The State of the Lakeshore Basin

Toft Point, Door Co. E.J. Epstein. Bur. Endangered Resources

A report by the
Wisconsin Department of Natural Resources in cooperation with the Lakeshore Basin Partnership Team and stakeholders

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To: Recipients of the Lakeshore Basin State of the Basin Report

We are pleased to present the first *Lakeshore Basin State of the Basin Report.* The primary purpose of this report is to provide direction to Department staff in preparing biennial work plans that reflect the priorities of our agency, our partners, and the public that provide for the best management and protection of our valuable natural resources. This is a working document that will change from time to time to reflect the natural and societal changes that occur within the Lakeshore Basin.

The *Lakeshore Basin State of the Basin Report* was prepared by an integrated team of experts working in the basin representing both the Department's Land and Water programs. Their hard work and dedication is greatly appreciated. Special Thanks go to Guy Willman and Mike Toneys, who coordinated those efforts and authored this document.

The previous efforts of many of our partners to solicit public input on environmental issues of concern, especially from the various County Land Conservation or Soil and Water Conservation programs, are reflected in this report. The Lakeshore Basin Partnership Group and the Door County Stewardship Council have provided valuable input.

Our natural resources are facing more and greater challenges every day. No single group or agency has the means to successfully face these challenges alone. We must all work together to meet these new and more complex challenges. We must talk, we must learn, we must plan, and we must act.

Future generations are counting on us all to do our best!

Sincerely,

Arnie Lindauer, Land Leader

Ronald Fassbender, Water Leader

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THE WISCONSIN COASTAL MANAGEMENT PROGRAM, part of the Wisconsin Department of Administration, and overseen by the WISCONSIN COASTAL MANAGEMENT COUNCIL, was established in 1978 to preserve, protect and manage the resources of the Lake Michigan and Lake Superior coastline for this and future generations.

This report and other information can also be found on the DNR website at
http://www.dnr.state.wi.us/org/gmu/lakeshore/index.htm

TABLE OF CONTENTS

LIST OF MAPS

LIST OF APPENDICES

EXECUTIVE SUMMARY

The primary purpose of the State of the Lakeshore Basin Report is to provide direction to Department staff during preparation of biennial work plans. The report reflects the priorities of our agency, our partners, and the public for the best management and protection of the valuable and abundant natural resources in the Basin.

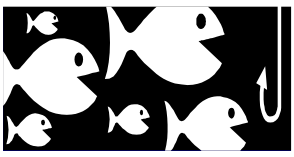
Basin Description

The Lakeshore Basin is a water-rich area sprinkled with an assortment of inland lakes, major rivers and small streams and bounded by the waters of Green Bay and Lake Michigan. The Basin completely encompasses the counties of Door, Kewaunee and Manitowoc and parts of Brown and Calumet Counties. The area was sculpted by glaciers and is dominated by the Niagara limestone formation, which underlies most of the Basin, but projects above ground prominently as the Niagara Escarpment, visible throughout much of Door County. Tourism, manufacturing and agriculture dominate the economy. The Basin's blend of picturesque open land and abundant water combined with seemingly limitless recreational opportunities are increasingly in demand. However, the close proximity of this area to large urban centers is putting enormous stress on natural resources. The challenge for all of us is to satisfy people's needs without destroying the abundant but fragile natural resources that make the Basin so attractive to so many people.

Natural Resource Concerns

Several techniques were used to determine the priority natural resource concerns in the Basin from the perspective of not only Department staff but, more importantly, the public. People are especially concerned about the loss of aquatic habitat and open land to certain types of development, pollution threats to surface waters, and the contamination of drinking and groundwater. A variety of issues related to the above major concerns, along with tactics for addressing them, provided a focus for Department staff work plans for the next two years and beyond. Many of the tactics are specific to Basin problems but also relate to the *Department's Fisheries, Wildlife, and Habitat Management Plan for Wisconsin (2001 – 2007).* Those issues are organized into broad categories of Aquatic Resources, Drinking and Groundwater Resources, and Terrestrial Resources.

Aquatic Resources



Fish management issues are a major topic in the report since Basin waters support both a tremendously popular and diverse sport fishery and a large commercial fishery. Issues discussed include stocking expectations, exotic versus native species, fishing tournaments, declining fishing opportunities, inadequate boating access, and contaminants. Projects are planned or ongoing to better meet stocking needs, provide more and improved boat access, and better understand changes in fish populations in inland and outlying waters.

The topic of habitat -- threats to it and loss of it -- is a priority public concern not only on inland waters but also outlying waters, especially along the Door County shore. Specific issues discussed include loss of fish spawning areas, shoreline development and fragmentation, and lack of shoreline buffers. Projects are planned to better determine impacts from nearshore habitat loss and areas in need of special protection.

The discussion of threats and existing impacts to surface water quality, another high priority concern, includes the issues of storm water runoff, agricultural practices, loss of forested and wetland vegetation, and quarries. All watersheds in the Basin are highly susceptible to nonpoint source pollution and controlling it is a major workload for Department staff that will only grow in the future.

Drinking and Ground Water Resources

Threats to drinking and ground water are a major concern to people in this Basin since most people depend on well water. The dominant issue is the contamination or potential for it from incompatible land uses on thin soils. Other issues discussed include deteriorating wells and the precarious balance between withdrawal and recharge of ground water. An ongoing study in Door County of bacterial contamination of ground water will continue and provide valuable health information to current and future well owners.

Terrestrial Resources

Historically most of the watersheds in the Lakeshore Basin were dominated by forested and wetland vegetation. Loss of forested and wetland vegetation has resulted in impaired watershed hydrology. These impairments include poor infiltration rates and an excessive percentage of the percent precipitation and snow melt running off causing non-point source pollution and overwhelming existing stream channels and aquatic habitat. With a majority of the Basin's land use being in farmland the best opportunities exist for forest and wetland vegetation restoration on marginal farmland areas as a part of a solid farmland land use plan which encourages responsible stewardship.

Sixty eight percent of the land in the basin is farmland. Today, many of the small farmers are finding it harder to make a living and face the need to either expand operations to survive or sell the land. Vacant farmland is being converted to rural home development, divided into smaller parcels for private recreation or potentially converted to tree planting, grassland or wetland restoration. Unfortunately most of the land is being converted to smaller parcels for private use or development. This trend greatly reduces recreational uses on lands that once were open to hunting or fishing opportunities. It also means a potential increase in silt and nutrient-laden runoff from further declines in forest lands and wetlands.

In the next two years our workplans will continue to address the issues identified in this report.

- An average of 75 management plans per year will be written through the managed forest law for sound forestry practices on privately owned forest property.
- Approximately 200 acres of grassland habitat will be developed and 70 acres of wetlands will be restored throughout the basin. Most of these projects are dependent on continuation of state and federal incentive programs.
- A new position will be added to the Northeast Region to coordinate the Gypsy Moth control efforts.
- With the new smart growth legislation, more staff will be devoting time to assist local units of government develop land use plans that recognize the benefits of and protect our water, forest, wetland and farmland habitat.
- Trail and infrastructure improvements to our State Parks and Forests will enhance the recreational opportunities on those properties.

Future Challenge

The challenge for the future will be to meet the demand for access to our rivers, lakes and forests while protecting the natural character of these valuable resources. In some instances it may be necessary to go beyond protection efforts and identify the restoration efforts needed to restore proper ecosystem function and health. The Land Legacy Study identifies the critical habitats that both the department and the public would like to preserve for the future. However, public land acquisition is not and should not be the primary avenue for resource management and protection. We believe that public awareness of resource conditions, issues and threats, and active public involvement in creative solutions to address these issues is the best way to attain sustainable resource management. It is through encouraging individual action, public involvement, and strong partnerships that we believe resource quality will be maintained for future generations.

Great Lakes beach, during low water levels of Lake Michigan, North Bay, Door Co. June 22, 2000. E.J. Judziewicz., Bureau of Endangered Resources

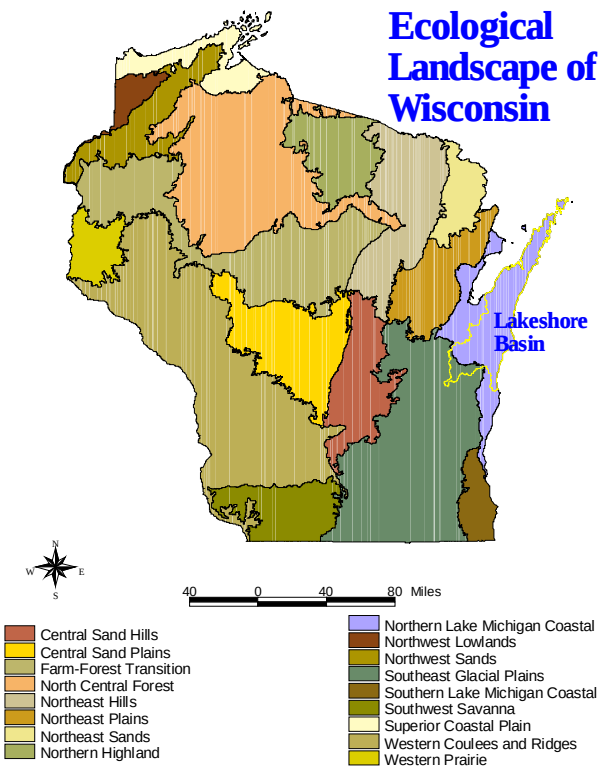
The Lakeshore Basin: A Description…And A Challenge

The Lakeshore Basin is first and foremost a water-rich natural resource gem that encompasses three entire counties - Door, Kewaunee, and Manitowoc - as well as parts of Brown and Calumet. Bounded by the productive outlying waters of Green Bay on the west and Lake Michigan on the east, the area also contains several major tributary rivers and a variety of inland lakes and streams. The basin includes a diverse and starkly contrasting mix of unique natural and developed land features from the Niagara escarpment along its spine, to remnant boreal forest in the north, to some of the largest dairy farm operations in all of Wisconsin in the southern part of the basin. Door County ranks number one among all counties in Wisconsin for its diversity of plant and animal species, including those that are threatened and endangered.

