

Wisconsin Water Quality Assessment Report to Congress 2004

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Bureau of Watershed Management

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**Wisconsin
Water Quality Assessment
Report to Congress
2004**

**Wisconsin Department of Natural Resources
Water Division**

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Adapted from the 2002 Water Quality Assessment Report to Congress,
Design/Layout by Georgine Price

Introduction

Wisconsin, rich with a broad array of cultural and natural resources, is known nationally for its exceptional water features. During the past two years, our state has made significant gains in the area of watershed management and protection. Governor Doyle's successful water initiatives include the passage of landmark legislation to protect both groundwater and sensitive surface water features from excessive consumptive uses; recognition of our significant Great Lakes through special management efforts to restore and protect this globally renowned resource; ramping up monitoring and educational outreach to stem the influx of aquatic nuisance species into our precious waterways; developing a special office to provide comprehensive environmental analyses of large-scale energy proposals in the state; and a steadfast commitment to fully implement the Clean Water Act while maximizing the efficiency of permitting processes.

This 2002-04 Water Quality Assessment Report describes our state's special resources and the programs and projects that help protect them. The work described reflects the DNR's commitment to four key goals: implementing the Clean Water Act, preserving the public trust doctrine, maintaining healthy fisheries, and protecting our groundwater for future generations. The hows, whys and results of our efforts to achieve these goals are described, and specific public and private activities to improve, protect and better understand our aquatic treasures are highlighted.



Chequamegon Bay, Lake Superior Photo: Courtesy of USEPA

July 2004

Subject: 2004 Water Quality Assessment Report to Congress

Citizens of Wisconsin:

Enclosed please find a copy of our biannual report to Congress detailing the status of Wisconsin's waters. This report satisfies Federal Clean Water Act requirements and provides a compendium of information on the status of our waters for you, the citizens of Wisconsin. This report describes how WDNR is working to meet four key goals related to water: implementing the Clean Water Act, preserving the public trust doctrine, maintaining healthy fisheries, and protecting our groundwater for future generations. We have included program descriptions and contact information, as well as recommendations to USEPA and Congress on how the federal government can help our state better carry out the responsibility of implementing the Clean Water Act. It is our goal to do everything we can to attain waters that fully support fish and aquatic life, recreation, and drinking water designated uses, as well as to ensure that the fish you eat is safe and free of contaminants.

This report includes statewide water quality assessment data for lakes, rivers and Great Lakes shoreline miles (2002), as well as updated total Great Lakes shoreline and stream miles and lake acres calculated using the most current technology available. From this analysis, it is clear that great progress has been made in restoring the integrity of our waters. Point sources have been and continue to be managed and significant progress has been made in developing a framework to improve management of nonpoint sources. In addition, significant policy initiatives designed to better protect groundwater and sensitive surface waters, such as outstanding resource waters, and to better address the special needs of the Great Lakes Ecosystem have been sponsored by the Governor. The new groundwater legislation will protect sensitive resources from excessive consumptive use, while a new Great Lakes Office will focus resources on one of our most beloved ecological treasures.

Despite this progress, however, problems continue to limit the use of surface water and groundwater and consumption of fish and other related aquatic life. Contaminated sediment, atmospheric deposition of pollutants, habitat destruction, and the continued influx of aquatic exotics all pose significant threats to our waters. Some land management activities or poorly planned development also negatively affect surface water and groundwater quality and quantity.

Today's water management issues are complex and cannot be addressed by any single entity acting alone. Whether the goal is to reduce phosphorus or mercury, protect critical habitat or prevent introduction of exotics, we need strategies designed by and for coalitions of partners — government, industry, advocacy interests and individual citizens. For success, these efforts need to be coordinated and integrated using a hydrologic and culturally inclusive orientation: the Watershed Approach.

Please use this report to help determine the status of waters that interest you. By familiarizing yourself with existing conditions and problems, you can help identify and carry out solutions. We can resolve remaining problems and prevent additional concerns by working together. Through sharing common goals for our watersheds, we can restore and protect the unique water wealth that largely defines the State of Wisconsin. For more information about this report, please contact Lisa Helmuth at 608-266-7768. I encourage you to participate in watershed management efforts in your area; everyone's involvement is needed to successfully protect and manage our state's water heritage.

Sincerely,

P. Scott Hassett, Secretary

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Recommendations

Many of Wisconsin's recommendations to USEPA and to the Congress can be addressed through a reauthorization of the Clean Water Act. These needs include national leadership on criteria, program guidance and funding commensurate with the range of activities required to fully implement the Clean Water Act. *Wisconsin recommends the following actions to Congress, USEPA and the Coast Guard:*

- Finalize national nutrient criteria guidance for surface waters.
- Establish a schedule for the completion of national sediment quality criteria guidance.
- Reauthorize the Beach Act and implement program improvements identified during the first five years of program implementation.
- Establish a more clearly defined and achievable program to develop and implement TMDLs, including developing national criteria for designating and delisting 303d impaired waters and leading multi-state efforts for regional issues, such as mercury TMDLs and listings.
- Develop clear regulations for discharges from sanitary sewer overflows.
- Regulate atmospheric mercury to levels that are protective of fish and aquatic life.
- Fund monitoring programs and require states to use the same criteria for biological assessment protocols. Provide fiscal support to states to improve the useability of STORET.
- EPA should develop a sediment remediation program which includes specific standards or quality criteria, timelines for implementation and a funding system to provide assistance to states for building state capacity and conducting remedial projects for sites identified in remedial action plans and lakewide management plans as a means of reducing toxicant body burdens in Great Lakes fish and wildlife.
- Develop guidance that requires integration of water program standards and regulation of substances through the Toxic Substances Control Act (TSCA); the Resource Conservation and Recovery Act (RCRA); the Clean Air Act and the Federal Insecticide, Fungicide, Rodenticide Act (FIFRA).
- Address discrepancies between regulatory clean up levels for PCBs under Superfund and clean up levels needed for water quality and aquatic life.
- Develop and enforce controls under the Federal Insecticide, Fungicide, Rodenticide Act for compounds found to be problematic for groundwater quality to a level protective of groundwater.
- Increase funding for Clean Water Act Section 106, 319, 104b(3) and 205(j) or local 604(b) related water quality efforts without sacrificing funding from other programs.
- Develop technical guidance and resources to support decisions related to wetland and riparian zone protection and management, particularly buffers for sensitive areas vulnerable to runoff.
- Modernize and simplify the permit compliance system (PCS) system for the NPDES program or implement other information systems or reporting mechanisms needed for the program.
- Congress should develop a continuing appropriation for USEPA and delegated states to support data systems needed to implement the Clean Water Act including monitoring, assessment, and permitting activities using new technologies that integrate complex data and allow dissemination of that data to partners, stakeholders and the public.

Part I: Report Summary

In 2002-04, Wisconsin progressed in its development of a comprehensive framework to reduce and manage nonpoint sources of pollution through statewide performance standards for this, the largest source of conventional pollutants to our waters. In addition, significant policy initiatives designed to better protect groundwater and sensitive surface waters, such as outstanding resource waters, and to better address the special needs of the Great Lakes ecosystem have been sponsored by the Governor. New groundwater legislation will help protect sensitive resources from excessive consumptive use, while renewed emphasis on the Great Lakes will focus talent and resources on this, one of our most-beloved ecological treasures.

Additionally, Wisconsin is improving its tracking of water quality condition through data management system upgrades for assessment, permitting and compliance. We are also implementing electronic discharge monitoring report submittals and web-based permit applications. These changes take advantage of new technology, making data more available to decision makers and the public. Enhancements incorporate spatial views, or maps, so that waterbodies and descriptive data can be viewed and edited interactively. This technology makes data available for integrated analyses and for “point-and-click” readability at the waterbody level to improve management and public access.

Using new tools that improve the accuracy of waterbody size calculations, we have found a significant difference in the total mileage historically reported for 305b purposes. The state’s 1:24 hydrography layer shows that our state supports 84,474 stream miles, 1.2 million lake acres and 1,000 Great Lakes shoreline miles. In 2005-06, assessment data will better match these summary figures (ie., the 1:24,000 scale hydrography layer will be used to calculate individual waterbody size), thereby changing our state’s assessment calculations. However, in this report we are resubmitting 2002 assessment figures, described below.

As of the 2002 reporting period, 24,422 stream miles (28% of total based on 84,474 mi) were “assessed” — 9,199 miles had been monitored (11%) and 15,222 miles were evaluated (18%) — all 57,698 stream miles are listed as impaired for one or more beneficial uses due to a statewide general fish consumption advisory for mercury. These data reflect cumulative work over a period of several years. In addition, direct habitat alterations negatively affect 8,459 stream miles; siltation or sedimentation affect 6,458 stream miles; and nutrients affect 2,717 stream miles. Following these key causes are turbid waters, low dissolved oxygen and the presence of pathogens (bacteria).

Sources of problems include atmospheric deposition (57,698 miles), agriculture (5,620 miles), hydrologic modifications (4,223 miles), non-hydrologic habitat modifications (3,583 miles), and streambank pasturing (2,736 miles). These stream figures reflect historic data (gathered prior to 2000-02) as well as assessments made in 2002.

Wisconsin lakes have been more comprehensively evaluated than streams, in large part due to outstanding Lake Monitoring Volunteers. Over 792,000 lake acres have been assessed, with 758,782 acres monitored and 33,519 acres evaluated. As with rivers, due to the presence of a general fish consumption advisory for mercury, all 792,000 lake acres are listed as impaired for one or more designated uses, with mercury via atmospheric deposition the chief cause/ stressor. Other problems include excess nutrients, siltation, organic enrichment, noxious aquatic plants, and the presence of aquatic invasive species. Key source categories include agriculture, construction, hydrologic modifications (dam construction and flow changes), and habitat modification or destruction.

Wisconsin plans to achieve comprehensive coverage of its waters through continuing to implement baseline monitoring utilizing random stratified sampling techniques and improve the tracking and assessment of all waterbodies. In addition, the state’s growing Volunteer Rivers Program will help provide “red flag” data to biologists, which will help focus valuable resources. These improvements, combined with substantial improvements in data management systems, will allow Wisconsin to better understand and communicate general trends or changes in water quality over time.

Issues of special concern include nonpoint source standards implementation, Great Lakes management, aquatic invasive species, water quantity, riparian development, habitat protection and restoration, atmospheric deposition of mercury, monitoring and data management, and compliance assistance.

Part II: Background

Atlas Data

Wisconsin is a state rich in water resources. There are many thousands of streams in the state covering 41,614 perennial river miles and 42,860 miles of intermittent streams for a total of 84,474 linear stream miles. The state's many inland lakes span over 1.2 million acres. Wisconsin also has over 1,000 miles of Great Lakes shoreline on lakes Michigan and Superior, 5.3 million acres of wetlands and, with a few exceptions, a largely abundant supply of groundwater.

The task of assessing, monitoring and managing these water resources is large, and quite frequently, available data for many of the resources is outdated or non-existent. As Figure 1 below shows, Wisconsin subdivides the state by basins for the purpose of managing water resources. Management basins are a mixture of hydrologic basins at the 8-digit HUC level, county boundaries, and DNR regional boundaries. Figure 2 shows that lake assessments have been completed and entered into the state's Waterbody Assessment Display and Reporting System (WADRS), our assessment database, for all management basins. Figure 3 shows that all of the management basins have been assessed for aquatic life use and fish consumption advisories, yet stream assessments for only a portion of the management basins have been entered into the WADRS database. The results of these assessments are discussed in Chapters 3 and 4.

Figure 1. Map of basins, counties, water management units

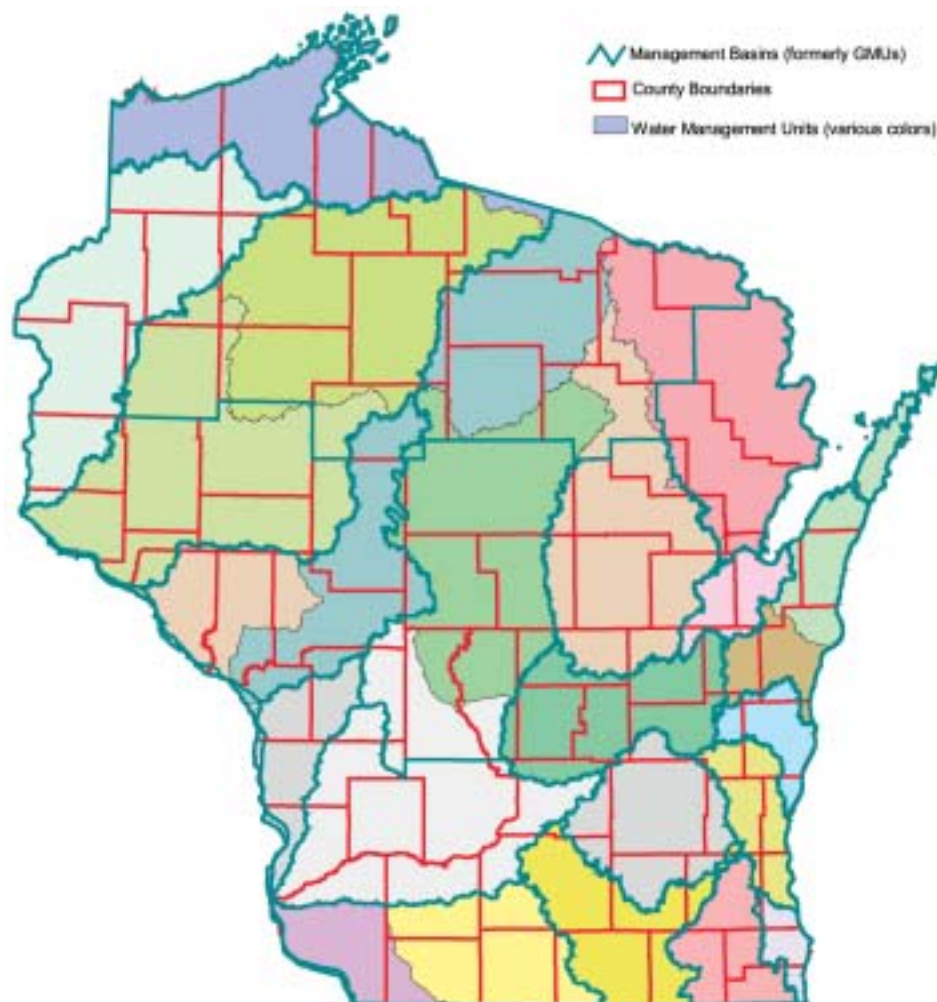


Figure 2. Lake assessments entered in database

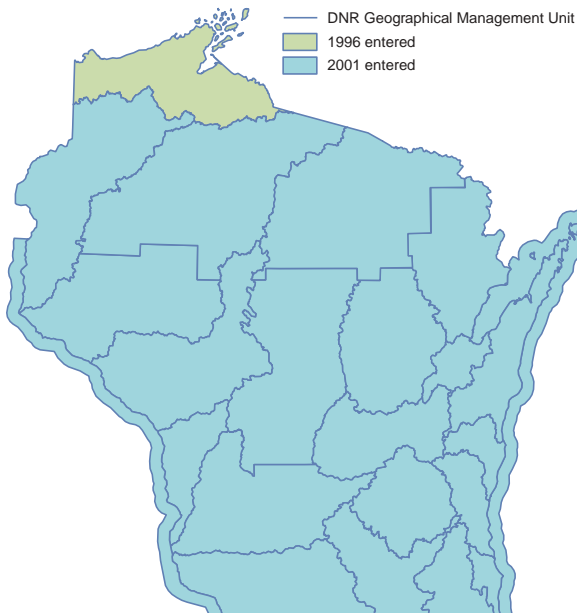
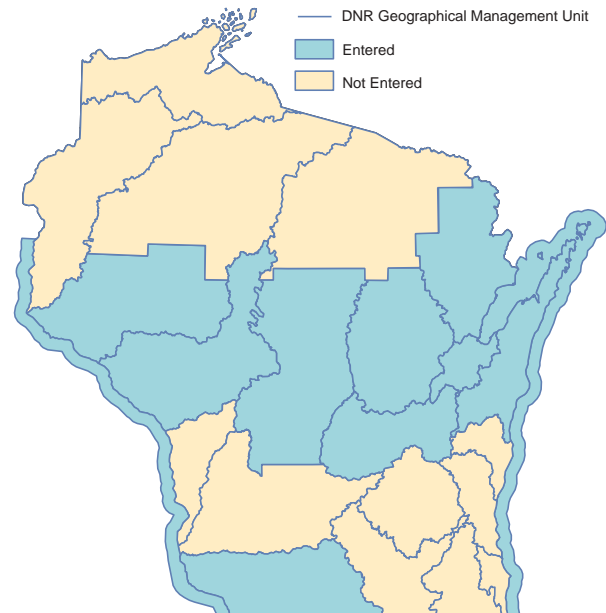


Figure 3. Stream assessments entered in the database



Protecting Our Water Heritage

Achieving the Department's goals of ecosystem protection and public health and safety involve key objectives that center on water, namely protecting the state's public trust doctrine and fully implementing the Clean Water Act. These critical areas are inter-related and both require using a Watershed Approach.

Wisconsin's Watershed Approach is an evolving framework, infusing traditional management tools (standards, regulations) with fresh ideas borne of cutting edge technology and visionary thinking. Wisconsin integrates its water programs through place-based management, using the basin as the focus of program implementation for many aspects of Clean Water Act implementation.

The Department is evolving its management programs to better integrate such diverse resource areas as water quality and quantity, surface water and groundwater, fisheries, habitat, wildlife, and forestry. Connections between water quality and resource sensitivity are being made through environmental corridor protection, shoreland management programs, and special studies that identify sensitive areas critical to pollution. Land management initiatives such as Wisconsin's Land Legacy and Ecological Landscapes (Figure 4) identify special resource areas with an eye toward aquatic sensitivity.

The Watershed Approach includes using adaptive management to continually review and adapt programs and structures to remove impediments to integration and to utilize incentive-based resource management practices where possible. The Division of Water is re-evaluating all aspects of structural and functional program implementation to better achieve the goals of clean water and protected resources for future generations. Further, the Department will continue to work with stakeholders, partners and in-place interstate initiatives to achieve these goals.

To protect and enhance our natural resources:

our air, land and water;

our wildlife, fish and forests

*& the ecosystems
that sustain all life.*

Science and Innovation in Water Management

During 2002 and 2003, the Wisconsin DNR participated in a number of research projects to enhance knowledge of watershed and contaminant transport processes, with the ultimate goal of refining and improving resource management and ecosystem health. Below are a few of these projects.

Watershed Studies

Development and Evaluation of Watershed Models for Predicting Potential Stream Condition and Making Land Use Decisions

The goal of this study is to develop and test models that quantify stream biological expectation and to predict how watershed land uses will influence the realization of this expectation. The approach used is to develop models that predict stream segment temperature, flow, and biological conditions based on climate, surficial geology, topography, soil, vegetation, and land uses for various regions of Wisconsin. These models are then linked to classify and map Wisconsin stream segments to explore how projected land-use changes may affect stream conditions for selected watersheds. Collection of field physical and biological data and developing GIS layers for watershed characteristics for this study is complete, and the data modeling process has begun.

These models can be used to classify stream reaches that lack adequate fish data and to estimate how watershed land-use has influenced thermal regimes, flow patterns, and fish communities across broad regions. Fisheries managers will be able to compare the expectations for a specific watershed with its current condition to determine its potential for improvement and to establish more realistic fishery goals. Planners can use these models to predict biological conditions under different landuse scenarios. Based on the stream classification, sampling and inventory efforts can be better allocated among watersheds and streams to maximize efficiency and statistical reliability for bioassessment.

Evaluation of the Wisconsin Priority Watershed Program for Improving Stream Habitat and Fish Communities

This project was designed to determine the extent to which installation of best management practices (BMPs) improves the quality of aquatic resources. The study design is to sample habitat and fish communities using standardized procedures with known accuracy and precision at treatment and reference streams several years before and several years after BMP installation. And, two physical habitat (one for low and one for medium-high gradient) and two fish biological indices (one for coldwater and one for warmwater) have also been developed and tested. Fish and habitat data from 81 sites on 33 streams for five priority watersheds and their reference watersheds during the past 14 years have been stored in a centralized database.

The evaluation of the Spring Creek Watershed, which demonstrated significant habitat and fish community improvements after BMP implementation, is complete and has been published. The evaluation of the Otter Creek watershed is also complete and in the publication process, but results were less than expected. Habitat conditions improved in Otter Creek, but fish communities did not. A likely reason the fish community did not change much is because the fish community was pretty good prior to the project and implementation of BMPs that would most directly influence the fish community (upland sediment control, riparian protection) were not implemented at a level high enough to elicit a response in the fish community.

Impacts of Watershed Urban Land Use on Coldwater Streams

This study was designed to develop models that describe relations between watershed urban land use and biological communities and to answer the question "at what level of watershed urban development can a coldwater stream no longer support trout populations?" Thirty-nine (39) coldwater streams with different levels of watershed urban development for physical habitat,

water temperature, base flow, fish, and macroinvertebrate were sampled. Urban land use in both riparian and watershed were digitized using GIS. This study is complete and published. *Results indicate that stream base flow and biological indices decrease dramatically for watersheds with 7-11% impervious area, beyond which stream base flow is consistently low and biological indices are consistently poor.* Trout were not found in streams with more than 11% impervious surface area.

The models developed from this study can be used to predict stream quality for projected urban development, which can be used by policymakers, resource managers, planners, and developers to design strategies to minimize the impacts of urban development on coldwater streams.

Monitoring & Management Studies

Impacts of Phosphorus and Nitrogen Concentrations on the Biological Integrity of Wisconsin Stream

The objective of this project is to determine what phosphorus and nitrogen concentrations impair stream biological integrity; to develop a database that can be used to refine the phosphorus criteria for Wisconsin streams; and to determine how watershed characteristics affect the relation between phosphorus, nitrogen, and biological communities. DNR has gathered data for nitrogen, phosphorus, other physical and chemical variables, periphyton, macroinvertebrate, fish, and physical habitat from 160 headwater streams, 80 larger but wadeable streams, and 40 nonwadeable streams/rivers. DNR gathered watershed land use and identified periphyton and macroinvertebrate community composition. Staff are now in the process of analyzing the data and the results will be available during this next reporting period.

The results of this study will be used to help interpret TMDL data and to refine nutrient criteria.

Status Assessment and Development of a Fish Index of Biotic Integrity (IBI) for Small Warmwater Streams

The objectives of this study are to evaluate fish and habitat status and to develop a fish IBI for very small and intermittent warmwater Wisconsin streams. Ninety-eight (98) small warmwater streams throughout the state with different levels of impairment (from least to highly impacted) have been sampled for fish and habitat twice a year for two years. Watershed boundaries have been delineated and land use information for these stream catchments has been gathered.

The results from this study will provide information on fish and habitat conditions for these small warmwater streams, which is currently unknown. The IBI developed here will provide a tool for setting regulatory criteria and bioassessment for these types of streams.

Comparison of Multi-level BMPs for Improving Stream Quality

This study is designed to evaluate if current levels of BMP installation improve stream habitat, fish, and macroinvertebrates and to examine if riparian buffer width has any influence on the upland BMPs effectiveness. Thirty-eight (38) small watershed streams with different levels of agricultural impairment and with different levels of BMP implementation (high impact - high BMP; high impact - low BMP; low impact - high BMP; low impact - low BMP) have been sampled. And, field data collection on fish, macroinvertebrate, and physical habitat is also complete. Riparian and watershed land use data has been gathered and watershed BMP implementation information is being assembled.

The results from this study can help researchers and managers understand if large-scale, low-level BMP implementation will improve stream quality. With this knowledge, resources can then be allocated more effectively.

Development of a Probability-Based Stream Monitoring and Assessment Strategy

To learn more go to:
<http://dnr.wi.gov/org/es/science/>

The purpose of this study is to find a cost-effective approach for better understanding the state's resource condition. This work will help stem the loss of stream resources and help improve understanding of factors impacting water so that the state can more effectively monitor, assess and manage resources. The resulting information will be used to guide and evaluate stream resource assessment and management activities, and educate the public and political policy makers. This collaborative project is designed to: 1) determine whether three different methods used to select stream assessment sites significantly influence field data gathered to evaluate the condition of individual and populations of streams; 2) investigate how large-scale catchment attributes affect riparian and in-stream habitat and water chemistry, which in turn influence the biological integrity of streams; and 3) pilot the development of a multi-metric macroinvertebrate index for wadable streams in the driftless region ecoregion in western Wisconsin, and subsequently apply this process to develop a macroinvertebrate index for the entire state. The results of this study will be used to improve WDNR wadable stream monitoring and assessment program and advance and institutionalize the use of probability based monitoring in Wisconsin.

Development and Validation of a Macroinvertebrate-Based Index of Biotic Integrity (IBI) for Low-Gradient Streams

Biotic assemblages in low-gradient streams are inherently different from those assemblages inhabiting medium to high gradient streams. Assessment tools developed through empirical modeling of data collected from medium to high gradient streams inaccurately score the ecological integrity of low-gradient systems. Therefore, we propose to tailor a macroinvertebrate-based IBI to low-gradient streams. Fifty-nine (59) sites will be used to develop the index and twenty-two (22) sites were set aside for validation. Watershed, reach, and local scale variables will be used to determine environmental conditions at the sites independently of the biota. Macroinvertebrate metrics that correspond with the independent assessment of environmental condition will comprise the IBI. The macroinvertebrate-based IBI tailored for low-gradient streams is intended for use in Wisconsin's Baseline Monitoring Program.

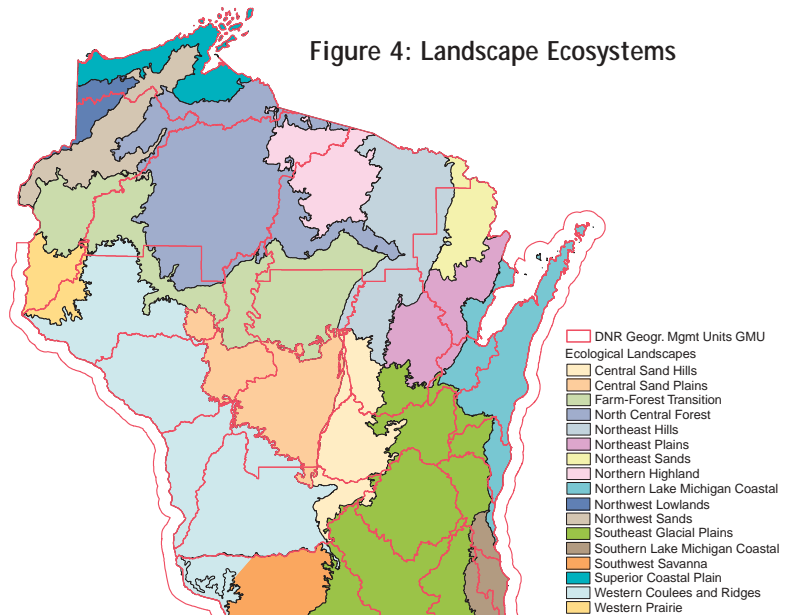


Water Management Programs

Water Quality Management Planning

Wisconsin's Water Quality Management Planning Program encompasses a broad array of activities, as 'basin plans' have historically served as the foundation for conformance reviews during implementation of many of the state's water-related programs, grants and permits. Water Quality Planning includes the following activities:

- Preparation of Basin or Integrated Management Plans.
- Assessment of rivers, streams, lakes and groundwater; entering data into the Waterbody Assessment Display and Reporting System (WADRS).
- Identification of areas for monitoring and management including identification of goals, objectives and projects.
- Ranking nonpoint source priority areas for streams, lakes or groundwater.
- Recommendations for specific Lake or River Planning or Protection Grants.
- Recommendations for prioritizing waterbodies for total maximum daily load (TMDL) implementation.
- Administration of the Local Water Quality Aid Program, which provides grant funds to local and regional governments for water quality management planning.
- Preparation of Sewer Service Area Plans.
- Oversight, review and approval of plans developed by designated planning agencies (Southeast Regional Planning Commission, Dane County Regional Planning Commission) and for additional designated management areas (Fox Valley Area, including Brown County and portions of East Central Regional Planning Area.
- Oversight, review and approval of sewer service area plans developed by communities with populations of greater than 10,000 – these undesignated planning areas.



Integrated Basin Plans

The State's 32 major rivers fall into 23 management basins. During 2000-2001, 19 of these management basins developed State of the Basin Reports through an integrated planning process with partners. This multi-step process involved external partners in the identification and prioritization of issues and to help identify goals and objectives for ecosystem management. Integrated Basin Plans (or "State of the Basin Reports") can:

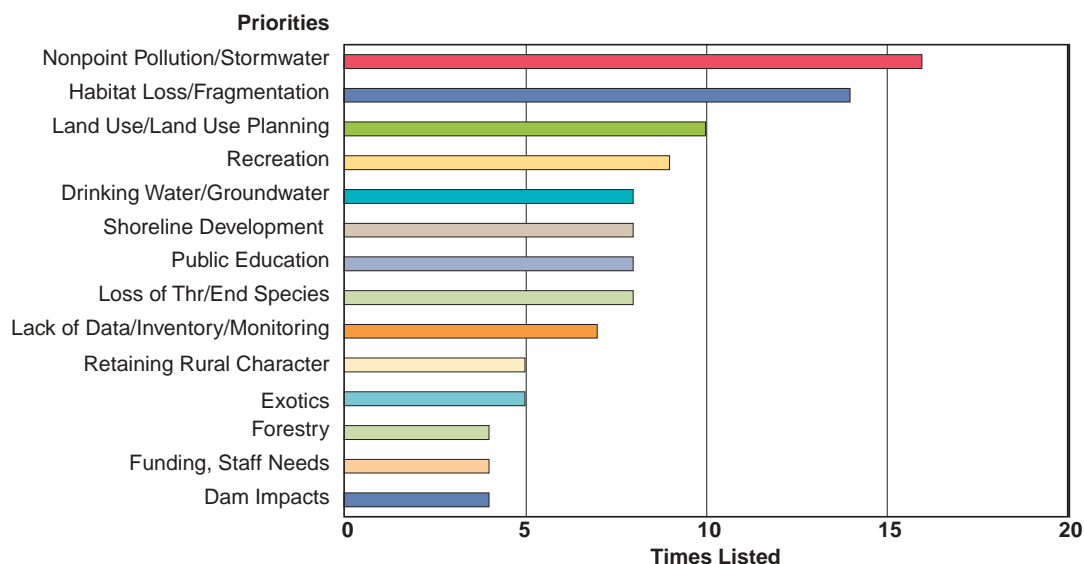
- ✓ Highlight priorities identified through a partner group process.
- ✓ Provide a descriptive summary of the physical and biological characteristics of the basin;
- ✓ Identify basin-specific water, fishery, wildlife and habitat issues. and
- ✓ Identify basin-specific objectives (in the form of recommended actions) linked to the GMU or basin-specific issues.

Planning Status

The state’s traditional planning schedule, updates on a five-year rotating basis, was replaced with a six-year schedule to support the structure of the basin-partner management approach. Through the identification of key issues, goals, objectives and recommendations, the plans provide a starting point for project identification and work coordination. This statewide schedule also coincides with DNR’s internal biennial workplanning schedule and fisheries management planning approach.

The broadened scope of basin planning reflects a broadening of the state’s key management issues as they relate to water. Priority issues identified in the plans are arrayed and compiled to identify the overall priorities identified at the basin level. Figure 5 shows the principle issues identified through the integrated planning process. These issues include habitat loss/land use conflicts, deterioration and fragmentation; nonpoint source pollution of surface waters; groundwater deterioration; contaminated sediments; user conflicts due to heavy recreational uses; contaminated sediments.

Figure 5: Principle Issues Identified Through Basin Planning



WDNR continues to make progress toward increasing the number of surface waters assessed for their water quality condition. This effort will be enhanced in the next year through an analysis of assessment protocols for streams, lakes and the Great Lakes and how these assessments relate to the identification of impaired waters under the Clean Water Act Section 303(d) requirements.

The primary issues for streams continue to be degraded habitat and polluted runoff. For lakes, it is Sewer Service Area Planning involves identifying a community’s 20-year growth pattern to design cost-effective and environmentally sound sewerage systems. A sewer service area plan has maps of existing sewer areas, adjacent land most suitable for new development, and areas where sewers should not go due to environmental constraints. Sewer service area planning is designed to provide structure to a community’s wastewater collection system and plays an important role in keeping Wisconsin’s water safe for drinking, recreation, and fish and aquatic life. Because the plans anticipate future growth they can be used as a tool to help consolidate wetland, shoreland, and floodplain protections in a community-based plan.

In “undesigned areas” (see above), sewer service plans identify future service areas for communities with populations exceeding 10,000 (as per NR 121.05(1)(g)(4)). Urban areas with wastewater treatment plants that treat 1.0 million gallons per day or more within standard metropolitan regions are included in the sewer service area planning process. There are 28 municipalities in the state that fall under this “undesigned area” definition. Most of these 28 areas have an approved sewer area plan. Only a two communities that are required to have a sewer service area plan still do not have an approved plan.

Water Quality Standards

In Wisconsin surface waters are classified for the beneficial uses they are capable of supporting if controllable impacts to water quality are managed. Protections afforded surface waters are derived from a series of administrative codes, ranging from ch. NR102 through NR106, Wisconsin Administrative Codes. Ch. NR 102 provides the classification of waterbodies in the state. Water quality criteria for wetlands is provided in ch. NR 103. Ch. NR 104 identifies waterbodies that have specific water quality classifications other than warm water sport fish or forage fish communities (i.e., those that are outstanding or exceptional resource waters or those that are identified as marginal (limited forage fisheries or limited aquatic life communities)). NR 105 provides standards for toxic substances and NR 106 details how to calculate water quality-based effluent limits (WQBELs) to meet standards found in NR 105.

Water Quality Classifications

NR 102 identifies water quality classifications for Wisconsin Surface Waters (see below). WDNR uses the state's fish and other aquatic life uses classification as the basis for its assessment procedures (see Chapter 2).

Fish and Other Aquatic Life Uses

Fish and other aquatic life uses are further subdivided in Wisconsin Administrative Code NR 102.04(3) in the following categories:

Cold water communities: These are surface waters that are capable of supporting a community of cold water fish and other aquatic life or serving as a spawning area for cold water fish species and includes, but is not limited to, surface waters identified as trout waters (Wisconsin Trout Streams, publications 6-3600(80)).

Warm water sport fish: These are surface waters capable of supporting a community of warm water sport fish or serving as a spawning area for warm water sportfish, such as bass.

Warm water forage fish communities: These are surface waters capable of supporting an abundant, diverse community of forage fish and other aquatic life.

Limited-forage fish communities: These are surface waters capable of supporting only a limited community of forage fish and other aquatic life due to low flow, naturally poor water quality, or poor habitat.

Limited aquatic life: These are surface waters of severely limited capacity due to very low or intermittent flow and naturally poor water quality or habitat, capable of supporting only a limited community of aquatic life.

Surface waters classified in the limited forage fishery or limited aquatic life subcategories are not capable of achieving Clean Water Act goals. These waters are listed in Wisconsin Administrative Code NR 104.05 to 104.10.

Outstanding & Exceptional Resource Waters

Wisconsin has classified many of the state's highest quality waters as Outstanding Resource Waters (ORWs) or Exceptional Resource Waters (ERWs). Chapter NR 102 lists the ORWs and ERWs. The identification of ORWs was one of the requirements for federal approval of the antidegradation policy. In the early 1990s WDNR conducted a statewide evaluation to determine which waters qualified for ORW and ERW classification. In 1993 and in 1996 waters were added to Chapter NR 102 as ORWs and ERWs after rigorous screening and public input processes. In 2002, the Public Service Commission donated Caldron Falls as a protected waterbody under the ORW/ERW program. Below is a summary of the number of waters that are classified in NR 102 as Outstanding and Exceptional Resource waters:

Table 1: ORW/ERW Waterbodies

	ORWs	ERWs - Number of Waters
Streams	220	1532
Lakes	97	
Flowages	6	

A total of 2,075 stream miles or 6.5% of the 32,010 perennial river miles in the state have been classified as ORW. A total of 3,661 stream miles or 12% of the river miles in the state have been classified as ERW. Of Wisconsin's 27,723 waterbodies, 1,855 (6.7%) are now classified in NR 102 as either Outstanding or Exceptional Resource Waters.

Recreational Use Waters

Surface waters in the fish and aquatic life use classifications may also be classified as recreational use waters. This classification assures standards protecting surface waters from fecal contamination. A bacterial examination of the water determines the suitability of a recreational use classification. As a result of this classification, municipal dischargers to recreational use waters may be required to disinfect their effluent.

Public Health and Welfare

All surface waters shall meet the human threshold and human cancer criteria specified in Wisconsin Administrative Code NR 105. The applicable criteria vary depending on whether the surface water is used for public drinking water supplies and the designated aquatic life use subcategory. All surface waters that provide public drinking water supplies, or are classified as cold water or warm water sport fish communities must meet taste and odor criteria as specified in NR 102.

Wildlife

All surface waters shall be classified for wildlife uses and meet the wildlife criteria as specified in NR 105.

Water Quality Classification Revision Process

Stream Classification Revision

An extensive list of streams and their designated aquatic life uses were promulgated by WDNR in 1976. Use designations are defined in NR 102 and represent a classification system that considers the type of aquatic life community that may be supported by a surface water and its naturally occurring background chemical (i.e., dissolved oxygen, pH, etc.), physical (i.e., temperature, flow, habitat, etc.), and biological (i.e., species of fish and other aquatic life present) features.

The WDNR is currently updating the aquatic life use designations and is repackaging the rules in a more logical, user-friendly format. Streams not meeting standards for fish and aquatic life, primarily due to natural conditions, were listed in NR104 in 1976. This system allowed the establishment of effluent limits in an efficient manner while also providing a level of water quality commensurate with the economic and cultural realities. Additional streams have been evaluated and their classifications will be included in a revised NR104. In addition, many of the classifications conducted in the 1970s have been reviewed and, based on new information, need to be reclassified to another Fish and Aquatic Life classification sub-category. These changes in classification typically cause a modification in water quality criteria and associated requirements (e.g. effluent limitations for point sources).

Phase I: Water Body Use Designation

To properly update stream classifications, revisions to chapters NR 102, 104 and 106 are underway. The revisions will be completed in two phases. Phase I revisions focus primarily on accurately updating current classifications listed in NR 104. Use designation changes included in

Phase I revision efforts should not force a wastewater treatment plant (WWTP) upgrade – these revisions are intended to make the rule current with respect to use designations and WWTP effluent limits. The proposed revisions to each of the Natural Resource code chapters are as follows:

To learn more go to: <http://dnr.wi.gov/org/water/wm/wqs/index.htm>

Chapter NR 102, *Water Quality Standards for Wisconsin Surface Waters*, will contain rule language that was previously located in NR 104. NR 102 is a more appropriate location for the language since the language is specific to designated use categories and water quality criteria necessary to support those uses for the surface waters of Wisconsin.

Chapter NR 104, *Uses and Designated Standards*, is the chapter that establishes uses and designated standards for surface waters of the state. Surface water use designations and variances included in this chapter have been updated. Further, specific waters that may be characterized as surface waters not able to support a Full Fish and Aquatic Life community are listed in this chapter.

Chapter NR 106, *Procedures for Calculating Water Quality Based Effluent Limitations for Toxic and Organoleptic Substances Discharged to Surface Waters*, is proposed to be re-titled. The purpose of this subchapter is to specify how the department will determine effluent limitations for substances discharged to waters that have been identified and designated as surface waters not able to support a Full Fish and Aquatic Life community.

Phase II: Water Body Use Designation

Phase II of the revisions will focus on further modifications to the listing of use designations in NR 104, as well as the exploration of several policy issues related to designating the use of a waterbody. Topics related to use designation have been identified that warrant additional thought and discussion. A Water Body Use Designation Advisory Committee (WBUD AC), comprised of members from the academic, environmental, and regulated community, has been charged with working through the topics. Several issues that have been identified for discussion including dealing with effluent discharges to various types of receiving waters, including cold water resources, Great Lakes waters, effluent channels and dry runs. There will also be additional research and discussion regarding how to appropriately classify wetlands to ensure that they are adequately protected from potential discharges. Finally, Phase II revisions will work through the aspects of implementation of new policy and procedure decisions into the existing use designation program. While these are some of the subjects scheduled for Phase II of the revision efforts, it should be noted that the focus of the effort might change over time, as different and/or additional needs are identified.

Proposed Classifications

Fish and Aquatic Life Stream Classification Guidelines

Surface water sources throughout Wisconsin vary in size, quality, and utilization, and can be grouped according to common characteristics. These groupings enable the Department to properly protect the resource while allowing the use of the resource by parties with various interests. To preserve and enhance water quality throughout the state, the following use designations have been established by WDNR: Fish and Aquatic Life, Recreation, Public Health and Welfare (including drinking water), and Wildlife. Of these classifications, the Fish and Other Aquatic Life classification is designed as a water quality management tool to qualitatively assess and designate fish and aquatic life uses for surface waters receiving waste discharges.

Within the Fish and Aquatic Life use designation, five sub-categories of uses have been proposed: Coldwater A, Coldwater B, Full Fish and Aquatic Life (FFAL), Limited Forage Fish (LFF) and Limited Aquatic Life (LAL). Minimum characteristics for each of these sub-categories are detailed in the guidance.

If there are controllable impacts on a specific waterbody that can be eliminated or reduced (e.g., point source discharges, construction site runoff, or landfill leachate), a waterbody could potentially have an improved **attainable use (currently referred to as potential use)**. The **desig-**

nated (or potential) use of a waterbody is the use that is selected and promulgated as a management goal.

When it is determined that a surface water needs to be classified (or re-classified), field data are collected and analyzed. These data include the assessment of existing information, fish communities, habitat, water quality, and macroinvertebrates. Collected data are interpreted, compared to reference sites, and a final use designation determination is made. This use designation, once promulgated, establishes the linkage to water quality criteria that are used to manage the discharge of pollutants into the waters of the state.

Waterbody Assessment Implications

Modifications to the system on which Wisconsin bases its aquatic life use designations demands a review and revision to the way in which the state assesses its waterbodies for the 305(b) Water Quality Assessment procedure. The current aquatic life community-based system (described in Part III, Chapter 2), which is used hierarchically to identify use support levels for state level assessments – and, which is used in conjunction with the waterbody’s codified use to identify additions to the state’s 303(d) list of impaired waters, may no longer be in effect once new classification rules have been promulgated. In addition, use of a random stratified sample design for the state’s baseline monitoring program requires the development of protocols to assess the condition of a waterbody in light of extrapolated data rather than the use of traditional monitoring and assessment protocols. This change also demands a re-evaluation and redesign in the way streams and lakes are assessed statewide. Thus, in the coming years, WDNR’s water and fisheries programs work together to evaluate potential changes in how assessments are conducted as a precursor to designing a new system for determining use designation support for waterbodies.

Thermal Standards. Water temperature is very important to the health, reproduction, and function of aquatic organisms and plants, as they exist only within certain temperature ranges. Water quality standards that protect aquatic organisms and plants from human discharges of elevated temperatures or heat loads (i.e. thermal pollution) are an important component of the overall regulatory strategy for protecting aquatic environments. Sources of thermal pollution include:

- industrial discharges (e.g. power plants, manufacturing plants, etc.),
- discharges from dams,
- urban runoff,
- changes in land use (e.g. loss of trees and shrubs along streams, loss of wetlands, etc.),
- and agricultural runoff.

