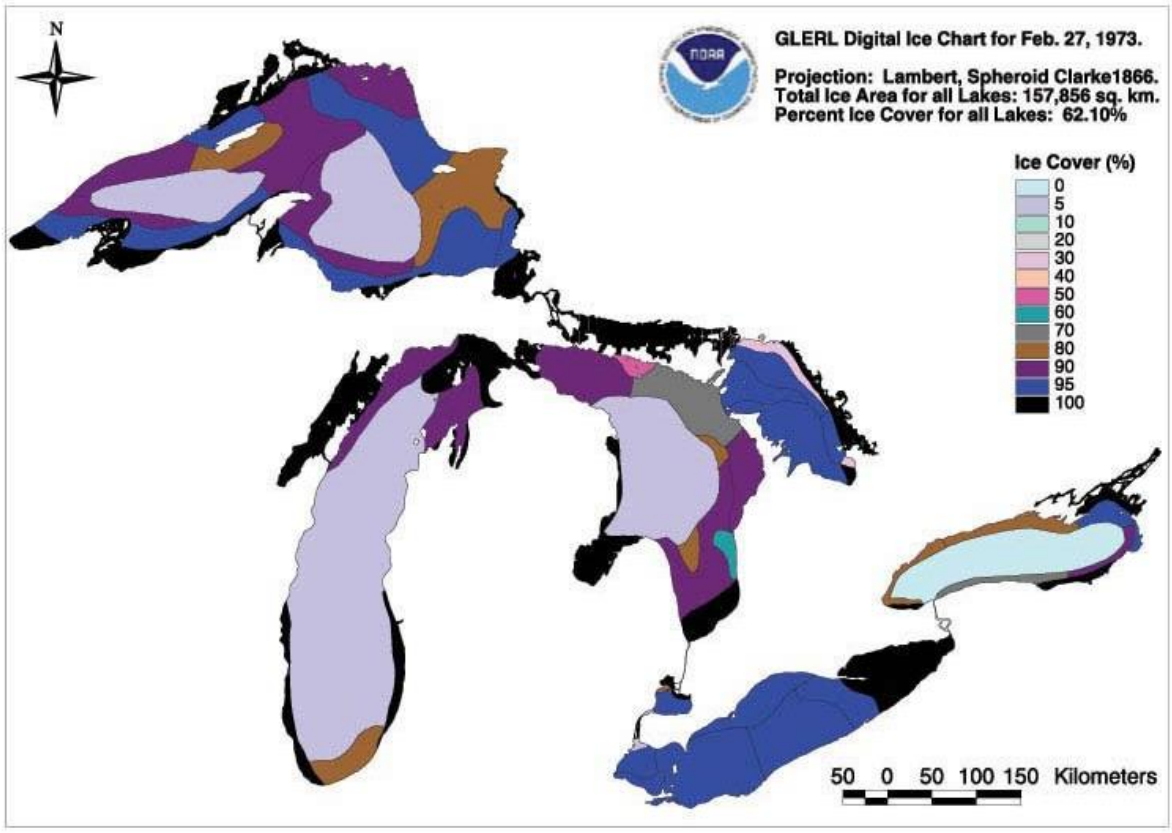
1973, roughly fifty years ago. (See Figures 6.12 and 6.13.) The GLERL forecasts Lake Michigan's long-term average annual maximum ice cover to be 40.2%.

Figure 6.11: Annual Maximum Ice Cover 1973 to 2022, Lake Michigan



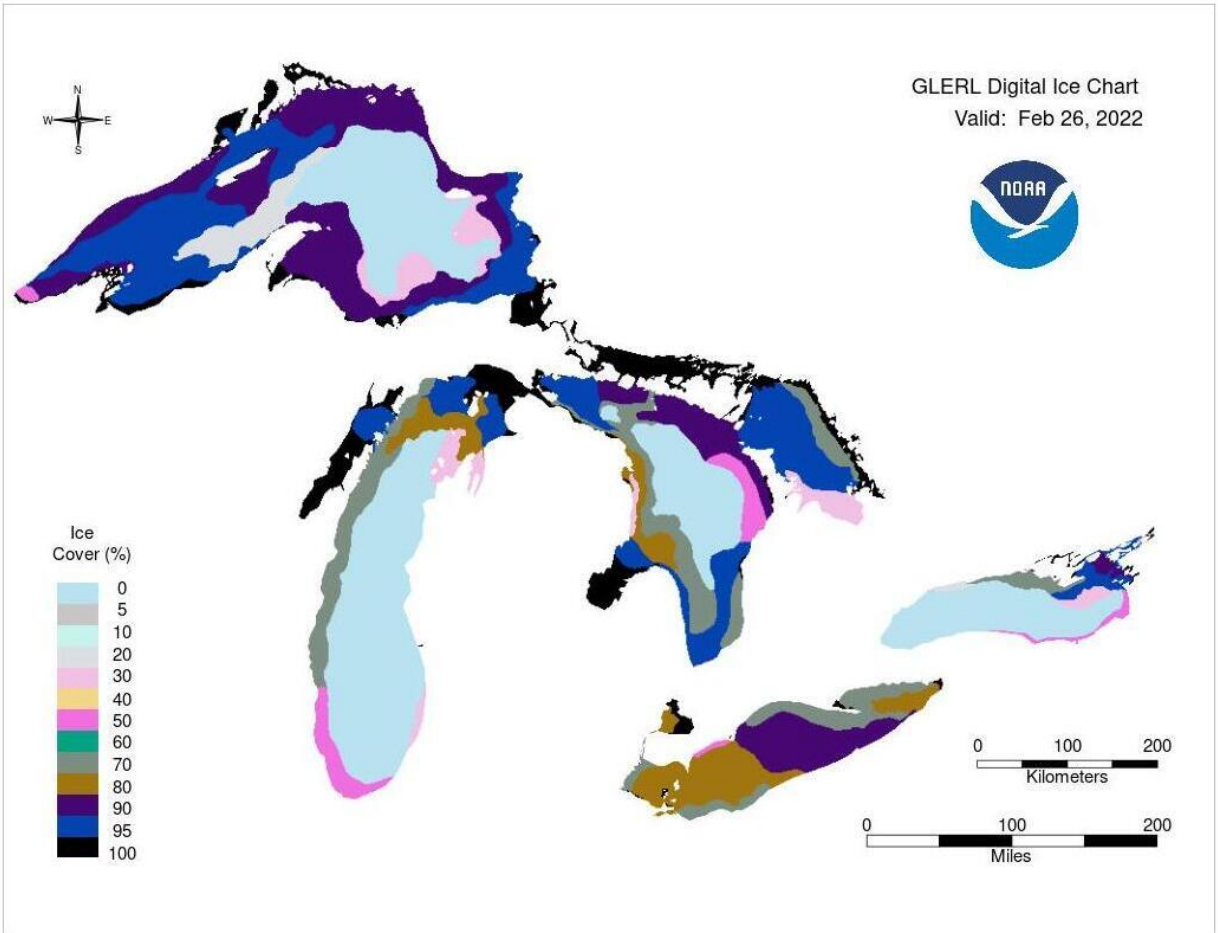
Source: NOAA GLERL, Ice Cover.

Figure 6.12: Ice Cover 1973, Great Lakes



Source: NOAA GLERL, Ice Charts.

Figure 6.13: Ice Cover 2022, Great Lakes



Source: NOAA GLERL, Ice Charts.

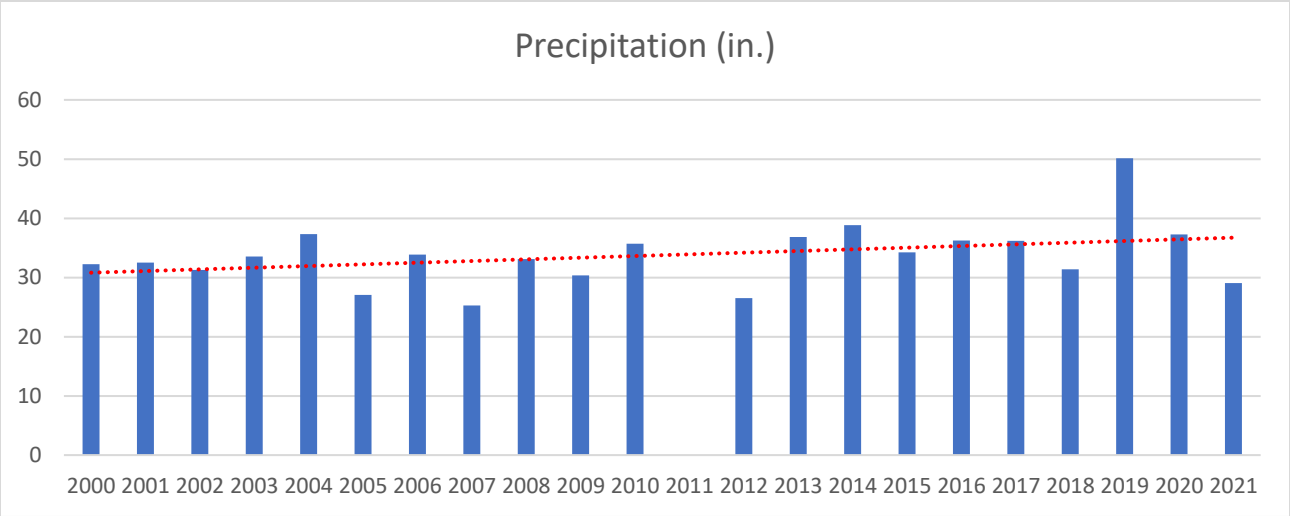
Wind Strength

Increased wind strength and extreme wind storms are another climate change-driven issue for Door County, as well as Wisconsin as a whole. The WICCI Report 2021 highlights derechos, or severe straight-line wind storms often accompanied by rapidly moving showers or thunderstorms, as a particular concern because these storms are most common in the Midwest. Per the NOAA Storm Prediction Center, derechos can produce destruction similar to that of a tornado, and are extremely damaging to the trees. As Door County consists of large swaths of forests, derechos and extreme winds threaten the integrity of these areas and habitats, as well as pose safety risks to those involved in outdoor activities.

Precipitation

In the past two decades, according to the NWS Sturgeon Bay Experimental Farm weather station, Door County experienced the highest levels of precipitation in 2019, at an annual total of 50.11 inches. All other years have fallen in the 20- to 40-inch range. Note that the data for 2011 is incomplete and, therefore, annual totals are not available. The average annual precipitation from 2000 to 2021 was 33.76 inches. There has been a slight upward trend in precipitation over the past two decades. See Figure 6.14 below.

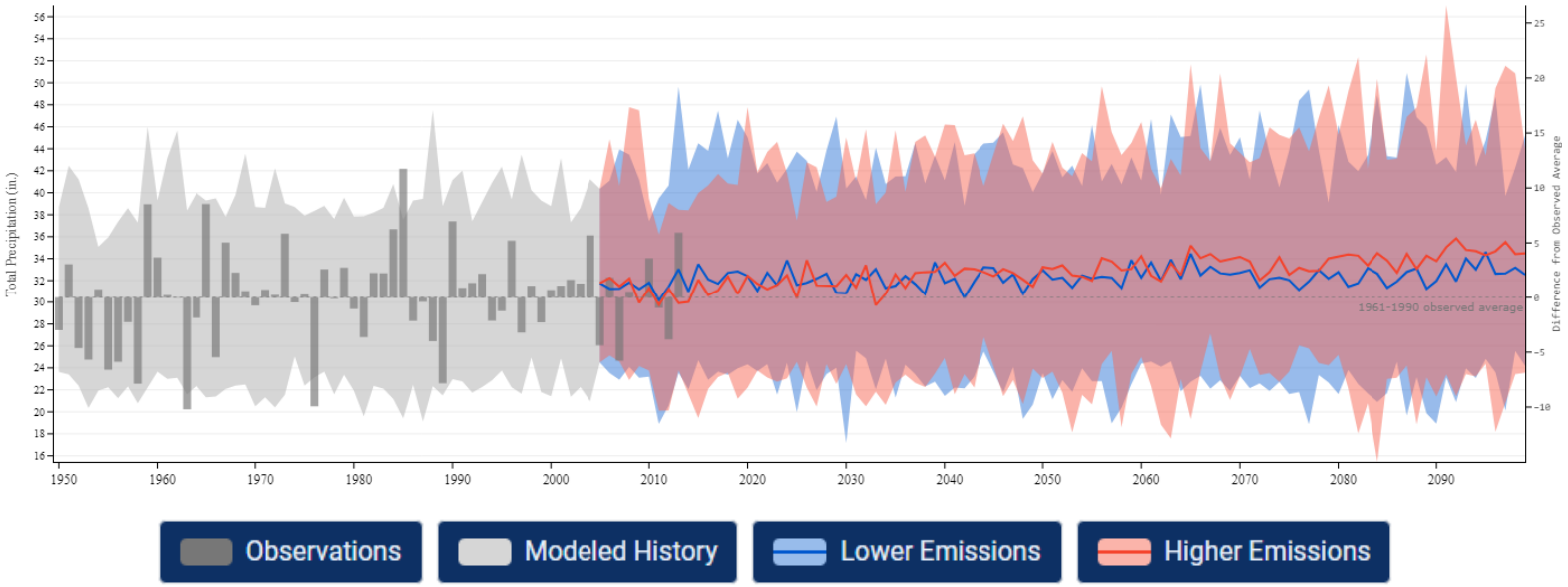
Figure 6.14: Annual Precipitation Totals, Door County



Source: National Weather Service, Past Data, NOWData.

According to the NOAA Climate Explorer, precipitation is expected to increase in the county in both low and high emissions scenarios, relative to the 1961-1990 observed precipitation average. Precipitation averages are projected to be three to five inches greater than the 1961-1990 average by the 2090s. Note that 2013 is the last year observed for these projections; the past ten years of precipitation information could have an effect on projections. See Figure 6.15 below.

Figure 6.15: Precipitation Projections, High and Low Emissions, Door County

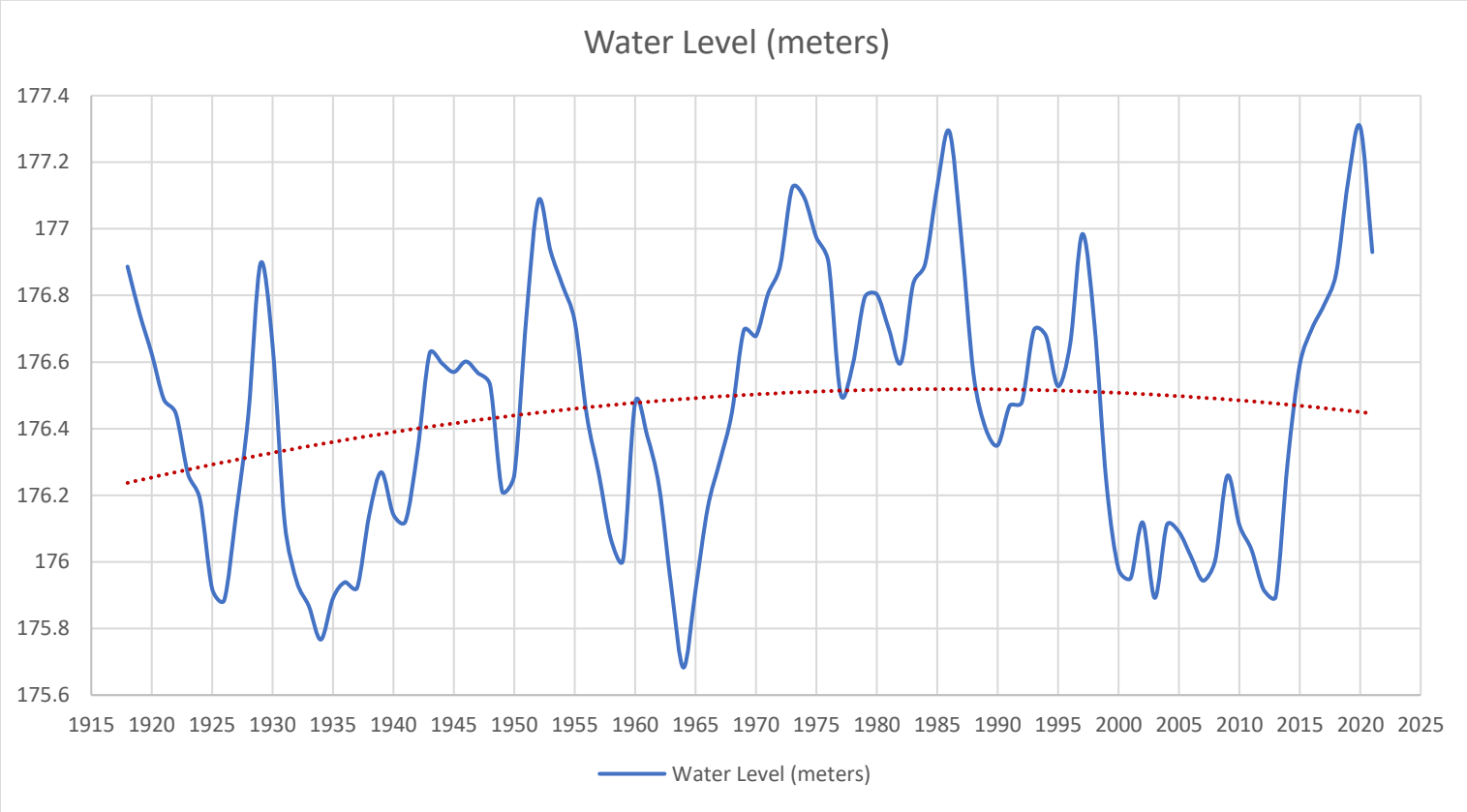


Source: NOAA Climate Explorer.

