CHAPTER 6: NATURAL RESOURCES

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, and 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's climate is a cool, humid, continental type in which temperature varies greatly from summer to winter. The surrounding Green Bay and Lake Michigan moderate the climate somewhat so that there are fewer days with extremely high and low temperatures than is common for this latitude. Water cooled during the winter delays spring and early summer while water warmed during the summer delays the first freeze in the fall. Mild and pleasant summers are typical.

About two-thirds of the annual precipitation falls during the growing season or the "freeze-free" period. It is normally adequate for crop production, although droughts are occasionally reported. The climate is generally favorable for dairy farming, fruit production (primarily cherries, apples, and berries), and crops such as corn, small grains, hay, and vegetables.

According to data taken from the weather center at the Sturgeon Bay Experimental Farm, between 1971 and 2000 the mean annual temperature was 43.6 degrees Fahrenheit. Mean seasonal temperatures between 1905 and 2001 were 20.3 in the winter, 65.8 in the summer, 48.4 in the fall, and 41.6 in the spring. The freeze-free season, or growing season, is a median of 148 days with a range between 132 and 161 days, which is considered lengthy for this northern latitude (the 45th parallel runs through approximately the middle of the county) and is due primarily to the moderating effect of Lake Michigan and Green Bay. The average date of the last spring freeze is May 12th and the average date of the first autumn freeze is October 8th.

Average annual precipitation for the county between 1971 and 2000 was 31.5 inches. For the same

timeframe, the mean number of snowfall inches was 47.9 and thunderstorms averaged about 33 per year. Occasional hail, wind, and lightning damage is also reported. The first snowfall of consequence, an inch or more, is usually in late November. Average annual duration of snow cover is approximately 111 days. This snow cover acts as protective insulation for grasses, autumn-seeded grains, alfalfa, and other vegetation.

Historical temperature and precipitation data for Wisconsin have shown that the state has become warmer and wetter since 1950. According to the Wisconsin Initiative on Climate Change Impacts (WICCI), between 1950 and 2006, Wisconsin's average annual temperature has risen by 1.1 degrees Fahrenheit and average annual precipitation has increased by 3.1 inches. WICCI scientists predict that these trends will continue and even occur at a faster rate, perhaps at a rate where plant and animal species will not be able to adapt. Using circulation models, WICCI scientists project that the warming trend will continue and increase, with future precipitation also likely to increase. More precipitation is likely to occur in the form of rain and freezing rain during the winter, as well as increasing in both frequency and intensity during the spring and fall. By 2050, temperatures for the state are predicted to warm between 6° and 7° Fahrenheit.

The combination of warmer temperatures, more precipitation, and more intense precipitation will have a critical impact on the quantity and quality of the state's water resources, natural habitats, agriculture, and the social and built environment. The state's coastal regions will face unique challenges in the form of shoreline erosion and recession and threats to coastal wetlands due to lower water levels, with Lake Michigan's average water level predicted to decrease by about a foot by the end of the century.

GEOLOGY AND TOPOGRAPHY

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. 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. 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 National 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, with velocity in karst aquifers that potentially reach those of surface streams. 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 the 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

Air quality is currently monitored by one EPA station in the county, located at Newport State Park in the Town of Liberty Grove. In 2004, Door County was identified by the U.S. Environmental Protection Agency (EPA) as a “non-attainment” zone for their ozone air quality standard. Non-attainment zones are areas that exceed the EPA’s 8-hour ozone national air quality standard intended to protect the public from breathing unsafe air. Ozone is unhealthy to breathe, especially for people with respiratory diseases and children; persons active outdoors are also at increased risk. In addition to the general environmental and health concerns high ozone levels pose, designation as a non-attainment zone may mean additional requirements for businesses wishing to move to a non-attainment area.

Since 2004, research conducted by the Wisconsin Department of Natural Resources (DNR) and the Lake Michigan Air Directors Consortium showed that the majority of Door County's ozone and ozone precursors originate from coal-burning power plants, manufacturing plants, and automobiles operating in northwest Indiana, the Chicago area, and southeast Wisconsin. These pollutants are transported to the county and surrounding area by weather patterns, which in turn elevate ozone levels beyond what they would be otherwise. Given that many of the emissions affecting Door County come from outside of the county, implementing any controls locally is not likely to have much of an impact on reducing ozone levels.

Due to these circumstances, the DNR requested in 2009 that the EPA re-designate Door and Manitowoc counties as "rural transport" attainment areas because their ozone problems are the result of pollutants transported from outside. In order for the EPA to assign this re-designation, the DNR had to show that the amount of local emissions contributing to the violation of the 8-hour standard is relatively minor compared to the amount transported into the area and that local emissions do not contribute significantly to ozone levels measured in other areas. Based on data provided by the DNR, the EPA approved the re-designation requests for both Door and Manitowoc counties in 2010.

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 are also found in this region.

SOIL DESCRIPTIONS

The U.S. 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 percent 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 percent 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 percent 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 percent 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 percent 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 fine sand outwash or that have a silt loam subsoil over stratified lake sediments; and very poorly drained, nearly level organic soils.

- Carbondale-Cathro association: Occupies approximately 7 percent 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 sub-stratum. 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

Participants at county-wide visioning sessions held between 2006 and 2007 and in the 2014 update process highly value the county's natural resources. Natural resources are valued 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 650-mile long ridge threading through portions of Wisconsin, Michigan, Ontario (Canada), and New York. (See Figure 6.1.) 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 slope 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 of 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 species, significant wetland areas, and an abundance of unique eco-systems and natural communities. Cultural resources include archeological sites, pictographs (rock art), mounds, petroglyphs, maritime structures and wrecks, various lime kilns and caves, and historic farmsteads.

Figure 6.1: Niagara Escarpment

Source: Bay Lake Regional Planning Commission, 2001.

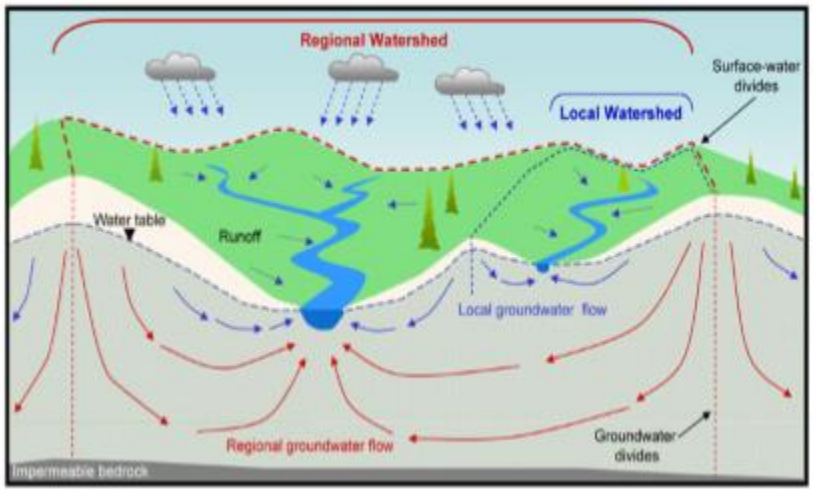
SURFACE WATERS

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 DNR applies the watershed approach – the presence, movement, and interaction of water in the landscape – in categorizing drainage patterns within the state. (See Figure 6.2.)

Figure 6.2: Watersheds and Drainage Patterns



Source: Central Wisconsin Groundwater Center, Kevin Masarik.

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 is divided into three major basins, each identified by the primary waterbody into which the basin drains; they are the Lake Superior, Mississippi River, and Lake Michigan basins. Door County lies entirely within the Lake Michigan Basin, which encompasses a large portion of eastern Wisconsin. Within Door County there are four major watersheds: 1) Upper Door County Watershed; 2) Red River and Sturgeon Bay Watershed; 3) Ahnapee River Watershed; and 4) Stony Creek Watershed. 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 Superior, Michigan, Huron, Erie, and Ontario. Combined, the Great Lakes contain approximately 20% of the earth's fresh surface water, 90% of North America's fresh surface water, and support a $15 billion economy. 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.

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 coastal shoreline miles of any county in the United States. 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, swamps, and marshes and 37 named rivers, creeks, streams, and springs draining into Lake Michigan. Table 6.1 lists the county's named lakes, ponds and marshes; Table 6.2 lists the county's named rivers, creeks, streams, and springs. Map 6.4, Surface Water Features, located at the end of this document, illustrates all the surface water features listed in these tables.

GROUNDWATER

Groundwater is defined as the useable 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.

Table 6.1: Lakes, Ponds, and Marshes, Door County

Name	Acres	Max. Depth
Arbter Lake	16	2
Gunnerson (Big) Marsh	31	2
Bley Pond	5	3
Bradley Lake (Little)	19	7
Butler Pond	3	2
Clark Lake	868	25
Coffee Swamp	2	2
Dunes Lake	80	1
Europe Lake	273	10
Forestville Millpond	65	5
Kangaroo Lake	1,123	12
Krause Lake (Mud)	4	24
Little Lake	24	6
Lost Lake	91	5
Mackaysee Lake	347	27
Mink River Lake	70	13
Mud Lake	155	5
Pinney Lake	2	6
Pluff Pond	1	5
Schwartz Lake	30	4
Thorp Pond	6	3
Upper Lost Lake	5	3
Voecks Marsh	19	2
Wickman (Little) Marsh	14	2
Zoo Lake	1	3

Source: Door County Land and Water Resource Management Plan, 2011 - 2020.

