Chapter 1. Targeting/Priority Setting

<u>Element 1.</u> Prioritize Watersheds on a Statewide Basis for Nitrogen and Phosphorus Loading Reductions

1.1 EPA and Gulf Hypoxia Task Force Expectations

1.1.1 Nutrient Reduction Framework Expectation:

From EPA's WQ-26 national performance measure:

States set priorities on a watershed or source-sector basis. States may also include a combination of watershed and sector approaches in prioritizations. State should set priorities reflecting each of the three following considerations:

- **Systematic and Data-Driven:** Prioritization of sub-watersheds (or water bodies) or source sectors should reflect a systematic evaluation based on available data concerning N and P loadings, high-risk receiving water problems, public and private drinking water supply impacts, or other environmental factors. States may: (a) identify watersheds in the state which are of highest priority, or (b) identify which key source sectors or sub-sectors are of highest priority (e.g., identifying which sectors could contribute the most near-term loading reductions, such as POTWs, industrial or municipal storm water, fertilizer usage, urban or rural BMPs, etc.). States are also encouraged to utilize an adaptive approach to priority setting; i.e., as new information is available, priorities may shift. Examples: Use the USGS SPARROW model to identify major watersheds or sectors that individually or collectively account for a substantial portion of loads (e.g. 80%) delivered to waters in a state or directly delivered to multi-jurisdictional waters. Or use the Recovery Potential Screening Tool (www.epa.gov/recoverypotential/) to screen potential nutrient load reductions.

- **Appropriate scale:** For setting watershed priorities, the state should use the scale (HUC 12, HUC 8, etc.) that is most appropriate for watershed management purposes. Within each major HUC 8 watershed that has been identified as accounting for a substantial portion of the load, identify targeted/priority sub-watersheds on a HUC 12 or similar scale where subsequent activities under the strategy will be focused. For setting priorities among source sectors, the state should use an appropriate level of source detail (e.g., sector or sub-sector) for watershed management purposes.

- **Inclusive:** The state should include all state waters and water body types for which it has data available, and/or all source sectors within the state for which it has data, in its priority-setting analysis. Example: Use SPARROW to estimate N & P loadings delivered to rivers, streams, lakes, reservoirs, etc. in each major watershed and/or from each source sector across the state.

The EPA encourages states to involve the public in their priority-setting approaches, or to make the priorities available to the public.

1.1.2 Gulf Hypoxia Task Force Essential Strategy Component

- Characterize watersheds and identify nutrient sources and contributions.
- Set geographic priorities

Federal Watershed Codes

In this and other chapters we use the federal agency watershed code, the Hydrologic Unit Classification (HUC) system. The number of digits in the code increases as the size of the watershed decreases. In this document, 8-digit (HUC 8), 10-digit (HUC 10) and 12-digit (HUC 12) codes are used. The table below shows the number of HUCs in Wisconsin for each of these three commonly used levels.

Major Basin	HUC 8	HUC 10	HUC 12
Lake Superior	5	22	108
Lake Michigan	13	90	450
Mississippi River	32	256	1244
Total	50	368	1802

The average size of a HUC 10 in Wisconsin is about 150 square miles (100,000 acres) while the size of a HUC 12 is about 30 square miles (20,000 acres).

Since the federal delineation of HUC watersheds extends across state lines, a number of the HUCs have a very small area in Wisconsin with the smallest being less than 10 acres. These very small HUCs may have been combined with adjoining HUCs in the analyses described in this chapter or not included in the analysis.

