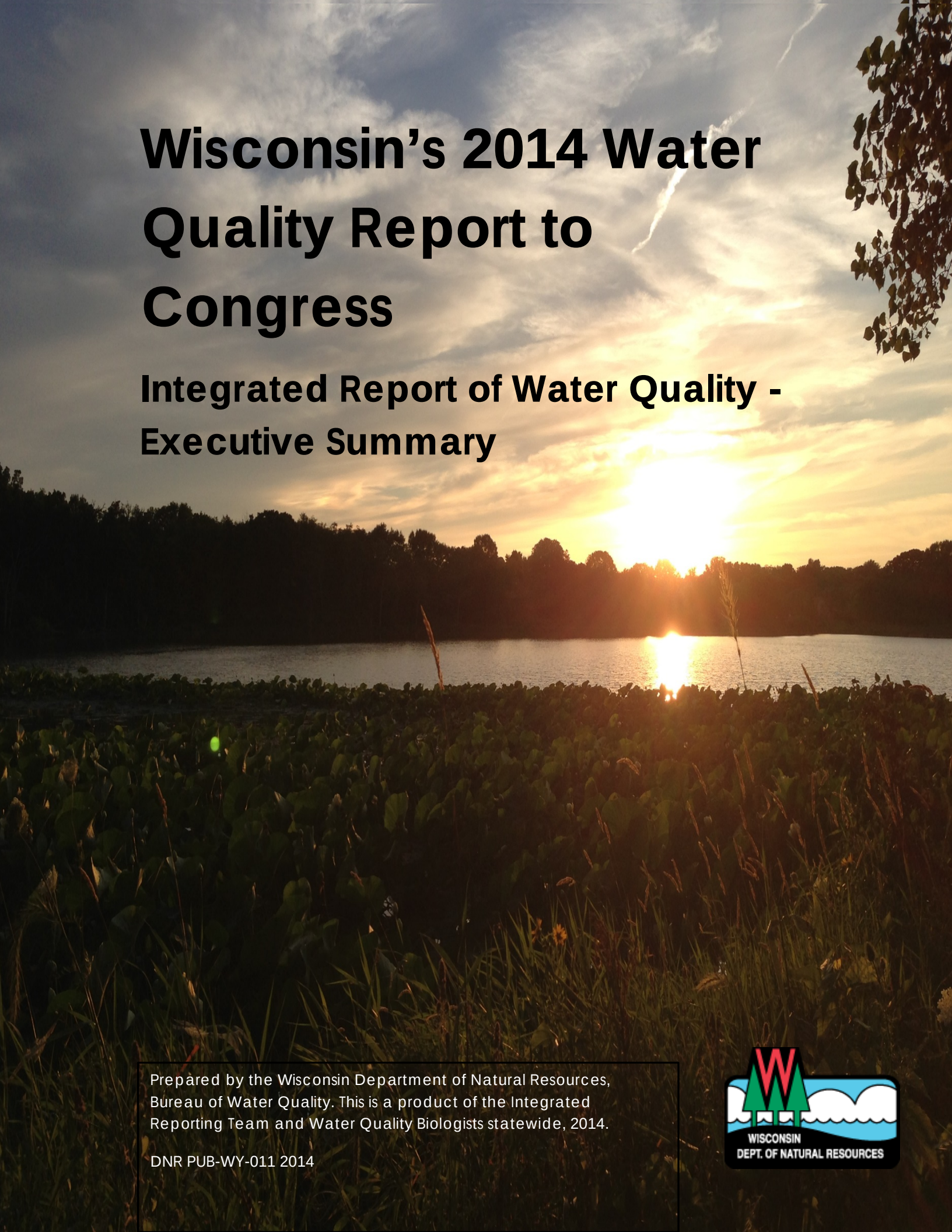

Wisconsin's 2014 Water Quality Report to Congress

Integrated Report of Water Quality - Executive Summary

Prepared by the Wisconsin Department of Natural Resources, Bureau of Water Quality. This is a product of the Integrated Reporting Team and Water Quality Biologists statewide, 2014.

DNR PUB-WY-011 2014

WISCONSIN
DEPT. OF NATURAL RESOURCES

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Photo by Lisa Helmuth 2013

Authors and contributors of this report include:

Jim Amrhein, Christina Anderson, Ashley Beranek, Tom Bernthal, Mark Binder, Donalea Dinsmore, Jennifer Filbert, Jim Fischer, Kari Fleming, Mary Gansberg, Steve Greb, Jen Hauxwell, Bryan Hartsook, Mark Hazuga, Katie Hein, Lisa Helmuth, Jeff Helmuth, Ann Hirekatur, Andrew Hudak, Casey Jones, Sudheer Kata, Jim Kreitlow, Aaron Larson, John Lyons, Kristi Minahan, Amanda Minks, Theresa Nelson, Ruth Person, Mike Shupryt, Patrick (Buzz) Sorge, John Sullivan, Susan Sylvester, Jo Temte, Brian Tinberg and all Water Quality Biologists, Water Resources Specialists and Water Program Managers.

Previous reports were published in 2012, 2010, 2008 (data submittal only), 2006, 2004, 2002, 2000, 1996, 1994, 1992, 1990, 1988, 1987, and earlier. WDNR's earlier documents are available for review at the GEF II building, 101 S. Webster Street, Madison. Later versions are available electronically.

Department name and address (central office or property):

Wisconsin Department of Natural Resources

Box 7921

Madison, WI 53707-7921

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INTRODUCTION

Wisconsin hosts bountiful natural resources, including a variety of lakes, streams, wetlands, aquifers, and springs. Every other year, the Wisconsin Department of Natural Resources (WDNR) assembles water quality information and reports status and trends to the United States Environmental Protection Agency (US EPA), which in turn shares this information with the United States Congress.

Wisconsin's 2014 Water Quality Report to Congress ("2014 Integrated Report") is available online. This digital version provides broad descriptions of water quality programs, emerging issues and new initiatives, and summary reports of current water quality conditions that are dynamically linked to WDNR's centralized databases.

The executive summary report highlights the process and results of this 2014 Biennial Water Quality Report to Congress, which was last published April 2012. The Water Quality Report to Congress fulfills reporting requirements under Sections 303(d), 305(b), and 314 of the Clean Water Act. Please note that there are live web links available throughout this report.

KEY POINTS

Wisconsin has made great strides in assessing a greater number of waters in the state. Through the combined use of careful study design, systematic assessment protocols, and innovative information technology tools that expedite the assessment and documentation process, more rivers, streams, and lakes have been assessed in this 2014 cycle than in previous cycles.

- In the area of rivers and streams, the Water Program has used a random stratified sample design to select its monitoring sites for river and stream condition. This study design provides data for "representative" stream conditions based on factors including the 'natural community' (temperature and flow characteristics of the stream), ecoregion, and other key variables. Experts have analyzed results from a multi-year study to find that most severe, and statistically significant stressors to macroinvertebrate condition (ie. degraded biological condition) are elevated total phosphorus concentrations, low dissolved oxygen levels, and degraded physical habitat. The most severe, and statistically significant, stressors to fish condition in the study were degraded physical habitat and low dissolved oxygen levels. In addition to these key findings, the study highlighted an optimal number of sites needed to represent conditions which will reduce the number of monitoring locations needed. By reducing the number of sites monitored, experts will be able to collect a richer array of data at each site, which will provide greater information about the resource. More information about the state's natural community random stratified sample design and results can be found in this River and Stream Monitoring Presentation.

- The number of assessed waters in Wisconsin also jumped dramatically this year due to a greater use of automated analysis, systematic decision making, and investments in information technology tools. For example, the Department uses a customized "assessment package" that generates trophic state index values (TSI values) for lakes in the state. TSI values are usually ascertained by comparing the results of sample data

against a set of condition thresholds derived from Carlson's Trophic Status Index. However, as in other states such as Michigan and Minnesota, Wisconsin routinely processes TSI values extrapolated from satellite imagery correlated with Secchi depth readings gathered by Citizen Lake Monitoring Network volunteers. These data are used to calculate general assessments for fish and aquatic life use assessments for lakes. This method provided the state with over 6,000 new lake assessments in 2014, bringing the number of lakes assessed to approximately 85%. This is an extraordinary accomplishment, particularly given the magnitude of waters in the state and the technical work involved in the analysis.

- In addition to the random stratified sample work and the satellite imagery work for lakes, water quality attainment analyses for rivers and streams, using a more automated approach for biological indicators took a great leap forward in 2014. Using assessment protocols programmed into the WDNR's fish database, its SWIMS database, and its assessment database (WATERS), more rivers and streams were analyzed for biological use condition than in any previous year to date. Experts matched calculations from fish surveys, such as the cold water index of biological integrity, and an analysis of aquatic macroinvertebrates (aquatic insects) to the type of stream that was sampled to make condition determinations on hundreds of miles of waters never before analyzed.

- Federal/State partnership efforts were used to design and implement cost-effective monitoring protocols that accurately gaged the health of Wisconsin's waters. USEPA and WDNR collaborated on two pilot studies carried out to optimize the number, type, and intensity of monitoring sites in a given catchment or hydrologic area to best understand the quality or condition of surface water using the least human power and least funding possible. Two studies in the Pecatonica and Yellow River Watersheds are posted on the 2014 Integrated Report website.

- Far reaching progress has been made to support the development and implementation of TMDLs in the state, including outstanding work on development of the Wisconsin River TMDL, far-reaching partnership outreach on the Rock River Recovery Plan, the creation of procedures, guidelines and protocols for the issuance of WPDES permits, and alternative measures such as adaptive management and water quality trading, for impaired waters. New procedures and rules were created to support the statewide variance on phosphorus limits now in effect.

- The long-standing collaboration between the Bureau of Science Services and the Bureaus of Water Quality and Fisheries Management has created an entirely new, innovative approach to the assignment of stream natural communities using a temperature and stream flow model (with an abundance of additional attributes) which guides water quality specialists in the assessment of water condition. Scientists have identified customized fish indices of biological integrity to coincide with specific natural community assignments from the stream model. Predicted temperature and flow "windows" coincide with an expected assemblage of fish species. When biologists study the water and fail to find the fish species predicted by the model, they go through a model assignment validation process to decide whether to adjust the natural community based on landscape and weather variables or to rate the stream condition value as

"poor" (due to the paucity or differences in fish species found at the site). The use of highly customized fish indices, along with Wisconsin's own stream macroinvertebrate index of biological integrity, has revolutionized and systematized Wisconsin's approach to water quality biological condition assessments. This work is cutting edge and places our state among very few in the nation with such an automated science-based and information technology savvy assessment and reporting framework.