Table 6.2: Rivers, Creeks, Streams, and Springs, Door County

Name	Length in Miles	Width in Feet
Ahnapee River	6.0	2.5
Bear Creek	4.0	---
Big Creek	13.0	4.5
Ephraim Creek	1.5	9
Fabry Creek	1.0	4
Fish Creek	1.0	8
Geisel Creek	3.6	20
Goldenrod/Fischer Creek	1.17	---
Heins Creek	2.9	14
Hibbards Creek	5.4	15
Hidden Spring	1.0	2
Kayes Creek	7.0	4
Krueger Creek	1.0	---
Larson Creek	4.0	---
Lily Bay Creek	3.4	5
Little Creek	---	---
Logan Creek	4.8	---
Lost Creek	2.5	8
Malvitz Creek	1.0	---
May Creek	3.0	---
Mink River	11.1	---
Peil Creek	---	---
Reibolt Creek	---	---
Renard Creek	6.0	6
Samuelson Creek	1.3	---
Schuyler Creek	4.0	27
Shivering Sands Creek	1.1	---
Silver Creek - Brussels	---	---
Silver Creek - Forestville	5.0	---
Silver Creek - Union	---	6
Stony Creek	13.6	6
Strawberry Creek	1.6	12
Sugar Creek	9.0	9
Three Springs Creek	2.3	4
Twin Harbor Creek	1.0	---
Whitefish Bay Creek	1.1	28
Woodard Creek	4.0	---

Source: Door County Land and Water Resource Management Plan, 2011 - 2020.

WETLANDS

Wetlands act as natural pollution filters for lakes, streams, and drinking water; act as groundwater recharge and discharge areas; retain floodwaters; provide habitat for many plants and animals; and provide scenic open spaces. Other common names for wetlands are swamps, bogs, and marshes. Wetlands store flood waters and filter water from precipitation before it enters lakes and streams. 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 also provide recreational opportunities for humans such as wildlife observation, hiking, hunting, etc.

Wetlands located in Door County are shown in Map 6.5, Wetlands, found at the end of this document.

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 are often rich in species diversity 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 chapter.

SHORELANDS

Shorelands are 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 problems 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, Shorelands and Floodplains, found at the end of this document.

FLOODPLAINS

Floodplains are defined by the DNR as the land calculated to be covered by floodwater during the regional so-called 100-year flood. This name is somewhat misleading since the 100-year flood actually has a 1% chance of occurring in any given year. The floodplain includes the floodway and the flood fringe. The floodway is the channel of the river or stream and those portions of the floodplain adjoining the channel required to carry and discharge the flood waters or flood flows associated with the regional flood (NR 116.03, Wis. Admin. Code). The flood fringe are areas inundated by the flood, but which do not experience a strong current.

Floodplains, as identified by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), provide for stormwater retention, groundwater recharge, habitat for various types of waterfowl and wildlife, and recreational uses. Furthermore, floodplains serve to provide flood and erosion control by storing floodwaters, reducing flood velocities, diminishing flood peaks, and reducing sedimentation.

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 of 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, Shorelands and Floodplains, 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 113,900 acres of woodland, covering about 37 percent 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 Door County Comprehensive Forestry Plan, Managed Forest Law Program, and State Nursery Program. The Door County Planning Department also administers woodland cutting regulations through the Door County 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 1 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 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. 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 small 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.

BIOLOGICAL DIVERSITY

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 chapter 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.

Municipal-level data may be found at http://dnr.wi.gov/topic/ NHI/ CountyDatahtml.

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 and 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 chapter 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 lists: 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 lake shores 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 Web sites 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 chapter.

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). Since then, Piping plovers have been absent as nesting birds from the Wisconsin shore of Lake Michigan, until 2012 when a pair was discovered nesting in northern Door County.

THREATS TO NATURAL FEATURES

This section provides an overview of threats to Door County's natural features, with discussion on climate change intertwined. As discussed previously, WICCI reports that Wisconsin's climate has become warmer and wetter since 1950. For the coastal region, including Door County, temperatures are expected to keep rising, resulting in increased evaporation, less ice cover, and greater wind strength. 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.

Discussed in this section are 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 Adaption,"* for which a link is provided in the Resources and Further Information section.

LAKE MICHIGAN WATER LEVELS

Overall, Great Lakes water levels have been dropping and Lake Michigan has in recent years faced near historic lows, negatively impacting the economy and environment in multiple ways, including increased transportation expenses, reduced wildlife habitat, and the spread of invasive species. In 2013, Lake Michigan's water level dropped to 21 inches below the long-term average, as measured every year in May, from 1918 - 2011, but was still 11 inches above the lowest recorded monthly mean measured in 1964. Decreasing water levels in Lake Michigan have been attributed to climate change, new rainfall patterns, and gravel mining and dredging along the St. Clair River.

On average, water levels in Lakes Michigan and Superior are projected to fall another 0.8 to 1.4 feet by the end of the century, with Lake Michigan falling more than Lake Superior. Although average water levels are expected to be even lower by the end of this century, average water levels are predicted to vary greatly from decade to decade, with both high- and low-water decades.

SHORELINE RECESSION AND DAMAGE

Reduced ice cover combined with an increase in wind strength will expose shorelines to larger waves for longer periods of time, resulting in shoreline erosion. Additionally, predicted immoderate rain events will make shorelines exceedingly vulnerable to erosion as the soil will retain moisture more of the time, making it unstable and inordinately prone to erosion. 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. However, recession does not immediately follow erosion and can take years to occur. Shoreline damage can also occur with fluctuating water 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.

FLOODING AND WETLAND DESTRUCTION

While it is generally agreed that water levels on Lake Michigan will decline overall by the end of this century, coastal flooding is likely to occur during high-water decades due to a combination of wind, waves, and water levels. Warmer, wetter winters combined with immoderate storm events will generate more runoff in the spring, leading to longer periods of flooding in streams and wetlands. Under normal circumstances, coastal wetlands help prevent floods, protect shorelines, and recharge groundwater supplies, but the effects of climate change are expected to reduce their effectiveness. 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 discussed 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 or threatening an estimated 40 percent of the streams, 90 percent of the inland lakes, many Great Lakes harbors and coastal waters, many wetland areas, and substantial groundwater resources in Wisconsin. To make matters worse, the WICCI predicts an increase in the size and frequency of rainfall, with a shift towards more rainfall in the winter and spring, creating even more runoff.

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 water 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 conditions, identified by WICCI as one of the greatest threats to the Green Bay aquatic system, greatly increases algae growth. 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. These conditions disrupt the food chain, sometimes resulting in a less desirable fish community where bottom-feeding fish, such as invasive carp, outcompete native species, such as walleye.

The EPA attributes most of the phosphate load into our waterbodies as coming from nonpoint sources, such as runoff from farmland, lawns, and failing septic systems. Much of it also comes from sewage treatment plants, despite water treatment techniques intended to reduce phosphorus

outflow. Prior to 2010, the main household sources of phosphate were lawn fertilizer and detergents formulated for automatic dish washers (containing up to 8% phosphate). In both applications, the use of phosphate has been in general deemed unnecessary.

In 2010, two Wisconsin laws went into effect that essentially banned phosphorus from lawn fertilizers and automatic-dishwasher detergent, except in limited circumstances. Stores are prohibited from displaying turf fertilizer containing phosphorus, although they may keep some in stock for the few circumstances where fertilizer containing phosphates may be sold. People who have a soil test showing that their soil is deficient in phosphorus and people installing new lawns may buy the fertilizer with phosphorus. The law does not apply to agricultural production, pastures, and home gardens. A second law that went into effect in 2010 limits phosphorus content to no more than 0.5% in automatic-dishwasher detergent sold in Wisconsin, although commercial and industrial detergents are exempt. Many other states also enacted a similar law in 2010, prompting the dishwasher detergent manufacturing industry to place what is essentially a nation-wide voluntary ban on home-use detergent containing phosphates.

While the effect of these laws on the phosphorus content in our waterbodies remains to be seen, agricultural and urban runoff are still a major source of phosphates and other pollutants. Both voluntary and regulatory programs implemented through the DNR's Runoff Management program are in effect. Originally implemented in 2002, the Runoff Management Program writes 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 federal Clean Water Act. Nearly all municipalities and farmers are affected by the rules in one way or another. As described later in this chapter, the DNR runoff programs are implemented locally by the 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 a gastrointestinal illness traced back to Nicolet Beach in Peninsula State Park, one of Door 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. The sampled beaches are located along both sides of the peninsula, on Washington Island, within the Sturgeon Bay Canal, and at three inland lakes. A final report published in 2007 notes that the most contaminated water samples came from shallow waters, 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.

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 of 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. 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. In 1983, governors from the Great Lakes region joined forces to create the Council of Great Lakes Governors, a non-partisan partnership between Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin. Subsequently, the Premiers of Ontario and Québec also joined with the governors. In December 2005, following a nearly five-year negotiation, the council reached agreement on the Great Lakes-St. Lawrence River Basin Water Resources Compact. This compact provides a comprehensive management framework for achieving sustainable water use and resource protection. The council also reached a similar, good faith agreement with Ontario and Québec, which the provinces are using to amend their existing water programs for greater regional consistency. During 2007 and 2008, each of the eight state legislatures ratified the compact. Federal legislative approval was completed in 2008 by the U.S. Senate and the U.S. House of Representatives. On October 3, 2008, President George W. Bush signed a joint resolution of Congress giving consent to the Great Lakes-St. Lawrence River Basin Water Resources Compact, which became law on December 8, 2008.

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 comes from communities bordering the basin that are experiencing water shortages and quality issues. During the 2007-2008 Wisconsin legislation session, there was a push to pass legislation that would provide greater protection than the federal compact, called the Strong Compact for a Strong Wisconsin. This proposed legislation, described below, lost momentum as the Great Recession was emerging at the same time and took priority. The legislation included:

- standards for environmentally responsible return flow;
- mechanisms for managing and regulating in-basin water use;
- requirements for communities seeking a diversion to meet enforceable, demonstrable water conservation standards;
- requirements for communities looking to extend or build new water supply systems as part of a diversion request to comply with current regional water supply and quality plans;
- clarification of the compact's treatment of bottled water withdrawals; and
- provisions for adequate citizen participation in a practical and protective manner.