Wisconsin continues its revision of thermal water quality rules, with rule adoption planned for 2005.

Wastewater Management

WDNR has primary state management authority over wastewater treatment and disposal in the state. This management responsibility is accomplished through the implementation of the following programs and activities:

- Wisconsin Pollutant Discharge Elimination System (WPDES) permits program.
- Industrial pretreatment for discharges to municipal sewerage systems.
- Approval of plans for wastewater treatment and disposal facilities and practices (“facility planning”)
- Enforcement and compliance assistance.
- Assuring continuing and sufficient wastewater management practices in municipalities through a compliance maintenance and reporting program.

WPDES Permit Program

The WDNR regulates municipalities, industrial facilities and significant animal waste operations discharging to surface waters or groundwater of the State of Wisconsin through the Wisconsin Pollution Discharge Elimination System (WPDES) Permit Program (See Section on Runoff Manage-

ment for discussion of WPDES permits for stormwater). No person may legally discharge to surface waters or the groundwater of the state without a permit issued under this authority. All permits issued under the WPDES permit program are either specific permits or general permits and may contain the following:

- Effluent limits for conventional pollutants and toxic substances in the discharge,
- Limitations on the quality and disposal practices for sludge (biosolids) and by-products solids,
- Pretreatment requirements, where applicable,
- Compliance schedules for facility improvements, and/or
- Monitoring and reporting requirements.

Specific permits are issued to individual facilities. The number and type of individual permittees currently regulated by the WPDES program as of January 2004 were 663 municipal permits, 430 Industrials and 130 CAFOs. These include major and minor facilities.

General permits are issued to cover a group of facilities with similar discharges which may be located anywhere in the state. Coverage under a general permit is conferred to each individual facility. The WDNR makes a determination on whether a particular facility is appropriately covered by a general or specific permit. There are 17 general permits that may be used to cover applicable discharges ranging from non-contact cooling water to land application to non-metallic mining operations. Two-thousand facilities are covered under a general permit.

Permit Backlog

The WDNR is not, in all instances, able to reissue permits before the 5-year term expires. The number of expired permits, however, is a small fraction of the total number of WPDES permits that are in effect at any given time. The goal of the WPDES permit program is to ensure that the Department does not exceed a statewide backlog of more than 10% at any time. As of January 1, 2004, the backlog of industrial and municipal permits, including both surface and groundwater discharges, was under the 10% goal (see below) and below that of many other states.

Under Wisconsin law, any permit that has expired continues in effect until it is reissued or revoked. Facilities with an expired permit, therefore, are restricted in the amount of pollutants they can discharge as if the permit has not expired.

Table 2. Wisconsin WPDES Permit Backlogs as of January 1, 2004

	Total (minors and majors)	Expired Total	% Backlog
Municipal	663	37	5.6%
Industrial	430	33	7.7%
(overall totals)	1093	70	6.4%
CAFOs	130	11	8.2%



Permits are not issued prior to the expiration date for several reasons including WDNR is awaiting additional data from the permittee, public or other comment necessitates additional review, rules are inadequate to address concerns with the discharge or a permittee is not in substantial compliance with the terms of the expired permit and enforcement action is underway.

In 2004 the Governor initiated a new permit tracking website for the public. It details both qualitative and quantitative WPDES permit issuance information.

Enforcement and Compliance Assistance

The WDNR monitors permitted discharges to assure permittees are complying with the terms and conditions of their permits. This “compliance assurance process” takes several forms and includes:

- Compliance maintenance—working with and assisting facilities to remain compliant.
- Compliance assessment—conducting inspections of facilities and on-site assessments, reviews of discharge monitoring reports and other reports for compliance, follow-up on self-reported violations.
- Enforcement—formal actions taken when a significant violation is identified including notification of a violation of a permit condition, formal enforcement conferences and/or contacts and referral to the state Department of Justice (DOJ).

Due to the excellent record of compliance of major permittees, the Department has revised its inspection strategy to allow it to focus greater attention on minor permittees who more frequently experience compliance difficulties. In June 2004, WDNR developed an updated enforcement strategy to assure there is appropriate and timely response to permit violations.

WPDES permittees have an excellent record of compliance. Table 3 shows the number of cases of significant violations identified during 1999, 2000 and 2001, along with the other formal enforcement data:

Table 3. Significant WPDES Violations

Enforcement Activity	2001	2002	2003
Number of wastewater cases referred to DOJ	9	17	10
Number of stormwater cases referred to DOJ	2	3	2

Effluent Limitations

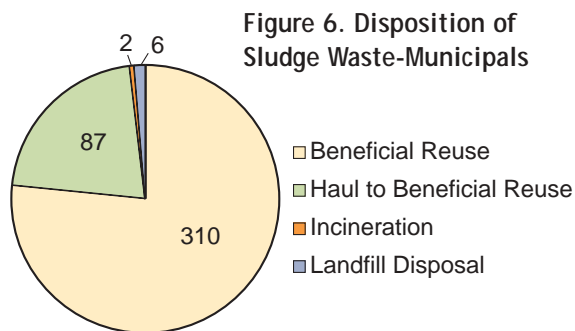
Each permit contains effluent limitations based on the type of facility or water quality-based effluent limitations calculated to meet water quality standards. Effluent limitations may regulate the amount of biochemical oxygen demand, suspended solids, pH, phosphorus, ammonia, chlorine, other toxic substances, or other conditions depending on the type of facility and the water to which it is discharged. The need for whole effluent toxicity testing is evaluated for permits that discharge to surface waters. Further information on the results of toxicity testing of wastewater effluents is contained in this report under Ecosystem Health Assessment. Land application systems normally regulate the amount of nitrogen, chlorides, or other materials that may contaminate the groundwater.

Biosolids and Sludge Disposal

About 40 percent of the costs incurred to construct, operate and maintain a municipal wastewater treatment facility come from processing, handling and recycling the residues—the sludge or biosolids—that result from wastewater treatment. Most municipal and many industrial facilities in Wisconsin land apply their wastewater treatment sludge or biosolids on agricultural land as a soil conditioner or fertilizer. Approximately 98 percent of municipal sludge generators, for example, either ultimately apply it on farmland or distribute it for individual use. Of 406 municipal facilities which must remove sludge at least annually, 310 directly beneficially reuse it, 87 haul it to facilities who beneficially reuse it, two incinerate it, and six dispose of sludge at least part of the year in a licensed landfill.

There are an additional 243 permitted facilities which treat wastewater in lagoon systems or systems which only require removal of sludge on an infrequent basis (10 - 20 year cycles). These facilities almost universally land apply their sludge.

Regulations and permit conditions control the amount of sludge or biosolids that may be



land-applied depending on the soil, slope, time of year, proximity to residences and wells and other factors. Application rates are limited to the agronomic needs of the crop to be grown and soil analyses are required at least every four years. Phosphorus levels in sludge have increased as Wisconsin has limited the amount of phosphorus that can be discharged directly to surface water in the effluent. Therefore, sludge must be managed in a way that will keep it on the land and minimize the potential for runoff to surface waters. The state also regulates all septage pumped from 698,000 septic systems (300,000 of them on required maintenance schedules) and 30,000 holding tanks. Septage must either be taken to a wastewater treatment plant for further treatment or directly land-applied. The same site criteria apply to septage as to sludge.

Pretreatment

Pretreatment dischargers are industrial facilities that do not discharge their wastewater directly to the waters of the state, but instead discharge into a municipal sewerage treatment plant. The WDNR has been delegated the authority to administer this federal program. Twenty-six municipal governments in the state are responsible for meeting state and federal requirements for implementation of pretreatment requirements. These “control authorities” regulate discharges to their systems through the issuance of permits and other local controls. Industrial discharges that are subject to the pretreatment requirements of the state, but are not within the systems of these municipal control authorities, must obtain permits directly from WDNR. There are a total of 165 facilities that receive permits directly from WDNR.

Over the past several years, the amount of WDNR oversight of the pretreatment program has declined substantially. This reduction is due to a variety of reasons including loss of staff to other high priority activities or budget reductions and a determination that most of the delegated municipalities are adequately implementing the program. In the past couple of years, however, the department has taken enforcement action against delegated municipalities for program violations. By implication, this indicates that the program is at a point of being so significantly reduced that it may be losing its effectiveness and relevance. The WDNR is reviewing this program to determine what actions are needed, if any, to assure the continued implementation of this program while at the same time reducing administrative overhead. In the past couple of years, the Department has added a pretreatment component to the SWAMP system, thereby enhancing program management.

Significant Wastewater Management Policy and Program Issues

Sanitary and Combined Sewer Overflows

In the period from 1998 through 2000, and again, in 2004, heavy rains in the Milwaukee urban area resulted in numerous incidents of overflows from the sanitary and combined sewerage systems serving the Milwaukee Metropolitan Sewerage District (MMSD) and tributary (satellite) communities. These overflow events resulted in impairments to local surface waters, and caused considerable public concern about the efficacy of these systems. In response, the Department published a report in 2001 describing the incidents and presented a lengthy series of recommendations for addressing the issue of sanitary sewer overflows in the Milwaukee area and statewide. In addition, this investigation resulted in the Department initiating an enforcement action against the MMSD for permit violations. The result of this action is the development of a stipulation requiring substantial work in the MMSD system to assure that sanitary sewer overflows are being addressed by the local governments. The Department has also initiated efforts to revise state regulations that govern the overflows from sanitary sewerage systems. In August 2004, WDNR referred to the state Department of Justice, the MMSD and 29 satellite communities for SSO violations.

Power Plants

As in many parts of the country, projected energy shortages have been identified as a concern. In response, several independent power producers as well as traditional utilities have proposed construction of power generating facilities in Wisconsin. Most of these plants are simple cycle or combined cycle gas turbine plants that recirculate cooling water and use cooling towers. Due to recent changes in state laws regarding the siting of power plants, permit actions in response to

these proposals have been elevated in priority. Additionally, the process requires substantial interaction with the project developers, and severely truncates the time scales for permit actions. As of late 2003, there were at least 5 power plant projects being reviewed by WPDES permit staff. These new projects affect the ability of the program to keep pace with the ongoing permit reissuance workload. In 2003, the WDNR established an Office of Energy to coordinate review of energy related projects. There will be a continuing workload associated with these projects for the foreseeable future.

Chlorides

The Department adopted water quality standards and WPDES program implementation procedures in 2000. Permit applications and point sources are being reviewed for the inclusion of chloride limits and compliance schedules. Source reduction activities to effectively reduce chlorides in discharges by significant amounts are difficult to implement. Permittees continue to evaluate opportunities and impediments to chloride reduction and the Department will continue to pursue reductions wherever possible. In some instances, reductions may be technologically and economically not feasible.

Mercury

Water quality standards and point source implementation procedures to control the discharge of mercury were enacted in 2002. This rule was necessitated by the enhancements to the analytical detection improvements and the presence of mercury at very small, but detectable, concentrations in almost all wastewater effluents. This policy establishes a system for prioritizing permittees according to their potential for detecting mercury in their wastewater effluent and, if present, requiring implementation of source reduction measures to reduce the amount of mercury in a discharge. Permittees are required to submit and implement a "pollutant minimization program" to effect technologically and economically feasible reductions of mercury in their wastewaters.

Ammonia

Regulations were adopted establishing water quality standards and WPDES permitting procedures for ammonia in 2004. Although the Department has been regulating ammonia in many discharges since the late 1970s using a relatively consistent procedure, EPA's revision to the water quality criteria for ammonia in 1999 provided the impetus to enact rules governing the discharge of this substance. The new rules will not substantially impact whether a permittee has to replace or construct entirely new wastewater treatment facilities to attain the new standards. Rather, small changes in effluent limitations may occur and require some modifications to operations to meet the limits. One aspect of the rules is to establish a variance process that will allow wastewater stabilization lagoon systems additional time to meet the ammonia limitations. In many instances, these systems will be replaced by more complex wastewater treatment technologies with an associated increase in costs.

Temperature

Water quality standards for temperature will be adopted in 2005. Existing standards were declared invalid for many dischargers more than 20 years ago, and the Department's ability to regulate heated water discharges is limited. Significant efforts have been made to establish scientifically valid and protective temperature criteria to protect different aquatic life communities. Temperature is a critical factor in aquatic life protection, and heated water from point source discharges must be appropriately regulated to assure protection of those organisms (see additional discussion under "Water Quality Standards").

Waterbody Use Designations

The designated uses of waterbodies is a significant factor in establishing effluent limitations on discharges from point sources. The current system for designating aquatic life uses for surface waters is in need of review and updating. WPDES permittees may be substantially impacted by this effort and permit limits may change as use designations change or are established based on new scientific procedures and information (see additional discussion under "Water Quality Standards").

System for Wastewater Applications, Monitoring and Permits (SWAMP)

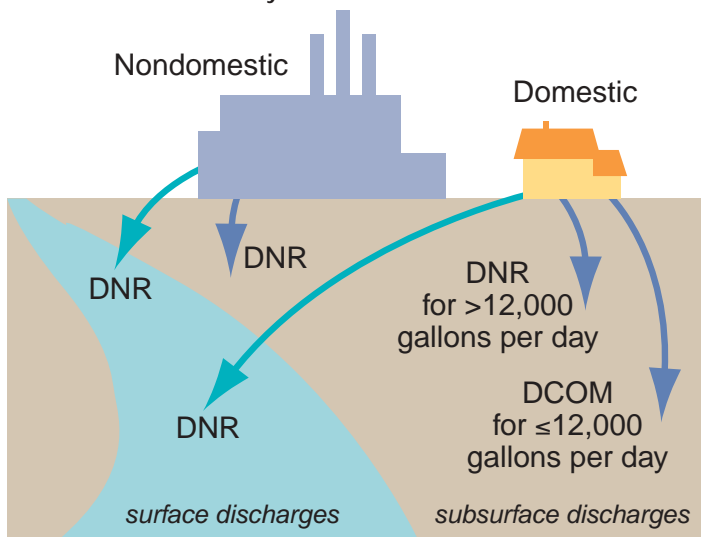
An effective data management system is essential for managing the WPDES permit system. The System for Wastewater Applications, Monitoring and Permits (SWAMP) features a consistent permit drafting system, storage capacity for monitoring and attribute data, linkages of monitoring and compliance data to permit limits and conditions, and an ability to track compliance, enforcement and other information related to the permit.

The SWAMP database was developed to provide access to monitoring, facility and inspection information, and permit drafting systems. The system was first available for use in late 1998 and additional segments and enhancements have been added as system use increased and funding became available. All permits are now being written through use of the SWAMP system, all Discharge Monitoring Report (DMR) data is being entered into the system, and it is being used by staff to assess compliance. The time needed to draft a permit has been significantly reduced as a result of the efficiencies gained through use of the system. In 2004, the Department began accepting discharge Monitoring Report information electronically for a limited number of facilities, creating further program efficiencies. It is expected that all facilities will be able to electronically submit WDNR data by 2006. Web-based permit applications are being developed now and will be online by early 2006.

Wastewater Systems Plan Review

Wisconsin Statutes require the owners of sewerage and industrial wastewater systems to submit plans and obtain plan approval from the Department of Natural Resources for new construction or modification of sanitary sewers,

Figure 7. DCOMM/DNR Wastewater Regulation Jurisdictional Boundary



wastewater pumping stations, wastewater treatment plants, large septage storage facilities and effluent outfall sewers. Plan review is intended to be a proactive and preventive component of the Department's Watershed program, designed not only to ensure compliance with applicable regulations, but also to promote attainment of various objectives beneficial to system owners, operators, the environment, and the general public.

Plan review provides an intervention point in the wastewater treatment system planning process that promotes an exchange of information, technical assistance, coordination between owners and various agencies, documentation of sewerage system infrastructure, and development of appropriate technologies for statewide use. For major projects, plan review includes an evaluation of project environmental impacts and an opportunity for public input.

Privately—Owned Onsite Wastewater Treatment Systems

The Wisconsin Department of Commerce (DCOMM) has authority to review and approve installation of wastewater treatment systems that use subsurface disposal for the wastewater. These are normally in the form of septic tanks and drain fields, although DCOMM has adopted new rules in early 2000 that allows the use of alternative treatment methods prior to disposal into the subsurface systems. WDNR regulates facilities greater than approximately 12,000 gallons per day, and DCOMM has the review and approval authority for smaller systems (see Figure 7). WDNR began to issue WPDES permits for large new and replacement systems in 2000. WDNR additionally retains review authority for all sizes of systems that contain and are used for the disposal of non-domestic wastewater. Some of these systems fall within the regulatory authority of Class 5 Injection wells under the Safe Drinking Water Act and are reviewed to conform to those regulations.

Permit Program Policy Initiatives

The following policy initiatives have been underway in 2002-2004:

- Incorporating new requirements for Mercury and Ammonia into permitting and SWAMP,
- Incorporating new requirements for Confined Animal Feeding Operation (CAFO) permits into permitting and into SWAMP,
- Upgrading capabilities for automatic generation of CAFO inspection reports in SWAMP,
- Incorporating the capability to track pretreatment facilities in SWAMP, and
- Updating geographic data reference fields in SWAMP to reflect GIS data standards at the WDNR.
- Creating electronic guidance and documents (“EGAD”), an intranet database so all policy, guidance and rules are located in one place

To learn more go to: <http://dnr.wi.gov/org/water/wm/ww/>

Innovation in Pollution Reduction

The Bureau of Cooperative Environmental Assistance works primarily with the industry regulated community to implement activities through innovative, non-regulatory programs. The following examples apply to industries within the WPDES program:

- An Innovation Stakeholders Group has been convened as an informal, quarterly forum of business, consulting, government, environmental and academic leaders for the exploration of environmental, economic and social issues associated with environmental regulation.
- WDNR has been using environmental management systems for the past five years as a part of enforcement settlements, compliance strategies and “beyond compliance” programs.
- Three ongoing programs address environmental performance within industry sectors including the Pollution Prevention Partnership (Paper), 5 Star Program (Dry Cleaners), and Environmental Excellence Award (Asphalt Pavers).
- Recognition awards are provided through the Federation of Environmental Technologist’s “Governor’s Environmental Excellence Awards” and the Wisconsin Manufacturers and Commerce “Business Friend of the Environment” award.
- The Environmental Cooperation Pilot Program (Program) has allowed seven participating companies, the Department and the public to implement regulatory streamlining, energy reductions, emissions reductions, and materials reuse and recovery.
- A Permit Primer was created as an interactive web tool for managing the full scope of permitting and prevention strategies to avoid the need for permitting or reduce permit requirements for new and expanding businesses.
- The Dairy Gateway project (building a sustainable dairy agriculture region) and the Community Mercury Reduction program are using the strength of community participation and building networks to achieve better environmental results than would be achieved through traditional regulatory approaches.
- The Wisconsin Pollution Prevention Partnership Web site (<http://wip2.uwex.edu>) is a jointly maintained site with resources, contacts and links to pollution prevention activity affecting all media.
- A full-scale strategy is being implemented for the reduction in mercury containing products, reductions in air emissions (voluntary and rule based) and the community mercury reduction program to prevent mercury in wastewater.
- Legislation (Environmental Results Act or “Green Tier”) has been enacted to provide an opportunity that combines growth and environmental improvement, but also for a program that can build new and better working relationships with businesses, communities and environmental groups. The legislation also provides the potential for new frameworks to make compliance strategies more effective, administrative burden more manageable and administrative direction more focused on significant environmental problems.
- The Regulatory Reform Act of 2004 contains additional provisions on permit reporting requirements that in the view of industries and others, should improve efficiency and effectiveness of WDNR’s programs.

Management of Polluted Runoff

Control of polluted runoff continues to be one of the most significant challenges in the state's effort to protect the quality of Wisconsin's water resources. Urban and rural land use activities are the source of runoff pollutants entering Wisconsin's lakes, streams, wetlands and groundwater. Common pollutants in runoff include the following:

- Sediment from construction sites, croplands, and other urban and rural sources,
- Nutrients and pesticides from both urban and rural sources,
- Oil, grease, heavy metals, and other toxic materials from impervious surfaces such as streets, highways, roof and parking lots, and
- Farm animal wastes from barnyards and pet wastes from urban areas.

The effects of polluted runoff can be seen in degraded fish habitat, fish kills, nutrient-loaded waters causing heavy weed growth, degradation of drinking water supplies, siltation of harbors and streams, diminished recreational uses, and changes in the natural hydrology of streams, rivers, and lakes.

To address these pollutant problems, water quality managers encourage landowners and municipalities to implement and install "best-management practices" (BMPs) in rural and urban areas. BMPs, such as buffer strips, nutrient management, manure storage facilities, or detention ponds, help to prevent movement of pollutants to surface water and groundwater.

The state's efforts to restore water resources affected by polluted runoff center around Wisconsin's runoff management program. The WDNR worked with state agencies, local governmental units and the affected publics to develop the redesigned runoff management program. The program redesign is embodied in nine administrative rules promulgated in October 2002, eight to be administered by the WDNR and one to be administered by the Department of Agriculture, Trade and Consumer Protection (DATCP).

Three primary components of the WDNR's runoff management program include the implementation of the three runoff management grant programs, point source permitting of storm water and agricultural runoff sources, and implementation of state regulatory performance standards. The management strategy for these programs is aimed at abating urban and rural polluted runoff. Wisconsin has been recognized as a leading state in the effort to control polluted runoff.

The runoff management program is a joint effort of the WDNR, the DATCP, county Land Conservation Departments (LCDs), and municipalities, with assistance from a variety of federal, state, and local agencies, particularly the USDA Natural Resources Conservation Service (NRCS) and the University of Wisconsin-Extension.

Priority Watershed/Lake Program

The Priority Watershed/Lake Program provides financial assistance to local units of government in selected watersheds to address land management activities, which contribute to urban and rural runoff. The WDNR issues grants for the implementation of watershed/lake projects through a cost-share approach. The grantees use the funds to reimburse costs to landowners for installing voluntary BMPs. From the start of the program in 1978 through December 31, 2003, approximately \$175 million in cost-share grants has been provided to these priority watershed/lake projects.

Since the program began, 86 of the state's watersheds and lakes were designated as priority watershed or lake projects (see Figure 8). Thirty-eight (38) of the 86 projects have been closed or completed. All of the remaining projects have been approved and are in the implementation phase.

Priority watershed/lake project goals focus on water quality improvements or protection resulting from reductions in pollutant levels delivered to streams, rivers, and lakes. Annual report data for 2002 indicate that projects are making progress towards reducing phosphorus from barnyards and upland sediment/soil loss. Approximately 68 percent of the projects are meeting their barnyard phosphorus reduction goals by 50 percent or more. Fifty-four (54) percent of the projects are meeting their upland sediment/soil loss reduction goal by 50% or more. In 2002, 17 projects reported a cumulative total of 325,815 feet of streambanks or shorelines that were stabilized, and a lake project reported 75,700 square feet of shoreline erosion control established.

projects have been funded by TRM grants. Approximately \$8,818,186 was authorized to fund these projects. Thus far, 41 of the 93 projects have been completed.

Urban Nonpoint Source and Storm Water Management Grant Program

The Urban Nonpoint Source and Storm Water Management Grant Program provides funding to urban areas with a population density of 1,000 people per square mile or greater, where there is a commercial land use, or non-permitted privately-owned industrial land. Recipients can receive 70 percent cost share for storm water planning, informational and educational activities, ordinance development and enforcement, training and design. Eligible best management practice construction costs (ie., detention ponds, streambank stabilization, shoreline stabilization) and are cost-shared at 50 percent. The funded projects last between two to three years. Since 2000, \$18,890,795 has funded 71 planning and 73 design/construction projects (Table 4).

Table 4. Targeted Runoff & Stormwater Grants

Grant Type	CY 2001			CY 2002		
	Grant Funds	# of Projects	# Completed	Grant Funds	# of Projects	# Completed
Agricultural	\$466,361	4	2	\$1,423,924	12	8
Urban	\$564,350	4	2	\$512,670	8	4
Subtotal	\$1,030,711	8	4	\$1,936,594	20	12
SW Planning*				\$952,950	19	8
Design/Const.**				\$5,861,917	28	8
Subtotal				\$6,814,867	47	16

Grant Type	CY 2003		
	Grant Funds	# of Projects	#Completed
Agricultural	\$1,703,370	19	4
Urban	\$664,750	12	0
Subtotal	\$2,368,120	31	4
SW Planning*	\$1,252,630	21	0
Design/Const.**	\$2,067,480	20	2
Subtotal	\$3,320,110	41	2

* stormwater planning

** Design and Construction



*Indicator of stream quality:
Ash Creek Macroinvertebrate Sample*

Storm Water Management

WDNR regulates storm water discharges through NR 216, Wis. Adm. Code, through three categories of storm water discharges – municipal, industrial and construction sites. WDNR has issued permits to 32 Municipal Separate Storm Sewer Systems (MS4s), and has 40 additional MS4s in the application process. Revisions to ch. NR 216 to reflect phase II of the federal law were sent to the State legislature for review in March 2004. Approximately 250 MS4s, including cities, villages, towns, counties and state and federal institutions, will need permits once the Phase II regulations are implemented.

Most sediment entering urban lakes, streams, and wetlands originates from construction sites. The amount of sediment that comes off a construction site per acre is generally an order of magnitude greater than the amount that comes from agricultural cropping practices. Construction site pollutants include sediment, nutrients (phosphorus and nitrogen), heavy metals, oil, and grease. WDNR permits 500 new construction sites each year for sites disturbing five or more acres of land. Phase II storm water regulations will require construction sites one acre or more land disturbance to obtain permit coverage and there are estimated to be 3,000 to 4,000 construction sites that will require permit coverage annually in Wisconsin.

Approximately 5,800 industrial facilities are covered under a WPDES storm water general permit. The WDNR has issued six general permits to cover storm water discharges from industrial facilities. Three of these permits were drafted specifically to cover one type of industry each, namely scrap recycling, used auto parts recycling, and non-metallic mining facilities. The scrap and auto parts recycling permits include the option for a facility to join a Cooperative Compliance Program (CCP). A CCP is an organization that provides additional training and auditing of its members and provides compliance reports to the WDNR. More than 60% of permitted facilities have voluntarily joined a CCP, and those facilities have done substantially better at maintaining compliance than the non-CCP managed facilities. Thus, the CCP has been successful in its first 4 years of operation.

Non-Agricultural Performance Standards

On October 1, 2002, Wisconsin promulgated non-agricultural performance standards under ch. NR 151, Wis. Adm. Code. The performance standards apply to construction site development and post-construction management of storm water runoff as well as runoff pollution from transportation facilities, including highways, railroads, and airports. To the maximum extent practical and by design, the construction performance standard requires an 80% control of sediment. The post-construction standards are also by design with an 80% total suspended solids control to the maximum extent practicable. Additional requirements include buffers for streams, lakes, and wetlands, peak flow control, and infiltration where feasible and so that groundwater is protected from potential contamination. Chapter NR 151 also includes total suspended solids controls for permitted MS4 facilities and general information and education requirements for all urbanized areas. The transportation performance standards generally parallel the non-agricultural performance standards. Wisconsin contractors are now required to provide long-term post-construction storm water controls in addition to controlling runoff during construction.

To learn more go to: <http://dnr.wi.gov/org/water/wm/nps/index.htm>

Model Ordinances for Storm Water Management

Implementation of non-agricultural performance standards by cities, counties, towns, and villages will be critical to achieving water quality goals. Although the state has ultimate authority for enforcing these standards, local regulation will greatly enhance their implementation. The WDNR has developed two model ordinances to help assure statewide consistency in storm water regulations. One ordinance covers regulation of construction site erosion, the other post-construction storm water runoff. These ordinances are included in ch. NR 152, Wis. Adm. Code. The performance standards contained in these ordinances are consistent with the non-agricultural performance standards contained in ch. NR 151, Wis. Adm. Code. Adoption of either ordinance by a local governmental unit is voluntary, although the department strongly encourages that any

local regulation be at least as stringent as the state's performance standards. The WDNR makes these ordinances available to local governments and provides assistance to local governments that wish to use the models as a basis for local regulations.

Agricultural Runoff Management

Approximately 38,000 active livestock operations exist in Wisconsin. Manure from livestock operations contains organic materials, nitrogen, phosphorus and other water pollutants. Through WPDES permits issued under ch. 283, Wis. Stats., and ch. NR 243, Wis. Adm. Code, the WDNR has helped to avoid many water quality impacts from larger-scale livestock operations. In addition, the WDNR has used the Notice of Discharge (NOD) program under ch. NR 243, Wis. Adm. Code, and the agricultural performance standards and prohibitions promulgated in ch. NR 151, Wis. Adm. Code, in October 2002 to address water quality impacts from many smaller-scale livestock operations in the state.

WPDES Permits

Water quality concerns associated with livestock operations with 1,000 animal units (AU) or more (also referred to as Concentrated Animal Feeding Operations or CAFOs) are addressed through the WPDES permit program. One thousand (1000) AUs are approximately equal to 700 milking cows, 1,000 beef cattle, 2,500 swine or 55,000 turkeys. These operations are required to obtain a WPDES permit that addresses storage, runoff, and land application of manure and other process wastewaters from these operations. There are about 126 CAFOs permitted under the WPDES program. (NOTE: one individual permit covers approximately 50 poultry operations owned or operated by the same company.) The WDNR has experienced a significant increase in the number of operations applying for permits in recent years, especially in the dairy sector. The WPDES permit program meets or exceeds federal NPDES requirements for livestock operations with 1,000 AUs or more, particularly in the areas of addressing groundwater quality impacts. USEPA recently revised its regulations for CAFOs, and Wisconsin is in the process of modifying ch. NR 243, Wis. Adm. Code, to reflect changes at the federal level. To this end, WDNR formed an advisory committee to provide input on revisions to ch. NR 243, which are expected to be complete by the spring of 2005.

Addressing Water Quality Impacts from Operations with Fewer than 1,000 AUs

WDNR regulates livestock operations with fewer than 1,000 AUs that have discharges that significantly affect water quality through the Notice of Discharge (NOD) Program. In addition, under ch. NR 243, operations with 301 to 999 animal units that have discharges that meet the federal definition of a "point source" are also required to apply for a WPDES permit. With the promulgation of agricultural performance standards and prohibitions under ch. NR 151 (described below), the WDNR has an additional tool to address impacts from smaller-scale livestock operations as well as impacts from crop production. The statutory authority under ch. 281, Wis. Stats., and the creation of ch. NR 151 also provide local governments (e.g., towns and counties) the authority to enforce agricultural performance standards and prohibitions.

Notice of Discharge



NODs may be issued to smaller-scale livestock operations if an on-site investigation reveals the presence of a discharge to waters of the state. Technical assistance to control the discharge is typically available through the county Land Conservation Departments (LCDs) and cost-share financial assistance can be obtained through local, state and federal cost-share programs. If the water quality impact is not the result of a discharge that meets the federal definition of point source, cost sharing must be provided to cover at least 70 percent of eligible costs. Throughout the process of addressing impacts identified in an NOD, WDNR may conduct follow-up investigations to monitor compliance. A livestock operator who fails to implement necessary corrective measures within a

specified timeframe is subject to a loss of cost-share funding and may be required to obtain a WPDES permit from the WDNR. Historically, the NOD program has been based on citizen complaints against livestock operations. The WDNR has changed to a targeted approach, investigating impacts from livestock in areas draining to Impaired Waters (Clean Water Act Section 303(d) waters) and high quality waters (Outstanding and Exceptional Resource Waters) instead of relying solely on citizen complaints.

Six NODs were issued during the 2002-2003 time period. For all NODs where cost sharing was provided, the average grant amount was approximately \$20,000 with a range of \$144 to \$179,121. About 55 percent of the livestock operations that received NODs from the WDNR received cost-share grants. Most livestock operations that received funding corrected their problem. About nine percent of the livestock operators failed to take required actions under the NOD and have been issued WPDES permits or have a WDNR enforcement action pending.

Agricultural Performance Standards and Prohibitions

The WDNR, in consultation with the DATCP, codified statewide performance standards and prohibitions for all agricultural operations in ch. NR 151, Wis. Adm. Code. These include standards for sheet, rill and wind erosion; manure storage and clean water diversions; and four manure management prohibitions (no overflow of manure storage facilities; no manure stacking near surface waters or on porous soils; no direct runoff from barnyards/feedlots to waters of the state; and no unlimited livestock access to water of the state). These standards and prohibitions are intended to occur through county Land Conservation Departments for crop producers and livestock operators with fewer than 1,000 AUs. Since promulgation of ch. NR 151, the WDNR has issued three notices of noncompliance with state standards and prohibitions.

Financing Compliance with Performance Standards

The total estimated annualized cost to implement the performance standards is \$92 million. The estimated portion for state government is \$22 million (24%), for local government is \$46 million (50%) and for private landowners and operators is \$24 million (26%). The majority of the local government and private sector costs are associated with meeting the non-agricultural performance standards. Sources of government funds include state bonding, segregated and general purpose revenue sources for cost-sharing and local staff, the state clean water revolving loan fund, federal programs, including EQIP, CRP, CREP and section 319, and local funding sources, including county cost-share programs and storm water utilities. These funds are needed to meet standards across the state, including waters listed as impaired on the Clean Water Act Section 303(d) list.

Dam Management

Wisconsin's 3,500 dams have a significant impact on the state's river systems. Many dams in Wisconsin served useful purposes, ranging from the generation of power to supporting recreational opportunities. Responsible individuals or municipalities own the vast majority of these dams. When faced with a decision to repair or reconstruct a dam, owners are always provided with a range of options, including removal. WDNR does not issue orders to remove a dam in situations where owners want to repair a failing structure and have the financial capability to do so. In selected cases the WDNR advocates for removal of a dam or may establish financial incentives to facilitate removal.

Dams can also cause water level fluctuations, changes in water temperature and oxygen levels, sedimentation leading to inhibition of fish movement, habitat loss, and fish mortality. Under the authority of Chapter 31 created in 1917 under the Water Power Law, the state has responsibility for and oversight of

- Dam permitting
- Dam safety, construction, operation and maintenance
- Alteration or repair of dams
- Dam transfer and dam removal
- Water level and flow control

Dam Safety

Wisconsin's Dam Safety Program was developed under Chapter 31 to ensure that dams are safely built, operated and maintained. Three state Natural Resources regulations provide structure to the program. **NR 333** provides design and construction standards for large dams, **NR 335** covers the administration of the Municipal Dam Repair and Removal Grant Program, and **NR336** covers the administration of a new grant program to remove small or abandoned dams.

The authority under Chapter 31 includes approval of plans for dams, alteration or additions to an existing structure and removal of a dam. Chapter 31 requires the owner of a dam to operate and maintain their dam in a safe condition. The owner can initiate repair, reconstruction or removal actions. However, dam removal is more frequently the result of a failure or of an inspection finding significant defects requiring major repairs.

Dam Removal

The decision to remove a dam is primarily an economic decision made by the dam owner. Dam removal, which requires WDNR approval, must follow specific guidelines to assure protection of life, health, and property, as well as the surrounding environment. Chapter 31 requires the WDNR to inspect all of the large dams in the state at least once every 10 years. Approximately 1,130 of the state's dams are classified as large dams, which are over six feet high and impound more than 50 acre-feet of water or they are 25 feet or more in height and impound more than 15 acre-feet of water. If these dams fail, they can cause loss of life or significant property or environmental damage.

To learn more go to: <http://wi.dnr.gov/org/water/wm/dsfm/>

In the last 20 years, over 50 dams have been removed from the state's waterways. Most of these were economic-based decisions made by the dam's owner or were abandoned dams where a responsible owner could not be found. There is a growing awareness of the negative affects dams can have on river ecosystems. Where dams have been removed, significant improvements have been noted in water quality, habitat and biodiversity at many of these sites. In recent years, the DNR has been more proactive in discussing potential habitat and water quality benefits from dam removal. Integrated management plans (see Chapter 3: Rivers and Streams) identify rivers that would benefit from dam removal in a given basin. WDNR has worked with partners to advocate for the removal of a dam or helped establish financial incentives to facilitate removal. See Chapter 3 for case studies on dam management and removal.

Dam Relicensing

The Federal Energy Regulatory Commission (FERC) is responsible for licensing the state's hydropower plants and reviews the 30- to 50-year-old leases to ensure that they meet federal regulations for safety and resource protection. Since 1993, 55 licenses have expired in the state, with 17 of those between 1998 and 2001. Most facilities operate under interim annual licenses until FERC completes its reviews.

DNR is actively involved in the FERC relicensing. The Department's regulatory role was expanded through Federal court cases to require facility receipt of a State water quality certification under Section 401 of the Clean Water Act. FERC facilities must evaluate both direct and indirect impacts to water quality, reflecting a recognition of the role of nearby land use on water quality, for example. Issuing a Water Quality Certification requires the applicant to conduct studies and provide information about intentions concerning anticipated changes in land use of owned properties near the dam and reservoir. Utilities often own substantial acreage of wild and scenic property adjacent to the dam and reservoir.

Preparing a Land Use Position Paper Related to Transfer of FERC facility lands

In 2001, WDNR prepared an issue paper regarding sale of FERC owned properties. Licensed hydropower facilities in Wisconsin and nationally have increasingly made requests to the FERC to sell land or change land use within project boundaries. Much of this land is wild, scenic and undeveloped and contributes to maintenance of high quality surface water resources. Although

utilities can realize additional income and reduced long-term maintenance costs through land sales, those that result in subsequent development can have substantial impacts to the quality of lakes and rivers. The impacts of property sales are site specific and in fact may include cases where a land sale may be compatible with the Department's local land management interests.

There should be individual analyses of proposed land use changes in light of state land acquisition plans and license conditions. Further early coordination work among regional staff can help determine where hydro project lands overlap planned state land acquisitions, which can then be followed by legal intervention or acquisition.

Unless protected land use is guaranteed, the Department should oppose FERC approval of hydropower facility property sales or changes in land use. By analyzing public benefits (using current land acquisition plans) the Department can decide on a case-by-case basis, the best course of action.

Issuance of Run of River Guidance

In 2001, WDNR issued guidance to manage the concept of Run-of-River flows. Under Section 31.02, Wis. Stats., the Department may regulate and control the level and flow of water for dams on navigable waters. Pursuant to Section 401 of the Clean Water Act and under Wis. Admin. Code NR 299, Water Quality Certification (WQC) authority, the Department may also regulate flows and water levels on FERC licensed hydroelectric dams. The guidelines are designed to help assure *consistent* regulation of run-of-river operations were appropriate and provide s training tool for new staff and interested parties.

In most cases, a run-of-river operating mode should be used to minimize disruptions to natural river flows. At all times there must be water flowing from the dam (includes powerhouse, spillway or diversion channel) so that at any time, outflowing water equals inflowing water into the reservoir.

Contaminated Sediment Management Program

Contaminated Sediment Management in Wisconsin involves a multidisciplinary approach within the Department and coordination with and other state and federal agencies and private partners. The goal of the program is to restore surface waters to assure the applicable water quality standards are achieved where resource uses have been impaired by the presence of contaminated sediments. Managing contaminated sediments and floodplain soils associated with Wisconsin's inland and Great Lakes waters is a multi-program effort within the Bureau of Watershed Management and other Bureaus, such Remediation and Redevelopment. The integrated work of the scientists and engineers involved is designed to:

- Develop a consistent and holistic contaminated sediment strategy,
- Integrate contaminated sediment issues with other program efforts,
- Ensure consistency in evaluating and assessing contaminated sediment sites, and
- Ensure current and applicable technology is used in remediating sediment sites.

Key elements of the integrated effort

Key elements of the integrated effort for managing contaminated sediments include:

- Evaluation, development, and application of appropriate sediment quality assessment tools that will yield a weight-of-evidence approach to demonstrate actual or potential effects to biota including humans from contaminated sediments.
- Development of site-specific sediment quality objectives to be used with other balancing factors in making management decisions at contaminated sediment sites, applying controls on wastewater dischargers, and abating discharges from non-point sources to surface waters.
- Understanding and integrating sediment issues into various regulatory programs such as Superfund, RCRA (Resource Conservation and Recovery Act), and State Environmental Repair

To learn more go to: <http://wi.dnr.gov/org/water/wm/sed/>

Program sites (includes Manufactured Gas Plant Sites) and other programs including Great Lakes Remedial Action Plans.

- Maintaining a statewide sediment data base from all sediment related sampling projects.
- Developing, maintaining, and updating a statewide inventory of sites with contaminated sediments, floodplain soils, and wetland soils.
- Development of a site ranking and prioritization system to be used in the decision making process for selection of contaminated sediment sites for remediation based on available funding and resources.
- Investigating remedial and treatment technologies including dredging, capping, in situ and ex situ treatment, and handling and disposal of sediments.

While many sediment projects are large-scale endeavors, many smaller scale projects are ongoing throughout the state. The state has established a Contaminated Sediment Standing Team — CSST to develop guidance, provide technical guidance, and to communicate with the Regional offices pertaining to sediment management. This work includes standardization and implementation of policies, procedures and guidance for identification and inventory of sites, assessment of environmental and human health impacts, and enhancement of water quality in Wisconsin's surface waters through various remedial techniques. During 2002-2003 the CSST worked on further developing its website and refining a GIS-based data layer with the location of and information on each of the ongoing sediment projects in the state. In addition it is developing consensus-based sediment quality guidelines and assessment procedures to address contaminated sediment issues for dredging sites. In 2004, the Watershed Bureau has established a Sediments Section to take the lead on contaminated sediment issues.

Impaired Waters Program

In 1998, as required under the provisions of Section 303(d) of the Clean Water Act, the Department submitted to EPA for approval a list of surface waters considered impaired. This list of impaired waters was subsequently approved with a small number of additions. DNR's vision is that each waterbody on the 303(d) list will be validated through monitoring; restored where best management practices or other management efforts can be implemented; and the waterbody removed from the list. One of the available actions is the development of Total Maximum Daily Load (TMDL) analyses. Because many of the waters on the list are impaired by complex, multi-source problems, restoration of the waterbodies will happen over an extended period of time. Wisconsin's 1998 list of impaired waters contained 552 waters, which includes rivers, lakes and river segments, harbors and bays. For purposes of management, the waterbodies are placed into the following categories based on cause of the impairment:

- Contaminated sediment – 63 waters
- Nonpoint source dominated – 170 waters
- Point source and nonpoint source blend waters – 74 waters
- Point source dominated – 2 waters
- Physical habitat – 12 waters
- Other (or multiple) – 32 waters
- Atmospheric Deposition (mercury or other toxics) – 241 waters

Clean Up Progress - A Categorical Approach

Since 1998, Wisconsin has made progress in water quality cleanup relating to a number of these categories. For **contaminated sediment waters**, the Department will pursue "de-listing" the *Bay Shipping Building site in Sturgeon Bay* and the *Fountain City Bay Boatyard in the Mississippi River* due to successful contaminated sediment removal projects. In addition, removal of contaminated sediment has taken place as part of the *Hayton Area Remediation Project along Jordan Creek and in Wausau along the Wisconsin River*. Remediation plans have been developed for the *Lower Fox River and Sheboygan River*.

