Chapter 2. Setting Nutrient Reduction Targets

Element 2. Set Watershed Load Reduction Goals Based Upon Best Available Information

2.1 EPA and Gulf Hypoxia Task Force Expectations

2.1.1 Nutrient Reduction Framework Expectation

From EPA's WQ-26 national performance measure:

1. Develop a methodology to evaluate the nitrogen and phosphorus loadings from all sectors.

2. Establish numeric goals for loading reductions that will likely be needed to meet water quality goals. States may opt to submit a schedule of load reduction targets within interim goals.

Quoting from the recommended elements, "[load reduction] goals should be based upon best available physical, chemical, biological, and treatment/control information from local, state, and federal monitoring, guidance, and assistance activities including implementation of agriculture conservation practices, source water assessment evaluations, watershed planning activities, water quality assessment activities, Total Maximum Daily Loads (TMDL) implementation, and National Pollutant Discharge Elimination System (NPDES) permitting reviews." For the protection of watersheds that are not impaired, instead of setting load reduction needed to meet water quality goals, the states may determine an alternative baseline for setting load reduction goals.

Load reduction goals may be set using, for example, any of the three considerations below:

- Pounds of total phosphorus and/or pounds of total nitrogen;
- Percentage of downstream pour point goal or targeted sector estimated loadings; and
- Water quality standards-based calculation based on flow/volume.

2.1.2 Gulf Hypoxia Task Force Essential Strategy Component

- Evaluate and select analytical tools
- Establish current status and trends
- Establish quantitative reduction targets

2.2 Wisconsin's Approach

As illustrated in the Table 2.1, Wisconsin's federal, state and local programs use a mixture of approaches to meet water quality standards, restore impaired waters, protect interstate downstream waters, protect high quality waters and minimize contaminants reaching groundwater. The specific programs and their implementation progress are described in subsequent elements of this strategy. The purpose of this chapter is to relate the primary program features to identified water quality goals. Specifically, this chapter describes the following:

- Analytical tools
- Current status
- Nutrient trends
- Attaining the 45% phosphorus and nitrogen load reductions to the Mississippi River and Gulf of Mexico.
- Estimating phosphorus load reduction to Lake Michigan.
- Water quality- based effluent limits for municipal and industrial wastewater facilities. (See description of point source requirements in Chapter 3)
- Wasteload and load reductions identified in EPA-approved TMDLs.

2.2.1 Analytical Tools

In developing this strategy a number of analytical tools were used primarily and fall into three groups: analysis of stream, river and well monitoring data; results of modeling and compilations of point source discharge concentrations. The following is a brief description of the analytical tools, why they were selected, how they were used and how they may be used in the future.

- Stream, river and well water monitoring data

  Stream, river and well water river monitoring data was used to provide an analysis of the current status of nutrient related water quality in Wisconsin (section 2.2.2 of this chapter), determine which waters are considered impaired under section 303(d) of the Clean Water Act, rank watersheds for targeting future actions (Chapter 1), determining trends (section 2.2.3 of this chapter), measuring and reporting progress (Chapters 8 and 9). Three sets of monitoring data were primarily used in developing this strategy. The first set is data collected at the downstream "pour point" of over 300 watersheds (about HUC 10 watershed size). At each site, data was collected monthly for a 12-month period. Between50 and 60 watersheds were monitored each year from 2006 through 2011. The second set is data collected monthly for a number of decades at long-term river trend sites across the state. Data from these sites was used to conduct the trend analysis summarized in section 2.2.4 and will be part of Wisconsin's approach for measuring progress. The third set is public well monitoring data from wells across the state. Data from these wells was used in the targeting/priority setting analysis in Chapter 1 of this strategy.

- Modeling

  Models are used extensively in nutrient management in Wisconsin with the specific model tied to the specific use. For example, the nutrient model SNAP+ is frequently used to develop cropland nutrient management plans. Total maximum daily load analyses may use a variety of models including the Soil and Water Assessment Tool (SWAT) to estimate nutrient loads reaching streams.

In preparing this strategy, the SPARROW model (see Chapter 1) was used in a number of analyses. SPARROW model results were used to estimate phosphorus and nitrogen yield and loads for HUC 8 watersheds in Chapter 1 and for targeting HUC 10 watersheds also in Chapter 1. SPARROW was selected for these analyses because it provides information for both phosphorus and nitrogen, is available for both the Mississippi River and Great Lakes Basins, is calibrated based on monitoring data and has had extensive review. For future modeling, all available models, including enhanced versions of SPARROW, will be considered.

- Discharge Monitoring Reports and Watershed Project Research Results

  Analyses in this strategy also made extensive use of discharge monitoring report information from hundreds of municipal and industrial wastewater facilities and research results from nonpoint source implementation research projects.

2.2.2 Current Status

The current status of Wisconsin's waters is illustrated by the maps in Figures 2.1, 2.2 and 2.3. For total phosphorus, Figure 2.1 shows about half of the monitoring sites meet the water quality standards criteria and about half of the sites exceed the criteria. The criterion for streams is 0.075 mg/L (75 *u*g/L) and the criterion for rivers is 0.100 mg/L (100 *u*g/L). Figure 2.2 shows the total nitrogen concentrations for these same sites. No water quality standards criteria have been adapted for total nitrogen. See Chapter 10 of this strategy for more information.

Figure 2.3 shows the locations of public (use) drinking water wells across the state. The non-community public wells include restaurants, bars, schools, etc. The drinking water quality standard is 10 mg/l for nitrate and the preventive action level is 2 mg/L.

