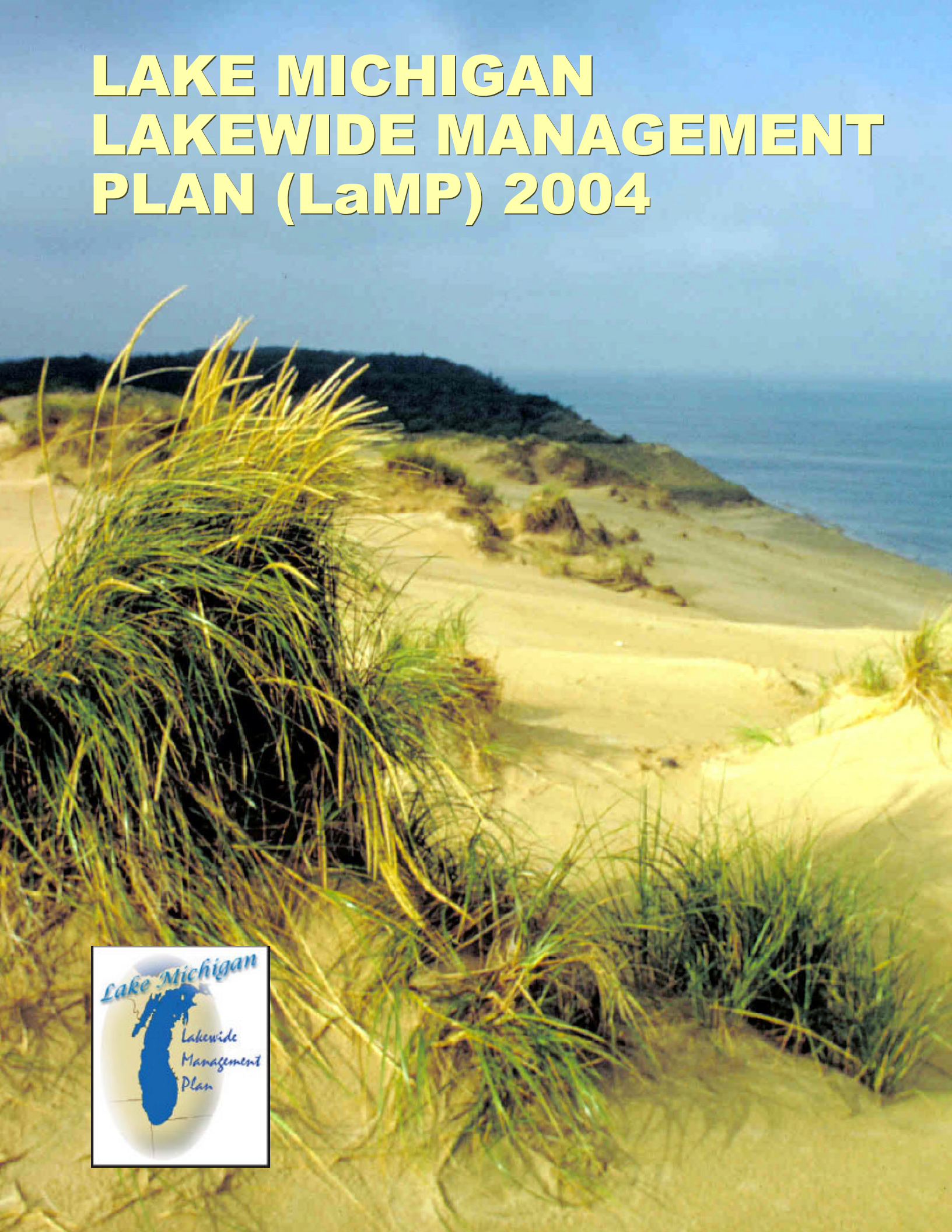
LAKE MICHIGAN LAKEWIDE MANAGEMENT PLAN (LaMP) 2004



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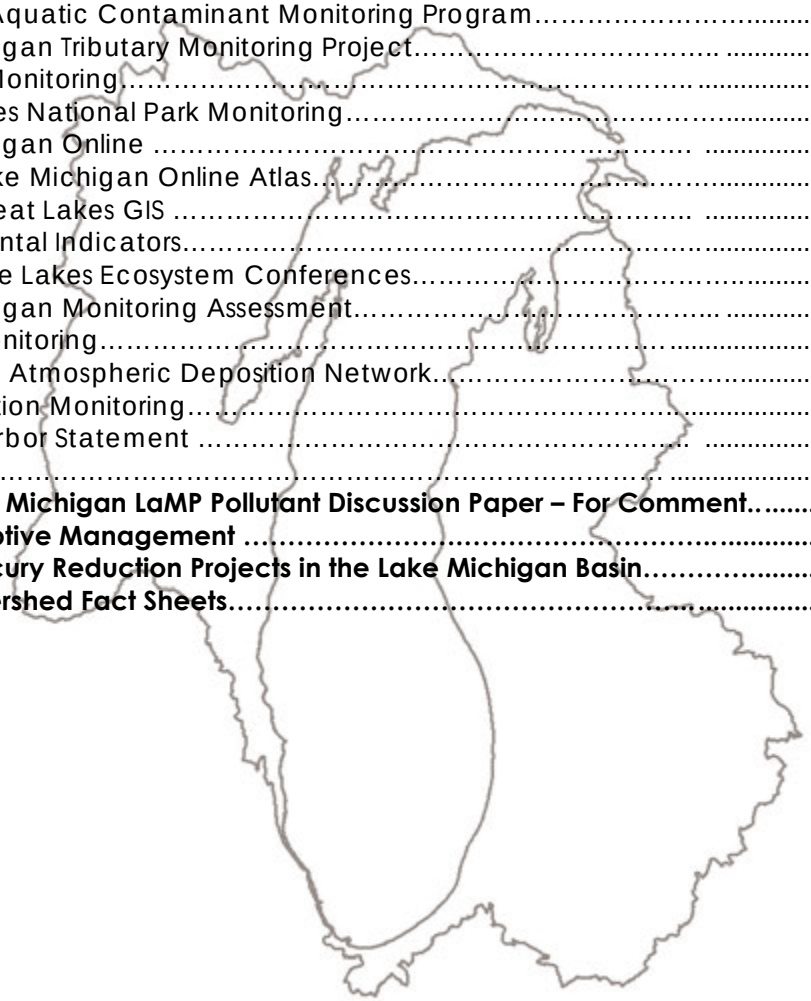


Lake Michigan Lakewide Management Plan 2004 Status Report

Introduction

The purpose of this Lakewide Management Plan (LaMP) 2004 status report is to provide:

- An executive summary of the status of the Lake Michigan ecosystem;
- A report on the progress in achieving the Lake Michigan goals described in LaMP 2000 and examples of significant activities completed in the past two years since LaMP 2002;
- A summary of the current Lake Michigan mass balance data and findings;
- Links to more detailed information in LaMP 2000, 2002, or other sources;
- An opportunity to comment on targets and plans for pollution reduction and ecosystem restoration;
- A proposal to identify additional pollutants to be addressed by the LaMP in the future; and
- An overview of the 33 major sub-watersheds that flow into Lake Michigan, and their status.

What is the Status of the Lake?

"Lake Michigan is an outstanding natural resource of global significance, under stress and in need of special attention." **LaMP 2000**

Since the release of LaMP 2002, several key indicators point to the continuing concern for the health of the ecosystem.

- Beach season data exhibited a continued number of beach closings.
- Data reveal that a critical layer of the Lake Michigan aquatic food web continues to disappear, and with the discovery of new aquatic nuisance species–there are now a total of 170 in the Great Lakes ecosystem–the integrity of the food web of Lake Michigan is in question.
- Mercury in fish is such a prevalent problem that 44 states now have mercury fish advisories, and a national advisory has been issued for certain ocean fish pointing to a problem of global proportions.
- Climatic pattern changes, whether temporary or permanent, are lowering lake levels as well as raising concerns about groundwater levels and lake/groundwater interaction and diversion.
- The interaction between ground water and surface water is becoming better understood in the Lake Michigan basin as declines in water levels from overpumping are resulting in regional declines in baseflow levels in streams that affect habitat.
- Following the September 11, 2001 terrorist attacks, the issue of protecting the lake's vast supply of fresh drinking water has become a higher priority.

Despite these concerns, Lake Michigan supports many beneficial uses. For example, it provides drinking water for 10 million people; has internationally significant habitat and natural features; supports food production and

The Lake Michigan-Mississippi River basin divide: Chicago Avenue west of East Avenue in Oak Park, Illinois.

processing; supplies fish for food, sport, and culture; has valuable commercial and recreational uses; and is the home of the nation's third-largest population center. Furthermore, significant progress is being made to remediate the legacy of contamination in the basin. Specifically, ongoing actions to restore the Areas of Concern (AOC) have been successful and have received new resources from the passage of the 2002 Great Lakes Legacy Act. Their status is outlined in Chapter 8. The Lake Michigan Watershed Academy was launched from four states and has brought together the regional planning agencies for the first time.

Background on the LaMP

Under the Great Lakes Water Quality Agreement (GLWQA), as amended in 1987, the United States and Canada agreed " to restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem." To achieve this objective, the parties agreed to develop and implement, in consultation with state and provincial governments, LaMPs for open waters. In the case of Lake Michigan, the only one of the Great Lakes wholly within the borders of the United States, the Clean Water Act (Section 118c) holds the U.S. Environmental Protection Agency (EPA) accountable for the LaMP.

Work on the Lake Michigan LaMP began in the early 1990s with a focus on critical pollutants affecting the lake. At that time, monitoring data showed that point source regulatory controls established in the 1970s and 1980s were reducing the levels of persistent toxic substances such as polychlorinated biphenyls (PCB), DDT, and other pesticides. Monitoring results also indicated that nonpoint sources of pollution such as runoff and air deposition, as well as aquatic nuisance species, were stressing the Lake Michigan ecosystem. The LaMP states that "pathogens, fragmentation and destruction of terrestrial and aquatic habitats, aquatic nuisance species, uncontrolled runoff and erosion are among the stressors contributing to ecosystem impairments."

It has been documented that core regulatory programs at the federal, state, tribal, and local levels have effectively controlled many pollutants. Increased water quality protection is now being addressed with the adoption of more stringent water quality standards for the Great Lakes basin by each Great Lakes state, with the goal of having the new standards reflected in all permits by 2006. What remains is a set of difficult, persistent, and multifaceted problems. In response, agencies must develop new tools, refocus their strategies and methods, and continually obtain new data. As the 1994 State of the Lakes Ecosystem Conference reported, "governments have traditionally addressed human activities on a piecemeal basis, separating decision making on environmental quality from decision making on natural resources management or on social or economic issues...." In addition, decisions at different levels of government or across political boundaries are being made unilaterally without regard to watershed or ecosystem alignment. LaMP 2004 recommends using a watershed framework as the most effective scale and structure working on these problems.

Linking LaMP Goals to RAPs

Remedial Action Plans (RAP)

The GLWQA amendments of 1987 also called for the development of RAPs for specific Area of Concern. The two Federal governments were directed to cooperate with the state and provincial governments to develop and implement RAPs. The RAPs and LaMPs are similar in that they both use an ecosystem approach to assessing and remediating environmental degradation, focus on the 14 beneficial use impairments outlined in GLWQA, Annex 2, and rely on a structured public involvement process. RAPs, however, encompass a much smaller geographic area, concentrating on an embayment, a single watershed, or stretch of a river. The RAP focus is on local areas that also use impairments for the local areas and the lake as a whole.

Forging a strong relationship between the LaMPs and RAPs is important to the success of both efforts. The RAPs serve as point source discharges to the lake as a whole. Improvements in the AOC areas will eventually help improve the entire lake.

Much of the expertise and land use control about use impairments, possible remedial efforts and watershed planning reside at the local level. Cooperation between the two efforts is essential in order for LaMPs to remove lakewide impairments and for the RAP watershed to be able to restore integrity.

LaMP 2000, 2002, and 2004: How and by whom are they used?

The publication of LaMP 2000 documented the beginning of a basinwide dialogue on which pollutants and stressors should be prioritized for control, what reduction targets should be applied to them, and which ecologically rich areas should be identified for restoration and protection. Some issues, such as aquatic nuisance species, legacy sites, and drinking water protection, require immediate attention. Other issues continue to be the subject of public dialogue, and new issues may arise that require additional research. In 2000, the GLWQA Binational Executive Committee determined that an adaptive management approach would guide the LaMP process, making it an iterative approach. LaMP 2004 provides new information since 2002, responds to input received, and provides targets, objectives, and strategies and a set of watershed fact sheets for public comment.

Door County, Wisconsin, Lake Michigan Lakeshore
Photograph by Karen Holland, EPA

What was Accomplished and What Challenges Remain?

Issues that were highlighted in LaMP 2000 and 2002 and that have been accomplished include the following:

- Setting targets for reduction of critical pollutants and stressors (see Chapter 7 and Appendix A),
- Reviewing the LaMP list of contaminants and stressors (see Appendix A),
- Filling data gaps, including the Lake Michigan Mass Balance Project (see Chapter 7),
- Identifying ecologically rich areas and habitats (see Chapter 4 and Appendix D,
- Developing the concept of the area of stewardship (see Chapter 9),
- Convening public conferences and workshops for development of a Total Maximum Daily Load (TMDL) strategy, beach management, monitoring issues, and watershed management (see Chapter 1), and
- Further developing remedial action plans and coordinating them with other basinwide and local efforts.

Progress made on accomplishing these objectives is outlined in this status report.

In addition, Appendix A to LaMP 2004 reports on a number of pollutants that could be placed on the LaMP pollutant list. The process for identifying LaMP pollutants, the 2004 pollutants list, potential pollutants to be added in 2006, and information on pollutant management activities completed since 2002 are presented in Appendix A.

Areas of LaMP Work that Remain a Challenge

Finalization of a monitoring plan and prioritization of indicators are still in progress. A draft monitoring plan was issued along with a set of recommendations in August 2000. To prioritize indicators and gather missing data, two major Great Lakes wide initiatives have begun that are focused on wetlands and the importance of the "coastal area." The results of these efforts will

Status of LaMP Pollutants Proposed in LaMP 2002

	Lake Michigan LaMP Pollutants Proposed in LaMP 2002	Lake Michigan LaMP Pollutants in LaMP 2004
Critical Pollutants	PCBs, chlordane, DDT/DDE, mercury, dioxin	PCBs, chlordane, DDT/DDE, mercury, dioxin
Pollutants of Concern	PAHs, lead, cadmium, chromium, copper, zinc, arsenic, cyanide, endrin, heptachlor epoxide, lindane, nickel, nutrients, pathogens, sediments	PAHs, lead, cadmium, chromium, copper, zinc, arsenic, cyanide, endrin, heptachlor epoxide, lindane, nickel, nutrients (a category which includes phosphorus), pathogens, sediments
Pollutant Watch List	atrazine, selenium, PCB substitute compounds	atrazine, selenium, PCB substitute compounds

provide not only new data but also refined indicators for wetlands, and the LaMP will utilize this work in finalizing a set of LaMP indicators by 2006.

One of the key functions of the LaMP process is to identify pollutants that are or have the potential to adversely affect the Lake Michigan ecosystem. In Appendix A to LaMP 2004, the process for identifying three categories of Lake Michigan LaMP pollutants on a geographic basis is outlined:

- Critical pollutants,
- Pollutants of concern, and
- Watch List pollutants.

LaMP 2004 finalizes the critical pollutants, pollutants of concern, and watch list pollutants that were proposed in LaMP 2002. See Table I-1. In addition, pollutants in each category are proposed for finalization in LaMP 2006. See Appendix A, especially Table A.6. Finally, a more detailed discussion of the LaMP pollutant identification process is provided in Appendix A.

In addition, a list of the pollutants that were proposed for these categories in LaMP 2002 and are now made final in LaMP 2004 is provided (see Table 1-1). Finally, information for a set of potential Watch List pollutants for LaMP 2006 is also provided in the Appendix.

A Focus on Ecosystems and Watersheds

In 1995, the Federal Interagency Ecosystem Management Task Force defined an ecosystem as "an interconnected community of living things, including humans, and the physical environment with which they interact. As such, ecosystems form the cornerstone of sustainable economies." With regard to ecosystem management, the Task Force explained that "the goal of the ecosystem approach is to restore and maintain the health, sustainability, and biological diversity of ecosystems while supporting sustainable economies and communities. Based on a collaboratively developed vision of desired future conditions, the ecosystem approach integrates ecological, economic, and social factors that affect a management unit defined by ecological–not political–boundaries."

In 1998, the Lake Michigan Management Committee adopted the ecosystem approach. The significance for the Lake Michigan LaMP was the intent to address not only the 10 areas that had been formally designated AOCs by the 1987 GLWQA amendments, but also other areas that were responsible for impairing the lake's ecosystem. The prime example was the Chicago area. Because of the rerouting of the Chicago River into the Mississippi River system, Chicago's surface water has been diverted out of the basin;

however, groundwater from the Chicago area has not been diverted, and the city's large airshed has been shown to be a source of pollutants that are deposited in and affect the lake. The watershed/diversion connection is currently critical as steps are underway to prevent invasive or aquatic nuisance species from entering the Lake from the Mississippi River system (See chapter 8).

A Focus on Partnerships and Innovation

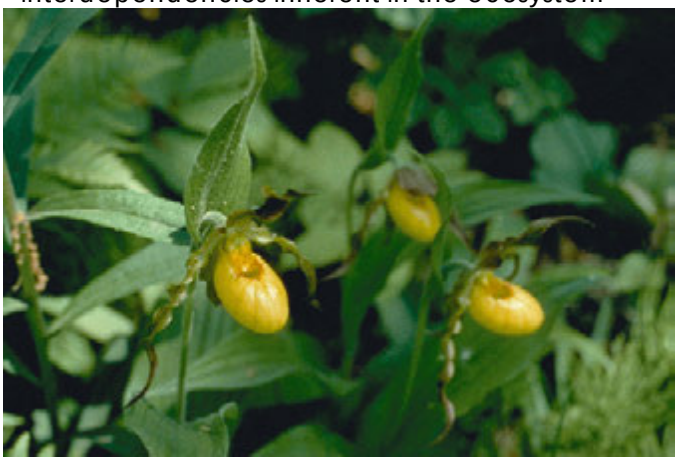
As the LaMP 2000 points out, this framework "also develops partnerships of organizations brought together to solve problems too large or complex to be dealt with by one agency with a limited mission. This approach also has the potential to leverage and direct local, state and federal, and private resources into a coordinated effort. The challenge is to create the framework for participating organizations to contribute their expertise and resources, often on an uneven basis, but in a manner that allows all partners to participate in the decision making on an even basis" (see chapter 10).

A Focus on Shared Information

A key to engaging the necessary partners is a common, accessible, and scientifically sound body of knowledge. Lake Michigan protection and restoration requires open dialogue between academia and government agencies, as well as a collaborative monitoring plan to provide a current database. Reporting of current data and conclusions to the public is an important component of this system. This component presents many challenges, as data quality plans improve data accuracy but hinder the speed of reporting. Current management decisions are often made with gaps in both data and interpretation. These gaps may lead to incorrect problem assessments or incorrect response actions. The Lake Michigan LaMP has formed a basinwide coordinating and monitoring council to coordinate and promote common protocols and comparability in monitoring. The goal is to facilitate data sharing across agencies as well as among academic and research disciplines. Lake Michigan as a studied object is a moving target, and to provide adaptive management, there is a continuing need for monitoring and reporting of the lake's current status (see chapter 11)

A Focus on the Future: Sustainability and Stewardship

While partnerships can leverage resources, they also must be led and supported. Setting shared goals, objectives, and indicators in alignment helps to conserve resources but does not do away with resource needs. The interdependencies inherent in the ecosystem approach require a balance among three fundamental elements: environmental integrity, economic vitality, and sociocultural well-being. The ability of these elements to function in balance over time is one measure of sustainability. Complex ecological processes link organisms and their environment. These processes are often referred to as "ecological services" because they perform functions that combine to sustain life in the ecosystem. The significant natural features of Lake Michigan, such as its encompassing the world's largest collection of freshwater sand dunes, supporting 43 percent of the Great Lakes' large sport fishing industry, and providing drinking water for over 10 million residents, means billions of dollars not only to the economies of the four states that share the lake but also to the nation as a whole (see chapter 6).



Yellow Moccasin, Gibson Woods, Indiana
Photography by Karen Holland, USEPA

Organization of the LaMP and this Status Report for 2004

This document is intended to provide a status report on the health of the Lake Michigan ecosystem and a summary of the activities related to the Lake Michigan LaMP that have occurred during the last 2 years. It is based upon the vision, goal and subgoals of the Lake Michigan LaMP. The vision and goal were adopted by the Management Committee August 18, 1998. The vision is:

A sustainable Lake Michigan ecosystem that ensures environmental integrity and that supports and is supported by economically viable, healthy human communities.

The LaMP goal is:

To restore and protect the integrity of the Lake Michigan ecosystem through collaborative, place-based partnerships. Specifically, this report is organized to provide a summary status report on the subgoals identified by the Lake Michigan LaMP. These subgoals are stated as questions and are organized in the following 11 chapters:

Sub-goals:

1. Can we all eat any fish?
2. Can we all drink the water?
3. Can we swim in the water?
4. Are all habitats healthy, naturally diverse, and sufficient to sustain viable biological communities?
5. Does the public have access to abundant open space, shorelines, and natural areas, and does the public have enhanced opportunities for interaction with the Lake Michigan ecosystem?
6. Are land use, recreation, and economic activities sustainable and supportive of a healthy ecosystem?
7. Are sediment, air, land, and water sources or pathways of contamination that affect the integrity of the ecosystem?
8. Are exotic species controlled and managed?
9. Are ecosystem stewardship activities common and undertaken by public and private organizations in communities around the basin?
10. Is collaborative ecosystem management the basis for decision-making in the Lake Michigan basin?
11. Do we have enough information, data, understanding, and indicators to inform the decision-making process?

Each chapter provides reports on current status, challenges and next steps. The chapters describes the status of the 11 Lake Michigan LaMP subgoals. The targets for each subgoal are depicted graphically, followed by a short description of the status of the subgoal and the challenges facing the LaMP process to improve the status of the subgoal. Key activities or updates relevant to the subgoal that have occurred over the past two years are then described, followed by a brief description of key next steps to achieve the subgoal targets.

Overall, the finding of this report is that the status of achieving the goals is mixed. Some successes have been achieved in pursuing these subgoals – notably, drinking water quality is generally good throughout the basin– but there is much room for improvement in all the other areas. Water quantity is an issue that is developing quickly. One objective of the LaMP is to foster activities that will cause the status of the subgoals to be "mixed/improving" by 2010 and "good" by 2020. A summary graphic at the start of each chapter of this report highlights the current and projected future status of each subgoal. In addition, following this introduction, an executive summary of this status report is provided in the form of a table. The table outlines the status of the subgoals organized under the strategic agendas outlined in LaMP 2000, significant activities completed in the last 4 years, and next steps to achieve the targets for each goal. Comments are requested on the next steps and proposed targets and other portions of the LaMP.

Following the status report, this document concludes with a proposal for updating the list of pollutants addressed under the LaMP. The LaMP has adopted an adaptive management approach that requires a continuing review of the LaMP goals and pollutants. The proposed process for updating the LaMP pollutant list along with an updated proposed list of pollutants for 2004 are provided in Appendix A and are being offered for comment. Appendix D includes

information on the 33 major watersheds of the Lake Michigan system.

What are the "Text" Boxes and What Do They Provide?

Throughout the document, "text" boxes are employed to portray examples of work underway in the basin, or, in some cases, a noteworthy event. They are also used to provide details of what is being discussed in the chapter. They often contain a web address where the reader can follow up if interested. The information does not necessarily imply LaMP activity.

Where Can I Find LaMP 2000 and the 2002 Status Report? Where Do I Send Public Comments?

Lake Michigan LaMP 2000 and 2002 are available on line at www.epa.gov/glnpo/michigan.html. For a CD or printed copy of the LaMP or to make a public comment, contact the U.S. Environmental Protection Agency, Mail Code T-17J, 77 West Jackson Boulevard, Chicago, IL 60604. Public comments are factored into LaMP deliberations and will be reflected in LaMP 2006.

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Details on the Bullets Below are Found in the Individual Subgoal Sections for the 2002 and 2004 LaMP Reports
New information for 2004 is bold and italicized

Goal: To Restore and protect the integrity of the Lake Michigan ecosystem through collaborative place-based partnerships.

Strategic Action Agenda	Subgoals of the Lake Michigan LaMP	Significant Happenings 2000-2004	Near-Term Objectives 2004-2006	Long-Term Objectives
	END POINT SUBGOALS			
Human Health Actions that prevent human exposure to pollutants in the ecosystem and prevent or minimize sources	**Subgoal 1** We can all eat any fish ***Status*** • Mixed in 2004 • Mixed/Improving by 2010 • Good by 2020 **Subgoal 2** We can drink the water ***Status*** • Good in 2004 • Good in 2010 • Good in 2020 **Subgoal 3** We can swim in the water ***Status*** • Mixed in 2004 • Mixed/Improving by 2010 • Good by 2020	• Fish advisories for mercury by USFDA and for dioxin by Michigan and Tribes • Grand Cal and Fox River AOC sediment cleanup plans underway • Sokaogon Chippewa Community Bans Burn Barrels • Grand Traverse Band of Ottawa and Chippewa Indians ban burning trash/garbage on tribal lands • TMDL workshops with regulators and stakeholders held • Mercury Phase-Out proposal proposed • Drinking water monitoring and reporting information available on the web • Great Lakes Beach Conference held • Beaches Environmental Assessment and Coastal Health Act of 2000 • EPA and FDA issue joint mercury fish advisory • ***Legacy Act 2002 to clean up sediments passed and $10 million appropriated for FY 2004, $46 million proposed for FY 2005*** • ***Fish consumption advisory outreach programs developedd for non-English speakers*** • ***Impaired waters strategy under development*** • ***Source water assessment programs almost completed*** • ***Public Health Security and Bioterrorism Preparedness and Response Act of 2002 being implemented*** • ***Drinking water education programs developed*** • ***Defense Department Developing Rapid Water Quality Testing Technology*** • ***Constructed wetland effectiveness researched*** • ***Chicago and Milwaukee to control CSOs*** • ***Cladophora alga resurges***	• By 2003, hold a mercury phaseout TMDL stakeholder meeting • By 2004, a TMDL Strategy will be developed for Lake Michigan. • By 2002, EPA will track and report on raw source water for Green Bay, Milwaukee, Chicago, and Muskegon. • By 2003, source water assessments (including security assessment) will be completed and reported. • By 2004, states will adopt criteria, standards, and monitoring programs for beach bacteria. • In Summer 2004, complete public comment draft Guidance for Mercury Pollutant Minimization Program • Develop impaired waters strategy. • Seek funding to develop a source water protection GIS system.	• By 2006, the Binational Toxics Strategy goals of 90 percent reduction of high-level PCBs, 75 percent reduction of total dioxin and furan releases, and 50 percent reduction of mercury use and release will be reached. • By 2007, concentrations of PCBs in lake trout and walleye will be reduced by 25 percent. These results are based on early Lake Michigan Mass Balance model runs. • By 2005, plans will be in place to address drinking water susceptibility to contamination. • By 2005, achieve a 30 percent reduction from the 1992 per capita loadings from combined sewer overflows (CSO), POTWs, and industry. • By 2005, 95 percent of high-priority beach waters (as defined by the state) will be monitored and a public advisory system will be in place. • By 2007, 90 percent of monitored high-priority beach waters (as defined by the state) will meet federal and state bacteria standards for more than 95 percent of the average swimming season. • By 2006 Great Lakes Initiative should be incorporated into renewed permits. • By 2006, source water assessments will be completed and reported. • Cleanup superfund sites and other PCB-contaminated harbors

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Strategic Action Agenda	Subgoals of the Lake Michigan LaMP	Significant Happenings 2000-2004	Near-Term Objectives 2004-2006	Long-Term Objectives
	END POINT SUBGOALS			
Restoration and Protection Actions that restore, enhance, and sustain the health, biodiversity, and productivity of the ecosystem	**Subgoal 4** All habitats are healthy, naturally diverse, and sufficient to sustain viable biological communities ***Status*** • Mixed in 2004 • Mixed/Improving by 2010 • Good by 2020	• Perch population still dropping • Northwest Indiana Advanced Identification of Wetlands Study underway • Keystone species (diporeia) in Lake Michigan food web vanishing • Supreme Court Ruling narrows wetland regulation • Wisconsin passes wetlands protection law • Piping Plover critical habitat designated by USFWS • *Antrim County, Michigan Wetland Protection ordinance rescinded* • Wolf populations recovering • Habitat and Land Use Management Tool Box under development • Established a 1994 baseline for land cover • NIPC "Biodiversity Recovery Plan" document produced • Northwest Indian greenway plan unveiled • Sturgeon restoration efforts begin • ***Diporeia density continues to decrease*** • ***Dam removals in southeastern Wisconsin improve fish habitat*** • ***Nature Conservancy develops Biodiversity Blueprint*** • ***Chicago signs migratory bird treaty*** • ***Bald eagles return to Little Calumet River*** • ***Manistee Watershed grant*** • ***Wisconsin non-point source regulation promulgated***	• By 2002, a process for developing biodiversity recovery manuals for major ecosystem types in the Lake Michigan basin will be implemented. • By 2004, set targets for critical areas (fish spawning areas, dune and swale complexes, wetlands, alvars, prairies, and oak savannas) will be identified, mapped, and presented on line. • Habitat and Land Use Tool Box published, distributed • Utilize SOLEC and Duluth lab indicators and the Wetland Consortium to finalize Lake Michigan indicators • NACD stream buffer report release • A basin-wide buffer program will be explored • Utilize 2000 landsat data to update 1994 baseline land cover GIS • Critical areas mapped and presented on-line • By 2004, critical areas (fish spawning areas, dune and swale complexes, wetlands, alvars, prairies, and oak savannas) will be identified, mapped, and presented on line • Midwest grey wolf moves from endangered to threatened • EPA and states take action to protect isolated wetlands • By 2005, no net loss of wetland acreage and function will be achieved in the basin. • By 2006 a process for developing biodiversity recovery manuals for major ecosystem types will be implemented • By 2006, set targets for critical areas will be identified, mapped and presented on-line.	• By 2012, the 2004 target acreages will be enhanced, restored, or protected: 1,000 acres of spawning areas (islands under water reefs); (example acreages: 12,500 acres of system wetlands; 1,000 acres of isolated wetlands; 1,000 acres of dunes; and 37,500 acres of stream buffers - comments requested).

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Strategic Action Agenda	Subgoals of the Lake Michigan LaMP	Significant Happenings 2000-2004	Near-Term Objectives 2004-2006	Long-Term Objectives
	END POINT SUBGOALS			
Sustainable Use Actions that concurrently sustain the health of the environment, the economy, and the communities of the ecosystem	**Subgoal 5** Public access to open space, shoreline, and natural areas is abundant and provides enhanced opportunities for human interaction with the Lake Michigan ecosystem ***Status*** • Mixed in 2004 • Mixed/Improving by 2010 • Good by 2020 **Subgoal 6** Land use, recreation, and economic activities are sustainable and support a healthy ecosystem ***Status*** • Mixed in 2004 • Mixed/Improving by 2010 • Good by 2020	• Governors and Premiers sign Great Lakes Charter Annex 2001 • Indiana moves into Coastal Zone Management program • Wisconsin Smart Growth act • Historic Agreement to Manage Fisheries in 1836 Treaty Waters • Economic valuation studies by Northeast-Midwest Institute, Lake Michigan Federation, and University of Wisconsin Sea Grant • Lake Michigan Potential Damages study continues in sixth year • USGS Lake Michigan Trends Project funded • USGS Pollutants of Concern list developed • Upland Michigan Land Use report • Federal two-year ban on drilling under the Great Lakes continued in 2003 • Michigan moratorium on drilling under the Great Lakes • Dams removed in Milwaukee and Muskegon Rivers • Menominee tribe purchases proposed Crandon Mine site • Groundwater studies document unsustainable withdrawal • UIC study shows economic benefits of sediment clean ups • ***Crandon Mine site purchased by tribes*** • ***Northwest Indiana mayors join to remake Indiana lakeshore.*** • ***Lake Michigan water trail proposed*** • ***Chicago launches new water agenda.*** • ***Michigan governor outlines comprehensive water agenda.*** • ***MMSD creates river revitalization program using easement acquisition.*** • ***Chicago diversion deficit reduced faster than planned***	• By 2003, the LaMP will partner with coastal zone management programs in the Lake Michigan basin to ensure public access to the lake is balanced with protection of the ecosystem • Identify the need for additional facilities and access points (such as boat ramps canoe, and bicycle and walking trails around Lake Michigan). • Expand the Northeastern Illinois water trail to other states around Lake Michigan. • Publication and distribution of a Habitat and Land Use Management Tool Box that provides web-based information sources on environmentally sensitive habitat and land use management policies and programs. • Establishment of a Lake Michigan Watershed Academy to provide training to local planners and policy makers on balancing environmental concerns with economic and social activities in a watershed context. • Convening of a Brownfield to Greenfield Conference to highlight the need for redevelopment of facilities that have mild to medium contamination rather than developing greenspace. • Convene Planning Commissions to partner on identifying societal indicators and gathering data. • On-line habitat atlas operational. • Forum/Grand Valley State University boat tour to AOC ports • Support Great Lakes Charter Annex improvement standard activities • Support studies to determine groundwater sustainable yields	• Sustainable management of the basin by 2020

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Strategic Action Agenda	Subgoals of the Lake Michigan LaMP	Significant Happenings 2000-2004	Near-Term Objectives 2004-2006	Long-Term Objectives
	END POINT SUBGOALS			
Remediation and Pollution Prevention Actions that achieve substantial pollution reduction by remediating sites, controlling pathways, preventing or minimizing sources	**Subgoal 7** Sediments, air, land, and water are not sources or pathways of contamination that affect the integrity of the ecosystem ***Status*** • Mixed in 2004 • Mixed/Improving by 2010 • Good by 2020 **Subgoal 8** Exotic species are controlled and managed ***Status*** • *Mixed in 2004, possible deterioration* • Mixed/Improving by 2010 • Good by 2020	• Lake Michigan Mass Balance (LMMB) findings published • PCB levels in lake trout achieving equilibrium • U.S. EPA Atrazine Reassessment initiated • IADN results consistent with LMMB findings • Bush administration announced climate change and "Clear Skies" initiatives • 1999Toxic Air Emissions inventory released • U.S. EPA published Air Great Lakes Deposition (GLAD) Strategy • PCB/mercury Clean Sweep in Cook County, IL • Wisconsin mercury regulations • States act to control animal operations • New aquatic nuisance species found in Lake Michigan • Michigan Ballast Water Bill • St. Lawrence Seaway Corporation to incorporate ballast water practices • Chicago River invasive species dispersal barrier installed • ANS Task Force and Great Lakes Panel on ANS continue work to control ANS • Great Lakes Governors ANS group created • ***Corps funding secured for building permanent Asian Carp barrier on Chicago River system*** • ***Wisconsin begins mandatory rural NPS program*** • ***Michigan and Indiana add animal operation to permits*** • ***Milwaukee Metropolitan Sewerage District adopts mercury dental program.*** • ***Michigan proposes new NPDES permit for CAFOs*** • ***National Aquatic Invasive Species Act of 2003 passed.*** • ***Asian carp move closer to Chicago River.***	• A mercury source reduction and sediment remediation strategy will be finalized. • Contaminated sediment sites will be reviewed and their status will be updated. • EPA will compile a report on nutrient contributions from the agricultural sector and on point sources during wet weather. • Fall 2003 State of Lake Michigan Conference will present updated mass balance results. • By 2004 and 2005, develop coordinated monitoring to provide a 10-year trend for the lake • Track and provide information on ANS developments as an important part of the LaMP education and outreach efforts. • By 2003, a multi-agency "SWAT" Team will be developed to respond to newly discovered invasive species with the latest control technology. • EPA to release dioxin inventory. • Ensure full funding and research to keep Asian Carp from becoming established in Lake Michigan including the construction of a physical barrier in the Chicago Sanitary and Ship Canal • Continue to educate people in the basin about the importance of preventing the introduction and spread of ANS. Pilot project for outreach to members of Asian community in Chicago and elsewhere who purchase live aquatic organisms for food • Develop a rapid response system for sighting reports. • Review and respond to the LMMCC ANS survey results and recommendations. • Complete LMMCC ANS monitoring survey results and recommendations	• By 2010, remediation of 50 percent of AOC sites • By 2020, remediation of 70 percent of AOC sites • By 2025, remediation of 100 percent of AOC sites • By 2010, vessels entering the Great Lakes will discharge ballast water free of invasive species. • Eliminate further ANS introductions by 2010.

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Strategic Action Agenda	Subgoals of the Lake Michigan LaMP	Significant Happenings 2000-2004	Near-Term Objectives 2004-2006	Long-Term Objectives
	END POINT SUBGOALS			
Information Sharing, Collaboration and Stewardship Actions that provide data access and exchange, facilitate involvement, and build capacity	**Subgoal 9** Ecosystem stewardship activities are common and undertaken by public and private organizations in communities around the basin ***Status*** • Mixed in 2004 • Mixed/Improving by 2010 • Good by 2020 **Subgoal 10** Collaborative ecosystem management is the basis for decision-making in the Lake Michigan basin ***Status*** • Mixed in 2004 • Mixed/Improving by 2010 • Good by 2020	• Lake Michigan Forum developing Stewardship trust • State of Lake Michigan Conference held - November 2001 • Forum/Grand Valley State University "Making Lake Michigan Great Tour" continues to educate about Lake Michigan ecosystem during summer cruises • Great Lakes Strategy released in 2002 by U.S. EPA • Great Lakes Human Health Network established • Voluntary monitoring Conference March 2002 • Wingspread Accord signed • Participation by regional councils in watershed planning and water supply conferences • ***Watershed Academy training held and 6 regional conferences held or planned*** • ***Indiana Coastal Zone program gives out first grants*** • ***Illinois Conservation Congress recommends investigation of CZM participation*** • ***Great Lakes Cities Initiative launched*** • ***Illinois Ecosystem Partnership for Lake Michigan in development*** • ***Waukegan recognized as an EPA Environmental Justice community*** • ***Great Lakes restoration bill introduced into Congress*** • ***EPA utilizes watershed focus*** • ***Mona Lake Watershed Stewardship Assessment completed*** • ***Illinois-Indiana-Wisconsin planning agencies agree to consistent groundwater planning***	• Publish additional education and outreach materials • Establish the Lake Michigan Watershed Academy • Publish the habitat and land use management tool box • On-line habitat atlas will be operational • Hold FY 2002 State of Lake Michigan Conference • Convene a bi-state St Joseph Watershed conference on June 10 and 11, 2002 • Establish the Lake Michigan Watershed Academy • Hold a 2003 State of Lake Michigan conference • Take comments on proposed changes to Lake Michigan pollutant and stressor lists • Determine the usefulness of Lake Michigan LaMP watershed fact sheets and exploration of other needed tools (see Appendix D) • Continue the Lake Michigan Watershed Academy and support GIS and models workshops and small implementation grants to local communities • Provide additional education and outreach materials on water conservation and source water protection • Promote the habitat and land use management tool box • On-line habitat atlas continues to build layers • Hold FY 2005 State of Lake Michigan Conference • Continue the research vessel boat tour – Making Lake Michigan Great	• Clean up and delist AOCs • Implement the Lake Michigan Watershed Academy

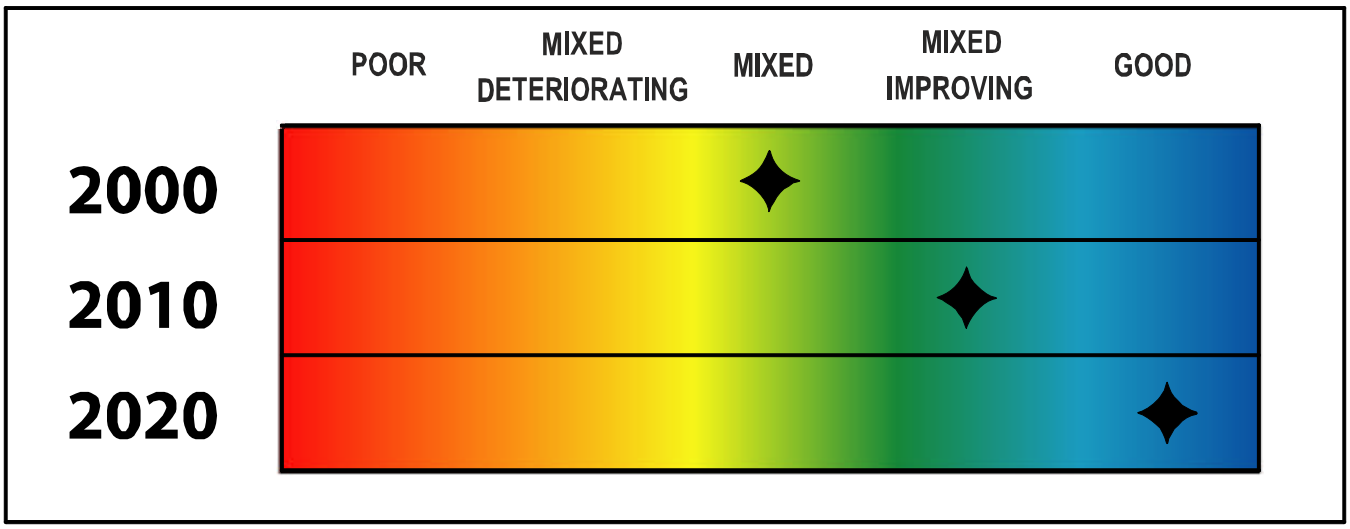
Executive Summary

Details on the Bullets Below are Found in the Individual Subgoal Sections for the 2002 and 2004 LaMP Reports
New information for 2004 is bold and italicized

Strategic Action Agenda	Subgoals of the Lake Michigan LaMP	Significant Happenings 2000-2004	Near-Term Objectives 2004-2006	Long-Term Objectives
	END POINT SUBGOALS			
Research and Monitoring Actions that monitor the ecosystem, reduce uncertainty, and inform our decisions	**Subgoal 11** We have enough information/data/understanding/ indicators to inform the decision-making process ***Status*** • Mixed in 2004 • Mixed/Improving by 2010 • Good by 2020	• LMMB project findings • Lake Michigan Monitoring Coordinating Council monitoring and assessment inventory • Lake Michigan Monitoring Assessment report released • Beach monitoring program (BEACH) created by U.S. EPA • BEC statement and monitoring conference • IJC/Delta Institute/Lake Michigan Forum Air Deposition Workshop • Great Lakes Wetlands Consortium consolidates wetland information • EPA/ORD wetlands indicators • LaMP pollutant list review • Beach Conference, web site, and manager's group • ***National Park Service monitoring begins*** • ***Lake Michigan Monitoring Council develops 2005 intensive monitoring year plan*** • ***Midwest Spatial Information Partnership formed - Workshop held in conjunction with Lake Michigan Watershed Academy*** • ***LMMB data sets available*** • ***Ann Arbor Statement on long-range atmospheric transport proposed***	• A LMMB Study report will be prepared for each contaminant studied added to the LaMP 2000 online. • Progress will be made in prioritizing indicators for the lake and monitoring them. • The coordinated monitoring plan for the lake will be finalized. • LMMB Study findings will be documented and model runs will be completed. • Monitoring and research will be reviewed to identify LaMP pollutants. • Progress will be made in aligning monitoring programs and indicators. • The coordinated monitoring plan for the lake intensive monitoring year 2005 will be finalized. • Cladophora alga research and development needed.	• Special effort and emphasis on coordinated monitoring in the Lakes Michigan basin by 2004-05

Subgoal 1

Can we all eat any fish?



Status

About 40 species of fish currently inhabit Lake Michigan, most of which are native to the lake. Over 43 percent of all Great Lakes fishing in the U.S. is done in Lake Michigan, and both commercial fishing and sport fishing are significant contributors to the economies of the states in the basin. Commercial fish production (both nontribal and tribal) reaches over 14.6 million pounds of fish annually.

While fishing is an important Lake Michigan resource, the need exists for all four Lake Michigan states to maintain advisories to warn the public about potential health effects resulting from consuming certain species of fish in the lake. As a result, achievement of the subgoal in Lake Michigan is mixed.

Challenges

- Determine the source of toxic atmospheric deposition to Lake Michigan.
- Secure resources to clean up contaminated sediment sites.
- Make fish consumption advisory data widely accessible and user-friendly.

Fish Consumption Advisories

Fishing is one of the most popular forms of outdoor recreation in the Midwest, and Americans are eating more fish as our diets shift toward more low-fat foods (for additional information, see *http://www.usda.gov/factbook/intro.htm* , which provides statistics on fish consumption). Fish consumption, however, has been shown to be a major pathway of human as well as wildlife exposure to persistent toxic substances, such as polychlorinated biphenyls (PCBs) and mercury. Contaminants released from many sources are transported through the environment and are carried into streams and lakes. Small organisms absorb these contaminants and are, in turn, eaten by other organisms and small fish. Some of these contaminants bioaccumulate in the fish –and in humans who eat them –to levels that can pose health risks.

State fish consumption advisories are issued to protect people from potential adverse health effects associated with contaminants found in fish. These advisories recommend amounts and types of fish that are safe to eat. Fish consumption advisories may also include information to educate the public on how to minimize exposure to certain contaminants through proper fish

preparation and cooking. The advisories are viewed as a temporary measure to protect the public while control measures and site cleanups reduce contamination to safe levels.

While fish are a good, low-fat source of nutrition, some individuals, particularly pregnant women, developing fetuses and young children, are more sensitive to contaminants than the general adult population. State fish consumption advisories include advice specifically targeted to these sensitive populations.

PCBs are the primary contaminant behind the fish consumption advisories published by all four Lake Michigan states. Other contaminants are present in fish at levels that do not require advice beyond the PCB-based advice. Mercury is also present in Lake Michigan fish advisories, and all four Lake Michigan states have issued warnings about the consumption of fish from inland waters as well. Dioxins, chlordane, and DDT are also present in fish but rarely require advice more stringent than advice based on PCBs with the exception of dioxins/furans in some larger species.

States frequently use fish consumption advisories as indicators of whether their waters are meeting designated uses, triggering the need for investigation and setting a total maximum daily load (TMDL) for contaminants. TMDLs for PCB and mercury are therefore required for Lake Michigan. The fish consumption advisories are updated annually and can be found in the adjacent text box.

Web Links for State Fish Consumption Advisories

Illinois: http://www.idph.state.il.us/envhealth/factsheets/fishadv.htm
Indiana: http://www.in.gov/isdh/programs/environmental/fa_links.htm
Michigan: http://www.michigan.gov/mdch/0,1607,7-132--13110--,00.html
Wisconsin: http://www.dnr.wi.gov/org/water/fhp/fish/advisories

A consolidated source for Great Lakes fish consumption advisories as well as information on other standards applicable to the lakes is available on a Great Lakes Information Network site:

http://www.great-lakes.net/envt/flora-fauna/wildlife/fishadv.html

Mercury Advisories

Mercury is emerging as a growing concern in fish in Lake Michigan, inland lakes in the basin, and in the ocean. To address this concern, the states, U.S. Food and Drug Administration (FDA) and USEPA have issued advisories governing the consumption of fish.

Mercury is a metal that occurs naturally in small amounts in the environment. It also enters the environment from burning coal or trash which can then enter the food chain. Mercury gets into lakes and rivers in several ways, including rain and runoff.

Once released into the environment, inorganic mercury can be converted to organic mercury (methylmercury) which is the primary form that accumulates in fish and shellfish. Methylmercury biomagnifies up the food chain as it is passed from a lower food chain level to a subsequently higher food chain level through consumption of prey organisms or predators. Fish at the top of the aquatic food chain, such as pike and bass in lakes, and shark and swordfish in oceans, bioaccumulate methylmercury approximately 1 to 10 million times greater than dissolved methylmercury concentrations found in surrounding waters. Methylmercury is stored in the muscle of fish, the part of the fish people eat. Skinning and trimming the fish does not significantly reduce the mercury concentration in the fillet, nor is it removed by cooking processes. Because moisture is lost during cooking, the concentration of mercury after cooking is actually higher than it is in the fresh uncooked fish. In contrast, PCBs adhere to fat, so the removal of skin and fat, as well as broiling the meat, removes up to 90 percent of the contamination.

States recommend that if a woman is pregnant or could become pregnant, if a woman is nursing or

in child-bearing years, consumption of freshwater sportfish caught by family and friends should be limited to one meal per week. For adults, one meal is 6 ounces of cooked fish or 8 ounces of uncooked fish; for a young child, one meal is 2 ounces of cooked fish or 3 ounces of uncooked fish.

The FDA has issued advice concerning mercury in commercial fish in stores and restaurants, which includes ocean and coastal fish as well as other types of commercial fish. FDA advises that women who are pregnant or could become pregnant, nursing mothers, and young children not eat shark, swordfish, king mackerel, or tilefish. FDA also advises that women of childbearing age and pregnant women may eat an average of 12 ounces of fish purchased in stores and restaurants each week. Therefore, if in a given week such a woman eats 12 ounces of cooked fish from a store or restaurant, she should not eat fish caught by her family or friends that week. It is important to control the total level of methylmercury consumed from all fish. EPA, FDA, and state officials are working together to ensure the advice is effective and gets to the appropriate audiences.

PCB Advisories

PCBs are a group of more than 200 similar man-made chemicals that were used as insulating fluid for electrical equipment like capacitors and transformers. They are oily liquids or solids, clear to yellow in color, with no smell or taste. More than 1 billion pounds of PCBs were manufactured in the United States. Because of the health effects associated with exposure, commercial production of PCBs ended in 1977. In 1979, the U.S. Environmental Protection Agency (USEPA) banned all use of PCBs; however, PCB removal or replacement was not required for equipment that already contained these chemicals and was in a closed system. PCBs are still present in many products made prior to 1979. Because these contaminants were used so widely and take a long time to break down, they can be found everywhere. PCBs accumulate in the fat of people and animals.

Developing a Lake Michigan Strategy for Impaired Waters

The purpose of this strategy is to outline a draft process to develop a collaborative Lake Michigan Strategy for Impaired Waters to reduce and virtually phase out the introduction and remediation of mercury, PCBs, and certain banned pesticides, which have resulted in fish consumption advisories, into the Lake Michigan ecosystem.

Although the States have primary responsibility for preparing Total Maximum Daily Loads (TMDL) for impaired water bodies, EPA has agreed to provide resources, technical assistance and facilitation to support the States' TMDL development efforts on interstate waters like the Great Lakes. Furthermore, recent changes to EPA 303(d) list guidance allow the States to address impaired waters that are being remediated by other means in a manner that could delay or possibly eliminate the need for TMDL development.

This raises the question of what a strategy to address the impaired waters of Lake Michigan should be? Any strategy will take time to develop and implement. It should provide opportunities for the parties to work collaboratively and avoid duplication of effort. Such a strategy would be

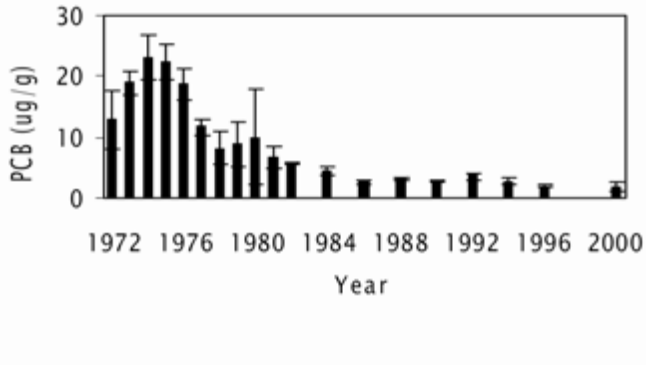


Figure 1-1: PCBs in Lake Michigan Whole Lake Trout
Source: United State Geological Survey

useful to divide the development and possible products from the discussion into stages aligned with the LaMP publications from 2006 through 2010 (see Figure 1-2 for a comparison of the LaMP and TMDL processes). The stages could include activities and milestones tracked over time to ensure that progress is being made to remediate Lake Michigan. Any strategy would need to be reviewed and mid-course changes considered at each two year interval. If sufficient progress is not made by 2010, work on standard TMDLs for Lake Michigan would need to begin and be completed by 2013 per the current 303(d) schedule.

To implement this approach, the following activities should be conducted over the next two years:

- Introduce Strategy concept in LaMP 2004 (spring 2004)
- Finalize 2005 Intensive Lake Michigan Monitoring Plan and GLNPO Open Lake Organics monitoring (summer 2004)
- Present Lake Michigan Mass Balance models to states and stakeholders; Begin strategy discussion (fall 2004)
- Develop and share matrix of successful state programs (see appendix C for example) (spring 2005)
- Present strategy dialogue status at State of Lake Michigan Conference (fall 2005)
- If developed, propose strategy in LaMP 2006 (spring 2006)

The Lake Michigan LaMP 2000, Appendix E, provided an overview of issues and information needs for a full TMDL Strategy for Lake Michigan. LaMP 2002 summarized the dialogue and meetings since LaMP 2000 and provided an early draft of a Mercury Phase Out Proposal. LaMP 2002 also provided data from the Lake Michigan Mass Balance Study and Enhanced Tributary Monitoring Project.

Appendix C includes Pollutant Minimization

Fish Smart! Eat Safe!
PCB Risk Communication and Outreach Project

This two-year study and outreach campaign found that non-English-speaking urban fishers and their families may be at risk for excessive PCB exposure from consuming their catch because they have not heard about fish advisories for this contaminant.

Funded by a Persistent Bioaccumulative Toxics (PBT) Program regional project, researchers surveyed urban fishers at two Lake Michigan sites during the summers of 2002 and 2003, and developed several outreach tools during the second year to increase awareness of PCBs in the local catch. They also built relationships with local ethnic associations and health agencies to generate interest and possible assistance on this issue.

Among the findings were:

- 82% of the 217 respondents share their catch with family and friends.
- Among all fishers, 14% eat their catch once per month; 13% eat twice or more per month; and 33% eat their catch once per week or more often.
- 60% of Non-English speakers eat their catch once per week or more often; fish may be a larger part of their diet.
- Among all fishers, 41% have not heard of fish advisories; among Non-English speakers, 65% have not heard of them, which represents a significant difference.
- Non-English speakers may also have additional exposure based on the species they prefer to consume, and the cooking methods used.
- Finally 14% of all fishers reported consuming catfish and carp, neither of which should be consumed from Lake Michigan.

The researchers concluded that traditional fish advisories may not be reaching non-English speakers adequately. They identified several systemic factors contributing to this problem, and recommended steps to address them.

For details and additional information, please call Seth Dibblee, Toxics Program Section, University of Illinois-Chicago, at (312) 886-5992.

TMDL/LaMP Comparison

	TMDL	LaMP
Scope	Water body quality	Ecosystems/watersheds
Goals	State designated uses and standards	Adopted goals, beneficial uses
Problem Identification	Problem identification and documented source assessment	Problem identification and documented source assessment
Targets	Numerical targets for loadings	Endpoint target reductions and ecosystem objectives
Research and Development	Link targets/sources = load and waste load allocations	Link target/sources = projects
Tools/Impacts	Monitoring plan for stream reach	Ecosystem monitoring plan
Point Source	Permit limits (per effluent guidelines)	Indicators, compliance assistance projects
Non-point Sources	Voluntary (mandatory in Wisconsin or requires a cost share), best management practices, pollution prevention, education	Voluntary, best management practices, pollution prevention, education
Follow-up Plan	Permit/stream specific regulated entity	Sector specific, both public and private projects
Process	CWA, defined in regulation, technical calculation reviewed by EPA	CWA and GLWQA partnership approach to manage pollutants
Tribes	Must have treatment as a State-adopted water quality standards	LaMP committee membership

Figure 1-2 TMDL/LaMP Comparison

Program examples of state mercury reduction activities.

Pollutant Minimization Program

In addition the US EPA Region 5 Water division and states have reached agreement on a draft guidance document for the NPDES Permit Pollutant Minimization Program (PMP) for Mercury. The goal is to aid in meeting the Great Lakes Initiative water quality standards the states adopted for mercury in permits. The PMP guidance will be out for public comment in Summer 2004. contact *gluckman.matthew@epa.gov* or go to the Pretreatment Website at: http://www.epa.gov/r5water/npdestek/npdprta.htm

Next Steps

- Develop the Impaired Waters Strategy.
- Gather public comment on the Draft Guidance for Mercury Pollutant Minimization Program during summer 2004.
- Cleanup of superfund sites and other PCB contaminated harbors

Long-Term Objectives

- By 2006, the Binational Toxics Strategy goals of 90 percent reduction of high-level PCBs, 75 percent reduction of total dioxin and furan releases, and 50 percent reduction of mercury use and release will be reached.
- By 2007, concentrations of PCBs in lake trout and walleye will be reduced by 25 percent. These results are based on early Lake Michigan Mass Balance model runs.
- In summer 2004, complete public comment draft Guidance for Mercury Pollutant Minimization Program, summer 2004.

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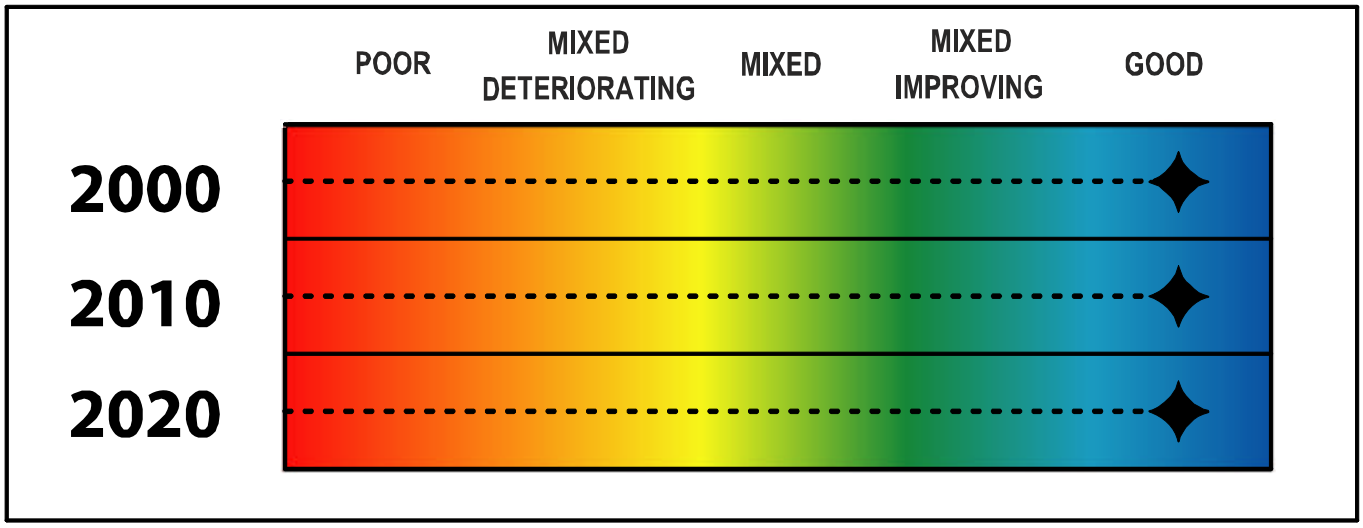
Subgoal 2
Can we drink the water?



Status

The drinking water in the Lake Michigan basin is of good quality, although there have been sporadic outbreaks of illness related to drinking water. The waters of Lake Michigan and surrounding areas are a primary source of drinking water for 10 million people who live in the basin. The Lake Michigan states currently are delegated to run their own drinking water programs. Since LaMP 2000 the issue of ground water depletion has been growing in importance with implications for drinking water sources and habitat (see Chapter 6 for more information on ground water).

Challenges

- To understand possible vulnerabilities in water sources and prepare protection plans.
- To monitor for possible new contaminants.
- To understand the implications and monitor groundwater depletion in the basin as it relates to Lake Michigan as a source.
- To educate the public on the hydrological cycle and the need for stewardship of both drinking water quantity and quality.

Drinking Water Contaminants

Various contaminants can adversely impact drinking water, including microorganisms (e.g., bacteria, viruses, and protozoa such as cryptosporidium), chemical contaminants (including naturally occurring compunds and anthropogenic or synthetic chemicals), and radiological contaminants (including naturally occurring inorganic and radioactive materials and metals). Some contaminants in raw (untreated) water supplies, such as aluminum, arsenic, copper, and lead, can be both naturally occurring and the result of human activities. Other contaminants, such as household chemicals, industrial products, urban storm water runoff, fertilizers, human and animal waste, nitrate (from fertilizers and sewage), and pesticides, may also end up in raw water supplies (EPA, 1999a; Health Canada, 1998).

Certain contaminants pose a concern when present in drinking water because of possible health consequences associated with these substances. These contaminants may be in raw water as a result of industrial and agricultural activities or treated wastewater discharges (Minnesota Pollution Control Agency [MPCA], 1997). Some may also be present in treated water as a result of chemicals used in the drinking water treatment process (Health Canada, 1998). The impact of contaminants is diluted in a large water body like Lake Michigan but could be more serious in a groundwater source.

In general, drinking water provided by public

Source Water Assessment Program Status

The Safe Drinking Water Act Amendments of 1996 established the Source Water Assessment Program (SWAP) to help States locate and identify existing and potential threats to the quality of public drinking water for the purpose of fostering local efforts to benefit and protect this resource. States are responsible for assessing the condition of source water for all public water systems within their borders.

Each states' source water assessment program differs since they are tailored to each state's water resources and drinking water priorities. However, each assessment must include four major elements:

- delineating (or mapping) the source water assessment area,
- conducting an inventory of potential sources of contamination in the delineated area,
- determining the susceptibility of the water supply to those contamination sources, and
- releasing the results of the determinations to the public.

Wisconsin and Illinois of the Lake Michigan basin states have completed all steps in the assessment process. The remaining Region 5 States are in the process of completing assessments. Regionwide, assessments have been produced for approximately 82% of all water systems. Assessment distribution to the public is progressing at a slower rate, in order to ensure that sensitive information is properly delivered and that opportunities for encouraging local voluntary protection efforts are maximized.

More information on this program is available at the following internet address: *http://www.epa.gov/safewater/protect/assessment.html#Anchor-Source-11481*.

water suppliers is likely to remain of good quality because of the multiple pollutant barrier approach being implemented across the basin. Not only are treatment systems and operating practices continually improving, increased monitoring is also providing more information about source water supplies and the need for source water protection. In the past two years, greater emphasis has been placed on assessing and protecting raw sources of drinking water. Both the source water assessments that were completed for public water supplies by 2003 (see text box) and recent data collected from 22 sites around the Great Lakes are providing more information about raw water supplies.

Drinking Water Monitoring and Reporting

Continuing efforts must be made to inform health professionals and the public of the results of analyses of drinking water. EPA requires that public water supplies be monitored for bacteriological, inorganic, organic, and radiological contaminants. The analyses of drinking water include tests for the physical and chemical characteristics of the water as well as for contaminants from natural sources or human activities. In addition, the EPA Office of Groundwater and Drinking Water (OGWDW) web site at *www.epa.gov/OGWDW/* provides detailed information on the nation's drinking water, including drinking water and health information, drinking water standards, and local drinking water information. Community water suppliers deliver high-quality drinking water to millions of people every day, and a network of government agencies is in place to ensure the safety of public drinking water supplies.

Inadvertent Water Contamination

Contamination of drinking water sources can result inadvertently during the production, use, and disposal of the numerous chemicals used in industry, agriculture, medical treatment, and in the household conveniences. Knowledge of the environmental occurrence or toxicological behavior of contaminants has resulted in increased concern for potential adverse environmental and human health effects. For many contaminants, public health experts have incomplete understandings of their toxicological

Public Health Security and Bioterrorism Preparedness and Response Act of 2002

The Act requires community drinking water systems that serve populations greater than 3,300 persons to conduct assessments of their vulnerabilities to terrorist attack or other intentional acts intended to substantially disrupt the ability of the system to provide a safe and reliable supply of drinking water. The systems must submit a copy of their vulnerability assessments to the US EPA. Prior to receiving the assessments, EPA has the responsibility to implement a protocol to protect the vulnerability assessments from unauthorized disclosure.

The Act requires every community water system that serves a population of greater than 3,300 persons to:

1. Conduct a vulnerability assessment. The vulnerability assessments shall include, but be limited to, an assessment of the following:
   - pipes and constructed conveyances,
   - physical barriers,
   - water collection, pretreatment, treatment, and storage facilities,
   - electronic, computer, or other automated systems,
   - use, storage, or handling of various chemicals, and
   - operation and maintenance of the system.
2. Certify and submit a copy of the assessment to the EPA Administrator (see schedule below);
3. Prepare or revise an emergency response plan that incorporates the results of the vulnerability assessment; and
4. Certify to the EPA Administrator, within 6 months of completing the vulnerability assessment, that the system has completed or updated their emergency response plan.

Systems serving population of:	Certify and submit Vulnerability	Certify Emergency Response
100,000 or greater	March 31, 2003	Six months following the completion of the vulnerability assessment
50,000 - 99,999	December 31, 2003	
3,301 - 49,999	June 30, 2004	

significance (particularly effects of long-term exposures at low-levels). The need to understand the processes controlling contaminant transport and fate in the environment, and the lack of knowledge of the significance of long-term exposures has increased the need to study environmental occurrence down to trace levels. Furthermore, the possibility that environmental contaminants may interact synergistically or antagonistically has increased the need to define the complex mixtures of chemicals that are found in our waters (*http://toxics.usgs.gov/regional/emc.html*)

Water Quality Tracking

A key action was set in the 2002 Great Lakes Strategy that, "Beginning in 2002, the US Environmental Protection Agency (USEPA), in cooperation with local utilities, will track water quality at the intake points of selected drinking water treatment plans around the Lakes. Findings will be reported to the public through the biennial State of the Lakes Ecosystem Conference (SOLEC) State of the Lakes report." *http://www.epa.gov/glnpo/gls/gls04.html*.

As of April 2003, the USEPA has examined data

provided by 114 public water systems in the Great Lakes basin and by the U.S. Safe Drinking Water Information System. Specifically, USEPA has evaluated various contaminants, including the following:

- Atrazine, an agricultural pesticide
- Nitrate and nitrite, which are naturally occurring nutrients found at high levels in fertilizers
- Total coliform bacteria, E. coli, protoza, giardia, and cryptosporidium may contaminate water supplies after sewage spills

Drinking Water Education

Drinking Water Academy

Established by the U.S. EPA Office of Ground Water and Drinking Water, the Drinking Water Academy (DWA) is a long-term training initiative whose primary goal is to expand EPA, State, and Tribal capabilities to implement the 1996 Amendments to the Safe Drinking Water Act (SDWA). In addition to providing classroom and Web-based training, the DWA acts as a resource for training materials pertaining to SDWA implementation. EPA formed the DWA to help States, Indian Tribes and water suppliers enhance their program capability to meet the public health protection objectives of the SDWA requirements. The 1996 SDWA Amendments created a number of new programmatic challenges for the States, Tribes, and the water systems they regulate. The Amendments also provided new funding opportunities to meet these growing needs. DWA training will support EPA, State, and Tribal efforts to implement these new regulations, *http://www.epa.gov/safewater/dwa.html*.

Drinking Water Security Education Materials

The USEPA has recently developed a collection of useful education and resource materials on drinking water security. The information includes resources on Emergency preparedness, drinking water security, and law enforcement information. All materials can be found at: *http://www.epa.gov/safewater/security/flyers/*

USEPA has also examined the turbidity, taste, odor, and organic carbon content of drinking water supplies to assess any other potential health issues. Of the public water systems evaluated between 1999 and 2001, none exceeded drinking water standards for atrazine, and only one exceeded drinking water standards for nitrate and nitrite after treatment. However, atrazine, nitrate, and nitrite are detected at elevated levels in the Great Lakes, which indicates that advanced treatment technologies prevent the entry of significant concentrations of these contaminants from entering drinking water systems. For total coliform and E. coli, only one violation of drinking water standards occurred between 1999 and 2001 in the Great Lakes basin. Finally, public water systems rarely have problems with turbidity, taste, odor, or organic carbon content.

Remedial Action: Drinking Water State Revolving Fund

The Nation's water systems must make significant investments to install, upgrade, or replace infrastructure to continue to ensure the provision of safe drinking water to their 240 million customers. Installation of new treatment facilities can improve the quality of drinking water and better protect public health. Improvements are also needed to help those water systems experiencing a threat of contamination due to aging infrastructure systems.

The Safe Drinking Water Act, as amended in 1996, established the Drinking Water State Revolving Fund (DWSRF) to make funds available to drinking water systems to finance infrastructure improvements. The program also emphasizes providing funds to small and disadvantaged communities and to programs that encourage pollution prevention as a tool for ensuring safe drinking water. The funds are passed from EPA to each state. For more information see *http://www.epa.gov/safewater/dwsrf.html*.

Drinking Water Quality Reports

Information on local water quality is available from several sources, including state public health departments and local water suppliers. To inform

the public of the results of analyses of drinking water and to demonstrate a commitment to protecting human health, each community public water supplier is required to generate an annual Consumer Confidence Report that is made available to all residents receiving water from the water system. A Consumer Confidence Report provides information about the source of water used, its susceptibility to contaminants, the levels of contaminants detected in the water, the likely sources of contaminants, and potential health effects of any contaminant detected at a concentration above its maximum contaminant level (MCL). Consumer Confidence Reports can be reviewed to get an indication of the overall quality of treated surface water and groundwater and the condition of the drinking water provided. In addition, starting in 2003, the states will distribute information on the status of the source waters used by public water suppliers and the level of susceptibility of those source waters to contamination.

Next Steps

- Seek funding to develop a source water protection GIS system.

Long-Term Objectives

- By 2005, plans will be in place to address drinking water susceptibility to contamination.
- By 2006, source water assessments (including security assessment) will all be completed and reported.

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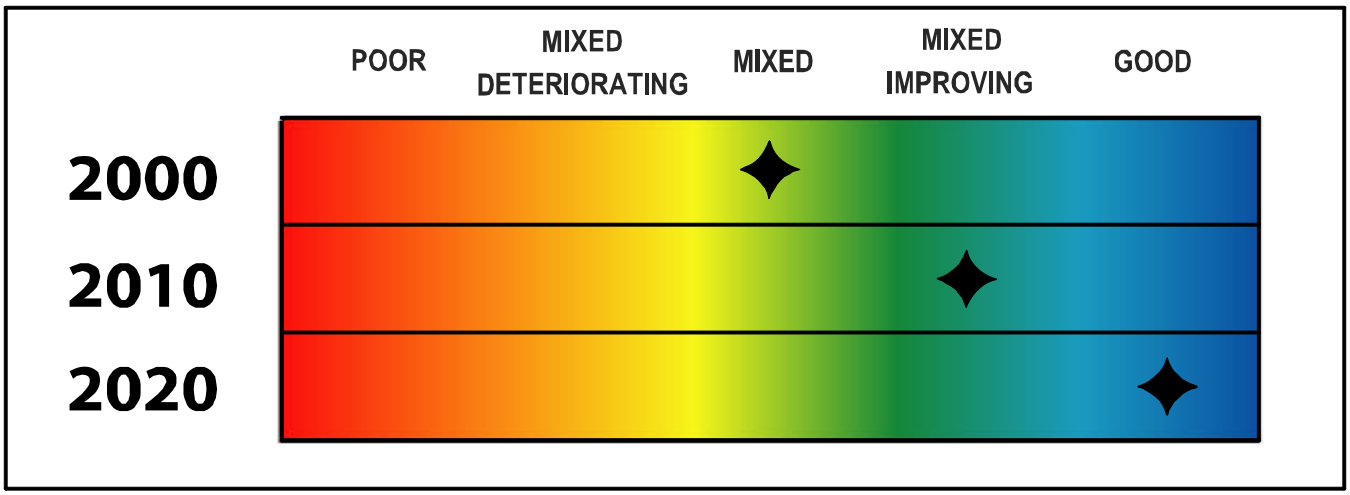
Subgoal 3

Can we swim in the water?



Status

Lake Michigan contains the world's largest collection of freshwater sand dunes and associated beaches, particularly along its eastern shore. Of a total of 3,100 coastal acres, 1,200 acres is publicly owned and available for use, while an additional 1,200 privately owned acres has significant potential for public use. It is important to note that most shoreline areas along Lake Michigan support swimming and secondary contact recreation. However, some areas do experience episodic beach closures because of elevated levels of *E. coli* bacteria. This may be due to stormwater runoff, sewer overflows or even waterfowl droppings. Recent studies show other factors like geography, water depth, weather, beach grooming practices and nearby animal populations contribute to beach closures. As a result, the current status of the goal is mixed.

Challenges

- Maintain and not overtax the wastewater control infrastructure.
- Address nonpoint sources of pathogen load to beaches and water bodies.
- Build a real-time beach monitoring and reporting system.
- Continue research and development on testing systems and beach grooming

Federal Beach Act

Beach closures resulting from high pathogen loads have a negative effect on the lake's significant tourist industry. Wet weather that causes overflows from aging wastewater collection systems or treatment plants, runoff from cities and farms, improperly sited or maintained septic systems, and natural sources release pathogens into tributaries and the lake. When pathogen levels exceed standards, beach managers post "Beach Advisory or Closure" notices in order to protect human health.

In October 2000, the U.S. Congress passed federal legislation amending the Clean Water Act that is

Defense Department Developing Rapid Water Quality Testing Technology

The U.S. Army Tank-Automotive and Armament Command (TACOM) are moving forward with a $250 million development of a portable water quality detector for its soldiers. In addition, TACOM hopes to develop a hand-held device that can be used in the field to take samples and identify potential biological and chemical threats in real time. This technology will be made available to troops and civilians and can be used to monitor water quality on beaches more effectively in the future so that the public can be warned more quickly when it is unsafe to swim at beaches.

NEEAR Water Study Helps Set New Beach Alert Standards

The National Epidemiological and Environmental Assessment of Recreational (NEEAR) Water Study is a multi-year research project evaluating the health effects of persons using recreational waters for swimming, boating, diving, surfing, and other activities. The objectives of the NEEAR Water Study are to (1) evaluate the water quality at two to three beaches per year for three years concurrently with a health study, (2) obtain and evaluate a new set of health and water quality data for the new rapid, state-of-the-art methods, and (3) develop new federal guidelines and limits for water quality indicators of fecal contamination (USEPA Office of Water) so that beach managers and public health officials can alert the public about the potential health hazards before exposure to unsafe water can occur. *http://www.epa.gov/nerlcwww/neearnerl.htm*

Constructed Wetlands Could Help Beach Health

Wetlands and marshes help to clean water naturally before the water makes its way to its destination following the lowest point. Wetlands that are not ditched or filled in by developers provide this filtering to water. Ditches short-circuit the water from the treatment benefits of being spread out over large areas where the proper conditions of light, plants, and soil filtering take out some unwanted contaminants such as *E. coli*.

A man-made one-acre wetland is under construction at the Indiana Dunes State Park in the Dunes Creek watershed to help filter runoff before it gets to the beach on Lake Michigan. The constructed wetland will give scientists insights into the dynamics of how wetlands work and may serve as a prototype for building additional wetlands.

referred to as the Beaches Environmental Assessment and Coastal Health Act, or the BEACH Act. The BEACH Act requires adoption of consistent bacterial standards nationwide, research on new pathogens and pathogen indicators, issuance of new or revised criteria and guidance within 5 years, and development of rapid analytical techniques for faster notification of the public regarding elevated bacteria levels. The act also authorizes EPA to award grants to eligible coastal and Great Lakes states in order to set up beach monitoring and public notification programs. In 2001, $2 million was appropriated for coastal states to develop beach monitoring and notification programs, an additional $10 million was appropriated in 2002 to continue program development and in 2003, and $9.935 million was made available to coastal states to implement beach monitoring and notification programs. A similar amount will be made available this summer to continue program implementation. Out of the 2002 and 2003 appropriations, the four Lake Michigan states received over $1 million each year.

To provide more protection against gastrointestinal illness, EPA requires that all states adopt *E. coli* criteria for use as beach water quality indicators by 2004. The BEACH Act grants will result in improved beach monitoring and public notification programs. EPA's Office of Research and Development (ORD) will be conducting epidemiological studies to examine health risks associated with swimming at several beaches across the country, including beaches on the Great Lakes.

Significant progress by state, county, and tribal governments has been made since the BEACH Act was implemented. Now, there is more widespread monitoring that takes place within the basin.

Great Lakes Beach Conference and Follow-up Activities

In February 2001, an EPA, LaMP, and City of Chicago-sponsored Great Lakes Beach Conference was held to share information on the science and technology of beach monitoring as well as research on exposure, health effects, and water quality indicators. More than 250 environmental and public health officials, beach managers, and regulators attended the 3-day conference. The conclusions of the conference saw the formation of the Great Lakes Recreation Association whose list serve and annual meetings provide quick sharing of research findings. In addition, Great Lakes beach closure maps have been updated by EPA Region 5. Additional opportunities for information sharing and networking will be pursued. A National Beach Guidance and Performance Criteria for Recreational Waters was produced by EPA.

Additional information regarding the BEACH Act is available at *www.epa.gov/OST/beaches*. For more information on beach management issues, see the following web sites:

- BeachNet e-mail list - *www.great-lakes.net/lists/beachnet/beachnet.info*
- Great Lakes Beach Conference 2001 complete conference proceedings - *www.glc.org/monitoring/beaches/GLBC/*
- Additional beach information or applying for beach grant funds - *www.epa.gov/waterscience/beaches*

Monitoring and Notification Program Development

Wisconsin: In the 2003 season, about 100 percent of the high and medium priority beaches identified along the Lake Michigan coast had beach monitoring and public notification programs in place. Thirty-six percent of the low priority beaches are being monitored. Those beaches that are not being tested because they are very small beaches with little or no use at all.

Illinois: In the 2003 season, 100 percent of Illinois' high-priority beaches in the Great Lakes basin had beach monitoring and public notification programs in place. The method of notification varied from web-based notification to posting paper notices at the beaches. Dog beaches were also monitored in many communities.

Indiana: In the 2003 season, 100 percent of Indiana's high-priority beaches in the Great Lakes basin had beach monitoring and public notification programs in place.

Michigan: In the 2003 season, 59% of Michigan's beaches in the Great Lakes basin had beach monitoring and public notification programs in place.

