Wisconsin Water Quality Assessment Report to Congress 2002

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Wisconsin
Water Quality Assessment
Report to Congress

2002

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Water Division

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Introduction

Wisconsin is a state rich with resources – terrestrial, aquatic, cultural, intellectual, economic and human. It is the mix of how these resources are applied on the landscape that affects and is affected by the quality of our water. This report describes one aspect of this complex web of interaction – the known quality of our surface water and groundwater. While fundamental to the health of our state, this information provides only a narrow view into the type and level of function of our ecosystems. For a complete picture, this information must be interpreted in the context of other pertinent aspects of ecosystem health, such as the type and quality of our fisheries; the presence and quality of various ecological systems; and the type, quantity and location of human land uses, for example. Further, the information in this report is gathered, interpreted and understood through the prism of existing social, economic and political conditions.

Nonetheless, this summary of water quality in our state provides the most comprehensive view of the existing condition of water quality in the state. As WDNR moves forward to develop and implement tools to enhance the ease and accuracy of assessing waters, we anticipate being able to report a more accurate and more complete picture of water resource condition.

January 2003

Subject: 2002 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 was prepared to satisfy requirements of the Federal Clean Water Act. We have included recommendations to identify existing problems and programmatic gaps that need to be addressed if we are to attain the state and national goals of waters that fully support fish and aquatic life uses as well as our societal needs.

This report includes a statewide update of water quality assessment data for lakes and a partial update of our river assessment information. From this analysis, it is clear that great progress has been made in restoring the integrity of our waters. Point source problems have been largely controlled and significant progress has been made in developing a framework to improve management of nonpoint sources. Yet other problems continue to limit use of surface and groundwater supplies and consumption of fish and other related aquatic life. These problems also continue to degrade the welfare of our state's aquatic ecosystems. Additionally, the seemingly inexhaustible amounts of water available to us may now be more limited than we previously believed, calling into question our existing water quantity management approach. Issues like contaminated sediment, atmospheric deposition of pollutants, habitat alteration or degradation, and introduction of exotic species all pose additional significant threats to our waters. Some types of land management activities or poorly planned development also exert negative impacts on groundwater quality and quantity. In addition, as demand for clean water continues to grow in the future, the relationship between surface water and groundwater supplies will need to be better understood.

We are moving into a realm of extremely complex water management issues. These issues cannot be addressed by the Department or by any governmental entity alone. Whether we need to reduce phosphorus or mercury, protect critical habitat or prevent introduction of exotics, we need strategies that allow us to work together — government, industry, advocacy interests and individual citizens. To be most successful, these efforts need to be coordinated and integrated using a regional hydrologic orientation: *the Watershed Approach*.

The first step in developing a state watershed program requires a common understanding of the current state of our water resources and the problems affecting them. The enclosed report provides a first step in that direction. Please take this report and use it to help determine the status of waters in your watershed. By familiarizing yourself with the existing problems, you can help identify and implement necessary solutions. Together we can start to resolve our remaining problems and to prevent additional future problems. By shaping and sharing common goals for our watersheds, we can all work together to restore and protect the unique water wealth that largely defines the State of Wisconsin.

For more information about this report, please contact Ms. Lisa Helmuth at 608-266-7768. I encourage you to participate in watershed management effort in your area — for everyone's support and involvement is needed to successfully protect our state's water resources.

Sincerely,

P. Scott Hassett, Secretary

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Recommendations

Many of the specific needs for action could be most effectively addressed through a reauthorization of the Clean Water Act. This would also be the most effective approach for resolving the needs, which are currently identified through the Gap Analysis. The Gap Analysis is defined as the difference between currently available staffing and fiscal resources and the staffing and fiscal resources necessary to manage and implement state water quality programs in a way that would achieve the environmental and public health goals contained in the Clean Water Act. The recommendations are summarized below.

Congress should complete reauthorization of the Clean Water Act, incorporating the following issues:

- U.S. EPA should establish a schedule for the finalization of national nutrient criteria guidance.
- U.S. EPA should establish a schedule for the completion of national guidance for sediment quality criteria.
- U.S. EPA should develop watershed management program guidance, which requires sources regulated by the Toxic Substances Control Act (TSCA); the Resource Conservation and Recovery Act (RCRA); the Clean Air Act or the Federal Insecticide, Fungicide, Rodenticide Act (FIFRA) to be integrated in accordance with water program requirements. Include the concept of best environmental management by allowing the state director to waive specific requirements or individual categorical requirements related to specific source controls. The objective is to implement integrated solutions that would cause the improvement of water quality through installation, or use of, best or most feasible technologies.
- U.S. EPA should develop consistent national goals for attainment of water quality standards through Total Maximum Daily Loads (TMDLs) or other watershed implementation strategies, such as development of regulations and guidance to address atmospheric deposition and “air TMDLs.”
- U.S. EPA should establish national water resource monitoring programs to ensure that consistent and timely data are available to assess the condition of the nation’s waters including protocols for sampling and analysis.
- The U.S. Congress should establish base appropriations to fund state obligations created by the federal commitments in the Boundary Waters Treaty with Canada and the associated Water Quality Agreement. This includes both staffing and project implementation funds to address the restoration of use impairments identified in both remedial action plans and lakewide management plans.
- U.S. EPA should increase funding for Clean Water Act Section 106, 104b(3) and 205(j) or local 604(b) related water quality planning efforts.
- U.S. EPA should develop technical guidance and resources to support management decisions related to wetland and riparian zone protection and management.
- U.S. EPA should develop lake protection and management programs supported by technical research, technology transfer activities and resources for implementation funding.
- U.S. EPA should incorporate water resource needs as the basis for national and international efforts to reduce atmospheric transport and deposition of toxic pollutants.
- U.S. EPA should move to quickly modernize the PCS data system for the NPDES program or implement other information technology systems and/or reporting mechanisms that provide the information necessary to implement the national program.

The Coast Guard should establish clear and concise biological standards for the discharge of ballast water that is 99-100% effective (the goal is zero discharge) in preventing the introduction of new invasive aquatic species. In conjunction with development of a standard, a short-term plan should be developed to address the problem of NOBOBs (No Ballast On Board). An implementation schedule should be set to achieve the new technology in a series of steps for both new and existing ships. Subsequently, the standards and the implementation schedule should be incorporated into the reauthorization of the National Invasive Species Act.

Part I: Report Summary

Wisconsin's overall water quality remains good. While the number of diffuse sources of pollution continues to grow with increases in development statewide, strategies and programs to stem problems with reduced infiltration, urban and rural runoff, and degraded groundwater quality are also moving forward. These programs include statewide performance measures for nonpoint sources of pollution, identification of source water protection areas, and a number of public-private waterbody restoration projects.

Additionally, Wisconsin is improving its tracking of water quality condition through new data management applications that take advantage of new communication technology. These data systems include a river and lake monitoring and management database and enhancements to the state's waterbody assessment database. In time, these data will be linked to spatial representations, or maps, of the state's water features for point-and-click information at the waterbody level.

This report describes the how the state's 57,698 stream miles faired during the Year 2002 assessment period. While 24,422 stream miles were "assessed" — 9,199 miles were monitored and 15,222 miles were evaluated — 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. In addition, habitat alterations other than flow 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 of problems are the presence of turbid waters, low dissolved oxygen readings and the presence of pathogens (bacteria).

Sources of these problems include atmospheric deposition (57,698 miles), agriculture (5,620 miles), hydrologic modifications (4,223 miles), and non-hydrologic-based habitat modifications (3,583 miles), and stream bank pasturing (2,736 miles). These stream figures reflect historic data (gathered prior to 2000-02), as well as assessments made in 2002. Approximately 50 percent of the available 2000-02 assessments were entered into the watershed database to calculate these numbers. Thus, key cause and source categories may change when the remaining updated information is entered into the database.

Wisconsin lakes have been more comprehensively monitored than streams, according to the assessment database. Over 792,000 lake acres have been assessed, with 758,782 monitored and 33,519 miles 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 beneficial uses, with mercury via atmospheric deposition the chief cause/stressor to lakes. Other causes of problems include excess nutrients, siltation, organic enrichment, noxious aquatic plants, and the presence of exotic species. Key source categories include agriculture, construction activities, hydrologic modifications (including dam construction and flow modification), and habitat modification other than hydrologic modification related.

Wisconsin plans to achieve comprehensive coverage of its waters through a variety of methods, including the implementation of a baseline monitoring program utilizing random stratified sampling techniques, as well as better tracking and assessment of all waterbodies. These improvements will allow Wisconsin to better understand and communicate general trends or changes in water quality over time.

Issues of special concern to the state include eutrophication, aquatic nuisance species, water quantity issues, riparian development, habitat protection and restoration, the presence of mercury and the need for improved monitoring and data management. Water management techniques being used include (just a sample):

- management of water resources through the basin management (or watershed management) approach,
- development of integrated resource management plans,
- development of biological indicators or biocriteria for wetlands,
- development and implementation of performance standards for nonpoint sources of pollution, and
- development of public/private partnerships in the area of pollution prevention, innovation, and resource monitoring.

Part II: Background

Atlas Data

Wisconsin is a state rich in water resources. There are more than 32,000 miles of perennial rivers and streams and approximately 23,000 miles of intermittent rivers and streams for a total of 57,698 linear stream miles. The state has 15,057 inland lakes (about 944,000 acres) of which 6,040 are named and 9,017 are unnamed. Wisconsin also has 1,751 square miles of Great Lakes' estuaries and bays that adjoin 1,017 miles of Lake Michigan and Lake Superior shoreline, 5.3 million acres of wetlands and two quadrillion gallons 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 Geographic Management Units (GMUs) for the purpose of managing water resources. GMUs 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 waterbody assessment database for all GMUs in 2002. Figure 3 shows that all of the GMUs have been assessed for aquatic life use and fish consumption advisories, yet stream assessments for only 9 of the 21 GMUs have been entered into the 305b database. The results of these assessments are discussed in Chapters 3 and 4.

Figure 1. Map of GMUs, counties, basins

Figure 2. Map of assessment work completed for lakes

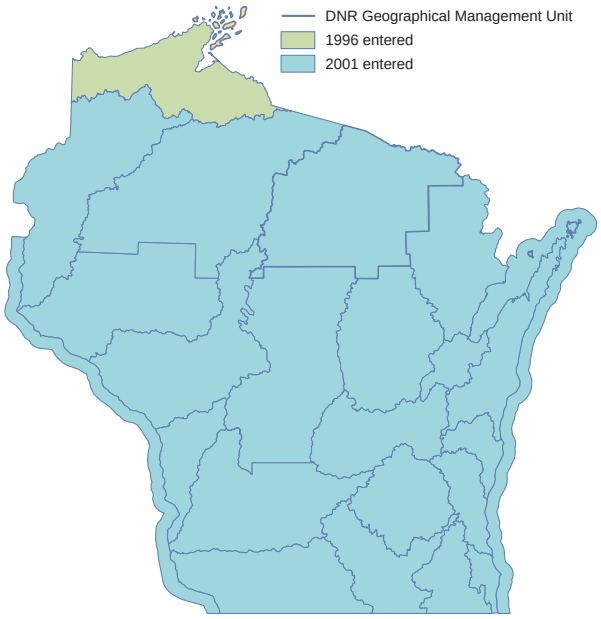
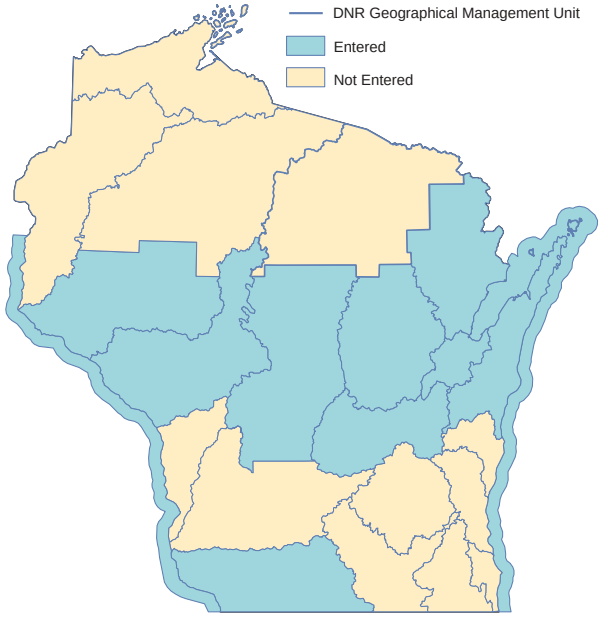


Figure 3. Map of assessment work completed for streams



Resource Management Framework

To learn more go to: http://www.dnr.state.wi.us/aboutdnr/plans/

Strategic Planning

In the summer of 1999, we completed the Department's Strategic Plan. Our Strategic Plan presents our four goals - Making People Our Strength, Providing Outdoor Recreation, Sustaining Ecosystems and Protecting Public Health and Safety - plus numerous strategies that will help us achieve our goals. Shortly after the Strategic Plan was completed, we initiated our efforts to create the Strategic Implementation Plan. The purpose of this Plan was to create clear, measurable objectives of major outcomes that the Department wants to achieve between now and 2006. These objectives typically state *what* we want to achieve - whether it is improving the working environment for staff, cleaner air and water, or better recreational opportunities for our citizens and visitors - and by when. *How* we achieve these objectives is not described in the Strategic Implementation Plan; the paths for achieving these objectives will be found in the creativity of our staff and partners. And, we'll know whether we're successful in achieving our objectives by following the performance measures that are included in the Strategic Implementation Plan, along with the stories that we create to describe our efforts.

This Strategic Implementation Plan establishes a limited number of objectives that are intended to provide a link between the Strategic Plan and the everyday work done by department staff, as set forth in biennial work plans. The objectives in the Strategic Implementation Plan are limited to those that emphasize newer directions and strategic initiatives. As part of the Strategic Implementation Plan Process, the department has identified performance measures by which achievement of the objectives can be determined. The department is committed to evaluating progress towards achieving the plan objectives and to reporting progress based on the performance measures. Biennial work plans will continue to allocate time and resources to these "core" activities. Some programs, such as forestry, fisheries and wildlife, are developing more specific implementation plans to further guide their work and assure that the work important to the public will be accomplished.

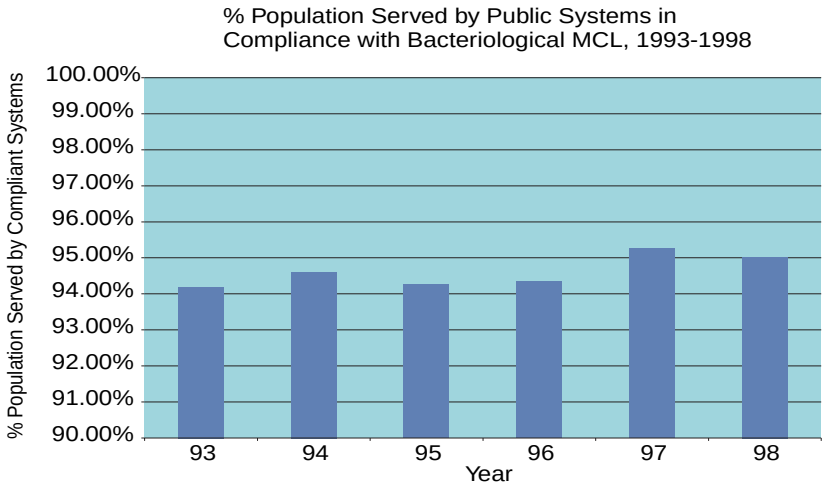
To effectively achieve its mission and the four goals, the department is using an Ecosystem Management Decision Model. The model helps department staff make decisions that sustain Wisconsin's environment, economy and quality of life. Under this model, department staff share ecological, social and economic information with the public to effectively engage them to collectively make decisions within the context of guiding laws and institutions. The department will apply the model to address the four goals of *sustaining ecosystems, protecting public health and safety, providing outdoor recreation and making people our strength.* The objectives outlined in this Strategic Implementation Plan will be the strategic focus of the department over the next six years. The objectives will be reviewed and modified, as appropriate, each biennium.

Performance Measures

In support of the Department's Strategic Planning and Implementation effort, the DNR began developing performance measures for aspects of the ecosystem and the programs designed to manage resources. These performance measures were "reported out" in the state's first and second "State of the Natural Resources Report," published in 2000 and 2001. In the Water Division, performance measures were developed for a variety of ecological and work-based aspects of resource management. Some of these performance measures had previously been identified in the state's Environmental Performance Partnership Agreement as core performance measures. Examples of water-related performance measures include:

- River Restorations/Dam Removals
- Walleye Densities, Catch Rate
- Commercial Whitefish Harvest on Lake Michigan
- Distribution of Zebra Mussels
- Number of stream miles meeting or not meeting their potential uses

Figure 4. Graphic of a performance measure as an example



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. Prior to 1999, Wisconsin integrated its water and water-related programs to protect water quality through basin planning and linking this planning with monitoring, regulatory and non-regulatory action, such as grant distribution. Each plan described water resources and recommendations for actions on an array of water-related issues.

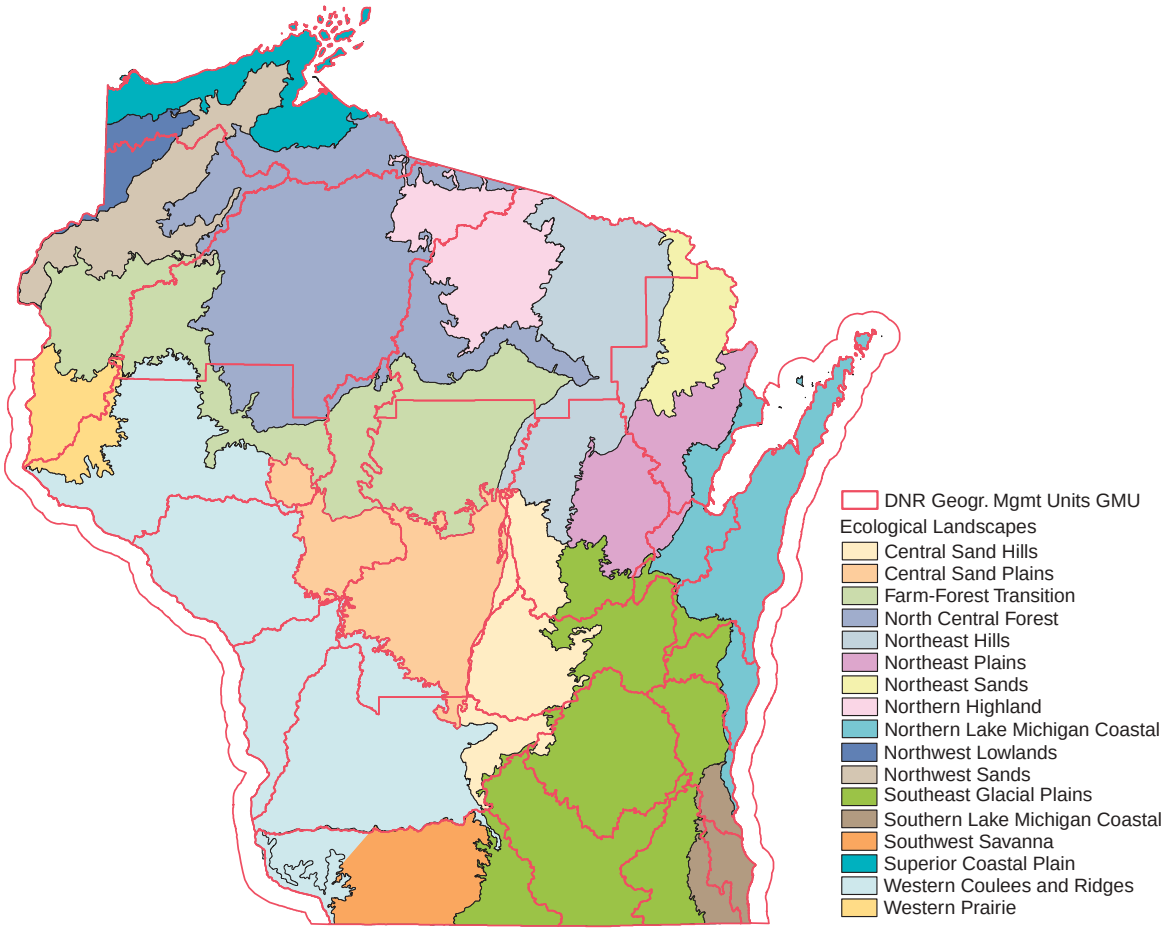
Implementation of DNR's reorganized structure, however, has called for moving beyond a programmatic or media-specific approach. While still focused on the basin as a hydrologic unit (modified by the state's Geographic Management Unit (GMU) structure), the Watershed Approach has moved even closer to an idealized model for ecosystem management and protection. With the GMU or Basin as the focus of planning and management, the integrated planning process (see

below) has enhanced the breadth of coverage, including such diverse areas as water quality, fisheries, habitat, wildlife, and forestry. Connections to the state's Ecological Landscapes Fig 5, which describe an area's ecological potential, are being made. Further, integrated plans are being developed through meaningful cooperative decision making on priority issue identification and strategic direction between the GMUs/Basins and partner groups. In each plan this participatory dynamic is exhibited somewhat differently, reflecting the necessarily adaptive framework employed to involve the people and address the issues pertinent to particular basins.

With the broadening of Wisconsin's Watershed Approach, the depth of water-related information in the plans has somewhat diminished. However, because Integrated Planning is focused on developing "living documents," resource-specific reports such as research projects or issue summaries will be amended to the initial reports, providing fresh, detailed information on an ongoing basis. Further, the Division of Water will continually look to the redesign and re-adaptation of its programs to remove unnecessary impediments to integration and to utilize incentive-based resource management practices where possible. The Division will focus on integrated data management, structural linkages between critical watershed initiatives such as an Agricultural Strategy, the Conservation Research and Enhancement Program (CREP), and a new eutrophication strategy; performance indicators and monitoring; and adaptive management paired with evolving regulatory (TMDLs, permits, nonpoint source performance standards) and non-regulatory (monitoring, data communication, EMS, Green Tier) approaches or tools.

Further, the Division of Water will continue to rely on the state's Watershed Advisory Committee, the Groundwater Coordinating Council, and in-place processes such as the Upper Mississippi Water Quality Task Force work, the Lake Superior Bi-National Program, the two Great Lake LAMPs, and the St. Croix Basin Water Management Initiative.

Figure 5. Map of Ecological Landscapes vs. GMUs



Science and Innovation in Water Management

To learn more go to: http://www.dnr.state.wi.us/org/es/science/project/project.htm

During 2000 and 2001, 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

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. Practical, standardized procedures have been developed for determining the characteristics and quality of wadeable stream physical habitat and fish communities. 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 11 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*. DNR is in the process of evaluating Otter Creek watershed, which will continue through 2002. Due to the lack of BMP implementation, sampling three of the five priority watersheds has been discontinued until sufficient BMPs have been installed. The results from Spring Creek provide novel information regarding the sufficiency of riparian and watershed BMPs in improving stream habitat and biological communities.

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 of - 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. *Preliminary results indicate that stream base flow and biological indices decrease dramatically for watersheds with 7-11% imperviousness, beyond which stream base flow is consistently low and biological indices are consistently poor.* No trout is found in streams with more than 11% imperviousness. The models that will be developed 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.

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 was 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. At the time of report publication, collection of field physical and biological data and developing GIS layers for watershed characteristics was being conducted. The developed 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 land-use 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.

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

The objective of this project is to determine what phosphorus and nitrogen concentrations impair stream biological integrity; to develop 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. We have gathered data for N, P, periphyton, macroinvertebrate, fish, and physical habitat from 160 wadable streams and are in the process of gathering watershed land use and identifying periphyton and macroinvertebrate. The result of this study will be used to help interpret TMDL data and to refine nutrient standard.

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 answer if large-scale, low-level BMP implementation will improve stream quality.

Status Assessment and Development of a Fish IBI for Small Warmwater Streams

The objectives of this study are to evaluate fish and habitat status and to develop a fish IBI for small warmwater Wisconsin streams. Ninety-eight (98) small warmwater streams throughout the state with different levels of impairment (from lest 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.

Impacts of Land Use and Groundwater Flow on Trout Streams Water Temperature

The objective of this study is to modify and calibrate a stream water temperature model developed for the driftless area (in Wisconsin) for use in the other state ecoregions. Water temperature, stream flow, and channel morphology data have been collected from six trout streams and watershed and riparian land use information is being gathered. The results of this study will be used to (1) evaluate potential impacts of changes in management of riparian zone on stream temperature; (2) evaluate potential impacts of watershed land use on groundwater discharge and stream temperature; (3) determine the sensitivity of stream temperature to changes in groundwater inflow.

The Effect of Near-Shore Development on Water Quality Loadings to Lakes in Northern Wisconsin

Over the past two years, the Bureau of Integrated Science Services and US Geological Survey have been involved in a field study to compare nutrient losses from lake-shore residential lawns to adjacent natural forest areas. Lawn/forest pairs were chosen at four lake locations in Vilas or Forest counties. Both surface runoff and ground water quantity and quality were monitored over the two-year period. Nutrients quantified included ammonia, nitrate, total Kjeldahl nitrogen, dissolved and total phosphorus.

The total number of runoff samples generated at the 11 sites varied from zero to 25 with lawns generally producing more runoff than the adjacent forested areas. The sites producing the largest quantities of runoff were either underlain with clay or facing south, which resulted in rapid large volume snowmelt events. Differences in nutrient yields (lbs/ac/yr) were generally found between lawn and forested paired sites. Twenty-nine out of the 35 paired comparisons were significantly different ($p<0.05$), with the lawns producing a greater nutrient yield.

Monitoring & Assessment

Development of a Probability-Based Stream Monitoring and Assessment Strategy

Millions of dollars have been spent in the state of Wisconsin on monitoring and watershed and stream management activities, yet aside from limited site-specific examples, there is little evidence of the effectiveness of these efforts in broadly protecting or restoring stream resources. Certain land use practices continue to significantly impact many of the state's waters and in some areas continued severe degradation of stream resources are apparent. In the absence of comprehensive data on the status of Wisconsin's stream resources and lack of understanding of how land use factors impact streams, politics continue to drive land and water resource management activities. To reverse stream resource losses, improvements in stream monitoring, assessment, and greater understanding of factors impacting water resources are needed. The resulting data and 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 the Wisconsin Department of Natural Resource's (WDNR) wadable stream monitoring and assessment program, and advance and institutionalize the use of probability-based monitoring in Wisconsin.

Refinement and expansion of the Wisconsin wetland biological index for assessment of depressional, palustrine wetlands

This project represents the evaluation and expansion phase of an earlier study that resulted in the preliminary development of a Wisconsin Wetland Biological Index based on plant and macroinvertebrate metrics. This study is designed to: 1) Test and refine a Biotic Index for Wisconsin's palustrine wetlands. 2) Expand the list of assemblages to include macroinvertebrates, zooplankton, diatoms, amphibians, plants, and small mammals. 3) Establish a biological integrity rating system for classifying wetlands based on the response of selected biological attributes (metrics) of the above communities to surrogate measures of human disturbance

Data from the current study will be used to refine and further evaluate the preliminary indices and expand communities covered to include zooplankton, diatoms, amphibians, and small mammals. Field studies for this project were conducted during the spring and summer of 2000, with laboratory analysis and data synthesis in progress. Funding was provided by a grant from the U.S. Environmental Protection Agency - Region 5. A final report will be prepared and distributed after April1, 2002.

Water Management Programs

Water Quality Management Planning

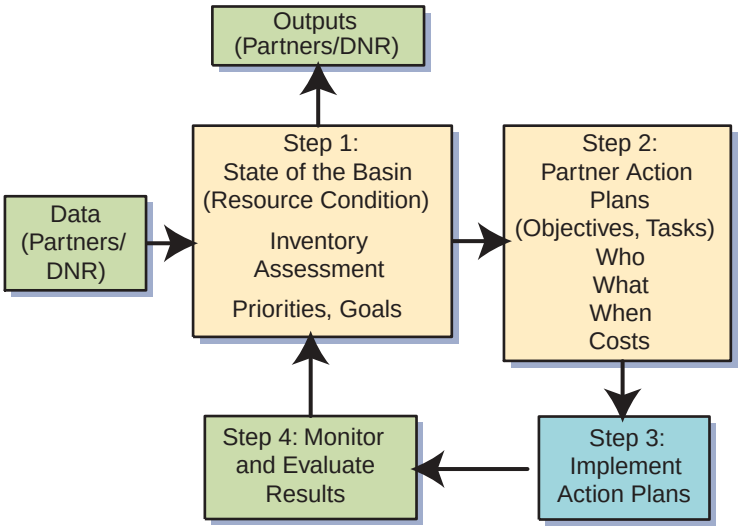
Wisconsin's Water Quality Management Planning Program encompasses a broad array of activities, as the 'basin plans' serve as the foundation for conformance reviews during implementation of many of the state's water-related programs, grants and permits. Water Quality Planning includes the following key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

- Preparation of 'Basin' or Integrated Management Plans under NR121;
- An assessment of rivers, streams, lakes and groundwater in basin plan "watershed tables"; includes identification of potential waterbodies for addition or removal from state's Impaired Waters (303d) List;
- Identification of key areas for monitoring and management and identification of goals, objectives and projects;
- Ranking of nonpoint source priorities for large scale, small scale and individual streams or lakes for ranking under the state's Targeted Runoff and Urban Stormwater Grant Programs;
- Recommendations for specific Lake or River Planning or Protection Grants, which provide additional weight to the applicant's proposal during the grant award process;
- Recommendations for prioritization of total maximum daily load (TMDL) implementation among a region or GMU's identified Impaired Waters;
- Administration of the Local Water Quality Aid Program or "604b Grant Program," which provides grant funds to local and regional governments for assistance to DNR in administration of various aspects of the Clean Water Act, specifically water quality management planning;
- Preparation of Sewer Service Area Plans under NR121;
- 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 major portions of the East Central Regional Planning Area;
- Oversight, review and approval of plans developed by communities with populations of greater than 10,000 – these undesignated planning areas.

Integrated Basin Plans

The State's 32 river basins fall into 23 geographic management units (GMUs), 21 of which are "inland." During 2000-2001, each of the 21 in-land GMUs or 'basins' was responsible for developing a State of the Basin Report through the integrated planning process. This multi-step process (Figure 6) utilizes the strengths of the basins external partnerships to identify, prioritize and implement goals and objectives for ecosystem management. First, the basins worked with partner groups to evaluate data and identify key issues or priorities for the area. The resource inventory takes into account WDNR data and other available information on water and land resources to develop an accurate ecosystem assessment for each basin. Second, basins developed goals, objectives and tasks or recommendations for specific work projects, which provided the basis for work planning and budget decisions for fisheries, habitat, wildlife, and water resources. For DNR the Step 2 in the integrated planning cycle will involve translating these priorities, goals and

Figure 6. Four-step integrated basin planning process



objectives into workplan commitments under the state's biennial workplanning cycle. Step 3 involves implementing these projects over a two year period, and Step 4 involves both ecological monitoring and program monitoring and evaluation to assess whether the plans priorities and goals have been reach, and to evaluate if new priorities and goals should be developed due to changing conditions.

Integrated Basin Plans (or "State of the Basin Reports"):

- Highlight priorities identified through a partner group process;
- Provide a descriptive summary of the physical and biological characteristics of the basin;
- Identify GMU-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.

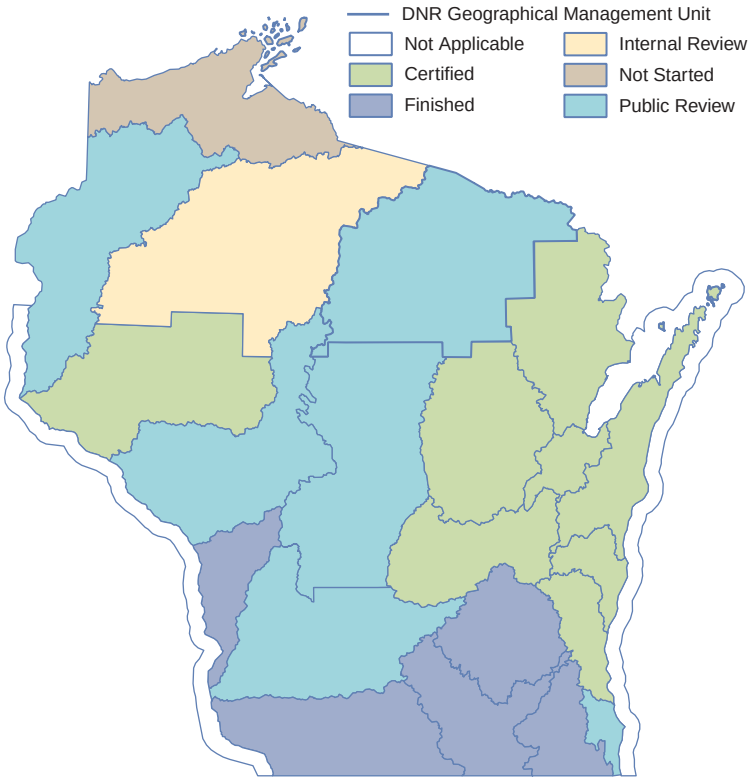
Planning Status

The state's traditional planning schedule, that of plan updates on a five-year rotating basis, was replaced with a simultaneous six-year schedule to support the structure of the basin/GMU-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. Through refinement of the Integrated Planning Process over the next few years, the Division will make additional linkages to enhance how this process supports internal needs and external reporting requirements. Figure 7 shows the status of integrated plan development.

To learn more go to: http://www.dnr.state.wi.us/gmu/index.htm

The broadened scope of water quality management planning reflects a broadening of the state's key management issues as they relate to water. Priority issues identified in newly developed integrated plans are arrayed and compiled to identify the overall priorities identified at the GMU or basin level. Figure 8 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 7. Status of integrated plan development

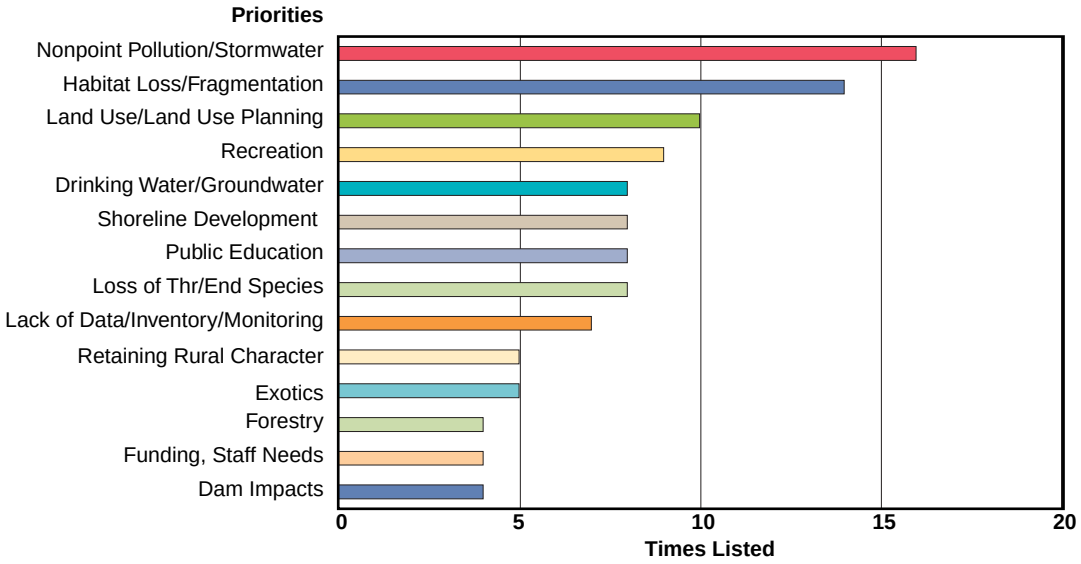


WDNR continues to make progress toward increasing the number of surface waters assessed for their water quality condition. This effort will be enhanced in the next year through an analysis of assessment protocols for streams, lakes, Great Lakes and how these 305b assessments relate to the state's impaired waters or 303d list.

The primary issues for streams continue to be degraded habitat and polluted runoff. For lakes, it is mercury contamination from airborne pollutants, polluted runoff, and hydrologic modifications and shoreline development.

For the Great Lakes, priority issues include fish consumption advisories, the presence of toxic pollutants, runoff and habitat loss. For wetlands, it is degradation and loss of wetlands through development, and for groundwater, contaminants from agricultural activities, groundwater quantity issues, and storage and spills of materials.

Figure 8. Principle Issues Identified through the Integrated Planning Process



These problems are addressed through a variety of programs and initiatives focused on stemming the influx of contaminants as well as removing in place contaminants from historic discharges. This work can be achieved through end of the pipe controls, pollution prevention or enhancing ecosystem function by securing buffers or wild places. The following is a summary of DNR's core water programs.

Local Water Quality Planning Aid Program

The Local Water Quality Planning Aid (LWQPA) Program is a grant program designed to support local and regional water quality planning activities that assist WDNR in its administration of the Clean Water Act. Grant priorities are determined based on statutory requirements, bureau priorities and emerging issues. WDNR receives authority for this grant program from 604(b) of the Federal Clean Water Act, s. 281.51, Wisconsin Statutes and from Chapter NR 121 of the Wisconsin Administrative Code.

Grant Priorities and Eligibility

Financial support is provided to local and regional planning agencies to assist the WDNR in the development of watershed and areawide water quality management planning activities. The first priority is the funding of water quality implementation in designated management areas of the state, as defined in NR 121. These areas include the Southeast Wisconsin Regional Planning Commission (seven counties in southeastern Wisconsin), Dane County, and the Fox Valley Region that encompasses Brown County and portions of the East Central Regional Planning area. A second priority are those areas in the state that are required to develop sewer service area plans, or long-term plans that identify where public sewers will be placed in the future (refer to the Sewer Service Area Planning section). Municipalities with populations greater than 10,000 are required under law to develop such a plan. These are called "undesignated" or "nondesignated" management areas (designated versus undesignated planning areas). This grant program generally funds the first of these plans for the community. The community is then responsible for the implementation of the plan, including updates. A third priority is plans and studies that support watershed management. Examples include municipal stormwater analyses for municipalities with populations greater than 10,000, regional wastewater facility planning studies, identification and protection of environmentally sensitive areas (environmental corridors), or special watershed studies in support of pollution trading.

In addition to the ongoing funding of RPCs in the designated management areas (DCRPC, SEWRPC, BCPC, ECRPC), recently funded projects include:

- Cities of Beaver Dam, Monroe, Platteville and Watertown Sewer Service Area Plan development;

- Stormwater Management Study by the city of Platteville to evaluate impacts to Rountree Branch River;
- Village of Lake Delton wastewater infrastructure study (lift station analysis).

Sewer Service Area Planning

Sewer Service Area Planning is a process that anticipates a community's future needs for wastewater treatment. This planning helps protect communities from adverse water quality impacts through development of cost-effective and environmentally sound 20-year growth plans for sewerage systems. A sewer service area plan identifies existing sewered areas, adjacent land most suitable for new development, and areas where sewers should not go because they are environmentally sensitive and would cause adverse impacts on water quality. Sewer service area planning plays an important role in keeping Wisconsin's water safe for drinking, recreation and fish and aquatic life. The plans are designed to provide structure to a community's wastewater collection system. The plans also accommodate current and future growth while at the same time consolidating wetland, shoreland and floodplain protection programs within a community-based plan for sewered development.

In "undesignated 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 "undesignated area" definition. Most of these 28 areas have an approved sewer area plan. Only a handful (6) require the development of an initial plan to come into compliance with state law (See Table 1 below).

Table 1. "Undesignated" Communities Needing a SSA Plan

City, County	Population (1999)*	Plan Required	Plan In Place?
C PLATTEVILLE, Grant	10,030	Yes	In Development
C BARABOO, Sauk	10,487	Yes	In Development
C MONROE, Green	10,638	Yes	In Development
C FORT ATKINSON, Jefferson	11,342	Yes	No
C WHITEWATER Jefferson, Walworth 2,582+10,920=	13,502	Yes	No
C WATERTOWN Dodge, Jefferson 8,002+13,149=	21,151	Yes	In Development

* Population Projection from the Wisconsin Department of Administration website

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 codes, ranging from the classification of the waterbodies found in NR102 to the specific details on how to calculate effluent limits for toxic substances found in NR106. NR103 provides water quality criteria for wetlands and NR104 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). NR105 provides standards for toxic substances and NR 106 details how to implement standards found in NR105 through calculation of water quality based effluent limits or "WQBELs."

Water Quality Classifications

NR102 identifies water quality classifications for Wisconsin Surface Waters (see below). WDNR uses the state's fish 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. All surface waters in the state not listed in Wisconsin Administrative Code NR 104 are, by default, classified as warm water forage fish communities.
- 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. By January 1993, through a highly public and controversial process, a significant number of waters were added to Chapter NR 102 as ORWs and ERWs. At that time, only two flowages were included as ORWs because the WDNR did not have adequate information or a systematic approach for classifying flowages. Subsequently, at the direction of the Natural Resources Board, the agency conducted an extensive monitoring and evaluation program on eight flowages over a 3-year period from 1993-96. As a result of that effort, selection criteria were developed by the WDNR staff for flowages and approved by the Natural Resources Board. Four flowages were classified as ORWs using these criteria and added to the list of waters in NR 102 in January 1998. These flowages, all of which are located in northern Wisconsin, include the St. Croix Flowage in Douglas County, the Gile Flowage in Iron County, the Willow Flowage in Oneida County and Caldron Falls Flowage in Marinette County. The classification of these flowages corresponded with the state's purchase of 16,145 acres surrounding the Willow Flowage from the state's Stewardship Fund.

No additional waters have been classified as ORWs or ERWs since January 1998. Below is a summary of the number of waters that are classified in NR 102 as Outstanding and Exceptional Resource waters:

	ORWs	ERWs
Streams	220	1532
Lakes	97	
Flowages	6	

To learn more go to: http://www.dnr.state.wi.us/org/water/wm/glwsp/

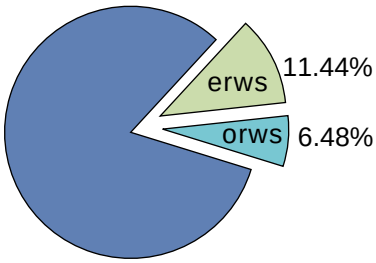


Figure 9. ORW/ERW Waters as a Percent of Waterbodies Statewide

Figure 9 shows that 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 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

Phase I: 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 they type of aquatic life community that may be supported by a surface water after carefully considering its naturally occurring 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 DNR is currently updating the aquatic life use designations and is repackaging the rules in a more logical, user-friendly format. In the original NR 104 (October 1976), streams that did not meet standards for fish and aquatic life, primarily due to natural conditions, were listed in the rule. 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. Since the original publication of NR 104 many additional streams have been evaluated and need to be added to the rule. In addition, many of the classifications conducted in the 1970s have been reviewed and, based on new information, need to be reclassified to another classification sub-category. These changes in classification carry with them different water quality standards and associated requirements (e.g. effluent limitations for point sources).

To properly update stream classifications, revisions to chapters NR 102, 104 and 106 are necessary. The revisions will be completed in two phases. In Phase I, the revisions are minimal and focus primarily on accurately updating current classifications. There are no use designation changes included in the Phase I rule revision that force a WWTP upgrade – this revision is 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:

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 rule to locate 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 "limited use" waters 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*, has been re-titled. The proposal is to change the title to "*Water Quality-Based Effluent Standards and Limitations for Discharges to Limited Aquatic Life Waters*." The purpose of this subchapter is to specify how the department will determine effluent limitations for substances discharged to waters that have been designated as "limited use" surface waters.

Phase II: Water Body Use Designation and Five Subgroups

Phase II of the rule revision deals with several issues. One issue that will be completed by the department is to compile and maintain an updated listing of all classified waters in NR 104 - including outstanding resource waters (ORWs) and exceptional resource waters (ERWs). All classified waters will eventually be made available in a GIS (Geographic Information System) format for use with appropriate data systems. Five other main issues will be addressed under the purview of the Water Body Use Designation Advisory Committee (WBUD AC), which has members from the academic, environmental, and regulated community. This advisory committee has been sub-divided into five different subgroups which each deal with a specific WBUD issue. Following are brief explanations of each of the five subgroups that are part of the WBUD AC.

SUBGROUP 1: Use Designation Guidelines: The guidance that is used by Department staff to designate surface waters was completed in 1981. The Department, with much internal and external input, has re-drafted this guidance for designating fish and aquatic life uses for Wisconsin surface waters using current knowledge and science. Cold water use designations have been expanded to account for different dissolved oxygen requirements and the procedures used for classifying fish and aquatic life waters have been updated and more fully developed. The subgroup has provided input and commented extensively on the Guidance.

SUBGROUP 2: Cold Water Issues and Great Lakes Drinking Water Designation: This subgroup is dealing with issues related to seasonally protecting fish species that may be present in surface waters during specific times of the year and also determining drinking water designations with respect to Great Lakes tributaries.

Currently, the subgroup is discussing which categories of streams should be considered for seasonal use classifications. This determination is based on an assessment of where dischargers are located on tributaries as well as what tributaries are currently or proposed to be managed for cold water species. Initially, this effort focused on the tributaries to the Great Lakes, but has since been expanded to consider the seasonal classification approach for inland waters.

This subgroup has also completed an analysis of where persistent bioaccumulative toxic substances (PBTs) have been detected in the Great Lakes Basin. This analysis will be used to develop a site-specific approach for developing limits for discharges of toxic substances to protect drinking water sources. This site-specific approach will be used while additional data is gathered to develop a more comprehensive approach.

SUBGROUP 3: Effluent Channels/Discharges to Dry Runs/Ratcheting: This subgroup is dealing with situations where a discharger "creates" a continuous flowing surface water (and thereby habitat for aquatic life) by virtue of the location of their discharge.

The subgroup has agreed on a definition of an effluent channel and is discussing a proposal for how to deal with discharges to dry runs (including effluent channels) and the ratcheting (more restrictive limits) issue.

SUBGROUP 4: Wetlands: This subgroup is dealing with wetland use designations — how to determine those use designations and how to protect wetlands from discharge impacts. Increased flows to wetlands from discharges that adversely impact the functional value of a wetland are of major concern.

SUBGROUP 5: Implementation Strategy/Procedural Issues: This subgroup will determine how to mesh and implement the different approaches proposed by the other four subgroups. To date, this subcommittee has focused on how to involve "interested parties" in the use designation process.

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 the Department: Fish and Aquatic Life, Recreation, Public Health and Welfare (including drinking waters), and Wildlife. Of these classifications, the Fish and Aquatic Life classification is designed as a water quality standard 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: Salmonid A, Salmonid 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 table below.

There are environmental requirements associated with each Fish and Aquatic Life sub-category. These physical and chemical characteristics of water volume, habitat structure, and water quality are used to determine an appropriate use designation. Each of these factors influences the assemblage of fish and aquatic life that can be present in an aquatic ecosystem. Analyzing surface waters by considering common characteristics allows the Department to assign use designations consistently on a statewide basis.

The use designation system is one that is dynamic, and it is possible for designations of surface waters to change. The current use of a waterbody is referred to as the **existing use**. 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 **designated (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.

Table 2. Fish and Aquatic Life Use Minimum Characteristics (Proposed)

Sub-category	Dissolved Oxygen(mg/L)	Minimum Characteristics
Salmonid A	6 and 7	1. Naturally reproducing salmonid community. 2. Year to year survival. 3. More than 2 individuals per 100 meters. Potential to meet all expectations
Salmonid B	6	1. No natural reproduction with population sustained by stocking or migration. 2. More than 2 individuals per 100 meters Potential to meet all expectations
Full Fish And Aquatic Life	5	1. Game fish community with more than 2 individuals per 100 meters (except Green Sunfish and salmonids). 2. Non-game fish community with a significant number of individuals (5 to 25 % or more) belonging to species that are not tolerant to low dissolved oxygen. 3. Macroinvertebrate communities with a significant number of individuals (5 to 25 % or more) belonging to taxa with an HBI value of 5 or less. 4. Any fish or macroinvertebrates listed as endangered, threatened, or special concern species that are not tolerant to low dissolved oxygen or other factors with inadequate protection provided by the limited use sub-categories. Potential to meet one or more expectations
Limited Forage Fish	3	1. No potential to meet the above criteria. 2. Non-game fish community dominated by individuals (numerically 75_to 100%) belonging to species that are tolerant to low dissolved oxygen. 3. Macroinvertebrate community with a significant number of individuals (numerically 75 to 100%) belonging to species with an HBI value greater than 5. Potential to meet one or more expectations
Limited Aquatic Life	1	1. No potential to meet the above criteria. 2. No potential to contain a fish community. 3. Any macroinvertebrate community is dominated (75 to 100%) by individuals belonging to species with an HBI value of greater than 8. Potential to meet one or more expectations

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 codifed use to identify additions to the state's 303(d) list of impaired waters, will no longer be in effect once new classification rules have been promulgated. In addition, the state's new baseline monitoring strategy (described in Part III, Chapter 1) has the potential to change the nature in which assessments for wadeable streams and lakes are conducted (ie., use of the stratified random sample design for possible extrapolation of resource information to carry out assessment work). This change also demands a re-evaluation and redesign in the way streams and lakes are assessed statewide. Thus, in the coming years, the DNR's various water and fisheries programs will be working 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.

Wastewater Management

To learn more go to: http://www.dnr.state.wi.us/org/water/wm/ww/

Wisconsin DNR 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 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. 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. Specific permits are issued to individual 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.

Permits issued under the WPDES Permit Program 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.

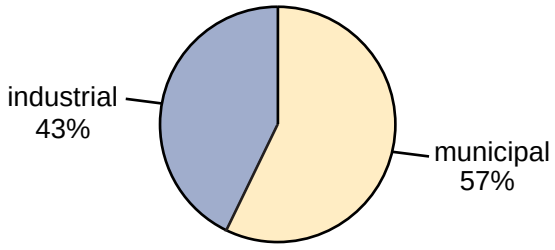
The number and type of individual permittees currently regulated by the WPDES program as of January 2002 are displayed in Figure 10.

Figure 10. Individual Permit Type

Municipal 666

Industrial 486

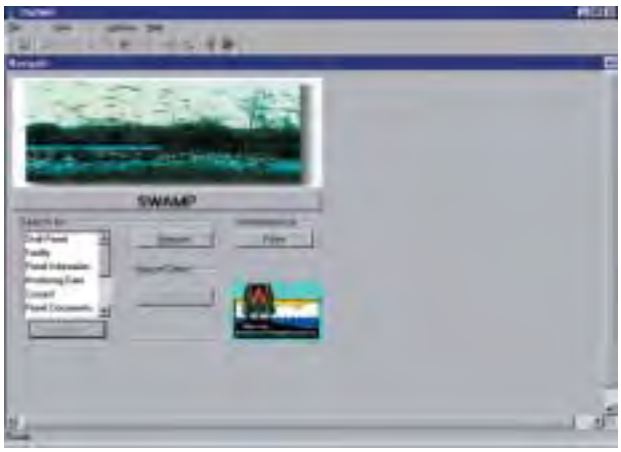
CAFOs - 115



System for Wastewater Applications, Monitoring and Permits (SWAMP)

Data management has become a focal point for managing the state's permit system with the development of the System for Wastewater Applications, Monitoring and Permits (SWAMP), which modernizes the WPDES system. The system's primary features include 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.

Figure 11. SWAMP System Screen



The SWAMP database was developed to provide access to monitoring, facility and inspection information, and permit drafting systems using an Oracle-based network. The system was first available for use in late 1998 and additional segments and embellishments have been added as system use has expanded and as funding was 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 reduced about 150 hours to about 70 hours and the permit backlog has been reduced to less than 10% as a result of the efficiencies gained through use of the system.

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 objective of the WPDES permit program is to ensure that the Department does not exceed a backlog of more than 10% at any time. As of January 1, 2002, the backlog of industrial and municipal permits, including both surface and groundwater discharges, was under the 10% goal (see below).

Congressional oversight has highlighted the permit backlog as an issue of importance to U.S. EPA. National tracking of permit backlogs reveal that many states and U.S. EPA Regions that issue NPDES permits have backlogs that exceed 40%. Therefore Wisconsin's program has a backlog that is much less than most other states or the U.S. EPA. Importantly, 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 3. Wisconsin WPDES Permit Backlogs as of January 1, 2002

	Total	Expired Total (minors and majors)	Percent Backlog
Municipal	666	41	6.2%
Industrial	498	43	8.6%
(overall totals)	1164	84	7.2%
CAFOs	120	5	4.3%

Permits that expire and 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, and a permittee is not in substantial compliance with the terms of the expired permit and enforcement action is underway.