LAKE MICHIGAN WATER LEVELS

Overall, water levels in the Great Lakes have fallen over the past century. In 2013, Lake Michigan faced near historic lows, with the water level dropping 21 inches below the long-term average. However, in 2020 Lake Michigan reached historically high levels of over 177 meters, roughly 582 feet. Lake Michigan's water levels have still trended downward since the mid-1980s, though. (See Figure 6.16.)

Figure 6.16: Historic Lake Michigan-Huron Water Levels, 1918 – 2021



Source: Great Lakes Coordinating Committee, for years cited.

In the short-term, water levels of Lake Michigan are forecasted to decrease. Over the next century, Lake Michigan water levels are projected to continue this trend, falling anywhere from a few inches to up to 9 feet.

SHORELINE RECESSION AND DAMAGE

Reduced ice cover in combination with increased wind strength and storms exposes shorelines to larger waves for longer periods of time, resulting in shoreline erosion. Additionally, increased precipitation and flood events make shorelines exceedingly vulnerable to erosion, as more moisture in the soil makes it unstable. Shoreline erosion eventually leads to shoreline recession, the change in distance from a shoreline feature's original position to the eroded position, the most visible aspect of erosion. Shoreline damage can also occur with fluctuating water levels, which are often affected by precipitation levels, and excessive wave impact. As waves down-cut the lakebed during low-water times, shoreline erosion happens more quickly; then, when water levels rise again, waves can reach further inland and lead to shoreline damage. This damage can affect ecosystems, property, and infrastructure. In 2019, areas of

Baileys Harbor lost residential access after the road washed out due to the high Lake Michigan water levels. (See Figure 6.17.)

Figure 6.17: Shoreline Damage, Baileys Harbor, Door County

Town of Baileys Harbor maintenance crews and contractors work to restore residential access with giant limestone boulders after the road collapsed into Lake Michigan due to high water levels. Photo taken Dec. 19, 2019. (*Credit: Brett Kosmider / Door County Pulse*)

Source: PBS Wisconsin, 2021.

FLOODING AND WETLAND DESTRUCTION

While it is projected that Lake Michigan water levels will decline overall by the end of the century, coastal flooding is likely to occur during high-water decades due to a combination of wind, waves, and water levels. As discussed in previous sections, climate change is leading to warmer, wetter conditions as well as an increase in frequency and severity of extreme weather events. These conditions, in turn, generate more runoff, thus leading to longer periods of flooding in streams and wetlands. Under normal circumstances, coastal wetlands would help prevent floods, protect shorelines, and recharge groundwater supplies, but climate change is reducing their effectiveness, as wetlands are highly sensitive to elevated temperatures. With falling water levels, stream channels will erode, delivering more sediment downstream that could potentially bury aquatic communities located within wetlands. In high-water decades, rising water levels could either drown or seriously erode coastal wetlands. Further discussion on the ecological impacts of climate change are at the end of this section.

NONPOINT SOURCE POLLUTION (RUNOFF)

The two types of water pollution that contribute to impaired water quality are point source and non-point source. Point source pollution created by municipal and industrial operations discharging wastewater to surface water or groundwater is regulated by the DNR through its Pollutant Discharge Elimination System (WPDES) permit program. Nonpoint source pollution, or runoff, is much more difficult to regulate because the source of pollution is not identifiable.

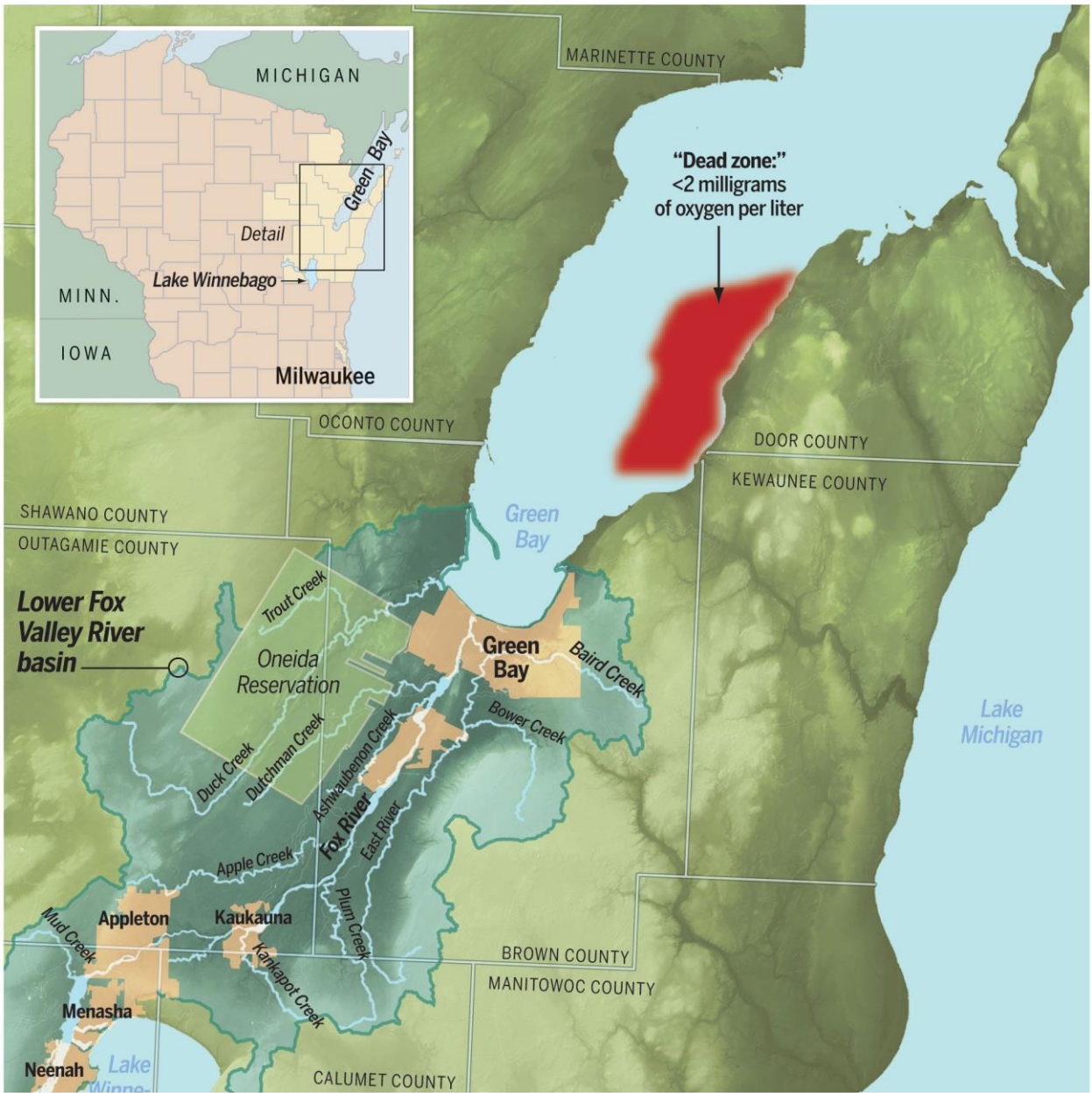
The DNR describes runoff as water from rainfall or melting snow that flows across the landscape, washing soil particles, bacteria, pesticides, fertilizer, pet waste, oil, and other toxic materials into lakes, streams, and groundwater. This is called "nonpoint source pollution," because the pollution cannot be traced to one definitive point or source. Conversely, point source pollution is that which originates from a definitive point such as pipes, drains, ditches, wells, containers, or other identifiable sources that serve as direct conduits of pollutants into the water. Nonpoint source pollution is the result of a variety of human activities, including the use of fertilizers, pesticides, and herbicides on lawns and farm fields; plowing fields for crops and other agricultural activities; driving and maintaining cars; constructing buildings and roads; mining; and maintaining roads in the winter. Actual pollutants found in runoff from agricultural and developed lands include sediment, phosphorus, nitrogen, bacteria, and pesticides.

According to the DNR, urban and rural nonpoint source pollution is the leading cause of water quality problems in Wisconsin, degrading and threatening an estimated 40 percent of the streams, 90 percent of the inland lakes, many Great Lakes harbors and costal wetlands, many wetland areas, and substantial groundwater resources in Wisconsin. Further, runoff may be exacerbated by climate change-related events, such as increased precipitation, particularly in winter, and more frequent and intense storms.

SEDIMENTATION AND PHOSPHORUS

Two of the greatest problems associated with runoff are increased amounts of sedimentation, and phosphorus, a type of nutrient. Sedimentation reduces visibility for the fish and birds that rely on clarity for hunting. Sedimentation also makes growth difficult for submerged vegetation, resulting in decreased vegetation and degraded habitat for all types of insect and fish species. High phosphorus levels in Green Bay have been a consistent threat to the aquatic system of the bay, and Lake Michigan, due to large algae blooms. In particular, phosphorus generates a type of blue-green algae that outcompetes more desirable algae, contributing to reduced light penetration and lower oxygen concentrations in the water. Low oxygen levels in the bay have created what is known as a "dead zone," defined as the area which contains less than two milligrams of oxygen per liter. (See Figure 6.18 below.)

Figure 6.18: Green Bay/Lake Michigan Dead Zone



Source: Milwaukee Journal Sentinel, 2012.

The EPA attributes most of the phosphate load into our waterbodies as coming from nonpoint sources, such as runoff from farmland, since phosphorus is a common ingredient in commercial fertilizers; urban areas and lawns; and failing or leaking septic systems. Much of it also comes from sewage treatment plants, despite water treatment techniques intended to reduce phosphorus outflow.

Both voluntary and regulatory programs have been implemented through the DNR's Runoff Management Program. As described later in this chapter, the DNR runoff programs are implemented locally by the Door County Soil and Water Conservation Department (SWCD).

E. COLI CONTAMINATION

E. coli contamination has been found to be another problem associated with runoff. In 2002, the Door County Public Health Department began to monitor E. coli in the water at many Door County beaches because of an outbreak of gastrointestinal illnesses traced back to Nicolet Beach in Peninsula State Park, one of the county's most popular beaches. In 2003, the SWCD began an extensive beach contamination source identification effort, collecting data at 31 beaches between 2003 and 2006, and at 34 beaches in 2007. A final report published in 2007 notes that the most contaminated water samples came from shallow water, indicating onshore sources of contamination. The report goes on to identify stormwater discharge during and after rain events as one of the clear sources of E. coli contamination in beach water throughout the county. According to the DNR Beach Monitoring Program, as of April 2022, Fish Creek Beach was deemed to be "Impaired Water" due to E. coli contamination, as the bacteria were causing recreational use impairments.

CLADOPHORA

Door County has seen increasing amounts of Cladophora along its beaches – a filamentous, green, slimy algae that stinks when it starts to rot. Cladophora is a native aquatic plant that has grown naturally in Door County waters for hundreds of years in relative harmony with other plants. More recently, two major human-induced environmental impacts have escalated the amount of Cladophora to nuisance levels: the introduction of the non-native zebra mussel and the surge of phosphorus in the waters.

The zebra mussel, introduced to Lake Michigan through the bilge waters of European ships, procreates quickly and eats by filtering particles out of the water, making it distinctly clearer than it would be naturally. Sunlight then penetrates deep into the water, expanding the habitat where Cladophora can grow from depths of 10 feet, to depths up to 45 feet, allowing for massive expansion. In addition to enabling Cladophora growth by filtering the water, the zebra mussel carpets sandy lake bottoms, providing additional hard surfaces where Cladophora filaments can attach. Lastly, the zebra mussel filters phosphorus into a form that feeds the Cladophora.

GREAT LAKES WATER DIVERSION

A threat to water quantity comes from communities located outside the Great Lakes basin, including other states and countries, looking to divert water to help them with their water shortages. As the global climate warms, and drought and water scarcity mounts, the demand for Great Lakes water is higher than ever before. Diverting water outside of the Great Lakes basin is a problem because there is no natural way to return it to the lake and future diversions would only contribute to the dropping water levels. When Great Lakes water is used by communities within the basin, it generally makes its way back to the lake it came from.

States within the Great Lakes region, and Canadian provinces bordering the Great Lakes, have been working together to address and manage potential water diversion for four decades. In 2005, the Great Lakes-St. Lawrence River Basin Water Resources Compact, or Great Lakes Compact, was created, and became law in 2008 after President George W. Bush signed a joint resolution of Congress giving consent to the compact. The Great Lakes Compact is an agreement between the states of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin and the Canadian provinces of Ontario and Quebec which details how the states and provinces will work collectively to manage,

protect, conserve, restore, and improve the water of the Great Lakes basin. The compact provides a comprehensive management framework for achieving sustainable water use and resource protection. As part of this compact, Wisconsin registers water withdrawals, receives and analyzes water use reports, requires water use permits, implements a conservation program, and manages Great Lakes diversions.

Due to the legal and regulatory barriers, technical difficulties, and prohibitive cost, the likelihood of diverting water out of the Great Lakes region remains low at this time. The greater threat coms from communities bordering the basin that are experiencing water shortages and quality issues. Per the DNR, the compact bans diversions of Great Lakes water with limited exceptions, such as:

- "Straddling community" – communities that straddle the Great Lakes boundary, lying partially inside and partially outside the Great Lakes basin.
- "Community in a straddling county" – communities that are wholly outside of the Great Lakes Basin, but are located in a county that straddles the Great Lakes basin boundary.

Currently, the DNR and the Great Lakes Compact have approved diversions for four communities in Wisconsin: New Berlin, Racine, Somers, and Waukesha. The requirements for a "straddling community" or "community in a straddling county" and more information on Wisconsin's current Great Lakes diversions can be found at the DNR Great Lakes Compact website page, listed in the Resources and Further Information section at the end of this document.

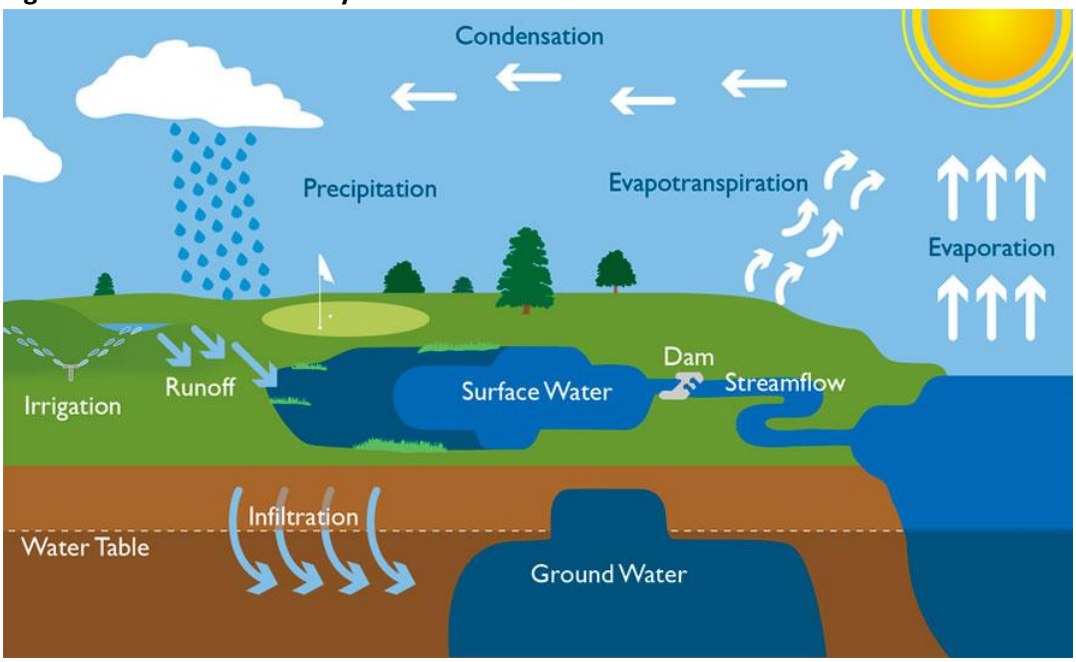
GROUNDWATER QUALITY AND QUANTITY

CONTAMINATION

Because the county's groundwater is recharged from water that infiltrates through a land surface consisting of thin soils and bedrock formations, Door County has one of the highest risks of surface water pollution to groundwater of any county in Wisconsin. The dolostone bedrock contains many karst features that provide for large water-holding capacity and lateral flow, but also allow water and accompanying contaminants to quickly and directly enter the dolostone aquifer. (See Figure 6.19.)