Because the Lake Michigan states currently use different standards and measurement methods to determine the need for beach closings, there are limitations on the ability to compare frequencies of exceedances of microbiological standards in order to evaluate trends in recreational water quality. However, all states use *E. coli* standards officially and unofficially. Despite these limitations, the frequency of beach postings has traditionally been used as an indicator of recreational water quality. Microbial standard exceedances may be a better measure of the actual health risk associated with recreational water quality. By 2004, all Great Lakes states intend to adopt bacteria criteria at least as protective as EPA's Ambient Water Quality Criteria for Bacteria – 1986. EPA's annual voluntary beach survey program

Chicago, Milwaukee Deep Tunnels to Control Combined Sewer Overflows

Both the Chicago Metropolitan area and the Milwaukee Metropolitan area have undertaken deep tunnel plans. Both tunnel systems allow for the containment of overflow wastewater until a time when the excess can be treated and returned to the nearest water body. The Chicago Tunnel and Reservoir Plan (TARP) (http://www.southholland.org/Tarp_Plan.htm) was created to address combined sewer systems of Chicago and 51 older municipalities in Cook County and their continuous problems of flooding and water pollution. The TARP was selected due to its cost effectiveness and its ability to incorporate other systems already in place. The TARP consists of 109 miles of underground tunnels that are burrowed under the city it intercept combined sewer overflow and divert it to large storage reservoirs until it can be treated. The United States Environmental Protection Agency has provided nearly 75% of the funds necessary for the TARP. The Milwaukee Deep Tunnel Plan was also instituted to address the problem of the area's flooding and water pollution (*http://www.mmsd.com/tunnelfactsheet.html*). The MDTP consists of 19.4 miles of tunnel and can hold up to 405 million gallons of wastewater.

Wisconsin Beach Monitoring Program

In 2003, Wisconsin launched its first comprehensive beach monitoring program for Great Lakes beaches. Over 117 beaches were monitored for *E. coli* bacteria. Advisory or Closure signs were posted whenever the results exceeded EPA's recommended criteria of 235 cfu/100mL. The data was also posted on the Beach Health website, giving the public access to monitoring data and beach advisories or closures. In 2004 over 132 beaches will be monitored. For more information about the Wisconsin beach program visit dnr.wi.gov/org/water/wm/wqs/beaches/.

Cladophora Alga

Cladophora is a branching, green filamentous alga found naturally along the coastline of most of the Great Lakes. Research in the 1960's and 70's linked *Cladophora* blooms to high phosphorus levels in the water, mainly as a result of human activities such as fertilizing lawns, poorly maintained septic systems, inadequate sewage treatment, agricultural runoff and detergents containing phosphorus. Due to tighter restrictions, phosphorus levels declined during the 1970's and *Cladophora* blooms were largely absent in the 1980's and 90's.

There has been a recent resurgence of macroalgae, predominantly *Cladophora*, along the coast of Lake Michigan and other Great Lakes. These algae blooms lead to unsightly and foul-smelling beaches and have negative economic consequences as a result of the lowered beach use. In addition, *Cladophora* blooms result in reduced quality of drinking water and decreased property values. Reasons for the current resurgence are unknown. Possible causes include increased nutrient inputs, increased water clarity, increased water temperature and changing lake level. While there have been some efforts to remove *Cladophora* from beaches, ultimately the solution to the *Cladophora* problem requires the identification of the factors promoting *Cladophora* growth in the lake, and if possible the mitigation of those factors.

It is unknown if there are increased nutrient concentrations entering the lake via streams and rivers or if zebra mussels redistribute existing nutrients from the phytoplankton they consume to the *Cladophora*. Both may be happening. Work on the Milwaukee River indicates that input of the nutrient most likely to foster *Cladophora* growth, phosphorus, has increased in recent years. (Source: Great Lakes Water Institute, University of Wisconsin-Milwaukee)

For more information on cladophora, see chapter 8 and *www.uwm.edu/Dept/GLWI/cladophora*.

provides an indication of the status of beach health.

- **Illinois:** Illinois has a total of 69 beaches on Lake Michigan, 23 of which are in Chicago. In the 2003 season, 10% of Illinois beaches in the Great Lakes basin outside of Chicago met bacteria standards more than 95% of the time. In Chicago, based on the Chicago Park District's beach closure procedures, 60% of the lakefront beaches met bacteria standards more than 95% of the time.*
- **Indiana:** In the 2003 season, 28 percent of the Indiana beaches in the Great Lakes basin met bacteria standards more than 95 percent of the time.
- **Michigan:** In the 2003 season, 70 percent of the Michigan beaches in the Great Lakes basin met bacteria standards more than 95 percent of the time.
- **Wisconsin:** In the 2003 season, 45% of the beaches monitored met bacteria standards more than 95% of the time.

Water Quality Research and Indicators

New research in the field of water quality indicators has revealed that the use of fecal coliform and *E. coli* are no longer the most accurate indicators of contaminated water available. According to M.E. Bruesch and P. Biedrzycki of the Milwaukee Health Department, Division of Disease Control and Prevention, "Prediction of *E. coli* levels can support but does not assure accurate prediction of risk to swimmers at the time of contact". The usefulness of these indicators is dependant upon the source (animal or human) and local conditions. Time is no longer a variable in determining a health risk through the detection of *E. coli*. A study by R.L. Whitman, et al (2003) entitled, "Seasonal Persistence of *Escherichia coli* and Enterococci in Backshore Sand at the Groundwater Table of Two Lake Michigan Beaches" states that the "long-term persistence of these bacteria independent of pollution events further complicates their use as indicator organisms." Current practices rely on

* The Chicago Park District (CPD) closes a beach if a water quality standard is exceeded for 2 consecutive days, not when one sample exceeds the bacteria standard, as recommended by EPA. Therefore, the percentage of beach closures in Chicago is not consistent with the number of beach closures in Illinois and other states.

the use of *E. coli* and Enterococci as water quality indicators. While these indicators are useful in detecting potential threats to human health, they are not the most efficient indicators and much of this new research helps to demonstrate the need to adopt new indicators.

Great Lakes Information Network's new human health web site - *www.great-lakes.net/humanhealth/*

Next Steps

- Help coordinate outreach materials development.
- Continue support of Great Lakes recreation managers meetings at State of Lake Michigan meetings.
- Report on research on beach grooming, tests and cladophora cause.

Long-Term Objectives

- By 2004, states will adopt criteria, standards, and monitoring programs for beach bacteria.
- By 2005, achieve a 30 percent reduction from the 1992 per capita loadings from combined sewer overflows (CSO), POTWs, and industry.
- By 2005, 95 percent of high-priority beach waters (as defined by the state) will be monitored and a public advisory system will be in place.
- By 2007, 90 percent of monitored high-priority beach waters (as defined by the state) will meet federal and state bacteria standards for more than 95 percent of the average swimming season.

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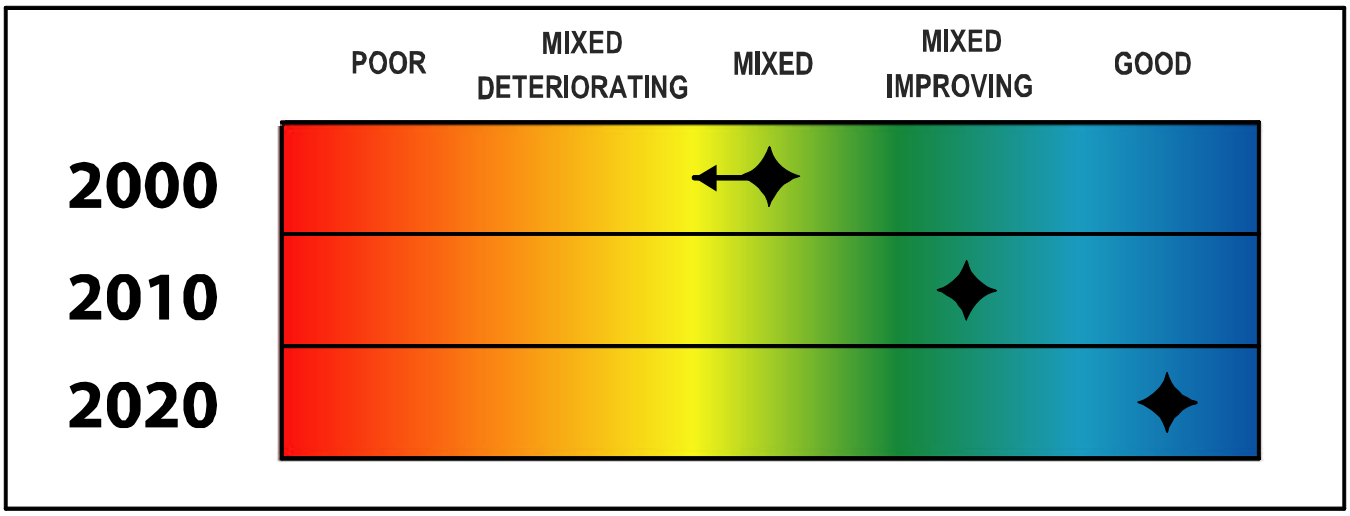
Subgoal 4

Are all habitats healthy, naturally diverse, and sufficient to sustain viable biological communities?



Status

The Lake Michigan ecosystem continues to experience profound changes because of development, impacts of nuisance species, and pollutant loading. Overall, the status of Lake Michigan habitats, including open water, wetlands (coastal and inland), coastal shore, tributaries, lakeplains, and inland terrestrial systems, is mixed to deteriorating. Many species' habitats rank as globally rare or imperiled based on their restricted distribution, the level of threat, their ecological fragility, and widespread damage or because they are part of the single largest source of fresh surface water in the world. This section assesses the status of each of the general habitat types in the Lake Michigan ecosystem and highlights significant events since the issuance of LaMP 2000. This assessment includes an overview of continuing trends in habitat loss and decreased biodiversity as well as the impacts of aquatic nuisance species.

Challenges

- To make habitat information on status and value readily available.
- To build on the above challenge to promote projects, to identify, enhance, restore, or protect critical ecosystem features and habitat through purchase or voluntary protection or improved management.

Open Lake System

The open lake waters of Lake Michigan consist of both nearshore and offshore waters, including all waters from the offshore edge of coastal wetlands lakeward. Significant changes in the lake ecosystem began in the mid-1800s when large numbers of people began to settle and develop the region. Multiple stressors continue to negatively impact the open lake ecosystem. The status of this ecosystem is changing and is heavily dependent on human management through predator fish stocking and control of exotic species such as the sea lamprey and zebra mussel.

Fish communities represent the highest trophic levels within the Lake Michigan aquatic ecosystem. They are also the most visible indicators of ecosystem health and to most people, they represent one of the most important resources of the lake. Originally, Coregonids (including lake whitefish, lake herring, chubs, and ciscoes) dominated the fish communities,

successfully inhabiting the many niches within the lake. Following the introduction of the sea lamprey in the 1950s, the population of top predator fish (such as lake trout and burbot) were decimated, and exotic species such as the alewife and rainbow smelt flourished. The alteration of fish communities has been the most obvious impairment to the aquatic ecosystem of Lake Michigan.

Threats to the Top of the Food Chain

The Lake Trout

Lake trout *(Salvelinus namaycush)* is a North American salmonid that thrives in cold, fresh water. Following the retreat of the last glacier, the lake trout colonized Lake Michigan, and over the subsequent 10,000 years or so, it became the top predator in a complex ecosystem that co-evolved with the other fish species.

During the 1800s, Commercial fishing for lake trout also became an industry, and by the beginning of the 20th century, the lake trout population was in decline. The decline continued until the mid-1950s, when predation by sea lamprey, overfishing, and the effects of industrial pollution

Lake Trout
Photo Courtesy of the Ontario Department of Fisheries and Oceans

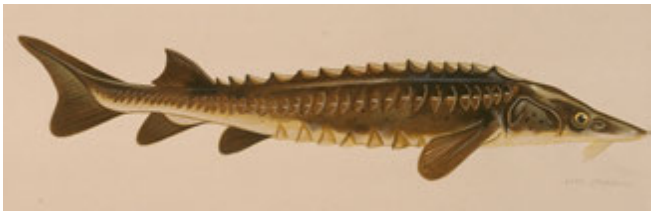
led to the destruction of lake trout fisheries and the disappearance forever of many of the strains of lake trout that had evolved in the lake.

Currently, federal, state and tribal management agencies around the lake are attempting to re-establish naturally reproducing populations of lake trout by planting yearlings and eggs in historical spawning areas. Assessments indicate that self-sustaining populations of lake trout have yet to be established. Research into the reasons for this failure are ongoing, but may include:

- Loss of suitable spawning habitat
- Environmental contaminants
- Predation on larval lake trout by alewife
- Thiamine deficiency from a diet of alewife
- Loss of genetically distinct strains

The Lake Sturgeon

Eight species of sturgeon live in American waters today. Four are endangered and another is threatened. Unlike most other fish, sturgeon mature late and reproduce slowly. Sturgeons survive in the Great Lakes only in scattered remnants, even though large-scale commercial fishing for them ended a century ago.



Lake Sturgeon
Figure Courtesy of the Ontario Department of Fisheries and Oceans

Lake sturgeon populations in Lake Michigan continue to sustain themselves at a small fraction of their historic abundance. Based on available data, an optimistic estimate of the lakewide abundance of adult lake sturgeon is below 5,000 fish, well below 1% of the most conservative estimates of historic abundance. Remnant populations currently are known to spawn in waters of at least 8 tributaries having unimpeded connections to Lake Michigan. Estimates of spawner abundance in these rivers range from just a few fish to several hundred annually. Successful reproduction has been documented in six tributaries to date, though it is suspected in several others.

There are currently 16 agencies and institutions involved with investigations of lake sturgeon in Lake Michigan, including determining the status of known and suspected remnant spawning populations. Reintroduction efforts have been ongoing in upriver reaches of the Menominee and Wolf rivers for several years and were initiated in the Milwaukee and Manitowoc rivers in 2003. A

Lake Sturgeon Task Group has been formed under the auspices of the Lake Michigan Committee to develop and coordinate the implementation of a lake-wide lake sturgeon rehabilitation plan for Lake Michigan. More information is available at: *http://greatlakes.fws.gov/GLSturgeonCoordMttg02.pdf*

Threats to the Food Web Foundation

The plankton communities (microscopic plant and animals) of Lake Michigan are the foundation of the food web and therefore are one of the most critical components of the lake's ecosystem. Changes to these communities may be occurring as a result of the presence of contaminants and nutrients in the water and sediment as well as exotic species such as the spiny water flea (*Bythotrephes cederstroemi*) and the zebra mussel (*Dreissena polymorpha*).

The abundance and types of phytoplankton are highly variable within the lake, depending on the time of year, area of the lake, and availability of phosphorus and other nutrients. They are generally found throughout the open lake waters to the depths of light penetration. The amount of phosphorus in the lake has been the most important man-induced change to phytoplankton communities, especially in nearshore areas. In addition, studies indicate that increased salinity and other environmental changes in Lake Michigan are enabling nonindigenous animals and algae to adapt more readily to the Great Lakes environment.

Zooplankton communities include many different invertebrates and comprise the bulk of the planktivorous fish diet. Because most zooplankton feed on phytoplankton, their abundance and geographic occurrence are similarly dependent upon water temperature, seasonal changes, and food availability. Zooplankton colonize open

Status of Perch

A large decline in the number of yellow perch surviving their first year of life (young-of-the-year or YOY) has caused a reduction in the number of perch in Lake Michigan with serious effects on the sport fishing industry. The number of YOY perch captured lakewide has dropped dramatically since 1988. The number of yellow perch larvae captured at one site in Illinois has severely declined since 1994. Data from one site, however, cannot be used to decide what has happened lakewide. Therefore, WDNR along with other agencies and scientists has used a variety of assessments to analyze the status of the current yellow perch population. These assessments have focused on (1) egg deposition, (2) spawning, (3) post-larval perch, (4) YOY perch, and (5) winter-graded mesh gill net assessment.

Although more information is needed, these studies may indicate some recovery in the yellow perch population:

- In 2002, the LaMP update reported that the number of yellow perch egg masses found in spawning areas in the lake increased from 0.5 per 1,000 square meters (m^2) searched in 1997 to 7.29 per 1,000 m^2 searched in 2001. That number increased to 11.53 per 1000 square meters in 2002.
- In 1998, a total of 4,512 yellow perch were captured during a spawning assessment, of which only 221 or 4.9 percent were females. In 2001, a total of 1,431 yellow perch were captured; 993 were males, and 438 (31 percent) were females. The percentage of females captured in 2002 dropped to 11 percent of 1812 total captured.
- The trend to detect the 1998 year-class continued . The largest year-class detected was once again from 1998 represented by 118 yellow perch observed as 4 year old fish in 2002. The represents the most 4 year old yellow perch caught since 1999 but is much lower than was found in the early 1990's. The majority of yellow perch in the population are 4 year old fish. The increase in egg masses found during the summer of 2002 indicates that most of the 4 year old females are mature and represent the best chance to produce another good year class.

Courtesy of the Ontario Department of Fisheries and Oceans

For more information, see http://dnr.wi.gov/org/water/fhp/fish/lakemich/YELLOWPERCH.htm

waters from the surface to the lakebed. Research conducted in the past 15 years indicates that zooplankton populations such as *Daphnia*, may be experiencing changes induced by *Bythotrephes*, an exotic species.

The *Diporeia spp.*, also known as scuds, sideswimmers, beach hoppers, and sand fleas, belong to the group of invertebrates called amphipods and are about 0.5 inch long. *Diporeia* have inhabited Lake Michigan since the Great Lakes were formed 5,000 to 10,000 years ago, and they are environmentally sensitive, thriving only in clean, cold, well-oxygenated water. *Diporeia* are eaten by a variety of Great Lakes fish and provide an important energy source because they contain high amounts of fat.

The numbers and density of these amphipods is decreasing in Lake Michigan (see Figure 4-2). While scientists have not yet determined the exact cause of the disappearance of the amphipods, they suspect it is linked to the introduction of zebra mussels in Lake Michigan in 1989, severely limiting the food available to *Diporeia*.

***Diporeia spp.*,**
Photo courtesy of GLERL

In addition, zebra mussels appear to be having a significant impact on benthic (bottom-dwelling) community structures and plankton abundance. Zebra mussels, which can attach themselves to any hard surface in the lake, have reached densities higher than 16,000/m^2 in southern Lake Michigan. Negative impacts of their presence include increased food competition (at the expense of fish fry) for nearshore fish species (such as yellow perch), increased biomagnification of contaminants in fish eaters feeding on organisms that eat benthic

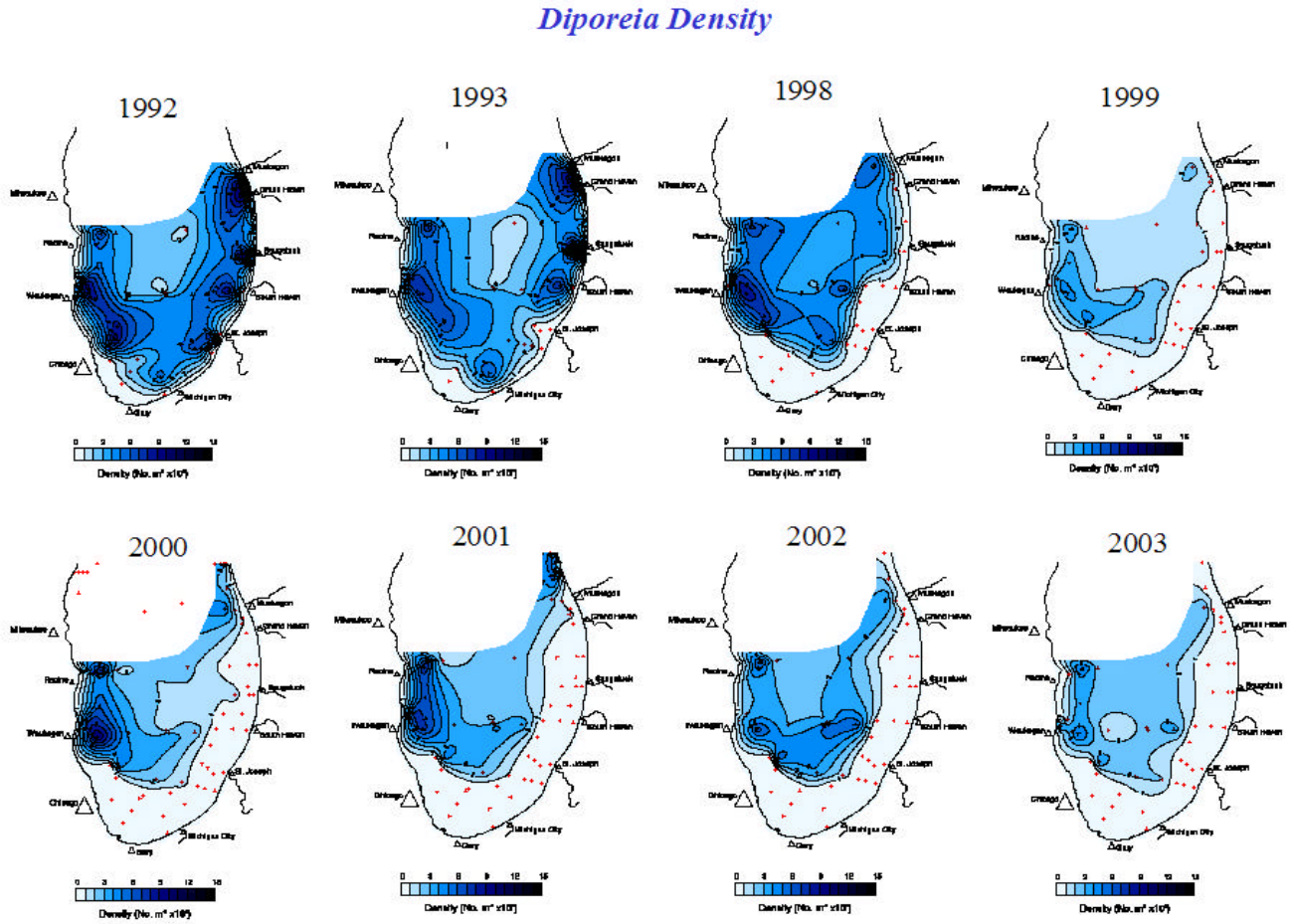


Figure 4-1 Diporeia density
Source: NOAA GLERL

organisms, and possible zebra mussel-induced mycrocystis blooms, which affect taste and odor in the water.

Coastal and Inland Wetland Systems

The coastal wetland system supports the greatest biological diversity and productivity in the Lake Michigan basin. Coastal wetlands are classified as open shoreline; unrestricted bays; shallow, sloping beach; restricted riverine; lake-connected inland; and protected or barrier beach. These wetlands are important because they collect nutrients and organic materials that are washed off the land into tributaries. These wetlands support both the aquatic food web and habitats for birds (resident and migratory), mammals, reptiles, amphibians, fish, and invertebrates, all of which depend on coastal wetlands for at least one life stage. Both lake level fluctuations and longshore sediment transport are important in maintaining this highly productive system.

Coastal wetlands differ from inland wetlands in that they are shaped by lake processes such as waves, wind tides, and water level fluctuations. These processes result in constant shifting of the wetland communities, permitting hardy species able to accommodate such conditions to survive while eliminating other species that would thrive under stable conditions. Multiple stressors continue to degrade the Lake Michigan coastal wetland system. Nonindigenous species, such as purple loosestrife, are still largely uncontrolled despite attempts to eradicate them. Changes in sediment composition and deposition have affected the habitat types, productivity, and diversity of these wetlands. The pace of shoreline modification is increasing, and there are no coordinated stewardship activities to protect or restore the remaining fragments.

The inland wetland system—wetlands away from the Lake Michigan shoreline—is a reservoir for water in the Lake Michigan drainage basin. There are many types of inland wetlands, including fens, bogs, wet meadows, and wet forests. The health of inland wetlands depends on the quantity and quality of groundwater and surface water present. Inland wetlands help to regulate the basin's volume of water as well as sediment and certain pollutant loads. They also store nutrients and serve as the nutrient exchange vehicle for the diverse species that use inland wetlands as habitat and feeding areas. Both wetland and upland species breed and feed in the Lake Michigan basin's inland wetlands.

Millions of acres of inland wetlands have been lost in the Lake Michigan basin to agriculture, industry, and urban development. Over the last two centuries, wetland losses in the four states at least partially within the Lake Michigan basin have been disproportionately greater than in many other U.S. regions. Since the 18th century, Lake Michigan basin states have lost an estimated 21.9 million acres (62.9 percent) of their wetlands out of the original 34.8 million wetland acres. This compares with an average loss of 52.8 percent nationwide. An estimated 12.9 million acres of wetlands remains in the four states, representing more than 12.3 percent of the wetlands within the lower 48 states.

Changes in Wetland Regulation: Impact of the Supreme Court Ruling

In January 2001, the U.S. Supreme Court, in the case of *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* (commonly referred to as to "SWANCC") narrowed federal authority to protect certain types of wetlands. The court's five-to-four decision narrowed the U.S. Army Corps of Engineers (USACE) regulating authority for wetlands not associated with waters of the United States such as a lake, stream, or river.

The Court's decision overturned the USACE's assertion of federal jurisdiction over certain isolated wetlands based on the presence of migratory birds. EPA and the Corps responded by issuing revised guidance to their field offices. At the same time, the Agencies reaffirmed federal jurisdiction over the majority of wetlands not impacted by the decision.

The court's decision came in response to a landfill battle in northern Illinois. The regional solid waste disposal authority sought to fill a wetland for its new landfill. The wetland in question was actually

Great Lakes Wetland Consortium

The Great Lakes Wetland Consortium was launched in December 2000 with a cooperative agreement between EPA GLNPO and the Great Lakes Commission with more than 40 participating organizations. It began by testing scientific methods and indicators of coastal wetland integrity (Phase I),is currently developing a classified inventory of Great Lakes coastal wetlands and a data collection system (Phase II), and will conclude by planning and implementing a Great Lakes coastal wetlands monitoring program (Phase III). The Consortium is designing standard protocols and delineating benchmarks for the implementation of a binational/basinwide monitoring program capable of tracking and assessing the existing status and projected integrity of Great Lakes coastal wetlands. The program will serve as decision support for programs and policies affecting the conservation and management of Great Lakes coastal wetlands.

Consortium Timeline

The Consortium is in the first phase of its program. The timeline for completion of its work is as follows.

Phase I
Evaluate scientific indicators for wetlands monitoring, including biological, physical, chemical, and landscape measures. Each indicator is evaluated against seven criteria: Cost, measurability, data availability, sensitivity to wetland condition changes, basin-wide applicability, ability to set endpoint or attainment levels, and statistical approach.

The Consortium awarded $300,000 in small grants to six research teams for pilot studies at more than 30 wetland sites across the Great Lakes basin to test the indicators.

Phase II
- Develop a comprehensive Great Lakes Coastal Wetlands Inventory, using existing data
- Develop a geomorphically-based classification system for the inventory, incorporating a standard
- classification process
- Evaluate and verify methods for collecting basinwide information in order to address landscape-level and wetland contamination indicators
- Assess results of Phase I pilot studies, including gap analysis and indicator development work plan
- Develop an overall monitoring plan, including specifications for site selection, data collection, storage, analysis, and reporting

Phase III
1. Develop a monitoring database
2. Develop an implementation plan
3. Coordinate implementation with Consortium member organizations

created when an abandoned quarry filled with water and over time, the new wetland became a nesting spot for migratory waterfowl. The landfill proponents were able to successfully argue that USACE lacked regulatory authority to prohibit creation of the new landfill because the wetland was not linked to waters of the United States. The court ruled that the USACE must provide a nexus other than solely migratory bird stopovers.

The ruling now places the responsibility for protecting certain isolated wetlands primarily in the hands of state and local authorities. The results are mixed. Wisconsin passed a law protecting these wetlands in 2002. Antrim County, Michigan first passed, and then repealed an ordinance that would have protected isolated wetlands. Michigan Governor Jennifer Granholm issued an Executive Order in January 2004 directing the Department of Environmental Quality to promulgate a rule to protect isolated wetlands on state-owned land from development. Two examples of this change in state and local roles are found in Wisconsin and in Antrim County, Michigan (see box).

In December 2003, EPA and the USACE announced that they would not issue a new rule that would have withdrawn federal regulatory jurisdiction over isolated wetlands. After soliciting

public comment to determine if further regulatory clarification was needed, the EPA and the Corps decided to preserve the federal government's authority to protect wetlands. The agencies will continue to monitor implementation of this important program to ensure its effectiveness.

The federal government currently implements 30 programs to protect and restore millions of acres of wetlands. These include the Food Security Act's "Swampbuster" requirements and the Wetlands Reserve Program, both under the authority of the U.S. Department of Agriculture. EPA programs include its "Five-Star Restoration" grant program, the EPA wetlands grants programs and the National Estuary Program. Other federal programs include: the Fish and Wildlife Service's "Partners in for Wildlife" program, the National Marine Fisheries Service's Coastal Wetlands Restoration Program and the Migratory Bird Conservation Commission, composed of the Secretaries of Interior and Agriculture, the Administrator of EPA, and Members of Congress.

Coastal Shore System

The Lake Michigan coastal shore system includes sand dunes, sand beaches, sand spits, bluffs, bedrock and cobble beaches, alvars, and islands. These features buffer coastal wetlands and inland ecosystems from Lake Michigan waves, wind, and ice. These habitats are rich in species diversity but are greatly affected by natural processes such as weather, erosion, and lake level fluctuations.

Sand Beaches

Sand beaches are a prominent coastal Lake Michigan feature. They may be erosional,

Wisconsin Wetland Law

On May 9, 2001, Wisconsin Governor Scott McCallum signed the nation's first state law designed to protect wetlands from the effects of the Supreme Court ruling that left some categories of wetlands largely unprotected. The Wisconsin law is expected to become a template for other states' efforts to step up wetland preservation. The law covers at least 1 million acres of wetlands, among them sedge meadows, shallow marshes, and seasonal wetlands that are among some of the state's most productive in providing waterfowl and amphibian habitat, storing flood waters, and helping to protect water quality. The law will not impose any new regulations on landowners but allows the state to continue following the same process that was used for the past decade to decide whether a project that potentially affects wetlands can proceed.

Since the January 9, 2001, Supreme Court ruling, USACE has informed 37 Wisconsin applicants that it has no jurisdiction over wetlands that the applicant's projects affected. A handful of applicants had already filled or excavated the wetlands by May 1, 2001. Those applicants who had been notified that the USACE did not have jurisdiction over their wetlands but who had not yet filled or dredged their wetlands must now await approval from WDNR and any applicable local government body before beginning any filling or dredging.

Wisconsin's law gives WDNR the authority to protect isolated wetlands in Wisconsin that the USACE has no jurisdiction over as a result of the Supreme Court's ruling. No person can fill or dredge such a wetland unless the state certifies that the project meets Wisconsin's water quality standards for wetlands.

Antrim County, Michigan, Wetland Protection Ordinance Rescinded

The Antrim County Board of Commissioners adopted an Ordinance for the Protection and Regulation of Wetland Areas in the county at its regular meeting on December 13, 2001. The ordinance was rescinded by the County Board on October 10, 2002. Fear of a "takings" lawsuit (if a property owner was denied the right to build and sued), creating an extra layer of government, and duplication of state enforcement efforts were the reasons stated for rescinding the ordinance.

Implementation of the ordinance would have meant that the county would have local control over the protection of wetlands as a valuable resource. Additionally, the ordinance would have provided the authority to regulate the wetlands contiguous to lakes and streams and the authority to regulate other wetlands that are not connected to a water body.

transitory, or depositional. Shoals, sandbars, and sand spits protect lagoons and coastal marshes from wind and wave action. Artificial shoreline structures and hardening of the shoreline have interrupted the longshore sediment transport that naturally erodes and replenishes sand beaches. In many areas, tons of sand are brought in each year to artificially replenish beaches for recreational purposes. Beach closure problems caused by excessive levels of pathogens are discussed in Section 4.

Tributary System

Tributary streams and rivers are connected to Lake Michigan in several ways. Energy and material are transferred from lake to tributary and tributary to lake by means of fish movement upstream and downstream and by waters carrying material and nutrients downstream. Diverse plant and animal habitats are found throughout the tributary system, and many of these habitats accommodate Lake Michigan fish. The range of tributary habitats present depends on the size, slope, substrate, and geology of the drainage basin; basin land use; groundwater characteristics; the climate; and the nature of the terrestrial vegetation. The connection of the streams and rivers to the lake maximizes the biodiversity and production of fish in the lake.

The quality of many tributary rivers in the Lake Michigan basin has been significantly impaired by channelization, dredging, damming, sedimentation, bankside vegetation loss, eutrophication, increased spring flooding, and toxic contamination. Large areas of inland forests and wetlands that once served to regulate the quantity and quality of water flowing into tributaries have been lost. As a result, tributaries carry increased pollutant and sediment loads to the lakes, and the suitability of those tributaries as fish spawning habitats has been seriously impaired. Habitat degradation has been the most severe in urban areas. Pollution from agriculture, industry, and urban development has contaminated rivers and sediment as well as the fish and wildlife that depend on those rivers. Many rivers, particularly at the rivermouths, have been declared AOCs and many of their beneficial uses have been impaired.

Although the public uses many Lake Michigan basin rivers and streams, the uses are not necessarily sustainable at this time. Progress is being made in improving and protecting tributary rivers and streams, largely through the efforts of watershed groups and remedial actions at AOCs. For information on Lake Michigan tributaries, Surf Your Watershed at *www.epa.gov/surf*. See also Appendix D for more information on Lake Michigan watersheds.

Lakeplain System

The lakeplain system occupies the area of the ancestral lakebed of Lake Michigan that was formed as the last glaciers receded. This lakeplain system has served two important ecological functions: it provided a refuge during severe weather events, and it was historically important in flood water retention. The system once harbored a rich diversity of plants and animals, several of which appear on the federal endangered species list. Lakeplain prairies and savannas, two of the most imperiled ecological communities in North America, are found in the southern Lake Michigan basin.

The lakeplain system has been largely transformed since European settlement began. Many of the original plants and animals survive only in small, previously protected areas that are no longer viable or sufficient to sustain these historically diverse communities. These communities are still threatened by human development and by invasive species.

Inland Terrestrial System

The inland terrestrial, or upland, system of Lake Michigan includes numerous types of forests, barrens, and prairies. These areas are a result of glaciation and climatic effects. Oak and pine barrens found in the northern part of the basin are globally significant and rare ecological communities.

One of the significant inland terrestrial features of the Lake Michigan basin is the Niagara Cuesta, a rocky outcrop of dolomite and limestone that arcs from the Door County peninsula and the Garden Peninsula to Niagara Falls. Many rare land snails, some of which were only recently

Dam Removals in Southeastern Wisconsin Improve Fish Habitat

The Chair Factory dam on the Milwaukee River was removed in 2000, In 2003, Wisconsin state environmental researchers have found that there are more and a greater variety of fish than ever before found in that section of the Milwaukee River in Grafton, Wisconsin.

The removal of the barriers allows fish to move more freely in the stream and provides a more diverse bottom habitat, with sections of stone and gravel, than is found in the muddy pond of an impoundment. It also increased the flow of the river, once dominated by carp when it was a slow flowing, murky artificial lake. There are now more than a dozen fish species, including smallmouth bass of all sizes, golden and shorthead redhorse, rock bass, emerald and spotfin shiners, hornyhead chub, and the rare greater redhorse. These species are not tolerant of muddy water and were not

Shorthead redhorse
Courtesy of NOAA

found in that stretch of the river previously.

Removal of the North Ave. dam in Milwaukee in 1997 allowed the stream to establish a more narrow, meandering channel through the former impoundment, and invited fish and aquatic insects not tolerant of pollution. Two other dams on the Milwaukee River were removed: at Waubeka in 2003 and at New Fane in the Northern Unit of the Kettle Moraine in 2002.

discovered, inhabit the thin- layered soils and rocks of the escarpment. Increased tourism in Door County and on the Garden Peninsula has led to increased development on the escarpment, threatening these fragile habitats.

Coastal Wetlands

Lacustrine (controlled directly by the waters of the Great Lakes), riverine (occurring in rivers and creeks that flow into or between the Great Lakes), and barrier-protected (separated from the lakes by a barrier with periodic breaches) coastal wetlands can be found throughout the Lake Michigan basin. At this time, the status of the ecological health of Lake Michigan coastal wetlands is unknown. However, recent Michigan legislation and stewardship efforts are impacting coastal wetland health, and scientists and managers are working to increase our ability to monitor them.

In 2003, Michigan enacted Public Act 14, amending the Natural Resources and Environmental Protection Act to allow beach maintenance activities without a permit in areas classified as wetlands or submerged lands. Private property owners are now able to groom their beaches during low water levels. Currently, these activities are regulated by the Michigan Department of Environmental Quality and the U.S. Army Corps of Engineers. The Michigan Departments of Environmental Quality and Natural Resources, as well as many other agencies and environmental groups, objected to the legislation because "beach grooming" is synonymous with wetland vegetation removal. Removal will result in loss of habitat for wetland species and the erosion of natural shoreline features.

In Door County, 12 agencies and organizations developed *A Guide to Significant Wildlife Habitat and Natural Areas of Wisconsin* in 2003. This Guide provides the location, site description, ecological significance, threats and conservation goals for significant natural areas, including coastal wetlands like the Mink River Estuary. The Mink River Estuary is one of the larger coastal wetlands on Lake Michigan, significant for its rare plant communities and lack of human disturbance. Threats include groundwater quality, surface water runoff for impervious surfaces, non-native invasive species, and home development adjacent to this protected area. Immediate conservation goals are to enhance wildlife corridors and control aggressive non-native

Little River Band of Ottawa Indians Awarded National Watershed Grant to Protect the Manistee River

To support community-driven initiatives that protect habitat, improve water quality, and enhance outdoor recreation, the EPA awarded $15 million in grants to 20 watershed organizations selected as part of a new Watershed Initiative in 2003.

Among the watersheds selected was the Manistee River, Michigan through the Little River Band of Ottawa Indians, which is a tribe of 2,600 members. The river provides important resources, which are vital to the survival of the tribe. EPA awarded the tribe Watershed Initiative grant money to support their efforts to restore and monitor the water quality of the Manistee River. Planned projects include: repairing road and stream crossings, stream bank stabilization, extensive monitoring, habitat inventories, invertebrate surveys, fish assessment, and a sturgeon spawning site reclamation project.

Regional and national experts selected the winners from a highly competitive field of more than 176 nominations. The winners were chosen because they best demonstrated the ability to achieve on-the-ground environmental results in a short time frame. Each of these watershed organizations exhibited strong partnerships with a wide variety of support, showed innovation, and demonstrated compatibility with existing governmental programs.

species (*A Guide to Significant Wildlife Habitat and Natural Areas of Door County, Wisconsin. March 2003)*.

Lake Michigan Islands

More than 30,000 islands throughout the Laurentian Great Lakes form the world's largest freshwater island system. The islands have unique landforms, plants and animals, and cultural history. Islands are vulnerable, sensitive to change, and irresistible to humans, whose impact to island natural communities is growing. The U.S. Fish and Wildlife Service (FWS) Great Lakes Basin Ecosystem Team incorporated conservation of islands as a management goal 2001. In 2003, the Great Lakes Island Collaborative was formed by the Northeast-Midwest Institute with FWS, The Nature Conservancy, and the Nature Conservancy of Canada and funded by USEPA's Great Lakes National Program Office. The Collaborative is creating a framework to ensure the long-term conservation of Great Lakes islands. An island biodiversity assessment tool is being finalized and will be used to assess and characterize the entire suite of Great Lakes islands. All islands are being mapped by FWS with data from many sources. Indicators of island health are being developed as part of the State of the Lakes Ecosystem Conference (SOLEC) indicator process. Conservation targets will be identified. Future implementation activities will be directed toward these targets.

Lake Michigan islands can be grouped into two archipelagoes. The Grand Traverse Islands are a chain of 19 islands in Lake Michigan and Green Bay around the Door Peninsula. The Beaver Islands are located in the north eastern part of the Lake. The status of Lake Michigan's islands is considered moderately degrading. Habitat loss due to human development and recreation, as well as invasive species, are the primary reasons for this conclusion.

The Grand Traverse Islands are part of the Niagara Escarpment and contain more than 850 acres of wetlands, primarily on the eastern and northwestern portions of Washington Island. Several of the islands are home to a rare natural community known as alvars, rocky, thin-soiled places with globally rare plants and animals. Island plant and animal data from 25-75 years ago was compared with recent inventories ((Judziewicz and Kopitzke 1999). Colonial waterbirds on the smaller islands and human development and white-tailed deer browsing in general have severely impacted vegetation over the last decade. A comprehensive ecological management plan to protect the rare natural communities and plant and animal species is one conservation goal put forth by Door County community collaborators.

Several islands in the Beaver Island group--Gull, Pismire, Hat, and Shoe—are part of the Michigan Islands National Wildlife Refuge. Administered by

Seney and Shiawassee National Wildlife Refuge staff, Beaver Islands habitats are varied from little or no ground cover to sand dunes and forested areas. Their 235 acres provide habitat for migratory birds and colonial nesting birds and are home to several federally threatened plants, the dwarf lake iris and the Pitcher's thistle. North and South Manitou Islands, the southern most islands in the Beaver Islands group are primarily managed by Sleeping Bear Dunes National Lakeshore.

Nearshore Aquatic Habitats/Fisheries

In March 2003, the Lake Michigan Committee of the Great Lakes Fishery Commission reported on the status of the Lake Michigan fishery. Issues of concern included salmonid reproduction, yellow perch recruitment and population dynamics, and development of fish health indicators and measures. In a September 2003 report by the Lake Trout Task Group, historically important lake trout spawning reefs are said to be degraded. Based on the issues outlined in the two reports, the status of the ecological health of Lake Michigan nearshore aquatic habitats and fisheries is poor.

The yellow perch population remains low with catch rates the lowest since the mid-1980s and 90s. Zebra mussels have declined in certain areas. Diporeia are now absent from major portions of the lake. Bloater chubs, alewife, and smelt have continued to decline. Sea lamprey populations have increased in abundance and are now higher than in Lakes Superior or Huron.

Lake sturgeon were stocked in the Milwaukee and Manitowoc, Wisconsin Rivers at undisclosed locations in 2003. In Illinois, the Shedd Aquarium proposed to stock about 200 older aged fish per year beginning in 2003. Some scientists and managers are concerned that stocked sturgeon will genetically impact the small remnant native populations. The Lake Michigan Committee and Great Lakes Fishery Trust will cooperate in promoting sturgeon rehabilitation efforts.

The Lake Trout Task Group identified 14 impediments to lake trout reproduction in Lake Michigan. Impediments to the size of the lake trout population are thought to be number of fish stocked, sea lamprey mortality, sport and commercial fishing, and the abundance of spawning fish on historically important reefs. Threats to the survival of lake trout include habitat degradation, contaminants, predation on eggs and fry by native and non-native predators, and mortality from early mortality syndrome. This synthesis of current knowledge and interpretation by the Task Group will be the basis for a new lake trout rehabilitation plan for Lake Michigan that will recognize technical, informational, and biological limitations but take full advantage of lessons learned from past experiences on Lake Michigan and the other Great Lakes.

Forests

The status of Lake Michigan basin forests is considered good due to current positive revisions to national forest plans and to the continued practice of sustainable forestry management by Menominee Tribal Enterprises.

In September 2003, the Hiawatha and Huron-Manistee National Forests published in the Federal Register a Notice of Intent to revise their forest plans. In the Hiawatha, since the last plan was approved by the Regional Forester in 1986, information about forest landscape functioning and capacity has been conducted and ecological units have been mapped. New plans will help to determine sites to manage old growth as well as lands suitable for harvest. In southern Michigan, the emerald ash borer is attacking native ash (genus *Fraxinus*) tree species, posing a threat to the Huron-Manistee.

Located on the transition zone between the central and northern hardwood forests, the Menominee Reservation forest lands total some 235,000 acres and 33 tree species, including northern hardwood, hemlock and pine. Menominee Forest Enterprises (MTE) is a tribal-owned business employing more than 300 people and dedicated to the culture, values, and spirituality of the tribe as stated by MTE Forest Manager Marshall Picore in the Journal of Forestry (July 1992):

"It is said of the Menominee that the sacredness of the land is their very body, the values of the

culture are their very soul, the water is their very blood. It is obvious, then, that the forest and its living creatures can be viewed as food for their existence."

Recognized as one of the finest examples of forest management in the Great Lakes basin, Menominee Tribal Enterprises is the recipient of numerous recent awards, including several in 2000: the U.S. Department of Commerce distinguished recognition award for "innovative economic development activities," and the National Arbor Day Foundation Good Steward Award. In 2003, MTE was honored with a Forest Stewardship Award from the National Hardwood Lumber Association (NLHA).

Shorelands

The Door County Natural Area Mapping Project began in 1998 with a commitment by conservation organizations, governmental agencies, and community members to identify, map, and describe the highest quality unprotected natural areas of Door County, Wisconsin. The project was initiated by a coalition of 6 conservation organizations (The Nature Conservancy, the Door County Land Trust, the Door County Environmental Council, the Gibraltar Preservation Commission, the Door Land Use Forum, and the Door Property Owners Association), several governmental agencies (U.S. Fish and Wildlife Service, Wisconsin Department of Natural Resources, Door County Planning and Zoning Department, and Door County Soil and Water Conservation Department), the University of Wisconsin – Green Bay, University of Wisconsin – Extension, Bay-Lake Regional Planning Commission, several community members, and local elected officials. This has been an open and fluid group process facilitated by staff from the Door Office of The Nature Conservancy, the Door Land Use Forum, the WDNR, and the University of Wisconsin – Extension.

With the assistance of a small grant from the WDNR and donated time and material from the partners, a 202 page document entitled "A Guide to Significant Wildlife Habitat and Natural Areas of Door County, Wisconsin" was published in March 2003.

According to WDNR Bureau of Endangered Resources, Door County has both the highest number of state listed rare species and the highest density of such species per square mile of any county in Wisconsin. Door County also contains 22 State Natural Areas, two state wildlife areas, five state parks, six ecoregional conservation areas of The Nature Conservancy, a National Natural Landmark (the Ridges Sanctuary), a U. S. Fish & Wildlife National Wildlife Refuge, and several other locally protected sites of regional ecological significance.

This collaborative community project purpose has been to provide practical information that might assist citizens and civic and political leaders in supporting preservation and protection of those still unprotected natural landscapes in and around their communities. The Natural Areas Guide was the first step towards that end. The information in the guide is now being used by townships in their comprehensive plans, by local land trusts in their conservation planning projects, and by community citizen groups as a basis for increased community involvement in watershed and wetland protection. The group has also received funding from the EPA's Great Lakes Program to produce detailed site conservation plans at two of the landscapes identified in the project.

Repositories for the document include the county library system, county offices, WDNR, high schools, UW-Green Bay Biodiversity Center, Bay-Lake Regional Planning, and all other coalition member agencies and organizations.

Sand Dunes

Massive coastal sand dunes flank the Lake Michigan shoreline from northern Indiana continuing northeasterly through Michigan. Ancient high lake levels formed the beach ridges, and as the lake receded, the prevailing onshore winds continued to blow beach sand up the slopes. Lake Michigan is now home to the largest collection of freshwater sand dunes in the world. They run along the entire shore to heights of 300 feet and widths of more than 1 mile; they are interrupted only by river valleys, cities, and roads. The Lake Michigan dunes are numerous, diverse, and irreplaceable.

The dune system is composed of successive ridges of dunes: foredunes, interdunal areas, and backdunes (usually several). Dune and swale or ridge and swale community complexes are found at several locations throughout the Lake Michigan basin. In the south, the dunes or ridges run parallel to the Lake Michigan shore and are rich in oak savanna species. The wet swales between these ridges support rich prairies and sometimes rare coastal plain marsh communities. In the north, the ridges are typically dominated by red and white pine and other conifers, and the swales by white cedar swamps or sedge meadows. Sand dunes around Lake Michigan are threatened by residential development, often very close to the shore, and by mining. On the eastern shore of Lake Michigan, an invasive, nonindigenous species, Baby's breath, is threatening dune ecosystems. "Blowouts," which occur most frequently in the foredune area, are created when the vegetation is disrupted and the wind quickly erodes the sand, leaving a saucer-shaped depression. The most serious blowouts occur as a result of human activity.

Indiana Dunes
Courtesy of the Indiana National Lakeshore.

A recent report by the Lake Michigan Federation states that Lake Michigan has the largest concentration of freshwater sand dunes in the world. The dunes provide habitats for significant plant and animal species. In spite of the Michigan Sand Dune Protection and Management Act of 1976, this report reveals that the areas in which sand mining is permitted have increased and that more than 46.5 million tons of sand have been extracted since the law was passed.

Nature Conservancy Biodiversity Blueprint

This map shows places identified in the Conservation Blueprint for the Great Lakes that are critical to the conservation of biodivesity in the Great Lakes region. The Nature Conservancy (TNC) worked with more than 220 scientists and conservation experts and led a large-scale study to identify these lands and waters that are important for the preservation of the Great Lakes ecosystem. The Conservation Blueprint scientifically and systematically identifies native species, natural communities and aquatic systems characteristic of the region and determines where they need to be preserved to ensure their long-term survival. The map will be updated as TNC gains knowledge and understanding of the Great Lakes 'natural systems. The Conservation Blueprint is a framework for coordinated action. It guides The Nature Conservancy 's work in very Great Lakes state and is the logical foundation for conservation of biodiversity within the Great Lakes region. The Nature Conservancy of Canada is leading efforts to complete the Canadian portion of the Conservation Blueprint. For more information, please visit the Nature Conservancy's website at *www.nature.org/greatlakes.*

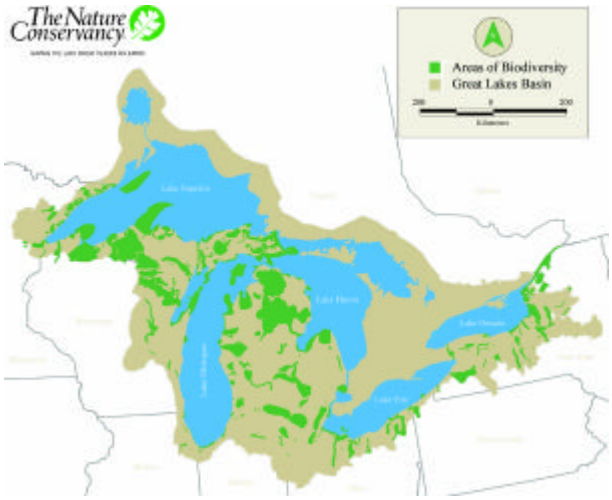


Figure 4-3 Areas of Biodiversity

Growing concern for the health and conservation of sand dunes lead to the formation of the Michigan Dune Alliance in 2000. The Alliance is a coalition of seven environmental organizations—Chickaming Open Lands, Grand Traverse Regional Land Conservancy, Leelanau Conservancy, Little Traverse Conservancy, Southwest Michigan Land Conservancy, and The Nature Conservancy—united by a commitment

Chicago Wilderness

Chicago Wilderness is a broad coalition of more than 150 agencies and organizations in Northeastern Illinois and Northwest Indiana formed to protect and restore native species and habitats in more than 250,000 acres of woodlands, wetlands, prairies, and dunes. Over the last several years, Chicago Wilderness members have produced numerous educational materials about restoration projects that are underway and the biodiversity of the region including Chicago Wilderness Magazine, Chicago Wilderness Journal, an Atlas of Biodiversity, an activity guide for families, and a Biodiversity Recovery Plan.

More than 180 projects have been funded across the region. The Illinois Biodiversity Basics and the Chicago Wilderness Training Hub are training educators to help in recovery of biodiversity. The Mighty Acorns Program has involved more than 250 teachers and 8,500 students in hands-on local native environment restoration. Future goals include improving the membership in the Corporate Council, strengthening ties among organizations in the three-state region, and completing the Chicago Wilderness State of the Region Report Card.

to protect unique shoreline systems, including sand dunes. The Alliance engaged in a comprehensive conservation planning process and developed an Eastern Lake Michigan Shoreline Plan. Currently, the group is identifying shoreline sites and compiling data that will be used to qualitatively rank criteria in order to prioritize areas for protection and restoration.

Wisconsin's Shorelands

The Wisconsin Shoreland Management Program, a partnership between the state and local governments, helps local communities to adopt zoning ordinances that mitigate the impacts of development near rivers and lakes. The goal is to protect water quality and fish and wildlife habitat, as well as provide recreational opportunities. Minimum standards for shoreland development are intended to control the intensity of development and create a vegetative buffer adjacent to water to protect it from impacts.

The Lake Michigan Shorelands Alliance, organized in 2003, is completing 12 site conservation strategy plans for eight Lake Michigan land trusts. The plans include stating key conservation goals, identifying and prioritizing core conservation areas and buffer zones, identifying threats and strategies to minimize the threats, and developing conservation implementation strategies. Gathering Water Conservancy has taken the lead in organizing the Alliance. The following land trusts are partners: Caledonia Conservancy, Door County Land Trust, Milwaukee Area Land Conservancy, Northeast Wisconsin Land Trust, Ozaukee Washington Land Trust, Sheboygan Area Land Conservancy, and The Nature Conservancy.

Great Lakes Environmental Indicators (GLEI)

The Great Lakes Environmental Indicators project (GLEI) is an EPA Office of Research and Development (Mid-Continent Ecology Division, Duluth, Minnesota) initiative to develop ecosystem or environmental indicators of conditions for the coasts of the United States. A binational consortium of 27 scientists from nine institutions is focusing on the Great Lakes shoreline. GLEI is examining the usefulness of State of the Lakes Ecosystem Conference (SOLEC) indicators as well as indicators from other efforts and developing new indicators as needed to report on the health of the Great Lakes coastline.

Tributaries

Information on Lake Michigan's tributary watersheds is presented in Appendix D in a series of fact sheets. These fact sheets address key management activities in the tributary watersheds. For example, The Great Lakes Fishery Trust and its Scientific Advisory Team selected the Muskegon River watershed to develop a model approach to integrated ecosystem fishery-habitat management. The Muskegon is one of the largest watersheds in the state of Michigan, covering a great part of nine counties. The total watershed area is 2,660 square miles. Additional information about the initiative is presented in Chapter 10.

Chicago Signs Urban Migratory Bird Treaty

Chicago is one of five U.S. signatory cities to the Urban Conservation Migratory Bird Treaty, having signed in 2000. The treaty commits the U.S. Fish and Wildlife Service to a long-term partnership with cities and its conservation partners for the benefit of migratory birds. The Urban Conservation Treaty pilot program was started in 1999 when the City of New Orleans became the first Urban Conservation Treaty city. The Service hopes to use these agreements as models for bird conservation in other cities in future years.

The Urban Conservation Treaty provides a framework to support initiatives that improves the area's ability to sustain bird populations. In addition to working with the City and Parks District to incorporate bird- friendly landscaping into Chicago's parks and open spaces, the treaty partners will launch a campaign to educate Chicago-area homeowners about bird-friendly spaces in their back yards. Partners coordinate migratory bird education programs and outreach activities to inform the public about the benefits and needs of urban and migratory birds. Many of these birds stop in Calumet area wetlands, in city parks and forest preserves, and in backyards across the city. Urban and migrant birds also flock to spots in Chicago such as the Department of Environment's North Park Village Nature Center, which contains woodland, wetland, prairie and savannah habitat.

More than 7 million birds pass through the Chicago area during their spring and fall migrations, following the Lake Michigan shoreline and stream corridors such as those on the Chicago River. Treaty partners will classify and map key habitat for migratory birds along the lakefront and river, and in parks, cemeteries and other open spaces. They will also develop and implement recommendations for conserving and enhancing that habitat.

Among the actions Chicago is taking is to work with building owners to dim bright lights on skyscrapers to protect birds during migration season. Birds become confused by bright lights and can lose their way. Many crash into brightly lit skyscrapers and become injured or die. Depending on the weather, tens of thousands of birds can fly over Chicago in a single night and hundreds of birds might be killed at one building on a night of heavy migration. The city also provides information on landscaping with birds in mind, avoiding using pesticides, keeping cats indoors, and modifying hazardous windows.

More information is available at the City of Chicago website at:
www.cityofchicago.org/Environment/BirdMigration/sub/main.html

Measuring and Monitoring Lake Michigan's Ecological Changes

The U.S. EPA Region 5 is undertaking an effort to identify critical ecosystems and their status that are most sustainable in the Great Lakes basin. The EPA Region 5 Critical Ecosystems Team undertook a three-year study that has produced a physical baseline built on 1994 Land Satellite imagery (Landsat). The result is a GIS-based tool that can characterize landscapes based on three ecological criteria: (1) ecological diversity, (2) sustainability, and (3) rarity of species and landcover. The combination of these criteria identify high quality ecosystems. The modeling can also pinpoint ecosystems that are not protected, in public ownership or environmental management programs. Areas of highest diversity can be mapped against areas of lowest sustainability to highlight the richest ecosystems that are currently being threatened by chemical, physical or biological stressors. A low sustainability rating results from habitat fragmentation, pavement color, and other impairments.

This information can be used to help refine restoration and protection targets for the Lake Michigan basin as well as document the areas of change and trends. Once the model is peer reviewed and resources are identified to run the model with the new 2000 data, a comparison with the Lake Michigan 1994 baseline status can be made. The National Land Cover Data Base is a

cooperative project including USEPA, U.S. Geological Survey (USGS) and the National Oceanographic and Atmospheric Administration (NOAA).

Lake Michigan Basin Species of Concern

In March 2003, the status of the Midwestern **gray wolf (*Canis lupus*)** was changed from endangered to threatened. Under new rules, threatened wolves may be killed under certain circumstances. State and Tribal agencies may kill a wolf if it has attacked domesticated animals and is likely to kill again. Private citizens are not allowed to kill a wolf under any circumstances. The change in the gray wolf status comes as populations rise throughout the upper Midwest. More information is available at *http://midwest.fws.gov/wolf/*

According to a 2003 report, "Great Lakes Lake Sturgeon Coordination Meeting, Proceedings of the December 11-12, 2002 Workshop, Sault Ste. Marie, Michigan," **lake sturgeon (*Acipenser fulvescens*)** populations in Lake Michigan continue to sustain themselves, although it is thought that less than 5,000 fish, or below one percent of historic estimates, remain. At least eight tributaries currently support spawning because they have unimpeded connections to Lake Michigan. Sixteen agencies, tribes, and universities are involved in lake sturgeon research and conservation. Extirpated in the Menominee and Wolf Rivers, lake sturgeon is being reintroduced. A 2003 initiative to stock the Milwaukee and Manitowoc Rivers is underway. Plans for additional stocking in southern Lake Michigan are proposed. The lake sturgeon is on the Service's Region 3 draft Species of Concern list. More information is available at *http://greatlakes.fws.gov/GLSturgeonCoordMttg02.pdf*

The **Kirtland's warbler (*Dendroica kirtlandii*)** is a tiny songbird that breeds in the northern jack pine forests of Michigan's Upper and Lower Peninsulas and winters in the Bahamas. One of the first species to be federally-listed as endangered under the Endangered Species Act of 1973, two threats, cowbird nest parasitism and disappearance of its forest habitat, are being addressed aggressively. The U.S. Fish and Wildlife Service is working to intensively manage native jack pine forests and control cowbird nest parasitism. A long term research program with staff from The Nature Conservancy's Great Lakes Office is linking scientists from Michigan and the Bahamas in order to better understand the warbler's life cycle needs. More information is available at *http://midwest.fws.gov/endangered/birds/kirtland/kiwa-facts.html*

The nesting areas for the **piping plover (*Charadrius melodus*)**, a small, sand colored shorebird, include the sandy shores of the Great Lakes. Commercial, residential, and industrial development has eliminated historic nesting sites. The plover is federally-listed as endangered. The

Piping Plover
Courtesy of the National Park Service

presence of gulls, humans, and human-dependent animals such as dogs on sandy beaches has led to nest predation and abandonment. Critical habitat for the Great Lakes piping plover breeding areas was designated on May 7, 2001. On July 5, 2001, the Service designated areas of coastline in eight southern states as critical habitat for the wintering areas of piping plover. In September 2003, the U.S. Fish and Wildlife Service recovery plan for the Great Lakes piping plover was approved. Access to beaches set aside for nesting is being limited and many Michigan residents are formally agreeing to protect this habitat. Piping plover "patrols" have been organized to encourage citizen participation.

The **Hine's emerald dragonfly (*Somatochlora hineana*** federally-listed as endangered is found in the calcareous marshes and sedge meadows of Door, Kewaunee and Ozaukee Counties, Wisconsin and the Des Plaines River basin of northeast Illinois . The draining and filling of these wetlands, water pollution, and changes in groundwater are the greatest threats to dragonfly habitat. The U.S. Fish and Wildlife Service finalized the recovery plan for this species in 1991 which will aid in the protection and recovery of the dragonfly and its habitat. More information is available at *http://midwest.fws.gov/endangered/insects/hins_fct.html*

In September 2003, the U.S. Fish and Wildlife Service approved the recovery plan for the **Karner blue butterfly *(Lycaeides melissa samuelis)***, which is federally-listed as endangered. The caterpillar of this small butterfly feeds only on the leaves of the lupine, which grows in pine barrens and oak savannas. Wisconsin has implemented a statewide Habitat Conservation Plan (HCP) for the butterfly that permits management activities (such as roadside and utility corridor maintenance and timber harvests) in areas that support Karners but ensures that the activities are conducted in ways that conserve and protect the species and its habitat. In the Lake Michigan basin, the recovery plan is focusing on management of black oak savanna habitats in the dune areas of Northwest Indiana and in the savanna and barrens areas in the central sand counties of Wisconsin. Prescribed burning and invasive species control, as well as propagation of wild lupine habitat, is being conducted by the Indiana Dunes National Lakeshore and The Nature Conservancy. Habitat restoration work is ongoing at various Wisconsin sites as well. More information is available at *http://midwest.fws.gov/endangered/insects/kbb/kbb_fact.html*

The **dwarf lake iris (*Iris lacustris)*** is federally-listed as threatened. The habitat of this small plant with deep blue flowers, is being threatened by shoreline residential and second home development, as well as road salting and off-road vehicles.. The U.S. Fish and Wildlife Service is in the process of developing a recovery plan for this species. Implementation of that plan is anticipated to reduce the threats to the species and its habitat and prevent the plant from becoming endangered. Populations are currently being monitored to determine population trends and habitat requirements. More information is available at *http://midwest.fws.gov/endangered/plants/dwarflak.html*

Houghton's goldenrod *(Solidago houghtonii)* is a showy goldenrod found only on the northern Great Lakes shoreline of Lakes Huron and Michigan. This endemic species is threatened by loss of habitat due to increased human activity such as heavy foot and vehicular traffic in shoreline areas. The Michigan Natural Features Inventory is engaging in cooperative conservation efforts with private landowners and developing management plans with public agencies and

Bald Eagles Return to Little Calumet River

Bald Eagles, once thought unable tothrive in and near Chicago, have returned to the city's south side. A boat crew from the Water Reclamation District was taking water samples from the Little Calumet when members spotted the nest and the birds.

Two bald eagles constructed their nest in a treetop overlooking the Little Calumet River, the first time the birds have nested in the area in more than a century.

Bald Eagle
Courtesy U.S. Fish and Wildlife Service

Eagles have rebounded spectacularly since their near demise in the 1970s after the pesticide DDT was banned and the federal government protected the birds as an endangered species.

Chicago-area bird records include two eagle nests in Cook County, Illinois in 1896, then one in 1897. There is no recorded sighting since then.

According to government and private experts, the eagles' return is a sign that efforts to revitalize the pollution-plagued Calumet area are working.

private developers through state-wide permitting and enforcement systems. More information is available at *http://midwest.fws.gov/endangered/plants/houghton.html*

Habitat loss, competition from non-indigenous species, and deer browse are the most common threats to the **eastern prairie fringed orchid (*Platanthera leucophaea*)**, which is federally-listed as threatened. The prairie fringed orchid depend on hawkmoths for pollination and reproduction. Any threat to these insects, such as the use of insecticides, is a threat to the orchid. The orchid is found in the lakeplain prairies of northeastern Illinois and southeastern Wisconsin, as well as in Michigan. A group of experts and volunteers lead by the Chicago Botanic Garden are monitoring and propagating the rare orchid in native prairie remnants in Illinois. Monitoring and restoration efforts are on-going in Wisconsin as well. More information is available at *http://midwest.fws.gov/endangered/plants/prairief.html*

Whooping Cranes are using wetlands in Wisconsin's Lake Michigan watershed as stop over places during migration, and are anticipated to use such areas in the future as breeding and nesting sites.

Next Steps

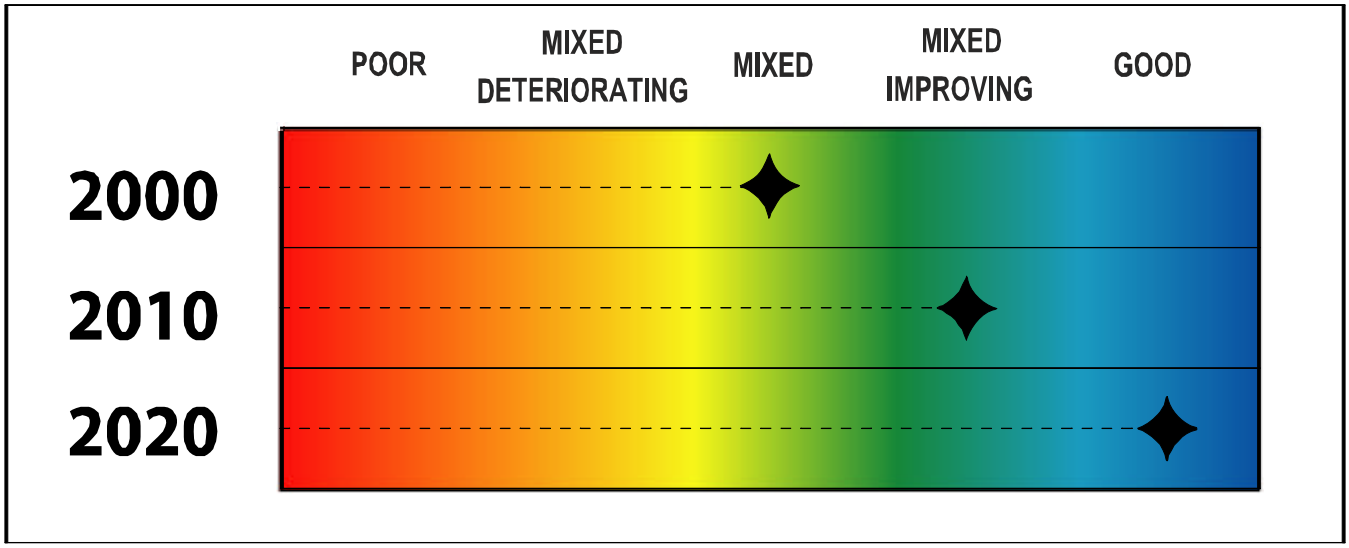
- Continue to support components of lake basin biodiversity plan though watershed academy grants.
- Identify species-sensitive to ground and surface water interaction.
- Provide GIS tools and land use models in workshops to promote knowledge of and protection of key habitat areas.

Long-Term Objectives

- By 2005, no net loss of wetland acreage and function will be achieved in the basin.
- By 2006, a process for developing biodiversity recovery manuals for major ecosystem types in the Lake Michigan basin will be implemented.
- By 2006, set targets for critical areas (fish spawning areas, dune and swale complexes, wetlands, alvars, prairies, and oak savannas) will be identified, mapped, and presented on line.
- By 2012, the 2004 target acreages will be enhanced, restored, or protected: 1,000 acres of spawning areas (islands, underwater reefs); (example acreages: 12,500 acres of system wetlands; 1,000 acres of isolated wetlands; 1,000 acres of dunes; and 37,500 acres of stream buffers - comments

Subgoal 5

Does the public have access to abundant open space, shoreline, and natural areas, and does the public have enhanced opportunities for interaction with the Lake Michigan ecosystem?



Status

Currently, the status of the goal is mixed due to the competing needs of the public and the ecosystem. To move to mixed/improving status by 2010 and finally to good status by 2020, there is a need to find a better balance between public access and ecosystem protection. The Lake Michigan LaMP focuses on the health of the Lake Michigan ecosystem, so management actions implemented under the LaMP are to take an ecosystem approach to remediation and protection. The 1994 SOLEC Integration Paper developed by EPA and Environment Canada states that "Governments have traditionally addressed human activities on a piecemeal basis, separating decision making on environmental quality from decision making on natural resource management or on social or economic issues.... An ecosystem approach to management is a holistic approach that recognizes the interconnectedness of and addresses the linkages occurring among air, water, land, and living things."

Challenges

- Public involvement in preservation and stewardship of special natural areas with public access for sport and recreational activities should be fostered by the following:
- Broaden the dialogue with state and local government land-use planners and decision-makers to balance environmental and recreational needs.
- Provide tools for local communities to understand the value of the resource and develop long-term management programs.
- Identify open space multi-use opportunities.

Public Interaction with the Lake Michigan Watershed

According to the Federal Interagency Ecosystem Management Task Force, an ecosystem is defined as: "... an interconnected community of living things, including humans, and the physical environment with which they interact. As such, ecosystems form the cornerstones of sustainable

economies. The goal of the ecosystem approach is to restore and maintain the health, sustainability, and biological diversity of ecosystems while supporting sustainable economies and communities" (1995). Based on a collaboratively developed vision of desired future conditions, the ecosystem approach integrates ecological, economic, and social factors that affect a management unit defined by ecological—not political—boundaries. The foundation of the ecosystem approach is relating human beings and their activities to the ecosystems that contain them.

As access to Lake Michigan increases, so does the pressure for development. Growth of summer homes and year-round homes on the shoreline leads to more road construction, pollution from increased use of automobiles, and human use of areas that interrupts the natural web of basin life. In response, Smart Growth policies are being developed and pursued by many communities, and resources such as the "Wisconsin Planning Guide for Smart Growth" (see www.dnr.state.wi.us/org/es/science/landuse/smart_growth/index.htm for more information) and the Northeastern Illinois Planning Commission's "Environmental Considerations in Comprehensive Planning: A Manual for Local Officials" (see www.nipc.org for more information) are becoming more widely available.

Outdoor Recreation Opportunities

Outdoor recreation in the Great Lakes basin is an important component of the region's economy. The region offers outstanding tourism and recreational opportunities ranging from wilderness activities in pristine national parks to swimming at beaches in major cities. A well-defined four-season climate supports many types of recreation ranging from ice fishing, skiing, and snowmobiling in the winter to golf, fishing, boating, and swimming in the summer. There are approximately 40 state parks in or near the Lake Michigan basin as well as a large number of national lakeshore parks and fish and wildlife refuges. These can be visited by following the Circle Tour route around Lake Michigan. The Great Lakes Commission, in cooperation with the Great Lakes states and provinces in the 1980s and 1990s, coordinated the

Northwest Indiana Mayors Join to Re-Make Indiana Lakeshore

The mayors of East Chicago, Gary, Hammond, Portage, and Whiting, Indiana signed a memorandum of understanding to collectively pursue a master plan for the Lake Michigan shoreline. Each city contributed $8,000 to secure a $160,000 matching grant from the Indiana Department of Natural Resources to pay for the plan's development. The "Marquette Greenway Plan" involves a transformation of Northwest Indiana's lakeshore, covering about 45 miles from the state line at Hammond to the eastern edge of Portage from industrial to public use.

The master plan will provide the cities with a detailed map analysis and evaluation of the shoreline and its potential for public recreational use. The key elements of the plan include recapturing 75 percent of the shoreline for public use, a minimum 200-foot setback from the shoreline for all new structures and facilities and a continuous pedestrian/bicycle trail along the shore.

The partnership is the culmination of a vision first proposed by Indiana Representative Peter Visclosky.

Crandon Mine Site Purchased by Tribes

Twenty-eight years of opposition to restart the proposed Crandon mine in northeastern Wisconsin came to an end in October 2003 when two Native communities next to the site, the Forest County Potawatomi and the Mole Lake Sokaogon Chippewa (Ojibwe), paid $16.5 million for a 5,000-acre mine site. Mole Lake now owns the Nicolet Minerals Company.

Exxon Coal and Minerals Company discovered a deposit located in Forest County during the mid-1970's through geophysical reconnaissance and an extensive exploration drilling program. Nicolet Minerals Company proposed to develop the ore body.

Many in the area opposed the proposed mine because it was upstream of many wetlands, Ojibwe wild rice beds, Native burial sites, and prized trout, walleye and sturgeon in the Wolf River. The Wolf River is also prized for both its smooth and white water canoe opportunities.

Many who opposed the mine hope tribal ownership will result in open space and habitat protection for the area.

Proposed Lake Michigan Water Trail

The creation of Great Lakes automobile and bike trails around Lake Michigan and the creation of several water trails around the lake has led to discussions of linking the emerging water trails into a larger system of water trails by the U.S. National Park Service (NPS) and LaMP committees.

The Lake Michigan Water Trail program would encourage coordination among lakefront communities to develop a water trail segment that links their communities and provide a safe, educational, and legal access experience to Lake Michigan. Water trail creation brings together a broad coalition of interested groups including public land managing entities, self-powered boating interests, environmental and historical groups, private property owners, tourism offices, and physical activity advocates. The Rivers and Trails Program of the NPS will provide technical assistance to communities who wish to participate in water trail development.

Rivers and Trails staff has a history of assisting communities around the country in water trail development. In each of these projects, Rivers and Trails staff serve as convener, facilitator, coordinator, and technical advisor on the design, research, marketing, and, oftentimes, all of the above. NPS staff assisted in developing water trails in Chesapeake Bay, Florida's waterways, Pugent Sound, San Francisco Bay, the Great Lakes and numerous rivers in between. In the Great Lakes, NPS Wisconsin staff assisted in developing three water trails in Lake Superior (one in each state of Minnesota, Wisconsin, and Michigan), one in Lake Huron, and are currently embarking on one in northwestern Lake Michigan.

Creating a water trail on the northwest shore of Lake Michigan raises the challenge of how to link with an existing water trail segment on Lake Michigan's southwest shore and to expand around the lake. Spearheaded by the Northeastern Illinois Planning Commission, Openlands Project, and the Illinois Paddling Council, the Northeastern Illinois Regional Water Trails Plan was developed in 2002 and includes the Lake Michigan shore from Indiana to Wisconsin.

For more information, contact Angie Tornes at angie_*tornes@nps.gov*.

Follow the Circle Tour signs!

creation of the Circle Tours along existing roadways. The Lake Michigan Circle Tour route is marked by signs that feature Lake Michigan and the four surrounding states. In addition, guides prepared by states and localities that highlight enjoyable areas are important tools for promoting public access as well as critical ecosystem protection.

The eight Great Lakes states have about 3.7 million registered recreational boats, or about a third of the nation's total. Michigan leads the nation in the number of boat registrations and six Great Lakes states rank in the nation's top ten in total registrations. The commercial and sport fishing industry in the Great Lakes basin is valued at more than $4 billion annually.

The Benefits of Open Space

Open space plays an important role in supporting the economy. According to the National Association of State Park Directors, use of geologically or environmentally sensitive areas as open space or for recreational purposes can reduce potential property damage costs. Hazards that can be mitigated through conservation of open space include flooding, slope instability, and structural fire damage. The combination of habitat protection and recreation is often the highest and best use of lands that are too fragile for development. The cost of not protecting such assets as slopes, aquifers, woodlots, wetlands, fens, alvars, floodways is incredibly high in the long run.

Coastal Zone Management Programs

The Coastal Zone Management Program is a national initiative, administered by the National Oceanic and Atmospheric Administration (NOAA) that focuses on balancing the economic prosperity and environmental health of the nation's coasts. Participation in the Coastal Zone Management Program will make over $900,000 available annually to achieve the goals of the Indiana Lake Michigan Coastal Program. The following information is on recent developments in Indiana and Illinois. Michigan and Wisconsin, which have had coastal zone programs for many years also participate in the program.

Indiana

The Indiana Department of Natural Resources has completed the development process for the Lake Michigan Coastal Program, including a framework for Indiana's participation in the Coastal Zone Management Program in 2002. The Indiana Lake Michigan Coastal Program was developed to enhance the State's role in planning for and managing natural and cultural resources in the coastal region and to support partnerships between federal, state and local government agencies and organizations. The Lake Michigan Coastal Program is based on a network approach that uses existing state laws and programs. It is a new tool to implement existing programs and to provide funding for unique or under-funded projects.

The Indiana Lake Michigan Coastal Program will, through grants and partnerships with local communities, support activities that achieve the following goals in the coastal region:

- Protect and restore significant natural resources,
- Prevent the loss of life and property in coastal hazard areas;
- Improve public access for recreational purposes;
- Protect and restore important historic and cultural resources;
- Improve government coordination and policy and decision making;
- Prevent, reduce, or remediate nonpoint source pollution that affects coastal waters;
- Revitalize urban waterfronts and ports; and
- Provide for priority water dependent uses.

An extensive effort was made to continue public involvement during the development of the Lake Michigan Coastal Program.

In 2004, eleven projects were selected to be funded, totaling $1.158 million. This is down slightly from the 2003 awards of $1.171 million. Initial reports indicate that 2005 awards will be lower than the 2004. The initial Presidential budget requests $4.6 M less for Coastal Grant Programs than the 2004 appropriation. This reduction would most likely be spread out among all 34 participating Coastal State or territories.

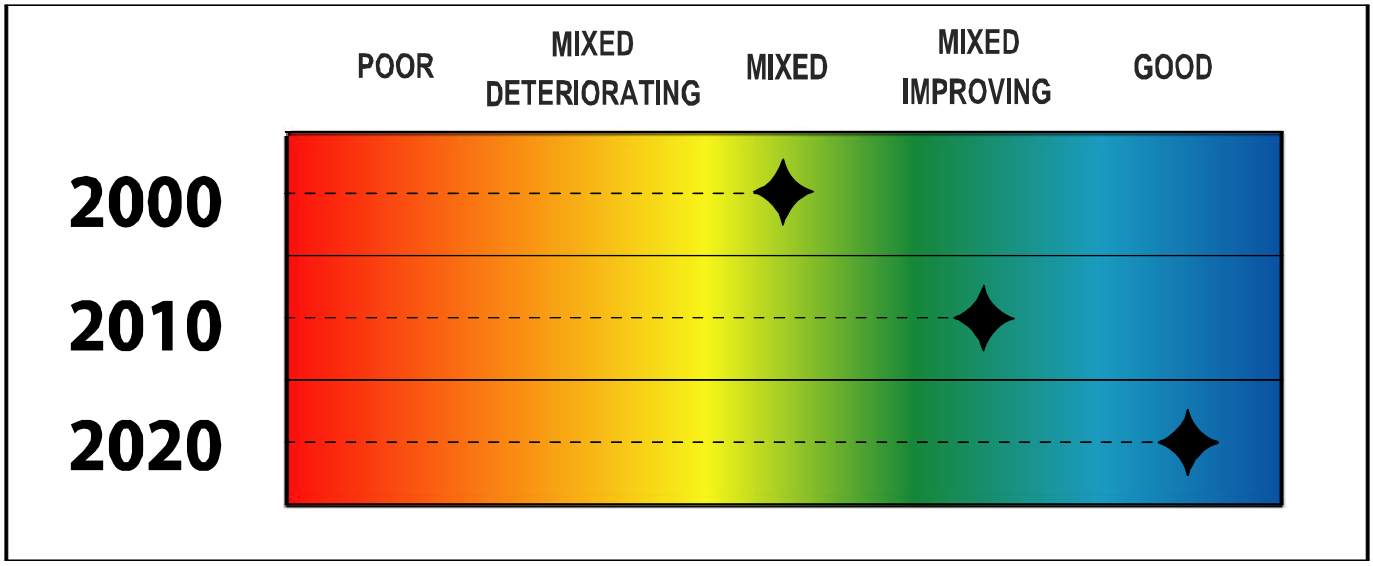
Illinois

In January 2004, the Illinois Conservation Congress passed a recommendation that Illinois investigate participation in the National Coastal Zone Management Program. The Illinois Department of Natural Resources has the recommendation under review.