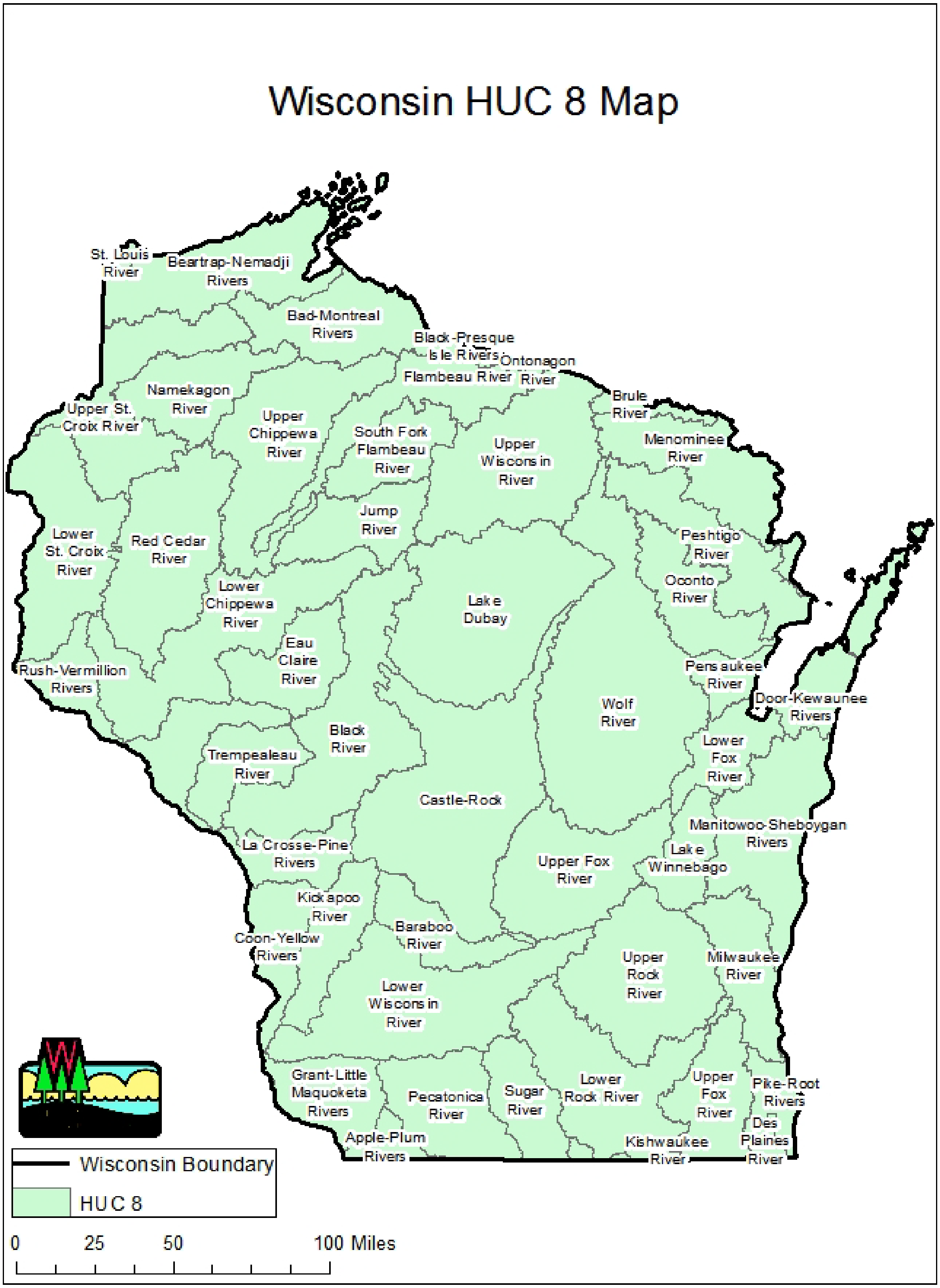

Figure 1.1 HUC 8 Watersheds in Wisconsin

1.2 Wisconsin's Approach

Major sectors of nutrient contributions to lakes and streams and groundwater in Wisconsin are generally considered to include:

- Publicly (e.g. municipal) and privately (e.g. industrial) owned wastewater treatment facilities[4];
- Permitted storm sewer systems that are separate from municipal systems(MS4s);
- Industrial storm sewer systems;
- Concentrated animal feeding operations (CAFOs);
- Non-permitted municipal storm sewer systems (smaller communities);
- Septic systems and other on-site disposal systems;
- Agricultural lands, including land contributing nutrients in runoff from croplands, animal lots, dry lots as well as leaching of nitrogen through soil profiles;
- Eroding stream banks; and
- Timber harvesting sites[5].