Lakeshore Basin Ecological Landscapes

Northern Lake Michigan Coastal

The Lakeshore Basin lies almost exclusively within the Northern Lake Michigan Coastal Ecological Landscape (Map 1). This Ecological Landscape is characterized by the influence of Lake Michigan and past glaciation. The major rivers include the Manitowoc, East Twin, West Twin, Kewaunee and Ahnapee. There are numerous small inland lakes; most are found in the southern half of the basin. Soils are very diverse. Lacustrine soils are primarily excessively or poorly drained sands, often over clays or bedrock within only a few feet of the surface. Poorly drained sands are more common and are found in the flat lake plain or depressions between dunes and beach ridges. The low sand dunes and beach ridges along the shoreline support unique native plant species. On the ground moraine, which is quite extensive in the Door Peninsula, soils are stony and range from loamy sands to loams. In some areas soils are somewhat leached, red calcareous clays. Vegetation is made up of maple-basswood-beach forest and wetlands. Boreal forests occur along the Lake Michigan coast. Soils in the southern two-thirds of the basin range from silts to heavy clays. These heavy clay soils can negatively impact surface water quality because high runoff rates can cause significant soil erosion. This is especially a problem in watersheds where much of the original forest cover has been removed and replaced with agriculture and residential development with even higher rates of runoff. Major land uses are dairy agriculture, cash and vegetable crops in the southern two-thirds of the basin. Tourism and outdoors recreation is also a significant land use throughout the basin, especially in the northern one-third of the basin.



Southeast Glacial Plains

Southern Calumet and Southwestern Manitowoc County lie within the northern reaches of the Southeast Glacial Plains Ecological Landscape. This Ecological Landscape is characterized by glacial topography with a mix of former mesic forest, savanna and wetlands and much of the land is in agriculture. Kettle lakes are common in Manitowoc County. The Kettle Moraine is a critical landscape for many species of southern Wisconsin. This ecological landscape has the highest wetland productivity for plants, insects and invertebrates of any area statewide. Soils are loamy till underlying a silt-loam cap of loess, but there are areas of clay soils and sand soils. The primary land use is agriculture made up of dairy farms, cash grain crops and vegetable crops. Most riparian zones have been degraded by agricultural practices.

Geology

The topography of the Lakeshore Basin is largely the result of glaciation. Much of the terrain is gently rolling with drumlins, eskers, kettles and end moraines. Beneath the glacial drift is the Niagara limestone formation, which slopes gently eastward toward Lake Michigan. This formation is most visible in Door County through the extensive outcroppings of bedrock at the surface and rock bluffs along the Green Bay shoreline. The depth of glacial deposits varies widely from 100 feet in the southern half of the basin to exposed dolomite in the north. These glacial deposits provide the rich fertile soils that attracted the dairy farming industry. In Door, the shallow bedrock makes the groundwater highly susceptible to contamination, as does the karst landscape in north central Manitowoc County.

Early History

Prior to European settlement, the Lakeshore Basin area was an important food gathering location for various Native American tribes, especially along the shores of Green Bay and Lake Michigan. The first white settler arrived in the mid 1830's. Early settlements sprang up along the shores of Lake Michigan and Green Bay where major rivers provided natural harbors for transporting goods and passengers. Early settlers found a landscape dominated by vast stands of beech, hemlock, maple and basswood around large conifer swamps and wetlands. Sawmills sprang up as the logging industry flourished. Commercial fishing and shipbuilding soon followed. Ample supplies of hemlock provided the tannins necessary for the tanning industry

which first located on the shores of Lake Michigan. As land was cleared, agriculture production expanded and continues to be the dominant land use industry today.

Landscape Today

Dairy farming is the dominant industry in the basin. Recent trends for fewer but larger dairy operations present resource challenges that will be discussed further in this report. Manufacturing is also a major industry in the basin.

Tourism in the basin is as strong as ever. Door County, sometimes referred to as the *Cape Cod of the Midwest*, is a major destination for people throughout the Midwest and is nationally recognized as a premier vacation destination. Five state parks and one state forest provide year round outdoor recreational opportunities and provide a wealth of scenic beauty and natural features that make the Lakeshore area a major attraction. Seventeen state natural areas are found in the Lakeshore Basin. The diversity of islands, forests, wetlands, boreal forests, sand dunes and ridge and swale topography provide habitat to an abundance of rare, threatened and endangered plants and animals.

Communities throughout the basin recognize the tourism potential and capitalizing with unique shops, maritime museums, historic villages, and waterfront and marina development.

The major cities within the basin by population include Manitowoc, Two Rivers, Sturgeon Bay, Algoma, Kewaunee, Luxemburg, Chilton, New Holstein, Brillion, and Hilbert. The residential building boom of the past decade has not only occurred within city limits but is expanding rapidly in the surrounding countryside. The demand for rural residential building sites fueled by a strong economy is causing a conversion of agricultural lands and open space to residential areas. Increased rural development in turn places increased demands on local governments for improved roads, fire protection, schools, and amenities often associated with cities and villages. This increase in rural development also causes fragmentation of forest and wildlife habitats.

Historic reductions in forest and wetland vegetation throughout the Basin have resulted in watersheds that suffer from flashy runoff and inadequate infiltration of precipitation and snowmelt. The problem is more serious in the Southern half of the Basin, with the Manitowoc and Twin Rivers watersheds having low percentages of forest and wetland vegetation.

The Challenge

The water and land resources share an intimate relationship due to their close proximity in this basin and what affects one ultimately impacts the other. Historic losses of forest and wetland vegetation have resulted in excessive runoff and increased sediments and nutrients that impact water quality and degrade aquatic habitat. The common denominator is the cumulative impact from people — and lots of them on the land and adjoining waters. Most of the basin and its natural resources are less than 100 miles away from the third most populated city in Wisconsin, Green Bay, as well as the spreading metropolis of the Fox River Valley. Within a few hours' drive are the major urban areas of Milwaukee, Madison, and Chicago. The magnet is water and people’s age-old need to be near it, to recreate in and on it, to experience its peaceful solitude,

and ultimately to live near it and "own a piece of it". The land comes increasingly under pressure as a means to gain access to the water.

One needs only to look at traffic on the roads during warm months and the pace of new construction along shorelines and inland to realize that the natural resources of the Lakeshore Basin have been under pressure from people and that pressure is growing. Future plans for a four-lane highway into to Sturgeon Bay is the latest example of the potential to accelerate those pressures even more.

On the positive side, concurrent with increasing pressures has come increasing concern and action from local governmental officials, resource agencies both public and private, and other private groups to identify and address environmental concerns. Examples include discussion and passage of land use plans by many townships in the Basin (Appendix III); Door County Future Search conference which resulted in creation of the Stewardship Council; the Door County Land Trust; the Manitowoc County Lakes Association; and the Manitowoc Fish and Game Association, among others. While there have been some positive actions and initiatives on behalf of the environment throughout the basin, Department staff and others know much remains to be done.

Great Lakes dune, Point Beach State Park, Manitowoc Co., October 19, 2000. E.J. Judziewicz., Bureau of Endangered Resources

NATURAL RESOURCE CONCERNS IN THE BASIN

While the state of the natural resources in the basin probably appears to be good in the minds of most people, there are nagging and developing problems that need immediate attention. Identification of those priority natural resource issues of concern on which this plan is intended to focus began with Department staff working in the Basin. They identified major issues from their perspective as specialists in a variety of natural resource management fields. This exercise was followed by the public's input in development of this plan.

Public participation was a three-step process. Initially, Department staff reviewed a number of completed plans and other documents prepared by Department staff, other governmental bodies, or private groups that dealt with natural resource issues within the basin boundaries and that included some level of public input on developing those issues of concern (Appendix I). The intent was to get some sense of public concern on priority issues by making use of relatively recent and available public comments.

The list of natural resource concerns gleaned from those documents is presented below. The highest priority issues were those mentioned most frequently in documents reviewed

Highest Priority Concerns

- Development of rural areas
- The need for protection of environmental/natural areas
- Development of agricultural land
- Degradation of water quality
- Management and disposal of farm animal waste
- Wetland protection
- Education and communication
- Soil and bluff erosion

High Priority

- Groundwater contamination
- Fish: habitat, stocking, edibility, and sustainability of fisheries
- Adequate public access
- The importance of joint public and private efforts for natural resource management
- Stormwater runoff

Next, the recently formed *Lakeshore Basin Partnership Team* was asked to provide a prioritized list of what that group believes are the most pressing issues impacting natural resources within the Basin. The Team identified thirty-five natural resource issues, which were then narrowed to the top ten through a nominal group process. The prioritized list of those issues is presented below.

Prioritized List of Most Pressing Issues Impacting Natural Resources Within the Basin

1. Loss of riparian buffers
2. Inadequate identification and protection of wetlands, wetland corridors and groundwater recharge areas *
3. Need for better land use planning and improved local zoning *
4. Inadequate management and protection of woodlots
5. Absence of stewardship ethic
6. Loss of small farms and/or conversion to large farms
7. Contamination of drinking water
8. Illegal dumping of toxins
9. Loss of biodiversity
10. Loss of shoreline habitat

**Issues 2 and 3 are of equal priority.*

The final step was the public review of the draft Lakeshore State of the Basin Report that occurred in April and May of 2001. The draft was available for review in hard copy and on the Department's Internet site. A public hearing in the form of an open house was held on May 4, 2001. All public comments received a written response and comments were incorporated into the draft as appropriate.

The three public issue identification exercises demonstrated that there is much common ground among many diverse groups in the basin on the topic of major concerns and threats to the Basin's natural resources.

What follows in the next section of this report is a listing of specific natural resource and environmental issues related to the above concerns that need attention in the Lakeshore Basin. Each issue includes a brief explanation of the current situation and current and potential problems and impacts. Also included are proposed tactics that could be used to address problems and eliminate or at least minimize impacts.

These tactics will form the basis for work planning by Department staff for the next biennium (2001-2003) and beyond. Some of these projects could be planned as joint efforts with partners and other interested public groups. The one tactic common to all the issues that goes without saying is the need for more education and communication about the threats to natural resources.

Issues are organized under three broad headings***: Aquatic Resources, Drinking and Groundwater Resources and Terrestrial Resources***. The divisions are somewhat artificial but are intended to organize the material as an aid to the reader. There is some redundancy between divisions and issues owing to the underlying theme throughout this document – the land and water are part of one system and what affects one can ultimately impact the other.