Next Steps

- Partner with the growing coastal zone management programs in the Lake Michigan basin to ensure that the issue of public access to the lake is balanced with protection of the ecosystem
- Identify the need for additional facilities and access points (such as boat ramps canoe, and bicycle and walking trails around Lake Michigan).
- Expand the Northeastern Illinois water trail to other regions and states around Lake Michigan in partnership with National Park Service state and local organizations.

Subgoal 6
Are land use, recreation, and economic activities sustainable and supportive of a healthy ecosystem?



Status

Land use, recreation, and economic activities are more sustainable, healthy and supportive of a healthy ecosystem, but there is significant work that needs to be done. There is more information available on critical ecosystems, significant activity in better managing water resources and determining the true value of a healthy ecosystem. There is danger, however, that the ecosystem could deteriorate if the knowledge is not shared widely and translated into actions.

Challenge

- Land use and human activities are undertaken by individuals aware of the lake ecosystem's capacity to support human and environmental activities.

Sustainability

Effective, sustainable protection of the Lake Michigan ecosystem requires that the LaMP partners focus on promoting balance between the environment and society. The interdependencies inherent in the ecosystem

Chicago's Water Agenda 2003

Chicago's Water Agenda 2003, outlines a strategy for caring for water resources as a whole. The agenda calls for a comprehensive approach to the City's waterways to ensure that they are conserved for future generations, protected improved, and managed. Chicago's Department of Water Management is implementing a five-year, $620 million capital improvement program that includes replacing approximately 50 miles of old leaking water mains every year. Additionally the Department is helping other units of local governments examine their distribution systems for leaks. The improvements in Chicago alone will save an estimated 120 million gallons of water each day.

The City will continue to review its procedures and implement water conservation measures wherever possible in city buildings and services. Many programs to reduce use in city-owned buildings are already underway. The City is examining the Building Code for opportunities to allow for more efficient fixtures, like waterless urinals and dual flush toilets; explore the potential of installing gray water systems to irrigate landscaping or for flush toilets in public buildings and plant native species that are drought tolerant to reduce the need for watering. Further, the city is developing a plan to meter all residential water use. Currently, many older residential buildings or residential buildings with fewer than three units pay a flat, semi-annual fee for water use.

Study Shows Residential Property Values Could Increase if Sediment Pollution Eliminated

A study conducted by the University of Illinois and the Northeast-Midwest Institute found residential property values throughout Lake County, Illinois could increase by as much as $333 million if sediment pollution in Waukegan Harbor is eliminated. The study also suggests that redevelopment of the Harbor area, improved shipping, and attraction of new residents and businesses could further add to the benefits of Harbor clean-up.

More information is available at *www.nemw.org/Waukegan-July-press-release.pdf*

perspective require a balance between three fundamental elements: environmental integrity, economic vitality, and sociocultural well-being. The ability of these elements to function in balance over time is a measure of sustainability. The ecosystem perspective requires a shift of focus from resource programs to resource systems and in some cases their interaction. It places human activities and communities within an ecosystem and consequently, within ecosystem management.

The LaMP helps to identify the activities, partnerships, and locations where ecosystem management needs adjustment in order to attain a sustainable Lake Michigan basin. Sustainable landscapes are local ecosystems that are healthy enough to provide a range of valuable benefits and services, both now and in the future. Such benefits and services to humans include the following:

- Moderating natural events and human activities. Healthy landscapes can make communities safer and more livable by tempering the effects of natural events and human activities. For example, wetland systems can absorb and store storm waters, thereby aiding in flood control and ensuring more predictable stream flows and water levels and often providing for recharging local ground water.
- Enhancing social well-being. Healthy landscapes provide services that make communities more enjoyable and rewarding. For example, they provide opportunities for outdoor recreation, while also providing habitat for diverse plant and animal species. Plantings along stream banks can also provide buffers to filter pollutant runoff.
- Supporting local economies.

New Information on Groundwater Flow

Groundwater divides are not necessarily the same as the Great Lakes watershed divide. In the Great Lakes basin, most shallow flow discharges to local

Michigan Governor Outlines Comprehensive Water Agenda

Michigan Governor Jennifer M. Granholm sent a special message to the Michigan Legislature in January 2004 in which she unveiled a comprehensive plan to protect Michigan's great, fresh waters. The cornerstone of the initiative is the Michigan Water Legacy Act, a comprehensive water withdrawal statute based on the principles of the Great Lakes Charter, which will subject all significant water withdrawals to review by the Department of Environmental Quality (DEQ) to ensure that Michigan's water resources are not impaired or compromised.

In addition to the proposed Water Legacy Act that was delivered to state lawmakers in February, the initiative includes administrative steps that the Granholm Administration will immediately implement to protect Michigan waters. Those steps include an executive directive that prohibits state agencies from approving the open water disposal of contaminated dredge materials in Michigan waters; and, a second executive directive that asks the DEQ to protect critical isolated wetlands on state land from harm.

Further, the Governor asked the Michigan Attorney General to join a number of environmental and conservation groups in a lawsuit against the EPA to compel them to regulate ballast water discharges, and ask state lawmakers to live up to the 2004 budget agreement by approving user fees to fund the National Pollutant Discharge Elimination System, a critical component in monitoring what goes into our water. The Governor also asked the Bush Administration to fund the first installment of a multi-year Great Lakes restoration effort. The last two activities have been accomplished.

Basin water supply for the Great Lakes

Lake	Overlake Precipitation (percent)	Surface-Runoff (percent)	Indirect groundwater discharge (percent)
Superior	56.3	11.0	32.7
Michigan	56.2	9.3	34.5
Huron	42.2	16.3	41.5
Erie	53.5	24.3	22.2
Ontario	34.8	22.8	42.4

Source: USGS. 1998. Water Supply Paper 98-52, D.J. Holtschlag and J.R. Nicholas

streams - the Great Lakes watershed divide (i.e., the subcontinental divide) also serves as a ground-water divide for shallow flow. Most deep flow discharges to regional sinks and the deep aquifer divide, however, can be distant from the surface watershed divide.

Groundwater's role in the Health of the Lake Michigan Ecosystem

Ground water is a major natural resource in the Great Lakes Region because it indirectly contributes more than 50 percent of the stream discharge to the Great Lakes. In addition, ground water is the source of drinking water for millions of people in the region, is an important source of supply for agriculture and many industries, and provides a relatively uniform supply of water in some ecologically sensitive areas to sustain plant and animal species. Therefore, to improve our understanding of water resources issues in the Great Lakes Region, it is important to have a better understanding of the role that ground water plays in the overall hydrologic system of the lakes. The main ground water resources issues in the Great Lakes Region are related to the amount of ground water, the interaction of ground water and surface water, changes in ground water quality as development expands, and ecosystem health related to the quantity and quality of water.

A relatively small amount of ground water flows directly to the Great Lakes

The Great Lakes are in topographically low settings that, under natural flow conditions, causes them to function as discharge areas or "sinks" for the ground-water-flow system. Most ground water that discharges directly into the lakes is believed to take place near the shore (Grannemann and Weaver, 1999). Of all the Great Lakes, Lake Michigan has the largest amount of direct ground water discharge (2,700

Figure 6-1 Groundwater Withdrawals in the Great Lakes Region

Milwaukee Sewage District Teams With River Revitalization Foundation for Easement Acquisition Under Greenseams Program

A teaming of the River Revitalization Foundation and the Milwaukee Metropolitan Sewerage District (MMSD) under the Greenseams program purchased a conservation easement on nearly four and a half acres along the Milwaukee River. The easement connects two Milwaukee County owned parcels along the western shore of the river between Gordon Park and North Avenue. The project is intended to protect the riverbank from development and promote greater public use of this land, advancing a policy that provides additional flood protection, reduces dirty runoff and keeps undeveloped riverfront land in its natural state. The purchase price for the conservation easement was $150,000.

The easement will preclude development of the land and allow MMSD access for flood management projects and other improvements to the natural shoreline. Future Greenseams efforts will increase recreational opportunities for people throughout the MMSD region. For example, the Conservation Fund analyzed undeveloped land in three other Milwaukee watersheds and identified 41 sites, totaling 7,065 acres that contained the necessary soil conditions to provide future flood-reduction benefits. In all, the group estimated the sites could provide 4.7 billion gallons of storage. The sites range in size from 30 acres to 674 acres.

The MMSD Commission approved a plan in September 2001 to work with local community groups, municipalities and others to purchase easements or acquire outright properties identified as critical for guarding against future flooding in the Menomonee River, Oak Creek and Root River watersheds. The Commission approved a contract with The Conservation Fund, a national non-profit conservation organization to act on MMSD's behalf in acquiring easements and property, and administering the program.

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Smart Growth Information Sources

Smart growth is development that serves the economy, the community, and the environment. It changes the terms of the development debate away from the traditional growth/no growth question to "how and where new development should be accommodated."

Smart Growth answers these questions by simultaneously achieving:

- Healthy communities -- that provide families with a clean environment. Smart growth balances development and environmental protection -- accommodating growth while preserving open space and critical habitat, reusing land, and protecting water supplies and air quality.
- Economic development and jobs -- that create business opportunities and improve local tax base; that provide neighborhood services and amenities; and that create economically competitive communities.
- Strong neighborhoods -- which provide a range of housing options giving people the opportunity to choose housing that best suits them. It maintains and enhances the value of existing neighborhoods and creates a sense of community.Transportation choices -- that give people the option to walk, ride a bike, take transit, or drive.
- A sample of smart growth information sources include:

    - *http://www.epa.gov/smartgrowth/*
    - *http://www.cwp.org/index.html*
    - *http://www.lowimpactdevelopment.org/*

ft^3/s) because it has more sand and gravel aquifers near the shore than any of the other Great Lakes (Grannemann and Weaver, 1999). Although this is a relatively low inflow compared to the total streamflow into the lake from land areas (41,200 ft^3/s) (Croley and Hunter, 1994), it is nearly equal to the amount of water diverted from Lake Michigan through the Chicago Ship and Sanitary Canal (Oberg and Schmidt, 1996).

Ground water provides refuge for aquatic organisms

Ground-water discharge to streams may help provide important habitat for aquatic organisms, including fish. In addition, because ground water temperatures are nearly constant throughout the year, stream reaches with relatively large amounts of ground water discharge can provide refuge to organisms from heat in summer and from cold in winter. For example, some stream reaches in the region remain unfrozen even though air temperatures are well below 32° Fahrenheit. Other possible benefits to the survival of aquatic organisms related to ground water discharge to streams include increasing concentrations of dissolved oxygen, adding small amounts of nutrients that are essential to the health of organisms, providing cold pockets of water in summer, and maintaining streamflow during dry periods.

Issues related to the amount of ground water

Although the amount of water in the Great Lakes Region is vast, issues related to relatively small quantities of water are being raised more and more often. For example, even though the amount of ground water pumped in the region is small compared to the total amount of water present, ground water is an important source of public water supply as well as an important source of supply for industrial, agricultural, and domestic needs. Less clearly understood, however, is the relation between the amount of streamflow discharging to the Great Lakes and the large portion of that flow that originates as ground water. The implications of this understanding for water- and land-use practices and, in turn, their effects on water quantity and quality, have not been fully incorporated into a policy framework. To help include information about the implications of the role that ground water plays in addressing regional water issues, a comprehensive analysis of indirect ground-water discharge to the Great Lakes is needed.

Direct ground-water discharge to the Great Lakes is not a large factor in water budget analyses for the Great Lakes. Locally, however, direct ground water discharge to the Great Lakes may be important, even though the rates and places of discharge are

Lake Michigan Water Resource Planning Conference

Holiday Inn, Merchandise Mart, Chicago, Illinois

A conference, "Straddling the Divide: Water Supply Planning in the Lake Michigan Region" is planned for February 15-16, 2005. The objective of the conference is to influence local governments in the Lake Michigan region to integrate water supply considerations including water demand forecasting, land use planning, and water conservation into local and regional planning processes. The one and a half day conference convenes local, regional, and state level policy and decision-makers from Wisconsin, Illinois, Indiana, and Michigan to discuss and strategize about the implications about water supply and water quality issues in the Lake Michigan region. The conference is co-sponsored by the Northeastern Illinois Planning Commission and the Southeast Wisconsin Regional Planning Commission

The conference has a policy track geared toward municipalities, counties, and regions and a technical track geared toward science and engineering in support of regional-scale activities. More information is available at *www.nipc.org*.

Michigan Water Bottling Court Case

A Michigan judge ordered the Ice Mountain bottled water plant to discontinue pumping water from wells in Mecosta County, Michigan. The judge ruled the operation damages the environment by depleting neighboring lakes, streams, and wetlands, violating Michigan Environmental Protection Act (MEPA) and other state water laws. A three-judge panel of the state Court of Appeals held that the Ice Mountain operation could continue while it appeals the Mecosta Circuit Court ruling. The appellate panel did limit the amount of water the firm could draw to its current average while the appeal continues.

The Michigan Department of Environmental Quality's Water Division originally granted the permit in 2001 allowing Ice Mountain's water-bottling plant to withdraw up to 400 gallons per minute, or 576,000 gallons per day from four spring wells. The plant's average pumping rate has been around 200 to 250 gallons per minute.

not well known. A long-term evaluation of direct ground-water discharge to the Great Lakes would help place this hydrologic process in proper perspective. Near-shore areas with high rates of direct ground water discharge may provide valuable habitat for aquatic organisms.

Lake Levels

Lake Michigan was measured at 2 feet below the long-term average in 2001, having dropped more than 40 inches since 1997 when it was at near record highs. Levels increased for the 2002, but were still below average. The decrease in precipitation over the last five years and resulted in Lake Michigan being at its lowest point since 1966. Lake levels rose between the mid 1960s and the late 1990s.

The lower lake levels has caused problems for the shipping and boating industry. Cargo ships were forced to lighten their loads, and many boat ramps became inaccessible. According to the U.S. Great Lakes Shipping Association, for every inch of water that Lake Michigan loses, a cargo ship must reduce its load by 90 to 115 metric tons, leading to losses of between $22,000 and $28,000 per trip.

Early reports for 2004 indicate that the lake is at about average due to increased rainfall early in the year. This fluctuation may be part of a 30 year cycle but deserves close monitoring.

Lake Level Monitoring

Current Lake Michigan levels can be monitored online through a new National Oceanographic and Atmospheric Administration website, *http://glakesonline.nos.noaa.gov*. The site provides immediate water level and meteorological data from water level stations. There is a 6 minute interval between data readings and plans for real time wind speed and direction data, in addition to barometric pressure and air temperature data. This augments the U.S. Army Corps of Engineers website that provides water level information *http://huron.lre.usace.army.mil/levels/hmpglv.html*.

Great Lakes Charter Annex 2001

There has been increasing focus on the issue of water withdrawals and diversions from the Great Lakes resulting in the Great Lakes Governors and Premiers signing the Great Lakes Charter Annex in June 2001. The Annex is an amendment to the Great Lakes Charter of 1985 which outlined a voluntary process for managing withdrawals of water from the Great Lakes. It sets guidelines for new Great Lakes water withdrawals.

The Annex establishes a series of principles for a new standard used to review new water withdrawals that will require new water withdrawals – whether for use inside or outside the basin - to result in an improvement to the Great Lakes. This standard is the first that would directly link water use to restoration and improvement of the ecosystem. A new draft binding agreement will be released for public review during the Summer of 2004. More information on the Annex is available at *www.cglg.org/projects/water/index.html*.

Lake Michigan Diversion to Chicago Water Deficit Reduced Faster than Planned

During the late 1990s, the diversion of water from Lake Michigan to the Chicago River exceeded the U.S. Supreme Court consent decree limit (2.1 billion gallons per day) by nearly 15% because of leakage at the Chicago River control works. Following a Memorandum of Agreement among the Great Lakes states, Illinois agreed to reduce its annual diversion over 14 years to pay off its water debt caused by the leakage. Repairs to the Chicago River locks and construction of new control works were completed in 2000.

The most recent certified Army Corps of Engineers information for Illinois' diversion is from 1997. At the end of the 1997 Water Year the cumulative deviation (debt) stands at -3408 cubic feet per second (cfs)-years. The running average of the diversion is at 3400 cfs. The general pace for repayment of the water debt is faster than required under the memorandum of understanding signed by the Great Lakes states in 1995. This is due to the repairs at the river locks and the lower water levels. At one point during the 1990s, the locks did not fully close, allowing the water to flow freely from Lake Michigan. The lower water levels have decreased the amount of water that flows between the lake and the river when the Chicago locks are opened.

Wisconsin Smart Growth Program

The Wisconsin Comprehensive Planning Law was passed as part of the 1999-2001 Wisconsin biennial budget. Although sometimes referred to as the Smart Growth Law, the Comprehensive Planning Law does not actually dictate how or where development will occur. Those decisions are left to local communities. However, because the Comprehensive Planning Law does improve on the amount and quality of communication within and between jurisdictions, it may indirectly lead to more informed decisions that result in smart growth.

The law requires localities to develop a comprehensive plan containing 9 elements:

- Issues and opportunities.
- Agricultural, Natural and Cultural Resources
- Housing
- Economic Development
- Transportation.
- Intergovernmental Cooperation
- Utilities and Community Facilities
- Implementation.

Land Use

After January 1, 2010, all community programs and actions that affect land use must be guided by, and consistent with, the community's comprehensive plan. This will make land use decisions much more predictable. The state provides a total of $3 million annually to help local communities develop comprehensive plans. To date, the comprehensive planning grant program has awarded $9.5 million to 535 Wisconsin communities, almost 1/3 of the state. The Comprehensive Planning Law requires public participation at every stage of the comprehensive planning process, including adopting a public participation plan to provide a diverse range of opportunities for the public to help shape the community's comprehensive plan and holding at least one public hearing prior to adopting the comprehensive plan, Plan drafts must be sent to adjacent jurisdictions, the Wisconsin Land Council, the regional planning commission serving the community, the public library serving the area, and all other area jurisdictions located entirely, or partially within the boundaries of the community.

Land Use Impacts Water Quality

The urbanized land area in the United States has quadrupled since 1954. To compound the problem, populations in coastal areas, which contain some of the most sensitive ecosystems, have been increasing even faster than in the rest of the country. From 1982 to 1996, the population in the Chicago-Northwest Indiana area grew by 10.9 percent but consumed 44.2 percent of the land. (Urban Roadway Congestion: Annual Report 1998) Wetlands, which naturally help control runoff from urban areas by storing flood and surface water and slowly releasing and filtering it, have been destroyed in the Lake Michigan basin to a greater degree than elsewhere in the country.

EPA's Office of Environmental Information states that "the construction of impervious surfaces such as roads and rooftops leads to the degradation of water quality by increasing runoff volume, altering regular stream flow and watershed hydrology, reducing groundwater recharge, and increasing stream sedimentation and water acidity." A 1-acre parking lot produces a runoff volume 16 times as large as that produced by an undeveloped meadow. Many impervious construction materials have higher surface temperatures that may cause ambient air temperatures to rise. When combined with a decrease in natural vegetation, areas are subject to what is called the urban heat island phenomenon, which may increase utility bills, cause health problems associated with heat stress, and accelerate formation of harmful smog. Clearly the effect of urban development on our communities and environment is a cross-cutting issue.

Oil and Gas Drilling in the Great Lakes

With the energy "crisis" in California in 2001 came renewed interest in tapping oil and natural gas

reserves. In the Great Lakes basin, much of these resources lie under the lakes themselves. Drilling under the lakes raises concerns because a spill would lead to harm of the world's single largest source of freshwater.

Due to this concern, an amendment to the Energy and Water Development Appropriations Act of 2002 prohibits all federal and state governments from issuing leases or permits for new oil and gas directional or offshore drilling in or under the Great Lakes for two years. Michigan's legislature passed legislation that would ban all direct and directional drilling in its portion of the Great Lakes basin. Furthermore, a proposed natural gas pipeline for lake bed of Lake Michigan from Wisconsin to Indiana was withdrawn in 2001.

Currently in the Lake Michigan basin, only Illinois has never issued an oil or gas mineral lease for Lake Michigan bottomlands. Indiana has permitted limited exploratory drilling, but no oil or gas has been produced. Wisconsin allows drilling for oil and gas in certain circumstances and Michigan has allowed drilling that begins on land with the pipes "slanting" under the lake.

Next Steps

All of the LaMP subgoals are interconnected with this chapter. For example, subgoal 9 addresses stewardship and is the response to the sustainability challenge. See Chapter 9 for needed steps, and as well as Chapter 2 for source water assessment needs.

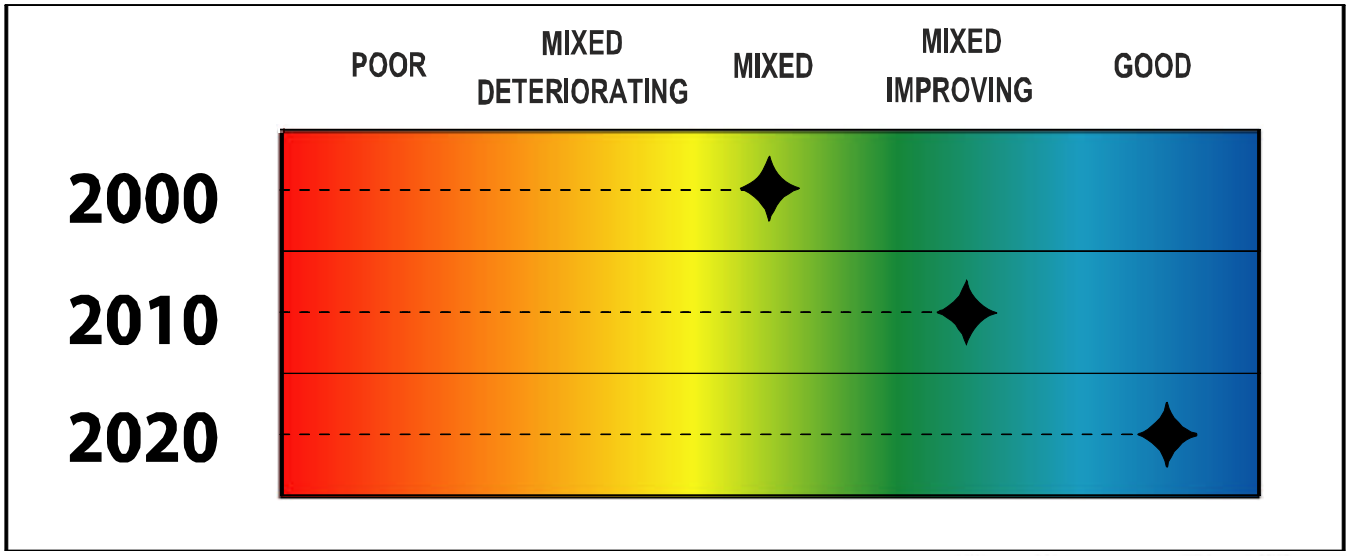
Over the next 2 years, the LaMP is also targeting the following for completion:

- Promote studies that provide the status of groundwater resource and impact on water quality and aquatic habitat.

Long-Term Objectives

- Sustainable use of lake resources by 2020.
- Support research and development and monitoring efforts that track the impact of any possible Charter Annex Improvement Standard activities.
- Support studies to determine sustainable yields for Great Lakes water resources, i.e., a Lake Michigan water budget.

Subgoal 7
Are sediments, air, land, and water sources or pathways of contamination that affect the integrity of the ecosystem?



Status

Sediments, air, land, and water continue to be sources or pathways of contamination that affect the integrity of the Lake Michigan ecosystem. While regulatory and remediation programs reduce pollutant sources, ongoing releases and the region's legacy of contamination continue to serve as sources of pollutants. As a result, the status of this goal is mixed. There has been significant activity that will assist in changing the status to mixed/improving over the next decade. In particular, the findings of the Lake Michigan Mass Balance Study will allow decision-makers to better understand pollution pathways and adopt policies to address pollutant sources.

A major event during the last two years was the passage of the Great Lakes Legacy Act which provides $45 million over three years to clean the legacy of contamination in the Areas of Concern, mostly involving mercury and PCBs. In addition, while annual monitoring of the lake by the U.S. EPA Great Lakes National Program shows no nutrient problems in the open waters of the lake,

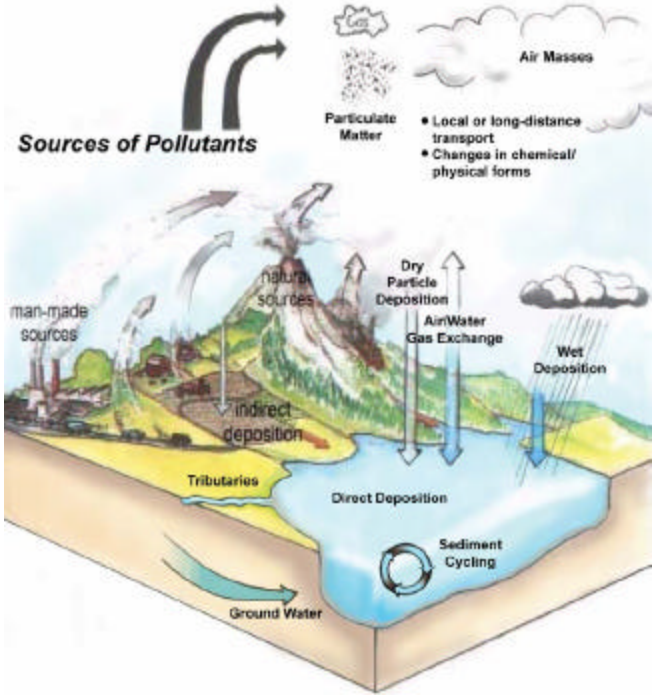


Figure 7-1 Pollutants enter Lake Michigan through several pathways
Source: *http://www.epa.gov/owow/oceans/airdep*
Augmented by Joseph F. Abboreno

Cladophora blooms have been reported in nearshore areas and embayments and the need exists to investigate the cause.

The following section presents recent findings regarding pollution pathways and predictions of future levels of PCBs in lake trout fish tissue and atrazine in the waters of Lake Michigan. The section concludes with an overview of specific pathways that continue to serve as sources of pollutant load to Lake Michigan.

Challenges

- To gather data on sources and pathways of contaminants in Lake Michigan.
- To develop a better understanding of the natural dynamics that affect pollutant distribution in the Lake Michigan ecosystem.
- To reduce pollutant loads with effective control and pollution control measures
- To develop coordinated monitoring in 2004 or 2005 and to develop a 10-year trend analysis based on the 1994 mass balance project for the lake.

Lake Michigan Mass Balance Project

The Lake Michigan Mass Balance (LMMB) Project is an enhanced monitoring and modeling project that is working to develop a scientific base of information to inform LaMP policy decisions and better understand the science of pollutants within an ecosystem. The LMMB Project's specific objectives are:

- To identify relative loading rates of four categories of pollutants (PCBs, mercury, pesticides, transnonachlor, and atrazine) entering Lake Michigan from major media (air, tributaries, and sediments);
- To establish baseline loading estimates in 1994-95 against which to gauge future progress
- To develop the predictive ability throught the use of models to determine the environmental benefits of specific load reduction scenarios for toxic substances and the time required to realize those benefits;
- To improve our understanding of key environmental processes governing the movement of pollutants through and out of the lake (cycling) and fish and plant life (bioavailability) within relatively closed ecosystems.

The LMMB Project focused on constructing mass balance models for a limited group of pollutants. Polychlorinated biphenyls (PCBs), trans-nonachlor, atrazine, and mercury were selected for inclusion in the LMMB Project because these pollutants currently or potentially pose a risk to aquatic and terrestrial organisms (including humans) in the Lake Michigan ecosystem. These pollutants were also selected to cover a wide range of chemical and physical properties and represent other classes of compounds which pose current or potential problems. Once a mass budget for selected pollutants is established and a mass balance model calibrated, additional contaminants can be modeled with limited data.

In the Lake Michigan system, pollutant inputs may

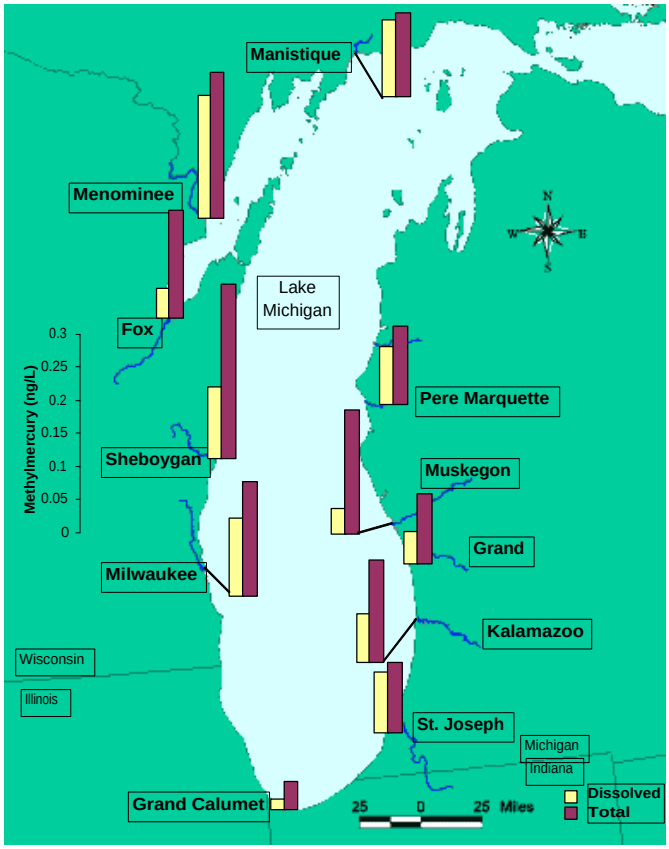


Figure 7-2 Lake Michigan Mass Balance Findings: Methylmercury in Lake Michigan Tributaries

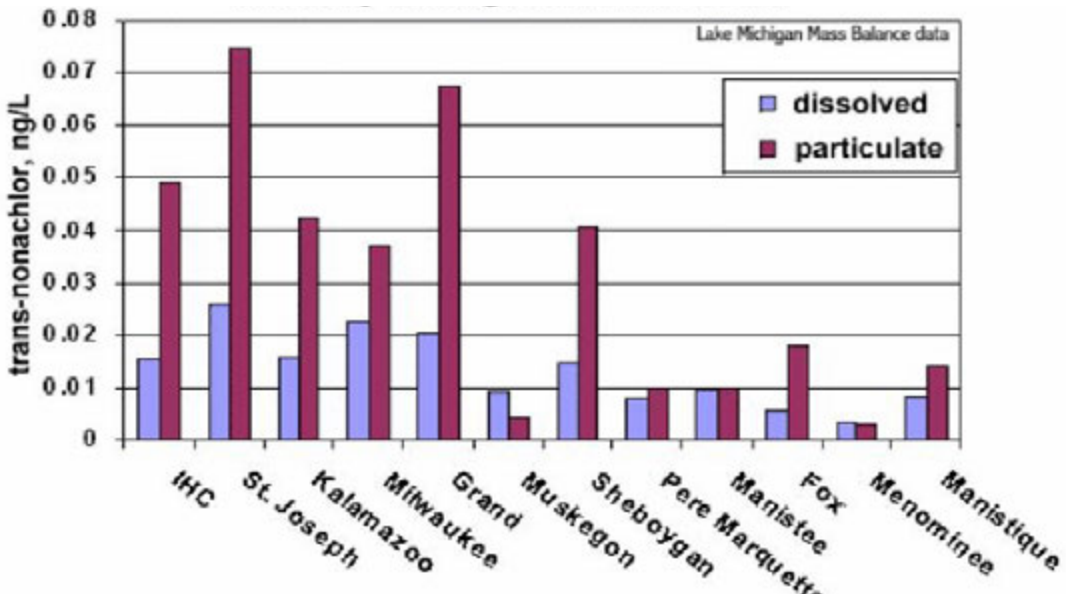


Figure 7-3 Average Tributary trans-nonachlor Concentrations

come from atmospheric deposition, tributary loads, or sediments. Pollutants may leave the system through volatilization to the atmosphere, or discharge through the Straits of Mackinac. Pollutants within the system may be transformed through degradation or stored in ecosystem compartments such as the sediments, water column, or biota, including humans.

Pollutants and Pathways to Lake Michigan

While the LMMB study focused on four pollutants to develop a better understanding of pollutant fate and transport within the Lake Michigan ecosystem, many other pollutants are entering the ecosystem through a variety of pathways. The following discussion addresses recent investigations of four of these pathways:

- Atmospheric deposition,
- Nonpoint source runoff, including combined sewer overflows (CSO)
- Sediment
- Groundwater

Atmospheric Deposition

The role of air pollution as an important contributor to water pollution has long been recognized and has been the subject of growing scientific study and concern in recent years. Over the past three decades, scientists have collected a large and convincing body of evidence showing that toxic chemicals released into the air can travel great distances before they are deposited on land or water. Most notably, PCBs and some persistent pollutants (including several pesticides that have not been used in significant amounts in the United States since the 1970s) have been widely distributed in the environment and are now part of the global atmospheric background. Section 112 of the Clean Air Act required congressional reports of the effect of air deposition on the "Great Waters" of the United States, including the Great Lakes.

Loadings of pesticides whose use has been canceled or restricted in the United States to Lake Michigan are primarily from atmospheric sources that may be impossible to regulate or control.

PCB Loads (kg/year) to Lake Michigan from Major Monitored Tributaries, 1994-1995

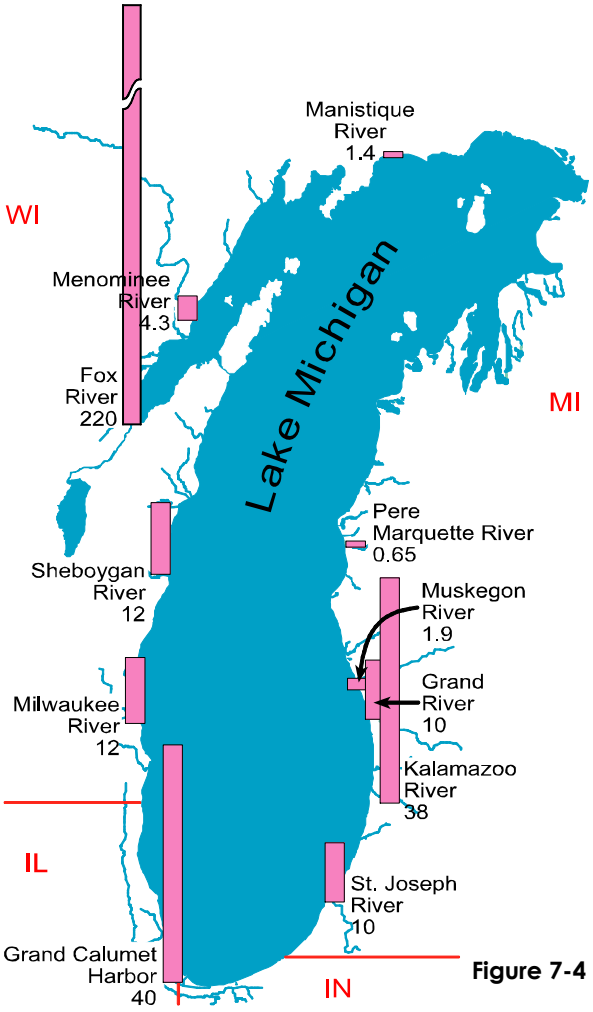


Figure 7-4

Although there are no current commercial sources of banned pesticides in the United States, loadings continue from use of remaining consumer stocks, evaporation from soils, resuspension of contaminated sediments, and atmospheric transport from other countries that continue to apply these substances. Further pesticide reductions can only be achieved through cleanup of contaminated sites, collection and disposal of existing stockpiles ("clean sweeps"), and use reduction in other countries.

Between 1988 and 2001, EPA Region 5 estimates that agricultural clean sweeps have removed 1.9 million pounds of pesticides from the Great Lakes basin (Figure 7-5)

While long-range atmospheric transport is an important pollutant source for Lake Michigan, recent studies also point to the influences of local sources, particularly from urban areas. For example, air sampling over Lake Michigan when the wind is blowing from the southwest shows contributions of PCBs, PAHs, and mercury from the Chicago area to the lake. The relative importance of each pollutant source to the overall loadings is variable depending on the season and local weather conditions.

Nonpoint Source Pollution

According to the U.S. EPA National Water Quality Inventory Reports to Congress, states, tribes, and other jurisdictions consider siltation and the over enrichment of nutrients two of the three most significant causes of impairment in many of the streams throughout the Nation. Siltation alters aquatic habitat and suffocates fish eggs and affects other bottom dwelling organisms. Excessive nutrients have not only been linked to hypoxia in the Gulf of Mexico, but also to eutrophication and *Cladophora* blooms in many of the bays and beaches around Lake Michigan. Research in the 1960's and 70's linked *Cladophora* blooms to high phosphorus levels in the water, mainly as a result of agricultural runoff, detergents containing phosphorus, inadequate sewage treatment, and other human activities such as fertilizing lawns and poorly maintained septic systems (More information is available at *www.uwm.edu/Dept/GLWI/cladophora*). Due to tighter restrictions, phosphorus levels declined during the 1970's and *Cladophora* blooms were largely absent in the 1980's and 90's. Recently

Region 5 Agricultural Clean Sweep Results 1988-2001

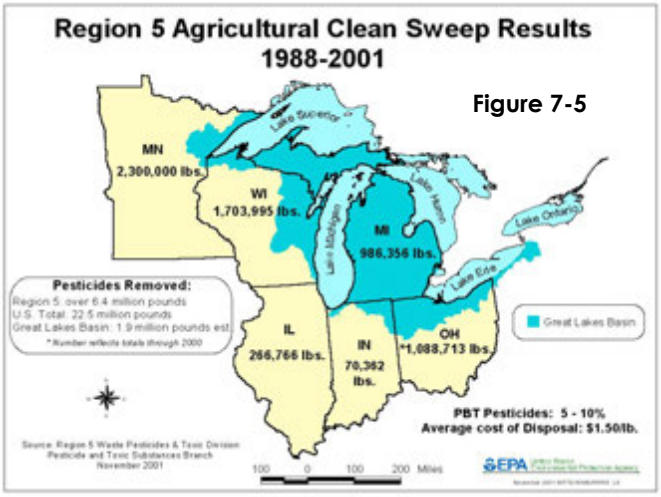


Figure 7-5

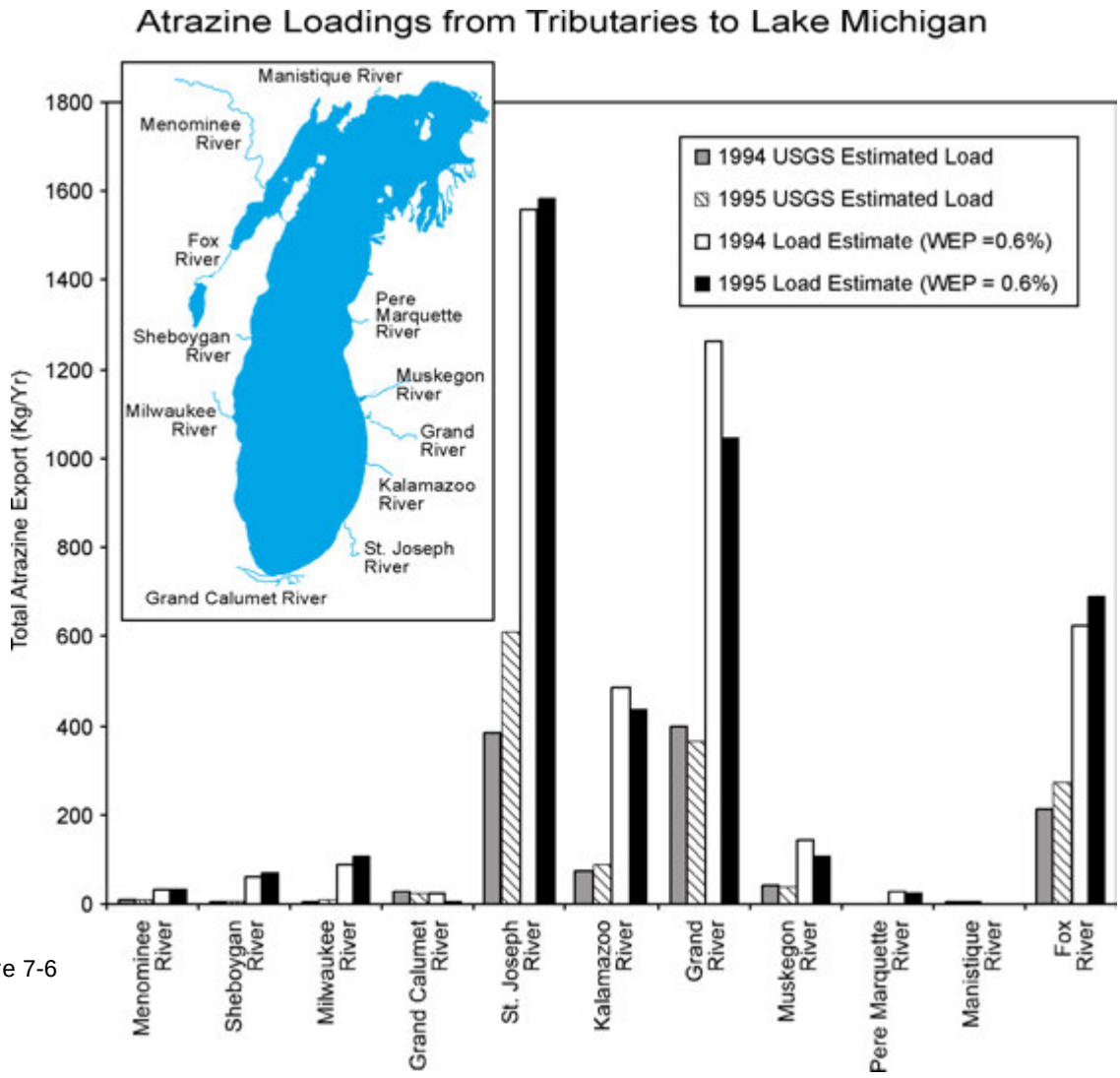


Figure 7-6

Cladophora blooms are again a common occurrence along the coast of Lake Michigan; however, the cause of these blooms is unknown.

U.S. EPA identifies polluted runoff as the most important remaining uncontrolled source of water pollution and provides for a coordinated effort to reduce polluted runoff from a variety of sources. Previous technology-based controls, such as secondary treatment of sewage, effluent limitation guidelines for industrial sources, point sources and management practices for some nonpoint sources, have dramatically reduced water pollution and laid the foundation for further progress. However, nonpoint source loads continue to turn rivers and streams into pollutant pathways to the lake. Total maximum daily load (TMDL) studies are needed for impaired tributaries to identify the management measures needed to bring them back into compliance with water quality standards. Over the next several years, states will be developing many TMDLs for pollutants entering into water bodies from both point and nonpoint sources. TMDLs will provide data to help manage water quality on a watershed scale.

Major sources of nonpoint pollution include urban stormwater runoff, discharges from animal feeding operations, cropland runoff, and episodic combined sewer overflows. In addition, pollution can arrive via air from outside a watershed.

Urban nonpoint source stormwater is water from rain or snow that runs off city streets, parking lots, construction sites, and residential yards. It can

Rural Nonpoint Source Pollution Prevention

Federal legislation has established several programs to provide financial incentives or actual payments to agricultural landowners who choose to take land out of production. Using prescribed land cover for 10 to 15 years is a means of reducing agricultural runoff and the resultant erosion, sedimentation, water quality degradation, and habitat destruction in streams and lakes. Among these programs are the Conservation Reserve Program (CRP), the Conservation Reserve Enhancement Program (CREP), and the Continuous CRP (CCRP), which are managed through the Department of Agriculture's Natural Resource Conservation Service (*www.nrcs.usda.gov*). The U.S. Fish and Wildlife Service operates a private land management program to provide cost-sharing incentives to individual landowners for habitat improvement projects. There are similar programs at the state and local levels offering grants, tax offsets, or conservation easements. These programs are accomplished through local, voluntary partnerships between individuals and government and make use of financial incentives, which limits the number of participants because of resource constraints.

Approximately 1.4 million acres of buffers have been established in the Great Lakes region through continuous Conservation Reserve Program (CRP) and Conservation Enhancement Reserve Program (CREP) (over 54 percent of the nation's buffers are in the Midwest region). According to the Department of Agriculture's Natural Resource Conservation Service, the estimated benefits of these programs in relation to improved wildlife habitat and water quality rather than resource loss and degradation is 3 times more than the costs of the programs.

Catalog of Federal Funding Sources for Watershed Protection and Nonpoint Source Control

U.S. EPA has compiled a Catalog of Federal Funding Sources for watershed protection and nonpoint source control at *http://cfpub.epa.gov/fedfund/*. The web site is a searchable database of financial assistance sources (grants, loans, cost-sharing) available to fund a variety of watershed protection projects. Examples of funding sources include the U.S. EPA administered Section 319 Nonpoint Source grant program under the Clean Water Act and the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Easement Program (CREP) administered by the U.S. Department of Agriculture.

carry sediment, oil, grease toxicants, pesticides, pathogens, and other pollutants into nearby storm drains. Once this polluted runoff enters the storm sewer system, it is discharged, usually untreated, into local streams and waterways. It can contaminate drinking and recreational waters and remains a major source of beach closures.

In late 1999, EPA promulgated rules to reduce stormwater runoff from construction sites between 1 and 5 acres and municipal storm sewer systems in urbanized areas serving populations of less than 100,000 through the issuance of permits. These controls must be in place by 2003. This new stormwater rule builds on the existing program to control stormwater runoff from municipalities with populations greater than 100,000 and 11 industrial categories, including construction disturbing over 5 acres. Under the expanded program, sediment discharges from approximately 97.5 percent of the acreage under development across the country will be controlled through permits.

The Lake Michigan basin has a high concentration of agricultural enterprises where animals are kept and raised in confined environments. Polluted runoff from animal feeding operations is a leading source of water pollution in some watersheds. Potential impacts include the absence or low levels of dissolved oxygen in surface water, harmful algae blooms, fish kills, and contamination of drinking water from nitrates and pathogens and beach closures.

For the vast majority of animal feeding operations (AFO), voluntary efforts will be the principal approach to assist owners and operators in developing and implementing site-specific management plans. Impacts from higher risk, concentrated animal feeding operations (CAFO), such as sites with the equivalent of 1,000 beef cows, are addressed through National Pollutant Discharge Elimination System (NPDES) permits under the authority of the Clean Water Act. About 5 percent of all animal feeding operations are expected to need permits.

Control of Combined Sewer Overflows

Combined sewer overflows (CSO) continue to be a major source of pollution in the Lake Michigan basin. Combined sanitary and storm sewers were

commonly built throughout the Lake Michigan watershed as an economical means of managing urban wastewater. These systems are heavily concentrated in the northeast and Great Lakes regions. Under normal conditions, these combined systems are able to transport sanitary wastes and limited amounts of stormwater to a wastewater treatment plant for disposal. However, during heavy precipitation events, the combined sewer can become overloaded and discharge the untreated overflow containing sanitary and stormwater directly into surface waters. Because the overflows contain pathogens, toxic pollutants, solids, and debris, CSOs can create serious public health and environmental problems. CSOs are considered point sources under the Clean Water Act and are therefore subject to regulation.

On January 29, 2002, EPA delivered a Report to Congress on Implementation and Enforcement of the Combined Sewer Overflow Control Policy. This report provides an overview of the progress made in controlling CSOs across the United States. It also provides state-by-state summaries of CSO control programs. Additional information on the report and state CSO programs as well as the state-by-state summaries can be found at *http://cfpub.epa.gov/npdes/* .

Sediments: Both a Contaminant and a Pathway

Land disturbed by natural or man-made processes produce sediments that impair tributary mouths and spawning areas. Better understanding of sediment movement in the lake is the goal of the Episodic Events: Great Lakes Experiment (EEGLE) at *www.glerl.noaa.gov/eegle/*.

Sedimentation in the tributary mouths and nearshore areas of Lake Michigan has been an ongoing problem. See the end of this chapter for a summary of sediment contamination and cleanups at the Lake Michigan AOCs. Substances found in Lake Michigan sediment reflect the land uses in near and upper portions of the watershed. Runoff from agricultural lands washes soil particles as silt that can smother aquatic habitat. The soil particles may also carry agricultural chemicals and nutrients into water bodies. Urban runoff also contributes sediments contaminated with pesticides, nutrients, oils, and other pollutants. Other contaminated substances discharged directly to the lake and its tributaries may bind preferentially with sediment particles. These substances accumulate or persist in the tributary mouths and nearshore areas because unlike smaller rivers that are constantly flushed with water, the lake is a sink. A drop of water

Michigan Proposes New NPDES Permit for CAFOs

In March 2004, the Michigan Department of Environmental Quality released for public comment a new general National Pollutant Discharge Elimination System (NPDES) permit for new Large Concentrated Animal Feeding Operations (CAFOs), and announced public hearings on the permit. This new general permit has been developed to complement DEQ Director Steven E. Chester's February 27, 2004, Final Determination and Notice that directs certain new large CAFOs to get individual permits, and other new large CAFOs to obtain coverage under the general permit for new large CAFOs. In order to constitute a valid authorization, the general permit must be complemented by a certificate of coverage issued by the DEQ to an individual facility.

The general permit allows for the discharge of wastewater under very limited circumstances involving certain precipitation events and also lists prohibited discharges. Construction of manure and wastewater containment structures using a composite liner design is required, and the permit specifies the design factors. Also included is a requirement to have a minimum of six months of storage available at the beginning of winter. A Comprehensive Nutrient Management Plan (CNMP) must be developed and implemented. A CNMP describes the production practices, equipment, and structure(s) that the CAFO will implement to sustain livestock in a manner that is both environmentally and economically sound. The permit lists the minimum standards a CNMP must meet to prevent the discharge of pollutants to the waters of the state.

The general permit requires a field-by-field assessment to determine the suitability of each field for land application, and a field-specific spreading plan must be included in the annual report for the upcoming 12 months. Certain land application timing and methods are specified in the permit, including setbacks, restrictions on land applications when the land is flooded, saturated with water, frozen or snow covered, or if one-half inch or more of rain is predicted by the National Weather Service.

Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams, 1999-2000: A National Reconnaissance

To provide the first nationwide reconnaissance of the occurrence of pharmaceuticals, hormones, and other organic wastewater contaminants (OWCs) in water resources, the U.S. Geological Survey used five newly developed analytical methods to measure concentrations of 95 OWCs in water samples from a network of 139 streams across 30 states during 1999 and 2000.

OWCs were prevalent during this study, being found in 80% of the streams sampled. The compounds detected represent a wide range of residential, industrial, and agricultural origins and uses with 82 of the 95 OWCs being found during this study. The most frequently detected compounds were coprostanol (fecal steroid), cholesterol (plant and animal steroid), *N*,*N*-diethyltoluamide (insect repellant), caffeine (stimulant), triclosan (antimicrobial disinfectant), tri(2-chloroethyl)phosphate (fire retardant), and 4-nonylphenol (nonionic detergent metabolite).

Measured concentrations for this study were generally low and rarely exceeded drinking-water guidelines, drinking-water health advisories, or aquatic-life criteria. Many compounds, however, do not have such guidelines established. The detection of multiple OWCs was common for this study, with a median of seven and as many as 38 OWCs being found in a given water sample. Little is known about the potential interactive effects (such as synergistic or antagonistic toxicity) that may occur from complex mixtures of OWCs in the environment. In addition, results of this study demonstrate the importance of obtaining data on metabolites to fully understand not only the fate and transport of OWCs in the hydrologic system but also their ultimate overall effect on human health and the environment.

More information is available at:
http://toxics.usgs.gov/regional/emc_sourcewater.html

entering Lake Michigan will take an average of 100 years to either evaporate or be washed into Lake Huron. The retention time for a particle of sediment is even longer.

Remediating Lake Michigan's legacy of contaminated sediment continues to be a high priority, and some progress has been made toward remediating the most highly contaminated sites on the lake in the past two years. As discussed under subgoal 1 "Can we all eat any fish?," two examples are moving forward on the Fox River in Wisconsin and Grand Calumet River in Indiana. From December 2002 to December 2003, USS removed 788,447 cubic yards of non-native sediments from the first 5 miles of the Grand Calumet River. The sediments are contaminated with PCBs, heavy metals, benzene, PAHs and cyanide. This project was conducted pursuant to a RCRA Order and Clean Water Act Decree at an approximate cost of $51 million. An estimated 8 tons of PCBs and 2,400 tons of heavy metals were removed from the river.

Sediment dredging is also moving forward in other areas of Lake Michigan. The U.S. Army Corps of Engineers is moving forward with a Comprehensive Dredge Material Management Plan for Waukegan Harbor, Illinois. The plan calls for dredging 250,000 cubic yards of polluted material and disposing the material in a confined disposal facility.

Groundwater Pathways in Lake Michigan

Groundwater enters the Great Lakes as either direct or indirect discharge. Direct groundwater discharge is flow directly into a lake through the lake bottom. Indirect groundwater discharge is flow into a lake by way of a tributary stream.

Groundwater discharge is a significant determinant of the biologic viability of tributary streams and coastal wetlands. In undisturbed areas, groundwater discharge throughout the year provides a stable inflow of water with consistent dissolved oxygen concentration, temperature and water chemistry. Where land uses significantly reduce groundwater flow to a stream, reaches of the stream or wetlands may lose their biologic viability. Likewise, where land uses add contaminants to a stream or wetland, they also may become impaired.

Until recently, the impact of groundwater on surface water quality has largely been ignored. Nonetheless, groundwater can have a significant effect on the quality of water in stream tributaries to the Great Lakes and on coastal wetlands by

transporting natural and man-made pollutants to them. In agricultural and urban areas of the Great Lakes basin, contaminants on the land surface become dissolved in groundwater and eventually flows into streams, wetlands, and the Great Lakes. This widespread, diffuse flow of contaminants by way of groundwater is a type of nonpoint source contamination. Pesticides and nutrients, such as nitrate and phosphorus, are the principal nonpoint source form of pollution that reaches the Great Lakes by way of indirect groundwater discharge to tributary streams and coastal wetlands. The growing understanding of the importance of this pathway has led many States to begin setting ground water quality standards and regulating the substances that can be discharged to groundwater.

Areas of Concern: Legacy of Contamination and Community Stewardship

LaMP 2000 explained: In 1987 the Great Lakes Water Quality Agreement (GLWQA) between the US and Canada was expanded to address critical stressors affecting the basin's ecosystem. The intersections of major tributaries and the Lakes are areas where human activity by-products and collected river deposits concentrate. " The Parties recognize that there are areas in the boundary waters of the Great Lakes system where, due to human activity, one or more of the General or specific Objectives of the Agreement are not being met. Pending virtual elimination of the persistent toxic substances in the Great Lakes system, the Parties, in cooperation with the State and Provincial Governments and the Commission, shall identify and work toward restoring and protecting beneficial uses in Areas of Concern or in open waters." (GLWQA)

For each AOC a stakeholder group was convened to work with federal and state agencies to develop remedial action plans that defined the problem and suggested remedial actions. This program has been very successful in capturing the energy and creativity of the communities. Unfortunately, agency funding and resources have been uneven and have never approached the scale needed for remediation of large-scale legacy sites. Federal authorities like Superfund, Resource Conservation and Recovery Act Corrective Action Program and the Clean Water Act have provided EPA the tools to address some of the large-scale actions needed. The U.S. Army Corps of Engineers has been given specific program authority for AOCs.

Federal and State agencies and the AOC communities want to move ahead, remediate and restore impairments and delist their AOC. Matching authorities to specific impairment sources and the recovery time needed for the

Milwaukee Metropolitan Sewerage District Joins with Dental Associations to Reduce Mercury in Wastewater System

The Milwaukee Metropolitan Sewerage District (MMSD) approved a first of its kind program in Wisconsin that, through the help of dentists, will be a significant tool in preventing mercury pollution from getting into Lake Michigan.

MMSD's new program will require approximately 500 dentist offices in the District's service area to install amalgam separators, devices that capture amalgam so that it can be recycled or disposed of properly. It is anticipated that this program will prevent 95 percent or more of the amalgam from dentist offices from getting into Lake Michigan, Dental offices are the largest source of mercury discharges to wastewater treatment plants, which are not designed to remove mercury from sewage. Used for fillings, dental amalgam is 50 percent mercury. When dental work occurs, vacuum systems remove waste amalgam from the mouth and deliver it into the sewer system. Amalgam separators are commercially available and range in price from several hundred to several thousand dollars for purchase. They can also be leased. Dentist offices will have until February 2008 to install the devices.

Revisions to MMSD's policy were developed through a partnership between MMSD, the Wisconsin and Milwaukee area dental associations and the Wisconsin Department of Natural Resources.

remediation actions to "take" in the environment are lengthy procedures. A number of new tools are now available:

- Delisting Principles and Guidelines- adopted by the U.S. Policy Committee in December 2001
- Workshops- Target setting and Delisting are the topics of a series of workshops sponsored by EPA's Great Lakes National Program Office and the Great Lakes Commission
- Area of Recovery terminology is being used to bridge the gap from remediation until impairments improve Lake Michigan
- Watershed Academy established in 2003 to promote watershed planning to address non-point-source pollution source of impairments
- Lake Michigan Watershed Academy providing framework for stewardship activities post AOC delisting- many AOC groups have evolved into watershed groups
- The Legacy Act- providing funding and new authorities for putting remediation partnerships together

Great Lakes Legacy Act

To address the problem of contaminated sediment in the Great Lakes, the Great Lakes Legacy Act of 2002 (the Legacy Act) was passed by Congress and signed into law by the President on November 27, 2002. The Act authorizes $270 million in funding over five years beginning in fiscal year 2004, and includes specific funding designated for public outreach and research components. President Bush's 2005 budget proposal will include an unprecedented $45 million for the cleanup of contaminated sediments in the Great Lakes system. The $45 million will be used to start or further the cleanup of four to six of the areas of concern. The request is a $35 million increase over 2004 Legacy Act funding.

Contaminated sediments are a significant problem in the Great Lakes basin. Although discharges of toxic substances to the Great Lakes have been reduced in the last 20 years, persistent high concentrations of contaminants in the bottom sediments of rivers and harbors have raised considerable concern about potential risk to aquatic organisms, wildlife, and humans. As a result, advisories against fish consumption are in place in most locations around the Great Lakes. The problem harbor and tributary areas in the Great Lakes basin have been identified and labeled as “Areas of Concern” (AOCs), with 31 of these AOCs located on the U.S. side of the Great Lakes.

Under the Act, priority is given to the following projects:

- Remedial action for contaminated sediment;
- Projects that have been identified in a Remedial Action Plan;
- Projects that are ready to be implemented;
- Projects that will use an innovative approach, technology, or technique that may provide greater environmental benefits, or equivalent environmental benefits at a reduced cost; or
- Projects that include remediation to be commenced not later than one year after the date of receipt of funds.

Projects must lie within a U.S. Area of Concern and must include monitoring and evaluation of contaminated sediment, implement a plan to remediate contaminate sediments, or prevent further or renewed sediment contamination. All remediation projects require a 35% non-federal match, and must not suffer significant, further or renewed contamination. A site assessment, remedial alternatives evaluation, short-term/long-term effects analysis, and remedial design work must be completed or being addressed. Non-Remediation projects must have a 35% non-federal match, and must meet the Act’s priorities as outlined above. Research and development projects must conduct research on the development and use of innovative approaches, technologies, and techniques for the remediation of contaminated sediments at U.S. AOCs. Public information projects must provide funding for public outreach and information at U.S. AOCs regarding remediation. The latter two aspects of the Act have not been funded. More information is available at *www.epa.gov/glnpo/legacy*.

Next Steps

- A mercury source reduction and sediment remediation strategy will be finalized.
- Contaminated sediment sites will be reviewed and their status will be updated for Legacy Act funding or delisting opportunities.
- Investigate nutrient contributions from the agricultural sector and non point sources during wet weather. Determine if nutrient levels are linked to *Cladophora* blooms.
- Hold meetings to discuss Lake Michigan Mass Balance models.
- Develop Impaired Waters Strategy through basinwide meeting.

Long-Term Objectives

- By 2004 and 2005, develop coordinated monitoring to provide a 10-year trend for the lake
- By 2010, remediation of 50 percent of AOC sites
- By 2020, remediation of 70 percent of AOC sites
- By 2025, remediation of 100 percent of AOC sites

Areas of Concern Overview

There is an increasingly strong focus on remediating the problems of areas of concern (AOCs). The ultimate goal is to ensure the effective clean-up of these contaminated areas and protect them by utilizing watershed stewardship activities as a means of ensuring their on-going protection.

The following matrix provides summary information for the Lake Michigan AOCs. It provides information regarding:

- AOC Name and Beneficial Use Impairments (BUIs)
- Primary Contaminants
- Geographic Area
- Stressors
- Programs
- Clean-Up Actions
- Key Activities Needed
- Challenges
- Next Steps

The Great Lakes Water Quality Agreement calls for Remedial Action Plans (RAPs) to restore and protect 14 beneficial uses in Areas of Concern. An impaired beneficial use means a change in the chemical, physical or biological integrity of the Great Lakes system sufficient to cause any of the impairments listed below (BUIs are listed in the AOC name column using the following numeration).

I. **Restrictions on fish and wildlife consumption** - When contaminant levels in fish or wildlife populations exceed current standards, objectives or guidelines, or public health advisories are in effect for human consumption of fish and wildlife.

II. **Tainting of fish and wildlife flavor** - When ambient water quality standards, objectives, or guidelines for the anthropogenic substance(s) known to cause tainting are being exceeded or survey results have identified tainting of fish and wildlife flavor.

III. **Degraded fish and wildlife populations** - When fish or wildlife management programs have identified degraded fish or wildlife populations. In addition, this use will be considered impaired when relevant, field-validated, fish and wildlife bioassays with appropriate quality assurance/quality controls confirm significant toxicity from water column or sediment contaminants.

IV. **Fish tumors or other deformities** - When the incidence rates of fish tumors or other deformities exceed rates at unimpacted control sites or when survey data confirm the presence of neoplastic or preneoplastic liver tumors in bullheads or suckers.

V. **Bird or animal deformities or reproductive problems** - When wildlife survey data confirm the presence of deformities (e.g. cross-bill syndrome) or other reproductive problems (e.g. egg-shell thinning) in sentinel wildlife species.

VI. **Degradation of benthos** - When the benthic macroinvertebrate community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics. In addition, this use will be considered impaired when toxicity (as defined by relevant, field-validated bioassays with appropriate quality assurance/quality controls) of sediment-associated contaminants at a site is significantly higher

than controls.

VII. **Restrictions on dredging activities** - When contaminants in sediments exceed standards, criteria, or guidelines such that there are restrictions on dredging or disposal activities.

VIII. **Eutrophication or undesirable algae** - When there are persistent water quality problems (e.g. dissolved oxygen depletion of bottom waters, nuisance algal blooms or accumulation, decreased water clarity, etc.) attributed to cultural eutrophication.

IX. **Restrictions on drinking water consumption or taste and odor problems** - When treated drinking water supplies are impacted to the extent that: 1) densities of disease- causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances exceed human health standards, objectives or guidelines; 2) taste and odor problems are present; or 3) treatment needed to make raw water suitable for drinking is beyond the standard treatment used in comparable portions of the Great Lakes which are not degraded (i.e. settling, coagulation, disinfection).

X. **Beach closings** - When waters, which are commonly used for total-body contact or partial-body contact recreation, exceed standards, objectives, or guidelines for such use.

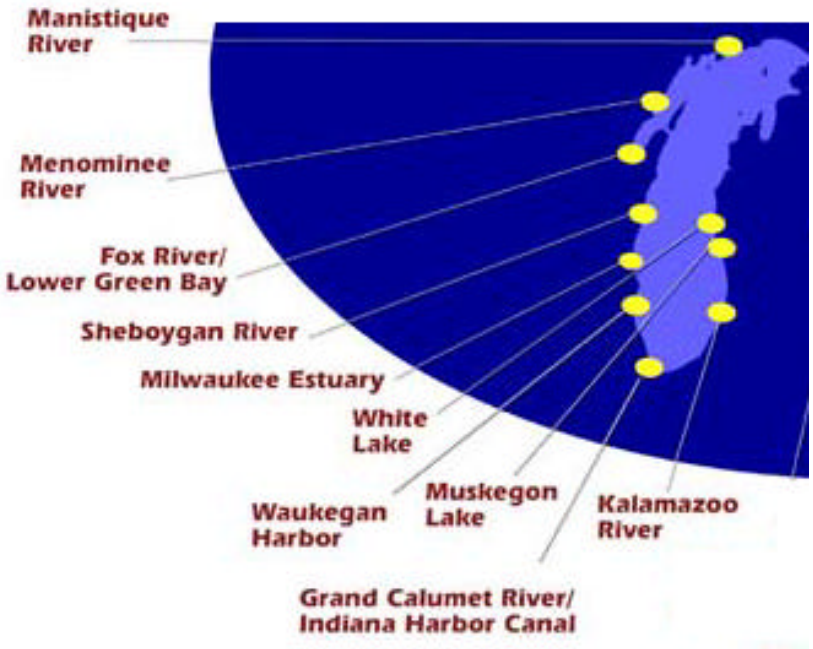
XI. **Degradation of aesthetics** - When any substance in water produces a persistent objectionable deposit, unnatural color or turbidity, or unnatural odor (e.g. oil slick, surface scum).

XII. **Added costs to agriculture and industry** - When there are additional costs required to treat the water prior to use for agricultural purposes (i.e. including, but not limited to, livestock watering, irrigation and crop-spraying) or industrial purposes (i.e. intended for commercial or industrial applications and noncontact food processing).

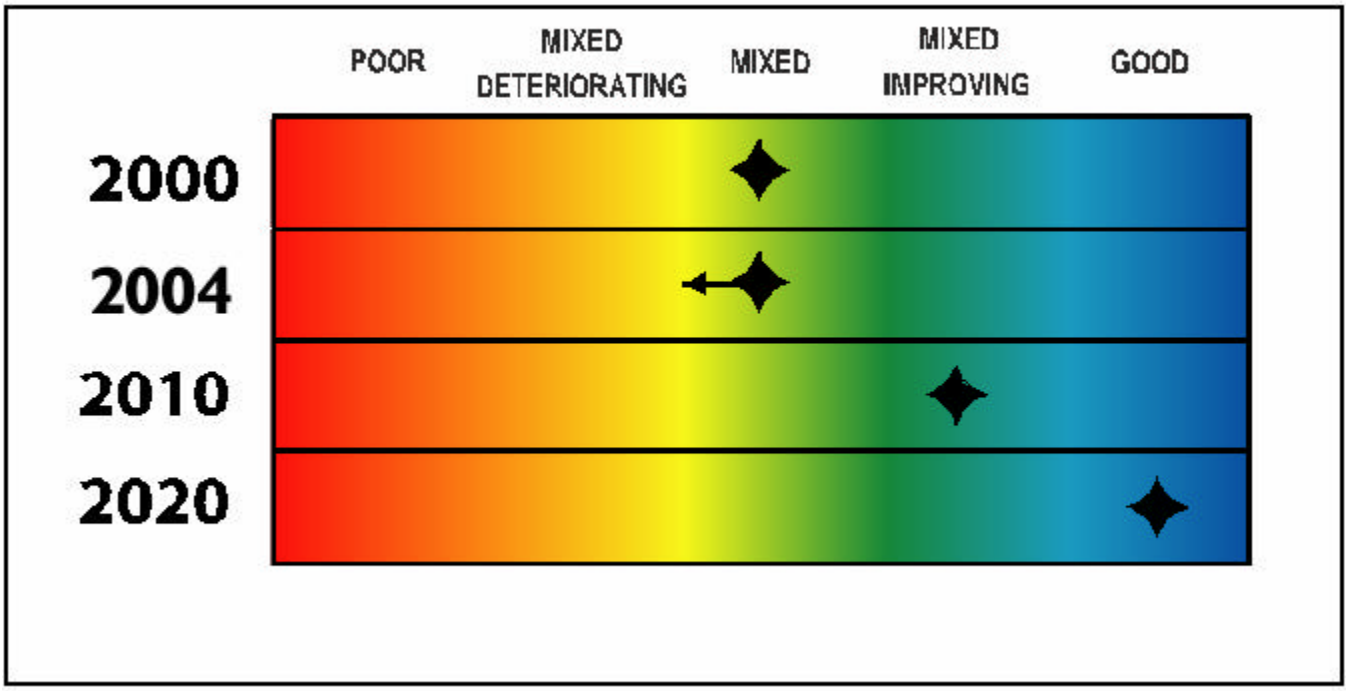
XIII. **Degradation of phytoplankton and zooplankton** - When phytoplankton or zooplankton community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics. In addition, this use will be considered impaired when relevant, field-validated, phytoplankton or zooplankton bioassays (e.g. Ceriodaphnia; algal fractionation bioassays) with appropriate quality assurance/quality controls confirm toxicity in ambient waters.

XIV. **Loss of fish and wildlife habitat** - When fish or wildlife management goals have not been met as a result of loss of fish or wildlife habitat due to a perturbation in the physical, chemical or biological integrity of the Boundary Waters, including wetlands.

Lake Michigan Areas of Concern



Subgoal 8
Are exotic species controlled and managed?*



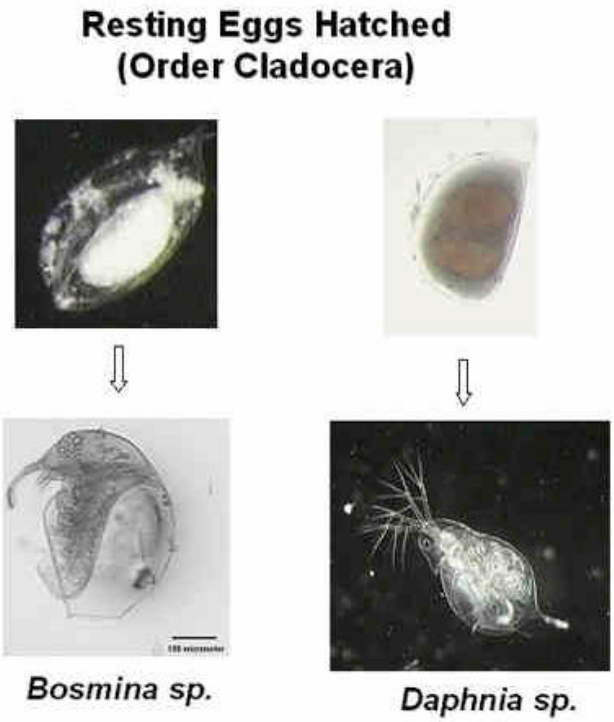
Status

The record of exotic species prevention and control in Lake Michigan is mixed. While there are success stories for the control of sea lamprey and the potential to prevent future introductions, zebra mussels and other new species continue to proliferate and are competing for food and habitat with native species. In the last 4 years, a new exotic, the spiney water flea, was introduced to Lake Michigan. Non-indigenous mussels are successfully competing with native species like the Diporeia, threatening the health of the entire Lake Michigan food chain. Furthermore, there is a danger that other new exotics, the bighead and silver carp from Asia, accidentally released into the Mississippi River, could enter Lake Michigan during the next few years through the Illinois River system. Currently, these carp are just outside the Lake Michigan system, at river mile 268 about 28 miles downstream of an electronic barrier in the Sanitary and Ship Canal. Until the trend for exotics is reversed, the status of this goal is mixed/deteriorating.

In the past year, the governments of Canada and the United States produced the fifth biennial report titled "State of the Great Lakes 2003". The report notes several negative signs of degradation regarding invasive species including the following:

- Non-native species are a significant threat to the ecosystem and continue to enter the Great Lakes.
- Scud (*Diporeia*) are continuing to decline in Lakes Ontario and Michigan.
- Native mussel species are being lost throughout Lake Erie and Lake St. Clair as a result of invasive zebra mussels.

*** In LaMP 2006, this chapter title is proposed to be revised to read "Are aquatic nuisance species prevented and controlled?" We invite comments on this proposed change.**



Example of invertebrate resting eggs (top row) and the organisms that hatched from them (bottom row) in lab cultures. Cladocera are small invertebrates (zooplankton). (image: Great Lakes NOBOB team, University of Windsor)

Lake Michigan, in particular, has suffered repeated invasions of aquatic nuisance species (ANS) which have seriously altered the native ecosystem. In recognition of the unique position of Lake Michigan as a receptor and pathway for continued invasions, the Lake Michigan LaMP has formed an ANS subcommittee to address these problems in this and future iterations of the LaMP. It is hoped that the new subcommittee will help facilitate communications between various national, regional and local entities involved in the prevention and control of ANS and help to highlight the special needs for the effort on Lake Michigan.

There have been several significant developments since the 2002 LaMP report including:

- European ruffe were discovered for the first time in Lake Michigan in 2002. A viable population of the perch sized fish have become established in Little and Big Bay de Noc in Northern Lake Michigan.
- Continued disruptions in the ecosystem of Lake Michigan, probably due to zebra mussel proliferation, have resulted in such phenomena as rampant *Cladophora* algae growth. This algae, which grows on the bottom of the lake, is uprooted and washes up in huge masses on Lake Michigan beaches resulting in unsightly and smelly messes more often in recent years. Recently, the algae has also become entangled in the nets of commercial fishers resulting in loss of revenue and threatening the livelihood of people who are already struggling due to ANS damage.
- Asian Carp continue to threaten Lake Michigan via the Chicago Sanitary and Ship Canal. A demonstration electric barrier has been installed to prevent migration into the lake. Federal and state funding for a second, permanent barrier has been secured for construction in 2004.

Challenge

- To develop a coordinated rapid response system
- To understand all pathways for introduction of unwanted species
- Education and engagement of the public on this issue
- Monitor international, national, and state developments

Scientist collecting mud from a NOBOB ballast tank (image NOAA).

The

The Lake Michigan Food Web. Diporeia, central in the diagram (p), was historically an important food for the fish on the second line in the red squares. They are the prey for the large predator fish like Salmon and Lake Trout at the top of the chart and food web in the purple squares. Non-native species are competing with, and possibly replacing the Diporeia in the Lake Michigan ecosystem. The loss of Diporeia threatens the species that feed upon it and the whole food web.

History of Exotics in the Great Lakes

Sea lampreys entered the Great Lakes following construction of the Welland Canal in the 1950s, which provided oceangoing vessels with access to all the Great Lakes. More recent arrivals such as the zebra mussel, round goby, and ruffe entered the lake through ballast water releases. The current number of non-native species in the Great Lakes is over 170. Governmental efforts have found the need to use various integrated measures to control exotic species. Some include

use of barriers to prevent movement of the exotics into tributary rivers and streams, specially formulated chemicals to target and kill young and sterilization. Experience has shown that a number of tools need to be employed to yield any measure of control

LaMP 2000 recognized that ANS have caused irreparable harm to the ecosystem of Lake Michigan. Prevention of unintentional introductions of such species, not only in the Lake Michigan basin but throughout the Great Lakes, is therefore one of the most important actions for achievement of subgoal 4 - "All habitats are healthy, naturally diverse and sufficient to sustain viable biological communities."

Ballast Water Continues to be a Vector

Despite heightened public awareness and attempts by state and federal lawmakers to prevent introductions into the Great Lakes via ocean-going ships, ballast water discharges are still the largest contributor to new ANS introductions to the Great Lakes. One of the main reasons may be that more than 90% of ships coming into the Great Lakes report that they have no ballast on board (NOBOB) and are therefore exempt from current laws which require ships to exchange ballast at sea. Yet NOBOB ballast tanks retain residual volumes of unpumpable ballast water and sediment which may contain live aquatic organisms and resting stages - eggs, spores, and cysts - accumulated over numerous previous ballasting operations. While operating in the Great Lakes, NOBOB vessels take on water as ballast to maintain their trim and stability. This new ballast water mixes with the residual ballast water, mud, and associated organisms in these tanks and can later be discharged as the vessel takes on new cargo at a various ports along its route.

Pacific Ballast Water Poster

Shipping Federation of Canada Code of Best Practices for Ballast Water Management

1. Conduct ballast water management whenever practical
2. Regular inspection of tanks and removal of sediment
3. Use of ballast water exchange procedures as provided for in U.S. legislation
4. Record keeping and reporting according to Coast Guard regulations
5. Provide information for verifying the vessel's compliance
6. Minimizing ballast water uptake under the following conditions:
   - In areas identified in connection with toxic algal blooms, outbreaks of known populations of harmful aquatic organisms and pathogens, sewage outfalls and dredging activity
   - In darkness, when bottom dwelling organisms may rise in the water column
   - In very shallow water
   - Where a ship's propellers may stir up sediment
   - In areas with high levels of suspended sediments
   - In areas where harmful aquatic organisms or pathogens are known to occur
7. Disposal of sediments outside International ballast water management areas or as approved by port authorities
8. Support research sampling programs and analysis
9. Participate in standards development and treatment systems testing

In order to test the theory that NOBOB ships might still be a vector for introductions, the U.S. National Oceanic and Atmospheric Administration (NOAA) is heading a team of researchers in conducting a study of the sediment in the ballast tanks of NOBOB ships. Initial results of this study indicate that viable organisms can be found in ships which claim no ballast on board (*http://www.glerl.noaa.gov/res/Task_rpts/nsreid10-1.html*).

The implications of this study and other evidence of recent introductions, indicate that the National Invasive Species Act (NISA) regulations that require ships entering the Great Lakes to exchange ballast water at sea, are inadequate to prevent ANS introductions. The good news is that a bill to reauthorize NISA has been introduced in Congress.

International Developments

A new international convention to prevent the potentially devastating effects of the spread of harmful aquatic organisms carried by ships' ballast water has been adopted by the International Maritime Organization (IMO), the United Nations agency responsible for the safety and security of shipping and the prevention of marine pollution from ships. The instrument was adopted at an international conference held from 9 to13 February 2004 at IMO's London Headquarters.

The Convention will require all ships to implement a Ballast Water and Sediments Management Plan. All ships will have to carry a Ballast Water Record Book and will be required to carry out ballast water management procedures to a given standard. Existing ships will be required to do the same, but after a phase-in period. Parties to the Convention are given the option to take additional measures which are subject to criteria set out in the Convention and to IMO guidelines yet to be developed.

The GEF/UNDP/IMO Global Ballast Water Management Programme (GloBallast) is already providing technical support and expertise under a multi-million dollar project (GloBallast: *http://globallast.imo.org/*). The Convention will enter into force 12 months after ratification by 30 States, representing 35 per cent of world merchant shipping tonnage. The Conference was attended by representatives of 74 States, one Associate Member of IMO; and observers from two intergovernmental organizations and 18 non-governmental international organizations.