Currently, the DNR is reviewing its first application, received in May 2010, for water diversion from Lake Michigan to the City of Waukesha, an area that lies outside of the Great Lakes Basin. If Waukesha's request to divert water for public water supply purposes is approved, it will serve the city and potentially serve adjacent communities. Currently, Waukesha obtains its public water supply from an aquifer that contains high levels of radium and where water levels have declined by more than 500 feet and are continuing to decline by an additional five to nine feet annually. Waukesha seeks to divert from Lake Michigan up to an annual average of 10.9 million gallons of water daily, with a maximum daily diversion of 18.5 million gallons. Under the proposed application, a volume of wastewater equal to the volume of water withdrawn from Lake Michigan would be returned to the

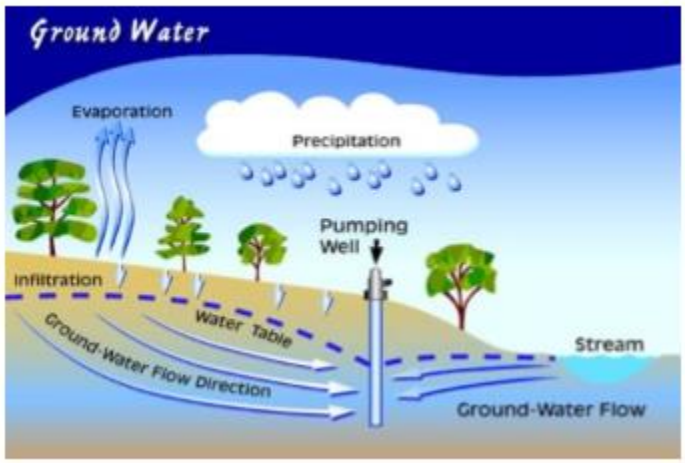
Lake Michigan Basin. The DNR is currently reviewing an updated application received in October of 2013.

GROUNDWATER QUALITY AND QUANTITY

CONTAMINATION

Since 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. (Figure 6.3.) 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.

Figure 6.3: Groundwater Cycle



Source: www.norcalblogs.com/commission/images/groundwater.jpg

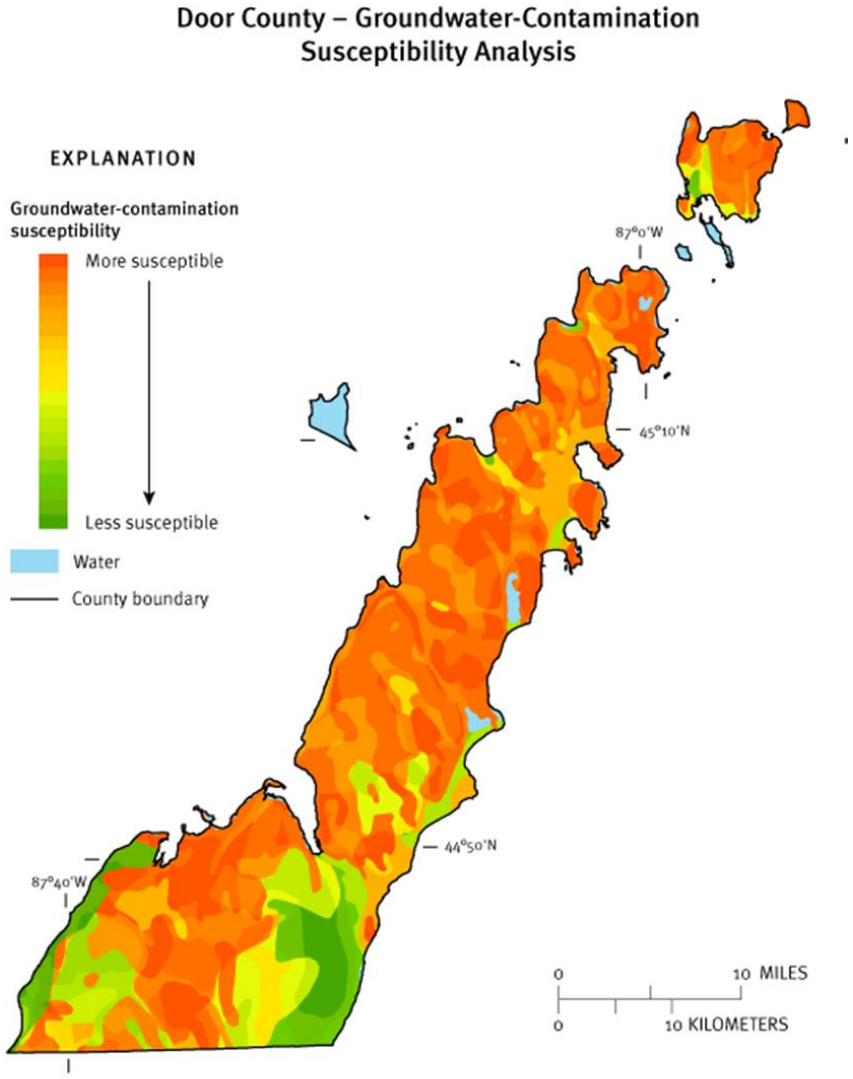
As development in an area increases, so does the impervious surface area, such as roofs, driveways, and parking lots. This affects the amount and quality of water that infiltrates to the groundwater due to the changes to vegetative cover, slope, soil composition, and soil depth. Groundwater may be contaminated by construction and agricultural runoff events, which can lead to contamination of private wells, fish kills, and an influx of nutrients into surface waters, 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 6.4 is a groundwater contamination susceptibility map, created by the DNR in partnership with the United States Geological Survey, University of Wisconsin-Extension, and Wisconsin Geological and Natural History Survey. Five physical resource characteristics were identified as important in determining how easily a contaminant can be carried through overlying materials to the groundwater. These characteristics are depth to bedrock, type of bedrock, soil characteristics, depth to water table, and characteristics of surficial deposits (glacial deposits lying between bedrock and soil).

Municipal wells serve approximately 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 Villages of Forestville and Sister Bay, and Maplewood (Town of Forestville) have municipal water. The Village of Sister Bay also serves some households located in the Town of Liberty Grove. The City of Sturgeon Bay and the Villages of Forestville and 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 contributions, the City of Sturgeon Bay,

Town of Liberty Grove, and the Village of Sister Bay have adopted wellhead protection ordinances. While municipal wells are routinely tested for contaminants, proper monitoring of contaminants in private wells often does not occur. Copper and lead can be present in groundwater, but usually come from plumbing/piping and sometimes from pesticides or herbicides. 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 contained approximately 10,000 acres of cherry orchards and 2,000 acres of apple orchards - lead arsenic was the primary insecticide used. (Note that it was also used on potato crops on Washington Island.) The lead arsenic was brought to mixing stations in powder form and mixed with water to produce a solution for spray application on the fruit trees in the orchard. Widespread use of lead arsenic ended by 1960, but it was still sporadically applied in parts of the county until the early 1970s.

Figure 6.4: Groundwater Contamination Susceptibility Analysis, Door County



This groundwater-contamination susceptibility map is a composite of five resource characteristic maps, each of which was derived from generalized statewide information at small scales, and cannot be used for any site-specific purposes.

Map source: Schmidt, R.R., 1987, Groundwater contamination susceptibility map and evaluation: Wisconsin Department of Natural Resources, Wisconsin's Groundwater Management Plan Report 5, PUBL-WR-177-87, 27 p.

Figure created for the "Protecting Wisconsin's Groundwater Through Comprehensive Planning" web site, 2007, *http://wi.water.usgs.gov/gwcomp/*

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. Lead arsenic 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, but the larger area of an orchard, as compared 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. Presently, the primary sources contributing to high levels of nitrates are runoff or seepage from the over-application of fertilizer on agricultural and residential lands, municipal and industrial waste water, refuse dumps, animal feedlots, septic tanks and private sewage disposal systems, urban drainage, and decaying plant debris. 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.”

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 wells. Scientists predict, however, that climate change will negatively impact groundwater quality and quantity, because of predicted increases in the amount, intensity, and seasonal distribution of rainfalls, as well as increased temperatures, across Wisconsin. Although it is uncertain exactly how, climate change will also affect the recharge rate and amount of groundwater, the quality of groundwater, and the likelihood of groundwater flooding. Some of the potential effects of climate change on groundwater are described below.

Groundwater Recharge

- Typically, an increase in precipitation leads to a rise in groundwater, but increased temperatures could also lead to increased evaporation. Groundwater will be lowered if evaporation happens at a faster rate than groundwater. Certain parts of the state are at risk, especially in areas where development patterns are predicted to intensify.

- Increased amounts of rainfall could 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 summer temperatures and a longer growing season could 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 to lakes.

Groundwater Flooding

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

Groundwater Quality

- Less groundwater recharge may mean 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 the 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. The DNR defines an invasive species as one that has been introduced by human action to a location, area, or region where it did not previously occur naturally (i.e., is not native), becomes capable of establishing a breeding population in the new location without further intervention by humans, and spreads widely throughout the new location.

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, economic value of ecosystems, 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 specifically.

The Door County Invasive Species Team (DCIST) - a voluntary alliance of businesses, non-profit groups, public agencies, educational institutions, organizations, private landowners, and other parties interested in controlling invasive species - created the following list (Table 6.3) of species deemed to be the most detrimental biologically and economically to Door County ecosystems.