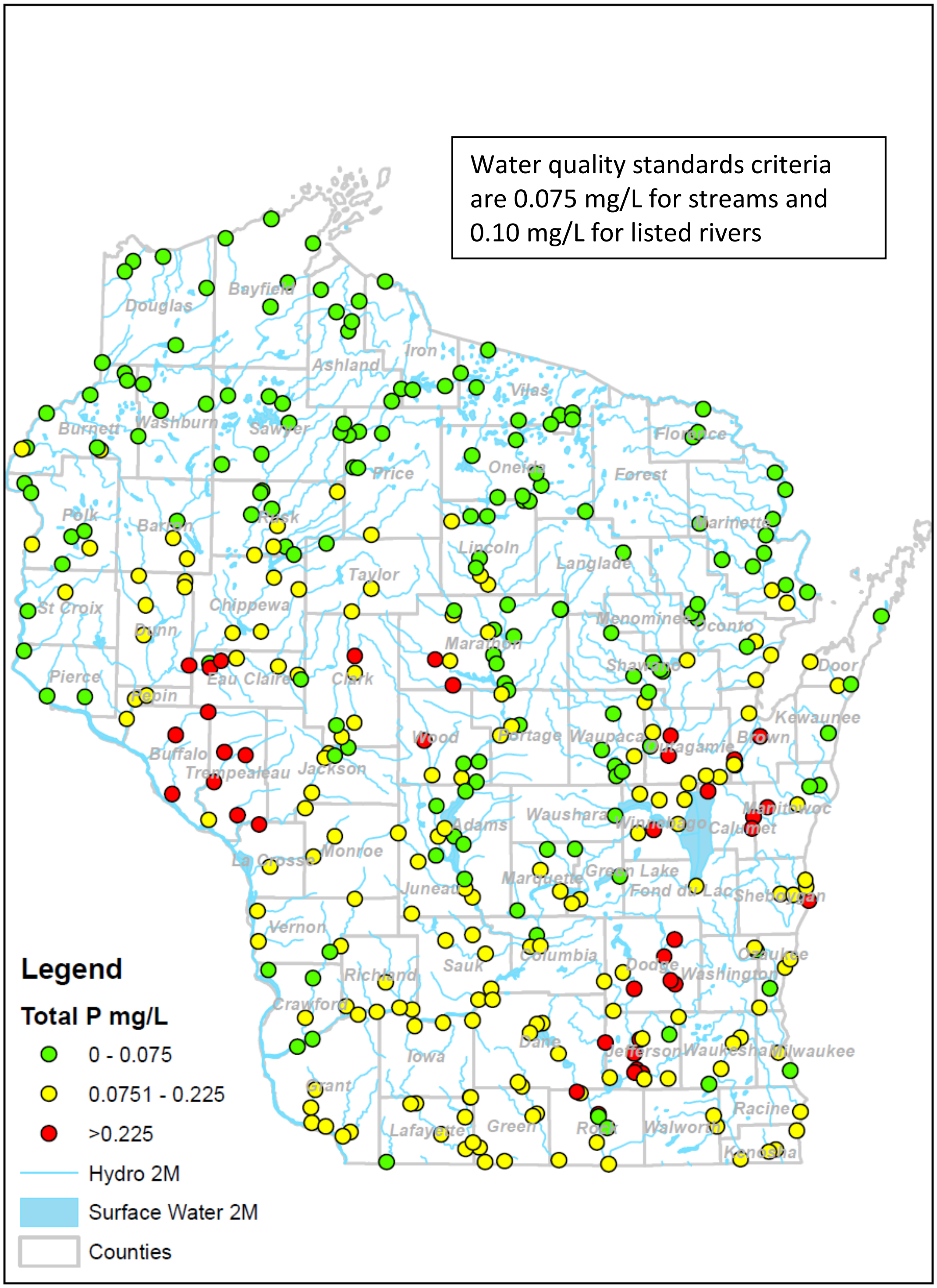

Figure 2.1 Stream Phosphorus Concentrations (Median May-October)

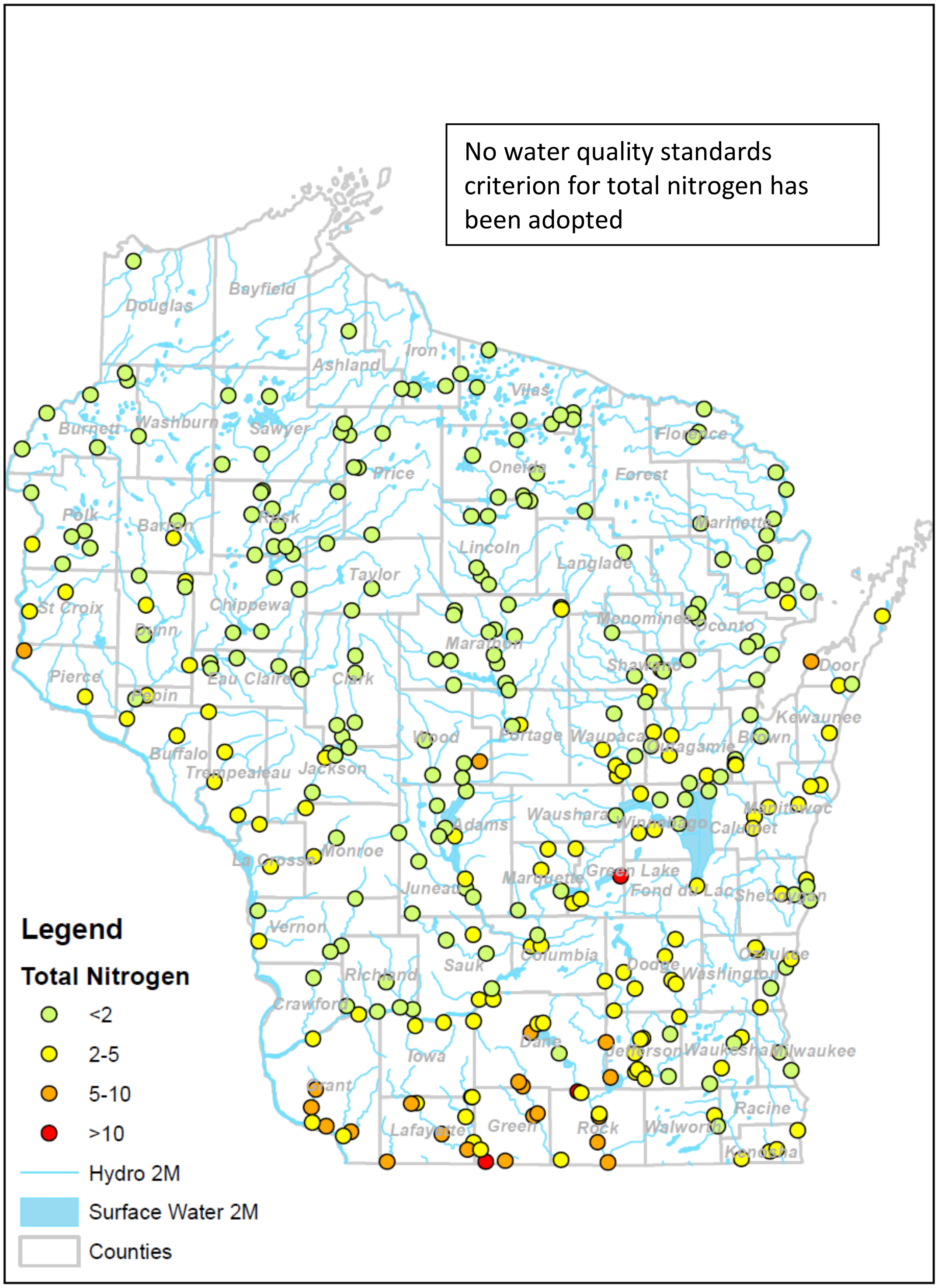

Figure 2.2 Stream Nitrogen Concentrations (Median May-October)