National Developments

National Aquatic Invasive Species Act of 2003

The National Aquatic Invasive Species Act of 2003 (NAISA) was introduced into the U.S. Senate and U.S. House of Representatives on March 5, 2003 by Senators Carl Levin (D-MI) and Susan Collins (R-ME), and Representatives Wayne Gilchrest (R-MD) and Vernon Ehlers (R-MI), NAISA (S. 525 and Hr.S. 1080 and 1081). The act re-authorizes and strengthens NISA, including ballast water regulations, and increases authorized funding in several categories of actions for

prevention and control of ANS. These actions include many that are critical to the Great Lakes and in particular for Lake Michigan because of the authorization in the act for continued upgrading and operation of the electrical barrier to fish passage in the Chicago Sanitary and Ship Canal. The Council of Great Lakes Governors sent a letter to Congress in support of the National Aquatic Invasive Species Act in November, 2003 on behalf of all the Governors. The letter can be read on the Council's web site at: *http://www.cglg.org/1projects/glwq/index.asp*. Although not yet passed into law as of April, 2004, further congressional action on the act is expected in 2004.

Lacey Act

A primary law in the United States to prevent the importation of injurious aquatic species is the Lacey Act Amendments which makes it unlawful to import, export, transport, buy or sell fish, wildlife and plants taken or possessed in violation of federal, state or tribal law. Interstate or foreign commerce in fish and wildlife taken or possessed in violation of foreign law also is illegal. Wildlife are considered injurious if their importation could impact negatively on agriculture, horticulture, forestry, the health and welfare of humans, and the welfare and survival of wildlife and wildlife resources in the U.S.

Declaring a species injurious involves a five-step process: Petition, Notice for Information, Record of Compliance, Proposed Rule, and Final Rule. The U.S. Fish and Wildlife Service may initiate a proposed rule without a petition or notice for information if the scientific data support a listing. The Lacey Act does not set a time frame for making "injurious" determinations. It typically takes 12 to 18 months to complete the evaluation and publish a Final Rule. Currently, 16 species, or groups of species, are listed as "injurious" under the provisions of the Lacey Act.

In the LaMP reporting period, all species of snakehead fish have been listed as injurious species under the Lacey Act. Bighead carp, silver carp and blackhead carp are currently being reviewed to determine whether these species should be added to the list.

The Shipping Federation of Canada has developed the *Code of Best Practices for Ballast Water Management*. The Code, recently enacted into Canadian law, is a condition of passage in the St. Lawrence Seaway for vessels entering into the Great Lakes and commits all vessels to ten practices for ballast water management.

Also, the Lake Carriers' Association and the Canadian Shipowners' Association have developed a voluntary plan to take action to reduce the risk of transferring aquatic nuisance species. The voluntary plan applies to U.S. and Canadian vessels that operate entirely within the Great Lakes and St. Lawrence Waterway. The plan entitled "*Voluntary Management Practices to Reduce the Transfer of Aquatic Nuisance Species within the Great Lakes by U.S. and Canadian Domestic Shipping*" identifies seven voluntary ballast water management practices recommended to be carried out by these ships. These correspond with the Canadian code.

State Efforts to Prevent the Spread of ANS

The states which share Lake Michigan's resources, (Illinois, Indiana, Michigan and Wisconsin) know all too well the negative effects that ANS have had on their industries, tourism and lifestyles. The states, collectively, are sharing the burden of controlling the ANS already established in Lake Michigan but they also share the desire to prevent further introductions. The following efforts are being conducted to prevent and control ANS on a state by state basis:

Illinois

Illinois is addressing ANS issues through a combination of management, research and outreach activities. These activities are being conducted by a variety of agencies and organizations throughout the state. Below is a sampling of projects currently taking place in Illinois.

Management

In 1998, Illinois developed a Comprehensive Management Plan for Aquatic Nuisance Species

to address the ANS issue. The three goals of the plan are 1) preventing new introductions of ANS, 2) limiting the spread of established ANS, and 3) abating harmful impacts from infestations of ANS. In 1999, the U.S. Fish and Wildlife Service approved the Plan for funding, and continues to provide baseline funds for its implementation. A complete copy of the plan can be seen at *http://www.iisgcp.org/il-ans/index2.html*.

Purple Loosestrife

Purple loosestrife is an invasive plant that can reduce biodiversity and ecosystem functioning of Illinois wetlands. The Illinois Natural History Survey has developed a project involving students in the biological control of purple loosestrife. This project involves the raising and release of Galerucella beetles (natural enemies of purple loosestrife) into wetlands infested with this noxious weed. The Illinois Natural History Survey has also been involved with creating a similar project for 4-H youth.

Dispersal Barrier

Prior to the 1880s, the Great Lakes and Mississippi River basins were separated by a sub-continental divide. Creation of the Chicago Sanitary and Shipping Canal, however, linked the waters of the two basins, and provided a pathway from one basin to another. In order to examine the feasibility of impeding movement of species between these two basins, an experimental dispersal barrier has been installed in the canal. The first phase of this barrier is electrical, and is designed to impede fish movement; additional technologies are planned for the future. Illinois has provided the $2 million non-federal cost share for a US Army Corps of Engineers project to construct a second electrical barrier. This barrier will be located approximately 1,000 feet downstream of Barrier I and is expected to be operational by fall 2004. Funding also has been obtained for the operation and maintenance of Barrier I and additional funding to upgrade Barrier I is being actively pursued. More on the dispersal barrier can be found at *www.seagrant.wisc.edu/outreach/nis/barrier/barrier.html*

The Migration rate of Asian carp species advancing up the Illinois River system is being monitored through a cooperative partnership consisting of the Illinois DNR, USFWS, USACOE, and the Metropolitan Water Reclamation District. In 2003 Asian carp were not found beyond an area approximately 30 miles downstream of the Barrier, which is near the Starved Rock State Park.

A Rapid Response Plan is being developed to address the scenario of Asian carp being found in close proximity of Barrier I prior to Barrier II becoming operational. When Barrier II becomes operational the Plan will be modified for treating the segment of the Cal-Sag Sanitation and Shipping Canal located between the two barriers.

To minimize the potential of Asian carp species being introduced into Lake Michigan the City of Chicago passed an ordinance banning the possession, importation, and sale of live Asian carp.

Research

Various researchers, including both investigators funded by Illinois-Indiana Sea Grant and ones working for the Illinois Natural History Survey, are examining the impacts and methods for control of ANS. Their research projects cover an array of topics ranging from testing effectiveness of the Chicago waterways dispersal barrier against Asian carp to developing methods for detection of the West Nile virus. Information garnered from this research will ultimately lead to a greater understanding of ANS, their role in our aquatic ecosystems, and the ways in which these species can be controlled.

Outreach

Illinois-Indiana Sea Grant's Outreach and Education programs and the Illinois Natural History Survey conduct a variety of outreach activities for the citizens of Illinois. These programs have been developed for a wide range of audiences including recreational water users, lake managers, aquarium hobbyists, teachers, students, bait shop owners, and commercial shippers. More information is available at *www.seagrantnews.org/extension*.

Indiana

The Indiana Department of Natural Resources recently selected D.J. Case & Associates from Mishawaka to provide facilitation of work group meetings and preparation of an Indiana State Aquatic Nuisance Species (ANS) Management Plan. The long-term plan addresses ecological and economic impacts of aquatic exotic species invasions in the waterways of Indiana and their potential threat to Lake Michigan, Lake Erie, and Ohio River basins.
Representatives from agencies, universities, industries, nongovernmental organizations, and citizens having an interest in ANS management formed a work group to provide input and review for the plan. The plan was recently approved by the National ANS Task Force. A copy of the plan can be found at *www.in.gov/dnr/invasivespecies/inansmanagementplan.html*.

Addition of ANS Fish to Illegal Possession List

The IDNR has statutory responsibility for regulating the importation of fish (IC 14-22-25-2) and regulates possession of live exotic nuisance species of fish (312 IAC 9-6-7). Listed fish are illegal to import, possess, or release into public waters without a permit. As of December 1, 2002, the department issued an emergency rule that modifies the list of fish species to include the following species:

- black carp (*Mylopharyngodon piceus*);
- bighead carp (*Hypophthalmichthys nobilis*);
- silver carp (*Hypophthalmichthys molitrix*);
- white perch (*Morone americana*); and
- snakehead fish (28 species in the Family *Channidae*).

Upon review of the results of public comment, the Natural Resources Commission adopted the changes as a permanent rule on May 20, 2003. The text of the rule can be found at *http://www.in.gov/dnr/invasivespecies/illpossession.html*.

Michigan

Michigan has been implementing its updated aquatic nuisance species management plan with a variety of actions relating to legislation, policy, education, information, research, and monitoring. A few highlights of the actions since LaMP 2002 are below. The web site for aquatic nuisance species actions in Michigan with additional information, including the updated management plan, can be found at: *www.michigan.gov/deq/ogl/ans*.

Ballast Water Reporting Program:

The Office of the Great Lakes continues to implement Michigan's ballast water management reporting program, established by legislation in 2001. Approximately 185 ships are registered on the program's web site, reporting compliance with best management practices for controlling aquatic nuisance species in ballast water. (See sidebar for the lists of BMPs). The Ballast Water Reporting program web site is at: *www.michigan.gov/deq/ballastwaterprogram*.

Aquatic Nuisance Species Research:

Six aquatic nuisance species research projects were funded through the Michigan Great Lakes Protection Fund, including a project on ballast water treatment for the Michigan Department of

Invasive Species Field Course

Inland Seas Education Association in Suttons Bay, MI conducted the second annual Invasive Species Field Course in June, 2003. This course provides an opportunity for agency staff, educators, business personnel and stakeholders from a variety of organizations to come together for 3 intensive days to learn about identification, effects, prevention, and control of invasive species in Lake Michigan waters. The web site for the ISEA is at www.greatlakeseducation.org

Environmental Quality. Other projects underway are studying Diporeia in Lake Huron and Lake Superior, use of pheromones in round goby, patterns of aquatic nuisance species along Great Lakes shorelines, and a model GIS assessment of aquatic nuisance species in Michigan. Results of these projects will be available in late 2004 and early 2005. Michigan Great Lakes Protection Fund project reports are available at *www.michigan.gov/deq/ogl/mglpf*

Aquatic Nuisance Species Awareness Week

The first Aquatic Nuisance Species Awareness Week was proclaimed by Governor Jennifer Granholm to be the first week of June, 2003. The week was filled with aquatic nuisance species prevention programs and activities, including a research symposium, production and airing of a segment on aquatic nuisance species for the TV program Michigan Out of Doors, and distribution of educational materials to marinas and bait shops statewide.

Aquatic Nuisance Species Council

Michigan's Aquatic Nuisance Species Council was created by Executive Order in November, 2002. The order implements a primary recommendation of Michigan's Aquatic Nuisance Species Management Plan Update. The purpose of the Council is to advise the Office of the Great Lakes and the Departments of Environment Quality, Natural Resources, Agriculture and Transportation on implementation of the updated state management plan for aquatic nuisance species. There are 9 members on the Council representing the above 4 state departments plus 4 at-large members appointed by the Governor on a 2 year rotating basis. The Director of the Office of the Great Lakes chairs the Council. The Council meets 2 times per year in the spring and fall. Meetings are open to the public and posted on the Council's web site which can be found by going to: *www.michigan.gov/deq/ogl/ans*

What are Asian Carp?

Asian carp are a significant threat to the Great Lakes because of their size, rapid reproduction, and ability to consume large amounts of food. Asian carp can grow to 100 pounds and up to four feet. They are well-suited to the cold water climate of the Great Lakes region, which is similar to their native Asian habitats. It is expected that they would compete for food with the valuable sport and commercial fish. If they entered the system, they would likely become a dominant species in the Great Lakes, replacing highly valued native species.

Silver Carp (*Hypophthalmichthys molitrix*)

Bighead and silver carp were imported into North America in the early 1970s to consume algae in ponds used by fish farmers in southern states. The carp had escaped into open waters of the Mississippi River basin by the 1980s and are now at the doorstep of Lake Michigan.

Bighead Carp (*Hypophthalmichthys nobilis*) photo David Rieks

Black Carp eat molluscs like snails and clams and were also imported by southern fish farmers to control snails that carry a disease that catfish are susceptible to. This species also escaped into the Mississippi River basin and poses a serious threat to native molluscs. The black carp has been listed as an injurious species under the Lacey Act and is illegal to possess in all of the Great Lakes states.

Black Carp (*Mylopharyngodon piceus*) photo by Leo G. Nico

Angler's Monitoring Network

An Angler's Monitoring Network for detecting new introduction of aquatic nuisance species fish species in Michigan has been created and

Snakeheads were probably imported as aquarium pets and for food.

implemented using funds from U.S. EPA's Great Lakes National Program office. The purpose is to augment monitoring for new invasions, with the goal of preventing effects of new aquatic nuisance species through rapid response. The network is an informal system of information, education and reporting that provides a mechanism for potentially all anglers in the state to monitor for and report on any new introduction of invasive fish to Michigan waters, acting as a potential additional 1.3 million sets of eyes (number of 2002 licensed anglers in Michigan). An information system has set up to inform anglers to watch for new invasive fish, provide a mechanism for angler identification of known and potential aquatic nuisance species, and to report suspected new introductions to appropriate contacts. The network's web site can be found at: *www.michigan.gov/deq-anglers-monitoring-network*

Wisconsin

The National ANS Task Force approved Wisconsin's Comprehensive State Management Plan for Aquatic Invasive Species (AIS) at their November 2003 meeting. The goals of Wisconsin's plan are designed to address different stages of the AIS invasion:

- The initial introductions of aquatic invasive species into Wisconsin waters from other parts of the continent or world;
- The spread of AIS populations to previously unaffected state waters; and
- The colonization of self-sustaining AIS populations within water bodies, including the harmful impacts resulting from such colonization

For detailed information about this plan visit *www.dnr.state.wi.us/org/water/wm/GLWSP/exotics/compplan_913_01.pdf*

Other projects being implemented by Wisconsin include the following:

- **Watercraft inspection program**—Sixteen field staff have been hired to conduct watercraft inspections and monitor for invasive species in the regions. In addition several inspectors will be hired in the summer of 2004 through Sea Grant to conduct inspections on the Great Lakes. There will be a statewide training effort in April to train all the watercraft inspectors.
- **Monitoring**—In past years most of the monitoring for invasive species has been Eurasian water milfoil and zebra mussels. The monitoring efforts will be expanded this year to include other problem species such as rusty crayfish and the fishhook and spiny water fleas. A statewide database is also being established to track the spread of invasive aquatic species.
- **Information/education and outreach efforts**—The DNR and UW-Extension have developed a number of new publications and posters for distribution to the public as well as revising some existing publications. A statewide boater survey was conducted in October/November 2003 to determine the effectiveness of the I&E program. The results will be available in the next month. A full-time staff person in Extension (funded by DNR) coordinates the I&E efforts.
- **Purple loosestrife biocontrol**—Volunteers have been instrumental in ensuring the success of this program. A full-time extension staff person (funded again through DNR) coordinates this effort.
- **Aquatic invasive species grants**—The Department is in the process of writing permanent rules to administer a cost share grant program with an annual appropriation of $500,000. Eligible projects will include plan development, invasive species surveys, watercraft inspections and development of educational materials. The Department will

present the draft rule to the Natural Resources Board in April 2004. Meanwhile, while the rules are in development, grant funding for these activities will be available through the existing Lake Planning and Protection Grants.

- **Volunteer watercraft inspection and monitoring efforts—**A full time UW-Extension staff person is in the process of setting up workshop around the state to train volunteers on watercraft inspections and monitoring to augment the Department's efforts. The purpose of the volunteer program is helping prevent the spread of aquatic invasives species through boater awareness and education.
- **Coastal Zone grant—**The Department received funding in FY 04 from the DOA Coastal Zone program to fund information & education and outreach efforts in the coastal counties adjacent to the Great Lakes. Most of those resources have already been spent on various activities such as: airing radio and TV public service announcements; producing signs for boat landings; developing wild cards, posters, brochures and publications; developing background video packages for TV stations; developing a special issue of Environmental Education News devoted to invasive species; conducting training sessions on invasive for Project WILD, Project WET and Project Learning Tree facilitators; and developing expanded and modified versions of the Great Lakes Park Packs for distribution to the DNR hatcheries in the coastal counties.
- **State Implementation Plan—**The Department received funding in FY04 to implement the State Implementation Plan for aquatic invasive species. The Watershed program will soon be deciding what elements of the program will be funded for FY 04.

Other Efforts to Prevent and Combat ANS in Lake Michigan

Great Lakes Panel on Aquatic Nuisance Species

The Great Lakes Panel on Aquatic Nuisance Species was officially convened in late 1991 by the Great Lakes Commission in response to section 1203 of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (P.L. 101-646). The Panel is directed to perform the following tasks:

- Identify Great Lakes priorities
- Assist / Make recommendations to a national Task Force on Aquatic Nuisance Species (also established via P.L. 101-646)
- Coordinate exotic species program activities in the region
- Advise public and private interests on control efforts
- Submit an annual report to the task force describing prevention, research and control activities in the Great Lakes Basin
- Develop a rapid response system for sighting reports.

The panel membership is drawn from U.S. and Canadian federal agencies, the eight Great Lakes states and the province of Ontario, regional agencies, user groups, local communities, tribal authorities, commercial interests, and the university/research community.

In 2003 and 2004, the 3 committees of the Panel; Information and Education, Research and Monitoring, and Legislation and Policy, all initiated an update of priorities for prevention and control of ANS in the Great Lakes region. The committee reports will be available on the Panel's web site in 2004. Further information about the Panel, its activities, and its membership can be found at: *http://www.glc.org/ans/*

Next Steps

- Reathorization of NISA by the National Aquatic Invasive Species Act
- Ensure full funding and research to keep Asian Carp from becoming established in Lake Michigan including the construction of a physical barrier in the Chicago Sanitary and Ship Canal
- Continue to educate people in the basin about the importance of preventing the introduction and spread of ANS. Pilot project for outreach to members of Asian community in Chicago and elsewhere who purchase live aquatic organisms for food
- Develop a rapid response system for sighting reports.
- Review and respond to the LMMCC ANS survey results and recommendations.

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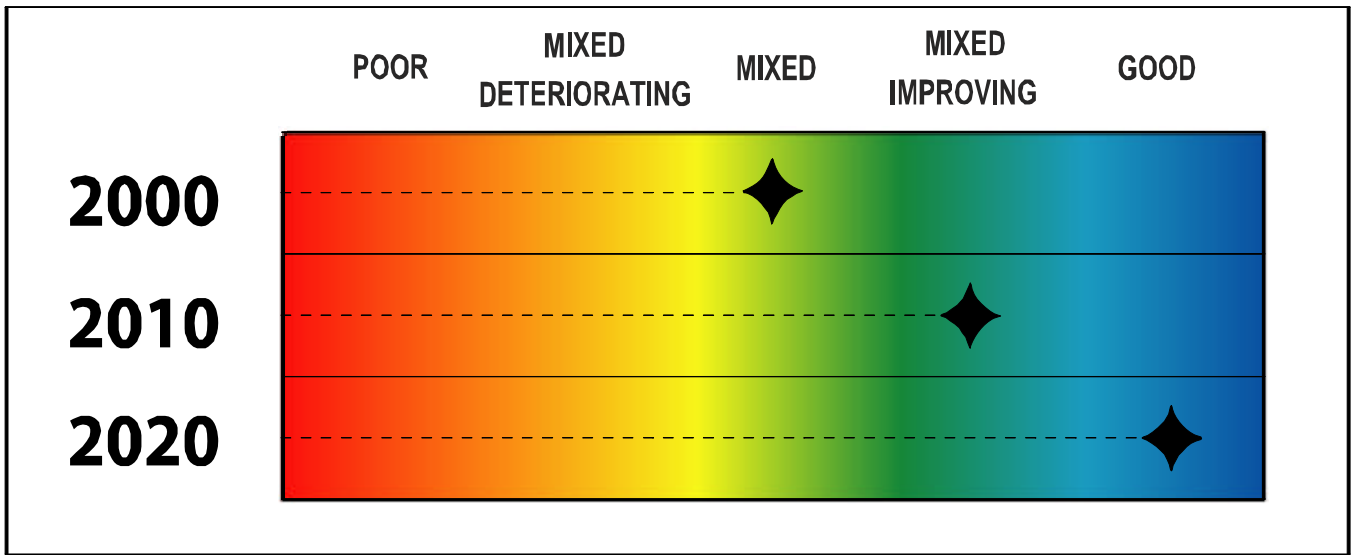
Subgoal 9
Are ecosystem stewardship activities common and undertaken by public and private organizations in communities around the basin?



Status

Each government, institution, organization, and individual within the Lake Michigan basin has a potential role in ecosystem stewardship; however, no single government, institution, organization, or individual has the ability to implement stewardship activities and achieve sustainability in the basin unilaterally. The watershed fact sheets in Appendix D is one tool created to encourage the recognition of the linkage between local watersheds and Lake Michigan. The current status of stewardship is mixed but will improve as more Lake Michigan watershed partnerships are formed.

Challenge

- To create a framework of goals and activities tailored to the watershed and community level while promoting Lake Michigan basin-wide interaction and partnerships.

The Importance of Partnerships

The past decade of ecosystem management in the basin has seen a profound shift from a top-down, command and control, government-dominated approach to a bottom-up, partnership-based, inclusive approach. This evolution is the manifestation of a number of developments, including changes in federal, state, and local relationships; local community empowerment; increased focus on local partners; and watershed-based institution building. If a sustainable Lake Michigan ecosystem is to be achieved, it falls to us to rearrange ourselves, our interest groups, and our governments into a new institutional framework—a framework that consists of existing organizations and governments "rafted" together as full partners in the pursuit of the LaMP goals.

Effective place-based partnerships are the result of the rafting of "full partners." Full partnership implies moving beyond the stakeholder model, wherein citizen committees (stakeholder groups)

are briefed about agency plans and projects, to a model based on full collaboration in the definition of basin-wide goals and the sharing of resources to achieve these goals.

Lake Michigan's Watershed Academy

The challenge of translating Lake Michigan scale watershed data and planning to local governments divided by political boundaries is being undertaken through the development of the Lake Michigan Watershed Academy. In 2000 and 2002, the Lake Michigan Lakewide Management Plan highlighted the need to promote a series of dialogues with local decision makers about the status of their watersheds and their impact on Lake Michigan. Monitoring data and Geographic Information System presentations clearly show the interconnected aspects of the basin and the need to plan and cooperate across political boundaries in order to conserve habitat and sustain biodiversity.

The Lake Michigan Watershed Academy was launched in March 2003 when the Academy hosted a three-day event for staff, commissioners, and local officials from six regional planning commissions that operate on the shores of Lake Michigan. The purpose of the sessions was to introduce many of them to the watershed planning concept and provide an overview on how the approach can be implemented on the local level. The meeting was co-sponsored by Western Michigan University's Institute for Water Sciences. The participating regional planning commissions from the four Lake Michigan states include the Bay Lakes Regional Planning Commission, the Southeastern Wisconsin Regional Planning Commission, the Northeastern Illinois Regional Planning Commission, the Northwest Indiana Regional Planning Commission, West Michigan Regional Shoreline Development Commission, and the Northwest Michigan Regional Planning Commission.

The Academy meeting provided an opportunity to present perspectives from EPA Region 5, EPA headquarters, other federal agencies, tribal, state, and environmental perspectives on clean water issues and their relationship to watershed planning. The regional planning commissions then followed up with conferences in their respective areas tailored for their communities. In addition to two pilot conferences in South Bend, Indiana, and Kalamazoo, Michigan, conferences were held in Green Bay, Wisconsin, Traverse City, Michigan, Muskegon, Michigan, and Milwaukee, Wisconsin. Additional conferences in northwest Indiana and northeastern Illinois are planned for May and June of 2004.

The concept of a Lake Michigan Watershed Academy is to provide a "packaging and delivery system" that brings together the tools, data, and expertise of many federal, state, local, and tribal agencies as well as NGOs and environmental organizations to explore opportunities for new partnerships, thereby impacting the quality of the land use plans and partners in the Lake Michigan watershed.

Many training materials and tools have been developed including EPA's Watershed Academy

Midwest Partnership for Watershed Management On-line Tools

The Midwest Partnership for Watershed Management was launched in 2002 by the Wisconsin DNR and EPA Region 5 Water Division to provide access to free, coherently organized, scientifically based watershed–based information for local officials and planners, natural resource managers, and the general public. The partnership aims to provide the maximum information and analytic tools to those levels of government closest to the actual problems. It offers both direct access to its own free web-based decision support tools and road maps to other sites where additional tools can be found. The effort has been working closely with the Lake Michigan Watershed Academy.

Many communities cannot afford even the most basic approach to, or initial screening of, their environmental problem and need cost effective, user friendly tools to assist them. Existing information and analytic tools, properly presented and freely accessible, can help meet this challenge. Watershed management data and decision support tools can allow informed screening and preliminary selection of alternatives, eliminating large amounts of preliminary "leg work".

More information is available at *www.epa.gov/waterspace*

Web-Based Training (*www.epa.gov/OWOW/watershed/wacademy*), Drinking Water Academy, American Water Works Association Source Water Training, Land Trust Alliance training materials, other existing videos and state and local training materials such as Michigan's Department of Environmental Quality's "Developing a Watershed Management Plan for Water Quality." EPA and the Great Lakes Commission are cooperating in the Lake Michigan on-line atlas *http://mapserver.glc.org/website/atlas/viewer.htm*

The Lake Michigan LaMP has also developed a "Habitat and Land Use Management Tool Box" that is a collection of hundreds of useful web sites annotated for detailed follow-up. It is available on CD-ROM from the EPA GLNPO and on the GLNPO website at www.*epa.gov/glnpo/lakemich/lm02/index.html*.

The Lake Michigan Watershed Academy Phase II began in Spring 2004 and will provide start up funding for efforts to implement projects resulting from the regional conference discussions. For more information contact Jason Navota at the Northeastern Illinois Planning Commission at *jnavota@nipc.org*.

EPA Utilizes Watersheds for Regulatory Focus

In December 2002 EPA's Assistant Administrator for Water issued a policy memorandum entitled: "Committing EPA's Water Program to Advancing the Watershed Approach." The memorandum not only reaffirmed EPA's commitment to the watershed approach, but also reenergized efforts to ensure that EPA as a whole fully integrates the watershed approach into program implementation. The memorandum established an EPA Watershed Management Council (WMC) to accelerate efforts to develop and issue National Pollutant Discharge Elimination System (NPDES) permits on a watershed basis. The EPA issued final guidance on watershed permitting in December 2003 (EPA 833-B-03-004).

Watershed-based NPDES permitting is an approach to developing NPDES permits for multiple point sources within a defined geographic area. The primary difference between this approach and the current approach to permitting is the consideration of watershed goals and the impact of multiple pollutant sources and stressors, including nonpoint source contributions. Watershed-based permitting may encompass a variety of activities ranging from synchronizing permits within a basin to developing water-quality based effluent limits using a multiple discharger modeling analysis. The type of permitting activity will vary from watershed to watershed, depending on the unique circumstances in the watershed and the sources affecting watershed conditions. The ultimate goal of watershed-based NPDES permitting, however, is to develop and issue NPDES permits that consider the entire watershed, not just an individual point source discharger.

Although significant water quality improvements have been made during the past three decades, water quality problems remain. Many of the remaining problems involve complex mixtures of sources and impacts that require integrated, holistic solutions. Over the past decade, the number of sources subject to the NPDES program has increased almost tenfold. There is a pressing need for innovative and efficient solutions to permitting these point sources that will result in further water quality gains. As a mechanism to help integrate other water program activities and to target the most pressing environmental issues within a watershed, a watershed-based approach to NPDES permitting can serve as one innovative tool for achieving new efficiencies and environmental progress.

The Lake Michigan Forum

The Lake Michigan Forum provides input on the LaMP to EPA from representative stakeholders of the Lake Michigan basin. In recognition of the LaMP statement that every basin resident is a "Lake Michigan Manager," the forum seeks opportunities to foster ecosystem stewardship through multi-organizational initiatives and partnerships, looking for LaMP implementation opportunities beyond what can be achieved by government efforts.

As the nongovernmental component of the Lake Michigan LaMP, the Forum has a number of responsibilities, including

- Representing the diverse interests and geography of the Lake Michigan basin and creating a communication link between the forum members' constituents and the LaMP process
- Providing input to and review of LaMP updates and assisting in their completion and implementation
- Identifying targets of opportunities for demonstration projects relating to LaMP goals and recommendations
- Promoting the LaMP to the public and building a constituency for its implementation
- Serving as a forum for regional and watershed approaches to accomplish LaMP goals;
- Serving as a forum for identifying, discussing, and conveying critical/priority issues
- Serving as a conduit for public concerns and input to the LaMP process

The forum's membership consists of representatives of local governments, industry, environmental groups, sport fishing interests, academia, agriculture, Native American tribes, sewerage districts, and AOCs.

The forum holds public meetings quarterly at different locations around the Lake Michigan basin and, in partnership with EPA and Grand Valley State University, sponsors an education and outreach tour. Each summer since 1998, the ship *W.G. Jackson* has made its way around Lake Michigan on the Making Lake Michigan Great Tour, spreading the word about the Lake Michigan LaMP. The tour provides hands-on experience in water issues for the public aboard a research vessel operated by the Robert B. Annis Water Resources Institute of Grand Valley State University in Allendale, Michigan. The event includes cruises for students and the public, open houses, and community activities. Since it began, thousands of people have participated in the tour at 26 ports of call around Lake Michigan. For more information, visit the forum web site at *www.lkmichiganforum.org*.

Lake Michigan Forum: Mona Lake Watershed Stewardship Assessment

In LaMP 2000, the Lake Michigan Forum put forth the concept of developing "Areas of Stewardship" around the lake. Following up on the concept, the watershed framework provides opportunities at the appropriate scale to develop stewardship.

During the spring and summer of 2003, the Lake Michigan Forum conducted an assessment of environmental stewardship in Michigan's Mona Lake watershed. The Mona Lake Watershed Stewardship Assessment process was aimed at identifying opportunities for enhancing environmental stewardship among leaders and the general public in the local watershed. The Lake Michigan Forum sees this ethic of stewardship - a commitment by government, businesses, other organizations, and individuals to restore and protect the ecosystem into the future - as essential in watersheds at the local level, in order to establish the sustained health of the Lake Michigan basin as a whole. The Forum hopes to conduct similar assessments in other watersheds around the basin in coming years, as a means of enhancing stewardship activities in local communities and focusing broader regional policy and resources in order to build stewardship capacity at the watershed level. To this end, the Forum has begun a stewardship assessment process in Baird Creek, a subwatershed in the Lower Fox River Area of Concern, near Green Bay, Wisconsin.

Working closely with many local partners in the small Mona Lake watershed located almost entirely within Muskegon County in western Michigan, the Lake Michigan Forum gathered existing environmental information and interviewed individuals living and working in the Mona Lake watershed. Using the resulting information, the Forum characterized

existing stewardship activities in the watershed and compared these against a set of elements that, if in place, would represent a "best-case stewardship scenario" for Lake Michigan watersheds. The Forum explored those stewardship elements in the Mona Lake watershed and developed an initial set of strategic opportunities for enhancing stewardship. This set of opportunities was further refined and developed through input from local partners, public focus groups, and additional analysis on the part of the Forum.

Recommendations from the report highlighted the following stewardship opportunities:

Existing Laws and Planning Efforts

- Convene units of government to consider a set of model ordinances and work through a process that will lead to widespread adoption.
- Train on how enforcement and implementation of these ordinances can impact the environmental health of the watershed.
- Integrate stormwater and soil erosion and sedimentation control programs into construction site inspections.
- Establish a framework for implementation that goes beyond the planning process.
- Use tax incentives and other policy tools to encourage local business owners to integrate environmental considerations into their regular decision-making processes.

Legacy Pollution and Remediation Efforts

- Continue to monitor existing remediation efforts and consent decrees for effectiveness.
- Identify remediation, restoration or pollution prevention opportunities eligible for funding through Supplemental Environmental Projects (SEPs).

Pollution Prevention and Waste Minimization

- Establish a Good Neighbor Dialogue with companies and community groups to address pollution prevention and other watershed-related issues.
- Encourage existing groups to incorporate pollution prevention outreach into ongoing activities.
- Promote the adoption of environmental management systems (EMSs) that include provisions for pollution prevention among area businesses and agriculture.
- Encourage employees to identify opportunities for pollution prevention and reduced costs within their company.
- Assess the potential constraints to and opportunities created by organizing a waste exchange.
- Enable government units to fill leadership roles in pollution prevention.
- Develop a 'scorecard' of toxic releases within the Mona Lake watershed to distribute annually.

The Lake Michigan Forum presented final report and its findings to stakeholders in the Mona Lake Watershed in October, 2003. The Forum continues to work with local partners there to implement specific activities recommended in the assessment report, to which the Forum can bring its resources and expertise.

Waukegan, Illinois Selected as Environmental Justice Project Community

The Waukegan Cleanup and Revitalization project was one of 15 projects selected nationwide for the environmental justice demonstration program. Selection for this project officially designates Waukegan as an environmental justice community which provides national recognition and exposure, greater access to resources and status as a model for future projects.

Using 2000 census data, the city of Waukegan qualifies as an environmental justice community due to the city's high percentage of low-income residents and its high percentage of minority residents. The census showed that Waukegan's population is 44.8 percent Hispanic and 19.2 percent African-American. Waukegan has the highest increase in poverty rates in Lake County, rising to 13.9 percent in 1999 from 9.5 percent in 1989.

Project partners are the United Latino Coalition of Lake County, the city of Waukegan, the Waukegan Harbor Citizens Advisory Group, EPA and the Corps of Engineers. They have been working to ensure that all Waukegan communities can participate and share in the benefits of the revitalization process.

The full Mona Lake Stewardship report is available on the Lake Michigan Forum's website at: *www.lkmichiganforum.org*

Baird Creek Watershed Assessment

As part of a broader effort to conduct similar assessments as a model for analysis, planning, and design in other watersheds around the Lake Michigan Basin, the Forum has begun a stewardship assessment process in Baird Creek, a tributary to the lower Fox River AOC through the East River. Though this sub-watershed is rapidly urbanizing eastward from the city of Green Bay toward agricultural areas in the east, it nevertheless contains in its eastern portion an ecologically significant 350-acre wooded riparian greenway corridor within the city. The corridor provides bike and foot access from diversely populated urban concentrations to high quality natural resources and open space areas, and could serve as the basis for development of a model integrated shoreline pedestrian system in Green Bay. This greenway corridor and other opportunities in the Baird Creek watershed serve as a focal point for local discussion among public officials, non-government organizations, business interests, and the general public. Each of these stakeholder groups will provide valuable input in the Baird Creek watershed as the Forum's stewardship assessment work there moves forward.

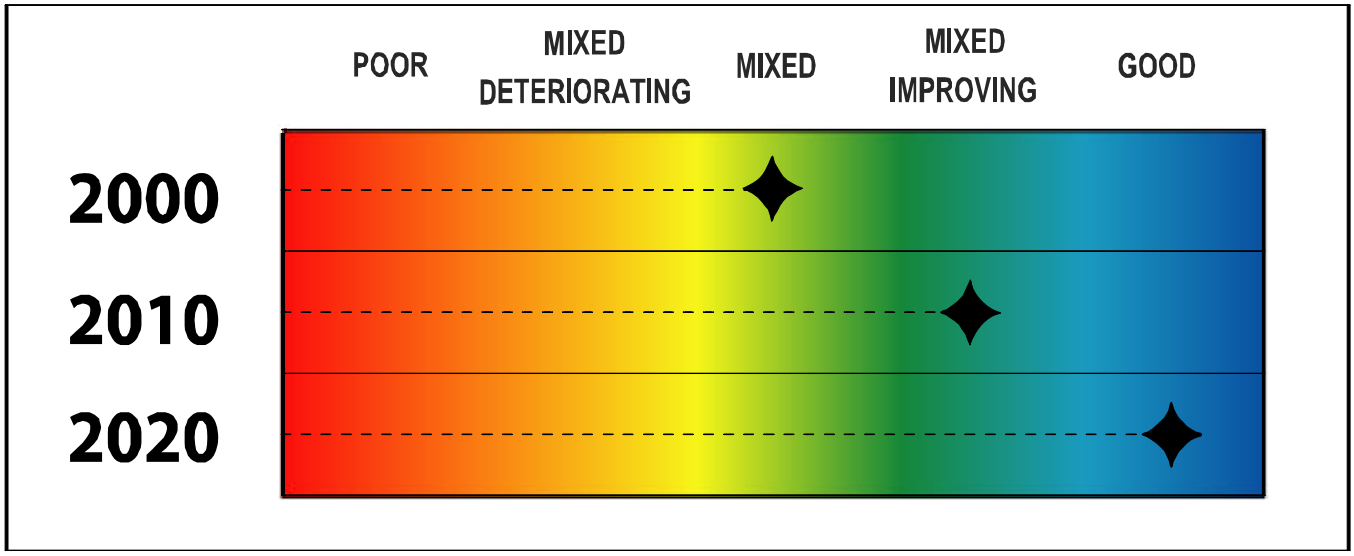
State of Lake Michigan Conference

In November 2003, EPA, Lake Michigan Forum, and Grand Valley State University hosted the State of Lake Michigan conference in Muskegon, Michigan. The conference brought together over 300 attendees and presenters to discuss the status of the lake. Presentations from the conference inform and are often incorporated into the next LaMP publication.

Next Steps

- Determine the usefulness of Lake Michigan LaMP watershed fact sheets and exploration of other needed tools (see Appendix D)
- Continue the Lake Michigan Watershed Academy and support GIS and models workshops and small implementation grants to local communities
- Provide additional education and outreach materials on water conservation and source water protection
- Promote the habitat and land use management tool box
- On-line habitat atlas continues to build layers
- Hold FY 2005 State of Lake Michigan Conference
- Continue the research vessel boat tour – Making Lake Michigan Great

Subgoal 10
Is collaborative ecosystem management the basis for decision-making in the Lake Michigan basin?



Status

The LaMP provides a lake-level framework serving both as a reference document and a proposal for a process to remediate past errors and achieve a sustainable Lake Michigan basin ecosystem. To this end, every effort has been made to ensure that the Lake Michigan LaMP and updates contain clear, comprehensive goals, specific objectives, a strategic plan, and a system of indicators and monitoring to judge the environmental status and effectiveness of current actions. In providing these to a widespread audience, partnership and collaboration are promoted

Collaboration among a variety of stakeholders to improve the Lake Michigan ecosystem continues to increase since LaMP 2000. This chapter documents several of these collaborative activities, which have a Great Lakes focus with Lake Michigan involvement, including:

- The Great Lakes Strategy (*www.epa.gov/glnpo/gls/index/html*)
- The Binational Executive Committee
- Great Lakes Binational Toxics Strategy (*www.epa.gov/glnpo/p2/busintro.html*)
- The Great Lakes Human Health Network
- The Great Lakes Fishery Commission (*www.glfc.gov*)
- Shared goals project involving EPA Region 5 and state water quality programs (*www.epa.gov/region5/watergoals.htm*)
- The 2002 Wingspread Accord into the Watershed Academy
- The Great Cities Initiative (*www.greatlakescities.org*)
- The Great Lakes Legislative Caucus

Other collaborative activities such as the Lake Michigan Watershed Academy, are discussed in other sections of this document. As the number of groups and efforts grow, the LaMP provides a status report and framework for these efforts.

Challenge

To develop a framework for clear goals and objectives that facilitate coordinated actions among agencies and stakeholders.
To provide and facilitate opportunities for partnerships and leveraging resources.

Great Lakes Strategy

Great Lakes Strategy 2002 was created by the

Bills to Restore the Great Lakes Introduced in Congress

Legislation was introduced in both the U.S. House and Senate to provide significant resources to restore the Great Lakes. The legislation would give states restoration funding in the form of block grants, authorizing between $4 and $6 billion. Money would be allocated to states by a formula that takes into account criteria such as population, exposure to the Great Lakes Watershed, number of Areas of Concern and critical habitat.

In order to qualify for funding, states would be required to develop a state management plan. The state plan would be approved by the EPA Administrator and must comply with the President's "Great Lakes Strategy 2002" and appropriate Lakewide Management Plans.

In addition to providing restoration funding, the bill would create a Great Lakes Advisory Board. Comprised of the governors of the Great Lakes states, representatives of the federal government, local mayors, as well as the business, scientific and advocacy communities, the board would be tasked with developing a Comprehensive Lakes Management Plan. This plan would build on the existing catalog of Great Lakes research to provide a clear vision of the Lakes' future. Further, the plan would review the value of current restoration efforts and recommend to Congress and states which programs should be strengthened, combined, or eliminated altogether. Further, it would target:

- Cleaning up toxic hot spots;
- Combating invasive species;
- Controlling pollution from urban and agricultural runoff;
- Restoring and conserve wetlands and critical coastal habitat; and
- Increasing public education of Great Lakes issues.

U.S. Policy Committee – a forum of senior-level representatives of federal, state, and tribal agencies responsible for environmental and natural resource management of the Great Lakes – to help coordinate and streamline the efforts of the many governmental partners involved in protecting the Great Lakes. The strategy focuses on multi-lake and basinwide environmental issues and establishes common goals that the governmental partners work toward. It supports efforts already underway, including LaMPs and RAPs for AOCs, by addressing issues that are beyond the scope of these programs and helping to integrate them into an overall, basinwide context. The strategy also advances the implementation of the United States' responsibilities under the 1987 GLWQA.

The strategy is a concise, policy level statement of basinwide priorities and activities that address the current state of the Great Lakes basin ecosystem and key environmental goals for the future so that a unified approach to implementation can be carried out by a diverse set of federal, state, and tribal agencies. The long-term vision of the strategy can be simply expressed as follows:

- All Great Lakes beaches are open for swimming all the time.
- All Great Lakes fish are safe to eat all the time.
- The Great Lakes are maintained and enhanced as a safe source of drinking water.
- The Great Lakes basin is a healthy natural environment for wildlife and people.

The Binational Executive Committee

The Binational Executive Committee (BEC) is charged with coordinating the implementation of the binational aspects of the 1987 GLWQA. The BEC is co-chaired by Environment Canada and U.S. EPA, and includes members of the Great Lakes states, the Province of Ontario, and other federal departments and agencies in Canada and the United States. The BEC addresses binational, basinwide issues of concern and provides strategic direction to the LaMPs, RAPs, and other Great Lakes programs such as the Binational Toxics Strategy, and the State of the Lakes Ecosystem Conference.

Great Lakes Binational Toxics Strategy

The Canada-United States strategy for the virtual elimination of persistent toxic substances in the Great Lakes basin, known as the Great Lakes Binational Toxics Strategy (GLBTS), provides a framework for actions to reduce or eliminate persistent toxic substances, especially those which bioaccumulate. The strategy was jointly developed by Canada and the United States in 1996 and 1997, and it was signed by the two governments on April 7, 1997 .

The GLBTS establishes reduction challenges for an initial list of persistent toxic substances targeted for virtual elimination: aldrin/dieldrin, benzo(a)pyrene, chlordane, DDT, hexachlorobenzene, alkyl-lead, mercury and compounds, mirex, octachlorostyrene, PCBs, dioxins and furans, and toxaphene. These substances have been associated with widespread, long-term, adverse effects on wildlife in the Great Lakes and through their bioaccumulation, pose threats to human health. The strategy marked the first time that specific reduction targets were set jointly by the two countries.

Recognizing that virtual elimination is a long-term process, the GLBTS provides the framework for actions to achieve reductions for specific toxic substances in the 1997 to 2006 timeframe. Flexibility is provided in the GLBTS to allow for revision of challenges, timeframes, and the list of targeted substances. The development of baseline measurements for tracking and measuring progress toward reductions is a key element. A "Technical Support Document" appended to the GLBTS provides action items that will be undertaken to pursue reductions (*www.epa.gov/glnpo/p2/bnsintro.html*).

Great Lakes Human Health Network

A Great Lakes-wide human health network was formed by the BEC to maximize resources and efficiencies of scale. The U.S. EPA's GLNPO provides staff resources to facilitate the exchange of information and expertise among health and environmental agencies. The human health network brings together experts and agencies from throughout the basin to share information and provide technical assistance on human health issues for inclusion in the LaMP. Currently, the Network has representative from six federal government agencies, five tribal government agencies, eleven state and provincial government agencies, and one county government agency. The Network anticipates that the membership will continue to grow as the Network becomes more widely known. Current information on the Network and its work may be found at www.epa.gov/glnpo/health.html.

The Great Lakes Fishery Commission

The Great Lakes Fishery Commission (GLFC) is a critical partner in achieving a balanced and healthy fish community in Lake Michigan, both in terms of controlling exotic species and rehabilitating native species in the lake. GLFC has adopted and implemented an integrated management of sea lamprey (IMSL) approach to control sea lamprey in the Great Lakes. The IMSL process involves using a variety of control

Illinois-Indiana-Wisconsin Planning Agencies Agree to Consistent Groundwater Planning

In May 2002, the Northeastern Illinois Planning Commission, the Northwestern Indiana Regional Planning Commission, the Southeastern Wisconsin Regional Planning Commission and the Chicago Area Transportation Study signed the Wingspread Tri-State Regional Accord to address a potential water shortage with comprehensive and consistent planning. The accord is an historic agreement in which the four planning agencies along Lake Michigan in Wisconsin, Illinois and Indiana committed to work together as they consider major environmental and economic issues.

Both Milwaukee and Chicago are facing similar water supply constraints in their western suburbs as the metro regions continue to grow. The deep aquifer system is being overtaxed, leaving shallow aquifers as the region's primary future water supply resource. The Illinois State Water Survey estimates that the current and projected use of the region's shallow aquifers is much less than their

Collaboration on a Watershed Scale: The Muskegon River Projects

This project is a basin-wide analysis of the Muskegon River, integrating the hydrologic, geomorphic, ecologic, and social systems in play to develop a process-based ecosystem model and identify potential stressors. The overarching goal of the Muskegon River Assessment project is to refine the scientific methods and information necessary to manage watershed resources. The project was started 2 years ago with 4 primary objectives:

Assess and monitor the ecological health of streams, lakes, and wetlands throughout the MRW using a tiered, integrated approach with citizens and experienced scientists;
Develop regionally defined, quantitative relationships between ecosystem attributes, specific pollutants, and human activities that can be used in management models;
Develop monitoring technologies that will enable continuous assessment of ecosystem processes at the land-water interface; and
Increase public awareness of intrinsic values of MRW ecosystems and the science used to make management decisions.

This project will help with developing new bioindicators. For instance, zooplankton have only recently been used an indicators of wetland quality (Lougheed and Chow-Fraser 2000). Using data from previous studies, as well as data on 40 new species from the MRW, investigators updated zooplankton species environmental tolerances, to create a more robust Wetland Zooplankton Index (WZI).

It is also intended to increase public awareness of intrinsic values of MRW ecosystems and the science used to make management decisions. The Muskegon River Watershed website (*http://envirosonic.cevl.msu.edu*) has been designed to allow users to access several forms of acoustic data through an intuitive interface. The web site contains pictures, sounds, videos, the opportunity to perform on-the-fly analyses, and background information about research in the Muskegon River Watershed.

Finally, there is great public and volunteer involvement through the actions and activities of the Michigan Lake and Stream Association (ML&SA), interactions with field crews and formal presentations by researchers on the project. The volunteer activities in the watershed included monthly lake monitoring samples for 30 lakes in and around the Muskegon watershed during the summers of 2001-2003. These data include Secchi depth, chlorophyll-a, total phosphorus, and dissolved oxygen profiles for some lakes.

Big Rapids Dam Removal and Riverwalk Construction Project. The city's Muskegon River dam was removed, eliminating an obstruction and reconnecting portions of the Muskegon River. The high gradient portion of the Muskegon River was recovered, which, based on previous work on the Muskegon River, will directly and positively affect the ecology of the river. There are 75,000 dams within the United States. A large number of the antiquated, low head structures are located in the Great Lakes region.

Rapid assessment of lake sturgeon spawning stocks using instream hydroacoustic technology. Throughout the Great Lakes Basin, remnant stocks of lake sturgeon exist at low abundance. Traditional fish sampling and assessment methods are marginally effective for these populations and can lead to fish mortality. Lake sturgeon congregates each spring when they spawn in large rivers. Non lethal hydroacoustic technology, successfully used to count salmon in Pacific Northwest river systems, will be used to evaluate the lake sturgeon population in the Sturgeon River, Michigan, and then applied to evaluation of the Muskegon River population.

Portable hydroacoustic technology has been developed to accurately determine size and direction of movement of migrating salmon and trout in the NW, but has been applied to few other species. This project is designed to test and refine the effectiveness of portable hydroacoustic sampling gear for monitoring lake sturgeon spawning in the Sturgeon River, Michigan. To verify data collected by hydroacoustics we are also tagging the spawning population on the spawning site each spring. Data collected by hydroacoustics include fish counts, estimates of individual size, spatial distribution and direction (upstream or downstream) movement.

methods instead of relying solely on chemicals. For example,

GLFC is reducing the minimum lethal concentrations of chemicals used to kill larval sea lampreys in order to protect young lake sturgeon and is scheduling chemical treatments later in the summer to reduce the effects on young lake sturgeon. GLFC has reduced chemical use by 50 percent compared to the amounts used in the 1990s.

GLFC is also using sterile-male releases to impede the reproductive success of sea lampreys, conducting mark-and-recapture studies with juvenile and adult sea lampreys to measure population trends, and researching other strategies to reduce populations of sea lampreys without harming other parts of the ecosystem.

GLFC technical committees have also developed lakewide lake trout population models that estimate total allowable catches of lake trout, evaluate various fishery management strategies, and estimate damage by sea lampreys to lake trout populations.

Despite the great progress made, sea lampreys continue to kill many fish each year, threatening the restoration of lake trout to Lake Michigan. The principal challenge in controlling the sea lamprey and other exotic species in the lake lies in balancing the use of effective control measures for exotic species with preservation and restoration of native species.

Mayors Create Great Cities Initiative

Mayors of several cities around the Great Lakes created the Great Lakes Cities Initiative (GLCI) in July 2003. GLCI is a binational coalition of mayors and other local officials that works actively with federal, state, and provincial governments to advance the protection and restoration of the Great Lakes. GLCI, chaired by Chicago Mayor Richard Daley and headquartered in Chicago, is a project of the Northeast-Midwest Institute. In creating the project, Mayors stated that they have a direct interest and stake in the sustainability of the Great Lakes. As the world's largest freshwater resource and an international treasure, the Great Lakes are essential to the continued vitality of the cities, townships, villages and counties along the shores and in the surrounding watershed. The GLCI enables mayors and other local officials to be active participants in Great Lakes issues relating to governance, economics, and science.

To date Mayors have not had a coordinated active voice in the development and implementation of Great Lakes policies and programs. A variety of Great Lakes efforts have been underway for decades, but almost none involve municipal leaders. Furthermore, these efforts need more coordination with each other and more focus on long-term protection and restoration of the Great Lakes as a vital resource. GLCI provides the active forum that allows mayors to coordinate their activities in meeting their stated goals in preserving the Great Lakes and enhance public and environmental health as well as the economic prosperity of all Great Lakes communities.

More information is available at:
www.greatlakescities.org

Great Lakes Legislative Caucus Formed

State lawmakers from the eight states and two Canadian provinces that surround the Great Lakes have formed a caucus to coordinate legislative action on Great Lakes issues. The group, comprised of lawmakers from the 10 states and provincial Legislatures, will serve as a clearinghouse for information, policies and coordination on issues such as beach closings, water diversion, and invasive species. The caucus will have its first meeting in Pittsburgh, PA in October 2004.

EPA Region 5 Shared Water Program Goals

The EPA Region 5 Office of Water is collaborating with state and tribal partners to protect and enhance water quality throughout the area. On December 11, 2001, IEPA, IDEM, the Minnesota Pollution Control Agency, WDNR, EPA Region 5, and the EPA Great Lakes National Program Office (GLNPO) all signed a Joint Commitment to Achieve Shared Water Goals. The shared water goals are as follows:

- Goal 1: All waters in Region 5 will support healthy aquatic biological communities.
- Goal 2: All waters in Region 5 will support fish populations with safe levels of contaminants.

- Goal 3: Designated swimming waters in Region 5 will be swimmable.
- Goal 4: All people in Region 5 served by public water supplies will have water that is consistently safe to drink.
- Goal 5: The quantity and quality of critical aquatic habitat in Region 5, including wetlands, will be maintained or improved.

More information is available at *www.epa.gov/region5/goals.htm*.

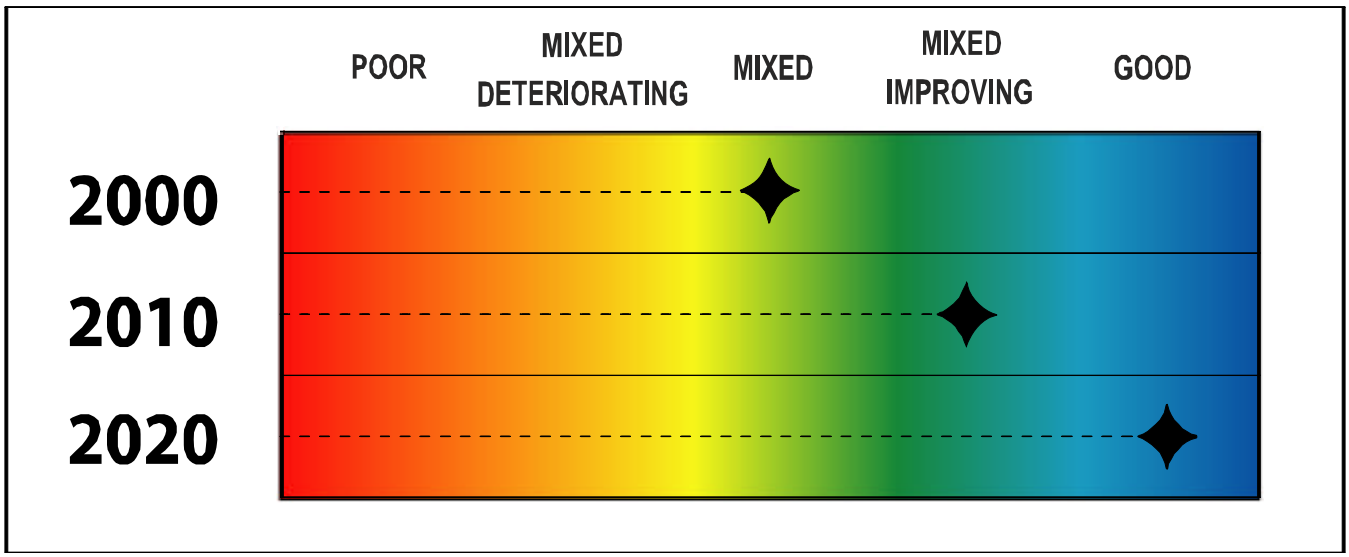
Next Steps

Over the next 2 years, the LaMP will support the following activities to increase collaborative activities:

- Continue the development and linkage of local watersheds with basin-wide issues and activities through the watershed academy.

Subgoal 11

Do we have enough information, data, understanding, and indicators to inform the decision-making process?



Status

Some information sources are available to support Lake Michigan decision-makers, but there is a need to better collate, coordinate, and interpret existing data in addition to gathering more data and developing new indicators are needed to address complex management issues. Numerous monitoring programs and activities are currently underway in the Lake Michigan basin at the federal, state, county, municipal, and watershed levels. These programs monitor water quality, sediments, fish, air quality, and habitat. They involve collecting chemical, microbiological, fish and wildlife, physical characteristic, land use, and other environmental data.

The Lake Michigan LaMP has also begun identifying indicators to guide these monitoring efforts. If the environmental indicators identified by the Lake Michigan LaMP are to support future management decisions, they must be adopted by monitoring programs basinwide and used to guide sampling and assessment parameters and media. Over the last 2 years, efforts have been undertaken to gather data on wetlands, beaches, stream buffers, and other items that will ensure that the goal status changes from mixed to mixed/improving by 2010 and to good by 2020. The following section describes these data collection efforts.

Challenges

- To expand Lake Michigan basin monitoring collaboration and coordination by promoting data comparability and joint planning and to deliver efficient and timely reporting on the status of the Lake Michigan ecosystem.
- To leverage the 1994-95 Lake Michigan Mass Balance sampling with a 2005 Lake Michigan intensive and coordinated effort.

Coordination of Monitoring

The Great Lakes Water Quality Agreement requires that LaMPs "include a description of surveillance and monitoring to track the effectiveness of remedial measures and the eventual elimination of the contribution to impairments of beneficial uses..."

Monitoring collaboration and coordination need to be maximized in order to promote data comparability, enhance data utility, extend resources and deliver efficient and timely reporting on environmental change and progress as measured by Lakewide Management Plans (LaMPs) and State of the Lakes Ecosystem Conference (SOLEC) indicators.

Responsibility for monitoring in the Great Lakes is divided among a vast number of program and agencies throughout the basin. While these monitoring efforts meet individual program needs and mandate, the lack of consistency in protocols and methodology limits the usefulness of the resultant data for sharing, comparing and opportunities coordination might provide. The Binational executive Committee (BEC) sponsors two frameworks for developing indicators and reporting on the status of the Great Lakes ecosystem: LaMPs and The State of the Lakes Ecosystem Conference (SOLEC)..

BEC requested agencies to investigate opportunities to enhance monitoring coordination and prepare a status report for the BEC Spring 2002 meeting and a set of options for the Fall 2002 meeting. A series of workshops were conducted to develop a draft proposal which is being refined.

Lake Michigan Intensive Sampling Year

The Lake Michigan LaMP Technical Coordinating Committee and the Lake Michigan Monitoring Coordinating Council's (LMMCC) broad-based membership are leading a collaborative effort to extensively sample the lake in 2005. The resulting data, when compared with the 1994-95 data reports would provide key trend data.

The LMMCC is taking the lead in planning and coordination. One outcome of this effort is to also help the Lake Michigan AOCs with their data needs.

GLNPO's Aquatic Contaminant Monitoring Program

GLNPO is responsible for monitoring the water quality of the Great Lakes. GLNPO has been collecting data on levels of persistent bioaccumulative toxic (PBT) substances in air and fish since 1990 and the 1970s, respectively. Many PBTs have the potential to increase the risk of cancer, birth defects, and neurological and developmental problems through long-term, low-level exposure. These pollutants can enter the Lakes in significant quantities from the air and subsequently build up in fish, which results in limits on consumption of Great Lakes fish. Data complementary to the air and fish data is needed for the water so that EPA can accurately estimate the net amount of these pollutants that are being put into the lakes from the air and to determine how high levels are in fish relative to the levels in the water. Levels in fish can be millions of times higher than in the water itself. EPA monitored these contaminants in the past and will start again for Lake Michigan this year.

The following chemicals will be monitored:

- Polychlorinated biphenyls (PCBs)
- Ploycyclic Aromatic Hydrocarbons (PAHs)
- Organochlorine pesticides including DDT and toxaphene
- Dioxins and furans
- Mercury and methylmercury
- Polybrominated diphenyl ethers (PBDEs) (flame retardants used in materials and plastics)
- Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) (from a waterproofing product now off the market)

Lake Michigan Tributary Monitoring Project

The Great Lakes Commission developed an inventory of monitoring programs in the Lake Michigan drainage basin. This project has resulted in two major projects. The Lake Michigan Tributary Monitoring Project report (http://www.glc.org/monitoring/lakemich/) was

Lake Michigan Monitoring Coordinating Council

The Lake Michigan Monitoring Coordinating Council was established to enhance coordination, communication, and data management among agencies and other organizations that conduct or benefit from monitoring efforts in the Lake Michigan basin in the interest of supporting the Lake Michigan LaMP.

The Council has 31 members representing federal, state, tribal, and local governments, nonprofit watershed groups, and other environmental organizations, educational entities, and the regulated community. The Council meets twice each year in locations throughout the watershed. Council meetings, biennial conferences, and feedback from constituents shape the Council's work plan and activities. The Council will develop goals, each with an active working group, whose broad membership will expand the core Council membership.

In 1999, four short-term working groups were created to develop information to move the Council forward: Data Inventory and Analysis; Monitoring Objectives; Watershed Pilots; and Outreach and Collaboration. The progress of those short-term working groups set the stage for the development of a new Council operating framework in 2001.

The new Council framework has been developed to increase coordination between appropriate monitoring entities, allow the development of a strategic plan for monitoring, and add value to the individual efforts of the Council's member organizations. The new Council framework takes advantage of the logical interactions between the various resource-based monitoring entities and other affected stakeholder groups.

The working groups formed under this new framework will build on the efforts to coordinate monitoring within individual resources by groups such as the Lakewide Management Plan Committees, the Wisconsin Groundwater Coordinating Council, and the Great Lakes Fishery Commission. Each of these resource-based working groups will coordinate existing monitoring networks around several common considerations: monitoring objectives; spatial, temporal and parameter network design; methods comparability; quality assurance and control planning; database sharing; and data analysis approaches. Currently, an ANS basin survey is being completed.

developed after the initial inventory and includes a detailed review of programs in each of ten subwatersheds, along with an analysis of gaps and recommendations for further initiatives. Please see the report for detailed information about the inventory process.

The second result of this project is the interactive monitoring inventory database. Through the inventory information about monitoring programs (or "metadata") was collected and a database was designed for long-term storage and access. One aspect of program metadata is information about the geographic area covered by each monitoring program. For many programs, we were able to obtain information on fixed monitoring stations. These stations and other geographic descriptors (such as watersheds, counties, etc) can now be searched through this website, and all the metadata about those programs can be viewed.

Wetland Monitoring

The Great Lakes Coastal Wetlands Consortium was formed in 2000 to develop a long-term, binational, coastal wetland monitoring program. The Consortium is composed of a multi-organizational Project Management Team. Consortium progress thus far includes: the mapping and classification of all coastal wetlands (will be completed June 2004), pilot studies to demonstrate monitoring protocols for coastal wetland indicators, and an upcoming report on the status of coastal wetlands at the October 2004 SOLEC.

One of the pilot studies conducted by the Consortium took place in five northern Lake Michigan coastal wetlands: Ogontz, Nahma, St. Ignace Bridge, Escanaba, and Ludington Park. The objectives of the pilot study were to evaluate the performance and test the robustness of a preliminary Index of Biotic Integrity (IBI); identify and eliminate any problems and make improvements to the IBI where necessary; test the applicability of the IBI in similar wetlands of Lake Michigan; and, establish stressor - ecological-response relationships that could be used to manage high quality wetlands and restore degraded ones. Over the next two years, the

Great Lakes Wetlands Consortium

On November 29, 2000, EPA's GLNPO awarded a cooperative agreement to the Great Lakes Commission for the first large-scale, binational, collaborative effort to assess the ecological health of Great Lakes coastal wetlands. A consortium brought together by the Great Lakes Commission will (1) design and validate indicators to assess the ecological integrity of Great Lakes coastal wetlands; (2) design an implementable, long-term program to monitor Great Lakes coastal wetlands; and (3) create and put coastal wetland data in a binational database accessible to all scientists, decision-makers, and the public. GLNPO has contributed $400,000 to the effort, and the other consortium members are contributing over $200,000. The consortium currently includes Great Lakes wetland scientists and resource managers from the U.S. and Canadian federal governments, states and provinces, nonprofit organizations, and academia. Similar funding levels are expected fir each of the next 2 years. The award is premised on the recognized need to assess the health of Great Lakes coastal wetlands, which are an integral part of the Great Lakes basin ecosystem. Coastal wetlands have critically important ecological values and functions, yet little basinwide data is available for assessing their ecological health. For this reason, a suite of 13 Great Lakes coastal wetland indicators was presented at SOLEC 1998. An assessment of five of these indicators was presented at SOLEC 2000 in Hamilton, Ontario. The consortium's work will expand the monitoring and reporting capabilities of the United States and Canada under the GLWQA. For additional information, contact Karen Rodriguez of

Consortium will be working with state/provincial, tribal, and private landowners to develop a long-term monitoring program involving Lake Michigan sites representative of coastal wetland types.

At the southern end of the Lake, work is progressing on assessing the extent of invasive plant species in interdunal wetlands of the Indiana Dunes National Lakeshore and State Parks. These special wetlands are highly vulnerable to invasives such as purple loosestrife and Phragmites. Park staffs are working with The Nature Conservancy, Save the Dunes Council, and Shirley Heinze Trust Fund to formulate a control program that will eliminate invasives and protect the native plant species.

A Biodiversity Blitz was held in the Calumet Region of Chicago in August 2002. This 24-hour inventory of species involved more than 130 scientists for the purposes of establishing a user-friendly database, and launching community-based wetland conservation initiatives. A total of 2,257 species at wetland, prairie and woodland sites were recorded during the Blitz. The City of Chicago is working with many groups to develop a design for the recovery of the region's wetlands, survivors of the industrialization of the region.

Great Lakes National Park Monitoring

Two national parks in the Lake Michigan basin are participating in a Great Lakes Network made up of 9 national park units from four states in the Great Lakes region. These parks extend from Minnesota to Indiana. The Sleeping Bear Dunes and the Indiana Dunes National Lakeshore are working as a unit for monitoring, fostering the exchange of information and resources between parks with similar issues, reducing per park costs through multi-park studies and providing network-based expertise that would not be affordable to the parks individually. The overall purpose is to develop broadly-based scientific data on current status and long-term trends in composition, structure, and function of the parks' ecosystems.

Lake Michigan Online

Lake Michigan Online Atlas

The Lake Michigan Online Atlas provides Internet access to a number of information resources related to the Lake Michigan basin. Reference maps offer an overview of the region. Computer-compatible data layers can be downloaded for use in a geographic information system (GIS). Hyperlinks and contact information improve access to regional resources. And an online mapping tool allows internet users to explore data and create custom maps using a web browser. More information is available at *http://mapserver.glc.org/website/atlas/viewer.htm*.

Lake Michigan Watershed Academy sessions have indicated a great deal of interest in research, decision making, data creation and mapping in the Lake Michigan basin. The list of interested people includes staff at many of the agencies and organizations active in the region, local governments, researchers, residents and students. For many of these people, a central

coordinating point for mapped information about the region is a valuable tool. Access to overview information and to resources already developed can significantly enhance their work or understanding of a topic. A central point from which to share data may help them reach a broader audience. And improved awareness of regional resources, issues and active players may lead to better cooperation, more focus and new directions.

Great Lakes GIS

The Great Lakes Fishery Commission is developing an aquatic atlas in GIS format that pulls together data from the Lake Michigan Mass Balance studies, historical sediment surveys, coastal wetland data as well as dam databases to facilitate a holistic approach to managing the Great Lakes basin. These layers of aquatic habitat information will compliment the current on-line atlas work of the Great Lakes Commission.

A GIS database should, for the first time, allow the integration of data developed by the numerous U.S. and Canadian agencies responsible for conserving this system. In addition to integrating existing data from federal, state, provincial, tribal, and non-governmental organizations, this information system will also provide a means of inventorying and monitoring basin habitat (e.g. terrestrial, tributary, nearshore, and offshore systems)..

The primary objective of this project is to integrate data from across each lake basin into a common database to provide an inventory of basin-wide aquatic resources. Additionally, many new layers and tools are also being developed to ensure that the DSS is a powerful tool for analysis of whole-system responses to management alternatives.More information is available at *http://www.glfc.org/glgis*.

Environmental Indicators

The Lake Michigan LaMP promotes use of environmental indicators to track progress in achieving the LaMP goals. For a list of potential indicators, see Chapter 3 of LaMP 2000. The concept of environmental indicators is not new. State and federal agencies have used indicators to track trends in environmental health, particularly fish population trends and to help guide management decisions. Effective use of the LaMP indicators will link actual environmental responses directly to programs and activities.

The LaMP indicators are environmental, social, and economic measures used to assess the achievement of LaMP goals and objectives. These indicators will demonstrate improvements in and protection of the Lake Michigan ecosystem and will function as an early warning system to identify pressures on the ecosystem. The indicators will measure conditions such as ecosystem integrity, aquatic health, human health, and the quality of life. Work on Lake Michigan specific indicators has slowed pending the outcome of a number of projects on the same issue.

State of the Lakes Ecosystem Conferences

Additional work has been completed on the indicators over the past 2 years through the State of the Lakes Ecosystem Conference (SOLEC) process. The SOLEC is hosted biennially by U.S. EPA GLNPO and Environment Canada. The last SOLEC was held in October 2002 in Cleveland, Ohio. The next conference will be held in Toronto, Ontario, in October 2004. The conferences are intended to provide a forum for exchange of information on the ecological condition of the Great Lakes and surrounding lands. A major goal is to bring together a large audience of government (at all levels), corporate, and not-for-profit managers to discuss problems that affect the lakes. The conferences have led to information gathering by a wide variety of agencies and organizations. In the year following each conference, a State of the Great Lakes Report is prepared by the governments based on the conference itself and on extensive public comments following the conference.

Lake Michigan Monitoring Assessment

The Great Lakes Commission, in partnership with EPA and the Lake Michigan Monitoring

Coordinating Council, issued a report on Lake Michigan monitoring in October 2000. The report provides a comprehensive review of monitoring programs at the federal, state, and local levels for targeted watersheds; an analysis of gaps, inconsistencies, and unmet needs; an assessment of the adequacy of existing efforts to support critical ecosystem indicators; and recommendations for addressing major monitoring needs, particularly those considered most important for lakewide management decision-making. The study focused on monitoring in Grand Traverse Bay, White Lake, Muskegon Lake, the Grand River, the Kalamazoo River, the St. Joseph River, the Grand Calumet River, Waukegan Harbor, the Milwaukee River and Estuary, the Sheboygan River, the Fox-Wolf River Basin, Door County, the Menominee River, the Manistique River, and the open waters of Lake Michigan.

The report outlines a series of recommendations for improving monitoring in Lake Michigan. These recommendations are having a broader impact as organizations and governments in the United States and Canada are beginning work on better coordinating the Great Lakes systemwide monitoring strategy.

BEACH Monitoring

EPA initiated the Beaches Environmental Assessment, Closure, and Health (BEACH) program to strengthen individual beach programs and water quality standards, better inform the public, and promote scientific research to further protect the health of people who use beaches. EPA is improving laboratory testing methods for detecting contaminants at beaches and is assisting local governments in monitoring beach water quality. The Great Lakes Commission is pilot-testing a program for communicating the results of the National Beach Survey, assessing the consistency of beach closures with restriction advisories, and creating maps that connect with the national BEACH effort.

Integrated Atmospheric Deposition Network

U.S. EPA is a participant in the Integrated Atmospheric Deposition Network (IADN), established in July 1988, by the Atmospheric Deposition Monitoring Task Force of the International Joint Commission. The objective of IADN is to acquire sufficient, quality-assured data to estimate the loading to the Great Lakes Basin of selected toxic substances. The relative importance of the atmospheric pathway can then be ascertained and appropriate control strategies developed.

Air Deposition Monitoring

During the 1999-2001 priority work cycle, the International Air Quality Advisory Board (IAQAB) and the Great Lakes Science Advisory Board (SAB) held two workshops, in cooperation with the Delta Institute and the Lake Michigan Forum, focusing on the capability of atmospheric models to support the development of policies, including source control strategies, by confirming deposition trends and identifying significant sources of persistent contaminants.

At the workshops, presentations from leading researchers and modelers were followed by discussion of the policy implication of their work. Participants included representatives of municipal, state and provincial governments, the U.S. and Canadian governments, universities, consultants, industry and environmental group. A Task Force has been formed in response to the many recommendations.

The Ann Arbor Statement

In September 2003, a group of over 70 scientists and policy makers met in Ann Arbor, Michigan, to discuss the long-range atmospheric transport of persistent, bioaccumulative and toxic substances (PBTs) to the Great Lakes Basin. This meeting was entitled "The Great Lakes Binational Toxics Strategy Long-Range Transport Workshop: The Atmospheric Pathway of Toxic Substances to the Great Lakes."

The Delta Institute developed the Ann Arbor Statement based on the proceedings of the workshop. The Statement recommends actions to better understand and reduce the impacts of the long-range transport of these chemicals. The Ann Arbor Statement is summarized below. To view the Statement in its entirety, visit *www.delta-institute.org*

The Ann Arbor Statement recognizes that, while considerable progress has been made in decreasing contamination in the Great Lakes Basin, PBTs remain at levels that pose threats to human and ecosystem health. Long-range atmospheric transport, at the regional, continental, hemispheric, and even global scale, is a significant contributor of some of these pollutants, and unless long-range transport issues are addressed, the Great Lakes Water Quality Agreement (GLWQA) goal of virtual elimination will not come into reach. There remain important gaps and uncertainties in our scientific understanding of the sources and the transformation and transport processes that control the environmental levels of PBTs. Resolving these scientific uncertainties is required for making wise policy decisions to further reduce pollutant concentrations, exposures and impacts. The discussion and deliberation in Ann Arbor resulted in a set of recommended actions to improve long-range transport science and to better inform policy. These actions, which are presented in the Ann Arbor Statement as some 60 specific research needs, fall into four categories (see box).

Next Steps

- Monitoring and research will be reviewed to identify LaMP pollutants.
- A LMMB Study data report has been or will be prepared for each contaminant studied and added to the LaMP 2000 online as available.
- Progress will be made in aligning monitoring programs and indicators.
- The coordinated monitoring plan for the lake intensive monitoring year 2005 will be finalized.
- Lake Michigan models will be documented further, and additional scenarios will be simulated with results shared through the LaMP and in other ways.
- Complete LMMCC ANS monitoring survey results and recommendations.
- Cladophora alga research and development needed.

Ann Arbor Statement Proposes Actions

Emissions Inventories
Canada and the United States must improve, coordinate and disseminate, in a more timely fashion, emissions and usage inventories of PBTs. Priority actions include standardizing estimation techniques, characterizing poorly understood sources, and improving the review and accountability of inventories. These efforts must be coordinated not only within the Great Lakes Basin but also on a continental and even global scale with the assistance of continental and international organizations.

Monitoring
Improved coordination, harmonization of chemicals and methods, effective data sharing, and enhanced data analyses must become immediate priorities for PBT monitoring. The successful Integrated Atmospheric Deposition Network (IADN) program should continue with a focus on these and other priorities including improved expert review, inclusion of emerging substances of concern, more timely dissemination of results, and incorporation of new and emerging technologies such as passive air samplers. Stations should also be set up to monitor inter- and intra-continental transport to and from the Great Lakes watershed basin.

Modeling
The full benefits of emission inventories and monitoring can only be realized if the results are used in modeling assessments which seek to: establish a complete mass balance or budget; calculate rates of transport to and from the Great Lakes basin; identify sources and/or source regions responsible for transport to the basin; and understand cross-media fluxes between air, water, soils, sediments and biota. Uncertainties regarding mercury must receive focused attention. Furthermore, an international modeling initiative is required in which various modeling approaches are tested, compared and coordinated and the findings presented to the lay public in a compelling and understandable format.

Integration and Synthesis
In order to fill the knowledge gaps and more efficiently use existing resources, future efforts should focus on coordinating emissions inventory, monitoring, and modeling efforts and improving accessibility and comparability of data and methods. International scientific cooperation is critical, as is support from stakeholder groups, including non-government organizations, academic institutions, and industry. Long-term funding commitments are necessary to improve our scientific understanding of the long-range transport of PBTs. To secure the required funding, scientists must work together to effectively communicate to the general public the linkages between understanding long-range transport and protecting public health and environmental quality.

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Glossary

Aquatic Nuisance Species (ANS)
Water-borne plants or animals that pose a threat to humans, agriculture, fisheries, and/or wildlife resources.

Area of Concern (AOC)
Areas of the Great Lakes identified by the International Joint Commission as having serious water pollution problems requiring remedial action and the development of a Remedial Action Plan. AOCs are defined in the Great Lakes Water Quality Agreement as: "a geographic area that fails to meet the general or specific objectives of the Great Lakes Water Quality Agreement, or where such failure has caused or is likely to cause impairment of beneficial use or of the area's ability to support aquatic life." Initially, there were 43 AOCs in the Great Lakes Basin.

Area of Stewardship
An Area of Stewardship watershed focus is an area, most often a watershed, for which a level of ecosystem integrity has been established as a goal and where an integrated, multi-organizational initiative or partnership is actively working to achieve that goal. The Lake Michigan Watershed Academy is being established to promote the concept of stewardship. Examples of such areas include the Chicago Wilderness, the Kalamazoo Multi-Jurisdictional Watershed Agreement, and the work in Grand Traverse Bay, Michigan and Door County, Wisconsin.

Basin
The land area that drains into a lake or river. This area is defined and bounded by topographic high points around the waterbody.

Beneficial Use
The role that the government decides a waterbody will fulfill. Examples of these uses include healthy fish and wildlife populations, fish consumption, aesthetic value, safe drinking water sources, and healthy phytoplankton and zooplankton communities. Restoring beneficial uses is the primary goal of the Remedial Action Plans for the Areas of Concern and of the Great Lakes Water Quality Agreement.

Beneficial Use Impairment
A negative change in the health of a waterbody making it unusable for a beneficial use that has been assigned to it. Examples of the 14 use impairments designated in the Great Lakes Water Quality Agreement include: restrictions on fish and wildlife consumption, beach closings, degradation to aesthetics, loss of fish and wildlife habitat, and restrictions on drinking water consumption. Local use impairments occur in Areas of Concern or other areas affecting the lake. Regional use impairments occur in an Area of Concern cluster or multi-jurisdictional watershed. Open water or lakewide impairment is a condition of pervasive impairment.

Binational Executive Committee (BEC)
The Binational Executive Committee (BEC) is a high-level forum composed of senior-level representatives of the USPC and Canadian counterpart agencies who are accountable for delivering major programs and activities to fulfill the terms of the GLWQA. The BEC derives its mandate from the provisions of the GLWQA which relate broadly to notification, consultation, coordination, and joint activity. In particular, Article X specifies the commitments of the Parties to consultation and review: "The Parties (U.S. and Canada), in cooperation with State and Provincial Governments, shall meet twice a year to coordinate their respective work plans with regard to the implementation of this Agreement and to evaluate progress made."

Biological Integrity
The ability of an ecosystem to support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to the best natural habitats within a region.

Boundary Waters Treaty
The international treaty between the United States and Great Britain signed on January 11, 1909, regarding the waters joining the United States and Canada and relating to questions arising between the two nations. It gave rise to the International

Joint Commission and the Great Lakes Water Quality Agreement.

Buffer Strips
Vegetated buffer strips along waterways act as filters for sediment, nutrients and pesticides that are washing off the land heading for the nearest stream. They are often wetlands that can also mitigate flood water movement and serve as habitat for wildlife.

Cladophora
A natural occurring macroalgae found predominantly along the coast. Large blooms lead to unsightly and foul-smelling beaches and have negative health and economic consequences. The blooms can result in reduced drinking and swimming water quality. Possible causes include increased nutrient inputs, increased water clarity and /or temperature and changing lake levels.

Conservation Easement
A conservation easement is a deed restriction placed on a piece of property to protect resources associated with that parcel, sometimes irrevocable. It can cover a whole parcel or be for a stream bank or lake shore. The easement is often held by government entities while land owners receive tax reductions or other payments

Criteria Pollutants
A group of air and water pollutants regulated by the EPA under the Clean Air Act and Clean Water Act on the basis of criteria that includes information on health and environmental effects. Criteria pollutants include particulates, some metals, organic compounds, and other substances attributable to discharges.