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).

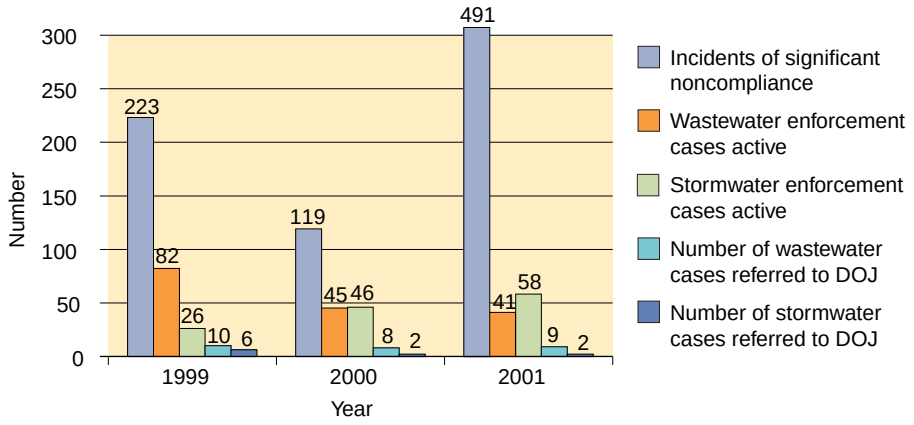
Due to the excellent record of compliance of major permittees, the Department has initiated efforts to revise its inspection strategy to allow it to focus greater attention on minor permittees who more frequently experience compliance difficulties. This inspection strategy is expected to be completed prior to mid-2002. Additionally, the Department has identified a need to update its overall enforcement strategy to assure there is appropriate and timely response to permit violations. This update will be completed in spring 2002.

WPDES permittees have an excellent record of compliance. Figure 12 and Table 4 show the number of cases of significant violations identified during 1999, 2000 and 2001, along with the other formal enforcement data:

Table 4. Significant WPDES Violations

Enforcement Activity	1999	2000	2001
Incidents of significant noncompliance	223	119	491
Wastewater enforcement cases active	82	45	41
Stormwater enforcement cases active	26	46	58
Number of wastewater cases referred to DOJ	10	8	9
Number of stormwater cases referred to DOJ	6	2	2

Figure 12. Incidents of Significant Noncompliance for WPDES, 1999-2001



There are sometimes cases which include both wastewater and stormwater violations. The cases would be coded to the program with the more serious violation. The water program also referred 9 Fisheries and Habitat cases in 2000 and 6 cases in 2001.

Permit Adjudications

Permittees may legally appeal terms and conditions of a permit within a specified time following issuance. As of March 2002, there were 17 outstanding adjudicatory requests pending resolution. Many cases are resolved by modification or reissuance of a permit to include revised regulatory requirements.

General Permits

General permits cover groups of facilities or industries with similar types of wastewater discharges to surface water or groundwater. There are 17 general permits that may be used to cover applicable discharges. Efforts are underway to place information on facilities covered by general permits into the SWAMP system. However, due to workload constraints, not all facilities have been inserted into this data system. The number of facilities covered under a general permit is over several thousand.

Non-Contact Cooling Water, Condensate and Boiler Blowdown - This permit is intended to cover non-contact cooling water, air conditioning condensate and boiler blowdown (with no additives or nontoxic additives) discharges to Wisconsin surface waters or seepage systems.

Contaminated Groundwater from Remedial Action Operations - This permit covers wastewater from soil and groundwater remediation projects involving organic contaminants (primarily hydrocarbons and solvents) discharged to surface waters or seepage systems. The permit also contains requirements for infiltration discharges to enhance in-situ bioremediation.

Petroleum Contaminated Water - This permit is intended to regulate petroleum contaminated water from fueling areas (auto, rail, airport, etc.) and petroleum storage tank farms discharged to surface waters or seepage systems.

Pit/Trench Dewatering - This permit is intended to cover construction site pit and trench dewatering wastewater discharges to surface waters or seepage systems.

Concrete Products Operations - This permit is intended to cover concrete products operations (excluding concrete asphalt) where washwater, boiler blowdown, non-contact cooling water, and dust control wastewater are discharged to surface waters or seepage systems. The permit also contains stormwater requirements in accordance with NR 216, Wis. Adm. Code.

Nonmetallic Mining Operations - This permit is intended to cover sand, gravel, dimension stone, rotten granite, clay pit, and crushed stone operations where wash water, pit dewatering, dust control and non-contact cooling wastewaters are discharged to surface waters or seepage systems. The permit also contains stormwater requirements in accordance with NR 216, Wisconsin Administrative Code (see sidebar).

Swimming Pool Facilities - This permit is intended to cover pool cleaning, pool drainage and pool filter backwash wastewaters that are discharged to surface waters or seepage systems.

Potable Water Treatment and Conditioning - This permit is intended to cover iron filter, lime softener, alum coagulation, granular media filter and reverse osmosis facilities where backwash, regeneration, and rinse water are discharged to surface waters or seepage systems.

Dredging Operations - Carriage and Interstitial Water This permit is intended to cover dredging operations where carriage water or interstitial water from sediment dredging projects is discharged to surface waters or seepage systems.

Hydrostatic Test Water and Water Supply System Water - This permit is intended to regulate discharges of hydrostatic test water and water supply system water to surface waters or seepage systems.

Nondomestic Wastewater to Subsurface Absorption Systems -This permit is intended to cover discharges of liquid industrial wastes containing biodegradable pollutants discharged to subsurface absorption systems (septic tanks followed by subsurface drainfield systems). Typical wastewaters will come from, but not be limited to, food processing facilities (including fruit, vegetable, meat, fish and poultry processing facilities), mink raising operations, and aquaculture operations.

Land Application of Liquid Wastes -This permit is intended to cover discharges of liquid wastes to landspreading sites from, but not limited to, food processing facilities (including fruit, vegetable, dairy products, meat, fish, and poultry processing facilities), mink raising operations, and aquaculture operations. The wastes will typically contain biodegradable pollutants with annual limitations on the application of nitrogen and chlorides.

Land Application of Industrial Sludges This permit is intended to cover the application of industrial sludges to landspreading sites regulated under ch. NR 214, Wis. Adm. Code. These sludges must not have detrimental effects on soils, crops or groundwater, and have beneficial properties as a soil conditioner or fertilizer. These sludges are typically from the treatment of food processing wastewaters.

Land Application of Food Processing By-Product Solids - This permit is intended to cover discharges of by-product solids to land spreading sites. By- product solids are waste materials from the animal or food processing industry including, but not limited to: vegetable waste leaves, cuttings, peelings, husks and sweet corn cobs; animal paunch manure (stomach contents); and waste fruit and pits.

Asphalt Operations Using Wet Scrubbers - This permit is intended to cover facilities that produce asphalt (bituminous concrete) with wet air scrubbers using lagoons, ponds, or holding tanks to contain recycle wastewater. For this type of wastewater there is no discharge allowed to either surface water or groundwater. The permit requires that there is no discharge from the wastewater holding pond.

Outside Washing of Vehicles, Equipment and Other Objects - This permit is intended to cover a variety of facilities that wash equipment, vehicles and other objects outside and can not direct the wastewater to sanitary sewage facilities. Discharges from these washing operations typically contain contaminants (suspended solids and foam) that can be addressed by implementing Best Management Practices. Occasional residential and non-profit vehicle washing is exempt.

Bypasses and Overflows from Sanitary Sewer Collection Systems - This permit is intended to cover inadvertent or deliberate discharges of untreated sewage either directly or indirectly to the ground and/or surface waters of Wisconsin. This permit regulates municipal entities or sanitary districts that own or maintain a sanitary sewer system but are tributary to a neighboring municipality's or regional wastewater treatment facility.

Nonmetallic mining

The nonmetallic mining general discharge permit contains requirements for discharges of nonmetallic mining process wastewater and stormwater to Wisconsin surface waters and groundwater. The guidance document for this permit was finalized and signed by the watershed bureau director on August 7th, 2001. Due to limited Department resources and a very large number of active and inactive nonmetallic mining operations required to submit NOI's under Ch.. NR 216, the Watershed Management Program has establishing a priority system for conferring WPDES general permit coverage to nonmetallic mining operations. This priority system has been chosen to assure that sites with the greatest potential for adverse impacts on waters of the state will receive the highest priority for regulation under the permit. Establishing these priorities will focus the limited staff resources on the nonmetallic mining operations with the highest potential for adverse water quality impacts.

Electronic Transfer of WPDES Discharge Monitoring Report Data (EDMR)

Although the SWAMP system has enhanced the permit issuance process, the discharger monitoring information continues to be submitted in paper format and must be entered into the database with DNR resources. The Department has initiated an effort to allow for data to be more efficiently received through the electronic transfer of data.

The DNR and many permitted or regulated facilities have had a long-term goal to develop an electronic data transfer system. Prior to the development of SWAMP, approximately 170 of 1200 facilities generated Discharge Monitoring Reports (DMRs) onsite using various software packages. The EDMR project will allow data to be transferred directly from the permitted facility to the WDNR to be used in the generation of DMRs. Provisions will be in place to ensure the integrity of the data..

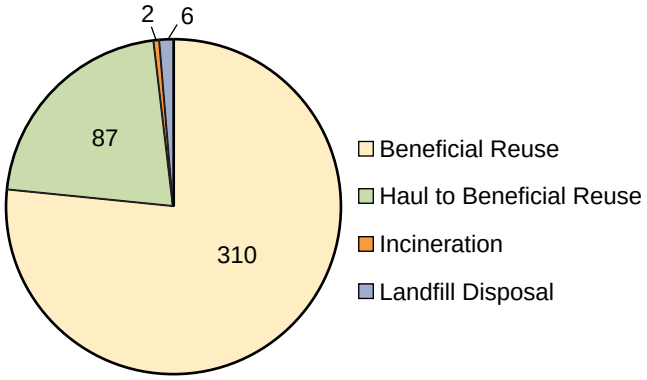
Effluent Limitations

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 requirements is evaluated for all 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. Figure 13 shows that 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.

Figure 13. Disposition of Sludge Waste from Municipal Facilities



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.

Delegation of the Sludge Program

Wisconsin became the fourth state in the nation to be delegated authority to implement the biosolids program under Sections 402 and 405 of the Clean Water Act, in July 2000. This grant of authority verified that Wisconsin's state program met and exceeded all federal requirements for program implementation and oversight. Wisconsin is in the national biosolids program through participation on various U.S. EPA-sponsored groups, including a National Academy of Sciences review of the program

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. Recent efforts have been made to incorporate pretreatment program

activities into the workload of Regional staff that have other WPDES program responsibilities. The program is, however, at a point of being so significantly reduced that it may be losing its effectiveness and relevance. The WDNR will be reviewing this program to determine what actions are needed, if any, to assure the continued implementation of this program.

Sanitary and Combined Sewer Overflows

In the period from 1998 through 2000, 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. In addition, the Department has initiated efforts to revise state regulations that govern the overflows from sanitary sewerage systems.

Power Plants

As in many parts of the country, projected energy shortages have been identified as a concern. In response, several independent power producers 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 early 2002, there were at least 6 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. There will be a continuing workload associated with these projects for the foreseeable future.

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, 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.

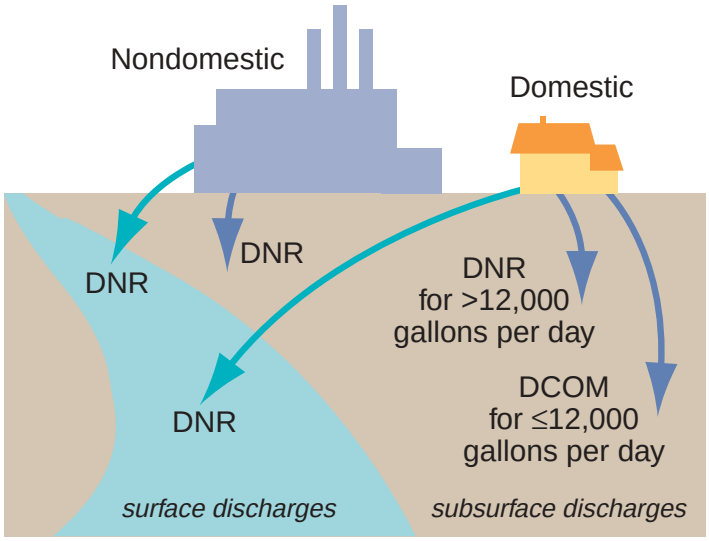
Plan review provides an intervention point in the wastewater treatment system planning process that promotes an exchange of information, technical assistance, coordination between owners and various agencies, documentation of sewerage system infrastructure, and development of appropriate technologies 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. In 1999, WDNR and DCOMM signed a Memorandum of Understanding that establishes the jurisdictional boundary between the agencies regarding regulation of these types of on-site disposal permits for facilities greater than approximately 12,000 gallons per day, and DCOMM has the review and approval authority for smaller systems (see Figure 14). 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.

Figure 14. DCOMM/DNR Wastewater Regulation Jurisdictional Boundary



Regulating Mercury in Wastewater

The Department began work on revising, and formalizing in rule form, its wastewater mercury strategy in early 2001 by forming an advisory committee that included representatives from EPA, municipal and industrial permittees, laboratories, environmentalists and dentists. In January 2002 the Natural Resources Board authorized the Department to gather public input through the formal public hearing process. This rule package advocates a common-sense approach to regulating mercury in wastewater.

Current rules, in place since the late 1980's, that limit the levels of toxic pollutants in wastewater discharges, have not worked well for mercury, largely because we lacked a test method sensitive enough to detect mercury and a means to collect uncontaminated samples. Water quality criteria for mercury are very low and many wastewater professionals acknowledge that it's technically and economically not feasible to treat large volumes of wastewater to levels necessary to meet standards.

In the mid 1990's, although there was evidence that mercury was in many wastewater effluents, we were unable to measure the concentrations. Intent on not ignoring this important contaminant, the Department implemented a pollution prevention approach for mercury from the more traditional regulatory mode of limits, monitoring and enforcement. That approach appears to be working. However, about 2 years ago, EPA approved a much more sensitive test method. This, along with clean sampling techniques, now allows us to measure mercury concentrations at or below water quality criteria levels. It is now possible to compare effluent concentrations to water quality standards and determine effluent limits. The rule package proposes to:

- Formally promulgate the new test method for use in Wisconsin
- Begin reissuing wastewater permits for large and medium-sized facilities with requirements to use that test method on their effluents
- Require that facilities institute pollution prevention measures if they find mercury levels that would cause them to exceed water quality standards
- Issue variances that would allow permittees to discharge at current levels while pollution prevention steps achieve reductions.

WDNR does not anticipate major obstacles during finalization of this rule package during 2002.

Innovation in Pollution Reduction

Pollution prevention initiatives in Wisconsin contribute to improving water pollution control efforts. Through their prevention efforts, facilities reduce the pollution they generate, and in the process, save millions of dollars and make Wisconsin's environment a safer, cleaner and more sustainable place to live. In the past few years, Wisconsin has been active in developing programs and initiatives designed to go beyond the traditional regulatory framework to achieve pollution reductions. Major initiatives include Green Tier, Cooperative Agreements, and Pollution Prevention work.

Green Tier Legislation

In June 2001 a coalition of large and small businesses, environmental groups, municipalities, law firms and community organizations submitted draft "Green Tier" legislation after having met seven times since July, 2000. This proposal encourages entities subject to environmental regulations to adopt Environmental Management Systems (EMS), achieve superior environmental performance and obtain appropriate regulatory flexibility. The Departments of Natural Resources and Justice and the USEPA provided technical assistance to this group during its deliberations. The process that was used to develop Green Tier required substantial give and take by all involved and allowed a solid trust relationship to build was built around the attached draft

Cooperative Agreements

The Environmental Cooperation Pilot Program is a Wisconsin initiative designed to test an innovative approach to regulation. In February, 2000, the Wisconsin Electric Power Company was the first business in the state to sign a cooperative environmental agreement with the state under which the utility committed to pursuing environmental improvements beyond those required by current regulations.

Under the agreement, the company will beneficially reuse coal ash from its landfills as a fuel source, thus reducing its use of coal, freeing landfill space and protecting groundwater. It will also develop and carry out a facility-wide environmental management system (EMS) at its Pleasant Prairie electric generating plant to identify and minimize or eliminate all environmental impacts. Wisconsin Electric will also conduct mercury emissions testing and research, expand its efforts to inform and involve the public in decisions affecting the environment, and publicly report on its environmental performance. In return, DNR will speed up and streamline permitting procedures, eliminate unnecessary monitoring requirements, and increase electronic information sharing to reduce paper use and speed decision-making.

Pollution Prevention

A second major initiative carried forward during the 2000-2002 period was the state's Pollution Prevention work. In Wisconsin, efforts are targeted to assist businesses and communities by providing them with information, technical assistance and training on waste reduction. During the 1999-01, statutory language was included in the state budget that broadened the definition of pollution prevention beyond the old definition of hazardous waste pollution prevention. Non-hazardous wastes and emissions can be as much of a problem as the hazardous ones. Work has gradually shifted to incorporate high volume industrial wastes and secondary impacts such as energy use under the pollution prevention umbrella. This statutory language change brought Wisconsin into conformance with U.S. EPA, other states, and the current thinking about pollution prevention. A few pollution prevention case studies are described below.

Community Mercury Reduction

The DNR is partnering with fourteen Wisconsin communities to reduce the public's use of mercury-containing products, to promote recycling of mercury products that continue to be used, and to reduce he potential for mercury spills. Educational outreach is provided by community and trade association staff to the medical, dental, school, HVAC, and household sectors of the community. Related mercury reduction programs are focused on recovering dairy farm mercury manometers and automobile mercury switches. Participating communities include Appleton, Ashland,

DePere, Eau Claire, Green Bay, Kaukauna, Kenosha, LaCrosse, Madison, Manitowoc, Marinette, Milwaukee, Racine, and Superior.

Through a combination of federal and state grants these communities have been able to offer free or reduced cost recycling of mercury-containing products to facilities in the participating sectors. The 1996-1998 "Mercury Roundup Program" recycled over 5,000 pounds of mercury from these communities. The 1999-2001 "Wisconsin Mercury Recycling Program" has recycled over 3,000 pounds of mercury with final tallies pending. Mercury-containing products that are recycled are replaced with non-mercury alternative products. In addition, most municipalities in Dane, Douglas, and Racine Counties have passed legislation banning the further sale of mercury fever thermometers.

The mercury reduction experiences of the Wisconsin communities will be captured in guidance for municipal "Mercury Pollutant Minimization Programs" that will be implemented throughout Wisconsin as communities comply with wastewater discharge standards resulting from the Great Lakes Water Quality Initiative.

Pulp and Paper Pollution Prevention Partnership

The Pollution Prevention Partnership with the pulp and paper industry, now in its eighth year, features voluntary reduction in environmental releases by one of the state's largest industries and goes beyond what is required by law. In cooperation with DNR, the Wisconsin Paper Council coordinates the Pollution Prevention Partnership (PPP), the industry's trade association. Twenty-five (25) firms and 45 facilities participate in this program, which is designed to find cost-effective ways to reduce potentially harmful by-products from the paper industry's manufacturing process. PPP covers air emissions, wastewater discharges, and solid and hazardous wastes. It also includes voluntary reduction goals for seven "target" substances – chlorine, chloroform, formaldehyde, hydrogen sulfide, methanol, phosphorus and xylene. One way to measure progress is to compare environmental releases with production data. In 1992, the paper industry released 11.73 pounds of process-related pollutants for every ton of pulp, paper and paperboard produced in Wisconsin. In 1997, it released 5.11 pounds per ton of production, a drop of 56 percent in just five years. Other achievements since 1992 include:

To learn more go to: http://www.dnr.state.wi.us/org/caer/cea/mercury/index.htm

- Chlorine releases are down 21 percent;
- Overall chloroform emissions are down 47 percent;
- Formaldehyde emissions have declined almost 32 percent;
- Emissions of hydrogen sulfide have decreased almost 14 percent;
- Methanol releases are down 35 percent; and
- Xylene releases are down 28 percent.

Phosphorus releases dropped 13.6 percent during 1997. The major phosphorus dischargers in PPP also conducted minimization studies in 1998-99 to enhance performance while maintaining efficient wastewater treatment.

Wisconsin Department of Defense Alliance

This Alliance's mission is to create a working relationship with government agencies and local communities to promote and implement pollution prevention as the preferred strategy for protecting the environment, conserving resources, fostering community well-being and enhancing mission readiness at Department of Defense (DOD) federal facilities in Wisconsin.

Active participants include the Army, Army National Guard, Army Reserve, Air Force, and the Air National Guard. These units are implementing pollution prevention in their activities at Fort McCoy, Volk Field, Mitchell Field, Truax Field and the local Army National Guard and Reserve stations in cities throughout the state. Other participants are DNR, EPA and SHWEC.

DNR and Fort McCoy are co-chairs of the Alliance, which has a charter that states the vision, mission and goals of the alliance. The informal exchange of information between the military units during the meetings and base tours often leads to discussions about successful pollution prevention practices.

Management of Polluted Runoff

Control of polluted runoff continues to be one of the most important 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. Three primary components of the WDNR's runoff management program include the implementation of the voluntary Priority Watershed/Lake Projects, 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 Wisconsin Department of Agriculture, Trade, and Consumer Protection (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 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, 2001, approximately $159 million in local staffing and 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 15). Thirty of the 86 projects have been closed or completed. All of the remaining projects have been approved and are in the implementation phase. Table 5 provides additional details about the location and size of the large-scale priority watershed projects. Table 6 provides a similar summary of the small-scale priority watershed and lake projects.

Priority watershed/lake project goals focus on water quality improvements or protection resulting from reductions in pollutant levels delivered to streams, rivers, and lakes. Each year, project grantees submit reports to the WDNR, showing progress made towards meeting pollutant reduction goals in the watersheds/lakes. For a given project, information may be submitted as reductions in sediment/soil loss from uplands, streams, gullies, and phosphorus reductions from barnyards and croplands. Other projects are focused on protecting shoreline and habitat in a watershed or lake.

As of 2000, the annual report data indicate that projects are making progress towards reducing phosphorus from barnyards and upland sediment/soil loss. Approximately 54% of the projects continuing more than 6 years are meeting their barnyard phosphorus reduction goals by 50% or more. Sixty one percent of these projects are meeting their upland sediment/soil loss reduction goal by 50% or more. Each year approximately 235,000 pounds of phosphorus from barnyards and about 57,000 tons of sediment from eroding streambanks or shorelines are prevented from entering waterways through the installation of best management practices in priority watersheds and lakes. Over 354,000 feet of streambanks or shorelines have had best management practices put in place to prevent erosion and enhance habitat and about 750 acres of wetlands have been restored.

In 1997, the Wisconsin legislature significantly changed the direction of the state's runoff management programs. The 1997 Wisconsin Act 27 placed the Priority Watershed/Lake Program, which is chiefly administered by the WDNR, into a multi-year phase-out period. It also strengthened the role of DATCP in addressing agricultural runoff. The changes required the agencies to develop explicit regulatory performance standards for polluted runoff. Further, Act 27 created new competitive funding programs, discussed in the next section, which are available across the state rather than just in priority watersheds/lakes. In 1999, the legislature reinforced these changes by shifting more funding to DATCP for them to coordinate the local staffing grants for the priority watershed/lake projects. Funding for ongoing watershed and lake projects will continue through 2009. To bring program expenditures in line with the available funding, no additional projects will be started.

Figure 15. Priority Watershed Projects in Wisconsin

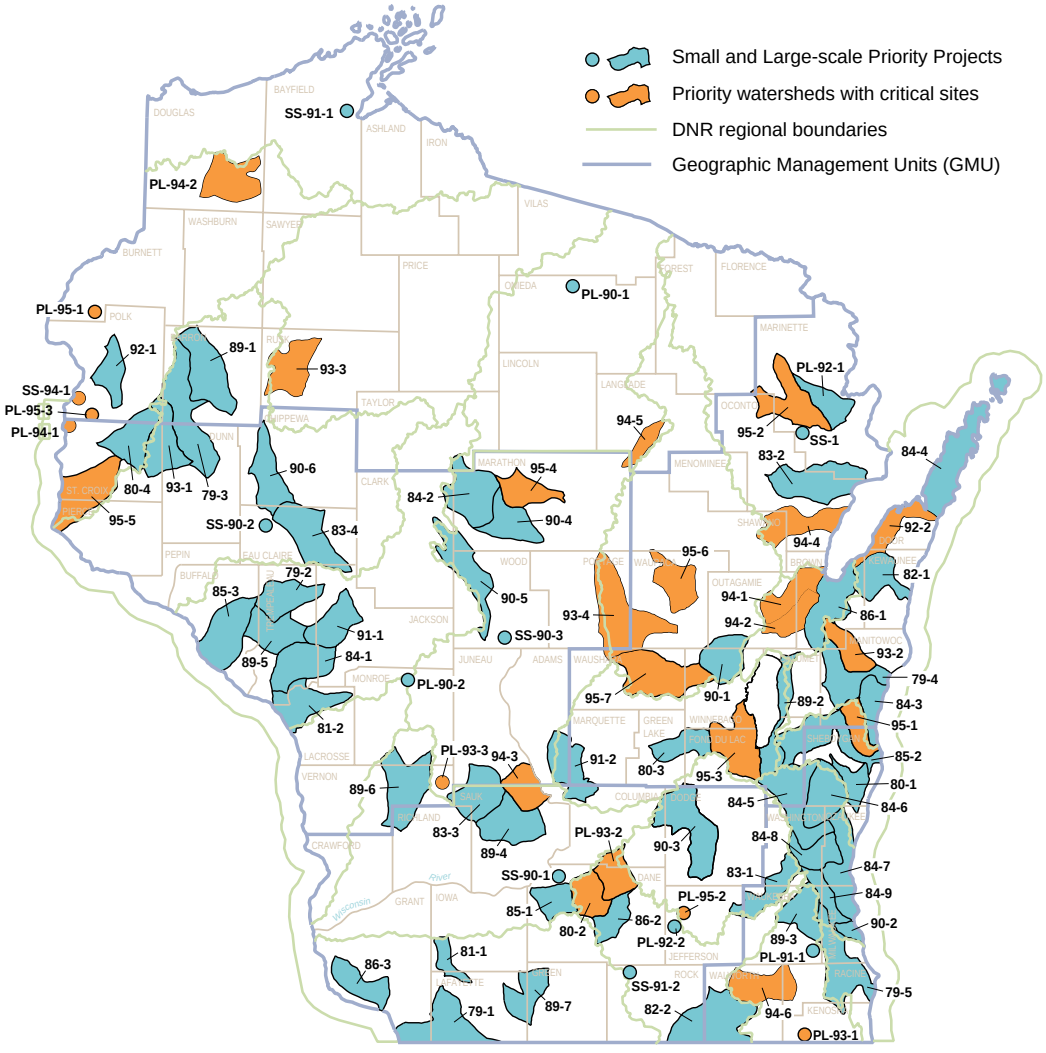


Table 5. Large-Scale Priority Watershed Projects

Yr. Start	Project Name/Map Code	Location	Size – Sq. Miles
1979	Galena River* 79-1	Lafayette, Grant	241
	Elk Creek* 79-2	Trempealeau	112
	Root River* 79-5	Racine, Waukesha, Milwaukee	198
	Lower Manitowoc River* 79-4	Manitowoc, Brown	168
	Hay River* 79-3	Barron, Dunn	289
1980	Big Green Lake* 80-3	Green Lake, Fond du Lac	106
	Upper Willow River* 80-4	St. Croix, Polk	183
	Six-mile Pheasant Branch Creek[1] 80-2	Dane	119
	Onion River 80-1	Sheboygan, Ozaukee	97
1981	Upper W. Branch Pecatonica River* 81-1	Iowa, Lafayette	77
	Lower Black River* 81-2	La Crosse, Trempealeau	189
1982	Kewaunee River* 82-1	Kewaunee, Brown	142
	Turtle Creek* 82-2	Walworth, Rock	288
1983	Oconomowoc River* 83-1	Waukesha, Washington, Jefferson	130
	Little River* 83-2	Oconto, Marinette	210
	Crossman Creek/Little Baraboo River* 83-3	Sauk, Juneau, Richland	213
	Lower Eau Claire River* 83-4	Eau Claire	399
	Beaver Creek 84-1	Trempealeau, Jackson	160
1984	Upper Big Eau Pleine River* 84-2	Marathon, Clark, Taylor	219
	Seven-mile/Silver Creek* 84-3	Manitowoc, Sheboygan	112
	Upper Door Peninsula* 84-4	Door	287
	East & West Branch Milwaukee River* 84-5	Fond du Lac, Washington, Sheboygan, Dodge Ozaukee	265
	North Branch Milwaukee River* 84-6	Sheboygan, Washington, Ozaukee	149
	Cedar Creek 84-8	Ozaukee, Washington	129
	Milwaukee River South 84-7	Ozaukee, Milwaukee	167
	Menomonee River* 84-9	Milwaukee, Waukesha, Ozaukee, Washington	136
1985	Black Earth Creek* 85-1	Dane	105
	Sheboygan River 85-2	Sheboygan, Fond du Lac, Manitowoc, Calumet	260
	Waumandee Creek* 85-3	Buffalo	221
1986	East River 86-1	Brown, Calumet	206
	Yahara River-Lake Monona 86-2	Dane	93
	Lower Grant River 86-3	Grant	129

Yr. Start	Project Name/Map Code	Location	Size – Sq. Miles
1989	Middle Trempealeau River 89-5	Trempealeau, Buffalo	205
	Lake Winnebago/East 89-2	Fond du Lac, Calumet	99
	Middle Kickapoo River 89-6	Vernon, Monroe, Richland	246
	Yellow River 89-1	Barron	239
	Upper Fox/Illinois River 89-3	Waukesha	151
	Narrows Creek/Baraboo River 89-4	Sauk	176
	Lower E. Branch Pecatonica River 89-7	Green, Lafayette	144
1990	Arrowhead River/Daggets Creek 90-1	Outagamie, Winnebago	142
	Kinnickinnic River 90-2	Milwaukee	33
	Beaver Dam River 90-3	Dodge, Columbia, Green Lake	290
	Duncan Creek 90-6	Chippewa, Eau Claire	191
	Lower Big Eau Pleine River 90-4	Marathon	138
	Upper Yellow River 90-5	Wood, Clark, Marathon	212
1991	Upper Trempealeau River 91-1	Jackson, Trempealeau	175
	Neenah Creek 91-2	Adams, Marquette, Columbia	173
1992	Balsam Branch Creek 92-1	Polk	104
	Red River/Little Sturgeon Bay 92-2	Door, Kewaunee, Brown	139
1993	Branch River 93-2	Brown, Manitowoc	108
	Soft Maple/Hay Creek 93-3	Rusk	176
	South Fork Hay River 93-1	St. Croix, Dunn, Polk, Barron	181
	Tomorrow/Waupaca River 93-4	Waupaca, Portage	290
1994	Apple & Ashwaubenon Creeks 94-2	Brown, Outagamie, Oneida Nation	113
	Dell Creek 94-3	Juneau, Sauk	133
	Duck Creek 94-1	Brown, Outagamie, Oneida Nation	151
	Pensaukee River 94-4	Oconto, Shawano	163
	Spring Brook 94-5	Langlade, Marathon	69
	Sugar & Honey Creeks 94-6	Racine, Walworth	166
1995	Fond du Lac River 95-3	Fond du Lac, Winnebago	244
	Kinnickinnic River 95-5	Pierce, St. Croix	206
	Lower Little Wolf River 95-6	Waupaca	152
	Lower Rib River 95-4	Marathon	129
	Middle Peshtigo & Thunder Rivers 95-2	Marinette, Oconto	193
	Pigeon River 95-1	Manitowoc, Sheboygan	78
	Pine & Willow Rivers 95-7	Waushara, Winnebago	303
		TOTAL	11,328

* Completed projects

[1] Six-mile/Pheasant Branch is a part of the Lake Mendota Priority Lake Project (1993).

Table 6. Small-Scale Priority Watersheds & Priority Lake Projects

Year Start	Project Name/Map Code	Location	Size – Sq. Miles
Small-Scale Watershed Projects			
1986	Bass Lake* SS-1	Marinette	1
1990	Dunlap Creek SS-90-1	Dane	14
	Lowes Creek* SS-90-2	Eau Claire	10
	Port Edwards Groundwater Proj.* SS-90-3	Wood	10
1991	Whittlesey Creek SS-91-1	Bayfield	12
	Spring Creek SS-91-2	Rock	6
1994	Osceola Creek SS-94-1	Polk	9
Priority Lake Projects			
1990	Minocqua Lake* PL-90-1	Oneida	10
	Lake Tomah PL-90-2	Monroe	32
1991	Little/Big Muskego-Wind Lakes PL-91-1	Waukesha, Racine	41
1992	Middle Inlet-Lake Noquebay PL-92-1	Marinette	155
	Lake Ripley PL-92-2	Jefferson	8
1993	Camp/Center Lakes PL-93-1	Kenosha	8
	Hillsboro Lake PL-93-3	Vernon	35
	Lake Mendota PL-93-2	Dane, Columbia	230
1994	St. Croix Lakes Cluster PL-94-1	St. Croix	3
	St. Croix Flowage/Upper St. Croix Lake PL-94-94-2	Douglas	45
1995	Big Wood Lake PL-95-1	Burnett	20
	Horse Creek PL-95-3	Polk	15
	Rock Lake PL-95-2	Jefferson	10
		TOTAL	274

* Completed projects

Additional Runoff Management Grant Programs in Wisconsin

In 1997 and 1999, the Wisconsin Legislature created two additional grant programs, as part of the nonpoint source program redesign discussed later in this report. The grant programs, namely the Targeted Runoff Management Grant Program and the Urban Nonpoint Source and Storm Water Grant Program, address the effects of polluted runoff statewide. Both programs are administered by the WDNR and provide competitive financial awards to control polluted runoff. Grant applications are scored based on fiscal accountability, cost effectiveness, water quality, extent of pollutant control, extent of local support and likelihood of project success. The funded projects are site-specific, generally smaller than a sub-watershed, and are targeted at high-priority resource problems.

Targeted Runoff Management Grant Program

The Targeted Runoff Management (TRM) Grant Program provides financial assistance to rural and urban governmental units. The maximum cost-share rate available to TRM grant recipients is 70 percent of eligible project costs, up to a maximum of $150,000 (total state share). Local governments that are awarded TRM grants may use the funds on lands they control or make the funds

available to private landowners. To date, TRM grants have funded construction of rural and urban best management practices. The projects last from two to four years. Please refer to Table 7 for additional information regarding the TRM grant projects. The first grant cycle for the program was in 1999, and 16 rural and 26 urban projects have been funded by TRM grants since then. Approximately $4,513,472 was authorized to fund these projects. Thus far, 31 of the 42 projects have been completed.

Urban Nonpoint Source and Storm Water Grant Program

The Urban Nonpoint Source and Storm Water Grant Program focuses on financial assistance in urban areas. To be eligible for a grant, urban areas should have a population density of at least 1,000 people per square mile, have a commercial land use, or include a non-permitted portion of a privately owned industrial site. Urban Nonpoint Source and Storm Water Grants can be used to pay for a variety of activities. Eligible technical assistance costs for planning, related informational and educational activities, ordinance development and enforcement, training and design are cost-shared at 70 percent. Eligible construction costs may include such projects as storm water detention ponds, streambank stabilization, and shoreline stabilization and are cost-shared at 50 percent. The funded projects last between two to three years. Table 7 provides additional details about the projects. Since the first grant cycle in 2000, approximately $8,755,818 were authorized to fund 31 planning and 25 design/construction projects.

Table 7. Runoff Management Grant Programs

Targeted Runoff Management Grants

	CY 1999			CY 2000			CY 2001		
Grant Type	**Grant Funds**	**Number of Projects**	**Number Completed**	**Grant Funds**	**Number of Projects**	**Number Completed**	**Grant Funds**	**Number of Projects**	**Number Completed**
Rural	$716,275	7	7	$581,900	5	1	$466,361	4	0
Urban	$1,278,920	12	12	$905,666	10	10	$564,350	4	1
TOTAL	$1,995,195	19	19	$1,487,566	15	11	$1,030,711	8	1

Urban Nonpoint Source & Storm Water Grants

	CY 2000		
Grant Type	**Grant Funds**	**Number of Projects**	**Number Completed**
Planning	$2,130,422	31	21
Design/Construction	$6,625,396	25	11
TOTAL	$8,755,818	56	32

Storm Water Management

In 1993, the Wisconsin Legislature adopted section 283.33 of the Wisconsin Statutes, which gave the WDNR the authority to regulate storm water discharges. The WDNR then promulgated Chapter NR 216, Wisconsin Administrative Code to regulate storm water discharges under a Wisconsin Pollutant Discharge Elimination System (WPDES) permit. Chapter NR 216 has three subchapters that regulate three categories of storm water discharges – municipal, industrial and construction sites.

To date, the WDNR has given WPDES storm water permit coverage to 19 Municipal Separate Storm Sewer Systems (MS4s), and approximately 50 other MS4s have been designated and are in the application process. The WDNR will be actively working on revising Chapter NR 216 during 2002 to comply with EPA Phase 2 storm water regulations. It is expected that approximately 200

MS4s, including cities, villages, towns, counties and state and federal institutions, will be required to have permit coverage once the Phase 2 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 also include nutrients (such as phosphorus and nitrogen), heavy metals, oil, and grease. The WDNR gives permit coverage to approximately 500 new construction sites each year that disturb five or more acres of land. The WDNR is revising its regulations to require permit coverage of construction site that disturb one acre or more of land by March 10, 2003 in accordance with the federal Phase 2 regulations.

Over 4,000 industrial facilities are covered under the general storm water industrial WPDES permits. 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 50% 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 3 years of operation.

Wisconsin has been actively working for the past three years on developing a new set of performance standards for runoff under proposed Chapter NR 151, Wis. Adm. Code. The performance standards will apply to construction site development and management of storm water runoff from urbanized areas. It is anticipated that the standards will be promulgated in 2002. The proposed standards identify a level of sediment control for construction sites during construction as well as post-construction total suspended solids control. Additional requirements are buffers for streams, lakes, and wetlands, peak flow control, and infiltration devices. Chapter NR 151 also includes total suspended solids controls for permitted MS4 facilities and general information and education requirements for all urbanized areas.

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 Chapter NR 152, Wisconsin Administrative Code, which is part of the redesign of the nonpoint source program. The performance standards contained in these ordinances are consistent with the performance standards contained in Chapter NR 151, Wis. Adm. Code, which is also part of the runoff management program redesign. 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 40,000 active livestock operations exist in Wisconsin. Manure from livestock operations contains organic materials, nitrogen, phosphorus and other water pollutants. Through Chapter NR 243, Wisconsin Administrative Code, discharges from larger-scale operations have been avoided, and many smaller-scale sites in the state with manure discharges have been addressed.

WPDES Permits

Water quality concerns associated with livestock operations with 1,000 animal units or more (also referred to as Concentrated Animal Feeding Operations or CAFOs) are addressed through the Wisconsin Pollutant Discharge Elimination System (WPDES) permit program. One thousand animal units 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 issues associated with these operations. The WPDES permit program meets or exceeds federal NPDES requirements for livestock operations with 1,000 animal units or more, particularly in the areas of addressing groundwater quality impacts and the land application of CAFO manure. About 110 livestock operations are currently required to have a WPDES permit. The WDNR has experienced a significant increase in the number of operations applying for permits in recent years.

Notice of Discharge

Wisconsin regulates livestock operations with fewer than 1,000 animals units with discharges that significantly affects water quality through the Notice of Discharge (NOD) Program. The WDNR may issue NODs to livestock operators if an on-site investigation reveals the presence of a significant discharge to waters of the state. Technical assistance to control the discharge is available through the county LCDs and cost-share financial assistance has been available through DATCP for the implementation of corrective measures. Beginning in 2002, the WDNR will be the primary cost-sharing agency for NODs. Throughout the process, the WDNR may conduct follow-up investigations to monitor compliance. A livestock operator who fails to implement necessary corrective measures within a specified time frame 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 recently changed to a targeted approach, investigating impacts from livestock in areas draining to impaired waters (federal 303(d) listed waters) and high quality waters (Wisconsin Outstanding and Exceptional Waters) instead of relying solely on citizen complaints.

Since 1984, 579 NODs have been issued; during this time, DATCP has provided an estimated $6.4 million in cost-sharing and $531,510 in technical assistance for 319 smaller animal feeding operations to correct deficiencies identified in NODs. Nine NODs were issued during the 2000-2001 time period; during this time, DATCP provided an estimated $412,875 in cost share funds and $38,717 in technical assistance. For all NODs where DATCP has provided cost-sharing, 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 grants from DATCP. Most livestock operations that received funding from DATCP 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 action pending.

Performance Standards and Prohibitions

The WDNR is currently in the process of codifying statewide performance standards and prohibitions for all agricultural operations. These include manure management prohibitions, nutrient management, manure storage and clean water diversions. Implementation of these standards and prohibitions is intended to occur primarily through county LCDs. The WDNR will continue to regulate WPDES permitted livestock operations and serve as an implementation back-up to local governments for crop producers and livestock operators with fewer than 1,000 animal units.

Redesign of the Nonpoint Source Pollution Program

As mentioned previously, the Wisconsin Legislature made significant changes to the state's nonpoint source pollution program in 1997 and 1999. A redesign of the program was mandated to address persistent urban and rural runoff pollution problems statewide. The legislative initiatives were part of Wisconsin Act 27, which required WDNR and DATCP to create nonpoint source

pollution standards and to restructure existing programs. Other affected state agencies include the Wisconsin Department of Transportation (DOT) and the Wisconsin Department of Commerce (COMM). Since 1997, the WDNR has been working with state agencies, local governmental units and the affected publics to develop the redesigned nonpoint source pollution program. The program redesign is embodied in 9 administrative rules, 8 to be administered by WDNR and one to be administered by DATCP.

Key components of the redesigned program for WDNR include regulatory performance standards, implementation and enforcement strategies and financing.

Statewide Performance Standards

Agricultural, non-agricultural and transportation performance standards apply statewide wherever applicability criteria are met. Although the performance standards are directed at nonpoint pollution sources, these same standards have been incorporated into the WDNR's point source regulation for animal feeding operations and storm water management.

Agricultural performance standards address runoff pollution from both croplands and livestock facilities. Cropland performance standards address cropland erosion and nutrient management. Livestock performance standards address manure storage and facilities needing clean water diversions. In addition, there are manure management prohibitions that address overflowing manure storage facilities, unconfined manure piles, direct runoff of manure to state waters and trampled shoreline areas.

Non-agricultural performance standards address runoff pollution from construction sites, post-construction runoff from new development and re-development and runoff from developed urban areas. Construction site standards target sediment reduction. New development standards target suspended solids and peak flow discharges and contain special provisions for infiltration, protective buffer areas and vehicle fueling and maintenance areas. Standards for smaller developed urban areas focus on development and implementation of information, education, municipal housekeeping and municipal nutrient management activities. Permitted municipalities must also meet these requirements in addition to phasing in practices to reduce storm water discharges of suspended solids.

Transportation performance standards address runoff pollution from transportation facilities including highways, bridges, railroads and airports. The standards generally parallel those for non-agricultural performance standards.

Implementation and Enforcement

Implementation and enforcement strategies differ for agricultural and non-agricultural performance standards.

Agricultural Performance Standards. County land conservation departments will, on a voluntary basis, carry out administrative, technical and enforcement activities (through local ordinances) necessary to achieve compliance with performance standards. Support will be provided by state agencies, including WDNR and DATCP, federal agencies, including NRCS and FSA and educational institutions including the University of Wisconsin-Extension. Where a county is unwilling or unable to perform these activities, the WDNR will fulfill the required functions. WDNR will continue to take the lead in assuring compliance at livestock operations subject to WPDES permits. Funding must be made available to require compliance for existing livestock facilities and croplands. Funds will be provided by WDNR through its priority watershed and targeted runoff management programs, in addition to funding made available under federal programs, other state programs, such as those administered by DATCP, and county cost-share programs.

Non-agricultural and Transportation Performance Standards. The WDNR will use its storm water permitting program and an equivalent cooperative agreement with DOT to carry out administrative and enforcement activities needed to assure compliance with non-agricultural and

transportation performance standards. In addition, DOT and COMM will play key roles in implementing these standards through their own administrative rules. Although funding does not have to be offered to require compliance, the department will offer funding under its Targeted Runoff Management Grant Program and its Urban Nonpoint Source and Storm Water Grant Program.

Targeted Performance Standards. Uniform adherence to the statewide performance standards and prohibitions are expected to resolve many nonpoint source pollution problems. However, statewide performance standards may be inadequate to meet water quality goals in certain areas. In these areas, targeted performance standards requiring a higher level of treatment or protection may be established by the WDNR or local units of government. Targeted standards may be identified in integrated resource management plans and through local ordinances, and must be promulgated in administrative rules by the WDNR.

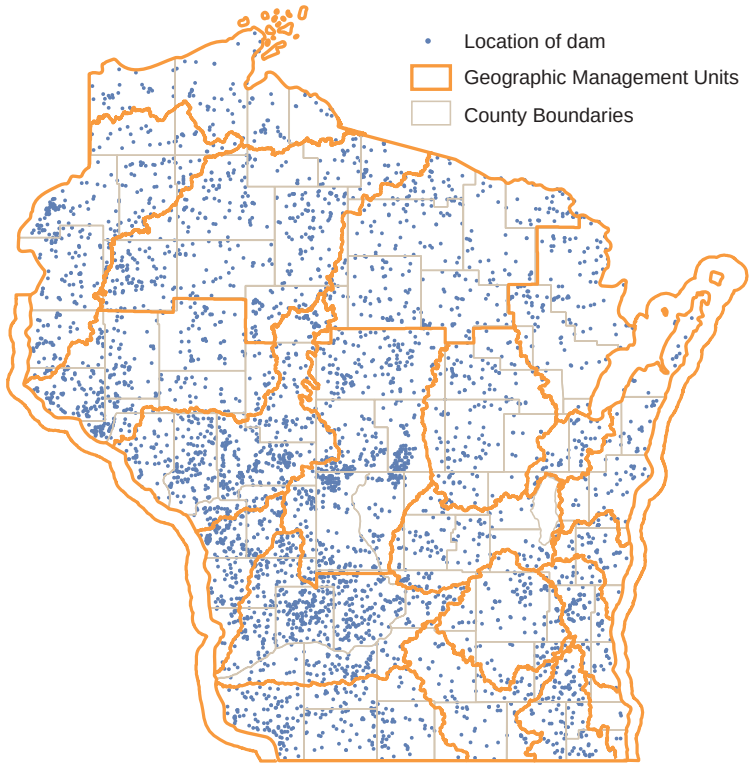
Financing Compliance with Performance Standards

The total estimated **annualized** cost to implement these 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 the 120 waters listed as impaired on the federal CWA Section 303(d) list.

Dam Management

The state's over 3,500 dams (Figure 16) have a significant impact on the state's river systems. Many dams in Wisconsin serve 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. The 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 has advocated for the removal of a dam or helped establish financial incentives to facilitate removal.

Figure 16. Dams in Wisconsin



Although some dams serve useful purposes, 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 construction Dam safety, operation and maintenance
- Alteration or repair of dams
- Dam transfer and dam removal
- Water level and flow control

Dam Safety

To learn more go to: http://www.dnr.state.wi.us/org/water/wm/dsfm/section/index.htm.

The state's Dam Safety Program was developed under Chapter 31 to ensure that dams are safely built, operated and maintained. Two state Natural Resources regulations provide structure to the program. **NR 333** provides design and construction standards for large dams and **NR 335** covers the administration of the Municipal Dam Repair and Removal Grant Program. DNR is responsible for administration of these regulations.

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 uncovering 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, meaning they 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.

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 of this report 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.

To assure continued protection of surface water systems relating to FERC facilities and other state regulated dams, the Department has been active in several areas as indicated below.

Information to the Congressional Delegation on Proposed FERC License Process Revisions

In October of 2001, DNR Secretary Darrell Bazzell informed members of Congress of the Department's concern with recommendations advanced by the Federal Energy Regulatory Commission (FERC) to either remove or limit the scope of the State Water Quality Certification now provided during the re-licensing process for hydroelectric facilities. The Secretary argued that our Certifications are completed in a timely fashion and in cooperation with the U.S. Fish and Wildlife Service and National Park Service to help establish terms and conditions for protection, restoration, and enhancement of natural resources and recreational opportunities.

The letter emphasized that reducing the scope of State Water Quality Certification will not produce the benefits intended by the Commission. Staff closely associated with riverine systems near hydropower facilities best know what improvements are needed and know what can be practically accomplished. Secretary Bazzell requested Congressional support to retain the existing Water Quality Certification process for FERC facilities to ensure that Wisconsin continues to have a strong voice in the relicensing process to find the best balance of environmental and power generation needs

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

In December, 2001, Department staff prepared a draft 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 October of 2001, the Department issued statewide program guidance to help 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* Department application and regulation of run-of-river operations at state regulated and FERC regulated dams. The guidelines can also be used as a training tool for new staff and serve to help clarify points of discussion or negotiations with dam operators, FERC staff or other interested parties.

The guidance indicates that unless site-specific analyses show that an alternate operating regime would not have serious adverse environmental impacts, run-of-river operating mode should be ordered so that dam operations are least disruptive to the normal river flow. The guidance provides definitions, information on how to process applications, how to determine performance standards for dam operators to assure clarity and a solid base for enforcement, if needed.

The guidance indicates that at all times dam owner/licensee shall maintain a discharge from the dam (includes powerhouse, spillway or diversion channel) so that, at any concurrent point in time, flows, as measured downstream, approximate the sum of inflows (main channel and tributaries) to the reservoir. Provisions are included for exceptions and monitoring.

Contaminated Sediment Management Program

To learn more go to: http://www.dnr.state.wi.us/org/water/wm/wqs/sediment/index.htm

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:

1. Develop a consistent and holistic contaminated sediment strategy,
2. Integrate contaminated sediment issues with other program efforts,
3. Ensure consistency in evaluating and assessing contaminated sediment sites, and
4. Ensure the most current and applicable technology is used in remediating contaminated 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 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 2000-2001 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.

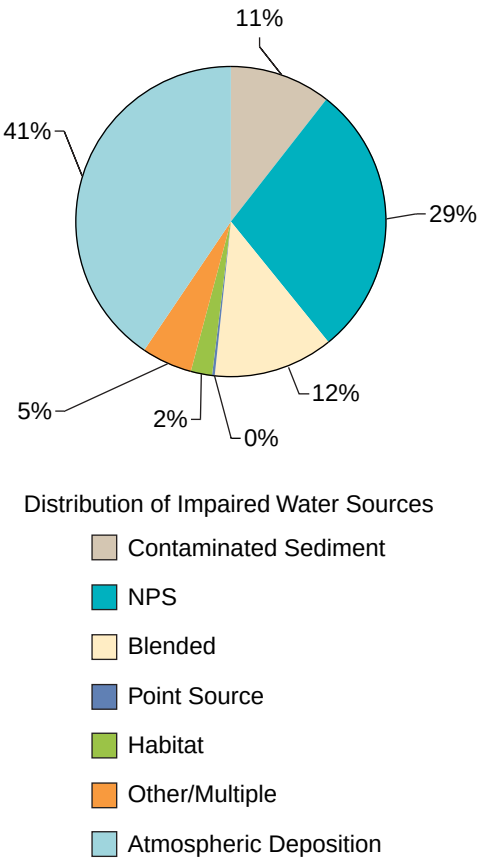
Impaired Waters Program

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, as they do not meet Wisconsin water quality standards. This list of impaired waters was subsequently approved with a small number of additions. EPA's vision is that a Total Maximum Daily Load (TMDL) analysis and allocation will be prepared for each of the listed impaired waters. The Department will be again be submitting an update to its list of impaired waters in October 2002.

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 Department placed those 552 waters into categories shown in Figure 17 based on causes 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

Figure 17. Categories of Impairment and Numbers of Waterbodies or Waterbody Segments



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" in 2002 for 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*.

For **nonpoint source dominated waters**, *Spring Creek in Rock County* will be proposed for "de-listing" in 2002 due to a substantial improvement in the stream and fishery resulting from a small-scale priority watershed project. In addition, a TMDL has been approved for *Squaw Lake in the St. Croix Basin*, a priority lake project, and a TMDL has been developed for sedimentation problems in *Token Creek in the Rock River Basin*. 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 2002. 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 Aquisitions 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 developed following the 1987 amendments to the Clean Water Act. The CWFP began making loans in 1991, using funding from the capitalization grant authorized by the Clean Water Act. Supplemental funding, generated through state borrowing, was also available as a means to leverage the federal capitalization grant. The CWFP has played a crucial part in achieving the state's water quality goals and the objectives of the Clean Water Act.