As development in an area increases, so does the impervious surface area, such as roofs, driveways, and parking lots. This affects the amount and quality of water that infiltrates to the groundwater due to the changes to vegetative cover, slope, soil composition, and soil depth. Groundwater may be contaminated by construction and agricultural runoff events, which can lead to contamination of private wells, fish kills, and an influx of nutrients into surface waters, in turn causing algal blooms. Additionally, leaking private septic system tanks, usually made out of steel, or other malfunctioning portions of private septic systems, are primary contributors of bacteria such as fecal coliform and E. coli to groundwater.

Figure 6.19: Groundwater Cycle



Source: Northeast Regional Climate Center.

Figures 6.20 and 6.21 are groundwater criteria concern maps, created by the Door County Land Use Services Department. Five physical characteristics were identified as important in determining how easily a contaminant can be carried through overlying materials to the groundwater:

1. Depth of bedrock;
2. Type of bedrock;
3. Soil characteristics;
4. Depth to water table; and
5. Characteristics of surficial deposits (glacial deposits lying between bedrock and soil).

Municipal wells serve roughly one-third of the county's households, while private wells serve approximately two-thirds of the county's households. Only the City of Sturgeon Bay, the Village of Sister Bay, and Maplewood (in the Town of Forestville) have municipal water. The Village of Sister Bay system also serves some households located in the Town of Liberty Grove. The City of Sturgeon Bay and the Village of Sister Bay have mapped their "zones of contribution," the surface area on the land that contributes rain and snowfall to the groundwater for a particular well site. Subsequent to mapping their zones of contribution, the City of Sturgeon Bay, Town of Liberty Grove, and the Village of Sister Bay adopted wellhead protection ordinances. While municipal wells are routinely tested for contaminants, proper monitoring of contaminants in private wells often does not occur. The DNR recommends testing well water at least once a year for bacteria and every three to five years for nitrates. Those with private wells should also have their water tested if they notice any change in the look, taste, or smell of the water.

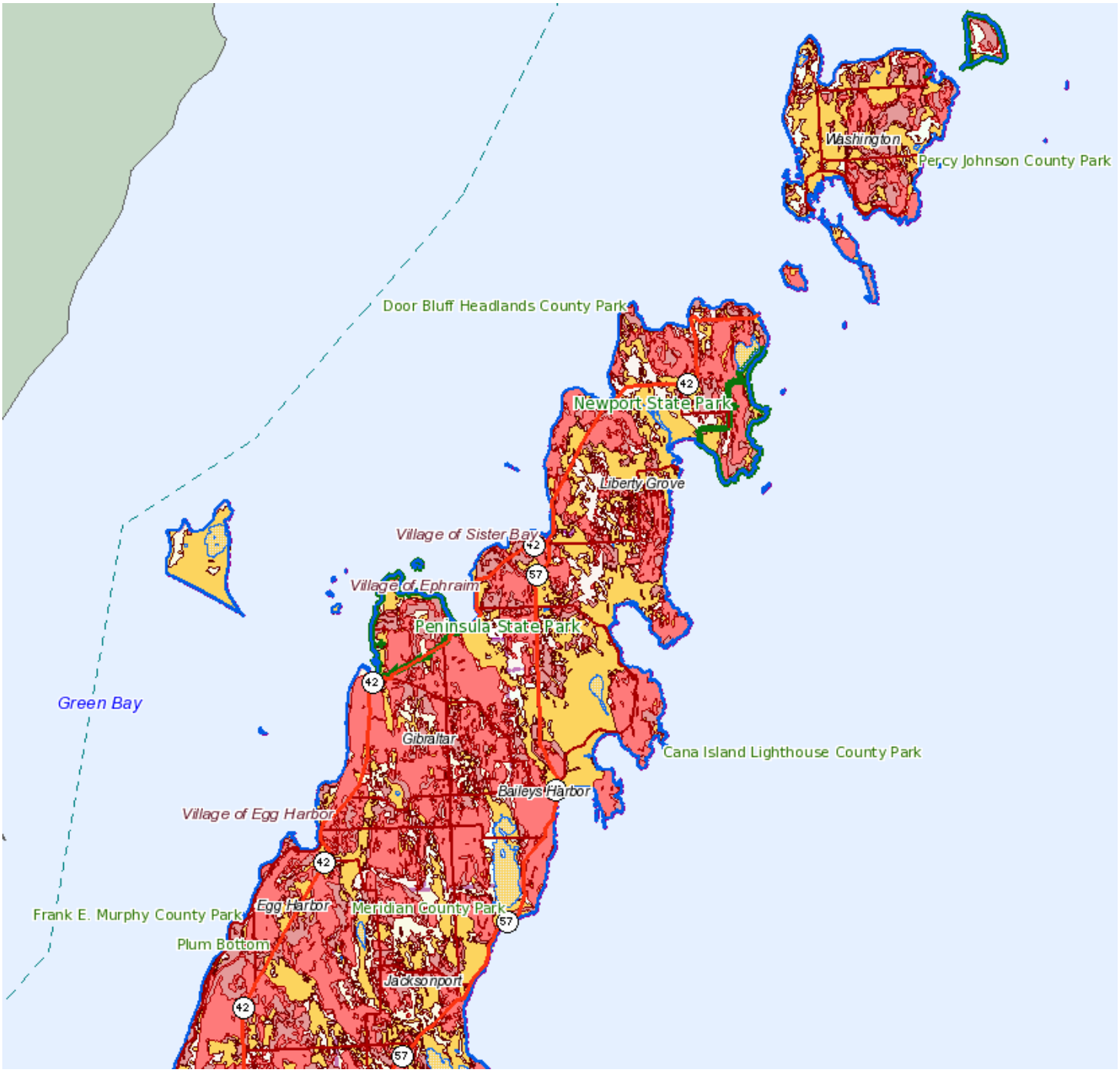
Copper and lead can be present in groundwater, but usually come from plumbing/piping and sometimes from pesticides or herbicides. Reported by the *Door County Pulse*, as of 2016, the Sturgeon Bay Utilities had 180 customers still serviced by lead pipes, while the Sister Bay Water Utility had no lead and all

copper service lines. Lead can also be present in groundwater because of the county's past agricultural practice of using lead arsenic for controlling diseases in orchards. Starting in the early 1900s and continuing through the 1940s – at which time the county had approximately 10,000 acres of cherry orchards and 2,000 acres of apple orchards – lead arsenic was the primary insecticide used; it was also used on potato crops on Washington Island. Widespread use of lead arsenic ended by 1960, but it was still sporadically applied in parts of the county until the early 1970s.

Elevated levels of lead arsenic in soils at abandoned mixing sites, orchards, and fruit processing plant wastewater discharge points are still of concern today as it poses a threat to drinking water supplies and to anyone coming into direct contact with it. The current DNR "Lead in Drinking Water" brochure notes that those living close to these sites in Door County should have their water tested for lead. Levels are highest at mixing sites and processing plant wastewater discharge points due to either spillage or concentrated presence in the water that washed the fruit to which it was applied. Concentrations are lower in former orchards where the pesticide was applied. However, the larger area of an orchard, as opposed to a processing plant, creates a potentially more widespread contamination problem.

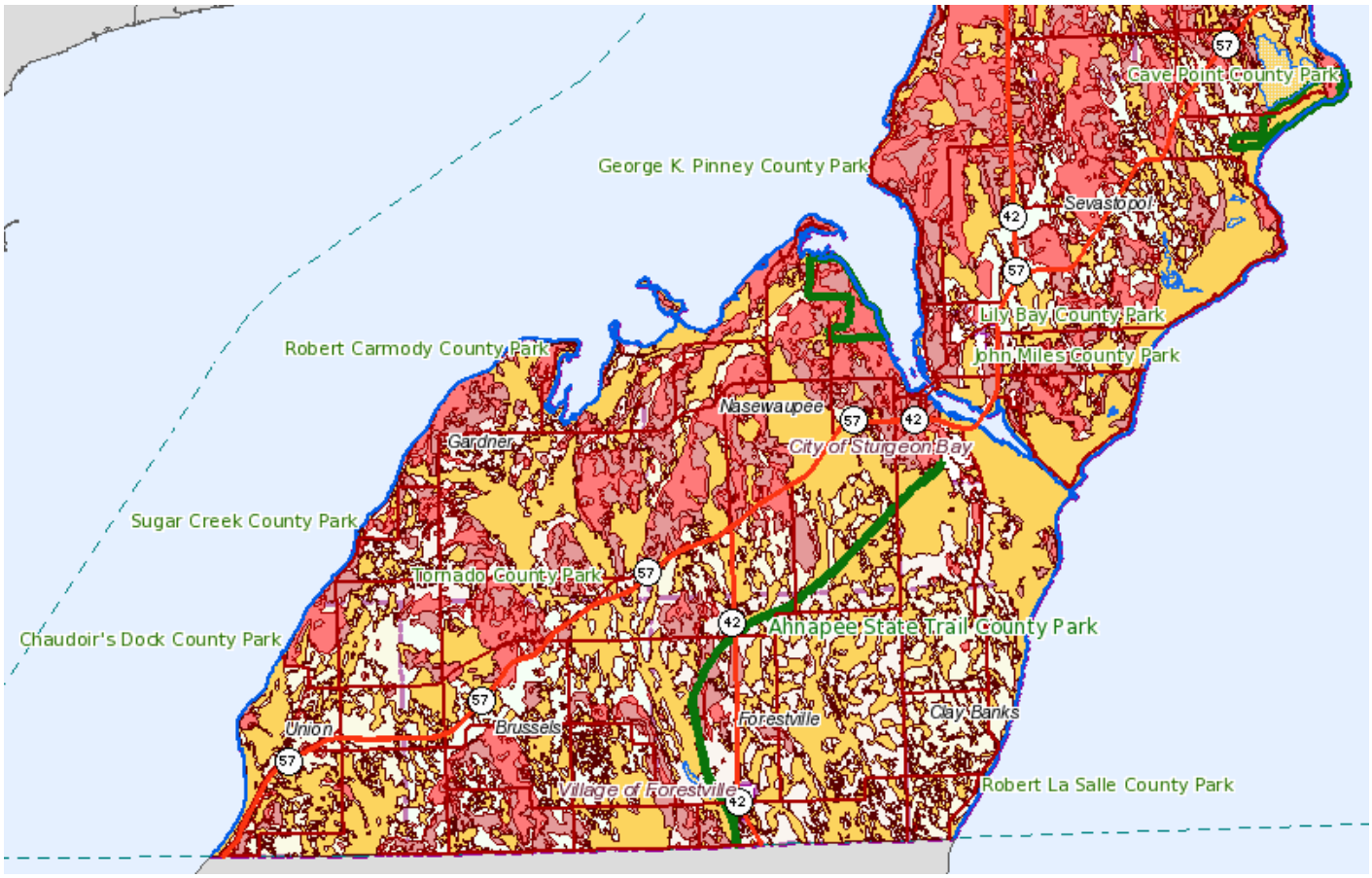
Finally, nitrates can also impact groundwater quality in Door County. Low levels of nitrates do occur naturally in some areas of the county due to geologic formations and direction of groundwater flow. Currently, the main sources of high levels of nitrates are nitrogen fertilizers, manure, septic systems, sewage treatment practices, animal feedlots, and municipal and industrial wastewater. High levels of nitrates can affect the ability of blood to carry oxygen, potentially leading to a serious condition in infants and young children known as "blue baby syndrome."

Figure 6.20: Groundwater Criteria Concern, Northern Door County



Source: Door County Land Use Services Department, Maps and Land Records.

Figure 6.21: Groundwater Criteria Concern, Southern Door County



Source: Door County Land Use Services Department, Maps and Land Records.

POTENTIAL CLIMATE CHANGE EFFECTS ON GROUNDWATER

Geologists and other water experts consider Door County to have an ample supply of groundwater, sufficient to supply the drinking water needs for both municipal and private systems. However, according to the WICCI Assessment Report 2021, groundwater supplies are affected by various climate change impacts including warmer temperatures and changing, more extreme precipitation patterns. Climate change is also expected to affect the recharge rate and amount of groundwater, quality of groundwater, and likelihood of groundwater flooding.

Groundwater Recharge

- Typically, an increase in precipitation leads to a rise in groundwater, but higher temperatures also lead to increased evaporation. Groundwater levels will be lowered if evaporation happens at a faster rate than groundwater recharges.
- Increased amounts of rainfall can either increase or decrease groundwater levels in the wintertime, depending on whether or not the ground is frozen. If the ground is frozen, more rainfall will increase runoff and decrease recharge; if the ground is not frozen, more rainfall will allow for more infiltration and increased recharge. The amount of recharge versus runoff will be affected by soil type, soil moisture, vegetation, and frost. During the summer months, as crops

absorb more water, warmer temperatures and a longer growing season may lead to a decrease in groundwater recharge.
- Since groundwater feeds the lakes, rivers, streams, and wetlands, a slower recharge could result in less flow from springs, lower baseflow in streams, loss of some wetlands, and lower lake levels. Increased recharge could result in more flooding and conversion of some wetlands into lakes.

Groundwater Flooding

- More frequent and high-intensity storms cause groundwater levels to rise above the ground surface in some areas, resulting in flooding.

Groundwater Quality

- Less groundwater recharge means less dilution of contaminants and higher levels of total dissolved solids.
- Increased groundwater levels would reduce the distance between the ground surface and groundwater, making groundwater more susceptible to contamination.

BIODIVERSITY

INVASIVE NON-INDIGENOUS SPECIES

Invasive species, along with climate change, negatively affect rare species and are expected to become an even greater threat in the future. Per the DNR, Wisconsin Statute defines invasive species as "nonindigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health."

One of the reasons that invasive species are able to succeed is that they often leave their predators and competitors behind in their native ecosystems. Without these natural checks and balances they are able to reproduce rapidly and out-compete native species, altering ecological relationships among native species, ecosystem functions, ecosystem services, and human health. Encroachment and invasion of aggressive and non-indigenous terrestrial and aquatic plant species threaten native species and ecological diversity in a variety of ways:

- Reduction in water and nutrient levels important to the survival and health of native species can result in monotypic vegetation (e.g., purple loosestrife) that lowers the ecological and aesthetic value of coastal areas.
- Invasive aquatic plants modify water chemistry, which in turn damages fish habitat.
- Dense vegetation growth within navigable waterways, typical of aggressive and invasive species, impedes fish migration and recreational opportunities.
- Plant community alterations result in dense vegetation (e.g., buckthorn) that shades out wildflowers.
- Increase in plant-to-plant competition lowers species diversity generally and limits crucial habitat for threatened/endangered species.

Door County has a Door County Invasive Species Team (DCIST), a group of natural resource professionals and interested public members that seek to educate, prevent, minimize, and eradicate invasive species,

thus reducing their impact on the county's natural resources, economic viability, and human welfare. DCIST created the following list (see Table 6.3 below) of the top invasive species in the county.

Table 6.3: Top Invasive Species, Door County

Aquatic/Wetland Species	Terrestrial Species
Bighead Carp	Autumn Olive
Canada Thistle	Bush Honeysuckle
Common reed (Phragmites)*	Common Buckthorn
Curly-Leaved Pondweed	Common Teasel
European Marsh Thistle	Dame's Rocket
European Water-Milfoil	Garlic Mustard
Fishhook Waterfleas	Glossy Buckthorn*
Flowering Rush	Hound's Tongue
Gloosy Buckthorn*	Japanese Barberry
Japanese Knotweed*	Japanese Knotweed*
Lyme Grass	Leafy Spurge
Narrow-Leaved Cattail	Phragmites*
Purple Loosestrife*	Purple Loosestrife*
Quagga Mussels	Reed Canary Grass*
Reed Canary Grass*	Wild Parsnip
Round Goby	
Rusty Crayfish	
Silver Carp	
Spiny Waterfleas	
Starry Stonewort	
White Perch	
Yellow Water-Flag Iris	
Zebra Mussel	

Source: Door County Invasive Species Team.