To see the list of 303(d) waters, go to:
<http://wi.dnr.gov/org/water/wm/wqs/>

For **nonpoint source dominated waters**, *Spring Creek in Rock County* was “de-listed” in 2003 due to a substantial improvement in the stream and fishery resulting from a small-scale priority watershed project. In addition, TMDLs have been approved for 18 other waterbodies listed for either sediment or phosphorus. Also, ongoing priority watershed project implementation has been taking place in watersheds draining to 57 waters on the 1998 impaired water list.

For **point source and nonpoint source blend waters**, many of the waters are receiving reduced phosphorus loads due to the requirement for phosphorus removal at municipal and industrial wastewater treatment plants under the provisions of Chapter NR 217, Wis. Adm. Code. For the nonpoint source portion of these blend situations, ongoing priority watershed project implementation has been taking place in watersheds draining to 22 waters on the 1998 impaired water list.

For **the nonpoint source dominated, point source and nonpoint source blend and certain of the “other” category waters**, in late 2001, Wisconsin began implementing the Conservation Reserve Enhancement Program (CREP). CREP is targeted towards establishing vegetated, riparian “buffers” along more than 95% of the impaired waters in these categories.

Progress in the other categories is limited. For the **point source dominated waters**, it appears that the impairments are likely due to past discharges and current discharges are not causing further degradation of the receiving waters. For the **physical habitat** category, removal of three dams on the Baraboo River will result in that segment of water being “de-listed” in the future. For waters with fish consumption advisories resulting from **atmospheric deposition** of mercury, progress will depend largely on reduction in air emissions of mercury both in Wisconsin and outside of the state. The Department is working with the Environmental Council of States and EPA and others to identify the best approach to address air emissions causing water impairments.



TMDL Monitoring and Modeling

Technical guidance for developing a total maximum daily load (TMDL) allocation has been developed based on a three-tiered approach: simple, intermediate and complex. Monitoring methods have been identified to provide a basic framework to assist staff in developing an integrated approach for TMDL development and work planning. Monitoring options were developed based upon staff experience working on these types of projects; however, each situation requires independent evaluation and adjustment based on site-specific conditions. *The WDNR's TMDL Monitoring and Modeling Technical Guidance Document (2001)* identifies pollutants to be monitored, sample collection, duration and frequency. The document also identifies suggested station locations for monitoring based on the type of model used and other factors. Model selection is also based on this tiered approach. Project specific issues to be considered in determining the appropriate resource level of monitoring and modeling would include:

- Regulatory implications for dischargers.
- Input from interested stakeholders.
- Financial and work load resources.
- Accuracy needs.
- Knowledge and types of pollutant sources.
- Size of the water body/watershed.

Cost Benefit Assessment

The Clean Water Act requires states to report to Congress on the social costs and benefits of actions necessary to achieve the objectives of the Clean Water Act. WDNR believes that while cost benefit assessments can inform the decision making process, this type of analysis should not override the goals of environmental or ecosystem health as a single dominant decision point.

The complex and multi-jurisdictional nature of environmental protection and water quality regulation and restoration precludes a precise analysis of fiscal outlays in the context of this biannual report. In addition, rapid change in our understanding of the complexity of environmental systems - for example - as well as evolving knowledge of precise endpoints for environmental damage exerted by a single contaminant further complicate our ability to assess potential benefits of specific actions or regulations. Thus, this section of the report assessment is limited to a brief discussion of some of the major financial outlays related to water quality, including the Environmental Improvement Fund (with special emphasis on the Clean Water Fund and the Safe Drinking Water Program), the state's Stewardship Program (Land Acquisitions and Easements) and the state's Polluted Runoff Management Program.

Environmental Improvement Fund

Wisconsin's Environmental Improvement Fund (EIF) consists of three separate financial assistance programs: the Clean Water Fund Program for wastewater treatment and urban runoff projects, the Safe Drinking Water Loan Program for drinking water projects, and the Land Recycling Loan Program for brownfields projects. The EIF directs limited financial resources to projects with the highest environmental priority score.

The EIF is an excellent tool for Wisconsin in meeting its responsibilities under the 1987 Clean Water Act. EIF programs provide financial assistance to local units of government in the form of subsidized loans and, in some cases, grants or interest subsidy payments.



Clean Water Fund Program

The Clean Water Fund Program (CWFP) is Wisconsin's revolving loan program. The CWFP uses funding from the capitalization grant authorized by the Clean Water Act and supplemental funding from state borrowing to help achieve state water quality goals and the objectives under the Clean Water Act.

Repayments of principal and interest from CWFP loans will make up the primary source of funding for future EIF programs. The programs are administered jointly by WDNR and the Department of Administration. The CWFP provides financial assistance to municipalities for planning, design and construction of surface water and groundwater pollution abatement facilities. Over the years an increased emphasis has been placed on preventive maintenance for existing pollution abatement facilities. Financial assistance is administered by the CWFP through: 1) a federal revolving loan program, 2) a state leveraged loan program, 3) a state direct loan and hardship program, 4) a federal hardship program, and 5) a small loan program. The state programs are a commitment made by the Legislature to exceed the federal funding for surface water pollution abatement.

From 1991 through 2003, the CWFP entered into 532 financial assistance agreements with Wisconsin municipalities totaling \$1.88 billion in loans and \$115 million in financial hardship assistance grants. In addition, the CWFP has executed agreements with 48 municipalities to subsidize interest payments on wastewater treatment project loans made to the municipalities by a state program other than the CWFP. The amount of financial assistance provided for individual

CWFP projects ranges from \$25,000 to over \$134 million. The Milwaukee Metropolitan Sewerage District, which is comprised of 28 individual municipalities serving a population of about 1.2 million, has received 49 CWFP loans totaling over \$566 million. This amount represents 30% of the CWFP's total loan dollar volume since the program began in 1991.

The CWFP provides financial assistance for the following types of projects:

- Compliance maintenance projects – These wastewater projects are necessary to prevent a municipality from exceeding effluent limitations contained in their Wisconsin Pollution Discharge Elimination System (WPDES) permit.
- New or changed limits projects – These wastewater projects are necessary for a municipality to meet effluent limitations contained in its WPDES permit which were newly established or modified after May 17, 1988.
- Unsewered projects – These wastewater projects provide treatment facilities and sewers for unsewered or partially unsewered municipalities.
- Urban runoff projects – These stormwater/nonpoint source projects are necessary to meet WPDES permit requirements, meet non-agricultural performance standards, or control urban stormwater problems under WDNR-approved plans.

The CWFP may provide financial assistance to municipalities in the following ways: provide loans at or below market interest rates, provide grants under a state or federal hardship assistance program, purchase or refinance the debt obligations of municipalities incurred for CWFP-eligible water pollution control projects, and make subsidy payments to municipalities to reduce interest on loans made by the Board of Commissioners of Public Lands for CWFP-eligible projects.

Each project is prioritized using a system established by Wisconsin Administrative Code. The environmental criteria used to select projects include: impacts to human health, maintenance of fish and aquatic life, maintenance of wildlife, impacts to outstanding and exceptional resource waters, the ability to treat septage and leachate, and the population served by the project. The priority system assigns a score to every project based on the criteria. Projects are ranked numerically, so in the event funding is not available for all requested projects in a given year, awards will be made by the order in which they are ranked. Funding each biennium has been sufficient to fund all eligible CWFP projects, except for those projects requested under the financial hardship assistance program.

Safe Drinking Water Loan Program

The Safe Drinking Water Loan Program (SDWLP) was enacted in 1997 to provide financial assistance to municipalities for the planning, design, construction or modification of public water systems. To be eligible for SDWLP funding, projects must comply with national primary drinking water regulations under the Federal Safe Drinking Water Act or otherwise significantly further the health protection objectives of the Act. The SDWLP began providing assistance in 1998. From the beginning of the program through 2003, the SDWLP has provided 31 loans to local units of government totaling \$99.4 million.

Land Acquisitions and Easements

WDNR Bureaus of Facilities and Lands and Community Financial Assistance manage the Stewardship Program, which provides funding for a variety of fee simple and easement acquisitions that protect natural resources and increase public recreational opportunities. Typical projects include preserving green space and incorporating proper land management practices; expansion of wildlife management areas, fisheries areas, natural areas, and state parks; recreational development projects; and habitat restoration areas. Where possible, the WDNR looks for opportunities to blend funds from the Stewardship Program with funds from other federal programs such as the Land and Water Conservation fund (LAWCON).

This funding, \$46 million dollars a year through the year 2010, is to provide for both land acquisition and property development. Portions are to be used by non-profit conservation organizations and local governments, both for acquisition and property development purposes. Ex-

amples of projects funded by Stewardship in the past several years include establishment of the Peshtigo River State Forest, Capitol Springs State Park, and the Lower Chippewa River State Natural Area. In addition, substantial expansions to several water-based properties have occurred including the Turtle Flambeau Scenic Waters Area and Tomahawk River State Natural Area. WDNR looks for opportunities to partner with other organizations or to cost-share project costs with federal dollars available for acquisition of lands protecting wildlife, fishery or water quality.

Two of the five acquisition priorities for Stewardship funding are lands that preserve or enhance the state's water resources. This includes land along the Lower Wisconsin State Riverway; land abutting wild rivers and wild lakes, and land along the shores of the Great Lakes. In addition, the Stewardship program focuses on efforts to protect water quality and fishery habitat by acquiring buffer areas along streams. This program provides funding for WDNR projects and provides cost sharing to municipalities and nonprofit organizations. Since 1990, approximately \$10 million has been spent on WDNR streambank projects, and about \$4.5 million in grants have been provided to municipalities and nonprofit organizations for 45 projects. The WDNR has targeted 146 stream corridors with a goal of 21,075 acres or 1,317 miles for easements and 19 stream corridors totalling approximately 30,334 acres or 130 miles for acquisitions.

In addition to the Stewardship Program, the Nonpoint Source Pollution Abatement Program provides funding for WDNR easements to reduce polluted runoff. This program has funded approximately \$3.3 million for purchase of 61 easements totaling 1,400 acres. Management of properties owned by the WDNR is outlined in master plans for each property. These plans cover maintenance, management, and development that will occur on the property for at least 15 years. Contained in the plans are recommendations for a variety of land management and recreational activities, especially for those properties that include large water features that are aimed at protecting water quality and scenic natural features. Master plans for properties such as the Lower Wisconsin Riverway, Brule River State Forest, Turtle-Flambeau Flowage Scenic Waters Area, Chippewa Flowage, and Dells of the Wisconsin River State Natural Area contain provisions for protection of water quality and scenic beauty.

Polluted Runoff Management Program

Priority Watershed/Lake Program

Expenditures for polluted runoff including pass through funding to communities via the Priority Watershed/Lake Program, open competition grants through the Targeted Runoff Management (TRM) Grant Program, and Urban Nonpoint Source and Storm Water Grant Program. Financing compliance with performance standards (described above under "polluted runoff"), has a total estimated **annualized** cost of \$92 million. The estimated portion for state government is \$22 million (24%), for local government is \$46 million (50%) and for private landowners and operators is \$24 million (26%). The majority of the local government and private sector costs are associated with meeting the non-agricultural performance standards. Sources of government funds include state bonding, segregated and general purpose revenue sources for cost-sharing and local staff, the state clean water revolving loan fund, federal programs, including EQIP, CRP, CREP and section 319, and local funding sources, including county cost-share programs and storm water utilities. These funds are needed to meet standards across the state, including the 120 waters listed as impaired on the federal section 303(d) list.

Special State Concerns and Recommendations

Wisconsin has identified key priorities around which the Water Division, particularly the Watershed Bureau, will work in the coming years. The special state concerns described below outline the topical area, issues involved and key priority objectives for the Department and partners for the coming reporting period.

Great Lakes

The Great Lakes bound the eastern and northern borders of Wisconsin. With the islands of Door County and the Apostle Islands, there are over 1000 miles of Great Lakes shoreline. With over half of the state's population living in the basin, the Great Lakes are critical as source of drinking water, industrial and commercial process and cooling water, a significant transportation system and a highly desirable tourist destination for fishing, boating or the beaches. As interstate and international waters, management programs must be established at a regional scale to be effective.

In 2004, the Department elevated the status of Great Lakes issues by creating an Office of the Great Lakes. This office works closely with DNR's administration to support Wisconsin's Governor in his chairing of the Council of Great Lakes Governors. The Council is developing a regional agenda in response to a Congressional inquiry that focuses on 9 priority areas:



- ensuring the sustainable use of Great Lake waters
- protection of public health from adverse impacts of pollution
- controlling pollution from diffuse sources
- continue to reduce the introduction of bioaccumulative substances into the ecosystem
- stop the introduction and spread of non-native invasive aquatic species
- enhance fish and wildlife by protecting and restoring important habitats
- restore the environmental quality in Areas of Concern
- standardize and enhance methods for data collection, analysis and distribution
- adopt sustainable use practices to protect environmental resources and enhance the recreational and commercial values of the Great Lakes.

Using this agenda, Wisconsin will be working in partnership with other states to carry out specific actions to eliminate the need for fish and wildlife consumption advisories through remediation of contaminated sediment, atmospheric pollutant controls, nonpoint source reductions. Important habitat areas will be identified and protected or restored in those cases where habitat quality may be impaired. Plans to stop exotic species will be implemented with an emphasis on preventing new introductions from any sources. Sources of pollution which lead to beach closure will be identified and corrected. Through this agenda, the Great Lakes state Governors will seek federal support for a multi-year campaign to restore the quality of the Great Lakes ecosystem.

Because of their immense size, management actions will require extensive collaboration and cooperation among jurisdictions and among all levels of government, advocacy interests and industry. These are large-scale problems which need multi-year efforts. With 20 percent of the world's supply of freshwater at stake, increasing the prominence and national investments into the Great Lakes restoration projects are necessary and reasonable actions.

Aquatic Invasive Species

Since the early 1800s, more than 140 aquatic nonindigenous species (ANS) have arrived in the Great Lakes. Not all arrivals – or introductions – have resulted in harm. However, some threaten the diversity or abundance of native species, the ecological stability of habitats, and/or commercial, agriculture, aquaculture and recreation activities. The pace of introductions is increasing and

it will only get worse with increasing global trade unless national/international prevention and control measures can be put in place.

In 2002, WDNR completed a Comprehensive Management Plan to Prevent Further Introductions and to Control Existing Populations of Nonindigenous Aquatic Nuisance Species (ANS). This plan is a blueprint for managing aquatic invasive species and is designed to help prevent new introductions, to slow the spread of existing ANS and to control or abate the ecological and economic impact of existing problem species. water, for example, likely involve and affect the other - surface water.

This plan was prepared in partnership with the University of Wisconsin Sea Grant Institute and in 2002 was submitted to the National Aquatic Nuisance Species Task Force, when it was approved.

The invasives program recognizes the need for regional, national and international action and coordination in targeting ballast water of ocean going vessels — the primary, documented way many invasive species reach the Great Lakes. Also, the Comprehensive Plan calls for a coordinated study of the potential for introductions by the bait and aquaculture industry and development of recommendations to reduce this pathway for importation of aquatic exotics. Many aquatic activities can result in the transport of invasive species and their introduction into uninfested waters, but the bait shops, pet pet sales, and aquaculture operations are a much lesser threat than ballast water represents.

The primary way invasive species spread to new inland waters is by hitching a ride aboard the boats, trailers, bait buckets and other equipment of recreational boaters and anglers. Inspections of recreational boats at key public landings and an expanded information and education campaign and outreach efforts to slow the advance of zebra mussels and Eurasian watermilfoil are also recommended.

During 2002-04, the state has begun developing a coordinated, comprehensive program for aquatic invasives modeled after the state of Minnesota's. Key program elements include prevention, control and abatement through watercraft inspection at boat landings, enforcement efforts, and a stepped up public awareness campaign that includes television and radio messages to reach a large audience. An integrated data system to support this work is also being developed. Minnesota's program has been credited with greatly slowing the spread of invasive species – in particular, Eurasian water milfoil. Results from recent boater surveys have shown that Minnesota has been effective in getting the message out to boaters by slowing the spread of Eurasian Water Milfoil in inland waters by more than 50%.



Water Quantity Issues

Wisconsin is known for its abundant water resources. However, there is a growing concern about the availability of enough high quality water for uses ranging from public water supply to sustaining cold water habitat for fish. Wisconsin's surface water and groundwater quantity concerns, while seemingly distinct, are as closely linked as the resources. Studies throughout the state illustrate the direct connection between shallow aquifers and the state's streams, rivers, lakes and wetlands. Thus, in general, water quantity concerns with one aspect of the resource — groundwater, for example, likely involve and affect the other - surface water.

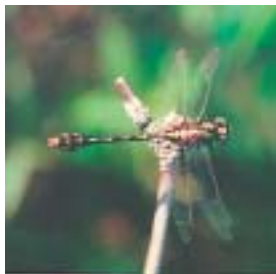
Groundwater availability in a given area is limited by geologic and hydrologic factors. Over the years the state's increasing population, rapid widespread development and increasing and varied industrial demands in some areas have increased demands for groundwater beyond the amount that can be sustained. This imbalance can result in cumulative water quantity and related water quality problems. Significant regional groundwater quantity impacts are documented in the Lower Fox Valley, and Southeastern Wisconsin and are beginning to be seen in Dane County. These three areas are experiencing substantial groundwater level declines. Localized surface expressions of quantity issues include lake level drops, stream flow declines, wetland size and level declines, and the disappearance of springs. In addition these declines have contributed to drinking water quality problems in the Lower Fox Valley and Southeastern Wisconsin.

Historically, management of Wisconsin's groundwater and surface water has been functionally distinct. The State's regulations for water use cover installation of high capacity wells, surface

water diversions, in-stream flows and water conservation. The recent evaluation of placement of a high capacity well for a drinking water bottling plant in a spring-fed region illustrated the complexity of social, ecological and institutional issues involved and underscored the state's limited powers to protect sensitive water bodies, such as springs, from the impacts of high capacity wells. In Spring 2004, the state has taken an important step towards integrated management of water resources by passing groundwater quantity legislation designed to further protect groundwater and surface waters from the impacts of high capacity wells. Specifically, the law expands the

DNR's authority to regulate high capacity wells that may impact certain critical surface water resources. The law also designates two large regional groundwater management areas for which a coordinated water management strategy is needed to alleviate pressures of increasing water demands and creates a Groundwater Advisory Committee to make recommendations on management strategies in these regions.

In addition, increasing interest in and demand for water diversions involving the Great Lakes Basin also mandate a coordinated programmatic response. Most recently, Wisconsin has been participating on a binational committee to oversee implementation of Annex 2001 to the 1985 Great Lakes Charter. The Great Lakes Charter and the Great Lakes Charter Annex are voluntary agreements through which the Great Lakes states and provinces cooperatively manage the waters of the Great Lakes. In the Annex, the Governors and Premiers outline the framework for a set of binding agreements among the Great Lakes States and Provinces and establish a series of principles for a new standard for reviewing proposed withdrawals of Great Lakes water.



Riparian Development

Few natural scenes are more treasured than a golden sunrise over a mist-covered lake. Perhaps it is the sense peace this scene provides that, ironically, has resulted in the tremendous changes in the state's shoreland areas. The sense that many, if not most, of the state's lakes and increasingly its riparian shore areas were fully or nearly completely developed prompted the WDNR to initiate its Northern Initiative in the early 1990s. Surveys in 1994 and 1995 indicated that residents and visitors were very concerned about retaining northern Wisconsin's wild and scenic qualities. Follow-up surveys of land use change in the northern part of the state confirmed suspicions that undeveloped riparian areas were being lost at a rapid rate. Generally, land cover data and land use analyses show extraordinarily rapid growth throughout the entire state. Development pockets are occurring in the Milwaukee to Madison corridor, the Fox Valley/Green Bay area, the Hudson/Eau Claire/Chippewa Falls region (tributary to the Twin Cities) and a generalized growth pattern stretching across the entire northern portion of the state. Within each of these areas and beyond, land values for shorelands have escalated while the same land parcel becomes even more critical (as it becomes more rare) for its ecological functions. Several initiatives, at the federal, state and local levels, are ongoing to address the issue of land use generally—and riparian development specifically—including:

- The Northern Initiative (WDNR), a geographically-based framework for focusing interest and resources on preserving the fundamental values of wild places in the north;
- Land Legacy (WDNR), a proposed 50-year land acquisition framework for public land purchase and easement development in the state;
- Conservation Reserve and Enhancement Program (Federal), a federal match program to secure buffers through easement and acquisition;
- Smart Growth (Local), a series of state level requirements for comprehensive planning and the local level which involves identifying key natural resource features in a community. This may result in some type of local protection for key riparian resources.
- Shoreland Management Program (State/Local). In the 1960s Wisconsin established an administrative code known as "NR 115" to protect water quality, wildlife habitat and natural shoreline beauty through statewide minimum standards for land uses and development adjacent to lakes, rivers and streams in unincorporated areas. NR 115 was implemented via mandated county shoreland ordinances. NR117 is a similar provision





applying to shoreland-wetlands in incorporated areas. NR118 covers shoreland management associated with the Lower St. Croix Riverway.

- Lakes Planning, Protection and Classification Grants (State/Local) have provided funds for careful resource planning and protection at the local level, resulting in initiatives designed to meet the resource protection needs of lakes based on waterbody characteristics and development potential.
- Rivers Planning and Protection Grants (State/Local) have provided funds to protect rivers through resource planning at the local level to help prevent water quality, fisheries habitat, and natural scenic beauty from deteriorating as residential, recreational, industrial and other uses increased along rivers.

Issues

While Wisconsin's Shoreland Management Program was landmark legislation in the 1960's, it has not kept current with development trends or the impacts of the resulting development. Studies have shown that the current minimum standards may be inadequate to prevent water pollution, shoreline erosion and the loss of fish and wildlife habitat. The Department has updated Ch. NR 115, Wis. Admin. Code, to offer landowner more flexibility in developing and maintaining shoreland property, while offsetting the impacts of shoreland development and increasing environmental protection.

Many local communities have adopted local land use policies that exceed the state minimum standards recognizing the need to protect Wisconsin's resources, however, turnover is often high in local government. As a result there is a continuous need to provide education and training to local governments.

Private property rights groups are becoming more active in the State, and many local communities are turning to the Department for help in understanding the legal implication of proposed regulations, as well as implications of State and Federal Supreme Court cases. Concerns range from regulation and takings to when can a variance be issued. Education and training is needed for local Corporation Counsels, as well for the general public.

Land prices have skyrocketed surrounding Wisconsin lakes and rivers. One result is that it is more expensive to preserve the remaining undeveloped land, and the State is often at odds with developers for the same piece of land. The other problem is more and more people are turning to "marginal" pieces of property to develop, often with large areas of wetlands that are difficult to develop and often, the landowners have unrealistic expectations of how the property can be managed.

Contaminated Sediment

Contaminated sediment is by no means a new issue to the state of Wisconsin — the state has been working in partnership with public and private entities for many years to identify, understand and remove contaminated sediment. Today, however, the state is redoubling its efforts to remediate contaminated sediment as this issue has been identified as a priority for the Water Division. Showcasing the latest technology and partnership approaches is the Fox River Sediment Remediation. As one of the Governor's top environmental program priorities, the Fox River work is spurring momentum for a much broader effort — the development and implementation of a contaminated sediment strategy for the state.

This Department's cross-program approach to this complex environmental hazard will be lead by the Sediment Management Section within the Bureau of Watershed Management in coordination with the Department's Contaminated Sediment Standing Team. This team has inventoried all known sites through the state and maintains a log that reflects each site's status from 1) site identification 2) site assessment 3) remediation planning 4) implementation to 5) post-remedial monitoring. These data and tools provide a framework for developing a more comprehensive approach to managing, monitoring and remediating contaminated sediment statewide. In the coming year, available resources will be engaged to further develop and implement this broad strategy for realizing concrete environmental restoration.

Habitat Protection and Restoration

Habitat issues have become increasingly important in water resource management due to the connection with water quality and quantity in both surface water and groundwater. Many of the restoration goals for streams are imbedded in developing a better understanding of regional hydrology and the impacts of land cover and land use types as they relate to these flow patterns. While programs like the Conservation Reserve Program buffers and Conservation Research and Enhancement Program buffers and filter strips have been established to protect zones, the design of riparian practices and the assessment of the regional hydrological patterns must occur together.

Instream habitats, or the stream morphology, are significantly affected by the speed and volume of runoff delivery. Practices designed to reduce pollutants should be assessed to promote loss of energy in these overland flows. These designs will also promote greater opportunities for recharge and support of base flows, while working to minimize both the amount of fluctuations and duration of peak to average flow variations. These land practices to support attainment of in-stream habitat goals will also result in increases in habitat quality and amounts for wildlife needing riparian areas for survival

Thus, there is a need for an equivalent program of some kind to support continuous sign-up for buffers and filter strips in non-agricultural areas. Further, regional and local, where possible, hydrologic modeling should be encouraged during the design of large developments, and all practical steps should be taken to encourage infiltration and preservation not only of pre-development flow patterns, but of water quality as well.

During development of the state's "Smart Growth" network, DNR is creating shared datasets and governmental outreach to support communities in their identification of sensitive resources so that protection can take place locally through planning, ordinances, and public awareness.

Mercury

Mercury is critical pollutant of concern for Wisconsin waters. Emissions of mercury from fossil fuel-fired boilers, which are used to generate electricity, and from other major sources significantly contribute to mercury entering waterbodies and ultimately fish and wildlife. During the past few years, Wisconsin has continued to study the biogeochemistry and ecological movement of mercury, while simultaneously developing strategic initiatives to stem its influx into the environment through regulatory and nonregulatory controls.

The WDNR Air Program assembled a Mercury Analysis Team to address the problem of mercury in the environment through the development of a strategic initiative involving non-regulatory and regulatory tools. The Mercury Analysis Team is charged with developing an atmospheric mercury modeling system for Wisconsin and the Great Lakes region. This process includes conducting a comprehensive analysis of the emission, transport, transformation, and deposition of mercury to land and water surfaces in the region. The modeling system was peer reviewed and should be available soon to support development and evaluation of the effectiveness of mercury emission reduction initiatives and strategies. These initiatives and strategies include atmospheric mercury TMDLs (Total Maximum Daily Loads) for impaired water bodies, proposed state regulations for the reduction of mercury from fossil fuel-fired utility plants, and other volunteer mercury reduction programs.

Monitoring and Data Management

Effective water management demands knowledge of resource quality conditions. Without such information, management actions may or may not be effectively applied, prioritization of work may be misguided at best – arbitrary at worst, and ecological evaluation of project effectiveness is impossible. Monitoring and associated management of data, however, is both “behind the scenes” and expensive, so that garnering a constituency for support is difficult. Further, in the area of data management, the pace of change and the availability of new systems result in rapid technology turnover – which can inhibit investment in new data initiatives. While these problems have been somewhat overcome in some areas of water management in Wisconsin, in other areas they persist and result in loss of efficiencies from lack of communication, data availability and accessibility. These problems are exacerbated by severe budget cuts in this routinely under-funded area of work. Despite these problems, Wisconsin is making progress in several areas of surface water monitoring and database development and management including:

Accomplishments

- Developing and implementing standardized protocols for baseline monitoring for Wadeable and nonwadeable streams, lakes and wetlands;
- Monitoring biological, habitat and physical aspects of waterbody systems to understand ecological conditions;
- Implementing a random stratified sample design for Wadeable streams;
- Continuing long-term trend monitoring on large river systems;
- Identifying key stations where flow gages are needed to conduct TMDL modeling and floodplain management;
- Developing a state-of-the-art web-interactive biological and habitat database for surface water data;
- Upgrading the state’s 305b assessment database (WADRS) into a web-interactive tabular and spatial system linked to the state’s 1:24,000 hydrography layer;
- Upgrading and deploying the state’s water inventory, the Register of Waterbodies, with a spatial/mapping interface to better identify waterbody identification numbers and to QAQC attribute data associated with the system (name, size, etc.);
- Making water-related data available in a web-mapping application (WT Webviewer) to enhance staff access to integrated environmental data for better and faster decision making.
- Expanding datasets linked to the Surface Water Inventory System (SWIS) including general permit data inSER to demonstrate integrated data queries for assessing cumulative impacts.



Work Yet to Accomplish

- Development of an inter-program monitoring strategy that encompasses baseline monitoring components and specialized monitoring for program specific data including TMDLs, sediment remediation, 303(d) list validation, permit compliance, etc.;
- Obtain sufficient funding to fully implement the state’s baseline and program-specific monitoring;
- Obtain funding sufficient to maintain required data systems and to manage data for program management, (i.e., Nonpoint Source Performance Standards);
- Evaluate and modify the state’s use designation assessment procedures in light of major changes in NR102, the state’s water quality classification code;
- Fully implement the WADRS (Assessment System), enter and QAQC all data the 2005 for Consolidated Assessment and Listing Methodology (CALM) submittal;
- Link key databases (baseline data; 303(d) waters, outstanding and exceptional resource waters, aquatic invasives, outfalls, assessment data from WADRS, and STORET data through the Surface Water Integration (SWIS) system;
- Progress in developing and implementing a long-term strategic perspective for the state’s water and water-related databases.

Implementing the Nonpoint Source Performance Standards

Implementing the state's new Nonpoint Source Performance Standards is a high priority for the Water Program. On October 1, 2002 the state promulgated nonpoint source performance standards and prohibitions for agricultural and urban runoff as part of the redesign of the state's nonpoint source pollution control program. Agricultural performance standards cover sheet and rill erosion, manure storage facilities, clean water diversions and nutrient management. Agricultural prohibitions restrict overflows from manure storage facilities, unconfined manure piles, direct runoff from feedlots and stored manure and unlimited livestock access to state waters. Non-agricultural (urban) and transportation facility performance standards cover construction site erosion, post-construction storm water runoff and runoff from developed areas. Creating and implementing an intergovernmental framework to ensure full implementation of these standards is critical to realizing the intent of the legislation - achieving and protecting water quality standards.

Compliance Assistance for Permitted Facilities

Compliance assistance is any activity designed to: 1) help a permittee comply with all permit program requirements; 2) help the permittee understand their responsibility in complying with a permit; and 3) help the permittee stay in compliance with the terms and conditions of a permit. Compliance assistance is usually not provided when a permittee is violating a permit and an enforcement action is underway.

WDNR has had a long-standing emphasis on compliance assistance as a primary function for program staff. Many of WDNR's WPDES resources are located in field offices across the state to enhance the access permittees have with agency staff and to create a "field presence" whereby permittees understand the role of the WDNR regulator in assuring state waters remain clean. As the Department moves toward the regulation of new, non-traditional sources of pollution such as stormwater, the need for compliance assistance will increase significantly. The generally high rate of compliance that permittees in Wisconsin have is, in part, a measure of the success of compliance assistance.

Compliance assistance for municipal and industrial wastewater systems includes the following activities:

- Providing technical assistance for treatment plant operators on system operations and maintenance.
- Assisting permittees in understanding and implementing all terms and conditions of the permit.
- Providing advice to permittees on appropriate actions necessary to assure compliance with permit terms and conditions.
- Reviewing reports and plans for wastewater treatment and disposal systems and providing approvals, comments and advice, as appropriate.
- Providing training to permittees and operators on new regulatory requirements.
- Providing feedback to permittees during and following inspections and other facility evaluations by identifying minor non-compliance and recommending actions to prevent more significant permit violations.

Compliance assistance for new permittees or new categories of permittees is especially important to assure that such dischargers understand not just the terms and conditions of the permit, but also the broader implications associated with holding a permit. This is especially important for permit coverage for CAFOs and stormwater sources that have traditionally not been regulated under state or federal regulations. Guiding these new permittees through the regulatory process and making available to them the resources needed to attain and maintain compliance is an important proactive step in assuring water quality protection. In many instances, this involves training sessions for groups of permittees to assure that all aspects of the permitting process are followed.

We recommend that compliance assistance be recognized as a basic and important part of the WPDES program. Enforcement actions are appropriate and necessary when compliance assistance does not address or is not adequate to assure long-term compliance with state and federal clean water laws.

Part III: Water Resource Assessments

Chapter 1: Surface Water Monitoring Program

Monitoring and assessment are the cornerstones upon which the state's water quality program rests. Monitoring information is an essential element in environmental management programs. Without data and information, we cannot characterize the condition of the environment, assess and solve problems or evaluate the effectiveness of management and regulatory actions. The overall goal of surface water monitoring is to gather information needed to effectively manage and regulate surface water resources. Furthermore, the Clean Water Act and State of Wisconsin law and associated rules mandate monitoring of surface waters. The collection of information is also essential to educating and increasing public awareness of the environment and environmental issues.

Multiple types of monitoring are implemented to achieve a comprehensive understanding of the state of our surface waters. These types include ambient or baseline monitoring; special project monitoring, long-term trend monitoring, and total maximum daily load monitoring. During the 2004 calendar year, the DNR assembled a draft monitoring strategy which describes the need for various chemical, physical, habitat, and biological monitoring data. Also during the 2004 calendar year renewed special emphasis has been placed on WDNR's use of the USEPA STORET system. An information technology analysis is being conducted to evaluate STORET capabilities in light of federal reporting requirements, water program business needs, WDNR user input and available funding.

Baseline Monitoring

As both the theory and the practice of "comprehensive monitoring" evolve with improved science and understanding, Wisconsin's approach to documenting the baseline quality of its waters continues to change. Historically much of the DNR's monitoring work focused on degraded watersheds or evaluation of waters with a high public profile. Today, our baseline water quality monitoring approach is founded on the premise that our abundance of surface water resources precludes monitoring each resource individually. However, with proper program design not every waterbody need be tested to provide solid spatial coverage of baseline conditions; much can be inferred from good data and information. For example, over 60% of the state's wadeable streams are small, "headwater" first order streams. These streams provide excellent candidates for implementing a random stratified sample design. This statistically valid scientific approach will provide greater breadth to the number of waterbodies assessed under our basic or core water data gathering efforts.



In 2002 Wisconsin piloted the use of a "random stratified sampling technique" for assessing wadable streams for an across-the-board look at the condition of our waters. From this work, WDNR has developed standardized assessment techniques for aquatic habitat, macroinvertebrates and fish that are being applied throughout the state. All data from this baseline monitoring is captured in a web-accessible database.

Baseline monitoring strategies have been developed for four key resource areas: wadeable streams, non-wadeable rivers, lakes, wetlands. Development of baseline protocols is occurring for toxicological monitoring of sediments and fish, as well. Baseline monitoring is intended to provide spatial and temporal aquatic sampling activities to address the following management questions:

- What are the use expectations for Wisconsin's water resources?
- Are the state's waters meeting their use potential?
- What factors are preventing the state's water resources from meeting their potential?
- What are statewide status and trends in the quality of Wisconsin's surface waters?

To achieve program goals, the following specific set of monitoring objectives were established:

- Determine the designated attainable uses of each waterbody. Stream and lake habitat information (including volume, temperature and limited water chemistry) and fisheries data, and stream macroinvertebrate data collected during baseline assessments will be compared with biological criteria obtained from “least-impacted” regional reference waters to determine the water’s use classification.
- Determine the level of use attainment of each waterbody. Stream habitat, macroinvertebrate and fisheries data collected during baseline assessment monitoring will allow the WDNR to determine if waterbodies designated uses are being attained.
- Determine why some waterbodies are not attaining their designated uses. Physical, chemical and biological data collected during baseline assessment monitoring will provide some, if not all of the information needed, to determine why streams are not meeting their designated uses.

Monitoring data is captured in the state’s Biological and Habitat Database. In the future, this data will be linked to the state’s 1:24K hydrography layer for spatial display. The data will also be linked to the Surface Water Integration System (SWIS) for complex analyses.

In addition, the state is responsible for submitting monitoring data to USEPA through STORET. In 2005, WDNR will address various monitoring data needs, including: developing a system to consistently assign, obtain and utilize monitoring site identification codes; ensuring all relevant data is uploaded into the STORET system and exported to USEPA on a regular schedule; and evaluating and developing solutions to enhance accessibility and integration of chemical, physical, habitat and biological data statewide. Resource managers continue to work on linkages between the baseline program, the various relational databases, and the state’s overall designated use assessment process.

Wadeable Streams

For the past four years DNR fisheries and water quality biologists have been applying standardized protocols to address local and basin-wide data needs. Staff have become more familiar and efficient with field protocols and the data entry system. With increasing confidence in the fact that the data being collected can serve both local and statewide data needs, the number of sites assessed and the power of the database has increased markedly.

Since the beginning of the Baseline stream monitoring effort, over 1000 stream sites have been assessed using standardized field protocols to collect stream habitat and fish community data, and macroinvertebrate samples. All data have been entered into an electronic database, and are accessible to staff statewide.

Since all stream assessment sites are geo-located, the distribution of the sampling effort to date has been analyzed to identify geographic data gaps. During workplanning, geographic gaps are recognized and baseline sampling efforts are directed to areas of the state where baseline stream data is lacking. Similarly, development of a GIS data layer that identifies streams by stream order (size) is helping WDNR to disperse the stream sampling effort into differing size-strata of streams (small first and second-order headwater streams) that have been underrepresented in previous sampling efforts. Analysis of populations of streams by ecoregion and stream size helps WDNR define expectations for physical, chemical, and biological conditions to refine management objectives.

Continuing improvements in the baseline program include refining field protocols, field data forms, electronic data entry screens, and automated database output. Using new, lower cost technologies (ie., continuous water temperature recording devices) allow staff to better understand the physical characteristics of streams, critical to developing realistic management expectations. For example without comprehensive water temperature data, fisheries biologists and managers may not be certain if coldwater, cool, or warmwater species should be present or managed for.

In 2002 a USEPA-EMAP project was initiated in the Driftless Region ecoregion. The objectives of this two-year research project are to study ways to improve how WDNR selects and monitors wadeable streams. The three components of the study are: 1) Develop and institutionalize a probability-based stream site-selection method; 2) Develop a multi-metric index that uses stream

invertebrates as biological measures of stream integrity; 3) Use watershed land use, water chemistry, macroinvertebrate, and fish community data - collected at the randomly selected stream sites - to determine the effects of land cover and land use on the quality of stream resources. This data will help improve our understanding and management of factors affecting stream health.

During the 2003 field season, 60 randomly-selected stream sites located in the Driftless Region ecoregion were sampled. These same streams were also sampled at the nearest “easy-access” point, typically a roadway bridge. A comparison of these paired sites will allow determination of what sort of bias is induced when not sampling truly random sites. When using sample populations to make inferences about target populations (i.e., all streams in the Driftless Region ecoregion), reducing site-selection bias is extremely important, hence the desire to use truly random sites. Conversely, sampling truly random sites can be significantly more time and labor intensive if the sites are far from roadways. Also, landowner access-denial to off road sites, or the need to use more portable sampling equipment to reach random sites can influence which streams or how effectively they are sampled. Findings from this component of the study will have national significance, since many states are or will be incorporating random-sampling designs into their monitoring strategies.

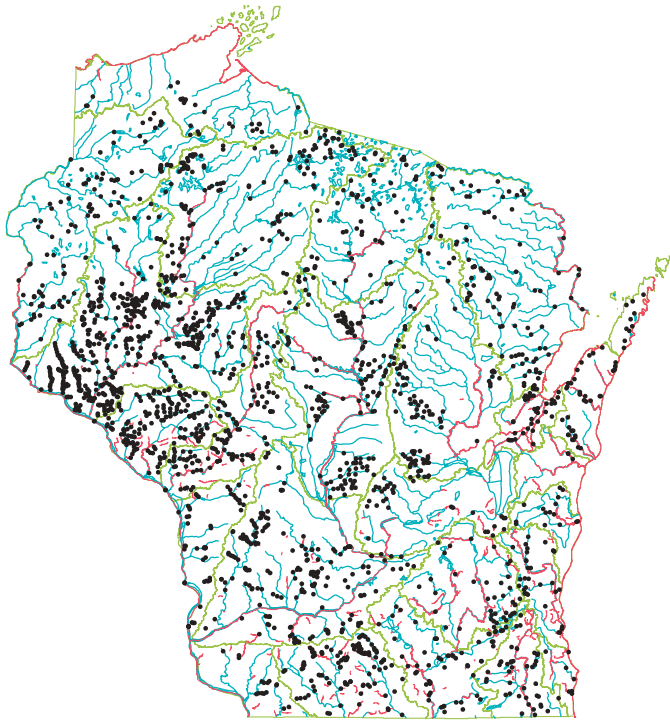


Figure 9. Baseline Monitoring Sites and 303d waters 1999-2003

Stream habitat and fish community data, and macroinvertebrate and water chemistry samples were collected at all sites. Two different macroinvertebrate field sampling protocols were used at all study sites. WDNR’s standard single-riffle kick sampling, and a 100 meter reach length 20-jab proportional-habitat sample where the 20 jabs are allocated in proportion to the habitat types found. For example if half of the benthic habitat is riffles and the other half is sand-bottomed runs, 10 jab samples are collected in the riffles and 10 jabs are collected along the sandy runs. Findings from this component

of the study will help determine whether one protocol is more discriminating than the other at detecting environmental degradation. These findings as well will also be of national significance.

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Nonwadeable Streams

A nonwadeable stream is differentiated from a wadeable stream by needing a boat to conduct biological sampling under normal flow conditions – a stream with a depth of at least 3 to 4 feet for at least 10 miles. Wisconsin has 34 nonwadeable streams with a total length of approximately 2,500 miles. Nonwadeable streams are located in throughout 17 of the state’s 23 management basins.

Program Definition and Goals

Wisconsin’s Baseline Monitoring – Nonwadeable Streams Program targets rivers that typically have basin areas greater than 650 km² (about 250 mi²), a mean water depth greater than 1 meter and a mean width of greater than 40 meters. Program objectives include determining the biological potential and evaluating the status relevant to this potential. If a river’s potential is not being attained, analysis of monitoring data will help determine which management efforts to pursue. The long-term potential of this program includes identifying changes in ecological integrity or characteristics of sportfish, threatened species, and endangered species. With adequate trend analysis, monitoring data can be used to document changes related to management decisions versus altered disturbance regimes. Monitoring efforts also foster development of biocriteria, habitat indices, macroinvertebrate-based index of biotic integrity (IBI), and baseline data for rivers.

Sites and Sampling Frequency

Monitoring is employed over a broad scale to characterize the variety of Wisconsin's river types and the kinds and intensities of human disturbances upon each river type. We identified 92 reaches on 32 rivers as priority sites. The effort necessitates a strong temporal component to evaluate trends in river health, fish biostatistics, and management over time. Priority sites are to be sampled annually from 2003 through 2007 so we can analyze variation in fishery statistics and then reevaluate sampling frequency.



Wisconsin DNR biologists sample macroinvertebrates in wadeable streams to assess water quality.

Parameters Sampled

The standardized fish-shocking protocol for calculating the fish-based IBI on large rivers is the staple of our monitoring. Additional surveys to collect sportfish, threatened species, and endangered species can be done if standard sampling is biased against collecting these species in rivers of interest. A qualitative habitat assessment is performed and basic water chemistry values (e.g., DO, pH, conductivity, and turbidity) are determined once at the time of fish sampling. Macroinvertebrate monitoring will be incorporated in the program after IBI development and testing is complete.