In addition, the 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. Since 1991, the CWFP shifted the state's financing of wastewater treatment facility construction from grants to loans. An increased emphasis was placed on preventive maintenance for existing pollution abatement facilities. The CWFP replaced the point source pollution abatement grant program, which provided grants to municipalities for wastewater treatment systems from 1978-90. 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 2001, the CWFP entered into 472 financial assistance agreements with Wisconsin municipalities totaling $1.43 billion in loans and $97.1 million in financial hardship assistance grants. In addition, the CWFP has executed agreements with 41 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 $67 million. The Milwaukee Metropolitan Sewerage District, which is comprised of 28 individual municipalities serving a population of about 1.2 million, has received 36 CWFP loans totaling over $384 million. This amount represents 27% 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 wild and domestic animals, 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 2001, the SDWLP has provided 18 loans to local units of government totaling $80.5 million.

Land Acquisitions and Easements

WDNR Bureaus of Facilities and Lands and Community Financial Assistance manages the Stewardship Program, which provides funding for a variety of land acquisitions and easements that protect natural resources and increase public recreational opportunities. Many acquisition projects benefit water quality because they usually receive higher priority for funding. Typical project areas include streambank corridors, natural areas, habitat restoration areas, urban greenspace and large river corridors. Stewardship has also funded a number of recreational development projects, primarily for the State Park and Trail System.

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. Examples of projects funded by Stewardship funds 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.

The Stewardship Program includes a wide range of acquisition purposes all with the intent of preserving or enhancing natural resources as well as providing public recreational opportunities. Although these areas may not have water quality protection as a primary purpose, they do provide water quality protection by preserving green space and incorporating proper land management practices. Expansions of wildlife management areas, fisheries areas, natural areas, state parks, and habitat restoration areas are primarily funded through the Stewardship Program and other federal programs such as the Land and Water Conservation fund (LAWCON) and other federal sources.

Two of the five acquisition priorities for Stewardship funding are lands that preserve or enhance the state's water resources (including land along the Lower Wisconsin State Riverway; land abutting wild rivers and wild lakes, and land along the shores of the Great Lakes) and land for the stream bank protection program. The purpose of the stream bank protection program is the protection of 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 $6.7 million has been spent on WDNR streambank projects, and about $3.4 million in grants have been provided to municipalities and nonprofit organizations for 38 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 totaling 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 manage-

ment 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

The information below can also be found in Part II under Water Management Program - Polluted Runoff Management.

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.

Targeted Runoff Management Grant Program

The Targeted Runoff Management (TRM) Grant Program provides financial assistance to rural and urban governmental units. The maximum cost-share rate available to TRM grant recipients is 70 percent of eligible project costs, up to a maximum of $150,000 (total state share). Local governments that are awarded TRM grants may use the funds on lands they control or make the funds available to private landowners. To date, TRM grants have funded construction of rural and urban best management practices. The projects last from two to four years. Please refer to Table 7 for additional information regarding the TRM grant projects. The first grant cycle for the program was in 1999, and 16 rural and 26 urban projects have been funded by TRM grants since then. Approximately $4,513,472 was authorized to fund these projects. Thus far, 31 of the 42 projects have been completed.

Urban Nonpoint Source and Storm Water Grant Program

The Urban Nonpoint Source and Storm Water Grant Program focuses on financial assistance in urban areas. To be eligible for a grant, urban areas should have a population density of at least 1,000 people per square mile, have a commercial land use, or include a non-permitted portion of a privately owned industrial site. Urban Nonpoint Source and Storm Water Grants can be used to pay for a variety of activities. Eligible technical assistance costs for planning, related informational and educational activities, ordinance development and enforcement, training and design are cost-shared at 70 percent. Eligible construction costs may include such projects as storm water detention ponds, streambank stabilization, and shoreline stabilization and are cost-shared at 50 percent. The funded projects last between two to three years. Table 7 provides additional details about the projects. Since the first grant cycle in 2000, approximately $8,755,818 were authorized to fund 31 planning and 25 design/construction projects.

Financing Compliance with Performance Standards

The total estimated **annualized** cost to implement these 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 the 120 waters listed as impaired on the federal section 303(d) list.

Special State Concerns and Recommendations

Eutrophication Strategy

In 2001, the Department began developing a strategy specifically designed to address eutrophication. Many of Wisconsin's lakes and streams are experiencing "eutrophic" conditions that are beyond what would be considered as "natural aging" of these waters and which is often associated with the impaired use of the water. Eutrophic conditions are most often caused by high concentrations of phosphorus or nitrogen. Phosphorus and nitrogen are essential nutrients necessary to support life in both terrestrial and aquatic systems. However, the presence of these nutrients in large amounts or high concentrations in the aquatic environment can result in nuisance algae conditions, prolific macrophyte growth, reduced dissolved oxygen, fish kills and other problematic conditions. In turn, these conditions may result in unaesthetic conditions for swimming and sightseeing, undesirable changes in fish and aquatic life communities. They may also result in increased costs to treat water for human consumption from surface water supplies. Public concern for water quality and federal and state regulatory and non-regulatory initiatives drive the development of this strategy. This strategy focuses on reducing eutrophic conditions through the management of nutrients. During 2002 and beyond the Wisconsin DNR will continue to identify and integrate various disparate initiatives that affect nutrients in surface waters to capitalize on opportunities for cost-effective approaches to reduce eutrophication in the state.

To learn more go to: http://www.dnr.state.wi.us/org/caer/ce/invasives/index.htm.

The handful of invasive aquatic species that Wisconsin now monitors has already taken a toll on Wisconsin ecosystems, recreation and economy. In the decade that zebra mussels have been in Wisconsin, they have decimated native mussel populations on the Mississippi River and contributed to low oxygen levels that endangered fish in the late 1990s. They have cost water utilities some $4 million a year to clear from their intake pipes and another $1 million for power plants — and those are 1994 figures, before the zebra mussels really took hold.

Rainbow smelt, which have invaded several lakes in Vilas County in northern Wisconsin, are causing significant declines in walleye reproduction and fish managers are now having to stock waters that once had healthy walleye fisheries.

Eurasian watermilfoil, a feathery-looking aquatic plant that forms thick mats at the water's surface, has spread to 310 lakes in more than 50 counties and is hampering boating, swimming and fishing.

Aquatic Nuisance 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 2001, DNR completed a draft of *A Comprehensive Management Plan to Prevent Further Introductions and to Control Existing Populations of Nonindigenous Aquatic Nuisance Species.* 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. This plan, prepared in cooperation with University of Wisconsin Sea Grant Institute, was submitted to the National Aquatic Nuisance Species Task Force. If the task force approves the plan, the state will qualify for federal funding to begin implementation of an invasive species program in Wisconsin.

The plan, submitted to a special *Governor's Task Force on Invasive Species*, 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 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 and pet sales and aquaculture operations is 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.

In 2001 Wisconsin Gov. Scott McCallum signed a biennial budget allocating $300,000 to DNR for aquatic invasive species control in each of the next two years – six times the amount allocated in each year of the last biennial budget. This money will be used to start developing a coordinated, comprehensive program modeled after the state of Minnesota's. Key program elements will 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. 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 overall availability of water for a varied spectrum of uses ranging from public water supply to sufficient 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 surficial or 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.

Over the years the state's increasing population, rapid widespread development and increasing and varied industrial demands have in some areas resulted in water quantity and related water quality problems. These short-term temporal factors affecting quantity add to the geological and hydrologic factors that result in less than abundant water supplies in a given area. Regional impacts from quantity problems are documented in the Lower Fox Valley, Southeastern Wisconsin and in Dane County. These three areas are experiencing substantial groundwater level declines with the added complexity of quality problems for drinking water. In addition, localized expressions of quantity issues include lake level drops, stream flow declines, wetland size and level declines, and the disappearance of springs.

While management of Wisconsin's groundwater and surface water programs are functionally distinct, coordination on this issue has become a priority. 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 drinking water bottling plant involving a high capacity groundwater well in a spring-fed region of Wisconsin illustrates the complexity of social, ecological and institutional issues involved. This 'case study' highlighted public concern for DNR to protect resources, while at the same time underscored the existing framework and procedures established by law. 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 magenta sunset over a glistening body of water or the serenity of dawn breaking while wildlife and fish scurry to take advantage of the early morning hour. Perhaps it is the sense peace these scenarios provide that, ironically, has resulted in a tremendous decline in the state's undeveloped 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 existing incorporated areas.
- Clean Lakes Program Grants (State/Local) have provided funds for careful resource planning and protection at the local level, resulting in lake shoreland classification schemes more stringent and protective than state rules.

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.

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. With new people inevitably come questions of why regulations exceed minimum standards. New staff also require training in administration and implementation of land use regulations, which the Department has begun to provide, but demand exceeds our ability to provide currently.

Private property rights groups are becoming more and 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 variance be issued. Education and training is needed for local Corporation Counsels, as well for the general public.

Land prices are skyrocketing on Wisconsin's lakes and rivers as it becomes harder and harder to find the perfect piece of property. 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.

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 signup 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 must help develop a vertical infrastructure to provide data to local governments about sensitive of resource areas so that protection can take place through local ordinance and planning, such as smart growth or comprehensive planning efforts.

Mercury

Mercury remains a critical pollutant of concern for Wisconsin waters. Emissions of mercury from fossil fuel-fired boilers used to generate electricity and from other major sources significantly contribute to mercury entering waterbodies and ultimately fish and wildlife. In the past two years, Wisconsin has continued to study the biogeochemistry and ecological movement of mercury, while simultaneously developing a strategic initiative to both better understand the contaminant and to stem its influx into the environment through regulatory and nonregulatory methods.

Ongoing Research

Four mercury research projects described in the Year 2000 305b report continued during 2000-2002. This research includes a study of total and methyl mercury and other trace metals in tributaries to Lake Superior to develop a predictive model responsive to changes in mercury emissions in the lake's airshed. WDNR also continued its wildlife risk assessment model using the common loon, developing lowest observable effect level (LOEL) and no observable effect level (NOEL) for Hg in the loon. A third study involves monitoring mercury cycling through lake bog connections and changes (over a 10-year period) in bioaccumulated Hg levels in young of the year fish. An additional study involves a 3-year monitoring of the Hg cycle in Devil's Lake to allow

verification of a USEPA Mercury Cycling Model, which is being used in the Devil's Lake TMDL pilot project. The pilot project is one of two atmospheric deposition pilot projects in the country.

Mercury Analysis Team

The DNR 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 model will be used 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.

Regulatory Initiatives

During the past two years the state has initiated or completed two major regulatory initiatives involving mercury. In response to the growing awareness and scientific study of mercury and its ecological effects, the Natural Resources Board in December 2000 adopted a resolution that granted a citizen petition seeking rulemaking to reduce mercury emissions to the air. The Board directed staff to develop proposed rules that protect public health and the environment and that are cost-effective, reasonable, and do not interfere with the ability of electric utilities to supply the state's energy needs. Under the authority of s. 285.11(9), Wis. Stats., proposed administrative rules to reduce mercury emissions was developed and presented to the Board in June 2001.

Included with the presentation of the proposed rule to the Board was the formation of a Technical Advisory Group (TAG) and Citizens Advisory Committee (CAC). The purpose of these two groups is to consider alternatives and making recommendations for changes to the proposed rule. The two groups continue to hold meetings and are expected to compile a report to the Secretary by the end of May 2002. After considering the recommendations in the report, the Department will then seek authorization from the Board to conduct public hearings on the proposed rule.

In February 2001, the Natural Resources Board adopted a statewide general advisory for mercury, covering all waters of the state, which is supplemental to the existing specific mercury advisories in place for waters with supporting fish tissue monitoring data. The state is evaluating how this general mercury advisory will affect its assessment criteria for lakes and streams.

Also, in January 2002, the DNR Board approved holding public hearing on modifications to NR106 and NR 219 that would control mercury in wastewater discharges. These rule modifications are designed to formalize, using a more rigorous regulatory format, the state's Wastewater Mercury Strategy, which has provided guidance to permit drafters since 1996 on how to handle mercury. Near the end of 1999, USEPA officially approved of a sensitive test method that allows direct evaluation of compliance with a mercury water quality standard. The proposed rule changes will require dischargers to utilize this new analytical method to test mercury in effluent and to then to plan for and implement pollution prevention actions or where necessary request a variance. Implementation of this rule may have a modest but still significant impact on mercury inputs into the environment.

Prior to these newer initiatives, in 1998 the state submitted to the USEPA a list of impaired waters, which are waters that do not meet water quality standards ("303d List") and for which remedial action should be initiated to improve the quality back to a level commensurate with standards. This Impaired Waters List and associated Total Maximum Daily Load (TMDL) initiative involves 421 streams, stream segments and lakes listed exclusively for mercury deposition related problems.

While progress on the influx of mercury may be achieved through rules regarding atmospheric deposition and municipal treatment plant discharges, the nature of the contaminant's biogeochemical cycle, the pool of existing contamination in waterbodies, and the breadth or scope of mercury sources (both in terms of number of products containing mercury and the regional and global nature of mercury air emissions) likely preclude substantive change in ambient mercury

concentrations in surface waters or in fish tissue for quite some time. The state believes that the nature of mercury deposition demands a multi-state, regional and national effort to stem the influx of this contaminant from the myriad of sources. Also needed are additional funds and time for stepped up pollution prevention efforts and for research to better understand this contaminant and its movement in the environment.

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

- Development and implementation of standardized protocols for baseline monitoring for wadeable and nonwadeable streams, lakes and wetlands;
- Monitoring for biological and physical parameters necessary to develop indices capable of summarizing ecological condition;
- Implementing a random stratified sample design for wadeable streams;
- Continuation of long-term trend monitoring on large river systems;
- Identification of additional key stations where flow gages are needed to conduct TMDL modeling and floodplain management;
- Development of a state-of-the-art web-interactive biological database for surface water data;

Work Yet to Accomplish

- Sufficient funding to fully implement the state's baseline monitoring program;
- Sufficient funding to achieve substantive progress in the area of data management for water systems;
- Incorporation of chemical monitoring into baseline monitoring program;
- Evaluation and modification of the state's 305b assessment procedures in light of major changes in NR102, the state's water quality classification code;
- Development of assessment procedures and linkage of chemical, biological and physical data into a cohesive database system for water quality assessments;
- Upgrade of the state's 305b assessment database system into an oracle, web-interactive system readily linkable to the state's 1:24,000 hydrography layer through the Surface Water Integration System (SWIS);
- Linkage of key related databases (Fish and Habitat Monitoring Database; 303d/Impaired Waters, Outstanding and Exceptional Resource Waters, Aquatic Nuisance Species locations, Outfalls; contaminated sediment/fish consumption advisory database) with the 305b assessment database, preferably through the DNR's in-house 'enterprise database' system.
- Progress in developing and implementing a long-term, strategic perspective for the state's water and water-related databases

These numerous yet important work items are necessary to support and provide for a basic understanding water quality condition in the state.

• recognizing ecosystem services as well as economic benefits of groundwater

Over the next year, the GCC and agency staff will be compiling results of the small group sessions, developing a set of strategic action items, and putting together full conference proceedings.

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 regulatory actions. The overall goal of surface water monitoring is to gather the 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.

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 abundance of surface water resources in Wisconsin precludes adequately monitoring these resources in a timely fashion. With proper program design, not every waterbody need be tested to provide solid spatial coverage of baseline conditions, as 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 idea, grounded in a statistically valid scientific approach, will provide greater breadth to the number of waterbodies assessed under our basic or core water data gathering efforts.

Wisconsin will in 2002 pilot the use of a "random stratified sampling technique" for assessing wadable streams for an across-the-board look at the condition of our waters that will provide us with greater knowledge of resource condition in a relatively shorter timeframe with less cost in the long run. In addition, standardized assessment techniques for aquatic habitat, macroinvertebrates and fish have been developed and are being applied throughout the state and all data is being captured in a web-accessible database.

Baseline monitoring strategies have been developed for four key resource areas: wadeable streams, non-wadeable rivers, lakes, and wetlands. Sampling designs are also is proposed for baseline toxicological monitoring of sediments and fish. Baseline monitoring is intended to provide adequate 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 is the statewide status and trend in the quality of Wisconsin's surface waters?

To achieve the goals of the program, 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.

The monitoring data is captured electronically in centralized database accessible to DNR field staff to improve data analysis and dissemination. The resulting information will be readily accessible to all resource stakeholders and management partners. This database, called the Statewide Fish and Habitat Biological Database, captures raw data and will eventually be linked to the state's 1:24K hydrodrography layer for spatial display. Resource managers are working on developing a linkage between the baseline program, the relational database and the state's overall designated use assessment process.

Wadeable Streams

Historically within DNR different types of information were collected from streams, depending upon the local management questions there were being addressed. This lack of standardized assessment and data-capture produced information of unknown quality inhibited data sharing, and made comparisons of stream quality over time or across geographic areas difficult. Standardized protocols and sampling effort, and electronic data capture will significantly increase the power and utility of field data collected.

For the past two years DNR fisheries and water quality biologists have been applying the standardized protocols to address local and basin-wide data needs. Staff have become more familiar and efficient with the 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 should increase markedly.

The next step is to improve spatial coverage of stream assessment sites. Baseline data already gathered has allow us to develop a statistically-valid assessment of how many sites need to be assessed on a stream to detect changes in stream habitat or fish community composition. A randomized sampling-site selection process will be piloted in the West Central Region. Relatively few (35-50) randomly-selected stream assessment sites can be used to answer the question of what proportion of streams are meeting (or not meeting) use attainment expectations within a DNR Region, a question that the Department has to date been unable to answer with statistically valid data.

In 1999, a total of 286 stream sites were sampled using baseline protocols, in 2000 a total of 506 stream sites were assessed, and in 2001 a total of 384 stream sites were assessed.

In 2002 an EPA-EMAP project will be initiated in the Driftless Region ecoregion. The objectives of this two-year research project will be to study ways to improve upon how WDNR selects and monitors wadable streams in WI. We currently use a targeted approach to sample streams (i.e. biologists pick stream sites to answer specific questions). This approach is great for addressing local management needs but bad for trying to assess statewide status and trends-type questions (since the resulting data from the targeted sampling is often biased toward either really good or really bad streams depending upon the focus of the study). 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 WI stream resources to improve our understanding and management of factors affecting stream health. The pilot study strategy will be applied to the rest of the state once the methods and metrics are refined.

Nonwadeable Streams

A nonwadeable stream is a stream in which you need 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 usually meets this definition. Wisconsin has 34 nonwadeable streams with a total length of approximately 2,500 miles. Some portion of a nonwadeable stream is located in 17 of the 23 geographic management units (GMUs) (See Table 8).

The stated purpose of baseline monitoring is to describe the health of the ecosystem, with the goal of answering the three management questions stated above. Answering these questions will benefit the Water Division's management programs, such as being able to respond to questions from the public about the condition of their stream. Further data analysis may allow tracking the spread of exotic species, for example (See Table 9).

Table 8. Nonwadeable Streams in Wisconsin

Code	River Name	Miles
Mississippi River Basin		
MS	Mississippi	231
IFX	Fox	26
RK	Rock R	132
PC	Pecatonica	60
EBP	E. Br. Pecatonica	20
SU	Sugar	29
BK	Bark	13
CR	Crawfish	21
GR	Grant	19
WI	Wisconsin	379
KP	Kickapoo	84
BA	Baraboo	74
LE	Lemonweir	50
YRW	Yellow	49
TH	Tomahawk	30
BL	Black	76
TR	Trempealeau	32
BU	Buffalo	23
CH	Chippewa	176
RC	Red Cedar	89
ECC	Eau Claire	29
FL	Flambeau	112
SFFL	S. Fk Flambeau	46
SC	St. Croix	144
NA	Namekagon	30
Lake Superior Basin		
SL	St. Louis	18
BA	Bad	34
Lake Michigan Basin		
ME	Menominee	119
PS	Peshtgo	52
OC	Oconto	18
FX	Fox	158
WF	Wolf	120
LW	Little Wolf	11
EM	Embarrass	34

Table 9. Benefits to Answering Management Questions

Help us answers questions from the public about the condition of their stream.
Help us track spread of exotic species
Help us prepare future 303d lists.
Help us prepare annual 305b report.
Help us do basin assessments.
Help us select NPS projects.
Help us provide some biological data for FERC re-licensing.
Help us improve IBI for nonwadeable streams.
Help us evaluate needs for changes in fish management activities, such as size limits.
Help us organize response monitoring
Help us collect fish samples for fish contaminant analysis.
Help us supplement aquatic terrestrial survey.
Help us compare quality of sediments below urban areas.
Help us document quality of fish statewide.
Help us document status of threatened and endangered species.
Help us update existing biological data.

Sampling Design

Sampling design includes 1) site selection criteria, 2) number of sites, 3) types of parameters, and 4) sampling frequency. Sampling design decisions are based on starting with the minimum monitoring effort needed to answer the three management questions, which minimizes costs.

Site Selection Criteria:

For nonwadeable streams, the stream is divided into three types of reaches: 1) riverine (unimpounded and more than 1 mile from a dam), 2) tailwater (unimpounded riverine stretches immediately below a dam), and 3) impoundments. Each type of reach tends to have distinct physical-chemical attributes, biological communities, and human use patterns.

Reference sites, which are relatively undisturbed areas used to track the natural variability of the stream's ecological health, are selected for each of the three types of reaches in each region for a total of twelve reference sites statewide. These sites are monitored annually, while other sites are monitored once every five years.

Number of Sampling Sites:

There are about 150 dams on the nonwadeable streams, with about 32 of those dams less than 2 miles in proximity, leaving about 118 dams with three distinct reaches, or a total of 354 reaches. Most regions seem to have about 150 miles of free flowing reaches, which represents about 5 reaches of 30 miles. An additional 20 reaches added for various reasons brings the total number of reaches to 374. The baseline strategy involves monitoring about half of these sites every five years, or about 46 sites each year. Including reference sites, the total number of sites monitored in five years is 180, or from 1-12 in each region each year. . Repeat monitoring at the 180 sites every five years provides data for long-term trend analysis, particularly over a 20-year time span.

Parameter List:

Below is a minimum parameter list. However, some method development is required before all the parameters identified below can be obtained.

Table 10. Types of Sampling Suggested for the Nonwadeable Stream Baseline Monitoring Strategy

Sampling for Riverine and Tailwater Reaches	
Habitat:	Need to develop checklist by next summer. Should include presence of macrophytes and exotic plant species.
Fish Community:	Measurement of IBI - Includes identification of exotic fish species.
Water Quality:	Includes instantaneous D.O., temperature, pH, and secchi disc readings recorded as part of fish community sampling.
Flow:	If available, check USGS flow for day.
Macroinvertebrates:	Need to develop sampling method.
Sport Fisheries:	A limited assessment of sport fisheries, such as catch per unit effort. Methods will vary between different rivers.
Types of Sampling for Impoundments	
Water Quality:	Chlorophyll-a, color, calcium, and Total P analysis, D.O. and temperature profiles along with secchi disc reading. Samples should be collected near the dam three times during a year.
Stage and flow:	If available, record USGS numbers.
Macrophytes:	Need to develop method.
Habitat:	Need to develop check list by next summer. Check list should include presence or absence of major types of macrophytes.
Sport Fisheries:	A limited assessment of sport fishery, eg. catch per unit effort and size structure.

Two monitoring methods that require additional development include macroinvertebrate sampling method for riverine and tailwater reaches and a macrophyte sampling method for impoundments. DNR must also better define the amount of work to be done for the sport fisheries monitoring. Most of the parameters selected for the impoundments will help define water quality. Water chemistry, color, dissolved oxygen, and secchi disk measurements will be used to estimate the trophic status of the impoundments. Macrophyte surveys should help us describe the amount of habitat available for fish and wildlife.

Sampling Frequency

All reaches selected for sampling, except reference sites, should be sampled once every five years. The twelve reference sites are sampled every year. Sampling once every five years means more than one visit during a year for water quality monitoring in impoundments and sport fisheries sampling. Sport fisheries sampling will require at least five consecutive days of visits to the site, while three visits are required for water quality monitoring in impoundments.

Lakes

The objective of the monitoring strategy for lakes is to determine the status of and trends in lake ecosystem health as it relates to the broad ecological endpoints of fishability and swimmability. The focus of the lakes program is on the effects of environmental change related to broad-scale changes in land use and shoreline development. WDNR also monitors human use of lake resources. The program samples all high-visibility waters and sub-samples other waters to provide:

- A context for data collected from all lakes and the capacity to compare lakes within strata.
- Information from trends lakes that will generate a context to compare lake health across strata through time.
- A basic inventory of lake condition.
- An answer to initial questions about the swimmability and fishability of individual lakes.

- A standardized set of spatial and temporal data that can be compared to current lake conditions.
- The capacity to make a statewide determination about the health of our lake resources.

Below are five 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. Develop and Evaluate Lake Stratification Framework
- Objective 2. Identify and refine metrics to appropriately assess the ecosystem health of the state's lakes. Determine properties of metrics, including robustness, variability, and sensitivity to changes in lake ecosystem health.
- Objective 3. Design Baseline Plan for Condition Monitoring
- Objective 4. Design an efficient monitoring program that assesses trends in the metrics measuring the ecosystem health of the state's lakes.
- Objective 5. Determine the status of and trends in human uses of lake resources. Document the links between human actions and lake ecosystem health.

Approach/Design

Target Lake Population: The monitoring program will focus primarily on assessing status and trends in Tier I lakes, defined as those > 100 acres in surface area and with public access. Sampling of Tier II lakes (< 100 acres with public access) is included on a reduced scale.

The design of the program includes both trends and status lakes. The status lakes provide spatial data needed for baseline monitoring and statewide assessments. Further, by sampling these lakes on a 5-10 year rotation, we can augment the trends set of lakes. The trend lakes will be monitored every other year beginning in the spring of 2000. This will provide information on interannual variability as well as trends in lakes representative of the lake strata defined below. Managers should use existing programs (e.g., ambient lakes monitoring) to guide their selection of lakes for trends monitoring.

Lake Stratification: Lakes will be hierarchically stratified according to physiography (GMU and ecoregion), hydrology (seepage and drainage type, including impoundments), and morphometry (shallow and deep). Stratification of lakes is necessary to minimize variance in measured response variables, permitting us to understand the patterns within the response measures. Further, stratification of lakes allows us to efficiently extrapolate information to non-sampled lakes.

Metrics Related to Ecosystem Health: Three groups of metrics have potential as endpoint measures of ecosystem health — fishery exploitation, riparian development, and watershed land use change. These metrics are all easily measured and well understood, and are either currently used by staff or are in the process of development. Together, they provide some redundancy as measures of ecosystem health and offer complementary measures of lake ecosystem function. All three metrics should be sampled during the same calendar year for all lakes on the plan as a minimum set of metrics. Additional metrics to measure angler harvest and habitat changes are being evaluated as well.

Trophic Status Indices (TSI): Trophic status is assessed by measuring the following water quality variables during the period of peak stratification (August): total phosphorus (TP), secchi disk transparency, chlorophyll a, dissolved oxygen and temperature profiles, color, and calcium. For the trends lakes, calcium will only be measured the first year, as these data are needed to refine the lake classification scheme.

Fish IBI: Currently under refinement, the IBI uses littoral fish assemblages as an index of biological integrity. This metric has proven to be a sensitive indicator of riparian and watershed land use change and can be calibrated to reflect other water quality problems. The first sampling objective is to create a complete species list from a combination of gears. The species list will be generated from summer seining and mini-fyke nets, and from the spring gamefish sampling. Sampling with seine and mini-fykes can be conducted from June-September. The second objective is to measure proportional abundance of species or guilds of fishes with specific sampling gears (seines and mini-fykes).

Game Fish: Spring gamefish is sampled by electrofishing the entire shoreline when water temperatures have reached 55-65 ^{0} F. If the amount of shoreline is excessive, then 25% of the total shoreline length or a minimum of four miles should be sampled. If the entire shoreline is not shocked then stations of 2 miles in length should be developed.

Wetlands

Unlike other surface waters, wetlands have not been included in planning and monitoring strategies. Resources regularly allocated for water quality programs have traditionally not involved wetlands. There is currently no explicit monitoring strategy for wetlands outside the Wisconsin Wetland Inventory (WWI). To complicate matters further, wetlands do not fall within any one program. Management typically occurs in the Land Division, regulations are administered in the Water Division and research is carried out in the Division of Enforcement and Science. A program to monitor wetlands must not only start at a very preliminary level, but it also must cross program boundaries to involve water, land and enforcement and science division programs.

The results of wetland monitoring are needed for analysis at the watershed and landscape level. Monitoring of wetland locations, types and health, can aid in the assessment of watershed "protector" functions (maintenance of hydrologic regime, stormwater and flood storage, downstream water quality related functions) and other human use values such as recreation and education. The ultimate goal is to determine how wetlands in a given landscape unit are functioning, how they are being used, what their potential uses are and how to restore functions.

- Provide a meaningful wetland analysis component for regionally based planning efforts (including evaluating the causes and cumulative effects of wetland loss in a given geographical area) for use in the basin planning process, in a redesigned priority watershed planning process, and in identifying acquisition, restoration and management priorities.
- Strengthen and prioritize the focus of the Department's water regulatory program.
- Provide good baseline information for use by the NRB, Department and public to set statewide policy on wetland protection, restoration and management.
- Answer current questions posed by the Natural Resources Board and public on wetland losses and gains.

Specific Goals and Objectives for Baseline Wetland Monitoring

Wetland baseline monitoring is broken down based on the types of questions this work can address — wetland quantity (by type and location) and wetland biotic health; monitoring goals and objectives have been developed for each area.

Goal: Quantify the amount and type of wetland in the pre-settlement landscape and what changes have taken place historically. Monitor current baseline status in wetland quantity (number of acres) and type.

Goal: Determine the overall health of the states' wetlands. Determine how wetland health is changing and what is causing the change.

In the area of identifying overall wetland health, development of assessment tools that can be used in a variety of applications, particularly at the watershed level, is needed. It is critical to focus attention on the biotic health of wetlands in discussing regulatory issues, planning and restoration, though we need to be very careful about how these tools are used.

Develop methods to quantify biotic integrity of wetlands.

Develop a multi-metric Index of Biotic Integrity using reference wetlands. The long-term goal is to develop IBIs for the most critical wetland types over the next few years. Examples are riverine, lacustrine, groundwater flowthrough, palustrine.

DNR has obtained funding from an EPA Wetland Grant for a research project to develop an Index of Biotic Integrity for Depressional Wetlands. The project goal is to develop a multi-metric index using macro-invertebrates and plants. Samples of diatoms and zooplankton have also been taken, but not analyzed. The grant project was to be completed in September 1999, with the project report due in December.

For the long term, continued research is necessary to test the Index, to expand it to other wetland types and to develop sampling methods that can be used by volunteers and school groups.

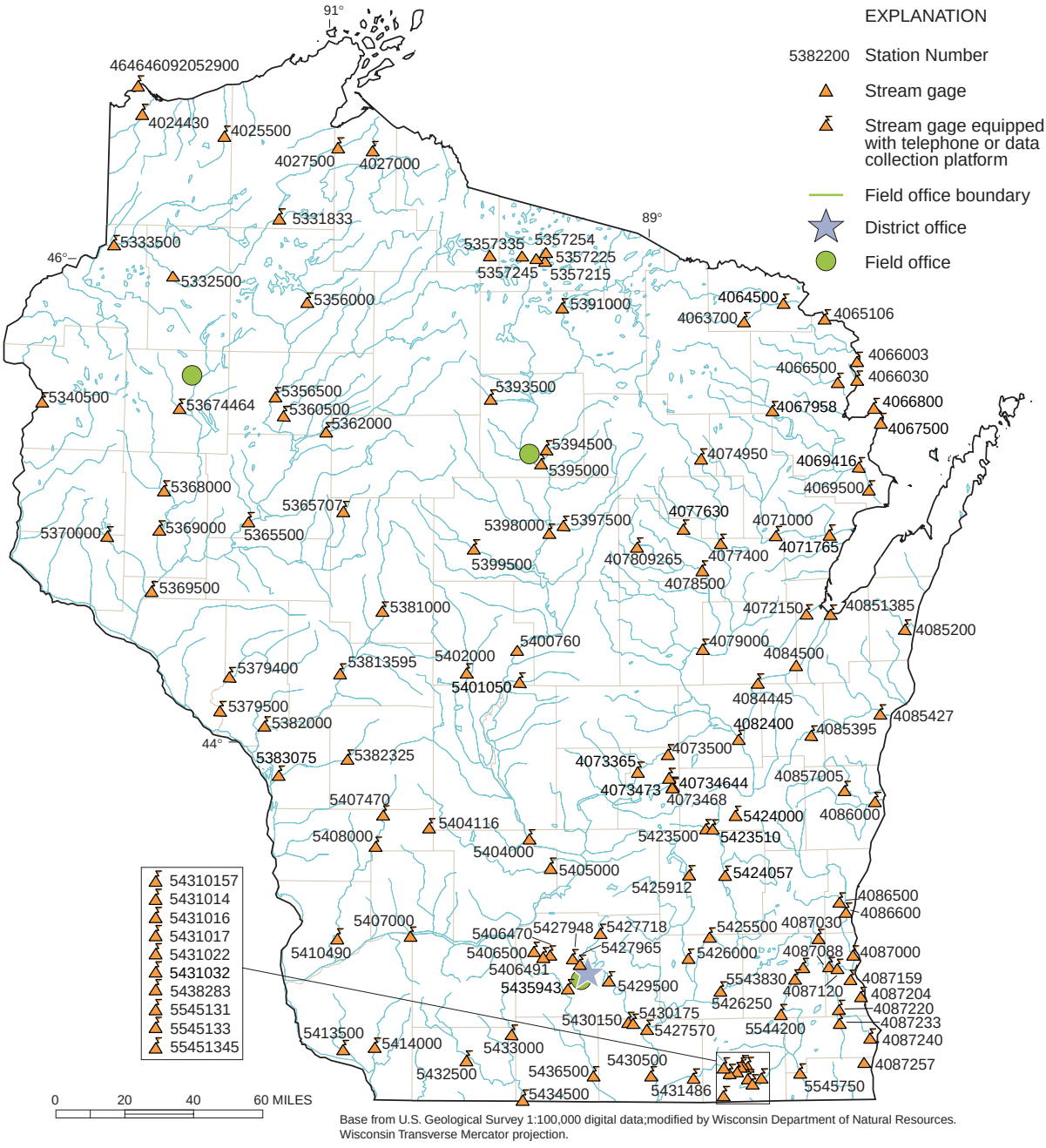
Pathogens

While the DNR does not regularly conduct pathogen monitoring, the department is working with local governmental units and state and federal partners to better coordinate monitoring of pathogens at beaches throughout the coastal waters through the USEPA BEACH Initiative.

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 18). 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 DNR. Real time data from all sites are available on USGS's web site.

Figure 18. Wisconsin Long Term Trends Sites



Base from U.S. Geological Survey 1:100,000 digital data;modified by Wisconsin Department of Natural Resources. Wisconsin Transverse Mercator projection.

In 2001, the DNR funded operation of 14 of the gages, 12 normal stage type and 2 acoustic velocity meters. As part of the budget process, DNR staff were asked to identify needs for additional gages. Ten 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

Sediment mapping continues to be an integral part of Wisconsin's contaminated sediment program. Sediment mapping techniques continue to improve in efficiency and data analysis with the use of Global Positioning Systems technology and multiple levels of GIS integration. By using proven field techniques and sound analytical methods, spatial and temporal components of contaminated sediment occurrence and transport can be identified. Subsequently, sampling, planning and site management efforts are greatly refined.

In the last two years WDNR sediment mapping has been used in a number of contaminated sediment investigations and post-remediation monitoring. Sites of primary concern include:

- Post-remediation mapping and sampling of the Rib River oxbow - metals contamination site (Rib River, Wausau).
- Contaminated sediment investigations at the Linen Mills Dam impoundment prior to removal of the Linen Mills Dam (Baraboo River, Baraboo).
- Sub-bottom profiling and sediment sampling for the Devils Lake phosphorous-reduction project (Devils Lake State Park).
- Sediment characterization and sampling for the Kewaunee Marsh Arsenic Site Remedial Investigation (Kewaunee River, Kewaunee).

WDNR is also currently investigating techniques to document the behavior of site-specific sediment bed dynamics in response to varying flow regimes.

Special Project Monitoring

A number of studies fall under the special project monitoring category, including total maximum daily load (TMDL) monitoring, best management practice (BMP) evaluation or assessment monitoring, and ongoing water quality sampling unrelated to the state's baseline monitoring program. Below is a list and description of selected special projects monitored during 2000-2001.

Castle Rock Creek Watershed TMDL Work

Castle Rock Creek has been receiving considerable attention from watershed landowners, trout angling enthusiasts and public agencies over concern for environmental threats and perceived water quality decline. In 1998/99 the stream was monitored to assess biological integrity and habitat as part of a stream bank restoration project. In 2000 a WDNR Rivers Protection Grant enabled the Castle Rock Creek Committee to monitor the stream, while WDNR staff conducted baseline monitoring. While these projects have provided valuable information on the health of biotic communities and habitat quality, a much more detailed study was needed to identify threats, use impairments, and pollutant loads. This project involves conducting intensive chemical and flow monitoring sufficient for use in support of TMDL development. The sampling design is based on a USGS study which included both baseflow and event pollutant load monitoring. Baseline bioassessment monitoring will also be continued during this time, and expanded to

include periphyton productivity and bacteria content in the stream. In addition, inventories of barnyards, land use types, crop rotation data, plant and harvest dates, fertilizer application rates and tillage practices will be gathered and used in TMDL model development.

Mill Creek TMDL Work

Mill Creek is on the Wisconsin 303(d) list of impaired waters, and will require development of a TMDL. Recent studies below Marshfield during summer 1998, winter 2000, summer 2000 and winter 2001 found persistent dissolved oxygen (D.O.) problems at various locations in Mill Creek. We suspect the DO problems are due to several potential causes including nutrient and BOD loading from point and nonpoint sources. The purpose of the synoptic surveys, nutrient load monitoring and modeling will be to better define the extent, severity, potential causes and sources of D.O. problems in Mill Creek, both during summer and winter conditions. Results of the monitoring and modeling will provide the technical basis for the TMDL.

Study Design

Synoptic water quality surveys were conducted on the main stem of Mill Creek during summer 2001 under low-flow conditions. DNR has not yet collected the above normal flow samples and budget problems may prevent their collection altogether. Grab water samples were collected from 36 sites located throughout the entire length of Mill Creek. Field parameters included pH, temperature and D.O. SLOH analyzed parameters included N-series, P-series, total suspended solids, volatile suspended solids, BOD5 and long-term BOD, chlorophyll a, hardness and chlorides. The surveys also included stream physical measurements (i.e. width, depth, shading) at sites located every 1mile of stream (the stream is about 50 miles in length). Stream travel time will be determined using dye studies. Dissolved oxygen, temperature and water levels will be monitored during the synoptic surveys using AQUA recording DO meters and staff gauges. The data collected during these surveys will be used in a QUAL II or water quality model to help determine the cause of DO problems in the stream.

In December 2001 two USGS continuous flow monitoring stations were installed at two sites in Mill Creek and monitoring began in February 2002; these stations will operate for two years. Semi-monthly (plus limited storm-chasing) water chemistry samples will be collected by USGS at the continuous flow sites to determine annual nutrient and sediment loads. In addition, wastewater treatment plant operators were asked to collect monthly total phosphorus samples starting in October 2001. The difference between stream and WWTP nutrient loads will provide an estimate of nonpoint loads to Mill Creek.

Little Lake Wissota/Moon Bay TMDL

Little Lake Wissota and Moon Bay are eutrophic embayments of Lake Wissota in Chippewa County. These waterbodies are on the Sec. 303(d) impaired waters list due to pH standards violations as a result of algae blooms caused by nutrient loading to the impoundments. Consequently, the Department is required to develop Total Maximum Daily Loads (TMDLs) for these waterbodies. Development of TMDLs will require considerable monitoring to determine current in-lake water quality conditions and annual nutrient loading from the Yellow River watershed.

Water sampling is being conducted for a minimum of two years beginning in April 2001at both stream and lake monitoring sites. Continuous flow monitoring stations have been established at 3 primary stream sites (Paint Creek, Yellow River, Drywood Creek). In addition, water levels will be measured continuously using a Telog level sensor at Miller Dam. These stations will measure nutrient loading using continuous streamflow and semi-monthly water chemistry sampling. Monitoring will also be conducted in 5 lakes (9 sites) over a two-year period. Samples will be collected in mid-lake at the deepest part of each lake during late winter, spring turnover and semi-monthly during May through September. Department staff will be responsible for lake sampling and U.S. Corps of Engineers (COE) staff will be responsible for stream gauging and sampling.

The internal P load will be estimated using soluble P release rates from sediment samples collected by COE from Little Lake Wissota and Moon Bay. The sediment sample release rate studies will be conducted at the COE field laboratory in Spring Valley.

During Wisconsin's FY03, nutrient loading from various land uses will be simulated using the SWAT model. The model uses a GIS database and will require some level of field verification of land use types, cropping and fertilizer practices and crop rotations. A student intern will be hired to conduct these county land use inventories.

The COE will use Flux and Bathtub to estimate P loads and to model the watershed lakes. The models will be used to simulate water quality conditions in Little Lake Wissota, Moon Bay, Otter Lake and Chequamegon Waters Flowage. The Bathtub model will also be used to simulate the effects of various nutrient load reduction scenarios for each lake.

Baird Creek Watershed Management Study

This study (May 2001-June 2003) involves collecting baseline information on the existing physical, chemical and biological conditions in Baird Creek to determine if water quality criteria and state standards are being met. The result will be a plan to establish criteria and standards to improve and protect use of the waters by aquatic life as well as for the public to enjoy.

- Review historical water quality data.
- Establish 3 sites in the Creek to collect chemical water quality samples that will determine current nutrient and sediment levels using the format (Robertson et. al. December 1999).
- Establish a stream gauging station that will allow us to measure flow on a continuous basis and determine nutrient and sediment delivery at various reaches of the stream as well as loadings to the East River.
- Determine land use in the watershed and estimate nutrient and sediment loadings to Baird Creek and the East River. Mathematical models will be used in this phase of the study. ARC VIEW and other GIS applications will be used to manage the data.
- Conduct a habitat assessment using the Department's current methods in several reaches of the stream.
- Collect macroinvertebrates from several reaches of the stream in the spring of 2002 to apply to Hilsenhoff's biotic index.
- Work with members of the public, other officials, Baird Creek Preservation Association, Lower Fox River Partnership Group for their input and approval in developing the final monitoring plan.
- Work with members of the Fox/Wolf Data Acquisition Group for their input and approval of the final monitoring plan.
- Use this information to apply to the 10 step US EPA Total Maximum Daily Load (TMDL) criteria.
- The final plan for improvement or protection can be used as a model for developing nutrient and sediment load allocations in the Fox/Wolf Basin, if the final conclusion determines its applicability.

Additional Special Monitoring Studies include:

- Mead Lake
- Cedar Creek Ruck Pond
- Sheboygan River, Fox River Sediment Projects
- Wisconsin River
- St. Croix
- Half Moon Lake
- Tainter Lake

Fish Tissue Monitoring

During calendar years 2000-2001, over 1200 fish samples were collected as a part of the fish contaminant monitoring program (Table 11).

Table 11. Fish Samples Collected Years 2000-2001

Year	Sites Sampled	Samples Collected
2000	96*	806*
		Statewide mercury advisory adopted
2001	57*	407*

* Estimated at time of publication

These samples were from inland waters (lakes and rivers) and the Great Lakes. In 2000-2001, samples were collected from approximately 80 lakes, 50 streams and river segments, and 20 areas of Lakes Michigan and Superior (preliminary data as of January 2002).

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.

In 1999, the WDNR initiated a new baseline strategy for lakes, wadeable, and non-wadeable streams and rivers for fish community and habitat monitoring. Under this monitoring strategy, fish are collected for contaminant analysis at a subset of the baseline sites where little/no data exists. The goal is 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 provide information to ascertain whether more intensive monitoring is needed at a given site.

In addition to baseline monitoring, special assessments will continue in order to update advisory waters and those involved in remediation efforts. 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 the 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, primarily is designed to determine contaminant trends and geographic patterns of contamination.

Public Health Fish Advisories

Refer to Chapter 7 for information on Wisconsin's public health fish advisories.

Intensive Surveys

Ongoing intensive studies on major waterbodies in the state are often implemented in conjunction with cooperators such as the USGS and the USEPA. Three major systems that DNR conducts special studies on include the Mississippi, Wisconsin and St. Croix Rivers. (See Part III, Chapter 3: Rivers and Streams for a discussion of these studies.)

Volunteer Monitoring

To learn more go to: http://www.dnr.state.wi.us/org/water/fhp/lakes/shlmmain.htm or http://clean-water.uwex.edu/wav/monitoring/index.htm

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.

Lake monitoring data collected by volunteers is now available at http://www.dnr.state.wi.us/apps/LakeSelfHelp/lakeshome.asp

For the lakes program, DNR provides all equipment. Training is provided by either DNR or University of Wisconsin - Extension staff. 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, U.W. Extension office, Lake Associations and other interested individuals. For example, data from this program is used extensively in the state's 305b Water Quality Assessment Database, which is summarized in this report.

Rivers Volunteer Program

Until recently, river monitoring in Wisconsin has been conducted in a much more decentralized and less structured fashion than the Lakes Monitoring Program. Central support for rivers monitoring is provided cooperatively by the Wisconsin Department of Natural Resources and the University of Wisconsin-Extension for the Water Action Volunteer (WAV) Program, an outreach education program for Wisconsin citizens that involves stream monitoring, storm drain stenciling, and river and shoreline cleanup programs. Historically this popular program has provided a rich format for ecology and water quality education. However, due to the complexity of river systems and the absence of laboratory support, this program has generally not produced data for use in DNR analysis of water quality.

Beginning in 1996, the Department and UW-Extension through the WAV Program initiated two pilot projects — in Dell Creek and in the Pigeon River watershed (see below)— involving community representatives and volunteers to develop systematic protocols for volunteer monitoring work. The goal of this part of the program is to standardize monitoring techniques so classrooms, citizen groups and staff are able to share information using the same technology. Today, there are over a dozen groups, monitoring about a hundred stream sites throughout the state. Citizen groups can now enter their data directly into a web-based database; the data can be viewed by anyone with internet access. Benefits of this program include providing useful data to the community and the department for the site-specific projects as well as this 305b Water Quality Report.

WAV Program Results

Painting a message next to storm drain inlets has become the water quality hallmark for almost 100 communities across Wisconsin. This highly visible event has educated communities about storm water pollution and ways to curb its effects. With spray paint in hand, volunteers representing 4-H clubs, school groups, religious groups and civic groups have painted storm drains with the message: "Dump no Waste." Brightly colored fact sheets are distributed that explain the origin of stormwater pollution with suggestions of practical ways for an individual to lessen the load. Both stencils and door hangers were also available in Spanish. About 3500 volunteers have stenciled over 9000 storm drains in the past five years. The success of this event is due to the many DNR, county, and UW-Extension local offices that worked closely with the WAV program to distribute or loan supplies to local volunteers.

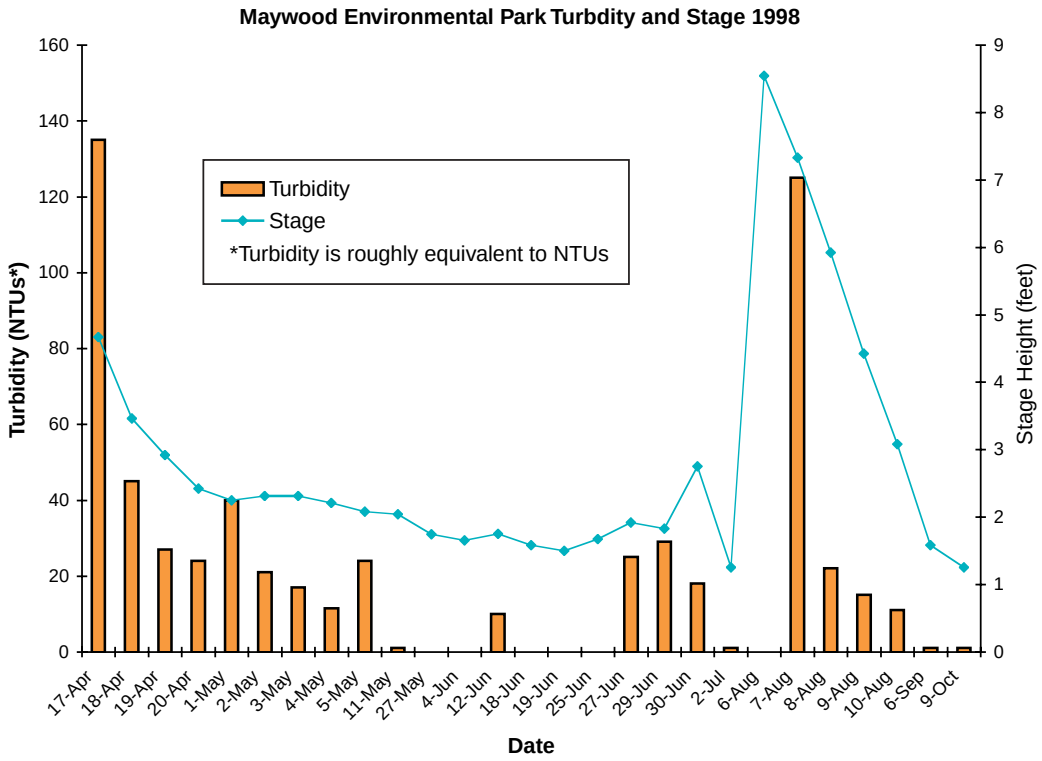
Another activity that WAV is involved in is cleanup of river and stream shorelines. Over 11,000 volunteers have collected over 80 tons of garbage from nearly 500 miles of Wisconsin's shoreline since 1997. All across Wisconsin, volunteers are joining together to make their local waterways cleaner, safer and healthier for everyone. Much of the success can be attributed to the cooperative effort of local interest groups that make cleaning a river a community-wide event.

Activity packets are a very popular way to get the message out about WAV. Since the program began in 1994, activity packets containing educational materials and hands-on activities specific to rivers and streams have been distributed free to Wisconsin residents. WAV outreach efforts include sharing water-quality related educational displays and programs, and assisting local groups with monitoring, storm drain stenciling.

Pigeon River Water Action Volunteers:

Citizens began monitoring water quality in the Pigeon River and its tributaries in 1996 as a pilot project for the WDNR's and UW-Extension's Water Action Volunteers' citizen stream monitoring program. In the 2001 monitoring season, 15 dedicated citizen monitors continued to collect data at nearly 25 sites in at least three sub-watersheds and along the main stem of the Pigeon River in both Manitowoc and Sheboygan Counties. Monitors collect data on water temperature, dissolved oxygen content, and turbidity on a monthly basis. Each spring, the monitors assess within-stream and riparian habitat. They assess biotic community health, using a macroinvertebrate biotic index, once in the spring and a second time in the fall. Some of the volunteers also collect stream stage height and precipitation data on a regular basis. The Pigeon River monitors cooperate with local WDNR biologists to determine monitoring sites and to provide data for the State of the Basin Report. Other integral cooperators with the program include both the Sheboygan and Manitowoc County Land/Soil and Water Conservation Departments, local municipal offices, UW-Extension's Basin Educators, and the Maywood Environmental Park, where training is held on a yearly basis for new and returning volunteers. The citizen monitoring effort is recognized as an important part of the Pigeon River Priority Water shed Project as well. The group meets yearly to discuss their results. They were one of the first groups to begin entering data into WAV's web-based database for citizen stream monitoring data. At the Maywood Environmental Park, an interesting correlation was observed between the stage height and turbidity as collected by one of the Pigeon River's most active monitors (Figure 19).