POTENTIAL CLIMATE CHANGE EFFECTS ON BIODIVERSITY

Climate change is a pervasive and growing threat to biodiversity. Warming temperatures, shifting precipitation patterns, and an increasing frequency of extreme weather have caused, and will continue to cause, physical changes to natural communities, triggering long-term biological responses from the species that live there. The National Climate Adaptation Science Center (NCASC) explains rising temperatures have influenced species to change behaviors. Varying responses among species include:

- altering feeding schedules to make better use of shade;
- physically adapting;
- changing the timing of biological events, (i.e. phenology); and
- shifting geographic range.

However, according to the NCASC, even these species that are responding to warming climates may be adapting too slowly to keep pace with climate change. Scientists predict the majority of species affected

by climate change will fare poorly. The WICCI Assessment Report 2021 identified key climate change impacts on our state's habitats and species, some of which are listed below.

- *Early onset of spring.* Spring thaw is occurring earlier and springs overall have become warmer and wetter. This extends the growing season, resulting in species range shifts or change in time of migrations.
- *Warming water temperatures.* Brook and brown trout are sensitive to changes in water temperature and cannot survive and reproduce above a certain temperature. Per the DNR, "If summer temperatures do rise as expected, scientists project that by 2050 trout habitat in streams will decline across the state by 32% for Brown Trout and by 68% for Brook Trout." Some species will benefit from warmer water temperatures, but most will suffer. In Door County, the endangered Hine's emerald dragonfly will suffer habitat loss as waters warm or increased rainfall prolongs wet conditions.
- *Reduced snow and ice cover.* By the end of the century, average snowfall is predicted to be reduced significantly, affecting plants and animals that have adapted to and/or rely on snow for their survival. Reduced snowpack is contributing to the loss of critical habitat and food sources for many wildlife species. Ice cover duration and ice thickness have both decreased over the last century. Nine of the top ten lowest ice cover years have occurred since 2002. The reduction in ice cover affects fish habitat, specifically cool-water fish like walleye.
- *Drought.* Much of the country, including Wisconsin, experienced moderate-to-severe drought conditions in the past decade. Although precipitation is likely to increase overall, primarily throughout the winter and spring, summers could experience drought conditions. Drought stresses forest ecosystems, increasing the risk of outbreaks of new pests and diseases. Additionally, summer droughts may accelerate the diminishing of species or species extinction rates. Decreasing water levels will also reduce habitat for many species and increasing stream temperatures will make it difficult for some species to survive.
- *Flooding.* As the climate becomes wetter with more frequent and intense precipitation events, flooding has become a larger risk. Increased flooding is reducing habitats and changing migration patterns of many species, especially wetland-dependent species like waterfowl.

CONSERVATION, PROTECTION, AND PRESERVATION PROGRAMS

Conservation, protection, and preservation programs that affect Door County are being conducted at the international, national, state, and local levels. This section provides an overview of plans and programs to protect and sustain surface water, groundwater, wetlands, woodlands, ecological areas and corridors, and vulnerable species. Lastly, discussion on preserved lands in the county and non-metallic mineral resources is provided.

SURFACE WATER

WATER LEVELS

As international boundary waters, the management of the Great Lakes involves cooperation among various parties to ensure the Great Lakes are protected and available for future generations. The current approach to managing water levels in the Great Lakes is through the regulation of outflows from

Lakes Ontario and Superior at dams located on the St. Mary's River at Sault Ste. Marie and at Cornwall/Massena on the St. Lawrence River. The International Joint Commission (IJC) administers the regulation that controls these outflows, specifying how much water may be let out under a range of conditions. Created by the Boundary Waters Treaty of 1909, the IJC is an international organization that acts as an independent and objective advisor to the U.S. and Canada. Each country appoints three of the six IJC commissioners, who traditionally work in consensus to find solutions that are in the best interest of both countries. The IJC has more than 20 boards and task forces whose members are expected to work in their professional capacities, not as representatives of an organization or region.

The IJC's ability to alter lake levels through outflow regulation is limited; changes in water supply caused by climatic factors, such as precipitation and temperature, have a far greater impact. Increases in temperature and changes in precipitation patterns are likely to continue affecting water levels in the Great Lakes-St. Lawrence River system. A mass of scientific evidence supports predictions of extreme water levels outside of historical ranges, both high and low, in the future.

As climate change persists, and IJC's regulatory power is limited, a broader, more comprehensive approach to managing the impacts of changing lake levels has been implemented. In 2012, the IJC created the International Great Lakes-St. Lawrence River Adaptive Management Task Team in order to develop a detailed adaptive management plan to address future extreme water levels in the Great Lakes-St. Lawrence River system. Adaptive management is a structured, iterative process designed to continually improve management policies and practices by learning from the outcomes of previous policies and practices. This process uses the best available information to take action, monitor results through the long term, and evaluate the effectiveness of actions taken. Actions are adjusted based on what is learned as knowledge improves or as conditions change.

In 2013, the Adaptive Management Task Team released its proposed *Adaptive Management Plan, Building Collaboration Across the Great Lakes-St. Lawrence River System: An Adaptive Management Plan for Addressing Extreme Water Levels.* The Plan proposes to address water level issues by working collaboratively with partners in the Great Lakes-St. Lawrence River system to gather and share critical information over time, assessing the information with state-of-the-art tools, developing adaption strategies, measuring collective success in managing the impacts of extreme water levels, and adapting accordingly. Its goal is to provide a more efficient and cost-effective way of supporting decision-making to reduce impacts associated with future extreme water levels.

This plan recommends engaging agencies, organizations, and institutions from across the Great Lakes-St. Lawrence River system in order to develop the following five areas:

- Hydroclimate monitoring and modeling to improve knowledge on water balance and water supply, the forecasting of net basin supply, lake levels, and climate modeling;
- Performance indicators and risk assessment to assess risks of extreme water levels to shoreline property, commercial navigation, municipal and industrial water uses, recreational boating, ecosystems hydropower, and other interests;
- Maintain, update, and improve tools needed for the evaluation of regulation plans over time and develop new tools to support decision-making regarding extreme water levels;
- Information management and distribution to facilitate sharing of water level-related data and information among the Great Lakes-St. Lawrence River system community; and

- Outreach and engagement to educate and establish two-way communication on water level-related issues throughout the Great Lakes-St. Lawrence River system community.

GREAT LAKES RESTORATION INITIATIVE

The Great Lakes Restoration Initiative (GLRI) was launched in 2010 as a non-regulatory program to accelerated efforts to protect and restore the Great Lakes, and to provide resources to progress toward long-term goals critical for this ecosystem. In October 2019, GLRI released its Action Plan III for fiscal year 2020 – fiscal year 2024. GLRI Action Plan III is responsive to Clean Water Act Section 118 amendments in 2015 and 2016 that codified the GLRI. The Action Plan III focuses on the following five focus areas:

1. **Toxic substances and areas of concern.** The Lower Green Bay/Fox River is the closest area of concern to Door County, but is identified as an area where completion of management actions could be achieved in the next five years.
2. **Invasive species.** Southern, Central, and Northern Green Bay all are locations sampled by the Great Lakes Early Detection and Surveillance Program to detect non-native species and track the expansion of non-native species over time. The GLRI is also in the process of developing invasive species control technology for the Great Lakes ecosystem.
3. **Nonpoint source pollution impacts on nearshore health.** The Lower Fox River is identified as an agricultural priority watershed. This focus area also targets issues of stormwater runoff to reduce water pollution in Great Lakes tributaries.
4. **Habitats and species.** GLRI focuses on protection and restoration of coastal wetlands, nearshore, and other Great Lakes community habitats. This includes increasing resiliency of species as well as promoting recovery in habitats and species that have been inadvertently harmed.
5. **Foundations for future restoration actions.** This focus area emphasizes education of the population and next generation about the Great Lakes ecosystem. This includes youth stewardship projects as well as comprehensive science programs and projects.

WISCONSIN DNR WATER QUALITY PROGRAMS

Wisconsin has conducted water quality planning since the mid-1970s, when Clean Water Act authorities were delegated to the DNR. The specific type of planning work has changed over time, but the end goal – restoring, protecting, and maintaining clean water and healthy aquatic ecosystems – has been a constant throughout. The current DNR Bureaus of Water Quality and Watershed Management oversees water quality through the Water Quality Program by setting water quality standards, implementing a runoff management program, surface water restoration, etc.

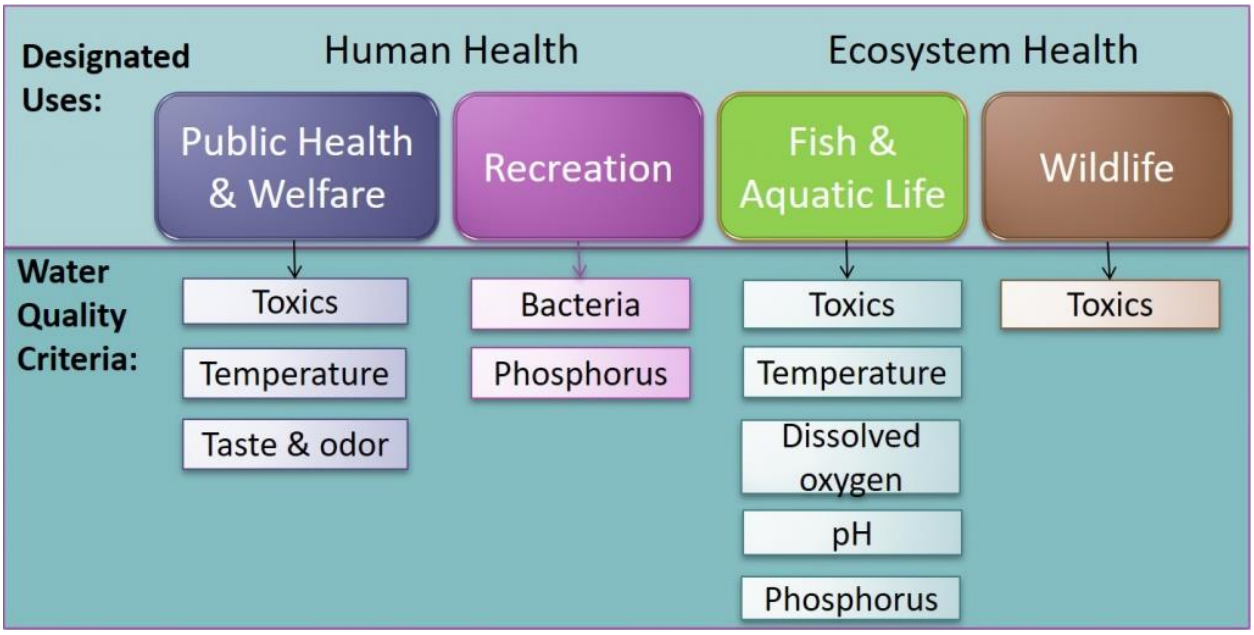
DNR Water Quality Standards

Chapter 281, Wis. Stats., authorized the DNR to establish water quality standards that are consistent with the Federal Clean Water Act (Public Law 92-500). These water quality standards are explained in detail in Chapters NR 102, 104-106, 207, and 217, Wis. Admin. Code. Water quality standards are the foundation of Wisconsin's water quality management programs and rely on three elements to collectively meet the goal of protecting and enhancing the state's surface waters: designated uses, water quality criteria, and protection from pollutants (anti-degradation).

1. *Designated Uses.* Assessing the health of a waterbody starts with determining what types of activities the water should support, or what is its designated use. Under the Clean Water Act, Wisconsin waters are each assigned four "uses" that carry with them a set of goals:
    a. *Recreational Use* – appropriate to protect for recreational use, which includes activities that involve contact with water such as swimming, water skiing, canoeing, kayaking, scuba diving, wading, boating, fishing, and hunting.
    b. *Public Health and Welfare Use* – protects for multiple avenues of human interaction with surface waters, including incidental contact and ingestion, fish consumption, and public drinking water supply.
    c. *Aquatic Life Use* – appropriate for the protection for fish and other aquatic life. There are also five sub-categories for this designation, due to the various fish and aquatic life communities supported by factors such as temperature, flow, habitat, and water chemistry.
    d. *Wildlife Use* – appropriate for the protection of birds and mammals that rely on the waterbody for food and water.
2. *Water Quality Criteria.* Water quality criteria represent the quality of water that supports a particular designated use. These criteria apply to Wisconsin's lakes, rivers, and streams, and are either narrative – statements that describe the desired water quality goal – or numeric – benchmarks set at a level of a pollutant that is protective of the designated use. The narrative criteria address pollutants such as:
    a. Floating or submerged debris, oil, scum, or other material;
    b. Substances that cause objectionable deposits on the shore or in the bed of a body of water;
    c. Substances that produce color, odor, taste, or unsightliness;
    d. Substances in amounts which are toxic or harmful to humans; and
    e. Substances in amounts that are harmful to animal, plant, or aquatic life.

    The numeric criteria are structured to protect the designated uses for a given waterbody. (See Figure 6.22 below.)
3. *Antidegradation.* This policy is implemented in NR 207, Wis. Admin. Code, with the purpose to address new or increased discharges to surface waters. The rule is intended to protect and maintain existing uses and high-quality waters.

Figure 6.22: Types of Numeric Criteria for Wisconsin's Waterbodies



Source: Wisconsin Department of Natural Resources, Surface Water.

Impaired Waters

Impaired waters are those not meeting state water quality standards – both water quality criteria for specific substances or designated uses – as defined by Section 303(d) of the federal Clean Water Act. Every two years, states are required to submit a list of impaired waters to the EPA for approval. States are required to document the methodology used to add or delete waters form the existing "303(d) List." A waterbody or segment of a waterbody may be added to the list because it is not meeting water quality standards or because water quality is threatened. Waters removed from the list must have data to support the fact that they are now meeting water quality standards. Door County's 303(d) Impaired Waters are listed in Table 6.4 below.

Table 6.4: Impaired Waters, Door County

Waterbody	Pollutant	Impairment	Year Listed
Ahnapee River	PCBs	PCBs Contaminated Fish Tissue	1998
Fish Creek Beach, Lake Michigan	E. coli	Recreational Restrictions - Pathogens	2022
Green Bay, Great Lakes Shoreline	PCBs	PCBs Contaminated Fish Tissue	1998
Haines Park Beach, Lake Michigan	E. coli	Recreational Restrictions - Pathogens	2022
Heins Creek	Unknown pollutant	Elevated Water Temperature	2020
Larson Creek	Total Phosphorus	Impairment Unknown	2022
Otumba Park Beach	E. coli	Recreational Restrictions - Pathogens	2022

Sand Bay Beach 1, Lake Michigan	E. coli	Recreational Restrictions - Pathogens	2022
Stony Creek	Sediment/Total Suspended Solids; Total Phosphorus	Degraded Habitat; Impairment Unknown	1998; 2018
Sugar Creek	Total Phosphorus	Impairment Unknown	2014
Unnamed Creek	Unknown pollutant	Degraded Biological Community	2022

Source: Wisconsin Department of Natural Resources, Surface Waters.

Outstanding and Exceptional Resource Waters

Chapter NR 102, Wis. Admin. Code, was created in 1973, establishing the "Outstanding and Exceptional Resource Waters Program" (ORWs and ERWs), in order to maintain water quality in Wisconsin's cleanest surface waters and in accordance with the Federal Clean Water Act. Waters are given these designations if they provide outstanding recreational opportunities, support valuable fisheries and wildlife habitat, have good water quality, and are not significantly impacted by human activities.

An ORW will receive the state's highest protection standards, with ERWs as a close second. ORWs typically do not have any point sources discharging pollutants directly to the water, while ERWs may have existing point sources at the time of designation; dischargers to ORWs and ERWs are required to maintain background water quality levels. There are six waterbodies in Door County that are designated ORWs or ERWs. (See Table 6.5 below.)

Table 6.5: Outstanding and Exceptional Waterbodies, Door County

Waterbody	ORW/ERW Designation
Hidden Springs Creek	ERW
Keyes Creek	ERW
Logan Creek	ORW
Mink River Lake	ORW
Mink River	ORW
Keyes Creek Tributary	ERW

Source: Wisconsin Department of Natural Resources, Surface Waters.