The relative importance of these different source sectors varies greatly by receiving lake or stream. In some watersheds, point sources may be the dominant source of nutrients, while in others nonpoint sources may dominate. From a statewide perspective, all are considered important. Wisconsin has federal, state or local programs in place to control nutrients -- particularly phosphorus – from each of these major sectors.[6] Targeting and priority setting based on watersheds recognizes these disproportionate nutrient contributions.

This chapter describes Wisconsin's approaches to targeting/priority setting in two sections. In the first section (1.2.1), a brief analysis of geographic extent of phosphorus sources is presented. In the second section (1.2.2), the top group of watersheds resulting from an analysis of modeling and monitoring information is summarized. Wisconsin state, federal and local agencies conducted a systematic and data driven analysis of nutrient contributions to geographically target watersheds. This should be considered as **an initial analysis** to be revisited and refined over time.

1.2.1. Geographic Extent of Nutrient Sources

Both EPA's Nutrient Reduction Strategy and the Gulf of Mexico Essential Strategy Components call for a characterization of watersheds and identification of nutrient contributions. EPA suggests identifying geographic locations for 80% of the nutrient contribution. Tables 1.1 and 1.2 show the nonpoint source phosphorus load (average pounds per year) for each of the HUC 8s in Wisconsin within the Mississippi River Basin and Lake Michigan Basin, respectively. In general, this simple analysis shows that much of the state that is not forested contributes to that 80% of the phosphorus load. Although some geographic areas contribute more per square mile or acre than others, it is not

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[4] Includes management of application of biosolids to agricultural lands
[5] Generally considered as a source of sediment and not generally considered as a major source of phosphorus.
[6] The suite of regulatory and non-regulatory programs is described in other chapters of this report.

feasible to achieve large reductions in nutrient loads to downstream waters, such as the Mississippi River or Lake Michigan, by working only in small portions of the state.

Both of the tables were developed using USGS SPARROW (SPAtially Referenced Regressions On Watershed) model results for agricultural, urban, forested and other lands.[7] In the SPARROW analysis, urban storm water runoff nutrient contributions are included as nonpoint sources even for urban areas under the WPDES storm water permit program. Wastewater treatment facilities were not included in this simple analysis. However, both point sources and nonpoint sources are included in the analyses described in Chapter 2 (Element 2). The HUC 8 river basins are listed in the tables in decreasing order of phosphorus yield (average pounds per acre per year). Yields are a better indication of the significance of the contribution, while total load tends to be more a response to the size of the basin given the wide variation in basin size. It is presumed that nitrogen contributions follow a similar geographic distribution, but a future analysis is warranted when better point source and nonpoint source information is available.

For the Mississippi River Basin, the HUC 8 river basins in southwest Wisconsin (e.g. Grant – Platte River Basin and Sugar – Pecatonica River Basin) have the highest phosphorus yields and also rank at the top for phosphorus loads (pounds per year). The Upper Rock River Basin, the Lower Wisconsin River Basin, the Buffalo --Trempealeau River Basin, the Lower Chippewa River Basin and the Central Wisconsin River Basin, although having a lower yield, also contribute relatively large phosphorus loads due to the large geographic area of each of the basins.

For the Lake Michigan Basin, the Lower Fox River, Pensaukee River and combined Manitowoc – Sheboygan Rivers HUC 8 basins contribute the highest phosphorus yields. However, the Wolf River Basin due to its very large size contributes a substantial phosphorus load.

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[7] Robertson, D. M., and Saad, D. A., 2011, Nutrient inputs to the Laurentian Great Lakes by source and watershed estimated using SPARROW watershed models: Journal of the American Water Resources Association. V. 47, p. 1011-1033, DOI: 10.1111/j.1752-1688.2011.00574.x.