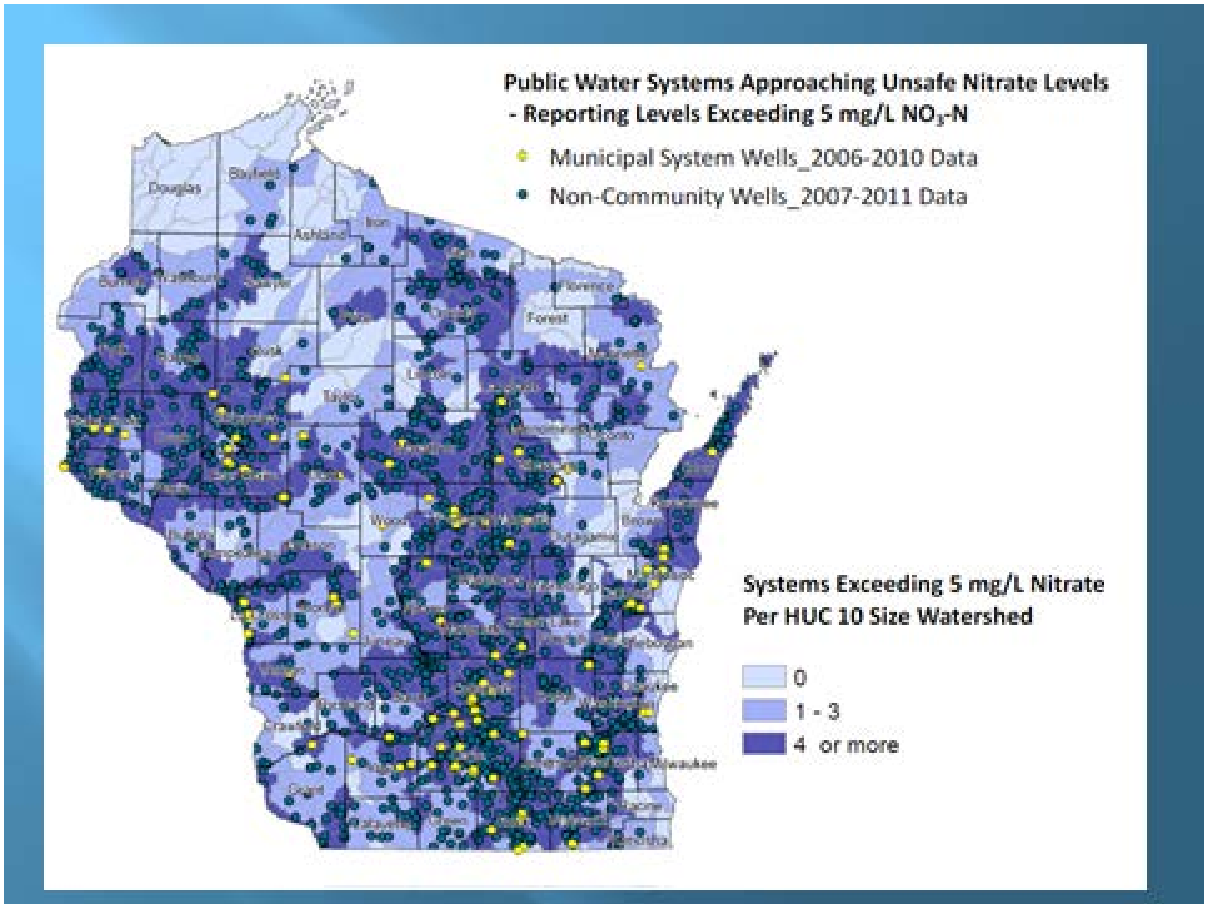

Figure 2.3 Public Water Systems with nitrate concentrations exceeding 5 mg/L.

2.2.3 Nutrient Trends

Data from the DNR Long-term River Trend sites and USGS flow gaging stations were used to analyze nutrient trends at over 30 locations across Wisconsin. In general, the phosphorus trends in the southeast and southwest Wisconsin show a decrease in phosphorus concentrations over the last few decades. Locations in the central and northern Wisconsin generally show no change; with the concentrations remaining relatively low. In contrast the total nitrogen concentrations tend to increase in southern Wisconsin. The numbers associated with the bars on Figures 2.4 and 2.5 indicate the period of record, such as "77" means that 1977 was used as the initial year for analysis. The analysis does not indicate the cause of the increase or decrease. Decreases in phosphorus concentrations are likely a combination in reductions from both point sources and nonpoint sources.

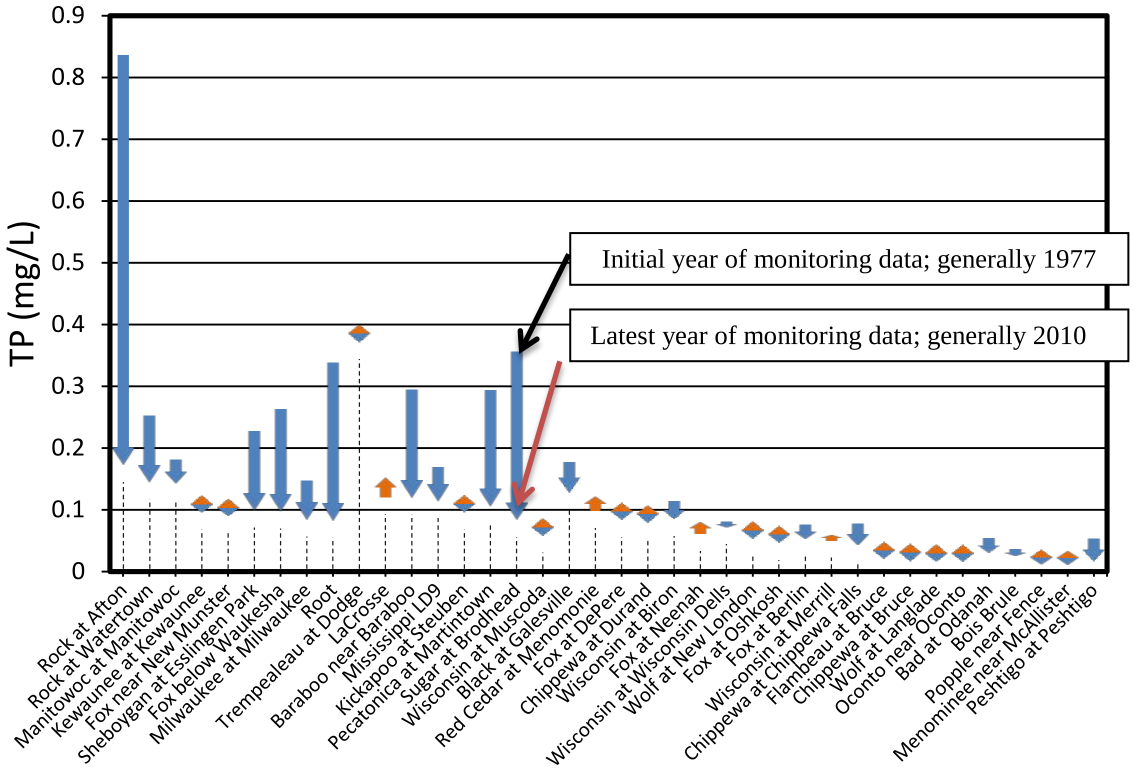

Figure 2.4 Total phosphorus concentration trends at Wisconsin River Long-Term Trend sites.