Progress and Plans

In 2003, WDNR sampled 86 sites on 26 rivers. We anticipate a similar level of monitoring through 2007. We are standardizing sampling methods for macroinvertebrates and intend to develop and validate a macroinvertebrate IBI for rivers. Macroinvertebrates were collected from 40 sites on 33 rivers in 2003. Over the next two years, we will sample 40 sites per year, for a total of 140 sites on 36 rivers.

Obstacles

Insufficient funding for permanent staff is the greatest impediment. Vacancies prevented us from sampling 17 sites on 6 rivers in 2003. The protocol should be bolstered for water chemistry analyses, habitat monitoring, and macroinvertebrate sampling but these will be at the expense of fish assessments if funding remains static or is decreased as expected.

Lakes

The goal of the baseline monitoring strategy for lakes is to determine the status of and trends in the health and condition of high visibility lakes and their fisheries, as measured by fish populations, fish community characteristics and lake trophic status. The focus of the strategy for lakes is to evaluate the effects of broadscale human use, such as changes in land use, shoreline development and angling on lakes. All high visibility waters, and a sub-sample of other waters, are sampled. The information collected provides:

- An inventory of lake health and condition
- A context for comparing data collected among lakes and the capability to compare similar lakes to each other.
- Standardized methods and data to evaluate statewide management activities.
- A screening tool to initiate more in-depth field investigations to confirm apparent water quality or fisheries problems.
- Effective surveillance for nonindigenous/invasive species occurrence.
- A comparison of lake health and condition through time.
- Synoptic data on the impacts of stressors on fish communities and trophic status.

- A comprehensive data set on the state's lakes that can be used for project planning and individual lake assessments.
- The capacity for statewide determinations about overall lake resource health and condition.
- Spatial data within a stratified design to develop an index of statewide lake condition.
- Inferences on the condition of non-sampled lakes.
- Information on the attainment status of lakes for aquatic life use designations.
- Integration of existing Water Division monitoring programs.

Below are four objectives considered critical to the success of a lake monitoring program. In addition, a proposal for trends monitoring is incorporated into the plan for baseline/condition monitoring because both are vital to achieving the goals for lake monitoring.

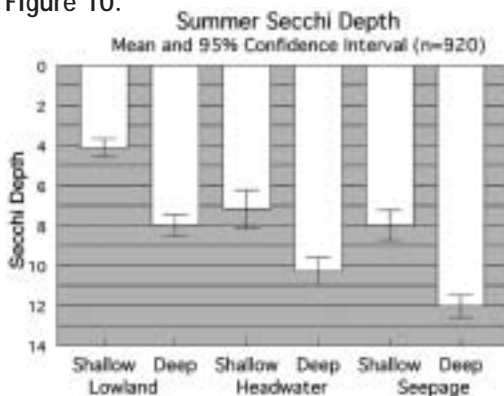
- Objective 1. Assess the health and condition of lakes and their fisheries.
- Objective 2. Assess trends in the health and condition of lakes and their fisheries.
- Objective 3. Continually improve the baseline monitoring program.
- Objective 4. Determine links between human uses of lake resources and lake ecosystem health.

Lakes Management - A Tiered Approach

The Baseline Lakes Monitoring Program collects fisheries and water quality data on a wide variety of lakes each year. To make sense of the information, the data are stratified into 6 different lake types. Lake classification reduces variance within a class and maximizes variance among classes, allowing you to compare "apples" to "apples." Expectations for fisheries and water quality vary depending upon the type of lake. These data provide a "baseline" with which to compare similar lakes to each other.

For example, looking at summer secchi depth data (Figure 10), shallow lowland drainage lakes typically have the poorest water clarity (about 4 feet) whereas deep seepage lakes typically have the best water clarity (about 12 feet). This lake classification scheme accounts for differences in watershed area, maximum depth, and water source. Shallow lowland lakes are unmixed lakes

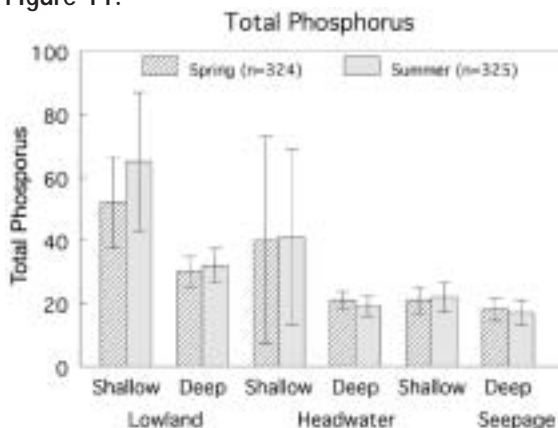
Figure 10.



receiving water from large drainage basins; deep seepage lakes are stratified lakes with predominantly groundwater inputs. In general, shallow (less than or equal to 18 feet maximum depth) unstratified lakes tend to have poorer water clarity than their deeper counterparts. Therefore, even the best shallow lowland lake should not be expected to achieve water clarity values that are similar to a deep seepage lake.

The same approach is used for other components of water quality. Figure 11 shows another example using Total Phosphorus, measured in spring prior to lake stratification and in summer at peak stratification, is highest in shallow, unmixed drainage lakes (lowland and headwater).

Figure 11.



Similarly, this approach is used for biological data collected through the Baseline Lakes Monitoring program. Figure 13 shows that northern pike catch per unit effort (CPE) is typically higher (with higher variability) in shallow lakes than in deeper, stratified lakes. Northern pike CPE is lowest in deep seepage lakes. These averages are produced for each species, which then form the basis for management goals within each type of lake.

Status Lakes

The Lakes Baseline Strategy also calls for additional types of monitoring on selected waterbodies. For example, staff will sample "Status Lakes" one time in the spring for total phosphorus and one time in the summer for TSI components (total phosphorus, secchi disk, and *chlorophyll a*). This work is coordinated with the lakes volunteer monitoring program to avoid duplication.

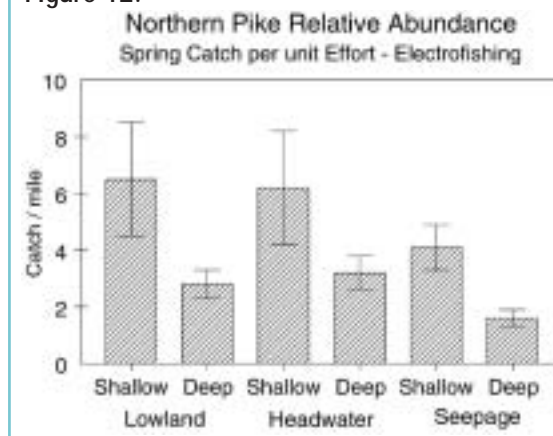
Trend Lakes

The program also samples 56 lakes statewide for long-term trends, which provides a much needed long-term temporal and spatial dataset which can be used for reference conditions for defined lake classes. This data is also used to characterize within lake and among-year variability in baseline water quality monitoring.

Wetlands

The Department's "Wetland Team" is developing a wetland assessment and monitoring program following an approach endorsed by a federal USEPA Workgroup on wetlands. This approach has three levels and is designed to maximize efficient use of scarce resources for wetland monitoring while gathering scientifically valid information to address management needs. Level 1 is Landscape Assessment relying on coarse, landscape-scale inventory information, typically gathered through remote sensing and preferably stored in, or convertible to, a geographic information system (GIS) format. Level 2 is Rapid Assessment at the specific wetland site scale, using relatively simple rapid protocols. Level 2 assessment protocols are to be validated by and calibrated to Level 3 assessments. Level 3 is Intensive Site Assessment using intensive ecological evaluation methodologies, particularly research-derived multi-metric indices of biological integrity. The Department's strategy is to develop complementary wetland condition assessment tools that can be used across the broad spectrum of wetland types at both the site-specific and landscape scales. Publications describing the methods developed by DNR are available on the DNR's Wetland Assessment and Monitoring web page: <http://dnr.wi.gov/org/water/fhp/wetlands/assessment>.

Figure 12.



<http://dnr.wi.gov/org/water/fhp/wetlands/assessment>

Pathogens



The 2003 beach season earmarked the implementation of the first comprehensive beach-monitoring program in the State of Wisconsin. The Water Quality Standards Section secured grant funding from U.S. EPA for development of a comprehensive beach-monitoring program. The primary focus of this program is the Great Lakes coastal waters Lake Michigan and Lake Superior although some inland lake monitoring will occur during the 2004 beach season. One of the program goals is to monitor selected beaches along the Great Lakes in accordance with the federal Beaches Environmental Assessment & Coastal Health (BEACH) Act requirements. The program requires prompt notification to the public whenever bacterial levels exceed

EPA's established criteria and establishes a beach monitoring and public notification plan. This plan is designed to assist lakeshore communities improve monitoring of and notification procedures for high bacteria levels.

Fixed Station/Long Term Trend Monitoring

In Wisconsin the U.S. Geological Survey operates 110 long-term flow gages, most of which are at least 60% supported by cooperators (Figure 13, next page). There are over 30 cooperators including the COE, FERC regulated dam owners, native American tribes, planning agencies, counties, cities, sewerage districts, as well as the WDNR. Real time data from all sites are available from USGS.

WDNR currently directly funds 14 of these flow gages at a cost of \$77,000. USGS provides the match. Hydroelectric dam owners fund about 20 additional sites. USGS has been successful in getting other local cooperators to pick up past reduction in funding from the WDNR so the total number of sites has stayed fairly constant.

A major review of the statewide flow-gaging network was published in a 1998 UW-Water Resources Institute Report. Annual meetings with USGS and their cooperators are held to review the current status of the statewide effort and to discuss changes in funding ability or priorities of the different groups. WDNR prioritizes funding sites that are uniquely critical to our needs as well as to fill in gaps to assure appropriate statewide coverage. WDNR's current goal is to at least maintain the current level of funding with increases to cover inflation while watching the needs that may arise due to new environmental concerns or reductions in funding by other USGS cooperators.

In 2004, WDNR expanded its number of short-term TMDL-related gages to five sites. Installation of a gage is a significant cost that USGS does not cost share. USGS has offered to cost share the operation of these sites at a 25% level. This is reduced from the 40% match for the long-term sites due to limitations in the amount of match money available and because these sites are generally of less use to other data users. WDNR's desire is to fund needed TMDL-related sites without reducing support of the long-term sites. In a review of the long-term sites co-funded by DNR, 10 sites were identified to support groundwater and high capacity well issues, long-term water quality needs, development of TMDLs, and floodplain zoning work. Many more sites would be useful and requested if money for long-term support was available.

Sediment Monitoring

Sediment monitoring is conducted as part of baseline condition monitoring or for special projects to 1) investigate areas with contaminants associated with pollutant sources, 2) investigate areas of fish advisories, 3) establish reference/background concentrations of metals and organic compounds through various sampling efforts, 4) determine pre-dam removal assessments or other stream disturbance assessments, and 5) assess contaminated sediment sites. Sediment mapping is conducted as part of the sediment investigation, monitoring and evaluation program.

Special Studies Monitoring

Special study monitoring projects include data gathering beyond the routine baseline monitoring program work. Because the baseline monitoring program does not routinely include water chemistry work, program monitoring requiring chemistry data is considered "special project" monitoring. These types of studies include validation monitoring for 303d listings, TMDL study monitoring, background monitoring for effluent limit calculations, dissolved oxygen studies or fish kill investigations. Several special project monitoring studies occurred during the 2003-04 reporting period, many of which involved TMDL work.

Fish Tissue Monitoring

During calendar years 2002-2003, over 1800 fish samples were collected as a part of the fish contaminant monitoring program (Table 5, as of April 2004). This includes fish samples that were collected as a part of the normal fish contaminant monitoring program, samples collected by cooperators, and samples collected under special projects and research.

In 2002-2003, samples were collected from approximately 137 lake locations, 36 sites in flowing waters, and 19 areas of Lakes Michigan and Superior (preliminary data as of April 2004).

Each year WDNR collects and analyzes samples of fish tissue from Wisconsin's inland waters and the Great Lakes, including their tributary streams. The objectives of the fish contaminant program includes protection of fish consumers by determining the levels of bioaccumulatory contaminants in the edible portions of fish and compare these levels to health guidelines as determined by the Wisconsin Division of Health.

Samples from the Great Lakes were analyzed for PCBs, pesticides, and mercury, while samples from river systems were primarily analyzed for PCBs and mercury. Fish samples from inland lakes were analyzed almost exclusively for mercury.

Fish consumption advisories are issued for certain species and sizes of fish from given areas where the concentrations of chemicals in the fish flesh exceed the health advisory levels. Fish contaminant data is also used to make natural resource and environmental management decisions.

Figure 13. 2003 USGS Gage Stations

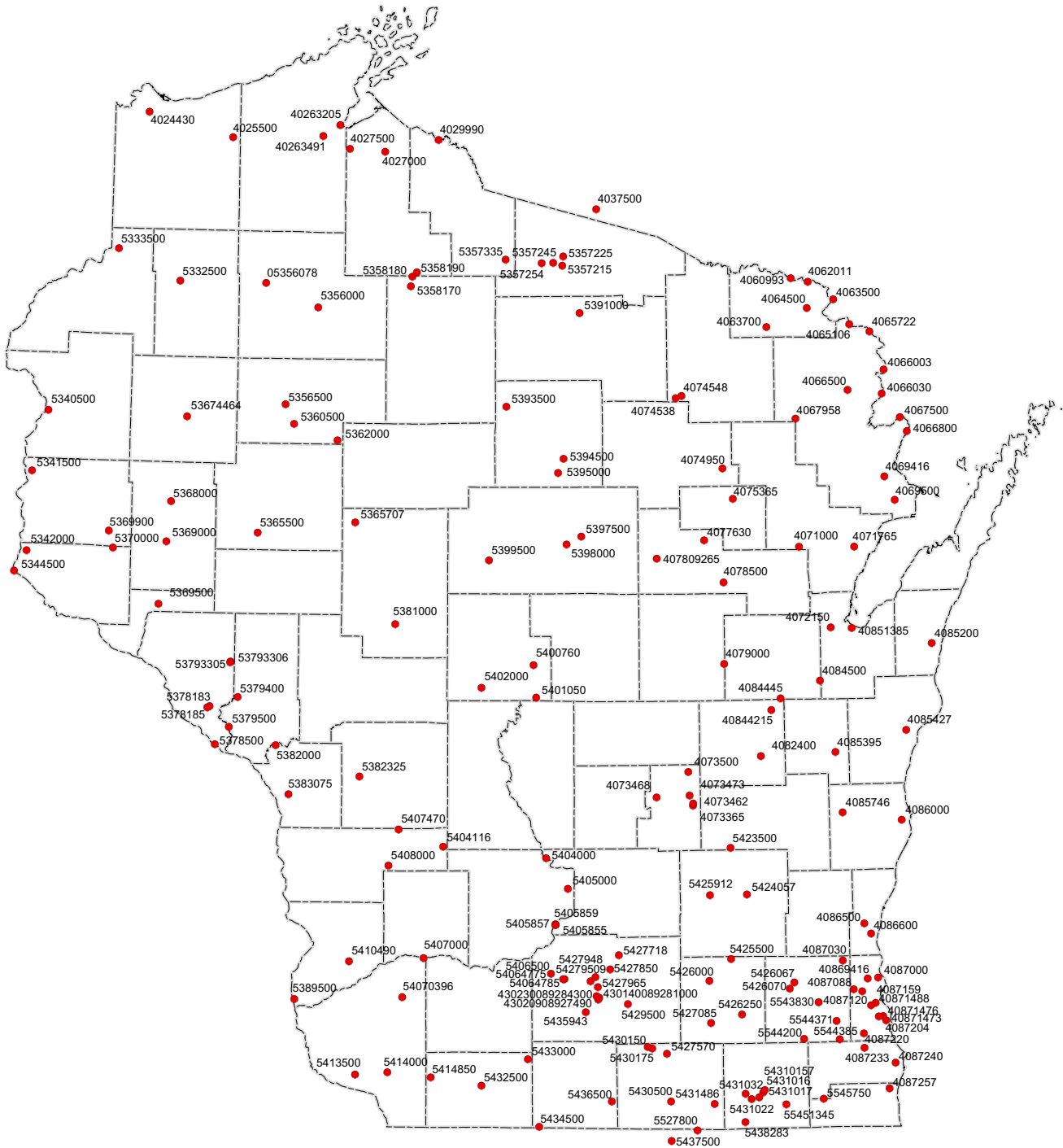


Table 5. Wisconsin's Fish Contaminant Monitoring Summary 2002-03

Time Period	Sites Sampled **	Samples Collected **
Prior to 1980	233	3,003
1980-1989	978	11,139
1990-1999	770	11,565
2000-2001	209	1,824
2002	110 *	997 *
2003	96 *	881 *
Total Cumulative 1,634 *	29,409*	

* Total number not yet available, based on data available as of April 2004. (Total cumulative number of sites does not include duplicate visits to a site.)

** includes samples collected and/or analyzed by cooperators

Through the WDNR baseline strategy for lakes and streams, fish are collected for contaminant analysis at a subset of sites where data is needed. This monitoring is conducted to determine statewide distribution of contaminants, provide a comparison of the levels of contaminants between impacted sites throughout the state and with unimpacted (reference) sites, and to determine if intensive monitoring is needed at a given site.

In addition to baseline monitoring, special assessments monitoring is conducted to update advisory waters and to document change resulting from remediation. In addition, WDNR uses fish tissue monitoring for source investigation, to track the effectiveness of remediation efforts, and to determine potential effects of toxic substances and contaminated sediments on fish-eating birds and wildlife.

Another major element of fish tissue monitoring is the assessment of contaminant levels for Lakes Superior and Michigan and their tributaries. This trend assessment, requiring the collection of game and forage species biennially, helps determine contaminant trends and possible geographic patterns.

Volunteer Monitoring

Lakes Volunteer Program

Wisconsin has had a solid volunteer monitoring program in place for lakes for several years. Self-Help Citizen Lake Monitoring and the Self-Help Volunteer Lake Monitors have been an integral part of the Wisconsin lake management since 1986. Citizens who live on their lake and know their lake better than anyone else have volunteered themselves in partnership with the Department of Natural Resources. This concept has been so successful that Self-Help Citizen Lake Monitoring was expanded to include volunteer opportunities for chemistry, dissolved oxygen monitoring, and aquatic plant surveys. Since its beginning, over 3200 volunteers have participated in the program on over 1000 different lakes.

For the lakes program, WDNR provides all equipment. Training is provided by either WDNR or University of Wisconsin-Extension staff (UWEX). Volunteers provide their time, expertise, energy and a willingness to share information with their lake association or other lake residents. The information gathered by the volunteers is used by lake biologists, fisheries staff, water regulation and zoning, UWEX office, lake associations and other interested individuals. For example, data from this program is used extensively in the state's 305(b) assessment database, now called the Waterbody Assessment Display and Reporting System (WADRS), which is summarized in this report.

Rivers Volunteer Program

Citizen stream monitoring in Wisconsin is coordinated as an educational and baseline monitoring effort through the Water Action Volunteers Program (WAV), an outreach education program for Wisconsin citizens that involves stream monitoring, storm drain stenciling, and river and shoreline cleanup programs. The program is coordinated through a partnership between the WDNR and UWEX. It is carried out via partnerships with locally-based professionals and volunteers from a variety of counties, non-profit organizations, nature centers, interest groups, and schools.

When developed in 1996, a premise of the stream monitoring portion of WAV was to standardize monitoring techniques across the state so citizen monitors would be able to share information across streams and sites because they were using the same methods and monitoring technologies. The goals of the program are to offer Wisconsin citizens an opportunity to monitor stream and river health, to support data sharing for educational purposes, to provide a network for volunteer monitors to interact, to provide support of civic conservation groups wishing to engage in stream monitoring, and to increase linkages between volunteer monitoring efforts and public resource protection programs.

By the end of 2003 there were 25 local programs with 200 adults and 600 students monitoring 135 streams at nearly 250 sites across the state. Today, most adult volunteers monitor stream flow, dissolved oxygen, temperature, and turbidity monthly from April until October; habitat is monitored once per year, and macroinvertebrates are assessed twice a year. Students usually monitor in spring and fall as a classroom activity, though some active school groups and ecology clubs monitor throughout the year. In 2003, 25 trainings were held for 400 individuals.

Since 2002, citizen volunteer monitoring data for streams has been entered into an internet accessible database. Over 2000 days of data have been entered by trained data coordinators from each of the local programs. The database, hosted by UWEX, is designed with a number of quality assurance checks and automatic calculations to help ensure good quality data. At the website, anyone with internet access can search the data by county, site, or stream name. Data are summarized and prepared into brochures for use by local citizens' groups, which are also accessible through the WAV database. An online mapping system that will link the WAV citizen stream monitoring database and the Self-Help citizen lake monitoring database is in the works with a partnership between the two monitoring efforts and the state's Aquatic and Terrestrial Resources Inventory (ATRI).

In the fall of 2003, WAV, in partnership with volunteer stream monitoring programs in five other states, was awarded a three year grant from the USDA Cooperative State Research Education and Extension Service (CSREES) to study and implement *E. coli* bacteria monitoring with volunteers in streams of the upper Midwest. Initial project planning began in late fall of 2003 to study the usability and reliability of five different *E. coli* test kits with volunteers. Studies will include comparison of test kit

results to certified laboratory results of *E. coli* concentrations as well as comparison of test kits based on volunteer and staff preferences. Efforts are being made to link this project's efforts to existing beach monitoring programs in each of the participating states. For project information visit:

In 2003 a grant was awarded to the WAV program and partners at the University of Wisconsin and WDNR through the Ira and Ineva Baldwin Fellowship to conduct "*Water for Everyone*," which is designed to address the need for additional education for citizen monitors and trainers to enhance the quality and usefulness of the data.

Use of Volunteer Data for Water Quality Management

Volunteer river data is a valuable contribution to the suite of information used in resource decision making. For years, lakes program volunteer data has been used for 305(b) assessments.

To learn more go to:
<http://clean-water.uwex.edu/wav>

Figure 14. WAV Database



With the development of Basin Partnership Teams and the Rivers Grant Program, as well as the evolution of the WAV program, volunteer river data is becoming more reliable and readily available to resource managers. Currently, volunteer data indicating water quality problems can provide a “red flag” to DNR biologists to conduct further investigation. However, due to the complexities of river systems, differences between the goals of the WAV program (primarily educational) and the level of structure and quality assurance needed for trend assessments and regulatory decisions, in the past citizen data have not been widely used for designated use assessments.

Future enhancements of the WAV program will increase the usefulness of the data for state agency decision making. These changes include more quality assurance controls, monitoring design and laboratory support, and biologist outreach.

Currently, the program provides some very interesting results and biological and habitat assessments have been used locally and incorporated in selected basins’ State of the Basin report.

Water Quality Modeling

WDNR uses water quality modeling to manage water resources. Modeling helps assess the assimilative capacity of a stream (how much of a pollutant a stream can carry and dilute without harming aquatic life) or the movement of pollutants in an aquatic ecosystem. Models are also used to help determine causes of existing water quality problems, to evaluate responses to proposed management options and to predict future changes likely to occur without any management action.

Development of water quality models often requires the collection of extensive amounts of data on existing water quality and stream flow, as well as the many factors that can affect water quality. Data requirements vary depending on the type of model and its intended use. WDNR uses models in the following areas:

- Stream dissolved oxygen models for waste load allocations
- Contaminated sediment transport models
- Watershed loading models
- Lake response models
- Mixing zone models

Beginning in the mid-1970s, WDNR developed waste load allocation models on stream segments such as the Wisconsin and Fox Rivers where multiple point sources contributed to water quality problems. The allocations were used to establish water quality based effluent limits for industrial and municipal point source discharges. The WDNR is currently re-evaluating allocations for Segment A of the Wisconsin River from Rhinelander to Tomahawk.

Contaminated sediment transport models are used to predict the transport and fate of sediments containing chemicals of concern. Fate and transport models help to predict the bioavailability of contaminants to the food chain but not the concentration of chemicals in the food chain. For this, food chain models are used. In particular, WDNR models sediments containing high levels of polychlorinated biphenyls (PCBs) to determine the rate of PCB movement and the biological concentration of the chemical in the food chain, and to predict the potential benefits from selected cleanup options. WDNR has applied fate and transport models to the Lower Fox, Sheboygan and Milwaukee River systems and all are on file with the Great Lakes National Program Office. While the Sheboygan and Milwaukee studies were screening level models and the Fox a much more detailed model, all three studies were developed for comparison with predictions made by USGS based on the Great Lakes steam tributary monitoring project.

Watershed loading models link pollutant export from various land use practices to loads in streams and lakes. WDNR uses both screening level (export coefficient) models, as well as more detailed mechanistic process based models such as the Soil and Water Assessment Tool (SWAT), a Barnyard Evaluation Model currently under development, the Source Loading and Management Model (SLAMM) and the P8 Urban Catchment Model. WDNR is also working with the U.S. Department of Agriculture, Agricultural Research Service, the developers of SWAT, to test and refine SWAT for application to agricultural practices in Wisconsin. SWAT is one of a number of modeling and analysis tools identified for TMDL development in Wisconsin.

Lower Wisconsin Basin

In Otter, Brush, and Black Earth Creeks, and Pine River watersheds of the Lower Wisconsin Basin, ten sites were monitored between 2000 and 2003.

- Black Earth Creek behind fire station in Cross Plains
- Black Earth Creek downstream from County KP in Cross Plains
- Black Earth Creek at Salmo Pond Park
- Brush Creek UW-Richland pedestrian bridge
- Brush Creek 17th drive at Kampf's
- Flint Creek below Harker/Lee confluence
- Harker Creek up from Lee Creek
- Lee Creek up from Harker Creek
- Pine River at old Richland Center dam site
- Pine River at junction County Hwy C & Dove Lane

Turbidity was measured monthly at most sites, sporadically at others. Of 118 observations, more than 80% found good water clarity with no negative effects on aquatic life. Storm events resulted in concurrent elevations in turbidity, with peak levels reached prior to the end of the storm. The fact that it was raining when the highest turbidity was recorded suggests that streamflow and erosion were affecting turbidity.

Lake models predict the changes in lake trophic state, as reflected in total phosphorus concentration, water clarity and the severity of algae blooms, to changes in nutrient loading to a lake. The purpose is to determine how individual lakes will respond to changes in land management practices or proposed lake restoration activities. The Wisconsin Lake Modeling Suite (WiLMS) is a lake and watershed evaluation tool developed by WDNR and currently used throughout the state for lake management. It is used for about 80% of the six to eight lakes modeled per year in Wisconsin. WILMS also is used extensively by consultants working on lake planning and protection grant projects. The Army Corps of Engineers BATHUB model is used for the other 20%.

WDNR reviews mixing zone models that are part of applications for modified mixing zones for industrial and municipal dischargers. Results are used to determine effluent limits for toxic compounds to protect fish and aquatic life in the receiving waters. Mixing zone models are a tool for determining the extent to which a diffuser outfall enhances rapid mixing of the effluent and reduces toxicity to aquatic organisms that may be caused by specific pollutants.

Laboratory Analytical Support

The DNR has annual contracts with the Wisconsin State Laboratory of Hygiene (SLOH) for water chemistry and sediment chemistry analyses. Physical analyses for sediment studies are conducted at UW-Madison Soils Laboratory. DNR contracts with UW-Stevens Point and UW-Superior for macroinvertebrate analyses and with various external, state-certified laboratories for parameters not covered by the existing state contracts.

Data Storage, Management and Sharing

Wisconsin has a growing number of systems to store, manage and share its aquatic monitoring, assessment, and implementation actions data. WDNR utilizes Geographic Information Systems (GIS) as a tool for water quality management, employing a systems approach to integrate data and assist in analysis. The latest technology uses GIS to link information from diverse sources in a "map view", allowing managers to use both spatial and tabular data to identify and analyze resource issues and problems. Not all DNR data systems are currently accessible via GIS; however, long-term plans for the Department involve converting key data systems to a GIS-compatible format. The foundation for the Water Division's data integration efforts has historically been the Surface Water Integration System (SWIS), described later in this section.

In fall 2003, the water program began reviewing and evaluating the its information technology or data systems. The objectives of this analysis were:

- document the status of data systems,
- define business priorities and determine where data systems are supporting or failing to support priorities, and
- provide recommendations to guide new system development and insure effective use of data systems in the future.

Through the use of the internet, many activities that previously occurred through expensive desktop applications can now take place through the use of the internet or through shared server

applications. This “revolution” of sorts is changing the way the water program is configuring its data systems.

Today, the major focus of work is the integration of a spatial component or “map view” into existing tabular relational database systems so that the data of interest can be interactively viewed and edited. Once the point is located through the use of this “embeddable locator tool”, managers can access the data in map view through the WDNR Water Program “Watershed MapViewer”, where multiple datasets can be overlaid in an ArcIMS mapping application. This ‘data integration’ can occur through a simple web-based mapping application where datalayers are provided one on top of another. The data can also be viewed and analyzed through the state’s advanced GIS tools in the Surface Water Integration System (SWIS).

Users of SWIS can specify conditions on the types of data requested so that relevant data is pinpointed to maximize decision making efficiency. For example: once the STORET system is incorporated into SWIS, for a given watershed (stream, basin or statewide), the user will be able to report back:

- all water chemistry data for a particular parameter (ie., total phosphorus) at a given level (ie., greater than 10 ppm, for example);
- all outfalls that discharge phosphorus equal to or greater than a certain level (1 mg/l);
- locations of usgs gage stations and related flow data;
- segments and/or waterbodies listed for excess phosphorus or turbidity on the 303d list;
- codified use, impairments sources and pollutants of those waterbodies;
- locations of best management practices to control phosphorus and/or sediment.

From the query, the user receives both a spatial display of the waterbodies of interest as well as a linked table showing integrated data of interest. This is just an example, but illustrates that analyzing cumulative impacts for regulatory or non-regulatory decision making will be much improved as the Department is able to get more data into the SWIS system.

Surface Water Integration System (SWIS)

To maximize the benefits of a GIS for water management, WDNR initiated development of a Surface Water Integration System (SWIS) in 1992. The SWIS is designed to integrate diverse data associated with water features. These datalayers can then be analyzed using built-in tools within SWIS. The ‘base’ datalayer, or framework, through which multiple surface water related databases are integrated is the 1:24,000 scale hydrography layer (see below). An updated hydrolayer (version 3.0) is available for data integration work. Continuing refinements to the configuration of this base datalayer will further advance its usefulness in the department.

1:24,000 Scale Hydrography Layer

In October of 2000, DNR produced the state’s first 1:24K Hydrography geographic data layer from 1:24,000-scale sources. This DNR corporate datalayer is integral to integrating various DNR databases related to waterbodies. Since the initial release of the WDNR 24K Hydrography database, a series of updates and enhancements have been completed, resulting in Version 3. A history shapefile has been created to track all features that have been spatially edited. Version 3 is now available for distribution on CD including the full 24K Hydrography data model in ArcInfo coverage format and as the 24K Hydrography data in shapefile format, accompanied by several pre-constructed ArcView legend files intended to facilitate use of the data. The coverage and shapefile versions are both provided statewide in extent and accompanied by the full set of current user documentation.

During the coming reporting period, DNR will undertake a complete review of hydrolayer data model, evaluating how to enhance the coverage to provide four critical features that are currently not available: 1) statewide connectivity (to support modeling work), 2) coverage beyond the 1:24K scale to support program needs involving waters that are not represented on the 1:24K scale, 3) timely edits to reflect documented changes in waterbody movement, size or configuration (ie., dam removals), and 4) consistency between the register of waterbodies (ROW, the state’s waterbody inventory) and the 1:24,000 scale hydrography spatial datalayer for name, location, waterbody identification codes (WBICs), and length/size.

Spatially-Enabled Data

Wisconsin's SWIS links geographically located ('geolocated') data points, lines or polygons together in one system for integrated data analyses or queries based on water features represented in the 1:24:000 Hydrography datalayer. Currently, the following systems are "geolocated" in SWIS: Register of Waterbodies (ROW); Master Fish File, Engineering Studies, NHI data for riverine species, dams, fish toxics, sediment toxics and General Permit Facilities (Milwaukee County only). In FY05, the following additional datasets will be "geolocated":

- Waterbody Assessment Display and Reporting System (WADRS) [waterbody classifications, use designations, assessments] July 2004 (QAQC in 2005);
- STORET (geolocation in Fall, 2004 (QAQC in 2005);
- Outfalls (point geolocation in June 2004, attribute data in 2005);
- Biological and Habitat Database (possible geolocation in 2004-05, attribute data in 2005-06);
- Exotics (zebra mussels and eurasian watermilfoil geolocated in 2004, attribute data for these and additional species in 2005-06).

Embeddable Locator Tool

A new geolocating tool called the Embeddable Locator Tool (eLT) has been developed and is being deployed in several WDNR applications to allow for the collection of more accurate locations. This mapping tool is called from the data system maintenance screens that staff use to enter new site locations and/or change existing ones. The eLT allows users to use create locations against Digital Orthophotos, Topo quads and other vector GIS data while they type in all of their attribute data. The tool also gives the staff the capability to "link" their location to the 24K Hydrography network and thus make their data available to others through SWIS.

Additional Data Management Projects

Fish and Habitat Statewide Database

The Fisheries and Habitat Database is an Oracle system developed by the Bureau of Fisheries Management and Habitat Protection through the United States Geological Survey (USGS), Powell Data Center. The database consists of data entry forms, exporting and reporting capabilities, and tools for analysis of fisheries and habitat data for streams, rivers and lakes. The FH Database directly supports the state's Baseline Monitoring Program in addition to other Fisheries and Habitat programs by providing an electronic "warehouse" to store fisheries and habitat data via a WEB-based application for data input and access. Since 2002, the FH Database has provided automated outputs of selected metrics for the identified media (lakes and rivers and streams) such as Index of Biotic Integrity (IBI) for fish data, and Habitat Indices, in addition to summaries used to answer local fisheries management questions about fish distribution, abundance, size, growth, recruitment, and mortality.

Currently, the database focuses exclusively on biological data, as chemical data are stored and accessed through STORET. However, work is being conducted to analyze connections between these two databases and with the state's SWIS.

Aquatic and Terrestrial Resources Inventory

The Aquatic and Terrestrial Resources Inventory (ATRI) is "a public and private partnership to gather, link, and make available data used for making decisions affecting Wisconsin's landscape." It is an integrated information management system that currently functions as an inventory of data, regardless of location or format. The goal of the program is the identification, inventory, storage and distribution of Wisconsin's ecological data. Products of the program include a metadata repository, department data standards which provide guidelines concerning the collection and structure of data that is consistent with current WDNR practices and recognized federal standards. The inventory is available to anyone with internet access, and includes interactive mapping using ArcIms.

Sediment and Fish Toxics Database

This oracle system contains sediment sample and fish tissue results used to track ambient sediment contamination levels and to develop the state's fish consumption advisories. This system will be reviewed during FY05 to identify possible enhancements to broaden use and accessibility of the system.

Register of Waterbodies – ROW

The Register of Waterbodies is the state's inventory of waters and is an Oracle-based system originally developed from historical county waterbody listings and descriptions. During the 2002-04 reporting cycle, the state invested resources to upgrade this waterbody identifying assignment system to update its interface to a web-enabled java user interface with a spatial component, or map view embedded in the system. These updated features will be available to DNR staff in 2004.

Master Waterbody Fish File

This database holds the sites of fish specimen collected using USGS Quads and Wisconsin Transverse Mercator (WTM 83/91). The purpose is to inventory the fish species and their distribution in Wisconsin waterbodies. This data was compiled by the Wisconsin DNR for fisheries inventory and monitoring and is stored in an Oracle database.

Wetlands Inventory

The state's Wetlands Inventory is a 1:24,000-scale GIS-based coverage containing all digitized wetlands down to at least 5 acres in size, and in some areas down to 2 acres in size. This database, used for regulatory purposes, is a critical element in the state's water management program. In 2001, a project was completed that makes this data more accessible to resource managers (see below).

Wetlands Datalayer GIS Coverage Clipping Project

The DNR completed a manipulation of the Digital Wisconsin Wetlands Inventory (DWWI) that allows the digital wetlands layer to be accessed and displayed by water basin in Arcview. Each major water basin or Geographic Management Unit (GMU) has an associated "clip-out" of the DWWI that displays the wetlands of the basin. The basin "clip outs" are available on the DNR's GIS library. This has made DWWI information much more accessible for basin planning and 305 (b) reporting. Summaries of wetland acreage by wetland type can now be provided for each water basin, and the distribution of wetlands throughout the basin can be displayed. Year 2000 -2002 State of the Basin Reports used this data. Prior to this project wetland information could only be displayed by county. The protocol developed for this project is also applied to "clip-out" the DWWI for subwatersheds to meet specific project needs.

Lakes Volunteer Monitoring Database

This database has undergone tremendous growth and change since 2001, when it first became accessible to the public through a web-based application on the DNR's website. This Oracle based application provides up-to-date information to residents on the quality of their lake through a series of pre-designed report formats. This system is described more fully in the Lakes Assessment Data Chapter 3.

Waterbody Assessment Display and Reporting System (WADRS)

The state's water quality assessment system is described in Chapter 2.

Chapter 2: Assessments & Summary Data

In Wisconsin, surface waters are assessed to determine attainment for each of four designated uses: Fish and Aquatic Life, Fish Consumption, Public Water Supply and Recreation. This determination of the potential use for each of the use designation categories, often called “use support status”, is described by one of the following: fully meeting, partially meeting, not meeting, threatened, insufficient information, or not assessed. Regional staff apply assessment protocols to available data to make a determination of the assessment status. Monitoring data is evaluated and assessments are written up in water quality management plans, which are published every five years.

In 2004, the new Waterbody Assessment, Display and Reporting System (WADRS) was launched to store and manage assessment data, including the state’s 305(b) and 303(d) information. This system will provide continual updates of assessment data by regional staff and provide a mechanism to conduct on-line water quality management planning in the future.

<http://dnr.gov.wi/org/water/wm/watersummary/Waterqualityassessment.html>

This 2004 report describes the state’s new WADRS database, its status and future plans for system implementation and data availability. For

further information on state designated use assessments, criteria, and use of available data, please refer to the online version of Wisconsin’s 2002 Water Quality Report to Congress and/or request a hard copy of the report from the DNR’s Bureau of Watershed Management.

Waterbody Assessment Display and Reporting System (WADRS)

Development of the Waterbody Assessment and Reporting System (WADRS) was funded in 2002-04 through two Clean Water Act Section 104(b)(3) grants from USEPA. WADRS is an integrated a tabular and spatial database (Oracle 9i, ArcGIS) designed to hold water quality assessment data for rivers, lakes, Great Lakes shoreline miles, and wetlands. WADRS can store assessment information from multiple disparate sources within one framework that is GIS enabled. The assessment data are linked to spatial features, which allows that data to be viewed spatially both within WADRS, as well as within webmapping applications and the Surface Water Integration System (SWIS) (see Chapter 1).

Figure 15. WADRS Homepage



WADRS Goals

The goals of WADRS include:

- Providing an integrated data system to improve water quality assessment data integrity and to remove state-level inconsistencies between 305(b) and 303(d) reporting.
- Provide a system that will both meet federal *Integrated Reporting* requirements for 305(b) and 303(d) and provide easy-to-use tools to enhance resource management.
- Provide a data system that is accessible over the intranet for easy access by DNR staff state-wide; system features restrict access and make read-only data widely available to users other than staff responsible for assessing waterbodies.
- Provide a mechanism to make assessment data readily available to the public (when the data is at an acceptable level of accuracy) to enhance public involvement in water quality and watershed activities.

- Provide a flexible system that will accommodate changes in decision rules for use designations and water quality standards (fish and aquatic life, public water supply, recreation, fish consumption) as needed.
- Enable the use of tabular and spatial tools to integrate water quality assessment data with the state's 1:24,000 scale hydrography data layer.

By integrating assessment data with the linear and polygonal spatial features that represent the state's rivers and lakes, WADRS enables the spatial display (or mapping) and spatial analyses critical to sound decision making (see Figure 16).

Assessment Units

Assessment unit records have discrete components, including the assessment unit size. Because the AU is "geolocated" (mapped), other data like where the AU is in the state in relation to boundaries for counties, management basins, water management units, watersheds, and hydrologic unit codes (HUCs) are generated automatically by other GIS datalayers. This feature cuts down on human-induced data entry error.

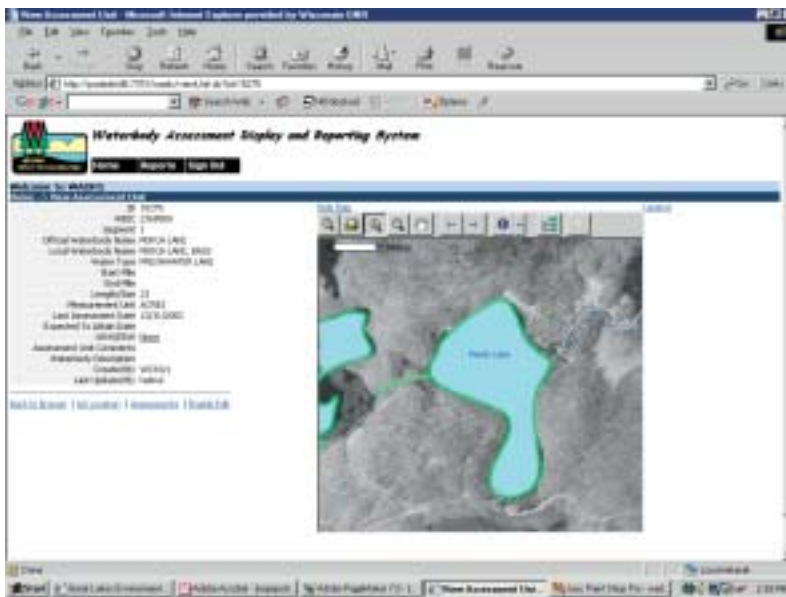
The assessment unit's designated uses (fish and aquatic life, public water supply, recreation, and fish consumption status) are defined by "state use categories". For Fish and Aquatic Life,

these state use categories include COLD, WWSF, WWFF, LFF, LAL, Default. The AU's current use and potential use are compared, resulting in a supporting use determination of fully, partially, not, threatened, insufficient information or not assessed. Linked to this decision is a data quality factor, which includes information about the data type (biological, habitat, and physical/chemical) and "integrity", an associated confidence level, which range from one through four, with one being the lowest and four, the highest. Related to this information is a place where staff can provide detailed references for documents or data sources used to make these decisions. Multiple data sources can be documented.

Knowledge of the type of impairment affecting a waterbody, the pollutants involved, and the sources of those pollutants and impairments is critical to effectively manage the water. WADRS tracks impairments, pollutants, and sources that

relate to the federal USEPA lists (for national consistency). Staff can also provide detailed narrative information about the sources. If an impairment and pollutant are identified for a given waterbody, the user then has the option of populating relevant "303(d)" listing, TMDL status, TMDL implementation date and water quality standards attainment dates, as available.

Figure 16. Assessment Unit



Planned Activities - 2005-2006

The Water Division anticipates that WADRS will contribute substantially to improvement of the state's waterbody analysis and management. WADRS has provided the first *spatial view* of the state's assessment units, ORW/ERW, 303(d) waters, trout waters, and codified uses in an interactive mode. This perspective has shed light on consistency issues between these datasets and raises some policy issues. Without viewing waterbodies in a spatial context, it is quite difficult, if not impossible, to attain an equivalent perspective as with a map view.