- Significant efforts to implement the phosphorus rule have been made through the enhanced monitoring and assessment protocols for this 2014 report. Key protocols include desktop gap analyses, use of volunteer monitoring support for data collection, and automated phosphorus packages that conduct statistical analyses of multi-year evaluations of phosphorus on streams against existing ambient river and stream standards. This work has led to a robust list of recommended waters that fall short of meeting water quality standards. This conservative yet protective approach to identify and declare waters impaired, and to highlight future waters for further analyses, was a significant workload that fulfilled water quality strategic plan goals and performance measures.

WATER QUALITY STANDARDS

Water quality standards help protect Wisconsin's water resources from pollution and support the requirements of the Clean Water Act, by:

- Determining the types of activities the water should support, also commonly referred to as a waterbody's "Designated Uses"
- Developing water quality criteria to protect these Designated Uses from excess pollution
- Establishing an antidegradation policy to maintain and protect existing uses and high quality waters

Water quality standards for surface waters are outlined in Chapters NR 102, 104, and 105 of the Wisconsin Administrative Code. Water quality standards serve as the benchmark in determining the health of the waterbody, helping to identify a range of conditions from the highest quality waters (Outstanding and Exceptional Resources Waters) to the impaired waters of the State.

DESIGNATED USES

As part of water quality standards, each waterbody is assigned a Designated Use. Classifying waters into each Designated Use category involves science that reflects an evaluation of the resource and its natural characteristics. Wisconsin's current designated uses are:

- Fish and Aquatic Life: All surface waters are considered appropriate for the protection of fish and other aquatic life. Surface waters vary naturally with respect to factors like temperature, flow, habitat, and water chemistry. This variation allows different types of Fish and Aquatic Life communities to be supported. Five subcategories for fish and aquatic life uses are outlined in s. NR 102.04, Wis. Adm. Code.

- Recreational Use: All surface waters are considered appropriate for recreational use unless a sanitary survey has been completed to show that humans are unlikely to participate in activities requiring full body immersion.
- Public Health and Welfare: All surface waters are considered appropriate to protect for incidental contact and ingestion by humans. All waters of the Great Lakes as well as a small number of inland waterbodies are identified as public water supplies and have associated water quality criteria to protect human health; fish consumption use falls under this category.
- Wildlife: All surface waters are considered appropriate for the protection of wildlife that relies directly on the water to exist, or relies on it to provide food for existence.

ASSESSMENT METHODOLOGY

Chapter NR 102, Wisconsin Administrative Code, establishes water quality standards for surface waters of the State, and describes the Designated Use categories and the water quality criteria necessary to support these uses. The State is responsible for assigning designated uses, and conducting periodic assessments of these uses on individual waterbodies. Implementation of our surface water quality standards is described in various guidance documents, including guidance on assessment of surface water quality data against applicable water quality standards.

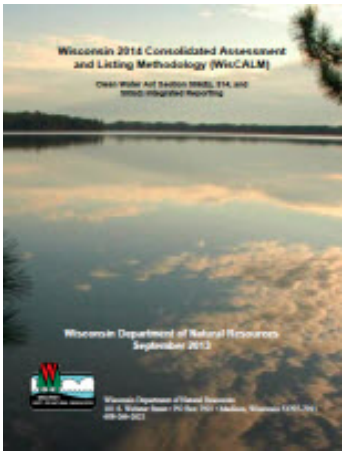


FIGURE 1 WISCALM 2014 [CLICK TO OPEN]

WDNR's water quality assessment goal is to use clearly defined and publicly accessible methods for collection and analysis of data to ensure scientifically defensible assessment decisions. Wisconsin's Consolidated Assessment and Listing Methodology (WisCALM) was updated in 2014. WDNR's website provides a full version of the.

WISCALM – YEAR 2014 CHANGES TO ASSESSMENT METHODOLOGY

- Clarifications of and revisions to minimum data requirements and assessment methods for water temperature and dissolved oxygen.
- Updates to describe revised protocols for assessment of fish and aquatic life and recreation uses based on total phosphorus, chlorophyll, and macrophyte data.
- Creation of a new reporting category for impaired waters within watershed improvement project areas for which TMDL development would be a low priority.
- Revisions to incorporate updated stream natural community classifications and corresponding assessment tools, including the coolwater fish biotic index and nonwadeable macroinvertebrate biotic index, as well as, applicable condition category and listing thresholds.
- Explanation of how WDNR will resolve any data gaps left after determining samples are unrepresentative.

Data Used for Assessment

Data submitted by the public and data collected through WDNR's monitoring program is used for assessments. The monitoring data used to make assessment decisions is stored in the Surface Water Integrated Monitoring System (SWIMS) and the Fisheries Database. Assessment data for the State's Integrated Report are stored in the State's Water Assessment, Tracking and Electronic Report System (WATERS). The public can view spatial (or GIS) data and written information about each waterbody using the WDNR's interactive mapping tool, the Surface Water Data Viewer (SWDV) and the searchable water detail pages: (http://WDNR.wi.gov/water/watersearch.aspx). WDNR staff ensures all data used for assessments meet quality assurance requirements and data are representative of current conditions.

Agencies and individuals submitting data for assessments must: meet minimum data requirements, demonstrate that sample collection occurred at appropriate sites, during appropriate periods, and use certified laboratories for sample analysis. If the quality assurance procedures are not adequate, staff may use this data to initiate further investigations by Department staff. If quality assurance procedures are adequate, WDNR may use this data to assess the water for possible impairment listing.

WDNR may assist outside groups in the design and implementation of data quality procedures necessary for data to be used for assessments. Department staff will consult with USEPA water quality criteria guidance, state WQS, and use professional judgment to interpret the results of field sampling to determine whether or not WQS are achieved. Groups outside of WDNR who regularly collect and submit data to WDNR may work with staff at Central Office to upload data into the SWIMS database to be considered as part of our evaluation and assessment process.

Wisconsin WDNR Biologists have exceptional knowledge of aquatic resources.

WDNR also supports a Citizen Based Monitoring Program for rivers, streams and lakes. As stated in the WDNR's Water Resources Monitoring Strategy for Wisconsin, "If citizens follow defined methodology and quality assurance procedures, their data will be stored in a Department database and used in the same manner as any Department-collected data for status and trends monitoring defined in the Strategy." Citizen data are currently used for water quality assessments, including broad-scale statewide assessments.

Statewide Designated Use Support Status

The vast number of water resources in the state precludes monitoring and assessing all waters within a reasonable timeframe. WDNR generally prioritizes the collection of water quality data for waters within targeted watershed areas, or waters within areas that are showing degradation or impairment. Over time, additional waters will be monitored, assessed and updated in the assessment database to ensure the documentation of the state's water conditions are as comprehensive as possible.

WDNR uses four levels of condition in describing a waterbody's current status within the overall water quality continuum. Waters assigned the condition category of "excellent" are considered to be attaining applicable WQS and fully supporting their assessed designated uses. Waters assigned the condition category of "good" or "fair" are also considered to be attaining applicable WQS and supporting their assessed designated uses. Waters assigned the poor condition category may not be attaining WQS or assessed designated use(s). Waters determined to be in poor condition are further evaluated and may be selected for additional monitoring or, if the limited dataset includes overwhelming evidence of impairment (e.g. large magnitude of exceedance), considered "impaired" and added to Wisconsin's Impaired Waters List.

A major goal of the federal Clean Water Act—securing water quality so that our resources are fishable and swimmable—is represented by Wisconsin's designated uses for recreation and fish and aquatic life. A third designated use, public health and welfare, was assessed to a very limited degree. While not an official designated use, fish consumption was also analyzed. Waters are placed in one of the following condition groups, depending on results:

- Fully supporting
- Supporting
- Not supporting
- Not assessed

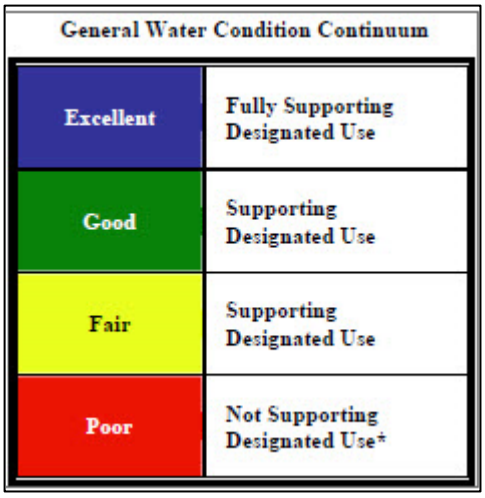


FIGURE 2 CONDITION ARRAY

When water quality criteria for the protection of a designated use are not met, the water is considered "**not supporting**" or "**impaired**". Fish consumption is considered "not supporting" where specific consumption advice is in effect due to elevated contaminants in fish tissue.

STREAMS AND RIVERS ASSESSMENTS FOR DESIGNATED USES

The state contains an estimated 88,000 stream miles from approximately 54,000 discrete rivers and streams; however, fewer stream miles (42,468) are delineated and documented in the Department's WATERS database. However, the database contains a majority of the larger stream and rivers in the state.

Fish and aquatic life (FAL) use is the primary assessed use in streams/rivers – 19,625 stream miles (46% of stream miles in the WATERS database) have been assessed for FAL use support (Table 1 and Figure 3). Of the stream miles assessed, approximately 70% are supporting FAL uses. The FAL use assessments are primarily based on Indices of Biotic Integrity calculated from

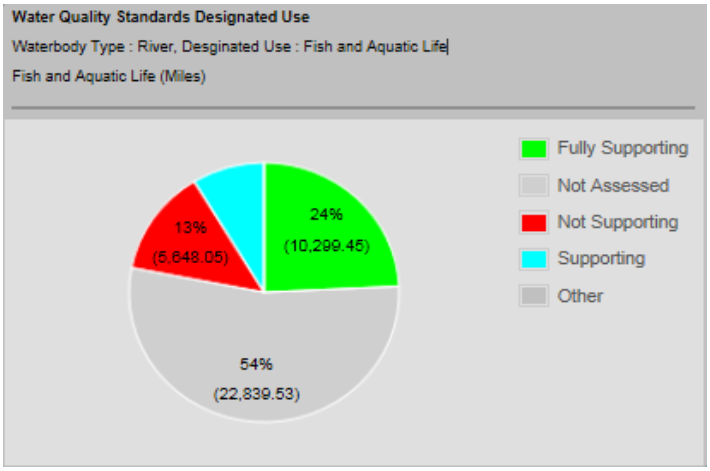


FIGURE 3 RIVER - FISH AND AQUATIC LIFE USES

macroinvertebrate sample and fish survey data. A very small amount of stream miles have been assessed for fish consumption and recreational uses, as these assessments are often conducted in response to a known problem or specific program need, such as a county health department monitoring program for swimming uses.