Table 1.1 Nonpoint Source Phosphorus Yield and Load Contributions for the **Mississippi River Basin** – By HUC 8 (in order of decreasing yields)

Mississippi River Basin 8-digit HUC	DNR Basin	Nonpoint Source yield (lb/a/yr)	Nonpoint Source Load (lb/yr)	Cumulative Total (lb/yr)	% of total	Cumulative % of Total
Grant- Maquoketa	Grant-Platte	0.99	499,755	499,755	6.8%	6.8%
Pecatonica River	Sugar – Pecatonica	0.88	642,667	1,142,423	8.8%	15.6%
Apple-Plum Rivers	Grant-Platte	0.74	82,735	1,225,158	1.1%	16.7%
Coon-Yellow Rivers	Bad Axe – La Crosse	0.59	254,458	1,479,616	3.5%	20.2%
Des Plaines River	South East Fox	0.51	44,392	1,524,009	0.6%	20.8%
Sugar River	Sugar – Pecatonica	0.49	216,708	1,740,717	3.0%	23.7%
Kickapoo River	Lower Wisconsin	0.47	229,545	1,970,262	3.1%	26.9%
Upper Rock River	Upper Rock	0.46	401,250	2,607,935	5.5%	32.3%
Baraboo River	Lower Wisconsin	0.45	186,795	2,794,730	2.5%	34.9%
Buff-Whitewater	Buffalo-Trempealeau	0.44	206,814	3,001,544	2.8%	37.7%
Rush-Vermillion Rivers	Lower Chippewa	0.37	121,479	3,123,023	1.7%	39.4%
Lower Wisconsin River	Lower Wisconsin	0.36	538,274	3,661,298	7.3%	46.7%
Trempealeau River	Buffalo-Trempealeau	0.35	527,810	4,189,108	7.2%	53.9%
Black River	Black	0.33	477,914	4,667,022	6.5%	60.4%
La Crosse-Pine Rivers	Bad Axe - La Crosse	0.31	119,466	4,786,488	1.6%	62.1%
Lake Dubay	Central Wisconsin	0.30	519,094	5,305,582	7.1%	69.1%
Eau Claire River	Lower Chippewa	0.25	138,624	5,444,206	1.9%	71.0%
Lower Chippewa River	Lower Chippewa	0.24	317,434	5,761,639	4.3%	75.4%
Upper Fox River	South East Fox	0.23	136,103	5,897,742	1.9%	77.2%
Red Cedar River	Lower Chippewa	0.22	268,346	6,166,088	3.7%	80.9%
Lower Rock River [#]	Lower Rock	0.19	236,423	2,206,685	3.2%	84.1%
Lower St. Croix River	St. Croix	0.19	209,114	6,728,886	2.9%	87.0%
Jump River	Upper Chippewa	0.19	105,681	6,834,567	1.4%	88.4%
Castle-Rock	Central Wisconsin	0.17	353,684	6,519,772	4.8%	93.2%
Upper Chippewa River	Upper Chippewa	0.13	161,258	6,995,825	2.2%	95.4%
Upper St. Croix River	St. Croix	0.10	99,276	7,095,101	1.4%	96.8%
Namekagon River	St. Croix	0.08	49,827	7,144,928	0.7%	97.5%
Flambeau River	Upper Chippewa	0.08	61,762	7,206,690	0.8%	98.3%
South Fork Flambeau R	Upper Chippewa	0.08	39,125	7,245,815	0.5%	98.8%
Upper Wisconsin River	Upper Wisconsin	0.06	85,220	7,331,035	1.2%	100.0%

Note: Lower Rock River data also includes Kishwaukee River and Piscasaw Creek 8-digit HUCs

Table 1.2 Nonpoint Source Phosphorus Yield and Load Contributions for the **Lake Michigan Basin** – By HUC 8 Watershed (in order of decreasing yields)