Development of WADRS to maintain use designation data is one of several interrelated steps in the continuing evolution and improvement of Wisconsin's assessment program. The following are activities related to the assessment of waterbodies:

- Continuing rule revision process for NR102/NR104 Water Quality Standards;
- Ongoing evaluation of the methodology for use designation assessments for 305(b) and 303(d) listings;
- Development of recreational use designation standards, criteria, assessment protocols and use assessments for lakes, rivers and Great Lakes shoreline miles;
- Continuing adaptation to changes in federal guidelines and reporting requirements related to these and other standards and water quality criteria issues;
- Ongoing development of a statewide strategic monitoring plan for all surface and groundwater related needs.

Long-term plans (2004-2006) for using data in WADRS for public outreach include developing "rivers pages" for each named river in the state, designed using a process now in development for the Lakes Program. This process involves generating a rivers page "on-the-fly" from WADRS and other pertinent data systems that hold monitoring data stored at DNR. These pages will be available through WDNR's external website in the respective waterbody's "basin page" in 2006.

<http://dnr.gov.wi/water/wm/wqs/303d/303.htm>

Impaired Waters Screening Criteria

Waters identified as "impaired" under Section 303(d) of the Clean Water Act include those that have either quantitative water quality standards violations or aquatic life and/or fish consumption use designation problems combined with that water not meeting its codified water quality classification. Once a waterbody is on the impaired waters list, it is categorized according to the factors causing impairment. Within each category is a description of the strategy the Department may use in development and implementation of TMDLs.

2004 Methodology for Placing Waters on Impaired Waters List

As required by section 303(d) of the Clean Water Act, states are to submit a list of impaired waters to EPA for approval. WDNR has submitted a list to EPA every two years up to 2004. Wisconsin is operating under the same federal regulations as used in 1998 and 2002. The WDNR has posted its Methodology for Impaired Waters on its website.

Chapter 3: Rivers and Streams

Assessment Summary

In 2002 the state reported a total linear stream mileage of 57,698, which includes intermittent and perennial waterbodies. About 44 percent (24,442 miles), of these miles were assessed at that time, and only a portion of the assessed miles (about 30 percent) have been monitored since 1997. Assessment decisions on the remaining 70 percent of assessed miles were based on evaluated data, or data more than five years old and/or from interpretation of field surveys or other data collected by external individuals or agencies.

Also, in 2002 WDNR reported all Wisconsin streams were assessed for fish consumption based on evaluated information. Due to the general fish consumption advisory for mercury, all waterbodies were assumed to not meet this designated use.

During the 2002 reporting period assessments for recreation or public water supply were not conducted. However, data gathering efforts through the Beach Program for Great Lakes shoreline health, as well as an inland water beach study, and through the state's Source Water Assessment and Drinking Water Program, will provide data for future use. Assessments will occur after pathogen water quality criteria have been developed and protocols for assessing public water supply and recreational uses are in place.

Data does exist for fish and aquatic life. Where waters are partially or not meeting designated uses, the cause and source of the non-support is documented. Water quality problems in the state are most often the result of watershed-specific land use activities, with the exception of atmospheric deposition of mercury. The most prevalent water quality problems include the presence of mercury in surface water, habitat alterations, siltation, excessive nutrients (phosphorus) and materials that use up oxygen as they decay, limiting oxygen availability for aquatic life. The *causes* of these water quality problems include atmospheric deposition, polluted runoff, and hydrologic modifications such as ditching and wetlands destruction. Wastewater discharges contribute moderate to minor impairments to Wisconsin's streams. A stream reach may be degraded by more than one source, causing more than one problem, the cumulative effect of which can be significant.

River Management

The Department's Rivers Team oversees the implementation of the state's Rivers Strategy, Rivers Grants, and tracking of river management performance measures.

Rivers Strategy - Report Card

Going with the Flow: A Rivers Strategy to Protect, Preserve, and Restore Wisconsin's Flowing Waters brought a coordinated approach to the support of local river management in the state. This strategy integrated various ongoing river management efforts in the Fish Management and Habitat Protection Program, and provided the momentum to further develop an ongoing relationship with key external partners, such as the River Alliance of Wisconsin.

Strategy goals include: **protecting and restoring riverine ecosystem integrity.** Development around rivers systems and the use of rivers have significantly modified many rivers' physical and biological characteristics. Dams have been constructed and have converted free-flowing rivers into a series of impoundments. Systems have become fragmented. Land use practices have degraded water quality and increased the amount and altered the rate of sediment and nutrient flow in the systems. The integrity of the ecosystem (combination of the physical, biological, and chemical components) must be protected and restored to preserve the functional riverine system.

The second goal is balancing legitimate river uses with environmental needs. Decisions on multiple river uses like recreation, waste assimilation, power generation, water supply, irrigation, transportation, etc. must be made together to sustain both river continuity and socioeconomic benefits.

Third, enhancing the public's personal stake or sense of ownership of rivers, this includes participation of user/citizen groups is critical to the success of a river program. The state's River Grant Program has provided over \$150,000 during each grant cycle to establish and support river organizations.

The strategy also includes developing a consistent and comprehensive approach that assures the effective and equitable protection and management of Wisconsin's rivers systems. Historically river management has been inefficient because of the lack of coordination or inconsistencies in the designated management approach. Identifying and protecting critical river systems by managing rivers according to their unique potentials and needs. Rivers differ in size, surrounding land, environmental and economic potential, threats, and protection needs

The Rivers Team strives for comprehensive management at the watershed level. To be most effective, working relationships with other agencies or groups must be formed to develop an integrated management plan that includes the entire basin or watershed and builds on existing efforts in river management. During 2002-2004 the Water Program developed a comprehensive data system to hold assessment and narrative data from the state's integrated management plans and field work. This system (WADRS), will make posting data online for public use much more efficient.

The strategy also calls for showcasing success stories based on realistic performance measures. Below are examples of high quality grant projects.

River Grant Program

The state's Rivers Grant Program supports community and nonprofit groups protect rivers by funding work that helps prevent water quality deterioration, restore fisheries habitat, and maintains natural beauty. This initiative is seen as fundamental to whole ecosystem protection as the density of residential development and recreational uses along rivers increases coincidentally with the exhaustion of available lake sites. Local units of government and nonprofit, qualified river management organizations are eligible to apply for these grants. Between 1999 and 2002, \$308,912 was awarded for 49 separate planning grant projects and \$419,599 was awarded for 11 separate management or implementation projects. Many additional dollars have been made available *to rivers organizations during the years 2003 and 2004.*

River Planning Grants are designed to help with river organization development, to support information and education work and local, community-based assessments of water quality, fish and aquatic life, and finally to help conduct nonpoint source evaluations. The grant program provides a 75% state share maximum, up to \$10,000 per grant.

River Management grants are designed to support purchase of land or easements, development of local ordinances for river protection, and restoration of in-stream or shoreland habitat. Again, this program provides a 75% state share maximum, up to \$50,000 per grant.

Performance measures for grants helps evaluate the effectiveness of rivers program. While the department continues to pursue ecosystem based performance measures that focus on numerical relationships between watershed activities and resulting riverine condition. Only recently has research been completed that describes such a relationship (See Science and Innovation in Water Management). "Useful efforts" is the term used to describe functions deemed valuable in restoring or maintaining sound riverine ecosystems. The rivers grants program lists "Useful Efforts" in its roster of eligible work projects and in the criteria used in ranking applications. "Useful Efforts" performance measures for planning include: the number of planning grants, number of publications, or the number of planning groups formed. For management grants examples include number of acres purchased or easement acquired lands, number of nonpoint source practices established, or river restoration projects completed. More expansive criteria — for example, evidence that DNR has participated effectively in preparation of a mission, goals and strategy for a local rivers organization — are also being developed. For river management grants, performance can be measured by pre- and post-monitoring and evaluation of whether the grant achieved its stated goals.

Highlighted Projects

During the reporting period, a number of grants were funded and implemented to enhance the capacity of local river organizations. Among those funded, the Rock River Headwaters, Inc., Upper Sugar River Watershed Capacity Building Project, and the Black Earth Creek Watershed Association made significant strides in increasing local knowledge of and support for watershed restoration.

The nonprofit group, Rock River Headwaters, Inc., focuses its efforts on the Upper Rock River Basin's headwater areas including the Horicon Marsh. The group was actively involved in development of the Rock River State of the Basin Report, completed in 2002 by hosting stormwater, groundwater and surface water protection discussions for the basin.

The Upper Sugar River Watershed Capacity Building project has received funding through the Rivers Grant Program for three consecutive years. In 2000 the Dane County Parks Department received a \$10,000 grant from the WDNR for three nonprofit organizations (the Deer Creek Sportsman's Club, the Friends of Donald Park, and the Upper Sugar River Watershed Association (USRWA)). Each of the three nonprofits set goals to carry out restoration work. For example, Friends of Donald Park formed to implement the goals of the Donald Park Master Plan, which contains 2.5 miles of the Sugar River Headwaters (Mt. Vernon Creek, Deer Creek and Frye's Feeder). The USRWA earned the 2002 Water Champion Award, presented by the Dane County Lakes and Watershed Commission and the 2002 Stewardship Award (nonprofit category) presented by the Natural Heritage Land Trust. In 2003, the USRWA implemented a variety of public educational efforts including radio, TV and print adds about being "RiverSmart," providing tips and pointers for protecting river quality.

Friends of the Pheasant Branch also received river grants in consecutive years, with funding allocated toward advancing its administrative functions, organizing volunteers for ecosystem restoration projects, and obtaining funds from alternative sources (leveraging) for the purchase of sensitive areas in the watershed. This high quality Friends organization also carried out educational efforts and promoted low impact development and conservation practices through its participation in the Pheasant Branch Watershed Task Force.

The relatively "pristine" ecosystem of the Jump River benefitted from the extraordinary efforts of the Friends of the Jump River, which carried out monitoring, networking, resource preservation and educational outreach work. This friends group successfully fought for the placement of 8000 acres of Price County Forest (involving 20 miles of Jump River frontage) into non-motorized status. Among a long list of accomplishments, the Friends' president is working with DNR to help develop additional citizens groups around other valuable water resources in the Chippewa Basin. The Friends also developed a strategic plan for management of the river.

The Black Earth Creek Watershed Association (BECWA) initiated a number of activities through the grant program including capacity building and leveraging (a variety of successful local networking contacts were made), assisting in local decision making, and educational efforts. The BECWA contributed to development of the Lower Wisconsin Basin Plan, the Dane County Open Space Plan and the Black Earth Creek Fishery Area Master Plan.

The BECWA and other dedicated, motivated friends groups illustrate why the Rivers Grant Program was formed – to enhance stewardship of river systems statewide through education, networking and providing start-up money to talented individuals and organizations.



Sampling on the South Fork Hay River in Wisconsin's driftless area, southwest ecoregion

Dam Removals

<http://www.dnr.state.wi.us/org/water/fhp/rivers/index.htm>

Dams negatively affect riverine fish communities by blocking migrations, altering natural stream flows and temperature regimes, and fragmenting critical habitats. Moreover, dams are typically constructed across high gradient river reaches, thus eliminating riffle habitats that function as spawning and nursery areas for native fish species. Consequently, substantial fish community shifts typically occur following dam construction, such as the replacement of sensitive riverine species by tolerant lentic species, the loss or degradation of fish migrations, and the extirpation of species due to the fragmentation of critical habitats. To mitigate the negative effects of dams on riverine fish communities, dam removal is considered a management option to reconnect and restore these fragmented habitats. However, despite the increasing use of dam removal as a restoration tool, there is a need for more quantitative biological information on how these systems recover after dams are removed. Understanding how riverine fish communities respond following dam removal will help resource managers and communities make sound decisions on future dam removals.

In Wisconsin, dams are a ubiquitous part of the drainage network as over 3,700 dams have been constructed in the state since European settlement. Most of the dams are small, low-head structures that were originally built in the mid- to late-1800s to provide hydropower to small textile, paper, and saw mills. Because of their age, many of these small dams are now dilapidated or non-functioning and are no longer economical to maintain. Consequently, many small dams are slated for removal, which in many cases is much less expensive than dam repair, and is thought to have aquatic ecosystem benefits. Recently, Wisconsin has been a national leader in dam removal, with over 60 small dams removed in the last 30 years (excerpted from Catalano, Matthew J., 2004, *The Effects of Dam Removal on the Fish Community and Habitat of the Baraboo River, Sauk County, Wisconsin, WDNR South Central Region*).

One interesting finding by the River Alliance of Wisconsin is that dam removal costs are often over-estimated. Removing the Willow Falls Dam on the Willow River cost 27% less than the original removal estimate (\$450,000 rather than \$622,000). On the Baraboo River, removing the Waterworks Dam cost 35% less than originally estimated (\$240,000 instead of \$387,000) And removing the Mounds Dam on the Willow River cost 85% less than the original estimate (\$170,000 instead of \$1.1 million).

Several dam removals throughout the state are in the planning stages or have recently occurred. The following examples summarize some of the issues involved in Wisconsin dam removals.

Token Creek Watershed Project

The Token Creek Watershed, a 27-square mile drainage area in the Rock River Basin, is the focus of intense restoration efforts following the removal of a dam in 1998. This small watershed likely sustained a native brook trout fishery prior to European settlement, prior to the construction of a grist mill dam 150 years ago. Over the years, the dam's original function as a grist mill changed to that of supporting recreational activities. However, when the dam failed in 1994, springs discharging greater than 4,000 gallons of cold water per minute to Token Creek were exposed, raising the question of how the waterbody should be managed. The Token Creek Coalition subsequently raised \$1 million to purchase the dam and surrounding reservoir from the Token Creek Inland Lake District.

Restoration of the channel and habitat, preservation of the springs, and reduction of polluted runoff to Token Creek continue today. In 2004, channel restoration will begin through funding from the Trout Stamp Act, Natural Resource Conservation Service, U.S. Fish and Wildlife Service, and the state's Yahara-Monona Priority Watershed Program. This work includes restoration of the Harbison (Pederson) Branch, creation of a sediment trap downstream of the dam, notching the Culver Springs impoundments and beginning the channel restoration. With the addition of other habitat improvements below the dam, at least 7 miles of stream will be re-established as a brook trout fishery. Dane County, WDNR and the City of Sun Prairie have also been working to encourage development that is more sensitive to this cold water system. For example, new developments use techniques to encourage stormwater infiltration rather than conventional retention ponds, which tend to lead to high water temperature and change in the aquatic habitat.

Baraboo River Restoration

The Baraboo River flows 120 miles from its headwaters near Hillsboro to a confluence with the Wisconsin River south of Portage, encompassing 650 square miles. The river drops 45 feet as it flows through the City of Baraboo. This concentration of relatively steep gradient was recognized by early settlers and used to generate mechanical power beginning 1837, when dams were constructed in this reach of the river. Dams formerly on this stretch of the river included: the Linen Mill Dam (removed in 2001), the Waterworks Dam (removed in 1998), the Oak Street Dam (removed in 1999), and the LaValle Dam (removed in 2001).

These dams negatively affected the Baraboo and Wisconsin River ecosystems by restricting the movement of game and forage fish species, as well as blocking valuable spawning and nursery areas for fish migrating from the Wisconsin River. This habitat fragmentation transformed the rapids from a fast-moving stream with healthy fish populations to a series of sluggish impoundments choked with sediment, excess nutrients and degraded habitat.



Baraboo River after removal of the Linen Mill Dam, courtesy of Konstantine E. Margovsky

In response to the potential importance of these systems to the state, many agencies, non-profits and citizens are working to restore the aquatic and riparian resources.

Today the dams have been removed and partners are monitoring the system to better understand the impact of dam removal on the fishery and on water quality. Recently, several fish species such as the Emerald Shiner and the Lake Sturgeon have either been observed and/or captured through surveys upstream of the former dams. This is a sign indicating system recovery.

Prairie River Dam

The Prairie River is an outstanding trout stream located in the Wisconsin River Basin. This high quality resource has a mean annual flow of about 180 cubic-foot-per second (cfs) and has the state record for brook trout (9 pounds, 15 ounces). The Prairie once hosted four dams, now all structures have been removed after 110 years of hydromodification.

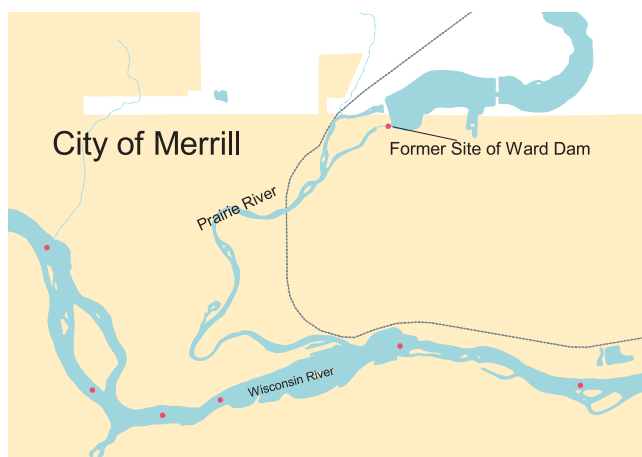
The Ward Dam was the last of four dams built to provide water for log drives in the late 1800's, and the last dam to be removed. Significant restoration work has occurred on the Prairie River to improve and restore habitat in the past two years. Restoration efforts have involved adding 1200 large boulders, 7000 trees, 225 pieces of large woody habitat, restoration of six wetlands, implementing erosion control measures, channel modifications, and installing nesting boxes. Extensive public information efforts have also occurred.

Recently, 100 acres of land was donated to the City of Merrill by International Paper, which previously owned the Ward Dam. WDNR, the city and International Paper have cooperatively designed and implemented a stormwater management system that routes stormwater through more than 3000 feet of ponds and wetlands, created during the dam removal, before flowing into the Prairie River. The total cost for the restoration work, including donations by Trout Unlimited, \$52,000 for two miles of stream that had been under water for over 120 years.

<http://www.wisflyfishing.com/friends/HTM/Prairie.htm>

http://www.wisconsinrivers.org/SmallDams/ward_removal.html

Figure 17. Prairie Creek System



Shopiere Dam

<http://www.wisconsinrivers.org/>

The Shopiere Dam, constructed across Turtle Creek, which is an Exceptional Resource Water and one of the finest small-mouth bass rivers in Southern Wisconsin, was located in the Town of Turtle, Rock County. The dam was built in 1848 as a rock and timber structure to power a grist mill. In 1925 the dam was reinforced with masonry and concrete, consisting of a 120-foot long, fixed-crest spillway with a structural height of 13.4 feet and a hydraulic head of 7 feet.

The owner of the dam left Wisconsin in the 1970s. Rock County owns a park immediately adjacent to the site of the former dam and tax-delinquent land. Although though the area was posted with signage indicating the flowage was not part of the public park, swimmers were known to cool off in the 'water fall', swim under the dam into the structural voids, and to jump off the spillway into the scour hole. This use posed a significant safety hazard.

The dam also obstructed fish movement. Studies showed that the number of small-mouth bass were greater below the dam, with an average of 85 fish per mile, versus above the dam with an average of only 50 fish per mile. The threatened gravel chub (*Erimystax x-punctata*), ozark minnow (*Notropis nubilus*), and the greater redhorse (*Moxostoma valenciennesi*) were documented downstream of the dam, but not upstream.

Recurrent failures in 1943, 1973, 1983 and 1993 led to the development of the Shopiere Dam Committee. The dam was completely removed by 2000 at a cost of \$82,000. Post-dam removal studies show fisheries improvements upstream of the dam including the presence of the three threatened species. Recent surveys show walleye and channel catfish present in multiple year classes, as well as other species not found in prior surveys.

Franklin Dam Removal

In 2000 and 2001 the WDNR removed the 148-year old Franklin Dam located on the Sheboygan River. The first step in dam removal was removing the gates and breaching a portion of the dam to reduce impoundment water levels; this work helped stabilize exposed sediment. Funding for the removal came from the Wisconsin Abandoned Dam Fund and two grants from the Great Lakes Protection Fund, one of which was obtained by the River Alliance of Wisconsin, a nonprofit organization. Today, the channel is still forming and will not be completely stable for some time, perhaps 10 years. Rivers are dynamic systems in constant search for "stability" (a balance of flow, sediment, energy, etc.). While there is still "head cutting" occurring, which means the channel bottom is cutting down to a better slope and there is a point that is slowly moving upstream where a form of clay is slowly eroding down to the original channel bottom, these are natural processes that will ultimately result in a more stable, sustainable system.



Looking downstream where the Franklin Dam once stood.

Big River Management

Mississippi River

Interstate Coordination

The Upper Mississippi River (UMR) is a resource of major importance to Wisconsin. Forming the boundary between Minnesota, Iowa and Wisconsin - and sharing management responsibilities for this Upper Mississippi segment with these states and federal agencies — WDNR participates in numerous multi-state planning, monitoring, and restoration projects involving this major resource, including the Environmental Management Program (EMP), navigation studies, environmental pool plans, channel maintenance plans, water level management and other planning activities.

During 2002-04, Wisconsin participated on the Upper Mississippi River Basin Water Quality Task Force, coordinated by the Upper Mississippi River Basin Association (UMRBA). This task force, comprised of water resource management administrators and staff from the five UMR basin states (Minnesota, Wisconsin, Illinois, Iowa and Missouri), met regularly to improve coordination of water resource management activities on the Mississippi. Issues such as water quality concerns related to hypoxia in the Gulf of Mexico, water quality standards, monitoring protocols and plans, assessment procedures, impaired waters listing 303(d), development of total maximum daily loads, etc. have been discussed. In 2003, the Task Force developed a Memorandum of Understanding, signed by the five UMR basin states, for the establishment of consistent assessment reaches on the UMR for use in water quality evaluations and reporting requirements under the Clean Water Act - 305(b) and 303(d). Wisconsin has begun to incorporate these changes in to its assessment procedures.

In 2003, Wisconsin assisted Minnesota in the evaluation of water quality data for their 2004 impaired waters listing for the Mississippi. In addition, Wisconsin worked with the Upper Mississippi River Conservation Committee Water Quality Technical Section in the development of proposed water quality criteria to protect submersed aquatic vegetation in the UMR. This proposal is currently being reviewed the UMRBA Water Quality Task Force.

Mississippi River Water Level Management

A two-year water level reduction demonstration was held in Pool 8 of the Upper Mississippi River during the summers of 2001 and 2002. Through this demonstration almost 2000 acres of mud and sand flats were exposed to provide favorable growing conditions for aquatic vegetation. Assessment monitoring is ongoing to determine the exact extent of aquatic plant bed expansion and the length of time vegetation will linger after reflooding. Initial aquatic plant response appears to indicate this is a positive habitat restoration tool for the Upper Mississippi River. A task force of natural resource managers has begun planning to conduct a similar demonstration on Upper Mississippi River, Pool 5, in 2005.

Figure 18. Pool 8 July 2001 to August 2002-Emergent vegetation response to a pool-wide drawdown, Mississippi River. Photos from Kevin Kenow, USGS.

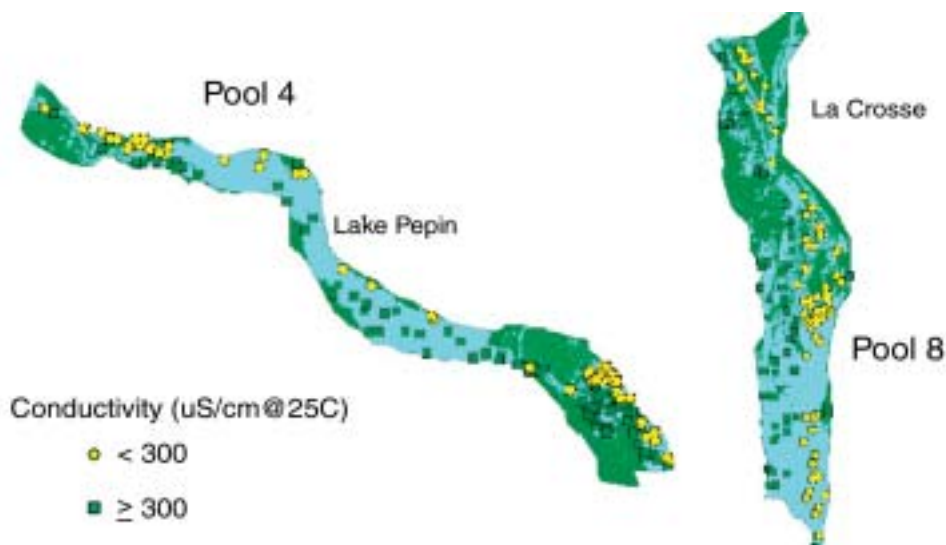


The WDNR has participated in the Corps of Engineers Navigation study since 1991. As a result of a congressional inquiry the study was restructured in 2001, to include an equal emphasis on commercial navigation and the ecosystem integrity of the Upper Mississippi River. The draft Feasibility Report and the Environmental Impact Statement are scheduled for release in 2004. Tentative recommendations from the study will likely include improvements at 12 locks and other small scale efficiencies with a 50-year cost estimate of \$2.3 billion. Ecosystem restoration tentative recommendations will likely include a wide variety of restoration tools with a 50-year cost estimate of \$5.4 billion. The final report including review by the National Research Council will be sent to the Chief of the Army Corps of Engineers in November 2004. If this plan is authorized and funded by congress, adaptive management principals will be applied to commercial navigation efficiencies and ecosystem restoration and will require periodic evaluation to move to the next phase.

Long Term Resource Monitoring Program (LTRMP)

In 2003, the WDNR's LTRMP worked on teams with staff from the other state field stations and USGS Upper Midwest Environmental Sciences Center to provide a 10-year summary of all monitoring components. Comprehensive temporal and spatial analyses of fish, vegetation, macroinvertebrates and water quality were performed. Results have been summarized and draft reports have been prepared. These reports will be published and released in 2004. These multi-year summary reports will be supplemented by more detailed appendices containing all analysis results on CD and by peer-reviewed articles in scientific journals. LTRMP monitoring was reduced in 2003 due to funding shortages and work centered on data analysis. The Wisconsin field station collected a full complement of vegetation monitoring in Pool 8 and aided in the evaluating aquatic vegetation response to water level management activities implemented in 2001 and 2002. In 2003, the Wisconsin field station also participated with USGS and the Iowa Field Station in conducting water quality monitoring (including light penetration) to aid in constructing of predictive models for submersed vegetation. In addition, limited fish monitoring activities were conducted.

Figure 19. LTRM 2001 Spatial Analysis. Spatial analysis of stratified random samples collected by the Long Term Resource Monitoring Program reveal strong persistent lateral gradients below major tributary inflows to the Mississippi River during spring periods. Data are from April 2001.



Freshwater Mussels

Freshwater mussels are an important biological component of large river ecosystems. They are generally considered good indicators of water quality since they are often the first group of organisms to be eliminated or lost from a compromised waterbody. In the upper Midwest, about one-third of the fauna is listed as endangered or threatened by Federal and State agencies. These lists are comprised of mostly large river species.

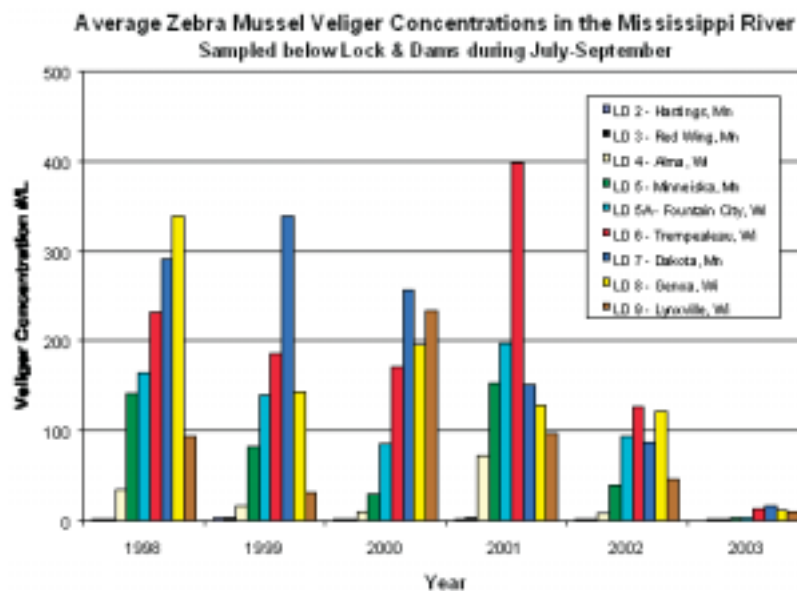
In 2003, Wisconsin participated with other State and Federal agencies in propagation of the federally endangered higgins eye freshwater mussel. The purpose of this multi-agency project, lead by the U. S. Army Corps of Engineers, is to mitigate for losses of freshwater mussels from the invasion of the non-indigenous and invasive zebra mussel. The final objective of this program is to establish or supplement endangered mussel populations in rivers or reaches of rivers where zebra mussels are absent or at low population densities. Monitoring of the success of this unique program is ongoing and initial findings are promising. Wisconsin also continues to actively participate in two federal endangered species Recovery Teams for the higgins eye and winged mapleleaf mussels in cooperation with the U.S. Fish and Wildlife Service. Host fish for the winged maple mussel have recently been discovered and plans are being prepared for the reintroduction of this very rare mussel into historically occupied locations.

WDNR recently surveyed large tributary streams to the Mississippi River for mussel and mussel habitat. WDNR evaluated the potential of these streams for mussel introduction or re-introduction. Suitable habitat conditions were found on the lower Chippewa River and limited conditions were found on the lower Black River. In both these streams, high levels of bedload were found to be limiting mussel populations. WDNR also continued its long-term mussel monitoring program begun in 1985. One location on the Lower Wisconsin River continues to experience sharply declining mussel populations. Population densities have declined 70 percent since 1988, with



Introducing juvenile endangered mussels into the Black River, Wisconsin.

Figure 20.



fewer young recruits and lower species richness. One of three locations on the St. Croix River has shown a steadily declining mussel fauna, while the remaining two appear to be stable. Reasons for these declines are unknown, although zebra mussel invasion has been extensive.

WDNR cooperated with members of the Upper Mississippi River Conservation Committee in the formulation of the "Conservation Plan for Freshwater Mussels of the Upper Mississippi River System." Further, WDNR is assisting UMRCC in a revision of "Freshwater Mussels of the Mississippi River," a popular information brochure for river managers and the public.

Contaminated Sediment Management

The nature of pollution in aquatic systems often results in the heaviest concentration of contaminants in either or both the waterbody's aquatic life and its sediment, or the "mud" that settles to the bottom. Sometimes, when sediment behind a dam is dredged or when known sites of municipal or industrial discharge are investigated, contamination is found. When contaminated sites are identified, the environmental and health risks are assessed, and integrated remediation efforts are carried out by scientists and engineers both internal and external to the Department. The following text illustrates some of the issues and concerns and even some of success stories in identifying, understanding and removing sediment from aquatic systems.

Contaminated Sediments at Former MGPs

Former Manufactured Coal Gas Plants (MGPs) produced gas from coke from the early 1800s through the 1950s. MGPs used coal as a feedstock, producing large quantities of byproducts during their operation. Waste byproducts included coal tars, sludges, oils and other chemicals, coal tar being the main byproduct of the gasification process. The plants typically operated in confined areas, and used the nearest convenient outlet for waste disposal, which was often a nearby surface water. The result is a scattering of contaminated MGP sites throughout the state.

Coal tar is the primary waste at MGP sites, but is usually a mixture of polycyclic aromatic hydrocarbons (PAH), such as benzo-pyrene, naphthalene, anthracene, acenaphthene and phenanthrene; phenolic compounds (phenol and methylphenols); light aromatic compounds (benzene, toluene and xylenes); miscellaneous organics (dibenzofuran), and small quantities of inorganic compounds (iron, lead, copper, zinc, sulfides, cyanides and nitrates). Coal tar is heavier than water and migrates downward, where it resides in an immobile state or spreads slowly, as a continuous source of contamination through the solubilization of contaminants over time. Once the waste products enter the environment, they do not degrade readily and are threat to aquatic, wildlife, and human health. For this reason, WDNR actively pursues remediation of contamination from MGPs.

Ashland Coal Gas

The Ashland Coal Gas site is located in Ashland Harbor, Ashland County, which is tributary to Lake Superior. The Excel Corporation contaminated 10 acres of surface water and groundwater. Contamination was first detected by WDNR 10 years ago. Since that time WDNR and the Excel Corporation have investigated the site, finding extremely high levels of coal gas waste. The USEPA, now involved through the Superfund Program, is conducting additional risk assessment work to further quantify human health and ecological risk. The contamination is also shore-based; there is known on-land subsurface contamination of PAHs in volumes potentially larger than that found in the surface water sediment.

Contaminated Sediments at Former Industrial Sites

Gruber's Grove Bay

Gruber's Grove Bay, a 20 acre-site, is located on Lake Wisconsin, adjacent to the former Badger Army Ammunition Plant near the City of Baraboo in Sauk County. Sampling in the Bay in 1999 indicated elevated levels of mercury, lead, copper, chromium and nickel. The contaminated sediments were the result of discharges from ammunition production at the former plant. Seventy-five thousand (75,000) cubic yards of mercury contaminated sediments have been hydraulically dredged and landfilled at a cost of \$6 million. During dredging operations, the use of a silt curtain was implemented to contain contaminants in the bay. In addition to this work by the WDNR and the Department of Army, USEPA, UWEX, and citizen volunteer groups contributed to cleanup efforts. Remediation was completed in November 2001. However, post-remediation monitoring indicates that sediment underlying the entire extent of Grubers Bay still contains levels of mercury and other metals at levels exceeding the previously identified sample results. Unfortunately, results also indicate that the levels found exceed WDNR's site specific sediment toxicity guidelines. Cooperative efforts with the Army in 2003-04 resulted in further sediment and toxicity testing and development of alternatives for future action.

Wausau Steel Corporation / Rib River Oxbow

Wausau Steel Corporation performed battery reclamation adjacent to the Big Rib River near Wausau in Marathon County. Runoff from the battery recycling operation reached a cutoff oxbow of the Rib River, resulting in sediment contaminated with lead and zinc. A feasibility study indicated that “capping” was the appropriate remediation for this four-acre site. This work was accomplished in 1997 by placing geo-textile fabric and sand on top of the ice cover and letting it settle over the sediments as the ice melted. Cobble “islands” were also placed on the cap to provide habitat for aquatic life. The approximate cost of remediation was \$400,000. Post-capping monitoring indicated that beneficial aquatic habitat has developed in the capped area and that healthy aquatic life is re-establishing. However, recent investigations by WDNR indicate that the geotextile membrane cap may be failing in some areas of the oxbow. Further investigations and followup work is needed; WDNR will pursue this work if funding is available.

Hayton Mill Pond

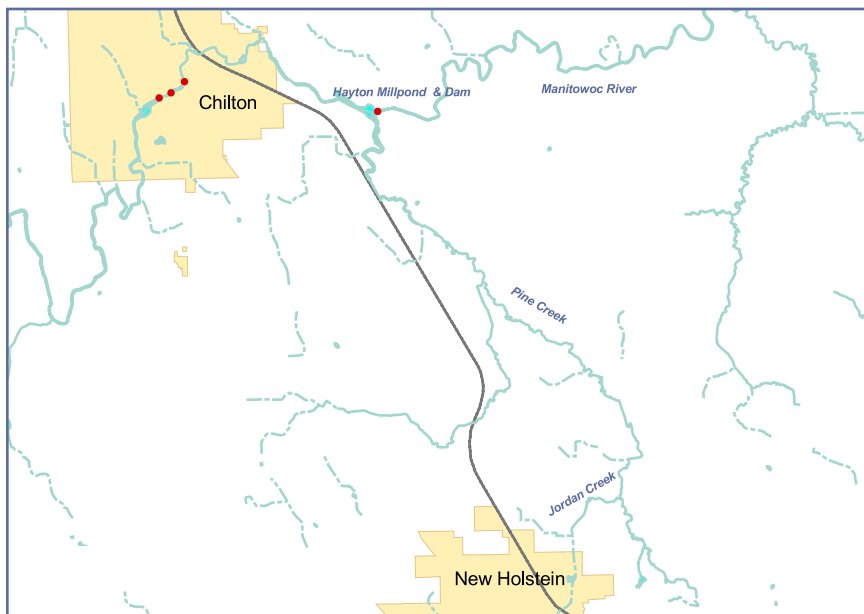
Contamination at Hayton Mill Pond in Calumet County, near the Village of New Holstein, was first identified by the Department in the early 1990s. In the late 1980s fish surveys conducted by WDNR and USEPA found fish in Hayton Millpond, a small impoundment on the south branch of the Manitowoc River, were contaminated with PCBs. Subsequent investigations found PCB contaminated sediment and fish in Pine Creek, a southern tributary to Hayton Millpond, and Jordan Creek, a feeder stream to Pine Creek. In 1991, the most stringent fish consumption advisory (do not eat) was issued for these waterbodies (Baumann, James. 2001. PCB Removal and Management in the Hayton Area Remediation Project, Wisconsin Department of Natural Resources).

Tecumseh Products, an engine manufacturer, is responsible for the contamination. Investigations revealed that the PCBs were probably released in the mid-to-late 1960s. The initial release of the PCBs has been exacerbated by the transport of this organic contaminant as it attaches to sediment and organic matter – and as the contaminated water, sediment and organic matter moved through the City of New Holstein stormsewer system. The pollution affects 20 miles of surface water, floodplain and wetlands. Of particular concern is the Killsnake Wildlife Area immediately downstream of the millpond, northeast of the Jordan Creek, Pine Creek and Hayton Millpond system.

WDNR and Tecumseh Products developed cleanup plans and implementation began in 2001. Sediments with the most contamination were removed and landfilled at a cost of \$1 million. To evaluate the success of remediation, chemical and biological monitoring was conducted prior to

remediation and will continue through the completion of the clean-up process. Remediation is being conducted by WDNR with the City of New Holstein, Calumet County, USEPA, and United States Geological Survey (USGS). In 2004, the second phase of remediation began along Jordan Creek and Pine Creek, covering 2.5 miles of stream and removing contamination from the sediment, streambeds and banks of the waterbodies.

Figure 21: Jordan, Pine and Hayton Millpond System



Kewaunee Marsh

Three acres of the Kewaunee Marsh in Kewaunee County is contaminated due to a Central Wisconsin Railroad car spill in the 1940's. This spill resulted in arsenic contamination of surface water and groundwater in this three-acres of wetland. As an interim remedy to reduce human and

Figure 22. Kewaunee Marsh Site



waterfowl exposure, a geo-textile liner and several feet of wood chips were used to cap the contaminated wetland. The perimeter of the contaminated area was also securely fenced to eliminate public access, and to safeguard human health. Biological and chemical monitoring was conducted prior to the remediation and is currently being conducted to ensure that the movement of the contaminated groundwater plume does not continue to pollute the river. In 2003 a Site Assessment and Remedial Actions Alternative Report, funded in part by USEPA, was completed. Currently, a feasibility study is underway to evaluate an innovative remediation technology using a permeable reactive barrier. This is an *in-situ*, or in-place, passive system which will allow the simultaneous flow of groundwater through the membrane while removing the arsenic. Cooperative work between WDNR and the responsible party will implement remedial actions in the next two years.

Ansul Corp / Menominee River

The Menominee River in Marinette is the location of 20 acres of arsenic contamination from the Ansul Corporation, a chemical manufacturer of flame retardant materials. On-site storage of wastes resulted in contamination of groundwater and of sediments in the Eighth Street boat slip, the ship turning basin, the Menominee River and in Green Bay. Remediation so far has consisted of removing contaminated sediment at the boat slip and sealing off the slip. During this removal work, silt curtains and sheet piling were used to isolate contaminated groundwater and prevent it from polluting other areas. Additional investigations of the turning basin are needed to determine a future course of action. WDNR, Ansul, USEPA, and USFWS have been involved in the remediation.

Figure 23. Slaughterhouse Creek Site



Rhinelander Landfill

An abandoned landfill in the City of Rhinelander in Oneida County is the source of pollution of surface water and groundwater pollution by ammonia and, perhaps also metals (see figure 23). The site is near Slaughterhouse Creek and Pelican River and the identified pollutants have degraded these nearby resources. The contamination was first discovered in 1996, and the Department, as well as the City of Rhinelander, has spent about five years investigating the site. Monitoring has focused on changes in water quality, toxicity studies, and degree of contamination. This sampling data is under review, as alternatives are considered to address the contaminated groundwater input into the Slaughterhouse Creek sloughs.

Moss-American/Kerr-McKee

Moss-American (now the responsibility of Kerr-McKee Corporation) was a chemical manufacturing industry that treated wood by a creosoting process from 1921 to the mid-1970s. Wood products were treated with a mixture of fuel oil and coal-based creosote. Moss American, which was located on the Little Menomonee River in Milwaukee, caused the contamination of sediments, groundwater, and surface water of a two-mile section of the river. The U.S. EPA has designated Moss-American as a Superfund site and has taken the lead on coordinating the clean-up investigation. To date, the U.S. EPA, WDNR and Kerr-McKee, have each spent seven years working on this project. The site remediation began with the removal of 137,200 tons of contaminated soil on the Moss-American property. The next stage involves rerouting about six miles of river in five stages or segments so that remediation of the contaminated sediment can take place. The re-route will

include a new river channel and plants and trees that stabilize the new channel and bank. The first segment of the site remediation, between Brown Deer and Bradley Roads, has been completed. The next segment will be conducted later in 2004.

Murphy Oil Refinery / Newton Creek

Murphy Oil Refinery, located in Superior, is responsible for the contamination of one river mile of Newton Creek, a tributary to Lake Superior. Investigations by WDNR showed that the 1.5 mile length of Newton Creek and about 17 acres of Hog Island Inlet connected to Superior Bay are contaminated by residual petroleum oils. Contamination of sediments by oil and grease and PAHs was discovered nearly 20 years ago. In 1996 Murphy Oil excavated sediments from the headwaters impoundment and a portion of Newton Creek. In 2003, WDNR excavated and disposed of 5,000 cubic yards of petroleum-contaminated sediments and floodplain soils from Newton Creek. Over the past seven years, the WDNR, Murphy Oil, and the City of Superior have cleaned up the two-acre impoundment at the headwaters of Newton Creek, and the majority of creek. Additional investigations are presently underway for dredging Hog Island inlet in 2005.