Figure 19. Pigeon River Graphic

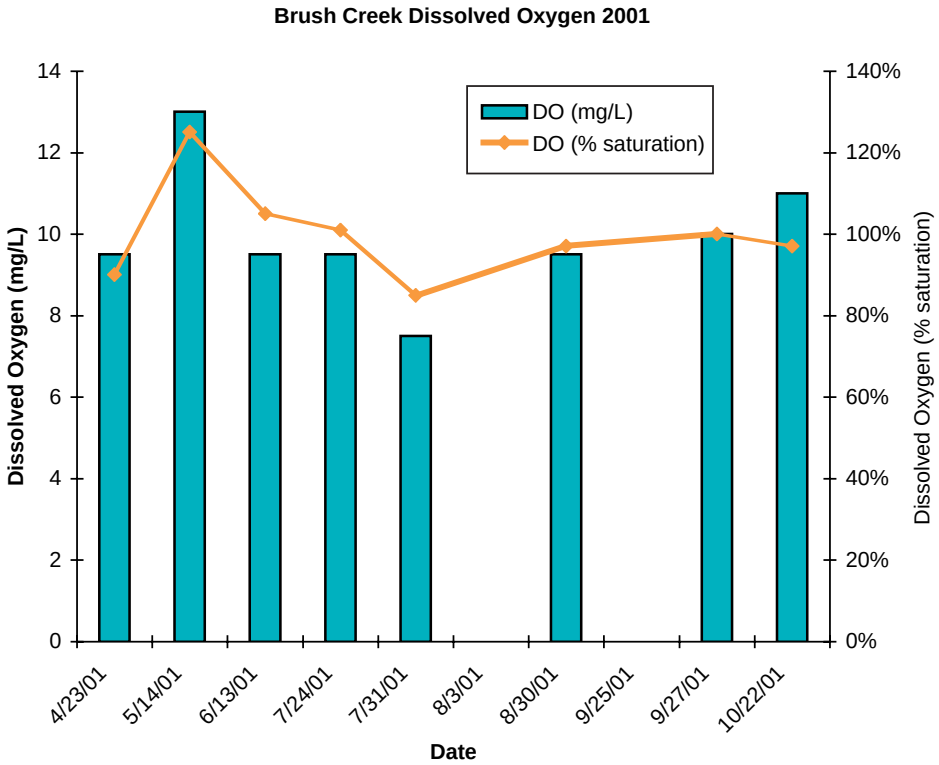


Nohr Citizen Monitors

Another group of citizens is monitoring stream quality using WAV protocols in the Grant-Platte-Sugar-Pecatonica (GPSP) Basin. The Nohr Network Stream Monitors are sponsored by the Harry and Laura Nohr Chapter of Trout Unlimited and UW-Extension. The group works in cooperation with the WDNR for program and event planning, training, and reporting. The goals of this group

are to promote citizen involvement in natural resources and to encourage citizens to appreciate and protect the water resources of southwestern Wisconsin. A training session was held as an interest indicator in 1999 and monitoring began in 2000 following a second training event. The Nohr Network Stream Monitors assess water temperature, turbidity and dissolved oxygen, as well as flow on a monthly basis. They monitor habitat and biotic index once a year. In 2001, the Network's 21 volunteers monitored 17 sites on as many streams in the GPSP Basin. The full-day training session brought together citizen monitors from not only the GPSP Basin, but those from the lower Wisconsin Basin as well. Second-year monitors shared their knowledge with new monitors by instructing at several of the training stations. DNR personnel were on hand to instruct and assist with the training as well. Also in 2001, the groups established an advisory committee made up of stream monitors and agency professionals to help guide their stream monitoring program. During the summer, the Nohr Network Stream Monitors hold an annual quality assurance picnic during which monitors come together to hear an educational speaker and also do a quality check on their dissolved oxygen kits. The event also offers the opportunity for monitors to interact with one another, which helps to keep this group going strong. For the past two years, the Nohr Monitors also held a Water Celebration in the fall. This event brought together school groups that have conducted monitoring efforts, college clubs conducting watershed research and the citizen stream monitors. Ninety people participated in the day-long event in 2001, showing the true interest citizens have in water quality programming. Both Trout Unlimited and UW-Extension report the group's data results on their websites. An example of their monitoring results is shown below. Afternoon dissolved oxygen sampling along Brush Creek showed saturated or nearly saturated conditions throughout the sampling season (Figure 20). Information about this group of monitors has also been included in both the Grant-Platte-Sugar-Pecatonica and the lower Wisconsin River State of the Basin Reports.

Figure 20. Nohr Citizen Monitoring Graphic



Note: all data collected between 4:30 and 5:30 PM

Valley Stewardship Network

For approximately the last five years the Valley Stewardship Network has organized citizen stream monitoring efforts in the Kickapoo River Valley. This group monitors the water chemistry and the flow of the streams. In addition, the group has placed temperature loggers in the streams to establish a record of the water temperature in the other portions of the basin, UW Extension in partnership with the Harry and Laura Nohr Chapter of Trout Unlimited (see above) have held training sessions to teach interested citizens how to monitor streams for temperature, turbidity, and dissolved oxygen and how to conduct biotic index and habitat assessments. As a result of these programs, there are numerous citizen stream monitoring projects in the Lower Wisconsin Basin. In the fall of each year, these stream monitors get together with others interested in learning more about water quality and citizen monitoring for the annual Water Celebration, sponsored by the Nohr Chapter of TU, UW Extension and the Valley Stewardship Network.

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.

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 BATHTUB 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

To learn more go to: http://www.dnr.state.wi.us/org/at/et/geo/

Wisconsin has a number of systems to store, manage and share its aquatic data and assessment information. WDNR utilizes Geographic Information Systems (GIS) as a tool for water quality management, employing a systems approach to integrate data and assist in analysis. GIS links information from diverse sources with a geographic layer of information, allowing resource managers to use 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 of this system is the Surface Water Integration System (SWIS), described below.

Surface Water Integration System (SWIS)

To maximize the benefits of a GIS for water management, WDNR initiated development of a **S**urface **W**ater **I**ntegration **S**ystem (SWIS) in 1992. The SWIS is designed to integrate diverse data layers of information with "point and click" technology to query and analyze surface water related data. The 'base' datalayer (or framework) through which multiple surface water related databases are integrated is the 1:24,000 scale hydrography layer (see update below), which has recently been completed. Using the SWIS, DNR staff will be able to see the spatial relationships between water-related datasets on screen and will examine these data using a customized Arcview interface tool.

SWIS provides the "framework" (*the 24K hydrography GIS layer*) for integrating the department's water data, *tools* for linking their data to the 24k hydro layer, *training* on how to use the tools, and *documentation* and guidance on how to get datasets integrated into the Surface Water Integration System. Additional program applications may be built upon this framework to meet specific needs beyond those provided for in the SWIS common query interface.

1:24,000 Scale Hydrography Layer

In October of 2000, the WDNR completed a multi-year effort to develop a statewide Hydrography geographic data layer from 1:24,000-scale sources. This DNR corporate data layer will play a major role in integrating various DNR databases containing information about features located in, along, and around waterbodies. Since the initial release of the WDNR 24K Hydrography database, a

series of data updates and enhancements have been completed, resulting in Version 2 of the 24K Hydro layer. Version 2 is now available for distribution on CD as the full 24K Hydrography data model in ArcInfo coverage format and as the 24K Hydrography data in shapefile format, accompanied by several preconstructed 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.

The WDNR 24K Hydrography data conversion effort was completed statewide using several *1:24,000-scale sources*. This layer includes information about surface water features represented on the USGS 1:24,000-scale topographic map series such as perennial and intermittent streams, lakes, and so on. A large portion of the Agency's Waterbody Identification Codes (WBICs) have been incorporated into the hydro layer, along with surface water names from the U.S. Geological Survey's Geographic Names Information System (GNIS) database.

Linked Water Related Databases

SWIS involves identifying and linking water related datasets to the 24K Hydrography layer. The User Database Status Table 12 shows datasets currently being prepared for SWIS. These datasets were originally chosen due to data quality, interest of others in using this data, availability, staff support, dataset size, and financial considerations. Additional datasets are being considered for a "Phase II" of SWIS, moving beyond the initial datasets to evaluate, ready and link additional user datasets. Datasets being considered for this effort include:

- Self-help lake monitoring data
- Stream and Lake Classifications: 305b Assessment Data (includes outstanding resource waters, variance waters and impaired waters)
- Storet (new and legacy data)
- Outfalls
- Exotics
- Fish and Habitat Biological Database

Table 12. User Database Status (Status as of November, 2001)

Data System	# Records to Process	# Records Processed	% Complete	Anticipated Completion Date
Register of Waterbodies (ROW)	28,000	22,000	79%	September 1st, 2000
Chapter 30 Permits	53,000	0	0%	July 1st, 2001
Engineering Studies	5,800	0	0%	July 1st, 2001
Master Fish File	22,150	0	0%	July 1st, 2001
Natural Heritage Inventory	Approximately 8,000-10,000	0	0%	July 1st, 2001
Dams Location	4,635	4,635	100%	Complete (as of 12/00) **
Fish/Sediment Toxics	2,445	2,445	80%	October 1, 2001

Additional Data Management Projects

To learn more go to: http://infotrek.er.usgs.gov/pls/wdnr_biology_wdb/wdnr_biology_wdb.home

Fish and Habitat Statewide Database

This oracle database, a project of the Bureau of Fisheries and Habitat Protection and the United States Geological Survey (USGS), involves capturing and providing tools for analyzis of data for streams, rivers and lakes. This database directly supports the state's baseline monitoring program, providing an electronic "warehouse" to store the data via a WEB-based application for data input and access. Within 2002, plans are to provide an automated method of calculating selected metrics for the identified media (lakes and rivers and streams). These metrics include the Hilsenhoff biotic index (HBI) for macroinvertebrate data, stream suitability index for physical habitat, and the Index of Biotic Integrity (IBI) for fish data. All data can also be utilized for additional analyses; for example, fish data can be used not only to calculate an IBI, but also to develop summary data for fish managers, such as fish size, distribution or population estimates.

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

Integrated Planning Automated Mapping System (DV_Map)

This mapping package has provided a distributed mapping solution to people developing integrated plans statewide. In the past, DNR contracted for centralized map production. With the distribution of this mapping application and a related program that works with ArcView, DNR has been able to decentralize, simplify and standardize the map generation aspect of the planning process. Further, because this mapping package utilizes a variety of general datasets that are commonly used in mapping and analysis, this mapping package can move beyond integrated planning and serve a variety of ArcView users. Even though this application is advertised as a mapping package, as with any GIS dataset, analysis can be performed on this data to answer questions otherwise missed without the use of GIS technologies.

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.

To learn more go to: http://maps.botany.wisc.edu/atri/

Sediment and Fish Consumption Advisory Database

This oracle-based system contains sediment sample and fish tissue results used to develop the state's fish consumption advisories.

Contaminated Sediment Active Project Sites

This GIS-based datalayer, accessible in ArcView, provides a listing of all active sediment management sites in the state, the waterbody and waterbody identification code involved, the key contact for the project, an indication of the project's status status, and the region in which the site is located.

305B Access Database (Microsoft Access)

This Microsoft Access database, containing assessment data used in this 305b report, is currently centrally located. However, future plans include conversion of the data to a web-compatible program to allow access and update privileges by regional staff. This change in data sharing would eliminate the duplicative step of developing streams and lakes tables in basin plans and then re-entering the data into the database. The data would be entered by regional staff and assessment information would be generated directly from the database.

Impaired Waters/TMDL Database

Currently this database, which is also in Microsoft Access, is not physically connected with the "305b Database" (described above). However, managers believe it is imperative to connect the two, as the impaired waters database is, in part, derived from assessments developed through updating the 305b database (ie., Wisconsin's impaired waters list is a subset of 305b "impaired waters").

Register of Waterbodies – ROW

The Register of Waterbodies is another Oracle-based system that was originally developed from historical county waterbody listings and descriptions. Because this database is partially duplicative with the state's 305b database, the two systems need to be evaluated and meshed together when the 305b database is converted to an Oracle-based system.

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. Recently a project was completed that makes this data more accessible to resource managers (see below).

Wetlands Datalayer GIS Coverage Clipping Project

The DNR has 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. Recently completed State of the Basin Reports have used this data layer. Prior to this project wetland information could only be displayed by county. The protocol developed for this project can also be applied to "clip-out" the DWWI for subwatersheds to meet specific project needs.

To learn more go to:
http://www.dnr.state.wi.us/org/water/fhp/wetlands/mapping.shtml

Lakes Volunteer Monitoring Database

In 2001 all data from the Volunteer Monitoring Program (Self-Help) 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 predesigned report formats.

Chapter 2: Assessment Methodology & Summary Data

Every surface water in the state is assessed for "use support status" by DNR regional staff using available monitoring and evaluation data from DNR files. The use support status for surface waters (lakes, rivers) includes fully, partially, threatened, not meeting, or not assessed for a given designated use. Data is evaluated and assessments are written up in water quality management plan rivers and lakes tables, which in the past have been published every 5 years. New management systems are being implemented to allow continual update of tables by regional staff as they occur. Once assessments have been made, data is entered into the "305b Surface Water Quality Database", a Microsoft Access Database developed by the USEPA for use by states. Wisconsin is evaluating this system for possible conversion to an inhouse oracle-based system that would be accessible to DNR and the public through the internet.

Assessments typically involve watershed specialists consulting with lake managers, fisheries managers and water quality biologists on the quality or condition of the stream or lake. This information is often found in DNR files in the form of reports and more recently in data systems developed for maintaining records of baseline data results and from STORET. DNR also relies on the use of best professional judgement in the assessment of streams and lakes that have older available data.

Data used in assessments include:

- Baseline data (includes Fish Community, Macroinvertebrate, Habitat/Physical data)
- Intensive Surveys (ie., like TMDL studies)
- Ambient Fixed Station Data
- Fish advisory data
- Surface water use classification reports
- River basin water quality management plans
- County soil erosion and animal waste management plans
- Water chemistry data (STORET database)
- Sediment data
- Effluent data
- County surface water resources publications
- Wisconsin trout streams publications
- Wastewater discharge and polluted runoff impact assessment data
- Fishery resource master plans
- Inventory of non-metallic mining sites
- Wisconsin Adm. Code, NR102 antidegradation stream classifications
- Wasteload allocation reports
- Environmental impact statements, Environmental assessments
- Endangered resources data

Water Quality Assessment Criteria – Rivers/Streams

Aquatic Life Use Support

A waterbody's designated or beneficial uses are based on the type of aquatic community the water should be able to support. DNR evaluates whether the stream's existing use is equivalent to its potential biological use to determine if it is meeting is aquatic life use support (ALUS).

Existing Use: This indicates the biological use that the stream or stream segment currently supports. This is not a designation or classification; it is based on the current condition of the surface water and the biological community living in that surface water. Information in this column is not designed for, and should not be used for, regulatory purposes. In cases where the existing use is unknown, "UNK" was entered. The biological use categories are defined in NR102(04)(3) under fish and aquatic life uses, which are the same categories used to describe the

stream's codified use. The following abbreviations for existing stream uses are used in the table. See also *Guidelines for Designating Fish and Aquatic Life Uses for Wisconsin Surface Waters (6/98 Draft). This draft guidance is used for determining existing and potential use for Cold (generally), WWSF, WWFF, LFF, and LAL. Until this draft is formally adopted, the categories listed below will be used, as opposed to the proposed revisions incorporating CWT-1-3, CWF, and GLM waters.*

COLD Cold Water Community; includes surface waters that are capable of supporting a community cold water fish and other aquatic life or serving as a spawning area for cold water fish species. The cold water community may be indicated by a trout class based on the document, *Wisconsin Trout Streams* (DNR Publ. 6-3600[80]). The approximate length or portion of stream meeting each of the use classes is indicated.

CLASS I high-quality stream where populations are sustained by natural reproduction;

CLASS II stream has some natural reproduction, but may need stocking to maintain a desirable fishery;

Class III stream has no natural reproduction and requires annual stocking of legal-size fish to provide sport fishing.

WWSF Warm Water Sport Fish Communities; includes waters capable of supporting a community of warm water sport fish or serving as a spawning area for warm water sport fish.

WWFF Warm Water Forage Fish Communities; includes surface waters capable of supporting an abundant, diverse community of forage fish and other aquatic life.

LFF Limited Forage Fishery (intermediate surface waters); includes surface waters of limited capacity due to low flow, naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of tolerant forage fish and aquatic life.

LAL Limited Aquatic Life (marginal surface waters); includes surface waters severely limited because of low flow and naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of aquatic life.

Potential (Attainable) Use: This column indicates the biological use that the investigator believes the stream or stream segment could achieve through proper management of "controllable" pollution sources. Beaver dams, hydroelectric dams, low gradient streams, and naturally occurring low flows are generally not problems that can be controlled.

The potential (or attainable) use may be the same as the existing use or it may be higher. Abbreviations for "potential use" are the same as those used in the "existing use" column. Information sources used to determine stream potential are indicated by footnotes in each table. Unless otherwise noted, the source for trout streams was *Wisconsin Trout Streams* (DNR Publ. 6-3600[80]), Wis. Adm. Code NR102.10 and NR102.11, and the professional judgment of WDNR personnel.

Supporting Potential Use: This column indicates whether a stream is threatened or is fully, partially, or not meeting its potential biological use. An entry in this column shows the relationship between the stream's current and potential biological use. To determine if a waterbody or segment supports a potential use, one or more of the following is used: chemical, physical (habitat, morphology, etc.), or biological information, direct observation and/or best professional judgment. When biological data contrary to chemical or physical data exists, the biological data overrides the other data.

Fully Supporting "FULLY"

A stream or stream segment's existing biological use is the same as its potential biological use (E = P). This includes stream or stream segments that are *not affected* and stream or stream segments that have *culturally irreversible* impacts. An example of culturally irreversible impacts are those effects in a river system with an "optimally operating" dam—a dam that operates with minimal to no effect on the fish and aquatic life community assemblage, productivity, and diversity. Note that fairly to poorly operating dams are not considered "culturally irreversible" and their effect on biological resources is factored into the use support designation (see partially supporting).

Fully Supporting/Threatened "FULLY-THR"

A stream or stream segment's existing biological use is the same as its potential biological use (E = P), but there is a *clear and imminent* "threat" to the existing use remaining at its current level of biological productivity and ecological health. This threat could be due to actions likely to occur on or to the stream and/or in the watershed, such as:

- Rapid commercial, residential, and/or industrial development in the watershed,
- The advent of large-scale industrial operations in the watershed,
- Planned or active channel modifications that have been, or will be permitted, or cannot be regulated under existing state or federal rules (i.e., drainage districts).

Partially Supporting "PART"

A stream or stream segment's existing biological use is the same as its potential biological use, except that implementation of management practices could enhance the overall ecological health of the biological community. Management practices in this category include modification of hydro-regimes to reduce the impact of dam operations on the biological community.

Thus, E = P, but the potential use assessment is below the stream or stream segment's maximum biological potential and this "less than optimal" condition is reversible.

Not Supporting "NOT"

When a stream or stream segment's existing biological use is less than its potential biological use by a factor of 1 or more of the following codified use classifications:

Cold (includes Cold I, II, IIN, and III in one group);

WWSF

WWFF

LFF

LAL

Thus, E < P, with problems considered reversible by implementation of management actions.

Miles Assessed — Monitored, Evaluated, or Unassessed: To substantiate the Use Support designation of "fully," "partially," "not," or "threatened," the terms monitored, evaluated, or unassessed are defined as the following:

Monitored: A stream has been "monitored" for the purposes of Wisconsin water quality management plans and/or Wisconsin's Water Quality Assessment Report to Congress (305[b]) if:

Site-specific data has been collected on that stream or stream segment in the past five years; For the purposes of this document, data is defined as structured information gathered to assess the quality or integrity of a resource. Data from outside the WDNR can be used to help determine the quality or integrity of waters in the State of Wisconsin.

The data are adequate to develop a best professional judgment about the existing and potential biological use of that stream or stream segment;

The data should be adequate to judge the difference between the "existing" versus "potential" biological use for that stream or stream segment.

This information is used to determine if the Existing Biological Use matches or supports the Potential Biological Use "fully," "partially," or "not:"—and if that use is "threatened."

Evaluated: A stream has been "evaluated" if information other than site-specific data is adequate to determine a Potential Biological Use and to determine if the stream is currently meeting that level of biological use.

Sources of "evaluated" information include:

- Site-specific data that is more than five years old,
- Information on file provided by the public or others,
- Best professional judgment of a WDNR biologist or a WDNR fish manager.

Unassessed: A stream has been not been assessed.

Fish Consumption Use Support

In the past, the following decision criteria were applied: rivers that **Fully** meet fish consumption use support have been tested but *no special advisory* has been issued. All fish are edible under the *General Advisory* rules. **Threatened** rivers are ones that have localized contaminant problems but the extent of the contamination is not yet known. **Partially** meeting rivers for fish consumption are those that have type of restricted consumption, which includes any advisory beyond the General Advisory. In Wisconsin's tiered consumption advisory system, this includes any type of restriction *short of a do not eat* (i.e., limited consumption for women, children, etc.). Rivers that are **Not Supporting** their fish consumption designated use are those that have *any type of a Do Not Eat advisory* under a special advisory. However, In 2002, Wisconsin is listing all 57,698 stream miles as not meeting fish consumption uses due to the presence of the general mercury advisory in place for all Wisconsin waters.

Other Uses:

Other designated uses of interest to USEPA — Shellfishing, Drinking Water Supply, Swimming, Primary and Secondary Contact, Agriculture, and Aesthetics — are either not evaluated by Wisconsin DNR at this time due to a lack of data or a lack of a standardized assessment protocol.

Water Quality Assessment Criteria - Lakes

Lakes are assessed for Aquatic Life Use Support, Fish Consumption, and Secondary Contact Recreation. During 2001 DNR enhanced the criteria it uses to make aquatic life use and fish consumption use designations. Enhancements include adding aquatic nuisance species, use of nutrient sensitivity categories, and inclusion of language noting the tiered consumption advisories and special vs. general advisories for Hg. Statewide, lakes tables have been updated during 2000-2001 through the integrated planning process.

Aquatic Life Use Support

In Wisconsin, support of Aquatic Life Use indicates the health of lakes measured by fish population dynamics, absence or presence of disease, or through indicators such as nuisance or exotic macrophytes, TSI scores coupled with the presence of activities known to cause excess phosphorus loading, often the limiting nutrient for lake productivity.

Lakes that are **Fully** meeting do not winterkill or they are considered Class IA lakes with no identified source or causes of problems identified in the lakes tables. **Threatened** lakes also do not winterkill, but have stunted panfish or carp, *or* they are Class IA lakes and have specifically identified source or causes of problems in the lakes tables that involve export of excess phosphorus into the lake such as NUT, TURB, or SED

Lakes that are **Partially** meeting do not have winterkill, but do have high levels of contamination in fish tissue or turbidity/sedimentation problems, *or* Encroachment by exotic species, *or* Seasonally high levels of phytoplankton/anoxia, *or f*ish threatened by infectious disease. Finally, lakes that are **Not** meeting aquatic life use support do have winterkill problems or they are listed as a Class IIB lake.

Fish Consumption Use Support

In the past, Wisconsin applied the following criteria for fish consumption uses: lakes that **Fully** meet fish consumption use support have been tested but *no special advisory* has been issued. All fish are edible under the *General Advisory* rules. **Threatened** lakes are ones that have not yet been tested for a special advisory. **Partially** meeting lakes for fish consumption are those that have type of restricted consumption, which includes any advisory beyond the General Advisory. In Wisconsin's tiered consumption advisory system, this includes any type of restriction *short of a do*

not eat (i.e., limited consumption for women, children, etc.). Lakes that are **Not Supporting** their fish consumption designated use are those that have *any type of a Do Not Eat advisory* under a special advisory. However, In 2002, Wisconsin is listing all 900,000+ lake acres as not meeting fish consumption uses due to the presence of the general mercury advisory in place for all Wisconsin waters.

Secondary Contact Recreational Use Support

Secondary contact recreation pertains to the safety of waters for direct exposure to individuals through recreational activities (as opposed to Primary Contact, which is full contact swimming). Lakes **Fully** supporting are those that are oligotrophic, mesotrophic or dystrophic; *or* Class IA lakes with no accompanying source/cause categories indicating excess phosphorus is actively mobilized by human activities in the watershed. **Threatened** lakes include oligotrophic or mesotrophic lakes with seasonal nuisance densities of plants or algae, *or* Class IA lakes coupled with source/cause categories that include any type of problem that contributes excess phosphorus to the lake, such as NUT, TURB, or SED.

Lakes that are **partially supporting** include those that are eutrophic, *or* turbid, *or* have nuisance densities of plant or algae, *or* lakes that are considered Class IB. Lakes **not support** secondary contact recreation are those that are hypereutrophic, *or* considered Class IIB lakes.

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.

Impaired Waters Categories

Point source dominated - Waters (usually waterbody segments) in which the impairment is present as a result of a current discharge from an existing point source. The WPDES program is implemented to assure the attainment of standards at the time of permit issuance. Existing law and rules including the water quality standards and WPDES permit rules preclude the issuance of a permit if it will not attain water quality standards. Waters in this category are likely between permit cycles, or may have obtained a variance to the water quality standards under current law. TMDLs in this category may also be implemented through the development of waste load allocations under the provisions of NR 212.

Nonpoint source dominated - Waters in which the impairment is present primarily as a result of nonpoint source runoff or from the destruction of habitat caused by nonpoint sources. Many of these waters are headwater segments, or subwatershed areas. Others are large bodies of water at the downstream end of large drainage basins. TMDLs for waters affected by nonpoint sources will, therefore, vary according to the system impacting the impaired waterbody. The implementation strategy for NPS includes the following: the priority watershed program for watershed size or small scale projects selected prior to 1998 through cost-sharing incentives based on voluntary participation by landowners and other participants; enforcement of nonpoint source controls is implemented through the designation of “critical sites”; the new NPS program established under Act 27, Laws of 1997, which will include options for site and waterbody designation based on application and need; application of standards of performance; other statutory requirements. All urban stormwater sources are included as nonpoint sources for purposes of this list.

Point source and nonpoint source combined - Waters in which nonattainment of standards is substantially affected by both point source contributions and nonpoint source runoff, and in which both types of sources, each may be contributing to the failure to achieve water quality standards. Listing a water which is impacted by a point source does not imply that the source is not meeting all the requirements in its discharge permit, but only indicates that additional analy-

ses are needed to determine relative contributions by the sources and what additional requirement, if any, might be needed. Development of TMDLs will be based upon the waterbody specific evaluation and could include specific segments, watersheds or subwatersheds or sites. Segment-based modeling and assessments, watershed level analyses, or other analyses specific to the individual waters, will be used as necessary. Implementation will be through the permit program and the nonpoint programs described above, potentially using innovative approaches such as pollutant trading or other cost-effective strategies.

Contaminated sediment waters - Waters(usually segments of waterbodies) in which the impairment is present primarily as a result of toxic or other substances in the sediments which may be affecting either the ecology or uses of the site or moving off-site and affecting other uses of the water at locations beyond the boundary of the contaminated sediment. Contaminated sediments frequently are associated with the bioaccumulation of contaminants in fish and wildlife, thereby resulting in consumption advisories or harm to wildlife populations. The list of contaminated sediment waters originates from a list which was developed cooperatively by the Department's Remediation and Redevelopment and Watershed Management programs. The list reflects sites at which the Department and other parties have active investigations and, in some instances remediation underway. Several additional sites have been included based upon an inventory and scoring system for contaminants in sediments compiled by the Department in 1995. The implementation strategy for waters listed under this category will be addressed in a variety of ways depending on the nature of the impairment and the program activities which are deemed best for the location. Cleanups at sites will be implemented through the application of the NR 700 series within the Remediation and Redevelopment program and may include cooperative as well as enforcement techniques; some projects are implemented under the federal Superfund program. The TMDL analysis will vary with the complexity of the site and nature of the contamination and may include determination of sediment quality objectives, sediment transport modeling, remedial investigations, risk assessments, feasibility studies, etc.

Atmospheric deposition dominated - Waters in which the impairment is present primarily as a result of atmospheric deposition of toxic substances(such as mercury) into the waterbody and sediments resulting in concentrations in fish tissue above levels safe to consume. Most of these waters are lakes and main stems of major rivers. Waters impaired by atmospheric deposition were identified using the state's fish consumption advisory list. Because the transport of air toxic substances is transboundary in nature and not entirely known, it is impossible to assign state-only responsibility. Therefore, the state does not plan to undertake individual TMDL analyses for these waterbodies at this time. Waters listed under this category must be addressed through actions taken by U.S. EPA in cooperation with the states under the provisions of the Clean Air Act. The Department will continue to monitor waters potentially impacted by atmospheric deposition and, when deemed necessary by current practice, issue fish consumption advisories to provide public health protection.

Habitat/physical impaired - Waters in which the impairment is present primarily as a result of destruction of habitat for aquatic organisms due to flow obstructions or physical barriers to the movement of water where aquatic organism populations are impacted by alterations in the natural flow of water at a particular site. These waters are usually stream segments or may be impoundments. (Note: Habitat impairment caused by point or nonpoint sources are not included in this category.) In the 1998 listing process relatively few waters which may be impaired by habitat/physical causes have been listed. The Department is aware of concerns which exist regarding the impact of dams(including beaver dams and other impoundments), channelization, and other physical changes have on water resources. However, the data base for making consistent decisions regarding such impairments has not been fully developed to select sites for inclusion on this list. The Department plans to address this issue prior to the development of the year 2000 list. Waters listed under this category will be addressed in a variety of ways depending on the nature of the impairment and the program activities which are deemed best for the location; operations of dams which affect organism populations may be addressed through licensing of dams or other orders the Department may issue.

Other factors - Waters in this category primarily include large waters, involving basins, or multibasin areas, which may be impaired as a result of several different categories of impairment

or there are uncertainties regarding the cause of impairment. For example, Great Lakes Areas of Concern have been identified and Remedial Action Plans prepared which identify many impairing factors including point and nonpoint sources, contaminated sediments, etc. causing violations of water quality criteria and designated uses, fish consumption advisories, and others. Implementation of TMDLs for these waters may be addressed in a variety of ways depending on the nature of the impairment and the program activities which are deemed best for the location; combinations of implementation strategies identified in specific categories above will or may be used.

Removing Waters From The List

The manner in which waters are removed from the impaired waters list once they have been placed on the list is contained in EPA guidance (August 1997). The process requires that information be presented to demonstrate there is no longer an impairment or there is evidence to show that the basis for the original listing was in error. The Department intends to use these bases for its ongoing evaluation of the waters on the list.

Waters of Special Interest

Several interstate waters are included on the list or described below. In some instances, the waters listed by Wisconsin are also listed by the other state(s) bordering that waterbody. It will be important for EPA to evaluate any discrepancies in these listings, and assist the border states in resolving any differences. If and when TMDLs are conducted for those waters, coordination and collaboration among the states will be necessary.

Lake Michigan

The waters of Lake Michigan contain contaminants at levels which bioaccumulate to levels in fish and other biota to levels of human health, wildlife or aquatic life concerns. There is, therefore, a consumption advisory for Lake Michigan fish. Because of the migration of fish into and out of Lake Michigan tributaries, the consumption advisory extends into the tributaries of the Lake. The Lake and tributaries therefore are impaired and do not meet water quality standards for those specific substances.

Lake Superior

Some fish in the waters of Lake Superior contain levels of contaminants sufficiently high to warrant a consumption advisory and therefore would warrant inclusion on the 303(d) list. However, Lake Superior is, by agreement between the adjacent states of Minnesota and Michigan, the Province of Ontario and the federal governments, a special water for which many efforts are underway to assure protection of water quality. It is the Department=s position that those efforts are sufficient to improve and protect the Lake and any other TMDL activities will not be implemented. As with outstanding and exceptional water designations, Lake Superior is not included.

Mississippi River

The Mississippi River is an interstate water for which the state has issued fish consumption advisories for the entire river along the western border. It is, therefore, included on the 303(d) list for this impairing factor. Adjacent states may not include this water on their list submitted to EPA.

Sources Of Information

Water Quality Management Plans/Integrated Plans

Water Quality Management Plans are a primary source of information for the waters placed on the list because they provide the Water Program's primary source of integrated information on the state of the waters. They are developed with input from multiple programs during the basin planning update process and are grounded in codified classifications and a formal hearing process. Within those plans are tables and descriptions indicate whether a water's existing aquatic life biological use is less than its codified use or the use specified or referenced in the

Water Quality Standards

Those waters which have Priority Watershed Program data more recent that the most recent basin plan data has been reviewed for accuracy and updates of the basin plan information. For this list, impairment is defined as a waterbody that has an existing biological use that is not

meeting its codified classification and for which the potential biological use is equal to or greater than the codified use.

Fish Consumption Advisory

This document is published periodically by the DNR and Division of Health and contains a list of waters where data indicates fish exceed levels protective of human health. This list contains only those waters where the Department has actual data to support the listing for the noted species and sizes of species.

Contaminated Sediment Inventory and Project Lists

In 1995 the Department developed an inventory list of waters for which there was data on levels of contaminants in sediments. Using that data, the Department developed a list of waters containing sediments which were most contaminated. The 303(d) list contains these waters. In addition, the Department's Remediation and Redevelopment and Watershed Management programs have developed a list of additional projects which have been identified as potentially containing toxic substances. These are oftentimes associated with land-based sites where contaminants are known to be present.

Other information

In a limited number of instances, Department staff have identified waters for which there is data to indicate impairment. These waters are included on the list. A few waters are also included based upon data and information submitted to the Department by outside parties following submittal of the 303(d) list in 1996.

For more information about the impaired waters program and TMDL development see the "Impaired Waters Program" section in Part II.

Borah Creek, Grant County is a high quality water in SW Wisconsin. Portions are classified as trout water and exceptional resource water.

Chapter 3: Rivers and Streams

Assessment Summary

Most of Wisconsin's waters already meet the standards for water quality established for them. We reported roughly 55,000 miles of state rivers and streams in water quality management plans for the state's 23 Geographic Management Units, including some intermittent streams. Of these, 24422.16 or about 44.5 percent, were assessed (Table 13). This report identifies that 57,698 stream miles or 100% of all stream miles are impaired for one or more uses due to the presence or potential presence of mercury in surface waters from atmospheric deposition. The table below also shows assessment results for river miles due to factors other than atmospheric depostion of mercury. We believe the number of threatened stream miles does not adequately reflect threatened waters because the criteria for "threatened" may not be uniformly applied. In older water quality management plans "threatened" was not reported. New guidance issued for plans, and the continuous process for assessment data updates should clear up this discrepancy.

Table 13. Fully Supporting, Threatened and Impaired Streams and Rivers

	Assessment Basis		
Degree of Use Support	**Evaluated**	**Monitored**	**Total Assessed**
Size Fully ALL assessed uses	6106.41	1882.50	7988.91
Size Fully ALL assessed uses but Threatened for at Least One	2898.90	1506.20	4405.10
Size Impaired for one or more uses	6217.60	5810.55	12028.15 **57,698.00****
Size Not Attainable for any use and not included in items above	0	0	0
Total Assessed	15222.91	9199.25	24422.16

** All rivers, both perennial and intermittent, in the state are listed as not meeting potential uses due to the presence of a general fish consumption advisory for mercury for all Wisconsin Waters

Table 14. Individual Use Support, Streams and Rivers – National and State

Goals	Use	Size Assessed	Fully	Threatened	Partial	Not
Protect and Enhance Ecosystems	ALUS*	23129.51	7808.01	4270.40	9667.80	1383.30
Protect & Enhance Public health	Fish Consumption	3879.35	0	0	0	57,698**

* ALUS = Aquatic Life Use Support

** All rivers, both perennial and intermittent, in the state are listed as not meeting potential uses due to the presence of a general fish consumption advisory for mercury for all Wisconsin Waters

Where waters are only partially, or not meeting designated uses, we report the cause (Table 15) and source (Table 16) of the non-support. Water quality problems in the state are most often the result of land use activities with the exception of atmospheric deposition of mercury. The most prevalent water quality problems are the presence of mercury in surface waters, habitat alterations, siltation, excessive nutrients such as phosphorus and oxygen-demanding materials that use up oxygen as they decay, limiting the oxygen available to aquatic life. The *causes* of these water quality problems are atmospheric deposition, polluted runoff, especially from agricultural areas, and river 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.

Table 15. Total Sizes of Streams and Rivers Impaired by Various Cause/Stressor Categories (Rivers and Streams Reported in Stream Miles)

Cause/Stressor	Size of waters by Contribution to Impairment
Unknown	41.00
Unknown Toxicity	14.00
Pesticides	244.25
Priority Organics	147.50
Nonpriority Organics	1.00
PCBs	299.90
Metals	
(includes Mercury)	57,698**
Unionized Ammonia	91.20
Chlorine	6.00
Nutrients	2717.95
Nitrogen	47.00
pH	45.10
Siltation (includes Sedimentation)	6458.15
Organic Enrichment/DO	1233.20
Salinity/TDS/Chlorides	8.50
Thermal Modifications	1888.55
Flow Alterations	1668.40
Other Habitat Alterations	8459.60
Pathogen Indicators	1208.25
Taste and Odor	53.00
Suspended solids	6.00
Noxious aquatic plants (macrophytes)	278.60
Algal Growth/Chlorolophyll a	70.00
Turbidity	1567.60
Exotic species	90.00

** due to the presence of the general fish consumption advisory for mercury for all Wisconsin surface waters.

Table 16. Total Sizes of Streams and Rivers Impaired by Various Source Categories

Type of Waterbody: Rivers/Streams (reported in miles)

Source Category	Size of waters
Industrial Point Sources	1048.70
Municipal Point Sources	1537.55
Domestic Wastewater Lagoon	29.00
Agriculture	5620.90
Crop-related sources	3357.65
Non irrigated crop production	2168.40
Irrigated crop production	184.25
Grazing-related sources	3629.20
Pasture grazing, riparian and/or upland	2736.50
Pasture grazing, upland	579.60
Intensive Animal Feeding Operations	2212.35
CAFOs	95.20
Off farm animal holding/management area	142.40
Silviculture	76.30
Forest management	73.00
Logging road maintenance	3.30
Construction	470.60
Highway/Road/Bridge Construction	89.60
Land Development	243.40
Urban Runoff/Storm Sewers	921.10
Highway/Road/Bridge Runoff	113.90
Erosion and Sedimentation	19.80
Resource Extraction	140.10
Surface Mining	9.00
Subsurface Mining	22.50
Mine Tailings	8.00
Land Disposal	111.40
Landfills	80.50
Septage Disposal	30.90
Hydromodification	4223.80
Channelization	675.75
Dredging	202.50
Dam Construction	78.60
Upstream Impoundment	26.55
Flow Regulation/ Modification	22.30
Habitat Modification (non-Hydro modification related)	3583.95
Removal of Riparian Vegetation	235.35
Bank or Shoreline Modification/ Destabilization	138.00
Drainage/Filling of Wetlands	48.80
Atmospheric Deposition	57,698**
Highway Maintenance and Runoff	17.90
Contaminated Sediments	118.80
Natural sources	1742.10
Waterfowl	4.00
Recreational activities	3.70
Groundwater Loadings	145.10
Source Unknown	82.50

** due to the presence of the general fish consumption advisory for mercury for all Wisconsin surface waters.

Water Quality Planning and Management

River Management

Rivers Team

For years DNR staff and management in multiple programs have worked together on issues central to river management. One aspect of this work involved a group informally called the FERC Team, as Federal Emergency Regulation Commission issues were the foremost issues of concern. In 1999, the WDNR formalized this working relationship by initiating the development of a Rivers Team with a full-time permanent Rivers Team Leader. While the Team Leader position is not yet filled, the Rivers Team has developed a Rivers Strategy, a Rivers Grant Program, and most recently grant program performance measures.

Rivers Strategy - Report Card

Since 1999, when the WDNR formally initiated a rivers strategy –*Going with the Flow: A rivers strategy to protect, preserve, and restore Wisconsin's flowing waters*, much has been done toward its development and implementation. The strategy is aimed at bringing a coordinated approach to the support of local river management while helping initiatives that protect and restore riverine ecosystem integrity and that balance legitimate river resource uses with environmental needs. Below is a list of strategy Goals and objectives and progress to date.

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

Goal I. Protect and restore 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.

Goal II. Balance legitimate river resource 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.

a) Establish a personal stake or sense of belonging with regards to the river. Encouraging the participation of user/citizen groups is critical to the success of a river program.

Progress: The state's River Grant Program has provided over $150,000 during each grant cycle for the establishment and support of River Organizations. In addition, through a grant with the Rivers Alliance of Wisconsin, that nonprofit organization has hired two full-time river organization support staff to help achieve this goal.

b) Provide 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.

Progress: Issued guidance on multiple topics and established a statewide Rivers Team (see below)

c) Identify and protect 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

Progress: Issued program guidance and improved data systems (see below)

d) Strive for a comprehensive management approach at the watershed level. If a rivers strategy is to be 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. Education (integrate programs and people to recognize the connection between land uses and river system quality); Coordinated planning (who's doing what, where and when; what are the opportunities; partnership formation - GMU's, river advocacy groups). Take the next step (identify projects, take advantage of existing opportunities, grants, etc. What needs to be done to make a long-term difference?

Progress: During 2000-2002, Basins/GMUs initiated, and in many cases completed, integrated management plans in which partnership priorities were identified and ecologically-based goals and work tasks were specified. All of these plans identify river and river related issues as key focal areas for work in the coming years.

All plans are posted on the web at http://www.dnr.state.wi.us/org/gmu/index.html

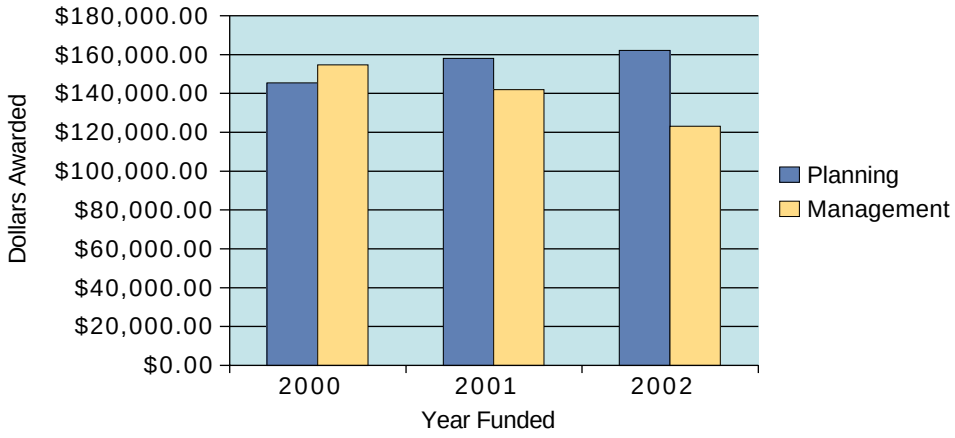
e) Effectively showcase the results and benefits of the varying components of a rivers management program. Develop realistic performance measures for a comprehensive, integrated rivers management program.

Progress: Issued press releases on important river projects, such as the Franklin Dam Removal, multiple dam removals on the Baraboo River, Prairie River and other key sites around the state. Developed an internet presence. Drafted performance measures for the Rivers Grant Program.

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. In the 2 1/2 years since the program has been in implementation, $308,912 has been awarded for 49 separate planning grant projects and $419,599 has been awarded for 11 separate management or implementation projects. (See Figure 21).

Figure 21. River Grant Program Project Awards



River Planning Grants

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

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

Creating performance measures for the rivers grants program is the first step in an on-going effort to evaluate the effectiveness of all rivers programs. Ideally, performance measures would be ecosystem-based, focusing 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). Until this information can be formally incorporated into the state's water management structure, performance measures for the grant program will focus on procedural measurements. "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 Planning Projects

Pine Creek Acquisition:

The Wisconsin Farmland Conservancy obtained a $50,000 river management grant to purchase approximately 84 acres on Pine Creek in Southeastern Pierce County. Pine Creek is a Class I brook trout stream, with trout densities approaching 3,000 brook trout per mile. This acquisition protects critical brook trout spawning, nursery and adult overwintering habitat on about 3/4 of mile on lower Pine Creek. In addition to protecting critical stream habitat the parcel also protects valuable blufflands and a large wetland complex near the Mississippi River. Local residents in the Pine Creek valley were very supportive of the Conservancy's efforts. Other landowners in the valley have donated conservation easements on several properties and the Conservancy is actively working with local landowners in the Valley for future conservation measures. This parcel will be open to the public for fishing, hunting, hiking and other nature based outdoor recreation.

Sugar Creek Acquisition:

The Mississippi River Valley Conservancy obtained a river management grant to purchase 35 acres on lower Sugar Creek in Western Crawford County. Sugar Creek is a Class II brook and brown trout stream. This acquisition protects .4 miles of stream frontage and adjacent wetlands along lower Sugar Creek. This parcel also links to an additional 77-acre bluffland that the Conservancy purchased through the stewardship program. This parcel also links to existing DNR easements upstream and over 5 miles of lower Sugar Creek have been protected through Department and the Conservancy efforts. This parcel will be open to public fishing, hunting, hiking and other nature based outdoor recreation.

Lower Chippewa River Basin Buffer Initiative

River Country RC+D obtained a $50,000 river management grant to hire a buffer specialist to install CRP and CREP buffers in five counties in the lower Chippewa River Basin. This person is working with local county land conservation departments and NRCS office to install approximately 250 miles of CREP buffers on streams within the basin. This project also obtained matching

funding from a US Fish and Wildlife Foundation Grant and local donations from such groups as Pheasants forever and Trout Unlimited. Currently over 50 miles of buffers have been installed on streams within the basin and the project will continue over the next few years.

West Fork of the Kickapoo River Stream Restoration

The West Fork Sportsman Club obtained a $31,000 river management grant to restore over 3,000 feet of the West Fork of the Kickapoo River in Vernon County. The West Fork of the Kickapoo River is known as one of the midwest finest trophy brown trout fisheries. This project also links to existing work that the West Fork Sportsman Club has conducted on other portions of the West Fork over the past decade. Overall over 5 miles of stream have been restored by the club over the past ten years. This project will be open to public fishing.

Kinnickinnic River Land Trust

The KRLT received a $50,000 river management grant to purchase a conservation easement on the lower Kinnickinnic River. This development easement will protect one of the last remaining large farms on the lower Kinnickinnic River from development pressure. By preserving this parcel in an undeveloped condition, existing conditions on the lower Kinnickinnic River will be maintained. As part of this acquisition over .35 miles and over 250 acres of adjacent upland farmland, hardwoods and blufflands along the lower Kinnickinnic River will be protected as well as a host of rare and endangered plant and animal communities. This river portion of the conservation easement will be open to public fishing opportunities. By obtaining this parcel over 70% of the lower Kinnickinnic River has been protected through the Department, KRLT and local landowner efforts.

Dam Removals

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

Token Creek Watershed Project

The Token Creek Watershed, a 27-square mile subwatershed of the Yahara-Lake Mendota Watershed, located on Madison's northeast side, immediately adjacent to the City of Sun Prairie. This small watershed likely sustained a native brook trout fishery prior to European settlement, prior to the construction of a grist mill dam in the center of the watershed about a 150 years ago. Over the years the dam's original function as a grist mill changed to supporting recreation and aesthetic interests. In 1994, however, the dam failed, exposing magnificent springs that discharge over 4000 gallons per minute of cold water (50 d.f.) to Token Creek. Resource managers became aware of the creek's true potential as a cold water fishery – for at least 5 to 7 miles of its length. The Token Creek Coalition was formed from a several diverse groups with interest in the watershed and the river's restoration. The Dane County Natural Heritage Foundation, Trout Unlimited, the Token Creek Watershed Association, the River Alliance, the Town of Windsor, Dane County and the DNR worked under this umbrella organization to raise $1,000,000 to purchase the dam and surrounding reservoir from the Token Creek Inland Lake District.

On December 11, 1998 the Department and the Town of Windsor completed acquisition of the dam and surrounding reservoir. This acquisition and subsequent dam removal enabled the restoration of 5-7 miles of brook trout stream in Eastern Dane County. Most of the water supply supporting this restoration emanates from a single spring source known locally as Culver Springs.

Continuing System Restoration

In addition to removal of the dam, this project has involved restoration of the channel and habitat, preservation of the springs, and reduction of polluted runoff to Token Creek. To help restore the larger river system, the Town of Windsor and DNR requested that the Corps of Engineers (COE) conduct an Ecosystem Restoration Project, which will result in restoration of the channel through the old millpond. 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.

In addition DNR has been working with the UW Madison to develop hydrogeologic models to better understand the area's unusual springs and to ensure protection of critical recharge areas from development or placement of municipal wells.

Dane County and DNR have also been working with the City of Sun Prairie to encourage development that is more sensitive to the receiving cold water system. For example, new developments in this area utilize techniques that encourage stormwater infiltration rather than conventional retention ponds.

Token Creek has also been designated a "priority area' within the Yahara-Mendota Priority Watershed Project, which is designed to reduce sediment and nutrient inputs into Lake Mendota. Project leaders work with the agricultural industry to ensure that best management practices are installed throughout the watershed, but in particular, the Token Creek area.

In summary, the following are outcomes anticipated from the Token Creek Restoration Project:

- The Token Creek Spring complex, one of the most unusual in its quality and quantity in Southern Wisconsin will be restored to its original state.
- Token Creek, up and down stream of the dam, will be restored to enable the stream to be restocked with a native brook trout. Ultimately as much as 7 miles of stream will be converted from use as a warm water fishery to a class I native brook trout fishery.
- A 69-acre tract of wetland will be reestablished providing habitat for waterfowl, migratory songbirds and small mammals.
- Public access will be established to provide easy access to this 69-acre wetland preserve and trout stream.
- Water quality in Lake Mendota and other Yahara Lakes will benefit from increased baseflow and improved water quality in system.
- A new recreational resource will be established for use by all Dane County residents. Beneficial uses include trout fishing, bird watching, wildlife observation, educational enhancement opportunities for grade and high schools.
- The Token Creek area will experience increased use, benefiting local merchants.

Rockdale Dam Removal and Restoration of the Upstream Channel and Reservoir Bed

During 2001, the Rockdale Millpond Dam on Koshkonong Creek was removed and site restoration and habitat improvement began. The Koshkonong Creek Watershed, which lies east of Cottage Grove and south of the City of Sun Prairie, flows into Lake Koshkonong. The Rockdale Dam created a small shallow 72-acre impoundment in the center of the watershed. Heavy agricultural practices in the upper watershed resulted in sedimentation of the impoundment, reducing its depth to about 4 feet. Depths throughout the remaining reservoir were less than a foot, with slightly deeper water in the historic channel and a single deep hole in front of the dam. Approximately 10 residences, one tavern and the old mill building adjoin the pond, with the remaining shoreline located within Cam-Rock Park. This park is heavily used with several cross-country ski trails, a mountain bike trail, playgrounds, picnic sites and a day park with shelter.

Upstream of Rockdale Dam two days after complete dam removal.

In September 2001, the dam was breached exposing 72 acres of historic sedimentation. Work included removing the rest of the dam, site restoration, channel restoration, habitat improvement and bank stabilization. Dane County hopes to incorporate the exposed millpond bed into its existing park. Much of the bed will be converted to prairie and wetland.

This project will result in enhanced water quality and biologic integrity of Koshkonong Creek by:

- Restoration of the riverine nature of this section of Koshkonong Creek.
- Elimination of the summertime thermal impacts caused by the shallow impoundment.
- Restoration of fish migration to upper portions of the creek.
- Elimination of carp spawning/rearing habitat.
- Restoration of two miles (the impoundment) of stream habitat.
- Restoration of fishery and potential spawning habitat along the stream itself in areas upstream of existing dam. This can be done with habitat work and by opening up silt-covered spring areas found in, or nearby, tributaries to the old millpond. The enhanced spring areas should provide brood water for wood duck, teal and mallards, as well as habitat for other amphibians and reptiles.
- Elimination of the shallow impoundment as nutrient source to downstream waters.

Enhancements to the adjacent Dane County owned Cam-Rock Park include:

- Restoration of approximately 47 acres of prairie, which will provide nesting habitat for waterfowl and grassland nesting bird species, as well as habitat or cover for a variety of mammals.
- Expansion of the existing trail systems.
- Improvements in the connectivity of the eastern and western portions of the county park, which are currently divided by the shallow impoundment.
- Restoration of spring complexes presently buried by sediments.
- Restoration of approximately 20 acres of wetlands.

Baraboo River Restoration

The Baraboo River flows approximately 120 miles from its headwaters near Hillsboro to its confluence with the Wisconsin River south of Portage. Its watershed encompasses 650 square miles and drops over 150 feet in elevation. The river drops forty-five feet as it flows through the City of Baraboo. This concentration of relatively steep gradient was recognized by early settlers for its potential to generate mechanical power and in 1837 they began constructing dams in this reach of the river, including:

Excavation work prior to the removal of the Linen Mill Dam, Baraboo River, October, 2001.