Many of the tactics for addressing resource issues listed below relate closely to objectives in the recently completed Department document ***A Fisheries, Wildlife, and Habitat Management Plan for Wisconsin (2001 – 2007)***. Some tactics in this Basin plan will help implement objectives of that management plan. Where tactics correspond with objectives of that management plan, we

reference the specific goal and objective, such as (FWH IIB Great Lakes Salmon) at the end of applicable tactics.

The Basin report concludes with several Appendix Tables that provide Basin-specific information on exotic species, public lands, and the current status of lakes and streams within watersheds in the Lakeshore Basin. There is also an updated list of priority watersheds in the Basin.

Figure 2: Lakeshore Basin Watersheds

AQUATIC RESOURCES

The Lakeshore Basin has 309 miles of shoreline along Green Bay and Lake Michigan and is comprised of the Twin-Door-Kewaunee and Manitowoc River sub-basins (Figure 2). The waters of Green Bay and Lake Michigan support richly diverse cool and cold water communities of native and stocked fishes in open waters, numerous bays and harbors, and tributary streams. Major commercial fisheries are still active for yellow perch, lake whitefish, smelt and chub. The only major spawning and nursery area for whitefish in Wisconsin waters occurs off Door County. Popular sport fisheries for perch, northern pike, walleye, and smallmouth bass in the nearshore waters and nationally renowned sport fisheries for stocked trout and salmon in the offshore areas draw tens of thousands of anglers each year. The Mink River estuary, a rare and relatively undisturbed freshwater estuary in northern Door County, provides spawning habitat to native smallmouth bass and northern pike in addition to numerous birds, mammals, and amphibians. Much of the Door County shoreline along Green Bay also provides ideal spawning habitat for smallmouth bass and related species.

The Basin also encompasses 139 inland lakes, natural ponds, or flowages and 193 miles of streams within its boundaries (See Appendix IV A and B). These too support a tremendous variety of sport and forage fish communities. The majority of shoreline along these water bodies is privately owned. The lure of abundant water resources in this basin to an ever increasing number of people for a variety of uses is putting enormous strains on these resources as exemplified by the following trends:

- The decade-old record-breaking economy has put enormous wealth in the hands of more people who are buying up undeveloped land, who are building more and larger homes along coastlines, and buying larger boats requiring more and larger docking facilities
- Byproducts of urban and agricultural development are finding their way into public waters
- Number and speed of watercraft are increasing along with user conflicts
- The economic face of sport angling is changing and anglers expectations for success are increasing
- Lake Michigan remains a disturbed aquatic community plagued with continuing colonization by new exotic organisms
- Continuing losses of forested land and wetlands

These trends, among others, have resulted in a variety of issues impacting aquatic resources in the Lakeshore Basin.

Fish Management Issues

Fish Stocking Expectations Are Not Always Realistic

Wisconsin has a long history of stocking a variety of species for a variety of biological reasons, including maintenance of a fishery, introduction or restoration of a desired species into a lake, or as a means of balancing a fish community. The Lake Michigan trout and salmon stocking program has produced a world-class sport fishery for three decades now while providing predation pressure on the exotic alewife. However, fish stocking in public waters is not a panacea for solving complex lake problems and must follow strict department guidelines. Property owners and fishers on outlying waters and inland lakes with reproducing populations of native sport fish frequently request supplemental stocking of those same species, sometime regardless of need or the potential for failure or adverse impact. The demand to stock to provide big fish and more of them is all too frequent as soon as fishing success takes an unexpected dip.

Tactics

- Work with lake associations to use stocking as a part of a wider ecosystem-based plan for lake rehabilitation projects, like Silver Lake in Manitowoc County. (FWH – II.A.1 Sustain diversity in Ecosystems)
- By 2003 implement a joint project between DNR, Walleyes For Tomorrow and the Green Bay Area – Sport Fishermen to help produce walleye in Basin for maintenance stocking in Sturgeon Bay area. (FWH – IV.A.9 and F.3 Walleye Management Plan and Fish Production)
- Evaluate the impact of walleye stocking on the reproducing fish populations in Harpts, Wilke, Pigeon, Bullhead, and English Lakes in Manitowoc County and of hybrid musky stocking in East Alaska Lake, Kewaunee County. (FWH – II.B.3.3 Protecting Existing Self-sustained Fisheries)
- Make maximum use of Internet to provide current survey and stocking summaries and other biological information to the general fishing public. (FWH – I.B.6 Fisheries Information)
- Identify watersheds with inadequate percentages of forest and wetland vegetation that may be inhibiting natural reproduction and greater survival of stocked fish.

Lake Trout Rehabilitation Efforts on Lake Michigan Have Not Worked

State, federal, and tribal agencies have invested enormous amounts of time, money, and manpower since 1965 in efforts to reestablish the native lake trout to a self-sustaining status in Lake Michigan. Long term surveys by WDNR indicate that large, mature populations of stocked fish have become established on historically productive reefs off shore of Sheboygan and Milwaukee. However, assessments by the Department so far have found no evidence of survival of any naturally produced fish. Biologists, administrators, sport and commercial fishers, and the general public are puzzled by this lack of success, are growing impatient, and questioning the future of this effort.

Tactics

- By 2003 complete review of previous rehabilitation strategies and revise the current Lake Michigan Lake Trout Management Plan to refocus joint efforts with other cooperating agencies through the Great Lakes Fisheries Commission. (FWH – II.D.4 Lake Trout Restoration)
- Provide manpower, research vessels, and other resources in joint efforts with other agencies around the lake to determine the reason(s) for reproductive failure, such as the early life history study on the Sheboygan Reef proposed by Dr. John Jansen, UW-Milwaukee that starts in 2001. (FWH – II.D.4 Lake Trout Restoration)

Live-release Fishing Tournaments May Have Adverse Impacts

The abundant populations of native smallmouth bass and walleye in the Green Bay waters off Door and Kewaunee counties annually attract thousands of sport anglers for the great fishing opportunities. During the past ten years, word of mouth and media publicity have drawn more competitive professional anglers to these same waters in the form of small and large-scale fishing tournaments. User conflicts have arisen as well as biological concerns for fish transported in live wells for hours, in heavy seas, only to be released in many cases 10-30 miles or more from locations where caught.

Tactics

- By 2004 work with interested and concerned sport and tournament fishers and organizers to draft voluntary rules or, if need be, legislation providing for more local control by biologists over tournament rules to protect fish.
- Participate in and support University of Wisconsin – Stevens Point research studies on impacts to fish caught and released during tournaments. (FWH – IV.A.13 Bass)

Incidental Kill of Trout and Salmon in Commercial Fishing Nets

Commercial fishers targeting chubs and lake whitefish in Basin coastal waters incidentally catch and kill thousands of lake trout and lessor numbers of other trout and salmon in their nets annually. This incidental kill continues to produce conflict between sport and commercial fishers. In some areas, the kill may be affecting efforts to restore native lake trout. The Department has successfully worked with the industry to reduce this catch but more can and needs to be done.

Tactics

- Complete trap net study in 2001 intended to help reduce the use of gill nets in the whitefish fishery in favor of entrapment gear. (FWH – II.E.1 Commercial Activities (see Lake Michigan Fishery Management Plan)
- Work with chub fishers to draft and implement rules that will reduce the incidental kill in that fishery. (FWH - II.E.1 Commercial Activities)

Shore Fishing Opportunities on Outlying Waters are Limited and Success Has Declined During the Past Decade

Shore fishing from piers and breakwalls used to be a major part of the trout and salmon fishery along Green Bay and Lake Michigan. Structures jutting out into Lake Michigan at the ports of Sturgeon Bay, Algoma, Kewaunee, Two Rivers, and Manitowoc were often crowded elbow to elbow. Anglers without boats were able to share in the fishing bonanza during various times of the year, especially for species like rainbow and brown trout and chinook salmon. That fishery has all but disappeared during the past decade, perhaps as a result of changes in fish movements, forage abundance, or perhaps innate behavior of some of the strains of fish currently being stocked.

Tactics

- Experiment with strains of trout that tend to remain near shore to improve this fishery, such as the current rainbow strain study. FWH – IV.A.2 and 3 Major Sport Fishing Opportunities)
- Locate areas that could provide more shore fishing access for the public for species other than trout and salmon and develop through partnerships. (FWH – IV.E.3 Access to Fishing Opportunities)
- Locate and develop urban fishing opportunities, especially for youth, to compliment outlying waters sites or as an alternative (Example - Partnership with Sturgeon Bay Open Bass Tournament Committee to stock Little Lake in Sturgeon Bay for Kids Fishing Derby). (FWH – IV.A.2 Fishing Opportunities)

The Renowned Lake Michigan Sport Fishery Relies on a Precarious Balance Between Number of Trout and Salmon Stocked and the Abundance of Their Prime Forage, the Exotic, Naturalized, and Somewhat Infamous Alewife

The salmonid sport fishery on Lake Michigan has rebounded in recent years from the devastating effects of the chinook salmon die-off during the late 1980's and early 1990's. That stress-induced event, probably triggered by too many stocked predators and too few alewives, is symptomatic of what can happen in a complicated and disturbed community that is Lake Michigan today. Hard lessons learned by management agencies around the lake have substantially diminished the chances of that event repeating itself. However, understanding how this complex system works is even more critical for successful future management.

Tactics

- Cooperate with management agencies and researchers around Lake Michigan in studies that further our understanding of how this aquatic community functions, such as the expanded lakewide acoustical study of forage fishes and the study of energy dynamics of chinook salmon, both scheduled to start in 2001. (FWH – II.B.4 and F.3 Great Lakes, Fish and Wildlife Health)

- Make research information more accessible to the interested public through the Internet. (FWH – I.B.6 Partners and the Public – Online Information)
- Complete revision of the current Lake Michigan Integrated Fisheries Management Plan through public participation by 2002. (FWH – II.B.4 Great Lakes)

Some Basin Waters have Fish Consumption Advisories Due to High Levels of Mercury and/or PCB in the Flesh of Some Species

Contaminants such as PCB's and mercury have been released into the environment over the years through recycling of carbonless paper (PCB's) or burning of coal (mercury). Airborne deposition of these contaminants continues today. In addition, some forms of mercury may be formed naturally. Health advisories that suggest limits to the amount and type of fish to consume have been in place for several decades. Within the Lakeshore Basin there is one lake that has a strict advisory for mercury (beyond the basic mercury advisory for all inland Wisconsin lakes) and one for PCB's. Lake Michigan, Green Bay, and their tributaries including the Manitowoc River above the first dam are also listed for PCB's (refer to Lakeshore Basin Watershed Tables for more detail, Appendix V and VI). With the high popularity of sport fishing in this water rich basin, contaminants will continue to be an issue well into the future.