Table 6.3: Top Invasive Species, Door County

Plants	Animals
Autumn Olive	Asian Lady Beetle
Bell's Honeysuckle	Bighead and Silver Carp
Common Reed Grass or Phragmites	Emerald Ash Borer
Common Buckthorn	Gypsy Moth
Common Teasel	Mute Swan
Dames Rocket	Oak Wilt
Garlic Mustard	Quagga Mussels
Glossy Buckthorn	Round Goby
Japanese Barberry	Rusty Crayfish
Japanese Knotweed	Spiny Waterflea and Fishhook Waterflea
Leafy Spurge	White Perch
Purple Loosestrife	Zebra Mussels
Reed Canary Grass	
Tartarian Honeysuckle	
Spotted Knapweed	
Wild Parsnip	

Source: Door County Invasive Species Team, 2012.

POTENTIAL CLIMATE CHANGE EFFECTS ON BIODIVERSITY

Climate change will affect the composition of all species. Rising temperatures, shifting precipitation patterns, and an increasing number of heavy rainfalls will cause physical changes to natural communities which in turn will trigger long-term biological responses from the species that live there. Some species will fare better than others, although scientists predict the majority of species affected by climate change will fare worse. The WICCI conducted the first preliminary assessment of climate change impacts on our state's habitats and species, some of which are described below.

- *Early onset of spring*. Spring arrives six to 20 days earlier than it used to, extending the growing season by two weeks and affecting the timing of biological events; relationships between plants and animals and migration of animals may be thrown out of sync.

- *Warming water temperatures*. Brook and brown trout are sensitive to changes in water temperature and cannot survive and reproduce above a certain temperature; models predict that rising stream temperatures could eliminate up to 95% of brook trout habitat across the state. Some fish species will benefit from warmer water temperatures, however, the loss of trout habitat will far exceed any gain in other fish habitat. The Hine's emerald dragonfly will also suffer habitat loss as waters warm or increased rainfall prolongs wet conditions.

- *Reduced snow and ice cover*. Reduced snow cover, predicted to drop by 40 percent over the next half century, will affect plants and animals that have adapted to and rely on snow for their survival. Snow provides moisture and warmth for both plants and animals. While the endangered American marten will suffer, white-tailed deer will thrive, as will invasive aquatic plants that benefit from an extended growing season.

- *Reduced soil moisture.* Less soil moisture will make growing conditions for many plants difficult, threaten certain types of forests, and change the composition of plants growing in these forests. Many animals, such as toads and salamanders, rely on the humidity and moisture in soils to maintain water balance in their bodies and will die if they do not get enough, in turn reducing food sources for other animals. Less soil moisture also means less groundwater recharge to streams, resulting in increased stream temperatures.

- *Drought.* Much of the country, including Wisconsin, experienced moderate-to-severe drought conditions in 2012. Although precipitation is likely to increase overall, primarily throughout the winter and spring, summers could experience drought conditions. More frequent or intense drought conditions will impact natural communities and their inhabitants by drying out wetlands where animals like to nest and stay moist. Decreasing water levels will also reduce habitat for many species and increasing stream temperatures will make it difficult for some species to survive. Some species will benefit, such as the rare Fassett's loco-weed, which had been found thriving in drought-ridden areas in northern Wisconsin.

- *Flooding.* With more frequent and intense rainstorm events predicted, more flooding is also likely to occur. More flooding will damage or destroy habitat by creating soil conditions that are too moist for some native species, while enhancing habitat for some invasive and non-native species. Some native plants and animals, such as giant ragweed and trout, will respond well to flooding.

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

The current approach to managing water levels in the Great Lakes is through regulation of outflows from Lake Superior and Lake Ontario at dams located on the St. Mary's River at Sault Ste. Marie and at Cornwall/Massena on the St. Lawrence River. Outflows are controlled according to regulation plans administered by the International Joint Commission (IJC) which specify how much water can 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. Canada and the U.S. each appoint three of the six IJC Commissioners, who traditionally work by 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.

Since the climate is changing and the IJC's ability to alter lake levels through outflow regulation is limited, a broader, more comprehensive approach to managing the impacts of changing lake levels is needed. 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 that addresses future extreme water levels in the Great Lake-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 adaptation 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

In 2009, the EPA began its Great Lakes Restoration Initiative, the largest investment in the Great Lakes in over two decades. A task force of 11 federal agencies developed an action plan intended to address five urgent issues plaguing the Great Lakes:

- cleaning up toxics and areas of concern;
- combating invasive species;
- promoting near-shore health by protecting watersheds from polluted runoff;
- restoring wetlands and other habitats; and
- working with strategic partners and tracking progress.

Door County has benefited primarily from a grant designed to improve beach health, including eliminating *E. coli* contamination, receiving over $700,000 to implement best management practices at 11 Door County beaches located within nine municipalities. With this grant money, the SWCD designed plans to install green infrastructure to improve water quality at public beaches by reducing, capturing, and treating stormwater runoff. These measures include the reduction of impervious surfaces near beach areas, installation of rain gardens and bio-filters, and reduction of waterfowl landing and congregation at beaches.

Door County is also indirectly benefitting from the EPA Great Lakes Restoration Initiative through a grant awarded to the DNR to conduct a comprehensive examination of the live plant trade by nurseries, water garden, and aquarium retailers. Approximately 100 Wisconsin retailers are estimated to be involved in this business and the grant supports education and outreach to reduce

invasive species introductions.

WISCONSIN DEPARTMENT OF NATURAL RESOURCES 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 are tasked with water quality planning and cover a range of areas, including setting water quality standards and implementing a runoff management program.

In response to state-wide runoff issues and to abide by EPA Clean Water Act rules, the DNR has developed multiple programs that are implemented locally through the SWCD. Such programs involve state-classified watersheds and waterbodies identified as particularly threatened or susceptible to primarily nonpoint source pollution. These watersheds and waterbodies are classified under the Priority Watershed Program, and the Outstanding and Exceptional Resource Waters Program. Other waterbodies identified as already impaired – not meeting state water quality standards – require monitoring and protection according to the Impaired Waters (303(d)) program. Other DNR programs implemented locally by SWCD and the Door County Planning Department are designed to protect groundwater quality and wetlands.

DNR Water Quality Standards
Ch. 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-degredation).

- *Designated Uses.* Designated uses are specified in water quality standards for each waterbody or segment, whether or not they are currently attained. Often, the designated use is based on the attainable use. Attainable uses are the uses that could be attained in a waterbody by implementing appropriate point and/or nonpoint source management actions. These actions can include effluent requirements for point sources and cost-effective and reasonable best management practices for nonpoint source control. As described in Chapter NR 102 and listed below, there are four designated uses:

    - *Recreational Use* – appropriate to protect for recreational use, unless a sanitary survey has been completed to show that humans are unlikely to participate in activities requiring full body immersion.

    - *Public Health and Welfare* – appropriate to protect for incidental contact by humans, with some protected even further since they serve as a drinking water supply to nearby communities.

    - *Wildlife* – appropriate to protect for wildlife that rely directly on the water to exist or to provide food for existence.

    - *Fish and Aquatic Life* – appropriate to protect 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 various factors such as temperature, flow, habitat, and water chemistry.

- *Water Quality Criteria.* Each of the use designations described above have a set of quantitative or qualitative requirements intended to achieve that designated use. These requirements relate to the amount of pollutants, chemical compounds, or bacteria that can exist without causing harm or changing physical measurements such as temperature or pH.

- *Antidegradation.* This policy is intended to maintain and protect existing uses and high quality waters. It also intends to prevent water quality from slipping backwards and becoming poorer without cause, especially when reasonable control measures are available.

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 from 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.

Table 6.4: 303(d) State-Designated Impaired Waterbodies, Door County

Waterbody	Pollutant	Impairment Indicator	Year Listed
Ahnapee River	polychlorobiphenyls (PCBs)	contaminated fish tissue*	1998
Mackaysee Lake	mercury	contaminated fish tissue*	1998
Stony Creek	sediment/total suspended solids	degraded habitat	1998

Source: Wisconsin Department of Natural Resources, 2013.

** Note that both the DNR and EPA have a variety of fish consumption advisories. See the Resources and Further Information section at the end of this chapter for their Web sites.*

Outstanding and Exceptional Resource Waters Program

NR 102, Wis. Admin. Code was created in 1973, establishing the "Outstanding and Exceptional Resource Waters Program" in order to maintain water quality in Wisconsin's cleanest surface waters and in accordance with the Federal Clean Water Act. Administered by the DNR, the initial listing of outstanding and exceptional resource water segments was established in 1988, and updates to the list were made in 1989, 1993, 1998, and 2006.

An Outstanding Resource Water is a lake or stream free from point and nonpoint source pollution and has excellent water quality, high recreational and aesthetic value, and high quality fishing. Door County has two Outstanding Resource Waters, Logan Creek and Mink River.

- *Logan Creek* is a 5.4-mile stream that originates at Lost Lake and flows southeast to Clark Lake. Its corridor is largely flanked by wetlands surrounded by land uses that include cropland, stump pasture, pasture, and orchards. Most of the stream rates only as fair in terms of water quality, but .65 miles has high water quality. The entire length of Logan Creek has a high nonpoint source ranking for potential pollution impacts to habitat.

- *Mink River* is a fresh water estuary that drains extensive wetlands and discharges to Rowleys Bay in Lake Michigan. It is thought to be the last pristine estuary on the Upper Great Lakes and one of the few high quality estuaries remaining in the United States. The estuary wetlands provide breeding habitat for the Hine's emerald dragonfly, an endangered insect.

An Exceptional Resource Water is a lake or stream exhibiting the same high quality resource values

as an Outstanding Resource Water, but may be impacted by point or nonpoint pollution or have the potential for receiving wastewater discharge from a non-sewered community in the future. Door County has two waterbodies designated as Exceptional Resource Waters, Hidden Springs Creek and Kayes Creek.