- The former Linen Mill Dam. Removed in October, 2001 by the DNR, Sand County Foundation, River Alliance and the USFWS.
- The former Waterworks Dam. Removed in April, 1998 through partnerships between the City of Baraboo, DNR, the State Historical Society, the Circus World Museum and River Alliance.
- The former Oak Street Dam. Removed in 1999. Alliant Energy assisted with the removal of coal tar deposits discovered in the bed of the river. Partners included the City of Baraboo, DNR, River Alliance, Sauk County and the USFWS.
- The former LaValle Dam. Removed in 2001 through partnerships between the Sand County Foundation, the USFWS, NRCS, DNR, Sauk County, and the residents of LaValle.

Before and after pictures of Linen Mill Dam removal on the Baraboo River.

Courtesy of Konstantine E. Margovsky.

These dams had a negative effect on the river ecosystems of the Baraboo and Wisconsin Rivers by restricting the movement of game and forage fish species from the Wisconsin River system into the upper reaches of the Baraboo River. In addition, the dams on the Baraboo River blocked 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. These millponds deteriorated substantially as a result of sediment loading, poor water quality, and degraded aquatic habitat.

In response to the river's importance as a fishery, the degraded quality of the millponds and the deterioration of the dams, many agencies, non-profit groups and citizens removed the dams on the Baraboo River, and are working to restore and enhance aquatic and riparian habitat and wetlands. The Baraboo River Restoration Project is focused on several main goals:

- Allow fish to assume historic spawning migrations.
- Restore in-stream habitat to course gravel deposits on bars and spits with cobble and boulder riffle and pools to enable fish to use the area for feeding, spawning and rearing, and as permanent habitat.
- Restore and enhance riparian habitat.
- Transport sediment in the former millponds downstream or remove mechanically.
- Restore steep gradient reach of the river to restore riffle areas and improve aeration for increased dissolved oxygen in the water column.

Today, all of the dams have been removed and partners are monitoring the system to examine the impact the removal of the dams has had on the fishery in the water and the water quality (Morton, 2000-2001).

Deerskin River Dam

The Deerskin River Dam, also known as the McDermott or Jones Dam, was an earthen dam constructed across the Deerskin River in the Town of Washington, Vilas County. At the turn of the century, the dam was used to float and sluice logs to lumber mills located downstream. When the logging era ended, the dam became a permanent structure, creating the Deerskin Flowage, an impoundment approximately 2.1 miles long and 110 acres in surface area. The dam was built for recreational purposes by the Eagle River Conservation Club in 1948, and it was authorized in 1949 by the Public Service Commission (PSC) under Order #2-WP-767. Due to concerns over the degradation of the trout fishery, the PSC granted a petition (Order #2-WP-1115) to lower the level of the flowage, resulting in a surface area of approximately 49 acres.

The Eagle River Conservation Club disbanded in the early 1970's, leaving the dam without an owner. The dam was inspected in 1985, and the Department sent recommendations for repairs of the dam to the Town of Washington. Following the statutory 10-year inspection cycle, the dam was inspected again on May 2, 1996. By that time the dam had deteriorated to the extent that a draw down and reconstruction was required to bring the dam up to safe standards. A public hearing was held on the evening of May 2, 1996 to inform the public of its deficiencies and owner-less status. On May 8, 1996, the Department sent a compliance schedule for establishing ownership and completing a reconstruction project to Vilas County and property owners on the flowage. All deadlines on this compliance schedule passed with no action being taken.

Although no parties expressed interest in taking ownership of the dam, there was significant local opposition to its removal. To address public concerns, the Natural Resources Board directed Department staff to prepare an analysis of removal and reconstruction alternatives. The report, titled Deerskin Dam – Alternatives Analysis was mailed to interested parties on October 15, 1999, and a second public hearing was held on November 15, 1999. A new compliance schedule was established with a March 31, 2000 deadline for finding an owner and submitting an application for reconstruction.

Spot inspections were performed by Department staff on June 23, 1999, April 20, 2000, and May 25, 2001. With the exception of a brushing project, no work took place to correct the dam's deficiencies, and its condition continued to gradually deteriorate.

The March 31, 2000 deadline passed with no action performed by proponents of dam reconstruction. On April 13, 2000 the Department issued Order 2-WP-767A to remove the Deerskin Dam. During May and June 2000, property owners on both sides of the dam denied access across their land for the Department to remove the dam. On August 24, 2000 the Department of Justice filed Case 00 CV 108 against four private property owners and Vilas County to gain access to the dam. This action resulted in signed access agreements from all parties, and all cases were dismissed by March 13, 2001.

During February 2001 the Vilas County Forestry Committee and the Wisconsin Association of Lakes expressed interest in finding an owner and reconstructing the dam. Due to lack of funds and the inability to find an interested owner, this effort reached no conclusion.

The Department contracted Lunda Construction Company to remove the dam. Drawdown and removal took place from June 5 through June 7, 2001. The earthen embankments and corrugated steel culverts were removed using two backhoes and a small Positrack bulldozer. After removal of the dam the riverbanks were stabilized by seeding and the placement of erosion mat and silt fencing. By agreement with the EPA, Lunda removed the dam at no expense to taxpayers.

Aerial spot checks of the former flowage area were performed in August and October 2001. The Deerskin River had already started to find a new channel and the flowage area was well underway in the process of vegetating its former bed.

Removal of the Deerskin Dam resulted in the elimination of an abandoned dam that had deteriorated to an unsafe condition. The Deerskin River above the former flowage is classified as an Outstanding Resource Water and a Class I trout stream. Removal of the dam is expected to result in approximately 2.1 miles of the flowage and an additional 3.5 miles below the dam being reclaimed as a cold water ecosystem. Initial action by the Department will consist of allowing the river to heal itself and monitor water temperature, water quality, sediment transport and fish populations. The need to provide additional fisheries habitat will be evaluated based on the monitoring efforts and how well the river naturally responds.

Thursday morning 6/7/01. Following drawdown, breaching, and channel relocation on the first two days, the contractor is preparing to widen the new channel to match the natural river width.

This shot of the former dam location was taken on an 8/17/01 flyover. It depicts revegetation of the flowage bed in progress.

This is an aerial photo taken on 10/5/01. It shows the former flowage taken from the upper end looking in a downstream (toward the dam) direction.

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 — 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, the Upper Mississippi River Conservation Committee (UMRCC), channel maintenance plans, water level management and other activities.

During 2000-02, Wisconsin participated on the Upper Mississippi River Basin Water Quality Task Force, coordinated by the Upper Mississippi River Basin Association (UMBRA). This task force, comprised of senior level water administrators in states adjacent to the Upper Mississippi River Basin (Minnesota, Wisconsin, Illinois, Iowa and Missouri), met regularly to discuss and move forward an agenda for addressing multi-state issues requiring interstate coordination on this mutual waterbody. 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. Recently the Task Force formally endorsed hiring (using federal 104(b)(3) funds) an interstate liaison to help describe differences and similarities between states on these various issues.

UMR Water Quality Assessment

Wisconsin participated in the development of a Water Quality Assessment of the UMR through its role as a member of the UMRCC Water Quality Technical Section. The study revealed that nonpoint source inputs from tributaries, discharges from major point source inputs, and river flows influence water quality conditions.

In Pool 2 nonpoint source pollution from the Minnesota River and wastewater discharges from the Twin Cities Metropolitan Area have strongly affected river quality in the past. Point source pollution abatement activities in the 1980s have resulted in improved water quality below the Twin Cities. Water quality changes also take place in the lower UMR where large agricultural watersheds, including the Missouri River, contribute to high nutrient or suspended solid concentrations.

The report documents that fish tissue PCB concentrations have decreased river-wide from the early 1980s to the 1990s and that compared to fish samples collected nationally, mercury concentrations in channel catfish fillets from the UMR were slightly greater than the national average. Median mercury concentrations in Walleye fillet were noticeably lower than the national average and appear to be declining. The decreasing trend is consistent with reduced inputs based on sediment coring studies of Lake Pepin (UMRCC Water Quality Technical Section, Water Quality Assessment Report, March 2002).

Report Recommendations

- The Water Quality Technical Section should update the assessment and associated databases at 5-year intervals
- State, Federal and local agencies need to continue to coordinate their monitoring efforts to more effectively monitor the entire length of the Upper Mississippi River.
- Statistical trend analysis of water quality data collected at specific sampling locations should be performed at select stations throughout the UMR where long term (>20 years) data are available.
- Monitoring agencies should be encouraged to include flow data from an appropriate gaging site to their water quality databases for the Mississippi River or tributaries
- UMR States and Federal agencies should coordinate consistent sampling and analysis of contaminant concentrations in fish from the river at 5-year intervals

Environmental Management Program

Long Term Resource Monitoring

In 2002 the Long Term Resource Monitoring Field Stations at Lake City, MN (MNDNR-Pool 4) and Onalaska, Wisconsin (WDNR, Pool 8), completed routine fish, invertebrate, vegetation, and water quality monitoring with some exceptions. Night electroshocking, seining, and all tandem net sets were eliminated from 2002 sampling due to data analysis results indicating some redundancies among these gears and others kept. Stratified random monitoring for submersed vegetation was added in Pools 5 and 7 in 2002. Water quality sampling was stopped as of October 1, 2002 due to funding shortages. Efforts are currently underway to restructure the current Long Term Resource Monitoring program for 2003 and out years to accommodate severe (40%) federal funding reductions anticipated. No routine monitoring is planned for the 2003 sampling season, and only very limited pilot projects are being considered, contingent on receipt of funds. This has been a good program providing needed information and we are concerned about the funding shortages, severe reductions and the disruption of long term datasets that will result.

Habitat Rehabilitation and Enhancement Projects

The state of Wisconsin has sponsored or co-sponsored 21 Environmental Management Program Habitat Rehabilitation and Enhancement Projects (HREPs) since 1986. These projects are planned by an interagency team made up of representatives form the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service and the neighboring state DNRs of Minnesota or Iowa, depending on project location. The Wisconsin DNR, as part of the interagency team, has also been involved in the planning of 19 projects in Iowa or Minnesota waters since 1986. FY 01-02 accomplishments included participation in the planning of 8 HREPs (5 co-sponsored by Wisconsin) and start of construction for the Pool 11 Islands, Sunfish Lake, and Ambrough Slough Stages 1-3. Together, these 2 projects will directly improve over 1,500 acres of habitat in the Mississippi River floodplain.

Environmental Pool Plans

Wisconsin participated with other State and Federal agencies and the public in a recent planning effort to develop common habitat goals and objectives to guide the development of future habitat restoration on the UMR Pools 1-10 (Twin Cities to Guttenburg, IA). A similar planning effort is underway for pools 11 to 26. An important aspect of this work was to develop a desired future state of the UMR pools accounting for current knowledge of the River's ecosystem, experience with habitat projects, observations of river managers, biologist and the public. An important aspect of the pool plans was to identify future habitat and conditions necessary to reverse negative trends in habitat quality and to progress towards a more sustainable ecosystem. Pool plans will be modified as more information is gained about the UMR ecosystem, response of future habitat projects and technical advances in habitat needs assessment.

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 hundreds of acres of additional aquatic vegetation have been produced to provide valuable fish and wildlife habitat. The next phase of this restoration technique will be examined for how long the results linger after reflooding, how often should it be repeated, and where and how should it be implemented next.

Upper Mississippi River - Illinois Waterway System Navigation Study

The Wisconsin DNR has participated in the Corps of Engineers Navigation study since 1991. As a result of a congressional inquiry the study has been refocused to include an equal emphasis on commercial navigation and the ecosystem integrity of the Upper Mississippi River. An Interim Report was released July 31, 2002 that charts the course for the partnering agencies to work on through the Feasibility Phase which is slated to be complete by December 2004.

Army Corps of Engineers Boatyard—Mississippi River

This site was located on the Mississippi River at Fountain City, and consisted of PCB contamination that resulted from the use of PCB-laden waste oils that were used as a dust-suppressing agent.

Concentrations of PCBs ranged from 5 mg/kg in river sediments to 65 mg/kg in land soils adjacent to the river. The spatial extent of soil and sediment contamination was less than 1 acre. Remediation, which took place in March 1999, involved the removal of the riverbank sediments and bed sediment with subsequent landfilling of the removed materials. Bed sediment was removed from a small area of the Fountain City Bay, adjacent to the site of soil contamination. WDNR and the Army Corps of Engineers each spent two years on the remediation of this site. Subsequent post-remediation monitoring in 2000 has indicated that the clean up goals were achieved. As a result of this remediation work, WDNR has submitted a petition to EPA to ask that this site be removed from the Wisconsin Section 303d list.

Wisconsin River

The Wisconsin River, the longest river in the state, supports diverse aquatic and terrestrial ecosystems as well as variety of human activities. The river begins at Lac Vieux Desert, a lake in Vilas County that lies on the border of Wisconsin and the Upper Peninsula of Michigan. The river is about 430 miles long and collects water from 12,280 square miles of land. As a result of glaciation, the river traverses a variety of different geologic and topographic settings. While the river has been modified by human activities over the last 150 years, its natural resource values continue to support abundant wildlife. Much of the river has been dammed for power production and flood control. Cities and industries have long discharged wastes into the river and by the 1950s the middle and upper parts of the river were severely polluted. Beginning in the early 1970s, massive water treatment programs were initiated to improve river water quality.

The Wisconsin River Basin is subdivided into three separate focal areas or “sub-basins” for management purposes, beginning with the Headwaters Basin, moving to the Central Wisconsin Basin, and ending with the Lower Wisconsin Basin. Below are summaries of Wisconsin River condition from Integrated Plans for these respective areas.

Headwaters Basin

The Wisconsin River is the largest waterway in the Headwaters Basin. It originates at Lac Vieux Desert (river mile 420.1), which lies in both the Upper Peninsula of Michigan and Vilas County in Wisconsin, and flows south through Vilas, Oneida and Lincoln counties to Merrill Dam (River Mile 286.7), approximately four miles south of Merrill. This portion of the river (133 miles) contains 7 hydroelectric generation plans, four paper mills, three municipal wastewater treatment plans, and two storage reservoirs. Most of the mainstem is classified as a balanced warm water fishery and aquatic life community. A very diverse game and nongame fishery exists. The greater redhorse and pirate perch, which are on Wisconsin’s watch species list, are found in the northern subbasin. A small portion of the mainstem above the confluence with Portage Creek contains a remnant brook trout population reproducing in this portion of the river.

Fish in this headwaters portion of the river appear relatively free of harmful levels of toxic constituents. Northern pike taken from the river a Lake Alice in Lincoln County are on the Health Advisory for mercury concentrations greater than .5 ppm. Walleye from Rainbow Flowage are also no the advisory for mercury (See Chapter 7 for more information about health advisories).

Central Wisconsin Basin

The central portion of the Wisconsin River main stem starts at Merrill Dam (River Mile. 286.7) and flows south to Castle Rock Dam (River mile 159.7). The Wisconsin River stretches for 127.0 miles within the Central Wisconsin River Basin and has fifteen impoundments that generate hydroelectricity. The river receives effluent from ten municipal wastewater treatment plants (WWTPs) and fourteen industrial wastewater treatment facilities, eight of which are paper mills. A comprehensive management plan for this portion of the river was completed in 1996.

The central portion of the Wisconsin River is classified as supporting a balanced warm water fishery and aquatic life community (WWSF), with a diverse game and non-game fishery. Of the 127.0 miles of the Wisconsin River only a small portion supports its potential biological use due to excess nutrient loading from point and nonpoint sources; urban runoff; fecal coliform bacteria exceeding the state standard; elevated levels of heavy metals and organic chemicals in sediments; and bioaccumulation of organic contaminants in fish tissue.

The DNR has collected ambient data on the Wisconsin River in this portion of the basin at six locations, which include the Wausau Dam, Lake DuBay Dam, Stevens Point Dam, Biron Flowage Dam, Nekoosa Dam and Petenwell Dam. These six stations, sampled and maintained by DNR, including collection and analysis of dissolved oxygen, pH, BOD_5, suspended solids, total phosphorous, ammonia, total Kjeldahl nitrogen, nitrate-nitrogen, calcium, conductivity, chloride, hardness, chlorophyll, magnesium, and fecal coliform bacteria. A review of this data indicates that the Wisconsin River is currently meeting water quality standards for all parameters with the exception of fecal coliform bacteria. Violations of the standard have occurred at all six stations, but most of them have occurred at Biron, Nekoosa and Wausau locations.

Toxins are a concern in this portion of the Wisconsin River, in particular pentachlorophenol (PCP), used in the wood industry as a wood preservative. Known spill sites exist adjacent to the Wisconsin River between Merrill and Rothschild. The chemical has been detected in the sediments below and above the Rothschild Dam (Weyerhaeuser) and may be discharged to the river below Merrill, and on the Rib River above Lake Wausau. More detailed sediment sampling needs to be conducted between Merrill and Wausau to show the distribution and extent of PCP contamination. Polychlorinated biphenyls (PCBs) have also been detected in sediments below the Wausau Dam. PCBs are also found in fish from Biron Flowage to Castle Rock Flowage. Dioxin (paper mill by-product) has been detected in fish from the Petenwell and Castle Rock Flowage. These chemicals may also exist within the sediments but further testing is necessary to confirm this.

Another concern in this segment of the Wisconsin River, as well as the whole river system, is nutrient loading. Many of the main stem reservoirs, especially the Petenwell and Castle Rock, suffer from severe algae, dense growths of aquatic plants and increased siltation or sedimentation due to excess available phosphorus. In many cases this impact on water quality prohibits recreational uses in these impoundments. Currently, WWTPs are required to remove phosphorus from effluent; their contribution to the overall phosphorus in the river is insignificant during low flows. In any event, research is needed to identify the source of the phosphorus that is affecting the river. A study is currently being conducted to document whether the annual load of phosphorus entering the river comes from point sources or other sources such as nonpoint source runoff. This information is needed to determine the necessity of phosphorus removal by WWTPs.

Fish from the Central Wisconsin River area have been analyzed for microcontaminants at 15 sample locations:

- Wisconsin River below Merrill Dam
- Wisconsin River at Brokaw
- Wisconsin River at Wausau Dam Lake
- Wisconsin River at Lake Wausau
- Wisconsin River at Rothschild
- Wisconsin River at Mosinee Flowage
- Wisconsin River at Lake DuBay
- Wisconsin River below Stevens Point Flowage
- Biron Flowage
- Wisconsin River below Biron Dam
- Port Edwards Flowage
- Nekoosa Flowage
- Wisconsin River below Nekoosa Dam
- Petenwell Flowage
- Castle Rock Flowage

Some of these locations contain fish on the state fish health advisory. Monitoring should continue to track trends. Whole fish sampling is being conducted for PCBs, Mercury, PCP, dioxin and furan — which are often associated with PCP as microcontaminants. In addition, the DNR is conducting follow-up sampling for dioxin and furans below Rothschild. Walleye are on the state fish health advisory for mercury from the Nekoosa Dam to the Castle Rock Dam, including the Castle Rock and Petenwell Flowage. Carp and white bass from the Petenwell Flowage and carp from Castle Rock Flowage are on the advisory for dioxin. Periodic sampling is conducted to analyze possible trends.

This section of the Wisconsin River receives effluent discharges from ten municipal and fourteen industrial WWTP facilities. Due to the number of dischargers on the river from Hwy WW in Brokaw to the inlet of Lake DuBay, this portion of the river has a wasteload allocation to ensure water quality standards are maintained at times of low flow and high temperatures in the river.

Based upon the information provided both the Petenwell and Castle Rock flowages are impaired due to:

- High density carp populations.
- Undesirable bluegreen algal blooms, some toxic algae.
- Phosphorus loading from both point and nonpoint sources, causing eutrophication.
- Dioxin, Mercury and PCB contaminated fish and sediments.
- Restrictions on fish and wildlife consumption.
- Degradation of desirable phytoplankton, zooplankton, bottom-dwelling organisms (benthos), and fish and wildlife communities because of poor water quality and lack of established rooted aquatic plants.
- Degraded aesthetics.
- Human interference.

Because both Petenwell and Castle Rock flowages have the potential to be outstanding resources from both a fishery and recreational viewpoint, a comprehensive management plan should be developed to recommend remedial measures to resolve these problems.

Lower Wisconsin Basin

The section of the river known as the Lower Wisconsin River crosses over several different geologic settings. From the Castle Rock Flowage, the river flows through the flat Central Sand Plain that is thought to be a legacy of Glacial Lake Wisconsin. Downstream from Wisconsin Dells the river flows through glacial drift until it enters the Driftless Area and eventually flows into the Mississippi River. Overall, the Lower Wisconsin portion of the river extends about 165 miles from the Castle Rock Flowage dam downstream to its confluence with the Mississippi River near Prairie due Chien. There are two major hydropower operating on the Lower Wisconsin, one at Wisconsin Dells, and one at Prairie du Sac. The Wisconsin Dells dam creates Kilbourn Flowage. The dam at Prairie du Sac creates Lake Wisconsin. Below the Prairie du Sac dam the river is free flowing for 92 miles.

The Lower Wisconsin continues to be an important economic resource throughout the state. The river's power and energy have been harnessed for use in a variety of different industries including the papermaking industry. This industry in particular has a long history of contributing pollution to the river. The impact so this industry included frequent fish kills, unpalatable fish flesh, and massive populations of bacteria, fungi and protozoans. Although Lake Wisconsin and the Lower Wisconsin mainstem are partially buffered from the impacts of the pulp and paper mill industry by the series of impoundments (which impede the flow of contaminated sediment to downstream areas), this segment of the river is nevertheless affected by pulp and paper mills.

Overall, the Lower Wisconsin River is classified as a diverse warm water sport fishery and anglers enjoy the opportunity to catch a variety of different sport fish on the river. The 92-mile stretch of river from Prairie du Sac to the Mississippi River supports a rich diversity of fish, mussels, herptiles and aquatic insects and fish species accounts indicate that the river and its backwaters support up to 95 native fish species; of these species, 19 are threatened or endangered. Several of these fish species are specific hosts for the glochidial stage of a number of rare, threatened and endangered freshwater mussels. This stretch of the river is also home to a variety of unusual and rare species insects and threatened and endangered amphibians and reptiles.

In addition to its abundant and diverse aquatic resources, the lower reach of the river has also been recognized for its aesthetics and potential for recreation. The US Park Service and US Forest Service nominated this stretch for inclusion in the National Wild and Scenic Rivers Program. The riverway is a unique natural and scenic area with abundant resources including a variety of habitat types, historical and archaeological sites, abundant wildlife and good quality fisheries. In recognition of its relatively undeveloped state, the Wisconsin Legislature created the Lower Wisconsin State Riverway in 1989; this designation includes a 92.3 mile free flowing stretch of the river from the Prairie du Sac dam down to the river's confluence with the Mississippi River.

Contaminated Sediment Management

The Department's Contaminated Sediment Program seeks to identify surface water communities that are contaminated by polluted sediments and manage those sediments in a manner that allows surface water quality standards to be maintained consistently. When sites are identified, and the environmental and health risks are assessed, an integrated effort by scientists and engineers in the Department allows for the remediation of contaminated sediments. These efforts result in the enhancement of water quality in Wisconsin's surface waters.

Contaminated Sediments at Former MGPs

A Manufactured Coal Gas Technical Team consisting of regional site project managers and water program staff within the Department review and coordinate technical issues involved in the investigation and remediation of former MGP sites. These plants have been identified as responsible for the contamination of surface water, sediments, and/or groundwater. Historically, MGPs utilized coal as a feedstock that was processed and ultimately resulted in waste products including coal tar, tar sludges and oil sludges. The primary pollutants of concern at MGP sites include VOCs (Volatile Organic Carbons), PAHs (Polycyclic Aromatic Hydrocarbons) and metals. The plants typically operated in confined areas, and utilized the nearest convenient outlet for waste disposal, which was often a nearby surface water. Once the toxic waste products enter the environment, they are not able to degrade naturally, and do not disappear without the help of human remediation (www.hatheway.net). For this reason, the contamination caused by MGPs is of great environmental concern, and the Department is actively pursuing remediation of these sites.

MGP Site Cleanups Completed

Baraboo MGP Site

Two acres of surface water and groundwater of the Baraboo River are contaminated with pollutants from activities that took place at the city of Baraboo MGP site in Sauk County. Alliant Energy was responsible for the contamination, which WDNR has known about since 1998. The Department and Alliant Energy each spent a year working on the remediation of the contaminated sediments, which was accomplished through mechanical dredging and landfilling. About 4,400 cubic yards of sediment were removed. As a precautionary measure, a silt curtain and sheet pile cutoff wall were utilized to discourage the contamination from spreading to other areas. All remediation, including reconstruction and revegetation of the stream bank was completed in Fall 2000. In addition to remediation efforts, the recent removal of several dams on the Baraboo River have lead to further restoration of the river corridor by improving aquatic and terrestrial habitat.

MGP Cleanups Pending

Lincoln Woods MGP site

Contamination at the Lincoln Woods MGP site in Merrill was caused by the city of Merrill MGP, however Lincoln Woods Window Manufacturer has since acquired the property and has assumed responsibility for the contamination. The contamination was detected in 1996, and the Department has been working on cleaning up the site for the past four years. Lincoln Woods has been involved in cleanup for about 6 months. A one-acre area, including both surface water and ground water, was affected by the contamination. Remediation efforts have involved dredging to remove the contaminated sediments. During the dredging process the river was drawn down to minimize river contamination by the groundwater. Initial remediation efforts have failed to meet the cleanup goals of the project. Due to lack of funds and other difficulties, contaminant removal in the river has been postponed as further options are being explored.

Manitowoc MGP

Surface water and groundwater contamination at the Manitowoc MGP - located in Manitowoc County – was identified in 1988. It has been determined that Wisconsin Fuel & Light is responsible for the contamination, which included VOCs, PAHs and metals. The Department has spent two months on remediation of this site, and Wisconsin Fuel & Light has spent six months. The City of

Manitowoc has also been involved in the cleanup process. An initial experimental remediation attempt, involving in situ stabilization of the bottom sediments, was unsuccessful. Silt curtains were utilized during remediation to contain the sediment. No further remediation is planned at this time.

Oshkosh MGP

The Oshkosh MGP site is located in Winnebago County, and has contaminated five acres of sediments in Lake Winnebago. The Department has known about this contamination, caused by a Wisconsin Public Service Corporation plant, for about 12 years. Contamination at this site involves both surface water sediments and groundwater. To date, the contamination that is present on land (versus the sediments of surface water) has been treated. This was accomplished by trenching below the area of contamination, and encapsulating the contaminated groundwater and soil. During this process, water tight sheet piling was implemented along the shoreline to keep any contaminated groundwater from entering the river's surface water. The Department has spent three months working on remediation, and Wisconsin Public Service Corporation has spent a year on the cleanup at this site. With the groundwater contamination remediated, the Department is now focusing its efforts on exploring ways to clean up the surface water sediment contamination.

Campmarina MGP

The Campmarina property in Sheboygan has contaminated soil, groundwater, and surface waters. Wisconsin Public Service Corporation's former manufactured gas processing plant operated more than 40 years ago on both Campmarina and an adjacent site to the south known as the Center Avenue Right-of-Way. Soil and groundwater cleanup activities were implemented in 2001 at Campmarina. The contamination in the Sheboygan River will be addressed in a separate remediation phase

MGP Sites Under Investigation

Appleton MGP

This site in Appleton in Outagamie County is currently under investigation. Sediment contamination by VOCs, PAHs, and metals, which affected an area of less than one acre, was discovered in 1993. To date, the Department and Wisconsin Energy have each spent about one month investigating the contamination.

Ashland Coal Gas

The Excel Corporation caused the contamination of ten acres of surface water and ground water at Ashland Coal Gas site located in Ashland County. Contamination was first detected by the Department ten years ago, and both the Department and the Excel Corporation have conducted three years of investigation. Extremely high levels of coal gas waste were found in Ashland Harbor of Lake Superior. The U.S. EPA Superfund program is now involved, and will be conducting an additional risk assessment.

Chippewa Falls — Duncan Creek

A MGP site in Chippewa County, believed to have contaminated Duncan Creek in Chippewa Falls, is in need of investigation. Preliminary exploration by WDNR is underway.

Fox River IL Burlington MGP

Investigation is needed at this former MGP in the City of Burlington, Racine County.

Green Bay MGP

Wisconsin Public Service Corporation is the responsible party for a former MGP in the City of Green Bay, Brown County. The existence of a two-acre area of surface water and groundwater contamination by PAHs, VOCs, and metals has been known about since 1993. The Department has spent about two weeks in preliminary investigation and Wisconsin Public Service Corporation has spent four months.

La Crosse MGP

The City of La Crosse MGP site in La Crosse County is situated along the Black River. Contamination was detected two years ago, and the responsible party is unknown at this time. The Department is conducting preliminary investigations at this site.

Marinette MGP

A former MGP site is located in Marinette County, in the City of Marinette. The coal gas wastes from this former plant contaminated ten acres of surface water with PAHs, VOCs, and metals. The Department first found out about this contamination ten years ago, and is currently in the preliminary stages of requiring additional assessment.

Milwaukee Third Ward MGP

A portion of the contamination in the Milwaukee River at Milwaukee Harbor is attributable to the Wisconsin Gas Company. Initial investigations are underway to determine future action.

Ripon MGP

Sediment and groundwater contamination at the City of Ripon MGP, located in Fond du Lac County, was caused by activities of Alliant Energy. The Department was made aware of this contamination in 1994.

Stevens Point MGP

The City of Stevens Point MGP site is located near the Wisconsin River in Portage County. The plant was operated by Wisconsin Public Service, and caused the contamination of groundwater and surface water. Groundwater remediation has already occurred, and investigations of sediment contamination continue.

Two Rivers MGP

Wisconsin Public Service Corporation is responsible for the contamination at Two Rivers, in Manitowoc County. The Department is working to determine whether additional assessment is necessary.

Wausau MGP

The contamination at the Wausau MGP site in Marathon County is due to activities of Wisconsin Fuel and Light. The contamination was discovered in 1999, and very little information is known regarding the extent of contamination. Further investigation is necessary to establish future actions.

Remediations Completed

Army Corps of Engineers Boatyard—Mississippi River

This site was located on the Mississippi River at Fountain City, and consisted of PCB contamination that resulted from the use of PCB-laden waste oils that were used as a dust-suppressing agent. Concentrations of PCBs ranged from 5 mg/kg in river sediments to 65 mg/kg in land soils adjacent to the river. The spatial extent of soil and sediment contamination was less than 1 acre. Remediation, which took place in March 1999, involved the removal of the riverbank sediments and bed sediment with subsequent landfilling of the removed materials. Bed sediment was removed from a small area of the Fountain City Bay, adjacent to the site of soil contamination. WDNR and the Army Corps of Engineers each spent two years on the remediation of this site. Subsequent post-remediation monitoring in 2000 has indicated that the clean up goals were achieved. As a result of this remediation work, WDNR has submitted a petition to EPA to ask that this site be removed from the Wisconsin Section 303d list.

Gruber's Grove Bay

Gruber's Grove Bay is located on Lake Wisconsin, and is adjacent to the former Badger Army Ammunition Plant. This 20-acre site is near the City of Baraboo in Sauk County. Sampling in the Bay conducted in 1999 by WDNR and the Army indicated elevated levels of Mercury, Lead, Copper, Chromium and Nickel. The contaminated sediments were the result discharges associated with the production of ammunition at the former plant. Seventy-five thousand (75,000) cubic yards of mercury contaminated sediments on site were hydraulically dredged and landfilled, at a total cost of $6 million. During dredging operations, the use of a silt curtain was implemented to contain contaminants in the bay. In addition to work done by the Department and the Department of Army, there was also involvement by U.S. EPA, University of Wisconsin Extension, and local citizen volunteer groups. Remediation efforts at this site were completed in November 2001.

Wausau Steel Corporation / Rib River Oxbow

Wausau Steel Corporation performed battery reclamation at a site 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, and contaminated surface water sediments with Lead and Zinc. It was determined through a feasibility study that "capping" was the appropriate remediation for this four-acre site. This 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. Monitoring conducted after capping the site indicated that beneficial aquatic habitat has developed in the capped area, and that healthy aquatic life is becoming established.

Cleanup pending

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. Tecumseh Products, an engine manufacturer, caused the contamination by PCBs at the site. The pollution affected twenty miles of surface water. Of particular concern at this site is the presence of Killsnake Wildlife Area immediately downstream of the millpond. The Department and Tecumseh Products have been working on the development and implementation of cleanup efforts since 1999. Clean up has begun on site in the Fall of 2001, with the sediments of greatest contamination the first to be removed and landfilled. To date, these efforts total about $1 million. To track the success of remediation, chemical and biological monitoring were conducted prior to remediation, and will continue through the completion of the clean up process. Remediation efforts are being conducted by the Department in conjunction with the City of New Holstein, Calumet County, EPA, and United States Geological Survey (USGS). Additional investigation to determine the appropriate remediation method for the contamination at this site is necessary.

Kewaunee Marsh

The Kewaunee Marsh, located in Kewaunee County, is the site of contamination due to a Central Wisconsin Railroad car spill in the 1940's. This spill caused arsenic contamination of surface water and groundwater in a three-acre area of the marsh. The Department, along with Wisconsin Central Railroad, has spent two years investigating and cleaning up the site. As an interim remedy to reduce human and 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 ground water plume doesn't further pollute the river. To date, remediation costs have totaled approximately $400,000. Groundwater monitoring investigations are underway to determine the necessity of future remediation.

Lower Fox River

The Lower Fox River in Outagamie County and Brown County is heavily polluted with PCBs as the result of the historical operations of seven local paper and pulp mills. The sediment contamination stretches for 39 river miles of the Fox River, and has affected several communities in the Fox River Valley, including Appleton, Green Bay, Neenah, and Menasha. Contamination was detected in the mid 1970's, and has been a subject of investigation by the U.S. EPA, the Department and local paper manufacturers for more than 20 years. Two deposits of PCBs in the river (Deposits 56/57 in Green Bay, and Deposit N in Appleton) were remediated in 1998-99. Additional cleanup of the river is being planned with proposed remediation plans currently under public review. The proposed cost of the clean up of the Lower Fox River is estimated at $238 million.

Many other agencies/organizations, including the U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Menominee Indian Tribe, and Oneida Indian Tribe have collaborated with the WDNR and local responsible industries to assist in remediation efforts.

Ansul Corp / Menominee River

The Menominee River in Marinette is the location of 20 acres of arsenic contamination caused by Ansul Corporation, a chemical manufacturer of flame retardant materials. On-site storage of wastes resulted in the contamination of groundwater, as well as sediments in the Eighth Street boat slip, the ship turning basin, the Menominee River and Green Bay. The contaminated sediment at the boat slip was removed, and the slip was sealed off. During removal of material from the boat slip, 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. Also involved in the remediation efforts were U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service.

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. Contamination of sediments by oil and grease and PAHs was discovered nearly 20 years ago, has affected the surface water at this site. Over the past five years, the Department, Murphy Oil, and the City of Superior have cleaned up a two acre impoundment at the headwaters of Newton Creek, and are investigating and planning an approach to remove remaining contaminants from downstream waters. Additional investigations are presently underway.

Sheboygan River

The Sheboygan River Area of Concern includes the Sheboygan Harbor and 14 miles of the river up to the Sheboygan Falls Dam. 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 shipped off site in September 2001.

The implementation phase of this project will usher in the long-awaited sediment remediation of the Sheboygan River. 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.

Under a legal agreement signed earlier this year between the U.S. Environmental Protection Agency (U.S. EPA) and Tecumseh, polychlorinated biphenyl (PCB)-contaminated sediment was loaded onto trucks lined with heavy plastic and hauled to the company’s New Holstein plant. From there, it was loaded into railcars and shipped to a licensed landfill in Tulsa, OK. This sediment was disposed of in Tulsa because it contained over 50 parts per million (ppm) PCBs and a landfill in Wisconsin was not available. The tanks were demolished after being decontaminated. After sections of the tank were removed, they were transported to a local recycling facility.

U.S. EPA has been communicating with Tecumseh officials for the past year hoping to reach an agreement that would commit the company to the cleanup of the upper river, which extends from the Tecumseh facility in Sheboygan Falls to Walderhaus Dam. Once the consent decree is lodged in federal court, the Department of Justice will begin a 30-day comment period by posting an announcement in the Federal Register. After the Department of Justice responds to the comments, it will ask that a judge enter the consent decree in federal court to finalize the agreement. Characterization and design of the cleanup components could proceed in 2002 with cleanup activities beginning soon after.

Under Investigation

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 that resulted in contamination of the sediment, as well as the overflow areas along a drainage ditch from the facility. Koppers Industries is under the Resource Conservation and Recovery Act (RCRA) program and has undertaken corrective measures related to the soil and groundwater contamination at the site. An investigation of the degree of contamination is being conducted by a consultant for Koppers Industries. Depending on the results of the investigation, the Department will take appropriate measures appropriate to moving forward on the remediation process.

Mercury Marine / Cedar Creek

Mercury Marine, an outboard motor engine manufacturer in Ozaukee County, is responsible for PCB contamination of approximately 20 miles of Cedar Creek and Ruck Pond in the cities of Cedarburg and Thiensville. The contamination was discovered 15 years ago, and the Department has been working with Mercury Marine for three years on remediation and further investigation of the site. The U.S. EPA and the City of Cedarburg were also involved in clean-up efforts at this site. Contaminated sediments removed from Ruck Pond were dredged and landfilled in 1998. Prior to this remediation effort, Cedar Creek was drawn down and diverted around Ruck Pond to allow for more effective removal of sediments. Pre- and post-remediation monitoring was conducted on Ruck Pond. Investigations are ongoing to determine the appropriate method of remediation for the remaining contaminated sediments of the creek. To date, $7 million have been spent on remediation efforts.

Moss-American

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 at this site. To date, the U.S. EPA, WDNR and Kerr-McKee, have each spent five years working with the EPA on this project. Currently, the EPA is waiting for the submission of a proposed remediation plan by the Kerr-McKee Corporation, at which time decisions regarding further actions will be made.

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. 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 three years investigating the site. Preliminary monitoring has focused on changes in water quality, as well as the performance of toxicity identification studies. Further investigations will identify the degree of contamination and allow for the determination of subsequent action.

Integrated Resource Management

Integrated planning, described in Part II of this report, involves identifying ecosystem status, ecological issues and concerns, and priority work areas for DNR and partner groups. The following summarize just a few of the many (18) integrated plans developed from 2000 through 2002. The Upper Chippewa, Superior, and Sugar Pecatonica are not completed.

Lower Fox River Basin

The Lower Fox River Basin Integrated Management Plan provides background information on the basin, identifies threats to basin resources, and details actions to improve the health of ecosystems in the basin. The ultimate goal of the plan is to improve resources through coordinated work planning and issue prioritization.

The physical features and geology of the basin influence the types of issues and problems that occur. The Fox River and the lower part of Green Bay are the major surface water resources; other major surface water features serve as the basis for dividing the basin into watersheds. Watersheds include the East River; Apple and Ashwaubenon Creeks; Plum and Kankapot Creeks; Fox River/ Appleton; Duck Creek; and Little Lake Butte des Morts.

The topography, surface water drainage, and drinking water availability are dictated by local geology, which consists of glacial deposits underlain by a series of eastward-dipping sedimentary bedrock units. The sedimentary bedrock consists of carbonates (dolomite and limestone), shale, and sandstone.

The basin supports a variety of unique and delicate ecosystems, including open land, woodlands, wetlands, riverine, and lacustrine ecosystems. Open lands and woodlands ecosystems provide habitat for wildlife, recreational opportunities for area residents, and areas for groundwater recharge. The wetlands ecosystems support a variety of unique plant and animal species and protect water quality by buffering surface water runoff to rivers and streams. The riverine and lacustrine ecosystems provide habitat for wildlife, commercial fisheries, and recreational opportunities. The Niagara Escarpment is an especially unique ecosystem located within the basin.

Past and current industrial activities, agricultural practices, and residential and commercial development threaten these ecosystems. The primary challenges identified for the basin include:

- Habitat loss, deterioration, and fragmentation;
- Nonpoint source pollution of surface waters;
- Deteriorating groundwater quality and diminishing groundwater quantity;
- Heavy recreational use of some resources, such as lakes and shorelines;
- Contaminated sediments;
- Inadequate program support and enforcement; and,
- Lack of education [on how to protect and manage area resources]

The main priorities identified to address the issues above include:

- Increase and protect critical habitats and habitat integrity;
- Sustain a diverse, balanced and healthy ecosystem;
- Improve surface water and groundwater quality and identify water conservation opportunities;
- Establish a self-sustaining, balanced, and diversified edible fish community;
- Manage resources for multiple users;
- Strengthen program support and enforcement initiatives; and
- Improve educational programs.

Existing programs and regulations are currently addressing some of the issues identified for the basin. WDNR staff are working to improve and protect basin resources through Wellhead Protection Planning, the Wisconsin Storm Water Management Permit program, the Priority Watershed Program, and Impaired and Outstanding Waters and Wetlands regulations. These programs and regulations provide a framework within which future actions may be conducted.

Lakeshore Basin

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

Natural Resource Concerns

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

Aquatic Resources

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

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

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

Drinking and Ground Water Resources

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

Terrestrial Resources

Historically most of the watersheds in the Lakeshore Basin were dominated by forested and wetland vegetation. Loss of forested and wetland vegetation has resulted in impaired watershed hydrology. These impairments include poor infiltration rates and an excessive percentage of the

percent precipitation and snow melt running off causing non-point source pollution and overwhelming existing stream channels and aquatic habitat. With a majority of the Basin's land use being in farmland the best opportunities exist for forest and wetland vegetation restoration on marginal farmland areas as a part of a solid farmland land use plan which encourages responsible stewardship. Sixty eight percent of the land in the basin is farmland. Today, many of the small farmers are finding it harder to make a living and face the need to either expand operations to survive or sell the land. Vacant farmland is being 0converted to rural home development, divided into smaller parcels for private recreation or potentially converted to tree planting, grassland or wetland restoration. Unfortunately most of the land is being converted to smaller parcels for private use or development. This trend greatly reduces recreational uses on lands that once were open to hunting or fishing opportunities. It also means a potential increase in silt and nutrient-laden runoff from further declines in forest lands and wetlands. In the next two years our workplans will continue to address the issues identified in this report.

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

Future Challenge

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

Upper Green Bay Basin

The Upper Green Bay Basin includes waters draining to Green Bay between the city of Green Bay and the Wisconsin-Michigan border. Major river systems include the Menominee, Oconto, and Peshtigo rivers in the north and the Pensaukee, Suamico and Little Suamico rivers further south. The Upper Green Bay GMU is a subset of the larger Green Bay hydrologic basin and includes all or portions of 16 watersheds entirely or partially within the Upper Green Bay Basin.

The basin's northern areas are largely forested. Agricultural uses are quite distinct in the southern portion of the basin. Marinette County is approximately 75% forested, while Oconto County is about 60% forested. Public lands make up a very large percentage of the land base in the Upper Green Bay Basin. In addition to federal and county land, the state now owns the Governor Tommy G. Thompson Centennial State Park. There are three main rivers within the basin — the Menominee River, the Peshtigo River and the Oconto River. Northern Oconto County contains a large concentration of lakes. Marinette County also has a large number of lakes, but is primarily noted for its miles of trout streams. Together there are 820 lakes in the basin covering almost 25,000 acres, and approximately 950 miles of trout streams, 650 miles of which are considered Class 1, or naturally reproducing trout streams.

The Upper Green Bay Basin includes the Northeast Hills, Northeast Sands, Northeast Plans and Northern Lake Michigan Coastal ecological landscapes. Most of the basin's outstanding and exceptional resource waters are located in the Northeast Sands and Northeast Hills areas. The Northeast Hills has hilly topography with silt loam soils, and extensive northern hardwood forests with little development. The Northeast Plains is an area with gently rolling to flat topography with sandy soil, a mixture of agriculture, and mixed hardwood forests and wetlands. The Northeast Sands includes gently rolling topography with sandy soils, primarily oak and pine forests. The Northern Lake Michigan Coastal ecoregion includes land and water influenced by Lake Michigan, with gently rolling to flat topography with clay and loam soils. The area is dominated by agriculture to the south and mixed hardwood forest in the north.

Basin Objectives

Below is a list of Upper Green Bay Basin Objectives, designed to provide direction for Department and Partner Team projects over the next six years.

- Target the west shore of Green Bay as a high priority for habitat protection. Complete feasibility analysis and planning process for the Western Shore of Green Bay Coastal Zone Habitat Restoration Area.
- Implement the fifty year acquisition/protection study recommendations identified as "Land Legacy projects" by and for the Upper Green Bay Basin.
- Increase emphasis on Water Regulation and Zoning efforts.
- Increase participation on regional Land Use Team, develop expertise in "Smart Growth" program, and work more closely with municipalities to promote wise land use and zoning.
- Review, revise and implement a Comprehensive Upper Green Bay Basin Fisheries Management Plan. This plan will include the following component plans.
- A revised Oconto River Fisheries Management Plan. Use this plan to implement and direct fisheries activities on the Oconto River system.
- A revised Menominee River Fisheries Management Plan. Use this plan to implement and direct fisheries activities on the Menominee River system.
- Incorporate the Lake Michigan Comprehensive Fisheries Management Plan.
- Develop and implement a Peshtigo River Fisheries Management Plan.
- Complete Master Planning process for Governor Tommy G. Thompson Centennial State Park. Implement master plan as resources become available.
- Increase emphasis on educational initiatives through routine activities and special projects, e.g. work with UW Extension, sportsmans groups, schools, the Citizens Natural Resource Academy, and other stakeholder groups.
- Continue to implement sound forestry practices on public and private lands to ensure a sustainable yield of forest products, a sound timber recovery, a variety of recreational opportunities, protection of waterways and optimum habitat for a variety of wildlife species.

Wolf River Basin

The water-rich Wolf Basin covers a large area, draining over 3600 square miles and portions of eleven counties in the northeast portion of the state. The basin is primarily located in the Northeast Hills and Northeast Plains Ecological Landscapes with small portions in the Central Sand Hills, Southeast Glacial Plains, and North Central Forest. The variable topography of the Northeast Hills are covered with extensive hardwood forests, while the Northeast Plains are characterized by gently rolling to flat topography with sandy soils and primarily oak and pine forests. Also present are hemlock, northern white cedar swap, and hardwood conifer swamp. Numerous wetlands exist, particularly those associated with the Wolf River floodplain. Agricultural activities are more prevalent in the southern portion of the basin, while development along lakes and riverways is occurring throughout the basin.

Various stretches of the Wolf River, the basin's largest water resource, are considered outstanding or exceptional resource waters (ORW/ERW). This waterbody drains to the Winnebago Lake System and the rapidly growing Fox Valley area. Numerous lakes and impoundments, many of which are human-made from low-head dams on streams, serve as focal points for fishery and wildlife habitat as well as recreation.

Challenges

The scenic beauty of the Wolf Basin and its proximity to rapidly developing areas such as Green Bay and the Fox Valley make enhance its susceptibility to habitat loss and pollution from urban runoff. Likewise, the basin's agricultural sector results in runoff of excess nutrients and sediment. Additional challenges to ecosystem managers include the introduction of exotic species such as garlic mustard, purple loosestrife, gypsy moths, zebra mussels, and others that disrupt the delicate balance of both uplands and lowlands. Shawano Lake is an excellent example of an unbalanced ecosystem, with annual bird die-offs related to the presence of an exotic trematode or flatworm.

Priorities

The partnership team has identified four main priorities or issues of concern along with a series of recommendations:

- Water Pollution
- Loss of Shoreline Habitat
- Hunting, Fishing, Trapping and Recreational Uses
- Need for an Inventory of Basin Resources

The DNR Wolf Basin Team shares these concerns and has identified its own top priorities as well:

- Preservation and protection of wetlands
- Preventing the introduction and reducing the spread of invasive exotic species
- Pressures from development
- Land use and 'Smart Growth'

Modifications in farming practices can have a tremendous positive impact on the quality of surface water resources.

Chapter 4: Inland Lakes

Lake Planning and Management

All of Wisconsin's 15,057 inland lakes are considered a significant public resource. 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 lakes prone to intensive algal growth.

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 and University of Wisconsin-Extension 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.

The 2000 305B Report highlighted lake management activities for the 1990-decade. This served a dual reporting purpose in that the close of the century also marked the projected end-point of the Lake Management Partnership's last strategic plan. In 2001, a new strategic plan, the *Water Way* was completed. This report primarily focuses on activities and accomplishments for 2000 and 2001 with an eye toward implementation of activities over the next 10 years.

For more detail on the individual aspects of the Lake Management Partnership, consult the 1994 Water Quality Assessment Report to Congress or visit the Partnership website at http://www.uwsp.edu/cnr/uwexlakes/

Strategic Planning

In the spring of 2000, a group of people concerned with the future of Wisconsin lakes gathered in Rhinelander to chart a course for working together on lakes issues. Visions, goals, strategies and performance measures were compiled from a facilitated two-day exercise led by members of the Wisconsin Lakes Partnership. The draft was shared at the 2001 Wisconsin Lake Convention and posted on the Partnership's website for review and comment. The completed plan, *The Water Way*, provides a map for the Partnership's work in the first decade of the 21st century.

Lake Organization and Education Assistance

The University of Wisconsin Extension (UWEX) at Stevens Point provides lake organization and education assistance statewide. Staff at UWEX provide development, publication and distribution of printed and electronic media, providing useful information to the citizen members of Wisconsin's hundreds of lake management organizations on a hosts of issues ranging from water law to limnology. It also publishes a quarterly newsletter, *Lake Tides*, which has a distribution of approximately 23,000. *Lake Tides* and many other publications are also now offered on-line through the Wisconsin Lakes Partnership website.

In March of 2001, UWEX published a comprehensive guide *Wisconsin Water Law: A Guide to Water Rights and Regulations*. Approximately 115 consultants, attorneys and government officials and staff attended a conference in May on the topic of Wisconsin's water law. A final draft of a book on recreational use on Wisconsin's waters, *How's The Water: Recreational Use on Wisconsin Lakes* was completed in 2001. The draft will be distributed at the 2002 Wisconsin Lake Convention for comments and will be finalized shortly thereafter.

UWEX is also the location of the Partnership's youth education efforts, staffing and coordinating the Project WET and Adopt A Lake programs. Over 635 teachers and youth participated in these program's various workshops in 2001.

To better prepare the next generation of citizens for positions in lake advocacy, the Wisconsin Lake Leaders Institute was established through UWEX in 1998. In 2000 the third "crew" of 30 people completed their training and in 2001, twenty-three past graduates of the Institute attended an Advanced Seminar focusing on water law and water use conflict.

UWEX staff also makes numerous "house calls" attending and speaking at numerous lake organization meetings, lake fairs and related events. Approximately 1200 people are reached annually through conferences and community meetings conducted by UWEX staff.

Finally, the Partnership was host to the North American Lake Management Society's 2001 International Symposium November 6 through 10 held in Madison. Attended by over 600 people from 19 countries, the Symposium focused in bridging the gaps between science and policy. It was regarded as one of the most successful NALMS events ever held.

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 provides a comprehensive approach to lake aquatic plant management. The new law provides for watercraft inspections, information and education, research initiatives, purple loosestrife management and directs the DNR to implement a statewide program. Authority in the new 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 invasive plants as EWM, curly leaf pond weed and purple loosestrife. Additional plants can be added by rule.

Rules to implement the new law are now being developed for enacting late this spring. A permit will be 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 will be 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.

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 reestablished 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, $100,000 from s. 319 will be used to assist in the restoration of Devil's Lake, Sauk County. Installation and operation of a bottom water withdrawal system will "mine" accumulated phosphorus from lake sediments over a period of approximately 15 years.

This 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 (refer to Table 17).

Table 17. Planning and Protection Grant Activity 2000 – 2001

Project Type	No. Lakes	Grants Awarded	$ Awarded
Total - All Grants	>174	211	5,390,000
Lake Planning	>116	159	1,290,000
Plans & Assessments	116	147	1,193,000
Regional Land Use	Multiple	12	97,000
Lake Protection	>58	52	4,100,000
Land Acquisition	12	12	1,346,500
Watershed BMPs	5	5	797,500
Diagnostic/Feasibility	30	4	306,000
Wetland Restoration	0	0	0
Classify/Ordinance	Multiple	20	830,000
Lake Restoration	11	11	820,000

Lake Planning Grants

Over one-hundred lakes and lake-chains were the subject of a study at least partially funded by the Wisconsin's Lake Planning Grant Program during this two-year period. These efforts include conducting water quality assessments and watershed inventories, developing nutrient budgets, conducting education programs and writing management plans (see Table 17). These plans often become the basis for protection grant applications or other sources of funding and assistance. For local units of government where there are an abundance of lakes, regional land use plans that focus on water resource protection are also funded.