Table 1. Stream and river miles assessed for designated uses (see also Figure 3).

Assessed Uses	Fully Supporting	Supporting	Not Supporting	Not Assessed	Total Size
Fish and Aquatic Life	10,299	3,677	5,648	22,844	42,468
Recreation	4	9	120	42,334	42,468
Fish Consumption	11	122	1,250	41,084	42,468
General*	0	0	231	42,237	42,468

* "General Use" is used in this instance for ambient water quality criteria exceedances in the Mississippi River.

Lakes Assessments for Designated Uses

Recreation and fish and aquatic life (FAL) uses are the primary designated uses assessed for lakes (Table 2 and Figure 4). WDNR assessed FAL use of 793,899 lake acres using a combination of in-lake water quality samples and water clarity data gathered from satellite imagery. Wisconsin's Citizen Lake Monitoring Network data, combined with satellite imagery analysis developed by the WDNR's Bureau of Science Services, contributed greatly to the 2014 assessments. Over 1,200 volunteers who sample 800 lake stations each year; this data is extrapolated based on modeling techniques with satellite data to provide assessments for over 6,000 lakes in the state. Based on these assessments, approximately 69% of assessed lake acres are supporting the FAL use. The recreation use of over 50,000 acres of additional lakes was assessed in this reporting cycle.

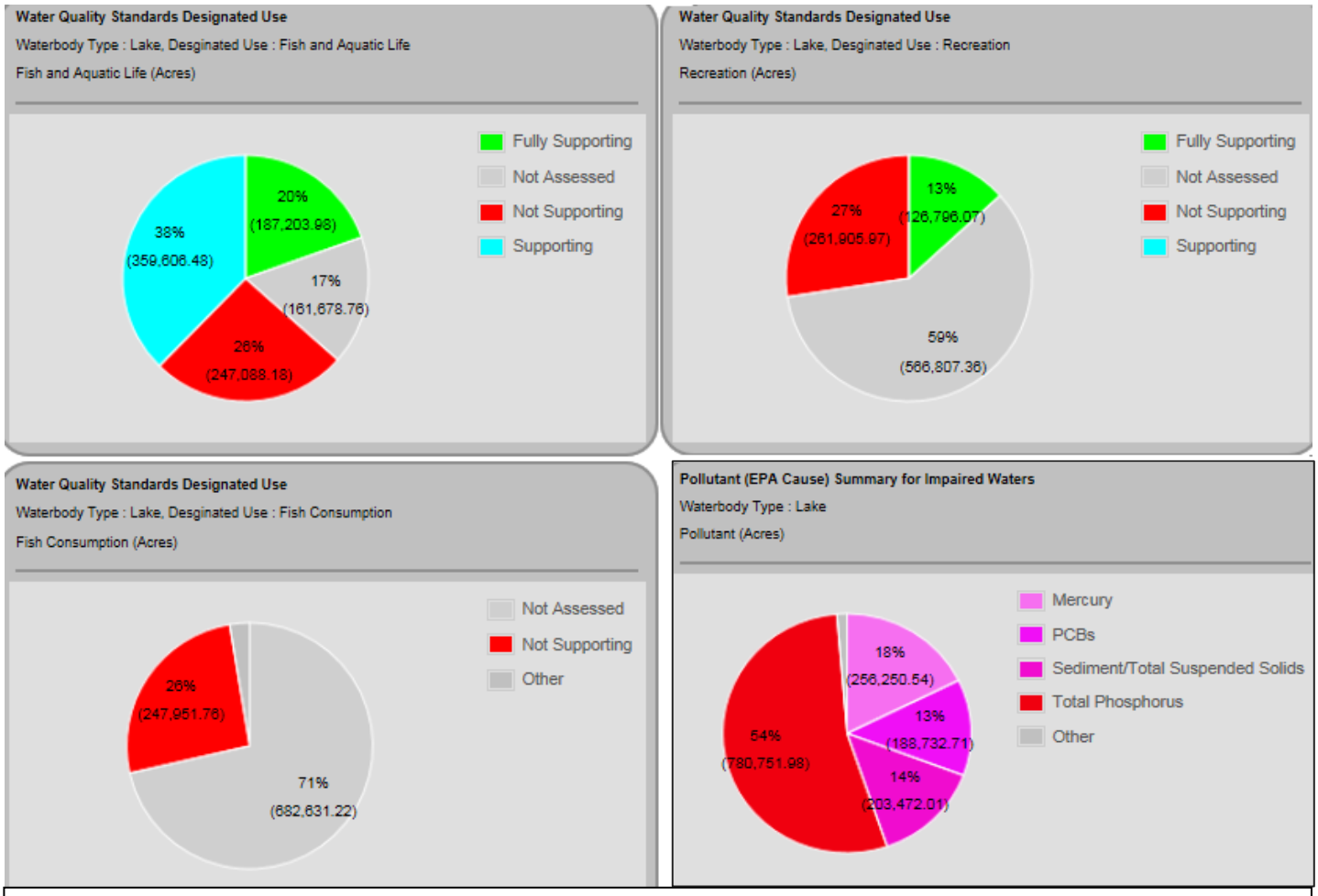
Table 2. Lake acres assessed for designated uses.

Assessed Uses	Fully Supporting	Supporting	Not Supporting	Not Assessed	Total Size
Fish and Aquatic Life	187,204	359,606	247,088	161,679	955,577
Recreation	126,796	68	261,906	566,807	955,577
Fish Consumption	7,437	17,558	247,952	682,631	955,577

The number of assessed waters in Wisconsin also jumped dramatically this year due to the greater use of automated analysis, systematic decision making, and investments in information technology tools. For example, the Department uses a customized "assessment package" that generates trophic state index values (TSI values) for lakes in the state. TSI values are usually ascertained by comparing the results of sample data against a set of condition thresholds derived from Carlson's Trophic Status Index. However, as in other states such as Michigan and Minnesota, Wisconsin routinely processes TSI values extrapolated from satellite imagery correlated with Secchi depth readings gathered by Citizen Lake Monitoring Network volunteers. These data are used to calculate general assessments for lake fish and aquatic life use. This method provided the state with significantly more lake assessments in 2014, bringing the

number of lakes assessed for fishable, swimmable waters to over 80%. This is a significant accomplishment, particularly given the magnitude of waters in the state and the technical work involved in the analysis.

FIGURE 4 LAKE DESIGNATED USE ASSESSMENTS



Only 17% of lakes are not assessed for fishable, swimmable uses. Use of the TSI package with satellite imagery analysis by the Bureau of Science Services has significantly improved Wisconsin's assessment coverage for lakes over the years. Primary pollutants include total phosphorus, sediment, PCBs and mercury.

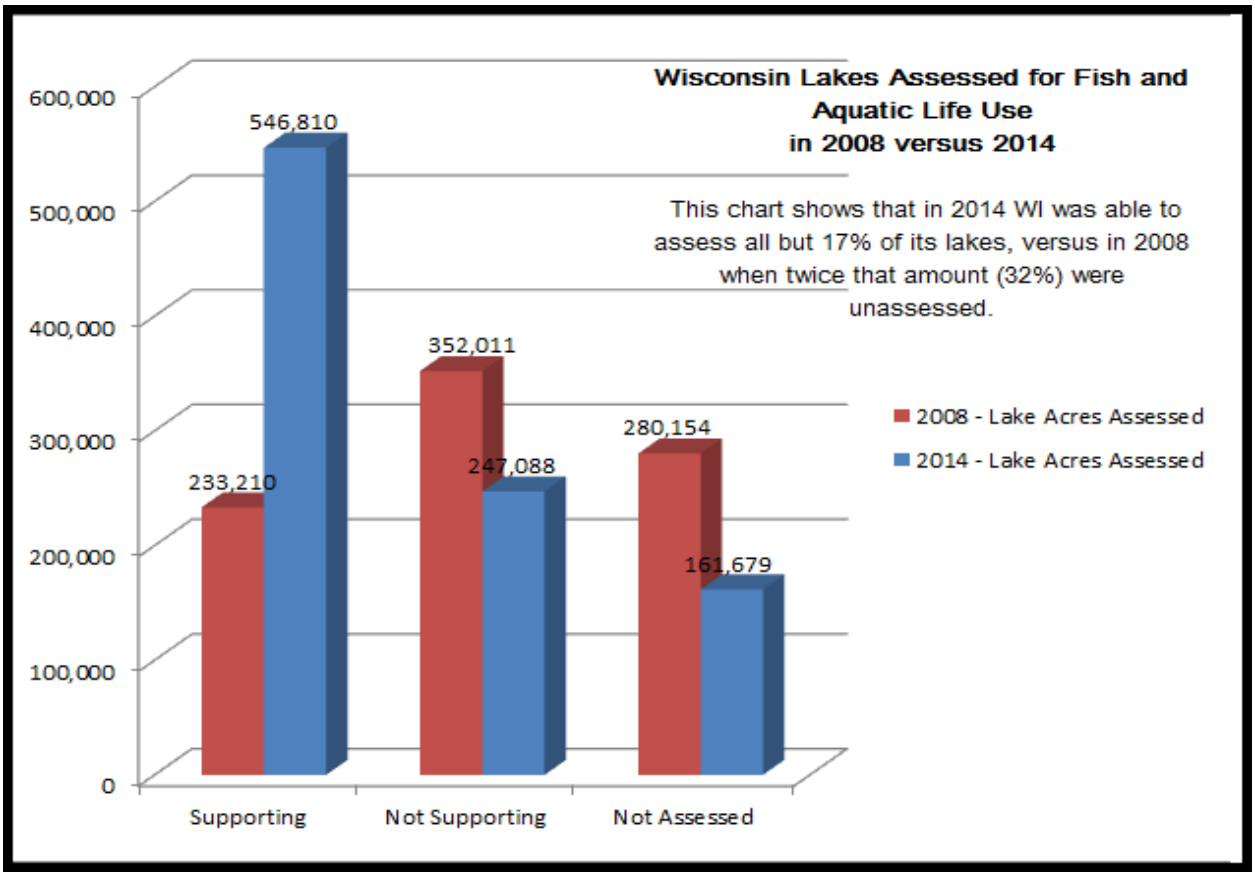


FIGURE 5 GRAPH OF LAKES ASSESSED IN 2008 VERSUS 2014

Wisconsin has increased the percent of lakes assessed and in doing so has identified that more nearly double the amount of lakes meet fish and aquatic life than previously thought.