Lake Michigan Basin 8-digit HUC	DNR Basin	Nonpoint Source yield (lb/a/yr)	Nonpoint Source Load (lb/yr)	Cumulative Total (lb/yr)	% of total	Cumulative % of Total
Lower Fox River	Lower Fox	0.65	270,672	270,672	10.6	10.6%
Pensaukee River	Green Bay	0.63	133,995	404,666	5.3	15.9%
Manitowoc -Sheboygan	Manitowoc Sheboygan	0.58	458,625	863,291	18.0	33.9%
Lake Winnebago	Upper Fox	0.48	114,353	977,644	4.5	38.4%
Door-Kewaunee	Twin-Door-Kewaunee	0.45	221,589	1,199,233	8.7	47.1%
Pike-Root Rivers	Southeast	0.44	94,562	1,293,795	3.7	50.8%
Milwaukee River	Milwaukee	0.38	212,662	1,506,457	8.4	59.2%
Upper Fox River	Upper Fox	0.22	229,076	1,735,533	9.0	68.2%
Wolf River	Wolf	0.21	489,918	2,225,451	19.2	87.4%
Oconto River	Green Bay	0.20	125,579	2,351,030	4.9	92.3%
Brule River	Green Bay	0.12	14,577	2,365,606	0.6	92.9%
Peshtigo River	Green Bay	0.11	85,594	2,451,201	3.4	96.3%
Menominee River	Green Bay	0.11	94,861	2,546,061	3.7	100.0%

1.2.2. Geographic Targeting/Priority Setting

For purposes of targeting and priority setting, HUC 10 watersheds currently provide the best match with available modeling and water quality information; even though the HUC 12 is more suitable for implementation projects. In general, analysis at the HUC 12 level would require more sophisticated modeling and water quality monitoring at many more streams or groundwater locations. Future efforts will move toward developing a HUC 12 analysis to better serve implementation project selection.

An initial suite of "top group" HUC 10 watersheds were identified through a data-driven, systematic analysis. Top groups were identified separately for the Mississippi River Basin and for the Lake Michigan Basin. Within each major basin, top groups were identified separately for phosphorus concerns and nitrogen concerns in surface waters. An initial statewide analysis of nitrogen concerns in groundwater was also conducted.

It is anticipated that the top groups of HUC 10 watersheds listed in this section will be used to help select future implementation nonpoint source projects, such as for the Mississippi River Basin Initiative (USDA – NRCS), Environmental Quality Incentives Program (EQIP) (USDA – NRCS) and the Great Lakes Restoration Initiative.[8] Several additional factors, such as local interest and capability; likelihood for the water to respond; coordination with other implementation activities; and availability of water quality monitoring data, will also be considered in future implementation

[8] Programs may also give priority to high quality waters where "threats or stressors" have been identified.

project selection. These top group HUC 10 watersheds may also be used in setting priorities for implementation programs. For example, Wisconsin federal, state and local agencies may focus water quality monitoring, technical assistance or other management tools in these watersheds.

This initial analysis uses a multiple lines of evidence approach. In such an approach, if multiple lines of evidence (e.g., SPARROW model results and monitored concentrations) identify the same top HUC 10s, there should be a high level of confidence that those HUC 10s are among the highest contributors. If different lines of evidence give substantially different rankings, then those HUC 10s are not necessarily in the top group. This is not meant to infer that any of the lines of evidence are in error, since they may measure or predict different parameters. In future analyses, it is anticipated that additional lines of evidence will be incorporated, such as likelihood of the lake or stream to respond to reduced nutrient loads.

A summary of information on each of the HUC 10 watersheds is included in Table A.1 of Appendix A. As shown on Figures 1.2 and 1.3, the HUC 10 watersheds tend to form clusters based on common land use, soils and topography. HUC 10 watersheds in the Lake Superior Basin would compare to the bottom half of watersheds in the Lake Michigan and Mississippi River Basin. Information on these Lake Superior Basin HUC 10 watersheds is included in Table A.1. Table A.1 also contains the following information:

- Percent agricultural and urban use
- Point source – nonpoint source phosphorus load ratio (identified by PRESTO model)
- The inclusion of the watershed in an EPA approved TMDL
- The presence of an Outstanding Resource Water or Exceptional Resource Water in or "touching" the watershed