Healthy Watersheds, High-Quality Waters

In 2021, the DNR launched its Healthy Watersheds, High-Quality Waters (HWHQW) initiative to provide a road map for striking an improved balance between restoration and protection of the waters of Wisconsin. The HWHQW Plan has a strategic framework, which states its main intent is to prioritize healthy watersheds and the high-quality lakes, rivers, streams, and wetlands within them for protection so those water resources can continue to support healthy ecosystems, biodiversity, and recreational use. The framework outlines four main objectives:

1. Increase capacity to provide technical assistance.
2. Leverage and adapt existing program tools to achieve results.
3. Increase utilization of funding for protection.
4. Increase external awareness of the HWHQW initiative and the places prioritized for protection.

Each objective contains various action items, outlining several strategies for success. The action items include strategies ranging from increased shoreland protection, to creating best management practices toolkits, to a "Wonderful Waters of Wisconsin Day."

Other Surface Waters

Many waterbodies fall between the Outstanding and Exceptional Water Resources and the 303(d) Impaired Water categories. Although these waterbodies do not receive any special designation, this does not minimize the importance of their protection. In 2000, the SWCD published The Surface Water Inventory of Door County, a report that inventories known surface waters and also addresses their geographical, geological, and ecological components. Overviews of wetlands, ridge and swale complexes, and the geology of the county are also discussed. The report does not attempt to classify waterbodies beyond the formally recognized 303(d) Impaired Waters, but does describe specific negative impacts and threats to water quality.

DNR Runoff Management Program

Chapter NR 151, Wis. Admin. Code, outlines runoff management pollution performance standards for non-agricultural facilities and transportation facilities, as well as performance standards and prohibitions for agricultural facilities. It also establishes runoff management practices designed to achieve water quality standards as required by s. 281.16(2) and (3), Wis. Stats. The Chapter authorized the DNR to administer the Runoff Management Program, which creates and revises administrative rules for the prevention and management of polluted runoff from agricultural practices, stormwater drainage, construction sites, developed urban areas, and other nonpoint sources. These rules often reflect the requirements of the Clean Water Act. Nearly all municipalities and farmers are affected by the rules in one way or another. The DNR also operates a Storm Water Program that regulates water discharges from construction sites, industrial facilities, and some municipalities through the Wisconsin Pollutant Discharge Elimination System (WPDES) program through Chapter NR 216, Wis. Admin. Code.

Nonpoint Source Program

Since 1978, Wisconsin's Nonpoint Source Program has made significant strides in addressing runoff-related water quality problems, some of which have existed for decades. This program works in partnership with organizations and citizens to address significant nonpoint sources in the state by combining voluntary and regulatory approaches with financial and technical assistance. Abatement activities include modifications to agriculture, forestry, hydrologic, urban, and wetland areas. Through this program, the DNR develops a Nonpoint Source Program Management Plan outlining the state's approach to addressing water quality impacts from nonpoint sources of pollution. The latest version of the plan, for fiscal years 2021 through 2025, covers the management activities and efforts for the state in compliance with U.S. EPA Clean Water Act requirements.

Runoff Management Grants

The DNR provides competitive funding to counties for cost-share projects to control nonpoint source pollution, helping them meet the Agricultural Performance Standards and Prohibitions, through the Targeted Runoff Management (TRM) Grant Program. Cities, villages, towns, counties, regional planning commissions, tribal governments, and special purpose lake, sewerage, and sanitary districts are able to apply for small-scale agricultural, large-scale agricultural, and small-scale urban runoff management grants through this program. Since 2002, the SWCD has been awarded 52 small-scale TRM grants and two large-scale TRM grants to offer cost share for 20 additional projects. (See Figure 6.23 below.)

Figure 6.23: TRM Grants Awarded, Door County

Source: Door County Soil and Water Conservation Department, Land and Water Resource Management Plan 2021-2030.

The DNR also offers competitive grants to local governments through their Urban Nonpoint Source and Storm Water Management Grant Program. The purpose of these grants is to control the pollution from

diffuse urban sources that is carried by storm water runoff. The DNR awarded over $2 million in Runoff Management Grants in fiscal year 2021.

DOOR COUNTY RUNOFF MANAGEMENT PROGRAMS

The Door County SWCD administers the DNR's Runoff Management Program locally and is guided by the Door County Land and Water Resource Management Plan (LWRMP) 2021-2030. This plan was developed by the SWCD and approved by the Land Conservation Committee (LCC) in accordance with requirements set forth in Ch. 92, Wis. Stats. The plan identifies current runoff/stormwater management challenges and establishes goals and strategies to protect the land and water resources of Door County.

Agricultural Implementation

The LWRMP 2021-2030 identifies two Agricultural Implementation Program Goals:

1. Protect water quality and address land and water resource needs through implementation of the agricultural performance standards and prohibitions in Chapter 23, Door County Code; and
2. Promote conservation practices that protect water quality and enable proper resource management by landowners.

SWCD Agricultural runoff-related programs include the following:

- *Agricultural Performance Standards and Prohibitions.* Implement state and local agricultural performance standards and prohibitions, as identified in Ch. 23, Door County Code.
- *Agricultural Sustainability and Land Protection.* Reduce the impacts of sprawl and fragmentation through preservation of farmland and other open spaces.
- *Chapter NR 243 Program.* Protect water quality through proper animal waste management; provide technical assistance and secure funding for cost-share assistance to priority farms.
- *Farmland Preservation Program.* Reduce soil erosion, urban sprawl, and fragmentation through the preservation of farmland; work with the Door County Land Use Services Department to update the Comprehensive and Farmland Preservation Plan (i.e., this plan).
- *Nutrient Management Program.* Protect water resources by reducing nonpoint pollution caused by improper nutrient and pest management. Under the program, a Nutrient Management Plan (NMP) is required for all crop and livestock producers that apply manure or other directly to agricultural fields in order to reduce runoff and nutrient loading. An NMP helps farmers make science-based decisions about when, where, and how many nutrients to apply to their cropland.
- *Targeted Runoff Management Program.* Protect water quality through implementation of agricultural performance standards and manure management in critical areas; provide technical assistance and secure funding.
- *Upper Door and Red River/Sturgeon Bay Priority Watersheds.* Protect water quality and reduce soil erosion, nutrients, sediment, and bacteria loading from a variety of sources; ensure compliance with agricultural operation and maintenance agreements and encourage proper resource management after agreements have ended.

Urban and Rural Non-Agricultural Implementation

The LWRMP outlines five Urban and Rural Non-Agricultural Implementation Program Goals:

1. Protect groundwater and surface water through proper erosion control and storm water runoff management;
2. Protect groundwater and surface water resources and control of the negative impacts of development through proper reclamation of nonmetallic mines;
3. Protect and improve beach water quality through continued monitoring and evaluation of installed practices so that sources of beach contamination are identified and abated;
4. Help Door County cropland owners address wildlife damage issues through the Wildlife Damage Abatement and Claims Program; and
5. Work with natural resources partners to implement watershed restoration projects to maintain and restore high quality and functional habitats.

SWCD Urban and Rural Non-Agricultural runoff-related programs include the following:

- *Adoption of Ordinances.* Develop and revise existing ordinances to address nonpoint source pollution.
- *County Water Pollution Abatement Cost-Share Program.* Adopted by Door County in 1980, the Water Pollution Abatement Cost-Sharing Program policy was designed to provide cost-share funding to landowners for installing practices designed to abate water pollution. The SWCD provides technical assistance in developing water pollution abatement plans, advises recipients of all cost-share options available, and inspects the installation of projects to ensure compliance.
- *Nonmetallic Mining Controls and Reclamation.* Work with mine operators on plan approval, modifications, and compliance checks to ensure reclamation activities are carried out as required by Ch. 36, Door County Code.
- *Stormwater Runoff Management and Construction Site Erosion Control.* Implement more comprehensive stormwater runoff construction site erosion control programs, including the development of a county-wide stormwater ordinance.
- *Technical Assistance.* Provide technical and research assistance regarding protection and conservation of Door County's natural resources to landowners/operators, interested groups, and other governmental units.
- *Well Abandonment Program.* Increase the number of properly abandoned wells through volunteer programs, enforcement referrals to the DNR, and potential well abandonment requirements in the Door County Comprehensive Zoning Ordinance.
- *Wellhead Zone of Contribution Protection Programs (City of Sturgeon Bay and Village of Sister Bay, and Maplewood Sanitary District [Town of Forestville]).*
    - Delineate the zone of contribution and develop a wellhead protection plan for the Maplewood Sanitary District.
    - Address water quality within all zones of contribution through implementation of agricultural performance standards and manure management; provide information and education to landowners within the zones regarding land use and its impact on the drinking water supply.

Other SWCD Runoff-Related Programs

- *Education and Awareness of Environmental Issues and Sustainable Farming Practices.* Increase awareness of the sensitivity of land and water resources and promote sound decisions using objective and science-based material.
- *Invasive Species Control.* Protect the habitat and biodiversity of fauna and flora through the control of aggressive, invasive non-indigenous species.
- *Lead and Arsenic Contaminated Sites.* Continue site identification of contaminated orchards and seek funding for remediation of historic lead arsenic mixing sites.
- *Wildlife Damage and Abatement Claims Program/Nuisance Animal Technical Assistance.* Expand the outreach in assisting landowners with wildlife damage issues.

The SWCD also helps to regulate Door County's only Concentrated Animal Feeding Operation (CAFO), S&S AG Enterprises, LLC, located in the Town of Forestville. A CAFO is defined by the DNR as a farm with 1,000 or greater animal units, with one animal unit the equivalent of a 1,000-pound animal. Chickens, turkeys, hogs, beef, or dairy animals, when combined to weigh 1,000 pounds, constitute one animal unit. The SWCD provides assistance to the DNR in regulating this CAFO by providing local knowledge of topography, water quality concerns, farm site needs, and by ensuring compliance with the state's CAFO permit.

CAFOs are required by the DNR to have a manure management system. In 2011, S&S AG completed construction of an anaerobic digester, a concrete vessel that holds the manure where bacteria break it down to produce methane. This methane is collected and piped to a generator where electricity is produced and sold to Wisconsin Public Service. Two additional benefits of digesting manure are the reduction of odor from manure that is to be applied to cropland as fertilizer and the sterilization of manure to be used for animal bedding.

GROUNDWATER

Groundwater protection efforts in place in Door County include federal monetary awards to clean up leaking underground storage tanks, various DNR regulations, Door County SWCD programs, and Door County Sanitarian programs (division of Land Use Services Department).

PETROLEUM ENVIRONMENTAL CLEANUP FUND AWARD

The Petroleum Environmental Cleanup Fund Award (PECFA) program was created in response to the enactment of federal regulations requiring release prevention from underground storage tanks and to clean up existing contamination from those tanks. PECFA was a reimbursement program that returned a portion of incurred remedial cleanup costs to owners of eligible petroleum product systems; the final round of applications for funding closed in July of 2020, ending the program. In its over 30 years of existence, PECFA invested over $8 million in Door County to clean up contaminated sites.

DNR GROUNDWATER PROGRAMS

The DNR regulates public water systems, approves wellhead protection plans, regulates private wells, and sets standards for compound levels in groundwaters.

- *Public Water Systems.* The DNR defines a Public Water System as a "system for the provision to the public of piped water for human consumption, if such a system has at least 15 service

connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year." Wisconsin public water systems are regulated by the Federal Safe Drinking Water Act (SDWA) which sets maximum contaminant level standards for drinking water as well as requirements for sampling, reporting, and inspection. These standards are enforced by the DNR Drinking Water Program and apply to all public water supplies in the state. Water sampling and inspection requirements are based on the type of system and population the system serves. The four types of public eater systems defined by the SDWA are as follows:

1. Community Systems, Municipal: In Door County, the City of Sturgeon Bay, Village of Sister Bay (including part of the Town of Liberty Grove), and the Maplewood Sanitary District #1 (part of the Town of Forestville).
2. Community Systems, Other Than Municipal: Trailer parks and non-municipal systems that serve more than 25 year-round residents; e.g., an apartment building with one well serving more than 25 people year-round.
3. Non-Community Systems, Non-Transient: Schools, businesses, government buildings that serve 25 or more people more than six months of the year.
4. Non-Community Systems, Transient: Restaurants, bakeries, motels, gas stations, places of worship, parks, campgrounds, buildings that serve 25 or more people for at least 60 days.

Community water systems – both municipal and "other than municipal" – are regulated under NR 809 and NR 811, Wis. Admin. Code. NR 809 includes water monitoring, system reporting, and inspection requirements and NR 811 includes construction, treatment, operation and maintenance requirements for water supply sources, storage, and distribution systems.

- *Wellhead Protection Plans and Ordinances.* The DNR approves municipal wellhead protection plans, which are required for the construction of new wells serving municipal water supplies. Wellhead protection plans are designed to protect public water supply wells from contamination by managing the land that contributes water to the wells. The basic requirements for these plans are established as goals in the Wisconsin statutes. Although adoption of an ordinance referencing the WHPP is not required, communities are encouraged to adopt one prior to putting the well online. The DNR also strongly encourages but does not require the development of WHPPs for older wells. (Note that the City of Sturgeon Bay and the Village of Sister Bay have adopted wellhead protection plans.)
- *Private Wells.* The DNR administers NR 812, Wis. Admin. Code, which applies to private wells and includes smaller non-community (less than 25 people) public water systems. NR 812 specifies well construction, pump installation, well water quality, treatment, and well sealing/filling standards. DNR staff review reports of these activities and may inspect wells, pump installations, and conduct surveillance of well drilling/pump installing activities to determine compliance.
- *Compound Health Standards.* The DNR enforces NR 140, Wis. Admin. Code, which specifies health standards for compound levels at which the compound in groundwater is considered a health risk. The health standard contaminant concentrations are usually the same as in the NR 809, which outlines the sampling requirements for public drinking water systems, however, NR 140 may include additional compounds that are known to be health concerns. NR 140

standards are referenced in treatment and sealing/filling regulations in NR 812 to provide additional protection standards for non-community water systems and private well owners.

The NR 140 standards also are used by the DNR to implement programs that regulate different land uses and to determine if remediation actions are needed to protect the groundwater. These programs specify what land uses are to be regulated and monitored by DNR staff members. The following DNR programs use the NR 140 standards:

- Landfill/Solid Waste
- Hazardous Waste
- Agricultural Runoff
- Wastewater
- Remediation and Redevelopment

STATE-LEVEL GROUNDWATER STUDIES AND PROJECTS

The University of Wisconsin-Stevens Point Center for Watershed Science and Education developed the *Well Water Quality Viewer: Private Well Data for Wisconsin*, an educational tool to help people better understand Wisconsin's groundwater resources that many Wisconsinites rely on for drinking water. The viewer incorporates data from voluntarily-submitted samples submitted by homeowners, as well as data collected by state agencies over the past 25 years. This includes well water quality data from the Center for Watershed Science and Education, the WI Department of Agriculture, Trade and Consumer Protection, and the WI Department of Natural Resources Groundwater Retrieval Network, Eau Claire County Health Department, and La Crosse County Health Department. The viewer can be accessed at the SWCD and the UW-Stevens Point websites which can be found in the Resources and Further Information section at the end of this document.

DOOR COUNTY SOIL AND WATER CONSERVATION DEPARTMENT GROUNDWATER PROGRAMS

The SWCD implements a variety of runoff management programs, as described previously, that also help protect groundwater: Agricultural Nonpoint Performance Standards and Prohibitions, Animal Waste Storage Ordinance, Nonmetallic Mine Reclamation Ordinance, Nutrient Management Program, and the Targeted Runoff Management Program.

In addition, in the late 1980s and early 1990s, the SWCD engaged in a cooperative effort with the state to remediate some of the more significant abandoned contaminated lead and arsenic mixing sites. Relative to the total number of contaminated sites, the areas remediated by this effort were only a small percentage. The current role of the SWCD is to advise property sellers and buyers, real estate agents, and financial institutions on the location of contaminated sites and provided technical assistance with respect to remediation and potential health concerns. The state generally does not provide funds for the cleanup of historic spills, but recently the Department of Agriculture and Trade Consumer Protection has indicated some willingness to consider the use of funds for eligible lead and arsenic remediation projects.