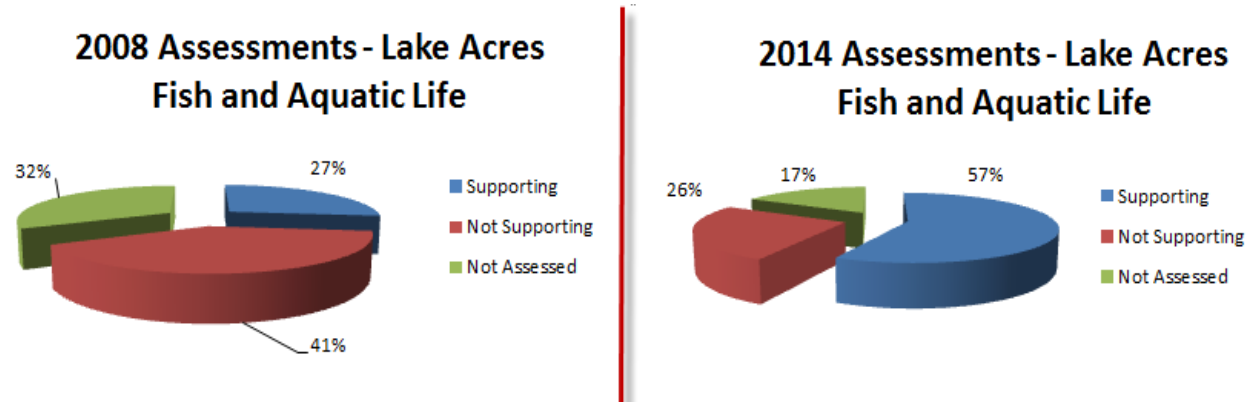


FIGURE 6 PIE CHARTS OF LAKES ASSESSMENTS

IMPOUNDMENT ASSESSMENTS FOR DESIGNATED USES

Impoundments are bodies of water created by structures (dams) which hold water either permanently or in a controlled fashion. Many of Wisconsin's large impoundments provide electricity service, controlled through the FERC process. Similar to natural lakes, WDNR primarily assesses the recreation and fish and aquatic life (FAL) uses for impoundments. Due to landscape and morphological features of impoundments (sediment transport, collection of nutrients and algal debris, a majority of impoundments assessed do not support fishing and swimming and are listed as impaired (75,139 acres, 63%) and a large majority of impoundments assessed (83,064 acres or 95%) do not support recreation use (Table 3). Due, in part, to the accumulation of sediment behind riverine structures and proclivity of pollutants (organic contaminants and metals) to attach to sediment, a large proportion of impoundments (80,906 acres or 89%) do not support fish consumption (i.e., these waters have specific advise that recommend strict limits on the number and type of fish consumed).

FIGURE 7 IMPOUNDMENT ASSESSMENTS

As the table 3 below and figure 7 indicate, a large proportion of impoundment acres are impaired, with the primary pollutants polychlorinated hydrocarbons (PCBs), total phosphorus, dioxin, and mercury.

Table 3. Summary of impoundment acres assessed and designated use support status.

Assessed Uses	Fully Supporting	Supporting	Not Supporting	Not Assessed	Total Size
Fish and Aquatic Life	19,174	24,878	75,139	3,964	123,155
Recreation	4,131	65	83,064	35,896	123,155
Fish Consumption	0	9,654	80,906	32,595	123,155

BEACHES ASSESSMENTS FOR DESIGNATED USES

Wisconsin's beaches provide wildlife habitat, recreation areas and tourist destinations. Beaches are especially vulnerable to agricultural, urban and industrial land uses, and some of our beaches are showing the effects of improper land management practices. Still, of the approximately 55 miles of Great Lake and inland beaches assessed, 39 miles (71%) supported recreation use. Conversely, 16 miles (29%) of beaches did not support recreation use, primarily due to elevated levels of *E. coli* – a bacterial indicator of potential risks to human health (Table 4) and Figure 8.

Table 4. Great Lakes and Inland Beach miles assessed for recreational use.

Assessed Uses	Fully Supporting	Supporting	Not Supporting	Not Assessed	Total Size
Recreation	34	5	16	2	57

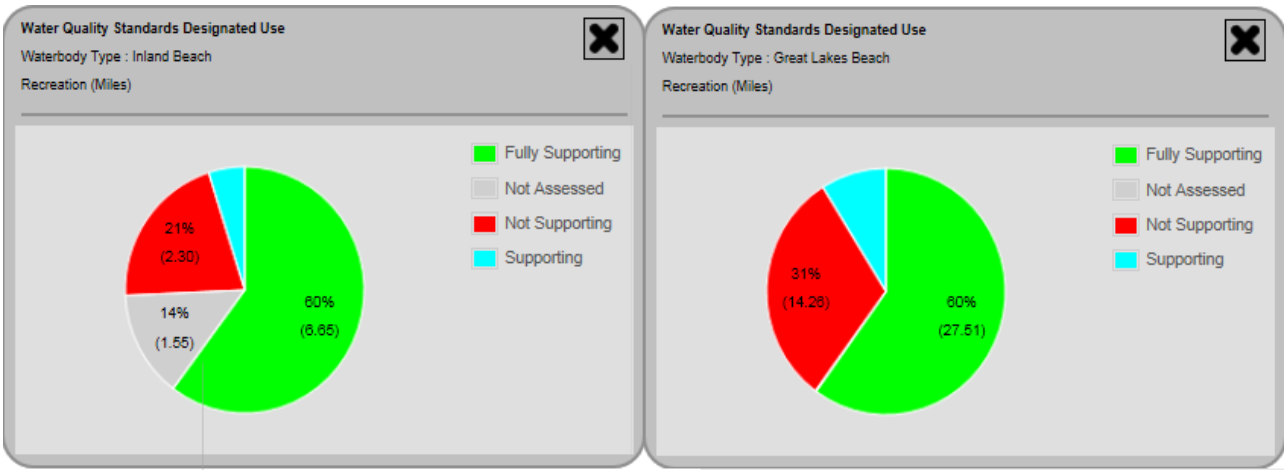


FIGURE 8 BEACH ASSESSMENT MILES

Great Lakes Shoreline Assessments for Designated Uses

Wisconsin has roughly 1,000 miles of Great Lakes Shoreline, with only a fraction of those shoreline miles considered assessed for Fish and Aquatic Life uses (see Table 5 and Figure 9). Many of these waters' fish and aquatic life uses are impaired due to sediment contamination from historic discharges or "legacy" pollutants. As staff and fiscal resources allow, WDNR will conduct a more comprehensive assessment of the Great Lakes shorelines in the future.

Table 5. Great Lakes shoreline miles assessed and designated use support status.

Assessed Uses	Fully Supporting	Supporting	Not Supporting	Not Assessed	Total Size
Fish and Aquatic Life	0	112	0	856	968
Fish Consumption	0	0	268	700	968

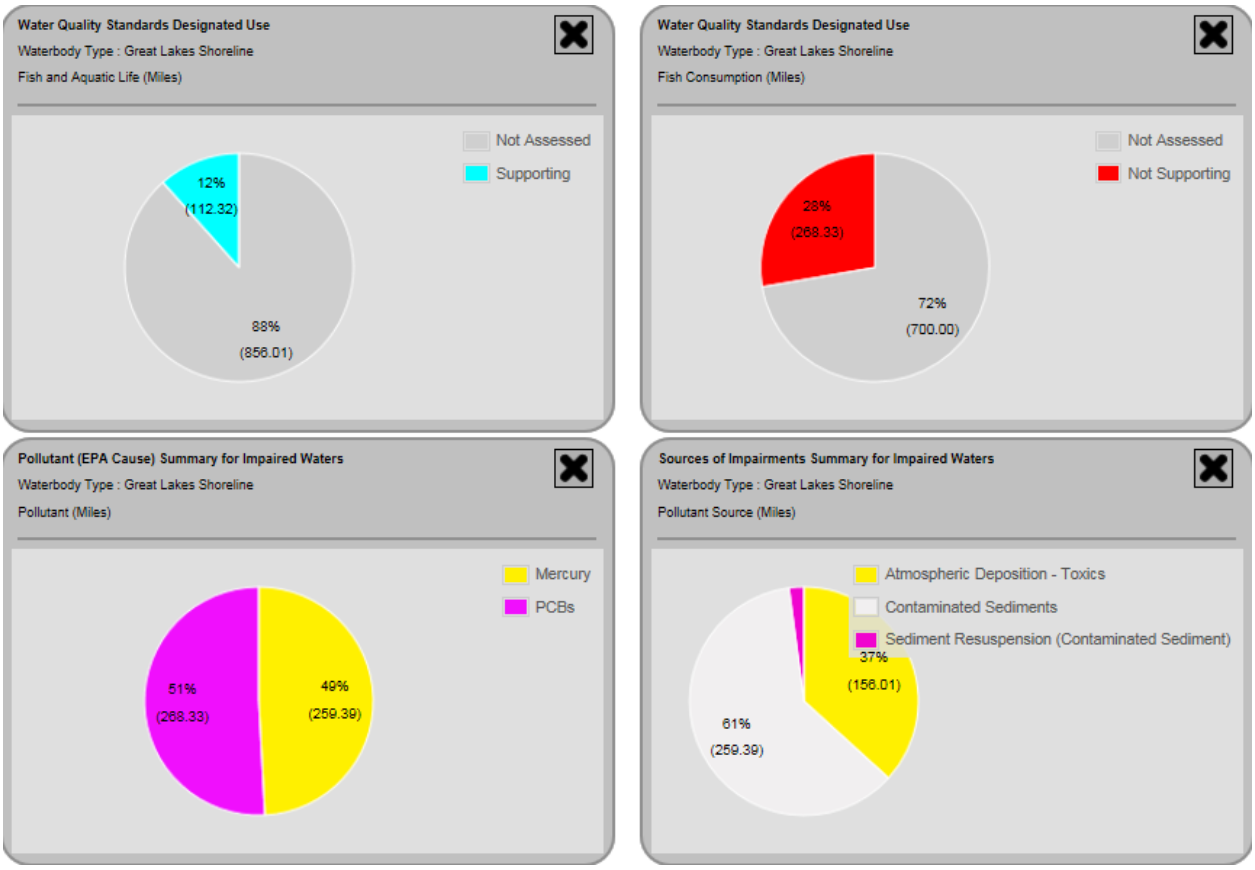


FIGURE 8 GREAT LAKES SHORELINE MILES

Great Lakes shoreline miles are selectively assessed, with major focus on contaminated harbors and bays and other areas included in the Great Lakes Water Quality Agreement's Areas of Concern. As the charts indicate, on Great Lakes Shorelines, fish consumption is the primary designated use that is 'impaired' with mercury and PCBs, the primary pollutants, stemming from in-place contaminated sediment, atmospheric deposition, or suspension of in-place sediments.