Figure 24. Newton Creek, Hog Island Inlet



Koppers Industries, Inc. / Crawford Creek

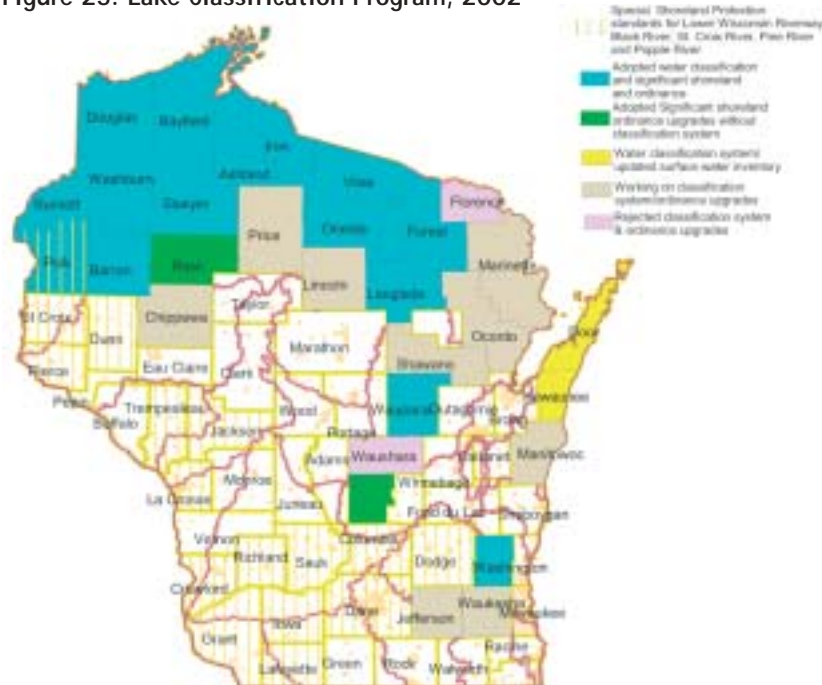
Koppers Industries, Inc. is a chemical manufacturing plant located on Crawford Creek in the City of Superior. Crawford Creek is tributary of the Nemadji River which flows into Superior Bay. The facility treated wood with pentachlorophenol and creosote and discharged waste into the creek, which resulted in contamination of the sediment and overflow areas along a drainage ditch from the facility. Koppers Industries has undertaken corrective measures related to the soil and groundwater contamination at the site. Koppers Industries (Beazer East, Inc.) has the goal of cleaning soils, groundwater, and a portion of the drainage ditch by 2005.

Chapter 4: Inland Lakes

Lake Planning and Management

All of Wisconsin's 15,057 inland lakes are considered significant public resources. The great variety of lake types makes management a challenge. Lakes range in depth from a few feet to 236 feet (Big Green, Green Lake County), from small ponds to 137,708 acres (Lake Winnebago, Winnebago County), and from clear soft water lakes to hard water lakes prone to intensive algal growth.

Figure 25. Lake Classification Program, 2002



Wisconsin's Lake Management Program combines monitoring and water quality assessment, research, and community financial, organizational, educational and technical assistance. The purpose is to plan, protect and restore the state's lakes and their ecosystems in partnership with other agencies and citizens. The Wisconsin Lakes Partnership is a team of WDNR, University of Wisconsin-Extension (UWEX) staff and citizens represented by the Wisconsin Association of Lakes, who bring technical expertise, outreach and stakeholder concerns together to focus on the state's lakes.

Strategic Planning

In 2002, the Wisconsin lakes strategy, *The Water Way*, was completed and distributed. *The Water Way*, provides a map for the Partnership's work in the first decade of the 21st century. This plan was the result of years of work by people concerned about the future of

Wisconsin lakes and includes visions, goals, strategies and performance measures. Different future scenarios are discussed and strategic work is outlined. All possible future avenues for lakes in Wisconsin are explored, including:

- "natural waters vision", which is possible under a protection strategy. This vision would include protecting water quality, habitat, aesthetics, and tranquility by maintaining low density development through the use of restrictive standards.
- "semi-developed waters vision", under a protection and restoration strategy. This vision involves protecting the remaining natural shoreline area and restoring the natural shoreline by establishing zoning standards for moderate density, single family and residential development; runoff controls, incentives; and motivational incentives.
- "developed waters vision", under a restoration strategy. This vision involves restoring the functional aspects of shoreline buffers to provide habitat, aesthetics and water quality. Protect from deteriorating growth of 2nd and 3rd tier development by establishing enforceable zoning ordinances.

While a variety of tools are used to encourage the types of protection and restoration work involved in all three scenarios, one of the most effective tools is the state's Lake Classification Program, which through the Lake Planning Grant Program, provides funding to local municipalities to develop protected areas around lakes through a local shoreland ordinance that may be more stringent than the state's required shoreland ordinances. The passage of these county local ordinances are based on outreach and discussion of the communities' desired future vision for

their lakes. Today, the majority of counties in the state have some type of local level water inventory, classification system, and about 20 percent have a local ordinance in place that is more protective of their lakes than the statewide model zoning ordinance. The DNR and local communities are working together to analyze how changes to NR115 may affect regulations already in place.

Lake Organization and Education Assistance

A community of lake enthusiasts help manage the state's rich array of lake resources. While the WDNR has state authority to manage and regulate lakes, provide public assistance and conduct research, the UW-Extension (UWEX) - Stevens Point provides lake organization and education assistance statewide. Staff at UWEX develop, publish and distribute printed and electronic media, providing useful information to citizen members of Wisconsin's hundreds of lake management organizations on a wide array of issues ranging from water law to limnology.

<http://www.wisconsinlakes.org/>

UWEX also publishes a quarterly newsletter, *Lake Tides*, which is distributed to 23,000 homes, businesses and nonprofits. *Lake Tides* and many other publications are also now offered on-line through the Wisconsin Lakes Partnership website.

In 2001, UWEX published a comprehensive guide *Wisconsin Water Law: A Guide to Water Rights and Regulations*. UWEX is also the location of the Partnership's youth education efforts, staffing and coordinating Project WET and Adopt-A-Lake programs.

To better prepare the next generation of citizens for positions in lake advocacy, the Wisconsin Lake Leaders Institute was established through UWEX. UWEX staff also attend and speak at numerous lake organization meetings, fairs and related events. Approximately 1200 people are reached annually through conferences and community meetings conducted by UWEX staff.

Aquatic Plant Management

Nuisance aquatic plants can limit aesthetic and recreational enjoyment of lakes and replace beneficial native plants that provide food and cover for fish and other wildlife. Historically permits have been issued for chemical treatment only to alleviate severe problems in specific areas. Manual and mechanical harvesting has gone largely unregulated. Much of Wisconsin's aquatic plant management, and especially preventing and managing the spread of invasives, particularly Eurasian water milfoil, have relied primarily on educational efforts.

In 2001, the Wisconsin legislature passed Act 16 which provided a comprehensive approach to lake aquatic plant management. The law requires watercraft inspections, information and education, research initiatives, and purple loosestrife management and directs the DNR to implement a statewide program. Authority in the law:

- Prohibits launching of watercraft with aquatic plants & zebra mussels;
- Regulates all the methods of aquatic plants management;
- Requires posting of public boat access sites;
- Designates Eurasian Water Milfoil (EWM), curly leaf pond weed and purple loosestrife as invasive plants. Additional plants can be added by rule.

A permit is now required for all methods of control including manual and mechanical removal as well as the introduction of nonnative aquatic plants. Plan approval for enacting most control methods is required by rule.

One key component of the aquatic plant management program is the identification of sensitive areas for protection that provide critical or unique fish and wildlife habitat, scenic beauty and other factors. The WDNR encourages a sensitive area survey as part of lake planning activities and recently compiled standardized methods for conducting these activities statewide.

The expansion of authority under the new rule did not, however, provide additional resources such as funding or staff to implement the program. DNR is working through the issues associated with greater level of work and a lower level of staff and funding to implement this and related programs.

Clean Lakes Program

In 1998, U.S. EPA amended its guidance for administering Nonpoint Source Pollution Abatement Program (section 319) to make all section 314 Clean Lake Program Activities eligible under s. 319. This allows Wisconsin to once again fund Clean Lake Program activities that were suspended when funding for s. 314 was eliminated in 1995. Wisconsin has completed all program funded activities previously funded under the s. 314 Clean Lakes Program. WDNR amended its work plan under section 319 to make Clean Lake Program activities eligible and re-established the state's Lake Water Quality Assessment Program, including lake monitoring and reporting. Currently, section 319 funding is used to support Lake Program activities including:

Self-help Citizen Monitoring – All aspects of this program including administration, data management, reporting and equipment purchase.

Lake Partnership Activities – Providing technical and informational assistance to lake organizations and management units, processing and administering the lake grant program, managing lake data and support for statewide meetings, conferences and training sessions.

Lake Planning and Evaluation – Support to select regional projects including exotic species prevention and monitoring, developing aquatic plant and sensitive area surveys, and collecting and summarizing water quality data and management actions on specific lakes.

Lake Protection and Restoration – Select projects that will protect or improve lake water quality and lake ecosystems. In 2002, s. 319 funding was used to assist in the restoration of Devil's Lake, Sauk County. Installation and operation of a bottom water withdrawal system to "mine" accumulated phosphorus from lake sediments over a period of approximately 15 years will reduce lake nutrient concentrations, alleviating fall algae blooms, incidences of swimmer's itch, and the bioavailability of mercury.

Lake Planning and Protection

WDNR's Lake Planning and Protection Grants have a major and diverse impact on the management of the state's lakes. These grants, which are 75% state cost-shared, are at the core of the partnership between state and local entities that are striving to protect and restore lakes and their ecosystems. Currently, \$2.6 million is allocated annually to support a balance of locally-initiated projects ranging from data collection and development of lake management plans to land acquisition, local ordinance development, and management plan implementation.

Lakes Assessment

The 2002 water quality assessment of lakes listed over 792,301 lake acres as impaired for one or more designated uses due to the presence of a general fish consumption advisory for mercury for all Wisconsin surface waters. Specifically, 767,533 lake acres were assessed for aquatic life uses and 361,598 acres were found to be fully meeting this designated use, while 270,055 lake acres are not meeting this use.

Data Sources

Assessment of lakes for the 305(b) report is an integral component of Wisconsin's overall Watershed Program. Data used in assessments are derived from multiple sources, including the self-help monitoring program, baseline monitoring, long-term trend monitoring, and special studies.

Trophic Status of Wisconsin Lakes

Summarizing the trophic status for all lakes for which data were available is another way to characterize the condition of Wisconsin's lakes. Data collected on lakes by WDNR staff, the Self-Help Citizen Monitoring Program and through projects funded by lake grants from 1997 through 2001 was compiled by WDNR staff. A trophic state index (TSI) was estimated for 990 lakes based on secchi disk (clarity). This data represents 45 percent of Wisconsin's total inland lake surface acreage. It is a biased sample in that it represents only the lakes that have been actively sampled.

Approximately half of the waters listed in the table below exhibit what is consider to be excellent to good water quality (oligotrophic and mesotrophic conditions).

Table 6. Trophic State of Lakes (1997 -2001)

Trophic Condition	No.Lakes	Lake Acres
Oligotrophic	512	164,164
Mesotrophic	139	47,968
Eutrophic	299	190,971
Hyper-eutrophic	40	55,442
Total Assessed	990	458,546

Table 7. Trends in Significant Public Lakes

	No.Lakes	Lake Acres
Assessed for Trends	708	453,459
Improving	78	36,613
Stable	258	293,324
Degrading	51	15,112
Trend Unknown	321	10,8410

Self-help Citizen Lake Monitoring

Wisconsin's Lake Partnership nurtures public involvement. High quality monitoring data supports sound management. WDNR relies on the public to gather data. There were over 1,200 citizen volunteers participating in the program at the end of 2003. Interest in volunteer lake monitoring continues to grow, with over 115 new volunteers starting in 2002, and 134 new volunteers in 2003. Many more volunteers are becoming involved in monitoring aquatic invasive species.

Figure 26: Self-Help Database



Table 8. Volunteer Monitors in Wisconsin, 2003

Parameter	# Volunteers (2003)
Secchi Disc Depth	1,210
Chlorophyll a and Total Phosphorus	394
Temperature and Dissolved Oxygen	221
Eurasian Watermilfoil	235
Purple Loosestrife	102
Aquatic Plants	72
Zebra Mussels	43
Curly Leaf Pondweed	6

The Volunteer Lake Monitoring program started in 1986, and by the mid-1990s the number of volunteers and interest exceeded WDNR's financial and data management capabilities. In 1999, this challenge was addressed through the expansion of the State Lake Planning Grant and significant improvements to the Self-Help Data Management System. Offering a small-scale, trend monitoring grants package in 5-year renewable increments, grant funding has facilitated growth in the chemistry-monitoring program. Approximately 30 additional lakes have been brought into the program each year under these grants.

The Self-Help Database is ever-improving, with better tracking of equipment, volunteer information, and more efficient data management. The database is searchable and contains over 17 years of data on many lakes. The website also features a data entry form, which allows volunteers to submit data through the Internet as an alternative to the existing touch-tone phone system or mail-in post cards. Changes in data management have enabled Annual Reports and awards to be completed on time. In 2003, over 900 annual reports were mailed to volunteers, along with hundreds to lake organizations. Also, over 267 awards were distributed in 2003 to volunteers who had completed 1, 5, 10 or 15 years of monitoring, or had taken 100 or 500 secchi readings. During the 2003 season, Self-Help awarded 7 fifteen-year awards.

Also significant is Self-Help volunteers' participation in a collaborative effort with UW Wisconsin Environmental Remote Sensing Center. Since 1999, volunteers have monitored their lakes on specific dates when satellites were overhead. Self-Help staff send the data to the UW Remote Sensing Center regularly to be used to calibrate computer programs that allow satellite imagery to be used to predict secchi disc depth and other water quality parameters on lakes.

Satellite Imagery to Characterize Lake Water Quality

In 1999, WDNR formed a partnership with the UW Environmental Remote Sensing Center (ERSC). A primary goal of this collaboration is to investigate the use of satellite imagery in characterizing lake water quality. The UW ERSC personnel provide the expertise in accessing satellite images and processing spectral characteristics of satellite images, while the WDNR, through its various water quality monitoring programs, provides the actual ground-truthed measurements of various parameters contributing to lake water quality.

Since 1999, hundreds of Self-Help lake monitoring volunteers have coordinated their sampling efforts with the dates of Landsat (satellite) overpass. This effort successfully resulted in the development of a relationship between field measured lake water clarity and that predicted by analysis of the satellite images. Water clarity data for over 6,900 lakes was obtained from satellite imagery between 1999-2001. The next step, which will be pursued in 2004, will involve operationalizing the Landsat-based statewide monitoring system; this includes facilitation of the actual adoption and day-to-day use of the methods developed and demonstrated during this project by WDNR lake managers.

Long-Term Trend Lakes Analysis (LTT)

The WDNR began a Long Term Trends Program in 1986, collecting nutrient, chemical, watershed and plant data on 50 lakes statewide to provide information for assessing, comparing and anticipating changes in lake quality. This program continues today, with some modifications to the protocols used.

The WDNR Lakes Program classifies LTT lakes into six hydrologic and depth classes within each ecoregion in Wisconsin and compares them with a larger set of lakes to evaluate the proportionality of the numbers in the different classes.

Overall, trends lakes should be representative of their class in their region. Consistency within classes will be evaluated by comparing a number of variables such as secchi depth, chlorophyll and total phosphorus levels. Following these analyses, changes may be made to the composition of the LTT lakes.

Figure 27. WDNR Long-Term Trend Lake Sites



Chapter 5: Great Lakes

Wisconsin's 1,017 miles of Great Lakes shoreline provide a vast reservoir of fresh water and much of the special character of the state. Rugged Great Lakes bluffs provide exceptional recreational opportunities; commercial fishing and shipping; and a host of additional aesthetic, ecological, biological and economic values. About a third of our state's 11 million acres of land and about 10,122 river miles drain to Lakes Superior and Michigan. Along this shoreline, however, resides the highest density urban development and most of the state's industry.

Wisconsin has long recognized the value of its unique resources and has established criteria to help protect waters draining to the Great Lakes. In partnership with other state, national and international efforts Wisconsin has committed significant resources to help protect and restore the water quality of all the Great Lakes. In 2004, Governor Doyle made a commitment to the Great

Lakes by establishing the Office of the Great Lakes within the WDNR. This office will provide targeted resources to support the complex resource work needed to protect, restore and maintain the quality and quantity of water, habitat and aquatic life that is integral to our state's prosperity and culture.

Lake Michigan

Lake Michigan, the second largest of the Great Lakes, covers 22,300 square miles and has a retention time of 99 years. It is the only Great Lake entirely within the borders of the United States. Lake Michigan is an important national resource supplying drinking water for 10 million people, providing important sport and recreational fishing opportunities and valuable recreational uses. It has also experienced profound changes in its aquatic ecosystem

over the last 140 years and is threatened by toxic pollutants that bioaccumulate in the food chain and persist in the environment. The Lake Michigan ecosystem is stressed through the loss of habitat, declines in biological diversity, the presence and spread of multiple aquatic and terrestrial invasive species, and the presence of persistent bioaccumulating toxic substances, as well as excess sediment and nutrients.

Lake Superior

Lake Superior provides a vast resource of freshwater covering 31,700 square miles. It is the largest freshwater lake in the world by surface area – its size could hold the water present in all the other Great Lakes along with three additional Lake Eries. Historically, Lake Superior has not experienced the same level of development, urbanization and pollution as the other Great Lakes. And, while this is cleanest and healthiest of the Great Lakes, toxic bioaccumulating substances are present in its food chain, as they are ubiquitous in the environment. These substances can be transported long distances in the atmosphere and end up in the lake. Because of its long retention time (191 years), pollutants entering Lake Superior can remain in the lake for over a century before draining to the lower Great Lakes.

Great Lakes Charter — Annex 2001

The Great Lakes Charter Annex was signed June 18, 2001. The original Great Lakes Charter (1985) set guiding principles for the U.S. governors and Canadian premiers to maintain and strengthen the Great Lakes ecosystem. The Annex contains six directives to guide the governors and premiers toward their goal of an improved Great Lakes region. The Annex calls for developing a new set of binding agreements, focusing on quantity issues; developing a broad-based public participation program; establishing a new decision making standard; a project review under the Water Resources Development Act of 1986 (amended 2000); developing a decision support system that ensures the best available information; and further commitments to implementing and monitoring the Charter and Annex.



The Council of Great Lakes Governors is coordinating the implementation of Annex 2001. A Water Management Working Group has been created to complete this task. Each state and province had representatives appointed to this group by their respective governors and premiers.

Additionally, an advisory committee which was formed to provide an opportunity for public input, will be comprised primarily of regional organizations from industry, environment, utilities, etc.

Wisconsin supports the development of a standard that focuses on real threats to the Great Lakes, while not making it impossible to access lake water in necessary situations. A uniform policy needs to be agreed upon which will put to an end to debates between parties due to the process being unclear or key terms lacking clarity. The goal of the current agreement is to initiate a broad public dialogue during the 2004 summer months. Public input will help the regional leaders determine which course of Great Lakes water quantity management to pursue.

Assessment Summary

Resources were not available to provide updated assessment data for the 2002-04 reporting period. Updated figures will be available in the 2006 report.

During the next few years, several key activities will be needed to meet this reporting goal: resource allocation to review and develop or update where necessary assessment protocols for Great Lakes shoreline. Assessment protocols that need to be updated or developed for Great Lakes shoreline miles include: fish and aquatic life use, recreation, public water supply, and fish consumption. Once these protocols are developed, they can be applied to the resource and documented in the WADRS system.

Great Lakes Ecosystem Restoration

Key Issues

Wisconsin's involvement in addressing key Great Lakes issues demonstrates our commitment to the restoration of these valuable resources. Great Lakes activities can be categorized as:

- **River Restoration/Dam Removal**—Restoring free-flowing streams and providing additional habitat for anadromous fishes. Coupled with dam removal, projects often involve assessment and remediation of contaminated sediments accumulated above the dams.
- **Habitat Restoration**—Improving habitat in tributary streams for spawning and nursery areas and enhancing habitat with a large-scale or landscape level approach.
- **Pollutant Reduction and Prevention**—Reduction of critical pollutants to levels identified in TMDL analyses for the lakes. Sediment remediation, reduction of atmospheric loadings and nonpoint source controls are needed to eliminate fish consumption advisories. Problematic Great Lakes beach issues such as the presence of *Cladophora*, a filamentous algae, and pathogens are the focus of new studies and management actions.
- **Exotic Species**—Prevent and where possible control populations of exotic species from becoming more established in the Great Lakes. These issues are regional to international in scope and must be dealt with at a national level to ensure that consistent across the board measures are employed for the management of exotic species.

Identification of these key areas has allowed local projects to move forward. However, some particularly difficult issues, such as regional atmospheric deposition of mercury, require coordination of regional solutions from U.S. EPA and other national partners.

Great Lakes Projects

Many Great Lakes projects are implemented through the Great Lakes Protection Fund, the Coastal Zone Management Program, the Lake Superior Binational Program and Lakewide Management Plan (LaMP), and the Lake Michigan LaMP. The completion of the LaMPs for both Lakes

Superior and Michigan has accelerated the development of implementation strategies. Interagency cooperation and commitment of the LaMP workgroups have resulted in moving forward with many projects designed to restore or protect the beneficial uses of the Great Lakes ecosystem as outlined in the plans. Likewise, work to alleviate problems identified in Remedial Action Plans is also underway for the state's five areas of concern at Duluth/Superior; Marinette, WI/ Menominee, MI; Green Bay; Sheboygan; and Milwaukee. On a two-year basis, either through the State of the Great Lakes Ecosystem Conference (SOLEC) process or the International Joint Commission (IJC) biennial meeting, the governments should provide updates on Great Lakes Project implementation through LaMP or RAP reporting.

Cladophora blooms on Lake Michigan Coast

Cladophora, a filamentous green algae, has increased its presence on Wisconsin Lake Michigan beaches, as well as Lake Ontario and Lake Erie beaches in other states. *Cladophora* grow attached to hard substrate on the nearshore lake bottom, but break off during storm events or summer "die off," washing onto beaches and where they decay. In some beach locations, windrows of decaying algae produce noxious odors and are potential incubators for harmful bacteria.

Cladophora is a native species that was previously seen at nuisance levels in the 1960's in the Great Lakes due to high phosphorus inputs. Phosphorus loads to Great Lakes tributaries declined in the 1970's due to tighter controls on point sources and a ban on phosphorus in laundry detergents and other restrictions.

Causes of the increased presence of *Cladophora* are not well understood; however increased water clarity, nutrient availability, and water temperature, combined with lower lake levels are key factors.

The presence of zebra mussels in Lake Michigan has dramatically increased water clarity, providing deeper light penetration and expanding the suitable range for *Cladophora*. In addition, zebra mussels concentrate available phosphorus in the nearshore through the deposition of feces, which may be fertilizing *Cladophora* beds.

Research by UW-Milwaukee indicates phosphorus loads to the Milwaukee River, for example, have increased in recent years. Other Lake Michigan tributaries are likely experiencing similar trends. Monitoring major tributaries by WDNR and the UW-Milwaukee will investigate possible changes in phosphorus loads.

Lower lake levels may also contribute to the problem by increasing areas suitable for *Cladophora* growth. Surveys of the Lake Michigan coastline are also scheduled to better understand the distribution of *Cladophora* along the coast.

Funding Sources

Projects designed to improve and enhance the resources of the Great Lakes and the goals and objectives of the RAPs, LaMPs and Binational Program are supported by federal grants from U.S. Environmental Protection Agency, the Army Corps of Engineers, the Coastal Management Program and the Wisconsin share of the Great Lakes Protection Fund. These funds are provided to individuals, universities, local and state government and groups to implement the projects that further the goals of preserving and enhancing the Great Lakes. A new source of funding will become available to states in the coming years, the Great Lakes Legacy Fund, which will provide resources for contaminated sediment and other types of remediation work in the Great Lakes.

Project Descriptions

River Restoration/Removal of Dams

Several dam removal projects on the Milwaukee and Sheboygan Rivers, tributaries to Lake Michigan, have experienced substantial progress in the past two years. These projects have included habitat improvement goals to reestablish fish and wildlife. Additional dam removal projects are in the planning or implementation stages within the basin (see the 2002 Water Quality Report to Congress). In the Lake Superior Basin, removal of the Orienta dam on the Iron River has been completed.

Habitat Restoration

In the Lake Michigan Basin, projects are underway for aquatic life and habitat enhancement in Green Bay through the Cat Island Chain Restoration Project and the Green Bay Marina Project.

Several projects are also on-going in the Lake Superior Basin. The Northern Pike habitat restoration project involves installing buffer strips on low order streams. Eighty-three (83) acres of buffers, or 12 miles of stream buffer, have been installed along parts of Trout Creek, Fish Creek, and the upper reaches of the Suamico and Little Suamico River watershed. This joint effort involves Outagamie and Brown Counties and the Oneida Nation Reservation.

The Manitowoc Soil and Water Conservation Department (federal agency) and the Kewaunee County Land Conservation Department (local) are reducing sediment and phosphorus loading to the West Twin River and East Twin River watersheds through buffers and wetland restoration.

Special efforts are underway to restore Lake Sturgeon and Lake Superior brook trout populations. Buffer strips were installed for water quality and habitat improvement along waterways. In Brown County along Baird Creek approximately 27 acres, encompassing 3.5 miles of stream buffers, were installed between 2002-2003. These efforts will reduce nutrient loading to the stream by 69 pounds of phosphorus, 38 pounds of nitrogen and 71 tons of sediment per year.

Efforts are underway to restore lost wetlands in several basins adjacent to the Great Lakes. Approximately 25 acres of wetlands were restored and spawning habitat was improved in a project in the City of Mequon along Trinity Creek, a tributary to the Milwaukee River. The wetland restoration will provide spawning area for northern pike as they move upstream on the river. The restored area also helps abate flooding along the creek and provides a natural recreational area.

In the Lake Superior basin the WDNR is working with several other agencies and the public to pursue a watershed-based strategy to reduce peak flows that contribute to streambank erosion and habitat degradation in tributaries. Among the pilot projects underway, WDNR, U.S. Geological Survey (USGS) and UW-Madison Engineering School are using submerged vanes to stabilize erosion on steep sandy slopes on North Fish Creek, a tributary to Chequamegon Bay. Increased runoff from agriculture and logging practices on areas with clay soils has increased flood magnitudes and the erosion transport of the streams. The creek's sediment load largely originates from erosion on 17 large bluffs. North Fish Creek contains important recreational fisheries limited by the loss of aquatic habitat from deposition of sediment on spawning beds. Currently submerged vanes are installed in the streambed at two sites on Fish Creek in Ashland. These vanes are designed to divert the water's energy forces away from the eroding bluff thus reducing sedimentation to the stream. Controlling erosion will improve the streambed, enhancing spawning of migratory fish from Lake Superior. In 2004, a third site will be installed. Available data show the stream is moving away from the eroding bluff, which in turn is decreasing sediment load to the stream.

WDNR is pursuing the use of the Conservation Research Program's continuous buffer sign-ups for tributary streambanks to help restore and protect important spawning areas for Great Lakes fish. The use of buffer strips along waterways helps improve water quality by trapping sediments and nutrients, as well as providing habitat for aquatic and terrestrial species. WDNR is working with counties, NRCS and other groups to combine resources and information to work with farmers and landowners to have more buffer strips installed, especially in critical Great Lakes watersheds.

Pollutant Reduction and Prevention

Sediment Remediation

Historic discharges have left a legacy of contaminants that have restricted human consumption of Great Lakes fish. Sediment remediation involves big projects with expensive solutions but as new ideas and approaches are being advanced and through collective public-private efforts, progress is being made. Projects include Hayton Millpond, Newton Creek and Hog Island Inlet, and the Fox River (see Contaminated Sediment Projects, Chapter 3).

Mercury and Other Persistent Chemical Reduction

Reduction of mercury and other persistent chemicals from the environment through proper disposal and education is a high priority in improving the water quality of lakes and streams. These efforts have included Agricultural Clean Sweeps in cooperation with the Department of Agriculture, Trade and Consumer Protection (DATCP) to removed hundreds of pounds of agricultural chemicals from the environment in the Great Lakes Counties by offering farmers a no cost option for proper disposal of their unused farm chemicals. Additional grants were offered to counties in the Great Lakes basins through the Great Lakes Protection Fund.

In 2002, over 279,714 pounds of chemicals were collected in 36 counties participating in clean sweeps (21 counties were in the Great Lakes Basin). In 2003, a total of 36 counties participated in the agricultural clean sweep, 16 of these counties are in the great lakes basins and collected 282,746 pounds of chemicals. Similar programs for household hazardous waste are also offered around the state. In particular, a grant offered a mobile household and agricultural waste clean sweep program in the Lake Superior basin. This program covers a four county area and provided a

mobile service that traveled to various communities to pick up chemical waste. On-going efforts by local governments, school districts and counties have increased the awareness of the impact of various household products, chemicals, and open burning have on the environment.

Mercury Reduction, Focus: Lake Superior

WDNR, UW – Water Resources Institute, and Lake Superior State University (Sault Ste. Marie, MI) continue to work on a comprehensive mercury study of Lake Superior. With financial support from USEPA and the Wisconsin Sea Grant Institute, the study is revealing the biogeochemical cycle of mercury in the open waters of Lake Superior and its tributaries. Water, plankton, and sediments were sampled for total and methyl mercury at sites throughout the lake. Total mercury concentrations were consistently below 1 ng/L throughout the lake. The methyl mercury concentrations were around 5 pg/L at both the surface and deep waters. Tentative results suggest that the sediments of Lake Superior are not a source of biogenic methyl mercury production. Surprisingly, however, methyl mercury has been measured in wet deposition around the lake. Future efforts will be made to evaluate the dynamics of methyl mercury inputs from tributaries to the lake and interactions at the mixing zones with the near-shore waters.

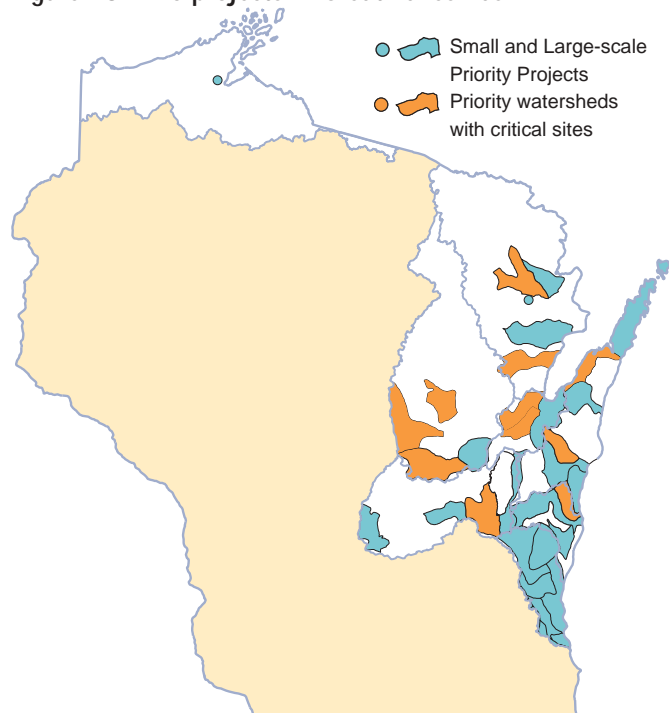
Exotic Species

Projects funded through the Great Lakes Program to control exotic species from spreading to uninfested waterbodies have included educational outreach projects to inform the public how their actions impact the spread of exotic species. These projects, aimed at changing boaters' behavior to clean their boats before leaving the launching sites, include Public Service Announcements (PSA) broadcast during sporting events, a special publication in the Natural Resources Magazine on the impacts of exotics on our fisheries, tourism and local economy, and a video to be used by sporting groups, lake associations and others at meetings and special events. Specific control structures were also funded, like the construction of lamprey barriers on the Brule River in the Lake Superior Basin.

Coastal Zone Program

Wisconsin is required to implement a nonpoint source management program under Section 6217 of the 1990 Coastal Zone Act Reauthorization Amendments. The program requires enforceable policies to regulate compliance with USEPA for six categories of nonpoint source activities including agriculture, urban, forestry, wetlands, hydromodifications and marinas. Specific management measures involve programs administered by WDNR; DATCP, the Department of Commerce; and the Department of Transportation. The management area includes all the Great Lakes drainage area in Wisconsin except the Wolf and Upper Fox Basins upstream of the outlet of Lake Winnebago. Wisconsin has many activities in this area, including 22 priority watershed projects. Nearly all of the urban areas will come under U.S. EPA's recently promulgated Storm Water Phase 2 regulations. Forestry activities are managed through use of best management practices contained in the WDNR published manual. Wetland protection and regulation of hydromodifications are statewide programs.

Figure 28. PWS projects in Great Lakes Basin



Lake Michigan Lakewide Area Management Plan (LaMP)

The Lake Michigan Lakewide Management Plan (LaMP), updated in 2004, outlines a vision, goals and ecosystem objectives for Lake Michigan. The following are broad goals identified in the report:

- All persons can eat any fish.
- All persons can all drink the water.
- All persons can swim in the water.
- All habitats are healthy, naturally diverse and sufficient to sustain viable biological communities.
- Public access to open space, shoreline and natural areas is abundant and provides enhanced opportunities for human interaction with the Lake Michigan ecosystem.
- Land use, recreation and economic activities are sustainable and support a healthy ecosystem.

For each of these goals, LaMP 2000 includes indicators and monitoring recommendations for lake ecosystem health, status, and stressor sources and loads, and recommends actions or “next steps” for remediation, restoration or other necessary work.

Lake Michigan LaMP Update

Wisconsin has worked with USEPA, other states, and other interested parties to revise the LaMP. Updates include a standardized procedure for reviewing the list of ‘critical pollutants’ included in LaMP 2000. Tools have also been developed to better identify habitat data and land use management resources. Tools include information regarding funding sources for best management practices, brownfields redevelopment, prevention and control of air pollution, water restoration work, and aquatic habitat conservation and restoration.

In addition, the LAMP updates identify specific actions that both support the goals of the LaMP and that are consistent with the Great Lakes Strategy, an overall framework with goals and objectives for management of the Great Lakes. For example, a proposed action in the current draft indicates that a TMDL Strategy will be developed for Lake Michigan, which is consistent with the USEPA’s Great Lakes Strategy.

Issues of major concern include the level of contamination in fish and the ultimate goal of removal of consumption advisories. Because advisories for mercury, for example, are in place largely due to atmospheric deposition, meeting this goal would require a national and international effort. Also, more knowledge, funding and additional resources are needed to fully address contaminated sediments, program coordination, ecological habitat and pathogen monitoring.

Lake Superior LaMP and Bi-National Program

WDNR is one of several partner agencies in the Binational Program to Protect and Restore the Lake Superior Basin (“Binational Program.”) This program was formed in 1991 by agreement signed by the governors of Wisconsin, Minnesota, Michigan, and by representatives of the USEPA, Environment Canada and the Province of Ontario. Its key features include a zero discharge demonstration program for Lake Superior and a broad program of coordinated ecosystem management. The Binational Program is often held up as a model of inter-jurisdictional resource management.

The Lake Superior Lakewide Management Plan (LaMP) reports progress on the Lake Superior Binational Program as well as the Great Lakes Water Quality Agreement. Stages 1 and 2 of the Lakewide Management Plan for Lake Superior came out in 1995 and 1999 respectively. These stages focused primarily on chemical pollutants. In 2000, a more comprehensive LaMP was developed, which includes strategies for pollutant reductions as well as strategies addressing issues of habitat, aquatic and terrestrial communities, human health, and sustainability. Progress reports and plan updates are produced every two years. LaMP 2002 and LaMP 2004 are available on the EPA Great Lakes National Program Office website.

The Wisconsin DNR is working with Lake Superior basin communities and citizen groups on watershed and habitat protection efforts and community-based pollution prevention. Another major implementation push in Wisconsin is to pursue resources for contaminated sediment remediation. The St. Louis River and estuary is the largest U.S. tributary to Lake Superior, and the

only Area of Concern in Wisconsin waters of Lake Superior. Many of the implementation projects underway in Wisconsin serve to meet the goals of the St. Louis River Remedial Action Plan as well as the Lakewide Management Plan for Lake Superior.

Zero Discharge Demonstration Program

The Lake Superior Zero Discharge Demonstration Program is unique in the Great Lakes. The goal is to eliminate sources of the “nasty nine” critical pollutants in the Lake Superior basin by the year 2020. The key to zero discharge and zero emission is pollution prevention. This is an experimental program to see if we can find ways to prevent these chemicals from being used in processes or products to prevent their release in the Lake Superior Basin. The nine targeted pollutants are mercury, PCBs, dioxin, hexachlorobenzene, octochlorostyrene, aldrin/dieldrin, chlordane, DDT/DDE, and toxaphene. These pollutants are toxic, bioaccumulative, and persist in the environment.

Why zero discharge for Lake Superior?

Lake Superior is vulnerable to toxic substances. Water stays in the Lake for over 150 years, on average. Although it is the cleanest of the Great Lakes, toxic pollutants accumulate in Lake Superior’s fish and wildlife. People feel strongly about protecting the Lake Superior basin, one of the world’s great places. The idea of a Lake Superior “zero discharge” demonstration came from public support in the 1980s. The 1991 Binational Program agreement stresses voluntary pollution prevention, but acknowledges that enhanced controls and regulations may be necessary.

Community Pollution Prevention

Many communities around the basin are working on ways to prevent pollutants, particularly mercury, from getting into the Lake Superior environment. Consumer and commercial products can be a significant source of mercury. Mercury-containing products can include thermometers, switches, dental amalgams, thermostats, button batteries, and fluorescent lamps. Industrial raw materials can also contain unwanted mercury. The City of Superior, Wisconsin has become a regional leader in community mercury reduction, working with Ashland, the Red Cliff Band of Lake Superior Chippewa, and with other Lake Superior communities in the U.S. and Canada. Key recent pollution prevention projects include the following

Superior set up a fluorescent bulb recycling program where local hardware stores provide collection facilities and local industries (Murphy Oil USA and Superior Water Light and Power) provide funds for bulb recycling.

The Cities of Superior and Ashland set up a program with auto dealers to replace mercury switches in vehicles before they leave the lots. The auto dealers display posters and flyers advertising their participation.

Superior and one of its major industries, the Murphy Oil refinery, are developing a plan to eliminate the use of mercury and PCB containing equipment at the refinery. The project includes development of a purchasing policy and project outreach that can be used by other industrial facilities. The Northwest Wisconsin Mercury Free Schools program has reached 85 schools. City of Superior staff presents programs to all age school groups. Schools pledge to remove mercury products and elemental mercury. The program includes technical assistance and facility audits. Northwest Wisconsin Regional Planning Commission collects the mercury devices and other hazardous waste. Thousands of mercury items and hundreds of pounds of mercury have been collected through this program.

City of Superior offered Dental Office Best Management Practices workshops to all Douglas County dentists. City of Superior and City of Ashland pollution prevention project staff have now visited most of the dental offices in the basin in Wisconsin to present training in best management practices.

Wisconsin agencies and individuals developed and produced poster displays on Lake Superior issues including mercury and burn barrels. The posters were used at county fair displays during the summer of 2002 and are placed in several locations including the Northern Great Lakes Visitor Center.

The Red Cliff Band of Lake Superior Chippewa Reservation has hired a mercury elimination coordinator to work with the community on mercury reduction and burn barrel projects. A June 2003 community workshop kicked off the project, which includes a radio show that combines music and environmental messages on the Red Cliff radio station.

The Town of Delta in Bayfield County, Wisconsin investigated mercury levels in soil at their abandoned town dump and hired a contractor to develop an erosion control plan at the site, which sits on a tributary to Lake Superior.

In 2002 Ashland, Wisconsin passed an ordinance banning the sale of products containing over 50 mg of mercury (with the exception of dental amalgam). The ban does not apply to fluorescent lights since they contain less than 50 mg mercury. Ashland's ordinance also requires mercury containing devices to be removed from buildings. Superior, WI banned fluorescent lights from landfills in 2002. The city of Ashland and Douglas County had banned the sale of mercury thermometers in 2001.

Hazardous Waste Collections: household, agricultural, small business

In Wisconsin's Lake Superior counties, collections for hazardous waste from households, small businesses, and agricultural operations is conducted through a mobile collection program operated by Northwest Wisconsin Regional Planning Commission. In 2002, the program expanded to provide "milk run" collections for small businesses to make proper disposal of hazardous waste more affordable in this rural area. The community based pollution prevention projects in the basin, including the Northwest Wisconsin Mercury Free Schools, utilize this collection program. The collection program has been funded through federal, state, and county government.

Table 9. Pesticides Collected in WI Lake Superior Counties by Northwest Cleansweep Program

Dates of Collection	Chlordane	DDT	Silvex/ 2-4D/ 2,4,5T	Total Pesticides ¹
Kg. collected (99-03)	39	36	89	8,682

Data from the Northwest Wisconsin Regional Planning Commission compiled by the Wisconsin Department of Natural Resources for Ashland, Bayfield, Douglas and Iron Counties.

Dioxin – A Burning Issue:

Burn barrels or backyard garbage burning is a continuing source of dioxin emissions in the rural Lake Superior basin. This practice produces dioxin that enters the environment and human food sources, posing health risks. Wisconsin Environmental Health Association and Wisconsin Department of Natural Resources produced the *Air Defenders: The Quest for Clean Air*, an educational program about open burning, air quality and asthma for children 10 years and older. The kit includes a CD of an interactive education game, posters, brochures, a WDNR video called *Give Burn Barrels the Boot* and a CD with music lyrics for songs such as *The Burn Barrel Blues*. This material is being used widely throughout the Lake Superior basin. Northwest Wisconsin Regional Planning Commission is developing a burn barrel education video for local officials.

Industry and Economic Changes

Elsewhere in the Lake Superior basin, facility closures in the mining sector resulted in reduced mercury emissions in the basin, but at a large economic cost to the region. Wisconsin has seen the closure of forest product industry facilities in the Lake Superior basin in recent years. Wisconsin's Lake Superior basin is facing growing development pressures as it becomes increasingly an area of second homes and recreational property. Sustainability is an important issue for the economic and environmental health of the Lake Superior region.

Continuing Challenges

Long-range transport of pollutants in the atmosphere

The zero discharge demonstration program focuses on air emissions, water discharges, and the use or formation of the nine critical chemicals within the Lake Superior drainage basin. However, sources outside of the basin greatly affect Lake Superior. Lake Superior with its large surface area

receives a relatively high deposition of airborne toxics. Actions on a national and international level have an extremely important role in protecting Lake Superior. Actions on a state-wide basis are also important for protecting Lake Superior.

Contaminated Sediment and Stormwater: Sources of Other Critical Pollutants:

In addition to the nine pollutants included in the Lake Superior Zero Discharge Demonstration Program, the LaMP process identified other critical pollutants for Lake Superior which impair beneficial uses. Although these critical pollutants are not slated for zero discharge, the goal is pollutant reduction so that beneficial uses are restored. Polynuclear Aromatic Hydrocarbons (PAHs) in particular cause multiple impacts in the Lake Superior basin. The presence of these pollutants in contaminated sediment and stormwater runoff is important to the Lake Superior ecosystem because they impact its most biologically productive region.

Lake Superior has a narrow rim. Less than 5 percent of its area is comprised of shallow nearshore area and embayments, which is a lake's most biologically productive area. Most species of Lake Superior fish use the nearshore waters for some critical life stages. Unfortunately, these nearshore and embayments are also the areas most affected by contaminated sediment and stormwater runoff carrying contaminants from industrial and developed areas. Considerable funding is needed to clean up contaminated sites and restore this important aquatic habitat.

In the St. Louis River Area of Concern, WDNR is working with partners to pursue resources for clean up at the Newton Creek / Hog Island inlet site in Superior. In 2003, most of Newton Creek's contaminated sediment and floodplain soils were removed. The ultimate goal is to restore this area of valuable shallow water habitat of Superior Bay (see Chapter 3: Contaminated Sediment).