Tactics

- Aggressively inform the fish-eating public, especially those at greatest risk, about the advisory, explain how to use it and how to reduce their risks through proper preparation and cooking techniques. (FWH – III.A.2 Consumption Advisories)
- Continue to monitor contaminant levels by collecting fish samples in basin waters that are needed to assess and establish current trends. (FWH – III.A.1 Contaminant Monitoring)

Some Public Waters Have Inadequate Access

The Lakeshore Basin has abundant water resources but the public needs access to these waters to enjoy them. Examples of access sites include small parks with boat ramps, fish and wildlife areas, parking areas with a trail to the water or roadside right-of-ways. Through the foresight of sportsmen clubs and state/county partnerships, access has been purchased or leased on many inland lakes and on large rivers. The recently opened public ramp in Baileys Harbor is an example of a successful partnership effort. However, the cost of shore property is rapidly increasing, and the elimination of some access sites through sale to private developers makes it difficult to satisfy the increasing demand to provide public access to some popular waters. One recent example is the Wave Point development in Little Sturgeon Bay. There is an acute need for public access sites in far northern Door County and in the Little Sturgeon Bay area, among other waters in the Basin.

Tactics

- Locate potential access sites on Basin waters that serve critical need areas, partner with local governments to manage, then start the land acquisition process, especially in high use areas like Little Sturgeon Bay in Door County. (FWH – IV.E.1,3 and 4 Access to Fishing Opportunities)
- Pursue public acquisition opportunities including the Manitowoc- Branch River Public Access Area. (FWH – IV.E.4 Access to Fishing Opportunities)

Double-crested cormorants are viewed by many people as nuisance predators on newly stocked fish and fish populations in Green Bay and northern Lake Michigan

The double-crested cormorant (DCCO) is a native North American bird that was not historically known to breed in the Great Lakes. However, between 1913 and 1945 DCCO expanded their range and colonized the Great Lakes region. The Great Lakes populations peaked in the early 1950's, but then quickly crashed due primarily to effects from contaminants (i.e. DDT/DDE and PCBs) that caused abnormalities and eggshell thinning. In the early 1970's, very low populations led states and the USFWS to list the DCCO as an endangered species.

The control of DDT and PCBs after the mid 1970's, along with the invasion and population expansion of alewife supported DCCO population increases around the Great Lakes. Currently, more than an estimated one million DCCO spend their summers on the Great Lakes. The diet of DCCO is almost exclusively live fish and an individual bird consumes about a pound of fish a day. These birds generally feed on whatever fish is available and most abundant. In the Great Lakes this has frequently been alewife. However, they have also been shown to eat substantial numbers of yellow perch, smallmouth bass, and recently stocked trout and salmon. Additionally, the colonial nesting habits of these birds has resulted in displacement of native birds and habitat destruction in some areas.

The USFWS is the agency responsible for DCCO management in the US under jurisdiction of the Migratory Bird treaty Act. In response to concerns raised around the Great Lakes and elsewhere, the USWFS is drafting an Environmental Impact Statement (EIS) as a first step in developing a National Management Plan (NMP) for the DCCO. The USFWS held a series of ten listening sessions throughout the range of the DCCO and solicited comments from concerned citizens and state agencies in affected areas. The WDNR has submitted a response to the USFWS and is awaiting the draft EIS and NMP. The WDNR comments focused on four topic areas: 1) need for additional research funded by the federal government (including population control, population dynamics, distribution, behavior, and diet); 2) continued public education; 3) including Wisconsin as a test site for cormorant population control; and 4) citizen and agency scientist involvement in establishing cormorant population goals.

Tactics

- Cooperate with the USFWS effort to establish a national management plan for the double-crested cormorant. (FWH – II.D.2 Non-Game Birds)

- Promote Door County as a site for a pilot research project on cormorant population management. (FWH – Same)

Habitat Issues

Fish Spawning Habitat and Nursery Areas are Threatened by Development

Increasing numbers of property owners along the shores of Green Bay, Lake Michigan, inland lakes, and to a lessor extent along streams are applying for permits to alter shorelines and nearshore waters by construction of solid piers, shore protection, sand blankets, and dredging. The trend toward larger shore homes is often accompanied by the desire for larger boats requiring deeper mooring areas in addition to more elaborate shore protection for the manicured shoreline. These alterations have the potential to destroy spawning habitat and nursery grounds for native species like bass, northern pike and walleye, panfish, and forage minnows. Excessive loss of forest and wetland vegetation has resulted in excessive runoff containing sediments and nutrients to surface waters, degrading spawning habitat and water quality.

Tactics

- Educate those seeking permits about the negative impacts and provide them with less intrusive alternatives. (FWH – I.B.1 Partners Involvement in Environmental Education)
- Encourage creation and expansion of more facilities for public mooring of boats, including the use of onshore warehouse storage facilities similar to one used at a lower Fox River marina and more extensively at saltwater marinas.
- Work with concerned citizens and organizations to draft and support legislation prohibiting dredge projects and solid structures on public lakebed for private use that are not in the public interest. (FWH – II.A.3 and 4 Identify Habitat Loss)
- Explore options for creating funds to help willing riparians pay for the cost of removing deteriorating solid piers rather than repairing them.
- Conduct and complete surveys by 2003 of near-shore habitat in bays of Washington Island to characterize habitat and its use by plants and animals on the Door Peninsula, and apply for sensitive area designation where appropriate. (FWH – II.A.3 Habitat Surveys)
- Work with riparians on Cedar, Wilke, Long, and Pigeon Lakes in Manitowoc County to reduce fish habitat loss occurring due to construction of seawalls, pea gravel blankets, and aquatic plant cutting. (FWH – II.B.3.3 – Protecting Habitat for Self-Sustained Fisheries)
- Improve smallmouth bass habitat on the Branch River by 2006 through the construction of pools and bank covers. (FWH – Same)
- Restore natural stream meandering and bank cover on Millhome Creek to enhance the natural brook trout population. (FWH – Same)
- Place large boulders in the Kewaunee River by 2006 to create rest stops and scour holes in the featureless stream sections and narrow wide and shallow

sections to improve flow rate for smallmouth bass and anadromous trout and salmon. (FWH – Same)

- Complete habitat restoration on the Little Scarboro River by 2004 by stabilizing eroding banks and removing fallen trees that have caused the stream channel to braid. (FWH – Same)

Dams Limit the Movement of Fish in Rivers and Degrade Fish Habitat

Many of the major rivers within the Lakeshore Basin have dams that block upstream and downstream migration of fish. Some dams, like that on the Kewaunee River at the Besadny Facility, are beneficial since they block upstream movements of undesirable exotic species like sea lamprey and white perch. Other dams prevent the upstream movement of non-native species, such as steelhead, that could jeopardize native trout species in small headwater tributaries. However, most dams adversely impact native fish communities. They prevent fish such as northern pike found in lower river sections from reaching upstream spawning locations. Dams alter fish habitat and consequently fish communities through sediment buildup and alterations in water flow and temperature. Dams also reduce the number of stream miles available to anglers targeting Great Lakes anadromous species. Removal of two dams on the Manitowoc River has opened up many stream miles to year-round fishing for anadromous species.

Tactics

- Identify dams within the Lakeshore Basin that impede fish movements and that could be removed safely without negatively impacting desirable fish communities. Follow the goals set by the Lake Michigan Integrated Fisheries Management Plan and the Steelhead Management Plan regarding dam removal. (FWH – II.A.5 Dams)
- Identify the owners of these dams, educate them on the benefits of dam removal and encourage them to consider dam removal.
- Provide passage for fish around the remaining dams, providing those fish do not impact upstream communities.
- Restore instream habitat lost through dam construction or operation after dam removal.

Power Boating Activity Can Destroy Habitat and Degrade Water Quality

Recreational boating, including use of personal watercraft, is a popular activity in Wisconsin. Nowhere is that more evident than on many inland lakes in the basin on a sunny and warm day in summer. Current estimates indicate one in ten Wisconsin residents owns a registered boat. Over the years the growth in boating has been accompanied by an increase in average horsepower from less than 5 to more than 55 during the past 50 years. The downside of boating activity is that it can and does cause environmental damage through uprooting of vegetation, resuspension of sediments, wave-induced shoreline erosion, and contamination of water from fuel and exhaust byproducts such as hydrocarbons and trace metals. Boats can also spread exotic species like Eurasian water milfoil and zebra mussels.

Tactics

- Aggressive education program for boaters regarding the importance and protection of aquatic habitat. Urge Law Enforcement to make this part of Boater Safety Classes for young people. (FWH – II.A.3 and 4 Habitat Identification and Protection)
- Use sensitive area designation and local adoption of ordinances as tools to protect critical habitat identified in basin waters, exemplified by the Kangaroo Lake (Door County) success story. (FWH – Same)
- Increase the enforcement of slow-no-wake areas on basin lakes. (FWH – II.A.8 Habitat Protection Through Enforcement)

Shoreline Development can Fragment and/or Destroy Aquatic Habitat and Degrade Water Quality

Shoreline property has been and continues to be the most coveted real estate for development. This fact is best exemplified in the basin by exorbitant land prices and the rapid pace and scale of development along the Green Bay and Lake Michigan shoreline and inland lakes. The development of a shore parcel can and does adversely impact adjacent aquatic habitat in a number of ways and the cumulative impacts of numerous projects can be substantial. Replacing natural vegetation with lawns, buildings, and driveways can result in increased runoff of nutrients and sediments impacting water quality and clarity. Addition of fertilizers and pesticides adds to the problem. Shore protection in the form of rock riprap or a seawall destroys the natural transition between upland and shore; can attract exotic species such as the round goby and the zebra mussel; and can increase erosion along nearby unprotected beach due to wave refraction. The placement of solid structures on lakebed and dredging destroys aquatic habitat for fish and invertebrates, often replacing it with ideal habitat for invasive exotic animal and plant species like Eurasian water milfoil.