- *Hidden Springs Creek* is a one-mile long, spring-fed creek that originates in the Ephraim Swamp and discharges into Eagle Harbor (Green Bay) in the Village of Ephraim.

- *Kayes Creek* is a seven-mile long stream that originates in the Gardner Swamp Wildlife Area and discharges into Little Sturgeon Bay (Green Bay).

More Door County waterbodies cannot be designated as outstanding or exceptional resource waters due to contamination by point and nonpoint source pollution.

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
Wisconsin's Runoff Management Program was created in 1978 by the state legislature as a way to protect watersheds from nonpoint source pollution. Ch. 281 and Ch. 283, Wis. Stats., authorized the DNR to administer the Runoff Management Program, which creates and revises administrative rules to control pollution from agricultural farms and fields, construction sites, and developed urban areas. Many of the water pollution control requirements outlined in the state statutes and administrative rules reflect mandates contained in the federal Clean Water Act. The Runoff Management Program provides financial and technical assistance to landowners and local governments to address land management activities that contribute to runoff. The core activities of these programs – research, monitoring, data assessment and management, regulation and enforcement, financial and technical assistance, education and outreach, and public involvement – work to address current water quality impairments and prevent future threats caused by nonpoint source pollution.

Runoff Management Grants - Nonpoint Source Rankings
Wisconsin initiated a process to rank watersheds for nonpoint source problems back in the mid-to-late 1980s in order to identify high priority areas under the state's Nonpoint Source Pollution Abatement Program. This program, administered through a network of federal, state, and local agencies working in partnership with other organizations and citizens, combines voluntary and regulatory approaches with financial and technical assistance. Abatement activities include agricultural, urban, forestry, wetland, and hydrologic modifications.

Nonpoint source rankings reflect the waterbody's potential to respond to best management practices and are used in the ranking of project proposals for the Targeted Runoff and Stormwater Management Grant Programs administered through the Door County SWCD. Watershed rankings are conducted annually by the DNR and are based on the lakes, streams, and groundwater within a watershed. The DNR gives the watershed an "overall" ranking, as well as individual rankings for the streams, lakes, and groundwater. Groundwater rankings are developed using available data on

presence of contaminants and evaluation of different land uses in relation to the susceptibility of groundwater contamination. The ranking of streams and lakes is based on impacts from nonpoint source pollution and the waterbody's potential response to best management practices.

All watersheds in the state have been or will get an overall rank and categorical ranks for groundwater, streams, and lakes. Eventually, individual streams and lakes in the state will also get ranked. Table 6.5 below describes each type of ranking – high, medium, low, or not ranked. All four watersheds in Door County have been ranked as having “high” overall potential for nonpoint source problems. All four watersheds also have a “high” potential for groundwater contamination and a “high” potential for stream nonpoint source pollution, except for the Red River/Sturgeon Bay Watersheds, which has a “medium” ranking for streams. The lakes category for Door County has not been ranked yet.

Table 6.5: Nonpoint Source Ranking Criteria

Ranking	Description
Groundwater - High, Medium, or Low	Presence of contaminants and the evaluation of different land uses and the susceptibility of groundwater contamination associated with those land uses.
High Stream	The stream is likely to respond to BMPs and has one or more of the following a) endangered or threatened species; b) fish population, diversity less than optimal; c) recurring fishkills, d) dissolved oxygen violations, ammonia standard violations, high nitrate levels, toxicity due to pesticides or other NPS toxicants, high levels of suspended solids or an HBI or Family Biotic Index rated poor or very poor. There might be a high rate of streambed sedimentation or accelerated negative physical changes to stream morphology occurring; there is a predominance of undesirable vegetation (algae or macrophytes).
Medium Stream	The stream may respond to nonpoint source controls and is a threatened outstanding or exceptional resource water or is considered threatened based upon data.
Low Stream	The lake is not sensitive to phosphorus or sediment and will not likely benefit from BMP implementation. The stream is not threatened.
High Lake	The lake is sensitive to phosphorus and sediment and is likely to respond to BMPs.
Medium Lake	The lake is moderately sensitive to phosphorus or turbidity but does not have any known sensitive species or is not an ORW/ERW.
Low Lake	A lake receives a low ranking if it is not sensitive to phosphorus and would not benefit from NPS BMPs.
Not Ranked	This waterbody is not yet assessed for nonpoint source ranking.

Source: Wisconsin Department of Natural Resources, 2013.

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) 2011-2020. This plan was developed by the SWCD and approved by the Land Conservation Committee 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. Federal, state, and local agencies as well as the general public participated in the formation of its runoff management goals, listed below.

- *Groundwater protection and improvement:* Improve and maintain the drinking water supply for Door County to acceptable state standards.

- *Surface water protection:* Protect and improve Door County’s surface water resources from nonpoint source pollution and maintain acceptable state surface water quality standards.

- *Impacts of development on natural resources:* Minimize the adverse effects of fragmentation, urban sprawl, construction site erosion, increased impervious areas, and other development pressures on Door County's land and water resources.

- *Human waste management:* Reduce the risks to water quality through proper repair/replacement of failing septic systems.

- *Animal waste management:* Reduce the risks to water quality through proper storage, handling, and disposal of animal waste.

- *Stormwater management*: Reduce the risk to Door County's water quality and prevent flooding through proper stormwater runoff management.

- *Soil erosion control; agricultural and construction site:*
  - Reduce soil erosion rates on agricultural fields through proper soil conservation practices.
  - Reduce soil erosion from construction sites through proper soil erosion control measures.

- *Non-metallic mine reclamation:* Reduce the impacts to Door County's water quality and other natural resources from nonmetallic mines through proper operation and/or reclamation procedures.

- *Invasive species:* Protect the habitat and biodiversity of Door County's native fauna and flora through the control of aggressive, invasive non-indigenous species.

- *Beach Contamination:* Protect the surface water resources of Door County through identification and abatement of beach contamination sources.

- *Agricultural Land Protection:* Reduce the impacts of sprawl and fragmentation through preservation of farmland and other open spaces.

- *Lack of Education and Awareness of Environmental Issues and Sustainable Farming Practices:* Increase awareness of sensitivity of Door County's resources and promote sound land use decisions.

The LWRMP recommends continuing and furthering the implementation of these goals through a variety of existing and potential programs, categorized here by agricultural implementation, urban and rural non-agricultural implementation, and other SWCD programs. More detailed descriptions of each program can be found in the LWRMP 2011 - 2020.

Agricultural Implementation

- *Upper Door and Red River/Sturgeon Bay Priority Watersheds.* Protect water quality and reduce soil erosion; ensure compliance with agricultural operation and maintenance agreements and encourage proper resource management after agreements have ended.

- *Farmland Preservation Program.* Reduce soil erosion, urban sprawl, and fragmentation through the preservation of farmland; work with the Door County Planning Department to update the Farmland Preservation Plan.

- *Nutrient Management Program.* Protect water resources by reducing nonpoint pollution caused by improper nutrient and pest management; work with landowners to develop and maintain their

own nutrient management plans.

- *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.

- *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.

- *Agricultural Performance Standards and Prohibitions.* Implement state and local agricultural performance standards and prohibitions, as identified in Chapter 23, Door County Code.

Urban and Rural Non-Agricultural Implementation

- *Adoption of Ordinances*. Develop and revise existing ordinances to address nonpoint source pollution.

- *Stormwater Runoff Management and Construction Site Erosion Control*. Implement more comprehensive stormwater runoff and construction site erosion control programs, including the development of a county-wide stormwater ordinance.

- *Beach Contamination Source Identification Program*. Work with municipalities on developing plans for abatement of runoff sources and educate the public regarding land use and its impact on water quality.

- *Well Abandonment Program*. Increase number of properly abandoned wells through volunteer programs, enforcement referrals to the DNR, and potential well abandonment requirements in the Door County 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.

- *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.

- *Village of Ephraim Stormwater/Construction Site Erosion Control Ordinance*. Assist the Village of Ephraim with their Stormwater/Construction Site Erosion Control Ordinance by reviewing construction site plans and aiding in updating the ordinance.

- *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 Chapter 36, Door County Code.

- *Soil Erosion Control on County Department Projects.* Ensure proper soil erosion control on all county projects.

- *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.

Other SWCD Runoff-Related Programs

- *Tree Sales and Planting.* Meet the demand and provide more options for large- and small-scale tree/shrub plantings.

- *Wildlife Damage and Abatement Claims Program/Nuisance Animal Technical Assistance.* Expand the outreach in assisting landowners with wildlife damage issues.

- *Aggressive Invasive Non-Indigenous Species Control.* Work with the Door County Invasive Species Control Coordinator to remediate areas with established invasive species and to prevent further spread.

- *Lead and Arsenic Contaminated Sites.* Continue site identification of contaminated orchards and seek funding for remediation of historic lead arsenic mixing sites.

- *Land Information Modernization Program*. Continue participation in maintaining and updating Geographic Information System data layers.

- *Information and Education*. Create and renew information and education efforts regarding department conservation programs, as well as current conservation issues in the county, targeted at the general public, schools, and other organizations.

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 breaks 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 is 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 money awards to cleanup leaking underground storage tanks, various DNR regulations, Door County SWCD programs, and Door County Sanitarian Department programs.

PETROLEUM ENVIRONMENTAL CLEANUP FUND AWARD

The Petroleum Environmental Cleanup Fund Award (PECFA) program was created in response to enactment of federal regulations requiring release prevention from underground storage tanks and to cleanup existing contamination from those tanks. PECFA is a reimbursement program returning a portion of incurred remedial cleanup costs to owners of eligible petroleum product systems, including home heating oil systems. Over $8 million has been spent in Door County to cleanup 92 sites contaminated with petroleum from leaking underground storage tanks.