Critical Pollutant
Chemicals that persist at levels that are causing or could cause impairment of beneficial uses lakewide. The Lake Michigan LaMP has identified six critical pollutants: PCBs, dieldrin, chlordane, DDT and its metabolites, mercury, and dioxins/furans. *See also* Great Lakes Critical Pollutants. Related program: Lakewide Management Program.

Designated Uses
The role that a waterbody is slated to fulfill, such as a drinking water source. Uses are specified in water quality standards for each waterbody or segment, whether or not the current water quality is high enough to allow the designated use. Other typical uses of a waterbody include propagation of fish and wildlife, recreation, agriculture, industry, and navigation.

Ecosystem
A biological community and its environment working together as a functional system, including transferring and circulating energy and matter. It is an interconnected community of living things including humans, and the physical environment with which they interact.

Ecosystem Indicator
An organism or community of organisms that is used to assess the health of an ecosystem as a whole. When tracked over time, an ecosystem indicator provides information on trends in important characteristics of the system. Also known as an environmental indicator.

Ecosystem Integrity
A measure of the capacity of ecosystems to renew themselves and continually supply resources and essential services. Ecosystem integrity is the degree to which all ecosystem elements-species, habitats, and natural processes-are intact and functioning in ways that ensure sustainability and long-term adaptation to changing environmental conditions and human uses.

Ecosystem Management
The process of sustaining ecosystem integrity through partnerships and interdisciplinary teamwork. Ecosystem-based management focuses on three interacting dimensions: the economy, the social community, and the environment. Ecosystem-based management seeks to sustain ecological health while meeting economic needs and human uses.

Emerging Pollutant
The Lake Michigan Lakewide Management Plan addresses emerging pollutants, which include those toxic substances that, while not presently known to contribute to use impairments or to show increasing loadings or concentrations, have characteristics that indicate a potential to impact

the physical or biological integrity of Lake Michigan. These characteristics include presence in the watershed, ability to bioaccumulate, persistence (greater than 8 weeks), and toxicity. Emerging pollutants include atrazine, selenium, and PCB substitute compounds.

End Point Subgoal
End point subgoals describe the desired levels of ecosystem integrity and ecological services required to restore beneficial uses and provide for healthy human natural communities in the basin.

Fish Consumption Advisory (FCA)
An advisory issued by a government agency recommending that the public limit their consumption of fish. Advisories are issued to limit exposure to toxic substances in the fish that have the potential to impact human health. A fish consumption advisory is prepared annually by each state. Fish caught from selected lakes and streams are tested for toxic substances.

Great Lakes Water Quality Agreement (GLWQA)
An international agreement signed by the United States and Canada in 1972 and updated in 1978 and 1987. The Agreement seeks to restore and maintain full beneficial uses of the Great Lakes system. Language committing the two nations to virtually eliminate the input of persistent toxic substances in order to protect human health and living aquatic resources was included when the Agreement was updated in 1978. The philosophy adopted by the two governments is zero discharge of such substances.

Habitat
That space that is or can be successfully occupied (inhabited) by a species or biotic community or some broader (taxonomic or phylogenetic) entity. Habitat is simply the place where an organism or group of closely related organisms live.

Lake Michigan
Lake Michigan is the only one of the five Great Lakes wholly within the U.S. border. It is bounded by the states of Michigan, Indiana, Illinois, and Wisconsin. It is connected with and flows into Lake Huron through the Straits of Mackinac.

Lake Michigan Basin
Used to describe Lake Michigan and the surrounding watersheds emptying into the lake.

Lake Michigan Lakewide Management Plan (LaMP)
This document is both a reference document and a proposal for a process that will guide remediation of past errors and the achievement of sustainable integrity of the basin ecosystem. It contains clear, comprehensive goals, specific objectives, a strategic plan, and a system of indicators and monitoring for use in judging environmental status and effectiveness of current actions.

Lake Michigan Management Committee (LMMC)
The LMMC guides the overall development and implementation of the Lake Michigan LaMP. The current membership includes: EPA (Lake Michigan Team, Great Lakes National Program Office, and Office of Research and Development), U.S. Fish and Wildlife Service, Army Corps of Engineers, U.S. Geological Survey, U.S. Department of Agriculture (Natural Resources Conservation Service), Illinois Environmental Protection Agency, Indiana Department of Environmental Management, Michigan Department of Environmental Quality, Wisconsin Department of Natural Resources, Great Lakes Fishery Commission, Chippewa/Ottawa Treaty of Fishery Management Authority, and the Grand Traverse Band of Ottawa and Chippewa Indians, Michigan.

Lake Michigan Mass Balance Study (LMMB)
This mass balance research project begun in 1994 is part of the Lake Michigan Lakewide Management Plan and is designed to develop a sound, scientific base of information that will guide future toxic pollutant load reduction and prevention activities.

Lake Michigan Monitoring Coordinating Council (LMMCC)
The Council provides a forum for identifying gaps and establishing monitoring priorities, exchanging information, and forming partnerships. It responds to the need for enhanced coordination, communication, and data management among the many agencies and organizations that conduct or benefit from environmental monitoring efforts in the basin.

LaMP Technical Coordinating Committee (TCC)
The TCC develops documents and programs, and

recommends strategies, goals, and objectives. The current membership includes the same agencies/entities as the Management Committee, plus the Oneida Tribe of Wisconsin. There is a steering committee and six subcommittees under the TCC.

Methyl Mercury
Any of several extremely toxic compounds formed from metallic mercury by the action of microorganisms and capable of entering the food chain. Methyl mercury is an organic form of mercury created when inorganic mercury is released into the environment where it volatilizes back to the atmosphere as a gas or as adherents to particulaltes. Methylmercury biomagnifies up the food chain as it is passed from a over food chain level to a higher food chain level through consumption of prey organisms or predators.

Nutrients
Elements or compounds essential as raw materials for organism growth and development, such as carbon, nitrogen and phosphorus. If out of balance can cause impairment of waterways

Pressure-State-Response Approach
The pressure-state-response approach involves linking environmental indicators to stressors that impact the environment and to program activities. The use of this approach should promote consistency in the development and application of environmental indicators. It is an organizing framework used by U.S. EPA Region 5 in its "Guide for Developing Environmental Goals, Milestones and Indicators," found in LaMP Appendix H.

Remedial Action Plan (RAP)
These are federally-mandated local plans designed to restore environmental quality to Areas of Concern on the Great Lakes (there are 10 in Lake Michigan and there were initially 43 throughout the Great Lakes). The Areas of Concern were identified for their persistent pollution problems. Remedial Action Plans were called for by a protocol added to the Great Lakes Water Quality Agreement in 1987.

Sediments
soil particles that are or were at one time suspended in and carried by water as a result of eroison and /or suspension. The particles are deposited in areas where the water flow is slowed such as in harbors, wetlands and lakes.

Stressor
Any chemical, physical, or biological entity that can induce adverse effects on individuals, populations, communities, or ecosystems and be a cause of beneficial use impairments. Examples of stressors include: pathogens; fragmentation and destruction of terrestrial and aquatic habitats; exotic nuisance species; nutrients; and uncontrolled runoff and erosion.

Sustainable Development
Sustainable development is the process of economic development to meet the needs of the present without compromising the ability of future generations to meet their own needs.

Total Maximum Daily Load (TMDL)
TMDLs are set by regulators to allocate the maximum amount of a pollutant that may be introduced into a waterbody and still assure attainment and maintenance of water quality standards.

U.S. Policy Committee

The U.S. Policy Committee is a forum of senior-level representatives from the Federal, State, and Tribal governmental agencies that share responsibility for environmental protection and natural resources management of the Great Lakes – to advance the restoration and protection of the Great Lakes Basin Ecosystem. U.S. Policy Committee Partners include the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Coast Guard, U.S. Department of Agriculture, National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, U. S. Geological Survey, Agency for Toxic Substances and Disease Registry, U.S. Forest Service, Great Lakes Fishery Commission, Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, Great Lakes Tribal Governments.

Water Table
The upper surface of the groundwater or that level below which the soil is saturated with water

Appendix A
Lake Michigan LaMP Pollutant Discussion Paper - For Comment

Process of Identifying and Categorizing LaMP Pollutants

Lake Michigan LaMP 2000 announced that adaptive management of the Lake Michigan ecosystem would be the focus of the LaMP process. Public comments received on LaMP 2000 requested that the adaptive management approach be applied to the Lake Michigan LaMP pollutants list and that all stressors, not just chemicals, be considered.

This appendix identifies work performed by the Lake Michigan LaMP Toxics Reductions Subcommittee, consisting of Federal and State partners, to implement adaptive management of Lake Michigan pollutants since preparation of the Lake Michigan Lakewide Management Plan (LaMP) 2002 (see pages 89 to 95). This appendix is organized in two sections. The first section describes the process of identifying and categorizing LaMP pollutants. The second section applies the process by gathering available information to identify LaMP pollutants.

Comments on the process and pollutants are welcomed. This approach -- taken in the 2002 and 2004 Lake Michigan LaMPs to identifying critical pollutants, pollutants of concern, and a pollutant watch list – is innovative. The primary goal for pollutant categorization is to identify problem-causing chemicals that need management on a lakewide/basinwide, regional, or local basis, regardless of the type of action to be taken. The critical pollutant and pollutant of concern categories are heavily dependent on public health fish consumption advisories and state water quality standards because data are available for these programs. The pollutant watch list also relies on data from programs that identify water use problems in the Lake Michigan basin. In addition, the pollutant watch list includes chemicals without final national water quality criteria and/or state water quality standards. Candidates for the watch list, therefore, include conventional pollutants like nitrogen or ammonia as well as "emerging" pollutants without regulatory thresholds or action levels.

Background

In Lake Michigan LaMP 2002, the pollutant review process was depicted in Table A-1 (p. 91). The Federal and State partners have reviewed available information from the Great Lakes National Program Office, the Clean Water Act Section 303(d) lists submitted by States for 2002, participated in the 2003 International Association for Great Lakes Research conference, participated in the 2003 State of Lake Michigan conference, and completed a literature review. These are the actions identified in Table A-1 of LaMP 2002, with the exception of receiving and reviewing written comments on the 2002 LaMP. Comments received during preparation of the 2002 LaMP were considered before publication. One comment identifying a potential watch list pollutant was received on Appendix A. In addition, Federal and State partners participated in meetings including but not limited to: a [Persistent, Bioaccumulative, and Toxic Substances] PBT Monitoring Strategy Workshop in April-May 2002, an Endocrine Disruptors Program Review Workshop in October 2002; [Centers for Disease Control] CDC & U.S. EPA Meeting regarding Overview of CDC's Environmental Health Tracking Program in July 2003; a Region/ [Office of Research and Development] ORD Workshop on Emerging Pollutants in August 2003, and the 2004 National Forum on Contaminants in Fish. At the majority of these meetings, discussion of Lake Michigan LaMP pollutant identification was solicited, primarily with respect to the watch list pollutants. Despite this, some dissatisfaction remains with the process of identifying LaMP pollutants. This is described in the following paragraphs and in the outstanding issues sections below.

LaMP 2002's Background section of Appendix A identified several national efforts to improve the quality and comparability of states' Clean Water Act section 303(d) lists of impaired waters and section 305(b) reports of water quality for navigable waters. Identified weaknesses included the use of differences in systems used to identify geographic location, differences in report format from State-to-State, the lack of explicit linkage

between the data and categorization of the waters, and a lack of coordination between States with shared waters. For example, States use latitude-longitude, an arbitrary grid, location names, and hydrologic unit codes to identify fish sample collection locations and impaired waters stream segments. The differences between State 303(d) lists prevented inclusion of all States' information in Table A-4. Illinois' data are presented in this LaMP as an example. Water bodies identified in State 303(d) lists are identified in the watershed fact sheets in Appendix D of this document.

On July 21, 2003, U.S. EPA Headquarters' Office of Wetlands, Oceans, and Watersheds in the Office of Water issued *Guidance for 2004 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act*. EPA's goal continues to be the support of State monitoring programs that balance the ability to conduct broad scale analyses of water quality conditions with the monitoring necessary to make scientifically and statistically sound assessment determinations for specific waters. Of particular interest to this LaMP, EPA requires States to identify pollutants causing or expected to cause violations of the applicable water quality standards. These standards frequently include biological criteria.. States should identify all pollutants that are known to be causing the impairment of a water. Prior to establishing a TMDL, the pollutant causing a biological impairment would need to be identified.

Outstanding Issues - Critical Pollutants and Pollutants of Concern

After preparation of LaMP 2002, State and Federal staff re-examined use of the terms "open waters" and "near-shore waters." Both terms are used in the criteria for critical pollutants and pollutants of concern, and their definition is not clear. The regulatory definition of "open waters of the Great Lakes" in the Federal Water Quality Guidance for the Great Lakes (Title 40 of the Code of Federal Regulations [40 CFR], Part 132) is as follows: "all of the waters within ... Lake Michigan ... lakeward from a line drawn across the mouth of tributaries to the Lakes, including all waters enclosed by constructed breakwaters, but not including the connecting channels." In other words, the entire lake is open waters. According to the report from the State of the Lakes Ecosystem Conference in 1996, "the nearshore waters begin at the shoreline or the lakeward edge of the coastal wetlands and extend offshore to the deepest lake-bed depth contour, where the thermocline typically intersects with the lake bed in late summer or early fall." Lake Michigan is grouped, by the SOLEC 1996 report, with Lakes Huron, Erie, and Ontario as having nearshore waters between the shoreline and 27 meters (about 89 feet) depth. From discussion with Great Lakes researchers in 2003, the definition of nearshore waters is not formal. In summary, "open waters" may include both nearshore and offshore waters or only offshore waters.

Whether or not a particular pollutant is a Lake Michigan LaMP critical pollutant or a pollutant of concern depends largely on fish monitoring. This is because contaminant concentrations in the open waters are so low that a very large volume of water must be sampled in order to detect the target analyte. Concentrating the sample generates hazardous waste, making the analysis of open water relatively more expensive. As a result, States and EPA have not been routinely sampling and analyzing the open waters of Lake Michigan. States perform fish monitoring for natural resource management and in order to prepare public health sport fish consumption advisories. The EPA's Great Lakes National Program Office also performs monitoring for long term ecological trends and for contaminant trends in fish fillets because the fish bioaccumulate some target analytes. States use the contaminants detected through fish monitoring, along with other information, to assess whether a particular water body or segment is meeting its designated use. If contaminants are present in edible portions of fish above a risk-based threshold for human or animal consumption, the water body is identified as impaired.

As a practical matter, whether or not the open waters of Lake Michigan are impaired also depends in part on which definition of "open water" or "nearshore water" is used. Using the regulatory definition of open waters of the Great Lakes, the number of critical pollutants would

increase, perhaps including pathogens, nutrients, and sediment. Locally or regionally impaired waters that are a function of surface water or groundwater discharge of critical pollutants would be addressed using federally- imposed lakewide responses. Using the State of the Lakes Ecosystem Conference 1996 definition of nearshore waters and the location of sample collection to categorize a sample as representing nearshore or open water, the number of samples taken in open waters may be severely reduced. For example, the State of Michigan collects fish in the fall when they are swimming upstream to spawn. Relying on sample location to categorize these samples would result in identification of only pollutants of concern in Michigan since the rivers are landward of the shoreline or lakeward edge of coastal wetlands. Another available option is to try to categorize fish species into "open water" and "nearshore water" groups. Yet another option would be to define these terms on a pollutant-specific basis, as in the preparation of

TABLE A-1. The fish species identified below are included in the State of Michigan Fish Consumption Advisory for the Lake Michigan Watershed.

Fish Species	Normally found in Open Waters	Normally found in Nearshore Waters	Normally found in Inland Waters
Brown Trout	X	X	
Carp		X	
Catfish			
Chinook Salmon	X	X	
Lake Trout	X		
Rainbow Trout (including Steelhead)	X		
Smelt	X		
Sturgeon			
Walleye			
Whitefish	X		
Yellow Perch	X	X	
Burbot	X		
Channel Catfish			
Longnose Sucker		X	
Northern Pike		X	
Smallmouth Bass		X	
White Perch			
White Sucker		X	
Largemouth Bass		X	
Rock Bass		X	
Redhorse Sucker			
Catfish			
Suckers			
Black Crappie		X	
Bluegill		X	
Yellow Bullhead		X	
Crappie		X	
Muskellunge			

TABLE A-2. The U.S. Environmental Protection Agency's Great Lakes National Program Office conducts whole fish monitoring to track ecosystem changes and fish filet monitoring for the trend of contaminants in sport fish.

Study component	Lake	Species	Size Range (mm)	Number of fish	Number of composites	Sample type
Open Lakes Monitoring	Michigan, Huron, Superior, Ontario	Salvelinus namaycush (lake trout)	600 to 700	50	10	Whole fish
	Erie	Stizostedion vitreum (walleye)	450 to 550	50	10	Whole fish
Sport Fish	Michigan, Huron, Superior, Ontario	Oncorhynchus kisutch (Coho Salmon) and Oncorhynchus tshawytscha (Chinook salmon) and	3 years of age Coho 4-5 years of age Chinook	15	3	Filet (skin-on)
	Erie	Salmo gairdneri (Rainbow trout)	600 to 700	15	3	Filet (skin-on)

TMDLs for reaches of streams.

State and federal staff asked biologists whether fish could be assigned into geographic categories such as: "normally found in open waters" or "normally found in nearshore waters." All biologists contacted rejected the notion because fish spend various life stages in more than one environment. Nonetheless, a member of the Great Lakes Fishery Commission filled in portions of the table supplied by state of Michigan staff (Table A-1). This table will be updated to include Lake Michigan fish identified in each state's fish consumption advisory for Lake Michigan. The LaMP may rely on the fishery categories because of the variation in metadata available for state fish contaminant monitoring programs. In addition, the Great Lakes National Program Office's fish monitoring program relies on single species trends and selected species because studies of stomach contents have shown the harvested fishes' diet to represent the open waters. See Table A-2. The Lake Michigan LaMP 2004 relies upon State-collected data for the period from 2000 to the present and other sources. In LaMP 2004, we continue to rely upon the criteria proposed to identify Lake Michigan LaMP critical pollutants and pollutants of concern in LaMP 2002.

Any one of these four criteria may be relied upon to define the Lake Michigan LaMP critical pollutants:

- Pollutants identified on Illinois, Indiana, Michigan, or Wisconsin Clean Water Act Section 303(d) lists or in Section 305(b) reports as sources of impairment to the open waters of the lake;
- Pollutants that have been found to exceed Great Lakes Water Quality Initiative (GLI) water quality criteria in the open waters of the lake;
- Pollutants that exceed or trigger a relevant Action Level, such as a fish consumption advisory (FCA) or a maximum contaminant level (MCL), in the open waters of the lake; or,
- Pollutants associated with other lakewide designated use impairments (e.g., impairment to aquatic life).

We continue to seek comment regarding whether hazardous constituents or substances detected in releases from Resource Conservation and Recovery Act installations or from Superfund sites should be considered an Agency action level for purposes of defining critical pollutants. We note that the Office of Wetlands, Oceans, and Watersheds' July 21, 2003 guidance for assessment, listing and reporting requirements identifies Superfund Records of Decision as a source of information and data to be considered.

Federal and State partners also seek comment regarding how contaminants detected in humans should be classified.

Any one of the following three criteria are proposed to define Lake Michigan LaMP pollutants of concern:
•Pollutants on State 303(d) lists identified as causing impairments in nearshore waters and Lake Michigan tributary mouths;
•Pollutants exceeding an Agency action level in nearshore waters or tributary mouths, including pollutants identified as a source of impairment in a Great Lakes Area of Concern; or
•Pollutants associated with regional use impairments (e.g., impairment of local fish communities or populations).

Between LaMP 2004 and LaMP 2006, we will examine the metadata from State and Federal fish monitoring programs in several scenarios. In the first scenario, we will rely on the Federal Water Quality Guidance definition of open waters of the Great Lakes and evaluate impairments as Lake Michigan or not Lake Michigan (i.e., Area of Concern); load reduction targets and total maximum daily loads would be calculated for the entire Lake. In the second scenario, we will attempt to apply the State of the Lakes Ecosystem Conference 1996 definition of nearshore waters; this would be consistent with dividing Lake Michigan into zones for calculating a total maximum daily load. In the third scenario, fish consumption advisories would be categorized by fish species into "open water" and "nearshore water" groups; this may also result in dividing Lake Michigan into zones. A fourth scenario might consist of identifying "open water" and "nearshore water" impairments by pollutant. For example, *E. coli* exceedances could be addressed through a TMDL for a geographically discrete nearshore zone.

Outstanding Issues – Watch List

In LaMP 2004, two general categories of information were reviewed to identify candidates for the watch list. First, we relied on the 303(d) lists to identify pollutants *upstream* of the tributary mouth. These upstream pollutants may include the LaMP critical pollutants and pollutants of concern, but such pollutants are not repeated on the watch list. The watch list candidates from the 303(d) lists may eventually become pollutants of concern or critical pollutants if their geographic distribution extends to the tributary mouth or lake. Second, we are identifying chemicals without relevant water quality criteria as watch list candidates if they qualify using the three criteria proposed in LaMP 2002. The three biggest process issues for identification of the watch list pollutants are: availability of analytical methods and reference standards; selecting chemicals to look for; and, the lack of toxicological information. In the following paragraphs of this section, these process issues will be examined one-by-one.

Environmental chemical analyses typically identify target analytes, tentatively identified compounds, recognizable artifacts, and the sample's relatively large proportion of naturally occurring and anthropogenic chemicals of varied toxicity. Each of these groups of chemicals varies in toxicity from high to low. The target analytes are those that can be identified with off-the-shelf chemical analysis technology and were identified, for the most part, in the 1970s. The regulatory target analytes were not selected based on toxicity (C.G. Daughton, U.S. EPA, July 2002). Finally, reference analytical standards are typically not commercially available for proprietary products, with exceptions such as the PCB congener composition of various Arochlor mixtures.

How does one select a chemical for detection in the environment? The possibilities seem endless because practically everything that we use will end up in the environment at some concentration. One approach would be to rank chemicals in order of volume produced. Chemicals produced in annual volumes above 1 million pounds are considered High Production Volume or "HPV" chemicals. This subset of 3,000-4,000 HPV chemicals is the main focus of EPA's Office of Pollution, Prevention, and Toxic's Existing Chemicals Data Collection and Data Development (Testing) activities. Data on chemicals that are collected or developed are made accessible to the public and are intended to provide input for efforts to evaluate potential risk from exposures to these chemicals (accessed 02/17/2004). The identification of 3,000 to 4,000

HPV chemicals narrows down the selection of a chemical for research a bit, but not quite enough to design an affordable monitoring program. Other ideas for identifying watch list pollutants include: testing for pharmaceuticals and personal care products; testing for disinfection by-products; following the European lead; and, testing environmental samples for constituents from recycling activities.

The universe of chemicals of concern to EPA as potential endocrine disruptors is estimated to number more than 87,000 items including: pesticides, commercial chemicals, cosmetic ingredients, food additives, nutritional supplements, and certain mixtures. Some Lake Michigan LaMP 2004 critical pollutants are among the reference chemicals used to develop standard test methods to identify endocrine disruptors. This is because they produced a well-documented positive response in one or more Tier 1 screening assays by an identified mode of action. Some chemicals may act by more than one mode of action. The standard test methods being developed include Tier 1 and Tier 2 assays targeting modes of action including: androgen, antiandrogen, estrogen, antiestrogen, hypothalmic-pituitary-gonadal axis, steroidogenesis, aromatase, and thyroid.

The Endocrine Disruptor Program is one of several ways the EPA attempts to identify toxic threats to human health and the environment. The Agency for Toxic Substances and Disease Registry (ATSDR) and the EPA prepare a list, in order of priority, of substances that are most commonly found at facilities on the Comprehensive Emergency Response Cleanup and Liability Act (CERCLA or Superfund) National Priorities List and which are determined to pose the most significant potential threat to human health due to their known or suspected toxicity and potential for human exposure at the National Priorities List sites. This list of substances is known as the CERCLA list. It provides guidance in selecting which substances will be the subject of toxicological profiles prepared by ATSDR. Another example is the TSCA Interagency Testing Committee (ITC). In 1976, under the Toxic Substances Control Act (TSCA), the U.S. Congress created the TSCA Interagency Testing Committee (ITC) as an independent advisory committee to the Administrator of the U.S. EPA. The ITC includes 16 U.S. Government Member organizations. The ITC was created to identify chemicals regulated by TSCA for which there are suspicions of toxicity or exposure and for which there are few, if any, ecological effects, environmental fate or health effects testing data. As mandated under section 4(e) of TSCA, the ITC must add these chemicals to the Priority Testing List and recommend them for testing or information reporting in May and November Reports to the Administrator. Chemicals are recommended for testing to meet the data needs of the ITC's 16 U.S. Government Member organizations. The ITC encourages producers and importers of recommended chemicals to voluntarily submit studies to meet these U.S. Government data needs. Since its first meeting on February 5, 1977, the ITC has reviewed thousands of chemicals.

In summary, the outstanding issues surrounding identification of watch list pollutants are much bigger than the Lake Michigan Basin. We will continue to use all three of the criteria proposed in 2002 for Lake Michigan LaMP watch list pollutant identification:

- potential to impact the Lake Michigan ecosystem;
- presence in the Lake Michigan watershed; and,
- bioaccumulation potential, persistence in water or sediment, or toxicity singly or through synergistic effects.

No comments were received on these criteria following LaMP 2002 publication.

LaMP Pollutants

Due to the timing of LaMP publication and the EPA due date for States' Clean Water Act Section 303(d) lists, the identification of critical pollutants and pollutants of concern is delayed. Section 303 (d) of the Clean Water Act requires states to prepare lists of waters within its boundaries that do meet or are threatened to not meet water quality standards applicable to such waters. These lists are due on April 1 of every even-numbered year. The target release date for the LaMPs is Earth Day, April 22 of even numbered

Table A-3. Status of LaMP Pollutants Proposed in LaMP 2002

	Lake Michigan LaMP Pollutants Proposed in LaMP 2002	Lake Michigan LaMP Pollutants Final in LaMP 2004
Critical Pollutants	PCBs, chlordane, DDT/DDE, mercury, dioxin	PCBs, chlordane, DDT/DDE, mercury, dioxin
Pollutants of Concern	PAHs, lead, cadmium, chromium, copper, zinc, arsenic, cyanide, endrin, heptachlor epoxide, lindane, nickel, nutrients, pathogens, sediments	PAHs, lead, cadmium, chromium, copper, zinc, arsenic, cyanide, endrin, heptachlor epoxide, lindane, nickel, nutrients, pathogens, sediments
Pollutant Watch List	atrazine, selenium, PCB substitute compounds	atrazine, selenium, PCB substitute compounds

years. At the time of LaMP 2004 preparation, the most recent federally approved CWA 303(d) lists were submitted in 2002.

LaMP Pollutants Proposed in 2002

Critical Pollutants

In LaMP 2002, federal and state partners proposed to identify polychlorinated biphenyls, chlordane, DDT/DDE (DDT and metabolites), mercury, and dioxin as LaMP critical pollutants. This proposal was based on the presence of these chemicals on state public health fish consumption advisories (an "action level exceedance") for the open waters of Lake Michigan and on state 303(d) lists. As no adverse comments were received, these pollutants are final critical pollutants in this LaMP 2004. See Table A-3.

Pollutants of Concern

Also in LaMP 2002, federal and state partners proposed to identify dieldrin, polycyclic aromatic hydrocarbons (PAHs), lead, cadmium, chromium, copper, zinc, arsenic, cyanide, endrin, heptachlor epoxide, lindane, nickel, nutrients, and pathogens (includes bacteria, parasites, and viruses) as pollutants of concern. These substances are identified as causes of impairment for nearshore waters and tributary mouths. Sediments are also identified as a cause of impairment in the Lake Michigan Impairments Summary, a geographic information systems map on p. 93 of LaMP 2002. State and federal staff applied judgement in determining which waters are nearshore waters and tributary mouths. As no adverse comments were received, these pollutants are final pollutants of concern. See Table A-3.

Watch List Pollutants

In LaMP 2002, we did not propose any new watch list pollutants. We anticipated receiving comments on the watch list criteria, and this did not happen. The same watch list pollutants from LaMP 2002 are carried over into LaMP 2004 as final. See Table A-3. Comments on the process for identifying candidate pollutants for the watch list are still invited.

LaMP Pollutants Proposed for Finalization in 2006

As stated in the introduction to this appendix, LaMP 2004 uses the same criteria to identify proposed pollutants as the criteria proposed in LaMP 2002.

Critical Pollutants

These pollutants still exceed at least one state's public health fish consumption advisories for Lake Michigan and Green Bay: PCBs, mercury, DDT, chlordane, and dioxin.

- In Illinois, the 2004 Lake Michigan fish advisory is for chlordane and PCBs in Chinook Salmon, Coho Salmon, Lake Whitefish, Rainbow Trout, Brown Trout, Lake Trout, Yellow Perch, Smelt, Channel Catfish, and Carp.

- In Indiana, the 2003 Lake Michigan fish consumption advisory is for mercury and/or PCBs in Black Crappie, Bloater, Bluegill, Brook Trout, Brown Trout, Carp, Channel Catfish, Chinook Salmon, Coho Salmon, Freshwater Drum, Lake Trout, Lake Whitefish, Largemouth Bass, Longnose Sucker, Northern Pike, Pink Salmon, Quillback, Rainbow Trout, Rock Bass, Round Goby, Silver Redhorse, Smallmouth Bass, Walleye, White Sucker, and Yellow Perch. See the advisory for location-specific guidelines.

- In Michigan, the Lake Michigan fish consumption guide is for PCBs, Chlordane, Mercury, Dioxin, and/or DDT in Brown Trout, Burbot, Carp, Catfish, Channel Catfish, Chinook Salmon, Coho Salmon, Lake Trout, Longnose Sucker, Northern Pike, Rainbow Trout (including Steelhead), Smallmouth Bass, Smelt, Splake, Sturgeon, Walleye, White Bass, Whitefish, White Perch, White Sucker, and Yellow Perch. See the guide for location-specific guidelines

- The 2003 Health Guide for Eating Fish in Wisconsin identifies Green Bay south of Marinette for PCBs and other chemicals in Northern Pike, Walleye, White Bass, Yellow Perch, Carp, White Perch, Smallmouth Bass, Channel Catfish, White Sucker, Rainbow Trout, Chinook Salmon, Whitefish, Splake, Brown Trout, and Sturgeon. The 2003 Health Guide for Eating Fish in Wisconsin identifies Lake Michigan for PCBs and other chemicals in Chinook Salmon, Coho Salmon, Brown Trout, Lake Trout, Rainbow Trout, Yellow Perch, Whitefish, Chubs, and Smelt. See the Guide for location-specific guidelines.

All Lake Michigan states' consumption advisories do not identify every chemical detected in fish monitoring programs. For example, Wisconsin believes that the advisory for PCBs protects consumers from PCBs and additional chemicals.

In addition to the fish consumption advisories, Illinois identified the use of Lake Michigan as a drinking water source as threatened due to priority organics and PCBs in its 2002 303(d) list. Indiana identified the use of Lake Michigan shorelines as impaired due to pathogens, as well as PCBs and mercury in places, in its 2002 303(d) list. PCBs, mercury, DDT and metabolites, chlordane, dioxin, pathogens, and priority organics are proposed Critical Pollutants for finalization in LaMP 2006.

Pollutants of Concern

The pollutants in Table A-4 for Illinois and in other states' 2002 303(d) lists are identified as the cause of impairments. In addition to the pollutants listed in text below, the critical pollutants were also detected in some stream segments discharging to Lake Michigan. States have prepared their 303 (d) lists for federal approval in 2004 and they have a few changes primarily due to clerical error.

- In Illinois, the water body segments discharging into Lake Michigan are impaired due to siltation, organic enrichment/low dissolved oxygen (DO), priority organics, nutrients, phosphorus, pathogens, metals, arsenic, cadmium, copper, chromium, lead, zinc, nitrogen, total (nitrates + total Kjehldal nitrogen), salinity/total dissolved solids (TDS)/ chlorides, and TDS (conductivity).

- In Indiana, the water body segments discharging to Lake Michigan are impaired due to critical pollutants plus pathogens (E. Coli) and impaired biotic communities (i.e., the possibility of a pollutant causing the impairment has not been eliminated).

- In Michigan, the water body segments discharging into Lake Michigan are impaired due to critical pollutants as well as nutrients and pathogens.

- In Wisconsin, the water body segments discharging into Lake Michigan are impaired due to critical pollutants plus nutrients, sediments, arsenic, and metals (chromium, copper, lead, and zinc).

Potential Watch list pollutants

The pollutants in Table A-4 for Illinois and in other states' Federally approved 2002 303(d) lists are identified as the cause of impairments. Watch list pollutants were detected in the tributary segments *upstream* of the segment discharging to Lake Michigan and therefore do not qualify as LaMP critical pollutants or pollutants of concern. The states' 303(d) lists document these pollutants' presence in the Lake Michigan watershed. These

303(d)-listed pollutants are subject to regulation under the Clean Water Act for their potential to impact the Lake Michigan ecosystem. Their bioaccumulation potential, persistence in water or sediment, or toxicity singly or through synergistic effects remains to be evaluated. In addition to the watch list pollutants listed below, the critical pollutants and pollutants of concern were also detected in some upstream segments. Water body segments upstream of the segment discharging to Lake Michigan are impaired due, in part, to these pollutants: suspended solids, cyanide, other inorganics (fluoride), total ammonia-N, nitrates, ammonia (unionized), total ammonia-N, inorganic-N, low DO, chlorides, salinity/TDS, siltation, impaired biotic communities (potentially caused by a pollutant), and oil and grease. All of these pollutants may not meet the watch list criteria proposed in 2002.

In addition to reviewing 303(d) lists, state and federal staff learned of additional candidates for

TABLE A-4. Illinois 303(d)-listed waters in the Lake Michigan and Calumet River Watershed. The first column identifies the water body by name and by Illinois code. The second column identifies the water body's designated use(s) and the status of that use. Status terms include Full (best), Threatened, Partial Support, Nonsupport (worst), and Not Assessed. The third column identifies the causes of impaired uses along with a confidence level code: H for confidence level 3, M for confidence level 2, S for confidence level 1, and T for no confidence level assigned. DO stands for Dissolved Oxygen.

Illinois Water Body	Status/Designated Use	Impairment Causes (2002)
Lake Michigan Open Water	Full overall use, full use aquatic life, nonsupport fish consumption, full primary contact, full secondary contact (recreation), full/threatened drinking water supply*	M priority organics, H PCBs
Lake Michigan Waukegan Harbor	Non-support Overall Use, Non-support Aquatic Life, Non-support Fish Consumption, Primary Contact (swimming) not assessed, Secondary Contact (recreation) not assessed	H PCBs, M metals, M arsenic, M cadmium, M copper, M chromium, M lead, M zinc, S nutrients, S phosphorus, Nitrogen, total (nitrates + TKN)
Lake Michigan (Great Lakes NTC, Wilmette, Chicago, & Calumet Harbors)	Overall use not assessed, Aquatic Life not assessed, Nonsupport Fish Consumption, Primary Contact (swimming) not assessed, Secondary Contact (recreation) not assessed	H PCBs
Lake Michigan Beaches (12)	Partial Primary Contact	H pathogens
Lake Michigan Beaches (18)	Non-support Primary Contact	H pathogens
Pettibone Cr. QA C4	Partial overall use, Partial support Aquatic Life	Habitat alteration (not flow), Priority organics, PCBs, Metals, Arsenic, Copper, Mercury, Zinc
Waukegan R. QC 03	Partial overall use, Partial support Aquatic Life	Salinity/TDS/chlorides, TDS (conductivity), Habitat alteration (not flow), Priority organics, PCBs
Waukegan R. QC 05	Partial overall use, Partial support Aquatic Life	Salinity/TDS/chlorides, TDS (conductivity), Priority organics, PCBs
S. Br. Waukegan R. QCA 01	Partial overall use, Partial support Aquatic Life	Salinity/TDS/chlorides, TDS (conductivity), Priority organics, Nutrients, Phosphorus, Total ammonia-N
S. Br. Pettibone Cr. QAA D1	Partial overall use, Partial support Aquatic Life	Priority organics, PCBs

* One sample event from the City of Chicago showed Phenols and the need to re-sample with the possibility of re-classifying the status. Follow-up Source Water Assessment works confirms "full use" status which is reflected in the IEPA 2004 303(d) draft list currently on-line for review.

the watch list by attending conferences and reviewing scientific literature. These candidates include: nonylphenol, alkylphenol polyethoxylates, and alkyl phenol and ethoxylates (APEs); polybrominated diphenyl ethers (PBDEs); polychlorinated naphthalenes; perfluorooctyl sulfonate (PFOS); asbestos; specific polycyclic aromatic hydrocarbons (PAHs); thallium, selenium, phthalates, atrazine, herbicides, personal care products, and pharmaceuticals, hormones, and other organic wastewater contaminants; radioactive material; synthetic musks; toxaphene; sulfur; 1-naphthol and 2-naphthol. Many more journal articles were located than could be reviewed in time for preparation of this LaMP. In order to determine whether these chemicals qualify as watch list pollutants, Table A-5. below should be completed. All three watch list criteria listed in Table A-5 must be met in order for a pollutant to be finalized in 2006 as a watch list pollutant.

In addition to the potential watch list pollutants identified thus far, additional pollutants may be identified under a Safe Drinking Water Ac t program. The Safe Drinking Water Act federal program implements an Unregulated Contaminant Monitoring Regulation for Public Water Supply. On October 29, 2002, analytical methods for chemical and mcrobiological contaminants were published as a final rule (67 FR 65888). This program was not

TABLE A-5. Evaluation of Potential Watch List Pollutants using Watch List Criteria.

Pollutant	Potential to Impact Lake Michigan Watershed	Presence in Lake Michigan Watershed	Bioaccumulation potential; persistence in water or sediment; or toxicity singly or through synergistic effects
Alkylphenol ethoxylates (APES) and degradation products (used in industrial detergents)	Yes		01/05/2004 Notice of Availability of Draft Aquatic Life Criteria Document for Nonylphenol and Request for Scientific Views, 69 FR 340
polybrominated diphenylether (PBDE) (flame retardant used in fabrics and plastics)	Yes	Environmental Science and Technology 35(6) 1072-1077 2001 "Comparison of Polybrominated Diphenyl Ethers (PBDEs) and Polychlorinated Biphenyls (PCBs) in Lake Michigan Salmonids" by Manchester-Neesvig, J.B. et al.	Yes - Dioxin 2003 (peer reviewed?). Suspected to affect thyroid function (ATSDR).
polychlorinated naphthalenes (PCN)	Yes	Environmental Science and Technology 2000 34(4) 566-572 "Polychlorinated Naphthalenes and Polychlorinated Biphenyls in Fishes from Michigan Waters Including the Great Lakes" by Kannan, K. et al	yes (e.g., Appendix VIII to 40 CFR Part 261–Hazardous Constituents)
perfluorooctane sulfonate (PFOS) & its salts (spray on fabric protectors)	yes		TSCA SNUR for 8-carbon chain cmpds. OECD PFOS hazard assessment

TABLE A-5, continued. Evaluation of Potential Watch List Pollutants using Watch List Criteria.

Pollutant	Potential to Impact Lake Michigan Watershed	Presence in Lake Michigan Watershed	Bioaccumulation potential; persistence in water or sediment; or toxicity singly or through synergistic effects
asbestos (flame resistant mineral)	Yes (people/ animals)	Yes (reference for LM beach in Illinois)	Yes - human carcinogen IRIS
specific polycyclic aromatic hydrocarbons (PAH) (a family of chemicals produced by incomplete combustion)	yes Atmospheric Environment 33 (1999) 5071-5079 "Source apportionment and source/sink relationships of PAHs in the coastal atmosphere of Chicago and Lake Michigan" by Matt Simcik et al.	acenaphthylene, acenaphthene, fluorene, 1 methyl-fluorene, phenanthrene, anthracene, 2- methylphenanthrene, fluoranthene, pyrene, retene, benzo(a)fluorene, benzo(b)fluorene, benz(a) anthracene, chrysene, benzo(b +k) fluoranthene, benzo(e)pyrene, benzo(a) pyrene, perylene, indeno (c,d)pyrene, diben(ah) anthracene, benzo(ghi) perylene, antanthrene, and coronene	D[1] RfD[2], NOAEL[3] D, RfD D D, RfD D, RfD D, NOAEL B2[4] B2 D, RfD B2 B2 B2 D
thallium (natural heavy metal released through coal burning and smelting)	Yes	T.S. Lin et al. 2001. "Thallium Concentration in Lake Trout from Lake Michigan." Bull. Environ. Contam. Toxicology, 67, 921-925.	IRIS: Tl compds. D with RfDs human health water quality criteria (CWA)

[1] "D" means that human carcinogenicity was not classifiable.

[2] "RfD" is an oral reference dose.

[3] "NOAEL" is the no observed adverse effects level.

TABLE A-5, continued. Evaluation of Potential Watch List Pollutants using Watch List Criteria.

Pollutant	Potential to Impact Lake Michigan Watershed	Presence in Lake Michigan Watershed	Bioaccumulation potential; persistence in water or sediment; or toxicity singly or through synergistic effects
selenium **(Se compounds in IRIS) (natural heavy metal)**	Yes	Food and Drug Administration-approved additive in animal feed and human dietary supplements	IRIS: D, RfD
phthalates (plasticizer)			water quality criteria for select phthalates 65 FR 66443. A National Academy of Sciences panel studied hormone-disrupting contaminants and said in its 1999 report that phthalates can cause health problems in humans and wildlife including birth defects and reproductive disorders.
radioactive material	yes	yes (e.g., nuclear waste)	yes - Chernobyl examples
synthetic musks: **six polycyclic musks (AHTN, HHCB, ATII, ADBI, AHMI, & DPMI) and two nitro musks (musk xylene and musk ketone) (used in personal care products)**	yes	Aaron Peck and Keri Hornbuckle, "Synthetic Musk Fragrances in Lake Michigan" Environmental Science & Technology, 2004, vol. 38, pp. 367-372.	
toxaphene (cancelled pesticide)	yes	ES&T 2001 35(16); 3287-3293. Accumulation of Atmospheric and Sedimentary PCBs and Toxaphene in a Lake Michigan Food Web	yes
sulfur (atmospheric) (natural element)	yes	Environmental and Experimental Botany Volume 36, Issue 3, October 1996, Pages 255 - 259 "Element concentrations in the lichen Hypogymnia physodes (L.) Nyl. after 3 years of transplanting along Lake Michigan" by James P. Bennett et al.	Environmental and Experimental Botany Volume 36, Issue 3, October 1996, Pages 255 - 259 "Element concentrations in the lichen Hypogymnia physodes (L.) Nyl. after 3 years of transplanting along Lake Michigan" by James P. Bennett et al.

TABLE A-5, continued. Evaluation of Potential Watch List Pollutants using Watch List Criteria.

Pollutant	Potential to Impact Lake Michigan Watershed	Presence in Lake Michigan Watershed	Bioaccumulation potential; persistence in water or sediment; or toxicity singly or through synergistic effects
atrazine (current use pesticide)	yes	GLNPO's Lake Michigan Mass Balance study	"Ambient Aquatic Life Water Quality Criteria for Atrazine - Revised Draft" (EPA-822-R-03-023)
herbicides (used on major crops such as corn and soybeans to kill weeds)	Detected in the Root River at Racine:	atrazine, deethyl-atrazine, deisopropylatrazine (and OEAT), acetochlor ESA, acetochlor OXA, acetochlor ESA, dimethenamid ESA, metolachlor ESA, metolachlor OXA, didealkylatrazine (CAAT), hydroxyatrazine (OIET), glyphosate, aminomethylphosphonic acid (AMPA) USGS Open File Report 03-217 Reconnaissance Data for Glyphosate, Other Selected Herbicides, Their Degradation Products, and Antibiotics in 51 Streams in Nine Midwestern States, 2002 by E. Scribner et al.	atrazine & degradation products acetochlor & degradation products metolachlor & degradation products glyphosate & degradation products Herbicides above are regulated by FIFRA during pesticide use. SDWA would regulate for public water supply. See the State Management Plan proposed rule.
wastewater-related	yes	1,4-dichlorobenzene (deodorizer); 2,6-di-tert-butylphenol, 2,6-di-tert-p-benzoquinone, Butylated hydroxy toluene (previous 3 antioxidants); Tri (2-chloroethyl) phosphate, tri (2-chloroethyl) phosphate (previous 2 fire retardants) 4-methyl phenol (disinfectant)	
personal care products	yes		
pharmaceuticals	yes	Cimetidine (antacid) Trimethoprim (antibiotic) Lincomycin (antibiotic)	
hormones	Yes	cholesterol (plant/animal steroid) coprostanol (fecal steroid)	

TABLE A-6. Proposed Lake Michigan Critical Pollutants and Pollutants of Concern for Finalization in LaMP 2006.

Pollutant Classification	Pollutants Proposed in 2004 for finalization in LaMP 2006
Critical Pollutants	PCBs, mercury, DDT and metabolites, chlordane, dioxin, and priority organics
Pollutants of Concern	siltation, sediments, organic enrichment/low dissolved oxygen (DO), nutrients, phosphorus, pathogens (E.Coli, Cryptosporidium, Giardia, Salmonella), metals, arsenic, cadmium, copper, chromium, lead, zinc, mercury, nitrogen, total (nitrates + total Kjehldal nitrogen), salinity/total dissolved solids (TDS)/chlorides, and TDS (conductivity), impaired biotic communities (i.e., the possibility of a pollutant causing the impairment has not been eliminated).

TABLE A-7. Pollutants Identified in 2004 for Proposed LaMP 2006 Watch List.

Watch List	
	PBDEs, PCNs, PFOS, asbestos, PAHs (acenaphthylene, acenaphthene, fluorene, 1 methyl-fluorene, phenanthrene, anthracene, 2-methylphenanthrene, fluoranthene, pyrene, retene, benzo(a)fluorene, benzo(b)fluorene, benz(a) anthracene, chrysene, benzo(b +k) fluoranthene, benzo(e)pyrene, benzo(a)pyrene, perylene, indeno (c,d)pyrene, diben(ah)anthracene, benzo(ghi)perylene, antanthrene, and coronene), thallium, selenium, phthalates, radioactive material, synthetic musks: six polycyclic musks (AHTN, HHCB, ATII, ADBI, AHMI, & DPMI) and two nitro musks (musk xylene and musk ketone), toxaphene, sulfur, atrazine & degradation products , metolachlor & degradation products, acetochlor & degradation products, glyphosate & degradation products, 1,4-dichlorobenzene, 2,6-di-tert-butylphenol, 2,6-di-tert-p-benzoquinone, butylated hydroxy toluene, tri (2-chloroethyl) phosphate, tri (2-chloroethyl) phosphate, 4-methyl phenol, cimetidine, trimethoprim, lincomycin, cholesterol, coprostanol, 1-naphthol, 2-naphthol

reviewed in time for publication of this document. If any unregulated contaminants were detected in the Lake Michigan Basin prior to 2004, these will be considered to have been proposed here as watch list pollutants in 2004.

In summary, the Lake Michigan LaMP critical pollutants have changed by inclusion of priority organics, and this is the first time for the Lake Michigan LaMP to acknowledge a State's identification of a threatened drinking water supply impairment for Lake Michigan. The pollutants of concern list has broadened to include conventional pollutants that are not a single chemical, as shown in Table A-6. The potential watch list presented in Table A-7 incorporates new information from the State-prepared 303(d) lists and research.

'PCB substitute compounds' are no longer proposed; however, some of the potential watch list pollutants serve a similar function as PCBs do. That is, PCBs are used as a dielectric fluid in high temperature applications that require fire retardants.

Summary and Request for Comments

In closing, LaMP pollutants could be categorized in many different ways. The current scheme is based on geographic extent of the impairment because a lakewide solution for a local impairment doesn't make sense. On the other hand, widespread watch list pollutants might be prevented from becoming critical pollutants through lake watershed-wide adaptive management. Upon preparation of this update to the pollutant lists, it seems that pollutants within each category may be targeted for different activities. For the critical pollutants, regulatory actions have already been taken, and additional regulatory actions might be needed. For the pollutants of concern, source track-down and reduction may be appropriate. For the watch list, additional toxicological work may be appropriate before developing a regulatory approach. Grouping pollutants into categories of need for monitoring, regulated, not regulated and identification of potentially appropriate steps for each pollutant would be a helpful analysis. There are not sufficient resources to complete this task prior to publication of LaMP 2004, but this analysis is offered to aid discussion of this important issue.

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Appendix B
Adaptive Management

A. Pollutant-specific Developments

1. Mercury and other metals

Inside EPA 04/11/2003 "States Defend Multi-Media Mercury Control Plan From Industry Criticisms" State environmental commissioners met in Washington April 8 - 10, 2003 for the Environmental Council of States (ECOS) spring meeting appeared ready to pass a draft resolution endorsing the draft multi-media strategy to address mercury releases in the environment. The strategy was developed over the past year by the Quicksilver Caucus, a group of state and EPA officials, and seeks to provide a number of regulatory and management strategies for dealing with mercury. Air emissions of mercury cross jurisdictional boundaries, complicating regulation. The strategy presents an argument for federal oversight over surplus mercury and proposed a way for regulators to set TMDLs for waters impaired by atmospheric deposition of mercury. Numerous industry groups objected.

BNA 06/13/2003 According to EPA's semiannual regulatory agenda published 05/27/2003, EPA intended to issue a final rule in January 2004 to encourage the recycling and better management of cathode ray tubes (CRTs). CRTs contain lead. Also e-waste mention (Hg).

BNA 07/21/2003 Illinois Gov. Rod Blagojevich signed legislation banning the manufacture, sale, distribution, manufacture, and promotional use of mercury fever thermometers beginning July 1, 2004. Exceptions include button-cell batteries and fluorescent light bulbs. Through IEPA's Mercury Initiative, it has assisted more than 50 schools in removing mercury-containing devices and other hazardous materials.

BNA 08/01/2003 France ratified a United Nations Economic Commission for Europe for Europe protocol July 25 that bans or restricts 16 polluting substances, POPs. France was the 16th nation to ratify, the protocol will officially be enacted 90 days after France formally notified the UN of its ratification. The protocol amends the 1979 United Nations Convention on Long-range Transboundary Air Pollution. The Stockholm Convention on Persistent Organic Pollutants (final in Sweden in May 2001) not ratified yet.

BNA 10/3/2003 EPA finalizes implementation plan for commercial and industrial solid waste incineration units burning nonhazardous wastes. Only six states have approved plans to implement the December 2000 standards; other states and tribal lands will be subject to EPA's implementation plan. The standards were designed to reduce emissions of lead by 62 percent, mercury by 34 percent, particulate matter by 71 percent, and sulfur dioxide by 72 percent from existing units. Most of the affected units are expected to install wet scrubbers.

Tannery Bay cleanup on mlive.com "Cleaned Tannery Bay to be Tested" 08/26/2003 by Susan K. Treutler, Chronicle Staff writer

"MMSD Commission enhances efforts to reduce mercury pollution to Lake Michigan, food chain" February 4, 2004 press release. Milwaukee Metropolitan Sewerage District Commissioners approved a program with dentists to prevent mercury pollution from reaching Lake Michigan. Dental offices are the largest source of mercury discharges to wastewater treatment plants, which are not designed to remove mercury from sewage. Dental amalgam used for fillings is 50 percent mercury. Waste amalgam vacuumed from dental work is delivered to the sewer system unless an amalgam separator is used. MMSD's new program will require approximately 500 dentist offices in MMSD's service area to install amalgam separators. The program was developed by the Department of Natural Resources, the Wisconsin Dental Association, and MMSD. Amalgam separators are available commercially and range in price from several hundred to several thousand dollars for purchase. Dental offices will have until February 2008 to install the devices.

BNA 02/05/2004 Air Pollution "Regional Campaign Announced to Limit Mercury-Containing Products, Emissions" The National Caucus of Environmental Legislators (NCEL)

announced lawmakers in Illinois, Iowa, Michigan, Minnesota, Ohio, and Wisconsin would introduce legislation limiting releases of mercury. In Illinois, S.B. 2551 to create the Illinois Mercury Reduction Act. In Wisconsin, the Legislature has directed the DNR to resubmit tougher rules on mercury emissions from power plants and banned mercury thermostats in new construction projects and to create a plan to enhance awareness of the hazards posed by mercury pollution and increase efforts to reclaim mercury from products headed to landfills.

02/16/2004 Great Lakes Ratio Consortium, "Multi-State Effort Targets Mercury Pollution" The multi-state effort targets coal-fired power plants and products that contain mercury, including thermometers. Wisconsin is looking to enact stricter pollution controls on power plants than what's being proposed in the Nation's capitol. Michigan is calling for a phase-out of products that contain mercury. Michigan and Wisconsin also want mercury parts and switches to be removed from cars and appliances ("white goods") before they are scrapped. A representative of the National Caucus of Environmental Legislators said, "You've got to look at it from all perspectives. Power plants represent 30 to 40 percent of the ambient mercury. But these other sources are significant, especially if they're not controlled properly."

BNA 02/17/2004 The National Electronics Products Stewardship Initiative negotiated for three years and didn't agree upon a way to finance electronics recycling nationally. The group of electronics manufacturers, state and local government officials, and others met in mid-February 2004 to consider an electronic waste recycling plan as a model for national legislation. The recycling plan would allow for a fee at the point of sale or allow companies to create alternative plans to manage costs without a fee on their products. The U.S. EPA had convened and funded the Initiative meetings in 2000. It dropped out when the group failed to produce a plan by the end of 2003. [mercury, heavy metals in e-waste]

2. Pesticides

BNA 07/18/2003 Syngenta's St. Gabriel plant manufactures atrazine. Workers there have an increased incidence of prostate cancer. The increased incidence could be caused by an effective screening program or by atrazine. Atrazine could not be ruled out as a potential cause. There is an ongoing EPA/National Cancer Institute epidemiological study of 90,000 pesticide applicators and their spouses in North Carolina and Iowa.

BNA 08/01/2003 France ratified a United Nations Economic Commission for Europe for Europe protocol July 25 that bans or restricts 16 polluting substances, POPs. France was the 16th nation to ratify, the protocol will officially be enacted 90 days after France formally notified the UN of its ratification. The protocol amends the 1979 United Nations Convention on Long-range Transboundary Air Pollution. The Stockholm Convention on Persistent Organic Pollutants (final in Sweden in May 2001) not ratified yet.

BNA 08/08/2003 The commonly used herbicide atrazine could cause developmental abnormalities among certain amphibians, but a causal link cannot be demonstrated. June 17-20 meeting of EPA's Federal Insecticide, Fungicide, and Rodenticide Act Scientific Advisory Panel (SAP). EPA white paper released May 29 examined 17 studies it deemed relevant and concluded that the scientific evidence does not support many of the study authors' conclusions. Additional information is required to evaluate potential causal relationships between atrazine exposure and gonadal development. SAP suggested how to design a conceptual model for standardized studies to examine the possible effects of atrazine on certain frogs. Http://www.epa.gov/scipoly/sap/2003/june/june meeting report.pdf

BNA 09/03/2003 EPA canceled its registration of the organophosphate diazinon, a widely used home and garden insecticide. (Slated for publication 9/3/2003) Syngenta Crop Protection of Greensboro, N.C. Started phasing out the chemical after a December 2000 EPA risk assessment found the insecticide posed risks of concern for residential use, including risks to children post-application. Trade names include Spectracide, D.Z.N., Knox-Out, and Diazol. Stopped manufacture as of June 30, 2003. Existing stocks may be distributed until December

31, 2004. The IRED called for similar cancellations of registrations for agricultural use; Syngenta and Mkhteshim Agan of New York informed EPA in 2000 that they would not support registration for some ag uses.

BNA 10/03/2003 As of October 2, 2003, EPA had completed its review of 6,627 pesticide tolerances as required by the Food Quality Protection Act of 1996. At that time, EPA was on track to complete the nearly 3,000 other pesticide tolerances in need of updating by August 2006. Pesticide tolerances are the amount of residual pesticide that may be present on food. EPA had also completed 457 out of 612 pesticide re-registration eligibility decisions (REDs). REDs are comprehensive reviews required by the Federal Insecticide and Fungicide, and Rodenticide Act amendments of 1988 to determine whether older pesticides may continue to be used and under what conditions.

3. Other organics (e.g., fire retardents, surfactants, PCBs)

BNA 06/09/2003 "More Biological, Exposure Data Sought For Determinations on Flame Retardents" Voluntary Children's Chemical Evaluation Program (VCCEP) meeting June 3-5. 98% of pentabromodiphenyl ethers (PBDE) used in the U.S. go into flexible polyurethane foam. The bulk of octabromodiphenyl ether (OctaBDE) products are added to hard plastic insulation for electrical equipment according to Great Lakes Chemical industrial hygienist Bob Campbell. Some health and toxicity data gaps identified during the meeting will be addressed by Health Canada and the U.S. National Toxicity Program.

BNA 07/10/2003 two negotiated enforceable consent agreements under Section 4 of TSCA for PFOA; work groups; five consumer products; seven types of industrial products http://cascade.epa.gov/RightSite/dk public home.htm (using a quick search under docket number OPPT-2002-0012)

BNA 07/18/2003 EPA will ban production and use of chlorobromomethane (CBM), a chlorine-based chemical used as a **fire retardent** and solvent because it harms the stratospheric ozone layer. Class I substance under the Clean Air Act after amendment due to the Montreal Protocol on Substances that Deplete the Ozone Layer. Most common uses fire extinguishers, as an explosion protection agent; also used as a feedstock for the production of pharmaceuticals, water treatment chemicals, and **biocides**. Trade in CBM with countries that are not party to the protocol is banned. Extremely limited production is allowed for laboratory applications.

BNA 10/02/2003 Two Paper Companies to Spend $60 Million To Clean up Area of Contaminated Fox River. P.H. Glatfelter Co. and WTM I Co., two paper companies responsible for the Fox River contamination, agreed to dredge contaminated sediments from the uppermost 6-mile portion of the river, according to the DOJ (U.S. v. P.H. Glatfelter Co., E.D. Wis., 03-C-0949, 10/01/2003). It's one of five areas.

BNA 08/26/2003 **Fifth Annual Workshop on Brominated Flame Retardents in the Environment** Between 5 percent and 30 percent of the weight of plastics can be attributable to flame retardent chemicals. Lower brominated forms more persistent and toxic. At Dioxin 2003, Jon Manchester-Neesvig presented what he said was the first information on levels of PBDE in sediments from Lake Michigan. PCB levels still exceed PBDEs. PBDEs have been accumulating in the sediments in Lake Michigan since the mid-1980s.

BNA 08/26/2003 William Telliard, analytical methods director in EPA's office of Science and Technology (part of Office of Water) announced the release of a draft EPA method to detect PBDEs in water, sediment, soil, sludge, and tissues– EPA Method 1614. Spoke at the **Fifth Annual Workshop on Brominated Flame Retardents in the Environment; organized by CDC**. Hope of issuing a final EPA approved method in 2004.

BNA 08/26/2003 researchers focusing on PBDE, hexabromocyclododecanes (HBCDD) and tetrabromobisphenol A, but many more flame retardents on the market Dioxin 2003/Fifth Annual meeting

BNA 09/02/2003 CDC/NECH to measure levels of perfluorinated compounds in the U.S. population. NCEH laboratory developed methods to detect 17 perfluorinated compounds. May test blood samples from 1999 and 2000 or may begin in 2003 and 2004 NHANES. The

compounds are found in many pieces of laboratory equipment. (from Dioxin 2003)

BNA 09/05/2003 Flame Retardant Chemicals; Bromine Science and Environmental Forum (manufacturers); mention of PBT FR in 1999 (64 FR 60,194); Toxicological Risks of Selected Flame-Retardent Chemicals, a report the National Academies issued in April 2000.

BNA 10/24/2003 John Dingell (D-Mich.), Rep,. Hilda Solis (D- Calif) drafting legislation for introduction later in October 2003 to phase out use of pentabromodiphenyl ether (penta-PBDE) and octa-BDE. European Union and California will ban penta-BDE and octa-BDE by 2004 and 2008, respectively. EPA's Voluntary Children's Chemical Evaluation Program (VCCEP) initiated in June 2001 examining several PBDEs (penta, octa, and deca). EPA submitted a letter to the Centers for Disease Control recommending the inclusion of PBDEs to the National Health and Nutrition Examination Survey (NHANES) as a potentially harmful substance that should be biomonitored.

BNA 02/17/2004 The National Electronics Products Stewardship Initiative negotiated for three years and didn't agree upon a way to finance electronics recycling nationally. The group of electronics manufacturers, state and local government officials, and others met in mid-February 2004 to consider an electronic waste recycling plan as a model for national legislation. The recycling plan would allow for a fee at the point of sale or allow companies to create alternative plans to manage costs without a fee on their products. The U.S. EPA had convened and funded the Initiative meetings in 2000. It dropped out when the group failed to produce a plan by the end of 2003.

BNA 09/12/2003 In 2000, 3M announced that it would phase out by the end of 2002 a $300-million line of Scotchguard (TM) and other products due to the environmental persistence of perfluorooctanyl chemicals. Chemicals with 8 carbon atoms are known as 8-carbon chain chemicals which could degrade to perfluorooctyl sulfonate (PFOS), a persistent chemical. 3M notified EPA of environmental concerns such as potential developmental, reproductive, and systemic toxicity. In 2002, EPA issued a significant new use rule pursuant to TSCA (SNUR, 12/9/2002, 67 FR 72,854; see 03/11/2002 letter from Charlie Auer of CCD/OPPTS) to allow EPA to review these 8-carbon chain chemicals before they were manufactured by someone other than 3M. 3M has replaced PFOS in carpet treatments and industrial surfactants with 18 chemicals based on perfluorobutane sulfonate (PFBS). While PFOS can persist and bioaccumulate by binding to protein, bioconcentration studies of PFBS indicate its safety. EPA proposed a different SNUR on March 11, 2003 identifying the types of data EPA wants for any potential substitutes for perfluorinated chemicals.

BNA 10/28/2003 EPA's Chemical Control Division working on an enforceable consent agreement with telomer manufacturers on research to be conducted to determine whether telomers break down into perfluorooctanoic acid (PFOA). Fluorinated telomers used as oil, stain, grease, and water-repellant coatings on carpet, textiles, and paper. The Telomer Research Panel consists of DuPont, Clariant GmbH, Asahi Glass, and Daikin America Inc.

proposed water quality criteria for nonylphenol (01/05/2004 Notice of Availability of Draft Aquatic Life Criteria Document for Nonylphenol and Request for Scientific Views, 69 FR 340;)

Federal limits on air pollution from oceangoing ships, including oil tankers, container ships, and cruise ships. **[PAHs, soot]**

The OilSpot News by DTN Energy March 8, 2004 "EPA Report Shows Manufacturers Meeting 2007 Deadline, New Diesel Engines to Cut Smog Causing Emissions" Engine manufacturers are on target to introduce new cleaner diesel engines in 2007. With clean low-sulfur diesel fuel . . . All manufacturers will use diesel particulate filters that reduce PM by more than 90 percent. NO_x control will rely on proven technologies in existence today with early engine prototype testing in 2005. These new engines will operate on 15 ppm **sulfur** diesel fuel in order to reduce NO_x emissions by 50 percent and **PM** [PAHs on soot] emissions by more than 90 percent. In October 2003, EPA published its "Summary and Analysis of the 2003 Highway Diesel Fuel Pre-Compliance Reports" showing that production of low sulfur diesel will be sufficient for a nationwide supply on time.

NEW nonpoint Pollution rule in Wisconsin

4. Nutrients, Pathogens, and Sediments

"DNR bashed over MMSD deals: Agreements fail to stop duming, provide for fines, environmental groups say" by Steve Schultze from http://www.jsonline.com/news/metro/jul02/62639.asp, accessed 08/02/2002 "MMSD dumped about 13 gallons of untreated storm and sanitary waste from combined sewers and about 900 million gallons of more concentrated sanitary waste from late 1994 through 2001. This year, the district dumped another 25 million gallons of raw sewage, gave only partial treatment to 95 million gallons in April and dumped 21 million gallons of partially treated sewage in June."

"Residents decry harbor dredging" 08/12/2002 published at http://www.indystar.com (Accessed 08/13/2002) Citizens fearful of health effects from dredging the Indiana Harbor and Shipping Canal. Sediments to be dredged contain oil, grease, lead, chromium, ammonia, and polychlorinated biphenyls. $247 million dredging project decades in the making. Preliminary construction at the holding site began spring 2002. Dredging to begin in 2005 and end in 2035. An estimated 4.6 million cubic yards of the dredged, polluted sediments will be stored at an open-air landfill.

BNA 07/23/2003 EPA approved some test methods for bacterial contaminants in fresh water (test methods 1622 and 1623) through a final rule published 07/22/2003 (68 FR 43,272). Its similar to the rule proposed in August 2001 (66 FR 45,811). Validated test methods for bacterial contaminants in wastewater are expected by the end of 2004. EPA established numeric water quality criteria for E. coli and enterococci and is considering criteria for cryptosporidium and giardia, gastrointestinal.

New Elevation Derivatives for National Applications (EDNA) Lake Michigan Viewer – 11/06/2003 E-mail from Judy Beck/Naomi Detenbeck/Susan Greenlee. TMDL potential? See 03/09/2004 E-mail sent.

03/09/2004 E-mail from Susan Greenlee to Sue Brauer: Currently we are finishing up some of the deliverables for Naomi for this year related to the Lake Mich EDNA database and web presence. The IAG we (USGS) have with EPA actually concluded last year. Here at EDC we have some base funding to do modeling with EDNA this year. Hopefully that will continue into the future, but we never know for sure. Kris Verdin (cc'd) and I will be going to the AWRA meeting in Nashville in May 2004 and plan to present some of the current accomplishments with EDNA along with what we see as potential future plans. We would like to develop partnerships to use EDNA, and also to move EDNA to a higer resolution (10m and 3m lidar resolution), bring EDNA into better agreement with NHD, and evolve the data structure to handle divergent flow. We certainly see many ways where these activities could benefit EPA and would like to continue the dialogue about EDNA's future.

B. Ongoing Chemical Screening Programs and Lists

Commission of the European Communities (CEC) White Paper Strategy for a future Chemicals Policy (presented by the Commission), Brussels, 02/27/2001 (32 p.). Regarding REACH model –registration, evaluation and authorization/rapid restriction of chemicals.

BNA 08/12/2003 new regulatory scheme REACH study by Risk & Policy Analysts Ltd. released July 29. European Commission released draft legislation in May for a public comment period. Manufacturers would have to register, evaluate, and obtain authorization for their products.

the development/disintegration of the European Union's legislation for registration, evaluation, authorization of chemicals (REACH). As initially proposed, chemical products were to undergo extensive testing to prove products are not a threat to public health and environment. (BNA 10/30/2003) Chemical intermediates are not included. Of 20,000 chemicals produced in the European Union in volumes of 1 - 10 tons, these are only 0.1 percent of total volume manufactured there annually.

Inside EPA 08/09/2002 "EPA Forming Toxics Panel to Reshape Strategy in Face of New Data"

EPA's toxics office is forming an advisory panel to guide the agency as it deals with a deluge of new chemical hazard information from ongoing testing programs, the toxics advisory committee (slated for fall 2002). HPV and VCCEP and "Information Update Rule Amendments" (Inventory Update Rule?).

BNA 07/16/2003 NTP conducts research on behalf of agencies that are a part of the Department of Health and Human Services. National Toxicology Program's Interagency Committee for Chemical Evaluation and Coordination. substances nominated for toxicological studies, FR notice scheduled for publication 07/16/2003. List includes flame retardents (antimony trisulfide, tetrabromobisphenol A and tetrabromobisphenol A (CAS 79-94-7), bis (2,3-dibromopropyl ether (CAS 21850-44-2); acrylamide and glycidamide; cadmium telluride; cedarwood oil, Virginia; dietary supplements (chondroitin sulfate, glucosamine, trans-resveratrol); dimethylethanolamine; tungsten; drugs that have been found to prolong the QT interval; and, nanoscale or tiny materials (asbestos-like?)

OECD report on PFOS

The Safe Drinking Water Act (SWDA) federal program maintains a contaminant candidate list. See 63 FR 10274, 3/2/98.

BNA 08/15/2003 August 18 - 20, 2003 EPA's Endocrine Disruptor Methods Validation Subcommittee to meet re: *White Paper on Species/Strain/Stock in Endocrine Disruptor Assays* outstanding question: Which animal model will provide the most appropriate data on the ability of the test chemical to interact with the endocrine system in order to predict the effects of endocrine-active chemicals in humans, and/or other species of concern? Subcommittee is part of EPA's National Advisory Council for Environmental Policy and Technology.

02/09/2004 BNA Toxic Substances "EPA Issues Schedule of Reviews, Meetings For Chemicals in Health Effects Database" See February 9, 2004 Fed. Reg. Ids 58 chemicals on which EPA is already working to update health effects information in IRIS. EPA plans to add new or update information on all of these substances by September 30, 2005. PFOA, PFOS, PBDE, and refractory ceramic fibers are included in the 58. On Feb. 2, EPA released draft toxicological reviews for three compounds–1,2-dichlorobenzene, 1,3 dichlorobenzene, and 1,4-dichlorobenzene. Public peer review sessions held in February 2004 for these three and toluene. Four chemicals identified w/ reasons why selected as new in FY 2004: 1,2-dichloroethylene; 1,4-dioxane, ethyl teriary butyl ether, and lead. Ten chemicals that are complex and will take a long time include: ammonium perchlorate, inorganic arsenic, asbestos, methyl tertiary butyl ether, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). IRIS is not focusing on pesticides due to the Office of Pesticide Programs' evaluation.

C. Adaptive Management on the Horizon

BNA 07/16/2003 Infant respiratory problems may be caused by chlorophenoxy herbicides used on wheat. [ongoing pesticide studies]

BNA, 10/22/2003 new advisory committee called the National Pollution Prevention and Toxics Advisory Committee, chartered by Congress to develop consensus advice on a wide range of issues with which OPPT deals. It consists of representatives of states, a tribe, environmental organizations, children's health advocates, the chemical industry, academic scientists, and an animal welfare organization. Lynda Knobeloch of Wisconsin's Dept. of Health and Family Services is one of three state and tribal representatives.

BNA 10/02/2003 The Science Advisory Board's Executive Committee approved, with some modifications, a draft report developed by another SAB committee. The draft report evaluated EPA's *Supplemental Guidance for Assessing Cancer Susceptibility Resulting from Early-Life Exposure to Carcinogens*. SAB's Supplemental Guidance for Assessing Cancer Susceptibility Review Panel concurs with the Agency's overall approach. There is sufficient evidence to support a broader conclusion that chemicals and other substances that cause cancer in ways other than by mutating genes also may pose a greater risk if the exposure occurs at a young age. A final version together with a final

Guidelines for Carcinogen Risk Assessment should be published by early 2004.

BNA 10/02/2003 The Committee to Advise on Reassessment and Transition (CARAT) was established in 2000 to help the agencies, the agricultural industry, and others through a transition toward tougher pesticide safety requirements under the Food Quality Protection Act of 1996. On October 1, the CARAT work group finalized a series of recommendations on safer and more efficient pest management techniques, including better coordination between EPA and USDA.

BNA 08/26/2003 Watershed approach to permitting and TMDL draft implementation guidance 08/25/2003, 68 FR 51011. http://cfpub.epa.gov/npdes/wqbasedpermitting/wspermitting.cfm Water quality trading (EW!), numerous challenges including extra time and coordination needed to bring multiple interest groups to the process and the integration of nonpoint sources of pollution, conflicting jurisdictional requirements such as differences in timing or permit provisions (e.g., reconciling schedules for stormwater or CSO controls that differ under existing permits)

Mlive.com July 17, 2003 "EPA wrong choice to lead $6 billion cleanup of Great Lakes, say experts" by Sarah Kellogg, Washington Bureau, Booth Newspapers copyright 2003 Michigan Live [Legacy Act]

Geographic variation in blood plasma protein concentrations of young herring gulls (Larus argentatus) and Caspian terns (Sterna caspia) from the Great Lakes and Lake Winnipeg (Grasman et al) Comparative Biochemistry and Physiology Part C 125 (2000) 365-375. PCB and DDE associated positively and negatively with alpha and beta globulin levels.

BNA 10/30/2003 Taconite rule cuts emissions 42 percent; critics say controls on mercury lacking (what about asbestos?)

Milwaukee Journal Sentinel online last updated October 21, 2003: Aesthetic impairment due to condom slick from Milwaukee Metropolitan Sewerage District.

BNA 08/28/2003 Sound bites from Dioxin 2003

BNA 07/09/2003

New York Times 12/14/2000 "Modified-Crop Studies Are Called Inconclusive" by Carol Kaesuk Yoon. Scientists still know little about the likelihood even of the environmental threats of most concern.

Inventory Update Rule

The Environmental Protection Agency (EPA) promulgated a rule in 1986, often referred to as the Inventory Update Rule (IUR), for the partial updating of the Toxic Substances Control Act (TSCA) Chemical Inventory data base. The rule requires manufacturers and importers of certain chemical substances included on the TSCA Chemical Substances Inventory to report current data on the production volume, plant site, and site-limited status of these substances. Reporting under the Inventory Update Rule takes place at four-year intervals which began in 1986.

Every four years, chemical manufacturers and importers provide EPA with the relevant information pertaining to their most recent fiscal year. Manufacturers and importers of chemicals already on the TSCA Inventory which are being produced at one plant site or imported at production volume levels of 10,000 or more pounds must report, unless either their chemical is excluded from the IUR or they fall under the Small Business exemption. Please note that there are exceptions to the normal exemptions both for chemicals and small businesses. The coverage of reporting and the exemptions are described in the instruction manual and the regulations at 40 CFR 710.23 et seq.

The 2002 annual reporting year begins on August 23, 2002 and concludes on December 23, 2002.

IUR Federal Register Notices - Requirements for reporting under the IUR have been published for each of the five reporting periods: 2002, 1998 (PDF Format 35KB), 1994 (PDF Format 32KB), 1990, and 1986. These rules are promulgated under the authority of Section 8(a) of TSCA, and are codified in Subpart B, Part 710, Title 40 of the Code of Federal Regulations (40 CFR Part 710).

[end Inventory Update Rule]

Quaternary Research, Volume 54, Issue 3, November 2000, pages 414-422, "Dominance of an ~150-Year Cycle of Sand-Supply Change in Late Holocene Dune-Building along the Eastern Shore of Lake Michigan" by Walter L. Loope and Alan F. Arbogast.

Based on radio-carbon dating of buried soils plotted against a late Holocene lake-level curve for Lake Michigan, these peaks are closely associated with many ~150-yr lake highstands previously inferred from beach ridge studies. The modern dune landscape of the eastern shore is dominated by perched dunes formed during ~150-yr lake highstands over the past 1500 yr.

Geoderma 85 (1998) 255 - 282 "Rates of weathering and chemical depletion in soils across a chronosequence of Lake Michigan sand dunes by John Lichter.

from abstract: "High concentrations of heavy metals in the organic horizon relative to the upper mineral soil indicate atmospheric inputs of industrial pollutants." His data doesn't support this statement.

Aquatic Toxicology Volume 47 (**1999**) 77 - 92, "Embryotoxicity of Great Lakes lake trout extracts to developing rainbow trout" by Peggy J. Wright, Donald E. Tillit.

Planar halogenated hydrocarbons (PHHs) include polychlorinated dibenzo-p-dioxins, dibenzofurans, and biphenyls. Study investigated embryotoxicity by injecting ("environmental") extracts from whole adult lake trout into two strains of newly fertilized rainbow trout eggs. Lake Michigan lake trout extract was embrotoxic. An additive model of toxicity is appropriate to quantify PHHs in relation to early life stage mortality in fish. Gross lesions characteristic of exposure to PHHs (i.e., yolk-sac edema, craniofacial deformities, and hemorrhaging) increased in a dose-related manner. The lowest observable adverse effect concentration (LOAEC) for these gross lesions and cumulative mortalities suggests that current concentrations of PHHs in lake trout from Lake Michigan are above a threshold for adverse effects and these compounds may have implications on the lack of recruitment in certain Great Lakes lake trout populations.

compare this to

Fundamental and Applied Toxicology, Volume 30, Issue 2, April **1996**, pages 178-186

"Potency of a Complex Mixture of Polychlorinated Dibenzo-p-dioxin, Dibenzofuran, and Biphenyl Congeners Compared to 2,3,7,8-Tetrachlorodibenzo-p-dioxin in Causing Fish Early Life Stage Mortality" by Walker et al

"Data suggest that TCDD-like congeners act via a common mechanism to cause toxicity during trout early development, but may not act strictly additively when combined in a mixture of TCDD- and non-TCDD-like congeners at ratios found in Great Lakes fish. The deviation from additivity, however, is less than the current safety factors of 10-fold commonly applied in ecological risk assessments, providing support for the continued use of a TE additivity model for assessing risk posed by complex mixtures of PCDDs, PCDFs, and PCBs to fish." from abstract

and

Marine Environmental Research Vol. 42, No. 1-4, pp. 129-134 **1996** "Rainbow Trout Embryotoxicity of a Complex Contaminant Mixture Extracted from Lake Michigan Lake Trout" by P.J. Wilson & D.E. Tillit

"Sublethal effects in the rainbow trout, such as delayed time to hatch, mild hemorrhaging, and moderate yolk-sac edema, resulted from estimated total PCB exposure as low as 8.8 ng/g, and this may have significant implications on Great Lakes lake trout fry and juvenile mortality." from abstract

[additivity/synergistic effects]

EDSP Chronology

The following graphic depicts the Endocrine Disruptor Screening Program (EDSP) chronology. Click on any of the events to view a brief description of each. http://www.epa.gov/scipoly/oscpendo/images/timeline.gif

August 1996: Statutory Authorities

In August 1996, Congress passed both the Food Quality Protection Act (FQPA) [link to 110 STAT. 1489 PUBLIC LAW 104–170—AUG. 3, 1996] and amendments to the Safe Drinking Water Act (SDWA) [link to http://www.epa.gov/safewater/sdwa/sdwa.html #96amendments], both containing provisions calling for the screening and testing of chemicals and pesticides for possible endocrine disrupting effects. These laws required EPA to develop a screening program that uses appropriate validated test systems and other scientifically relevant information to determine if the effect that certain substances have in humans is similar to the effect produced by a naturally occurring hormone.

The Food Quality Protection Act amends the Federal Food, Drug, and Cosmetic Act. Read more about the Federal Food, Drug, and Cosmetic Act Amendments. [link to title 21, chapter 9 of the U.S. Code]

1996: EDSTAC Convenes

The Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC) [link to http://www.epa.gov/scipoly/oscpendo/edspoverview/edstac.htm], a federal advisory committee, was formed in 1996 to make recommendations on how to develop the screening and testing program called for by Congress. Representatives from industry, government, environmental and public health groups, worker safety groups, and academia comprised EDSTAC. The members of EDSTAC were tasked with developing consensus-based recommendations for a screening program that would provide EPA with the information needed to make regulatory decisions about chemicals that disrupt the endocrine system.