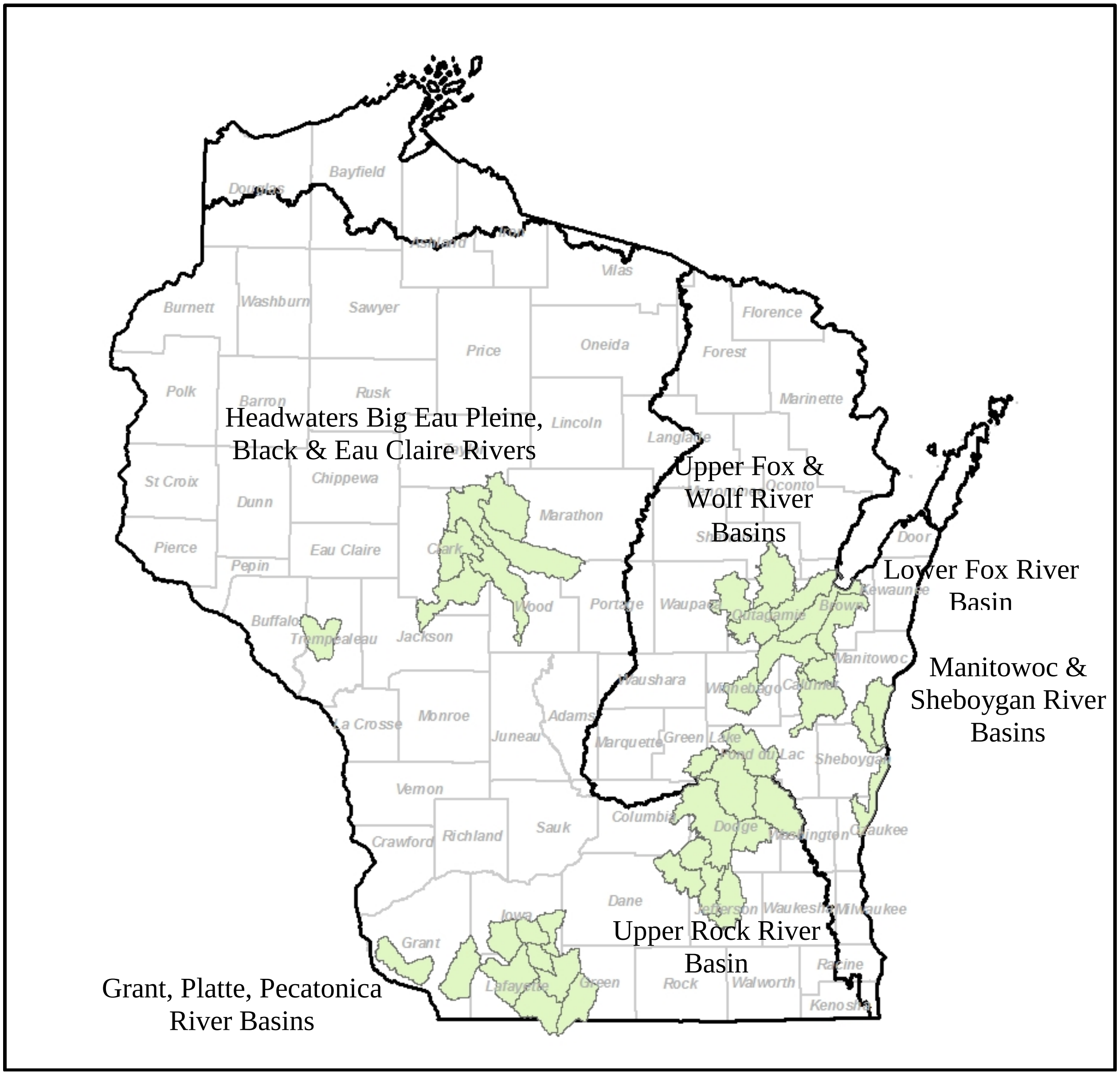

Figure 1.2 Top Group HUC 10 Watersheds for Phosphorus