DNR GROUNDWATER PROGRAMS

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

- *Public Water Systems.* The Federal Safe Drinking Water Act (SDWA) set maximum contaminant level standards for drinking water and requirements for sampling, reporting, and inspection. The DNR Drinking Water Program enforces these requirements, which apply to all public water supplies in the state. Water system sampling and inspection requirements are based on the type of system and population the system serves. The four types of public water 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 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. (Currently there are none of the latter in Door County.)

  3) Non-Transient, Non-Community Systems: Schools, businesses, government buildings that serve 25 or more people more than six months of the year.

  4) Transient Non-Community Systems: Restaurants, bakeries, motels, gas stations, churches, 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 chapters 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 on-line. 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 and ordinances. As of 2014, the Maplewood Sanitary District (Town of Forestville) was working with the SWCD to develop a wellhead protection plan.

- *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 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 are also 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

In 2012, two grants to study and improve groundwater usage in Door County were awarded by the Wisconsin Department of Administration's Wisconsin Coastal Management Program. One study, called the *Development of a Groundwater Flow Model for the Mink River Estuary,* was awarded to the University of Wisconsin-Extension under the Wetland Protection category. This project will create a groundwater monitoring network around the Mink River Estuary, located in northern Door County, and provide an analysis of groundwater inputs into the Estuary. An endangered species, the Hines emerald dragonfly, thrives in the Mink River Estuary area because of its clean groundwater, as described previously in this chapter.

Another grant was awarded to the Wisconsin Department of Natural Resources under the Land Use and Community Planning category, called "Water Use Audit and Retrofit - Peninsula State Park." Peninsula State Park receives more than 1 million visitors annually, the second-highest visitor rate of all Wisconsin State Parks. Through this project, the DNR will find out where and how water is used at Peninsula State Park, identify options for reducing water use or improving water efficiency, and fix leaks and retrofit water infrastructure such as toilets, showerheads, and faucet aerators to high-efficiency models. The project will also create a template for conducting water audits at other state parks. The water audit will be conducted in Spring 2013, followed by repair and replacement of water infrastructure in the early part of 2014, with a second audit to be conducted in the spring of 2014 to verify the water savings from the retrofit.

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 provide technical assistance with respect to remediation and potential health concerns. The state generally does not provide funds for the clean-up 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.

More recently, the SWCD participated in a task force 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 through karst features. Task force members agreed that the protection of groundwater 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.

DOOR COUNTY SANITARIAN GROUNDWATER PROGRAMS

The Door County Sanitarian Department addresses groundwater issues by requiring inspections of certain private septic systems and tanks. The department is also in the process of conducting a county-wide comprehensive sanitary survey.

- *County Sanitarian Transfer of Property Ownership.* The Door County Sanitarian Department has a “Time of Sale” ordinance that requires private on-site wastewater treatment systems (POWTS) one year or older to be tested at least 15 days prior to real estate transfer closings. Systems deemed to be in non-compliance (“failing”) must be replaced generally within one year. All evaluations are conducted by a private contractor and verified by the county. In addition to the sale of a property, other conveyances or transfers of any interest in real property or improvements may also require an inspection.

- *County Sanitarian POWTS Inspection Requirement.* All POWTS septic tanks must be inspected at least once every three 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.

- *Door County Comprehensive Sanitary Survey.* The Sanitarian Department is in the process of evaluating every POWTS in the county in order to assess the condition of each system, including the septic tank, pump tank, and drainfield. This survey was initiated in 2002 and will take approximately 15 years to complete. More about the survey can be found in Chapter 9, Community Facilities and Utilities.

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 University of Wisconsin-Stevens Point, Groundwater Center. Individuals may have their drinking water tested through the WEAL lab at any time or communities may also organize a Community Drinking Water Testing and Educational Program. The WEAL lab 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. Typically, between 7% and 20% of a community's households will volunteer to participate.

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 Educational 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 Web site address listed at the end of this chapter 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 was 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 be 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 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 of 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 DEPARTMENT OF NATURAL RESOURCES 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. Regional Water Management Specialists 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. Note 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 PLANNING DEPARTMENT WETLAND REGULATIONS
The Door County Planning 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 other five 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 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 Wisconsin Wetland Inventory that was completed by the DNR in 2009. Some wetlands do not appear on the map because they were too small to be identified by the WWI; 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

DOOR COUNTY COMPREHENSIVE FOREST PLAN
A comprehensive forest plan is a guide to the ecology, management, and conservation of forests. The *Door County Comprehensive Forest Plan* (2006) was developed as one of two pilot projects in the state as part of a program sponsored by the DNR. This plan provides a broad overview of the county's history and the landscape and ecology of the area, as well as detail on forestry topics and issues relevant to the county. The plan also provides background information on forest descriptions and management recommendations, with the goal of providing an understanding of sustainable forestry and helping landowners meet their land stewardship goals.

According to DNR foresters, increasing land values and property taxes have persuaded many landowners in Door County to divide and sell off blocks of their woodlands. Still others are increasing timber harvesting in order to offset rising taxes, often without addressing long-term sustainable forestry practices and other related environmental issues. Private property owners with forested areas should seek professional forestry advice in order to practice sustainable forestry and preserve the health of the county's remaining woodlands. The Door County Comprehensive

Forest Plan may be found at the DNR link provided in the Resources and Further Information section at the end of this chapter.

MANAGED FOREST LAW PROGRAM
Administered by the DNR, the Managed Forest Law is a landowner incentive program that encourages sustainable forestry on private in woodlands in Wisconsin. Working 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 Managed Forest Law program include:

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

Of the approximately 116,400 acres of woodland in Door County, 23,102 acres (20%) was enrolled in the MFL program as of May, 2014. Of that, 4,733 acres are open to the public for hunting, fishing, hiking, and cross-country skiing. There is also an additional 240 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 Web site listed in the Resources and Further Information section at the end of this chapter.

STATE NURSERY PROGRAM
Under the direction of the DNR, the mission of the State Nursery Program is to ensure “a consistent supply of high quality seedlings, of desirable forest species, at an economical price, to encourage reforestation in Wisconsin." Each spring, this program makes seedlings available at discounted prices through the SWCD; since 1937, over 16 million trees have been planted in the county. Average years see between 200,000 and 300,000 seedlings ordered by private landowners, school districts, and non-profit organizations. With the assistance of DNR foresters, landowners can have reforestation plans prepared for their property, as well as determine eligibility – and potentially secure cost-sharing dollars – for reforestation project costs. Landowners planting more than 2,000 seedlings in a given year are eligible to rent one of five tree-planting machines owned by the SWCD.

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 (BLRPC) has identified environmental corridors throughout the county based on a variety of scientific data layers analyzed within a Geographic Information System (GIS). 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

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 (WAP) to remain eligible for funding and the WAP 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. This plan identifies low and/or declining populations that are in need of conservation action, including various birds, fish, mammals, reptiles, amphibians, and invertebrates (e.g. dragonflies, butterflies, and freshwater mussels). The plan also 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 menu 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.

Wisconsin’s WAP 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 WAP’s management opportunities specific to Door County include protection and management of: key stretches of the Niagara Escarpment; coastal 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 WAP and Door County’s ecological landscapes may be found at the DNR Web site listed in the Resources and Further Information section at the end of this chapter.

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 or 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 support large colonies of herring gulls and double-crested cormorants. Spider Island 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 DEPARTMENT OF NATURAL RESOURCES

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 non-profit organizations are important components of this program. To foster partnership, the program provides 50% match grants to local governments and non-profit organizations for eligible projects. More than 7,000 acres have been purchased in Door County through this program, in partnership with non-profit organizations and local government.

State Natural Areas

The Wisconsin State Natural Areas program was established by the state legislature in 1951 to protect outstanding examples of Wisconsin's native landscape of natural communities, significant geologic formations, and archeological sites. Wisconsin's 560 State Natural Areas, encompassing 323,000 acres, are valuable for research and educational use and the preservation of genetic and biological diversity. They also provide some of the last refuges for rare plants and animals, protecting more than 90% of the plants and 75% of the animals on Wisconsin's list of endangered and threatened species.

State Natural Areas 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 natural area system by formal agreements between the DNR and the landowner. Natural areas are not appropriate for intensive recreation, but do accommodate low-impact activities such as hiking, bird watching, and nature study.

Door County has 28 State Natural Areas, as listed in Table 6.8 at the end of this chapter.

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 three state wildlife and fishery areas, as listed below and identified in Table 6.8 at the end of this chapter.

All Wildlife Areas are open to a full range of traditional outdoor recreational uses. These include hunting, fishing, trapping, hiking, nature study, and berry-picking.

- *Gardner Swamp Wildlife Area* - Gardner Swamp Wildlife Area is 1,112 acres in size, and consists of marsh, forested lowland, and Keyes Creek. Principal wildlife includes deer, waterfowl, ruffed grouse, rabbits, and raccoons.

- *Mud Lake Wildlife Area* - Mud Lake Wildlife Area, located in the Towns of Baileys Harbor and Liberty Grove, is 1,941 acres in size and consists of a lake, marshland, and farmland. Principal wildlife includes deer, waterfowl, ruffed grouse, rabbits, squirrels, black bear, and raccoons. Part of a county snowmobile trail also runs through this area.

- *Reibolts Creek Public Access* - Reibolts Creek Public Access, located in the Town of Baileys Harbor, is 121 acres and contains the outlet for Mud Lake. Its primary focus is stream access for fishing.

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 judgment 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 intends to guide 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 is not a list of places the DNR wants to buy nor does it identify how or when these places should be protected or who should help protect them. Many partners and stakeholders will need to be involved in evaluating more precisely where protection efforts may best be 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 chapter 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 Wisconsin to participate in a land acquisition grant program administered by the 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 over the long-term (e.g., minimal invasive species impact and surrounding land uses 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 Service & 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 or 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; acting as buffers between different land uses; controlling, moderating, and storing floodwaters; providing nutrient and sediment filtration; providing fish and wildlife habitat; and providing recreational opportunities.