EDSTAC thoroughly reviewed and discussed the scientific information available about endocrine disruptors and sought the opinion of other experts and members of the public during its 2-years of deliberations. EDSTAC presented its final report to EPA [link to http://www.epa.gov/scipoly/oscpendo/edspoverview/finalrpt.htm] in September 1998. Read more about the creation of EDSTAC [link to http://www.epa.gov/scipoly/oscpendo/edsparchive/keystone.htm] and it's participants.

August 1998: Federal Register Notice - EDSP

EPA outlined the Endocrine Disruptor Screening Program (EDSP), which incorporated many of

EDSTAC's recommendations, in an August 1998 Federal Register Notice [link to http://www.epa.gov/scipoly/oscpendo/docs/081198frnotice.pdf]. This notice provides operational details regarding the major elements of EPA's Endocrine Disruptor Screening Program.

December 1998: Federal Register Notice - Proposed Statement of Policy

EPA provided additional details on the Endocrine Disruptor Screening Program (EDSP), including the major elements of the Program and its implementation, in a December 1998 Federal Register Notice [link to http://www.epa.gov/scipoly/oscpendo/docs/122898frnotice.pdf].

1999: NRDC Settlement Agreement

EPA and the Natural Resources Defense Council (NRDC) entered into an agreement to settle part of a lawsuit that NRDC filed against EPA regarding implementation of the Endocrine Disruptor Screening Program (EDSP). In the settlement agreement, EPA agreed, among other things, to use best efforts to complete validation of certain screening and testing methodologies that are proposed for use in the program by specific dates, and to use best efforts to start requiring screening and testing of certain chemicals by specific dates.

Read the Signed NRDC Settlement Agreement [http://www.epa.gov/scipoly/oscpendo/docs/settlement.pdf].

2000: Report to Congress - EDSP Implementation Progress

EPA presented a Report to Congress in August 2000 [link to http://www.epa.gov/scipoly/oscpendo/docs/reporttocongress0800.pdf] summarizing endocrine disruptor issues and describing the Endocrine Disruptor Screening Program (EDSP). EPA also described its progress in implementing the program, ongoing studies relating to endocrine disruptors, and the measures being taken to address animal welfare concerns under the EDSP.

2001: EDMVS Formed

The Endocrine Disruptor Methods Validation Subcommittee (EDMVS) was established under the EPA's National Advisory Council for Environmental Policy and Technology (in accordance with the Federal Advisory Committee Act (5 U.S.C. App. 2 Section 9c)). EDMVS provides technical advice and counsel to EPA on scientific issues associated with the validation of Tier 1 and Tier 2 assays on topics including the development and choice of initial protocols; prevalidation study designs; and validation study designs. All of the study results generated during protocol development, prevalidation and validation will be combined into EDSP method-specific documents suitable for external peer review. External scientific peer review of the EDSP methods will be arranged by EPA through an Agency-approved external scientific peer review panel (63 FR 71542).

Read the EDMVS Mission Statement [link to http://www.epa.gov/scipoly/oscpendo/docs/revisedmissionstatement.pdf]

2002: Report to Congress - EDMVS Progress

EPA provided an update on the progress of EDMVS [link to http://www.epa.gov/scipoly/oscpendo/docs/edmvs/edmvsstatusreporttocongressfinal.pdf] and described validation processes that incorporated the advice of the EDMVS. It also summarized recent subcommittee meetings and presented a list of subcommittee members. Read Attachment A to the report [link to http://www.epa.gov/scipoly/oscpendo/docs/edmvs/edmvsstatusreporttocongressattachmentsffinalpartii.pdf].

December 2002: Federal Register Notice - Proposed Chemical Selection Approach for Initial Round of Screening

EPA set forth for public comment the Proposed Chemical Selection Approach for Initial Round of Screening [http://www.epa.gov/scipoly/oscpendo/docs/12-02-frnotice.pdf] which presents the approach EPA intends to use for selecting the first group of chemicals to be screened in the Agency's Endocrine Disruptor Screening Program (EDSP).

Assay Status Table

http://www.epa.gov/scipoly/oscpendo/assayvalidation/status.htm

The assay status table provides information for each of the assays in each stage of the validation process. The assay validation process is composed of five steps:

- Method Development
- Prevalidation
- Validation
- Scientific peer review
- Regulatory acceptance and implementation

Note that information related to scientific peer review and regulatory acceptance and implementation will be posted when it becomes available.

Table has headings “Assay Title” “Assay Development” “Pre-Validation” “Validation”

Assays under consideration at http://www.epa.gov/scipoly/oscpendo/assayvalidation/consider.htm

Interagency Testing Committee

http://www.epa.gov/opptintr/itc/

Under the Toxic Substances Control Act (TSCA)

EPA Home > Prevention, Pesticides & Toxic Substances > Pollution Prevention & Toxics > Interagency Testing Committee

- ITC Member Organizations
- VISION
- Reports
- Chemicals
- PAIR & 8(d) Information Collection
- Frequently Asked Questions

TSCA Interagency Testing Committee (ITC)

In 1976 under the Toxic Substances Control Act (TSCA), the U.S. Congress created the TSCA Interagency Testing Committee (ITC) as an independent advisory committee to the Administrator of the U.S. EPA. The ITC includes 16 U.S. Government Member organizations (see sidebar). The ITC was created to identify chemicals regulated by TSCA for which there are suspicions of toxicity or exposure and for which there are few, if any, ecological effects, environmental fate or health effects testing data. As mandated under section 4(e) of TSCA, the ITC must add these chemicals to the Priority Testing List and recommend them for testing or information reporting in May and November Reports to the Administrator (see sidebar). Chemicals are recommended for testing to meet the data needs of the ITC's 16 U.S. Government Member organizations. The ITC encourages producers and importers of recommended chemicals to voluntarily submit studies to meet these U.S. Government data needs. Since it's first meeting on February 5, 1977, the ITC has reviewed thousands of chemicals (see sidebar).

In response to the ITC's recommendations, the U.S. EPA must promulgate TSCA section 8(a) Preliminary Assessment Information Reporting rules and TSCA section 8(d) Health and Safety Data Reporting rules, unless otherwise requested by the ITC (see side bars). In addition when the ITC designates chemicals for testing, the U.S. EPA Administrator is required under TSCA section 4(e)(1)(B) to publish Federal Register notices either to initiate proceeding under TSCA section 4(a) or to provide reasons for not doing so.

This power point presentation is found at http://www.epa.gov/opptintr/itc/itc.ppt, [accessed 02/18/2004] provides a summary of ITC's statutory responsibilities and activities.

http://www.epa.gov/opptintr/itc/

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Appendix C
Mercury Reduction Projects in the Lake Michigan Basin

Indiana Mercury Dental Program

The Indiana Department of Environmental Management (IDEM), in partnership with the Indiana Department of Health, the Indiana Dental Association, and Indiana Solid Waste Management Districts, held an elemental (liquid) mercury sweep for Indiana dentists in early 2003. The sweep collected more than 240 pounds of elemental mercury from 52 dentists around the state. IDEM and its partners have also agreed to work together to create an environmental pledge program for Indiana dentists. The anticipated completion date of the pledge program is late 2003. More information can be found at http://www.in.gov/idem/mercury/programs/dentalmercury.html.

Hospitals for a Healthy Environment

The Hospitals for a Healthy Environment (H2E), a joint project of the American Hospital Association, Health Care Without Harm, the American Nurses Association, and the US EPA, is a voluntary program with 474 partners representing 1,936 facilities: 542 hospitals, 1,143 clinics, 52 nursing homes, and 199 other types of facilities. These partners are health care facilities that have pledged to eliminate mercury and reduce waste, consistent with the overall goals of H2E. This program is continuing to grow and has enlisted 139 new partners in the last year.

Air Emissions Regulation

The US EPA took a final rulemaking step to control emissions from waste burning in January 2003, when control standards for small municipal waste combustors were finalized. In addition, mercury emissions reduction requirements have been finalized for mercury cell chlor-alkali plants and iron foundries, and have been proposed for industrial boilers.

Indiana Mercury Air Deposition Program

IDEM, in partnership with the U.S. Geological Survey (USGS), has set up five mercury air deposition monitoring stations throughout Indiana. Data are being collected for both wet and dry deposition. Mercury released into the air (from both natural sources and human sources such as coal-fired power plants, municipal incinerators, and industrial boilers) is generally transported to the surface of the earth through precipitation. Mercury has been detected at precipitation monitoring stations throughout North America. USGS, in cooperation with IDEM, established and operates the precipitation-monitoring network for mercury in Indiana. This monitoring program is coordinated through the IDEM Mercury Work Group and is funded by the USGS and IDEM's Office of Air Quality and Office of Water Quality. An overview of the IDEM/USGS Monitoring Program and currently available data summaries for the Indiana monitoring network are available at http://www.in.gov/idem/mercury/air/index.html.

Chlorine Industry Voluntary Mercury Reduction Commitment

The Chlorine Institute released its *Sixth Annual Report to EPA*, showing a 74 percent capacity-adjusted reduction in mercury consumption by the U.S. chlor-alkali industry between 1995 and 2002, exceeding this sector's commitment to reduce mercury use by 50 percent by 2005. Including shutdowns of mercury cell factories, mercury use has decreased 81 percent. While this industry has reduced mercury consumption and purchases significantly since 1995, the *Sixth Annual Report* shows no significant change in mercury consumption between 2001 and 2002. Actual mercury purchases by the chlor-alkali industry increased in 2002, because of decisions by some factories to increase the amount of mercury in use within the mercury cells, a change which is expected to increase efficiency and reduce mercury consumption.

Mercury Switches in Motor Vehicles

The Alliance of Auto Manufacturers, a trade association of nine car and light truck manufacturers, reports that the use of mercury

switches in motor vehicles in the U.S. ended in December 2002. These switches represented 97 percent of the mercury that was contained in cars and light trucks. The remaining mercury-containing devices in motor vehicles range from 0.5 mg to 5 mg of mercury, and research is ongoing to find a replacement for the mercury that is used in these components.

Mercury in Auto Scrap

Use of mercury-containing switches in automobiles produced for the North American market ceased with the 2003 model year. Several Great Lakes States are implementing programs to remove mercury switches already placed in autos. A workshop organized by the US EPA Office of Solid Waste in August 2003 brought together States from across the U.S. to discuss implementing programs to address this issue. Moreover, implementation of clean scrap requirements through a new air emissions standard for iron foundries will require that suppliers of auto scrap to these facilities remove mercury light switches.

Auto Salvage Facility Sector Project

IDEM recently concluded the compliance assistance phase of its auto salvage facility sector project. This phase consisted of 11 compliance assistance workshops held across the state of Indiana. Close to 200 individuals attended these workshops, including facility owners, county agency personnel from health departments, and plan commissioners and staff from several Solid Waste Management Districts. PowerPoint presentations for each of the topics covered during the workshops, as well as a copy of the compliance assistance manual, can be obtained by visiting the project website at www.in.gov/idem/autosalvage. The manual provides the auto salvage facility sector with environmental regulatory information (e.g., how to identify and remove mercury-containing switches from vehicles). The project is now set to enter the inspection phase, which will consist of conducting multimedia compliance inspections across the state. Enforcement will be taken as appropriate. It is anticipated that inspections will begin in early November 2003.

Voluntary Mercury Pollution Prevention Initiative

The Voluntary Mercury Pollution Prevention Initiative was signed in September 1998 by ISG Burns Harbor (formerly Bethlehem Steel), Ispat Inland Inc., Indiana Harbor Works, and US Steel Gary Works. Also signatory to the initiative were the Lake Michigan Forum, US EPA Region 5, and the IDEM. The agreement called for the companies to inventory sources of mercury, such as manometers and switches, and identify replacement/disposal options. The agreement also called for specific action plans and specific reduction goals.

Since the signing of the agreement, these three mills have eliminated over 3,700 pounds of mercury from their plants, and are on target to meet a goal of 90 percent reduction in mercury in these facilities by 2008. The US EPA and IDEM are now considering using this voluntary initiative as a template for similar programs for other industries and other areas.

In September, 2003, the three steel mills received a Quality of Life Award for their contribution to the quality of life in northwest Indiana due to this mercury reduction effort. Formed in 1997, the Quality of Life Council promotes comprehensive sustainable development in Lake, Porter, and LaPorte Counties, Indiana. In his remarks at the presentation of the award, Valparaiso Mayor David Butterfield said that the award epitomized the goals of the council: economic development, environmental health, and social equity.

Lamp Recycling Increasing

The Association of Lighting and Mercury Recyclers (ALMR), a non-profit organization representing lamp recyclers in the U.S., recently estimated that 150 million mercury-containing lamps were recycled in the U.S. in 2002—twice the amount recycled in 1997. Using the number of lamps sold five years ago (since lamps last an average of 5 years), ALMR and the National Electrical Manufacturers Association (NEMA)

estimate that the overall lamp recycling rate in 2002 was 22.4 percent. Almost all lamp recycling is from non-residential users (business, commercial, institutional). The non-residential recycling rate was 27.6 percent. ALMR, the Solid Waste Association of America, and NEMA were awarded a grant by the US EPA to undertake a nationwide lamp recycling promotion program.

Thermostat Recycling

The Thermostat Recycling Corporation (TRC), a U.S. non-profit organization, recently announced that it had recovered nearly one ton of mercury from 221,000 used mercury switch thermostats between January 1998, when the program began, and June 2003. The TRC collected 358 pounds of mercury in the first half of 2003. If collections continued at the same rate throughout the rest of 2003, this would represent a 35 percent increase in the amount of mercury collected over 2002 and a 78 percent increase in mercury collected over 2001.

Indiana Mercury Thermostat Reduction and Recycling Pledge Program

The Mercury Thermostat Reduction and Recycling Pledge Program is the first of several initiatives to voluntarily reduce the amount of mercury-containing devices that may be found in Indiana homes. Since the beginning of the program in September 1997, nearly 200 heating, ventilation, and air-conditioning (HVAC) suppliers and contractors have signed up to participate in the voluntary program. Program participants are working with the Thermostat Recycling Corporation to utilize free recycling of discarded mercury-containing thermostats. For more information, visit IDEM's website at http://www.in.gov/idem/mercury/programs/hvac/index.html.

Indiana Mercury School Pledge and Lab Cleanup

On July 1, 2003, the Indiana Mercury and Mercury Products Law went into effect, restricting the sale of mercury-added novelties, thermometers, equipment, and mercury compounds for use in school laboratories, and the general sale of mercury-containing commodities. As a result, many Hoosier schools joined the Indiana Mercury Reduction and Recycling for Schools pledge program in an effort to remove mercury from their schools. There are currently over 400 Indiana schools in the program. To view the pledge, visit http://www.in.gov/idem/kids/mercury/schoolpledge.pdf. In addition to the school pledge program, IDEM, using EPA funds, provided assistance to 19 Indiana schools to clean up their science chemical closets.

Wisconsin Department of Natural Resources Mercury Reduction Program

Wisconsin's Department of Natural Resources (WDNR) started a mercury reduction program in 1998. Its goals are to: 1) reduce the public's use of mercury-containing products by promoting alternatives; 2) promote recycling of mercury products that continue to be used; and 3) reduce the potential for mercury spills. The program focuses on sectors where mercury products have historically been used. These include healthcare facilities; dental facilities; schools; heating, ventilation and air conditioning contractors; dairy farms; auto scrap yards; and households. The WDNR partnered with 22 of Wisconsin's largest municipalities in implementing mercury education and recycling programs.

Year	*Mercury Collected (lbs)*
1998-99	5100
2000-01	6600
2002	1000
2003 (Reported to date)	500
Total	**13,200**

The table reports the results of WDNR's mercury reduction program collection. As of October 2003, the dairy manometer program had removed and/or replaced 525 mercury manometers, bringing the total amount of

mercury collected to approximately 405 pounds. By the end of 2002, the auto switch sector had successfully removed 6,180 switches from automobiles before they were retired to a scrap yard. This equates to roughly 14 pounds of mercury. All of these programs are supported by U.S. federal and state grants, both to WDNR and mercury reduction communities.

Publicly Owned Treatment Works and Mercury Outreach in Indiana

In July 2003, IDEM received a Pollution Prevention Incentives for States (PPIS) grant from the US EPA Region 5 to provide workshops and on-site assistance and training to publicly owned treatment works (POTWs) through outreach to their local communities. The grant is an effort to reduce mercury in POTW influent and effluent. The Clean Manufacturing Technology Institute, local POTWs, other government representatives, and many more have agreed to participate in the stakeholder group. Further outreach could include training on incorporating pollution prevention into pretreatment permits.

Wisconsin DNR Community Mercury Reduction Project

Wisconsin Department of Natural Resources (WDNR) started a mercury reduction program in 1998. Its goals are to: 1) reduce the public's use of mercury-containing products by promoting alternatives; 2) promote recycling of mercury products that continue to be used; and 3) reduce the potential for mercury spills. The program focuses on sectors where mercury products have historically been used. These include healthcare facilities; dental facilities; schools; heating, ventilation and air conditioning contractors; dairy farms; auto scrap yards; and households. The WDNR partnered with 22 of Wisconsin's largest municipalities in implementing mercury education and recycling programs.

Wisconsin Dairy Mercury Manometer Replacement Program

The Dairy Mercury Manometer Replacement Project was started in 1998. The goal of this project is to replace all of the mercury manometers that are still on Wisconsin dairy farms. The farmers who choose to replace their mercury-filled manometer with a mercury-free gauge effectively receive a $200 reimbursement from an EPA grant to the Wisconsin DNR. The dairy equipment service providers receive a $100 reimbursement to find and remove a mercury manometer from a farm that is no longer milking. Participating dairy equipment service providers perform the work and a licensed hazardous waste hauler picks up the mercury from the equipment dealers. To date, 525 manometers have been removed or replaced by non-mercury manometers, which brings the amount of mercury collected and recycled to 405 pounds. Grant money from the EPA's Great Lakes National Program Office (GLNPO) and the Great Lakes Protection Fund has made this project possible.

Wisconsin Auto and Appliance Mercury Switch Recycling Project

In January 2002, the Wisconsin DNR partnered with Concerned Auto Recyclers of Wisconsin (CARS), the Wisconsin Institute of Scrap Recycling Industries (WISRI), and the Storm Water Cooperative Compliance Programs (CCPs) to help reduce mercury releases from auto switches into Wisconsin waters. As of July 2003, there were roughly 80 auto and scrap recyclers participating. So far the project has collected 200 lbs of mercury containing devices, most of which included auto mercury switches. The switches only take a few minutes to remove. Once removed, Wisconsin auto and scrap recyclers can take the mercury switches to twelve established mercury switch drop-off sites around the state. The cost of picking up and recycling the switches is currently paid for by a Great Lakes National Program Office (GLNPO) grant from EPA. Instructions for the removal, storage and transport of switches are available at http://www.dnr.state.wi.us/org/caer/cea/assistance/scrap/switches/removal.htm.

WDNR Mercury Program Collection Totals

1998-1999: Free recycling of mercury products from medical, dental, and school facilities. 5,100 lbs. Hg
1999-2001: Free recycling of mercury products from all sectors. 6,600 lbs. Hg
2002-2003: Free recycling of mercury products

from all sectors. 1,500 lbs. Hg
Manometer Project: 525 manometers collected which yielded approximately 405 pounds of mercury
Auto Switch Collection: 6,180 auto switches (14 lbs. Elemental Hg)

TOTAL COLLECTIONS: 13,620 lbs. Hg recycled

Mercury Pollutant Minimization Programs

Under NR106.145, a new rule administered by the Wisconsin Department of Natural Resources (WDNR), a Mercury Pollutant Minimization Program is required when treatment plant effluent has been demonstrated to exceed 1.3 ng/L water quality standard using low-level mercury analytical procedures. A temporary variance to the water quality standard is granted in exchange for planning and implementing a local mercury minimization program. About 100 of the largest municipal wastewater treatment plants in Wisconsin will need to implement mercury minimization programs during the next ten years. Low-level mercury effluent monitoring data is currently being collected. Mercury Pollutant Minimization Programs will need to be submitted to WDNR starting at the end of 2005. A website for the NR106 rule can be found at www.dnr.state.wi.us/org/water/wm/ww/mercury/mercury.htm.

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Appendix D
Watershed Fact Sheets

Linking LaMP Goals to Effective Implementation: The Watershed Scale

The development of the LaMP holds great promise for achieving environmental improvement in the Lake Michigan basin, but it also offers significant challenges in terms of practicing environmental restoration and protection on this scale. One of the most significant of these challenges is the need for cross-program and cross-jurisdictional coordination. This includes coordination between the U.S. and Canada, between federal agencies, and among states, provinces, and tribes, as well as coordination across a variety of statutory authorities. Because of this, EPA has taken the approach of using existing tools, as well as developing new and innovative ones, in concert with federal, tribal, state, and local partners to achieve environmental results that are relevant to a given place. To simplify the myriad of statutes, regulations, and resources affecting the management of Lake Michigan, Appendix D of LaMP 2000 presents a matrix of the major governmental units, regulatory agencies, and other significant stakeholders that are responsible for managing the Lake Michigan ecosystem. The matrix includes a description of these units, their goals, and their roles and responsibilities as they pertain to the restoration and maintenance of the chemical, physical, and biological integrity of the Lake Michigan ecosystem.

Lake Michigan's 33 Tributary Watersheds

The first step in advancing work watershed by watershed is to provide the available data in that format. Lake Michigan has 33 tributary watersheds at the 8-digit hydrologic unit code (HUC) in the U.S. Geological Survey system as EPA has indicated.

Although a decade of effort has resulted in a general awareness of the watershed approach within EPA, recent evaluations show substantial gaps in implementation. The watershed approach should not be seen as merely a special initiative targeted at just a selected set of places or involving a relatively small group of EPA or state staff. Rather, it should be the fulcrum of our restoration and protection efforts, and those of our many stakeholders, private and public. Failure to fully incorporate the watershed approach into program implementation will result in failure to achieve our environmental objectives in many of our nation's waters.

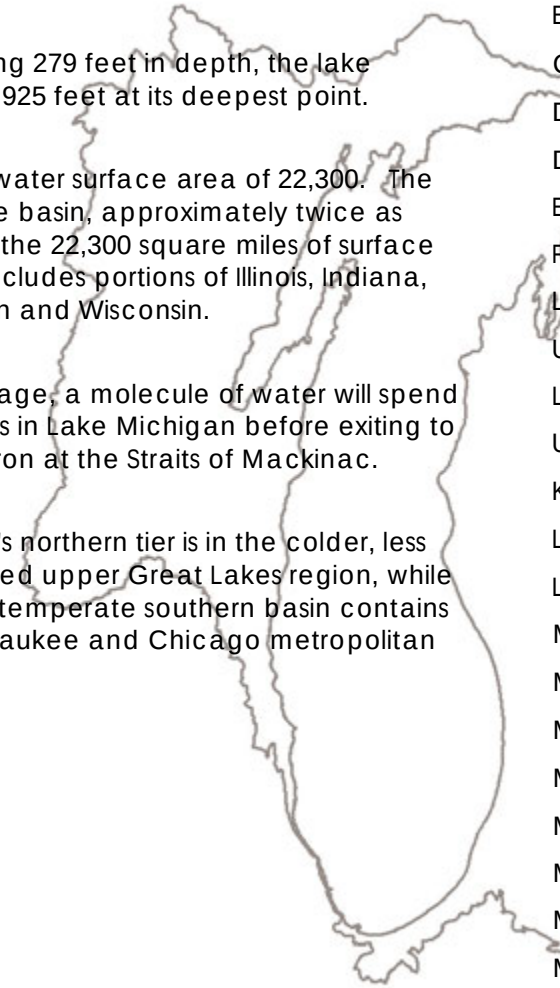
The hydrologic unit code (HUC) that represents a geographic area representing part or all of a surface drainage basin, a combination of drainage basins, or a distinct hydrologic feature

The Geographic Information Retrieval and Analysis System (GIRAS) was developed in the mid 70s to put into digital form a number of data layers which were of interest to the USGS. One of these data layers was the Hydrologic Units. The map is based on the Hydrologic Unit Maps published by the U.S. Geological Survey Office of Water Data Coordination, together with the list descriptions and name of region, subregion, accounting units, and cataloging unit. The hydrologic units are encoded with an eight- digit number that indicates the hydrologic region (first two digits), hydrologic subregion (second two digits), accounting unit (third two digits), and cataloging unit (fourth two digits).

The following fact sheets provide a picture of Lake Michigan divided into watersheds, showing the special and important elements present in the watershed as well as the impairments that currently exist. Also provided is an overview of the planning underway and the groups involved. We seek comments on these fact sheets as to content and usefulness of them as a tool. For additional information, see the Lake Michigan Watershed Academy description in Chapter 9, the EPA NPDES watershed permit discussions in Chapter 9, and the area of concern charts in Chapter 7.

Lake Michigan Overview

- Lake Michigan, the second largest Great Lake by volume with just under 1,180 cubic miles of water, is the only Great Lake entirely within the United States.
- Approximately 118 miles wide and 307 miles long, Lake Michigan has more than 1,600 miles of shoreline.
- Averaging 279 feet in depth, the lake reaches 925 feet at its deepest point.
- It has a water surface area of 22,300. The drainage basin, approximately twice as large as the 22,300 square miles of surface water, includes portions of Illinois, Indiana, Michigan and Wisconsin.
- On average, a molecule of water will spend 100 years in Lake Michigan before exiting to Lake Huron at the Straits of Mackinac.
- The lake's northern tier is in the colder, less developed upper Great Lakes region, while its more temperate southern basin contains the Milwaukee and Chicago metropolitan areas.



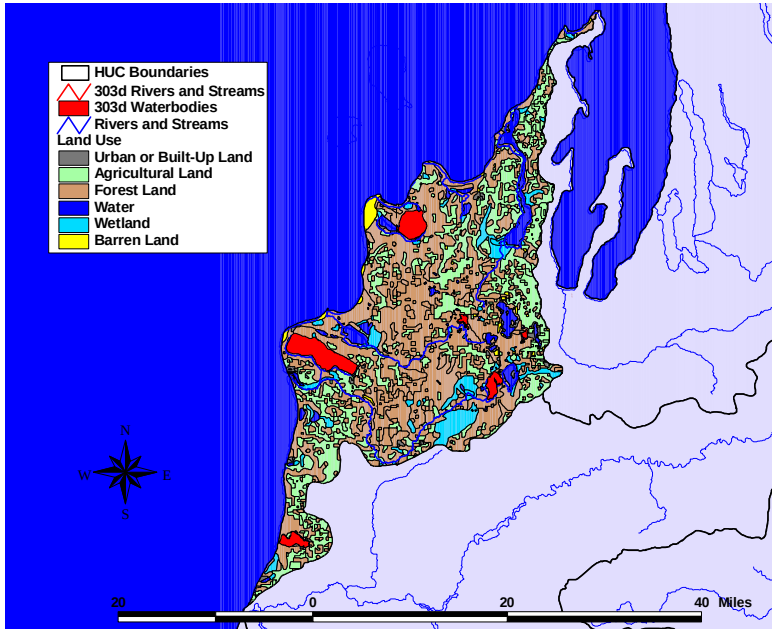
Lake Michigan 8-Digit HUC Watersheds

Watershed	HUC Code
Betsie-Platte	04060104
Black-Macatawa	04050002
Boardman-Charlevoix	04060105
Brevoort-Millecoquins	04060107
Brule	04030106
Cedar Ford	04030109
Door-Kewaunee	04030102
Duck-Pensaukee	04030103
Ecsanaba	04030110
Fishdam-Sturgeon	04030112
Lower Fox	04030204
Upper Fox	04030201
Lower Grand	04050006
Upper Grand	04050004
Kalamazoo	04050003
Lake Winnebago	04030203
Little Calumet-Galien	04040001
Manistee	04060103
Manistique	04060106
Manitowoc-Sheboygan	04030101
Maple	04050005
Menominee	04030108
Michigamme	04030107
Milwaukee	04040003
Muskegon	04060102
Oconto	04030104
Pere-Marquette-White	04060101
Peshtigo	04030105
Pike-Root (Waukegan)	04040002
St. Joseph	04050001
Tacoosh-Whitefish	04030111
Thornapple	04050007
Wolf	04030202

Betsie-Platte Watershed

Hydrologic Unit Code: 04060104

For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04060104



Approved Watershed Management Plans

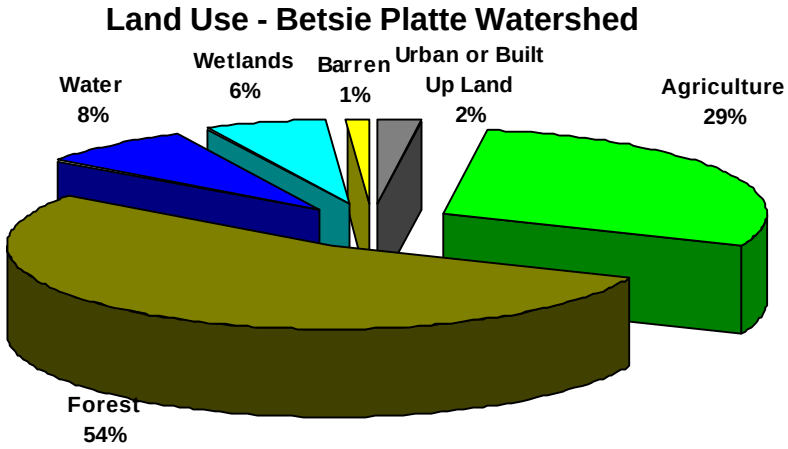
- Bear Creek (Benzie Co.) - Conservation Resource Alliance
- Betsie River - Conservation Resource Alliance
- Glen Lake/Crystal River - Glen Lake Association
- Lake Leelanau - Conservation Resource Alliance
- Platte River - Benzie Conservation District

Watershed Groups

- Conservation Resource Alliance: www.rivercare.org
- The Leelanau Conservancy: http://www.theconservancy.com/
- Glen Lake Association
- Green Lake-Betsie River Association
- Grand Traverse Regional Land Conservancy http://www.gtrlc.org/
- Crystal Lake Watershed Fund: http://www.clwf.org/
- Benzie Conservation District: http://www.benziecd.org/

Watershed Overview / Ecology / Biodiversity

- The Betsie-Platte watershed, part of the Grand Traverse Bay area in northern Lake Michigan, covers 811.04 square miles with a shoreline that extends 87.96 miles. 193 miles of streams and rivers in the watershed flow year round.
- Inland lakes make up 62.62 square miles of the watershed.
- The counties in the watershed have a population of over 144,000.
- The watershed saw significant logging activities in the late 1800s and early 1900s.
- Attempts at farming the cut over land proved largely unsuccessful due to meager soils. This further limited settlement expansion in the watershed.
- The watershed remained relatively undeveloped during the past century, however, deep sand deposits in the River and creeks are legacies of the impact logging and road building has had. Increasing weed growth in many lakes is further indication of the changes which have occurred since the area was first settled.
- Much of the agricultural land reverted back to State ownership and additional land was acquired in succeeding decades to create the vast State forest and Federal parklands existing today.
- Native plant species in the area range from the extremely drought tolerant species Bearberry (Arctostaphylos uvaursi) and Stiff Coreopsis (Coreopsis palmata) to the wetland species of Blue Flag Iris (Iris veriscolor) and Buttonbush (Cephalanthus occidentalis). More unusual species include the Red Milkweed or Swamp Milkweed (Asclepias incarnata), desired by the Monarch Butterfly as the favorite food source for the larvae.



Watershed Activities / Concerns / Priorities

- The Conservation Resource Alliance was recently awarded grants totaling $474,309 from the State's Clean Michigan Initiative (CMI) and $104,260 from the Michigan Department of Transportation's Enhancement Program to improve water quality and control erosion in the Betsie River Watershed. The Benzie County Road Commission and Betsie River Watershed Restoration Committee is repairing up to 5 eroding road/stream crossings on the Little Betsie and Dair Creek, and finish streambank stabilization at 12 sites on the mainstream up to Homestead Dam.

- The Michigan Department of Environmental Quality (DEQ) awarded $723,800 in matching funds to the Leelanau Conservancy as a part of the "Clean Michigan Initiative, Clean Water Fund." Funds provided by CMI must be matched by Conservancy land acquisition dollars to permanently protect wetlands and groundwater recharge areas in the Lake Leelanau watershed. The lake has an extremely important recreational fishery and high water quality. The health of the lake, and in particular the fishery, is dependent on healthy wetlands bordering the lake and its tributary streams. Having some funds to spend on the acquisition of conservation easements will help permanently protect some of the most critical areas.

- Identified Platte River impairments include fertilizers; human and animal waste; oils, toxic chemicals, and salt; sediment; heated runoff; altered stream; pesticides; bacteria; and channel flow.

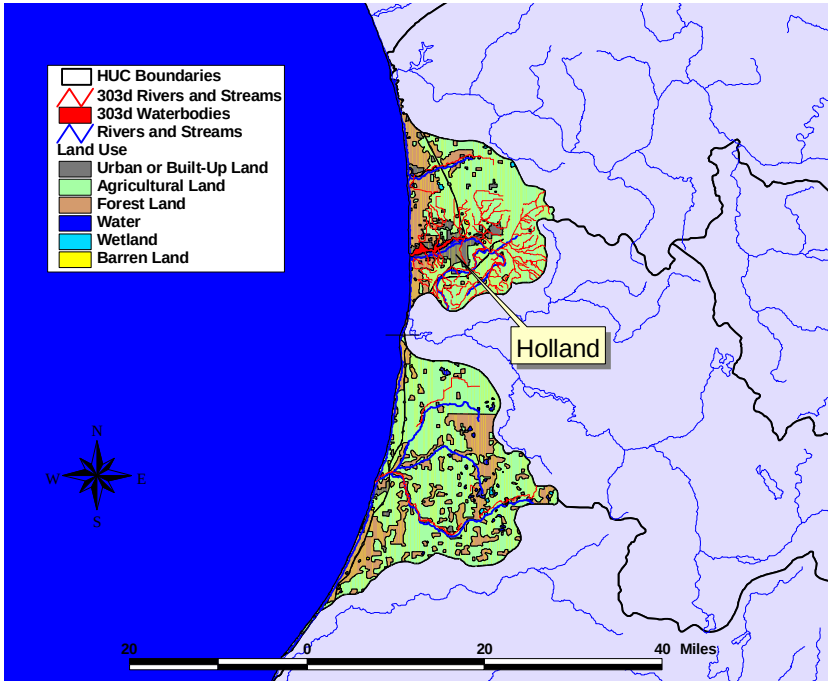
- The Grand Traverse Band of Ottawa and Chippewa tribe has a water quality protection program for the reservation Leelanau County.

Impaired (303d) Waters

Waterbody	Impairment	Anticipated TMDL Submittal
Bass Lake	Mercury Fish Consumption Advisory	2011
Crystal Lake	PCB Fish Consumption Advisory	2010
Glen Lake	Chlordane	2011
	Mercury	2011
	Mercury Fish Consumption Advisory	2009
Green Lake	Mercury	2011
Lake Ann	Mercury	2011
Portage Lake	Mercury	2011

Black Macatawa Watershed

Hydrologic Unit Code: 04050002



Watershed Overview / Ecology / Biodiversity

- The Black-Macatawa watershed covers 607.26 square miles
- It has 68.76 miles of Lake Michigan shoreline
- 151 miles of the rivers and streams flow year round.
- The inland lakes cover 4.09 square miles of the watershed.
- The Black-Macatawa watershed has eight listed impaired waters
- Holland and Benton Harbor, Michigan are the two urban areas in the watershed.
- The watershed includes 2 urban areas, Benton Harbor and Holland, Michigan.
- The counties located in the watershed have a population of over 594,000.
- 96 of the 151 miles of impaired waterways (or 64%) have been assessed
- Two and a half million visitors visit Holland, Michigan each year
- Saugatuck Dunes State Park offers 14 miles of hiking and cross-country ski trails. The park's 900-acre natural area contains a coastal dune system, as well as three endangered plant species and beautiful Lake Michigan waterfront.
- Ottawa County is rated as Michigan's most diverse agricultural county. Products grown include apples, asparagus, strawberries, cherries, annuals, perennials, pumpkins, squash, among others.
- TMDLs for phosphorus caused by alagal blooms and nutrients in Lake Macatawa were approved in 2000.

Approved Watershed Management Plans

- Pigeon River - Timberland RC&D Council

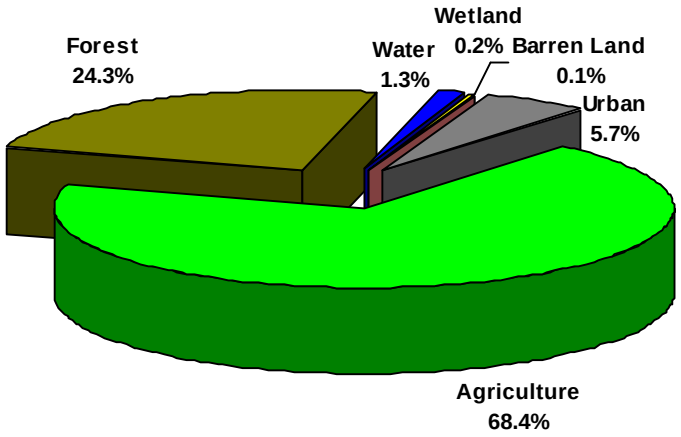
For more information, see the USEPA “Surf Your Watershed” website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04050002

Watershed Activities / Concerns / Priorities

- The Lake Macatawa Watershed includes all the land that drains to Lake Macatawa. Laketown, Fillmore, Overisel, Holland, Park, Zeeland, Port Sheldon, Olive and Blendon Townships all have some land in the Macatawa Watershed, as well as the cities of Holland and Zeeland. Each year thousands of pounds of phosphorus are carried from this Watershed into Lake Macatawa when it rains. Too much phosphorus causes overgrowth in aquatic plants and algae blooms, which can lead to depleted oxygen in the water, fish kills, and overall poor water quality. The Macatawa Watershed Project goal is to reduce the amount of phosphorus that enters Lake Macatawa by rain runoff by 70% by 2009. The Watershed Project works with local units of government, farmers, homeowners, developers, educators, and other members of the community to increase awareness of how we all impact the watershed, and what we can do to help reduce phosphorus.

- The cities of Holland and Zeeland, and the Townships of Holland, Zeeland, Fillmore, Laketown, and Park are included in this Lake Macatawa Phosphorus Reduction Loading Agreement.

Land Use - Black-Macatawa Watershed

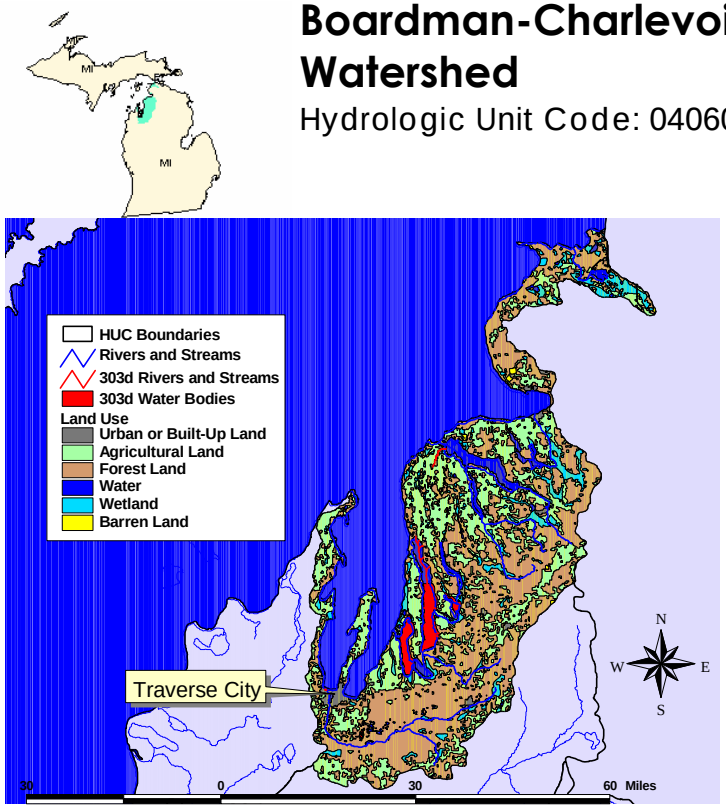


Impaired (303d) Waters

Waterbody	State Impairment	Anticipated TMDL Submittal
Black River (Main), S. Br. Black River	Chlordane	2000
	PCB Fish Consump-tion Advisory	2000
Black River Drain, N. Branch	Nutrients	2006
	Nuisance plant growths	2006
Haven-Max Lk. Dr./ Gr.Bear Lk./ Gr. Bear Lk. Dr.#	Nutrients	2004
	Algae	2004
Pigeon River	Nutrients	2007
	Algae	2007
	Fish community rated poor	2007
	Macroinvertebrate community poor	2007
Pine Creek	Pathogens	2007
	Macroinvertebrate community poor	2007
Silver Lake Inlet	Macroinvertebrate community poor	2008
	Simazine	2008
Lake Macatawa Watershed	Chlordane	2009
	PCB Fish Consump-tion Advisory	2009
Ten Hagen Creek	Fish community rated poor	2006
	Macroinvertebrate community poor	2006

Boardman-Charlevoix Watershed

Hydrologic Unit Code: 04060105



Approved Watershed Management Plans

- Boardman River - Grand Traverse Conservation District
- Elk River Chain of Lakes - Antrim Conservation District
- Long Lake - Grand Traverse Drain Commission
- Mitchell Creek - Grand Traverse Drain Commission

Watershed Plans Under Development or Pending Approval

- Lake Charlevoix, Charlevoix Conservation District and Tip of the Mitt Watershed Council
- Elk River Chain of Lakes Watershed - Antrim Conservation District, Tip of the Mitt Watershed Council, Conservation Resource Alliance
- Little Traverse Bay - Tip of the Mitt Watershed Council, Ann Baughman
- Grand Traverse Bay (pending approval), Watershed Center Grand Traverse Bay

Watershed Overview / Ecology / Biodiversity

- The watershed, which is part of the Grand Traverse Bay area, covers over 1660 square miles.
- The Grand Traverse Bay watershed is one of the premier tourist and outdoor recreation regions in the State of Michigan.
- The watershed has over 217 miles of Lake Michigan shoreline.
- Over 529 miles of streams and rivers flow year-round.
- Traverse City, Michigan is the lone urban area in the watershed.
- Two of the three fastest growing counties in the state, Grand Traverse and Leelanau, are located within the watershed's boundaries.
- Major waterways in the basin include the Elk River, the Boardman River, Lake Charlevoix, Little Traverse Bay, and the Carp River.
- As a trout steam, the Boardman River ranks among Michigan's top 10 streams. It contains excellent populations of brook and brown trout, particularly above Boardman Dam.
- Traditional uses of watershed resources have included agriculture, tourism and recreation. Cherries and other fruit crops dominate agricultural production in the region, and are harvested for the global market.
- The watershed includes species of black bear, deer, great blue heron, lady slippers and trillium.
- The watershed boasts scenic bluffs, forests, nearly a hundred inland lakes, several hundred miles of stream (including 55 miles of blue ribbon trout streams), intact wetland systems and globally rare ecosystems.

For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04060105

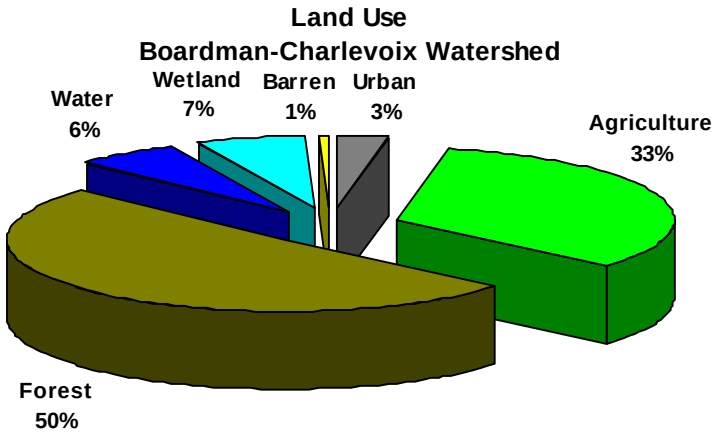
Watershed Activities / Concerns / Priorities

- None of the designated uses for the Grand Traverse Bay watershed are impaired on a watershed wide scale. However, in some cases, activities and resulting pollutants in the watershed may prove to be a threat to water quality and designated uses.

- Identified threats to the Grand Traverse Bay watershed include:
  1. Nutrients (for the Bay and its tributaries)
  2. Sediment for tributaries to the Bay
  3. Invasive species (emerging threat)

- Through the Boardman River Project and the Grand Traverse Conservation District (GTCD), eroded Boardman River banks, road crossings, utility line crossings, and other sources of sediment have been stabilized. These stabilization projects have prevented over 3,000 tons of sediment annually from entering the Boardman. In addition, more than 1,500 acres of land throughout the watershed have been permanently protected as nature reserves or with conservation easements. Many private landowners have also received technical assistance at their riverfront properties.

- Little Traverse Bay Bands of Odawa tribe has a water quality protection program.



Impaired (303d) Waters

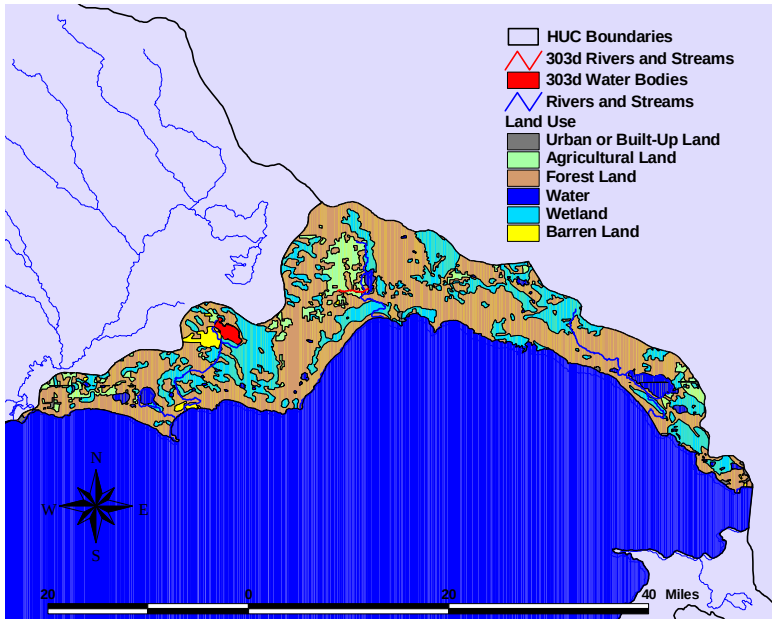
Waterbody Name	Impairment	Anticipated TMDL Submittal
Arbutus Lake	Mercury	2011
Elk Lake	Mercury	2011
	PCB Fish Consumption Advisory	2010
Kids Creek	Macroinvertebrate Community Rated Poor	2010
Lake Bellaire	Mercury	2011
Stover Creek	Macroinvertebrate Community Rated Poor	2008
Torch Lake	Chlordane	2011
	Mercury	2011
	PCB Fish Consumption Advisory	2009

Watershed Organizations

- Grand Traverse Conservation District
- Boardman River Project - www.boardmanriver.org/
- Grand Traverse Conservation District - www.gtcd.org/
- Grand Traverse Drain Commission - www.grandtraverse.org
- Antrim Conservation District - www.antrimcd.org/
- Charlevoix Conservation District -
- www.charlevoixcounty.org/cd.asp
- Tip of the Mitt Watershed Council - www.watershedcouncil.org
- Conservation Resource Alliance - www.rivercare.org
- Watershed Center Grand Traverse Bay - www.gtbay.org

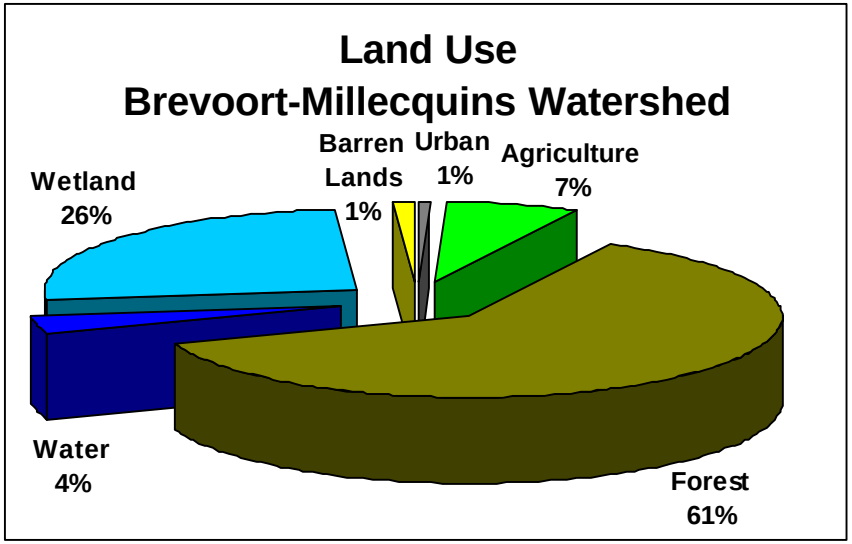
Brevoort-Millecquins Watershed

Hydrologic Unit Code: 04060107



Impaired (303d) Waters

Water Body	Impairment	Anticipated TMDL Submittal
Furlong Creek	Macroinvertebrate community rated poor	2006
Milakokia Lake	Mercury	2011



Watershed Overview

- The watershed is located at the southeastern portion of Michigan's Upper Peninsula
- The watershed covers 561.57 square miles.
- The watershed has 102.53 miles of Lake Michigan shoreline
- It has 19 square miles of inland lakes
- It has two listed impaired waters.
- Of the 248 river miles, 206 miles, or 83 percent have been assessed

For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04060107

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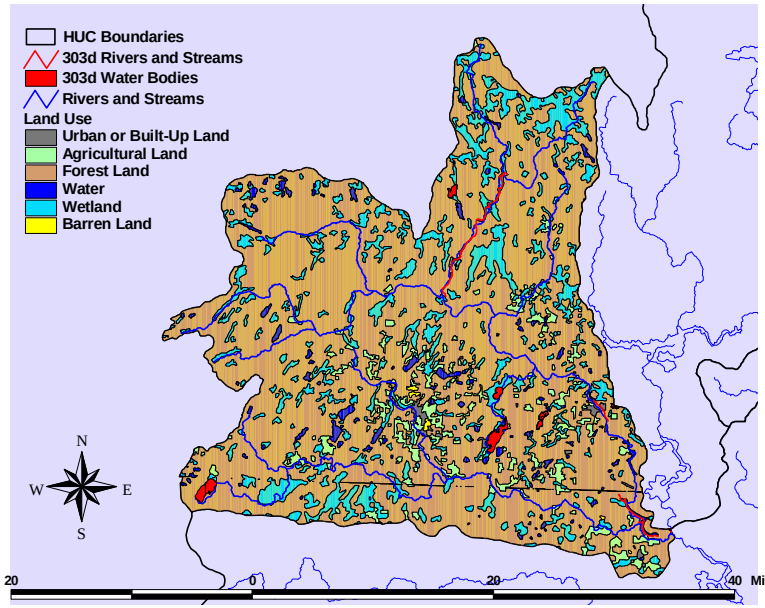
Brule River Watershed

Hydrologic Unit Code: 04030106

For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030106



Approved Watershed Management Plans

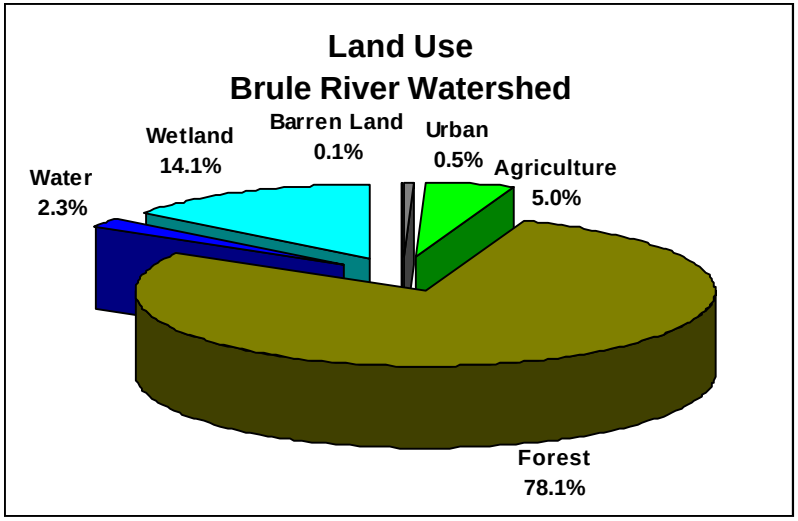
- Iron River Watershed - Iron Conservation District

Watershed Groups

- Iron River Conservation District

Watershed Overview / Ecology / Biodiversity

- The Brule River watershed covers 1057 square miles.
- It does not have any Lake Michigan shoreline and is upstream of the Menominee River watershed.
- The Brule watershed has 9 listed impaired waters.
- The Iron River in the watershed supports a naturally reproducing brook trout populations in the upper peninsula and is the source for brood stock for the Michigan Department of Natural Resources brook trout hatchery program.
- Of the approximately 40 miles of streams that constitute the Iron River watershed, 12 1/2are classified as blue-ribbon trout water.



Watershed Activities / Concerns / Priorities

- The Iron County Conservation District was awarded a 319 planning grant in 1999 to begin development for a management plan for the Iron River Watershed. With the Watershed Council acting as a steering committee, an inventory of the watershed was conducted, an information and awareness campaign begun, and strategies to address sources of non-point pollution were developed. The initial planning grant resulted in the successful award of two subsequent grants which will fund implementation of activities through 2004.

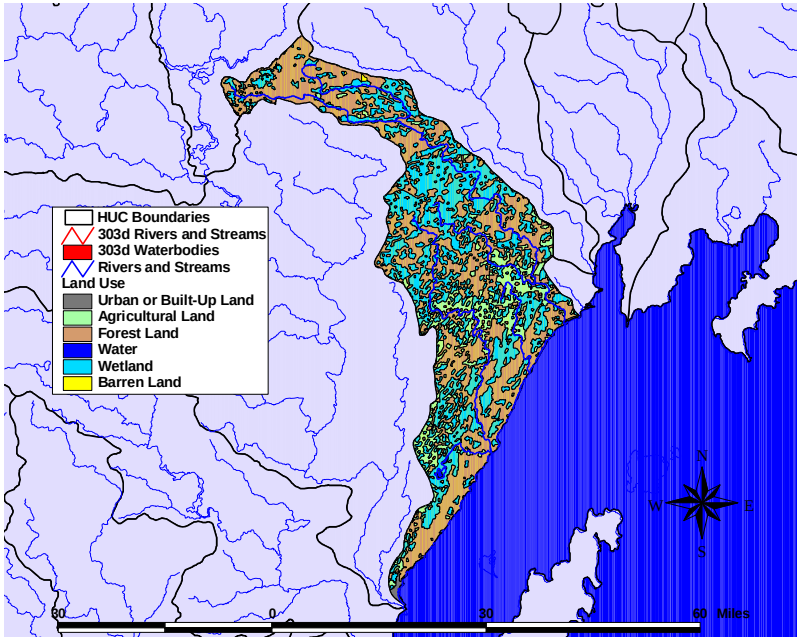
- One of the most damaging influences to the Iron River watershed came from the acid mine drainage from the Dober and Buck mines. In 1995, the Michigan Department of Environmental Quality filed a lawsuit against the Hanna Mining Company which sought retribution for the environmental degradation that occurred as a result of their mining practices. The parties agreed on a settlement in which the Hanna Mining Co. was made to apply remediation tactics to limit acid runoff as well as fined for $318,000.00 dollars in damages. This money was to be administered by the state, but managed by the newly formed watershed council. The award was earmarked specifically for activities to repair, enhance, or protect the Iron River, as well provide for increased public use.

Impaired (303d) Waters

Waterbody Name	Impairment	TMDL Cycle
Cable Lake (MI)	Mercury	2011
Chicagon Lake (MI)	Mercury	2011
Fortune Lake (Second	Mercury	2011
Lake Emily (MI)	Mercury	2011
Net River (MI)	Mercury Fish Consumption Ad-	2011
Ottawa River (MI)	Pesticides PCB Fish Consumption Adviso-	2007
Paint River (MI)	Pathogens	2009
Paint River Pond (MI)	Mercury Fish Consumption Ad-	2011
Kentuck Lake (WI)	Mercury Fish Consumption Ad-visories	None – Low Pri-ority

Cedar Ford Watershed

Hydrologic Unit Code: 04030109



Watershed Groups

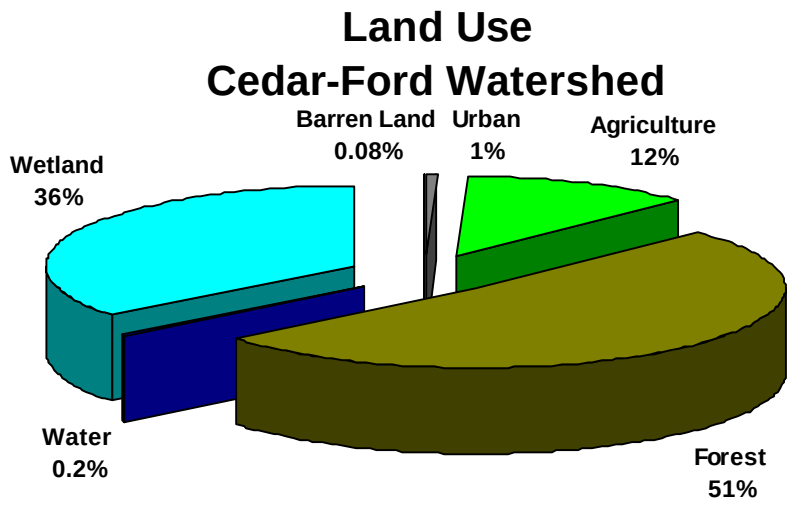
- Friends of the Cedar River
- Central Lake Superior Watershed Partnership - http://www.superiorwatersheds.org/shed.ford.asp

For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030109

Watershed Overview / Ecology / Biodiversity

The

- Cedar-Ford watershed covers 1028.1 square miles with almost 53 miles of Lake Michigan shoreline
- There are just over 2 square miles of inland lakes.
- The watershed has no listed impaired waters
- Fishing recreation, skiing, cross country skiing are some of the important basin recreational activities.



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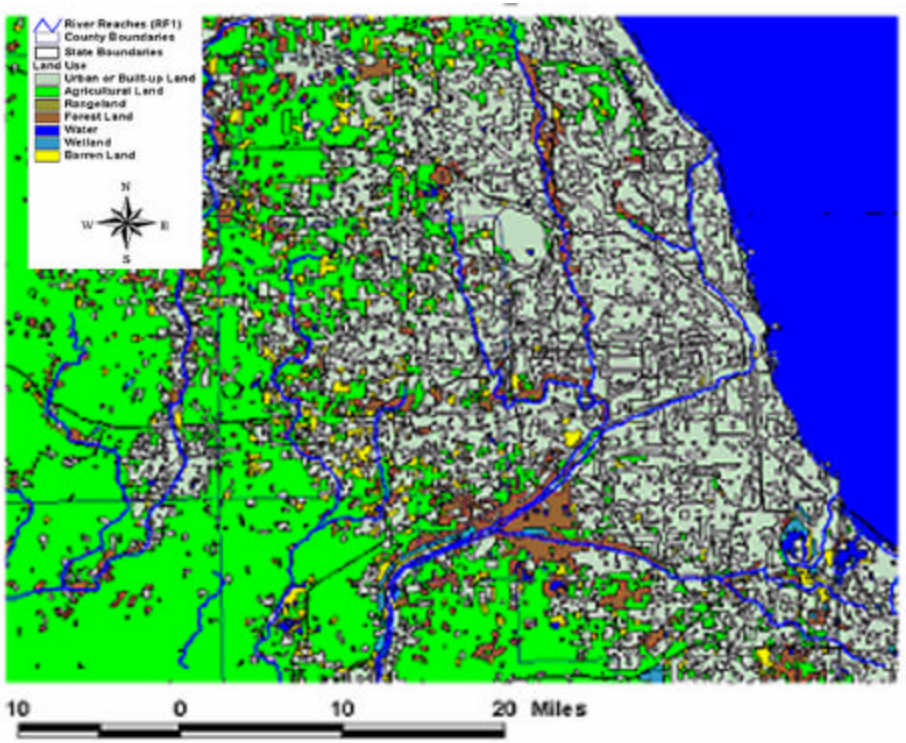
Chicago Waterway System



Water System Overview

- The Chicago River once flowed into Lake Michigan. To facilitate a reversal of the flow of the Chicago River to divert water from Lake Michigan to the CAWS, the Chicago Sanitary and Ship Canal, the Calumet-Sag Channel and the North Shore Channel were constructed over 100 years ago. The diversion and the artificial waterways facilitated navigation and protected the drinking water intakes in Lake Michigan from Chicago wastes. The Little Calumet River North Leg, the Chicago River, the South Branch of the Chicago River and North Branch of the Chicago River downstream from its confluence with the North Shore Channel are natural rivers that have been modified through channelization and widened and deepened.

- The Chicago Area Waterway System (CAWS) includes the Calumet River and Chicago River basin water bodies that are generally classified as Secondary Contact Recreation and Indigenous Aquatic Life. The CAWS also includes Lake Calumet and a variety of tributaries designated as General Use.

- Land use within the CAWS basin is generally urban with extensive industrial development. Basin stakeholders include the City of Chicago and 31 suburban municipalities. Flow in the CAWS is dominated by treated wastewater from 5 million residents and an additional industrial load of approximately 4.5 million population equivalents.

- Chicago's wastewater system was developed with a combined sewer system that accepted both stormwater and sanitary waste. After rainstorms, the capacity of the sewer system became overwhelmed on a regular basis and combined sewer overflows (CSO) occurred. These CSOs are discharged into the CAWS and frequently from the river into Lake Michigan. To address this problem, the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) developed the Tunnel and Reservoir project (TARP), which included the construction of the Deep Tunnel project. The Deep Tunnel is a series of tunnels that lie 250 to 300 feet below the Chicago River and are located parallel to it. The first phase of the TARP project or "Deep Tunnel" project has been completed. During periods of heavy rainfall, the TARP project directs combined sanitary waste and infiltrating rainwater into massive tunnels and collection reservoirs where it can be withdrawn for treatment after the rain subsides.

- A comprehensive multi-year evaluation of current conditions in the Chicago Waterway System, and its potential for expanded uses, has been launched by the Illinois EPA. This evaluation, also called a Use Attainability Analysis (UAA), will be the first in-depth look at the system in nearly three decades. In mid-February, the Illinois Environmental Protection Agency announced plans for the project that involves the Chicago River, its two main branches (North Branch and South Branch), the Cal-Sag Channel, the Chicago Sanitary and Ship Canal, and tributaries in an area extending from the metropolitan Chicago area to the Lockport vicinity. The Chicago Waterway System makes up the surface drainage network serving the majority of the Greater Chicago metropolitan area. The system receives discharge from three of the largest municipal wastewater treatment plants in the nation as well as releases from more than 100 individual combined sewer outfalls.

- Since passage of the Clean Water Act in 1972, there have been major upgrades of treatment facilities along the Chicago Waterway. Under IEPA oversight, extensive pretreatment programs have begun, as well as treatment of industrial wastes before discharge. The first phase of the Tunnel and Reservoir (TARP) project or "Deep Tunnel" project has been completed.

- Recreational boating and other sports are on the rise within the system and improved fish populations and species diversity now support a modest recreational fishing use. These benefits indicate that the current use classification is outdated, making the planned study a

timely undertaking. Jointly, these efforts have significantly improved conditions and public interest in the waterway, resulting in increased efforts to restore abandoned areas and provide public open spaces along the banks. As part of the study, a stakeholders advisory group will be created and involved through the review process and the completed review will be posted for Internet viewing.

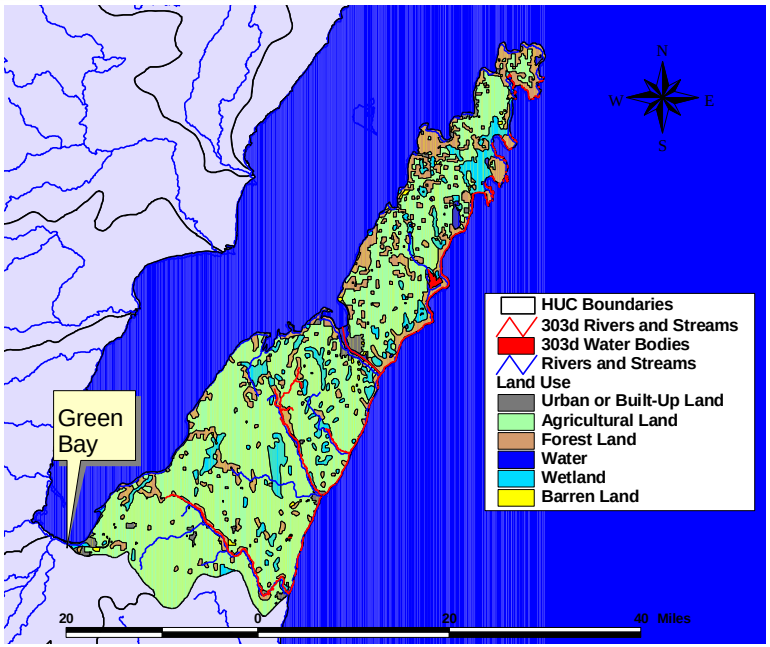
For more information, see the Chicago Waterways website at http:// www.chicagoareawaterways.org/.

Impaired (303d) Waters

	Designated Uses		
Waterbody Name	Overall Use	Fish Consumption	Secondary Contact and Indigenous Aquatic Life
N. Shore Channel	Full support	Nonsupport	Full support
N. Shore Channel	Full support	Nonsupport	Full support
N. Shore Channel	Full support	Nonsupport	Full support
S. Br. Chicago River	Full support	Nonsupport	Full support
N. Br. Chicago River	Partial support	Nonsupport	Partial support
Chicago San. & Ship Canal	Partial support	Nonsupport	Full support
Chicago San. & Ship Canal	Full support	Nonsupport	Full support
Chicago San. & Ship Canal	Full support	Nonsupport	Full support
Chicago San. & Ship Canal	Full support	Nonsupport	Full support
Chicago San. & Ship Canal	Full support	Nonsupport	Full support
Cal-Sag Channel	Partial support	Nonsupport	Partial support

Door Kewaunee Watershed

Hydrologic Unit Code: 04030102



Watershed Organizations

- 1000 Friends of Wisconsin - www.1kfriends.org
- Door Co. Environmental Council
- Door County Land Trust
- River Alliance of Wisconsin - www.wisconsinrivers.org
  Wisconsin's Environmental Decade - www.wienvdecade.org
- Lakeshore Natural Resources Partnership http://clean-water.uwex.edu/lakeshore/
- Doug Rossberg, Lakeshore Basin Water Team Leader - Doug.Rossberg@dnr.state.wi.us

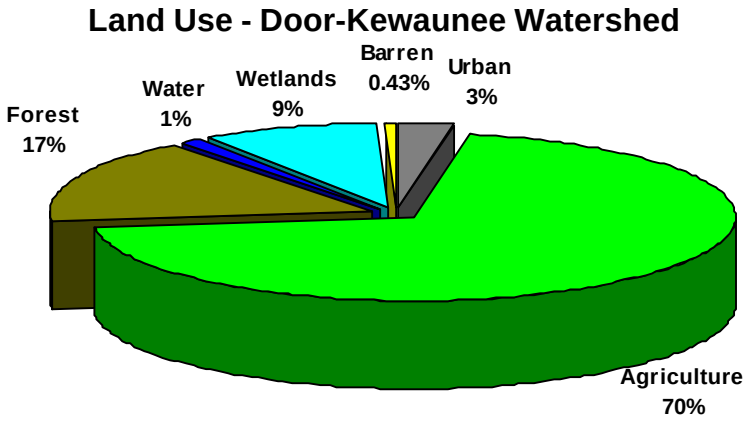
Watershed Overview / Ecology / Biodiversity

- Maple- basswood is the most common forest type, and the tree species with the greatest volume in the Lakeshore basin is ash followed by soft maple, aspen, basswood and beech.
- Recreational highlights include: hiking, birding, camping, rafting, canoeing, hunting, fishing, and boating on Lake Michigan and Green Bay.
- The diversity of islands, forests, wetlands, sand dunes, and ridge and swale topography provide habitat to an abundance of rare, threatened and endangered plants and animals.

Basin Ecology

- The Basin includes the Northern Lake Michigan Coastal and Southeast Glacial Plains Ecological Landscapes In the Northern Lake Michigan Coastal area, low sand dunes and beach ridges along the shoreline support unique plant species.
- Vegetation is maple- basswood- beach forests and wetlands. In the Southeast Glacial Plains area, former savanna (now farmed) and wetlands are predominant, along with kettle lakes and the Kettle Moraine landscape feature. This area's wetlands are highly productive for plants, insects, and invertebrates.
- Surface waters are a mix of lakes and cold and warm water streams with smallmouth bass, walleye, northern pike, panfish and trout. Great Lakes fisheries provide lake trout, lake whitefish, salmon and yellow perch.
- The basin's groundwater in Door County is underlain by Niagara Dolomite, or Karst (fractured limestone), which allows pollutants such as bacteria to move quickly and which makes this resource highly susceptible to contamination.
- Wildlife include white- tailed deer, turkey, ring- necked pheasant, ruffed grouse, waterfowl, geese, beaver, mink, otter, colonial waterbirds, trumpeter swans, eagle, osprey, northern goshawk, shorebirds
- Grasslands, which support over 105 bird species, are promoted through prescribed burns and mowing.

For more information, see the Wisconsin Department of Natural Resources' "Wisconsin's Basins" website at http://dnr.wi.gov/org/gmu/gmu.html and the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030102



Basin Priorities

In 2000 the Lakeshore Basin Partnership Team, which includes the Door-Kewaunee watershed, developed the following prioritized list of the most pressing issues impacting natural resources in the watershed management area.

1. Loss of riparian (stream and lakeside) buffers (streamside habitat)
2. Inadequate identification and protection of wetlands, wetland corridors, and groundwater recharge areas
3. Need for better land use Planning & improved local zoning
4. Inadequate management & 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

Basin Social Concerns

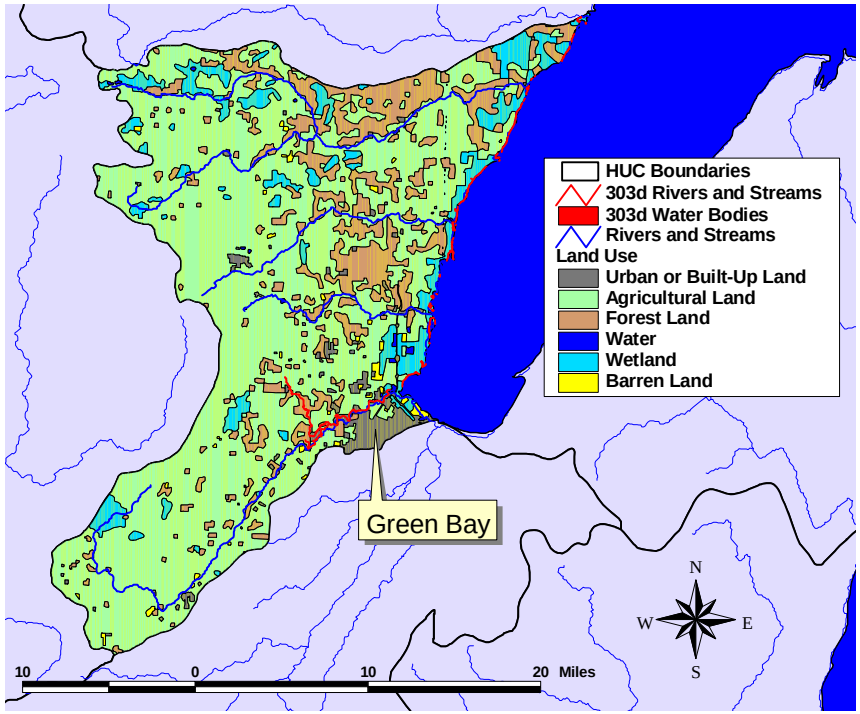
- Limit of aquatic habitat and open land to development, pollution threats to surface waters and contamination of drinking and groundwater.
- Address water quality problems from in- place pollutants, dams, urban and agricultural runoff.
- Preserve biodiversity and protect endangered and threatened species.
- Protect of large contiguous blocks of forestland, grassland and wetland that serve as habitat for mammals, birds, and amphibians, as well as providing a large self- sustaining forest ecosystem for all to enjoy.
- Exotic nuisance species, stocking issues, declining fishing opportunities, inadequate boat access.
- Monitoring of wildlife populations, water quality, and ecosystem function are needed to understand the status and trends of resources in the basin.

Impaired (303d) Waters

Waterbody Name	Impairment	Anticipated TMDL Submittal
Ahnapee River	PCB Fish Consumption Advisories	NA
Clark Lake	PCB Fish Consumption Advisories	NA
East Alaska Lake	Mercury Fish Consumption Advisories	NA
Kewaunee Harbor	Aquatic Toxicity	NA
	Fish Consumption Advisory	
Kewaunee River	PCB Fish Consumption Advisories	NA
Stony Creek	Loss Of Instream Habitat	NA
Sturgeon Bay, Ship Canal	Aquatic Toxicity	NA

Duck-Pensaukee Watershed

Hydrologic Unit Code: 04030103

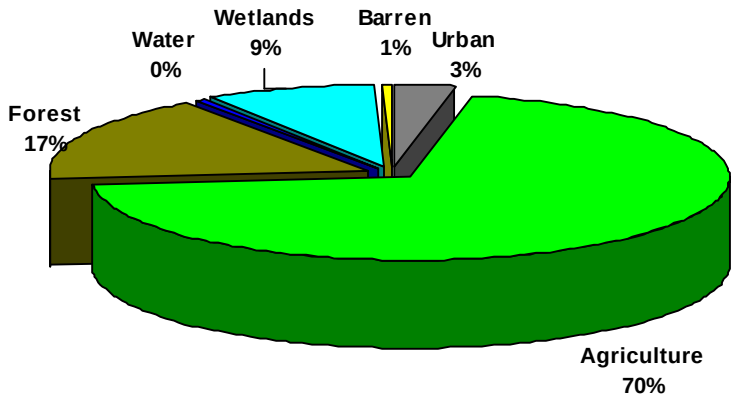


Watershed Overview / Ecology / Biodiversity

- The Duck-Pensaukee watershed covers approximately 490 square miles.
- There are approximately 35 miles of Lake Michigan shoreline.
- Green Bay is the sole urbanized area in the watershed.
- The watershed flows into the Green Bay.
- Just over 70 percent of the watershed is agricultural.
- Wildlife include black bear, white- tailed deer, turkey, ring- necked pheasant, ruffed grouse, waterfowl, geese, beaver, mink, otter, timber wolves, elk, colonial waterbirds, trumpeter swans, eagle, osprey, northern goshawk, shorebirds.
- Maple- basswood is the most common forest type and the tree species with the greatest volume in the basin is hard maple followed by aspen, white and red pine, soft maple and balsam fir.
- Coastal wetlands are an important feature of the watershed.
- Groundwater is the source of potable water for most residents within the Duck-Pensaukee watershed.
- Groundwater levels have dropped, causing suburban areas to seek direct withdrawals from Lake Michigan.

For more information, see the USEPA “Surf Your Watershed” website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030103

Land Use - Duck-Pensaukee Watershed



Watershed Activities / Concerns / Priorities

- The Wisconsin Department of Natural Resources manages the Duck-Pensaukee watershed in two integrated management plans. The northern portion is managed as part of the Upper Green Bay Basin and the southern portion as part of a larger Lower Fox River basin.
- The following are objectives for the Upper Green Bay management Basin, which includes a significant portion of the Duck-Pensaukee watershed:
- Target the West Shore of Green Bay as a high priority for habitat protection
- Implement the DNR's 50 year Land Legacy Study, an acquisition plan for the state
- Protect shoreland habitat and water quality through water regulation and zoning
- Work with local communities in developing "smart growth" plans & promoting wise land use and zoning
- Complete a comprehensive fisheries plan for the basin, focusing on the Oconto, Menominee, and Peshtigo Rivers and Lake Michigan, including addressing invasive exotic species
- Complete the Master Plan for the Governor Tommy G. Thompson Centennial State Park
- Encourage sound forestry practices on public and private land and identify and manage terrestrial invasive exotic species
- Enhance educational activities for forestry, water quality, wildlife management, healthy ecosystem.
- The Oneida are leaders in the Duck Creek watershed, which runs through the reservation.

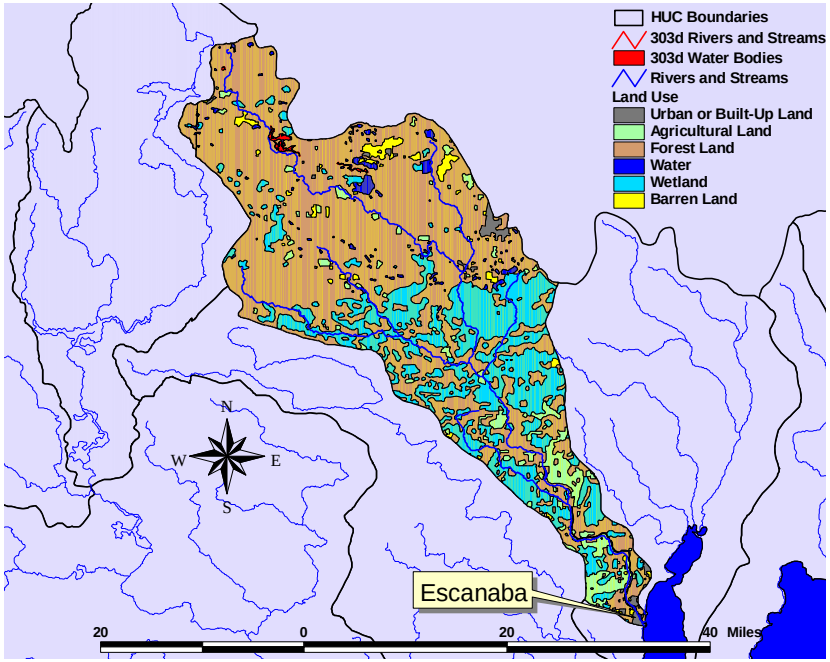
Impaired (303d) Waters

Waterbody Name	Impairment	Anticipated TMDL Submittal
Duck Creek * (1)	Nutrients	NA
	PCB Fish Consumption Advisory	
	Flow Alteration(S)	
	Loss Of Instream Habitat	
	Organic Enrichment/Low Dissolved Oxygen	
	Sediment	
Fond Du Lac River	Mercury Fish Consumption Advisory	NA
	PCB Fish Consumption Advisory	
	TOC	
Green Bay - South Of Marinette And Its Tribs Including The Menomi-nee, Oconto, Fox & Pesh-tigo Rivers From Their Mouths To The First Dam	PCB Fish Consumption Advisory	NA
Trout Creek (2)	Nutrients	NA
	PCB Fish Consumption Advisory	
	Flow Alteration(S)	
	Loss Of Instream Habitat	
	Organic Enrichment/Low Dissolved Oxygen	
	Sediment	

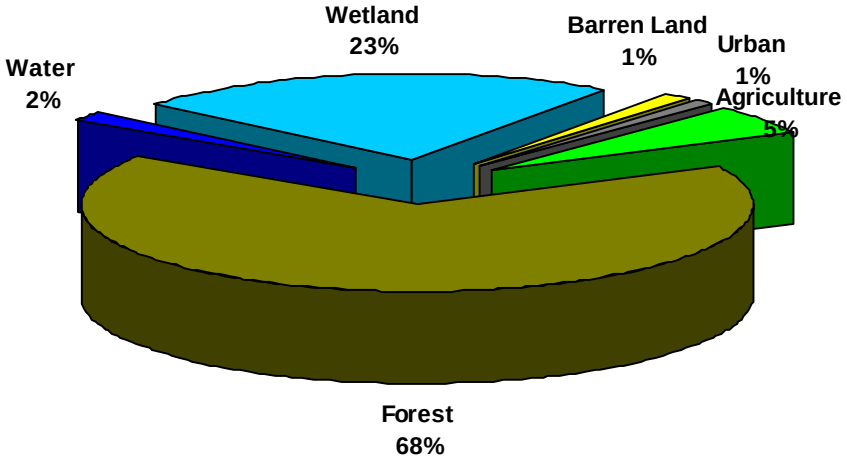
Escanaba River Watershed

Hydrologic Unit Code: 04030110

For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030110



Land Use
Escanaba River Watershed



Impaired Waters

Waterbody Name	Impairment	Anticipated TMDL Submittal
Greenwood Reservoir	Mercury	2011
Round Lake	Mercury Fish Consumption Advisory	2012
Schweitzer Reservoir	Mercury	2011

Watershed Overview / Ecology / Biodiversity

- The Escanaba River watershed covers over 920 square miles.
- Over 66 percent of the watershed is forested.
- Over 508 miles of the streams flow year-round.
- The Escanaba River watershed is one of the watersheds within which the Sault Ste. Marie Tribe of Chippewa Indians live.