In the last grant cycle of 2001, small-scale projects, capped at $3,000 per grant for trend monitoring, limited investigations, lake organization development and education efforts were offered for the first time. While the focus of the planning grant program traditionally emphasized comprehensive lake management planning, small-scale grants were developed to allow organizations to either ease into the planning process or conduct activities consistent with implementing protection strategies like trend monitoring and education. The changes were successful in broadening the availability of the funding to lakes that had not been previously engaged in the planning program. More diversity is on the horizon for this particular program as well.

Changes to the enabling legislation in 2001 allow schools districts to become sponsors of lake education efforts, providing a tie to implementing Adopt a Lake and Project WET activities.

Long Lake Watershed Assessment

Long Lake is a 1,052 acre, 101 foot deep drainage lake tucked into the forested moraine of northern Chippewa County. Historically oligotrophic, DNR's long term monitoring data indicated rising phosphorus levels and decreasing clarity. The lake protection district had done little formal planning and became concerned for the future of their pristine lake. With a limited budget and a modest state lake planning grant of only $2,475, they were able to contract with Applied Data Consultants, Eau Claire, to conduct a watershed assessment for setting nutrient management goals. Using GIS technology, publicly available digital land information, and Wisconsin's Lake

Modeling Suite (WiLMS) the consultants provided the District with maps of the lake's subwatersheds ranked in terms of high, medium or low potential phosphorus loading. This first level screening will allow the District to efficiently focus its future planning and management efforts on the most critical areas within the lakes' seven square mile watershed. This project also demonstrates that technology can deliver good quality products at low costs.

Lake Protection Grants

Lake Protection Grants provide up to $200,000 per grant for implementing projects that protect lakes and their ecosystems. In 2000-01, implementation projects took place on 32 lakes. These grants were used for land acquisition, watershed best management practices and in-lake restoration activities. In the last category, five lakes covering approximately 3,00 acres received grants for alum treatments or aeration systems to inactivate internal nutrient cycling providing dramatic improvements in lake water quality. Twenty of the projects were directed at regional protection efforts, encompassing large numbers of lakes, for classification and management efforts such as local ordinance development and diagnostic and feasibility studies.

Recent changes to the enabling legislation specifically allow for the development of a shoreland and littoral zone restoration grant sub-category to keep pace with the demand for these types of projects. Administrative rules are now being developed to implement this clarification of statute.

Silver Lake Restoration

Silver Lake is a lightly developed 69-acre lake just outside the city limits of Manitowoc. During construction of State Hwy 151 in the 1930's, Silver Creek was routed directly into Silver Lake expanding the watershed area to lake area ratio from about 6:1 to 175:1. Resulting poor water quality conditions placed extreme limitations on the lake's fish population and recreational uses eventually landing the lake on the State's 303(d) list of impaired waters. Following a 10-year effort to control nonpoint sources in the watershed, it became apparent that additional actions were necessary to achieve any significant water quality or habitat improvements. In 2001 a major construction project was completed to divert the creek out of the lake via the construction of an earthen berm and water control structure. The $454,000 project was supported by a combination of state grants and local funds with the County being the project lead. In the coming year, fish eradication and an alum treatment should restore the lake to a useable condition. A TMDL is currently being developed for the lake.

Lake Classification & Ordinance Development Grants

Lake classification grants provide up to $50,000 to counties to "classify lakes by use and implement protection activities for the lakes based on their classification." Other units of local government and lake associations can receive up to $50,000 to develop ordinances and conduct the land use planning activities that will protect lake resources. To date, more than half of the state's 72 counties and many townships have undertaken lake classification or ordinance development projects to facilitate improvements in shoreland zoning and land use management (Figure 22).

Other Lake Program Activities

Lake Manager Training

The Lake Partnership Team has begun development of a lake manager training series for staff and partners involved in lake management. The first series of sessions on lake planning, goal setting and lake modeling was recently conducted. The focus was on the use of the redesigned Wisconsin Lake Modeling Suite (WiLMS 3.0) a lake water quality-planning tool.

Lakes Assessment

As the table below shows, over 792,301 lake acres are listed 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, 767,533.4 lake acres were assessed for aquatic life uses and 361,598 were found to be fully meeting this designated use, while 270,055 are not meeting this use (see Chapter 2 for the assessment methodology used). The total number of lake acres assessed in

2002 is less than in previous years due to Wisconsin "cleaning" and quality control checking its assessment database; this process involved updating information and removing duplicates.

Status of Wisconsin Lakes

Table 18. Fully Supporting, Threatened and Impaired Lakes (Data from 305b waterbody database)

Degree of Use Support	Assessment Basis		Total Assessed
	Evaluated	Monitored	
Size Fully ALL assessed uses	0	0	0
Size Fully ALL assessed uses but Threatened for at Least One	0	0	0
Size Impaired for one or more uses	33518.80	758,782.60	792,301.40
Size Not Attainable for any use and not included in items above	0	0	0
Total Assessed	33518.80	758782.60	792301.40**

** Based on the presence of a general fish consumption advisory for mercury for all Wisconsin surface waters.

Table 19. Individual Use Support, Lakes - National & State (Data from 305b waterbody database)

Use	Size Assessed	Fully	Threatened	Partial	Not
Aquatic Life Use Support	767533.4	361598.8	42346	93532.8	270055.8
Fish Consumption	786349.4	0	0	0	786349.4
Primary Contact	55495	539	0	54251	705
Secondary Contact	439991	100425	19688.8	189873.6	130003.6

Figure 22. Shoreland Classification Graphic

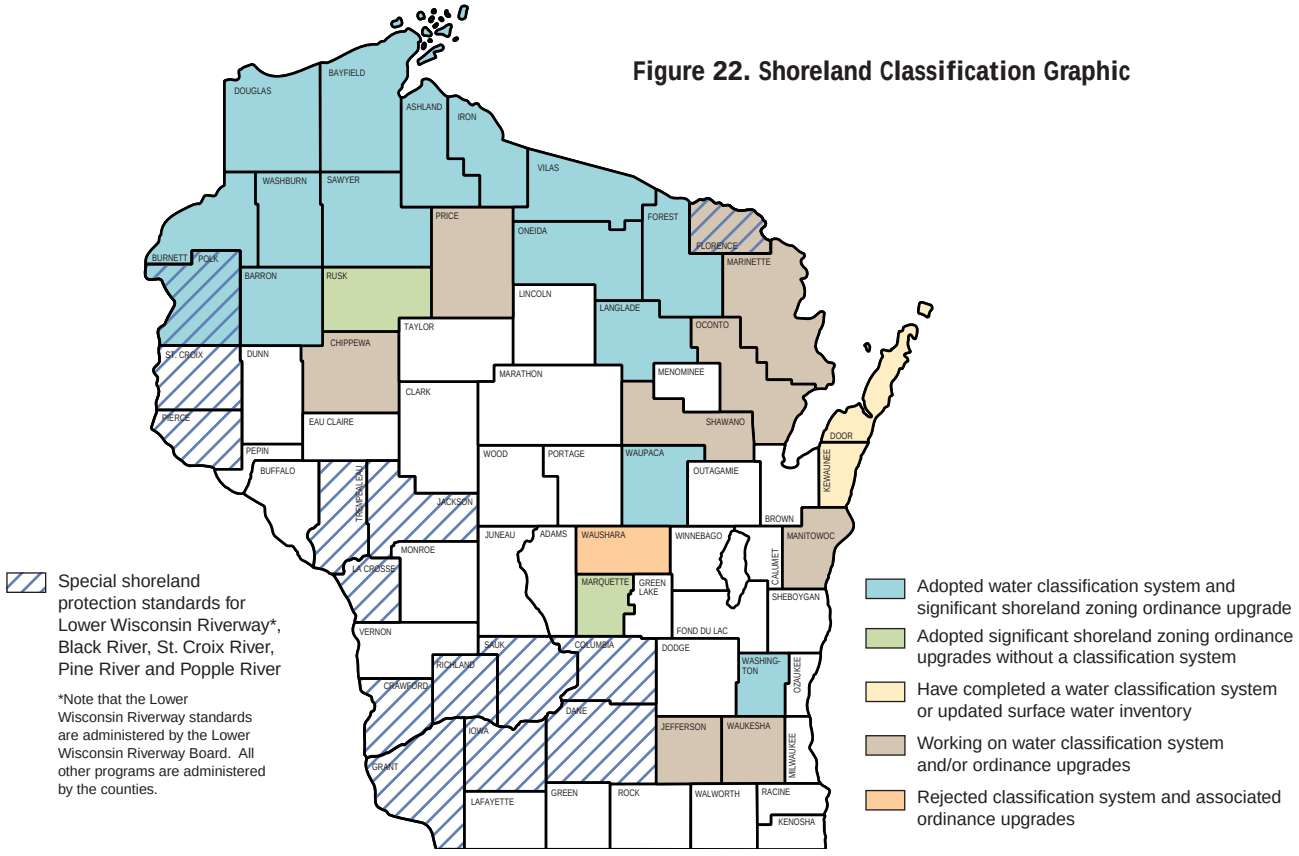


Table 20. Total Sizes of Lakes (Acres) Impaired by Various Cause/Stressor Categories

Cause/Stressor	Size of waters by Contribution to Impairment
Pesticides	1053
Metals	19269
Mercury	786,349.40**
Chlorine	87
Nutrients	103166
Other	3910
Siltation (includes Sedimentation)	62194.7
Organic Enrichment/DO	31951.6
Flow Alterations	1153
Other Habitat Alterations	46096
Pathogen Indicators	455
Noxious aquatic plants (macrophytes)	51171
Total toxics	7564
Turbidity	52033
Exotic species	107551
Excessive algal growth	41732

** All Wisconsin surface waters are listed under a general fish consumption advisory for mercury.

Table 21. Total Sizes of Lakes (Acres) Impaired by Various Source Categories

Source Category	Size of waters
Municipal Point Sources	383
Minor Municipal P.S.	353
Combined Sewer Overflows (collection system failure)	2965
Domestic Wastewater Lagoon	43
Agriculture	50705
Crop-related sources	48089
Grazing-related sources	12225
Pasture grazing, upland	10319
Pasture grazing, riparian	1779
Range grazing, riparian	127
Intensive Animal Feeding Operations	10446
Silviculture	
Construction	27782
Highway/Road/Bridge	24
Land Development	21991
Urban Runoff/Storm Sewers	23685
Erosion & Sedimentation	26
Land Disposal	8627
Onsite Wastewater Systems	8457
Septage Disposal	170
Hydromodification	39884
Dredging	158
Dam Construction	9882
Upstream Impoundment	253
Flow Regulation/ Modification	6576
Habitat Modification (non-Hydro modification related)	39108
Bank or Shoreline Modification	11513
Internal Nutrient Cycling	6633
Recreation and Tourism Activities	732
Atmospheric Deposition	786,349.40**

** All Wisconsin surface waters are listed under a general fish consumption advisory for mercury.

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 DNR 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)0. This data represents 45% 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 Table 22 exhibit what is consider to be excellent to good water quality (oligotrophic and mesotrophic conditions).

Table 22. Trophic State of Lakes (1997 -2001)

Trophic Condition	No.Lakes	Lake Acres
Oligotrophic	512	164164
Mesotrophic	139	47968
Eutrophic	299	190971
Hypereutrophic	40	55442
Total Assessed	990	458546

Table 23: 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

Data Sources

Assessment of lakes for the 305(b) report is an integral component of Wisconsin's overall Watershed Management 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. Assessments are conducted by the Bureau of Watershed Management based on lakes assessment criteria described in Chapter 2, Water Quality Assessment Criteria – Lakes.

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 much of the data. There were over 700 citizen volunteers participating in the program at the end of 2001. Interest in volunteer lake monitoring continues to increase, with over 122 new volunteers starting in 2000, and 194 new volunteers in 2001.

Table 24. Volunteer Monitors in Wisconsin, 2001

Parameter	# Volunteers (2001)
Secchi Disc Depth	709
Chlorophyll a and Total Phosphorus	354
Temperature and Dissolved Oxygen	165
Eurasian Watermilfoil	75
Purple Loosestrife	54
Aquatic Plants	44
Zebra Mussels	24

Begun in 1986, by the mid '90's Volunteer Lake Monitoring had reached a point where the number of volunteers and interest in lake monitoring exceeded WDNR's financial and data management capabilities. Beginning 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 can now be brought into the program per year under these grants.

In 2000, the Self-Help database was redesigned to enable staff to better track equipment, volunteer information, and to promote more efficient data management. The redesigned Self-Help Lake Data database made its debut on the web in 2001. The database is live, searchable, and contains over 15 years of data on many lakes. The new website also features a data entry form, which, starting in spring 2002, will allow volunteers to submit their data through the Internet as an alternative option 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. Over 1,600 annual reports were mailed in 2001, and over 290 awards were distributed in 2001 to volunteers who had completed 1, 5, 10 or 15 years of monitoring, or had taken 100 or 500 secchi readings. During the 2001 season, Self-Help awarded 30 fifteen-year awards. Three of these recipients have taken over 750 Secchi readings!

Numerous other improvements have recently been made to better use Self-Help resources. New equipment has been introduced, including the Integrated Sampler, a less costly sampler made of PVC pipe, used to sample a 6-foot column of water for chlorophyll and total phosphorus. The cost savings allowed WDNR to purchase new cable-temperature probes for the volunteers, improving the accuracy of temperature profiles as well as decreasing the time a volunteer was spending on temperature profile readings.

To accommodate the new equipment, the Self-Help Lake Monitoring procedure manuals have been completely updated. These new manuals contain video clips demonstrating many procedures, and will be available to volunteers on CD-ROM, in 2002 and will soon be added to the Self-Help website.

Other changes include the folding of the content of the Self-Help newsletter, *Lake Monitoring News*, into four pages of the Lake Tides Newsletter, put out by the UWEX. This change will save resources and make the content available to many more readers. The Self-Help display board has also been updated and has been used at the 2001 NALMS Symposium, and will be used in 2002 at the Wisconsin Lake Convention and local Lake Fairs.

Also significant is Self-Help volunteers' participation in a collaborative effort with University of Wisconsin Environmental Remote Sensing Center. In 2000 and 2001, volunteers monitored their lakes on specific dates when satellites were overhead. Self Help staff then sent the data to the UW Remote Sensing Center to be used to callibrate computer programs that allow satellite imagery to be used to predict Secchi Disc Depth and other water quality parameters on lakes.

Using Satellite Imagery to Characterize Lake Water Quality

DNR has recently formed a partnership with the University of Wisconsin's Environmental Remote Sensing Center (ERSC). A primary goal of this collaboration is to investigate the use of satellite imagery in characterizing lake water quality. Figure 23 illustrates graphic layouts of this effect. 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.

In 2000 and 2001, hundreds of Self-Help lake monitoring volunteers 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 (Figure 24). ERSC recently submitted a proposal to NASA for further development of an image processing protocol for lake transparency monitoring via Landsat data. The goals of our future partnership include:

- Continuing to compile a current statewide database of Landsat imagery.
- Continuing to collect current water quality reference data in order to "calibrate" the above satellite data.
- Completing a statewide Landsat-based assessment of current lake transparency conditions using the above databases.
- Completing a historical statewide lake transparency assessment.
- 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.

Figure 23. Satellite Image Graphic

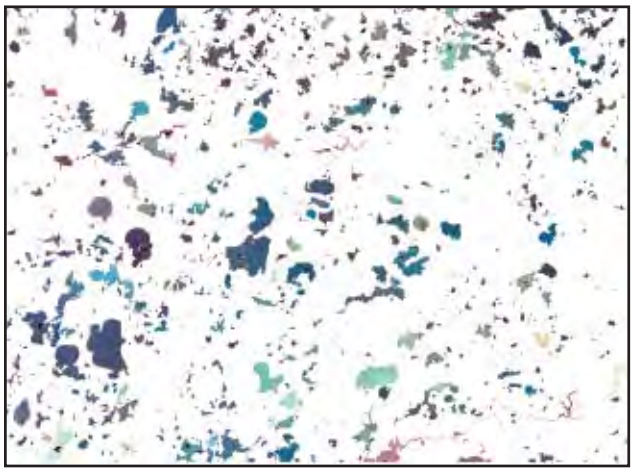
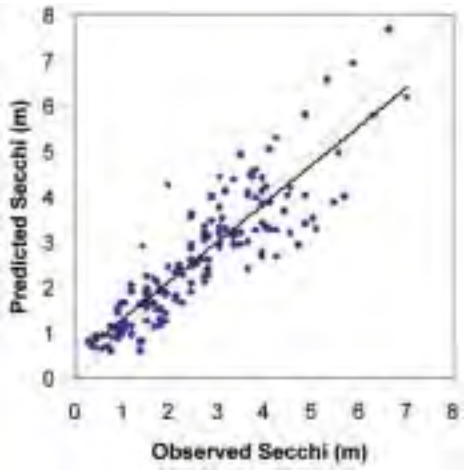


Figure 24. Comparison of field measured vs. remote sensing secchi readings



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.

In the 2000 305B Report, results of a comparison of trophic state indicators from 1986 to 1996 were presented. Wisconsin's Lakes Program is using these data to ask additional management questions. For example, are the LTT lakes representative of Wisconsin lakes overall? Are we sampling enough lakes to get a clear picture of what is happening in the state? Currently, the program is classifying the LTT lakes into six hydrologic and depth classes within each region in

Wisconsin and comparing them with a larger set of lakes to evaluate the proportionality of the numbers in the different classes. The representative value of the LTT lakes with regards to hydrologic and depth class will provide valuable data from understanding statewide trends.

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.

Monitoring Research

A much more complicated question is whether sampling frequency is sufficient in the program. How important are spring, summer and fall sampling results? This will vary with the question being asked. Although there have not been any trends revealed over the first eleven years of LTT sampling, managers still rely on LTT lakes to offer benchmarks against which to judge potential future change. Choosing to characterize lakes using mid-summer values would obviously make spring and fall sampling less useful. Many variables such as Secchi disk depth, chlorophyll, and nitrogen (as ammonia or nitrate) display predictable seasonal patterns of highs and low within a lake. Lake sampling during spring and autumn turnover will usually provide different results than mid-summer sampling for many of these variables. A subsampling design will be implemented to evaluate if conclusions are similar with fewer sampling dates or fewer sampling variables.

Sampler Comparison Study. Historically, a Van Dorn grab sampler has been the standard tool for collecting lake surface samples. However, over time new equipment has been introduced, including the Integrated Sampler, a less costly sampler made of PVC pipe, used to sample a 6 foot or greater column of water for chlorophyll and total phosphorus. While the integrated sampler provides cost savings, is easier to use and provides more accurate data, questions arose over data comparability — especially for trend monitoring on lakes where grab samples had been used for years.

WDNR research staff conducted a comparison study and found that the results from the Integrated Sampler for water column chlorophyll_a and total phosphorus were not statistically different from the results for the 3-foot grab sample. There was no bias of higher or lower CHL or TP when using Integrated Samplers versus Van Dorns. With this information, WDNR can proceed with using a mix of sampling gear without concerns about disrupting data integrity.

Shoreland Runoff Study

In recent years there has been a growing movement to promote protection and reestablishment of natural shorelines along residential and publicly-owned lakeshore lots. Local resistance to this practice has included the argument that water quality benefits of natural shorelines are not well documented in Wisconsin. To address this concern, the Lakes Management Partnership commissioned research to compare the volume and quality of runoff and groundwater from turf versus forested shorelands on several sites in Northern Wisconsin.

The research found that while concentrations of nutrients were not significantly different comparing lawns to forests, yields were higher for lawns by around 8:1 despite a high degree of site variation. The coefficients were generally lower but consistent with the published literature. This difference is attributed to specific exclusion of impervious surfaces in this study, which measured the vegetative lawn zone only. A second study phase will investigate near-shore hydrology impacts like impervious surface contributions. This data will also be used to update and improve the accuracy of WiLMS.

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 have inspired artists' enclaves in places like Door County—called the New England of the Midwest; and have provided exceptional recreational opportunities, commercial fishing and shipping. About a third of our state's 11 million acres of land, and 10,122 river miles, drain to our two bordering Great Lakes, Superior and Michigan. And along this shoreline resides the highest density of our urban populations and the majority of the state's industrial base. 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.

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 with 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. Lake Michigan is a system under stress due to loss fish and wildlife habitat, a decline in biological diversity and the introduction of invasive species. Efforts are underway to address these problems. Through Remedial Action Plans and Lakewide Area Management Plans, strategies are being developed to reduce the loading of critical pollutants to Lake Michigan and integrate environmental protection and natural resource management efforts.

Lake Superior

Lake Superior is a unique and vast resource of freshwater covering 31,700 square miles. It is the largest freshwater lake in the world by surface area and can hold the water from all the other Great Lakes along with three additional Lake Eries. Lake Superior has not experienced the same level of development, urbanization and pollution as the other Great Lakes. Although Lake Superior is the cleanest and most healthy of all the Great Lakes, it is still threatened by toxic pollutants that bioaccumulate in the food chain and persist in the environment. These substances can be transported long distances in the atmosphere and end up in the lake. Local sources contribute pollutants to air and water, adding to the pollutant load entering Lake Superior. Toxic pollutants are generated in the production of energy and the handling of wastes and they are found in the products we use. 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. Through the RAP and LaMP processes, the problems associated with toxic pollutants, as well as other environmental problems, are being addressed.

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. While significant progress has been made, the ecosystem is still at risk from pollution and poor water management practices. The purpose of the annex is to recommit the governors and premiers to the principles of the charter and its enforcement, as well

as to enhance water management systems to protect, conserve, restore and improve the Waters and Water-Dependent Natural Resources of the Great Lakes Basin.

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; (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 overseeing the implementation of Annex 2001. The 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. The Water Management Working Group had the second of its bi-monthly meetings on November 15, 2001. It was agreed to form sub-groups to work on (the structure of the compact; (the decision making standard; and (the provincial agreement. The sub-groups will then offer their proposals to the Working Group for discussion and final decision.

Additionally, an advisory committee is being formed to offer the opportunity for public input. It will be made up primarily of regional organizations representing industry, the environment, utilities, etc. Wisconsin is also putting together its own list of organizations and legislators who are interested in being kept up-to-date on the actions of the Working Group.

Wisconsin supports the need for a binding agreement and hopes to help develop a reasonable standard that focuses on real threats to the Great Lakes, while not making it impossible to access lake water in necessary situations. It is important to work on specific policy details with respect to standards and thresholds to help eliminate the current atmosphere of confusion amongst the Great Lakes states. A uniform policy needs to be agreed upon which will put to an end to debates between parties on issues like what constitutes a diversion.

Assessment Summary

Table 25. Summary of Fully Supporting, Threatened, and Impaired Great Lakes Waters
Size: Shoreline Miles

Degree of Use Support	Evaluated	Monitored	Total
Size Fully Supporting All Assessed Uses:	0.00	0.00	0.00
Size Fully Supporting All Assessed Uses but Threatened for at Least One Use:	0.00	0.00	0.00
Size Impaired for One or More Uses:	0.00	1017.00	1017.00
Size Not Attainable for Any Use and Not Included in the Line Items Above :	0.00	0.00	0.00
Total Assessed:	0.00	1017.00	1017.00

Table 26. Individual Use Support – Great Lakes Waters
Size: Shoreline Miles

Use	Size Assessed	Size Not Supporting
Aquatic Life Support	NA	NA
Fish Consumption	1,017.00	1,017.00

Table 27. Summary of National Causes Impairing Great Lakes Waters Size: Shoreline Miles

Cause/Stressor Category	Total Size (Miles)
Priority organics	NA
PCB's	NA
Metals	NA
Mercury	1017.00
Nutrients	1017.00
Other habitat alterations	NA
Exotic species	1017.00

Table 28. Summary of National Sources Impairing Great Lakes Waters Size: Shoreline Miles

Source Category	Total Size (Miles)
Industrial Point Sources	NA
Municipal Point Sources	NA
Agriculture	NA
Crop-related Sources	NA
Grazing related Sources	NA
Intensive Animal Feeding Operations	NA
Urban Runoff/Storm Sewers	NA
Hydromodification	NA
Channelization	NA
Habitat Modification (other than Hydro)	NA
Contaminated Sediments	NA
Sources outside State Borders	NA

Great Lakes Ecosystem Restoration

Key Issues

Wisconsin's active involvement in programs and projects designed to address key Great Lakes issues demonstrate its commitment to the restoration of these valuable resources. Key issue areas within which many Great Lakes projects fall include:

- **River Restoration/Removal of dams**—Restoring free-flowing streams and providing additional habitat for anadromous fishes. Coupled with removal projects, projects may involve assessment and remediation of contaminated sediments accumulated above the dams.
- **Habitat Restoration**—Improving the habitat in tributary streams for spawning and nursery areas and projects promoting the enhancement of habitat on a large scale.
- **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.
- **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.

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 EPA, ACOE, 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.

Project Descriptions

Below selected projects currently ongoing in the Great Lakes Basin in Wisconsin are summarized:

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 Milwaukee RAP below and Dam Removals in Chapter 3: Rivers and Streams)

Habitat restoration

In the Lake Michigan basin projects are underway for biota and habitat enhancement in Green Bay with the Cat Island Chain Restoration Project and the Green Bay Marina Project.

Green Bay Marina Project

Habitat structures being built at the new marina. In Green Bay, construction of cribs around the McDonald Marina, Green Bay will enhance spawning substrate. This project includes more than walleye spawning habitat. Wildlife use is expected along the headland to the east of the spawning area. The breakwater has been constructed. The headlands construction and spawning substrate will be done in the fall/winter of 2001-2002.

Other projects include a Northern Pike habitat restoration project using buffer strips, wetland restoration projects, streambank stabilization using buffer strips and innovative erosion control techniques. Special efforts are underway to implement recommendations for restoration of the lake sturgeon and Lake Superior brook trout populations.

Wetland Restoration is occurring throughout the basin. Fifty percent of wetlands in Sheboygan Basin have been lost; there has also been a loss of water quality and wildlife habitat for waterfowl, shorebirds, songbirds, pheasants, some mammals. The project involves restoring 10 to 15 wet-

lands and adjacent grasslands to improve water quality, aquatic habitat, and to provide nesting cover and improved/ increased habitat for food and shelter for wetland and grassland dependent wildlife species Partnerships include: private landowners, NRCS, County Land Conservation Departments, USFWS, etc., and local conservation and environmental groups. The photos below show wetland and grassland sites restored in 2001 in the Sheboygan wetland/grassland project. Both sites were wetland restorations with the rest of the field planted to native prairie grasslands. One site is private and one is public. Wetland vegetation will come up in the next few years also. See below.

In the Lake Superior Basin, WDNR, the USGS and UW-Madison Engineering School are developing the use of 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 clayey soils has increased flood magnitudes and the erosion potential/transport capacity of the streams. Most of the creek's sediment load originates from the erosion of 17 large bluffs. The creek contains important recreational fisheries potentially 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 waters 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.

The use of buffer strips along waterways to help improve water quality by trapping sediments and nutrients also has the added benefit of providing habitat for both aquatic and terrestrial species. Special funding for the establishment of buffer strips along critical waterways is being used to increase their use. 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 watersheds. The state is pursuing opportunities through the CRP continuous buffer sign-ups to enroll tributary stream banks to restore and protect important spawning areas for Great Lakes fish.

Pollutant Reduction and Prevention

Sediment Remediation

Historic wastewater discharges have left a legacy of contaminants that have restricted the human consumption of Great Lakes fish. Sediment Remediation involves big projects with expensive solutions but 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, Fox River, and the Milwaukee River (for more information, see Contaminated Sediment Projects, Chapter 3). A related project involves a new technology for sediment disposal. For the Lower Fox, Minergy Corporation proposed that a vitrification (melting) technology might be more effective and appropriate for dealing with contaminated sediments than some of the options in the Fox River RI/FS. Minergy prepared a multi-phased study to determine the cost effectiveness of this technology and the effectiveness of this technology to destroy organic contaminants (primarily PCB) and immobilize inorganic contaminants (primarily heavy metals). Partners in this project include the Great Lakes National Program Office and WDNR. The project also involves an independent evaluation of the contaminants' fate; WDNR requested assistance from US EPA's Superfund Innovative Technology Evaluation (SITE) Program.

Combined Sewer Overflows/Elevated Bacteria Levels

Progress is being made with local communities to find ways to reduce Combined Sewer Overflows and local community sewage bypassing following heavy rains. Studies of local beaches and public health effects are underway to determine the correlation between the bypasses and beach closings due to bacterial levels. In 2000 City of Racine north beaches were closed due to high E.coli levls 66 percent, and zoo beaches were closed 41 percent of the season. Elevated levels did not always correlate with wet weather events. The Racine Beach Study investigates the possibility that the interstitial zone or wet sand zone may provide a reservoir for E.coli. This data may provide a valuable predictive model for E.coli levels. The City of Racine is conducting is also evaluating storm water discharges, wastewater bypass events and waterfowl as possible sources.

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 1999, over 150,000 pounds of chemicals were collected in 17 counties participating in clean sweeps (12 of which were in the Great Lakes Basin), including 5,700 pounds of target chemicals.

Similar programs for household hazardous waste are also offered around the state. In particular an EPA Grant (X985901-01-2) offered a mobile household and agricultural waste clean sweep program in the Lake Superior basin. This program covered a four county area and provided a mobile service that traveled to various communities to pick up chemical waste. This program is designed to minimize travel of the individual homeowners and farmers by bringing the collection facility to them. It also reduced cost by having one program for all four counties eliminating duplication of efforts in a large area. There was also a very strong public awareness and outreach component to this grant to educate of the dangers of improper disposal of chemicals into the environment.

A project offering the removal of mercury manometer for dairies and replacement with a mechanical gage resulted in the collection and proper disposal of more than 312 pounds of mercury from 416 farm operations. This project was funded from Great Lakes National Program Office and Wisconsin Great Lakes Protection fund grants. The success of this project greatly reduces the further introduction of mercury into the atmosphere, food chain, lakes and streams.

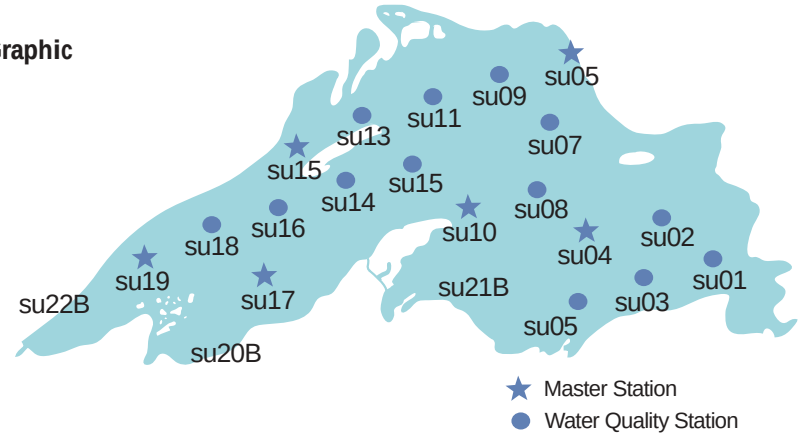
Educational efforts were developed for a wide variety of topical areas to inform people of the environmental damage that results from everyday activities like using burn barrels, old or improperly designed wood stoves, improper disposal of chemicals, runoff from construction sites, etc. Though videos, public service announcements, ad campaigns and educational programs aimed at school aged children, local officials and homeowners, people are learning how the effects of their daily lives impact water quality, fish consumption advisories, and other environmental problems. The Great Stove Buy Out was a project undertaken with the North Central Hearth Products Association to eliminate the use of old poorly designed wood burning stoves by offering a rebate incentive on a new wood burning stove designed to minimize pollution emissions. For the 6 months the program was in affect 436 new stoves were purchased and the old stoves were taken out of use eliminating harmful emission to the environment.

Mercury Reduction, Focus: Lake Superior

WDNR, the University of Wisconsin – 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 and as illustrated in Figure 25 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.

Figure 25. Mercury Graphic



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

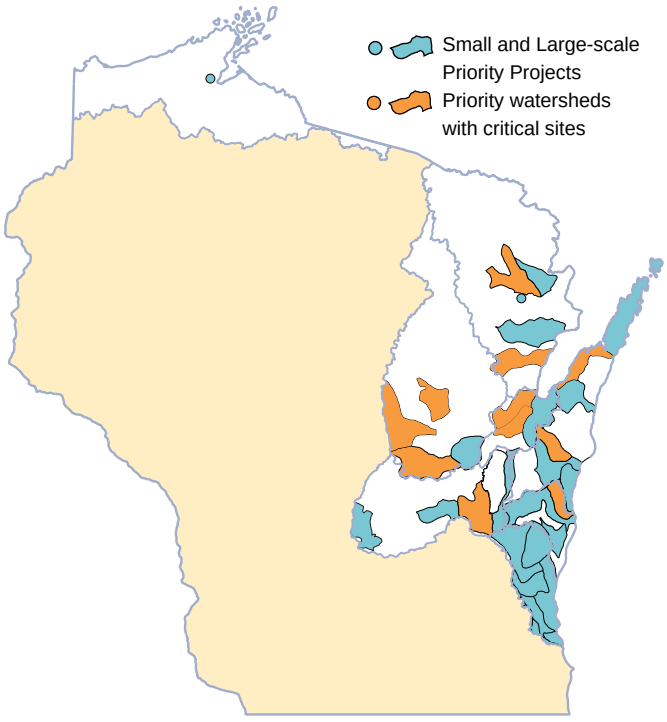


Figure 26. PWS projects in Great Lakes Basin

As a coastal state, Wisconsin is required to develop and implement a nonpoint source management program under the provisions of Section 6217 of the 1990 Coastal Zone Act Reauthorization Amendments. The program requires "enforceable policies" to regulate compliance with U.S. EPA for six categories of nonpoint source activities including agricultural, urban, forestry, wetlands, hydromodifications and marinas. The specific management measures involve programs administered by the Departments of Natural Resources; Administration; Agriculture, Trade and Consumer Protection; and Commerce and Transportation. The management area under section 6217 includes virtually all of the Great Lakes drainage area in Wisconsin except the portion of the Wolf and Upper Fox Basins upstream of the outlet of Lake Winnebago. Wisconsin has targeted many nonpoint source activities in this management area, including over 22 priority watershed projects (Figure 26). 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.

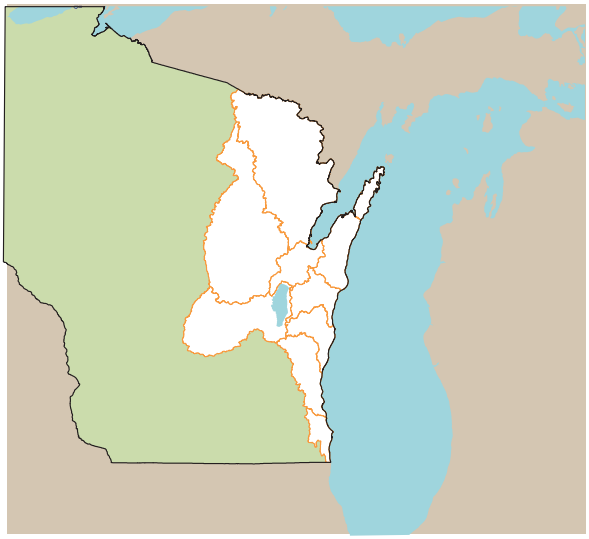
Lake Michigan Lakewide Area Management Plan (LaMP)

The Lake Michigan Lakewide Management Plan (LaMP), originally published in April 2000, outlines a vision, goals and ecosystem objectives for Lake Michigan (Figure 27). 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.

Figure 27. Map of the Lake Michigan Basin



LaMP Update

Wisconsin is currently working with EPA, the other Lake Michigan states, and other interested parties to revise the LaMP. A number of different committees have been established to systematically update the document. In the area of critical pollutants, both an initial review and the establishment of a standardized procedure for future review of the list of 'critical pollutants' included in LaMP 2000 are taking place.

The Habitat Committee has developed a "Habitat and Land Use Management Tool Box" that includes a description of habitat and land use management resources and where to locate them. It also includes information regarding funding sources available to support implementation of best management practices, Brownfields redevelopment, for the prevention and control of air pollution, Clean Water Act Funds, Great Lakes Coastal Projects and aquatic habitat conservation and restoration. The Education and Outreach Committee is promoting Lake Michigan through a Boat Tour, conferences and educational material for the public.

In addition to the committee work described above, parties involved in the LaMP 2002 update are identifying specific actions to 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 by 2004, a TMDL Strategy will be developed for Lake Michigan, which is consistent with the USEPA's Great Lakes Strategy.

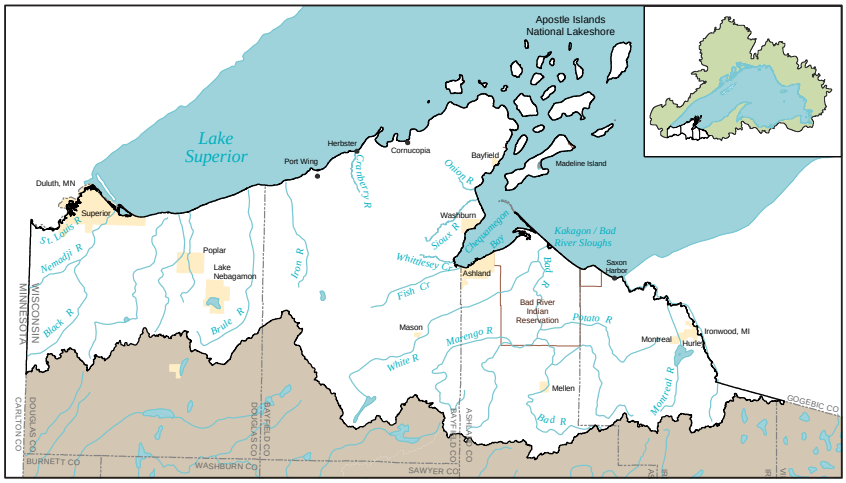
Barriers or issues that need to be addressed to achieve the goals of the LaMP include a national emphasis on the need to reduce the level of contamination in fish to a degree that the fish consumption advisories are no longer necessary. This would require a national and international effort to reduce atmospheric deposition of pollutants, additional resources and technical knowledge regarding contaminated sediments and coordination and support from EPA with the areas of concern and remedial action plans. There is also a need for support for ecological monitoring programs and a need for additional resources to access the public health risks from bacteria at our public beaches.

Lake Superior LaMP and BiNational Program

The Wisconsin DNR is one of the partner agencies in the 1991 Binational Program to Protect and Restore the Lake Superior Basin. Known as the "Binational Program," it was formed by agreement signed by the governors of Wisconsin, Minnesota, Michigan, and by representatives of the U.S. EPA, Environment Canada and the Province of Ontario. The program includes a zero discharge demonstration program for Lake Superior as well as a broader program of coordinated ecosystem management. The Binational Program is often held up as a model of inter-jurisdictional resource planning and management (Figure 28).

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. Following LaMP 2000, implementation projects have been the major focus in Wisconsin. 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.

Figure 28. Map of Lake Superior Basin



Zero Discharge Demonstration Program – 10 years

The Lake Superior Zero Discharge Demonstration Program is unique in the Great Lakes. The goal is to get rid of 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.

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.

Children are most at risk from toxic substances.

Progress

Community Pollution Prevention

Many communities around the basin are working on ways to prevent these 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. Many communities around the basin are working to find alternatives to products and processes that use mercury. By working with its wastewater customers and using hazardous waste collections, Western Lake Superior Sanitary District (WLSSD) in Duluth, MN demonstrated that they could significantly reduce mercury coming out of the plant. They developed a "Blueprint for Mercury Elimination" Guidance for Wastewater Treatment Plants in 1997.

Photo courtesy of City of Superior.

The community-based approach has caught on around the basin and many of the communities are working together. The City of Superior, Wisconsin has become a regional leader in community mercury reduction work. Currently in Wisconsin, Superior, Ashland, and the Red Cliff Tribe of Lake Superior Chippewa, are working together on community pollution prevention and outreach. They are also working with Lake Superior communities in Michigan, Minnesota, and Ontario. Collaborative projects include: pollution prevention workshops and projects with hospitals, clinics, dentists, contractors, and municipalities.

In 2001, Wisconsin provided $150,000 to support pollution prevention projects in the Wisconsin Lake Superior basin. City of Superior and WDNR work together to promote upgrades to energy efficient thermostats and proper disposal/recycling of mercury containing thermostats. This includes a state-wide recognition program for participating contractors. The City of Superior is working with auto dealers to replace mercury switches in cars with non-mercury alternatives. They are instituting a recognition program for mercury-free auto dealers. A new Wisconsin federally-funded project is working with the salvage industry state-wide to remove mercury switches from autos prior to crushing.

Students in Superior, Wisconsin conduct a thermometer exchange in the City-County complex.

Photo by Diane Thompson, City of Superior

In 2000-2001, several partners, including City of Superior, Northwest Clean Sweep and WDNR conducted an outreach, collection, education, and recognition program called, "Mercury Shake-Down, Northwest Wisconsin Mercury Free Schools." This project continued into 2002.

In 2001, both the City of Superior and Douglas County, Wisconsin, passed ordinances banning the sale of mercury thermometers.

Hazardous Waste Collections: household, agricultural, small business

Over the past decade, agricultural and household waste collections or "sweeps" have netted thousands of pounds of DDT, chlordane, dieldrin, toxaphene, and other pesticides in the Lake Superior Basin. Federal, state, and local funding has been used to support Northwest Wisconsin Clean Sweep mobile collection program for household, agricultural, and small business hazardous waste. In 2001, a special outreach project was funded to focus on the collection of mercury containing products. In 2001, the Northwest Wisconsin Regional Planning Commission also received state funding for small business hazardous waste "milk run" collections, which allows local business to use economy of scale to achieve cost effective collection of mercury and other hazardous waste.

Dioxin – a burning issue:

In 1990, small inefficient incinerators were a major source of dioxin emissions in the basin. Air emission requirements in the 1990s in large part have controlled this dioxin source. Burn barrels or backyard garbage burning is a continuing challenge in the rural Lake Superior basin. This practice produces dioxin that enters the environment and human food sources, posing health risks.

WI participates in regional cooperative work on burn barrel education. In addition, a statewide television public service announcement was produced and aired in 2001. In 2001, WI awarded a grant to the Northwest Wisconsin Regional Planning Commission to develop a video for town and county government officials in the WI L. Superior basin on state regulations and local ordinance options, as well as health and environmental effects of backyard garbage burning

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. In 2001, the WI DNR initiated rulemaking for a mercury emission regulatory program. This regulatory initiative is being pursued in advance of federal regulation of mercury emissions.

Mercury research

University of Wisconsin and the Department of Natural Resources, together with several other organizations continue research on the sources and fate of mercury in the Lake Superior ecosystem. In particular, they are investigating the pathways in the Lake Superior ecosystem, through which mercury deposited from the atmosphere is converted to the form (methyl mercury) that bioaccumulates in fish and wildlife. Wisconsin DNR research is showing that mercury levels which are common in northern Wisconsin fish are affecting loon reproductive success.

Contaminated Bottom Sediment

Although Lake Superior is the cleanest of the Great Lakes, its history of heavy industry in its harbor communities has left a legacy of contaminated bottom sediment. Polluted bottom sediments can serve as source areas for contaminants to bioaccumulate in Lake Superior fish and wildlife. These harbors and bays should be productive shallow water habitat, the biological engines for the Lake Superior ecosystem. Considerable funding is required to clean up contaminated sites and restore this important aquatic habitat.

Cleanup of Ashland Coal Tar Site seep.
Photo by Jim Bishop, DNR

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. The ultimate goal is to restore this area of valuable shallow water habitat of Superior Bay. In addition, site investigation continues at a wood preserving facility in Superior, Wisconsin that used pentachlorophenol in the past.

The Ashland Coal Tar Site includes a 10-acre area with 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. Clean up options are being considered and weighed by all the affected parties, including the public. In one on-land area of the Ashland city park however, highly contaminated ground water was "seeping" to the surface, posing a significant human health risk. In 2001, Wisconsin DNR cleaned up the seep using Great Lakes Protection Fund money. The U.S. EPA recently scored the Ashland Coal Tar Site as a Superfund site. The total price tag for site clean up will run into several million dollars.

Partnerships

Wisconsin Lake Superior Public Advisory Team

The Wisconsin Lake Superior Public Advisory Team is a 40 member stakeholder group established in 1998 by the Wisconsin Department of Natural Resources to advise state government on Lake Superior issues and to work with the state on Binational Program implementation. This group represents a broad cross section of basin citizens in Wisconsin, including municipal and county elected officials, business and industry, and citizen groups. Main areas of concern for the group have been mercury reduction, maintenance of hazardous waste collection programs, land use, funding issues, and special designations for Lake Superior. In 2000, the group endorsed a Wisconsin Lake Superior Basin Mercury Reduction Campaign. The initiative focuses on pollution prevention in many sectors, including medical, dental, schools, contractors, and the public. It is largely being carried out through the work of communities in the basin. In 2000-2001, the Advisory Team helped put into place a new state funding program for Lake Superior basin projects. Over the past year, the group has been working on special designations for Lake Superior.

The 2001 Wisconsin Lake Superior Protection Fund

In 2000-2001 the Wisconsin DNR began a new competitive grant program to support environmental protection and restoration projects to implement the Binational Program in Wisconsin's Lake Superior basin. The Wisconsin Lake Superior Public Advisory Team worked with the DNR to set funding criteria and priorities for 2001. They set mercury reduction and small planning grants as the priorities for the $250,000 available for 2001. Funds for this new Lake Superior grant program come from the Great Lakes Protection Fund, an endowment established by the Great Lakes states. Each year a portion of the earnings returns to each state for environmental cleanup and protection.

In 2001, the grants were awarded to ten organizations, area governments or tribes, schools, and individuals that are preventing pollution in the Lake Superior basin. The recipients will continue or begin efforts to prevent toxic pollution, reduce erosion, and increase public awareness of the issues facing the basin. The grants will expand and support community mercury reduction and other pollution prevention projects in several communities in the Lake Superior basin in Wisconsin. The grants will support public education and outreach on mercury and other Lake Superior issues and help tackle non-point source pollution and stream degradation problems.

Figure 29. Map of RAP Sites

Remedial Action Plans (RAPs) 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. What follows is a description of what activities are occurring and the progress that has been achieved over the last four years in meeting the goals and objectives established for Wisconsin's RAP sites. At all sites work toward restoration of beneficial uses has become incorporated into the routine planning process and regular work activities of the basins/geographic management units in which the AOC is located.

Lower Green Bay and Fox River

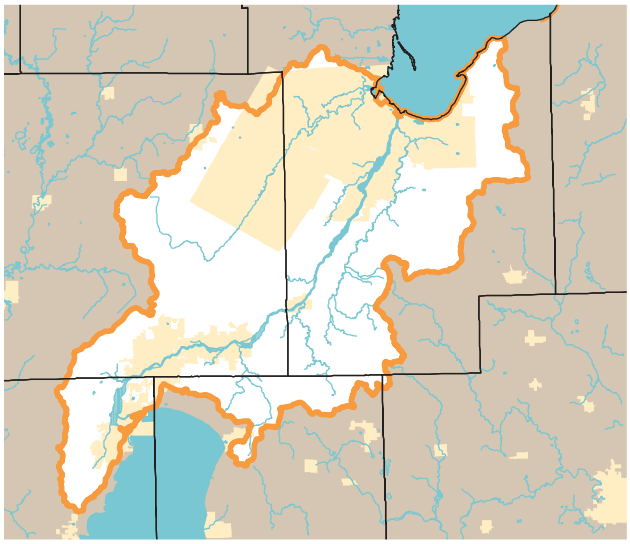


Figure 30. Lower Fox Basin/AOC

Table 29. Use Impairments in the Lower Fox AOC

• Restrictions on fish and wildlife consumption.
• Tainting of fish and wildlife flavor.
• Degradation of fish and wildlife populations.
• Fish tumors or other deformities.
• Bird or animal deformities or reproductive problems.
• Degradation of benthos.
• Restrictions on dredging activities.
• Eutrophication or undesirable algae.
• Restrictions on drinking water consumption, or taste and odor.
• Beach closings.
• Degradation of aesthetics.
• Degradation of phytoplankton and zooplankton populations.
• Added cost to agriculture and industry.
• Loss of fish and wildlife habitat.

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 (Figure 30). 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 (see Table 29). 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.

Stages I and II of the RAP were completed in 1987 and adopted as part of Wisconsin's Water Quality Management Plan in 1988. The RAP was updated in 1993. Since 1993, thirty-eight of the 120 recommended remedial actions have been implemented.

Substantial progress has been made in developing the RAP and implementing recommended actions. Nearly one-third of the plan's 120 recommended actions has been implemented and another one-third initiated. However, 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 solved. Recommendations are being implemented sequentially with the easiest ones having been completed and the more difficult and costly actions yet to be implemented. Full RAP implementation continues into the future.

Highlights

The Green Bay RAP Science and Technical Advisory Committee remains active. 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 priority 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.
- 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

The Remedial Action Plan states that thirteen of the fourteen use impairments are either "present" or "suspected" in the Area of Concern. It furthermore links ten of these use impairments, at least in part, to contaminated sediment. Since the RAP was originally completed in 1985, several studies have been conducted to assess the severity, extent and impact of the contamination. The result of these studies is the conclusion that sediments are the source of PCBs that continue to cause the impairments, and which cause exceedance of the state water quality criteria and issuance of fish and waterfowl consumption advisories.

In 1998, DNR in cooperation with the U.S. EPA initiated a formal remedial investigation and feasibility study to develop a remediation plan to address the PCB contamination at this site. The site is not listed on the National Priority List, however the work is being conducted in accordance with the laws and rules associated with the Superfund Program. In February, 1999 a draft RI/FS was issued by the DNR and a multitude of public comments were received. In addition, peer reviews were conducted on several aspects of this work to solicit critical analyses of basic approaches that were used. In October, 2001 the Department, with EPA's concurrence release a revised RI/FS and Proposed Remedial Action Plan to the public for their review and comment. The goal of the plan is to present a recommendation, to the public and to the Potentially Responsible Parties, for actions that will reduce the risks to humans and the environment caused by the PCBs in the ecosystem. The following is a brief description of the major components of the plan.

For the purposes of assessment and planning, the river was segmented into four reaches, and the bay of Green Bay was considered a separate management area. Each of these areas has been described in Superfund jargon as an "Operable Unit" or "OU." OU-1 is the six-mile stretch of river immediately below Lake Winnebago. OU-2 is a twenty-mile long stretch of the river from Appleton to the Little Rapids Dam that does not contain very much PCB mass. OU-3 and OU-4 comprise the last thirteen miles of the river, before it discharges into Green Bay. As previously mentioned, OU-5 is Green Bay. The plan calls for dredging, and off-site landfilling of all sediment that exceeds 1 ppm PCBs for OU-1, OU-3 and OU-5 and for Monitored Natural Recovery (MNR) in OU-2 and OU-5.MNR includes the monitoring of the environment to assess the extent of various natural processes such as contaminant dispersion, burial and degradation over time to monitor risk reduction over time. In developing the plan, it was determined that although there is a significant amount of PCB mass in the bay, there is little expectation that the risks could be reduced, even with extensive work being done. Monitoring of the system will allow regulators to continually assess the risk and maintain public awareness of the risk to protect them from exposure to the PCBs.

At the time of this report, the comment period on these documents has just closed. The department and EPA will be assessing the comments received in order to prepare a responsiveness summary and to prepare the final documents that will be included in the Record of Decision. The agencies expect to be able to prepare the ROD during the summer of 2002. The ROD will then be the basis for discussions with the PRP to initiate the remedial action.

Milwaukee Estuary

Description

The Milwaukee Estuary Area of Concern (AOC) encompasses about 14,000 acres (22 square miles) and includes: the Milwaukee River downstream of 35th Street; the Kinnickinnic River downstream of Chase Avenue; the Inner and Outer Milwaukee Harbor; and the near shore areas of Lake Michigan from Sheridan Park to the south, to the City of Milwaukee's Linnwood water filtration plant to the north (Figure 31). The AOC is at the end of a basin draining more than 850 square miles (the AOC is only 2.5% of the entire drainage basin), cleaning up the AOC also means correcting upstream problems too.

Figure 31. Milwaukee Basin

The 1995 Remedial Action Plan emphasizes the basin approach to correcting problems in the AOC. The plan further defined problems and made 32 recommendations to help meet the goals defined by the RAP committees. To date, substantial progress has been made on 30 recommendations (93%). The following is a brief progress report on meeting the RAP recommendations and on the contaminated sediment management strategy, a cornerstone of the RAP effort.