In 2005, Bay-Lake Regional Planning Commission (BLRPC) published the “Door Peninsula Environmental Corridors – A Coastal Resource Identification Project," after identifying a need to define environmental corridors in a consistent manner using digital data and geographic information system (GIS) software. Environmental corridors for Door County were defined using the following data layers:

- Navigable waters with a 75’ setback
- DNR wetlands of two acres or greater, with a 75’ setback
- Floodplains
- Steep slopes
- Public parks and recreation sites
- Historical/archaeological sites
- State Natural Areas
- State Wildlife Areas
- DNR Natural Areas Inventory sites
- DNR Land Legacy Places
- Significant coastal wetlands
- Significant Wildlife Habitat and Natural Areas
- Niagara Escarpment
- Other features of significance

A copy of the Environmental Corridor document, which includes a map of the environmental corridors in Door County, may found by visiting BLRPC’s Web site, listed in the Resources and Further Information section at the end of this chapter.

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 chapter.

VULNERABLE SPECIES

RARE SPECIES PROTECTION

Both the U.S. Fish and 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 landowners, 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

For now, Wisconsin's bat population is stable, but a deadly fungus is devastating cave-dwelling bat populations in eastern states. First discovered in 2006, White-nose syndrome is a disease affecting many species of North American bats, resulting in large-scale population declines. White-nose syndrome is caused by a fungus that is only grows at cool temperatures, thus it can only thrive on bats when they are hibernating and have a depressed body temperature. Recently discovered in southwestern Wisconsin, White-nose syndrome poses a potentially severe threat to Wisconsin's four cave-bat species. In order to help prevent the occurrence of this syndrome in Door County, the DNR received a grant from the Wisconsin Coastal Management Program to develop a cave inventory and management plan for the Horseshoe Bay cave hibernaculum. In the meantime, the U.S. Fish and Wildlife Service is currently assessing the status of bat species affected by the syndrome as potential candidates for listing under the Endangered Species Act.

PRESERVED LANDS

In 2014, roughly 27,894 acres, or about 9% 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 is 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 farmland 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 Preserve*. These lands are owned and designated by the federal government as nature or wildlife preserves. There are approximately 322 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 5,261 acres of state preserve in the county.

- *Non-Government 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 9,385 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 882 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 five 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 1,080 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 699 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 1,645 acres in the county.

- *Conservation Easement – DNR.* These properties are privately owned but subject to a conservation easement with the Wisconsin Department of Natural Resources. There are approximately 597 such acres in the county.

- *Conservation Easement – Non-Government.* These properties are privately owned but subject to a conservation easement with either the Door County Land Trust or the Door County Chapter of The Nature Conservancy. Such lands comprise approximately 2,752 acres.

While Map 6.8, Preserved Lands, depicts the location of state, county, and local parks, note that Chapter 9, Community Facilities and Utilities, provides a detailed description of the state and county parks.

For preserved lands acreage at the municipal-level, contact the Door County Planning Department.

NON-METALLIC MINERAL RESOURCES

NON-METALLIC MINERAL RESOURCES

Door County's nonmetallic 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 nonmetallic 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 nonmetallic mining reclamation program. The overall goal of NR 135 is to provide a framework for state-wide regulation of nonmetallic 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 nonmetallic 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 nonmetallic 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 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 Nonmetallic 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 TABLES

Table 6.6: Rare Plants, Door County

Rare Plants			
Common Name	**Status**	**Common Name**	**Status**
American Sea-rocket	SC	Maidenhair Spleenwort	SC
Beautiful Sedge	THR	Marsh Horsetail	SC
Bird's-eye Primrose	SC	Marsh Ragwort	SC
Broad-leaf Sedge	SC	Mingan's Moonwort	SC
Brown Beakrush	SC	Moonwort Grape-fern	END
Canada Gooseberry	THR	Northern Comandra	END
Chilean Sweet Cicely	SC	One-flowered Broomrape	SC
Christmas Fern	SC	Prairie Dunewort	END
Climbing Fumitory	SC	Purple False Oats	END
Coast Sedge	THR	Putty Root	SC
Cooper's Milkvetch	END	Ram's-head Lady's-slipper	THR
Downy Willow-herb	SC	Rock Whitlow-grass	SC
Drooping Sedge	THR	Rocky Mountain Sedge	SC
Dune Goldenrod	THR	Round-leaved Orchis	THR
Dune Thistle	THR	Rugulose Grape-fern	SC
Dwarf Lake Iris	THR	Sand Reedgrass	THR
Elk Sedge	THR	Seaside Spurge	SC
Fairy Slipper	THR	Slender Bog Arrow-grass	SC
Few-flower Spikerush	SC	Slenderleaf Sundew	THR
Giant Pinedrops	END	Slim-stem Small-reedgrass	SC
Green Spleenwort	END	Small Yellow Water Crowfoot	END
Hair-like Sedge	SC	Small-flowered Grass-of-parnassus	END
Handsome Sedge	THR	Spoon-leaf Moonwort	SC
Heart-leaved Foam-flower	END	Spreading Woodfern	SC
Hooker's Orchid	SC	Sticky False-asphodel	THR
Lake Huron Tansy	END	Striped Maple	SC
Lanceolate Whitlow-cress	END	Thickspike	THR
Large-flowered Ground-cherry	SC	Tufted Bulrush	THR
Limestone Oak Fern	SC	Tufted Hairgrass	SC
Livid Sedge	SC	Western Fescue	THR
Long-spurred Violet	SC	White Camas	SC
Low Calamint	SC	White Mandarin	SC
Low Spike-moss	END		

Sourec: Wisconsin Department of Natural Resources, 2012.

State Status:

END = Endangered

THR = Threatened

SC = Special Concern

Table 6.7: Rare Animals and Natural Communities, Door County

Rare Animals		
Common Name	**Status**	**Natural Communities**
American Bittern	SC/M	Alder Thicket
Appalachian Pillar	SC/N	Alvar
Bald Eagle	SC/P	Boreal Forest
Bat Hibernaculum	SC	Boreal Rich Fen
Beach-dune Tiger Beetle	SC/N	Dry Cliff
Black-crowned Night-Heron	SC/M	Emergent Marsh
Black Striate	SC/N	Forested Seep
Blanding's Turtle	THR	Great Lakes Alkaline Rockshore
Boreal Top	SC/N	Great Lakes Barrens
Bright Glyph	SC/N	Great Lakes Beach
Brilliant Granule	SC/N	Great Lakes Dune
Cherrystone Drop	THR	Great Lakes Ridge and Swale
Clear-winged Grasshopper	SC/N	Hardwood Swamp
Common Goldeneye	SC/M	Interdunal Wetland
Deep-throated Vertigo	SC/N	Lake--Shallow, Hard, Drainage
Dentate Supercoil	SC/N	Lake--Shallow, Hard, Seepage
Eastern Ribbon Snake	END	Lake--Shallow, Very Hard, Drainage (Marl)
Forcipate Emerald	SC/N	Moist Cliff
Henslow's Sparrow	THR	Northern Dry Forest
Hine's emerald dragonfly	END	Northern Dry-mesic Forest
Hooded Warbler	THR	Northern Mesic Forest
Lake Huron Locust	END	Northern Sedge Meadow
Lake Sturgeon	SC/H	Northern Wet Forest
Le Conte's Sparrow	SC/M	Northern Wet-Mesic Forest
Least Bittern	SC/M	Open Bog
Loggerhead Shrike	END	Shore Fen
A Long-horned Casemaker Caddisfly	SC/N	Shrub-carr
Midwest Pleistocene Vertigo	END	Southern Hardwood Swamp
Migratory Bird Concentration Site	SC	Southern Mesic Forest
A Minute Moss Beetle	SC/N	Southern Sedge Meadow
Mottled Darner	SC/N	Springs and Spring Runs, Hard
Mystery Vertigo	SC/N	Talus Forest
Northern Cricket Frog	END	
Northern Goshawk	SC/M	
Phyllira Tiger Moth	SC/N	
Piping Plover	END	
A Predaceous Diving Beetle	SC/N	
Red-shouldered Hawk	THR	
Sculpted Glyph	SC/N	
Semirelict Underwing Moth	SC/N	**State Status:**
Six-whorl Vertigo	SC/N	END = Endangered
Striped Shiner	END	THR = Threatened
Swamp Darner	SC/N	SC = Special Concern
Tapered Vertigo	SC/N	SC/H = Regulated by Open/Closed Seasons
Transparent Vitrine Snail	SC/N	SC/M = Protected by Migratory Bird Act
Upland Sandpiper	SC/M	SC/N = No Protection
Western Meadowlark	SC/M	SC/P = Fully Protected
Yellow Rail	THR	

Source: Wisconsin Department of Natural Resources, 2012.