Tactics

- Conduct and complete surveys by 2003 in near-shore waters in bays on Washington Island to characterize habitat and its use by plants and animals and apply for sensitive area designation where appropriate. (FWH – II.A.3 and 4 Habitat Surveys)
- By 2002 organize the first annual one-day workshop (using Citizens Academy format) to inform current and perspective riparian owners about the Water Regulations permit process, importance of habitat protection, and alternatives for private boat access. (FWH – II.A.3, 4, and 8 Protect Shoreline Habitat)
- Assist local governmental bodies interested in developing ordinances restricting or prohibiting shoreline modifications damaging to natural resources. Department staff assisted the Village of Ephraim in development of its pier ordinance. (FWH – Same)

Invasive Exotic Plants and Animals are Impacting Waters in the Basin

A growing number of exotic species have become or are becoming established as members of communities in outlying and inland waters of the basin. To some people, a few exotics seem to serve a useful purpose, such as alewife as forage for sport fish or zebra mussels improving water clarity. However, all have a dark side that directly impacts not only native aquatic species but humans as well. Dead alewives and zebra mussel shells littering basin beaches along Green Bay and Lake Michigan in some years and Eurasian water milfoil impeding navigation and rotting on shorelines are but two examples. The most recent arrival, the round goby may provide forage to smallmouth bass in Sturgeon Bay but may reduce or eliminate native minnow and darter populations as well.

Tactics

- Continue to aggressively support international efforts to eliminate incidental introductions into Lake Michigan through vigorous enforcement of ballast water exchange and treatment. (FWH – II.G.2 Exotic Species)
- Change the water management permit system to minimize or eliminate shoreline modifications that provide habitat for the spread of exotics. (FWH – Same)
- Encourage the addition of boat and trailer cleaning areas at Bay and Lake ramps to slow the inland spread of exotics
- Encourage changes in State Statutes to make transport of live fish illegal.
- Cooperate with UW- Milwaukee researchers on proposed study on impacts of round goby on smallmouth bass in Door County. (FWH – II.G.1)

Water Quality Issues

The Lack of Buffers Along the Shores of Lakes, Streams and Waterways Impacts Water Quality and the Diversity of Habitat.

The shoreline is where the land meets the water. The natural vegetation found along the shore not only provides habitat for many wildlife species such as birds, frogs and turtles but also acts as a buffer that removes nutrients and sediment from runoff. In an attempt to increase the water view and provide a manicured look to yards, many riparian owners destroy this buffer zone by cutting trees and shrubs, planting lawn to the water's edge, and adding rock riprap or seawalls. The end result is increased nutrient or silt-laden runoff reaching the water, degrading water quality. The diversity of nearhshore habitat important to aquatic life and wildlife declines or is lost completely at some sites. Healthy lakes and streams require natural shoreline vegetation buffers.

Tactics

- Educate waterfront owners and the general public on the importance of shoreline buffer areas. (FWH – II.A.1 and 12 Buffers)

- Educate County Zoning Administrators on the importance of buffers and the need to enforce current shoreline zoning rules. (FWH – II.B.3 Protect Shorelands)
- Assist in development of new shoreline zoning regulations that will protect the shoreline and the water resources of our basin. (FWH – Same)
- Develop pilot projects which require vegetative buffers along shorelines, such as on golf courses. (FWH – II.B.2.6 Stream Protection and restoration)
- Make use of funds from the Conservation Reserve Program and other similar conservation funding programs to create buffers and vegetative filter strips to protect and maintain water quality.

Historic Losses of Forests and Wetlands Have Resulted in Excessive Runoff to Surface Waters

Watersheds need a minimum percentage of forested and wetland vegetation to provide absorption of precipitation and snow melt to prevent excessive runoff. This increased runoff results in the delivery of excessive sediments and nutrients to our streams, reducing water quality and threatening survival of native intolerant or sensitive species of fish and aquatic invertebrates. Recent fish kills in basin streams and tributaries are an example of this problem. The ultimate solution is to increase the overall percentage of forest and wetland vegetation in affected watersheds. The importance of this issue is directly supported by two of the top ten priorities identified by the Basin Partnership Team (protection of forest and wetland vegetation) and relates to five of the other top ten priorities (riparian buffers, better land use planning, importance of developing a stewardship ethic, protecting biodiversity, and shoreline habitat).

Tactics

- Develop long-term minimum percentage goals for amount of forested and wetland vegetation for each watershed. (FWH – II.A.4 Identify causes of habitat loss or impairment)
- Work with State and local planners to integrate goals or objectives aimed at minimum percentages of forest and wetland vegetation into county land use plans and other plans. (FWH – I.B.1 Community Based action)
- Educate private landowners about the importance of restoring some minimum percentage of their land and each watershed into forest and wetland vegetation. (FWH – I.B.1 Community Based action)

Storm Water Runoff in Urban and Rural Areas Degrades Water Quality and Creates Health Hazards

Storm water runoff from municipalities and industries in urban areas, agricultural land, and rural areas under development is polluting most basin waters with nutrients, sediment, and contaminants including heavy metals, pesticides, and petroleum residues. All of the watersheds in the Lakeshore Basin are ranked High regarding potential for threats from nonpoint source pollution due to a combination of thin soils and/or intensive agriculture and increasing

development (refer to Nonpoint Table, Appendix VII). The clay color of the Kewaunee River after a substantial rainfall and the excessive aquatic weed growth in Sturgeon Bay are prime examples of storm water-related problems. Especially at risk are communities like Egg Harbor, Fish Creek, Sturgeon Bay, Luxemburg, Mishicot, and Two Rivers which are experiencing intensive development pressures. The management and regulation of storm water is complex but not thorough and is divided among federal, state, county, and local governments. Tools for dealing with storm water problems include drafting and adoption of ordinances dealing with erosion control and storm water management plans as well as strong enforcement of each.

Tactics

- Work with all municipalities in the basin that have constructed storm water runoff systems to adopt and enforce storm water control ordinances.
- Work with communities in basin to adopt and enforce a building construction site erosion control ordinance.
- Work with cities, towns, and counties in the basin to adopt and enforce a construction site erosion control ordinance for other land-disturbing activities like locally funded road and bridge construction.

Agricultural Operations Can Adversely Impact Water Quality in Lakes and Streams.

All agricultural operations have the potential to adversely impact water quality through the loss of soil, nutrients and pesticides. These impacts are usually the result of poor farming practices, but can also result from spills.

The recent trend in the dairy industry for consolidation of small family farms into larger operations has greatly increased the concern for management of manure in this basin and elsewhere. Under authority of the Clean Water Act, the state of Wisconsin, by delegation from the EPA, has started to regulate many of these facilities. A common practice for most large farms, both dairy and hog, is to have storage facilities that hold manure, which is then spread on adjacent fields. However, expanding farm operations also require more land for proper disposal of this material. Liquid or solid manure spread on steep slopes, near waterways, on frozen soil, or not plowed under soon after spreading can cause oxygen depletion and phosphorus loading in nearby waters after heavy rains. At worst this can result in fish kills or at least contribute to excessive algae or aquatic plant production in nearby lakes and streams. Improperly managed manure storage facilities can cause the same problems. Fischer Creek, a good quality cold water stream in Manitowoc County, had a major fish kill in 1998 linked to manure runoff. Nine miles of the Branch River suffered a similar fate in fall 2000. Sustainability of fish populations in these streams depends on future efforts to prevent anymore spills.

County soil and water conservation departments within the Lakeshore Basin have responded by developing strategies that help landowners comply with statewide performance standards and prohibitions (Appendix I). New and updated ordinances have also been developed.

Tactics

- Partner with county soil and water staff to increase voluntary participation by all farmers through education and financial incentives, especially at agricultural facilities that can potentially impact streams like Fischer Creek and the Branch River that have already been severely impacted. (FWH – II.B.3.3 Protection of Sustainable Fisheries)
- Work with local governments to develop ordinances that effectively implement statewide performance standards.

Quarry Operations are Becoming More Controversial Due to Dust, Noise, Wastewater, Stormwater and Ground Water Concerns

Quarries, also known as nonmetallic mining operations, include the commercial excavation of crushed stone, dimension stone, clay, rotten granite, sand and gravel. There are operating quarries located throughout the Basin. Neighboring property owners are annoyed by noise associated with blasting, heavy equipment and industrial sawing. Of greater and increasing concern is the impact to neighboring wells due to pumping of seepage water out of quarry pits (dewatering). Currently, the Department has little or no authority to regulate the impact dewatering may have on nearby wells. Wastewater and storm water discharges are also of concern but since there is a general permit in place to regulate these activities, the public is less concerned about these operations. Thirty-one quarries in the Basin currently operate under general permits. However, an unknown number of quarries are probably operating without a permit. A new law effective in December 2000 will require operators of nonmetallic mines to develop and implement reclamation plans for all active sites.

Tactic

- Identify quarries lacking wastewater permits and bring them into compliance with current rules.

DRINKING & GROUNDWATER RESOURCES

Groundwater is the source of potable water for all residents within the Lakeshore Basin, except for those served by municipal water systems in the cities of Two Rivers, and Manitowoc. The majority of the groundwater has historically been withdrawn from the upper limestone aquifer, the Silurian Formations. However, as demand for water has increased, water levels within many shallow wells have steadily declined. Consequently, more new wells are now routinely being drilled into the deeper Ordovician Formations (Sinnipee Group, St. Peter Formation, Prairie du Chien Group) lying below the Silurian. This is especially true in the southwestern part of the basin, an area important for recharge of the aquifer systems. That same recharge area is also affected by drought cycles and the large withdrawals occurring outside the Basin in the Lower Fox River Valley. Elsewhere in the basin, Lake Michigan buffers withdrawals from the adjacent aquifer, reducing the impact of increased draw down.

Land Use and Groundwater

Land Uses Can be Incompatible With the Ability of the Soils to Reduce Any Contamination From the Particular Use

Geologically sensitive areas with high bedrock and thin soil cover have a limited ability to filter surface contaminants prior to water entering drinking water aquifers and are highly susceptible to contamination. These areas are also the points of recharge for the aquifer systems. They are also expensive to blast through for construction of water and wastewater distribution systems. The Door County Peninsula, western Kewaunee and Manitowoc Counties, and the southern three-fourths of Calumet County, underlain by the Niagara Dolomite, are identified as being moderately to mostly susceptible to groundwater contamination.