STATEWIDE CONDITION ASSESSMENTS

LAKE TROPHIC STATUS

Wisconsin bases its general condition assessment of lakes on the Carlson Trophic State Index (TSI). The Carlson TSI is the most commonly used index of eutrophication (i.e., primary production via photosynthesis). A TSI value is calculated for each of the following indicators: chlorophyll concentration, Secchi depth and satellite-derived estimates of water clarity data. Because TSI is an indicator of algal biomass, typically the chlorophyll-based TSI value is a better predictor than Secchi depth or satellite data; however, water clarity as measured by Secchi depth or satellite is a practical measure of algal production and water color. Algal production is known to be highly correlated with nutrient levels. High levels of nutrients can lead to eutrophication and blue-green algae blooms. This limits the amount of available light to macrophytes and adversely affects other aquatic organisms. Information from each of these parameters is valuable because the interrelationships between them can be used to identify other environmental factors that may influence algal biomass.

TSI values range from low (less than 30), representing very clear and nutrient-poor lakes, to high (greater than 70), and representing extremely productive and nutrient-rich lakes. Wisconsin uses a categorization scheme using "natural communities" which provides a more accurate "fit" for TSI values with lake potential – attainable use. Each lake natural community has its own condition thresholds for TSI values. Even with the natural community schematic in place, very few lakes in Wisconsin are naturally "very clear, nutrient poor lakes." The cutoff for excellent TSI values would certainly include these lakes but also includes some lakes in the mesotrophic category, based on sediment core data which indicates that some lakes are naturally more productive than others.

Table 6. Trophic Status of Wisconsin Lakes

Number of Lakes and Trophic Status	
Trophic Status	**# lakes**
Eutrophic	2,159
Hypereutrophic	104
Mesotrophic	3,781
Oligotrophic	255
Grand Total (Number of Lakes)	6,299

Number of Lake Acres	
Trophic Status	**Total Acres**
Eutrophic	569,498.9
Hypereutrophic	302,21.83
Mesotrophic	311,692.7
Oligotrophic	67,202.6
Grand Total	978,616.1

STREAM BIOLOGICAL CONDITIONS

WDNR began a monitoring program in 2010 to assess the condition of wadeable streams across the state using a probabilistic design called the Natural Community Stratified Random (NCSR) monitoring program. The NCSR program design included monitoring at approximately 550 sites over four years that were spatially stratified to cover the entire stream, geographic, and land use types found throughout the state (Figure 10). By using a probabilistic design the State was able to use the results to determine the overall the physical, chemical & biological condition of Wisconsin's wadeable, perennial streams.

Biologic assemblages (macroinvertebrates and fish) were assessed using Indices of Biotic Integrity (IBI) that are unique to the assemblage and stream type (i.e., natural community). Based on macroinvertebrate IBI scores, 18% of streams, by length, are in poor condition. Based on fish IBI scores, *32% of streams are estimated to be in poor condition.* These results are comparable to the designated use support assessments that show approximately 29% of all assessed stream miles (see Table 1) are not supporting the fish and aquatic life use.

The NCSR study was also used to determine whether a measured stressor, such as a pollutant of concern, is severe enough to cause a significant level of risk to the health of a biological assemblage (e.g., fish or macroinvertebrates). A statistic called *Relative Risk (RR)* was used to measure the increased probability that a biologic assemblage will be in poor condition if the stressor is also in poor condition. ***The results show that the most severe, and statistically significant, stressors to macroinvertebrate condition were elevated total phosphorus concentrations, low dissolved oxygen levels, and degraded physical habitat.*** The most severe, and statistically significant, stressors to ***fish condition were found to be degraded physical habitat and low dissolved oxygen levels.***

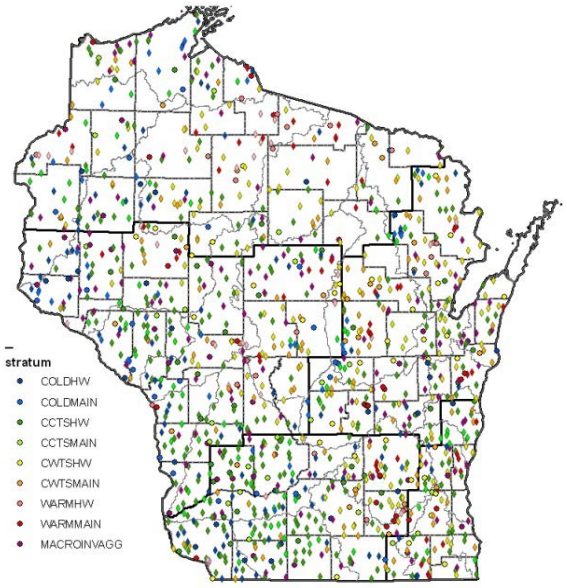


FIGURE 9 NATURAL COMMUNITY SITES 5 YEARS OF SAMPLING

LONG-TERM TREND WATER QUALITY MONITORING

LAKE LONG-TERM TREND (LTT) NETWORK

Sixty-three lakes across the state have been monitored annually for water quality over the long-term. One lake has been monitored since 1968, and the majority of lakes have been monitored for at least 20 years. These long-term records allow tracking of water quality changes over time and also provide regional reference conditions for each defined lake class. By characterizing within-lake and among-year variability in water quality, the LTT lakes provide context for lake assessments elsewhere that are based on a couple of years of data.

They also provide an invaluable resource to lake managers who can use this data set to help identify the source of and solve water quality problems.

Trend lakes are distributed throughout the state and were selected by both lakes and fisheries staff in each region with at least one lake in each of the defined lake classes. Trend lakes were selected to ensure that these lakes represent the lake class and will, over the long-term, represent trends for the region. Figure 11 shows the location of the LTT lakes.

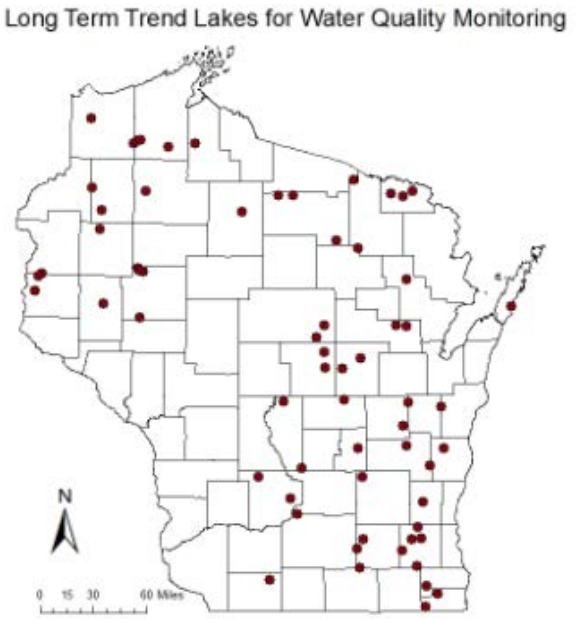


FIGURE 10 LONG-TERM LAKES MONITORING

Trend lakes are sampled annually for water quality during spring turnover and three times during summer (15 July - 15 September) for water quality. Total phosphorus, Secchi depth, chlorophyll, and field vertical profiles of dissolved oxygen, temperature, pH, and conductance compose the core indicators collected each sampling date (except chlorophyll in spring). Other supplemental water quality parameters collected once each summer may include conductivity, alkalinity, color; and on specified lakes, nitrate, nitrite, and total Kjeldahl nitrogen. Calcium and magnesium are sampled every 5 years on selected lakes.

RIVER LONG-TERM TREND (LTT) NETWORK

The current LTT river water quality monitoring network, rejuvenated in 2001, consists of 42 sites, with a minimum of one site per major river basin; generally located near the mouth of each river (Figure 12). Most of these sites were part of an earlier trend monitoring program with data available from as far back as the 1970s. Selection of the 42 trend monitoring sites considered different land coverage in the state varying from urban areas in the southeast, heavy agricultural use in the central and southwest, and forest cover dominating in the north. Just over half the sites (24) are sampled monthly and the rest are sampled quarterly. Monthly sites are generally located near the mouth of major rivers, whereas, quarterly sites are often located at additional sites on major rivers some distance above the mouth. Water quality samples are analyzed for nutrients, solids, specific conductance, pH, hardness, alkalinity, bacteria, chlorophyll, and biannually for triazine herbicides following approved USEPA methods. Low level metal sampling using "clean hands" techniques is conducted quarterly at a subset of the monthly monitoring sites and bi-annual sampling of triazine is done during winter and summer periods.

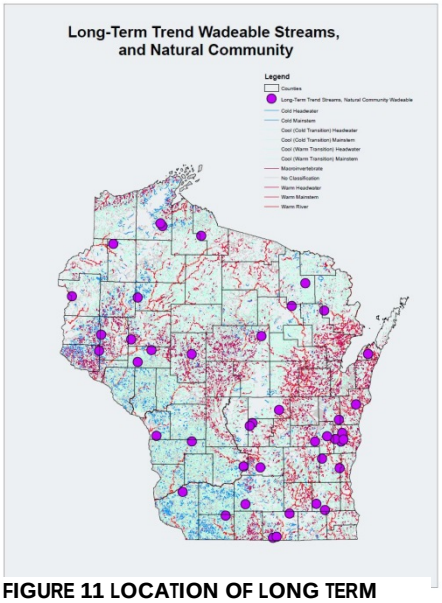


FIGURE 11 LOCATION OF LONG TERM TREND WADEABLE STREAM SITES. STREAMS ARE COLORED TO REPRESENT NATURAL COMMUNITY TYPES

Water quality trends in the state have been both positive and negative over the last 20 years. Phosphorus, ammonia, and suspended solids (sediment) concentrations have decreased at a majority of long-term trend river monitoring stations. This is probably due to a combination of decreases in wastewater effluent concentrations, improved farming practices, construction site erosion control, and urban stormwater management. Nitrate concentrations have increased at a majority of long-term trend river monitoring stations, which is likely due to increased nitrogen fertilizer use on crop fields, and may reflect increased corn production due to high corn prices.