Table 6.8: 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			
Black Ash Swamp Area				
Chambers Island				X
Cave Point - Clay Banks	X			
Coffey Swamp	X			
Colonial Waterbird Nesting Islands				X
Detroit Harbor	X			
Door Peninsula Hardwood Swamps				X
Duvall Swamp			X	
Eagle Harbor to Toft Point Corridor				X
Ellison Bluff County Park	X			
Europe Bay Woods	X			
Gardner Swamp (Au Grande Maret)		X		
Grand Traverse Islands				X
Jackson Harbor Ridges	X			
Kangaroo Lake	X			X
Little Lake	X			
Logan Creek	X			
Marshall's Point (Pine Ledges)	X			
Meridian County Park	X			
Mink River Estuary	X			X
Moon Light Bay Bedrock Beach	X			
Mud Lake	X			
Mud Lake Wildlife Area & Reibolts Creek		X		
Newport Conifer - Hardwoods	X			
Niagara Escarpment				X
North Bay	X			X
Northeast Coast Door Peninsula			X	
Peninsula Park Beech Forest	X			
Peninsula Park White Cedar Forest	X			
Peninsula State Park				X
Peninsula State Park to Jacksonport Corridor				X
Renard Swamp Area			X	
Rock Island Woods	X			
Shivering Sands			X	X
Sister Islands	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 ORGANIZATIONS AND INITIATIVES

Crossroads at Big Creek (http://www.crossroadsatbigcreek.org)
Crossroads at Big Creek is a private non-profit organization that has to date preserved over 115 acres of land for experiential life-long learning focusing on science, history, and the environment. Crossroads offers environmental education, history, astronomy, and recreational activities.

Door County Environmental Council (http://www.dcec-wi.org)
Door County Environmental Council seeks to protect Door County's natural areas through effective land use measures, including zoning, other regulations, and private stewardship.

Door County Green Fund (http://www.greenfund.com)
A component fund of the Door County Community Foundation, the Green Fund awards grants to local non-profits and municipalities for a variety of conservation efforts.

Door County Greenprint (http://tplgis.org/DoorCounty_Greenprint)
The Door County Greenprint, developed with the Trust for Public Land, can be used to analyze individual properties in relation to natural resource protection goals. Its interactive maps and customizable reports are intended to assist local elected officials, conservation organizations, property owners, and businesses make land use planning decisions.

Door County Land Trust (http://www.doorcountylandtrust.org)
The Door County Land Trust is a private non-profit organization established in 1986 to protect lands that contribute significantly to the scenic beauty, open space, and ecological integrity of Door County. The Land Trust protects land by working with private landowners who donate some or all of their development rights through conservation easement agreements, by accepting donations of land, and through selectively purchasing properties.

Door County Parks Department (http://map.co.door.wi.us/parks)
The Door County Parks Department oversees the development and operation of 19 county parks, including the Door County Fair Park.

Door County Planning Department (http://map.co.door.wi.us/planning)
The department's primary functions are administration and enforcement of the county's zoning, land division, and other land use management ordinances; preparation and implementation of the county comprehensive and farmland preservation plans; acting as a resource for local public officials and residents on a variety of community development plans or projects; and administering the county addressing program. See Chapter 10, Land Use, for a complete description of all plans and ordinances.

Door County Real Property Listing Department (http://www.co.door.wi.gov)
Real Property Listing processes all information recorded in the Register of Deeds Office pertinent to the transfer of land. Real Property assimilates information received from local assessors, clerks, treasurers, Department of Revenue, Department of Transportation, Department of Natural Resources, and various other sources.

Door County Sanitarian Department (http://www.co.door.wi.gov/county)
The Door County Sanitarian Department was created in the mid-1960s by the Door County Board of Supervisors in order to address concern over failing private sewage disposal systems within the county. The department administers the following programs:

- Time of Sale Ordinance
- POWTS Inspection Requirement
- Door County Comprehensive Sanitary Survey

Door County Soil and Water Conservation Department (http://map.co.door.wi.us/swcd)
The SWCD was created under the authority of Ch. 92, Wis. Stats., which was enacted to halt and reverse depletion of the state's soil resources and pollution of its waters. Per Ch. 92, the SWCD has the responsibility for the administration of the county soil and water conservation program and the authority to exercise the powers granted to the county's Land Conservation Committee, the county board oversight committee for the department. "A Guide to Significant Wildlife Habitat and Natural Areas of Door County, Wisconsin," discussed in the text of this chapter can be found at http://map.co.door.wi.us/swcd. The SWCD's programs and services include the following:

- Aggressive Invasive Non-Indigenous Species Initiative
- Agricultural Performance Standards And Prohibitions
- Animal Waste Storage Facility Ordinance
- Assistance to Municipalities
- Beach Contamination Source Identification Program
- Conservation Reserve Enhancement Program
- County Buffer Program
- County Water Pollution Abatement Cost-Share Program
- Farmland Preservation Program
- General Resource Management Assistance to the Public
- Gypsy Moth Suppression Program
- Information and Education
- Invasive Species Team
- Nonmetallic Mining Controls and Reclamation
- Nutrient Management Program
- Research Assistance to Universities and Other Agencies Pertaining to Door County's Resources
- Stormwater Runoff Management and Construction Site Erosion Control
- Targeted Runoff Management Program
- Tree Planting
- Village Of Ephraim Stormwater/Construction Site Erosion Control Ordinance
- Water Pollution Abatement Cost-Share Program
- Well Abandonment Program
- Wellhead Zone of Contribution Protection Programs

Door Property Owners (http://doorpropertyowners.net)
Door Property Owners' mission is to provide a forum for the discussion of land use issues and to support the conservation of Door County's natural, scenic, cultural, and aesthetic resources and to advocate for reasoned development that respects and enhances these irreplaceable resources.

Friends of Plum and Pilot Islands (http://www.plumandpilot.org)
The Friends of Plum and Pilot Islands are working to restore the historic 19th-century maritime structures found on these remote outposts.

Lakeshore Natural Resource Partnership, Inc. (http://www.lnrp.org)
The Lakeshore Natural Resource Partnership, Inc. (LNRP) works within northeast Wisconsin in the geographic area described as the Lakeshore Basin, comprised of Manitowoc, Kewaunee, Door, and portions of Brown and Calumet counties. LNRP's main goal is to promote community solutions to problems that affect the overall health and welfare of the Lakeshore Basin ecosystem.

The Nature Conservancy (http://www.tnc.org/wisconsin)
The Nature Conservancy is an international non-profit conservation organization dedicated to preserving the plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive. The Nature Conservancy has been working to protect wild places and wildlife on the Door Peninsula since 1962.

The Ridges Sanctuary (http://www.ridgessanctuary.org)
The Ridges Sanctuary, Inc. is a non-profit organization formed in 1937 and originally encompassing a 40-acre parcel of land in the Town of Baileys Harbor. The sanctuary has since grown to encompass over 1,600 acres of forests, wetlands, and the unique wildlife and plants within.

REGIONAL AND STATE ORGANIZATIONS AND INITIATIVES

Bay-Lake Regional Planning Commission (http://www.baylakerpc.org)
The BLRPC was created in 1972 by Governor Lucey under s. 66.945, Wis. Stats. as the official area-wide planning agency for northeastern Wisconsin. It currently encompasses eight counties: Brown, Door, Florence, Kewaunee, Manitowoc, Marinette, Oconto, and Sheboygan. BLRPC provides planning services on area-wide issues, represents local interests on state and federal planning program activities, and provides local planning assistance to communities in the Bay-Lake Region.

University of Wisconsin - Green Bay, Cofrin Center for Biodiversity
(http://www.uwgb.edu/biodiversity)
The primary purpose of the Cofrin Center for Biodiversity is to promote education, research, and community services that contribute to conservation of the western Great Lakes fauna and flora. The Cofrin Center for Biodiversity manages five natural areas in Wisconsin, including Toft Point and Peninsula Center, both located in the Town of Baileys Harbor.

Wisconsin Department of Natural Resources (http://www.dnr.wi.gov)
The DNR is dedicated to the preservation, protection, effective management, and maintenance of Wisconsin's natural resources. It is responsible for implementing the laws of the state and, where applicable, the laws of the federal government that protect and enhance the natural resources of our state. For the Comprehensive Forest Plan go to:
http://www.forestguild.org/ecological_forestry/Door_County_Comprehensive_Forestry_Plan.pdf.

Wisconsin Initiative on Climate Change Impacts (http://www.wicci.wisc.edu)
The WICCI project is bringing together scientists from various disciplines to assess potential climate change impacts and help Wisconsin adapt.

FEDERAL ORGANIZATIONS AND INITIATIVES

Environmental Protection Agency (EPA) (http://www.epa.gov)
Since 1970, the EPA has been working for a cleaner, healthier environment for the American people and leads the nation's environmental science, research, education, and assessment efforts. Its mission is to protect human health and the environment.

The Trust for Public Land (http://www.tpl.org)
The Trust for Public Land (TPL) is a national, non-profit, land conservation organization that conserves land for people to enjoy as parks, community gardens, historic sites, rural lands, and other natural places, ensuring livable communities for generations to come.

United States Army Corp of Engineers (http://www.usace.army.mil)
Section 404 of the Clean Water Act requires that the depositing, dredging, or filling of material into "waters of the United States, *including wetlands,*" must receive authorization for such activities. The Corps has been assigned responsibility for administering the Section 404 permitting process. Activities in wetlands for which permits may be required include, but are not limited to:

- placement of fill material
- ditching activities when the excavated material is “sidecast”
- levee and dike construction
- mechanized land clearing
- land leveling
- most road construction
- dam construction

United States Fish & Wildlife Service (http://www.fws.gov/midwest)

- Green Bay Ecological Services and Law Enforcement Offices (http://www.fws.gov/midwest/GreenBay)
- National Wildlife Refuge System (http://www.fws.gov/refuges)

The U.S. Fish & Wildlife Service is a bureau within the Department of the Interior. Their mission is to preserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

- Information on federally-listed species: (http://www.fws.gov/midwest/Endangered)
- Maps and information on the Hine’s emerald dragonfly groundwater recharge areas that feed the wetlands where the larvae live and critical habitat areas can be found at the Web sites listed below:
  - U.S. Fish & Wildlife Service (http://www.fws.gov/midwest/Endangered/insects/hed/index.html)
  - SWCD (http://map.co.door.wi.us/swcd/HED-fly/Hines-Emerald-Dragonfly.htm)