The SWCD also participated in a task force from 2010 to 2016 consisting of the UW-Extension and county conservationists in Brown, Calumet, Kewaunee, and Manitowoc Counties to study existing data and make recommendations on how to address the problem of polluted runoff entering the groundwater, indicating the focus should be based on the fractured carbonate bedrock, rather than

focusing solely on identifying and protecting karst features. The members also unanimously concluded that a uniform approach to regulation and enforcement across the entire carbonate bedrock region of northeastern Wisconsin is critical to the development of a stable and effective framework for environmental protection.

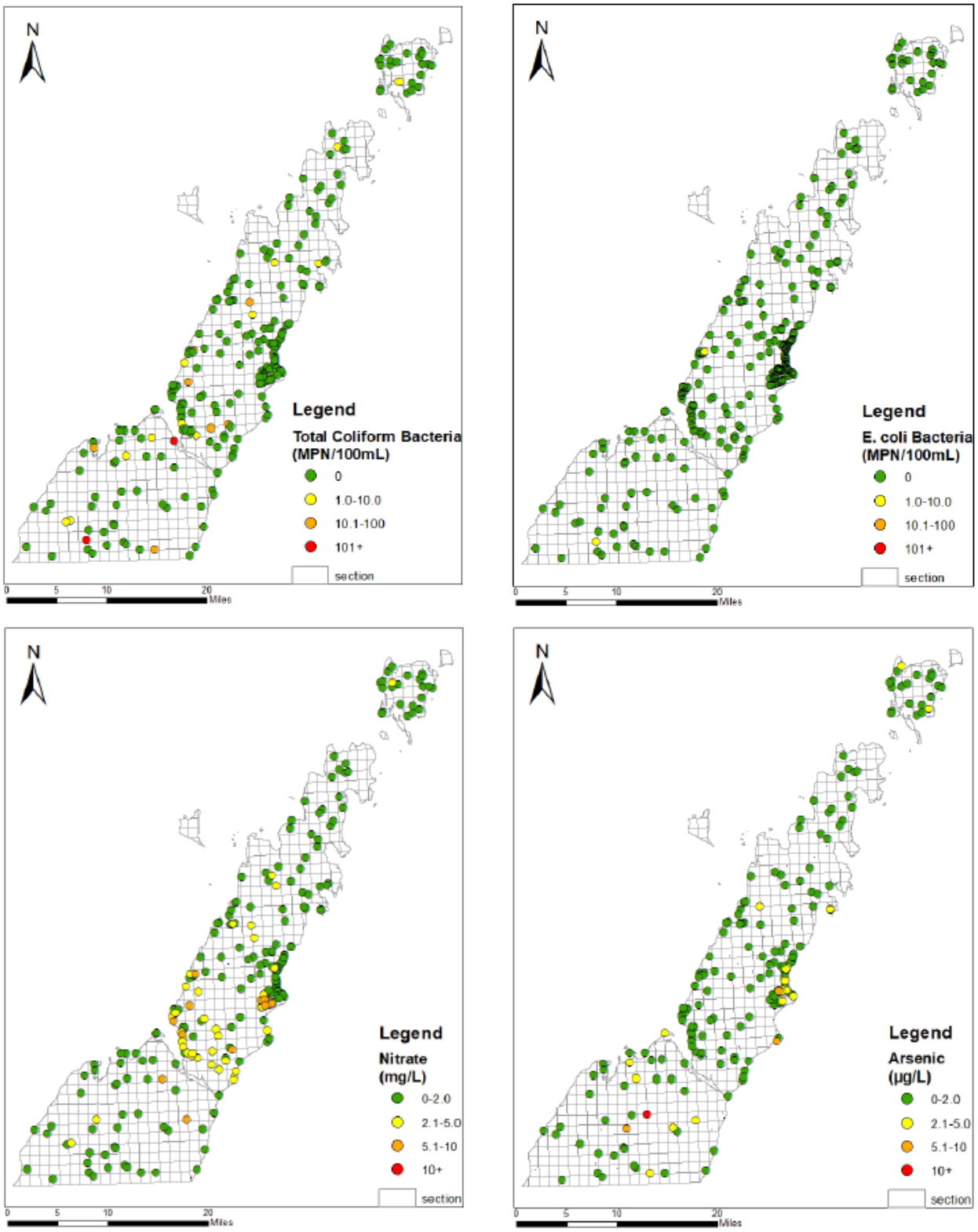
Most recently, the University of Wisconsin-Oshkosh Environmental Research and Innovation Center (ERIC) has been conducting continuous groundwater studies each spring and fall since 2019 in Door County. The study educates the private well owners about the importance of testing their well water, building a Door County groundwater quality database formulated from the results of the private well tests. The Spring 2022 study focused on four contaminants: Coliform, E. coli, Nitrate, and Arsenic. Results are shown in Figure 6.24 on the following page. Further information on this study can be found at the SWCD or UW-Oshkosh websites in the Resources and Further Information section at the end of this document.

DOOR COUNTY SANITARIAN PROGRAMS

The Door County Sanitarian, a program division of the Land Use Services Department, addresses groundwater issues through inspections of certain private septic systems and tanks.

- Property owners or potential property owners may request a “Time of Sale” or other inspection. Systems deemed to be in noncompliance must be replaced generally within one year. All evaluations are conducted by a private contractor and verified by the county.
- All private on-site wastewater treatment system (POWTS) septic tanks must be inspected at least once every 3 years and pumped if more than 1/3 full of solids. The owner of a POWTS must certify to the county Sanitarian, through hiring a private inspector, that their septic tank has either been pumped or is less than 1/3 full of solids.

Figure 6.24: Coliform, E. coli, Nitrate, and Arsenic Levels in Private Wells 2022, Door County



Source: University of Wisconsin-Oshkosh, Environmental Research and Innovation Center Lab, 2022.

VOLUNTARY DRINKING WATER TESTING PROGRAMS

Drinking water can be tested through private laboratories or through the Water and Environmental Analysis Laboratory (WEAL), housed at the UW-Stevens Point Groundwater Center. Individuals may have their drinking water tested through the WEAL at any time, or communities may also organize a Community Drinking Water Testing and Educational Program. The WEAL can conduct testing of up to 150 samples within a two-week timeframe. Participants in the program volunteer to have their drinking water tested for specific contaminants at a competitive price.

Approximately one month after the samples are submitted to the lab, specialists from the Groundwater Center hold an educational program to discuss groundwater concepts and test results. Topics covered include groundwater basics, hydrogeology of the test area, test results and interpretation, water quality trends, county groundwater activities, and groundwater protection strategies. Lastly, the Groundwater Center specialist gives the local coordinating agent a packet of material containing maps for each contaminant tested for and a statistical summary of the results.

Municipalities from Door County that have conducted a Community Drinking Water Testing and Education Program are the Towns of Baileys Harbor, Egg Harbor, Gardner, Jacksonport, Liberty Grove, and Sevastopol, and the Villages of Egg Harbor and Ephraim. Results from these programs are available online, at the website address listed at the end of this document in the Resources and Further Information section. Users are not able to identify specific wells, but can see aggregate data for areas where a minimum number of samples were collected.

WETLAND PROGRAMS

Wetlands provide many benefits to the environment, thus there are regulations to protect them at the federal, state, and municipal levels. The three main levels of jurisdiction concerning wetlands in Door County are the United States Army Corps of Engineers (federal), the DNR (state), and the Door County municipal zoning agencies. All of these agencies are involved with wetland regulation and management, with often overlapping jurisdiction. The basic concept behind all levels of wetland regulations is that these areas can only disturbed for limited reasons and only after issuance of a permit.

Each agency uses slightly different definitions, but all agree there are three basic factors in determining whether or not a property is a wetland: the presence of water at, near, or above the surface (hydrology); sustained aquatic plant life (hydrophytic vegetation); and soils indicative of wet conditions (hydric soils). The presence of standing water may or may not indicate the presence of a wetland; a property could have standing water for a portion of the year and still not be a wetland due to the lack of hydrophytic vegetation or hydric soils. It is also possible that a true wetland, with all three of the above characteristics, may never have standing water present.

UNITED STATES ARMY CORPS OF ENGINEERS WETLAND REGULATIONS

The federal Clean Water Act regulates the discharge of dredge and fill material into “waters of the United States,” including wetlands adjacent to, or with a hydrologic connection to, “navigable waters.” In the most general terms, federal law requires permits for construction activities in wetlands associated with lakes, rivers, and streams that have enough flowing water to float a canoe. Discharges of dredged and fill material into isolated wetlands are not regulated under the Clean Water Act because these types

of wetlands fall outside of the definition of "waters of the United States." (The State of Wisconsin does, however, regulate construction activities in isolated wetlands).

The St. Paul District of the U.S. Army Corps of Engineers administers the federal wetland regulatory permit program in Wisconsin, with oversight by the Region 5 of the U.S. Environmental Protection Agency. Army Corp district engineers handle the review and approval of wetland development proposals in federally regulated wetlands.

WISCONSIN DNR WETLAND REGULATIONS

The DNR regulates construction activities in all wetlands, regardless of wetland type, size, or location. State law requires review of all wetland development proposals to ensure the proposed activity complies with state water quality standards for wetlands. Wetland development activities authorized by federal permits must also acquire state approval. County Wetland Teams at the DNR review permit applications on behalf of the state, monitor approved projects for compliance with permit conditions, and assist with investigations and enforcement proceedings for unauthorized wetland fill.

Map 6.5, located at the end of this document, depicts wetlands of two acres or more in size as mapped by the DNR through interpretation of soil maps and aerial photography. Not that these boundaries should be considered approximate guidelines and also that there are many wetlands less than two acres in size not shown on this map.

DOOR COUNTY LAND USE SERVICES DEPARTMENT WETLAND REGULATIONS

The Door County Land Use Services Department has jurisdiction over wetlands in the areas where it has zoning jurisdiction: the nine towns under county comprehensive zoning and the shoreland areas of the five other towns. The nine towns under comprehensive zoning are Baileys Harbor, Clay Banks, Forestville, Gibraltar, Jacksonport, Liberty Grove, Sevastopol, Sturgeon Bay, and Washington. The five towns under shoreland zoning only are Brussels, Egg Harbor, Gardner, Nasewaupee, and Union. County regulations are not in effect in any incorporated municipalities; wetlands within a city or village boundaries are subject to the appropriate municipality's zoning or other regulations, in addition to applicable federal and state regulations.

The Door County wetland zoning district map is based on the most recent Wisconsin Wetland Inventory completed by the DNR. Some wetlands do not appear on the map because they were too small to be identified by the inventory; per the language of the county zoning ordinance, however, the county still has jurisdiction over many activities occurring in or near these wetlands. Note that both the Wisconsin Wetland Inventory and the Door County zoning maps are to be used as guidelines regarding wetland location, not maps that precisely locate wetland boundaries.

Note: Explanations of comprehensive and shoreland zoning may be found in Chapter 10, Land Use.

WOODLANDS

FISH CREEK PARK REFORESTATION PROJECT

Fish Creek Park has lost hundreds of ash trees due to the emerald ash borer infestation that began in the county in 2014; emerald ash borer infestation causes a tree's bark to fall off as woodpeckers search for emerald ash borer larvae to eat. In response to this loss, the Town of Gibraltar Parks and Lands

Committee developed a reforestation plan focused on restoring the natural beauty of the park and providing shade to the creek in an effort to keep the water temperatures cool, improving fish habitat. The reforestation plan calls for planting 400 saplings throughout the park over the next five years.

MANAGED FOREST LAW PROGRAM

The DNR administers the Managed Forest Law (MFL) program, a landowner incentive program that encourages sustainable forestry on private woodland. Sustainable forest management benefits Wisconsin's economy, hunting, fishing, wildlife, recreation, soils, waterways and air quality, and renews the state's beautiful forests for all Wisconsinites to enjoy.

In exchange for following sound forest management, the landowner pays reduced property taxes. The MFL was enacted in 1985, replacing the Woodland Tax Law and the Forest Crop Law. The MFL is the only forest tax law that is open to enrollment; land enrolled in the MFL program must be managed according to a plan agreed to by the landowner. Together with landowner objectives, the law incorporates timber harvesting, wildlife management, water quality, and recreation to maintain a healthy and productive forest. Conditions that must be met for a property to be enrolled in the MFL program include:

- At least 10 acres of contiguous forest land;
- At least 80% of the land must have a minimum productive capacity of 20 cubic feet of timber per acre per year;
- A minimum forest cover of 80%; and
- A minimum average lot width of 120 feet.

Of the approximately 113,852 acres of woodland in Door County, 19,158 (17%) was enrolled in the MFL program as of January 2023. Of that, 2,113 acres are open to the public for hunting, fishing, hiking, and cross-country skiing. There are also additional acres in the Forest Crop Law program, the precursor to the Managed Forest Law program; its acreage is shrinking each year as contracts expire. This land is also open to the public for the same activities.

Additional information about the Managed Forest Law program as well as a link to its "open" lands in Door County can be found at the DNR website listed in the Resources and Further Information section at the end of this document.

STATE TREE PLANTING REFORESTATION PROGRAM

The DNR's reforestation program grows high-quality native tree seedlings and shrubs to plant on private and public lands for conservation. Their nursery stock is reasonably priced, helping provide future forest products, improve wildlife habitat, prevent soil erosion, create aesthetic beauty, and increase carbon sequestration. The reforestation program consists of three sub-programs:

1. *Wisconsin Forest Tree Improvement Program*. The Wisconsin Forest Tree Improvement Program is a long-term collaborative effort between the Division of Forestry and the University of Wisconsin-Madison Department of Forest and Wildlife Ecology. The program promotes establishment of seedlings that are well adapted to Wisconsin's growing conditions and have a high potential for survival and growth to increase forest productivity and forest health.

2. *Give a Gift of Green*. The Give a Gift of Green program allows Wisconsinites to purchase quality nursery stock through the Reforestation Program to give to another person to plant on their land. Seedlings are available for planting in April and May. State nursery stock may only be used for conservation purposes.
3. *Forests for the Future Fund*. The Forests for the Future Fund program allows Wisconsinites to contribute to the sustainable management of Wisconsin's state forests. Donations help the DNR Division of Forestry provide economic, social, and cultural benefits for present and future generations.

FOREST LEGACY PROGRAM

The Wisconsin DNR administers the Forest Legacy Program (FLP) which identifies and protects environmentally important private forestlands threatened with conversion to non-forest uses, such as subdivision for residential or commercial development. The FLP aims to keep forests as forests by protecting large, unfragmented blocks of forest lands that provide the highest conservation value and public benefit. The FLP minimizes conversion of forests to non-forest uses through the purchase of various conservation easements. There currently are no Forest Legacy Areas in Door County.

ECOLOGICAL AREAS AND CORRIDORS

Door County has many natural areas already protected by federal, state, and local agencies, while many other ecologically important areas have been identified as being in need of protection. At the federal level, two National Wildlife Refuges exist in the county, maintained by the U.S. Fish & Wildlife Service. At the state level, there are a number of areas in the county designated by the DNR as significant natural areas; those designations include State Natural Areas, State Wildlife and Fishery Areas, Significant Coastal Wetlands (discussed previously), Land Legacy Places, and Wisconsin Coastal and Estuarine Land Conservation Plan (WCELCP) Areas. At the regional level, Bay-Lake Regional Planning Commission has identified environmental corridors throughout the county based on a variety of scientific data layers analyzed within a Geographic Information System. At the local level, a study conducted by local natural resource experts identified significant wildlife habitat and natural areas.

U.S. FISH & WILDLIFE SERVICE

Wildlife Action Plan (written by the DNR and approved by U.S. Fish and Wildlife Service)

In 2001, Congress authorized the U.S. Fish & Wildlife Service to implement and fund a program to help states proactively address the needs of declining wildlife species before they require official listing as "endangered" or "threatened." The State Wildlife Grants program provides federal funding to every state and territory to conserve its wildlife resources of greatest conservation need. Each state is required to prepare a Wildlife Action Plan to remain eligible for funding and the plan must focus on "Species of Greatest Conservation Need." Wisconsin's Strategy for Wildlife Species of Greatest Conservation Need was approved by both the DNR and U.S. Fish & Wildlife Service in 2005, and updated in 2015 to satisfy funding eligibility through the State Wildlife Grant Program. This plan is built upon three bioecological levels of organization: Species of Greatest Conservation Need; natural communities (as representative of a habitat); and ecological landscapes. The plan addresses the following:

- Which native wildlife species with low or declining populations are most at risk of no longer being a viable part of Wisconsin's fauna;

- What habitats they are associated with;
- Where they occur across the state; and
- A variety of conservation actions to be developed into specific on-the-ground projects to "get them off and keep them off" any endangered or threatened lists in the future.