Door County has had special well casing requirements since 1957 to attempt to address this problem. There are areas in the county where the aquifer is contaminated beyond the feasibility of greater casing requirements. Installation of water treatment devices may be the only option available to consistently provide safe drinking water in these areas. New regulations proposed by the Environmental Protection Agency (EPA) may require installations of treatment devices in sensitive areas such as Door County. This could be a significant cost for private well owners serving water to the public. Information is needed to better estimate how many systems may be impacted by this rule. In addition, information is needed to better define the risk and actual occurrence of illnesses due to contaminated groundwater consumption.

Tactics

- Continue and complete the ongoing study of fecal contamination of groundwater and potential links to human illness is being conducted in Door County through June 2001. The data collected will be used to estimate the number of systems that may be affected by proposed EPA rules as well as detect possible links between contamination and human illness.
- Utilize the information collected in the above study to educate the public and assist them in planning for their water system needs.
- Assist Sturgeon Bay and Manitowoc in updating their Sewer Service Areas plans.

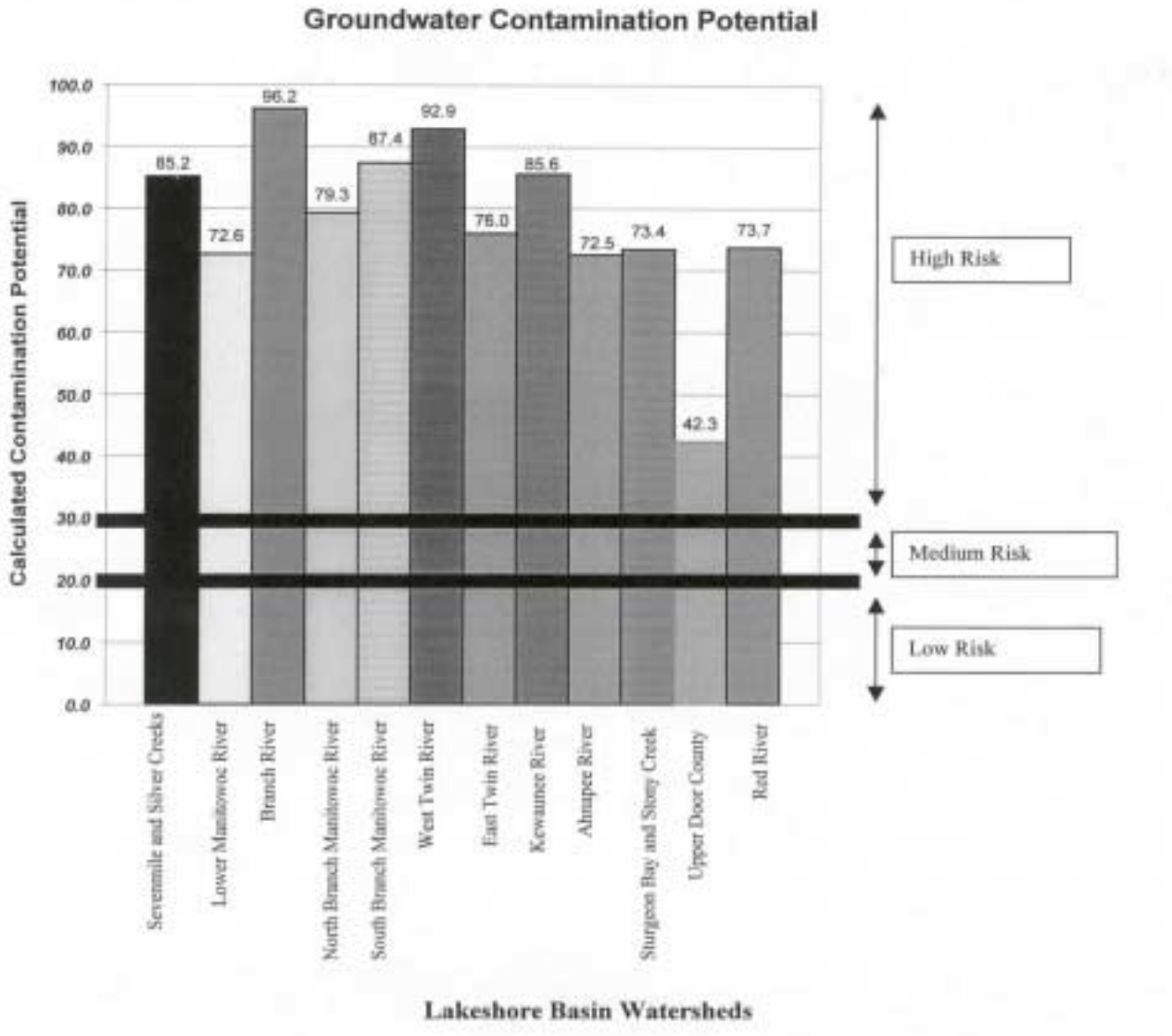
As development spreads throughout basin watersheds, more nonpoint source pollution of groundwater is inevitable. The following map shows groundwater contamination susceptibility in Wisconsin based on soil cover and geology.

Groundwater Susceptibility Map

Groundwater Ranking for Nonpoint Source Priorities

Watersheds throughout the state were ranked according to the potential for groundwater contamination. Scoring was based on land cover, nitrate and pesticide well water data (common non-point source contaminants), and the presence of concentrated animal feeding operations. The analysis did not include microbial contamination data. Therefore, basins with low agricultural development may be at a relative higher risk of groundwater contamination due to microbes than this ranking system suggests.

A score of 20 or greater ranks the watershed as being of medium susceptibility for groundwater contamination, and a good candidate for conservation and protection. Scores greater than 30 indicate that the watershed is ranked as a high risk for groundwater contamination. Restoration work is highly recommended in high-risk areas. Scorings of watersheds within the basin ranked from 42.32 (Upper Door County) to a high of 96.19 (Branch River). The figure below illustrates the relative scorings for the basin watersheds:



Tactics

- Provide information and guidance to townships and counties when they design Smart Growth strategies to determine appropriate land uses for geologically sensitive areas especially prone to groundwater contamination, like Door County.
- Design and conduct well water sampling studies to identify areas of groundwater contamination, both manmade and naturally occurring and identify alternate well construction methods in these areas to obtain potable water sources.

A study of fecal contamination of groundwater in Door County is currently being conducted.

Well Abandonment

Deteriorating Wells Can Act as Channels to Drain Surface Water to the Aquifers Below.

The two most common contaminants detected in groundwater within the basin are bacteria and nitrates. Old, deteriorating wells, especially those located in farm fields, can act as conduits that allow surface water, contaminated with bacteria and nitrates, to reach the aquifers. Proper maintenance and abandonment of these wells, a regular responsibility with land ownership, would do much to improve water quality and protect public health.

Local government entities are actively working on well abandonment issues. Calumet County is participating in the DNR County Delegation Program and has been administering the well abandonment portion of the private drinking water program since 1994. The Door County Soil & Water Conservation Department has a program that focuses on providing landowners with information and financial resources to abandon unused wells. The Door County Well Abandonment Program provides 90% cost sharing up to $600. Additional funding is available if the wells are located within the city of Sturgeon Bay municipal well water recharge areas. The Red River Priority Watershed also may provide funding beyond the $600 for landowners participating in the priority watershed program. The Manitowoc County Soil & Water Conservation Department has provided up to 75% cost sharing in abandonment of unused wells as part of the County Land and Water Resource Management Plan for over two years.

However, there is still a disconnect with many people regarding the relationship of old wells and the potential to contaminate area drinking water supplies. There is a tremendous need to educate the public and rural landowners on the need for well abandonment. There is also a need to educate county and township supervisors on the importance of well abandonment, to support initiatives already started.

Tactics

- Increase efforts to educate the public on the importance of properly capping unused and non-abandoned wells.

- Promote free nitrate testing at county fairs or sponsor a groundwater awareness week testing and information fair to get people thinking about well water and discussing the issues.
- Encourage abandonment of unused wells through county well abandonment programs. Counties with active programs may serve as mentors to encourage other counties within the basin to develop similar programs.

Water Quantity

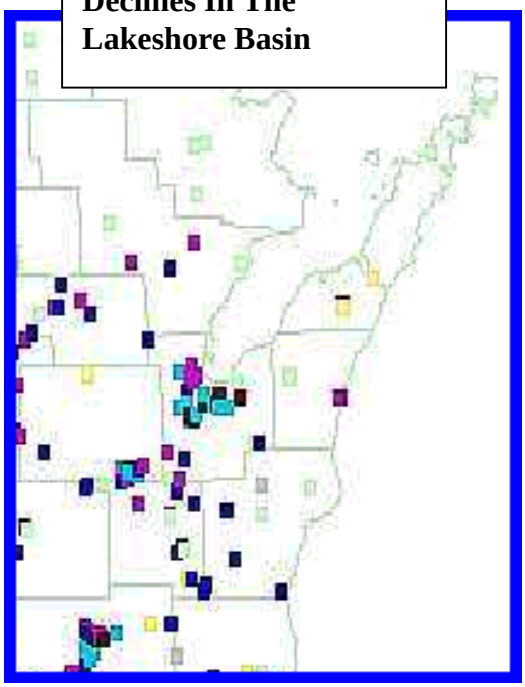
Excessive Withdrawal of Groundwater Reduces Recharge to Lakes, Streams and Wetlands, Lowers Water Levels in Wells and Changes Water Quality

Overpumping of the most productive aquifers used within this basin can cause a decline in water levels in wells, a decrease in the flow of streams and cause wetlands to dry up. Wells close to the lakeshore seem to be buffered, so far, from excessive pumping in the Green Bay and Fox Valley areas. In the western part of the basin, decreases in water levels averaging two feet per year have been detected since the 1980's (refer to chart below). Changes in water quality, such as an increase in mineralization, radioactivity, and metals, are possible with a further decline.

Tactics

- Evaluate water uses and withdrawals from aquifers versus recharge.
- Identify areas of declining water levels and inform the public of this information to better address planning issues in their community.