Highlights

The external partnership team for the Milwaukee River Basin is operational, providing a link to the public, businesses and organizations throughout the Milwaukee Basin. Many of the representatives on the partnership team are familiar with the RAP. The partnership team has included the objective to implement the Milwaukee RAP as one of their goals.

Milwaukee River Basin Environmental Indicators Project

The Milwaukee River Basin Environmental Indicators Project was initiated by the Wisconsin Department of Natural Resources (WDNR) with financial support from the U.S. Environmental Protection Agency (U.S. EPA). The main objective of this project was to use a public process to determine the most useful measures, in the public's point of view, to describe ecosystem conditions on a natural geographic basis. Focus groups and a work group were enlisted to determine the most important priorities for developing indicators. A consultant facilitated all public participation and was able to ensure enthusiasm for the project.

In addition to the success of public involvement in the early development process, much was gained through communication with other natural resource professionals within the community and the WDNR. The data identification process allowed contact with professionals across all media in the WDNR as well as contact with other professionals in the community. The common theme running through conversations with WDNR staff was a need for more comprehensive monitoring strategies to get at the heart of the data needed for indicator development. This project did not have a new data collection component, but rather relied on data collected through prior studies (legacy data).

In many cases throughout the indicator development process, we found that legacy data did not exist, or were not sufficient to develop the indicator. This is a common problem. Data are often collected with a short-term objective in mind, or are not collected with the frequency needed to develop meaningful indicators. Instead of over-generalizing limited data the work group agreed that we would report the indicator ideas with information about data sufficiency. In other cases where data were considered sufficient the information required extensive and time-consuming data management.

The biggest lessons learned from this project were not to count on prior collected data to develop strong environmental indicators unless data were collected using the same standard methods, and were at a frequency sufficient to determine trends. Higher level indicators that use biological community assemblages compared to reference conditions provide more information than water chemistry grab samples.

The WDNR recently established (1999) baseline monitoring protocols for streams and lakes that use biological and habitat measures rather than water chemistry to evaluate resource conditions. This look into streams and lakes give the Water Resource Biologists valuable insight into current conditions, and also provide insight into emerging problems.

This report has been shared widely throughout the WDNR and other interested parties and is available on the WDNR Internet site at http://www.dnr.state.wi.us/org/gmu/milw/indicators.html.

Dam Removals

Dam removal projects completed or ongoing within the last 2 years:

- Menomonee River Drop Structure Removed
- Falk Dam Removed
- Chair Factory Dam Removed (see below)
- New Fane Dam Removed
- Waubeka Dam breached
- Schweitzer Dam removal in planning stages (see below)

Figure 32. Milwaukee Dam Removals

Contaminated Sediment Strategy

This strategy is the cornerstone of the Milwaukee RAP. Contaminated sediments affect every ecosystem component. The RAP committee designed a strategy to effectively manage the sediments throughout the Milwaukee River Basin that includes the following:

- Continuing work on the Estabrook Impoundment PCB deposit investigation and pre-remediation design project. Sample collection began Fall 2001 and will be complete Summer 2002. Data gathered from this project should provide information needed to estimate costs and methods to remove this deposit (See Estabrook Sediment Project below)
- We continue to investigate ways to accomplish contaminated sediment removal projects in the AOC in partnership with local landowners, the City of Milwaukee Seaway Port Authority and the Army Corps of Engineers.

Estabrook Sediment Project

The Estabrook Impoundment on the Milwaukee River holds over 100,000 cubic yards of sediment contaminated with an estimated 5,200 Kg of polychlorinated biphenyls (PCBs). Previous work on the Milwaukee River system shows that remediation of this sediment deposit would result in a long-term reduction in PCB mass transport of up to 70% (Baird & Associates, 1997). The Milwaukee Remedial Action Plan (RAP) Technical and Citizen's Advisory Committees recognized contaminated sediment as the major contributor to use impairments within the area of concern (AOC). The contaminated sediment management strategy of the RAP (WDNR, 1995) identified remediation of upstream sources of contaminated sediments as a top priority.

This project will generate the data needed to conduct a conceptual remediation design for the sediment deposit. Specifically, this project will generate data reflecting the physical and chemical properties of the sediments, produce a more accurate estimate of contaminated sediment volumes, and confirm whether there is continued PCB transport from upstream areas. In addition, this project will generate data to satisfy the requirements of Wisconsin Administrative Code NR 347, which specifies sampling requirements for potential sediment dredging projects.

Thirty-two of the approximately 60 cores were collected during fall 2001 prior to the Estabrook Dam gates opening. Sampling will continue through spring and summer 2002 to collect the remaining samples and possibly resample some other areas to increase sediment recovery depth. In the fall sampling we obtained about 1.5-2.5 feet of recovery with the hand-powered push corer. The contamination horizon may extend below this layer. Next spring (2002) we will attempt to obtain samples from several areas using a vibracorer device.

Habitat Restoration

MMSD Conservation/Restoration Project

The Milwaukee Metropolitan Sewerage District (MMSD) hired The Conservation Fund and several consulting firms to prepare a conservation plan for the Menomonee River, Oak Creek and Root River Watersheds (October, 2001). The main objective of the plan was to identify parcels within these flood-prone Lake Michigan drainage watersheds that should be protected or restored as floodplains, riparian habitats, and environmental corridors or isolated natural areas. While

protection from flooding was a major consideration for this plan, the MMSD also recognized that protecting parcels from development for flood prevention would also provide important ecological benefits.

Over 7,000 acres of lands in the three watersheds were identified as high priority sites for conservation acquisition. Most of the high priority acres (5, 000) are in the Menomonee River Watershed. Sixty-one percent of the high priority sites have entities (land trusts, local governments, and other non-profit entities) definitely interested in partnering with MMSD for acquisition. MMSD has earmarked $15 million for project costs. Because of the variable nature of land prices in these urban watersheds, estimates of total acreage of lands that may be purchased with this money were not made for the Conservation Plan.

Public Information and Education

The Milwaukee River Basin Land and Water Partnership, the Revitalization Foundation and the WDNR co-hosted a Three Rivers Summit to highlight issues and projects concerning the Milwaukee, Menomonee and Kinnickinnic Rivers. One highlight of the summit was a debate with some of the candidates for governor. Tom Barrett, Kathleen Falk and Gary George shared their views on the connections between government and the environment.

Sheboygan River and Harbor

Description

The Sheboygan River Area of Concern includes the Sheboygan Harbor and 14 miles of the river up to the Sheboygan Falls Dam (Figure 33). 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 shipped off site in September 2001. The implementation phase of this project will usher in the long-awaited sediment remediation of the Sheboygan River. 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.

Figure 33. Sheboygan Basin/AOC

Under a legal agreement signed earlier this year between the U.S. Environmental Protection Agency (U.S. EPA) and Tecumseh, polychlorinated biphenyl (PCB)-contaminated sediment was loaded onto trucks lined with heavy plastic and hauled to the company's New Holstein plant. From there, it was loaded into railcars and shipped to a licensed landfill in Tulsa, OK. This sediment was disposed of in Tulsa because it contained over 50 parts per million (ppm) PCBs and a landfill in Wisconsin was not available. The tanks were demolished after being decontaminated. After sections of the tank were removed, they were transported to a local recycling facility.

U.S. EPA has been communicating with Tecumseh officials for the past year hoping to reach an agreement that would commit the company to the cleanup of the upper river, which extends from the Tecumseh facility in Sheboygan Falls to Walderhaus Dam. Once the consent decree is lodged in federal court, the Department of Justice will begin a 30-day comment period by posting an announcement in the Federal Register. After the Department of Justice responds to the comments, it will ask that a judge enter the consent decree in federal court to finalize the agreement. Characterization and design of the cleanup components could proceed in 2002 with cleanup activities beginning soon after.

Highlights

Franklin Dam

In the autumn of 2000, the Franklin Dam on the Sheboygan River was removed. The impoundment was first drawn down and seeded to stabilize the sediments over the winter, prior to removal. The Franklin Fire Department, the dam owner, notified adjacent landowners that they intended to deed the flowed lands to each landowner at the conclusion of the restoration work. The dam required either extensive repair or removal, and the owner did not have the funds needed to repair the dam.

Volunteer and DNR Monitoring

There continues to be a strong volunteer monitoring base in the Sheboygan area. The Ellwood H. May Environmental Center of Maywood established a pilot web site with WDNR and UW-Extension to manage volunteer water quality monitoring efforts.

WDNR is also conducting stream assessments in and around the Area of Concern as part of the baseline monitoring efforts.

Additional Activities during 2000-20001

- Implementation of canoe launch planning activity for the Sheboygan River commenced and a site plan was developed for one launch. Private funding has been obtained and canoe launch construction is anticipated on the Sheboygan River in 2002.
- DNR increased the frequency of long-term water quality monitoring in Sheboygan River from quarterly to monthly, added low-level metals and triazine monitoring, beginning Summer 2001;
- Initiation of two stream restoration projects in the headwaters of the Onion River which is tributary to the Sheboygan River (see discussion below):
- Removal of former fish ponds and re-establishing the stream channel – ongoing;
- Stream restoration of a historically channelized stream reach – ongoing;
- 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.
- Sheboygan County has a stream buffer initiative that has resulted in the establishment of buffers (see discussion below);
- The Sheboygan River Superfund Record of Decision was signed in May, 2000;
- 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;
- Two Brownsfield sites have being remediated along the Sheboygan River in the City of Sheboygan:
- Camp Marina – a former coal gasification site. The land portion of this remediation began in 2000;
- C. Reiss Coal – A remedial action plan has been developed for the vacant multiple use industrial site, 2001;
- Under Wisconsin's Source Water Assessment Program funded by EPA as part of the Safe Drinking Act (1996), assessments are being conducted for groundwater and surface water systems and include inventories of significant potential sources of contaminants to these system – ongoing;
- The State of the Sheboygan River Basin report was published in October, 2001. This document lists accomplishments, challenges and objectives for the basin;
- The Sheboygan County Land and Water Conservation Department installed 20 acres or 16,000 feet of stream buffers in Sheboygan County;
- The Sheboygan River Partners Team (comprised of DNR and interested public) created a map depicting recent conservation activities in the Sheboygan River Basin.

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 has declined since settlement because of agricultural operations, aquaculture (fish farming) and recreation. Two stream restoration projects in headwater areas of the Onion River Watershed are underway to correct water quality problems and enhance habitat for fish and wildlife.

Onion River Relocation Project

This project is located directly on the upper portions of the Onion River adjacent to a dairy operation. The stream was rerouted and straightened in the early 1970s to allow for expansion of a dairy operation. The modified channel had poor habitat for fish and other aquatic life and received significant runoff from the agricultural operations. The state threatened slippershell mussel is present at this site, but at low population levels. The Sheboygan County Land and Water Conservation Department, Lakeshore Chapter of Trout Unlimited, WDNR and the adjacent landowner have teamed up to restore this stretch of river.

This project entails relocating about 1000 feet of the Onion River away from the dairy operation, installing high quality in-stream habitat and creating a wetland filter area to intercept runoff from adjacent lands. A perpetual easement was purchased to allow for the channel relocation and provide additional buffer space from the dairy, row crop and pasture activities.

Silver Springs Restoration

This project involves restoring a series of trout rearing and recreation ponds to a free-flowing river condition on Mill Creek, a headwater tributary to the Onion River. The WDNR purchased 135 acres of land that included several ponds that were dug out from natural springs. Several of the ponds are "on line" with Mill Creek and have a detrimental effect on water temperature. This project will drain 15 ponds and restore about 1000 feet of cold-water river suitable for trout and other cold water species. About four acres of shallow marsh/shrub carr wetland will also be created.

Sheboygan County Stream Buffer Initiative

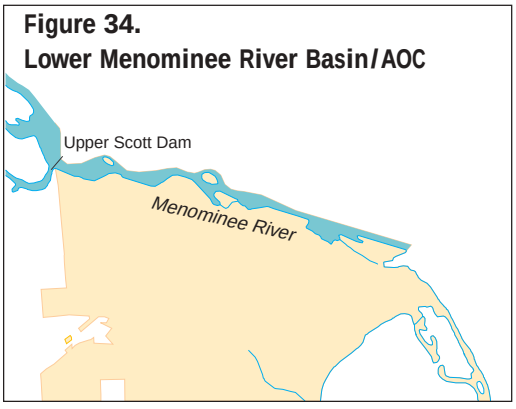
The Sheboygan County Land and Water Conservation Department is implementing the County's first Water Quality Improvement Program. Since the project began in 2000, the Land and Water Conservation Department has contracted with 27 landowners and installed nearly 11 miles (62 acres) of buffer strips that reduce the amounts of sediment and agricultural runoff from entering streams.

Sheboygan Marsh Management Plan

The *Broughton Sheboygan Marsh Strategic Management Plan 2001* was completed in 2001. 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.

Lower Menominee River

Figure 34.
Lower Menominee River Basin/AOC



Description

The Menominee River is a boundary water between Wisconsin and the Upper Peninsula of Michigan that drains to Green Bay. The Menominee River Area of Concern includes the lower three miles of the river from the upper Scott Paper Company dam to the river mouth and approximately three miles north and south of the adjacent shoreline of Green Bay (Figure 34). The Area of Concern includes portions of Marinette County in Wisconsin and Menominee County in Michigan.

The Lower Menominee River RAP, updated in 1996 by the WDNR, the Michigan Department of Environmental Quality and a citizen's advisory committee, addressed water quality concerns in the Area

of Concern. Implementation of this long range planning strategy continues. Some of the conditions contributing to the ecological impairments have been remediated and other actions are either ongoing or part of a long- term remediation strategy.

Highlights

A paint sludge contamination site on the shoreline of Green Bay in Menominee, Michigan, was cleaned up and wastewater treatment systems in Marinette (bypassing) and Menominee (combined sewer overflows) have been completed. An ecologically important shoreline in Marinette was designated and is protected as a Natural Area and a bulkhead line designation on the river shoreline in Marinette was removed. A coal tar contamination site has been included on the WDNR coal tar cleanup list.

Sediment Cleanup Efforts

Remediation of arsenic contamination at one of the primary contamination sites in the Area of Concern was started in 1999 and is scheduled to continue in the larger ship turning basin as part of an U.S. EPA Resource Conservation and Recovery Act (RCRA) consent order. The U.S. EPA has issued an Administrative Order of Consent requiring remediation of arsenic contamination in the Lower Menominee River Area of Concern. Ansul was required and has met the condition to remove all soft sediments from the Eighth Street Slip behind the cofferdam by the end of 1999. For a more detailed discussion of the cleanup efforts, refer to the "Contaminated Sediment Management Section."

Arsenic contamination of soil, sediment, groundwater, surface water and exposed biota was identified as a primary ecological problem within the Area of Concern. The source of arsenic was a former herbicide manufacturing facility at the site, which was identified as the greatest single source of arsenic to Lake Michigan. Ansul produced arsenic-based herbicides from 1957 to 1977. Processed wastes, including arsenic salts, were stored next to the river, and some of the wastes were discharged directly into the river. At one time an estimated 95,000 tons of waste salt were stored on site.

St. Louis River and Duluth Superior Harbor

Description

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 35). Minnesota has the lead for RAP coordination.

Figure 35. St. Louis River/Duluth Superior Harbor AOC

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. Some upland clean-up efforts have occurred. Remediation of contaminated sediments is expected to be underway at sites on both sides of the state line by 2005.

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. Even though the estuary has suffered extensively from habitat loss and degradation, it also retains tremendous habitat value. Because habitat issues are such a high priority, a comprehensive habitat plan is being developed to enhance the biological diversity and ecological integrity of the lower St. Louis River. The project will provide an estuary-wide vision for resource management and conservation. It will also provide a consensus list of conservation and management objectives, targets and actions along with a project that is ready to submit for funding.

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.

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 that includes primarily Eurasian Water Milfoil and zebra mussels.

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 DRAFT *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. The state will be submitting this plan to the national Aquatic Nuisance Species Task Force for their approval, which would also provide funding for the state's ANS program.

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.

Species of Concern in Wisconsin Great Lakes Basin

Species exclusively of concern in the Great Lakes Basin are indicated with an (*).

Round Goby (Neogobius melanostomus)*


Round Goby

The round goby, Neogobius melanostomus, is a bottom dwelling fish with a large head, resembling a tadpole, which can grow to be 250 mm (10 inches). First discovered in Lake St. Clair in 1990 after being introduced via ballast water from transoceanic vessels, the round goby has spread to lakes Erie, Michigan and Superior. Round gobies are thriving in the Great Lakes Basin because they are aggressive, voracious feeders which can forage in total darkness. The round goby takes over prime spawning sites traditionally used by native species, competing with native fish for habitat and changing the balance of the ecosystem. Of primary concern is their ability to prey o the eggs of other fish, particularly Lake Trout, thus impacting their numbers.

Sea Lamprey (Petromyzon marinus)*


Sea Lamprey

Sea lamprey, *Petromyzon marinus*, are predaceous, eel-like fish native to the coastal regions of both sides of the Atlantic Ocean. They entered the Great Lakes through the Welland Canal about 1921. They contributed greatly to the decline of whitefish and lake trout in the Great Lakes. The sea lamprey has had a devastating impact on lake trout and whitefish. By the 1960s, a sea lamprey control program had reduced their abundance by 90% to the point where lake trout and whitefish could once again thrive in the Great Lakes.

Rusty crayfish (Orconectes rusticus)

Rusty crayfish, *Orconectes rusticus*, are native to streams in the Ohio, Kentucky, arid Tennessee region. Spread by anglers who use them as bait, rusty crayfish are prolific and can severely reduce lake and stream vegetation, depriving native fish and their prey of cover and food. They also reduce native crayfish populations. Rusty crayfish populations are limited to northern Wisconsin lakes.


White Perch

White Perch*

Native to Atlantic coastal regions, white perch invaded the Great Lakes through the Erie and Welland canals in 1950. Prolific competitors of native fish species, white perch are believed to have the potential to cause declines of Great Lakes walleye populations. White perch have been found to eat the eggs of walleye, *Stizostedion vitreum*, white bass, *Morone chrysops*, other white perch and possibly other species as well. Another concern is that white perch, actually a species of the bass genus (Moronidae), have hybridized with native white bass in western Lake Erie. These hybrids were first noted in western Lake Erie in the early 1980s, the same time when white perch were increasing in abundance in this area. An excellent panfish highly regarded as a food fish in the Eastern United States, it is not often exploited as a game fish and generally is regarded as undesirable, especially when over-population in fresh waters causes the species to become stunted.

Flowering rush (Botumus umbellatus)

Flowering rush, *Botumus umbellatus*, is a perennial plant from Europe and Asia that was introduced in the late 1800s in the ballast water of ships and has been repeatedly introduced in the Midwest as an ornamental plant. It grows in shallow areas of lakes as an emergent and as a submersed form in water up to 10 feet deep. Its dense stands crowd out native species like bulrush. The emergent form has pink umbellate-shaped flowers, and is 3 feet tall with triangular shaped stems.

Curly-leaf pondweed (Potamogeton crispus)

Curly leaf pondweed, *Potamogeton crispus*, is an exotic plant that forms surface mats that interfere with aquatic recreation. The plant usually drops to the lake bottom by early July. Curly-leaf pondweed was the most severe nuisance aquatic plant in the Midwest until Eurasian watermilfoil appeared. It was accidentally introduced along with the common carp. Curly-leaf pondweed is frequently present at nuisance levels on some inland Wisconsin lakes. It can be controlled with mechanical harvesting or chemical treatment.

Zebra mussel (Dreissena polymorpha)

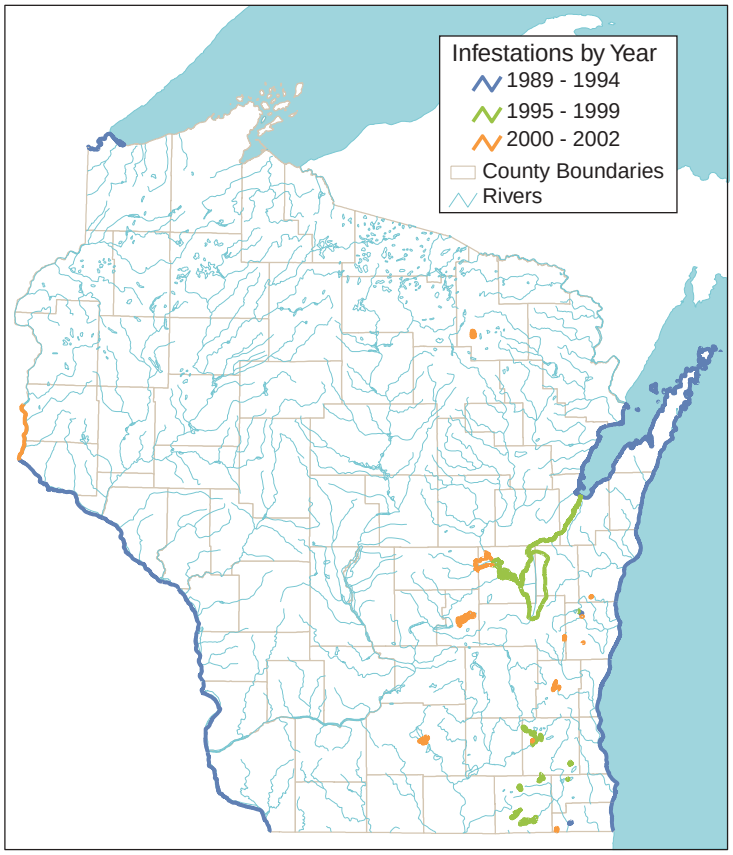
The zebra mussel (Dreissenia polymorpha) is a tiny (1/8-inch to 2-inch) bottom-dwelling clam native to Europe. The mussel takes its name from its striped shell. Zebra mussels were introduced into the Great Lakes system in 1985 or 1986 and first turned up in Lake St. Clair. They have spread throughout the Great Lakes and Mississippi drainage systems. Zebra mussels were first found in Wisconsin waters of Lake Michigan in 1990.

Zebra mussel

Since that time, zebra mussel populations have expanded their range in Wisconsin to include: the nearshore areas of Lake Michigan from Racine to Washington Island, Green Bay, Superior Harbor, the Mississippi River, 30 inland lakes in nine counties, the Lower Fox River, a portion of the Bark River in southeastern Wisconsin, and a number of rivers that are tributary to Lake Michigan. Figure 36 shows how zebra mussels have expanded their range in Wisconsin from 1994 to 2002. Zebra mussel populations are highest in Green Bay where densities are approaching levels found in Lake Erie. Resource managers are particularly concerned about the potential impacts to the food chain, native clams and fisheries in Wisconsin's waters.

Another area of concern is the Mississippi River where the population of zebra mussels is steadily increasing to over several thousand per square meter in some portions of the river. Unusually low dissolved oxygen concentrations in the range of 3-4 mg/L were observed in portions of the Mississippi River during the early summer periods of 1997 and 1998. High concentrations of zebra mussels were likely contributing to the low dissolved oxygen levels. Water clarity improved dramatically in some part of the Mississippi River in the late summer of 1997 which was likely influenced by the filter feeding activity of zebra mussels. These results are consistent with findings in other riverine systems where zebra mussels are present.

Figure 36. Zebra Mussel Infestations 1989-2002



Zebra mussels are also negatively impacting native mussel populations in the Mississippi River. Native mussels are being smothered by high concentrations of mussels that attach themselves to their shells. A recent survey by the Corps in the East Channel of the Mississippi River at Prairie du Chien has revealed a substantial reduction in the diversity and density of native mussels. The decline was likely the result of zebra mussels whose densities reached over 10,000 per square meter in 1998. The East Channel was one of the best mussel beds in the Upper Mississippi River. Future efforts are being considered to relocate native mussel beds to other waters that are less likely to be impacted by zebra mussels.

Financial impacts have been significant to Wisconsin's water utilities (about $4 million based on 1993 figures) and to power plants (approximately $1 million in 1993). Although some costs have also been incurred by the lock and dam operators on the Mississippi River, these costs have been substantially less than for the raw water users. The environmental costs of the zebra mussel invasion to water resources are more difficult to quantify, and in most cases, are unknown. The long-term costs, however, are likely to be significant. Ecological studies have recently been completed on two inland Wisconsin lakes where zebra mussels first invaded in 1994. The results of these studies should provide more information on the ecological impacts.

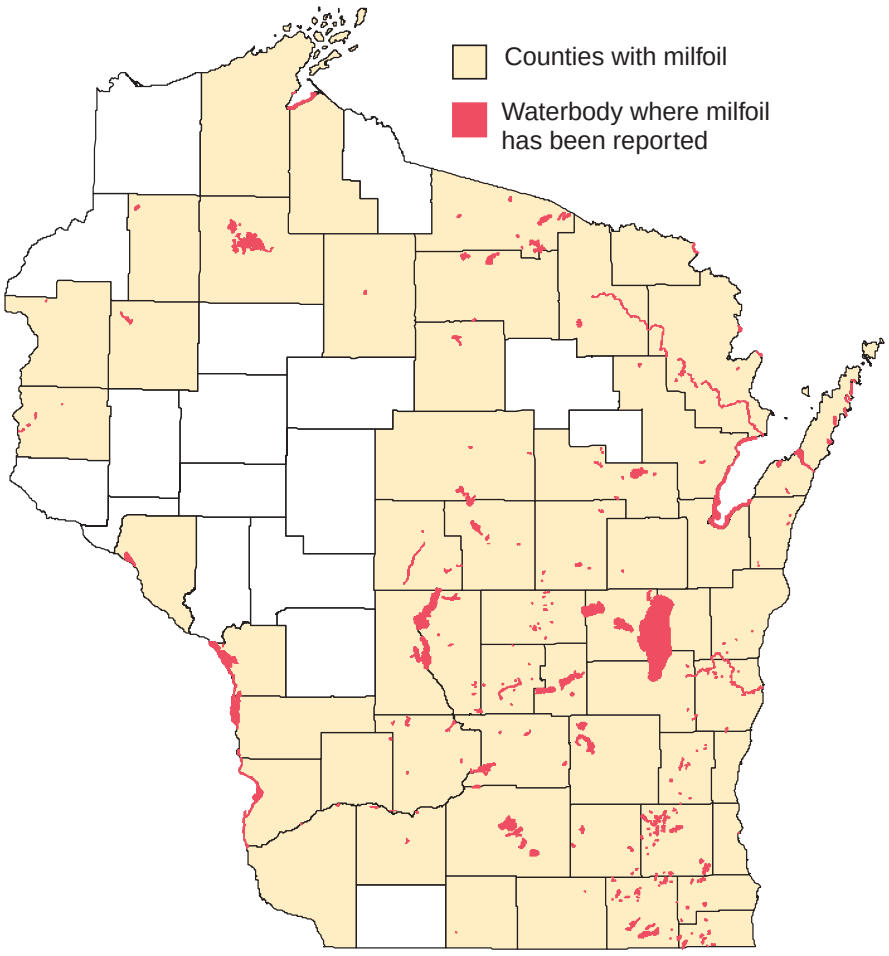
Eurasian watermilfoil

Eurasian watermilfoil (Myriophyllum spicatum)

Eurasian water milfoil (Myriophyllum spicatum) is a submersed aquatic plant native to Europe, Asia and northern Africa. It is one of eight milfoil species found in Wisconsin and the only one non-native to the state. Generally, the plant goes unnoticed until it has established itself in a lake and become a nuisance.

Eurasian watermilfoil first showed up in Wisconsin's counties in the 1960's. In the past three decades, this exotic species has significantly expanded its range to about 310 lakes in 54 of Wisconsin's 72 counties. The range of Eurasian watermilfoil has expanded in Wisconsin. Because of its potential for explosive growth and its incredible ability to regenerate, Eurasian watermilfoil can successfully out-compete most native aquatic plants, especially in disturbed areas. In a number of Wisconsin lakes, Eurasian watermilfoil has formed huge monoculture stands with vast mats of surface foliage that shade-out native aquatic plants and diminish the aesthetic beauty. Recreational activities like swimming, boating and sport fishing are also diminished on Wisconsin lakes infested with Eurasian watermilfoil. A variety of techniques have emerged for controlling Eurasian watermilfoil populations on Wisconsin's lakes. These techniques include mechanical cutting and harvesting in open areas, limited use of herbicide treatments and more recently the introduction of weevils as a biological control agent. A 1992 WDNR report to the Wisconsin Legislature on Eurasian watermilfoil provides more details on how Wisconsin has, and will continue to deal with this aquatic nuisance species.

Figure 37. Eurasian Watermilfoil Infestations 2002



Ruffe (Gymnocephalus cernuus) *

The Eurasian ruffe may pose a threat to water environments and commercial and sport fishing due to its competing with native fish for food and habitat. First reported in 1986 in Lake Superior, the ruffe population has increased in the St. Louis River at Duluth-Superior and spread to rivers and bays along the south shore of western Lake Superior. Ruffe competes specifically with walleye, yellow perch and a number of small forage fish that are currently threatened by expansion of the ruffe's range.

Spiny Water Flea (Bythotrephes cederstoemi) *

The spiny tailed *Bythotrephes* is a crustacean that invaded North America in the 1980s and is now established in all the Great Lakes. This small shrimp-like animal grows to an average of 10 millimeters in length and feeds on other small aquatic animals. This zooplankton has the potential to have a profound effect on the balance of the Great Lakes fisheries.

Fish Hook water flea (Cercopagis pengoi)

This tiny crustacean is related to shrimp, crayfish, and the spiny water flea. It becomes tangled on fishing lines, creating problems for anglers. Also, its rapid reproduction rate may pose an ecosystem threat due to potentially high densities in the system, resulting in the decline of native zooplankton species.

Purple Loosestrife

Purple Loosestrife (Lythrum salicaria)

This highly aggressive wetland plant invades marshes and lakeshores, replacing cattails and other native plants by forming dense, impenetrable stands that do not provide good habitat or shelter. Purple Loosestrife places many wetland plants and animals at risk. One adult plant can disperse 3 million seeds annually, and is able to re-sprout from roots and broken stems that fall to the ground or into the water. There are currently no known North American predators of Purpose Loosestrife.

Daphnia lummholzi

This exotic zooplankton species appears to be poised to invade Lake Michigan through the series of locks, dams and artificial canals on the Illinois River. This species of Daphnia is larger and has more spines than the North American Daphnia, which make it difficult for young fish to consume. This protection may lead the non-native Daphnia to replace native species, potentially reducing survivorship of young sport and food fishes in lakes, rivers and fish hatcheries.

Chapter 6: Wetlands

A few years ago, the Wisconsin Department of Natural Resources began a process to determine the vision and goals for protecting and restoring Wisconsin's wetlands. The state had many different programs with wetland responsibilities and their own individual goals, but there was no "big picture" strategy for wetlands. The department's Wetland Team was assigned to develop a vision and goals for protecting and restoring Wisconsin's wetlands. *"Reversing the Loss - A Strategy for Protecting and Restoring Wetlands in Wisconsin"* was the product of that process. The strategy will guide wetland staff over the next six years by charting a course for current and future department policies and programs involved in wetland education, protection, restoration, enhancement and management.

As part of the process, the Wetland Team has identified performance measures by which the success of the plan is measured and analyzed. The Wetland Team is evaluating progress toward achieving the goals of the plan and reporting that progress. The plan will be reviewed and modified, as appropriate, each biennium.

"Reversing the Loss" – the Wetland Strategy

Once considered wastelands and breeding grounds for mosquitoes that brought disease and death, Wisconsin wetlands are now recognized for providing critical habitat for wildlife, water storage to prevent flooding and protect water quality, and recreational opportunities for wildlife watchers, anglers, hunters, trappers and boaters. While better understood and no longer destroyed as rapidly as they were during Wisconsin's first century of statehood, wetlands continue to be lost and degraded today.

Only 53 percent, or 5.3 million acres, remain of the 10 million acres of wetlands present before statehood — and many of those wetlands are in peril. Wetlands continue to be drained for agriculture and filled for development and roads. Others are deteriorating as changing land use around them dramatically alters water flows to them and causes erosion, sedimentation and poor water quality. Invasive species such as purple loosestrife and reed canary grass are increasingly inhabiting wetlands and crowding out native plants, reducing species diversity and degrading wildlife habitat. Even some projects intended to improve wetlands are contributing to the loss of wetlands' natural functioning and species diversity. The result decreases the benefits wetlands themselves bring and decreases the overall health and functioning of the other ecological systems in the same watershed. Because Wisconsin wetlands are so interspersed with other major community types in the state - lakes, rivers, prairies, forest - any loss detracts from the diversity of species and the ecological health of these other landscape communities.

Federal, state and local regulations, wetland restoration, and acquisition programs are making progress in slowing further wetland loss. However, laws will never prevent all losses nor will financial resources ever provide enough funds to acquire all the wetlands that need protection. To reverse the loss, and to restore the benefits of wetlands, the department must act on many fronts. This strategy establishes four major goals and a series of performance measures to accomplish those goals. The timeframe for implementing the performance measures is by the year 2007. Below are the goals and performance measures that have been or are currently being accomplished:

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.

Public Outreach:

The department developed a wetland website with general information on wetland news, the Strategy, wetland functional values, wetland protection, wetland permits, inventory, restoration and management, publications and important links. The website address is www.dnr.state.wi.us/org/water/fhp/wetlands All new laws, rules and reports are or will be available at or through the site.

The department's 6-year wetland strategy, *Reversing the Loss: A Strategy for Protecting and Restoring Wetlands in Wisconsin* was published and widely distributed in 2001. The strategy forms the basis wetland work planning and budgeting in the department. Progress on implementing the strategy is posted on the departments' wetland website as a "report card".

The *Wetland Restoration Handbook for Wisconsin Landowners,* has been quite popular and has been used in hands-on workshops private property owners interested in restoring their wetlands.

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.

Restoration and Acquisition:

The Department's major restoration efforts are through the Upper Mississippi River and Great Lakes Region Joint Venture. In 2000 (the latest report) 2,486 acres were protected by purchase or easement, 2,030 acres restored and 230 acres enhanced.

The Wetland Reserve Program, administered by the US Natural Resources Conservation Service, funds wetland restoration efforts. In the years 2000 through 2001, it has restored 2.990.9 acres of wetlands in Wisconsin.

The department established a Land Legacy Team to identify priority acquisition areas for the next 50 years. Wetlands are a key component of that acquisition effort.

GOAL 3

Streamline our 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 authorizing 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.

Regulation

2001 Wisconsin Act 6 was signed into law on May 7, 2001 in response to the U.S. Supreme Court decision in *SWANCC v. Corps of Engineers.* The new law requires that a state water quality water certification be obtained for activities conducted in nonfederal wetlands. The law identifies certain activities that are exempt from state water quality certification subject to meeting specific performance requirements and requires the use of the 1987 Corps delineation manual. The following rules are being promulgated to interpret and implement the provisions of Act 6:

Chapter NR 300, Fees and Time Limits for Waterway and Wetland Permit Decisions

Chapter NR 351, Exemptions for Non-Federal Wetlands

Chapter NR 352, Delineation of Non-Federal Wetlands

After numerous public and legislative hearings the administrative rule, Chapter NR 350, *Wetland Compensatory Mitigation,* implementing 2000 legislation authorizing a compensatory mitigation program has gone into effect February 1, 2002.

The 2001-2003 state budget authorized 2.5 positions to begin implementation of the wetland compensatory program (the formal department request was for 5 positions). None of these positions has been filled, however, a 2001 US EPA Wetland Protection State Development Grant funded a half-time position to assist with wetland compensatory mitigation training.

The department has prepared and published a technical guide, *Guidelines for Wetland Compensatory Mitigation in Wisconsin,* for use by applicants, consultants, and agency staff and in training.

The Department is also pursuing a memorandum of agreement with the U. S. Environmental Protection Agency - Region 5, the St. Paul District of the U. S. Army Corps of Engineers, the U.S. Fish and Wildlife Service and the Natural Resources Conservation Service. All agencies are agreeing to use the standards and criteria in NR 350 and the *Guidelines* when reviewing and approving compensatory mitigation in Wisconsin.

A new administrative code, Chapter NR 353, *Wetland Conservation Activities*, is being promulgated to create a general permit for specific activities used in wetland conservation projects. The rule establishes a streamlined process to authorize wetland restoration and maintenance activities by private landowners.

A Memorandum of Agreement between WDNR, the United States Fish and Wildlife Service, and the Natural Resources Conservation Service was signed on September 11, 2001. The MOA creates a process for streamlining the regulatory approval process for federally funded wetland restoration and enhancement activities.

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, is crucial to the success of this strategy, as is developing a unified tracking and reporting system.

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.

Monitoring and Assessment

The department completed a monitoring strategy - *One Step at a Time, Wetland Monitoring Strategies* - which will be used as the implementation plan for future wetland monitoring efforts.

The department was successful in creating a permanent wetland monitoring position. This position should be filled in early 2002.

The University of Wisconsin Environmental Remote Sensing Center in cooperation with our Wetland Inventory program investigated new technologies to facilitate wetland map production. While new technologies will be incorporated into the Wisconsin Wetland Inventory to greatly speed the digitizing of wetland maps, none of the new photo interpretation technologies offered any advantages in speed or accuracy. The study report will be published in 2002.

Quality Assessment of Wetlands

The Department is developing a floristic quality assessment for Wisconsin. This project involves adapting a site-specific method for assessing plant community quality for use in Wisconsin. The method involves gathering a complete plant inventory and applying a "coefficient of conservatism" on a scale of 0-10, to each species, based on its likelihood of occurring in an undisturbed plant community. A mean coefficient of conservatism and a floristic quality index can then be calculated for the site.

An wetlands experts group assigned coefficients of conservatism (C of C values) to all 1700 species native to Wisconsin, considering the entire state as a region, using the Checklist of the Vascular Flora of Wisconsin, maintained by the University of Wisconsin – Herbarium. C of C values are listed on the UW-Herbarium website and are available directly from WDNR. A description of Floristic Quality Assessment is also included on the webpage. The website is http://wiscinfo.doit.wisc.edu/herbarium/. The FWS Regional Wetland Indicator Status for Wisconsin has also been added to the website.

The final report to EPA (funded under a 104 grant) is targeted for publication in May 2002. It will contain a table with scientific and common name, physiognomy, C of C value, regional indicator status, and threatened, endangered, special concern status, for all vascular species native to Wisconsin. Varieties, hybrids and subspecies are generally not treated except in special circumstances where they are recognizably distinct and the experts assigned different C of C values. A computer program is being developed to utilize the C of C values to calculate mean C and Floristic Quality Index (FQI) values. This will be housed on a WDNR website and made available to the public.

The Department is investigating mapping reed canary grass as a coarse-level, first-cut assessment of wetland quality at a landscape scale. This project involves developing a method to map occurrence of the most extensive invasive species in Wisconsin wetlands, reed canary grass, and correlate the extent of its occurrence with land cover and indicators of hydrologic disturbance, primarily wetland drainage features.

A classification has been performed using 30m resolution Landsat imagery to categorize wetlands in Landsat Scene (path 24, row 30), a182 km X 182 km area of southern Wisconsin. Wetlands in the pilot area are classified into 3 classes relative to dominance by the invasive species, reed canary grass: "reed canary dominated" (>80% cover), "mixed" (50% - 80% reed canary grass cover, mixed with other vegetation), and "other" (<50% reed canary grass cover). Accuracy assessment has begun.

Integrating Wetlands into the Watershed Approach

With the goal of developing a process to assess wetland functions on a watershed scale to provide managers and planners with information to guide allocation of scarce resources for protection and restoration, a two-year pilot project in the Milwaukee River Basin started in November of 2001. The project will utilize existing GIS information and develop some new data layers where necessary, to provide input into expert-derived GIS-based decision models of wetland functions that will also be developed in the project. The models will generate assessments (or predictors) of wetland function in the six watersheds that comprise the basin.

Staff training and method testing of the recently developed multi-metric biotic index for depressional wetlands (based on plants and macroinvertebrates) has begun. A 2-day training session in the use of the method was held in August 2001 for 12 department and Natural Resources Conservation Service staff volunteers. Training covered sampling methods, and focused on family-level macroinvertebrate identification.

In 2002 the twelve volunteers will work in six teams and each team will assess three wetlands for a total of 18 assessment sites distributed throughout the state. Each team will attempt to select their three sites to span a range of disturbance conditions. The original researcher will also sample the same 18 sites and compare results with the volunteers, for a quality control test. The volunteer field staff will evaluate the method's feasibility for use in various wetland assessment contexts.

In 2002 refinement of the depressional wetland biotic index to assess additional metrics will begin. This project will test and develop additional metrics for the Depressional Wetland Biotic Index. Field sampling and laboratory work was completed for the set of 75 wetlands used to investigate expanding the plant and macroinvertebrate based depressional IBI to include metrics for small mammals, zooplankton, and amphibians. Metrics are being developed for an expanded Index which will be published in May 2002 in the final report to EPA.

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 biennial state budget for FY 02-03 includes a position for a statewide coordinator for the growing Purple Loosestrife Biocontrol Network. This person will coordinate distributing education and technical assistance in all aspects of the biocontrol project to teachers, organizations and interested citizens. This will include both volunteer driven surveys to identify existing purple loosestrife infestations and monitoring the response of vegetation at beetle release sites.

Contingent on grant funding, plans are underway to join with the Wisconsin Wetlands Association to offer workshops for volunteers to conduct surveys and workshops to train volunteers to rear and release beetles and monitor vegetation at release sites. Survey information will be checked for quality control and entered into a GIS developed and maintained by the Great Lakes Indian Fish and Wildlife Commission (GLIFWC).

Table 30. Development of Wetland Water Quality Standards

	In Place	Under Development	Proposed
Use Classification	X		
Narrative Biocriteria	X		
Numeric Biocriteria		X	
Antidegradation	X		
Implementation Method		X	

Figure 38. Percent of County Mapped as Wetland

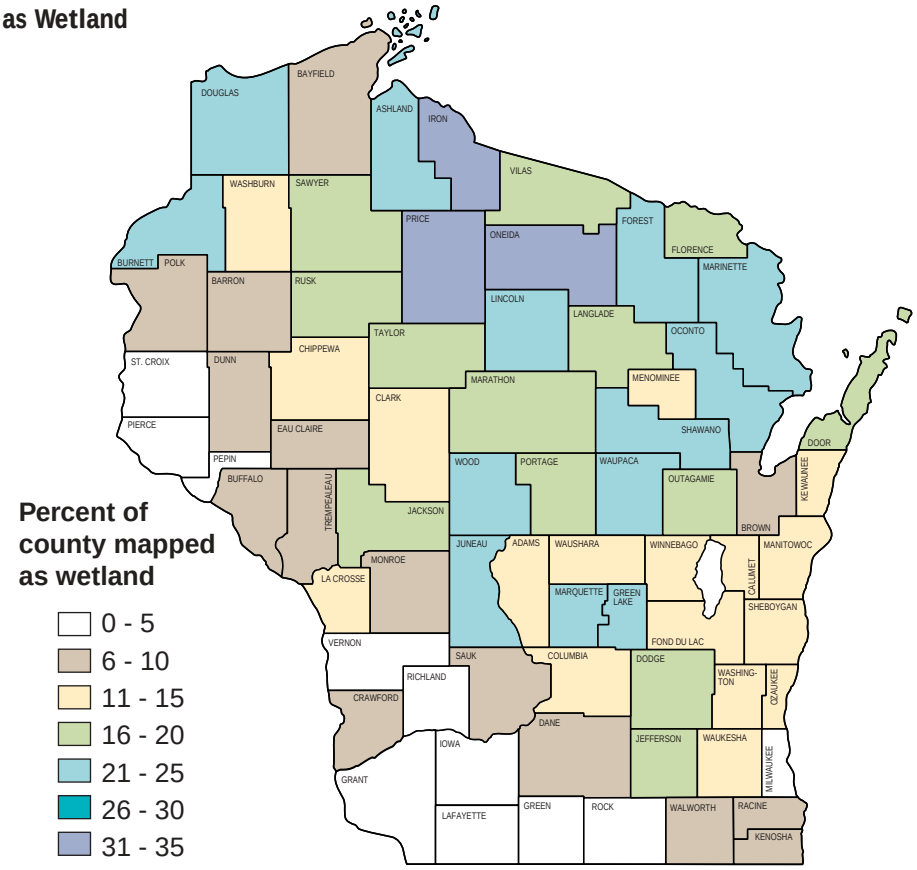


Figure 39. Percent of GMU mapped as wetland

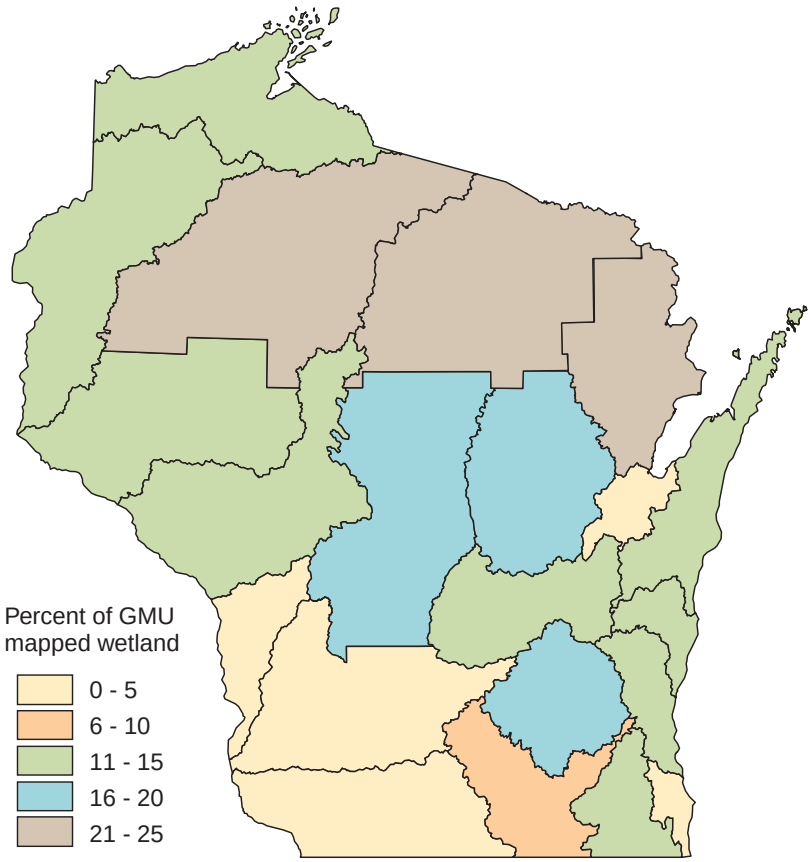
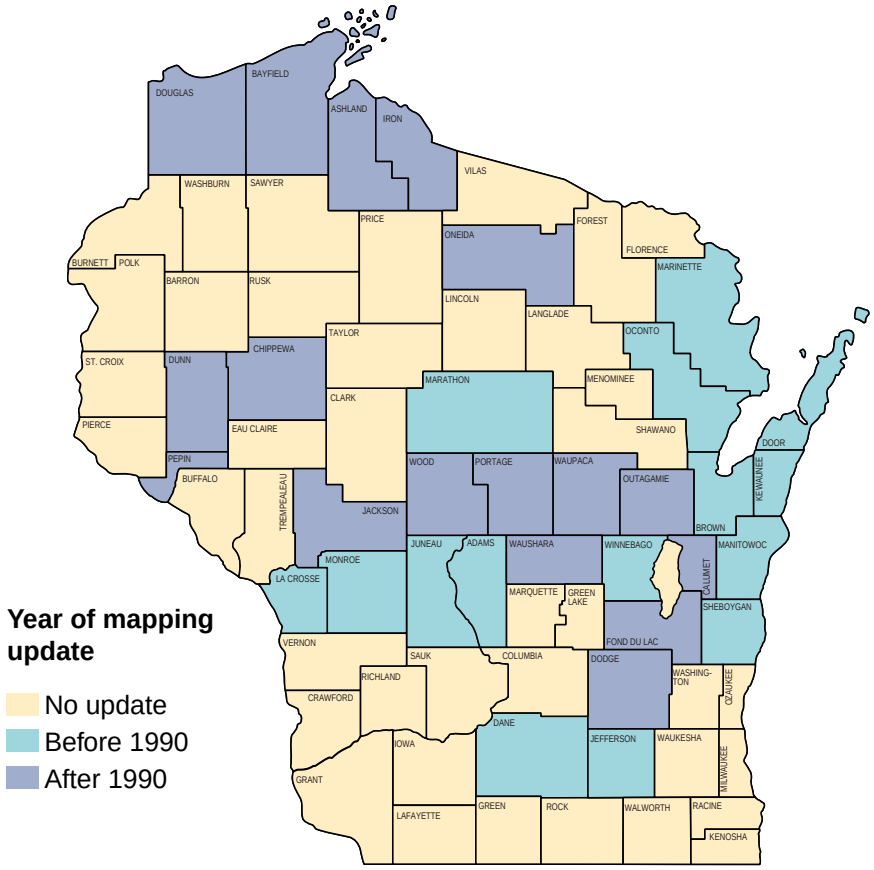


Figure 40. Year of Mapping Update



Recent Wetland Legislation

Wisconsin Gov. Scott McCallum, DNR staff, conservation groups and key lawmakers made Wisconsin the first state to restore protection to small, isolated wetlands left vulnerable to filling and dredging as a result of a January 2002 U.S. Supreme Court decision. The law, passed unanimously by both the Wisconsin Senate and Assembly, gives the state authority to protect more than 1 million acres of "isolated wetlands," among them sedge meadows, shallow marshes and seasonal wetlands that are among some of Wisconsin's most productive in providing waterfowl and amphibian habitat, storing flood waters, and helping protect water quality. The law was one of several victories for wetlands and water quality in a year that saw DNR staff make significant progress in carrying out DNR's strategic plan for protecting Wisconsin's 5.3 million acres of wetlands. Other achievements under that strategic plan, "Reversing the Loss," include:

- Signing an agreement with two federal agencies that will enable more wetlands to be restored more quickly under federal programs at the same time it saves taxpayers money by eliminating duplication of services;
- Creating rules that streamline the permitting process for people who wish to restore wetlands on their property while retaining the same safeguards for assuring the projects don't harm the environment;
- Completing the rules that will implement a program that may allow property owners in some cases to fill in poor quality wetlands if their proposal to develop their land includes restoring other wetlands. Wetland officials hope the new program, wetland compensatory mitigation, could give the state flexibility to make decisions that will result in the best overall outcome for the environment.

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 ambient water quality supplies 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' 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 reported during the 2000-2001 period, 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 31 below reports waters monitored for toxic substances and those with elevated levels of toxicants. *Streams are reported in Part III, Chapter 3.* Of the 24,422 miles monitored or evaluated, 1,138.25 miles of rivers or streams are partially or not supporting their designated uses due to elevated levels of toxic substances in the water column, fish tissue, or discharges.

Due to fish advisories, the entire length of Wisconsin Great Lakes shoreline miles (1,017) are considered to have elevated levels of toxicants. Pollutant sources to the Great Lakes are many, including airborne toxicants like mercury, sediments contaminated in the past, tributaries carrying toxic runoff, and wastewater discharges.

Table 31. 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

The WDNR works cooperatively with the University of Wisconsin-Madison's State Laboratory of Hygiene (SLH) to maintain a biomonitoring laboratory. This laboratory 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. Laboratory staff participate on WDNR policy teams dedicated to the development of new and improved toxicity testing methodologies. Additionally, WDNR and laboratory staff assess the applicability of alternative toxicological assessment methods to other WDNR watershed management programs. For example, during 1997-2000, the laboratory conducted research to improve algae toxicity test methods (with *Raphidocelis subcapitata*) for future addition to the chronic toxicity test battery required in Wisconsin Pollutant Discharge Elimination System (WPDES) permits.

Each year, the laboratory 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 2000-2001 are summarized below (see Table 32).

Excluding monthly batteries of reference toxicant tests, acute and chronic test batteries performed on WPDES-permitted facilities made up the majority of toxicity tests conducted in 2000 and 2001. Specifically, 54 acute test batteries were performed on wastewater effluent using two freshwater species: a waterflea (*Ceriodaphnia dubia*) and juvenile fathead minnows (*Pimephales promelas*). Municipal effluent accounted for 33 of those test batteries, 15 came from industrial dischargers, and 6 came from WDNR-owned fish hatcheries. While the majority of wastewater effluent samples were non-toxic, 4 indicated a high potential for acute toxicity (2 municipal, 2 industrial). The cause of toxicity was not determined in most cases, but is being addressed via WPDES permitting activities. Additional testing and/or toxicity identification will be recommended in future WPDES permits to further characterize the potential for significant effluent toxicity from these facilities.