The Plan also identifies 16 Ecological Landscapes, which are areas of Wisconsin that differ from each other in ecological attributes and management opportunities. They have unique combinations of physical and biological characteristics that make up the ecosystem, such as climate, geology, soils, water, or vegetation. They differ in levels of biological productivity, habitat suitability for wildlife, presence of rare species and natural communities, and in many other ways that affect how they are managed.

Door County lies mostly in the Northern Lake Michigan Coastal Landscape. A small portion of southwest Door County lies in the Central Lake Michigan Coastal Landscape. Some of the plan's management opportunities specific to Door County include protection and management of: key stretches of the Niagara Escarpment; costal ridge and swale forest, and the beaches, dunes, and boreal forest; alkaline rock shores, coastal estuaries, boreal forests, and alvar, beach, and dune communities; and significant spawning areas. More information about the Wildlife Action Plan and Door County's ecological landscapes may be found at the DNR website listed in the Resources and Further Information section at the end of this document.

National Wildlife Refuge System

The U.S. Fish & Wildlife Service administers the National Wildlife Refuge System, which is a network of wildlife habitats, most of which are open to the public. Door County has two National Wildlife Refuges located off the tip of the peninsula, near Washington Island: the Green Bay and Gravel Island refuges.

The Green Bay National Wildlife Refuge consists of Hog Island (2 acres), Plum Island (325 acres), and Pilot Island (3.7 acres). Hog Island was set aside by Executive Order in 1913 as a preserve and breeding ground for native birds. Portions of Plum and Pilot Islands were developed to serve as lighthouse facilities are life-saving stations during the late 19th century. These islands were transferred from the U.S. Coast Guard to the Fish and Wildlife Service in 2007. All public use is prohibited on Hog and Pilot Islands due to ground nesting by migratory birds and the limited and treacherous access. Plum Island essentially functions as a small ecosystem and retains natural qualities absent on the nearby mainland. Public use opportunities may be offered in the future provided they are compatible with the refuge's purpose and mission. Working in partnership with the National Wildlife Refuge, the local organization Friends of Plum and Pilot Islands have been working to restore the lighthouse facilities and other buildings found on these islands.

The Gravel Island National Wildlife Refuge consists of Gravel (4 acres) and Spider (23 acres) Islands. These islands are located in Lake Michigan, approximately one mile east of the northern tip of Door County, and were set aside by Executive Order in 1915 as a preserve and breeding ground for native birds. Public use is not allowed due to ground nesting by migratory birds. Together, Gravel and Spider Islands had a birch-cedar-tamarack forest until the 1970s, but it has since been destroyed due to the activities of thousands of cormorants that breed there. All of the trees have now fallen over or been washed away. Waterfowl use is limited since there is sparse vegetation, but the fallen trees provide

some cover for scattered nesting of species like mallards, black ducks, and Canada geese. Gravel Island has no permanent vegetation due to periodic over-washing by waves and ice during high-water years.

WISCONSIN DNR

Knowles-Nelson Stewardship Program

The Wisconsin Legislature created the Knowles-Nelson Stewardship Program (Stewardship) in 1989 to preserve valuable natural areas and wildlife habitat, protect water quality and fisheries, and expand opportunities for outdoor recreation. Conservation and recreation program goals are achieved through acquisition of land and easements, development of recreational facilities, and restoration of wildlife habitat. Cooperation and partnership between the DNR, local governments, and private nonprofit organizations are important components of the program. To foster partnership, the program provides 50% match grants to local governments and nonprofit organizations for eligible projects. A total of 7,669 acres have been purchased in Door County through this program, in partnership with nonprofit organizations and local government.

State Natural Areas

The Wisconsin State Natural Areas (SNAs) program was established by the state legislature in 1951 to protect outstanding examples of Wisconsin's native landscape of natural communities, significant geological formations, and archaeological sites. Wisconsin's 687 SNAs, encompassing 406,00 acres, are valuable for research and educational use, the perseveration of genetic and biological diversity, and for providing benchmarks for determining the impact of use on managed lands. They also provide some of the last refuges for rare plants and animals.

SNAs are protected by several means, including land acquisition from willing sellers, donations, conservation easements, and cooperative agreements. Areas owned by other government agencies, educational institutions, and private conservation organizations are also brought into the SNA system by formal agreements between the DNR and the landowner. Other than hunting, SNAs are not appropriate for intensive recreation, but do accommodate low-impact activities such as hiking, bird watching, and nature study. Most DNR-owned State Natural Areas are open to hunting. Hunting is also generally allowed on SNAs owned by partner organizations and agencies, such as The Nature Conservancy, U.S. Forest Service, and county forests. Specific rules vary depending on the partner's policies, and some may require a special permit. Door County has 29 SNAs, as listed in Table 6.8 at the end of this document.

State Wildlife and Fishery Areas

State Wildlife and Fishery Areas are lands that have been acquired by the DNR in order to preserve land and game for outdoor enthusiasts by protecting important habitats for wildlife and keeping them open for public use. Door County has two state wildlife areas and three state fishery areas, as identified in Table 6.6 below.

Table 6.6: State Wildlife and Fishery Areas, Door County

Name	Wildlife Area	Fishery Area
Gardner Swamp	X	
Mud Lake	X	
Heins Creek		X
Stoney Creek		X
Sturgeon Bay Pond		X

Source: Wisconsin Department of Natural Resources, Public Access Lands.

Land Legacy Places

The DNR has identified "Land Legacy Places" that will likely play a critical role in meeting Wisconsin's conservation and outdoor recreation needs over the next 50 years. Over a three-year period, from 1999 to 2002, the DNR hosted numerous public and staff meetings to gather information, local knowledge, and opinions about Wisconsin's land and water to develop criteria regarding the types or characteristics of places believed to be most important. These criteria were then used in conjunction with data on the distribution of various ecological attributes, human population trends, geographical features and other factors, as well as professional judgement by DNR staff members and local citizen knowledge, to identify the "Land Legacy Places."

By designating an area as a "Land Legacy Place," the DNR has intended to guide current and future land use decisions about the area, but it is not a legal designation and does not supersede any existing state or local regulations. The report was not a list of places the DNR wanted to buy, nor did it identify how or when these places should be protected or who should protect them. Many partners and stakeholders have been involved in evaluating more precisely where protection efforts are best focused and which protection strategies are most appropriate.

There are 12 identified Land Legacy Places within Door County, including Chambers Island, the Niagara Escarpment, the Mink River Estuary, and the Grand Traverse Islands, which include Plum, Detroit, Rock, and Washington Islands (the remaining Grand Traverse Islands are part of Delta County, Michigan). See Table 6.8 at the end of this document for a complete list.

Coastal and Estuarine Land Conservation Plan Areas

In November 2011, a Coastal and Estuarine Land Conservation (CELC) Plan for Wisconsin was approved by the U.S. Department of Commerce and the National Oceanic and Atmospheric Administration (NOAA). The plan, written by the Wisconsin Department of Administration – Coastal Management Program in partnership with the DNR, enables the state to participate in a land acquisition grant program administered by NOAA. The CELC Plan provides an assessment of priority land conservation needs and guidance for selecting projects to compete nationally for CELC grants.

The purpose of the CELC Plan is to protect important coastal and estuarine areas that have significant conservation, recreation, ecological, historical, or aesthetic values, or that are threatened by conversion from their natural or recreational state to other uses. The plan gives priority to lands which can be effectively managed and protected in the long-term (e.g., minimal invasive species impact and surrounding lands are compatible with long-term conservation of the area). Plans or data sources used in the development of the CELC Plan project areas for Door County are listed below:

- Wildlife Action Plan: Wisconsin's Strategy for Wildlife Species of Greatest Conservation Need (U.S. Fish & Wildlife Serve & DNR)
- Wisconsin Land Legacy Report: An inventory of places to meet Wisconsin's future conservation and recreation needs (DNR)
- A Data Compilation and Assessment of Coastal Wetlands of Wisconsin's Great Lakes (DNR)
- Lake Michigan Integrated Fisheries Management Plan – 2003-2013 (DNR)
- Wisconsin Coastal Management Program: A Strategic Vision for the Great Lakes (Wisconsin Department of Administration)
- Wisconsin Historic Preservation Database, State and National Register of Historic Places (Wisconsin Historical Society)

Project areas within the CELC Plan consist of:

- *Conservation Opportunity Areas (COAs).* Natural communities from the Wildlife Action Plan (highest priority).
- *Land Legacy Areas.* Land Legacy Areas that address primary conservation needs (all of the Land Legacy places listed in Table 6.8, except for Door Peninsula Hardwood Swamps, Kangaroo Lake, and Niagara Escarpment).
- *Important Bird Areas (IBA).* An IBA is a site that provides critical habitat to one or more species of breeding and non-breeding birds, as identified by the Wisconsin Bird Conservation Initiative.
- *Tributary corridors, coastal wetlands, and near-shore/tributary fish spawning habitat.* This category captures important coastal and estuarine areas not identified by the Wildlife Action Plan, Land Legacy Report, and Important Bird Areas.
- *Migratory bird stopover habitat.* Although not used to define project sites, the DNR has identified migratory stopover sites, both documented sites and modeled as likely bird stopover habitat sites. These sites will be used in the evaluation of CELC project proposals.

Note that the CELC Plan project areas are also encompassed by the Significant Wildlife Habitat and Natural Areas of Door County, as described below.

BAY-LAKE REGIONAL PLANNING COMMISSION – ENVIRONMENTAL CORRIDORS

Habitat connectivity – consisting of natural landscape features such as stream corridors – is essential for the survival of numerous wildlife species. In addition to wildlife population survival, countless ecological processes, such as maintenance of water quality, will not function if natural connections are severed.

Identification of environmental corridors – areas containing and connecting natural areas, green space, and other natural resources – is an advisory process utilized in various community planning efforts as a way to promote preservation of areas with environmental significance. Environmental corridors may also contain scenic, historic, scientific, recreational, and cultural resources. They often lie along waterways and other natural features, serving many purposes, such as: protecting water quality; providing nutrient and sediment filtration; providing fish and wildlife habitat; and providing recreational opportunities.

In June 2022, the Bay-Lake Regional Planning Commission provided an update to its regional environmental corridor dataset, following receival of a grant by the Wisconsin Coastal Management Program. The Bay-Lake regional environmental corridors dataset is split into three categories:

1. **Primary Corridors** include environmentally sensitive areas of steep slopes (greater than 12%), wetlands (with a 50-foot buffer), surface water (with a 75-foot buffer), and floodplains which are legally protected.
2. **Secondary Corridors** are areas that are sensitive in nature and should be protected but may not necessarily have rules and regulations for protection.
3. **Tertiary Corridors** include significant and vulnerable ecosystems that have been designated by the Wisconsin Wildlife Action Plan.

The complete dataset – a community map series and an interactive dashboard – is available at the Environmental Corridors of the Bay-Lake Region portal site, which can be found in the Resources and Further Information section at the end of this document.

LOCAL IDENTIFICATION OF ECOLOGICAL AREAS

Significant Wildlife Habitat and Natural Areas of Door County

A group of local natural resource protection experts and individuals interested in helping to preserve Door County's plants and animals and their habitats published in 2002 "A Guide to Significant Wildlife Habitat and Natural Areas of Door County, Wisconsin." Eighteen areas – most of which qualify as "corridors" per the above discussion – were identified as the most critical in maintaining the ecological integrity and diversity of the county. Each area contains significant value for recreation, aesthetics, clean air and water, and biodiversity. The guide, containing both maps and text describing these eighteen areas, was designed for use by all levels of local government, natural resource professionals, and interested citizens. Its purpose is to provide practical information that might assist people in supporting natural area preservation and in implementing protection activities in and around their communities. Information on how to obtain a copy of the guide may be found under the SWCD listing in the Resources and Further Information section at the end of this document.

VULNERABLE SPECIES

RARE SPECIES PROTECTION

Both the U.S. Fish & Wildlife Service and the DNR manage and regulate activities pertaining to federally- and state-listed threatened and endangered species. Under the Federal Endangered Species Act, all federally-listed animals (including insects) are protected from direct killing, taking, or other activities that may be detrimental to the species on any land, public or private. Federally listed plants have similar protection, but the direct killing or taking prohibitions are limited to federal lands. Under Wisconsin's endangered species law, it is illegal to take (which includes killing), transport, possess, process, or sell any animal (including insects) that are on Wisconsin's endangered and threatened species list on any land, public or private, without a valid threatened or endangered species permit. State-listed plants have similar protection, but the direct killing or taking prohibitions are limited to any public lands or land that is not owned privately. No one may process or sell any wild plant on any land public or private that is a listed species without a valid endangered or threatened species permit. A federal and/or state permit may be needed when conducting activities on any lands that may affect threatened and endangered species. See the Resources and Further Information section for DNR and U.S. Fish & Wildlife Service contact information.

DOOR COUNTY INVASIVE SPECIES TEAM

Controlling invasive species is especially important due to the numerous endangered, threatened, and special concern plant species in the county. The DCIST, overseen and partially funded by SWCD, is a voluntary alliance of businesses, non-profit groups, public agencies, educational institutions, organizations, private land owners, and other interested parties working towards controlling invasive species. DCIST's activities include the following:

- Identifying non-native, aggressive plant species in Door County
- Controlling the spread of and/or eradicating when possible the identified plant species
- Offering public assistance and acting as an information and education resource in the above

WISCONSIN'S CAVE BATS

In 2006, a fungal disease known as white-nose syndrome (WNS) was first discovered in New York cave-dwelling bat populations; it reached Wisconsin in 2014. WNS has caused the most precipitous decline of North American wildlife in history, and has wiped out more than 90% of cave-dwelling bats in Door County and Wisconsin as a whole. Of the eight species recorded in Wisconsin, the four cave-dwelling bats are listed as threatened – big brown, little brown, northern long-eared, and tricolored – while the four others are on the DNR watch list.

PRESERVED LANDS

In 2022, roughly 38,171 acres, or about 12% of the county's total land area of 308,427 acres, was considered permanently protected for conservation or recreation purposes. Permanently protected areas include federal, state, county, and municipal parks, natural areas, and wildlife refuges; non-governmental preserves; school-owned lands; and privately-owned lands bound by conservation easements.

Conservation easements are contracts property owners volunteer to enter into with private land trusts or public agencies that limit, or in some cases prohibit, the future development of designated properties. With the establishment of a conservation easement, the property owner sells or makes a tax-deductible donation of the development rights for the property to the land trust but retains ownership of the property. The owner is not prohibited from selling the property or leaving it to heirs, but future owners must also abide by the terms of the conservation easement. The designated land trust permanently responsible for monitoring and enforcing the easement, through legal action if necessary. A conservation easement never requires, although may allow if the owner wishes, public access to the property.

Individual property owners also employ a wide variety of land protection measures in addition to conservation easements. Many Door County property owners have added restrictions on the deeds to their property that limit future development. (Note that if a specific group or agency, such as a land trust, is not designated to permanently enforce the deed restriction, the restrictions may later be ignored.) Property owners have enrolled in managed forest programs, as well as programs available to help (re)establish wildlife habitats, wetlands, ponds, and other natural areas. Agricultural landowners also have the option of entering into a variety of temporary agreements regarding farming preservation or operational practices.

Map 6.8, Preserved Lands, found at the end of this document, depicts those lands in the county considered permanently protected. Properties included in each map legend category are as follows:

- *Federal Reserve.* These lands are owned and designated by the federal government as nature or wildlife preserves. There are approximately 323 acres in Door County considered federal preserves.
- *State Preserve.* These lands are owned and designated by the State of Wisconsin as state nature or wildlife preserves. There are roughly 6,173 acres of state preserve in the county.
- *Non-Governmental Preserve.* These lands are owned for conservation and/or recreation purposes by private non-profits such as The Nature Conservancy, the Door County Land Trust, The Ridges Sanctuary, Crossroads at Big Creek, Boy and Girl Scouts, the YMCA, The Clearing, etc. There are approximately 11,104 acres of non-governmental preserves in the county.
- *Owners in Common.* These are privately-owned properties held for conservation and/or recreation purposes by homeowner, neighborhood, or condominium associations. There are at least 257 acres of such lands in the county.
- *State Park.* These lands are owned and operated by the State of Wisconsin as public parks. There are roughly 8,863 acres within the fives state parks in Door County.
- *County Park.* These properties are owned and operated by the County of Door as public parks, although some allow limited access and use. County parks comprise a total of approximately 1,074 acres in the county.
- *Municipal Park.* These properties are owned and designated as public parks by municipalities within Door County (the city, the four villages, or one of the 14 towns). Acreage of municipal parks in Door County totals roughly 702 acres.
- *School-Owned.* These lands are owned for conservation, recreation, or education purposes by schools, including University of Wisconsin branches, Lawrence University, and local K-12 districts. School-owned lands total approximately 1,629 acres in the county.
- *Conservation Easement – DNR.* These properties are privately owned but subject to a conservation easement with the Wisconsin DNR. There are approximately 583 such acres in the county.
- *Conservation Easement – Non-Government.* These properties are privately owned but subject to a conservation easement with non-governmental organizations such as the Door County Land Trust. Such lands comprise 3,186 acres.