Nitrate levels in surface water are rising, but are not at levels where they would make water unsafe to drink (note: these data do not pertain to groundwater, public well or private well data). Better nutrient management on farms would reduce this trend. Chloride concentrations have increased at a majority of long-term trend river monitoring stations. This is probably due to increased road salt use during the winter. Use of new application methods and ice melting products could help stop this trend.

INTEGRATED REPORT FIVE-PART CATEGORIZATION

With the Integrated Report option, US EPA encourages States/Tribes to use a five-category system for classifying all water bodies (or segments) within its boundaries regarding the waters' status in meeting the State's/Tribe's water quality standards (Table 7). The classification system is based on designated uses for reporting on water quality. Each waterbody and designated use combination is assigned a reporting category.

Table 7. USEPA Integrated reporting categories.

Category/Subcategory	Description
Category 1	All designated uses are supported, no use is threatened.
Category 2	Available data and/or information indicate that some, but not all, designated uses are supported.
Category 3	There is insufficient available data and/or information to make a use support determination.
Category 4	Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed.
Subcategory 4a	A State developed TMDL has been approved by USEPA or a TMDL has been established by USEPA for any segment-pollutant combination.
Subcategory 4b	Other required control measures are expected to result in the attainment of an applicable water quality standard in a reasonable period of time.
Subcategory 4c	The non-attainment of any applicable water quality standard for the segment is the result of pollution and is not caused by a pollutant.
Category 5	Available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed.

Source: http://water.epa.gov/learn/training/standardsacademy/page7.cfm

WDNR has further refined subcategories. Category 5 (waters not meeting water quality standards and a TMDL is needed), subcategories distinguish among differing types of impaired waters and TMDL priorities. WDNR created 5B to identify waters impaired by mercury mainly from

atmospheric sources. Within the last two assessment periods, WDNR has added additional subcategories under Category 5. These additional subcategories are defined in Table 8.

Table 8. WDNR's Integrated Reporting subcategories for impaired waters requiring TMDLs.

Subcategory	Definition
Category 5A	Available information indicates that at least one designated use is not met or is threatened and/or the anti-degradation policy is not supported, and one or more TMDLs are still needed. This is the default category for impaired waters.
Category 5B	Available information indicates that atmospheric deposition of mercury has caused the impairment and no other sources have been identified.
Category 5C	Available information indicates that non-attainment of water quality standards may be caused by naturally occurring or irreversible human-induced conditions.
Category 5P	Available information indicates that the applicable total phosphorus criteria are exceeded; however, biological impairment has not been demonstrated (either because bioassessment shows no impairment or because bioassessment data are not available).
Category 5W	Available information indicates that water quality standards are not met; however, the development of a TMDL for the pollutant of concern is a low priority because the impaired water is included in a watershed area addressed by at least one of the following WDNR-approved watershed plans: adaptive management plan, adaptive management pilot project, lake management plan, or Clean Water Act Section 319-funded watershed plan (i.e., nine key elements plan).

Of the 6,169 waters assessed for impairment in 2014, 1,093 (18%) were found to not meet water quality standards and are included on the CWA Section 303(d) list (i.e., impaired waters list). Of the state's impaired waters, 148 (13%) have USEPA-approved TMDLs (Category 4A). For those impaired waters still requiring TMDLS, six waters are categorized as impaired due to suspected naturally occurring sources of pollution (Category 5C), 188 (17%) are impaired due to atmospheric deposition of mercury only (Category 5B), 176 (16%) are impaired due to levels of phosphorus only (5P), and 575 (53%) waters are impaired due to other causes (5A) (see Figure 13).

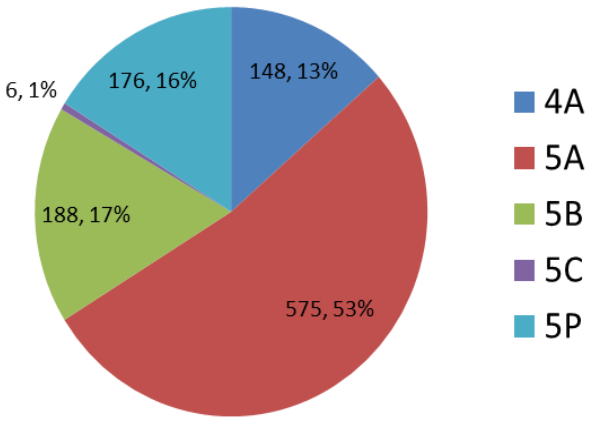


FIGURE 12 CATEGORY 4 AND 5 WATERS

CWA Section 303(d) List (Impaired Waters)

Assessing waterbodies against water quality standards and identifying impaired waters that don't meet standards is part of the overarching federal Clean Water Act (CWA) framework for restoring impaired waters. Waters that do not meet their designated uses because of water quality standard violations are impaired. Waterbodies are removed from the list when new data indicates that water quality standards are attained.

The 2014 impaired waters list contains more than 1,400 pollutant/water listing combinations. The primary pollutant listings are total phosphorus, total suspended solids (sediment), and mercury, representing 75% of the current listings (see Figure 14).

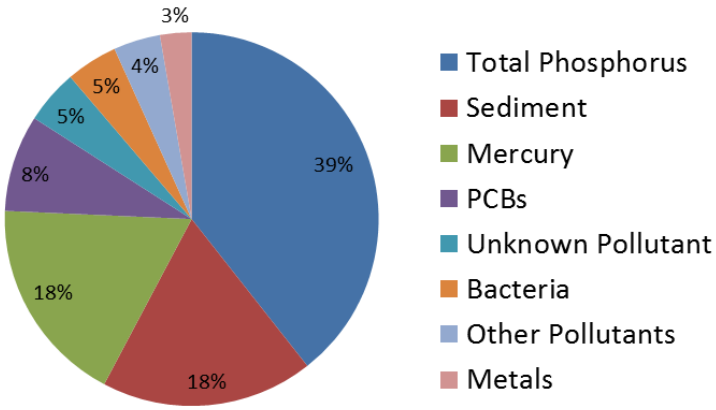


FIGURE 13 IMPAIRMENT POLLUTANTS

Figure 14 illustrates causes of impairment (or pollutants) for waters included on Wisconsin's 2014 CWA Section 303(d) list of waters not meeting water quality standards. "Unknown Pollutant" listings are biological or physical habitat impairments where the pollutant is not known.

A total of 301 pollutant/waterbody segment combinations (i.e. listings) are newly proposed for the list, of which 251 are for waterbody segments that have never been listed before. A majority of the new listings are based on exceedance of the total phosphorus criteria (n=225). A total of 56 listings are based on poor biological condition with unknown causes (i.e. pollutants).

The number of whole waterbodies "newly listed" is 248; while some of these waters had been listed previously for other impairments, 187 of these waters are have never been listed before. There are 20 listings, 10 whole waterbodies, proposed to be removed during the 2014 updates.

Impaired waters listings provide impetus for completing watershed restoration studies. Federal and state cost-share grants may be available to landowners for projects that address nonpoint sources of pollution, and some grants provide incentives for restoration of impaired waters. For certain grants, applicants with projects that help restore impaired waters have a greater chance of receiving funding; including the USDA's Environmental Quality Incentives Program (EQIP), Targeted Runoff Management (TRM) grants, and USEPA Section 319 Grant (funded projects must reduce pollutant(s) to an impaired water).

Integrated Reporting Summaries by Waterbody Type Groupings

Lakes, Impoundments, Bays and Harbors

Of the 4,482 assessed lakes, impoundments, bays and harbors, 4,088 (91%) were found to be supporting all assessed designated uses (Category 2). Of the remaining 394 waters that were not supporting at least one designated use, 379 still require TMDLs (Category 5) and 15 are addressed by EPA-approved Total Maximum Daily Load (TMDL) studies (Category 4). Roughly half (49%) of those impairments still requiring TMDLs are due to atmospheric deposition of mercury (Category 5B). (Figure 15)

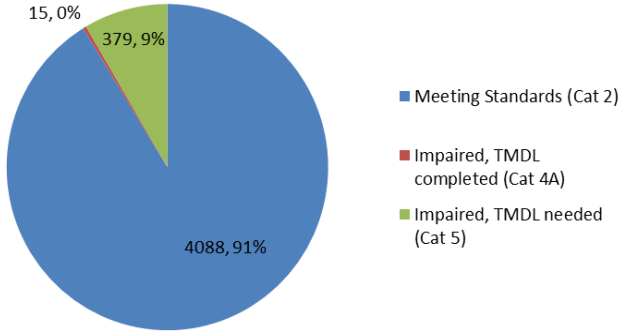


FIGURE 14 PROPORTION OF ASSESSED LAKES, IMPOUNDMENTS, BAYS AND HARBORS THAT ARE MEETING STANDARDS OR IMPAIRED.

Beaches and Great Lakes Shoreline Waters

Of the 220 assessed beaches and Great Lakes shoreline waters, 188 were found to be supporting all assessed designated uses (Category 2). The remaining 32 waters were not supporting at least one designated use (Figure 16). TMDLs have not been developed for beaches for Great Lakes shoreline waters.