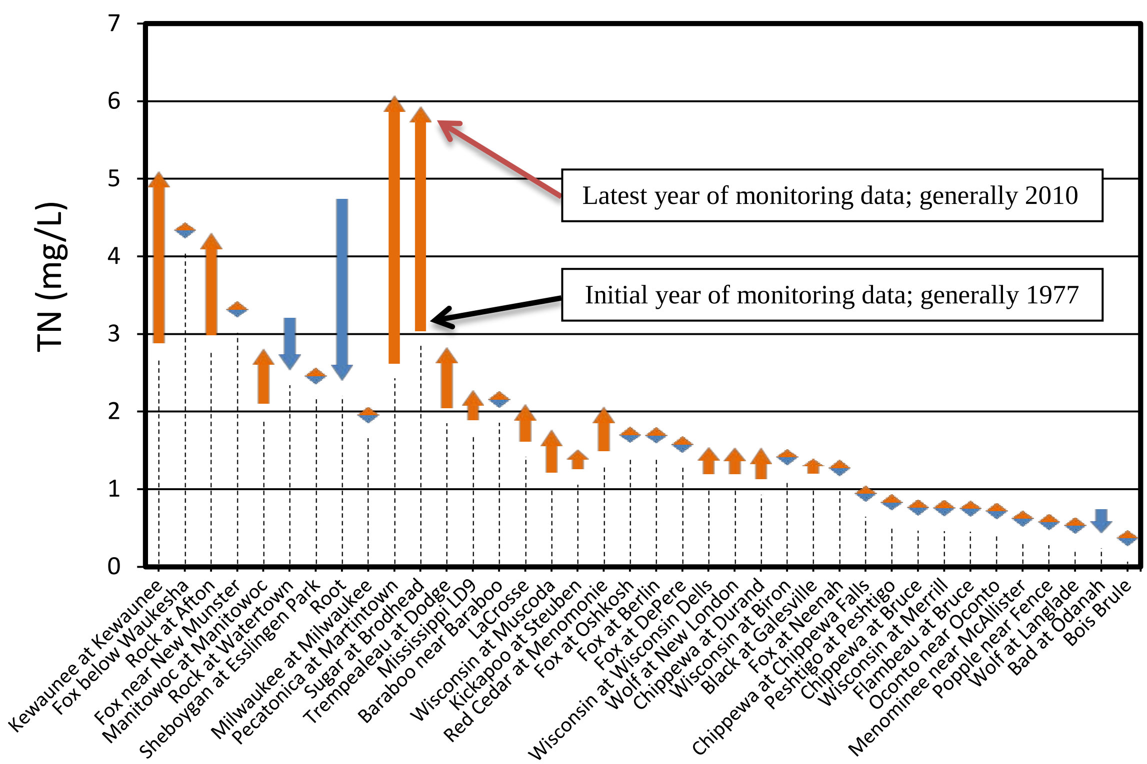

Figure 2.5 Total nitrogen concentration trends at Wisconsin Long-term River Trend sites.

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2.2.4 General Approach for Nutrient Management in Wisconsin

Wisconsin programs use a variety of technology-based and water quality based approaches to manage nutrients. Technology-based approaches tend to be uniform and tied to readily available technology or practice. They do not vary by the condition of the water quality. They may, however, be adequate to result in water quality standards being met in various locations. In contrast, water quality-based approaches tailor the level of management to the specific water quality needs. For example, a total maximum daily load (TMDL) analysis for a watershed tailors both the point source and nonpoint source management to meet water quality standards. Table 2.1 shows the mix of technology-based and water quality-based approaches used by Wisconsin programs.

Table 2.1 Overview of Wisconsin Water Quality-Based Approach by Sector

Sector (described in subsequent chapters)	Technology or uniform approach	Water quality standards – based approach	Other
Agricultural nonpoint sources	State adopted performance standards and prohibitions and local ordinance requirements. Practices to implement performance standards and prohibitions designed to minimize impact on groundwater.	Potentially identified as part of a TMDL implementation plan	Other conservation practices and programs, such as stream bank stabilization, riparian buffers, enrollment in Conservation Reserve Program, animal lot abandonment. Also, through source water (wellhead) protection plans
Concentrated Animal Feeding Operations -- WPDES permits	Federal and state-enacted requirements on “no discharge” from animal lot (less than 25-year, 24-hour storm) and compliance with state adopted performance standards (NR 243). Practices to implement performance standards and prohibitions designed to minimize impact on groundwater.	Potentially identified as part of a TMDL implementation plan Permits may include specific requirements to meet groundwater quality standards	
Municipal Separate Storm Sewer Systems – WPDES permits	Federal minimum management measures and state-enacted performance standards. Practices to implement performance standards and prohibitions designed to minimize impact on groundwater.	Potentially identified as part of a TMDL implementation plan	
Non-permitted urban areas or activities	State adopted performance standards and prohibitions. Practices to implement	Potentially identified as part of a TMDL implementation plan	

	performance standards and prohibitions designed to minimize impact on groundwater.		
Publicly and privately owned (e.g. municipal and industrial) wastewater treatment facilities – WPDES permits	Federal and state adopted technology-based requirements, including Subchapter II of NR 217 (1 mg/L or alternate limit). Also federal and state groundwater protection requirements.	Water quality based effluent limits based on federal and state requirements, including Subchapter III of NR 217 for phosphorus and NR 106 for ammonia	Note: Water quality based effluent limit compliance may be achieved through water quality trading or through implementation of a watershed adaptive management option plan
On-site waste disposal systems	State adopted WPDES requirements or state sanitary code.		

2.2.5 Mississippi River Basin/Gulf Hypoxia – 45% Reduction Goal

Wisconsin should be able to reach the 45% reduction goal for phosphorus load reduction to the Mississippi River and subsequently to the Gulf of Mexico, based on an analysis conducted by the Department of Natural Resources. This presumes a 1995 base year and phosphorus reduction from point sources and nonpoint sources within the Mississippi River Basin within Wisconsin beginning in that base year and going into the future. The analysis assumes current programs and current requirements for those programs.

1995 Baseline. Consistent with the Gulf Hypoxia Action Plan, 1995 was selected as a base year. Phosphorus loads were derived for the Wisconsin portion of each of the 32 HUC 8s in Wisconsin's Mississippi River Basin using 1995 point source monitored loads and "2002 normalized" SPARROW nonpoint source load estimates.[12] For most of the Mississippi River Basin, the 1995 point source load was not the dominant source of the estimated phosphorus loads, and the substitution for the 1995 point source loads for the 2002 point source loads would not significantly influence the baseline loads.

Under the derived 1995 baseline, the combination of point source and nonpoint source loads by HUC 8 are shown in the Table 2.2 and Figure 2.6. Although Wisconsin's technology-based phosphorus effluent limits became effective statewide in late 1992, they were phased-in primarily in the late-1990s as new permits were issued with compliance dates set within the five-year permit term.

Projected Reduction. The projected reduction is estimated for both point sources and nonpoint sources using existing data and a series of assumptions. This projection does not specify a time period.

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[12] For wastewater point sources 1995 discharge monitoring report data were used, if available. If not, data from the closest year were used. The 2002 SPARROW model results were deemed appropriate for a 1995 nonpoint source baseline since the calibration data used by USGS were collected near to 2002, including data that may have been collected five, ten or more years prior to 2002. For each HUC 8, the 2002 point source loads were subtracted from the total "2002-normalized: SPARROW load to derive a nonpoint source estimate.

For municipal and industrial wastewater treatment facilities, the projected reduction is based on comparing the actual or estimated 1995 baseline phosphorus loads to the actual 2009 point source contribution on a facility-by-facility basis using discharge monitoring report information. Discharges for 2009 are very similar to those for 2010 and 2011, and reflect current conditions and compliance with state WPDES permit program technology-based phosphorus control requirements described in Subchapter II of NR 217, Wis. Adm. Code. For the basin as a whole, the wastewater point source phosphorus discharge has been reduced by **67percent** since the 1995 baseline. Compliance with the more recent water quality-based requirements in Subchapter III of NR 217 may produce additional load reductions. However, compliance with these newer requirements may come in the form of water quality trading or implementation of watershed plans under the Wisconsin watershed adaptive management option. As such, there could be some overlap with the nonpoint source load reduction. Thus, the 2009 conditions are used in conservatively estimating future phosphorus loads from these facilities.

For storm water management in urban areas, the analysis assumes a 10% phosphorus load reduction. Current WPDES permits call for a 20% or 40% reduction in suspended solids loads. It is assumed that the phosphorus load reduction will be one-third to one-half of the reduction for suspended solids load reduction. Thus, the 10% load reduction is conservatively assumed for urban areas. Some TMDLs may call for further reduction.