Table 32. Summary Of SLH Toxicity Test Results For 2000-01

	Results			Results		
Sample type	**#of acute**	**Pass**	**Fail**	**#of chronic**	**Pass**	**Fail**
WPDES Industrial	15	13	2	12	8	4
WPDES Municipal	33	31	2	31	18	13
WPDES WDNR-owned fish hatcheries	6	6	0	8	8	0
Sediment	NA	NA	NA	12	10	2
Ambient Surface Water	107	107	0	116	86	30
Totals	161	157	4	179	130	49

NA = not applicable

Chronic toxicity test batteries using, *C. dubia*, larval fathead minnows, and algae (*R. subcapitata*) were also conducted at 51 sites: 31 municipal, 12 industrial, and 8 WDNR-owned fish hatcheries. While the majority of wastewater effluent samples were non-toxic, 17 indicated a high potential for chronic toxicity (13 municipal, 4 industrial). The cause of the toxicity was not determined in most cases, but is being addressed via WPDES permitting activities. Additional testing and/or toxicity identification will be recommended in future WPDES permits to further characterize the potential for significant effluent toxicity from these facilities.

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 (*Hyalella azteca*) were performed on 12 sediment samples in 2000 and 2001.

The lab also applied the acute and chronic toxicity testing techniques to several additional sample types. For example, 86 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. Also, 87 surface water samples from other areas of the state were tested to assess the potential for acute and chronic toxicity in lakes and rivers at those sites. 8 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 2000-2001 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 and the SLH efforts in the next biennium will continue to emphasize monitoring for WPDES-permitted facilities. Efforts will also be made to generate additional ambient toxicity data and to further supplement the toxicological database for compounds needing water quality criteria.

In addition to WDNR toxicity monitoring conducted by the SLH, WPDES-permitted facilities are evaluated by WDNR staff to determine their potential for acute and chronic toxicity. If it is determined that potential for effluent toxicity is present, permits require that acute and/or chronic whole effluent toxicity (WET) tests 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.

In Fiscal Years 2000-2001, 223 WPDES-permitted facilities (128 municipal, 95 industrial) conducted 363 acute tests, as required by their permits (see Table 33). Twenty of the 207 tests (9.6%) conducted by municipal dischargers demonstrated positive acute toxicity. Twelve municipal facilities experienced acute toxicity, but only three had severe or repeated toxic events. Twelve of 156 tests (7.6%) conducted by industrial dischargers demonstrated positive chronic toxicity. Eleven industrial dischargers experienced acute toxicity, but only one had repeated toxic events. In these cases where repeated or severe toxicity was noted, facilities are doing additional testing and/or toxicity identification in an attempt to identify the source(s) of toxicity.

In Fiscal Years 2000-2001, 175 WPDES-permitted facilities (115 municipal, 60 industrial) conducted 337 chronic tests, as required by their permits (see Table 33). Twenty-three of the 221 tests (10.4%) conducted by municipal dischargers demonstrated positive chronic toxicity. Eighteen municipal facilities experienced chronic toxicity, but only three had severe or repeated toxic events. Twenty-five of 116 tests (21.5%) conducted by industrial dischargers demonstrated positive chronic toxicity. Thirteen industrial dischargers experienced chronic toxicity, with five showing repeated toxic events. In these cases where repeated or severe toxicity was noted, facilities are doing additional testing and/or toxicity identification in an attempt to identify the source(s) of toxicity.

Table 33. Summary Of WPDES Toxicity Test Results For 2000-01

Sample type	#of acute		Results		#of chronic		Results	
	Facilities	Tests	Pass	Fail	Facilities	Tests	Pass	Fail
WPDES Industrial	95	156	144	12	60	116	91	25
WPDES Municipal	128	207	187	20	115	221	198	23
Totals	223	363	331	32	175	337	289	48

Fish Consumption Advisories

Wisconsin issued the year 2000 update of *Important Health Information for People Eating Fish from Wisconsin Waters*, the fish advisory for Wisconsin waters. With the 2000 update, almost 400 specific waterbodies or segments were listed with advice due to fish containing mercury or PCBs and other chemicals.

In 2001, Wisconsin changed the method for issuing fish consumption advisories as well as the format of the advice after new information showed that lower amounts of mercury are harmful to developing fetuses and young children. The National Academy of Sciences recommended that US EPA's reference dose for mercury be used for issuing fish consumption advice. A new general statewide advisory was developed based on the new effect levels and typical levels of mercury found in Wisconsin fish based on the mercury concentration data that Wisconsin amassed over the last 20 years. See Table 35 for a list of health criteria used for Wisconsin's advisories.

This new statewide advisory applies to most inland waters where other pollutants or where mercury concentrations do not require more stringent advice. Some waters contain fish with higher levels of mercury or PCBs and other pollutants that require more stringent fish consumption advice. In all, the advisory lists fish from 59 of the more than 2,000 lakes, river segments, and

border waters tested (Table 34) 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.

Since the adoption of the statewide general mercury advisory, the specific number of surface waters listed with more stringent advice is 92. This is because the new statewide general advisory provides equivalent advice and replaces the need to list many of the specific waters.

Table 34. Wisconsin's Fish Contaminant Monitoring and Cumulative Advisories

Year	Sites Sampled	Samples Collected	TOTAL Reaches or Waters w/Advisories PCB/Mercury
Prior to 1980	234	3,003	7/0
1980-1989	939	11,139	22/161
1990-1999	683	11,565	58/322
2000	96*	806*	59/331
			statewide mercury advisory adopted
2001	57*	407*	59/92
Total	2,009*	26,920*	59/92

* estimated at time of publication

Table 35. 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/>0.5 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 TEFs.

Sites of known sediment contamination

The following table lists ongoing sediment remediation sites in the state as of 1/01/02. The status column indicates what level of monitoring or management has occurred at the site since discovery.

Table 36. Sites of Known Sediment Contamination

Region	Project Name	GMU & Waterbody	Status**	Current & Projected Status FY 2000-2001
NER	Marinette MGP - WPS	Upper Green Bay GMU: Menominee R.	1	Initial site assessment completed; schedule for work plan for additional assessment due.
NER	Green Bay MGP - WPS	Lower Fox R.	1	FS for on-shore due. Initial sediment assessment completed.
NER	Two Rivers MGP - WPS	Lake Shore GMU: E. Twin River	1	Initial sediment assessment completed.
NER	Oshkosh MGP - WPS	Upper Fox R. GMU: L. Winnebago	2	Initial sediment assessment completed. More work needed.
NER	Appleton MGP - WEPCO	Lower Fox R.	1	Initial site assessment completed; coal tar found in the river from a DOT project.
NER	Manitowoc MGP - WF&L	LakeShore GMU: Manitowoc R.	3	Solidification pilot study completed and apparently unsuccessful.
NER	Menominee R. - Ansul Corp.	Upper Green Bay GMU: Menominee R.	2,3	Barrier installed around site. Eighth street slip sediments removed. Extent and degree studies of contamination in the turning basin under review.
NER	Sturgeon Bay- Shipbuilding Co.	Lake Shore GMU: Sturgeon Bay Canal	4	Site remediations complete in 1998.
NER	Ripon MGP - Alliant	Upper Fox R. GMU: Silver Cr.	1	Initial sediment assessment completed in September 2000.
NER	Kewaunee Marsh - Wis. Central Railroad,DNR	Lake Shore GMU: Kewaunee R.	4	Interim remediation measures implemented. Decision on effectiveness of interim measures and long -term solution pending. Funding for additional monitoring needed.
NER	Lower Fox R. from Neenah to the mouth - PCB Deposits	Lower Fox River	2	Site identification, remedial investigation, and priorities are in discussions. Pilot projects "N" and "56-57" have been implemented.
NER	Hayton Millpond	Pine & Jordan Creeks,& ditches; Hayton Millpond	2,3	Site investigations complete, and FS completed. Discussions for remedy are taking place. Initial source removal in OU-1 to take place in 2001.
NER	Fond du lac R.	Upper Fox R. GMU	1	Initial sediment sampling indicated potential high levels of metals and a potential coal gas site impact. Toxicity samples collected in fall of 2000.
NOR	Rhinelander Landfill - City of Rhinelander	Upper Wis. GMU: Slaughterhouse Creek & Pelican R.	2	Various remediation measures completed, including phytoremediation; chemical monitoring of surface waters on going.
NOR	Crawford Cr. - Koppers Corp.	Lake Superior GMU: Crawford Creek	2	Site investigation continuing; Screening ecological risk assessment completed. Decisions about additional monitoring for assessment continuing.
NOR	Ashland MGP- NSP	Lake Superior GMU: Chequamegon Bay	2	Designated as a Superfund Site in fall 2000. Discussions over risk assessments are continuing with EPA.
NOR	Superior Harbor - Fraser Shipyards	Lake Superior GMU: Superior Bay	2	Under enforcement.
NOR	Military Cr. at Phelps - C.M. Christenson	Upper Wis.GMU: Military Creek	1	Initial site assessment completed; additional assessment discussions needed.
NOR	Lincoln Woods Coal Gas Site	Central Wis. GMU	2	Initial sediment assessment completed. High levels of coal gas waste found. Discussions with RP will begin in spring 2001.

continued

Region	Project Name	GMU & Waterbody	Status**	Current & Projected Status FY 2000-2001
NOR	Newton Creek - Murphy Oil	Lake Superior GMU: Impoundment, Newton Creek, Hog Isle Inlet	4,2	Company remediated impoundment and first 700' of creek. Dept'.s consultant conducted additional site investigation of the next 2 segments of the creek. Scope of work under review for additional assessment on the remainder of the creek & impoundment.
WCR	Wausau Steel	Central Wis. GMU:Big Rib R.	4,5	Sand & geotextile cap installed in winter of 1998. Post observation and monitoring of cap effectiveness necessary.
WCR	Wausau MGP - WF&L	Central Wis. GMU: Wis. R.	1	Needs site assessment.
WCR	Wis. R. at Wausau below Rothschlid Dam.	Central Wis.GMU: Wis. R.	1	Some assessment work needed due to past spills.
WCR	Former Eau Claire STP outfall	Upper Chippewa R. GMU: Chippewa R. at Eau Claire	2	DNR assessment completed Levels of PAH's not as high as once thought.
WCR	Miss. R. at Fountain City - Army Corp. of Eng.	Miss. R. at Fountain City	4,5	ACE implemented a removal in 1999.
WCR	LaCrosse MGP site	LaCrosse.	1	Needs sediment site assessment.
WCR	Chippewa Falls MGP site	Duncan Cr.	1	Needs sediment site assessment.
WCR	Chippewa/ EauClaire MGP site		1	
WCR	Wis. R. at Port Edwards -	Central Wis. GMU: Wis. R. Vulcan Materials	4	Site clean- up completed in 1998. No post-remediation required as a part of the clean-up agreement.
WCR	Wis. R. at Stevens Point MGP site - WPS	Central Wis. R.GMU: Wis. R. at Stevens Point	2	Additional sediment sampling has occurred in the pond and at the confluence and downstream in the river. Needs interpretation.
SCR	Wis. R. at Badger Army Ammunition plant	Wis. R. at Gruber's Grove Bay	4	Site investigation completed, extent of contamination defined in 2000 and clean-up objective finalized. Dredging to occur in 2001.
SCR	OECI Superfund Site Ashippun	Upper Rock GMU: Davy Creek	4	Post assessment monitoring needed.
SCR	Baraboo River - MGP site	Lower Wisc. GMU: Baraboo river	4	Remediation completed in the winter of 1999.
SER	Sheboygan R. Superfund Site; Tecumseh Products	Sheboygan R. GMU: Sheboygan R. below Sheboygan Falls	3	ROD issued; final remedy discussions are still occurring. SQO's are .5ppm in water, 10ppm in the floodplain
SER	Sheboygan R. MGP - WPS Sheboygan R. in Sheboygan	Sheboygan R. GMU:	1	Remediation of upland is ongoing. Needs more sediment assessment.
SER	Fox R. (ILL.) MGP - WEPCO	Illinois/Fox R. GMU: Fox R. at Waukesha	1	Sediment assessment needed.
SER	Milw. R. - Milw. Third Ward MGP - Wis. Gas Co.	Milwaukee River GMU: Milwaukee R. in Milw.	1	Site investigations needed
SER	MIlw. R.- North Ave. Dam	Milwaukee River GMU: Milwaukee R. in Milw.	4	Dam removal completed. Shore stabilization completed.
SER	Cedar Creek - Mercury Marine	Milwaukee River GMU: Cedar Creek Below Cedarburg	3	Discussions are occurring regarding sediment assessment of the Hamilton Impoundment.
SER	Milwaukee R. & Cedar Cr.	Milwaukee River GMU: Cedar Creek to the harbor	2	EPA funded grant for transport modeling and associated reports are in preparation.
SER	Moss American Superfund Site	Milwaukee River GMU: Little Menomonee River	3	Discussions continue with EPA/WDNR and the responsible party regarding clean - up of the existing channel as opposed to digging an alternative channel.
SER	SC Johnson	Illinois/Fox R GMU: Waxdale Creek	1	Initial samples collected.

** Status Key:

1. Initial discovery
2. Detailed assessment
3. Remedial design
4. Remedy implementation
5. Post-remediation monitoring

Restrictions on bathing areas

In October 2001, U.S. EPA awarded a "developmental" grant to the State of Wisconsin under the BEACH Act of 2000 (Beach Environmental Assessment and Coastal Health) to finance the development of a consistent beach water-testing program aimed at reducing the risk of exposure of beach users to disease-causing microorganisms in beach water.

The project will bring together a work-group of state environmental and public health officials, local health officials, and other interested parties to design a beach monitoring and notification program that will meet the requirements of the grant. As a provision of the BEACH Act, EPA may also award an "implementation" grant of approximately $200,000 annually to the State of Wisconsin for the purpose of financing the full implementation of the statewide coastal beach monitoring and public notification program.

In addition, the DNR Bureau of Research has an EPA grant to determine the occurrence and origins of pathogens in urban streams using the Milwaukee Basin as the area of interest. The study will investigate E. coli, Salmonella, Crypto, Giardia and other pathogens during wet and dry events.

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.

EPA-established guidelines were derived from studies conducted in the 1970's and 1980's. In 1986 EPA recommended that *E. coli* and/or Enterococci be used as an indicator of fecal contamination. The EPA 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 EPA has published criteria. Under the statute, Wisconsin DNR must adopt new standards based on *E. coli* by April 10, 2004.

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.

Wisconsin is currently in its third year in implementing its 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. Wisconsin has until May 6, 2003 to complete all source water assessments.

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 are targeted to be completed by the end of 2003. Remaining public water systems will be assessed by the end of 2004.

Figure 41. Surface Water Source Water Protection Areas developed through the Source Water Assessment Program under the Safe Drinking Water Act.

Chapter 8: Ground Water

The WDNR has statutory authority to protect, maintain, and improve groundwater within the state. DNR 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 the 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 and clean-up responsibilities.

The 305(b) report gives WDNR the opportunity to characterize the quality of Wisconsin's groundwater and set goals for future needs identified by the report. The report gives a brief history of Wisconsin's groundwater laws, a description of each state agency with groundwater protection and cleanup responsibilities, a description of Wisconsin's major aquifer types, and a description of analytical efforts undertaken in the state to determine the condition of the resource.

Wisconsin's Groundwater Law

Wisconsin's Comprehensive Groundwater Protection Act, 410, was signed into law on May 4, 1984. The law expanded Wisconsin's legal, organizational and financial capacity for controlling groundwater pollution. Under Act 410, Wisconsin developed Chapter 160 Wisconsin Statues. Chapter 160, dubbed the "Groundwater Law," has been called the most comprehensive regulatory program for groundwater in the country. All state agencies involved in groundwater protection must adhere to numerical standards that define the level at which regulatory agencies must act to clean up pollutants in groundwater. These standards are defined not only by public health, but also by the effect a pollutant can have on the environment and public welfare.

One of the most important features of the Wisconsin's groundwater law is something that is not in it – aquifer classification. Aquifer classification involves looking at the use, value or vulnerability of each aquifer and allowing some to be "written off", as not fit for human consumption. The philosophical underpinning of Wisconsin's groundwater law is the belief that all of our groundwater must be protected as future sources of drinking water.

Under chapter 160, Wis. Stats., the Department of Natural Resources (DNR) 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 threat to groundwater or if they are detected in groundwater, they are placed on a priority list established by DNR in conjunction with other state agencies. The numerical standards are in chapter NR 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 action.

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 appropriate responses when standards are not met. The role of each agency in implementing the groundwater standards is described below under "Wisconsin Groundwater Programs."

Under Chapter 160, Wisconsin Statues, money from the Groundwater Account of the Environmental Fund has been used for problem-assessment monitoring, regulatory monitoring, at-risk monitoring and management–practice monitoring as well as creating a data management system for collection and management of the groundwater data.

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 officials, the governor, and local and federal governments.

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.

Wisconsin Groundwater Programs

A summary of Wisconsin's Groundwater programs is provided in U.S. EPA Table 37 (5-2).

Table 37. Summary of Wisconsin's Groundwater Protection Programs (Table 5-2)

Programs or Activities	Check	Implementation Status	Responsible State Agency
Active SARA title III Program	•	E	DNR
Ambient groundwater monitoring system	•	E	DNR, DATCP, DOT, UWS, WGNHS, GCC
Aquifer Vulnerability assessment			
Aquifer mapping	•	E	WGNHS
Aquifer characterization	•	E	WGNHS
Comprehensive data management system	•	E	DNR, DATCP, DHFS,COMM, DOT, WGNHS
EPA-endorsed Core Comprehensive State Groundwater Protection Program (CSGWPP)	•	E	DNR
Groundwater discharge permits	•	E	DNR, COMM
Groundwater Best Management Practices	•	E	DNR, DATCP
Groundwater legislation	•	E	DNR, COMM, DATCP, DOT, DHFS
Groundwater classification			
Groundwater quality standards	•	E	DNR, DHFS
Interagency coordination for groundwater protection ordinances	•	E	GCC, DNR
Nonpoint source controls	•	E	DNR, DATCP
Pesticide State Management Plan	•	E	DATCP
Pollution Prevention Program	•	E	DNR
Resource Conservation and Recovery Act (RCRA) Primacy	•	E	DNR
Source Water Assessment Program	•	E	DNR
State Superfund	•	E	DNR
State RCRA Program incorporating more stringent requirements than RCRA Primacy	•	E	DNR
State septic system regulations	•	E	COMM
Underground storage tank installation requirements		E	COMM

Programs or Activities	Check	Implementation Status	Responsible State Agency
Underground Storage Tank Remediation Fund	•	E	COMM
Underground Storage Tank Permit Program	•	E	COMM
Underground Injection Control Program	•	E	DNR
Vulnerability assessment for drinking water/ wellhead protection	•	E	DNR
Well abandonment regulations	•	E	DNR
Wellhead Protection Program (EPA-approved)	•	E	DNR
Well installation regulations	•	E	DNR
Other Programs or activities (please specify)			

E – Established
CE – Continuing Effort
UD – Under Development
UR – Under Revision
DATCP – Wisconsin Department of Agriculture, Trade and Consumer Protection
DHFS - Wisconsin Department of Health and Family Services
DNR – Wisconsin Department of Natural Resources
COMM – Wisconsin Department of Commerce
DOT – Wisconsin Department of Transportation
GCC – Groundwater Coordinating Council
WGNHS – Wisconsin Geological and Natural History Survey
UWS – University of Wisconsin System

Department of Natural Resources

The DNR 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 DNR, as well as other state agencies. The groundwater section has primary responsibility for adoption of groundwater standards contained in ch. 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 into basin reports and watershed plans, and maintenance of a data management system for groundwater data.

The DNR is the lead agency for coordination of wellhead protection (WHP) and source water assessment program (SWAP) activities. Of a total 1104 community groundwater supply systems, 73, serving a combined population of 212,600, have approved WHP plans. The Source Water Assessment Program will provide information that will help communities produce high quality wellhead protection plans.

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 sites, 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 run 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 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 protecting 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 onsite 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 funds 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 DNR administer the Brownfields Site 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.

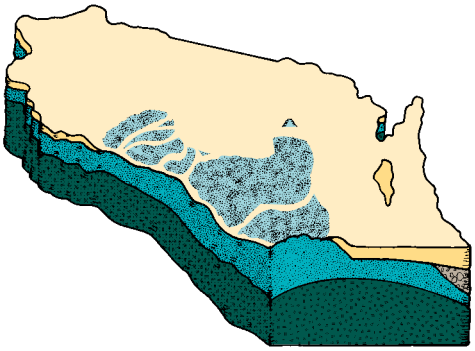
Department of Transportation

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.

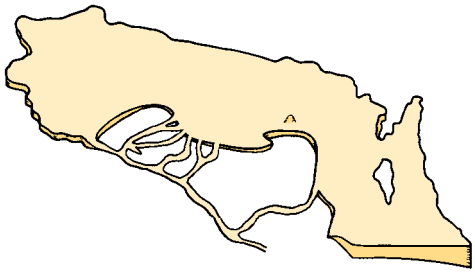
University of Wisconsin System

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.

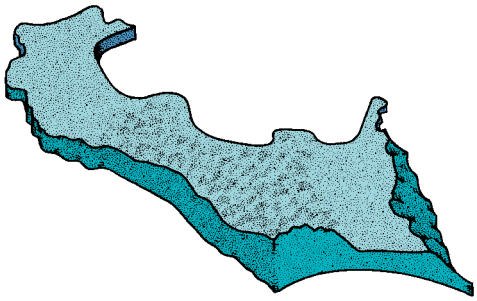
Figure 42. Wisconsin's Aquifers



Sand and gravel aquifer

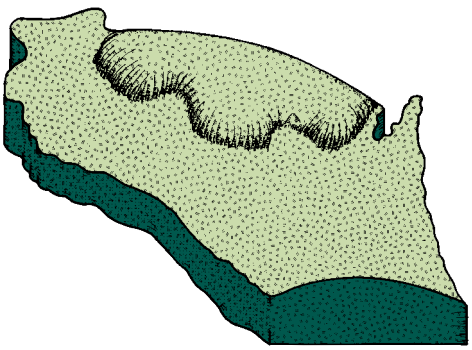


Sandstone and dolomite aquifer



Eastern dolomite aquifer

Crystalline aquifer



The guidance requests that the information in this table be provided based on aquifer or hydrogeologic setting. Wisconsin does not have this information so Table 38(5-3) is completed for the entire state.

Table 38. Groundwater Contamination Summary (Table 5-3)

Hydrogeologic Setting STATEWIDE

Spatial Description (Optional)

Map Available (optional)

Data Reporting Period As of February, 2002

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed groundwater contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL	40	40	40	Varied					
CERCLIS (non-NPL)	76	76	NA	Varied					
DOD/DOE									
LUST	18,500	18,500	NA	BTEX	18,500		18,500	5,190	13,310
RCRA corrective action	27	27	27	Varied					
Underground injection	0	0	0						
State Sites	3,400	1,000							
Non-Point Sources	NA	NA	NA						
Other (specify)									

NPL – National Priorities List
CERCLIS (non-NPL) – Comprehensive Environmental Response, Compensation and Liability Information System
DOE – Department of Energy
DOD – Department of Defense
LUST – Leaking Underground Storage Tanks
RCRA – Resource Conservation and Recovery Act
NA – Information not available

Wisconsin's Groundwater Monitoring Program

Each year since 1989, the WDNR has written a monitoring plan to identify and document the activities and priorities of its groundwater quality-monitoring program. The WDNR works with the GCC and other state agencies in evaluating existing monitoring information, available resources and future monitoring needs. Wisconsin's groundwater law identifies five groundwater-monitoring categories (s. 160.27(2), Wis. Stats.): Management practice monitoring, problem assessment monitoring, at-risk monitoring, regulatory monitoring and monitoring plan. Data collected as part of Wisconsin's monitoring plan was used to complete U.S.EPA Table 5-1 (Table 39).

Table 39. Major Sources of Groundwater Contamination (Table 5-1)

Contaminant Sources	Ten Highest-Priority Sources	Factors Considered in Selecting a Contaminant Source	Contaminants
Agricultural Activities			
Agricultural chemical facilities	•	A,C	A,B
Animal feedlots	•	A,C,D,F,G	E,J,K,M
Drainage wells	•	A,C,F	A,B,E
Fertilizer applications	•	A,C	E
Irrigation practices	•	A,C,F,H	A,B,E
Pesticide applications	•	A,C,F	A,B
On-farm agricultural mixing and loading procedures	•	A,C,D	A,B,E
Land application of manure (unregulated)	•	A,C	E,J,K,L,M*
Storage and Treatment Activities			
Land application (regulated or permitted	•	A,C,D,F	E,J,K,L,M*
Material stockpiles	•	A,C,D,E,F	H
Storage tanks (above) ground	•	A,C,G	C,D,H
Storage tanks (underground)	•	A,B,C,D,E,G	C,D,H
Surface impoundment	•	A,C,D,F,G	E,J,K,L,M*
Waste piles	•	A,C,D,F,G	E,J,K,L,M*
Waste tailings	•	A,C,D,E,F	H
Disposal Activities			
Deep injection wells	•	A,C,F,G	A,B,D,E,G,J,K,L,M*
Landfills	•	A,B,C,D,E	A,B,C,D,H,I,J,K,L,M*
Septic Systems	•	A,C,D,E	E,H,J,K,L,M*
Shallow injection wells	•	A,C,D,E,H	C,D,G,H
Other			
Hazardous waste generators	•	A,C,D,F,G	A,B,C,D,H
Hazardous waste sites	•	A,B,C,D,E,G	A,B,C,D,H,I
Large industrial facilities	•	A,C,D,F,G	A,B,C,D,E,G,H,I
Material transfer operations	•	A,C,D,F,G	H,I
Mining and mine drainage	•	A,C,D,E,F	H
Pipelines and sewer lines	•	A,B,C,F	E,J,K,L,M*
Salt storage and road salting	•	A,C,D,F	G
Salt water intrusion	•	A,C,F	G
Spills	•	A,B,C,D,F,G	A,B,C,D,E,J,K,L,M*
Transportation of materials	•	A,C,D,F,G	A,B,C,D,E,F,G,I,J,M*
Urban runoff	•	A,C,D,F,G	A,B,C,G,J,K,L,M*
Small-scale manufacturing and repair shops	•	A,C,D,F,G	C,D,H
Naturally occurring substances	•	A,B,C,D,E,F,H	G,H,I

A. Human health and/or environmental risk (toxicity)
B. Size of the population at risk
C. Location of the sources relative to drinking water sources
D. Number and or size of contaminant sources
E. Hydrogeologic sensitivity
F. State findings, other findings
G. Documented form mandatory reporting
H. Geographic distribution/occurrence
I. Other criteria (please add or describe in narrative)

A. Inorganic pesticides
B. Organic pesticides
C. Halogenated solvents
D. Petroleum compounds
E. Nitrate
F. Fluoride
G. Salinity/brine
H. Metals
I. Radionuclides
J. Bacteria
K. Protozoa
L. Viruses
M. Pharmaceuticals

Management-Practice Monitoring

The primary goal of management-practice monitoring is to evaluate management practices or provide effective management solutions to groundwater quality problems. This can include support activities like development of laboratory analyses techniques and geological resource description.

Problem-Assessment Monitoring

Problem-assessment monitoring is intended to define the nature and extent of groundwater problems in Wisconsin. Generally existing private drinking water supply wells are sampled to assess the significance of particular contaminants.

At-Risk Monitoring

At-risk monitoring is intended to define and sample at-risk potable wells in areas where substances have been detected in groundwater. At-risk and problem assessment monitoring both focus on drinking water wells. At-risk monitoring provides resources for sampling private domestic wells where there is a demonstrated concern that a well is "at-risk." Results of this monitoring are used to determine if the contamination is significant enough to warrant either Superfund or Environmental Repair fund investigations and if possible to trace the contamination back to the source.

Regulatory Monitoring

Monitoring requirements are contained in permits or administrative rules and apply to solid waste sites, hazardous waste sites and wastewater disposal facilities. This type of monitoring is used to determine if groundwater standards are exceeded at these regulated facilities and to obtain information necessary to respond at specific sites.

Monitoring Planning

Monitoring planning refers to preparing the plan for collection, management, and coordination of monitoring activities and exchange of information among other regulatory agencies.

Public Water System Data

Treated water from Wisconsin's public water systems is currently being monitored in accordance with the Federal Safe Drinking Water Act and Chapter NR 809, Wis. Adm. Code. The following table lists all the contaminants with enforceable standards that are currently regulated in Wisconsin under Administrative Code Chapter NR 809.

Table 40. Contaminants with Enforceable Standards Under NR 809 Total Coliform Rule (TCR)

Name of Contaminant	Maximum Contaminant Level (MCL) (mg/L unless noted)	Health Effects of Contaminant
Total Coliforms Fecal Coliforms Escherichia Coli	Less than 40 samples/mo., more than 1 positive. 40 samples or more a mo., more than 5% positive.	The presence of total coliform indicate that other disease causing organisms, like E. Coli, may be present in the drinking water. Total coliform detection in exceedance of the MCL triggers testing for fecal coliforms/E. Coli which are organisms associated with sewage or animal wastes.
Surface Water Treatment Rule (SWTR)		
Turbidity	1 NTU (average/mo.)	None, interferes with disinfection
Giardia lamblia Enteric Viruses Legionella Heterotrophic Plate Count	Treatment Technique	Giardiasis Gastrointestinal and other viral infections Legionnaire's Disease Gastrointestinal Infections
Lead and Copper Rule (LCR)		
Copper Lead	Treatment Technique Action Level at 1.3 for Copper and .015 for Lead	Gastrointestinal Effects, Cancer Risk, Kidney/ Nervous System Effects, Highly Toxic to Infants
Radionuclides		
Gross alpha Emitters	15 pCi/L	Cancer Risk
Gross beta particle and photon emitters	4mRem	Cancer Risk
Radium 226 plus 228	5pCi/L (combined)	Cancer Risk
Uranium	20 Ug/L (equivalent to 30 pCi/L)	Kidney Effects, Cancer Risk
Volatile Organic Compounds		
1,1-Dichloroethylene	0.007	Liver/ Kidney Effects
1,1,1-Trichloroethane	0.2	Nervous System Effects
1,1,2-Trichloroethane	0.005	Kidney/ Liver Effects
1,2-Dichloroethane	0.005	Cancer Risk
1,2-Dichloropropane	0.005	Cancer Risk
1,2,4-Trichlorobenzene	0.07	Liver/ Kidney Effects
Benzene	0.005	Cancer Risk
Carbon Tetrachloride	0.005	Cancer Risk
Chlorobenzene	0.1	Nervous System and Liver Effects
cis-1,2-Dichloroethylene	0.07	Nervous System and Liver Effects Liver/ Kidney/ Nervous/ Circulatory Effects
Dichloromethane (methylene chloride)	0.005	Cancer Risk
Ethylbenzene	0.7	Liver/ Kidney/ Nervous/ Circulatory Effects
ortho-Dichlorobenzene	0.6	Liver/ Kidney/ Blood Cell Effects
para-Dichlorobenzene	0.075	Cancer Risk

Name of Contaminant	Maximum Contaminant Level (MCL) (mg/L unless noted)	Health Effects of Contaminant
Volatile Organic Compounds		
Styrene	0.1	Liver/ Nervous System Effects
Tetrachloroethylene (PCE)	0.005	Cancer Risk
Toluene	1	Liver/ Kidney/ Nervous/ Circulatory Effects
trans-1,2-Dichloroethylene	0.1	Liver/ Kidney/ Nervous/ Circulatory Effects
Trichloroethylene (TCE)	0.005	Cancer Risk
Vinyl Chloride	0.0002	Cancer Risk
Xylenes (total)	10	Liver/ Kidney/ Nervous System Effects
Synthetic Organic Compounds (Pesticides)		
2,3,7,8-TCDD (Dioxin)	0.00000003	Cancer Risk
2,4-D	0.07	Liver/ Kidney Effects
2,4,5-TP (Silvex)	0.05	Liver/ Kidney Effects
Acrylamide	Treatment Technology	Cancer Risk/ Nervous System Effects
Alachlor	0.002	Cancer Risk
Aldicarb	0.003	Nervous System Effects
Aldicarb Sulfone	0.002	Nervous System Effects
Aldicarb Sulfoxide	0.004	Nervous System Effects
Atrazine	0.003	Liver/ Kidney/ Lung/ Cardio. Effects/ Cancer Risk
Carbofuran	0.04	Nervous/ Reproductive System Effects
Chlordane	0.002	Cancer Risk
Dalapon	0.2	Kidney/ Liver Effects
Di(2-ehtylhexyl)adipate	0.4	Liver/ Reproductive Effects
Dibromochloropropane (DBCP) (1,2-Dibromo-3-Chlorpropane)	0.0002	Cancer Risk
Diethylhexyl Phthalate	0.006	Cancer Risk
Dinoseb	0.007	Thyroid/ Reproductive Organ Effects
Diquat	0.02	Ocular/ Liver/ Kidney/ Gastrointestinal Effects
Endothall	0.1	Liver/ Kidney/ Gastrointestinal/ Reproductive Effects
Endrin	0.002	Liver/ Kidney/ Heart Effects
Epichlorohydrin	Treatment Technology	Cancer Risk
Ethylene Dibromide (EDB) (1,2-dibromoethane)	0.00005	Cancer Risk
Glyphosate	0.7	Liver/ Kidney Effects
Heptachlor	0.0004	Cancer Risk
Heptachlor Epoxide	0.0002	Cancer Risk
Hexachlorobenzene	0.001	Cancer Risk
Hexachlorocyclopentadiene (HEX)	0.05	Kidney/ Stomach Effects

Name of Contaminant	Maximum Contaminant Level (MCL) (mg/L unless noted)	Health Effects of Contaminant
Synthetic Organic Compounds (Pesticides)		
Lindane (gamma-hexachlorocyclohexane)	0.0002	Liver/ Kidney/ Nervous/ Immune/ Circulatory Effects
Methoxychlor	0.04	Liver/ Kidney/ Nervous/ Developmental Effects
Oxamyl (Vydate)	0.2	Kidney Effects
PAHs (Benzo(a)pyrene)	0.0002	Kidney/ Liver Effects
Polychlorinated Bi-Phenyls (PCBs)	0.0005	Cancer Risk
Pentachlorophenol	0.001	Cancer Risk
Picloram	0.5	Kidney/ Liver Effects
Simazine	0.004	Cancer Risk
Toxaphene	0.003	Cancer Risk
Inorganic Compounds		
Antimony	0.006	Decrease Longevity, Blood Effects
Arsenic	.050	
Asbestos (fiber length >10 um)	7 MFL	Lung Tumors/ Cancer Risk
Barium	2	Circulatory System Effects
Beryllium	0.004	Bone/ Lung Effects/ Cancer Risk
Cadmium	0.005	Kidney Effects
Chromium (total)	0.1	Liver/ Kidney/ Circulatory Effects
Cyanide	0.2	Spleen/ Brain/ Liver Effects
Fluoride	4.0	Dental Fluorosis
Mercury (total)	0.002	Kidney/ Central Nervous System Disorder
Nickel	0.1	Nervous System/ Liver Effects
Nitrate (as N)	10	Methemoglobinemia
Nitrite (as N)	1	Methemoglobinemia
Selenium	0.05	Nervous System Effects
Thallium	0.002	Kidney/ Liver/ Brain/ Intestinal Effects

U.S. EPA Table 41 (5-4) provides data from Wisconsin's public water supply database for the entire state. Information is not currently available by hydrologic setting or aquifer. Vulnerability assessments are not completed for all public wells. Information on public water system susceptibility and potential contaminant sources will become available as the Source Water Assessment Program progresses.

Table 41. (5-4): Aquifer Monitoring Data

Hydrogeologic Setting STATEWIDE

Spatial Description (optional)

Map Available (optional)

Data Reporting Period January 1, 2000 to January 1, 2002

Monitoring Date Type	Total No. of Wells used in the Assessment	Parameter Groups	Number of Wells								
			No detections of parameters above MDLs or background levels		Nitrate concentration range from background levels to less than or equal to 5 mg/l. No detections of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l. Other parameters are detected at concentrations exceeding the MDL but are ≤ the MCLs	Parameters are detected at concentrations exceeding the MCLs	Number wells removed from service	Number of wells requiring special treatment	Background parameters exceed MCLs
			ND	Number of wells in sensitive or vulnerable areas (optional)	Nitrate ≤ 5 mg/l VOC, SOC and other parameters not detected	Number of wells in sensitive or vulnerable areas (optional)					
Ambient		VOC		NA		NA					
Monitoring		SOC		NA		NA					
Network		NO_3		NA		NA					
(optional)		Other		NA		NA					
Untreated Water		VOC	23	NA	23	NA	1	1	NA	NA	NA
Quality Data from		SOC	23	NA	23	NA	1	6	NA	NA	NA
Public Water		NO_3	18	NA		NA	2	9	NA	NA	NA
Supply Wells		Other									
Finished Water		VOC	6737	NA	6737	NA	166	10	NA	NA	NA
Quality Data from		SOC	6737	NA	6737	NA	129	32	NA	NA	NA
Public Water		NO_3	6397	NA		NA	295	366	NA	NA	NA
Supply Wells		Other									

Groundwater Quality

Groundwater quality varies greatly throughout Wisconsin. Primary human-caused contaminants of concern are Volatile Organic Chemicals (VOCs), nitrate and pesticides. Iron, manganese, sulfate, arsenic and radium are naturally occurring groundwater contaminants that present health concerns present in Wisconsin groundwater. Microbial contaminants including viruses, bacteria, and parasites are becoming a concern.

Volatile Organic Chemicals

Over 80 different VOCs have been found in Wisconsin drinking water supply wells. Thirty different VOCs have been found to exceed the enforcement standard (ES), affecting over 770 drinking water supply wells. Trichloroethylene is the most common VOC detected in Wisconsin groundwater. Sources of VOCs include landfills, underground storage tanks, and hazardous substance spills.

Wisconsin has 90 active licensed solid waste landfills, all of which are required to monitor groundwater. In addition, the DNT currently tracks monitoring at 9,400 LUST sites, 4,000 waste disposal facilities and about 1,400 high priority Environmental Repair sites. Many of these sites have been identifies as sources of VOCs.

In 1998 and 1999 the DHFS sampled private wells down-gradient of 19 small, closed landfills in one Wisconsin county. Several of the private wells had sample analytical results for VOCs above the MCLs. Subsequently, 16 old, closed landfills around the state were investigated for VOC contamination. Of the 113 private wells monitored, VOCs were detected in 31 wells. Fourteen wells had VOCs in concentrations exceeding the MCLs.

Hazardous waste treatment storage and disposal facilities are another source of VOCs to groundwater. The DNR Bureau for Remediation and Redevelopment is investigation or remediating contamination at 27 sites.

Approximately 800 hazardous substance spills are reported to DNR each year. Groundwater monitoring is performed when necessary to delineate the extent of contamination.

Pesticides

Pesticide contamination of groundwater results from field applications, pesticide spills, misuse or improper storage and disposal. The most commonly detected pesticides in Wisconsin groundwater are metabolites of alachlor and metolachlor, atrazine and its metabolites, metribuzin, and cyanazine amide. Pesticide monitoring is conducted by DATCP. The following are recent monitoring studies:

Monitoring Reuse of Atrazine Prohibition Areas – DATCP is monitoring the limited reuse of the herbicide atrazine in selected areas where its use has been prohibited since 1993. Fourteen of the sites have two years of data. A statistically significant upward trend in atrazine levels occurs at eight of the sites.

Pesticide and Groundwater Impacts Study – The effect of normal pesticide application on different soil types is being monitored at 25 different sites across the state. Since 1992, over a thousand well samples have been collected and analyzed. In 2000, the last year for which data is available, eight compounds were detected in groundwater. Atrazine and nitrate were found at levels above an ES. Alachlor ESA, a break down product of alachlor, was detected in 41 of the samples. Cyanazine amide, a metabolite of cyanazine, was found in 9 percent of the samples in 2000.

The "2000/2001 Survey of Agricultural Chemicals in Wisconsin Groundwater" is a statistical analysis of pesticides in Wisconsin groundwater. Groundwater samples were collected from a stratified random sample of wells in the state. The samples were analyzed for agricultural chemicals including pesticides and nitrates. Results show that statewide an estimated 37.7% of wells sampled have detectable levels of herbicides or their metabolites. The estimate for total atrazine (atrazine and it's metabolites) is 11.6% of the wells in the state. Number of wells with total Atrazine greater than the ES is estimated at 1.1%. The total number of wells with detects of Alachlor ESA is estimated at 27.8%, Metalachlor ESA is estimated at 25.2% and nitrate greater than the ES

(10 ppm) is estimated at 14.1%. The number of wells with detects of atrazine parent compound is estimated at 5.1% and the number of wells estimated to have nitrate detects is 61.7% of the wells in the state.

Chloroacetanilide Herbicide Metabolites in Wisconsin Groundwater – In a study completed in 2000, 27 monitoring wells, 22 private drinking water wells and 23 municipal wells in Wisconsin were sampled for alachlor, metalachlor acetochlor, and their ethane sulfonic acid (ESA) and oxanillic acid (OA) metabolites. Wells were selected based on previous detections of pesticides or proximity to agricultural fields. Over 80 percent of the monitoring wells and drinking water wells contained the ESA and OA metabolites of alachlor and metolachlor. Fifty-two percent of the municipal wells had at least one herbicide detection though none exceeded the drinking water standards.

Triazine Screen Sampling – In 1991, the Wisconsin State Laboratory of Hygiene (SLOH) began a public testing program using an immuno assay screening test for triazine-based compounds. DNR groundwater databases contain more than 14,000 triazine screen results. In 42% of samples analyzed, a triazine-based compound was detected. Thirteen percent and 1.6% of sample analytical results exceeded the PAL and ES respectively.

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 of 10 mg/l and 50% exceeded the PAL of 2 mg/l. 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 parts per billion (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 10 ppb standard.

Radioactive Compounds

Two studies have been initiated by the DNR to evaluate radioactive compounds in groundwater. In 2000, DNR staff collected samples from 100 community and non-transient 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. DNR staff will sample 340 non-community non-transient 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 picocuries per liter (pCi/L).

Groundwater/Surface Water Interactions

Understanding groundwater/surface water interactions is a priority for the state of Wisconsin. Several management-practice monitoring projects dealing with groundwater/surface water interactions at specific locations in the state have been funded by the GCC joint solicitation process. These studies include:

- Assessment of Impacts on Groundwater/Lake and Wetland systems
- Groundwater-Surface Water Interactions in the Nine Springs Watershed
- Watershed-Scale Nitrate Contamination and Chloroflurocarbon Ages in the Little Plover Basin: A Study at the Groundwater/Surface Water Interface
- The Direct Effect of Agricultural Chemical on Wisconsin's Declining and Endangered Amphibians

- Relationships Between Water Quality in Stream Base Flow and Private Wells and Land use in the Tomorrow/Waupaca River Watershed
- Acute and Chronic Toxicity of Nitrate to Brook Trout (Salvelinus fontinalis)
- Importance of Groundwater in Production and Transport of Methyl Mercury in Lake Superior Tributaries
- A Basin-Scale Denitrification Budget for a Nitrate Contaminated Wisconsin Aquifer: A Study at the Groundwater/Surface Water Interface
- Effect of Clean and Polluted Groundwater on Daphnie Reproduction and Development

Groundwater Quantity

Groundwater is plentiful in Wisconsin, but concern is growing about its limits. Natural shortages of groundwater have occurred due to weather conditions and geologic setting. Human activities also cause quantity problems. Groundwater withdrawals in the Lower Fox River Valley, southeastern Wisconsin and Dane County have caused substantial decline in groundwater levels and have affected surface waters.

The Wisconsin Geological and Natural History Survey (WGNHS) and the U. S. Geological Survey (USGS) have maintained and operated a statewide groundwater observation-well network for collecting water-level measurements since 1946. The data is stored in a database and is available to the public on request. Starting in 1994, the wells were tested and for hydraulic connection with the surrounding aquifer. Well replacement was funded by the WDNR in 1999 and 2000.

Coordination of Groundwater Monitoring and Research

Four state agencies have had up to $750,000 available each year for groundwater-related monitoring or research. WDNR, UWS Groundwater Research, DATCP Pesticide Research, and Department of Commerce Sewage System research each fund groundwater monitoring and research projects. The GCC provides consistency and coordination among the funding agencies.

Future Directions in Groundwater Protection

Below are some of the priorities set by the Groundwater Coordinating Council for the most recent joint solicitation.

- **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. Through the DNR's Source Water Assessment Program, which will be implemented by 2003, this work will continue and will result in improved predictive capabilities.
- **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. However, subcommittee members are often concerned with regulatory issues that affect their communities while the GCC is a non-regulatory body limited to making recommendations to the appropriate regulatory agencies regarding groundwater issues. 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.

Wisconsin's Groundwater Summit

The Wisconsin Groundwater Coordinating Council (GCC) facilitated an important and timely event called "Wisconsin's Groundwater Summit" held on October 30, 2001 in Waukesha, WI. The purpose of the Summit was to bring together a broad representation of groundwater users and stakeholders to discuss current issues facing groundwater protection and management and to develop ideas and solutions to better protect Wisconsin's groundwater quality and quantity. Discussion was lively and wide-ranging, covering a variety of issues affecting Wisconsin's groundwater. Solutions encompassed educational efforts, research needs, data management, institutional needs, as well as policy recommendations. The discussion and materials developed as a result of the Summit will assist and guide State agencies, the university system, and the GCC in carrying out future groundwater protection programs.

135 delegates representing more than 50 agencies, organizations, and local governments attended the Summit. Groups included environmental and conservation groups, agricultural groups, industrial users, water utility groups, local and tribal government, planning agencies, state and federal agencies, and university researchers and educators.

The general format of the Summit was a set of keynote presentations and a panel discussion in the morning, followed by an afternoon of breakout sessions where participants were asked to address specific issues and suggest solutions. Quantity issues dominated the discussion in the morning session and in the breakout sessions.

Quality issues raised included emerging contaminants (pesticide metabolites, pharmaceuticals, viruses, and arsenic) and nonpoint pollution (nitrate and pesticides).

Some of the other key themes that emerged from the summit included:

- water conservation
- high capacity well reform
- reevaluating water pricing structures
- exploring options for "regionalization" of water management
- connecting land use and groundwater protection
- Smart Growth
- local government involvement
- building a "Groundwater Constituency"

- providing information and opportunities for further dialogue
- promoting innovative educational programs
- clarifying water rights related to groundwater
- strategic long term resource monitoring
- surface water connections
- recognizing ecosystem services as well as economic benefits of groundwater

Over the next year, the GCC and agency staff will be compiling results of the small group sessions, developing a set of strategic action items, and putting together full conference proceedings.

Groundwater - Conclusions

Wisconsin's comprehensive approach to groundwater protection as envisioned in Chapter 160, Wisconsin Statutes, will continue to drive state program development. Monitoring in support of identifying groundwater problems and providing solutions, defining the nature and extent of groundwater contamination problems, and insuring that groundwater standards are met at specific sites will continue. Public forums provide state agencies with information on how programs are working and what direction agencies will take in the future. Groundwater quality data and supporting hydrogeologic and contaminant mapping will continue to increase our understanding of groundwater and surface water resources in the state. In the future, groundwater data, including source water area delineations and assessments will be available to the public to improve land use planning and aquifer protection.

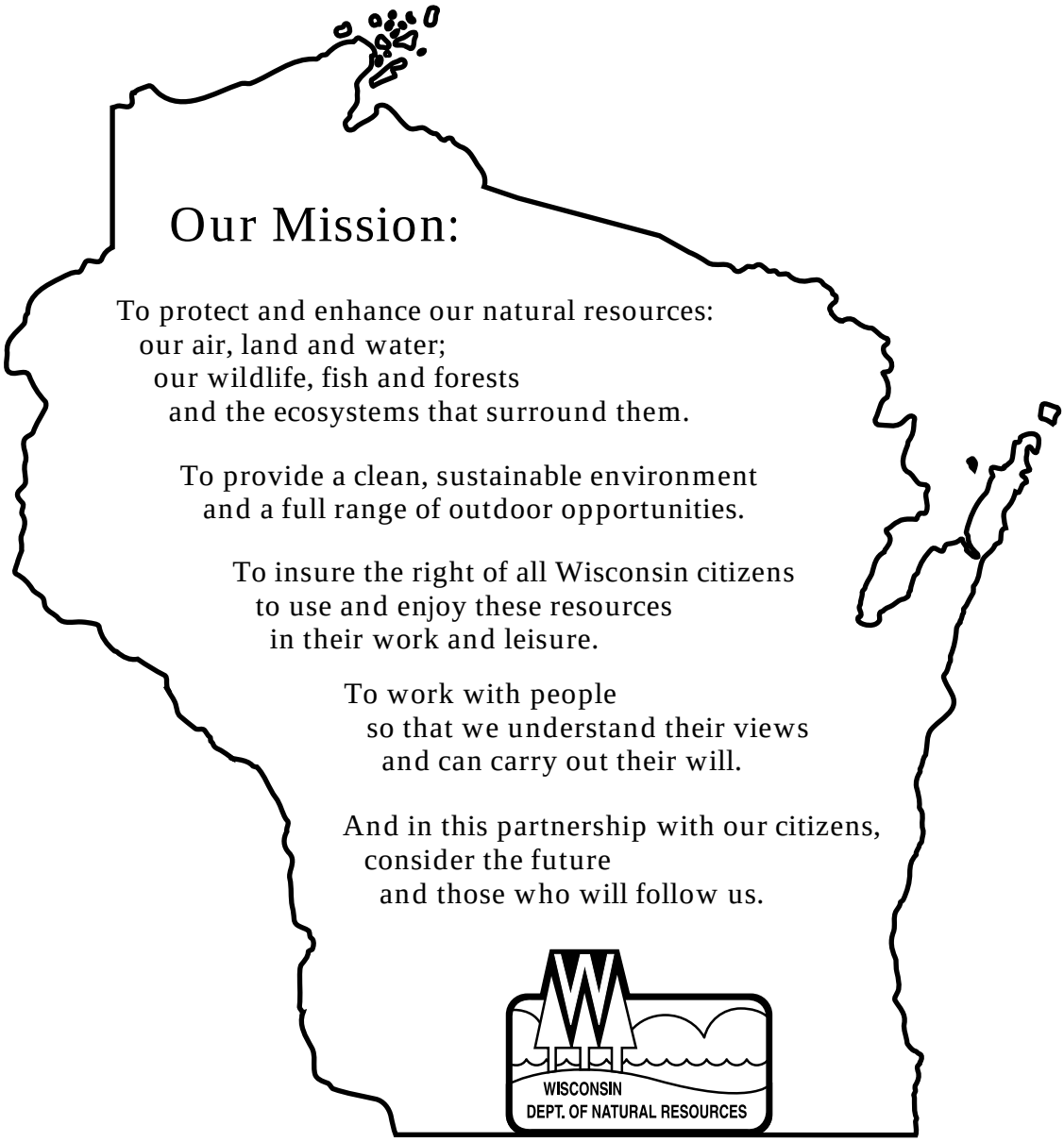
Water Quality Report to Congress - Conclusion

Recently the Wisconsin Academy of Sciences, Arts and Letters provided a forum in which over 700 citizens, policy makers, private sector, academic and governmental leaders discussed the status of and future direction for "Waters of Wisconsin" (WOW). Over 200 individuals reflecting this variety of backgrounds were involved in planning and carrying out the conference. One outcome from the Conference is the development of strategic plan which identifies specific actions for targeted areas of water management in the state. The groundswell of interest and participation in this conference reflects the changing nature of needed solutions for water protection and restoration — public/private partnerships, holistic approaches, cooperative decision making.

Immediately following the conference, Wisconsin's new governor, Jim Doyle, endorsed Wisconsin's Year of Water with the statement, "I strongly endorse designating 2003 as the Year of Water in Wisconsin. With the tremendous leadership of the Wisconsin Academy and others, I know we will take this occasion to build on the tremendous Waters of Wisconsin event, celebrate water as our most precious natural resource, participate in a statewide effort to understand and appreciate our waters, and to work together on projects that conserve and sustain our waters for future generations."

This sentiment is reflected in WDNR's commitment to continue to evolve and grow in our approach to managing surface and groundwater resources to meet the needs of both the resource and of the people of Wisconsin.

A Year of Water page has been added to the Academy website and can be found at http://www.wisconsinyearofwater.org



Our Mission:

To protect and enhance our natural resources:
our air, land and water;
our wildlife, fish and forests
and the ecosystems that surround them.

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

To insure the right of all Wisconsin citizens
to use and enjoy these resources
in their work and leisure.

To work with people
so that we understand their views
and can carry out their will.

And in this partnership with our citizens,
consider the future
and those who will follow us.

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Wisconsin Department of Natural Resources
Bureau of Watershed Management

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