Groundwater Level Declines In The Lakeshore Basin



Key:
yellow = >5 rise in water level
light green = between 5' rise or 5' decrease in water level
royal blue = 5-25' decrease in water level
purple = 25-55' decrease in water level
black = 55-95' decrease in water level
light blue = > 95 decrease in water level

TERRESTRIAL RESOURCES

The Lakeshore Basin encompasses over 1 million acres of land, 68 % of which is farmland, 13 % forested, 1 % urban, 12 % wetland, and 6 % grasslands. The percent of forests and wetlands was much higher historically in the Basin. For the most part these land cover types are interspersed in a mosaic across the landscape. A number of larger forested blocks (1000 acres +) are located in the basin with the bulk of woodlands in smaller blocks of 100 acres or less. A diversity of forest types is present ranging from remnant boreal forests bordering Lake Michigan to southern mesic forests of the Kettle Moraine. The dominant forest type is maple-beech-basswood followed by swamp hardwood, swamp conifer and aspen/birch. These are "second growth" forests resulting from turn-of-the-century logging and/or fires occurring 60 to 120 years ago.

The relatively low percentage of existing forest and wetland vegetation in the watersheds in the Southern half of the Basin combined with soils with high runoff rates results in excessive volumes of runoff which cause catastrophic impacts to in-stream habitat. These excessive runoff rates also result in the loss of valuable sediments and nutrients being stripped from terrestrial environment and being deposited in our streams and lakes, resulting in serious water quality and habitat impacts. Management efforts should focus on restoring forest and wetland vegetation in the Southern half of the Basin and maintaining and protecting existing percentages in the Northern half.

The decade of the 90's brought many positive changes for wildlife in the area. Thousands of acres of marginal cropland have come out of production as farming landowners have taken advantage of federal incentives to retire marginal cropland. Multiple agencies have cooperated and capitalized on this opportunity to restore wetland, grassland, and forested acres across the landscape. Both game and non-game wildlife populations have increased noticeably in all these habitats. Manitowoc County is one of the leading counties in the state for acres of wetlands restored. Local waterfowl populations are at an all time high. Bobolinks and meadowlarks once again grace fence posts and power lines. Hungarian partridge numbers are back on the rise and wild ring-necked pheasants have been reestablished in the southern portion of the basin. Wild turkey hunting began in the basin in '93 & '94, and a new harvest record has been set every year since. The Lakeshore Basin has led the state in acquisition of small parcels under the Statewide Wildlife Habitat Area project to develop and protect wetland/grassland complexes.

A number of economic and social trends have presented many challenges and some opportunities in stewardship of the basin's terrestrial resources including:

- Changing farm economy
- Rural development and fragmentation of the landscape
- Demand for public access
- Landowners with multiple land management objectives
- Exotic species
- Continuing losses of forest and wetland vegetation

Trends in Agriculture and Fragmentation of Rural Landscapes

Most of the land in the basin is privately owned (95%). Current land use or vegetation on the landscape consists of 68% farmland, 13% forest, 12% wetland, 1% urban and 6% grassland. Because dairy farming is the dominant land use in the basin, it has a large impact on all other resources. Currently the number of farms and acres farmed is declining. This trend is creating many opportunities and problems. When a farm goes out of business several things may happen to the land.

Cropland is taken out of agricultural production, providing the opportunity to plant trees or grassland and to restore wetlands

- Over 1 million trees have been planted annually in the basin for the past 6 years.
- Over 700 acres of wetlands have been restored the past 10 years
- Over 6,000 acres of grassland have been established

Cropland is converted to residential development

- Rural settings have become most desired building sites. In Manitowoc County building permits for rural residential construction have increased 50% while building in villages and cities has decreased 50%. The total population has not experienced a significant increase, however the amount of land used for homes has greatly increased.
- Conflicts have increased between farming operations and rural residents.
- Forests and wildlife habitat are fragmented by residential development.
- Character of rural land is lost.
- Cropland continues to be farmed

When vegetative communities get subdivided or reduced in size, it becomes increasingly difficult to maintain the ecological function of that natural community. Species of plants and animals that are adapted to living in fragmented habitats are already generally common in the basin, while species that depend on larger blocks of habitat are less common or declining.

Tactics

- Continue to help landowners that enroll cropland in the Conservation Reserve Program and other conservation programs. (FWH - II.B.5.1,5.5 Wetlands)
- Assist Counties and Townships in recognizing important natural resource features as they revise their land use plans according to Smart Growth legislation. (FWH - II.A.3 and IV.D.3)
- Help develop zoning criteria for land or habitat in need of protection. (FWH - II.A.4 and II.B.3.5)
- Encourage other methods of protecting land through Land Trusts or other legal protection like easements. (FWH – II.A.12)

- Provide education about the ecological values of different types of habitat and how rural residential development affects them. This is needed at several levels, landowners, town and county government.

Grassland

Maintenance of Newly Established Grassland

Although not historically present, significant grassland acres have become established in the basin as farmland has been retired. Due to the severe loss of grassland acres across Wisconsin, it is important to maintain the established acres of grass habitat in the basin. Grasslands provide habitat for up to 105 species of birds. Prescribed burning is the preferred method to maintain grassland habitat.

Maintenance needs– prevent conversion to woody plants with the use of prescribed burning, limited by availability of staff.

Tactics

- Utilize Wisconsin Conservation Corp to maintain grassland habitat.
- Hire more DNR staff.
- Involve volunteers (i.e. volunteer fire departments).
- Educate the public on the importance of upland habitat protection.
- Burn 25 acres of grasslands annually. (FWH – II.A.13 and II.C.3.1)

Wetlands

Need to Restore and Create Wetlands Due to Historic Losses

Development of land in the basin for agriculture, transportation, and urbanization has resulted in the loss of a significant amount of historic wetland acres. This has contributed to decreased water quality in most basin water bodies, decreased flood mitigation potential of the landscape, and decreased populations of wetland dependent plants and animals. Recent gains have been made in restoring wetland acres due to the current trend of retiring cropland into government set-aside programs. Manitowoc County is one of the leading counties in the state in restoration and creation of wetland basins and acres**.**

Maintenance Needs – continued replacement of historic losses of wetland acres, and structural maintenance of earthwork and water control devices on created wetlands as they age.

Tactics

- Pursue funding sources to hire contractors to complete work (i.e. state duck stamp, conservation organizations, and federal grants).
- Hire permanent or temporary staff to locate wetland restoration projects and monitor maintenance needs on existing restoration.

- Restore 25 acres of wetlands annually. Priority areas include Two Creeks and Habitat Restoration Area projects. (FWH – II.B.5.2 Wetland Protection)
- Partner with conservation organizations, local agencies, and private citizens to purchase and protect wetlands. (FWH – II.B.5.4)
- Educate the importance of wetlands and their value to a healthy ecosystem.
- Ensure that restoration projects do not convert one wetland type to another.

Exotic Species

Multitudes of invasive species from both the plant and animal kingdom have become established in the basin. These species tend to spread quickly and out compete native flora and fauna for space. The result is a less diverse natural community with fewer management options and degraded resource opportunities for the public. Exotic plants diminish fish and wildlife populations by displacing the native food and cover plants that these organisms depend on for survival. Recreational activities can be severely restricted by the uncontrolled growth of exotic plants.

Tactics

- Work with the NE Wisconsin weed task force to identify opportunities to limit invasive weed problems.
- Educate the public about the problem of invasive species and activities that promote their spread.
- Reduce or remove populations of existing invasive species on state lands and prevent establishment of others by monitoring and removal. (FWH – II.G.1, II.G.2.2, II.G.3)
- Make invasive species control a priority on DNR owned properties and set an example for other landowners to follow. (FWH – II.G.1, II.G.2.2, II.G.3)
- Educate the plant resale business community and consumers to prevent introduction or expansion of invasive species.
- Work with partners to aggressively seek out funding opportunities for coordinating the education, inventory and control measures needed in the basin.
- Encourage legislation that prohibits the granting of permits that allow the production and spread of exotic species.

Gypsy Moth

Gypsy moth is an exotic insect and can be a serious forest pest. Gypsy moths prefer oak, aspen and birch but will defoliate many species. Trees have a better chance of surviving defoliation if they are vigorous and in good health. Trees that are old, crowded, growing on drought-prone sites, or otherwise stressed, are at the highest risk to die following severe defoliation. Landowners that have been practicing good forest management through thinning and selection harvests will have healthier trees that are able to withstand more defoliation and should suffer far less mortality than stands with stressed trees. *Gypsy Moth Silvicultural Guidelines for Wisconsin by Charles Brooks and David Hall (WI DNR PUB-FR-123 97)* is an excellent reference.

State owned Parks in the basin have had little or no forest management for various reasons. Sound forestry practices should be considered before defoliation occurs.

Tactics

- Continue to help private landowners practice sound forestry.
- Work with State Property Managers to help them understand the upcoming problems associated with gypsy moths.
- Educate public about the need for action now. (FWH – II.G.1.2)
- Thin high risk stands to increase the vigor of the remaining trees.

Captive Wildlife Farms

The Lakeshore Basin has the highest density of deer and elk farms in the state. Ring-necked pheasant farms are also very popular. Captive wildlife is at a higher risk than free roaming animals of contracting contagious diseases. This combined with the frequent intentional or accidental release of captive wildlife poses a serious health threat to our wildlife populations (and possibly humans). Bovine tuberculosis (TB) has been documented 3 times in captive elk herds in Manitowoc County since 1997. In 1998, there were documented escapes of elk, red deer, and fallow deer in the basin.

Tactics

- Continue to monitor wildlife, especially white-tailed deer in the area of known TB occurrences and throughout the state. (FWH – II.F.5 and II.F.7)
- Educate the public and encourage the support of drafted captive wildlife legislation.

Wildlife Management

The landscape of the basin supports a diversity of wildlife species, some of which are recreationally and economically important to our residents. Species that are adapted well to the current landscape have healthy populations, some to the point of creating a public nuisance. Species that have struggled in the basin due to a lack of habitat, have seen significant improvements during the 1990's due to agricultural set aside programs that have added many grassland and wetland acres to the landscape. Population management of certain species is becoming increasingly difficult due to some of the trends mentioned above. State parks are under more pressure to provide additional hunting opportunities. Hunting in state parks is a controversial topic in the basin.

Deer Management

White-tailed deer have increased in number over the past decade due to the increase in acres of deer habitat being underhunted or no longer open to hunting. These deer "refuges" create areas where deer numbers grow well above management goals and create uneven deer distribution across the landscape. High deer populations result in crop damage, car/deer collisions, and

vegetative damage from deer browsing. Liberalized deer harvests may not remove deer from the desired problem areas due to lack of hunter access in these areas. This problem is not specific to our basin. It is occurring throughout the state.