For agricultural lands, two assumptions are made:

- A 10% load reduction from 1995 to present. With substantial implementation of federal, state and local conservation programs, a higher reduction could be assumed. However, available data, such as from the NRCS Natural Resource Inventory, shows a degree of backsliding in Wisconsin and other states during this period. Taking land out of the Conservation Reserve Program is commonly cited as one of the reasons for falling back. On the other hand there is much anecdotal information from across the state that many smaller animal lots immediately adjacent to streams have been removed, and new slope diversions have been installed on many other animal lots. Thus, the 10% reduction represents a conservative reduction from 1995 to present.
- A 30% reduction into the future. Experience in the Pleasant Valley watershed project in southwestern Wisconsin shows that a 25 to 30% reduction is reasonable to achieve through meeting the phosphorus index performance standard. Compliance with other performance standards will increase the percent reduction. Thus, a 30% future reduction is deemed a reasonable further reduction.[13] This reduction may be achieved through the programs listed in Chapter 3 of this strategy, including NRCS's Environmental Incentives Program, DNR's Runoff Management Program (including Targeted Runoff Management Grants and Notice of Discharge grants); DATCP's Farmland Preservation/Working Lands Initiative and county programs.

For all other lands, such as wetlands, barren lands and wooded lands, no reduction is assumed.

Using the above assumptions, about a 40% reduction is estimated. It is further expected that reductions in phosphorus load needed to implement TMDLs will bridge the remaining gap to

[13] Personal communication Laura Ward Good, University of Wisconsin – Madison.

achieve the 45% reduction goal. Table 2.3 and Figure 2.7 show the projected reduction for each Mississippi River Basin HUC 8 watershed using the assumptions described above.

Table 2.2. 1995 Baseline Phosphorus Loads by HUC 8 Watershed (listed in order of decreasing nonpoint source yields)

8-Digit HUC Name	Nonpoint Source Load (lb/yr) (1)	1995 Point Source Load (lb/yr) (2)	1995 Total Load (lb/yr)	% Nonpoint Source	% Point Source
Grant-Little Maquoketa	499,755	27,404	527,159	95%	5%
Pecatonica River	642,667	19,391	662,058	97%	3%
Apple-Plum Rivers	82,735	7,293	90,028	92%	8%
Coon-Yellow Rivers	254,458	15,657	270,115	94%	6%
Des Plaines River	44,392	8,283	52,675	84%	16%
Sugar River	216,708	27,743	244,451	89%	11%
Kickapoo River	229,545	19,359	248,904	92%	8%
Lower Rock River	236,423	379,639	616,062	38%	62%
Upper Rock River	401,250	330,414	731,664	55%	45%
Baraboo River	186,795	28,045	214,840	87%	13%
Buffalo-Whitewater Rivers	206,814	7,482	214,296	97%	3%
Rush-Vermillion Rivers	121,479	13,780	135,259	90%	10%
Lower Wisconsin River	538,274	21,454	559,728	96%	4%
Trempealeau River	527,810	45,467	573,277	92%	8%
Black River	477,914	55,769	533,683	90%	10%
La Crosse-Pine Rivers	119,466	255,094	374,560	32%	68%
Lake Dubay	519,094	124,151	643,245	81%	19%
Eau Claire River	138,624	2,706	141,330	98%	2%
Lower Chippewa River	317,434	59,941	377,375	84%	16%
Upper Fox River	136,103	61,372	197,475	69%	31%
Red Cedar River	268,346	35,295	303,641	88%	12%
Castle-Rock	353,684	514,524	868,208	41%	59%
Lower St. Croix River	209,114	27,256	236,370	88%	12%
Jump River	105,681	2,245	107,926	98%	2%
Upper Chippewa River	161,258	549	161,807	100%	0%
Upper St. Croix River	99,276	1,238	100,514	99%	1%
Namekagon River	49,827	-	49,827	100%	0%
Flambeau River	61,762	46,602	108,364	57%	43%
South Fork Flambeau River	39,125	5,243	44,368	88%	12%
Upper Wisconsin River	85,220	81,442	166,662	51%	49%
Totals	7,331,035	2,224,838	9,555,873	77%	23%

Table Notes:

(1)Nonpoint sources include agricultural lands, urban lands, wetlands, woodlands, etc.

(2) Point source loads do not include urban storm water runoff, CAFOs, and biosolids application to land. These runoff related point sources are included in the nonpoint source column.

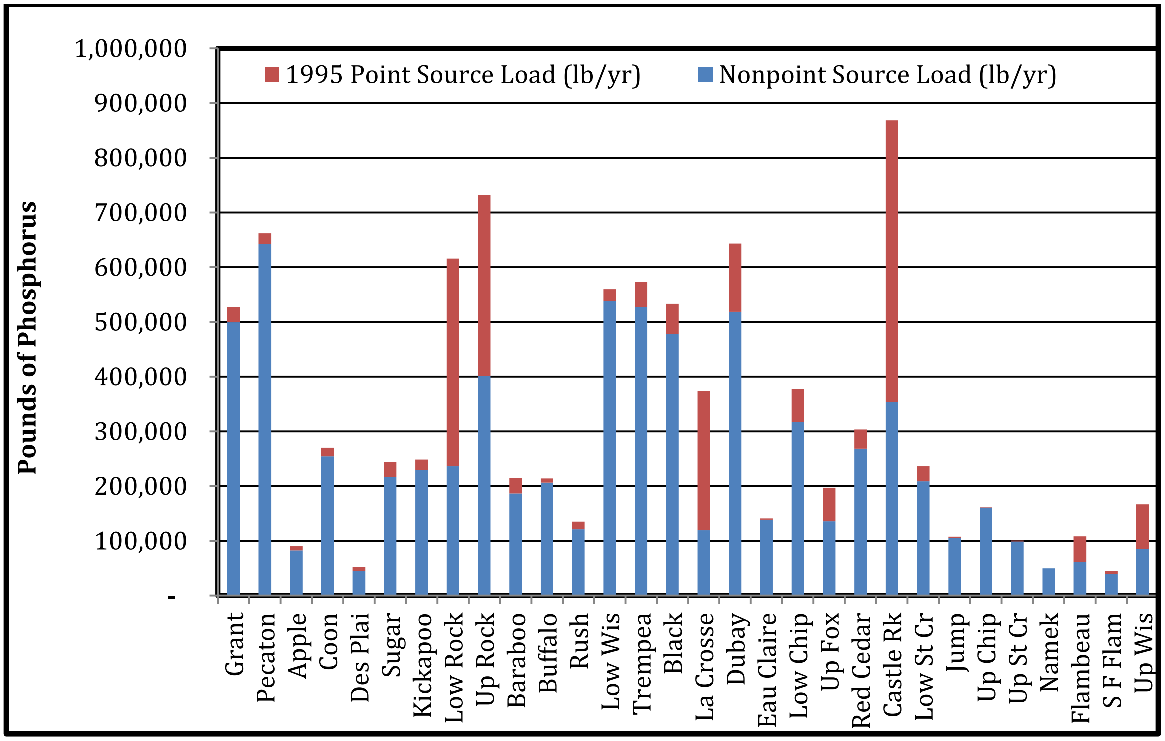

Figure 2.6 Estimated 1995 Baseline Phosphorus Load for Mississippi River Basin by HUC 8 Watershed

Table 2.3 Projected Phosphorus Reduction for Mississippi River Basin using Existing Point Source and Nonpoint Source Programs – By HUC 8 Watershed