WDNR, U.S. EPA, and responsible parties continue to investigate the Ashland – Waterfront Superfund site in Ashland, Wisconsin. Groundwater contamination and PAH contaminated sediment in a ten-acre area of the Ashland waterfront result from historical operation of a coal gasification plant. The site includes high concentrations of PAHs in bottom sediments and degraded aquatic habitat off the City of Ashland's Kreher Park in Chequamegon Bay. The contamination originates from the on-land location of a former manufactured gas plant (see Chapter 3: Contaminated Sediment).

The Lake Superior Stormwater Project

In 1993 to 1995, the Lake Superior Binational Program engaged in a project to investigate the importance of stormwater as a pollutant source in the Lake Superior Basin. Most urban storm runoff was delivered to the lake untreated, by way of ditches and storm sewers that flow into the lake or to tributary streams. This project was a partnership of Wisconsin, Minnesota, Michigan, the U.S. Geological Service and U.S. Environmental Protection Agency. The project estimated the amounts of stormwater pollutants entering Lake Superior, developed best-management practices for reducing contaminated runoff from bulk storage piles, conducted an information campaign about stormwater pollution, and assisted communities in stormwater planning. Samples of water from rain and melting snow were taken from streets, rooftops and storm sewers. Heavy metals and PAHs in storm sewers were typically at concentrations exceeding the allowable limits in point source discharges. Total loading of PAHs to the lake from storm sewers in urban areas on the U.S. side of the basin was calculated at 550 kilograms (1213 lbs)/year.

In the years following this project, stormwater-permitting requirements have been established by the USEPA for larger communities. The Lake Superior stormwater project helped lay the foundation for stormwater planning and controls in Duluth, Minnesota; Superior, Wisconsin; and Marquette, Michigan. USEPA's next phase of stormwater regulations (Phase II) will extend requirements for erosion control and on-going stormwater management to industries and activities in areas in which one acre of land or more is disturbed. While these new requirements will help the Lake Superior environment, they enhance the need for education. The following projects to address those needs:

- The Village of LaPointe, Wisconsin has a stormwater demonstration project at a commercial development near the Madeline Island waterfront funded by Wisconsin Coastal Management.
- Wisconsin Department of Natural Resources and University of Wisconsin-Lake Superior Research Institute have a watershed education and stormwater outreach project to reach local

officials and developers on the reasons for stormwater management to protect Lake Superior watersheds and fisheries (funded by WI Great Lakes Protection Fund).

- Superior, Wisconsin has a stormwater planning and education project. The local schools participate in educational events and have stenciled storm sewer covers with the message "Dump No Waste- Drains to Lake." The City also offers assistance to local homeowners for water management and has set up demonstration rain gardens and rain barrels. Wisconsin Great Lakes Protection Fund and the Great Lakes Commission have funded this work. The City is seeking funding for stormwater retention and treatment basins.

LaMP Habitat Projects in Wisconsin

A number of projects and activities are underway in Wisconsin to implement the ecosystem objectives of the Lake Superior LaMP.

Common tern habitat: In the fall of 2002 a new island was built for common terns – a Wisconsin endangered species – in Ashland. The Ashland colony is one of only two common tern nesting colonies in the entire Lake Superior basin. The other colony is located on Interstate Island in the St. Louis River estuary. In 2003 a slight increase in the number of nesting pairs using the new island was noted, with 90 pairs of terns nesting there. Production was one of the highest ever observed with nearly two young fledged per nest.

Iron River Habitat Restoration: In 2001, an abandoned hydropower dam was removed from the Iron River, about 1.5 miles above where it enters Lake Superior. What had been a warm water impoundment was restored to trout stream. The project took years to complete. The original hydropower dam was constructed in 1923 and was destroyed by later floods. In 2001, the remaining barrier was removed from the sandstone outcrop known as Orienta Falls, which old newspaper articles called the most scenic site in Bayfield County. At Orienta Falls, water drops 15 to 20 feet over a distance of 200 feet. Project partners include Xcel Energy (formerly NSP), which contributed about \$500,000 to remove the remains of both dams. The Wisconsin DNR and the Great Lakes Fishery Commission paid for construction of a low-head barrier to keep sea lamprey out of the 56 miles of trout streams in the Iron River watershed. Until a management plan is developed, fish migration from Lake Superior will remain blocked. In the meantime, the river is returning to a more natural state. Below the former dam site, lake-run salmonids are reproducing once again.

Land Management and Stormwater: A project is being implemented in Wisconsin to develop best land management practice guidelines for the Wisconsin portion of the Lake Superior basin to reduce nonpoint pollution and stream damage. The project was funded by the Great Lakes Protection Fund and is being implemented by the Ashland, Bayfield, Douglas and Iron Counties' Land and Water Conservation Departments with assistance from Wisconsin DNR.

Wisconsin Lake Superior Partner Team

The Wisconsin Lake Superior Public Partner Team is a 40-member stakeholder group established in 1998 by the WDNR to advise state government on Lake Superior issues and to work with the state on Binational Program implementation. The group worked on recommendations for Lake Superior special designations for several years and provided recommendations to the DNR in 2002. The Partnership Team, a broad cross section of basin citizens in Wisconsin, including municipal and county elected officials, business and industry, and citizen groups, continues to work on initiatives to promote watershed health in the Wisconsin Lake Superior Basin.

Wisconsin Lake Superior Protection Fund

In 2001 the Wisconsin awarded \$250,000 from the state share of the Great Lakes Protection Fund to 10 basin organizations to reduce mercury, prevent pollution, and support watershed based planning to reduce erosion and tributary degradation. The Lake Superior Partner Team helped establish the priorities for this funding: they set mercury reduction and small planning grants as the priorities for the \$250,000 available for 2001. The Great Lakes Protection Fund is an endowment established by the Great Lakes states. Each year a portion of the earnings returns to each state for environmental cleanup and protection. Many of the projects discussed in the Lake Superior section of this report have been funded through this program.

Remedial Action Plans for Water Quality Restoration

Wisconsin is responsible for implementing remedial action plans (RAPs) at five Great Lake sites – four on Lake Michigan and one on Lake Superior (Figure 29). At two of the RAP sites, implementation is a shared responsibility with adjoining states. For the Menominee RAP, Michigan and Wisconsin share responsibility for implementation. For the St. Louis and Duluth/Superior Harbor RAP, both Minnesota and Wisconsin are implementing recommendations that pertain to their authorities.

All of the five RAP sites are in the process of implementing the recommendations contained in the stage I & II planning documents. Actions are being implemented at each of the RAP sites that are aimed at restoring and protecting the designated uses in the Areas of Concern. At all sites work toward restoration of beneficial uses has become incorporated into the routine planning process and regular work activities of the basins in which the AOC is located. This 2004 report highlights three of the five areas of concern: the Lower Green Bay and Fox River, Sheboygan, and St. Louis River/Duluth Superior Harbor. Please see the 2002 report for a more extensive description of all five areas.

Lower Green Bay and Fox River

Description

The Lower Green Bay and Fox River Area of Concern (AOC) consists of the lower 11.2 kilometers of the Fox River below DePere Dam and a 55 square kilometer area of southern Green Bay out to Point au Sable and Long Tail Point. The drainage area encompasses portions of eighteen

counties in Wisconsin and 40 watersheds of the Upper Fox River, Wolf River and the Lower

Fox River Basins, including the largest inland lakes in Wisconsin – Lake Winnebago and its pool lakes. While water quality problems and public use restrictions are most severe in the AOC, water resources of the entire basin are affected by runoff pollution from rural and urban areas, municipal and industrial wastewater discharges and degraded habitats.

Eleven use impairments have been documented and two are suspected of being impaired for the Lower Green Bay and Fox River AOC through the Remedial Action Plan (RAP) process. Ecosystem services and human uses such as fishing, boating, swimming, hunting and passive recreation have been impaired. Soil erosion and runoff pollution cause most use impairments from upstream tributaries, persistent bioaccumulative contaminants in river and bay sediments, and habitat losses. Turbid, algae-laden waters degrade aquatic habitats and restrict swimming. Consumption advisories warn against eating mallard ducks and twelve species of fish. Shipping and navigation are impaired by sediment loading from soil erosion and the high cost of dredging and disposing contaminated sediments.

Despite incremental improvements to prevent water pollution, restore habitats, improve public access and further define the causes of impaired uses, none of the problems in the AOC have been completely resolved. Recommendations are being implemented sequentially with the easiest ones having been completed and the more difficult and costly actions yet to be implemented.

Highlights

Community leaders have established additional nonprofit organizations to promote implementation of nonpoint source pollution controls and to determine the most cost-effective actions to meet the nutrient and suspended solids objectives of the RAP. The following are remaining actions to be implemented:

- PCB contaminated sediment remediation in 39 miles of the Lower Fox River (see below)
- Nonpoint source abatement/pollution and prevention including comprehensive watershed projects to abate runoff pollution, TMDLs for phosphorus and suspended solids in the Fox-Wolf basin, and riparian buffers throughout the Fox-Wolf basin are ongoing.



Figure 29. Wisconsin RAP Sites

- Habitat protection and restoration that involve restoring an eroded chain of barrier islands and associated aquatic habitats (Cat Island archipelago), restoring littoral habitats, and protecting remaining wetlands
- Exotic species prevention
- Stewardship and sustainability which includes the Sustainable Green Bay Initiative
- Education and outreach
- Research and monitoring including the State of the Bay Report
- Public access enhancement

Fox River Remediation

Since the last report to Congress, the remedial action effort on the Lower Fox River/Green Bay site has advanced from the “evaluation and planning stages” to the “remedial action phase”.

In 2002, DNR in cooperation with EPA, issued the Remedial Investigations Feasibility Study and Proposed Plan (“RI/FS”) for public comment. Following the receipt of significant public input, the agencies issued a segmented Record of Decision (ROD). In June, 2003, the ROD for Operable Units 1 and 2 – the upper 26 miles of the Lower Fox River segment of this site – was issued. The selected remedy for OU-1 directs that all sediment which is contaminated in excess of 1 ppm PCB or which cover sediments with this concentration be dredged, dewatered, and landfilled. The estimated volume of sediment which would be removed is 784,000 cubic yards.

The implementation step began in June 2003, with the signing of an “Administrative Order on Consent” (AOC) by USEPA Region 5, Wisconsin DNR, and one of the Primary Responsible Parties (PRPs) identified for the site. The AOC ordered the PRP to conduct necessary fieldwork and prepare the remedial design for OU-1. This step was followed immediately on June 30, 2003, with the issuance of the ROD for OU-3, OU-4 and OU-5. The remedy selected in this ROD is very similar to the first ROD and identifies all sediment over the PCB concentration of 1 ppm to be removed, dewatered and landfilled. Because of advances in design and costing information, this second ROD also identifies vitrification, a process which melts the sediment and destroys the PCBs, as an alternative treatment and disposal method to be considered during design. The ROD also identifies desposits at the lowest end of OU-2 and at the mouth of the river in OU-5 to be remediated, as well as the estimated 6.5 million cubic yards of in-river sediment in OU-3 and OU-4.

On October 1, 2003 a consent decree was filed in federal court committing WTMI and the P.H. Glatfelter Company to fund implementation of the remedial action in OU-1. Following the public comment period, the consent decree was approved by the judge on April 12, 2004. Initial dredging will

be done in Fall 2004, and full-scale remediation will begin in 2005. The remedial action is expected to take three to five years to complete. Food chain models predict that fish consumption advisories will begin to be relaxed within three years following completion of the remediation.

On March 5, 2004 an Administrative Order on Consent was finalized to accomplish the Remedial Design to implement the ROD for OU-2 through OU-5. Wisconsin DNR and USEPA Region 5 jointly ordered Georgia Pacific and the NCR Corporation to develop this clean-up plan. The first step will be the collection of sediment characterization data. This data collection occurred summer 2004.

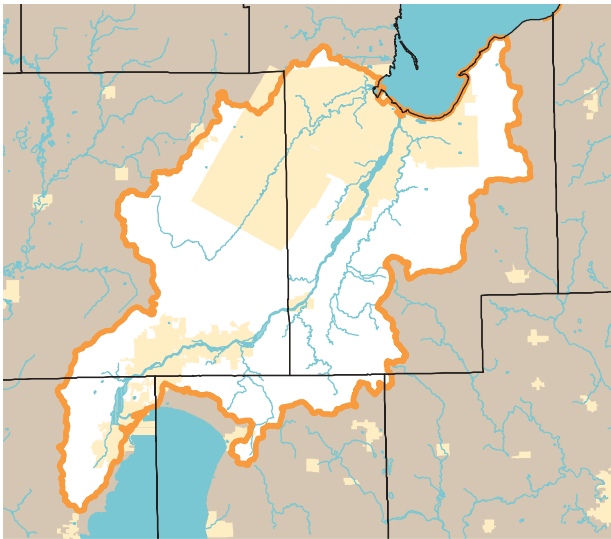


Figure 30. Lower Fox Basin/AOC

Sheboygan River and Harbor

The Sheboygan River Area of Concern includes the Sheboygan Harbor and 14 miles of the river up to the Sheboygan Falls Dam (Figure 31). The Sheboygan River, a tributary to Lake Michigan, was designated as a Superfund Site by U.S. EPA in 1985 because of PCB contaminated sediments. Tecumseh Products Company, Thomas Industries and Kohler Company have been identified as potentially responsible parties.

In May 2000, the Record of Decision for the Sheboygan River Superfund project was signed. About 4,300 cubic yards of contaminated sediment that had been previously dredged from the stretch of the Sheboygan River that runs from the area known as the “Upper River” and placed in steel storage facilities on the Tecumseh Products Company’s Sheboygan Falls property, was

Figure 31. Sheboygan Basin/AOC



shipped off site in September 2001. A consent decree was signed by U.S. EPA, U.S. DOJ and Tecumseh Products Company in 2003. This agreement requires Tecumseh to clean-up the upper portion of the Sheboygan River Superfund site including ground water at the Tecumseh facility, floodplain soil and river sediment. The Tecumseh facility clean-up is scheduled to proceed in 2004. River sediment characterization will be conducted in 2004 to complete a final remedial design for the floodplain and sediment clean-up. The river dredging and floodplain soil clean up phase is scheduled to begin in 2005.

WDNR staff is working with fellow trustees from U.S. Fish and Wildlife, and National Oceanic and Atmospheric Administration (NOAA) to determine the Natural Resources Damage Assessment for the restoration phase of the Sheboygan River Superfund Site. A sediment transport model was developed for the Sheboygan River Lower River and Inner Harbor reaches of the Superfund site to provide more information regarding the potential for scour of PCB contaminated sediment; this is an ongoing effort with EPA, ACOE and Baird.

C. Reiss Coal Peninsula on Lake Michigan and the Sheboygan River

DNR staff continues working closely with the City of Sheboygan and their consultants on the re-development of the former C. Reiss Coal Peninsula on Lake Michigan and the Sheboygan River. Elements include permitting for seawall re-construction on the Sheboygan River, remedial action plan for site cleanup, site grading permit, review of Lake Michigan revetment plans and a dune re-creation project. The city recently installed engineered stormwater devices to treat runoff from the newly developed areas on the peninsula. The city received a grant through DNR for a trail and fish cleaning station.

Other Basin Highlights

Dams

In the autumn of 2000, the Franklin Dam on the Sheboygan River was removed. The river is now free flowing in this reach and supports a more diverse fishery. For the last two years, DNR staff have been working with community members regarding the next dam downstream in Johnsonville. This dam on the Sheboygan River did not have an owner. Many local citizens are concerned about dam removal because they believe it prevents ice jams from forming downstream of their town. DNR is concerned this dam must be maintained or repaired, as it is a potential safety hazard. The Department is attempting to locate an owner for the structure. Dam removal is an option that can be considered if no owner is found and citizen concerns can be addressed (ice jam study). Dam removal would also benefit fish and recreational uses of the river.

Volunteer and DNR Monitoring

There continues to be a strong volunteer monitoring effort in the Sheboygan area. DNR staff assist in the coordination and training of volunteers for both the “Testing the Waters” and “Water Action Volunteers” (WAV) groups. The former is an environmental educational program that involves area students from numerous local school districts. WAV is comprised of private citizens who volunteer to collect and analyze data to assess stream ecosystem health. Both groups continue to grow in capacity and technology for stream assessment. The Ellwood H. May Environmental Center of Sheboygan also continues to sponsor and assist with program activities for both groups. Several of the survey locations are within the AOC for the Sheboygan River.

Additional Activities, 2002-2004

- A canoe launch access site was constructed on the Sheboygan River along a county owned public trail. Another canoe launch is planned for the former Franklin Dam Impoundment on the Sheboygan River.
- WDNR assisted several municipalities and lake groups in determining techniques to control or reduce exotic species or nuisance levels of aquatic organisms (i.e. *Cladophora* sp., Eurasian water milfoil, elevated bacteria levels, etc.).
- WDNR helped fund Lake Michigan Beach Monitoring efforts by Sheboygan County through the use of a USEPA Beach Act grant.
- The *Broughton Sheboygan Marsh Strategic Management Plan 2001* was completed in 2001 and approved by the Sheboygan County Resources Committee in February 2002. This plan outlines mutually agreed upon responsibilities between the different units of government responsible for resource management throughout the marsh. A broad public process with representatives from local and county government, non-profit organizations, the WDNR and citizens at large were responsible for completing the plan. One key element to the plan was to have periodic complete drawdowns of the marsh to improve the biological diversity of the marsh and to stabilize cattails. A drawdown of the Sheboygan Marsh occurred in 2002. Sheboygan County and WDNR worked together to collect data during the drawdown including high quality color air photography before and after the drawdown. WDNR also worked with local conservation groups to establish a carp trap in the marsh. In early 2004, approximately 14 tons of carp were removed from the Sheboygan Marsh. WDNR is also pursuing an additional land purchase for the Sheboygan Marsh.
- Under Wisconsin's Source Water Assessment Program funded by USEPA as part of the Safe Drinking Act, assessments are completed for groundwater and surface water systems and include inventories of significant potential sources of contaminants to these system –ongoing;
- The Sheboygan County Land Conservation Department is working with WDNR and others on an update to the Sheboygan County Land and Water Management Plan. This plan is required by the State of Wisconsin for use of funds for the implementation of agricultural best management practices. The plan includes some joint strategies for implementing the state non-point pollution regulations. Priorities are being established for agricultural runoff practices near impaired waters and outstanding or exceptional waters in the county.
- In May 2003 WDNR staff conducted a stream monitoring workshop for the public that was concentrated on a small waterway named Willow Creek that is tributary to the Sheboygan River. The workshop included information on monitoring streams for habitat, water quality and biological community. This small stream supports a cool/cold water fishery including evidence of spawning by brook trout and coho salmon from Lake Michigan. The watershed is located in an area that will likely experience rapid urban development within the next decade.
- Sheboygan County Planning, UW-EX, and the Bay Lakes Regional Planning Commission continue to work with local units of government on comprehensive land use plans. WDNR assist these agencies with information for the natural resource elements of these plans. The county recently sent out a resident survey. In addition, they are developing a natural areas and critical resource plan.
- WDNR issued municipal WPDES stormwater permits to the City of Sheboygan and the City of Sheboygan Falls in 2000. WDNR is also in the process of issuing WPDES permits for municipal storm sewer systems in the Town of Wilson, Town of Sheboygan and Village of Kohler. The permits require that these municipalities take action to improve the water quality of their storm water discharges.
- The Sheboygan River Basin Partnership is a consortium of local environmental and conservation groups, local business, local agency and government staff, and the public at large. The partnership is moving towards non-profit status and intends to raise funds that can be used to improve, restore or protect natural resources in the Sheboygan River Basin. The partnership has focused their resources on broad educational forums for residents in the Sheboygan area. In May 2003 they sponsored an educational forum on groundwater. In March 2004 they sponsored an educational forum on Lake Michigan bluff and dune erosion.

- The Sheboygan County Land Conservation Department continues to implement their stream buffer program for water quality improvement. Since the project began in 2000, the Land and Water Conservation Department has contracted with 40 landowners and installed more than 75 acres of buffer strips that reduce the amount of sediment and agricultural runoff from entering streams.

Onion River Stream Restoration Projects

The streams in the upper Onion River Watershed originate from numerous groundwater discharge points and have the ability to produce high quality water with temperatures suitable to support cold water species. Water quality in these cold headwater streams had declined since settlement because of agricultural operations, aquaculture (fish farming) and recreation. The Lakeshore Chapter of Trout Unlimited developed a strategic plan for restoration of the headwaters of the Onion River. The strategic plan encompasses both stream and watershed improvement combined with public acquisition. A number of stream and watershed restoration projects in the headwater areas of the Onion River Watershed are completed or underway to correct water quality problems and enhance habitat for fish and wildlife. Some of the actions that have occurred to date include:

- Removal of ponds and re-creation of natural, free flowing stream segments that are supported by springs.
- Relocation of an impacted 1,000 foot segment of the stream that was located adjacent to a farm operation and barnyard.
- Installation of in-stream fish habitat structures.
- Securing State funds (Targeted Runoff Management) for agricultural best management practices including manure storage.
- purchase 135 acres of land for public access and use

St. Louis River and Duluth Superior Harbor

The St. Louis River and Duluth-Superior Harbor area of concern includes 39 miles of the St. Louis River below Cloquet, Minnesota, the river estuary, Duluth-Superior Harbor and the lower Nemadji River. The area of concern straddles the Minnesota-Wisconsin border (Figure 32). Each state pursues implementation projects in their waters. The St. Louis River Citizens Action Committee, a local nonprofit organization that developed from the RAP citizens advisory committee, encourages implementation and facilitates coordination.

Stage 1 of the RAP, developed through a collaborative effort among the Minnesota Pollution Control Agency, the WDNR, and the Citizens Advisory Committee, identified nine of 14 beneficial uses as being impaired. Some impairments were associated with the physical loss and degradation of habitat, and with the lost of an estimated 7,700 of 12,000 acres of wetland and open water habitat in the estuary since settlement. Other problems were related more to pollution and toxicity. For years, the river smelled bad from industrial discharges. That changed in 1978, when the Western Lake Superior Sanitary District wastewater treatment plant began operation. Nevertheless, pollution continues to come from sources such as contaminated sediments, abandoned hazardous waste sites, poorly designed or leaky landfills, airborne deposition, industrial discharges, chemical spills, improperly sewered wastes and surface runoff.

Highlights

Contaminated sediments are an important priority in the AOC. Studies conducted by state and federal agencies in the late 1990s have provided a good understanding of the type, severity and location of contaminated sediments. These studies include work done at two Superfund sites on the Minnesota side. Recent accomplishments include the removal of 7500 cubic yards of PAH contaminated sediment and floodplain soils during the summer of 2003 from Newton Creek in the St. Louis River Area of Concern. Newton Creek flows through residential neighborhoods of Superior, WI into Hog Island Inlet of Superior Bay. Funding for this project was provided through the U.S. EPA Great Lakes National Program Office, Wisconsin Coastal Management Program, and the WDNR Harbors and Bays Remediation Program. WDNR is seeking funding to remediate contaminated sediment in Hog Island Inlet and restore this valuable shallow water and wetland habitat,

which lies 1.5 miles from the confluence of the St. Louis River through Superior Bay to Lake Superior

Currently, the St. Louis River Citizens Action Committee is facilitating updates to a contaminated sediment strategy focusing on PAH contamination in the Area of Concern with initial funding provided by the WDNR. Also, the Minnesota Pollution Control Agency has recently developed a GIS-based contaminated sediment database for the St. Louis River Area of Concern with funding from U.S. EPA GLNPO. Funding to complete this project on the Wisconsin side are also being pursued.

Mercury is a contaminant of particular concern in the St. Louis River. The St. Louis River Watershed TMDL Partnership will develop a total maximum daily load (TMDL) for mercury. The TMDL process is designed to improve impaired waters like the St. Louis River, where all facilities with discharge permits are operating within their permitted limits, but have pollutant levels exceeding state standards. This process will complement the mercury-reduction efforts that are already ongoing in the watershed.

Habitat restoration and protection are also important priorities. The Area of Concern has tremendous habitat value including several extensive Lake Superior coastal wetlands. The WDNR together with the state of Minnesota, federal, and tribal agencies worked with the St. Louis River Citizens Action Committee to develop the Lower St. Louis River Habitat Plan, published in May 2002. It provides detailed habitat maps and a consensus list of conservation and management objectives, targets and actions.

Public involvement and outreach have always been important components of this RAP. A host of partners are working together to improve the St. Louis River. These include the U.S. EPA, Minnesota Pollution Control Agency, Minnesota DNR, WDNR, local and tribal governments, Minnesota and Wisconsin universities and Sea Grant Programs, the St. Louis River Citizens Action Committee, River Watch Project, River Quest, Harbor Technical Advisory Committee, U.S. Army Corps of Engineers and numerous private businesses and individuals.



Figure 32. St. Louis & Duluth/Superior AOC

Exotic Species

WDNR has an active role in the development of strategies to research, monitor, and control nuisance (exotic) aquatic species in Wisconsin's waterways. The WDNR in partnership with the *University of Wisconsin Sea Grant Institute and UW Extension*, and through the assistance of volunteers have developed a monitoring program.

Beyond reporting and tracking the presence of some of the more troublesome exotic species, the DNR actively participates in projects to study their effects on the ecosystem as well as develop strategies for their control. Wisconsin has developed a *Comprehensive State Management Plan* to deal with this issue. The plan, developed in response to the National Invasive Species Act of 1996, provides the framework for a comprehensive state program to address the problems caused by invasive nuisance species. The scope of the activities are broad and aimed at preventing new introductions, controlling the spread of existing populations, and implementing abatement strategies to safeguard public health and the environment.

Specific initiatives involving exotics include development of ballast water management practices and standards, development of a rapid response initiative, a dispersal barrier project, and control of intentional introductions. These initiatives are designed to keep exotics from entering the Great Lakes ecosystem.

Chapter 6: Wetlands

In December 2000, the Wisconsin Department of Natural Resources Wetland Team developed *Reversing the Loss – A Strategy for Protecting and Restoring Wetlands in Wisconsin*. The Strategy charts a course for current and future Department policies and programs involved in wetland education, protection, restoration, enhancement and management. It established four major goals and performance measures to accomplish those goals by the year 2007. We are in the middle of implementing the Strategy and have made substantial progress in meeting some of the performance measures, however, there are also limitations to accomplishing others. Progress over the last two years on those goals and performance measures is described below:

“Reversing the Loss” – the Wetland Strategy

Goal 1 Strengthen relationships with property owners, nonprofit conservation organizations and local governments

Over 75 percent of the state’s wetlands (over 4 million acres) are in private ownership. The department will need to enlist wetland owners, nonprofit conservation organizations and local governments in preserving and restoring wetlands on private property while sustaining agriculture, forestry, recreation and other wetland uses including development when compatible with wetland health. An established dialogue with wetland owners, and focused outreach, education and incentives along with technical assistance, will be necessary components to make this strategy work.

Goal 1 Performance Measure: Public Outreach

Wetland Restoration Handbook for Wisconsin Landowners, 2nd Edition

The second edition of the Wetland Restoration Handbook for Wisconsin Landowners has recently been published by the DNR’s Bureau of Integrated Science Services. The handbook is a collaboration between the DNR and the Wisconsin Wetlands Association, a nonprofit organization. The handbook describes the fundamentals of wetland restoration in an interesting way. New chapters that have been added since the first edition include seeding and planting considerations, invasive species control information, wetland management recommendations, additional photographs and enhanced graphics. There is an expanded reference section of useful internet web sites, flora and fauna guides and a new statewide contact list.

Restoration workshops

Wisconsin Wetlands Association and Wisconsin Waterfowl Association held wetland restoration workshops with assistance from a US Fish and Wildlife Service grant in collaboration with DNR. These workshops were geared toward landowners and land managers interested in restoring their own wetlands.

Wetlands Internet Web Site

DNR continues to update the Wetlands web page as new information of interest becomes available. Some of the most significant changes include the addition of a Wetlands Mitigation page and Assessment and Monitoring page. Also, our What’s New page updates the public on recent events, laws and new publications. The DNR’s Wetland Web address is: <http://dnr.wi.gov/org/water/fhp/wetlands/index.shtml>.

Guidance and Policy

The Wetland Team continues to develop guidance and policy, as necessary. Administrative codes have been developed to establish standards for compensatory mitigation and to simplify the approval process for wetland conservation activities.

Wetland Restoration, Management and Protection

DNR staff continue to work with the public and other government agency staff to provide technical assistance on wetland restoration, management and protection.

Wetland Educational Publications

Informational materials both for the general public and focused on a selected group have been developed and are being distributed. Examples include *Midwestern Ephemeral Wetlands*, *A Vanishing Habitat* and *Guidelines for Wetland Compensatory Mitigation In Wisconsin*. There has been a great demand for these informational publications.

Regulatory Workshops

A conference was held with local road advocates and key stakeholder groups to discuss streamlining the regulatory process for those projects. Meetings have been held with various energy industry groups to develop methods and techniques for wetland avoidance and minimization of impacts from energy projects.

Training Sessions

Wetland delineation, ecological assessment and plant identification training conducted by DNR staff and an interagency group is a continuing process. Training for both the public (consultants and individuals) and agency staff are offered. Two Regulatory IV sessions were held for agency staff. Trainers included WDNR, Southeastern Wisconsin Regional Planning Agency, US Geological Survey, US Army Corps of Engineers and Natural Resources Conservation Service staff.

Wetland Compensatory Mitigation Workshop

The Department sought and received an USEPA grant to cover costs associated with a web-site and several powerpoint presentations. A full-day workshop for over 70 consultants involved in wetland regulatory work and wetland mitigation was held in April 2003. With limited Department staffing for the program, we felt it was key to provide very detailed training to the consultants that handle this type of work. Since April, the quality of submittals has improved noticeably.

In addition, Department staff have sought and taken many opportunities to present information at existing industry group forums over the last two years including three different Wisconsin Realtors Association events, the Milwaukee Builders Association, the Milwaukee Bar Association, the League of Municipalities, meetings of consulting engineers groups, and the Solid Waste Technical Advisory committee.

Incentives

The Department has developed a landowner's guide to property assessment, provided information and testimony to the state Legislature on "use value assessment" legislation which has passed and resulted in wetlands to be taxed at 50% of assessed value. We are currently developing a guide explaining the legislation and how it will impact the landscape and a report on other state and province tax policy and incentive programs which will include a recommendation for a Wisconsin program.

Goal 2: Manage wetlands to protect diversity of species, wildlife health, and ecological integrity

Wetlands are naturally productive and interspersed among our state's aquatic and terrestrial communities. Because protecting, restoring and enhancing wetlands contributes significantly to the ecological health of other biological communities, wetland communities should be a focus when managing Wisconsin's biodiversity. Wildlife that depends on water — everything from water fleas to mink to osprey — require adequate habitat and protection from ecosystem contaminants. Establishing a system of connected aquatic and terrestrial features for each eco-region will help target resources and activities on areas with the highest ecological potential. Acquiring exceptionally high quality or scarce wetland communities such as calcareous fens and floodplain forests, and managing them to preserve a diversity of species are key aspects of this strategy.

Goal 2 Performance Measure: Monitoring and Assessment

Development of Wetland Assessment Methods: Level 1, 2, 3 Approach

The Wetland Team is developing a wetland assessment and monitoring program following the general Level 1, 2, 3 approach endorsed by the USEPA Workgroup. This approach is designed to maximize efficient use of scarce resources for wetland monitoring while gathering scientifically valid information that addresses the needs of managers. Level 1 is Landscape Assessment relying

on coarse, landscape scale inventory information, typically gathered through remote sensing and preferably stored in, or convertible to, a geographic information system (GIS) format. Level 2 is Rapid Assessment at the specific wetland site scale, using relatively simple, rapid protocols. Level 2 assessment protocols are to be validated by and calibrated to Level 3 assessments. Level 3 is Intensive Site Assessment using intensive ecological evaluation methodologies, particularly research-derived, multi-metric indices of biological integrity. The Department's strategy is to develop complementary wetland condition assessment tools that can be used across the broad spectrum of wetland types at both the site-specific and landscape scales. Publications describing the methods we have developed are available on the Wetland Assessment and Monitoring web page at:

<http://dnr.wi.gov/org/water/fhp/wetlands/assessment>.

Level 3 Site Intensive Methods: Wisconsin Floristic Quality Assessment

The Department has adapted the Floristic Quality Assessment methodology for use in Wisconsin plant communities. The final report to EPA, *Development of a Floristic Quality Assessment Methodology for Wisconsin*, published in June 2003, describes the method, its uses and limitations. This method allows for an intensive, expert-based, assessment of the "Floral Diversity" function of a given wetland site. It can also be used to document the biological condition of the wetland, based on its plant community. The method relies on a "coefficient of conservatism" pre-assigned by a group of botanical experts to each native species. The coefficient is assigned on a scale of 0-10, based on the species' likelihood of occurring in an undisturbed plant community.

The method is applied by gathering a complete plant inventory and applying the coefficients to each species occurring on the site. A mean coefficient of conservatism and a floristic quality index can then be calculated for the site. The method requires a high degree of plant identification skill to correctly inventory the site. A computer program to enter plant inventory data and calculate WFQA statistics is now available.



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Multi-metric Indices of Biological Integrity for Depressional Wetlands

In 2002, refinement of the depressional wetland biotic index to assess additional metrics was completed. The results are published in *Refinement and Expansion of Wetland Biological Indices for Wisconsin*. Five separate indices were successfully developed that can separate impacted wetlands from least-impacted reference sites. The successful indices were for plants, macroinvertebrates, diatoms, and amphibians. These metrics can be combined into a composite Index of

Ecological Integrity, or applied separately.

Staff training and field testing of the original multi-metric biotic index for depressional wetlands (based on plants and macroinvertebrates) was held in 2002. The final report (2004) will assess the feasibility of implementing this method by existing staff on a routine basis.

Level 1 Landscape Level Method: Using Landsat Imagery to Map Invasive Reed Canary Grass (Phalaris arundinacea): A Landscape Level Wetland Monitoring Methodology

The Department has developed a protocol for mapping the most widespread invasive wetland plant using Landsat satellite imagery. This will provide a coarse-level, first-cut assessment of wetland condition at a landscape scale. The protocol was successful in mapping wetlands heavily dominated by reed canary grass to a 1-acre minimum mapping unit with satisfactory accuracy in a large pilot area (182 km by 182 km) in southern Wisconsin. The final report to USEPA discusses ways of using this data to report on this aspect of wetland condition by watershed. The resulting classification is in GIS format and can be used for a variety of planning and management purposes. The map is being made available on the Department's wetland assessment and monitoring webpage at <http://dnr.wi.gov/org/water/fhp/wetlands/assessment>.

Integrating Wetlands into the Watershed Approach – Milwaukee Basin Wetlands Assessment

In November of 2001, a two-phase pilot project in the Milwaukee River Basin was started with the goal of developing a process to assess wetland functions on a watershed scale. The project is intended to provide managers and planners with information to set priorities for wetland protection and restoration. The six watersheds of the Milwaukee River Basin have been further subdivided into 58 subwatersheds, allowing for analysis on a variety of scales. This project concentrates on developing Level 1 GIS-based decision support tools to aid planning for wetland protection and restoration. In the coming second phase of the project our existing Level 2 rapid assessment tool will be modified to serve as a check on the results of the decision support tools. We will also develop an assessment method to evaluate the restorability of degraded and former wetlands.

Project staff are utilizing existing GIS information to develop custom data layers for use in the Basin. New data layers have been created to map drainage ditches and wetlands dominated by reed canary grass. A map of potentially restorable wetlands has been produced using soils, wetland inventory and land use data to identify restoration opportunities. The Department is contracting with county land conservation and planning agencies in 2004 and 2005 to intensively ground-truth the potentially restorable wetlands map in selected subwatersheds and further assess the restorability of sites identified on the map. Department staff will ground-truth a stratified random sample of the potentially restorable wetlands that have been mapped across the entire basin.

Expert-derived GIS-based decision tools are used to assess at a coarse level the relative benefits of various restoration opportunities and the relative degree to which existing wetlands provide wildlife habitat, protect water quality in downstream waters and provide water storage to stabilize water flows in the watershed. These tools will be applied by the county cooperators to develop restoration and protection plans for several focus subwatersheds. Site assessment protocols will be developed and implemented by Department and cooperator staff at a select sample of sites to verify the results of the GIS-based assessments and refine the analysis with site level data. County cooperators will report to the Department on the feasibility of using the GIS tools for planning purposes.

Goal 2 Performance Measure: Restoration and Acquisition

Wetland Reserve Program

The Wetland Reserve Program is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. The USDA Natural Resources Conservation Service (NRCS) provides technical and financial support to help landowners with their wetland restoration efforts. The NRCS goal is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. This program offers landowners an opportunity to establish long-term conservation and wildlife practices and protection. DNR staff continue to provide assistance to NRCS staff and the public to facilitate implementation of this important wetland program. 4,733 acres of wetlands were restored through the Wetland Reserve Program in 2003 and 8,349 acres were restored in 2004.

WDNR Lake and River Protection Grants

Lake and river grants paid to restore, enhance and acquire wetlands. Three projects received grants solely to restore and enhance wetlands. Wetlands were enhanced through shoreland restoration and land acquisition projects for seventeen other projects.

Goal 3: Streamline DNR regulatory approach for permits and restoration activities in wetlands

Because Wisconsin's regulatory and enforcement program for wetlands is based primarily upon federal laws and regulations, several state and federal agencies are typically involved in every permitting decision. That system often leads to inefficient, inconsistent decision-making, which frustrates wetland owners and doesn't sufficiently protect wetlands. The department can improve the process by identifying and removing barriers to efficient and effective decision-making. The department can also eliminate duplication and provide consistency by establishing a state wetland protection program that supersedes federal regulation and oversight. New legislation autho-

izing compensatory mitigation and providing state enforcement authority is a necessary part of this regulatory approach. The department can encourage local officials and development interests to avoid wetlands or incorporate them into their project as a site amenity, reducing the need for wetland permits.

Goal 3 Performance Measure: Regulation

A rule to expedite the review and approval for wetland restoration projects went into effect in 2003. To facilitate wetland conservation projects, this new administrative code establishes a streamlined process to review regulated activities associated with the restoration of former wetlands, the enhancement of degraded wetlands and the maintenance or management of existing wetlands.

Wetland Compensatory Mitigation

Rules establishing standards for development, monitoring and long term maintenance of wetland compensatory mitigation projects that are approved by the Department and to establish procedures and standards for the establishment and maintenance of mitigation banks went into effect in 2003. With two years experience with the new program rules, it appears the changes are working as intended. Furthermore, the WDNR and US Army Corps of Engineers, US Environmental Protection Agency and US Fish and Wildlife Service entered into a memorandum of agreement that formally adopts the DNR's guidance document to make decisions between agencies consistent across the state.

Initial results indicate that the wetland compensatory mitigation program has not resulted in any increased review times for wetlands. Also, permitted wetland losses have not increased since the implementation of this new program.

Goal 4: Develop and use modern technology to map, monitor, protect and manage wetlands

Giving the public and staff a common up-to-date source of wetland information to use in making decisions is essential for the preceding strategies to succeed. An integral component of wetland information is the Wisconsin Wetland Inventory, which consists of over 1,700 maps showing the location and types of wetlands in Wisconsin. The cycle for updating inventory information is currently 24 years due to staff shortages and needs to be shortened to make it more useful. Making the wetland inventory available for planning and managing wetlands, in addition to its current use in regulating wetlands, as well as developing a unified tracking and reporting system, are crucial to the success of this strategy.

Much progress has been made and will continue to be made developing new strategies for wetland monitoring due to support through the US EPA's State Development Grant Program. New assessment methodologies are described under Reversing the Loss Goal 2.

Goal 4 Performance Measure: Wisconsin Wetland Inventory

The Wisconsin Wetland Inventory continues to improve its new methodology for creating digital orthophotography (aerial photos without distortion). The goal is to eventually have complete statewide seamless coverage available for downloading from the Internet. In 2004 USEPA funded a digital mapping process for a watershed wetland assessment project in the Lower Chippewa Basin.

Volunteer Monitoring of Purple Loosestrife (*Lythrum salicaria*) Infestations and Biological Control Effectiveness.

A survey protocol has been developed and baseline monitoring has been conducted at Galerucella beetle release sites to monitor the effectiveness of the beetles in reducing purple loosestrife populations and documenting the response of native vegetation. The Department has funded a purple loosestrife outreach and management liaison who coordinates education and technical assistance in all aspects of the biocontrol project to teachers, organizations and interested citizens. The coordinator works with the Wisconsin Wetlands Association to offer workshops teaching volunteers to map infestation sites. Follow-up workshops are offered to train volunteers to rear and release beetles and monitor vegetation at release sites. These surveys were

conducted in 2002 and 2003. Locational data on infestations are entered into a GIS developed and maintained by the Great Lakes Indian Fish and Wildlife Commission (GLIFWC).

Frog and Toad Survey

The *Wisconsin Frog and Toad Survey* is an on-going survey coordinated by the WDNR. The survey was initiated in 1984 and relies heavily on volunteer efforts. Background information on the survey is included in *Mossman and Hine (1985)*, and the history, analytical techniques, distribution maps, and trend results through 1995 are thoroughly summarized in *Mossman, et al. (1998)*. Survey routes are distributed statewide, with a goal of two survey routes in each county. Routes consist of 10 sites that are monitored 3 times annually. Presence/absence of each species is determined for each site based on the breeding calls of male frogs. The relative number of calling individuals at each site ranks the abundance of each species. Survey data are statistically analyzed and a calling index to the route populations is calculated. These route populations are regressed over years to create a species population trend (*Dhuey and Hay 1999*). While the results cannot be used to monitor the quality of wetlands, it does provide long-term trend data on anuran species over time.



Chapter 7: Public Health/Aquatic Life Concerns

The potential presence of toxic substances in surface water, groundwater and drinking water is a concern for individuals, businesses and governments. As more is understood about known and potential effects of individual contaminants — as well as suspected synergistic effects of multiple contaminants — the public is demanding to know more about environmental or ambient water quality and quality of water at the tap.

Federal and state requirements address these concerns, in part, through — for example — reporting requirements for communities on the vulnerability of drinking water systems to potential contaminant sources under the state's drinking water program or through protection afforded surface waters through the state's stringent provisions regulating the calculation of effluent limits for toxic substances found in NR106.

Major topical areas in this section include water quality assessments detailing the presence of and resulting impairments from toxic substances; aquatic life toxicity testing; fish consumption advisories, fish kill data, sediment contamination sites, reports of beach closings, incidents of waterborne disease and assessments of surface waters for drinking water use designation.

Water Quality Assessments - Toxic Substances

Table 10 below reports waters monitored for toxic substances and those with elevated levels of toxicants as of 2002. *Streams are reported in Part III, Chapter 3.* In 2002, of the 24,422 miles monitored or evaluated, 1,138 miles of rivers were partially or not supporting their designated uses due to elevated levels of toxic substances in the water column, fish tissue, or discharges.

The entire length of Wisconsin Great Lakes shoreline miles (1,017) are considered to have elevated levels of certain toxic contaminants. Pollutant sources to the Great Lakes are many, including airborne pollutants like mercury, sediments contaminated from historic discharges or activities, tributaries carrying toxic runoff, and wastewater discharges.