While Map 6.8, Preserved Lands, depicts the location of state, county, and local parks, note that Chapter 12, Bicycle, Pedestrian, and Recreational Resources, provides a detailed description of the state and county parks.

NON-METALLIC MINERAL RESOURCES

NON-METALLIC MINERAL RESOURCES

Door County's non-metallic mines provide topsoil, clay, sand, gravel, and aggregate for concrete, asphalt, construction, and road building. They also provide dimensional stone for shoreland protection, landscaping, building, and decorative use. The county has significant quantities of sand, gravel, and crushed stone that are used for constructing the sub-base layer for roads and are also the primary components in concrete used in building foundations, basement walls, and sidewalks.

Door County has active and inactive non-metallic mines scattered around the county. Prior to laws and zoning implementing requirements for mining operations – location and reclamation plans to prevent surface and groundwater contamination and to ensure proper reclamation – mines were developed without regard to their potential adverse impacts and restoration of the site after mining stopped. Abandoned rock, gravel, and sand quarries were left without reclamation and void of topsoil and vegetation.

Ch. 295, Wis. Stats., enabled the DNR to establish rules – NR 135, Wis. Admin. Code – to implement a non-metallic mining reclamation program. The overall goal of NR 135 is to provide a framework for state-wide regulation of non-metallic mining reclamation. The rule does this by establishing uniform reclamation standards and setting up a locally administered reclamation permit program. Reclamation standards address environmental protection measures including topsoil salvage and storage, surface and groundwater protection, and contemporaneous reclamation to minimize acreage exposed to wind and water erosion.

Any new non-metallic mines need to obtain a permit from the DNR and are subject to the requirements of NR 135, including measures for surface water and wetland protection, groundwater protection, final grading and slopes, topsoil redistribution, and re-vegetation and site stabilization.

Depleted mining sites may be reclaimed as parkland, wildlife habitat, recreational land, or other uses. NR 135 also allows landowners to register marketable non-metallic mineral deposits as a way to prevent future on-site development that would interfere with the extraction of those deposits; registered sites are protected from local zoning or other decisions that permanently interfere with mining on the site for at least 20 years after the date of registration with the DNR.

For unincorporated areas under county comprhensive zoning (see Chapter 10, Land Use), the establishment of new non-metallic mine sites must be approved by the county. For reclamation only (not active mining operations or site approval), the Door County SWCD administers a Non-metallic Mine Reclamation Ordinance, in effect in all incorporated and unincorporated areas of the county. The Towns of Brussels, Nasewaupee, and Union all have their own non-metallic mining ordinances that also regulate mining (operations only, not reclamation).

Door County currently has approximately 50 active mines regulated by the county, which are inspected annually by SWCD staff. The DNR regulates several additional mines located in shoreland areas.

For municipal-level data regarding active mines, contact the Door County Soil and Water Conservation Department.

CHAPTER 6:

NATURAL RESOURCES

ADDITIONAL FIGURES AND TABLES

Table 6.7: Rare Plants, Door County

Rare Plants			
Common Name	Status	Common Name	Status
American Sea-rocket	SC	Low Calamint	SC
Beautiful Sedge	THR	Low Spike-moss	END
Bird's-eye Primrose	SC	Maidenhair Spleenwort	SC
Broad-leaf Sedge	SC	Many-headed Sedge	SC
Brown Beak-rush	SC	Marsh Horsetail	SC
Calypso Orchid	THR	Marsh Ragwort	SC
Canadian Gooseberry	THR	Mingan's Moonwort	SC
Christmas Fern	SC	Northern Comandra	END
Climbing Fumitory	SC	Northern Yellow Lady's-slipper	SC
Coast Sedge	THR	Pale Moonwort	SC
Common Moonwort	END	Pitcher's Thistle	THR
Cooper's Milkvetch	END	Prairie Dunewort	END
Downy Willow-herb	SC	Purple False Oats	END
Drooping Sedge	SC	Putty Root	SC
Dune Goldenrod	THR	Ram's-head Lady's-slipper	THR
Dwarf Lake Iris	THR	Rock Whitlow-grass	SC
Elk Sedge	THR	Round-leaved Orchis	THR
False Asphodel	THR	Rugulose Grape-fern	SC
Few-flowered Spike-rush	SC	Sand Coreopsis	SC
Giant Pinedrops	END	Sand Reedgrass	THR
Giant Rattlesnake-plantain	SC	Seaside Spurge	SC
Great Water-leaf	SC	Shining Lady's-tresses	SC
Green Spleenwort	END	Slender Bog Arrow-grass	SC
Hair-like Sedge	SC	Small Yellow Water Crowfoot	END
Handsome Sedge	THR	Small-flowered Grass-of-Parnassus	END
Heartleaf Foamflower	END	Spoon-leaf Moonwort	SC
Hoary Whitlow-grass	END	Spotted Pondweed	END
Hooker's Orchid	SC	Spreading woodfern	SC
Lake Huron Tansy	END	Striped Maple	SC
Large-flowered Ground-cherry	SC	Thickspike	THR
Laurentian Blader Fern	SC	Tufted Bulrush	THR
Limestone Oak Fern	SC	Wafer-ash	SC
Linear-leaved Sundew	THRE	Western Fescue	THR
Livid Sedge	SC	White Adder's-mouth	SC
Long-spurred Violet	SC	White Camas	SC

Source: Wisconsin Department of Natural Resources, Natural Heritage Inventory.

State Status:

END = Endangered

THR = Threatened

SC = Special Concern

Table 6.8: Rare Animals and Natural Communities, Door County

Rare Animals Common Name	Status	Natural Communities
A Hydroporus Diving Beetle	SC/N	Alvar
A Predaceous Diving Beetle	SC/N	Boreal Forest
A Predaceous Diving Beetle	SC/N	Dry Cliff
A Predaceous Diving Beetle	SC/N	Great Lakes Barrens
American Bittern	SC/M	Moist Cliff
Appalachian Pillar	SC/N	Northern Dry-mesic Forest
Bald Eagle	NA	Northern Dry Forest
Big Brown Bat	THR	Northern Mesic Forest
Black Striate	SC/N	Southern Mesic Forest
Black-crowned Night-Heron	SC/M	Talus Forest
Blanchard's Cricket Frog	END	Boral Rich Fen
Blanding's Turtle	SC/P	Emergent Marsh
Boreal Top	SC/N	Forested Seep
Bright Glyph	SC/N	Great Lakes Alkaline Rockshore
Brilliant Granule	SC/N	Great Lakes Beach
Broad-banded Forestsnail	SC/N	Great Lakes Dune
Callused Vertigo	END	Great Lakes Ridge and Swale
Caspian Tern	END	Great Lakes Shore Fen
Cherrystone Drop	THR	Interdunal Wetland
Clear-winged Grasshopper	SC/N	Lake--Shallow, Hard, Drainage
Cold-eye Lichen	SC	Lake--Shallow, Hard, Seepage
Common Antler Lichen	SC	Lake--Shallow, Very Hard, Drainage (Marl)
Common Goldeneye	SC/M	Northern Hardwood Swamp
Common Tern	END	Northern Sedge Meadow
Confusing Bumble Bee	SC/N	Northern Wet-mesic Forest
Deep-throated Vertigo	SC/N	Open Bog
Dentate Supercoil	SC/N	Shrub-carr
Eastern Ribbonsnake	END	Southern Hardwood Swamp
Four-toed Salamander	SC/H	Southern Sedge Meadow
Grasshopper Sparrow	SC/M	Springs and Spring Runds, Hard
Hairy-necked Tiger Beetle	END	
Hanging Fringed Lichen	SC	
Henslow's Sparrow	THR	
Hine's Emerald	END	
Hooded Warbler	THR	
Lake Huron Locust	END	
Lake Sturgeon	SC/H	
Least Bittern	SC/M	

LeConte's Sparrow	SC/M	
Little Brown Bat	THR	
Loggerhead Shrike	END	
Northern Flying Squirrel	SC/P	
Northern Goshawk	SC/M	
Northern Long-eared Bat	THR	
Oakmoss Lichen	SC	
Painted Skimmer	SC/N	
Peregrine Falcon	END	
Phyllira Tiger Moth	SC/N	
Piping Plover	END	
Red-shouldered Hawk	THR	
Ribbed Striate	SC/N	
Sand Loving Iceland Lichen	SC	
Sanderson's Bumble Bee	SC/N	
Sandy Stream Tiger Beetle	SC/N	
Sculpted Glyph	SC/N	
Semirelict Underwing Moth	SC/N	
Six-whorl Vertigo	SC/N	
Swamp Darner	SC/N	
Transparent Vitrine Snail	SC/N	
Tricolored Bat	THR	
Upland Sandpiper	THR	
Western Meadowlark	SC/M	
Yellow Bumble Bee	SC/N	
Yellow Rail	THR	
Yellowbanded Bumble Bee	SC/N	

Source: Wisconsin Department of Natural Resources, National Heritage Inventory.

State Status:

END = Endangered
THR = Threatened
SC = Special Concern
SC/H = Regulated by Open/Closed Seasons
SC/M = Protected by Migratory Bird Act
SC/N = No Protection
SC/P = Fully Protected

Table 6.9: State-Designated Natural Areas, Door County

Significant Natural Area	State Natural Area	State Wildlife & Fishery Area	Significant Coastal Wetland	Land Legacy Place
Baileys Harbor Boreal Forest and Wetlands	X			
Bayshore Blufflands	X			
Big and Little Marsh	X			
Big island	X			
Cave Point-Clay Banks	X			
Chambers Island				X
Coffey Swamp	X			
Colonial Waterbird Nesting Islands				X
Detroit Harbor	X			
Donlins Creek			X	
Door Peninsular Hardwood Swamps				X
Dunes Lake			X	
Eagle Harbor to Toft Point				X
Ellison Bluff	X			
Europe Woods	X			
Gardner Swamp		X		
Grand Traverse Islands				X
Heins Creek		X		
Jackson Harbor Ridges	X			
Kangaroo Lake	X			X
Little Lake	X			
Logan Creek	X			
Marshall's Point	X			
Meridian Park	X			
Mink River Estuary/Newport State Park/Europe Lake	X			X
Moonlight Bay Bedrock Beach	X			
Mud Lake	X	X	X	
Newport Conifer-Hardwoods				
Niagara Escarpment				X
North Bay	X			X
Peninsula Park Beech Forest	X			
Peninsula Park White Cedar Forest	X			
Peninsula State Park/Jacksonport Corridor				X
Red Hill Woods-Brussels Grassland				X
Rock Island Woods	X			
Schwartz Lake			X	
Shivering Sands			X	X
Sister Islands	X			

Stoney Creek		X	
Sturgeon Bay Pond		X	
The Ridges Sanctuary	X		
Thorp Pond	X		
Toft Point	X		
Upper Door County Area			X
Washington Island Wetlands			X
White Cliff Fen and Forest	X		
Whitefish Dunes	X		

Source: Wisconsin Department of Natural Resources.

RESOURCES AND FURTHER INFORMATION

LOCAL

Crossroads at Big Creek (Crossroads at Big Creek)

Sturgeon Bay Experimental Farm (Daily Summaries Station Details: STURGEON BAY EXPERIMENTAL FARM, WI US, GHCND:USC00478267 | Climate Data Online (CDO) | National Climatic Data Center (NCDC) (noaa.gov))

Door County Environmental Council (HOME - dcec-wi.org)

Door County Facilities and Parks Department (Door County Parks | Door County, WI)

Door County Invasive Species Team (Door County - The Door County Invasive Species Team (doorinvasives.org))

Door County Land Trust (Door County Land Trust)

Door County Land Use Services (Land Use Services | Door County, WI)

Door County Land and Water Resource Management Plan (Land and Water Resource Management Plan | Door County, WI)

Door County Pulse (Door County News - Door County Pulse)

Door County Land Use Services (https://www.co.door.wi.gov/164/Land-Use-Services)

Door County Soil and Water Conservation Department (Soil and Water Conservation | Door County, WI)

- **Land and Water Resource Management Plan** (Land and Water Resource Management Plan | Door County, WI)

Friends of Plum and Pilot Islands (Friends of Plum & Pilot Islands - Home (plumandpilot.org))

Friends of Rock Island (Friends of Rock Island State Park, Wisconsin (squarespace.com))

Lakeshore Natural Resource Partnership, Inc. (Lakeshore Natural Resource Partnership (lnrp.org))

The Nature Conservancy (Door Peninsula Wisconsin | The Nature Conservancy)

The Ridges Sanctuary (The Ridges Sanctuary – Preservation, Education, and Research)

REGIONAL AND STATE

Bay-Lake Regional Planning Commission (Home: Bay-Lake Region Planning Commission (baylakerpc.org))

Great Lakes Environmental Research Laboratory (Home: NOAA Great Lakes Environmental Research Laboratory - Ann Arbor, MI, USA)

Great Lakes-St. Lawrence River Compact Council (The Great Lakes-St. Lawrence River Compact Council-The Great Lakes-St. Lawrence River Compact Council (glslcompactcouncil.org))

Knowles Nelson (Knowles Nelson Stewardship – Protecting Land and Water in Wisconsin)

Midwestern Regional Climate Center (MRCC - Midwestern Regional Climate Center (purdue.edu))

University of Wisconsin-Green Bay, Cofrin Center for Biodiversity (Biodiversity - UW-Green Bay (uwgb.edu))

University of Wisconsin-Oshkosh, Environmental Research and Innovation Center (Environmental Research and Innovation Center - UWO University of Wisconsin Oshkosh (uwosh.edu))

University of Wisconsin-Stevens Point, Center for Watershed Science and Education (Home - Center for Watershed Science and Education | UWSP)

University of Wisconsin-Stevens Point, Water and Environmental Analysis Laboratory (Home - Water and Environmental Analysis Lab | UWSP)

Wisconsin Department of Natural Resources (Wisconsin Department of Natural Resources (DNR) | Wisconsin DNR)

- **DNR Waterways** (Designated Waterways and Wetlands | Waterway protection | Wisconsin DNR)
- **DNR Natural Heritage Inventory** (Natural Heritage Inventory | Tools for accessing data | Wisconsin DNR)

Wisconsin Geological and Natural History Survey (WGNHS – Wisconsin Geological and Natural History Survey – UW–Madison)

Wisconsin Initiative on Climate Change Impacts (Wisconsin Initiative on Climate Change Impacts (WICCI))

- **WICCI 2021 Report** (2021 Assessment Report: Wisconsin's Changing Climate | Wisconsin Initiative on Climate Change Impacts (WICCI))

FEDERAL

Environmental Protection Agency (U.S. Environmental Protection Agency | US EPA)

Federal Emergency Management Agency (FEMA.gov)

Great Lakes Restoration Initiative (Great Lakes Restoration Initiative | Great Lakes Restoration Initiative (glri.us))

International Joint Commission (Home | International Joint Commission (ijc.org))

National Oceanic and Atmospheric Administration (Homepage | National Oceanic and Atmospheric Administration (noaa.gov))

- **Water Level Observations** (Operational Water Level Observation Information (noaa.gov))

National Weather Service (National Weather Service)

Natural Resources Conservation Service (Home | Natural Resources Conservation Service (usda.gov))

The Trust for Public Land (Trust for Public Land: Connecting Everyone to the Outdoors (tpl.org))

United States Army Corps of Engineers (Headquarters U.S. Army Corps of Engineers)

United States Fish and Wildlife Service (U.S. Fish and Wildlife Service (fws.gov))

- **National Wildlife Refuge System** (National Wildlife Refuge System | U.S. Fish & Wildlife Service (fws.gov))

United States Forest Service (Home | US Forest Service (usda.gov))

- **Wildland Planning Glossary** (Wildland planning glossary | US Forest Service Research and Development (usda.gov))

United States Geological Survey (USGS.gov | Science for a changing world)

- **Climate Adaptation Science Centers** (Climate Adaptation Science Centers | U.S. Geological Survey (usgs.gov))