HUC 8 Name	Nonpoint Source Load (lb/yr)	1995 Point Source Load (lb/yr)	1995 Total Load	Projected Nonpoint Source Load	Projected Point Source Load	Projected Total Load	% Reduc'n
Grant- Maquoketa R	499,755	27,404	527,159	315,601	10,593	326,194	38%
Pecatonica River	642,667	19,391	662,058	401,970	14,130	416,100	37%
Apple-Plum Rivers	82,735	7,293	90,028	51,426	6,928	58,354	35%
Coon-Yellow Rivers	254,458	15,657	270,115	169,543	12,336	181,879	33%
Des Plaines River	44,392	8,283	52,675	30,274	1,195	31,469	40%
Sugar River	216,708	27,743	244,451	137,511	11,574	149,085	39%
Kickapoo River	229,545	19,359	248,904	151,100	4,614	155,714	37%
Lower Rock River	236,423	379,639	616,062	157,748	145,897	303,645	51%
Upper Rock River	401,250	330,414	731,664	260,691	63,461	324,152	56%
Baraboo River	186,795	28,045	214,840	121,254	14,234	135,488	37%
Buffalo-Whitewater	206,814	7,482	214,296	137,540	2,338	139,878	35%
Rush-Vermillion Rivers	121,479	13,780	135,259	78,122	7,819	85,941	36%
Lower Wisconsin River	538,274	21,454	559,728	355,509	20,679	376,188	33%
Trempealeau River	527,810	45,467	573,277	345,743	6,074	351,817	39%
Black River	477,914	55,769	533,683	345,370	11,803	357,173	33%
La Crosse-Pine Rivers	119,466	255,094	374,560	84,331	31,059	115,390	69%
Lake Dubay	519,094	124,151	643,245	372,779	46,747	419,526	35%
Eau Claire River	138,624	2,706	141,330	97,542	1,873	99,415	30%
Lower Chippewa River	317,434	59,941	377,375	219,067	27,445	246,512	35%
Upper Fox River	136,103	61,372	197,475	96,493	56,714	153,207	22%
Red Cedar River	268,346	35,295	303,641	185,054	14,731	199,785	34%
Castle-Rock	353,684	514,524	868,208	254,443	118,066	372,509	57%
Lower St. Croix River	209,114	27,256	236,370	143,881	15,759	159,640	32%
Jump River	105,681	2,245	107,926	86,386	1,306	87,692	19%
Upper Chippewa River	161,258	549	161,807	142,102	259	142,361	12%
Upper St. Croix River	99,276	1,238	100,514	84,715	429	85,144	15%
Namekagon River	49,827	-	49,827	45,421	-	45,421	9%
Flambeau River	61,762	46,602	108,364	57,522	20,980	78,502	28%
S. Fork Flambeau River	39,125	5,243	44,368	35,745	906	36,651	17%
Upper Wisconsin River	85,220	81,442	166,662	79,670	56,242	135,912	18%
Total Mississippi River Basin	7,331,035	2,224,838	9,555,873	5,044,554	726,191	5,770,745	
% Reduction				31%	67%	40%	

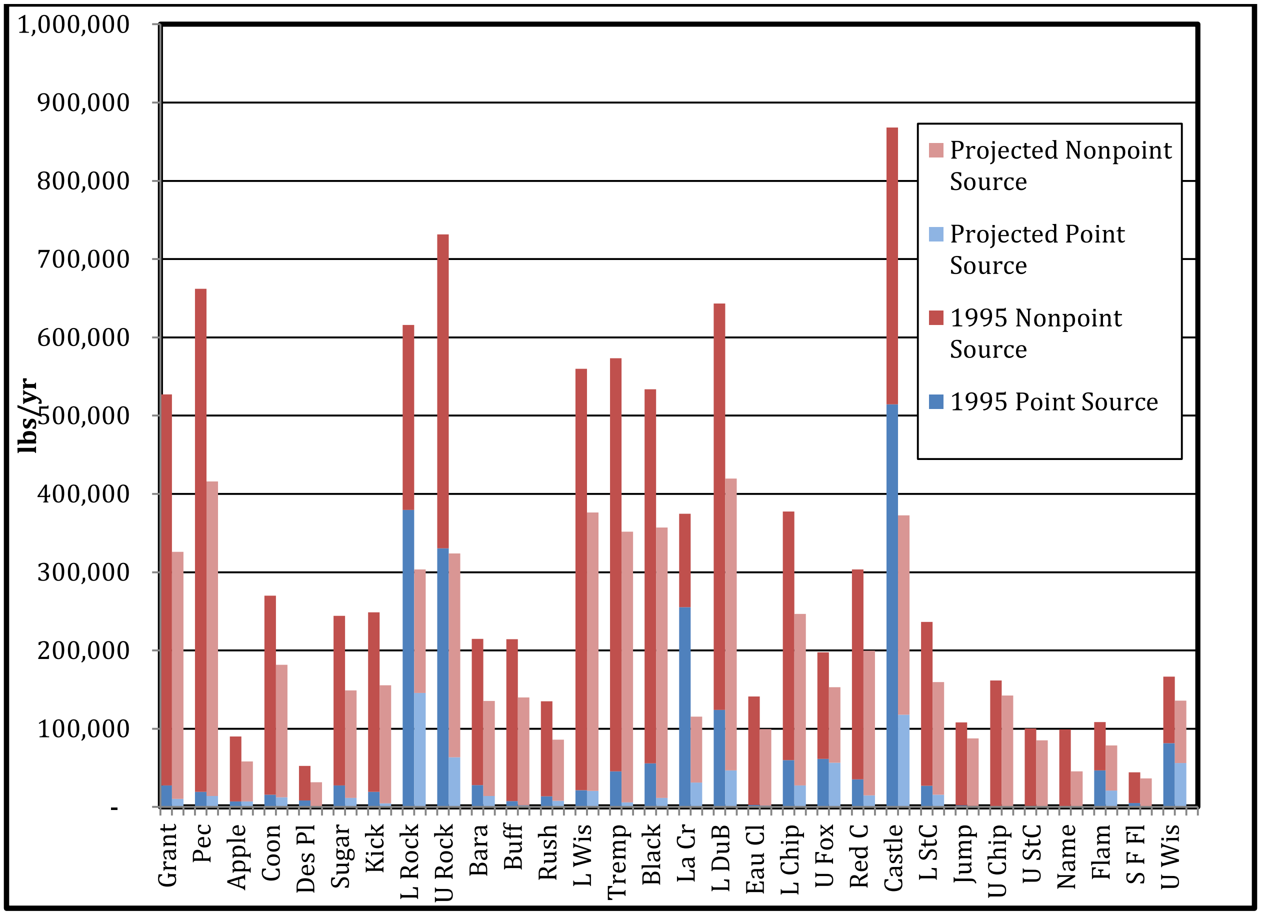

Figure 2.7 Estimated 1995 Baseline and Projected Future Phosphorus Loads for Mississippi River Basin by HUC 8 Watershed

<u>Progress to date – Gulf Hypoxia Goals</u>

The Gulf Hypoxia goals call for a 45% reduction in the phosphorus and nitrogen load (amount or mass) reaching the Gulf from each state using the early to mid-1990s as a base period. As shown in Figure 2.3 and described in greater detail in Chapter 2 of this strategy, the total average annual amount of phosphorus reaching surface waters in the Mississippi River Basin in 1995, the base year selected for this strategy, was estimated to be about 9,600,000 pounds. During 1995, municipal and industrial wastewater treatment facilities discharged about 2,200,000 pounds, about 23% of the total amount. The remainder is in a broad "nonpoint source" category that includes urban storm water runoff (many locations now under point source permits), agricultural sources (including Concentrated Animal Feeding Operations), forested areas, wetlands, etc.