Table 10. Total Size of All Waterbodies Affected by Toxicants

Waterbody	Size monitored for toxicants*	Size with elevated levels of toxicants
River (miles)		1138.25 (1)/ (2)
Lakes (acres)		
Great Lakes (miles)	1017	1017 (3)

(1) From USEPA database includes waterbodies monitored and evaluated

(2) Stream miles under fish consumption advisories

(3) Based on fish consumption advisories

Aquatic Life Toxicity Testing

In toxicity tests, aquatic organisms are exposed to samples (effluent, sediment, ambient waters) for a specific time period, and then are compared to a control treatment (e.g., an exposure of the test organisms to dilution water with no effluent added) to determine whether toxicity is present at levels of concern to the environment. There are two types of WET tests - acute and chronic. The objective of an acute test is to determine the concentration of test material that produces a harmful effect (usually mortality) during a short term exposure under controlled conditions. Chronic tests are used to predict the concentrations that interfere with normal growth, development, and reproductive potential of aquatic organisms. During a chronic test several life stages (or the entire life cycle) of the organism are continuously exposed to the test material.

University of Wisconsin-Madison's State Laboratory of Hygiene

The WDNR works cooperatively with UW-Madison's State Laboratory of Hygiene (SLH) to maintain a biomonitoring laboratory. The SLH maintains cultures of several fresh water species

and is capable of performing acute and chronic toxicity tests on effluent, ambient waters, and sediment samples collected statewide. The laboratory also provides sample collection services for these and other tests. SLH staff have participated on WDNR policy teams dedicated to the development of new and improved toxicity testing methodologies. Additionally, WDNR and SLH staff assess the applicability of alternative toxicological assessment methods to other WDNR watershed management programs.

Each year, the SLH accepts requests for toxicity testing from WDNR basin engineers and permits staff. WDNR staff select facilities to be tested by the laboratory in order to collect data for compliance inspections, permit reissuances, and enforcement situations. The tests completed in 2002-2003 are summarized below (see Table 11).

Table 11. Summary Of SLH Toxicity Test Results For 2002-03

Sample type	#of acute	Results		#of chronic	Results	
		Pass	Fail		Pass	Fail
WPDES Industrial & Industrial	33	33	0	33	20	13
WPDES WDNR-owned fish hatcheries	7	7	0	7	7	0
Totals	40	40	0	40	27	13

NA = not applicable

Acute and chronic WET tests performed by the SLH on municipal and industrial wastewaters made up the majority of toxicity tests conducted in 2002 and 2003. While the majority of wastewater effluent samples were non-toxic, 13 of 33 (39%) of the chronic tests performed by the SLH during 2002-2003 indicated the presence of chronic toxicity at levels of concern. Because most SLH tests are a result of WDNR staff selecting facilities that have suspected toxicity problems (except for WDNR-owned fish hatcheries, where SLH testing is required by WPDES permits), it is not surprising that a large number of chronic tests at these facilities failed. Additional data collected by the SLH in these situations is often used in permitting and enforcement situations to help staff make better-informed decisions. In many of these cases, the cause(s) of toxicity is not determined by the SLH during these tests, but the permittee is required to address the situation. Additional testing and/or toxicity identification is often required in subsequent WPDES permits, to further characterize the potential for significant effluent toxicity from these facilities.

The SLH also applied acute and chronic toxicity testing techniques to other sample types. WDNR's sediment management program continues to benefit from the ability of laboratory staff to conduct sediment toxicity tests. Acute and chronic toxicity tests using *C. dubia*, a midge larvae (*Chironomus tentans*) and an amphipod (*Hyallela azteca*) were performed in 2002 and 2003.

Stormwater runoff and receiving water samples from areas near the Milwaukee airport were analyzed for toxicity in order to determine the potential of deicing chemicals to impact nearby surface waters. Surface water samples from around the state were tested to assess the potential for acute and chronic toxicity in lakes and rivers at those sites. Individual chemicals were also tested at the lab in order to provide toxicological data to assist the Department in developing water quality criteria. Other testing at the lab in 2002-2003 included tests to:

- to assess the cause of fish kills and in emergency spill situations;
- to determine the potential impacts to surface waters from landfill leachates;
- to investigate the sensitivity of early life stages of burbot and northern pike, in support of WDNR efforts to develop water quality standards for ammonia; and
- to determine whether endocrine disrupting compounds were present in source water, drinking water, and wastewater effluent samples.

WDNR/SLH efforts in the next biennium will continue to emphasize monitoring for WPDES-permitted facilities. Efforts will also be made to generate additional sediment and ambient data and to supplement the toxicological database for water quality criteria, where needed.

Table 12. Whole Effluent Toxicity (WET) Test Results Calendar Years 2002-03

Acute			Chronic		
Results	Number tests		Results	Number tests	
	Pass	Fail		Pass	Fail
506	483	23	469	416	53

WPDES Permit-Required Toxicity Testing

All surface water dischargers with a WPDES permit are evaluated by WDNR staff to determine their potential for acute and chronic toxicity at the time of permit reissuance. If it is determined that a significant potential for effluent toxicity is present, individual permits require that acute and/or chronic whole effluent toxicity (WET) monitoring be performed during the permit term. The need for WET testing is evaluated using data regarding available dilution, industry type, type and number of industrial contributors to municipal treatment plants, detection of chemical-specific compounds, additive use, and other factors. WET tests completed for WPDES permit compliance during calendar years 2002 and 2003 are summarized below (see Table 12).

Whole Effluent Toxicity (WET) Test Results

During 2002-2003, a total of 975 WET tests (506 acute, 469 chronic) were completed by permittees and submitted to the Department as required by their WPDES permit. Of these tests, 23/506 (4.5%) acute tests and 53/469 (11%) chronic tests exhibited toxicity at levels of concern. In those cases where repeated or severe toxicity was noted, facilities are required to perform follow up testing, toxicity identification evaluations in an attempt to identify the source(s) of toxicity, and they may get WET limitations in subsequent WPDES permits.

The WDNR will continue to implement its WET program in the next biennium, including an emphasis on additional WET monitoring and toxicity problem resolution for WPDES-permitted facilities.

Fish Tissue Monitoring Program

During calendar years 2002-2003, over 1800 fish samples were collected as a part of the fish contaminant monitoring program (Table 13 below (April 2004)). This includes fish samples that were collected as a part of the normal fish contaminant monitoring program, samples collected by cooperators, and samples collected under special projects and research.

In 2002-2003, samples were collected from approximately 137 lake locations, 36 sites in flowing waters, and 19 areas of Lakes Michigan and Superior (preliminary data as of April 2004).

Each year WDNR collects and analyzes samples of fish tissue from Wisconsin's inland waters and the Great Lakes, including their tributary streams. The objectives of the fish contaminant program includes protection of fish consumers by determining the levels of bioaccumulatory contaminants in the edible portions of fish and compare these levels to health guidelines as determined by the Wisconsin Division of Health.

Samples from the Great Lakes were analyzed for PCBs, pesticides, and mercury, while samples from river systems were primarily analyzed for PCBs and mercury. Fish samples from inland lakes were analyzed almost exclusively for mercury.

Fish consumption advisories are issued for certain species and sizes of fish from given areas where the concentrations of chemicals in the fish flesh exceed the health advisory levels. Fish contaminant data is also used to make natural resource and environmental management decisions.

Fish Consumption Advisories

Wisconsin issues general advice that applies to most inland waters where other pollutants or where mercury concentrations do not require more stringent advice. The general statewide advisory is based on US EPA's reference doses for mercury and typical levels of mercury found in Wisconsin fish based on the mercury concentration data that Wisconsin amassed over the last 20 years.

In addition to the statewide advisory that applies to most inland waters, more stringent consumption advice applies where fish have been found to contain higher concentrations of mercury or PCBs and other pollutants. The 2003 update of the Wisconsin Fish Consumption Advisory lists fish from 50 of the more than 2,000 lakes, river segments, and border waters tested (Table 14) due to the presence of PCBs and other organic chemicals. The number of surface water segments with PCB-based advisories has remained fairly constant since 1990. The 2003 update of the Wisconsin fish consumption advice lists fish from 93 specific surface waters due to higher concentration of mercury. See Table 14 for a list of health criteria used for Wisconsin's advisories

Table 13. Wisconsin's Fish Contaminant Monitoring and Cumulative Advisories

Year	Sites Sampled**	Samples Collected**	TOTAL Reaches or Waters w/Advisories PCB/Mercury
Prior to 1980	233	3,003	7/0
1980-1989	978	11,139	22/161
1990-1999	770	11,565	58/322
2000-2001	209	1,824	59/331
statewide mercury advisory adopted			
2002	110*	997*	50/92
2003	96*	881*	50/93
Total	1,634*	29,409*	

* Total number not yet available, based on data available as of April 2004. (Total cumulative number of sites does not include duplicate visits to a site.) ** includes samples collected and/or analyzed by cooperators

Table 14. Wisconsin Fish Consumption Advisory Guidelines

Contaminant	Population	Concentration	Advice
PCB ¹	All	< 0.05 ppm	Unlimited Consumption
		0.05 – 0.2 ppm	1 meal/week or 52 meals/year
		0.2 – 1.0 ppm	1 meal/month or 12 meals/year
		1.0 – 1.9 ppm	6 meals/year
		> 1.9 ppm	Do Not Eat
Mercury	Sensitive Group ²	< 0.05 ppm	Unlimited Consumption
		0.05 – 0.22 ppm	1 meal/week or 52 meals/year
		0.22 – 1.0 ppm	1 meal/month or 12 meals/year
		> 1.0 ppm	Do Not Eat
	General Group ²	<0.16 ppm	Unlimited Consumption
		>0.16 ppm	1 meal/week or 52 meals/year
Dioxin ³	All	< 10 ppt	No Advice Given
		> 10 ppt	No one should eat
Chlordane	All	< 0.16 ppm	No advice given
		0.16 - 0.65 ppm	1 meal/week or 52 meals/year
		0.66-2.82 ppm	1 meal/month or 12 meals/year
		2.83-5.62 ppm	6 meals/year
		> 5.62 ppm	No one should eat

1. Although this advice is based on reproductive health effects, the same advice is given for women, children, and men to protect against other potential health effects such as immune suppression and cancer

2. Sensitive group includes pregnant women, women of childbearing age, and children under age 15. General Group includes women beyond childbearing age and men.

3. Sum of total dioxin equivalence expressed as 2,3,7,8 TCDD based on dioxin and furan congeners and EPA human health TEQs.

Sites of known sediment contamination

The table below lists selected sediment sites; the status column level of management. The full table of contaminated sediments can be found at dnr.gov.wi/org/wm/wqs/sediment.html

Table 15. Sites of Known Sediment Contamination

PROJECT NAME - RP Name	Basin & WATERBODY	Status**	CURRENT & PROJECTED STATUS FY 2002-2003	CONTAMINANT
Appleton MGP - WE Energies	Lower Fox River GMU - Fox River	5, 6	Initial site assessment completed; coal tar found in the river and removed in August 2002. Coal tar in River, on bank and all unsaturated soils (2 acres) excavated summer 2003. Coal tar on bedrock - few to no sediments. In-situ stabilization of saturated soils on site in progress. Anticipated ISS completion is July 31, 2004. Thermally treated soils will be mixed with organics and returned to site. Post-remediation monitoring is planned.	PAH, BTEX, CYANIDE, STYRENE
Fond du lac River - no RP	Upper Fox R. GMU - Fond du Lac River	2	Initial sediment sampling indicated potential high levels of metals and a potential coal gas site impact. Toxicity samples collected in fall of 2000. Impacts were noted but no specific RP to go after. Water program will need to assess the need for any work in the river, then come to RR for assistance.	METALS
Fond du lac MGP - Alliant Energy	Upper Fox R. GMU - Fond du Lac River	3	Sediments investigated and ecological study completed, low impact PAHs. DNR sent NFA letter for seds to Alliant Energy on 10-10-1996. Nad portion of clean-up still ongoing (groundwater pump and treatment)	PAHS, BTEX CYANIDE
Green Bay MGP - WPS	Upper Fox R. GMU - Fox River	2	Initial sediment assessment completed. Evaluate need for additional investigation before proceeding with a remedy.	PAHS, BTEX CYANIDE
Hayton Millpond - Tecumseh	Lakeshore GMU - Pine & Jordan Creeks, & ditches; Hayton Millpond	4, 5	Site investigations complete, and FS completed. Discussions for remedy are taking place. Initial source removal completed in OU-1 in 2001. OU-1 (segments 1 through 6) removal completed in fall 2001, OU-1 segment 7 and OU-2 (workplan in progress).	PCB'S
Hewitt Machines - Neenah Redevelopment Authority (John Bergstrom)	Lower Fox River GMU - Fox River	1	Sediment sampled, needs further investigation. Waited for final ROD from EPA. This area will not be addressed under Fox River cleanup plan and needs to be addressed by RP.	PCBs
Kewaunee Marsh - Wis. Central Railroad, DNR state lead	Lake Shore GMU - Kewaunee River	4	Interim remediation measures implemented. Phase II of SI/FS underway. Funding for additional monitoring sought via GLNPO grant. Grant awarded 2003-2005 doing continued monitoring and arsenic speciation at this time. Recently submitted second grant for treatability studies.	ARSENIC

Restrictions on Bathing Areas

The 2003 beach season earmarked the implementation of the first comprehensive beach-monitoring program in the State of Wisconsin. Beach Water Quality Standards staff at the Wisconsin Department of Natural Resources secured grant funding from U.S. EPA for the development of a comprehensive beach-monitoring program. This effort is being directed at Great Lakes coastal waters, namely Lake Michigan and Lake Superior. The purpose of the program is to monitor selected beaches along the Great Lakes in accordance with the Beaches Environmental Assessment & Coastal Health (BEACH) Act requirements. The program also allows for prompt notification to the public whenever bacterial levels exceed EPA's established criteria and establishes a beach monitoring and public notification plan that assists communities along the lake shore to improve their ability to monitor and notify beach users of risks associated with high bacteria levels.

In March 2001 the Department solicited the assistance of local health department officials and interested parties and formed a 12 member BEACH Act Workgroup. The goal of the Workgroup was to assist the Department in developing a consistently implemented beach monitoring and public notification program. The program was developed in accordance with EPA published guidance and performance criteria and involved the following:

- Identifying all public beaches along Lake Michigan and Lake Superior
- Evaluating and classifying each beach as "high", "medium" or "low" priority.
- Developing a monitoring scheme for each priority category
- Standardizing testing and sampling methods
- Developing methods to notify the public of health risks
- Developing methods to notify EPA
- Allowing for public input

For the purpose of the BEACH Act, a beach was defined as:

"A publicly owned shoreline or land area, not contained in a man-made structure, located on the shore of Lake Michigan or Lake Superior, that is used for swimming, recreational bathing or other water contact recreational activity."

A total of 173 public beaches along Lakes Michigan and Superior were identified as staff literally walked the coast to geo-locate each beach via the use of GPS and GIS technologies. County maps locating each beach were developed indicating the adjacent coastal recreation waters, points of access by the public, length of beach, as well as any known potential sources of pollution.

In addition to collecting GIS data, a survey was designed to assess the effectiveness of current notification procedures, and to identify our audience. Field staff also recorded the type of terrain within 5 miles of the beach, number of point source discharges, any known point and non-point sources of pollution, land use (farms, animals, houses, marinas, industry, restrooms, parking lots), and beach populations (bathers in/out of water, waterfowl, sand sports, water sports).

In December 2002 and January 2003, public meetings were held at locations around the state to present the BEACH Act Workgroup's proposals and solicit questions and comments from the public. Public comment was very instrumental in the beach ranking and public notification decisions.

With the help of guidance provided by EPA, the Workgroup designed a tiered monitoring plan for beaches in each of the priority categories. The general monitoring plan includes the following:

- Monitoring for all beaches will begin one week prior to the swim season
- Samples shall be collected from the middle of the typical bathing area or for longer beaches one sample shall be collected for every 500 meters of beach.
- Samples shall be collected where 24 to 30 inch depth is first encountered and taken 6 to 12 inches below the surface of the water.
- Additional samples shall be collected whenever there is a heavy rainfall, a known pollution event where the potential exists for fecal contamination and immediately following an exceedance of the water quality criteria.

More specifically, high priority beaches will be monitored at a minimum of 5 days each week, medium priority beaches will be monitored at least twice weekly and low priority beaches will be monitored once weekly or on a case-by-case basis.

A goal of the Wisconsin beach program is to produce a comprehensive communication process that will best inform the public about beach water health risks and water quality issues in general. Information obtained from the Social Survey and the public meetings was used to help determine the best methods to notify the public. Several products were developed for the Wisconsin program. A standard format for statewide beach advisory, beach closure, and beach open signs was developed. The signs were distributed to all beaches involved in the monitoring program. The same signs will be used consistently among all the beaches along the Great Lakes. Signs were developed in three languages: English, Spanish, and Hmong.

An informational brochure was developed to distribute to the public. The brochure addresses concerns expressed by survey respondents. The brochures describe in detail the circumstances under which advisories will be posted and removed and under which a beach will be closed and re-opened.

www.wibeaches.com

Wisconsin has partnered with USGS and the Southeast Beach Task Force to develop the Great Lakes Beach Health Website. Funds from the BEACH Act grant was used to enhance the existing Southeast Wisconsin Beach Health website that is administered by the USGS in conjunction with the Milwaukee Health Department. The public will have access to real time data and advisory information for all beaches monitored along the Great Lakes borders. The DNR website itself will feature a page about beach water quality, public health and the BEACH Act.

Water Quality Standards for Bacteria

Water quality standards define a relationship between the amount of bacteria in the water and the potential risk to human health. Swimming in water with bacteria concentrations that are in compliance with the standard will not eliminate the risk of illness, but the risk of disease due to exposure is decreased.

USEPA-established guidelines were derived from studies conducted in the 1970's and 1980's. In 1986 USEPA recommended that *E. coli* and/or *Enterococci* be used as an indicator of fecal contamination. The USEPA standard was set at a geometric mean of 126 colonies per 100 milliliters (mL) for *E. coli* in freshwater systems and 33 colonies per 100 mL for *Enterococci* in marine systems. These numbers are correlated with an illness rate of 8 individuals per 1,000 swimmers. Wisconsin's water quality standards are currently expressed as a fecal coliform standard. The Clean Water Act, as amended by the BEACH Act, requires Wisconsin to adopt new or revised water quality standards for pathogens and pathogen indicators for which USEPA has published criteria. Wisconsin has convened a Bacteria Standards Technical Advisory Committee and is in the process of adopting EPA's new criteria for *E. coli* and revising the applicable disinfection policy.

Economic Impacts of Beach Pollution

According to a report by the Natural Resources Defense Council, at least a third of all Americans visit coastal and Great Lake counties and their beaches annually. Recreational water tourism, attributable in part to clean beaches, generates substantial revenues for state and local governments. Polluted beaches not only cost local economies tourist dollars and jobs, but they also cause a loss to those who had planned to visit the beach and swim in the water. Economists estimate that a typical swimming day is worth \$30.84 to each individual. Depending on the number of potential visitors to a beach, this "consumer-surplus" loss can be quite significant.

Addressing the sources of pollution so that beach water does not pose a health risk is the optimal solution that will take significant time and money. In the meantime however, it makes sense from a public health perspective to monitor beach water and advise beach users of health risks associated with elevated bacteria levels at contaminated beaches. Such advisories, if used effectively, can provide beach-specific information that will discourage beach users from swimming and running the risk of getting sick. Given the large number of people using beaches, as well as the substantial income from recreational water tourism, the cost of establishing a beach-monitoring program is reasonable and will be supported.

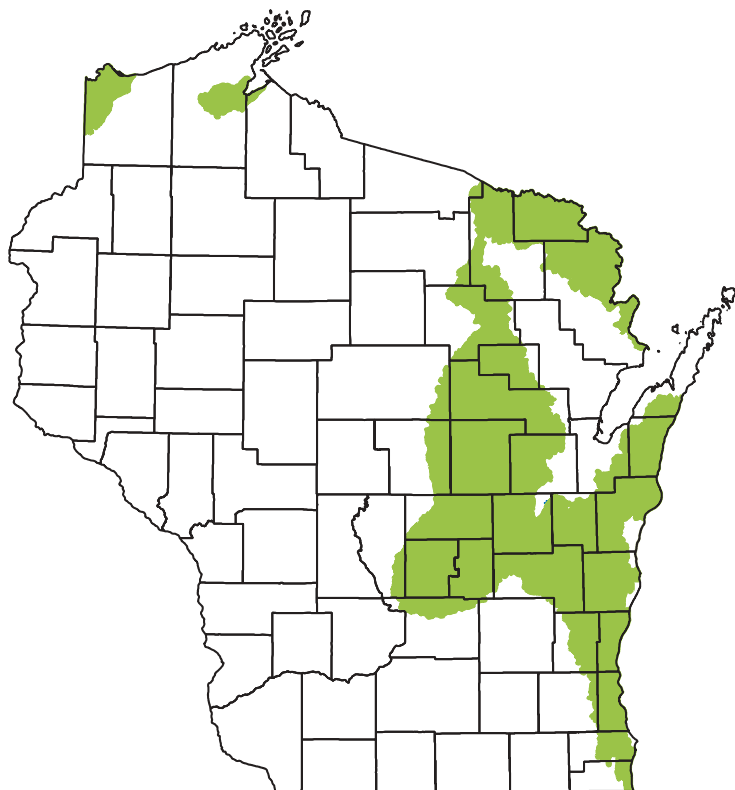
Source Water Assessment Program

The 1996 Amendments to the Safe Drinking Water Act require states to have an USEPA-approved Source Water Assessment Program (SWAP). The purpose of the program is to protect public health by providing information that can be used to prevent contamination of public water supplies. Other benefits include: preserving water resources for future generations; avoiding the expense of cleaning up a contaminated water supply or finding alternative sources of water; reducing system costs by providing the information needed to apply for a waiver from specific monitoring requirements; and encouraging economic growth by assuring an abundant supply of clean water.

In 2004, Wisconsin is in its fifth year of implementing the Source Water Assessment Program (SWAP). Assessments for each public water supply include: 1) delineation of source water area boundaries; 2) inventory of significant potential sources of contamination within those boundaries; 3) determination of susceptibility for each system; and 4) release of the assessment results to the public water supplier and to the public. Assessments must be completed for both groundwater and surface water systems.

Source water assessments for drinking water systems using surface water are nearly complete. These systems provide drinking water to 1.5 million people in communities along Lakes Michigan, Superior and Winnebago. Surface water source water areas are shown below. Source water assessments for drinking water systems using groundwater are in various stages of completion. Municipal systems were targeted to be completed by the end of 2003 and remaining public water systems will be assessed by the end of 2004.

Figure 33. Surface Water Source Water Protection Areas developed through the Source Water Assessment Program under the Safe Drinking Water Act.



Chapter 8: Ground Water

Groundwater

The WDNR has statutory authority to protect, maintain, and improve groundwater within the state. WDNR establishes the groundwater quality standards for the state, monitors groundwater quality, identifies and addresses groundwater quality problems and makes recommendations for preventing contamination. The Groundwater Section within WDNR's Bureau of Drinking Water and Groundwater takes a leading role in these activities. The Groundwater Section also works closely with the Groundwater Coordinating Council (GCC) to insure coordination between state agencies with groundwater protection responsibilities.

Wisconsin's Groundwater Law

Wisconsin recently enacted a Groundwater Quantity Management Law that will allow the WDNR to issue permits for high capacity wells. The law is considered a "first step" toward managing Wisconsin's groundwater quantity. Initially, the following steps will be taken to implement the law:

- Owners of new wells will notify the DNR of the well's location and pay a fee prior to construction;
- DNR will complete a limited number of well applications for wells in sensitive areas;
- Reporting requirements for high capacity wells will be expanded;
- Private well construction surveillance and inspection will be expanded by 2%; and
- A groundwater advisory committee will be established. The Groundwater Quantity Committee will be made up of representatives from government, private industry, agriculture, environmental interests and municipal water purveyors.

Two groundwater management areas are identified in the new legislation: the Fox River Valley and Southeastern Wisconsin. Groundwater levels in these two areas have declined significantly in the past 50 years.

Wisconsin's groundwater quality is protected under Act 410, which is the basis for Wisconsin's legal, organizational and financial capacity for controlling groundwater pollution. Under Act 410, Wisconsin developed Chapter 160 Wisconsin Statutes. Under Chapter 160, Wis. Stats., the WDNR must establish state groundwater quality standards based on recommendations from the Department of Health and Family Services (DHFS). Setting standards is a continuous process. As substances are determined to be a threat to groundwater or if they are detected in groundwater, they are placed on a priority list established by WDNR in conjunctions with other state agencies. The numerical standards are in chapter 140, Wis. Adm. code. For each substance there is an enforcement standard (ES) which determines when a violation has occurred and a preventive action limit (PAL) which serves as a trigger for possible early remedial actions.

Once groundwater standards are set, all state agencies must manage their regulatory programs to comply. Each state agency involved in activities that affect groundwater must promulgate rules to assure that the groundwater standards are met and to require appropriated responses when standards are not met. The role of each agency in implementing the groundwater standards is described below under "Wisconsin Groundwater Programs."

The Groundwater Coordinating Council

The responsibility for managing Wisconsin's groundwater is delegated to many different government agencies. The Groundwater Coordinating Council (GCC) facilitates cooperation between the different agencies on non-regulatory issues. Since 1984, The GCC has served as a model for interagency cooperation among state government official, the governor, and local and federal governments. The WDNR chairs this council.

Senior-level representatives from the departments of Natural Resources; Commerce; Agriculture, Trade and Consumer Protection; Health and Family Services; Transportation; the University of Wisconsin System; Wisconsin Geological and Natural History Survey and governor's office serve on the council. The GCC advises and assists state agencies in the coordination of nonregulatory programs and the exchange of information related to groundwater.

Department of Natural Resources

The WDNR is the designated state agency to protect, maintain and improve groundwater within the state. The Bureau of Drinking Water and Groundwater regulates public water systems and private drinking water supply wells. The groundwater section assists in coordinating groundwater activities of the WDNR as well as other state agencies. The groundwater section has primary responsibility for adoption of groundwater standards contained in chapter NR 140, Wis. Adm. code. Other duties of the Groundwater Section include: development of the annual groundwater monitoring plan; coordination of the joint solicitation for groundwater related monitoring and research proposals; review and management of groundwater monitoring projects; integration of groundwater in basin reports and watershed plans; the Source Water Assessment and Wellhead Protection Programs, and maintenance of a data management system for groundwater data.

Source Water Assessment Program

The 1996 Amendments to the Safe Drinking Water Act require states to have an USEPA-approved Source Water Assessment Program (SWAP). The purpose of the program is to protect public health by providing information that can be used to prevent contamination of public water supplies. Other benefits include: preserving water resources for future generations; avoiding the expense of cleaning up a contaminated water supply or finding alternative sources of water; reducing system costs by providing the information needed to apply for a waiver from specific monitoring requirements; and encouraging economic growth by assuring an abundant supply of clean water.

Wisconsin is currently in its fifth year in implementing its SWAP. Assessments for each public water supply include: 1) delineation of source water area boundaries; 2) inventory of significant potential sources of contamination within those boundaries; 3) determination of susceptibility for each system; and 4) release of the assessment results to the public water supplier and to the public. Assessments must be completed for both groundwater and surface water systems. Wisconsin has until December 30, 2004 to complete all source water assessments.

Source water assessments for the drinking water systems using surface water have been completed and are available on the Internet at: <http://www.WDNR.state.wi.us/org/water/dwg/swap/index.htm>. These systems provide drinking water to 1.5 million people in communities along Lakes Michigan, Superior and Winnebago. Surface water source water areas are shown below. Source water assessments for drinking water systems using groundwater are in various stages of completion. Assessments for municipal systems were completed in 2003 and are being hand-delivered to system operators. All public water supply system assessments will be completed in 2004. Brief summaries of all the completed assessments can be found at the Internet address above.

The Bureau of Waste Management regulates and monitors groundwater at proposed and active solid waste facilities and landfills. The Bureau for Remediation and Redevelopment oversees clean-up actions at spills, hazardous substance release sites, abandoned container site, state funded responses, Brownfields, "high priority" leaking underground storage tanks, closed wastewater and solid waste facilities, dry cleaner sites, hazardous waste corrective action and generator closures and sediment clean-up actions. The program runs the Dry Cleaner Reimbursement program and helps turn the Brownfield Site Assessment Grant program. Remediation and Redevelopment is also responsible for the Geographic Information System (GIS) registry of closed Remediation sites. This database is available on the Internet and includes information on site location and remaining residual groundwater contamination above the NR 140 ES. Department of Natural Resources Manual Code 4822.1 instructs staff on coordination of groundwater contamination investigations and regulated monitoring of potable wells.

The Bureau of Watershed Management regulates the discharge of municipal and industrial wastewater, by-product solids and sludge disposal from wastewater treatment systems and wastewater land treatment/disposal systems. The Bureau also issues WPDES permits for discharges associated with clean-up sites, regulated under the authority of the Bureau for Remediation and Redevelopment. The Bureau has primary responsibility for regulating stormwater and agricultural runoff as well as managing waste from large animal feeding operations.

Department of Agriculture, Trade and Consumer Protection

The Department of Agriculture, Trade and Consumer Protection (DATCP) manages pesticides and pesticide practices to assure that established groundwater standards for these contaminants are not exceeded. This may include prohibition of certain activities including pesticide use. The agency also manages practices to “minimize” groundwater contamination to the extent “technically and economically feasible.” DATCP regulates storage, handling, use and disposal of pesticides and the storage of bulk quantities of fertilizer. DATCP is also responsible for coordinating the development of Wisconsin’s “generic” and “pesticide specific” state pesticide management plans for protection groundwater from pesticides.

In 1993 the Agricultural Chemical Cleanup Program (ACCP) was established to address point sources of pesticide contamination the ACCP reimburses responsible parties for cleanup costs related to pesticide and fertilizer contamination at facilities and in nearby wells. The ACCP also funds DATCP oversight of pesticide and fertilizer cleanup activities.

The Land and Water Resource management program provides funding primarily to counties to assist in protection of groundwater resources. Some of this funding is dedicated to the development and implementation of improved nutrient and pest management practices.

DATCP funds the Agricultural Clean Sweep program which helps farmers dispose of unwanted pesticides, farm chemical and empty pesticide containers.

Department of Commerce

The Department of Commerce enforces private on-site wastewater treatment system rules and the plumbing code. The Department is also responsible for regulating storage tanks containing flammable, combustible liquid and hazardous substances. Since 1991 the data base inventory of petroleum product tanks regulated by Commerce has increased from 143,681 to 174,725. Commerce is responsible for the Petroleum Environmental Cleanup Fund Act (PECFA) which cleanup at leaking underground storage tank sites. Since its inception, PECFA has reimbursed petroleum storage tank system owners approximately \$1.05 billion to remediate petroleum contamination in soil and groundwater. Commerce and WDNR administer the Brownfields Sites Assessment Grant program for property owners.

Department of Health and Family Services

Chapter 160, Wis. Stats., directs the Department of Health and Family Services (DHFS) to recommend health-based enforcement standards for substances found in groundwater. DHFS staff provide information on health risks posed by drinking water contaminants, and investigate suspected cases of water-borne illness. The agency has been active in determining the extent, health effects and providing information to the public on naturally occurring arsenic in Winnebago, Shawano, Outagamie and Brown Counties.

Wisconsin Geological and Natural History Survey

The Wisconsin Geological and Natural History Survey (WGNHS) performs basic and applied groundwater research and provides technical assistance, maps and other information and education to aid in management of groundwater resources. The WGNHS groundwater program is complemented by geology and soils programs that provide maps and research based information essential to the understanding of groundwater recharge, occurrence, quality and movement.

Department of Transportation

The Department of Transportation (DOT) regulates the storage of highway salt to prevent groundwater contamination by dissolved chloride. DOT is also responsible for potable well sampling at 29 rest areas and 113 waysides. Other DOT groundwater related activities include road salt research, hazardous material and waste investigation or remediation, wetland compensation and research, and stormwater management and research.

University of Wisconsin System

The University of Wisconsin system (UWS) has research, teaching and information/education responsibilities. These three missions are integrated through cooperation and joint appointments of teaching, research and extension personnel who work on groundwater issues.

Wisconsin's Groundwater Monitoring Program

Wisconsin is drafting a new statewide groundwater monitoring strategy. Representatives from the WDNR, DATCP, USGS, WGNHS and the Academy of Arts, Letters and Sciences looked at existing monitoring programs and monitoring needs that still need to be met. The objective of the new monitoring strategy is to coordinate groundwater monitoring between all state agencies that regulate groundwater to get a complete picture of groundwater quality and quantity in the state. The statewide groundwater monitoring strategy will meet the prerequisites of the Clean Water Act Section 106(e)(1) as described in the EPA's "Elements of a State Water Monitoring and Assessment Programs" guidance document. Specific goals include:

- Documenting status and trends in groundwater quality, quantity and use;
- Improving of understanding of groundwater systems and groundwater/surface water interactions; and
- Improving communication of groundwater information to citizens, policy makers and resource managers.

The components of the groundwater monitoring strategy include:

- A summary of existing groundwater monitoring data to better identify what data is currently available and where gaps in our knowledge are;
- A fixed network of monitoring locations to be used by all agencies to answer groundwater quality and quantity questions;
- Groundwater quality sampling data in areas of concern;
- Stream flow monitoring stations in areas important to groundwater systems;
- Water use reporting data to improve optimization of groundwater resources;
- Data management mechanism; and
- Informational materials to communicate the state of groundwater in Wisconsin to citizens.

As funding becomes available to implement the components of the strategy, they will be integrated into WDNR's yearly monitoring plan. The GCC will take the lead role in data management while other agencies will continue to make improvements in their monitoring efforts based on the comprehensive strategy. The components of the strategy may change over time according to needs of the different agencies. The requirements of Chapter 160, Wis. Stats., will continue to be met under the strategy.

Groundwater Quality

Groundwater quality varies greatly throughout Wisconsin. Human-made contaminants of concern are Volatile Organic Chemicals (VOCs), nitrates, and pesticides. Iron, manganese, sulfate, arsenic and radium are naturally occurring groundwater contaminants that present health concerns and are present in Wisconsin groundwater. Microbial contaminants including viruses, bacteria, and parasites are also a concern. To address specific concerns the GCC selects research projects as part of joint solicitation process. DNR funded projects are listed below.

Nitrates

Nitrate-nitrogen is the most commonly found groundwater contaminant in Wisconsin. Of 10,112 private wells sampled in the state since 1991, 20 % exceeded the ES and 50% exceeded the PAL. The majority of these wells are located in agricultural areas. Arsenic

Naturally occurring arsenic in Wisconsin groundwater has become an important issue since it was first detected in 1987. The problem is especially prevalent in Outagamie, Shawano, Winnebago and Brown counties. In 2001, well sampling occurred in 15 townships in these counties. This data has not been evaluated yet, however, in two of the townships, almost 50% of the samples exceeded 5 ppb while 21.8% exceeded 10 ppb. In 2000, 3,300 public water supply systems were sampled for arsenic. Results show that 80 of these exceeded the proposed 10 ppb standard.

Radioactive Compounds

Two studies have been initiated by the WDNR to evaluate radioactive compounds in groundwater. In 2000, WDNR staff collected samples from 100 community and nontransient noncommunity public water supply wells which will be analyzed for total Uranium alpha activity, total Thorium alpha activity, Radium 226 and Polonium 210 alpha activities. Preliminary results indicate total Uranium is the major contributor to high gross alpha activities. A second study is looking at radon in drinking water supplies. WDNR staff will sample 340 noncommunity, nontransient and other than municipal water systems per year. Project results will determine the impact of new EPA standards for radon in drinking water. Preliminary results tend to support earlier findings that indicate approximately 50% of public water systems monitored in Wisconsin exceed the proposed radon standard of 300 pCi/L.

Joint Solicitation Projects

Continuing Projects:

Arsenic Contamination in Southeast Wisconsin: Sources of Arsenic and Mechanisms of Arsenic Release Jean Bahr and Madeline Gotkowitz, University of Wisconsin - Madison and Wisconsin Geological and Natural History Survey, Project #174.

New Projects:

Monitoring and predictive modeling of subdivision impacts on groundwater in Wisconsin Ken Bradbury and Jean Bahr, University of Wisconsin-Extension, Geological and Natural History Survey and Jean Bahr, University of Wisconsin - Madison, Project #178.

Field and Laboratory Validation of Photoactivated Adsorption for Removal of Arsenic in Groundwaters M. Anderson, University of Wisconsin-Madison, Project #179.

Development of a groundwater flow model for the Mukwonago River watershed, southeastern Wisconsin Jean Bahr, University of Wisconsin - Madison, Project #180.

Groundwater Pollutant Transfer and Export in Northern Mississippi Loess Hills Watersheds George Kraft and Bryant Browne, University of Wisconsin - Stevens Point, Project #181.

Future Groundwater Protection

Below are some of the priorities set by the Groundwater Coordinating Council for 2004.

- **Investigation of adverse impacts from groundwater withdrawals:** In FY 97, DNR staff with help from the Groundwater Quantity Technical Advisory Committee, completed a report on the groundwater quantity issue (see "Condition of the Resource - Groundwater Quantity" for the Executive Summary of this report). In the report, localized areas with groundwater quantity problems are identified and the effects of groundwater withdrawals on surface waters and long-term groundwater availability are discussed. There is a need to further quantify hydrographic relationships of surface and groundwater. The GCC should continue to encourage research efforts that will provide information useful in addressing this issue.
- **Investigation of recently discovered groundwater contaminants:** Recent research conducted in Europe and the U.S. indicates that traces of pharmaceuticals (including antibiotics and hormones) and pesticide breakdown products are common contaminants found in groundwater and surface water. Current testing methods do not allow adequate detection of these possible contaminants. Research is needed to determine whether these substances pose a threat to Wisconsin's groundwater resource. There is also a need to evaluate the sources, fate, transport, and chemistry of p-Isopropylbenzene (cumene), aluminum, molybdenum and strontium (non-radioactive form) in groundwater; evaluate existing databases; and sample at-risk potable wells for these contaminants.
- **Investigation of naturally occurring substances in groundwater:** Continued problems of elevated arsenic, low pH, and other water quality problems in domestic wells exist over large areas of northeast Wisconsin. DNR needs more information about the extent and causes of

these problems in order to give advice to homeowners and well drilling contractors. Additionally elevated sulfate and total dissolved solids have been found in some new deep municipal wells in the Lower Fox River Valley making the wells unusable. In some other existing deep wells as far south as Milwaukee the total dissolved solids have been steadily increasing over the years. These sulfate and TDS levels pose a problem for local water managers, and the origin of the dissolved solids is not completely understood.

- **Provide resources to local governments for Smart Growth/Comprehensive Planning activities.** Recent legislation has required local units of government to develop a comprehensive plan by 2010 in order to undertake land use activities. This plan must address 9 elements, including natural and agricultural resources, housing, utilities, and land use. This planning process presents a unique opportunity to address and implement groundwater protection at the local level. The GCC will seek ways to assist local communities in their planning efforts to encourage groundwater protection.
- **Promote consistency between the agencies on data management issues:** Through updates to the DNR's groundwater data system and the Directory of Groundwater Databases, state and local government agencies now have more convenient access to groundwater data. This effort must be maintained by continuing to identify what data needs exist and ways to make data easily accessible. Data consistency must be promoted by use of translatable geolocational coordinate systems and consistent data elements for use in a GIS environment. The GCC will continue to provide leadership and communication on data management through its subcommittees. This continued effort displays the GCC's commitment to management of the resource through sound scientific methods.
- **To act as a coordinating and facilitating mechanism for the publication and distribution of information and educational materials on groundwater related issues:** The public has benefited from the consistent educational messages that have been endorsed by the Education Subcommittee. The Education Subcommittee will continue to provide its leadership and assistance to state agencies providing educational materials to the public. Priorities for the future include promoting water stewardship, awareness of water quantity issues, and providing materials for local communities to assist in their comprehensive planning activities.
- **Distribution of findings from groundwater research or monitoring projects:** There has been considerable progress in preparing summaries of the results of groundwater-related monitoring and research projects funded through the joint solicitation process. More than 90 of these summaries are now available on the UW-WRI web site maintained by UW-WRI. The rate of response to the web site posting of research findings has been very encouraging so far. To maintain and enhance this response it will be important to add new summaries annually as they become available, create a more visually appealing set of front-end pages for the site, and publicize the web site location and content more widely. More work needs to be done to target interested audiences and distribute summaries and final reports more widely.
- **Identify tools that can be used to better predict Wisconsin's groundwater susceptibility to contamination:** Studies have demonstrated the need for developing statewide data layers that would facilitate better groundwater vulnerability assessments. These data layers include land use, soils, regional groundwater flow, hydrogeologic characteristics such as aquifer materials, and potential point sources of contamination such as underground storage tanks and pesticide spills. The studies also illustrate the importance of locational data for contaminant sources. The GCC's Planning & Mapping and Monitoring & Data Management Subcommittees have prioritized, promoted, and helped facilitate the development of data layers as part of a larger data integration initiative.
- **Research on land use management and its impact on the groundwater resource:** Additional research is needed on the effect of various land uses (e.g. urbanization) on groundwater quality and quantity. Several projects that study the impacts of land use on groundwater have been and continue to be funded through the joint solicitation. These projects must be managed in

such a way as to maximize their relevance to state land use problems. This issue crosses agency lines and promises to be an important issue for years to come.

- **Continued evaluation of alternatives to onsite sewage systems:** Although the DNR and Commerce have funded monitoring projects in this area, additional work is needed to find state-of-the-art private sewage system technologies that provide efficient, cost-effective options and protect groundwater resources.
- **Investigation of the causes and effects of nitrate in groundwater:** The GCC will support the agencies and the UWS in obtaining information pertinent to the human health implications of consuming nitrate contaminated groundwater and the effect of discharge of this groundwater on surface waters and their ecosystems. In addition, it will continue to facilitate consistent education to provide a clear message on the many causes and effects of nitrate in groundwater for urban and rural citizens.
- **Solutions to groundwater nonpoint pollution problems:** A 1997 DATCP report indicates that 8.5% of Wisconsin's wells still contain detectable atrazine residues. In addition, 10% exceed the nitrate standard. These rates are substantially higher in agricultural areas. Agriculture is the major source of these pollutants. More work is needed to determine how far Wisconsin groundwater will deteriorate without a substantial change in farming practices, and what practices will sustain both agriculture and groundwater quality.
- **Improved communication between local and state government:** The Local Government Subcommittee to the GCC was created in February 1993 to provide a line of communication between local and state governmental entities. To increase the responsiveness of state agencies to local government needs, local government needs must be communicated to the GCC and relayed to the appropriate agencies. An effort must be made by the GCC to increase interest in the GCC by local governments, and to offer opportunities to communicate concerns to regulatory agencies.





Our Mission:

*To protect and enhance our natural resources:
our air, land and water;
our wildlife, fish and forests
and the ecosystems that sustain all life.*

*To provide a healthy, sustainable environment
and a full range of outdoor opportunities.*

*To ensure the right of all people
to use and enjoy these resources
in their work and leisure.*

*To work with people
to understand each other's views
and to carry out the public will.*

*And in this partnership,
consider the future
and generations to follow.*





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