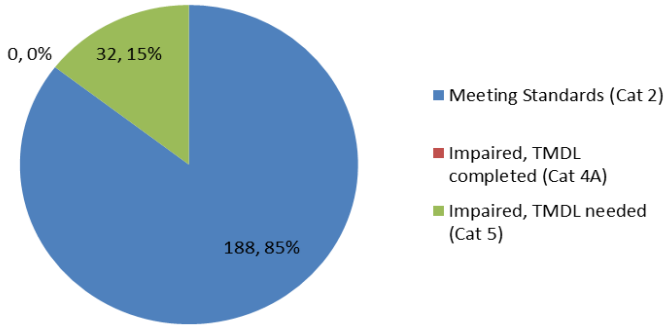


FIGURE 15 PROPORTION OF ASSESSED BEACHES AND GREAT LAKES SHORELINE THAT ARE MEETING STANDARDS OR IMPAIRED

Rivers and Streams

Of the 1,445 assessed river and stream segments, 782 (54%) were found to be supporting all assessed designated uses (Category 2). Of the remaining 663 waters that were not supporting at least one designated use, 531 still require TMDLs (Category 5) and 132 are addressed by EPA-approved Total Maximum Daily Load (TMDL) studies (Category 4) (Figure17).

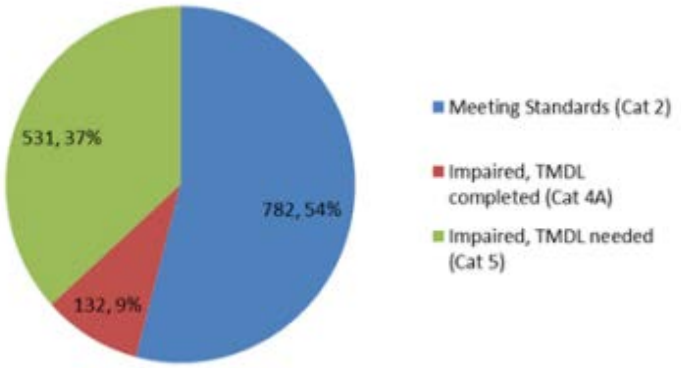


FIGURE 16 PROPORTION OF ASSESSED RIVERS AND STREAMS MEETING STANDARDS OR IMPAIRED.

RESTORATION OF WISCONSIN'S WATERS

Several types of management actions are used to restore waters. Wisconsin's Total Maximum Daily Load (TMDL) Program and Nine-Key Element Planning Program (particularly for waters with runoff dominated issues) are just two of the tools used to restore waters back to standards attainment.

TMDLS IN DEVELOPMENT

WISCONSIN RIVER TMDL

WISCONSIN TMDL WEBSITE

The Wisconsin River TMDL study area spans Wisconsin's central corridor from the river's in Vilas County to Lake Wisconsin in Columbia County, covering 9,156 mi_2 – approximately 15 percent of the state. The project area also encompasses:

- More than 110 wastewater dischargers
- 2nd & 5th largest inland lakes in Wisconsin
- 4 reaches impaired for suspended solids
- 16 reaches impaired for phosphorus
- 85 Cities and Villages
- 25 major tributaries
- 21 Counties

Wisconsin River TMDL

The Wisconsin WDNR, together with many public and private partners are working to improve water quality of the Wisconsin River, its reservoirs, and tributaries. The TMDL study and implementation plan will provide a strategic framework and prioritize resources for water quality improvement in the Wisconsin River Basin. The Wisconsin River TMDL study area spans Wisconsin's central corridor from the river's headwaters in Vilas County to Lake Wisconsin in Columbia County, covering 9,156 mi2 – approximately 15 percent of the state.

Under existing conditions, many reservoirs and tributaries in the Wisconsin River do not meet water quality standards due to excess pollutant loads, meaning they are not suitable for their designated uses, such as fishing, wildlife habitat, and/or recreational activities such as boating and swimming. The Wisconsin River Basin ***total maximum daily load*** (TMDL) will determine the total amount of phosphorus and suspended solids that can be discharged into the river, its tributaries and reservoirs, and still meet water quality standards and develop a plan for achieving the needed reductions.

Recent Project Updates

Monitoring

In 2009, a network of monitoring stations measuring discharge and water quality was deployed in support of TMDL model calibration. This included are 14 monitoring stations on the main stem of the Wisconsin River and 20 monitoring stations on Wisconsin River's tributaries. This also included regular monitoring at five major reservoirs within the basin where surficial samples were analyzed for and bottom samples were analyzed for water chemistry at multiple locations, and DO/Temp/pH/Cond profiles were measured, May through September for three years, 2010-2013.

The tributary, river, and reservoir monitoring that were completed specifically to support the development of the Wisconsin River TMDL ended in December 2013. Other water quality monitoring efforts such as the WDNR's long term trends sites or special projects such as monitoring of Fenwood Creek continue in the basin to answer specific questions related to water quality assessments at various scales.

Conceptualization

WDNR WR TMDL development team recently completed conceptualization of land use and land management of agricultural areas throughout the entire Wisconsin River TMDL Basin. The WDNR TMDL team used multiple years of satellite imagery, county transect data, meetings with county staff in all 21 counties, and meetings with local crop consultants to spatially define crop rotations, tillage and nutrient applications throughout the basin.

Modeling

Due to its size, the Wisconsin River Basin has been broken into four segments for modeling purposes: headwaters, upper, central, and lower. The headwaters section consists of 2,178 mi^2 from the headwaters of the WRB TDML (Lac Vieux Desert) to Tomahawk, WI and is dominated by wetlands and forests, soils with a high infiltration capacity, and relatively few point sources and urban areas. The upper region (Tomahawk, WI to the outlet of Lake Dubay) consists of 2,717 $mi^2$with a relatively high percentage of agriculture, urban, and soils with lower infiltration capacity. The central segment drains 2,121 mi^2 from the outlet of Lake Dubay to the outlet of the Castle Rock Flowage and consists of a mix of agricultural and wetland landcover with high infiltration capacity with the exception of the northwest portion of the segment which has low infiltration. The lower section between Castle Rock Flowage and the Prairie Du Sac dam consists of 2,140 mi^2 of primarily agricultural land with medium infiltration capacity.

The calculation of pollutant loads will be completed by the USGS with the use of a regression model such as LOAD ESTimator (LOADEST). Funding to contract with USGS to complete this work in FY 2015 has been obtained.

WDNR has begun the process of calculating surface water effluent loads. Staff have conducted a SWAMP query and compared it to the point sources previously identified in the PRESTO model. This list has been sent to basin engineers for further review to determine if any facilities are missing.

Other modeling tasks recently completed by the WR TMDL development team include identification of P criteria for all water bodies and development of a water budget and base flow separation. Tasks currently underway include subwatershed definitions, internally drained areas definition, and urban modeling extent mapping and dataset development.

Outreach and Communications

Technical Stakeholder Meetings

Two full-day meetings hosted by WDNR were held on November 6th and 13th 2013 at Central Wisconsin Environmental Station. During these meetings, WDNR and US Army Corps presented WR TMDL development technical approach outlined in Wisconsin River TMDL Technical Scope of Work. Small and large discussion groups were convened to listen to concerns/ questions/ ideas.

Sixty-seven attendees participated, representing a diverse cross section of a basin stakeholder types.

Website

Content development, design and posting of Wisconsin River TMDL Website complete. Information now available on the website includes: project overview, maps, timeline, FAQ, contacts, TMDL technical scope and technical stakeholder meeting presentations, Wisconsin River Basin Publications E-Library, WR TMDL presentations and webinars and four years of Wisconsin River Symposium Proceedings.

Wisconsin River TMDL Geocortex Spatial Viewer

The Wisconsin River TMDL development team recently launched a WR TMDL spatial viewer. Data currently available on the Spatial Viewer includes TMDL basin and major tributary drainages, flow and water quality monitoring stations, waste water outfalls, waterways and political boundaries. Data that will be added soon to the spatial viewer includes land cover, urban areas, citizen groups, model sub-basins, impaired waters and waterbody phosphorus criteria.

Wastewater

WDNR staff made a presentation about WR TMDL at statewide WWOA meeting in October 2013, and at a regional meeting in Rhinelander in March 2014. WDNR staff also made presentations at the February 2014 Government Affairs Seminar and are scheduled to make several presentations at the upcoming regional NCASI Wisconsin River TMDL workshop on May 6.

Wisconsin River Symposium

The fourth annual Wisconsin River Symposium was held on February 14, 2014. The Symposium co-planned and organized by WDNR WR TMDL team and UW-Stevens Point. Over 100 people attended the event.

MILWAUKEE RIVER BASIN TMDL

A draft TMDL report and preliminary TMDL allocation information was delivered to WDNR on December 31, 2013 for WDNR internal review. The WDNR draft included preliminary load allocation information for the Kinnickinnic and Menomonee River watersheds, as well as for the Milwaukee Harbor Estuary. Functionality issues with the existing Water Quality Initiative (WQI) models have caused a delay in developing preliminary allocation information for the Milwaukee River watershed. The source of the issues has been determined and the TMDL Development Team is currently resolving them to produce the Milwaukee River watershed allocations for WDNR review.

The Milwaukee Metropolitan Sewerage District maintains a website for the Milwaukee TMDL http://mmsd.com/waterquality/total-maximum-daily-loads

WDNR will review the draft report and require adjustments to the preliminary load allocations. The allocations and supporting documentation will be made available on MMSD's TMDL webpage (http://v3.mmsd.com/Report.aspx) for stakeholder review. TMDL allocations will be presented and discussed at a stakeholder workshop in 2014.

A stakeholder workshop is planned to discuss the allocations. Next steps include WDNR holding additional focused stakeholder workshops and public information sessions, providing an official public notice, delivering the final TMDL report submittal to USEPA for review and approval, and developing an implementation plan. Implementation plan completion is scheduled for December 31, 2014.

IMPLEMENTATION TMDLS

THE ROCK RIVER RECOVERY (RRR)

ROCK RIVER TMDL

The Rock River TMDL Implementation process began in 2009 and today involves WDNR, WI UW Extension, the Rock River Coalition (RRC - The Rock River Basin watershed organization), Renew the Rock (an MS4 basin-wide group), the Clean Lakes Alliance, and numerous external stakeholders, partners, and the general public. Interested participants include WPDES permit holders (MS4's), municipal and industrial WWTFs, CAFOs, County Land and Water Conservation Districts, numerous municipalities, and citizen groups. The RRR was formed by an executive level steering committee at the WDNR and a formal structure was adopted including the RRR Implementation Teams and five Sector Teams: Agriculture, Education & Outreach, Monitoring and Assessment, MS4's, and wastewater treatment facilities. More background information on the first few years of the RRR, including meetings, Sector Team assignments and activities, and related initiatives can be found on the WI WDNR RRR TMDL website: http://WDNR.wi.gov/topic/TMDLs/RockRiver/

The RRR has recently shifted into Implementation mode with two primary initiatives. The first is developing the framework and implementation planning, including drafting of a basin-wide Implementation Plan consistent with the Clean Water Act 9-key Element Plan. This plan will serve as the basin-wide roadmap to provide direction and guidance for the multi-year watershed and water quality restoration activities necessary to restore water quality standards once again support designated beneficial uses.