Today the phosphorus loads have been reduced. There has been substantial implementation of the technology-based phosphorus removal requirements adopted in 1992 for municipal and industrial wastewater point sources. The average annual phosphorus discharge from these point sources in the Mississippi River Basin has decreased by 67% to about 700,000 pounds; representing an overall reduction of nearly 16%. From 1995 to present, phosphorus has also been reduced from nonpoint sources; however, the specific amount cannot currently be accurately determined. Clearly much implementation has taken place. For example, the Wisconsin Nonpoint Source Pollution Abatement Program Priority Watershed Projects alone expended over $200 million in state funds with much of the expenditures occurring after 1995.[14] The federal Environmental Quality Incentives Program (EQIP), administered by the Natural Resources Conservation Service (NRCS), made comparable expenditures. A conservative estimate is that the nonpoint source phosphorus loads have been reduced by 10% or about 730,000 pounds since 1995. It can be argued that a higher estimate is appropriate.

Together, the documented wastewater point source reduction and the conservatively estimated nonpoint source reduction have decreased the Mississippi River phosphorus load by about 23%, halfway to the 45% reduction goal. (See Figure 2.8.)

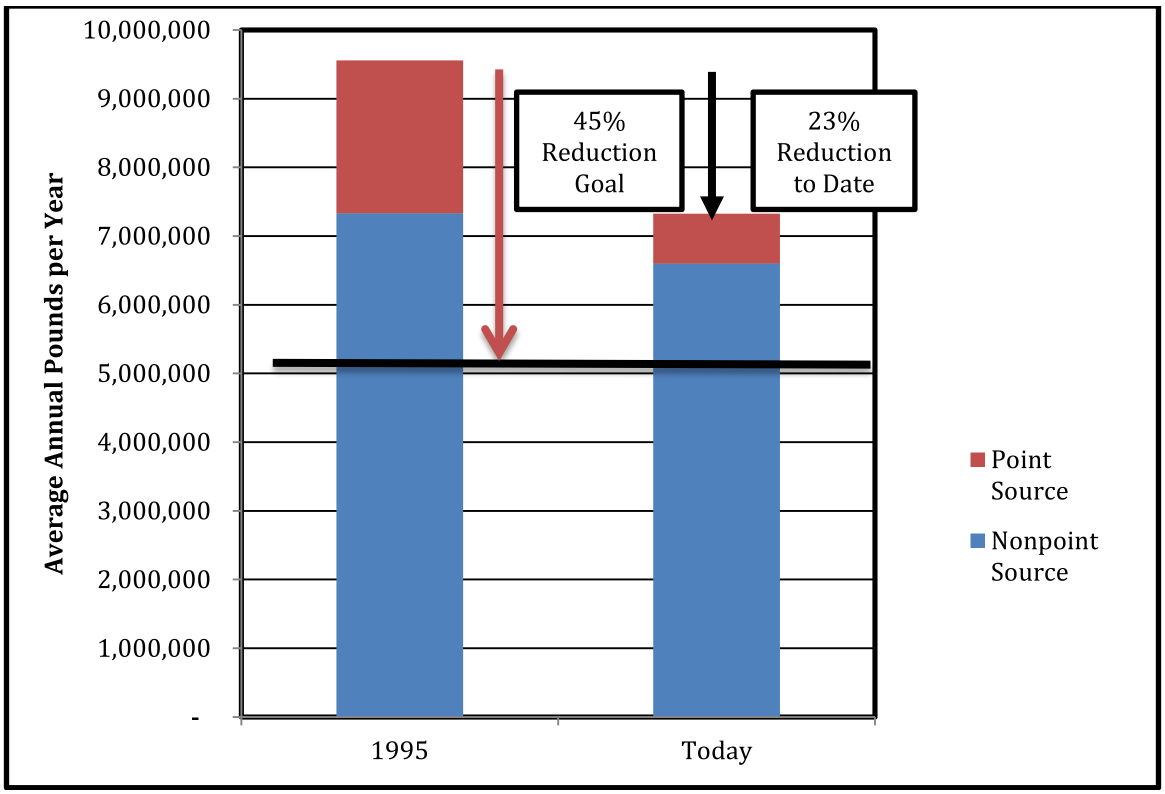

Figure 2.8. Gulf Hypoxia Phosphorus Load Reduction Goal and Estimated Progress to Date

[14] "Nonpoint Source Water Pollution Abatement and Soil Conservation Programs", Informational Paper 69, Wisconsin Legislative Fiscal Bureau, January 2013.

2.2.6 Lake Michigan – Estimated Phosphorus Load Reduction

No phosphorus or nitrogen load reduction goal has been identified for Lake Michigan. Presently, open water portions of Lake Michigan are meeting the phosphorus water quality standards criterion of 7 *u*g/L. Nearshore waters may be exceeding the water quality standards criterion. A load reduction, however, can be estimated through implementation of ongoing programs.

A phosphorus load reduction is estimated for Lake Michigan, including Green Bay, using the same assumptions, data inputs and analysis described for the Mississippi River Basin above and shown in Table 2.4 and Figure 2.9 below. The following items help illustrate differences between the two major basins:

- The majority of the municipal wastewater treatment plant discharge reduction came in the 1980s, prior to the base year, as a result of international agreements for phosphorus reductions for the Great Lakes. As a result, the point source phosphorus loads have remained unchanged or even increased in some of the HUC 8s since 1995.
- Some reductions in municipal wastewater facility phosphorus discharges have occurred, with the largest being at the Milwaukee Metropolitan Sewerage District plants.
- There has been a decrease in phosphorus discharges since 1995 from industrial wastewater facilities.
- For this analysis, urban storm water discharges are included in the nonpoint source category (as they are in SPARROW). Given the large urban areas within a number of the HUC 8s of the Lake Michigan Basin, this is a large component of the nonpoint source load for those HUC 8s.

Table 2.4 Projected Phosphorus Reduction for Lake Michigan using Existing Point Source and Nonpoint Source Programs – By HUC 8

HUC 8 Name	Nonpoint Source Load (lb/yr)	1995 Point Source Load (lb/yr)	1995 Total Load	Projected Nonpoint Source Load	Projected Point Source Load	Projected Total Load	% Reduc'n
Lower Fox River	270,672	344,201	614,873	193,293	157,807	351,100	43%
Pensaukee River	133,995	524	134,519	90,204	748	90,952	32%
Manitowoc-Sheboygan	458,625	87,646	546,271	300,839	69,289	370,128	32%
Lake Winnebago	114,353	19,628	133,981	77,207	18,942	96,149	28%
Door-Kewaunee Rivers	221,589	6,530	228,119	147,842	4,927	152,769	33%
Pike-Root Rivers	94,562	925,951	1,020,513	72,623	364,311	436,934	57%
Milwaukee River	212,662	80,206	292,868	157,419	41,982	199,401	32%
Upper Fox River	229,076	30,374	259,450	155,161	25,945	181,106	30%
Wolf River	489,918	49,403	539,321	350,479	25,945	376,424	30%
Oconto River	125,579	6,720	132,299	97,447	7,847	105,294	20%
Brule River	14,577	-	14,577	13,626		13,626	7%
Peshtigo River	85,594	10,733	96,327	69,133	4,278	73,411	24%
Menominee River	94,861	38,367	133,228	86,870	6,323	93,193	30%
Total Lake Michigan Basin	2,546,061	1,600,283	4,146,344	1,812,143	728,344	2,540,487	
% Reduction				29%	54%	39%	