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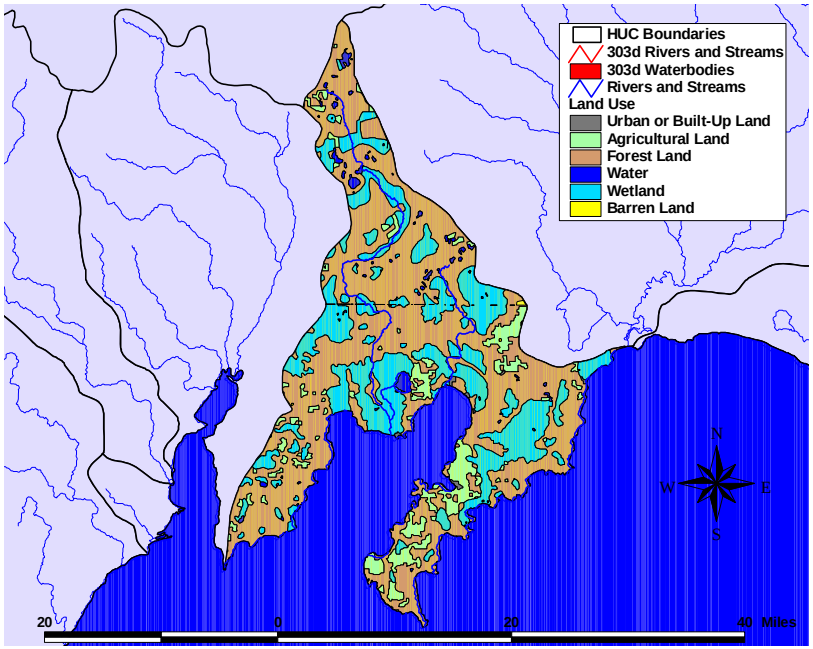
Fishdam-Sturgeon Watershed

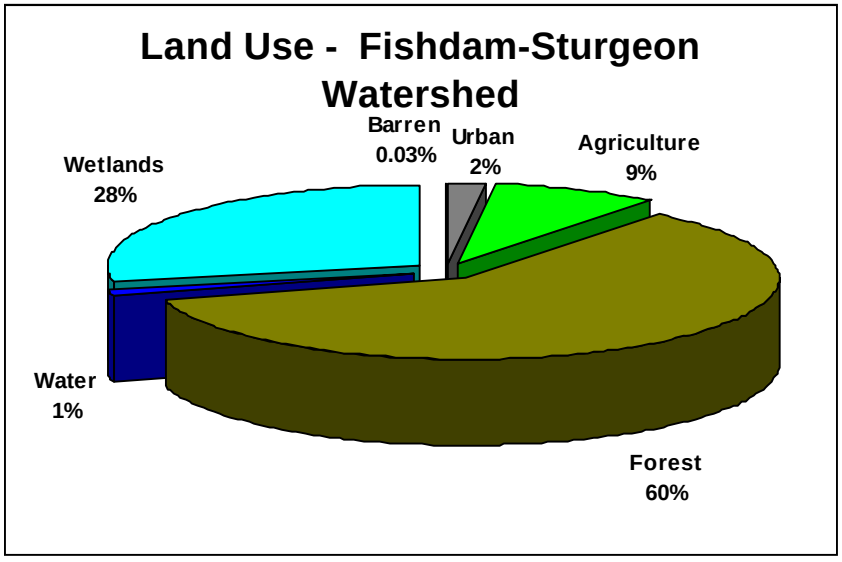
Hydrologic Unit Code: 04030112



For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030112

Watershed Overview / Ecology / Biodiversity

- The Fishdam-Sturgeon watershed is located in the upper peninsula of Michigan and covers approximately 559 square miles.
- The watershed has approximately 123 miles of Lake Michigan shoreline.
- The watershed is 60 percent forest and 28 percent wetland. Most of the wetlands are coastal wetlands.
- The watershed has 260 miles of rivers and streams.
- There are no impaired waters in the Fishdam-Sturgeon watershed.



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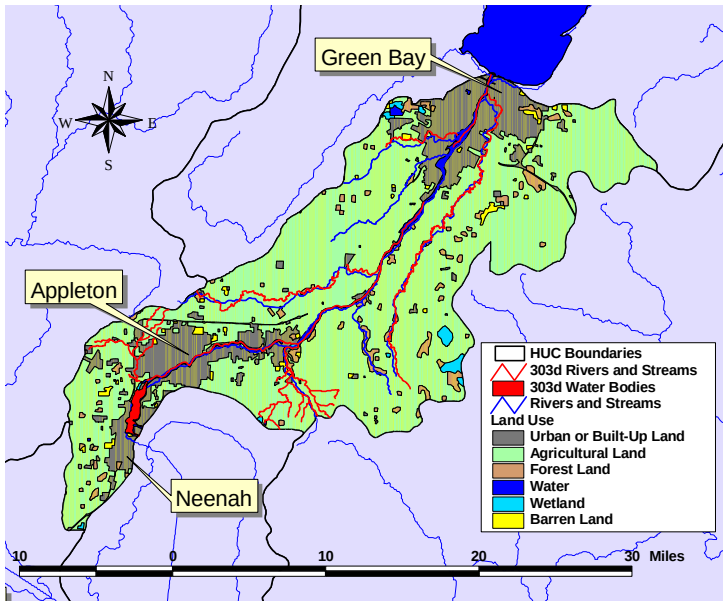
Lower Fox River Watershed

Hydrologic Unit Code: 04030204



Watershed Contacts

- The University of Wisconsin-Extension – http://clean-water.uwex.edu/foxwolf/
- Fox Wolf Watershed Alliance http://www.fwb2k.org/
- Lake Michigan Forum - http://www.lkmichiganforum.org/
- Bob Behrens, the Lower Fox River Water Basin Team Leader - behrer@dnr.state.wi.us

For more information, see the Wisconsin Department of Natural Resources' "Wisconsin's Basins" website at http://dnr.wi.gov/org/gmu/gmu.html and the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030204

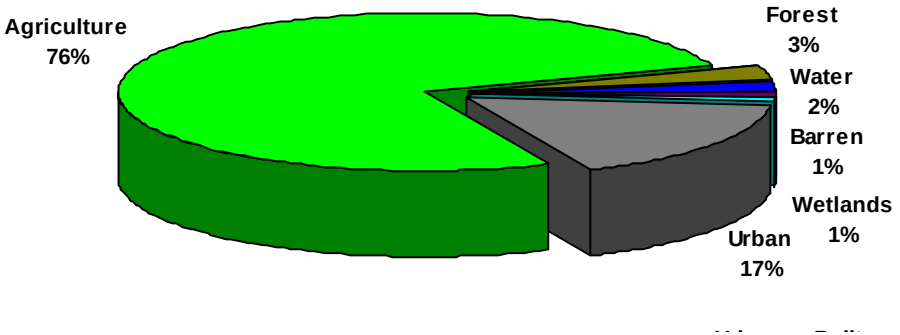
Watershed Overview / Ecology / Biodiversity

- Recreational highlights include wildlife watching, hiking, fishing, hunting, bicycling, horseback riding, snowmobiling, skiing, camping, picnicking, and water sports.
- The Lower Fox River originates at the outlet of Lake Winnebago and flows northeast for 39 miles where it empties into the bay of Green Bay.
- With an average daily flow of 4,320 cubic feet of water per second, the Lower Fox River is characterized as a large, non-wadeable, low-transparency river interrupted by a series of locks and dams.
- Much of the drinking water in the basin is derived from groundwater. However, the City of Green Bay receives its drinking water from Lake Michigan. Various basin communities are reviewing alternatives for drinking water as the basin's aquifer declines.
- Numerous endangered, threatened and otherwise rare species exist in the basin, including the endangered Barn Owl and the threatened Small White Lady's Slipper.
- The main stem of the Fox River in the Lower Fox River Basin is fragmented by a series of 17 locks and 12 dams that were built in the mid 1800's to aid navigation or produce power.
- The Oneida Reservation, established by an 1838 Treaty, is in the basin. It is participating in the State's priority watershed program and the WTCAC.
- Wildlife include songbirds, white- tailed deer, rabbits, red fox, coyote, pheasant, Hungarian partridge, squirrel, skunk, raccoon, upland game birds, waterfowl, bats, small mammals and invertebrates, reptiles, amphibians and many others.
- The Lower Fox River Basin encompasses three of the state's ecological landscapes: Northern Lake Michigan Coastal, Southeast Glacial Plains, and Northeast Plains.
- Wildlife diversity and populations are affected by the variability of habitats within the basin. The two main terrestrial habitats within the basin are open land and woodland. Aquatic habitats within the area are wetland, riverine, and lacustrine (lakes or lake- like).
- Open land consists of cropland, orchards, pastures, and meadows, and comprises the largest type of habitat within 0.5 mile of the Lower Fox River. Woodland habitat includes hardwood and conifer forest land and wooded lots with an associated understory of shrubs, grasses, legumes, and herbaceous plants.

Watershed Activities / Concerns / Priorities

- The Wisconsin Department of Natural Resources manages the watershed as part of the Lower Fox River management area that also includes a portion of the Duck-Pensaukee watershed. Environmental concerns include:
  - Habitat loss, deterioration and fragmentation from rapid development and conversion of rural lands.
  - Water quality problems from contaminated sediment, runoff in urban and agricultural areas, floodplain development and overuse of groundwater supplies (with groundwater quality implications).
  - Heavy recreational use of resources, such as lakes and shorelines;
  - Exotic species are a continuing emerging problem. Plant species such as reed canary grass, purple loosestrife, buckthorn, garlic mustard and Eurasian water milfoil quickly out-compete native species and affect ecosystem balance. Zebra mussels and rusty crayfish are spreading, disrupting stream and lake ecology.
  - Monitoring of wildlife populations, water quality, and ecosystem function are needed to understand the status and trends of resources.
- The main priorities identified in the integrated management plan include:
  - Increase and protect critical habitats and habitat integrity;
  - Sustain a diverse, balanced and healthy ecosystem;
  - Improve surface water and groundwater quality and identify water conservation opportunities;
  - Establish a self-sustaining, balanced, and diversified edible fish community;
  - Manage resources for multiple users;
  - Strengthen program support and enforcement initiatives; and
  - Improve educational programs.

Land Use
Lower Fox River Watershed



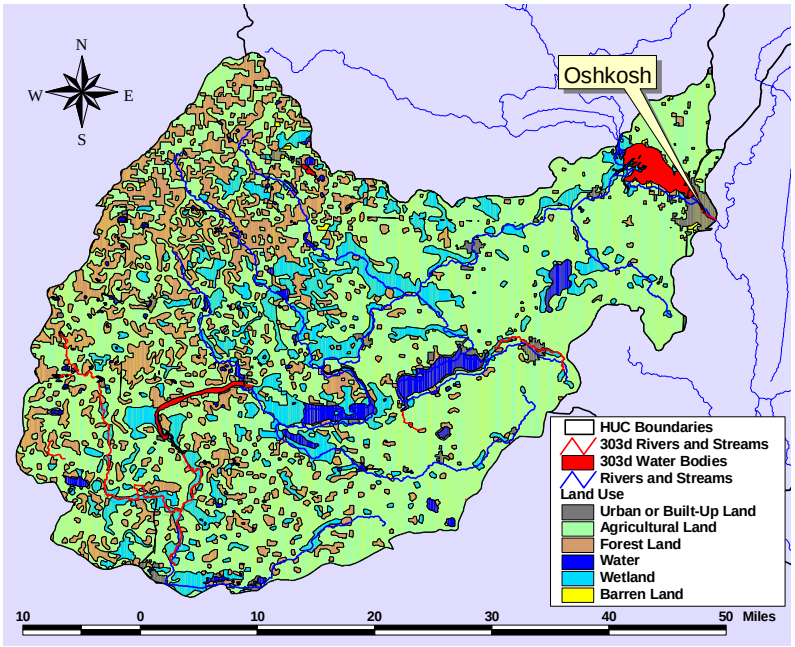
Impaired (303d) Waters

Waterbody Name	Impairment	TMDL Submittal
Apple Creek *	Nutrients	NA
	Flow Alteration(S)	
	Loss Of Instream Habitat	
	Organic Enrichment/Low Dissolved Oxygen	
	Sediment	
	Temperature	
Apple Creek *	Nutrients	NA
	Flow Alteration(S)	
	Loss Of Instream Habitat	
	Organic Enrichment/Low Dissolved Oxygen	
	Sediment	
	Temperature	
Dutchman Creek	Nutrients	NA
	Ammonia	
East River * *	Nutrients	NA
	Turbidity	
	Fish Consumption Advisories (PCBs)	
	Fish Kills	
	Loss Of Instream Habitat	
	Organic Enrichment/Low Dissolved Oxygen	
	Sediment	
	Toxics	
East River **	Nutrients	NA
	Turbidity	
	Fish Kills	
	Loss Of Instream Habitat	
	Organic Enrichment/Low Dissolved Oxygen	
	Sediment	
Fox River	Fish Consumption Advisories (PCBs)	NA
	Organic Enrichment/Low Dissolved Oxygen	
Kankapot Creek	Loss Of Instream Habitat	NA
Mud Creek	Loss Of Instream Habitat	NA
Neenah Slough	Fish Consumption Advisories (PCBs)	NA
	Organic Enrichment/Low Dissolved Oxygen	
Plum Creek	Loss Of Instream Habitat	NA
	Temperature	
Winnebago Lake	Nutrients	NA
	Fish Consumption Advisories (Mercury)	
	Fish Consumption Advisories (PCBs)	
	Organic Enrichment/Low Dissolved Oxygen	
	Sediment	

Upper Fox River Watershed

Hydrologic Unit Code: 04030201

For more information, see the Wisconsin Department of Natural Resources' "Wisconsin's Basins" website at http://dnr.wi.gov/org/gmu/gmu.html and the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030201http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030201



Watershed Contacts

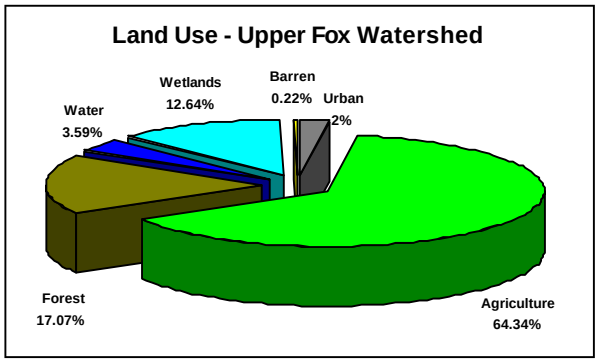
- The University of Wisconsin-Extension – http://clean-water.uwex.edu/foxwolf/
- Fox Wolf Watershed Alliance http://www.fwb2k.org/
- Lake Michigan Forum - http://www.lkmichiganforum.org/
- Rob McLennan, the Upper Fox River Water Basin Team Leader - Robin.McLennan@dnr.state.wi.us

Watershed Overview / Ecology / Biodiversity

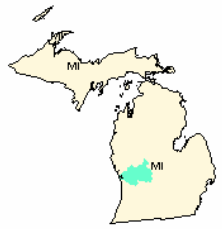
- The Upper Fox River basin is 1640 square miles, with 48 square miles of inland lakes.
- The watershed's primary land use is agricultural at 65 percent. Forests and wetlands provide significant land cover at 17 and 12 percent, respectively.
- Numerous endangered, threatened and otherwise rare species exist in the basin, including the threatened White Lady's Slipper, a species that needs fens and calcareous wet prairies, and Forster's Tern, which needs large marshes, estuaries and lake islands.
- Over 10% of the basin area is wetland greater than 40 acres in size, accounting for 145,428 acres. The total wetland area is actually much greater, as mapping identifies wetlands as small as 2 acres in size.
- There are over 55,678 acres of major public lands in the Upper Fox management basin including 51,311 acres of state wildlife, fisheries and park lands (not including the 11 state natural areas in the basin) and 4,367 acres of U.S. Fish and Wildlife Service wildlife refuge and waterfowl production acres.
- The Basin includes the Central Sand Ridges, Southeast Glacial Plains, and a small portion of the Central Sand Plains Ecological Landscapes.
- Most of the basin's cold water trout streams are located in the western portion of the basin near the Sandy Ridges ecosystem. Warm water rivers, streams and lakes support various game and non- game species including large and small mouth bass, walleye, northern pike, catfish and sturgeon.
- Common woodland wildlife include white- tailed deer, turkey, ruffed grouse; upland/ grassland wildlife includes ring- necked pheasant, non- game songbirds (vesper sparrow, bobolink (right), meadowlark); grassland nesting waterfowl include mallards and blue- winged teal. Wetland species include various waterfowl, amphibians and reptiles.
- Oak- hickory is the most common forest type and the tree species with the greatest volume in the Upper Fox Basin is white oak followed by black and pin oak, white and red pine, aspen and soft maple.

Watershed Activities / Concerns / Priorities

- The Upper Fox River basin is part of the Wisconsin DNR's Upper Fox River basin management area, which also includes the Lake Winnebago watershed.
- There are a large number of dams on the Upper Fox River system. Several have been removed, including 2 on the Baraboo River. Data collected from the removal demonstrate that historical fish species have returned, and the population of exotic species declined.
- The Upper Fox watershed is home to the state's largest Wetland Reserve Restoration Program (WRP). Duffy's Marsh is a 1,732 acre wetland restoration project in Marquette County. There are over 60 WRP contracts in the larger Upper Fox River management area (which also includes the Lake Winnebago watershed).
- The Upper Fox Basin Partnership held a workshop to identify concerns and issues facing natural resources in the basin. The three priorities listed below are not ranked against each other, but rather, they rose to the top when compared to all of the other stressors affecting the natural resources of the basin and the uses of those resources by the public.
  - Wetland filling/ loss
  - Habitat loss and fragmentation
  - Nutrient loading/ Nonpoint Source Pollution
- Other environmental concerns include:
  - Water quality problems from contaminated sediments, runoff in urban and agricultural areas, floodplain development and overuse of groundwater supplies.
  - Riparian/wetland, woodland, and grassland habitat loss, deterioration, and fragmentation from rapid development and conversion of rural lands. Protection and maintenance of habitat is important for maintaining spatial and temporal ecosystem diversity critical for wildlife.
  - Grassland restoration is a major initiative, with virtually the entire historic prairie, sedge meadows and oak savannas having been converted to agriculture due to their flat topography and rich soils.
  - Exotic species are a continuing and emerging problem. Plant species such as reed canary grass, purple loosestrife, buckthorn, garlic mustard, and Eurasian water milfoil can quickly out-compete native species and wreak havoc on ecosystem balance. Zebra mussels and rusty crayfish are spreading to basin waterways, disrupting stream and lake ecology.
  - Monitoring of wildlife populations, water quality, and ecosystem function are needed to understand the status and trends of resources.
- The Oneida Tribe has a water quality protection plan for the reservation and has participated in the State priority watershed Program. It is participating in sediment and phosphorus study for assessment and modeling for the Wisconsin Lower Fox Basin. It is also participating in the Wisconsin NRCS WI Tribal Conservation Advisory Council.



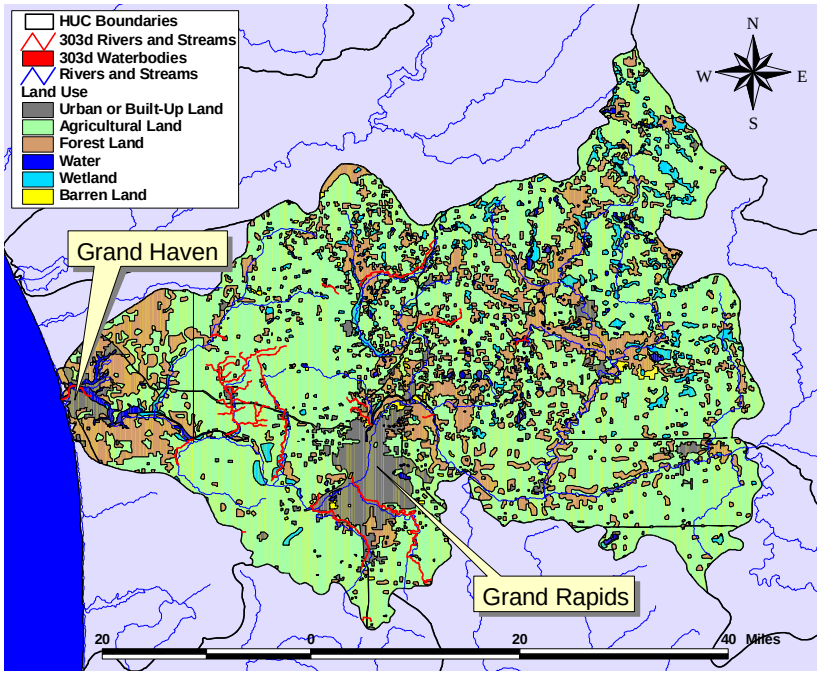
Waterbody Name	Impairment	TMDL Submittal
Buffalo Lake	Mercury Fish Consumption Advisory	NA
Butte Des Morts Lake	Nutrients	NA
	Mercury Fish Consumption Advisory	
	PCB Fish Consumption Advisory	
	Organic Enrichment/Low Dissolved Oxygen	
	Sediment	
Fox River (From Portage North To, But Not Including Buffalo Lake)	PCB Fish Consumption Advisory	NA
Fox River At Buffalo Lake	PCB Fish Consumption Advisory	NA
Fox River, Oshkosh	Aquatic Toxicity	NA
Neenah Slough	PCB Fish Consumption Advisory	NA
	Organic Enrichment/Low Dissolved Oxygen	
Peppermill Creek	Loss Of Instream Habitat	NA
	Sediment	
	Temperature	
Silver Creek (2)	Contaminated Sediments	NA
	Loss Of Instream Habitat	
	Temperature	
Silver Lake (Big)	Aquatic Toxicity	NA
Un. Trib To Mason Lake (T14nr7e S25	Loss Of Instream Habitat	NA
	Sediment	
Wurch Creek	Loss Of Instream Habitat	NA
	Sediment	



Lower Grand River Watershed

Hydrologic Unit Code: 04050006

For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04050006



Approved Watershed Management Plans

- Hager Creek - Ottawa County Parks & Recreation Commission,
- Lake Macatawa - Macatawa Area Coordinating Council
- Plaster Creek - Kent County Drain Commission
- Schoolhouse Creek - Kent County Drain Commission
- Spring Lake - Spring Lake Lake Board
- Bear Creek - Cannon Township
- Buck Creek - Grand Valley Metro Council
- Crockery Creek - Muskegon Conservation District
- Rogue River - Grand Valley Metro Council
- Sand Creek - Grand Valley Metro Council
- York Creek - Alpine Township

Watershed Overview / Ecology / Biodiversity

- The Lower Grand watershed covers 2012 square miles
- Over 68 percent of the land use is agricultural
- There are 17 listed impaired waters
- Grand Rapids and Grand Haven are the major urban areas in the watershed
- The Grand River Watershed is the largest watershed in the State of Michigan. The watershed has been divided into two parts, the Lower Grand River Watershed and the Upper Grand River Watershed. The Lower Grand River Watershed covers ten counties.

Conservation Groups

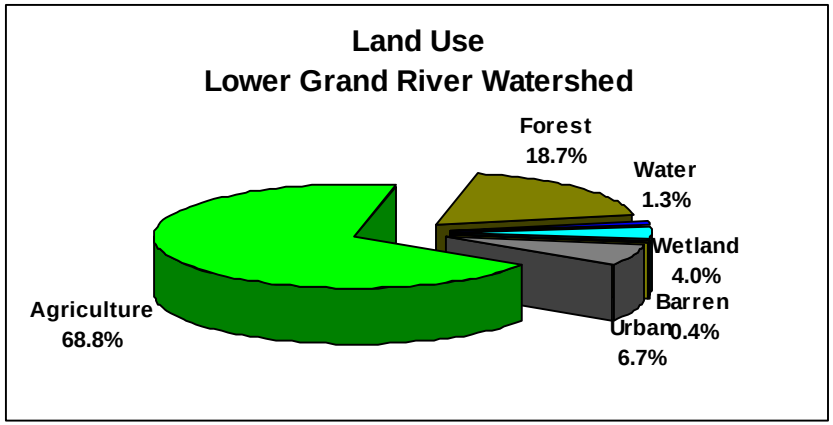
- Ottawa County Parks & Recreation Commission, http://www.co.ottawa.mi.us/parks/
- Macatawa Area Coordinating Council http://www.macatawa.org/~macc/
- Kent County Drain Commission http://www.accesskent.com/government/departments/drain_index.htm
- Kent County Drain Commission
- Spring Lake Lake Board
- Rogue River Watershed Council
- West Michigan Environmental Action Council
- Natural Resource Conservation Service
- Grand Valley State University Annis Water Resources Institute, http://www.gvsu.edu/wri/isc/lowgrand/

Watershed Activities / Concerns / Priorities

- A Section 319 Watershed Management Planning Grant was awarded by the Michigan Department of Environmental Quality (MDEQ) to facilitate the development of a watershed management plan for the Lower Grand River Watershed. The grant was awarded to the Grand Valley Metro Council. The Grand Valley Metro Council has contracted with the Annis Water Resources Institute and Fishbeck, Thompson, Carr & Huber, Inc. to complete the management plan. Many communities are participating in the development of this plan. Counties, cities, and townships are currently involved by matching funds or in kind services.

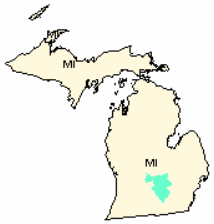
- Ottawa County Parks to stop this erosion and to restore the Hager Creek area to its natural condition. To achieve this goal, the Hager Creek Watershed Management Plan was developed. This plan, which has been approved by the Michigan Department of Environmental Quality, looks at the entire length of Hager Creek as well as the surrounding land including properties west of 28th Avenue.

- The primary goal of the Sand Creek Watershed Project is to restore or improve the cold water fishery. The secondary goal of the project is to protect and improve the habitats of native aquatic life and wildlife.



Impaired (303d) Waters

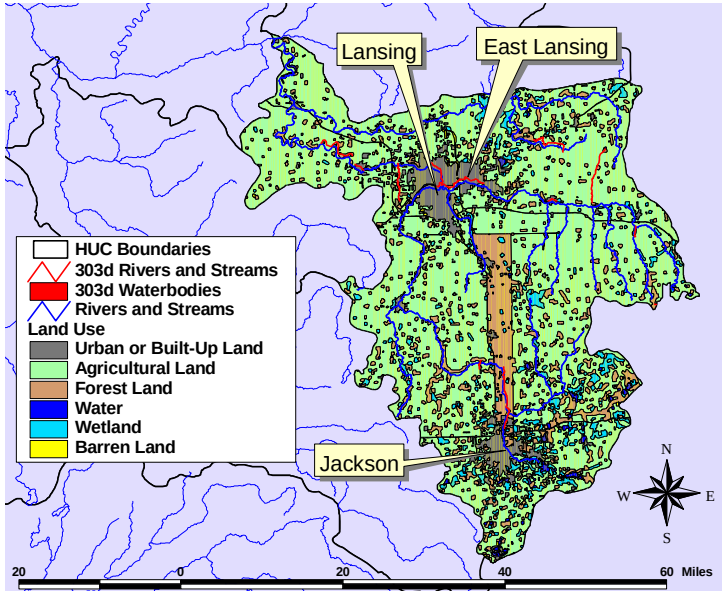
Waterbody Name	Impairment	Anticipated TMDL Submittal
Ball Creek	Macroinvertebrate Community Rated Poor	2001
Bass River	Pathogens	2006
	Fish Community Rated Poor	2006
	Macroinvertebrate Community Rated Poor	2006
Buck Creek	Pathogens	2006
Deer Creek (Watershed)	Nutrients	2011
	Pathogens	2011
	Dissolved Oxygen	2011
	Fish Community Rated Poor	2011
	Fish Kills	2011
	Macroinvertebrate Community Rated Poor	2011
Duke Creek	Macroinvertebrate Community Rated Poor	2006
Grand River	PCBs Fish Consumption Advisory	2009
	PCBS	2009
Grand River	Mercury	2010
Grand River	Pathogens	2006
Plaster Creek	Pathogens	2001
	Fish Community Rated Poor	2001
	Macroinvertebrate Community Rated Poor	2001
Rainbow Lake	Mercury	2011
Rio Grande Creek	Pathogens	2002
Sand Creek	Fish Community Rated Poor	2006
Stegeman Creek	Macroinvertebrate Community Rated Poor	2006
Strawberry Creek	Fish Community Rated Poor	2006
Unnamed Tributary To Grand River	Fish Community Rated Poor	2006
Wabasis Lake	Mercury	2011
York Creek	Fish Community Rated Poor	2006



Upper Grand River Watershed

Hydrologic Unit Code: 04050004

For more information, see the USEPA website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04050004



Approved Watershed Management Plans

- Carrier Creek - Eaton County Drain Commission

Watershed Management Plans Under Development

- Upper Grand River – Grand Valley State University Annis Water Resources Institute

Watershed Organizations

- Eaton County Drain Commission, http://www.eatoncounty.org/Drain/Drain.htm
- Grand Valley State University Annis Water Resources Institute, www.gvsu.edu/wri

Watershed Overview / Ecology / Biodiversity

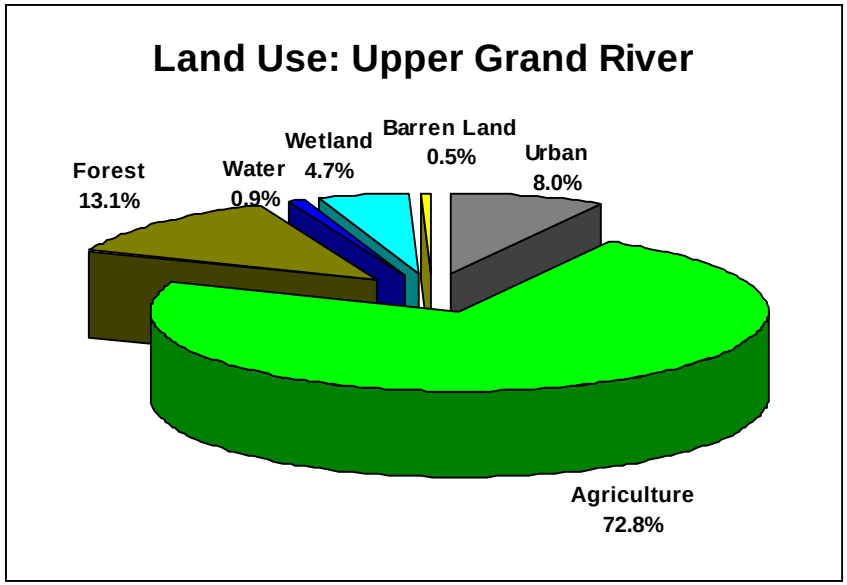
- The Upper Grand River watershed is almost 1750 square miles.
- Almost three quarters of the land is in agricultural use.
- There are three urban areas in the watershed: Lansing, East Lansing, and Jackson, Michigan.
- The watershed has 10 listed impaired waters.
- There are 958 miles of river and streams in the watershed.
- The Upper Grand watershed flows into the Lower Grand River watershed, where it then flows into Lake Michigan

Watershed Activities / Concerns / Priorities

- A 319 grant was awarded to the Annis Water Resources Institute to develop an Upper Grand River watershed management plan.
- The Dahlem Nature Center was awarded $12,000 in grant funds to assess the benthic macroinvertebrate community, stream habitat, and water chemistry in the Upper Grand River Watershed.
- Development in Delta and Windsor townships over the last several years has significantly changed the landscape around Carrier Creek:
  - An increase in the amount of impervious surface area (i.e., rooftops and parking lots) has caused an increase in the amount of rainwater draining into Carrier Creek.
  - Water levels are flashy, fluctuating from just a few inches to nearly four feet after heavy rains.
  - Because of past dredging activities, natural floodplains have been separated from the creek and are no longer available for water storage.
- The Carrier Creek Stormwater Management and Restoration Project was developed to address these challenges. Without improvement, the increased water volume entering the creek will cause increased flooding, further erosion, and increased flashiness.
  - South of I-496 (upstream), efforts will focus on creating an effective drainage system and reducing flashy hydrology to the downstream portions of the drain.
  - North of I-496 (downstream), work will focus on creek restoration.

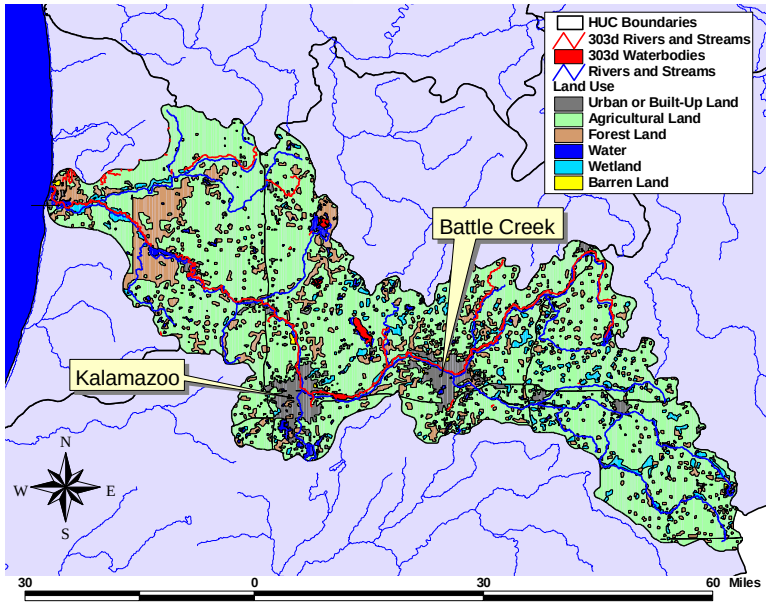
Impaired (303d) Waters

Waterbody Name	Impairment	Anticipated TMDL Submittal
Albrow Creek	Pathogens	2007
Carrier Creek	Erosion	2000
	Impaired Biologic Community	2000
Grand River	PCB Fish Consumption Advisory	2009
	PCBs	2009
Grand River	Pathogens	2008
Grand River	Pathogens	2003
	Dissolved Oxygen	2003
	Fish Community Rated Poor	2003
	Macroinvertebrate Community Rated Poor	2003
Grand River And Red Cedar River#	Pathogens	2011
	Dissolved Oxygen	2011
	Fish Kills	2011
Red Cedar River	Fish Community Rated Poor	2003
Red Cedar River	Pathogens	2011
	Dissolved Oxygen	2011
Vermillion Creek	Pathogens	2009
Wolf Creek	Nutrients	2005
	Fish Community Rated Poor	2005
	Macroinvertebrate Community Rated Poor	2005



Kalamazoo River Watershed

Hydrologic Unit Code: 04050003



Approved Watershed Management Plans

- Davis, Gourdneck and Portage Creeks - Forum for Greater Kalamazoo
- Four Townships Area - Four Townships Water Resources Council
- Greater Battle Creek Area - Calhoun Conservation District
- Little Rabbit River - Allegan Conservation District
- Portage and Arcadia Creek - Forum of Greater Kalamazoo
- Rice Creek - Calhoun Conservation District
- Upper Rabbit River - Allegan Conservation District

Watershed Groups

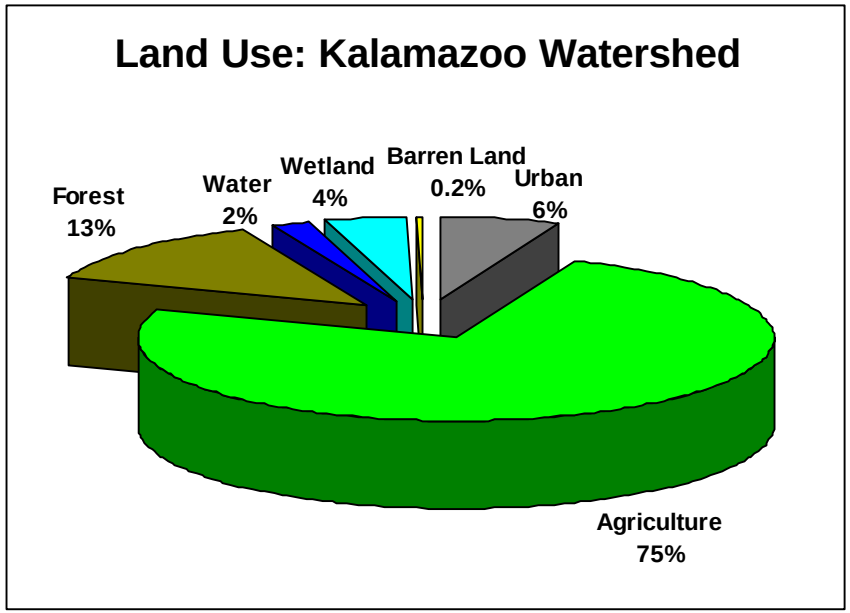
- Kalamazoo river Network www.kalamazooriver.net
- The Forum of Greater Kalamazoo www.theforum.com
- Four Townships Water Resources Council http://community.mlive.com/cc/4twrc
- Calhoun Conservation District - http://www.calhouncd.org/
- Allegan Conservation District -http://allegancd.org/

Watershed Overview / Ecology / Biodiversity

- The Kalamazoo basin watershed covers 2029 square miles.
- Almost 75 percent of the watershed is agricultural use
- There are three urban areas in the watershed: Kalamazoo, Battle Creek, and Albion
- The basin includes 22 listed impaired waterways.
- The Kalamazoo River is an Area of Concern due to PCB contamination.

Watershed Activities / Concerns / Priorities

- A Watershed Management Plan (WMP) [funded for a two-year period beginning July 1, 2001 by a Nonpoint Source Pollution Grant under Section 319 of the Clean Water Act (CWA)] is being developed for Portage Creek and Arcadia Creek in the south central portion of the Kalamazoo River Watershed. The Kalamazoo River Watershed drains eight counties in Southwest Lower Michigan and empties into Lake Michigan at Saugatuck, Michigan.
- In 2002 the Four Township Water Resources Council completed a 3 year program to protect surface water quality under Section 319 of the federal Clean Water Act. The Michigan DEQ and U.S. EPA have awarded the Council a second grant of $210,000 for 2 years. The Council will provide an additional $70,000 in local contributions towards the project. The project will continue current programs to assist local governments develop land use planning and zoning strategies, create and distribute research and educational materials and facilitate conservation easements. In addition two new important programs will be implemented. The Council will greatly expand its citizen education program on local resource protection and is expanding the Natural Features Inventory of the Four Township area.
- The Battle Creek River Watershed Project is an effort by landowners, residents, conservation groups, and local, state, and federal agencies to protect the quality of water for drinking, agriculture, recreation, wildlife, and fisheries. The Battle Creek River has been identified as one of the leading contributors of phosphorus and sediment to the Kalamazoo River. A watershed management plan will be developed that integrates the concerns of watershed stakeholders and, through implementation, improves the water quality within the watershed area.
- The goal of the Gun River watershed project is to improve water quality and aquatic habitat in the Gun River Watershed for the benefit of present and future generations. The objectives of the planning project are to locate sources of pollution in the watershed, to prioritize critical areas within the watershed in which to focus implementation efforts, and to build and retain a high level of stakeholder awareness and participation. The project is designed to compliment current efforts in the Kalamazoo River/Lake TMDL process, to reduce phosphorus, and improve water quality.
- Match-e-be-nash-she-wish Band of Pottawatomi (Gun Lake Band) is involved in Kalamazoo River watershed

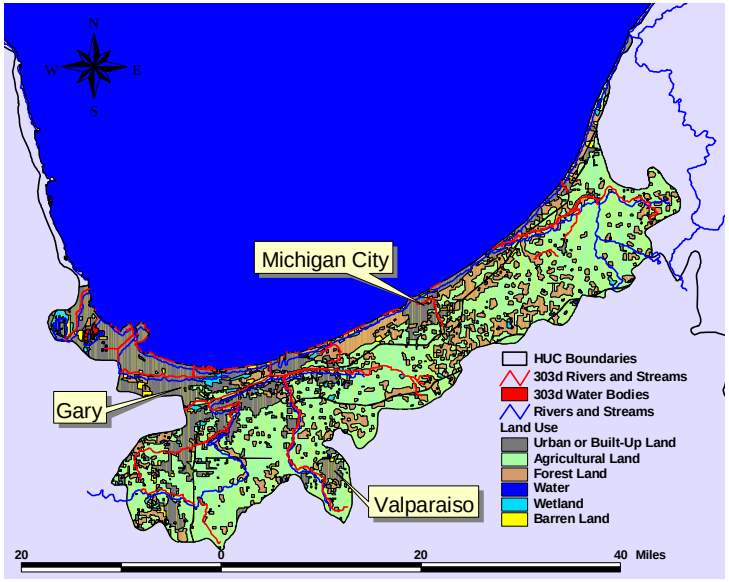


For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04050003

Waterbody	Impairment	TMDL Submittal
Augusta Creek	Macroinvertebrate Community Rated Poor	2006
Battle Creek River	Fish Consumption Advisories (PCBs)	2010
Black Creek	Nutrients	2004
	Macroinvertebrate Community Rated Poor	2004
	Nuisance Plant Growth	2004
	Total Dissolved Solids	2004
Brickyard Creek	Macroinvertebrate Community Rated Poor	2011
Chart Creek, E. Br.	Macroinvertebrate Community Rated Poor	2001
Crooked Creek	Macroinvertebrate Community Rated Poor	2011
Davis Creek	Fish Community Rated Poor	2004
	Macroinvertebrate Community Rated Poor	2004
Fenner Lake	Nutrients	2006
	Fish Consumption Advisories (PCBS)	2006
	Nuisance Plant Growths	2006
Gull Lake	Mercury	2011
	Fish Consumption Advisories (PCBs)	2010
Gun Lake	Pathogens	2011
Gun River	Macroinvertebrate Community Rated Poor	2011
Kalamazoo River	Mercury	2010
Kalamazoo River	Fish Consumption Advisories (PCBs)	2006
Lake Macatawa	Chlordane	2009
	Fish Consumption Advisories (PCBs)	2009
Little Rabbit River	Macroinvertebrate Community Rated Poor	2010
Mann Creek	Bacterial Slimes	2011
	Macroinvertebrate Community Rated Poor	2011
	Organic Enrichment	2011
Pine Lake	Mercury	2011
Rabbit River	Endosulphan	2005
	Macroinvertebrate Community Rated Poor	2005
Red Run	Dissolved Oxygen	2007
	Fish Community Rated Poor	2007
	Macroinvertebrate Community Rated Poor	2007
Rice Creek	Macroinvertebrate Community Rated Poor	2011
Selkirk Lake	Fish Consumption Advisories (Mercury)	2011
Wannadoga Creek	Macroinvertebrate Community Rated Poor	2011

Little Calumet – Galien Watershed

Hydrologic Unit Code: 04040001



Approved Watershed Management Plans

- Galien River - The Conservation Fund http://www.chikamingopenlands.org
- Berrien County Drain Commissioner http://www.berriencounty.org/draincomm/

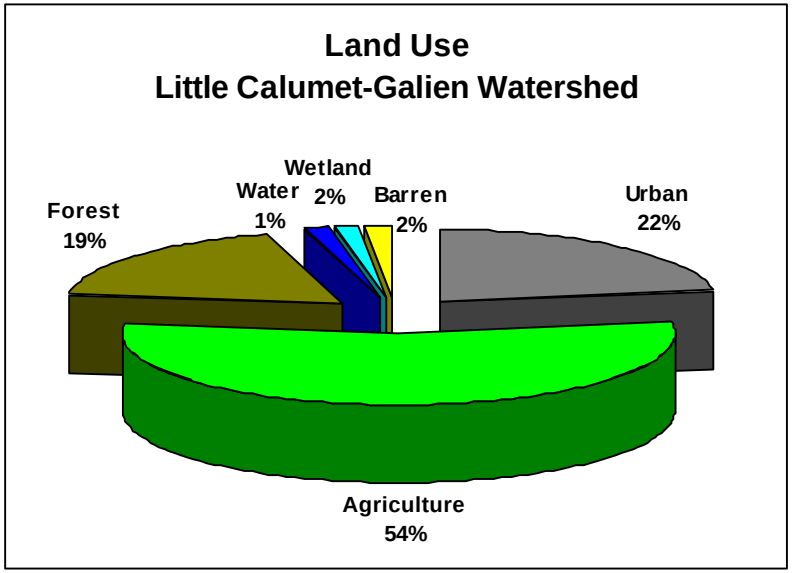
Watershed Organizations

- Grand Cal Task Force -http://www.grandcal.org/
- Save the Dunes Council - http://www.savedunes.org/
- Chicago Wilderness - http://www.chiwild.org/

For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04040001

Watershed Overview / Ecology / Biodiversity

- Urban areas include Chicago, Gary, Michigan City, and Valparaiso.
- The watershed covers 723.72 square miles
- The watershed has 27 listed impaired waters.
- Most coastal wetlands and nearshore aquatic habitats have been eliminated or degraded. The effect of natural forces on sand transport and shoreline development has been greatly reduced or eliminated entirely in some areas.
- Industry filled or drained the wetlands and leveled the dunes and used steel slag to fill low areas and the lakefront. The Little Calumet River has actually been moved several times to accommodate industry.
- The region remains one of the most industrialized in the Lake Michigan basin.
- Presettlement northwest Indiana was continuous wetland. As of 1979, less than 5 percent of the original wetland cover remained. This exists primarily as narrow strips of intact habitat.
- The Indiana Dunes National Lakeshore has more plant species (including exotics) than all but two other national parks, and at 16,000 acres is much smaller than most other national parks.
- Warren Dunes State Park provides 1,950 acres of recreational opportunities along the beautiful shore of Lake Michigan in southwestern Michigan. The rugged dune formation rises 240 feet above the lake The park has more than two miles of shoreline, six miles of hiking trails and is open year-round.



Watershed Activities / Concerns / Priorities

- The City of Gary and The Grand Calumet Task Force maximize the benefit of the Grand Calumet River cleanup by looking at ways to improve the surrounding environment for the benefit of the community in Gary.

- The US Army Corps of Engineers (USACE) is in process of dredging the sediments from the Indiana Harbor and Ship Canal in order to continue its use as a navigable waterway.

- The Galien River Watershed Project is focused on decreasing drainage and flooding problems along the river and the streams flowing into it. The focus of a 319 grant is flood prevention and improved water quality in the system. Beneficiaries will be local farmers and those interested in fishing and other recreational activities.

- The Grand Calumet Task Force in partnership with the City of East Chicago and the East Chicago Housing Authority will work together with the residents of the West Calumet section of East Chicago to create an Urban Open Space.

- The watershed includes a Great Lakes Area of Concern. Problems in the AOC include contamination from polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs) and heavy metals, such as mercury, cadmium, chromium and lead. Additional problems include high fecal coliform bacteria levels, biochemical oxygen demand (BOD) and suspended solids, oil and grease. Nonpoint sources include:
  - Contaminated Sediment.
  - Industrial Waste Site Runoff.
  - CERCLA Sites.
  - Hazardous Waste Sites under RCRA
  - Underground Storage Tanks (USTs)
  - Atmospheric Deposition
  - Urban Runoff.
  - Contaminated Groundwater

Point sources of contaminants include:
? Industrial and Municipal Wastewater Discharges.
? Combined Sewer Overflows (CSOs).

Impaired (303d) Waters

Waterbody Name	Impairment	TMDL Submittal
Deer Creek, MI	Pathogens	2004
	Algae	2004
	Bacterial Slimes	2004
	Macroinvertebrate Community Rated Poor	2004
Galien River, MI	Pathogens	2000
	E. Coli	2000
Galien River, MI	Chlordane	2009
	PCB Fish Consumption Advisory	2009
Galien River, E. Br., MI	Nutrients	2009
	Algae	2009
Sawyer Creek, MI	Nutrients	2003
	Algae	2003
	Macroinvertebrate Community Rated Poor	2003
Beaver Dam Ditch, IN	Impaired Biotic Communities	2007
Burns Ditch, IN	Pesticides	2004
	Lead	2004
	E. Coli	2004
	Mercury Fish Consumption Advisory	2012
	PCB Fish Consumption Advisory	2012
	Impaired Biotic Communities	2007
Deep River, IN	Impaired Biotic Communities	2007
Dunes Creek, IN	Impaired Biotic Communities	2007
Grand Calumet River (East Branch), IN	Pesticides	
	Copper	2000
	Lead	2000
	Cyanide	2000
	Oil And Grease	2000
	Mercury Fish Consumption Advisory	2000
	PCB Fish Consumption Advisory	2000
	Impaired Biotic Communities	2000

Little Calumet-Galien Watershed
Impaired 303(d) Waters continued

Waterbody Name	Impairment	TMDL Sub-mittal
Trail Creek, IN	Cyanide	2004
	E. Coli	2004
	Mercury Fish Consumption Advisory	2012
	PCB Fish Consumption Advisory	2012
Turkey Creek, IN	Impaired Biotic Communities	2007
Wolf Lake, IN	PCB Fish Consumption Advisory	2012
Calumet R, IL	Metals	
	Nutrients	
	Ammonia	
	Organic Enrichment/Low Dissolved Oxy-gen	
	Other Habitat Alteration(S)	
Calumet R, IL	Metals	
	Nutrients	
	Ammonia	
	Organic Enrichment/Low Dissolved Oxy-gen	
	Other Habitat Alteration(S)	
Wolf, IL	Nutrients	
	Suspended Solids	
	Noxious Aquatic Plants	
	Organic Enrichment/Low Dissolved Oxy-gen	
	Siltation	
Grand Calumet River (West Branch), IN	Pesticides	2000
	Lead	2000
	Cyanide	2000
	Ammonia	2000
	Chlorides	2000
	Dissolved Oxygen	2000
	Mercury Fish Consumption Advisory	2000
	PCB Fish Consumption Advisory	2000
	Impaired Biotic Communities	2000
Grand Calumet River Lagoons / Marquette Park Lagoon, IN	PCB Fish Consumption Advisory	2000
Indiana Harbor Ca-nal (IHC), IN	Pesticides	2000
	Lead	2000
	Dissolved Oxygen	2000
	Mercury Fish Consumption Advisory	2000
	PCB Fish Consumption Advisory	2000
Indiana Harbor Ca-nal (Lake George Branch Of), IN	Pesticides	2000
	Oil And Grease	2000
	Dissolved Oxygen	2000
	Mercury Fish Consumption Advisory	2000
	PCB Fish Consumption Advisory	2000
	Impaired Biotic Communities	2000
Lake George, IN	PCB Fish Consumption Advisory	2012
Lake Michigan, IN	E. Coli	2004
	Mercury Fish Consumption Advisory	2012
	PCB Fish Consumption Advisory	2012
Little Calumet River, IN	Pesticides	2004
	Cyanide	2004
	E. Coli	2004
	Mercury Fish Consumption Advisory	2012
	PCB Fish Consumption Advisory	2012
Little Calumet River, IN	Mercury Fish Consumption Advisory	2012
	PCB Fish Consumption Advisory	2012
Little Calumet River, IN	Pesticides	2004
	Cyanide	2004
	Mercury Fish Consumption Advisory	2012
	PCB Fish Consumption Advisory	2012
	Impaired Biotic Communities	2007
Niles Ditch, IN	Impaired Biotic Communities	2007
Salt Creek, IN	E. Coli	2004

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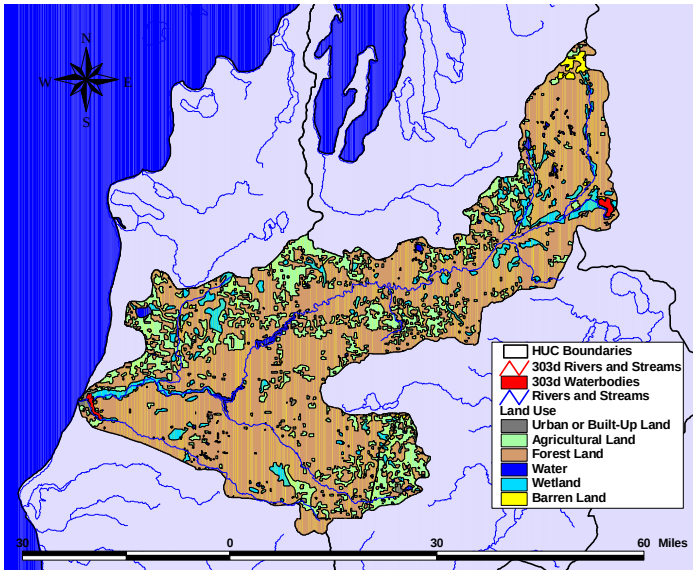
Manistee River Watershed

Hydrologic Unit Code: 04060103



Approved Watershed Management Plans

- Little Manistee River - Conservation Resource Alliance
- Manistee River - Conservation Resource Alliance

Watershed Organizations

- Upper Manistee River Association
- Conservation Resource Alliance
- Little River Band of Ottawa Indians

For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04060103

Watershed Overview / Ecology / Biodiversity

- The Manistee River watershed covers 1904.04 square miles, with less than half of mile of Lake Michigan shoreline.
- Its predominant land use is forest.
- The watershed has just over 15 square miles of inland lakes
- It has 833 miles of waterways, 93 percent of which have been assessed.
- Two waterways are TMDL listed waterways. One is listed for one contaminant and one is listed for three contaminants.
- The Manistee is one of the most stable, high-quality, coldwater streams in the country. It is a groundwater-driven stream.
- Excessive sediment is a primary problem in the watershed, affecting fish reproduction, alters channel morphology, and impairs aquatic invertebrates. The primary sources are erosion from degraded streambanks and poorly designed stream crossings.

Watershed Activities / Concerns / Priorities

- Watershed Restoration work on the Manistee River is carried out by a diverse group of partners organized as members of the Upper Manistee River Restoration Committee. This committee is administered by Huron Pines RC&D and has actively worked on stabilizing streambanks, restoring access sites, and creating aquatic habitat. A partner of the Restoration Committee, the Upper Manistee River Association, is now working on the designation of the Upper Manistee as an official Natural River. Such a status would give the Manistee extended protection from overdevelopment.
- The Little River Band of Ottawa Indians received a 319 grant to address four road-stream crossings that are failing, improve access to the river's edge, and reclaim a lake sturgeon spawning ground.
- The Little River Band of Ottawa Indians received one of the first 20 national watershed grants to support their efforts to restore and monitor the water quality of the Manistee River.

- The Conservation Resource Alliance (CRA) was awarded a Clean Michigan Initiative Grant for the Manistee River Watershed, including Bear Creek, for $696,691, utilizing $263,228 in local match, over a three-year period. Under this grant approximately 6 streambanks and 3 road/stream crossings within the Bear Creek Watershed will be repaired. Additionally, the CRA was awarded $80,000 in Ten Percent Funds from the U. S. Forest Service to repair 5 road/stream crossings in the watershed. CRA was also awarded a TEA 21 Grant from the Michigan Department of Transportation that includes money to address eroding road/stream crossings on Bear Creek.

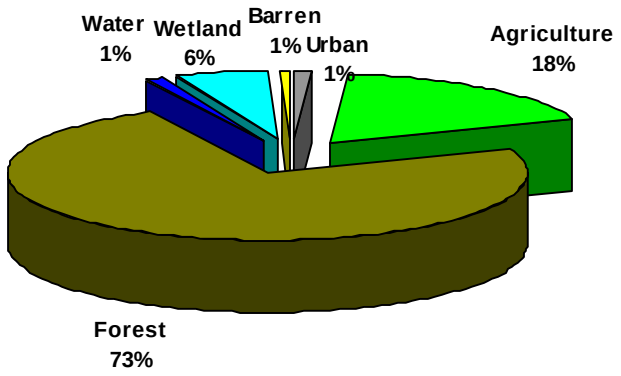
- Three county Road Commissions are working cooperatively in the Pine River subwatershed to address traffic safety and water quality concerns simultaneously. With Phase 1 completed, Phase 2 has been granted $225,000 by the Michigan Department of Transportation to fix failing road/stream crossings in the Pine and Little Manistee watersheds.

- In 2002, two stream bank sites were completed by the Little Manistee River Watershed Partnership using 319 funds.

- Two stream bank sites were restored through the Pine River Watershed Restoration Project in 2002 for the Big Manistee River watershed. Design work began on three Osceola County road crossing sites to be implemented in 2003 or 2004. Site planning work on one additional streambank on the Pine is in progress, with implementation planned for 2004.

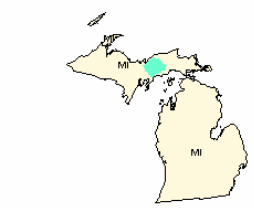
- A three year 319 project on the Manistee River was finished in 2002 by the Manistee River Watershed Partnership Project. The final project, a timber bridge over the north branch near Sharon was completed at a cost of over $320,000. The project was responsible for four large stream banks, and three large road crossings. In addition, the partnership was formed and signed by approximately 35 partners.

Land Use
Manistee River Watershed



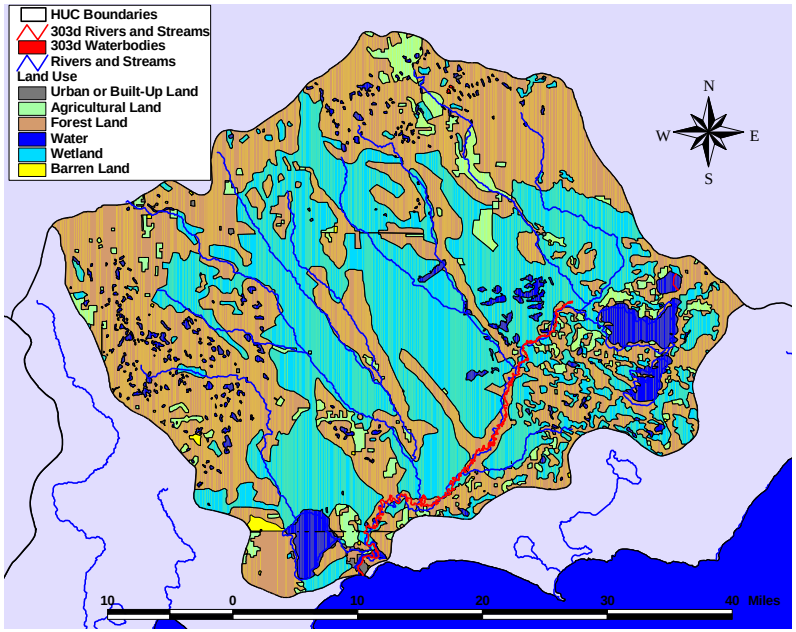
Impaired (303d) Waters

Waterbody	Impairment	Anticipated TMDL Submittal
Lake Margrethie	Mercury	2011
Manistee Lake	Mercury	2011
	Pathogens	2006
	PCBS	2010



Manistique River Watershed

Hydrologic Unit Code: 04060106



Watershed Organiozations

- The Manistique River Area of Concern Public Advisory Committee, Merilee Blowers, chair

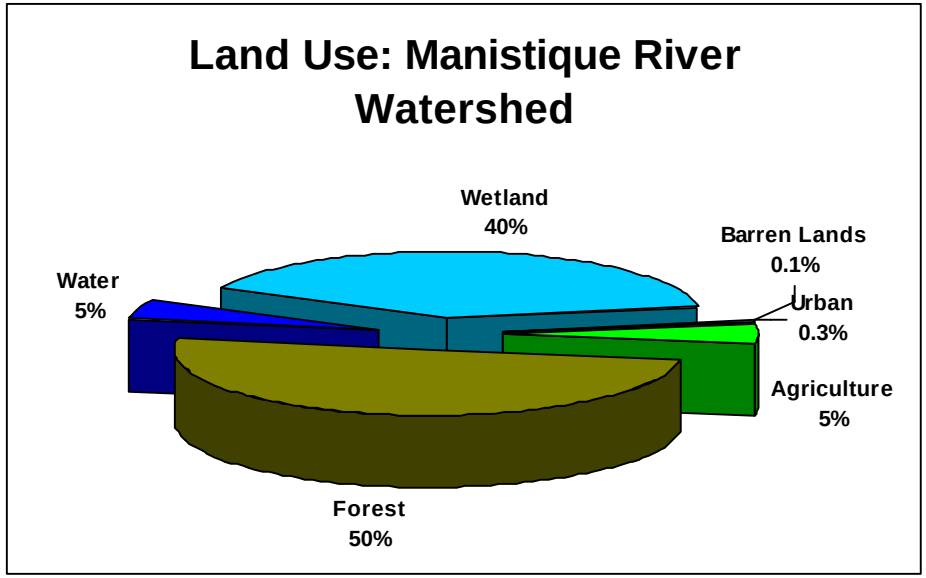
For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04060106 or contact Sharon Baker at bakerSL@michigan.gov.

Watershed Overview / Ecology / Biodiversity

- The Manistique River is an Area of Concern (AOC).
- Historical uses of Manistique River waters in the AOC include receiving wastes from sawmills, a paper mill, small industries, the municipal waste water treatment plant, plus navigation for shipping, ferrying, recreational boating and commercial fishing. Current uses include receiving the wastewater discharges from Manistique Papers, Inc. and the City of Manistique Wastewater Treatment Plant. Recreational uses are mainly boating, sightseeing, and fishing.
- Approximately 141,000 cubic yards of PCB contaminated sediments have been removed from the river and harbor from 1994-2000.
- The dredging of contaminated sediments was completed at the end of 2000. Final dredging was done by divers with hydraulic hoses to minimize resuspension of PCBs and to ensure a clean substrate when completed.
- The Seney National Wildlife Refuge is upriver of Manistique. The refuge is 95,455 acres of field and secondary growth forest. Almost two-thirds of the refuge are varying types of wetlands that provide habitat for threatened and endangered species and a variety of wildlife. The refuge is home to 200 bird species, 26 fish species, and 50 mammalian species. It is also home to such bird species as eagles, loons, and trumpeter swans.

Watershed Activities / Concerns / Priorities

- Restrictions on Fish & Wildlife Consumption include a ban for all persons banning consumption of all carp from the Manistique River below M-94/ Old U.S. 2. and consumption restrictions on channel catfish (below M-94/Old U.S. 2) for women and children, and consumption restrictions on northern pike (upstream from dam at Manistique) for all persons.
- There are beach closings and restrictions on recreational access due to the presence of PCBs at the site and the combined sewer overflow (CSO) pipe located within the AOC that can discharge sewage during storms and during the spring runoff. The AOC is on the list of Michigan Sites of Environmental Contamination identified under Public Act 307. It is one of the highest ranking sites in the state.
- The Manistique River RAP found that the main problem contributing to fishery use impairment was PCBs. Aquatic nuisance species also threaten the fishery productivity. The presence of sawdust in the water and in the sediments severely degrades plant and animal habitat. The dam at the head of the old flume restricts fish passage but effectively blocks lamprey from the upper river.
- There are plans to phase out combined sewer systems by 2020.

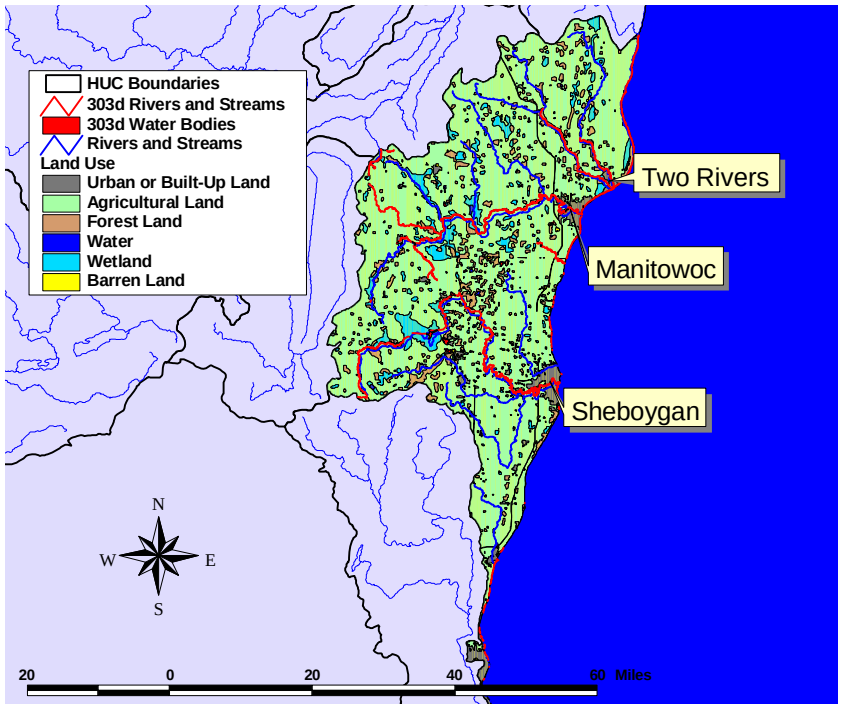


Impaired (303d) Waters

Waterbody Name	Impairment	Anticipated TMDL
Manistique River	Pathogens	2011
	PCBs Fish Consumption Advisory	2000
Manistique River And N. Manistique	Mercury Fish Consumption Advisory	2011
West Branch Lakes	Mercury Fish Consumption Advisory	2011

Manitowoc-Sheboygan Watershed

Hydrologic Unit Code: 04030101



Watershed Contacts

- Sheboygan Rivers Land and Water Basin Partners - http://clean-water.uwex.edu/sheboygan/
- Lakeshore Natural Resources Partnership http://clean-water.uwex.edu/lakeshore/
- Doug Rossberg, Lakeshore Basin Water Team Leader - Doug.Rossberg@dnr.state.wi.us
- Vic Pappas , Sheboygan River Basin Water Team Leader - Victor.Pappas@dnr.state.wi.us

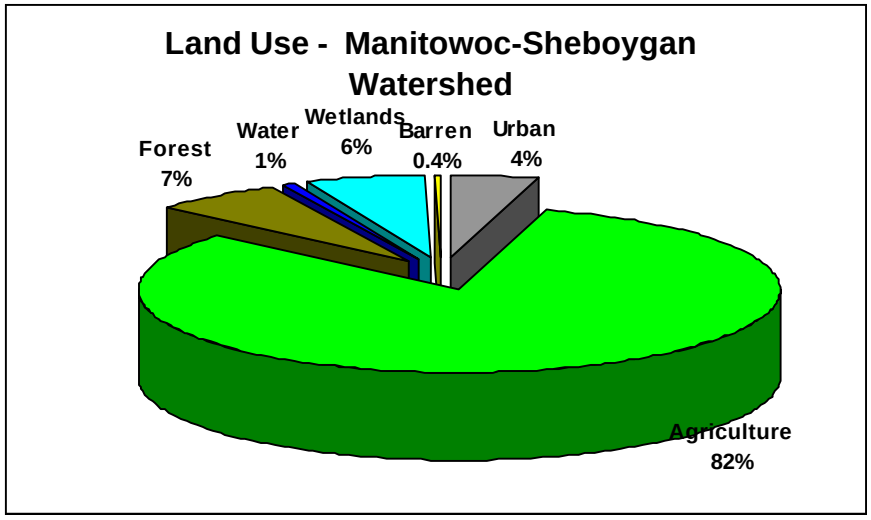
For more information, see the Wisconsin Department of Natural Resources' "Wisconsin's Basins" website at http://dnr.wi.gov/org/gmu/gmu.html and the USEPA website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030101

Watershed Overview / Ecology / Biodiversity

- The major tributaries of the watershed include the Branch River, the North and South branches of the Manitowoc River, the Lower Manitowoc River, Sevenmile and Silver Creeks, (all in the Manitowoc sub-watershed) Sauk and Sucker Creeks, the Black River,the Sheboygan River, the Onion River, the Mullet River, and the Pigeon River (in the Sheboygan River subwatershed).
- The Sheboygan River is an Area of Concern.
- Predominant land uses are agricultural or rural and include pasture land, cropland and vacant fields. Natural Areas, including open water, woodlands, wetlands, parklands and undisturbed non- agricultural lands are the second most abundant land use.
- The Natural Heritage Inventory has documented 10 endangered, 20 threatened and 37 special concern plant and animal species, and 24 rare aquatic and terrestrial communities within the Sheboygan River basin.
- Runoff from specific and diffuse sources, contaminated sediment, habitat modifications (such as channelization and dams) have degraded water quality throughout the Basin.
- Recreational highlights include wildlife watching, hiking, fishing, birding, bicycling, golf, horseback riding, snowmobiling, skiing, camping, picnicking and water sports.
- State facilities such as the Kettle Moraine State Forest, Kohler- Andrae State Parks, Harrington Beach State Park, various state wildlife areas, and the Ice Age National Scenic Trail provide both satisfying and unique recreational experiences.
- The Basin includes the Southeast Glacial Plains and Northern Lake Michigan Ecological Landscapes.
- Some streams have the ability to support rout populations. Others have spring and fall runs of stocked steelhead and salmon. Fishing opportunities also exist in the rivers and harbors for northern pike, small mouth bass, and yellow perch.
- Wildlife include white- tailed deer, ring- necked pheasant, waterfowl, geese, gray and flying squirrels, raccoons, woodcock, a variety of hawks, songbirds, and shorebirds.
- Grasslands and barrens are promoted through prescribed burns and mowing.

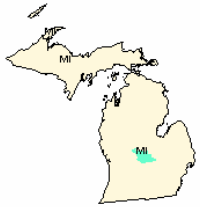
Watershed Activities / Concerns / Priorities

- The Wisconsin DNR divides the Sheboygan-Manitowoc watershed between the Sheboygan basin management area and the Lakeshore basin management area.
- Identified Environmental concerns for the Sheboygan River management area include:
  - Water quality problems are from in- place pollutants, runoff in urban areas, floodplain development, and agricultural practices.
  - Preservation of biodiversity and protection of endangered and threatened species, this is done by preserving their habitat.
  - A need for comprehensive approach to wetlands protection and restoration.
  - Educate people to help prevent the spread of exotic nuisance species, which can wreak havoc on ecosystem balance.
  - Monitoring of wildlife populations, water quality, and ecosystem function are needed to understand the status and trends of resources in the basin.
- Partnership Priorities for the Sheboygan River basin include:
  - Promote sound land use by helping communities identify; prime agricultural lands, environmental corridors and natural areas. Encourage re-development of brownfields and abandoned properties. Work with local communities in developing “smart growth” plans.
  - Conserve and restore riparian areas by conserving wetlands, enhancing sensitive habitat areas in lakes, and removing dams where feasible.
  - Acquire sufficient public lands to manage for multiple uses. Complete the Sheboygan Marsh Master Plan. Promote public land acquisitions that protect natural areas and provide recreational opportunities.
  - Improve water quality by encouraging best management practices in agricultural areas and promoting storm water management measures.
  - Enhance educational activities for forestry, air quality, water quality, wildlife management and healthy ecosystems.



Impaired (303d) Waters

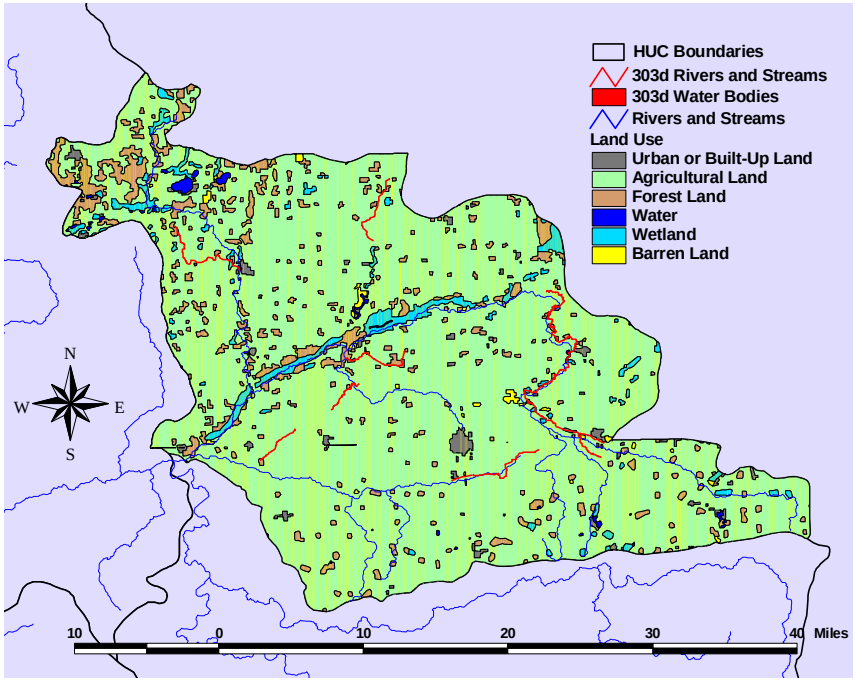
Waterbody Name	Impairment	Anticipated TMDL Submittal
Big Elkhart Lake	Mercury Fish Consumption Advisories	NA
Bullhead Lake	Mercury Fish Consumption Advisories	NA
Crystal Lake	Mercury Fish Consumption Advisories	NA
East Twin River Upstream To First Dam	PCB Fish Consumption Advisories	NA
Killsnake Creek	PCB Fish Consumption Advisories	NA
Manitowoc River (Mouth to N. Branch)	PCB Fish Consumption Advisories	NA
Manitowoc River (Mouth to N. Branch)	Loss Of Instream Habitat	NA
	Organic Enrichment/Low Dissolved Oxygen	
Manitowoc S. Branch	PCB Fish Consumption Advisories	NA
Pigeon Lake	Mercury Fish Consumption Advisories	NA
Pine Creek	PCB Fish Consumption Advisories	NA
Pine Creek	PCB Fish Consumption Advisories	NA
Sheboygan River	Fish Consumption Advisories	NA
	PCBs	
Sheboygan River Below Franklin Downstream To Sheboygan Falls	Mercury Fish Consumption Advisories	NA
	PCB Fish Consumption Advisories	
Silver Lake	Organic Enrichment/Low Dissolved Oxygen	NA
	Winter Kills	
Two Rivers Harbor	Aquatic Toxicity	NA
	Fish Consumption Advisories	
West Twin River	Nutrients	NA
	Fish Consumption Advisories	
	Sediment	



Maple River Watershed

Hydrologic Unit Code: 04050005

For more information see the USEPA website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04050005

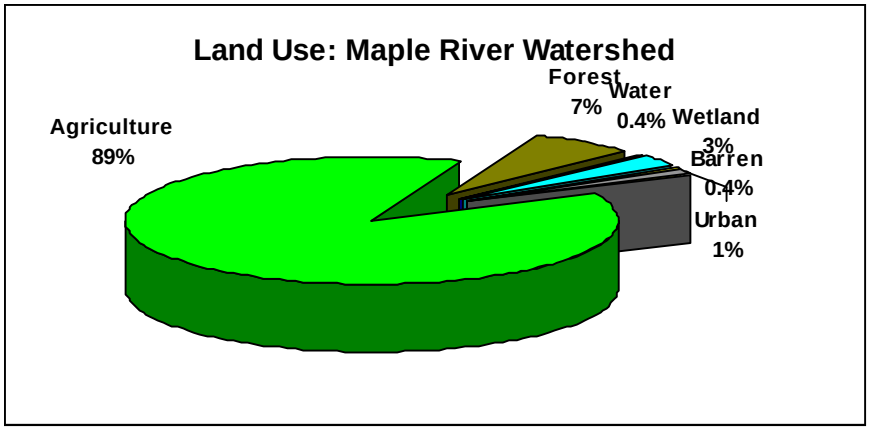


Watershed Overview / Ecology / Biodiversity

- The Maple River watershed covers over 936 square miles.
- The watershed has 404 miles of waterways that flow year round.
- The watershed is over 87 percent agricultural.
- The Maple River watershed feeds into the Lower Grand River.