The second initiative is the "TMDL" implementation through issuance of new WPDES permits with revised WQBELs consistent with wastewater load allocations in the total maximum daily load plan. This work will involve building partnerships at the local level to identify and develop trading and adaptive management opportunities. Despite the plan's status of in development, numerous implementation activities are already underway. This is especially true with point sources which have been actively engaged in Implementation activities for a couple of years.

To Learn More!

http://rockrivercoalition.org/

http://renewtherock.com/

Planning: A series of meetings were held with the Implementation Team and Sector Teams to formally adopt a scope, framework, strategy and schedule for drafting the RRR Implementation Plan. This has also included a number of public outreach activities to continually engage our partners throughout the basin (meetings, articles with the RRC the basin newsletter, WPDES permit meetings, website updates, outreach organizations, etc.) and includes the planning of the annual Basin-Wide RRR Forum in July 2014. This event will include numerous speakers from throughout the basin and feature topics such as; RRR Status Update, WPDES activities, trading and AM projects, general water quality education, and public participation forums/activities. In addition, the Implementation Team has a goal of presenting the draft RRRIMP plan to the entire basin community.

Implementation: WDNR has developed guidance documents to provide direction on interpretation of the CWA, TMDL development and Implementation, and extension of these fundamental documents through WI Statutes to WPDES permit holders, non-point sources, and the basin. Guidance documents now exist for Phosphorus, Trading and Adaptive Management, WPDES, MS4's (in draft), and NPS (in draft). In addition, the WDNR has been drafting load allocations and wasteload allocations through the WPDES program to all permits holders in the basin through a scheduled roll-out. Permit issuance has been conducted cooperatively with permit holders to facilitate acceptance and understanding of new permits terms and to identify alternatives for permit compliance.

Team meetings to explore water quality trading and adaptive management opportunities are underway with WPDES permit holders, education/outreach, county land and water conservation staff, nutrient management professionals, and consultants to identify partnerships between point and NPS community members.

Yahara WINS

The Yahara WINS Pilot Project is testing a new, innovative and collaborative compliance approach called **Watershed Adaptive Management** to meet regulatory requirements for phosphorus reduction in the Yahara Watershed. Over thirty entities are participating in the pilot project.

During 2013, Yahara WINs funded research, water quality monitoring, installation of phosphorus reducing practices, baseline inventories of agricultural land and other initiatives. By its completion in 2015, the pilot project will provide the data needed to help Yahara WINs participants make informed decisions relating to the use of adaptive management to meet the Rock River TMDL reduction requirements related to phosphorus and total suspended sediment.

Read more about the Yahara WINs project.

Within the Yahara Watershed, a major tributary to the Rock River, The WDNR is participating with numerous partners, including Clean Lakes Alliance, MAMSWP (The Madison Area Municipal Stormwater Partnership) and MMSD (Madison Metropolitan Sewerage District), Discovery Farms, and Yahara WINS (see inset text) to facilitate Load and Waste Load reductions of Phosphorus and TSS via a number of measures including treatment, agricultural and urban best management practices, manure management, and watershed wide education efforts for the general public. With the WINs project, there are promising opportunities with partners and are moving forward to realize measureable water quality improvements.

LAKE ST. CROIX TMDL

The St. Croix River and Lake St. Croix are highly valued resources that provide exceptional recreational opportunities and support a highly diverse ecology of aquatic and terrestrial species. However, over the years eutrophication, or nutrient enrichment, has occurred in Lake St. Croix due to excess phosphorus loading. This loading drives nuisance algae blooms which diminish the enjoyment and use of the lake. This report represents an important step in the improvement of Lake St. Croix by focusing on establishing the needed reduction in the loading of phosphorus from its contributing basin in order to achieve water quality standards. The St. Croix River basin represents a large area—approximately 7,760 square miles—with 44 percent of the basin land area (excluding water and wetlands) located within Minnesota and 56 percent within Wisconsin. It includes portions of both the Northern Lakes and Forests (NLF) and North Central Hardwood Forests (NCHF) ecoregions. The St. Croix River originates near Solon Springs, Wisconsin, and flows west and south more than 160 miles until it joins the Mississippi River at Prescott, Wisconsin. Lake St. Croix is a naturally impounded riverine lake in the lower 25 miles of the St. Croix River.

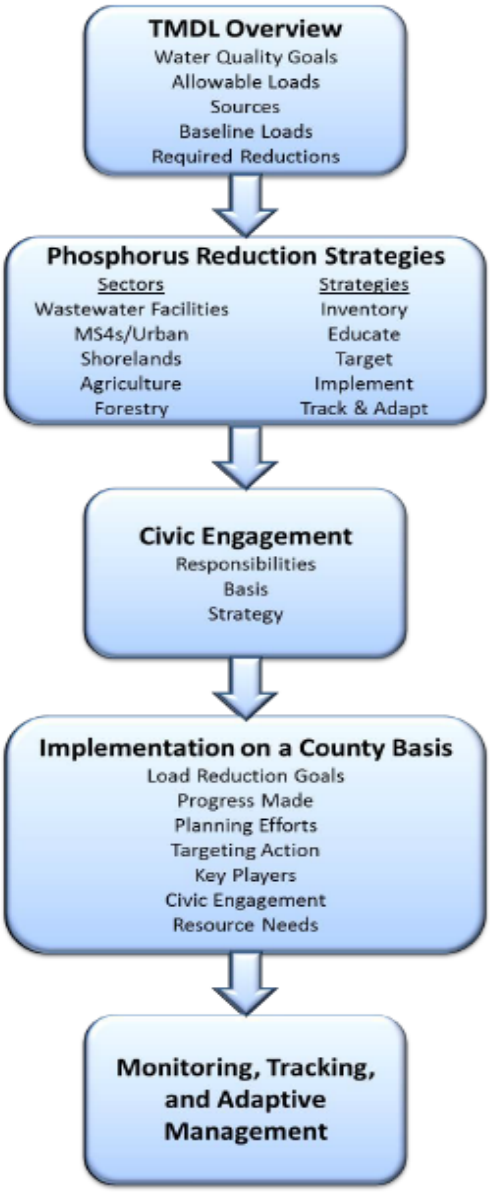


FIGURE 17 LAKE ST. CROIX TMDL FLOW CHART.

The St. Croix Basin Water Resources Planning Team has been involved in goal setting and TMDL development over the past several years. In 2013, the Lake St. Croix TMDL Implementation Plan was developed. This plan will follow the flow of activities listed (See Figure 18).

The TMDL covers loadings and reduction goals by sub-watershed for each state, as well as point source limits for all dischargers with specific permits. The overall goal is to reduce the inputs of phosphorus by 20% (100 metric tons) and return Lake St. Croix (the lower 25 miles of the river) to pre-1940's conditions. After accounting for natural background levels, this will require a net decrease of about 35 to 40% from point and non-point sources.

The TMDL report calls for a 38% reduction in the human-caused phosphorus carried to the rivers and streams of the basin, and eventually entering the St. Croix River and Lake St. Croix. The TMDL sets goals for each watershed in the basin, based on the respective land cover and land uses practices. It also sets a cap on the amount of phosphorus that can be discharged each year by wastewater treatment plants serving communities and industries in the St. Croix Basin. There are simple and practical things everyone can do to lower the amount of phosphorus entering our waters. By making wise choices on products used in our homes, lawns and gardens; improving farming practices, septic system maintenance and municipal and industrial wastewater treatment, all residents and visitors to the basin are encouraged to help make a difference for the St. Croix.

TARGETING FOR A BIGGER RETURN

The St. Croix TMDL Implementation Plan also advocates "targeting" of critical source areas in the basin. Small portions of the agricultural or urban landscape can have a disproportionately large impact on water quality. These are commonly called "Critical Source Areas." Identifying these areas is essential if clean water goals are going to be met. Current research suggests that if conservation practices are targeted to the most vulnerable areas of the landscape there may be a greater reduction of pollutants than if practices are evenly spread out across the landscape. Therefore, developing and implementing a prioritization framework for targeting phosphorus reduction efforts is critical for achieving the Lake St. Croix TMDL, with the limited human and capital resources available. One effort to address this need is a project the Minnesota Department of Agriculture is leading to develop a strategy for prioritization and targeting within a watershed: Minnesota Department of Agriculture Priority Management Zone Project

Upon completion, the results and guidance produced from this project should prove to be a valuable resource for decision-making within the St. Croix Basin. This comprehensive, ecosystem approach will integrate water quality, recreation, wildlife, and economic interests and ultimately better leverage the current federal, state, and local resources available to support action on the ground. Furthermore, the prioritization protocol will provide critical information for local implementers about where to target education, technical assistance, and incentive programs.

Existing assessment and targeting tools are also available in both Minnesota and Wisconsin based on a phosphorus index (PI), which is a planning and assessment tool for managing runoff phosphorus losses from cropland. The phosphorus index uses readily available information to evaluate the potential for phosphorus in runoff from a specific field.

Wisconsin Phosphorus Index

University of Minnesota Phosphorus Source Assessment Tool

Water quality models of watersheds may also be useful tools in identifying and targeting critical sources areas. The St. Croix Watershed Research Station has developed modeling tools for the Sunrise River in Minnesota and Willow River in Wisconsin that are being applied to support the targeting of implementation efforts. St. Croix Watershed Research Station Reports on Watershed Modeling

Key factors for consideration in targeting phosphorus reduction efforts within the St. Croix Basin include: Land use/land cover, including crop and tillage practices, Soil type, Slope of land surface, Soil phosphorus concentration, Manure application, Proximity/connectivity to the St. Croix River, Landowner consent, Opportunities for multiple benefits from efforts, such as ecological or recreational benefits.

Assessing priority management zones or critical source areas can be conducted at various scales, from the sub-watershed scale, to a farm scale, to a field scale, and, if needed, to a specific location on the edge of the field. Geographic information can be overlayed to help identify potentially critical areas, or models can be used to simulate higher loading areas in the watershed. More information on targeting projects can be found at the following links:

- National Institute of Food and Agriculture Conservation Effects Assessment Project
- The Wisconsin Buffer Initiative

APPENDIX A: Graphs of Designated Uses