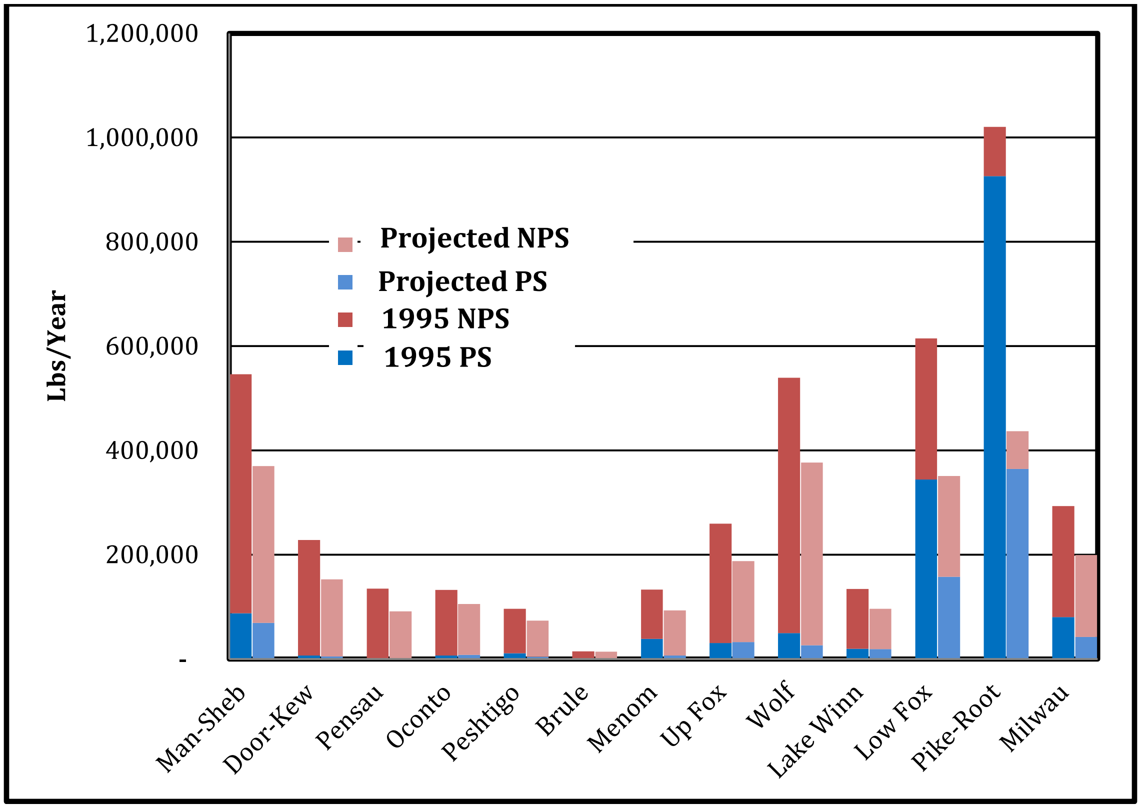

Figure 2.9 Estimated 1995 Baseline and Projected Future Phosphorus Load for Lake Michigan Basin by HUC 8 Watershed[15]

Progress to Date – Lake Michigan Basin

As shown in Figure 2.10, there has been an estimated 27% reduction since 1995 using the same analysis as used for the Mississippi River Basin. The municipal and industrial wastewater point sources' phosphorus loads have been reduced by 54%. However, there has been substantial reduction in phosphorus discharges in the 1980s, prior to the 1995 base year. No phosphorus or nitrogen load reduction goals have been identified for Lake Michigan.

[15] Man-Sheb = Manitowoc and Sheboygan; Pensau = Pensaukee; Menom = Menominee; Up Fox = Upper Fox; Lake Winn = Lake Winnebago; Low Fox = Lowr Fox and Milwau = Milwaukee

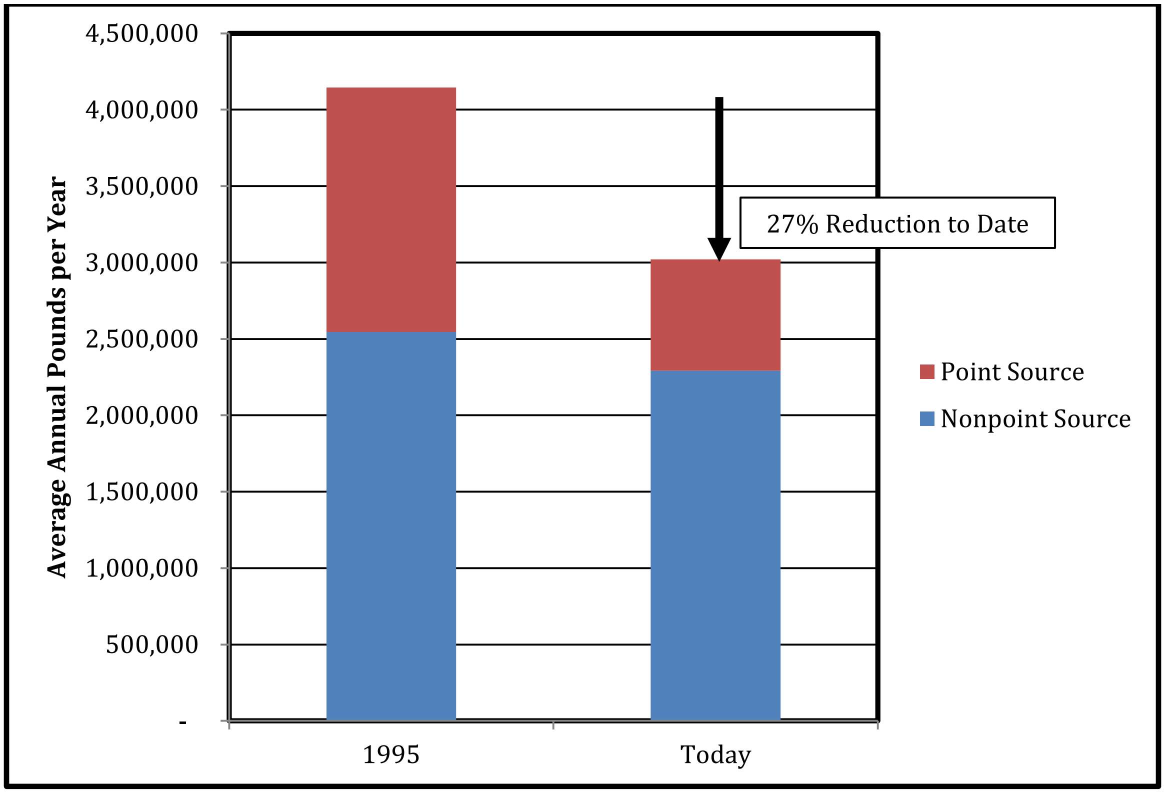

Figure 2.10 Lake Michigan Basin Phosphorus Load Reduction Estimated Progress to Date

2.2.7 Total Maximum Daily Load Analyses

Implementation of TMDLs will provide additional phosphorus load reductions beyond what would be achieved through compliance with the Chapter NR 151, Wis. Adm. Code, performance standards and prohibitions (see Chapter 4 for more information). TMDLs are the primary means for setting watershed specific load reductions for Wisconsin lakes and streams identified as impaired (not meeting water quality standards). In each TMDL analysis involving nutrients, such as phosphorus, specific load reductions are identified for both point sources and nonpoint sources (wasteload allocations and load allocations) that are necessary to attain water quality standards.

For many TMDL analyses, a level of nutrient reduction for nonpoint sources will exceed the reduction provided by the Chapter NR 151 performance standards and prohibitions. That is, compliance with the performance standards and prohibitions may not be adequate to achieve phosphorus water quality standards criteria. Implementation plans for approved TMDLs will specify what additional control is needed.