Impaired (303d) Waters

Waterbody Name	Impairment	Anticipated TMDL Submittal
Alder Creek	Nutrients	2009
	Algae	2009
	Fish Community Rated Poor	2009
Butternut Creek	Pathogens	2006
	Bacterial Slimes	2006
	Fish Community Rated Poor	2006
Cox Drain	Nutrients	2009
	Algae	2009
	Fish Community Rated Poor	2009
	Macroinvertebrate Community Rated Poor	2009
Lost Creek	Nutrients	2009
	Algae	2009
	Bacterial Slimes	2009
	Fish Community Rated Poor	2009
	Macroinvertebrate Community Rated Poor	2009
Maple River	Nutrients	2009
	Nuisance Plant Growths	2009
Peet Creek	Nutrients	2009
	Nuisance Plant Growths	2009
Pine Creek(Watershed)	Nutrients	2007
	Nuisance Plant Growths	2007
Spaulding Creek	Nutrients	2004
	Algae	2004



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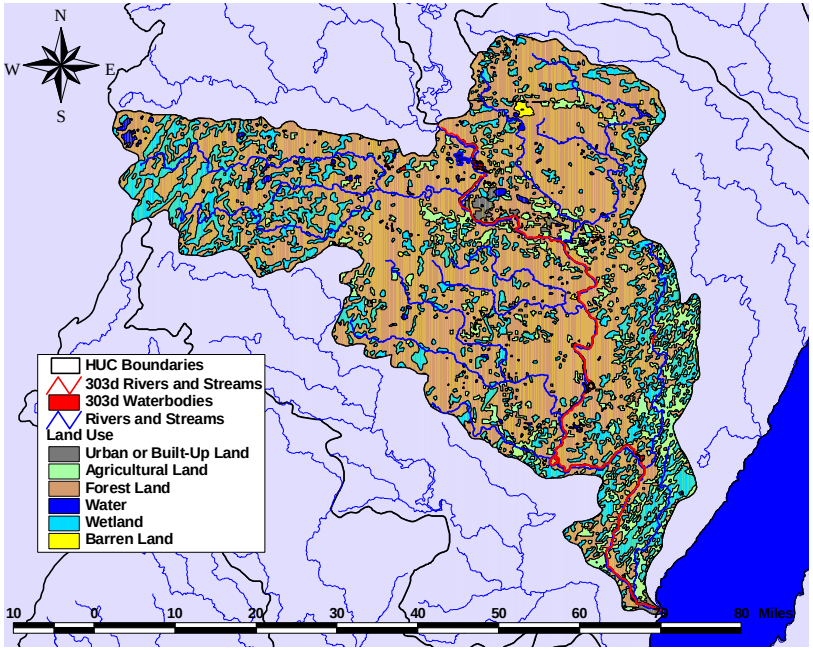
Menominee River Watershed

Hydrologic Unit Code: 04030108



Watershed Overview / Ecology / Biodiversity

- The Menominee River forms the boundary between Wisconsin and the Upper Peninsula of Michigan in Marinette, Florence, Forest, Vilias, Menominee, Dickinson, and Iron counties before draining its contents into Lake Michigan.
- The Menominee system is comprised of a number of large and small tributaries, the major tributaries being the Michigamme, Brule, Pike, Paint, Iron and Sturgeon Rivers. The Menominee originates at the confluence of the Michigamme and Brule Rivers and flows approximately 115 miles to the east towards the waters of Green Bay.
- The total basin covers approximately 4,070 square miles with 2,618 square miles located in Michigan and 1,452 square miles located in Wisconsin.
- The topography in the Menominee River basin was formed and heavily altered by periodic glaciation, the most recent of which was the Wisconsin period- 10,000-20,000 years ago.
- The region is characterized by lakes, glacial plains, end moraines, and poorly integrated east to west drainage. Bedrock outcrops and moraine deposits in the northern river basin create a more rugged terrain with a maximum elevation of 1300 feet, giving the basin a gradient of approximately five feet per mile. Due to extensive amount of glacial activity, the Menominee basin consists mostly of sand and gravel called outwash which is underlain by dolomite.
- Some of the developed areas are constructed on man-made soils that were deposited during the lumbering boom around the turn of the century. These man-made soils are composed of sawdust and waste wood that was discarded and then overlain with sand or topsoil as the building surface. These unstable soils have subjected many structures with excessive settling and alignment shifting.
- The lower reaches of the Menominee River have been subjected to a high amount of pollution from industries over the years and now this watershed is identified as an Area of Concern.

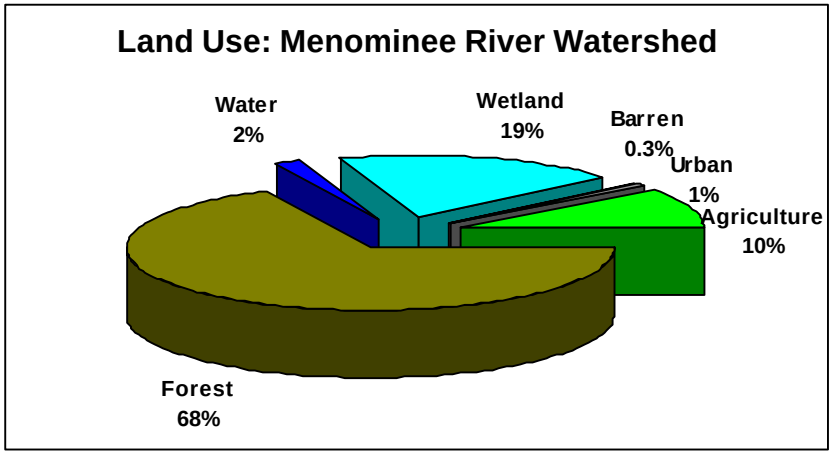
Approved Watershed Management Plans

- Fumee Creek - Dickinson Conservation District, http://www.dickinsoncd.org/
- Hamilton Creek - Dickinson Conservation District1
- Pine Creek (Dickinson Co), Dickinson Conservation District

For more information, see the USEPA website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030108

Watershed Activities / Concerns / Priorities

- The Wisconsin portion of the watershed is part of the Wisconsin DNR's Upper Green Bay basin management area.
- The Pine Creek Watershed Project is an ongoing effort to address non-point source pollution throughout this beautiful 48,000 acre watershed in south central Dickinson County, Michigan. Based on previous EPA grants, which created a Pine Creek Watershed Management Plan and installed twelve Best Management Practices, the watershed received a Clean Michigan Initiative Grant (CMI) that targets sediment and nutrient pollution. The sources of these pollutants include road crossings, forest harvest practices, agriculture, cropland erosion, ORV trail crossing, and eroding streambanks. During the three-year CMI grant, which began in June 1999 and ends June 2003, approximately 20 Best Management Practices will be implemented, on a cost-share basis, with watershed landowner/partners. The watershed has also received funding from an EPA Section 319 grant to promote education about Best Management Practices and non-point source pollution control.
- The Fumee Creek Watershed Project was awarded a two year Environmental Protection Agency Section 319 Clean Water Act Grant and officially began the planning phase of the watershed project in October 2000. The Department of Environmental Quality administers the grant funding while Dickinson Conservation District staff directly manages the project on a local level. The overall goal of the Fumee Creek Watershed Project is to protect and restore Fumee Creek and the lakes and streams within the watershed from further degradation due to non-point sources of pollution. Addressing the water quality issues in this urban watershed will allow the watershed project to effectively maintain and/or improve the surface water quality within the watershed.
- The Hamilton Creek Watershed plan is a two year project funded by a 319 grant to reduce runoff in the watershed, thereby reducing sediment, nutrients and heavy metals associated with this process; reduce erosion in the watershed, thereby reducing sediment, nutrients and heavy metals associated with these processes; improve or restore natural habitat for fish and wildlife within the watershed; and to promote stewardship activities in the watershed. The project is planting native plants surrounding Lake Mary, surveying frog population, monitoring water quality, and mapping aquatic plants.
- Hannahville Indian Community has a water quality protection program for the reservation

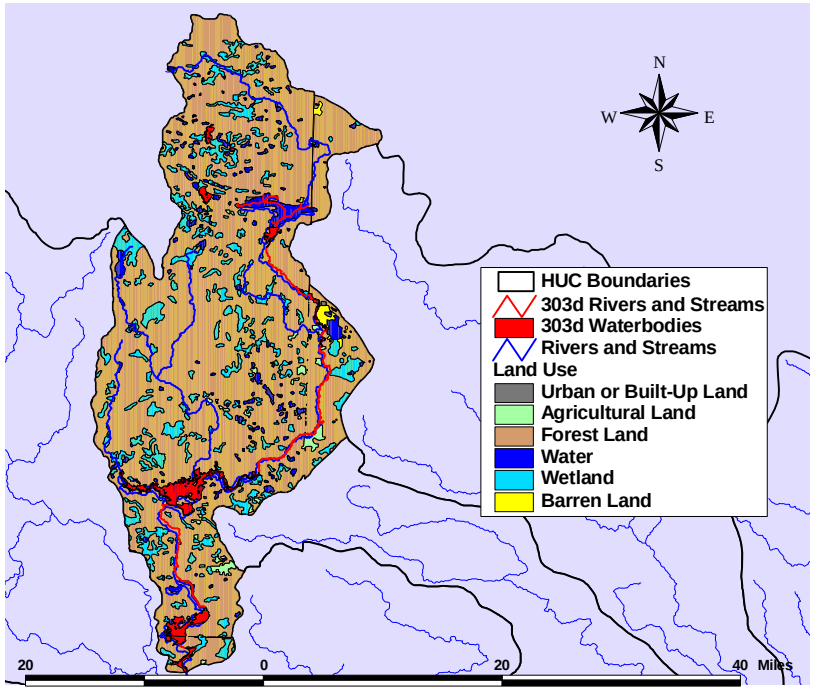


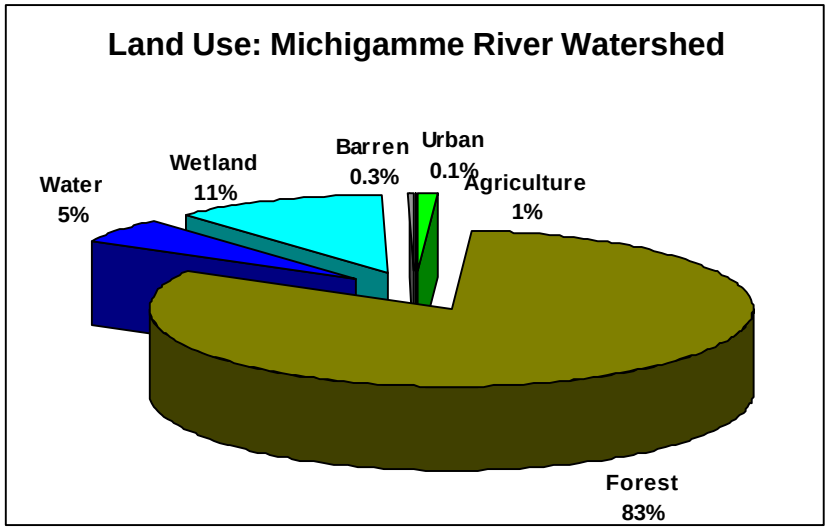
Impaired (303d) Waters

Waterbody Name	Impairment	Anticipated TMDL Submittal
Hamilton Lake, MI	Mercury	2011
Menominee River, MI	Mercury	2010
	PCBs Fish Consumption Advisories	2010
Menominee River, MI	Pathogens	2009
Unnamed Tributary To Potterfield Creek, MI	Nutrients	2009
	Algae	2009
Emily Lake, WI	Mercury Fish Consumption Advisories	NA
Menominee R. In Marinette County, WI	Fish Consumption Advisories	NA
Sand Lake T38 R18e S21, WI	Mercury Fish Consumption Advisories	NA
Sealion Lake, WI	Mercury Fish Consumption Advisories	NA
Van Zile Lake,,WI	Mercury Fish Consumption Advisories	NA

Michigamme River Watershed

Hydrologic Unit Code: 04030107





Impaired (303d) Waters

Waterbody Name	Impairment	Anticipated TMDL Submittal
Beaufort Lake	Mercury	2011
Craig Lake	Mercury	2011
Michigamme River And Impoundments	Mercury Fish Consumption Advisory	2011
Runkle Lake	Mercury	2011
Unnamed Lake	Mercury Fish Consumption Advisory	2011

Watershed Overview / Ecology / Biodiversity

- The Michigamme River watershed covers approximately 727 square miles.
- There are 465 miles of rivers and streams in the watershed.
- The Michigamme River system flows into the Menominee River watershed.
- Approximately 82 percent of the watershed is forested.
- There are five listed impaired waters.

For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030107

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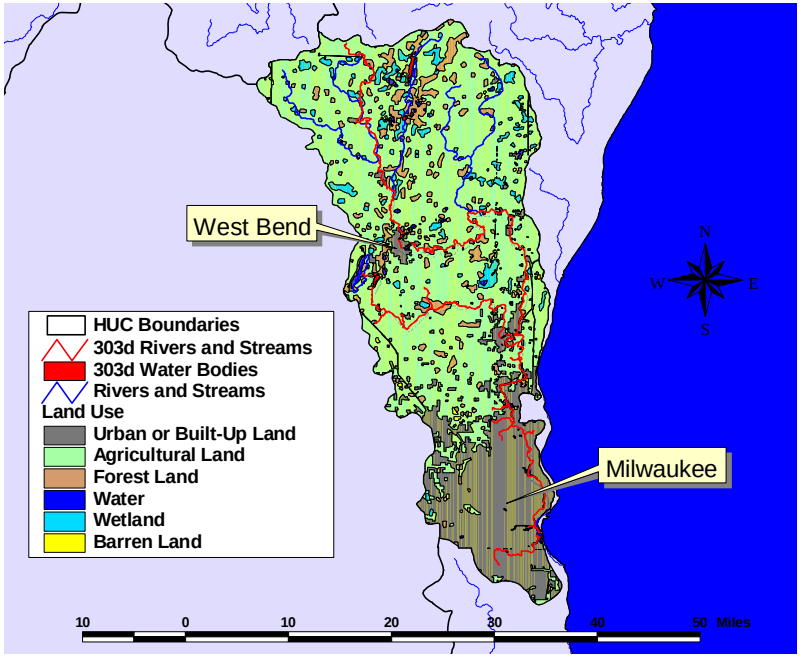
Milwaukee River Watershed

Hydrologic Unit Code: 04040003



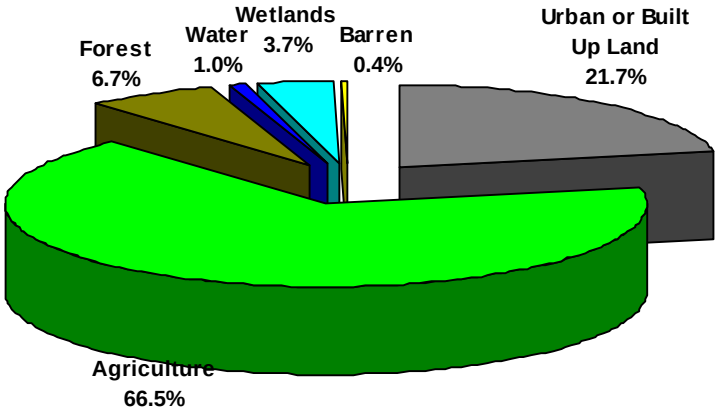
Watershed Overview / Ecology / Biodiversity

- The Milwaukee River Basin encompasses approximately 900 square miles of land in portions of Dodge, Fond du Lac, Milwaukee, Ozaukee, Sheboygan, Washington, and Waukesha counties.
- The Milwaukee River Estuary is an Area of Concern.
- The southern quarter of the basin is the most densely populated area in the state, holding 90% of the basin's population, which is approximately 1.3 million people.
- The Basin includes 6 watersheds, 3 of the watersheds (Milwaukee River North, Milwaukee River East- West, Milwaukee River South) contain the Milwaukee River from start to finish. The other three watersheds (Cedar Creek, Menomonee River and Kinnickinnic River) are named after the major rivers they contain.
- Collectively the six watersheds contain about 500 miles of perennial streams, over 400 miles of intermittent streams, 35 miles of Lake Michigan shoreline, 57 named lakes and many small lakes and ponds.
- Wetlands encompass over 68,000 acres or 12% of the basin land area.
- The predominant land uses in the Basin are generally grasslands, which account for 56% of the Basin land cover. As urban development proceeds further into the countryside, farmland decreases.
- The Natural Heritage Inventory has documented 16 endangered, 26 threatened and 65 special concern plant and animal species, and 30 rare aquatic and terrestrial communities within the Basin.
- Runoff from specific and diffuse sources, contaminated sediment, habitat modifications (such as channelization and dams) have degraded water quality throughout the Basin.
- Recreational highlights include wildlife watching, hiking, fishing, hunting, bicycling, horseback riding, snowmobiling, skiing, camping, picnicking, and water sports.
- The Basin includes the Southeast Glacial Plains, Southeast Lake Michigan Coastal and Northern Lake Michigan Ecological Landscapes.
- Some streams have the ability to support some trout populations. Others have spring and fall runs of stocked trout and salmon. Fishing opportunities also exist in the rivers and harbors for northern pike, small mouth bass, and walleye.
- Lake Michigan supplies drinking water to about 70 percent of the basin residents, as a function of population size. The remainder of the population receives their drinking water from groundwater sources.
- Wildlife include white- tailed deer, ring- necked pheasant, waterfowl, geese, gray and flying squirrels, raccoons, woodchucks, great horned owls, a variety of hawks, songbirds, and shorebirds.
- Grasslands are promoted through prescribed burns & mowing.
- Maple- basswood is the most common forest type and the tree species with the greatest volume in the Basin is ash followed by hard maple, basswood, soft maple and red oak.

Watershed Activities / Concerns / Priorities

- The Milwaukee River basin is part of the Wisconsin DNR's Milwaukee River basin management area.
- Water quality problems are from in- place pollutants, runoff in urban areas, floodplain development, and agricultural practices. As people move to the more rural areas of the basin, groundwater quantity and quality issues will become very important.
- Preservation of biodiversity and protection of endangered and threatened species, this is done by preserving their habitat.
- A comprehensive approach to the protection and restoration of wetlands is needed.
- Educate people to help prevent the spread of exotic nuisance species, which can wreak havoc on ecosystem balance.
- Monitoring of wildlife populations, water quality, and ecosystem function are needed to understand the status and trends of resources.

Land Use - Milwaukee Watershed



Priority Actions

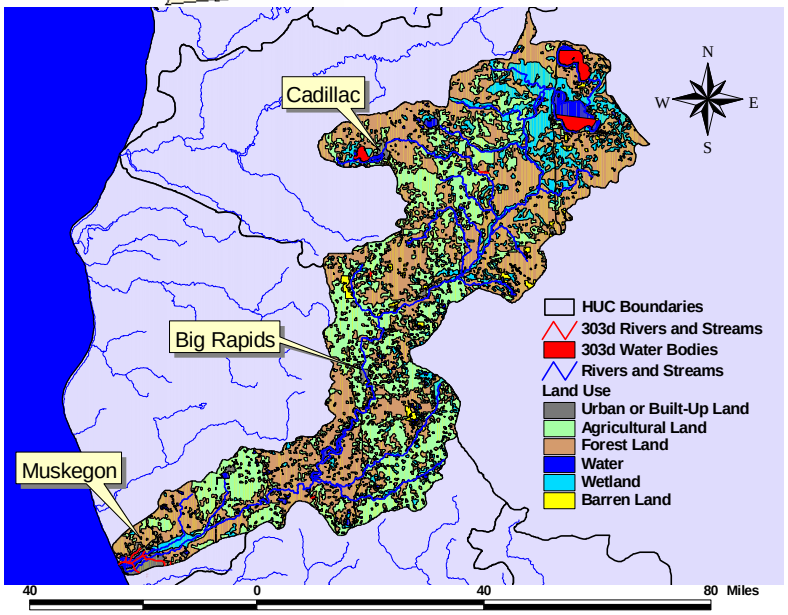
- Ten percent of the streams in the basin are listed as impaired, not meeting their potential. We need to fully understand the factors affecting water quality in the basin in order to make sound management decisions.
- Effectively managing the workload involved with the 1000 discharge permits to surface waters in the basin covering a wide range of activities from animal waste handling to construction sites to treating effluent.
- Protection of high quality and rare habitat and preventing further destruction, in addition to the restoration of degraded aquatic and terrestrial habitat.
- Work with local communities in developing “smart growth” plans & promoting wise land use and zoning.
- Work to better manage the excessive nutrients from known and unknown sources in the Basin.
- Improve the understanding of bacterial contamination of surface waters to make informed decisions for preventing future problems.
- Continuing efforts to work on the contaminated sediment concern.
- Continuing efforts currently being implemented (working with landowners, protection through acquisition, implementation of strategies found in Reversing the Loss: A Strategy for Protecting & Restoring Wetlands in Wisconsin).
- Keeping Lake Michigan safe and plentiful for drinking water needs.

For more information, see the Wisconsin Department of Natural Resources’ “Wisconsin's Basins” website at http://dnr.wi.gov/org/gmu/gmu.html and the USEPA “Surf Your Watershed” website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04040003

Waterbody Name	Impairment	TMDL Submittal
Beaver Creek	Aquatic Toxicity	NA
Cedar Creek	Fish Consumption Advisories	NA
	PCBs	
Evergreen Creek(T11n R19e Sec 36 Sw Se)	Nutrients	NA
	Bacteria	
	Channel Modifications	
	Hindrance To Fish Migration	
	Wetland Loss	
Forest Lake	Mercury Fish Consumption Advisory	NA
Indian Creek	Metals	NA
	Bacteria	
	Flow Alteration(S)	
	Organic Enrichment/Low Dissolved Oxygen	
	Sediment	
	Wetland Loss	
Jackson Park Pond	PCB Fish Consumption Advisory	NA
Lehner Creek	Nutrients	NA
	Bacteria	
	Sediment	
	Temperature	
	Wetland Loss	
Lincoln Creek	Metals	NA
	Aquatic Toxicity	
	Bacteria	
	Hindrance To Fish Migration	
	Organic Enrichment/Low Dissolved Oxygen	
	PCBs	
	Sediment	
	Toxics	
	Wetland Loss	
Little Menomonee R.	Toxics	NA
Long Lake	Mercury Fish Consumption Advisory	NA
Mauthe Lake	Mercury Fish Consumption Advisory	NA
Milwaukee River	Fish Consumption Advisory	NA
	PCBs	
Natural Channel Reaches	Metals	NA
	Bacteria	
	Flow Alteration(S)	
	Wetland Loss	
Trib to Cedar Cr.	Bacteria	NA
	Channel Modifications	
	Sediment	
	Wetland Loss	

Muskegon River Watershed

Hydrologic Unit Code: 04060102



Approved Watershed Plans

- Higgins Lake - Huron Pines RC&D Council
- Muskegon River - Grand Valley State University Annis Water Resources Institute
- Upper Clam River - City of Cadillac

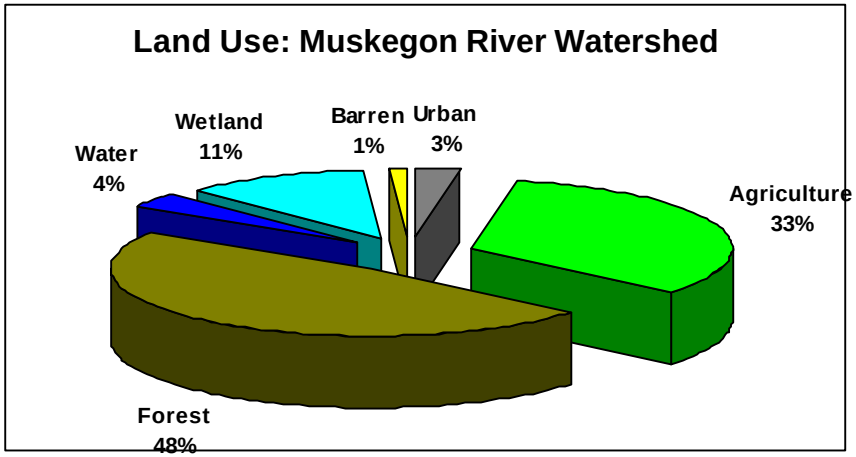
Watershed Organizations

- Muskegon River Watershed Association - www.mrwa.org
- Huron Pines RC&D Council, http://www.huronpines.org/homepage/main.htm
- Grand Valley State University Annis Water Resources Institute http://www.gvsu.edu/wri/isc/muskegon/
- City of Cadillac http://www.cadillac-mi.net/

Watershed Overview / Ecology / Biodiversity

- The Muskegon River Watershed drains approximately 2,723 square miles of land and is located in north-central Michigan.
- The River is approximately 219 miles long from its start at Houghton and Higgins Lakes down to its mouth at Muskegon Lake and, eventually, Lake Michigan.
- The Muskegon River Watershed is one of the of the largest watersheds in the State of Michigan and spans across the better part of nine counties: Wexford, Missaukee, Roscommon, Osceola, Clare, Mecosta, Montcalm, Newaygo, and Muskegon.
- Cities and towns located within the boundaries of the Muskegon River Watershed include; Cadillac, Lake City, McBain, Marion, Evart, Reed City, Big Rapids, Mecosta, Morley, Lakeview, Howard City, Newaygo, Fremont, and Muskegon.
- The Muskegon River and many of its streams and creeks are considered cool water fisheries. They can support both cold-water fish, such as trout and salmon, and warm water fish, such as northern pike and smallmouth bass.
- The sportfishery is worth an estimated $5 million per year.
- Impairments are excessive nutrient loading, sedimentation, hydrologic flow, invasive species and toxic substances.
- The river faces significant thermal pollution, which raises water temperature, from dams hydroelectric facilities, stormwater runoff, and a lack of streamside canopy. When temperature rises, available oxygen decreases, making it difficult for aquatic life to survive.

For more information see the USEPA “Surf Your Watershed” website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04060102



Watershed Activities / Concerns / Priorities

- The Annis Water Resources Institute (AWRI) from Grand Valley State University received a Section 319 grant to support the development of the since approved watershed management plan. The project currently has funds to do several structural practices in the watershed along with public education.
- The Great Lakes Fishery Trust (GLFT) selected the Muskegon River watershed as the focus of their "River Initiative," involving multi-million dollar, annual funding support for the next three to five years.
- The Community Foundation for Muskegon County received a $100,000 environmental grant from the Charles Stewart Mott Foundation to support a comprehensive, two-year assessment of the Mona Lake Watershed. The objectives of the Mona Lake Watershed Project are to conduct a preliminary assessment of the aquatic and terrestrial habitats and contamination sites present in the watershed and to identify areas of significant change and degradation.
- Hersey River Restoration Project is working to cleanup contaminated sediments and development of an agreeable plan between the village of Hersey and the MDNR for the removal of dilapidated dam structures on the Hersey River.
- The Marion Millpond/Middle Branch River project will remove the Marion Dam, retain the millpond by constructing a bermed dike between it and the River, and construct a covered bridge at the site of the .
- The Village of Marion, in Osceola County, together with the MDNR Fisheries Division have agreed on a plan to restore both the Middle Branch River and the Marion Millpond including the removal of the Marion Dam.
- The Muskegon Lake & Estuary Emergent Vegetation Restoration Demonstration Project will work to re-establish of native wild rice stands, soft stem bulrush and other aquatic vegetation for fish and wildlife habitat in the Muskegon Lake Area of Concern (AOC) and the lower river (estuary) located at the river mouth and within the Muskegon State Game Area.

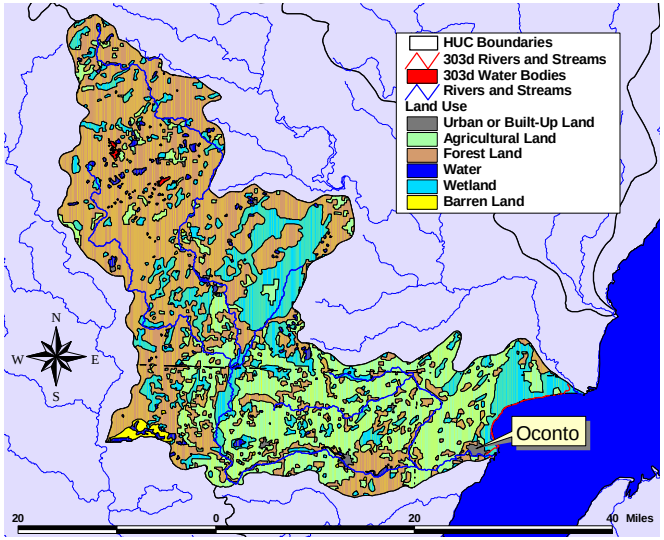
Impaired (303d) Waters

Waterbody Name	Impairment	TMDL Submittal
Bear Lake	Nutrients	2009
	ALGAE	2009
	PCBS Fish Consumption Advi-	2009
Bills Lake	Mercury	2011
Clam River	Nutrients	2003
	Fish Community Rated Poor	2003
	Nuisance Plant Growths	2003
Higgins Lake	PCBs Fish Consumption Advi-	2010
Houghton Lake	PCBs Fish Consumption Advi-	2010
Lake Mitchell	Mercury	2011
Lily Lake	Mercury	2011
Muskegon Lake And Muske-	Mercury	2010
	PCBS	2008
Ruddiman Creek	Fish Community Rated Poor	2008
	Macroinvertebrate Commu-	2008
Ryerson Creek	Fish Community Rated Poor	2008
	Macroinvertebrate Commu-	2008
Todd Lake	Mercury	2011

Oconto River Watershed

Hydrologic Unit Code: 04030104

For more information, see the Wisconsin Department of Natural Resources' "Wisconsin's Basins" website at http://dnr.wi.gov/org/gmu/gmu.html and the USEPA "Surf Your Watershed website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030104



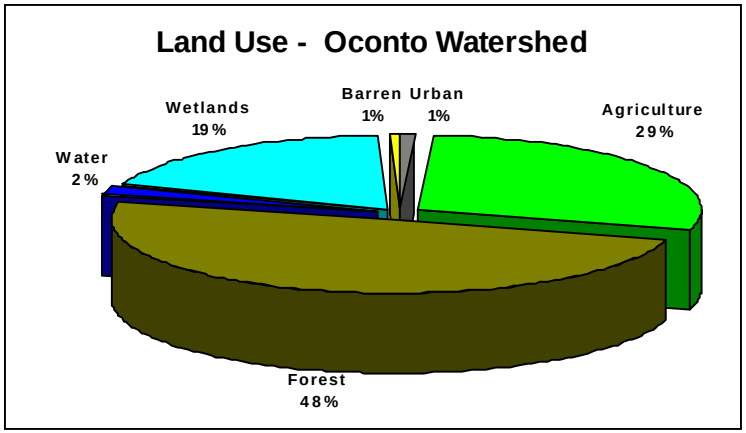
Watershed Overview / Ecology / Biodiversity

- The Oconto watershed covers over 1035 square miles and has over 560 miles of streams.
- The major waterways include the Oconto River, the Lower Oconto River, the Little River, the Lower North Branch Oconto River, and the South Branch of the Oconto River.
- Most of the watershed is part of the Upper Green Bay basin management area as identified by Wisconsin DNR.
- Wildlife include black bear, white- tailed deer, turkey, ring- necked pheasant, ruffed grouse, waterfowl, geese, beaver, mink, otter, timber wolves, elk, colonial waterbirds, trumpeter swans, eagle, osprey, northern goshawk, shorebirds.
- Maple- basswood is the most common forest type and the tree species with the greatest volume in the basin is hard maple followed by aspen, white and red pine, soft maple and balsam fir.
- Coastal wetlands are an important feature of the watershed.
- Groundwater is plentiful and clean and is used for drinking water
- Oconto is the primary urbanized area in the watershed.

Watershed Activities / Concerns / Priorities

The following are objectives for the Upper Green Bay management Basin, which includes the Oconto River watershed:

- Target the West Shore of Green Bay as a high priority for habitat protection
- Implement the DNR's 50 year Land Legacy Study, an acquisition plan for the state
- Protect shoreland habitat and water quality through water regulation and zoning
- Work with local communities in developing "smart growth" plans & promoting wise land use and zoning
- Complete a comprehensive fisheries plan for the basin, focusing on the Oconto, Menominee, and Peshtigo Rivers and Lake Michigan, including addressing invasive exotic species
- Encourage sound forestry practices on public and private land and identify and manage terrestrial invasive exotic species
- Enhance educational activities for forestry, water quality, wildlife management, healthy ecosystem



Impaired (303d) Waters

Waterbody Name	Impairment	TMDL Submittal
Green Bay – S. of Marinette & Tribs to the first dam	PCB Fish Consumption Advisory	NA
Maiden Lake	Mercury Fish Consumption Advisory	NA
Reservoir Pond	Mercury Fish Consumption Advisory	NA

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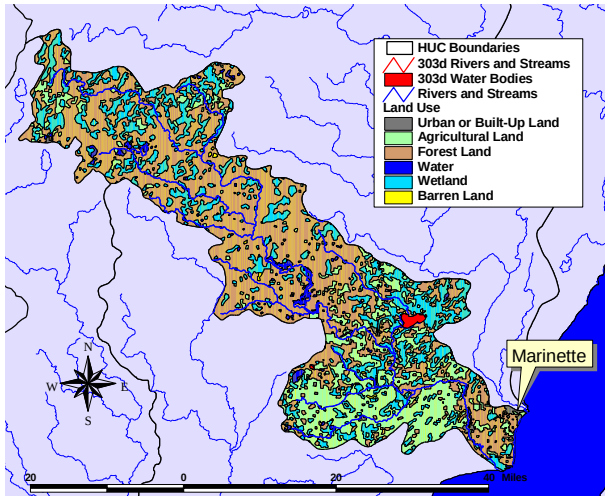
Peshtigo River Watershed

Hydrologic Unit Code: 04030105

For more information, see the Wisconsin Department of Natural Resources' "Wisconsin's Basins" website at http://dnr.wi.gov/org/gmu/gmu.html and the USEPA "Surf Your Watershed" website at: http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030105



Watershed Overview / Ecology / Biodiversity

- The watershed covers 1165 square miles with approximately 12 miles of Lake Michigan shoreline.
- The watershed flows into Green Bay in Wisconsin.
- The major waterways in the watershed include the Lower Peshtigo River, the Little Peshtigo River, The Middle Peshtigo and Thunder River, and the Upper Peshtigo River.
- The watershed has three listed impaired waters
- Marinette is the only urbanized area in the watershed.
- The watershed land uses are primarily forest (54%), wetland (22%), and agriculture (21%).
- Wildlife include black bear, white- tailed deer, turkey, ring- necked pheasant, ruffed grouse, waterfowl, geese, beaver, mink, otter, timber wolves, elk, trumpeter swans, eagle, osprey, northern goshawk, shorebirds.
- Maple-basswood is the most common forest type and the tree species with the greatest volume in the basin is hard maple followed by aspen, white and red pine, soft maple and balsam fir.

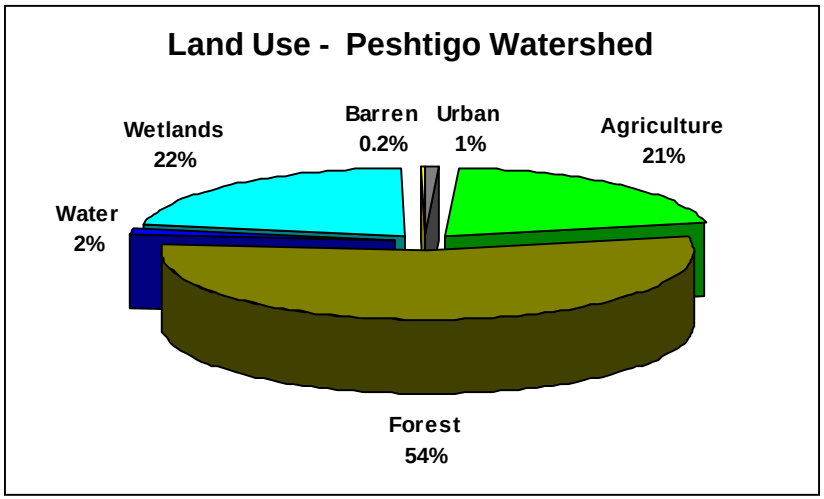
Watershed Activities / Concerns / Priorities

The following are objectives for the Upper Green Bay management Basin, which includes the Peshtigo River watershed:

- Target the West Shore of Green Bay as a high priority for habitat protection
- Protect shoreland habitat and water quality through water regulation & zoning
- Work with local communities in developing "smart growth" plans & promoting wise land use and zoning
- Complete a comprehensive fisheries plan for the basin, focusing on the Oconto, Menominee, and Peshtigo Rivers and Lake Michigan, including addressing invasive exotic species
- Encourage sound forestry practices on public and private land and identify and manage terrestrial invasive exotic species
- Enhance educational activities for forestry, water quality, wildlife management, healthy ecosystem

Impaired (303d) Waters

Waterbody Name	Impairment	TMDL Submittal
Bass Lake	Organic Enrichment/Low Dissolved Oxygen	NA
	Winter Kills	
Gilas Lake	Mercury Fish Consumption Advisory	NA
Noquebay Lake	Mercury Fish Consumption Advisory	NA



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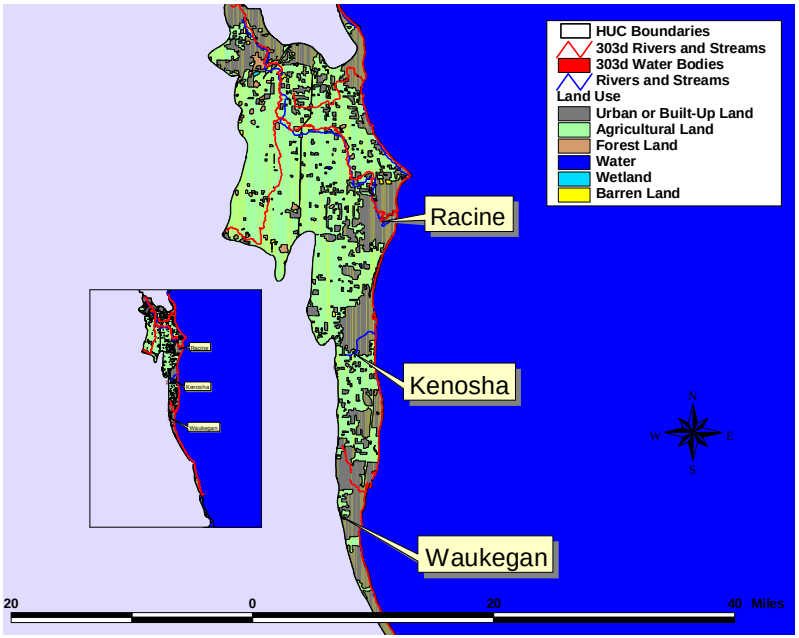
Pike-Root (Waukegan) Watershed

Hydrologic Unit Code: 04040002



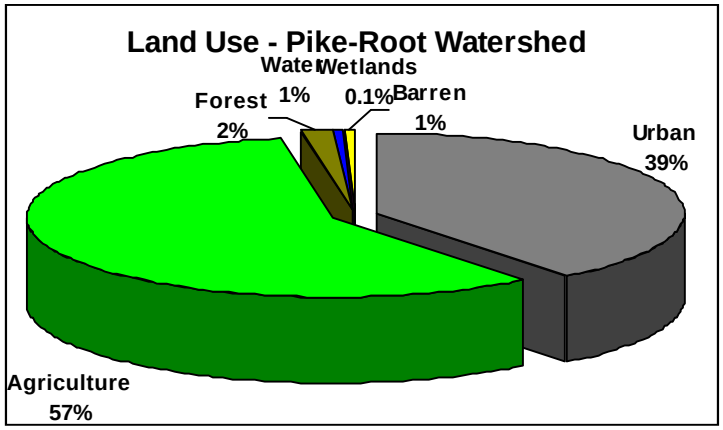
Watershed Organizations

- Pike-Root Watershed Initiative Network - www.rootpikewin.org/
- 1000 Friends of Wisconsin - www.1kfriends.org/
- Citizens for a Better Environment –www.cbemw.org/
- Friends of Root River/Sustainable Racine - www.sustainable-racine.com/
- Mike Luba, Root-Pike River Basin Water Leader: - Michael.Luba@dnr.state.wi.us
- The Waukegan Citizens' Advisory Committee - http://wkkhome.northstarnet.org/iepa/page2.html
- The Waukegan Environmental Justice Committee

Watershed Overview / Ecology / Biodiversity

- The Pike-Root watershed covers over 410 square miles and includes major subwatersheds as the Pike River, the Root River, Oak Creek, Racine Harbor, the Waukegan River, and Waxdale Creek..
- The watershed has over 113 miles of shoreline on the west side of Lake Michigan.
- The watershed stretches from south of Milwaukee to north of Chicago.
- The watershed includes the cities of Racine and Kenosha, Wisconsin, and Waukegan, Illinois.
- The Waukegan Harbor is an Area of Concern.
- While over 50 percent of the watershed is used for agricultural purposes, almost 40 percent is urbanized.
- Groundwater below the surface basin has seen significant overpumping. There are several cones of depression. In southeastern Wisconsin, groundwater that once flowed into Lake Michigan has dropped in level so that the lake now flows into the aquifer.
- The Waukegan River, which is part of the basin, is the only river in Illinois that flows into Lake Michigan.
- The National Heritage Inventory has documented 16 endangered, 20 threatened, and 52 special concern plant and animal species and 17 rare aquatic and terrestrial species in the watershed.
- The combined effects of the draining of the majority of wetlands and stream modifications like channel manipulation have led to degraded water and habitat quality throughout the Pike- Root Basin.

For more information, see the Wisconsin Department of Natural Resources' "Wisconsin's Basins" website at http://dnr.wi.gov/org/gmu/gmu.html and the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04040002



Watershed Activities / Concerns / Priorities

- The Root-Pike Watershed Initiative Network has awarded $21,886 to seven area watershed projects to improve rivers and lakefronts within the Root River and Pike River watersheds in the Racine area.
- Common recommendations for improving the Pike and Root River watersheds include:
  - Encourage implementation of urban nonpoint source best management practices.
  - Encourage implementation of agricultural nonpoint source best management practices, including buffer strip development.
  - Conduct baseline surveys on streams within the watershed.
  - Assess sediment delivery, sediment transport, and streambank erosion within the watershed.
  - Conduct aquatic habitat and sediment assessments above and below dams on the Pike and Root Rivers.
  - Evaluate and implement aquatic habitat restoration and water quality improvement practices where practicable.
  - Evaluate and implement wetland restoration projects where practicable.
  - Evaluate dams for removal
- Approximately 1 million pounds of PCBs have been dredged from Waukegan River

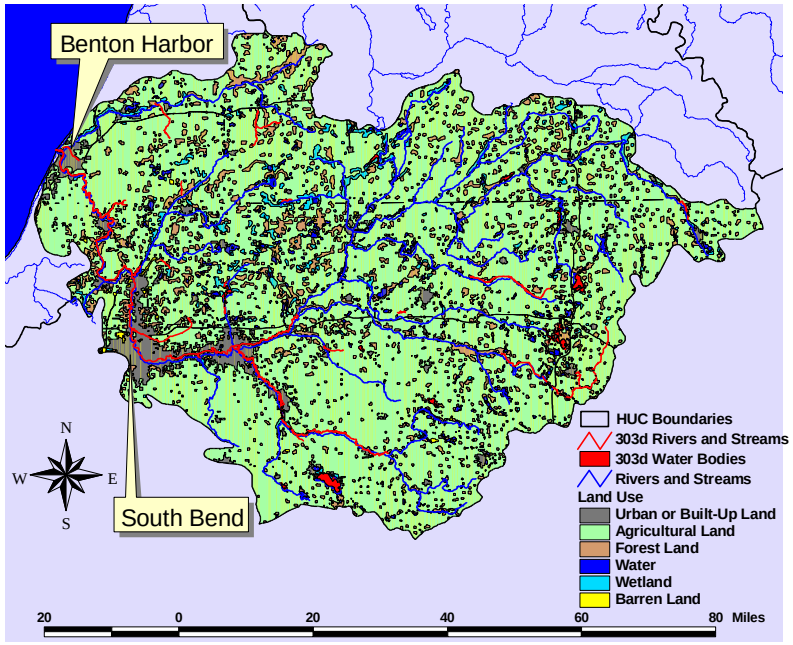
Impaired (303d) Waters

Waterbody Name	Impairment	Anticipated TMDL Submittal
Oak Creek, WI	Aquatic Toxicity	NA
Racine Harbor, WI	Aquatic Toxicity	NA
	Fish Consumption Advisories	
Root River, WI	Organic Enrichment/Low Dissolved Oxygen	NA
Root River Canal, WI	Organic Enrichment/Low Dissolved Oxygen	NA
Root River Canal W. Branch, WI	Organic Enrichment/Low Dissolved Oxygen	NA
Root River From Its Mouth Upstream To The Horlick Dam In The City Of Racine, WI	PCB Fish Consumption Advisory	NA
Waxdale Creek, WI	Fish Kills	NA
	Toxics	
Lincoln Pk North Pnd, IL	Metals	NA
	PCBs Fish Consumption Advisory	
	Nutrients	
	Suspended Solids	
	Noxious Aquatic Plants	
	Organic Enrichment/Low Dissolved Oxygen	
	Siltation	
Waukegan R, IL	Priority Organics	NA
	Metals	
	Other Habitat Alteration(s)	
	PCBs Fish Consumption Advisory	
Waukegan R, IL	Priority Organics	NA
	Metals	
	Other Habitat Alteration(s)	
	PCBs Fish Consumption Advisory	
Waukegan R S Br, IL	Priority Organics	NA
	Metals	
	Other Habitat Alteration(s)	
	PCBs Fish Consumption Advisory	

St. Joseph River Watershed

Hydrologic Unit Code: 04050001

For more information, see the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04050001



Approved Watershed Management Plans

- Dowagiac River - Cass Conservation District, http://users.beanstalk.net/casscons
- Nottawa Creek - Calhoun Conservation District http://www.calhouncd.org/
-

Watershed Groups

- Friends of the St. Joseph River http://www.fotsjr.org/
- St. Joseph River Basin Commission http://www.sjrbc.com/
- Cass Conservation District
- Calhoun Conservation District

Watershed Overview / Ecology / Biodiversity

- The St. Joseph River Watershed is located in the southwest portion of the Lower Peninsula of Michigan and northwestern portion of Indiana. It spans the Michigan-Indiana border and empties into Lake Michigan at St. Joseph, Michigan.
- The watershed drains 4,685 square miles from 15 counties (Berrien, Branch, Calhoun, Cass, Hillsdale, Kalamazoo, St. Joseph and Van Buren in Michigan and De Kalb, Elkhart, Kosciusko, Lagrange, Noble, St. Joseph and Steuben in Indiana).
- The watershed includes 3,742 river miles and flows through and near the Kalamazoo-Portage, the Elkhart-Goshen, the South Bend and the St. Joseph/Benton Harbor metropolitan areas.

Watershed Activities / Concerns / Priorities

- A Watershed Management Plan for the St. Joseph River basin, led by the Friends of the St. Joseph River, will be prepared through funding by the Michigan Department of Environmental Quality and include the Indiana portion of the basin.
- The St. Joseph watershed project has generated maps of subwatersheds, cities, USGS water resources stations, digital elevations, wetlands, river valley segments, land use, average annual precipitation, 1950-1999, designated trout streams, geological features, and soils.
- Under the Dowagiac River watershed management plan, nine municipalities in the Dowagiac River watershed have or will receive technical and/or financial assistance to work on master plans and zoning ordinances to protect farmland, open space, rural character, wetlands, floodplains and water quality.
- Pokagon Band of Potawatomi tribe is involved in Dowagiac River watershed,

Basin Prioritization of Concerns

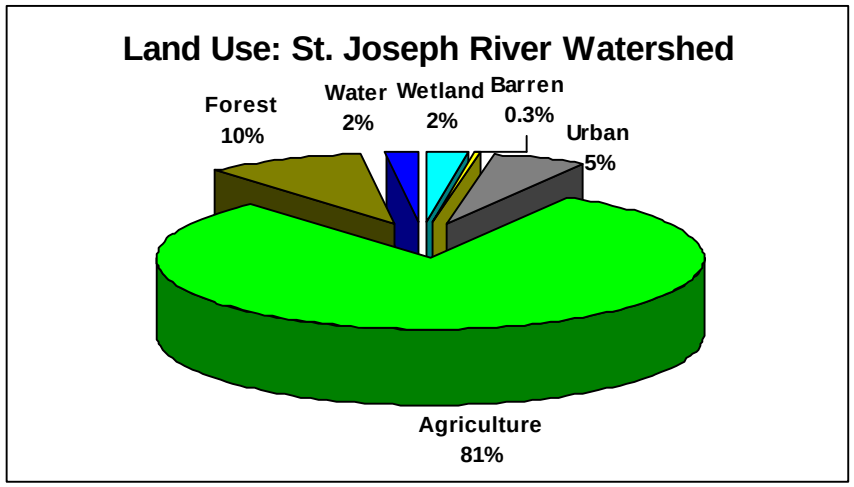
- The Watershed Concerns have been prioritized by the Steering Committee, according to the importance of each concern and the ease of implementing BMP's to correct those concerns, in the following manner:
  1. Sediments (tie)
  1. Nutrients (tie)
  3. Habitat Loss
  4. Wetlands (tie)
  4. Animal Waste (tie)
  6. Pesticides (tie)
  6. Urbanization & Land Use (tie)
  8. Biota
  9. CSO's
  10. Pathogens (tie)
  10. Hydrologic Modification (tie)
  10. Litter (tie)

Surface Water Designated Use Targets

- Warm water fishery
- Other indigenous aquatic life/wildlife
- Partial body contact, recreation
- Full body contact, recreation (May - October)
- Navigation
- Public Water Supply: Surface Intake Point
- Industrial Water Supply
- Agriculture
- Certain water bodies are also protected as a coldwater fishery

Additional Basin Designated Use Targets

- Groundwater
- Habitat preservation
- Increased public access (to the river/streams)
- Archeological preservation
- Preserve agricultural uses and access
- Preserve open space
- Greenways
- Public water trails
- Watershed linkages
- Manage invasive species.



Impaired (303d) Waters

	Impairment	Anticipated
Barton Lake, MI	Mercury	2011
Christiana Creek, MI	Macroinvertebrate Com-	2008
Coldwater Lake, MI	Mercury	2011
Dowagiac River, MI	PCBs Fish Consumption	2010
Eau Claire Extension	Macroinvertebrate Com-	2003
Farmers Creek, MI	Pathogens	2008
	Nuisance Plant Growth	2008
Fawn River, MI	PCBs Fish Consumption	2010
Mckinzie Creek, MI	Fish Community Rated	2003
Ox Creek, MI	Macroinvertebrate Com-	2008
Paw Paw River, S. Br. And	Macroinvertebrate Com-	2008
Pine Creek, MI	Fish Community Rated	2008
	Macroinvertebrate Com-	2008
Prairie River, MI	Fish Community Rated	2007
	Macroinvertebrate Com-	2007

St. Joseph River Watershed
Impaired (303d) Waters (cont.)

Waterbody Name	Impairment	TMDL Submittal
Jimmerson Lake,	Mercury Fish Consumption Advisory	2012
Juday Creek, IN	PCBs Fish Consumption Advisory	2012
Lake James, IN	Mercury Fish Consumption Advisory	2012
Lake Shipshe-	PCBs Fish Consumption Advisory	2012
Lake Wabee, IN	Mercury Fish Consumption Advisory	2012
Lake Wawasee, IN	Mercury Fish Consumption Advisory	2012
	PCBs Fish Consumption Advisory	2012
Long Lake, IN	Mercury Fish Consumption Advisory	2012
Marsh Lake, IN	Mercury Fish Consumption Advisory	2012
Mather's Ditch, IN	Dissolved Oxygen	2004
	Endrin	2004
Mud Creek, IN	Ammonia	2004
	Dissolved Oxygen	2004
Olin Lake, IN	Mercury Fish Consumption Advisory	2012
Oliver Lake, IN	Mercury Fish Consumption Advisory	2012
Orland Tributary,	Dissolved Oxygen	2004
Pigeon Creek, IN	Mercury Fish Consumption Advisory	2012
	PCBs Fish Consumption Advisory	2012
Snow Lake, IN	Mercury Fish Consumption Advisory	2012
	PCBs Fish Consumption Advisory	2012
St. Joseph River, IN	E. Coli	2004
	Mercury Fish Consumption Advisory	2012
	PCBs Fish Consumption Advisory	2012
Tippecanoe Lake,	Mercury Fish Consumption Advisory	2010
Randall Lake , MI	Mercury	2011
	PCBs Fish Consumption Advisory	2010
Rocky River, MI	Fish Community Rated Poor	2007
	Macroinvertebrate Community	2007
Silver Creek, MI	Macroinvertebrate Community	2008
St. Joseph River,	Macroinvertebrate Community	2007
St. Joseph River#, MI	Pathogens	2003
St. Joseph, River#, MI	PCBs Fish Consumption Advisory	2009
	Pcbs	2009
St. Joseph River#, MI	Mercury	2010
Union Lake, MI	PCBs Fish Consumption Advisory	2005
Crawford Ditch, IN	Copper	2004
	Oil And Grease	2004
Elkhart, River, IN	E. Coli	2004
	Mercury Fish Consumption Advi-	2012
	PCBs Fish Consumption Advisory	2012

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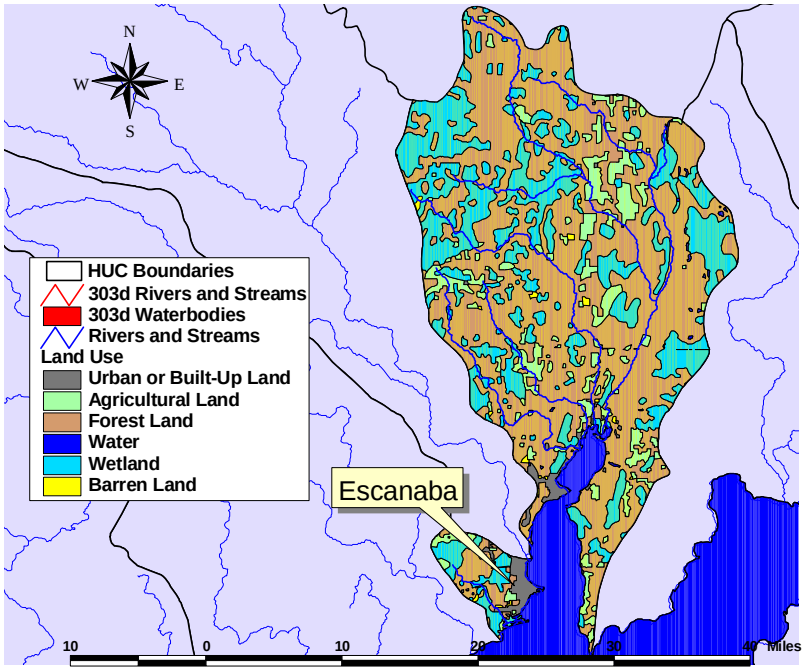
Tacoosh-Whitefish Watershed

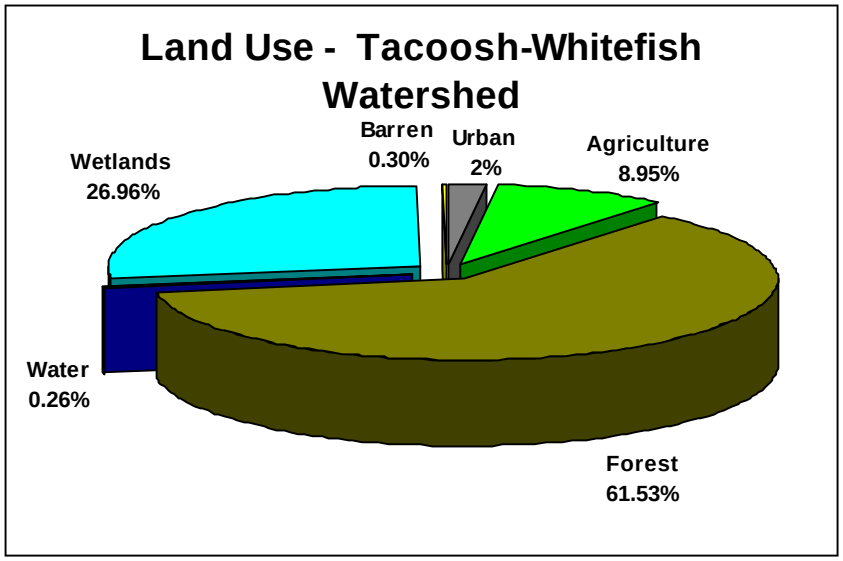
Hydrologic Unit Code: 04030111

For more information, see the USEPA "Surf Your Watershed" website at: http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030111



Watershed Overview / Ecology / Biodiversity

- The Tacoosh-Whitefish watershed is located in the upper peninsula of Michigan and covers approximately 633 square miles.
- The watershed has almost 53 miles of Lake Michigan shoreline.
- Escanaba, Michigan is the lone urbanized area in the watershed.
- The Tacoosh-Whitefish watershed has no listed impaired waters.
- The watershed is mostly forest and wetland.



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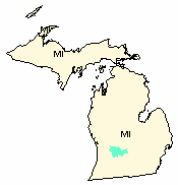
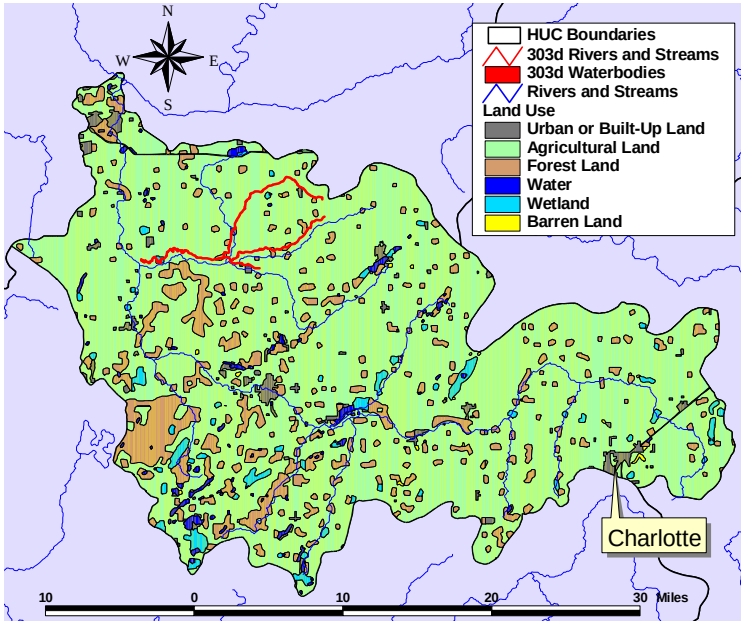
Thornapple River Watershed



Hydrologic Unit Code: 04050007

For more information, see the USEPA website at: http://cfpub.epa.gov/surf/huc.cfm?huc_code=04050007



Approved Watershed Management Plans

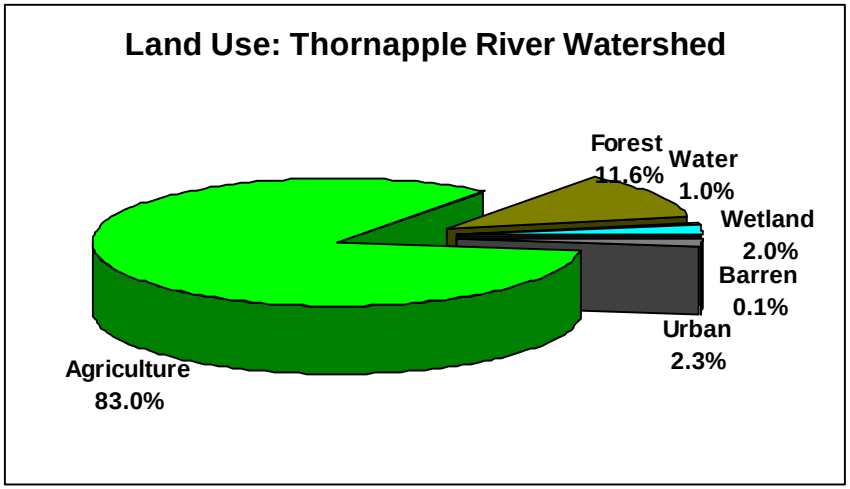
- Coldwater River - Coldwater River Watershed Council

Watershed Organizations

- Coldwater River Watershed Council
- Thornapple River Watershed Council
- Grand Valley State University Annis Water Resources Institute

Watershed Overview / Ecology / Biodiversity

- The Thornapple River watershed flows into the Lower Grand River watershed.
- The watershed covers over 855 square miles.
- Over 83 percent of the watershed is in agricultural use.
- Charlotte, Michigan is the lone urban area in the watershed.
- 324 miles of the watershed's streams and rivers flow year-round.



Impaired (303d) Waters

Waterbody Name	Impairment	Anticipated TMDL Submittal
Coldwater River	Pathogens	2006
Duck Creek	Macroinvertebrate Community Rated Poor	2010
Tyler Creek (Bear Creek)	Pathogens	2006
	Fish Community Rated Poor	2006
	Macroinvertebrate Community Rated Poor	2006

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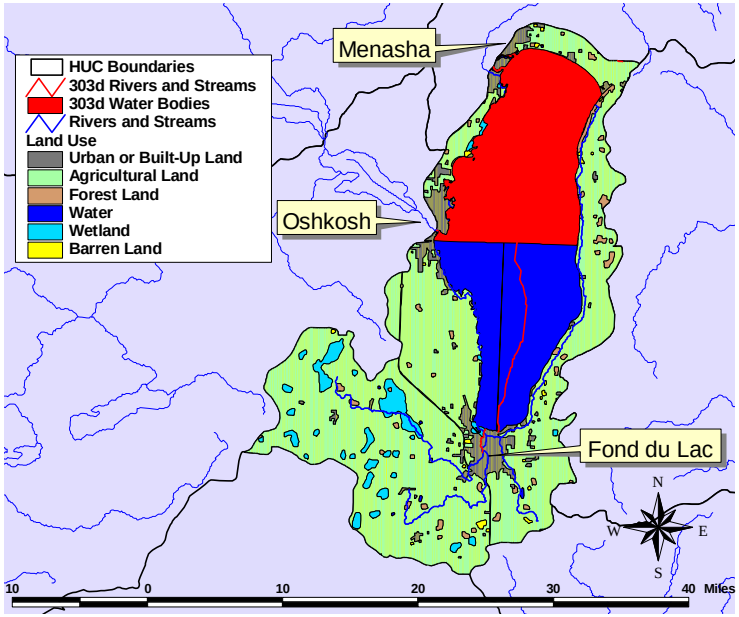
Lake Winnebago Watershed

Hydrologic Unit Code: 04030203



Watershed Overview / Ecology / Biodiversity

- The Lake Winnebago watershed covers over 581 square miles.
- Over 200 square miles of the watershed are lakes, the largest being Lake Winnebago.
- The watershed is located between the Upper and Lower Fox Rivers in Wisconsin.
- The watershed is primarily glacial plain.
- The watershed is above a sandstone aquifer.
- The Niagra Escarpment, a bedrock ridge, forms the eastern boundary of the Lake Winnebago watershed.
- Menasha, Oshkosh, and Fond du Lac, Wisconsin are the primary urbanized areas located in the watershed.
- High Cliff State Park is a 1,145 acre state park located in Calumet County.
- A Glacial Habitat Restoration Area (GHRA) is located in the watershed in Winnebago and Fond du Lac counties. The GHRA is an area where the state is restoring a patchwork of grasslands and wetlands over a large rural landscape so that wildlife can thrive side-by-side with agriculture.
- The basin hosts resident and migratory neo-tropical songbirds in its open grassland/ agricultural habitat.

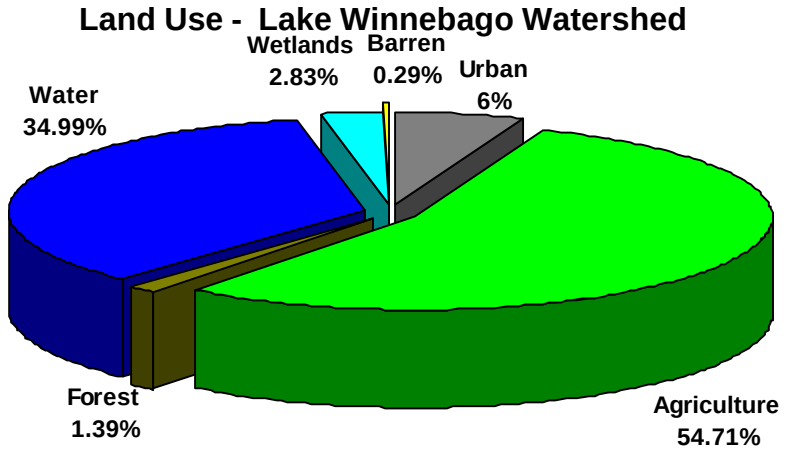
Watershed Contacts

- The University of Wisconsin-Extension – http://clean-water.uwex.edu/foxwolf/
- Fox Wolf Watershed Alliance http://www.fwb2k.org/
- Lake Michigan Forum - http://www.lkmichiganforum.org/
- Rob McLennan, the Upper Fox River Water Basin Team Leader - Robin.McLennan@dnr.state.wi.us

For more information, see the Wisconsin Department of Natural Resources' "Wisconsin's Basins" website at http://dnr.wi.gov/org/gmu/gmu.html and the USEPA "Surf Your Watershed" website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030203

Watershed Activities / Concerns / Priorities

- The Wisconsin DNR manages the Lake Winnebago watershed as part of the Upper Fox River basin management area.
- Numerous urban stormwater outfalls discharge to Lake Winnebago from portions of the Cities of Oshkosh, Neenah, and Menasha. Storm event runoff from commercial, industrial, and residential construction sites and from plat developments in rapidly developing sections of Oshkosh, Neenah, and Menasha are also nonpoint source pollution problems.
- Water quality modeling done by Northeast Wisconsin Waters of Tomorrow (NEWWT) have indicated this watershed to be a major contributor of phosphorus and suspended solids to Lake Winnebago.
- Critical animal waste and soil erosion problems are intensified by the steep slopes along the Niagara escarpment.
- Average soil loss in all of Calumet County is estimated to be 2.7 tons per acre. These factors accelerate nutrient and sediment delivery to Lake Winnebago. Both the Winnebago Comprehensive Management Plan and the Lower Green Bay Remedial Action Plan identified this watershed as a high priority for the control of nonpoint sources of pollution.
- The eastern portion of the watershed was selected as a nonpoint source priority watershed project in 1989. The primary goals of this watershed project are to reduce Phosphorus and sediment loading to Lake Winnebago and decrease the loading of heavy metals from urban nonpoint sources.
- Lake Winnebago specific fisheries priorities include:
  - Continue the Lake Winnebago Fisheries Community Assessment through trawling, seining, shocking, and netting to characterize the Lake Winnebago fish community and assess year-class strength.
  - Continue lake sturgeon management in the Winnebago-Fox-Wolf System. Conduct population and harvest assessments; continue public involvement and education; work closely with the Winnebago Citizens Sturgeon Advisory Committee; pursue Upper Fox River long term sturgeon spawning stock rehabilitation, spawning, and nursery habitat protection and enhancement; cooperate with other regional, statewide, national, and international sturgeon management and research programs; and prepare the annual Winnebago System Sturgeon Management report, direct sturgeon registration, and determine harvest cap for the annual sturgeon spearing season.

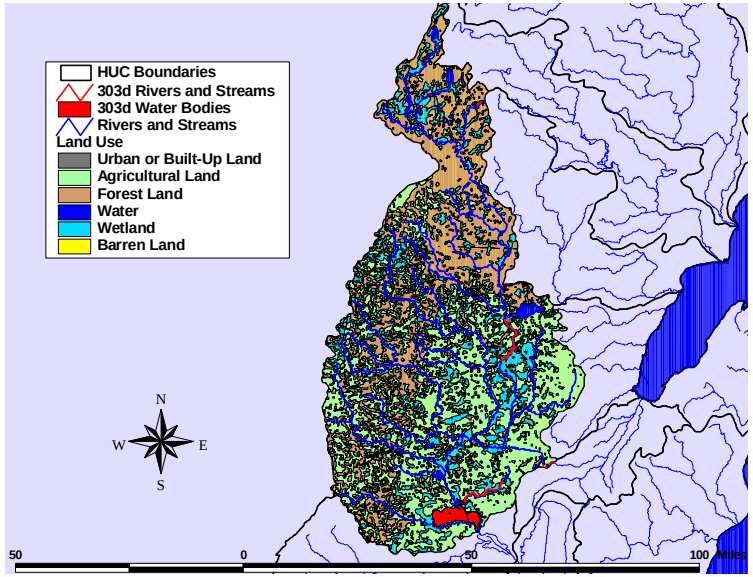


Impaired (303d) Waters

Waterbody Name	Impairment	Anticipated TMDL Submittal
Fond Du Lac River	Metals	NA
	Fish Consumption Advisories (Mercury)	
	Fish Consumption Advisories (PCBs)	
	Toc	
Winnebago Lake	Nutrients	NA
	Fish Consumption Advisories (Mercury)	
	Fish Consumption Advisories (PCBs)	
	Organic Enrichment/Low Dissolved Oxygen	
	Sediment	

Wolf River Watershed

Hydrologic Unit Code: 04030202



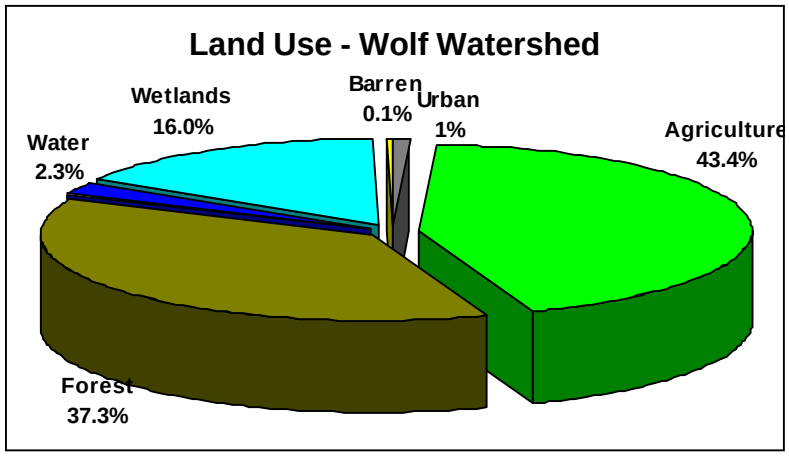
Watershed Contacts

- The University of Wisconsin-Extension – http://clean-water.uwex.edu/foxwolf/
- Fox Wolf Watershed Alliance http://www.fwb2k.org/
- Lake Michigan Forum - http://www.lkmichiganforum.org/
- Dan Helf, Wolf River Basin Water Team Leader:
  - Daniel.Helf@dnr.state.wi.us

For more information, see the Wisconsin Department of Natural Resources' "Wisconsin's Basins" website at http://dnr.wi.gov/org/gmu/gmu.html and the USEPA "Surf Your Watershed website at http://cfpub.epa.gov/surf/huc.cfm?huc_code=04030202

Watershed Overview / Ecology / Biodiversity

- The Wolf River Basin covers an area of 3730 square miles.
- The Wolf Basin's general topography can be characterized by rolling hills, plain meadows, lush and forested wetlands, numerous lakes and small tributaries. Vegetation consists primarily of hardwood forests mixed with large amounts of hemlock, northern white-cedar swamp, and hardwood-conifer swamp.
- The Wolf River originates with a discharge from Pine Lake located in Forest County. The river flows south for about 203 miles until it reaches Lake Poygan. At that point it becomes part of the Winnebago Lake system. Waters from the Winnebago system then flow into the Lower Fox River where they eventually reach the Bay of Green Bay.
- Development within the basin is predominately along the Wolf River or its major tributaries. Communities like Shawano, Clintonville, New London, Waupaca, Weyauwega and more were developed primarily because of being located on waterways that were used by the logging industry
- The Basin includes the Northern Hills and Northeast Plains Ecological Landscapes with small portions in the Central Sand Hills, Southeast Glacial Plains and North Central Forest.
- Surface waters are a mix of cold and warm water streams with smallmouth bass, walleye, northern pike, panfish, trout and salmon.
- Groundwater is generally abundant, clean and used for drinking water in many of the basin's communities.
- Over 143 rare animal species live in the Wolf River Basin, including northern goshawk, red- headed woodpecker, great gray owl, barn owl, red- shouldered hawk, bad eagle, osprey and various butterflies, beetles, dragonflies, fish, grasshoppers, mayflies, mussels, mammals, snails, snakes and turtles.
- The basin supports 57 rare plant (known accounts), including 8 state endangered, 11 state threatened, 38 special concern and two federally listed plants species. The majority of these plants are associated with wetlands.
- Menominee, Stockbridege-Munsee Band of Mohicans, Forest County Potawatomi Community, Sokaogon Chippewa, and Mole Lake--participate in the Wisconsin NRCS Tribal Conservation Advisory Council



Watershed Activities / Concerns / Priorities

Environmental Concerns

- Loss of aquatic habitat and open land to development; pollution threats to surface and groundwater. Simplification of diverse habitat and loss of special places that support rare species.
- Water quality problems from in- place pollutants, dams, urban and agricultural runoff.
- Preservation of biodiversity and protect endangered and threatened species.
- Protection of large contiguous blocks of forests, grassland and wetland that serve as habitat for mammals, birds, and amphibians and provide a large self-sustaining ecosystem for all to enjoy.
- Invasive exotic nuisance species: purple loosestrife, gypsy moths, zebra mussels, Eurasian water milfoil, garlic mustard (uplands), and others.
- Monitoring of wildlife populations, water quality, and ecosystem function are needed to the status and trends of resources in the basin.

Basin Priorities

Wolf Basin Partners identified the following areas as highest basin priorities:

- Water Pollution
- Loss of Shoreline Habitat
- Hunting/ Fishing/ Trapping and Recreational Uses
- Inventory of Resources

Wisconsin DNR's Wolf Team has also identified priorities to guide work:

- Preservation and protection of wetlands
- The presence and spread of exotic species
- Pressures on Natural Resources from development
- Promoting sound land use and "smart growth" or comprehensive planning

Impaired (303d) Waters

Waterbody Name	Impairment	Anticipated TMDL Submittal
Arbutus Lake	Mercury Fish Consumption Advisory	NA
Big Hills Lake	Mercury Fish Consumption Advisory	NA
Columbia Lake	Mercury Fish Consumption Advisory	NA
Deep Hole Lake	Mercury Fish Consumption Advisory	NA
Kusel Lake	Mercury Fish Consumption Advisory	NA
Little Sand Lake	Mercury Fish Consumption Advisory	NA
Mayflower Lake	Mercury Fish Consumption Advisory	NA
Pine Lake	Mercury Fish Consumption Advisory	NA
Poygen Lake	Mercury Fish Consumption Advisory	NA
	PCBs Fish Consumption Advisory	
	Organic Enrichment/Low Dissolved Oxygen	
	Sediment	
Rat River *	Organic Enrichment/Low Dissolved Oxygen	NA
	Flow Alteration(S)	
Rat River *	Organic Enrichment/Low Dissolved Oxygen	NA
	Flow Alteration(S)	
Roberts Lake	Mercury Fish Consumption Advisory	NA
Shawano Lake	Mercury Fish Consumption Advisory	NA
Winneconne Lake	Mercury Fish Consumption Advisory	NA
Winneconne Lake	Mercury Fish Consumption Advisory	NA
	Organic Enrichment/Low Dissolved Oxygen	
	Nutrients	
	Turbidity	
	PCBs Fish Consumption Advisory	
	Sediment	
Wolf River Below Shawano Dam Down To State Hwy 156	Mercury Fish Consumption Advisory	NA

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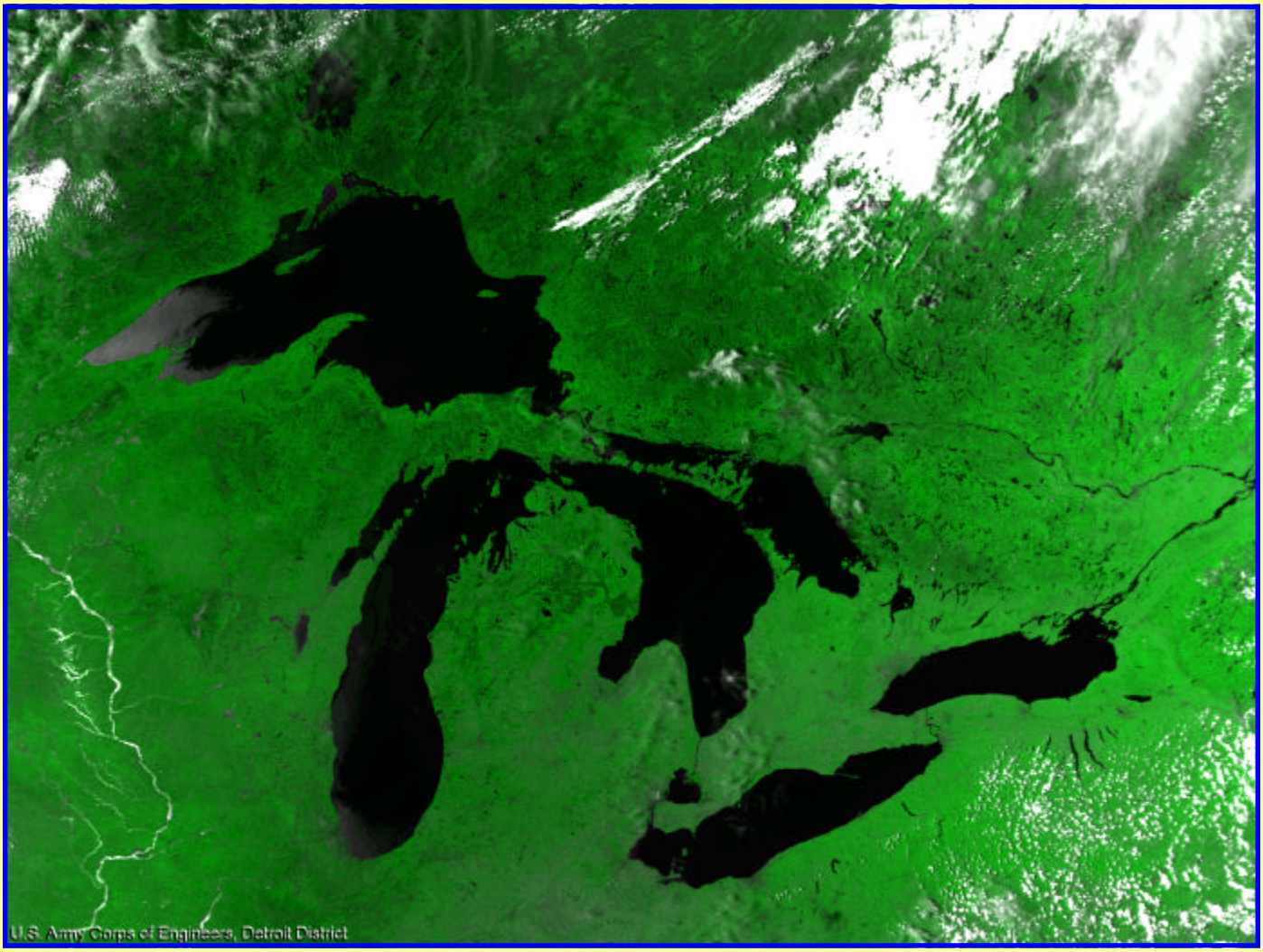

ACKNOWLEDGEMENTS

The Lake Michigan Management Plan 2004 was developed by the Lake Michigan Technical Committee with assistance from the Lake Michigan Forum and various other agencies and organizations. The LaMP benefited from the publicly and privately funded research of many institutions, results of pilot projects and generous critiques throughout the process. Our goal is to restore and protect the integrity of the Lake Michigan ecosystem through collaborative, place-based partnerships. The following is a list of some of the major contributors to the LaMP.

Agency for Toxic Substances and Disease Registry

Chippewa-Ottawa Resource Authority

Grand Traverse Band of Ottawa and Chippewa Indians

Illinois Environmental Protection Agency

Indiana Department of Environmental Management

Michigan Department of Environmental Quality

Oneida Tribe, Wisconsin

U.S Army Corps of Engineers

Great Lakes Fishery Commission

U.S. Department of Agriculture, Natural Resources Conservation Service

U.S. Environmental Protection Agency (Region 5, Great Lakes National Program Office, Office of Research and Development)

U.S. Fish and Wildlife Service

U.S. Geological Survey

Wisconsin Department of Natural Resources

The Lake Michigan LaMP 2000, 2002, and 2004 are available at:
http://www.epa.gov/glnpo/michigan.html