Tactics

- Support the Deer 2000 and Beyond process being conducted by the Conservation Congress. (FWH – IV.B.11.1 and 11.4)
- Offer liberal antlerless deer harvest opportunities as needed to maximize harvest. (FWH – II.C.2.5 and IV.B.11.2)
- Support food pantry donation of venison so hunters in a position to harvest more deer than they can use can shoot additional antlerless deer.
- Educate landowners about the need to adequately harvest deer across the landscape.
- Continue the WDNR committee dedicated to addressing hunting in state parks

Urban Wildlife

Several species of wildlife have adapted well to living in urban landscapes in recent years. Land use patterns and management in and around urban areas have increased the carrying capacity in these areas for deer, geese, gulls, and small carnivores. These populations often create real or perceived conflicts with residents who then turn to governmental agencies for assistance.

Tactics

- Educate communities about tools available to manage problem wildlife populations (i.e. removal permits).
- Direct the public to sources of nuisance wildlife abatement (i.e. USDA-APHIS-Wildlife Services). (FWH – II.H.1)

Forestry

Private Forestry

Forest management on private lands has been an active program for decades in the basin. Nearly 25% of eligible woodlands are enrolled in a long-term forest management agreement through the DNR forest tax law programs. This is well above the statewide average of 14%. Additional acreage not enrolled in the forest tax law programs is also actively managed under sound forest stewardship. Most forest landowners that actively manage their lands have multiple management objectives, which place greater demands on those providing professional forestry assistance (DNR & consultant foresters). There also exist a large percentage of landowners that have not taken the initiative in seeking professional stewardship advice for their forestland. It is important to reach as many of these landowners as possible to give them the opportunity to make informed land management decisions.

Tactics

- Implement the 8 major recommendations of the recently completed DNR Private Forestry Study per established timeline. (FWH – I.B)
- Equip & train field forestry personnel in the use of technology (i.e. GIS) to increase their efficiency and effectiveness. (FWH – I.A1)
- Work with private landowners to emphasize the importance of maintaining a minimum percentage of forested land to minimize excessive runoff (on their property and Basin wide)

Urban Forestry

The urban forest is all of the trees and other vegetation in and around a city, village, or development. Traditionally, it has meant tree-lined streets, but it is important to remember that this forest is a complex network of green space, extending beyond property lines and involving many different landowners. An urban forest also includes home and corporate landscapes, schoolyards, parks, cemeteries, vacant lots, riparian corridors, utility rights-of-way, adjacent woodlots and anywhere else trees can grow in and around a community. Streets, sidewalks, buildings, utilities, soil, topography and, most importantly, *people* are an integral part of the urban forest.

Currently, there are eleven communities within the Lakeshore Basin that are participating in the DNR urban forestry program. These include Algoma, Brillion, Chilton, Cleveland, Francis Creek, Kewaunee, Luxemburg, Manitowoc, Sturgeon Bay, Two Rivers and Valders. Since 1993, 19 DNR urban forestry grants have been awarded to nine of these communities totaling more than $174,000.

Another important program is Tree City USA, which is sponsored by the National Arbor Day Foundation. This program recognizes towns, cities and villages across America that effectively manage their public tree resources. There are a total of 5 Tree Cities USA in the Lakeshore Basin. These include Chilton (6 yrs), Cleveland (1 yrs), Manitowoc (17 yrs), Sturgeon Bay (6 yrs) and Two Rivers (6yrs).

The National Arbor Day Foundation also sponsors the Growth Award. This award recognizes communities that have gone above and beyond the four Tree City USA standards. Two of these communities, Chilton and Two Rivers, have received the Growth Award because of their dedication to community forestry.

Tactics

- Work with participating communities within the basin to expand community forestry programs.
- Outreach non-participating communities using grant programs and Tree City USA as incentives.

Public Access

The Lakeshore Basin has about 25,000 acres of public land available for hunting. Rural land ownership is changing from predominantly large agricultural parcels, which often are accessible to the public with permission, to smaller residential and recreational parcels which are more difficult for non-landowners to gain access to. Publicly owned land in the basin must accommodate hunters from large population centers in the Fox Valley and along the Lakeshore. With decreased opportunities to hunt private land, the existing public lands see more and more hunting pressure. The forest tax law program provides opportunity for access to nearly 14,000 acres of private lands in the basin but landowners have opted to keep over two thirds of the acreage closed to public access.

Tactics:

- Pursue public acquisition opportunities including the Manitowoc- Branch River Public Access Area.
- Improve habitat and facility maintenance of existing public lands to promote high quality outdoor experiences. (FWH – II.A.1 and II.D.1.4
- Develop an educational strategy to stress the benefits of selling an access and ways reduce user conflicts.

Real Estate Program

The Lakeshore Basin includes 80 DNR project areas, which include: fee acquisition areas for traditional projects such as wildlife habitat areas and parks, easement purchases for non-point areas and habitat restoration areas, leases for office sites and fisheries facilities and grants for non-profit conservation organizations. Projects in the basin are summarized as follows:

- Wildlife Management Areas – 5 projects, DNR fee ownership approximately 20,735 acres.
- Parks – 6 Parks, DNR fee ownership approximately 9,228 acres.
- Natural Areas – 17 natural areas, 9 with DNR fee ownership of approximately 1,079 acres, the other 8 natural areas are stewardship grant areas for non-profit conservation organizations.
- State Forests – 1 project, DNR fee ownership approximately 2,902 acres.
- Non –Point Easements – 608 acres of easements.
- Statewide Wildlife Habitat Restoration Areas – 8 projects, with a DNR fee ownership of approximately 330 acres.
- Public Access Sites-5 sites, with DNR ownership of approximately 23.14 acres.
- Fish Management Habitat Sites – 3 sites with DNR ownership of approximately 220.92 acres.

A high priority for land acquisition in the Lakeshore Basin is the completion of existing projects. The Department will be applying for patent to the Eagle Bluff Lighthouse within Peninsula State Park in the near future and will be working with the U.S. Fish and Wildlife Service to secure public use of Plum and Pilot Islands as a part of the Grand Traverse Island State Park. The

Department will also be working with Door County in their patent application for Cana Island. Acquisition will continue to focus on two of the basin's newest projects, the Baileys Harbor Boreal Forest and Wetland Natural Area in Door County and Red Banks Glades Natural Area in Brown County. Landowner interest is high in these areas with some key acquisitions available. The Rails to Trails program will continue to be a high priority. Negotiations will continue on the Denmark to Rockwood grade and the Kewaunee to Luxemburg grade. The focus on Statewide Wildlife Habitat Restoration Areas and Fish Habitat Restoration areas should also remain high with these areas being Stewardship funding priorities.

Competition is high for recreational lands in the basin. Demand for private recreational lands have pushed the value of recreational lands to equal or greater the value of agricultural lands. The purchase of agricultural lands requires a strong justification and may require the use of a long-term lease of the cropland to local farmers to keep portions of the purchase in cropland production. Purchase of waterfront properties for public access sites results in high unit values, which are often difficult to justify.

Tactics

- Managers should continue to closely monitor land uses occurring on DNR lands to insure that those uses are not in conflict with the intent of the purchase. (FWH – II.D.1.4
- Seek opportunities to secure conservation easements as a way of protecting open space or critical habitat areas. Often times these easements can be tailored to landowner needs. They can provide property tax reduction and protect valuable habitat from development. (FWH – II.A.11)
- Update masterplans.
- Property managers should continue to maintain contacts with landowners within masterplan boundaries for possible acquisition.
- Establish or maintain a close relationship with partners, conservation organizations and conservation land trusts to protect lands outside of Department acquisition areas. (FWH – I.B.1)

Recreational Opportunities

Year round recreational opportunities exist throughout the basin. Parks, forests and fish and wildlife areas provide personal, social, environmental and economic benefits to Wisconsin citizens. All of the State Parks and Forests have seen increases in attendance and revenue collected over the past decade. Camping seasons continue to expand into later fall and early spring. Some properties have benefited with major development projects like shower buildings and public entrance and visitor stations. These successes do not come without a price. Operating budgets have not kept up with increased utility and maintenance costs. Wages for seasonal employees are below what the private sector pays limiting recruitment.

There are five State Parks, one State Forest and one State Recreation Area in the Lakeshore Basin, comprising more than 9,100 acres. In addition there is a touring bike trail, the Ahnapee State Trail, which is thirty miles long. A brief narrative of each of these properties can be found in Appendix III.

The wildlife resource is used by many citizens, both consumptively (hunting & trapping) and non-consumptively (birdwatching, wildlife feeding, nature appreciation, etc.). Hunters and trappers have always been the primary stewards of all wildlife resources by funding the vast majority of wildlife management on the landscape. Therefore, it is beneficial to wildlife and all people that use the resource to maintain a high level of participation in hunting and trapping by providing the best possible opportunities to participate and enjoy traditional wildlife recreation.

Tactics

- Expand and optimize upland bird hunting opportunities by improving grassland and upland forest habitats in the basin. (FWH – IV.B.3, 4)
- Optimize waterfowl and other migratory bird hunting by creating and maintaining wetland habitat, and managing hunting season frameworks in the least complicated manner that meets conservation needs. (FWH – IV.B.7, 8, 9)
- Cooperate with partners to conduct "learn to hunt" workshops.

Endangered Resources – State Natural Areas

The goals of the endangered resources program are:

- to protect and manage native plant and animal species, natural communities and other natural features;
- to enhance and restore populations and habitats of rare and endangered species; and
- to promote knowledge, appreciation and stewardship of Wisconsin's native species and ecosystems for present and future generations.

There are 17 State Natural Areas within the Lakeshore Basin. Natural areas are tracts of land or water harboring natural features which have escaped most human disturbance and which represent the diversity of Wisconsin's native landscape. In Appendix III is a listing of the natural areas and their unique features. In most cases, little management is necessary except to protect them from human disturbance. For many sites in the Lakeshore Basin, invasive exotic species are a problem. High deer populations can also affect native populations of plants.

Tactics:

- Identify, designate and manage State Natural Areas. (FWH – II.D.7.1)
- Identify and protect critical habitat for endangered or threatened species. (FWH – II.B. 3.2)

Lakeshore Basin

Door County Land Use

Kewaunee County Land Use

Manitowoc County Land Use

Brown County Land Use

Calumet County Land Use