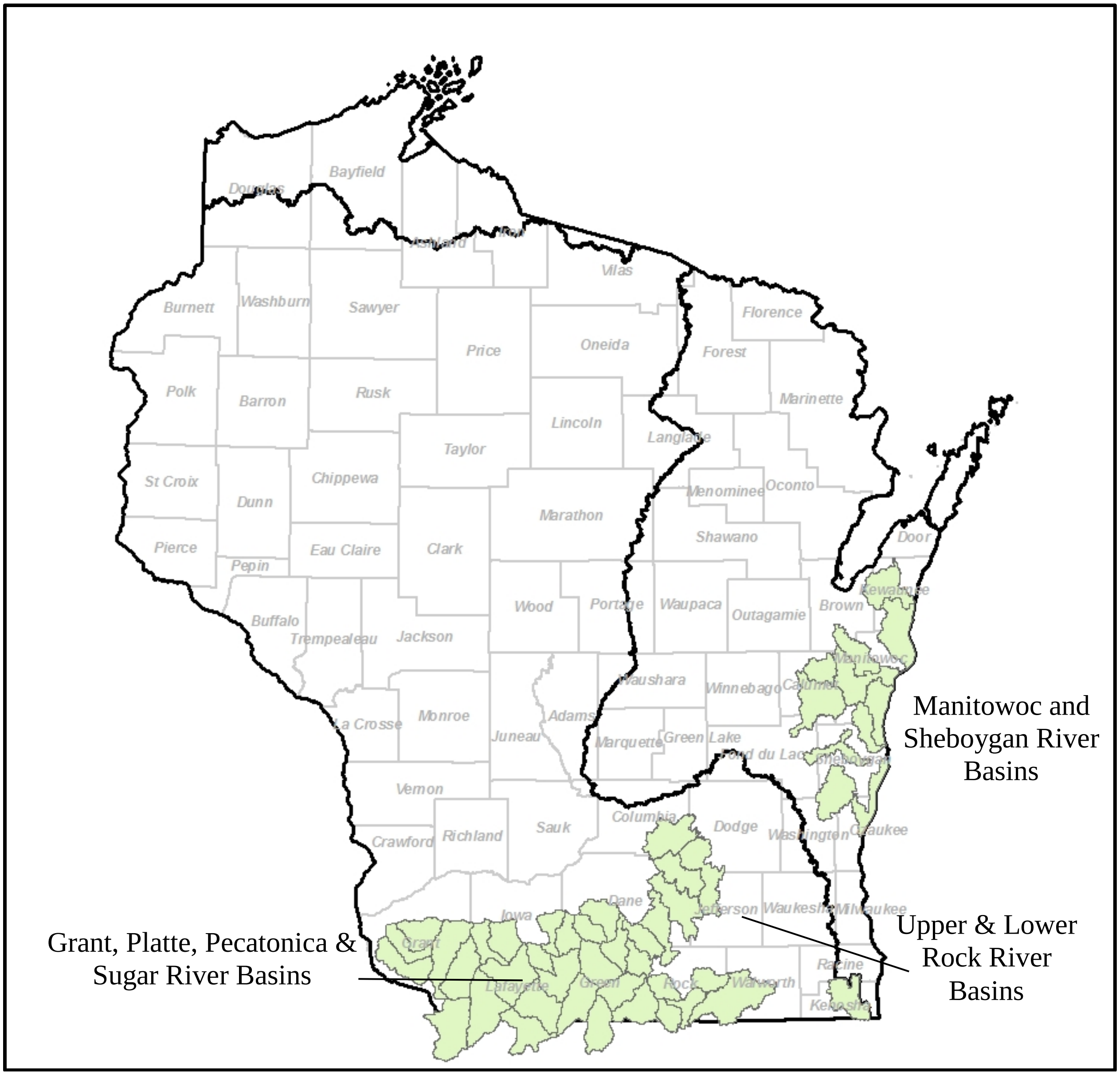

Figure 1.3 Top Group HUC 10 Watersheds for Nitrogen

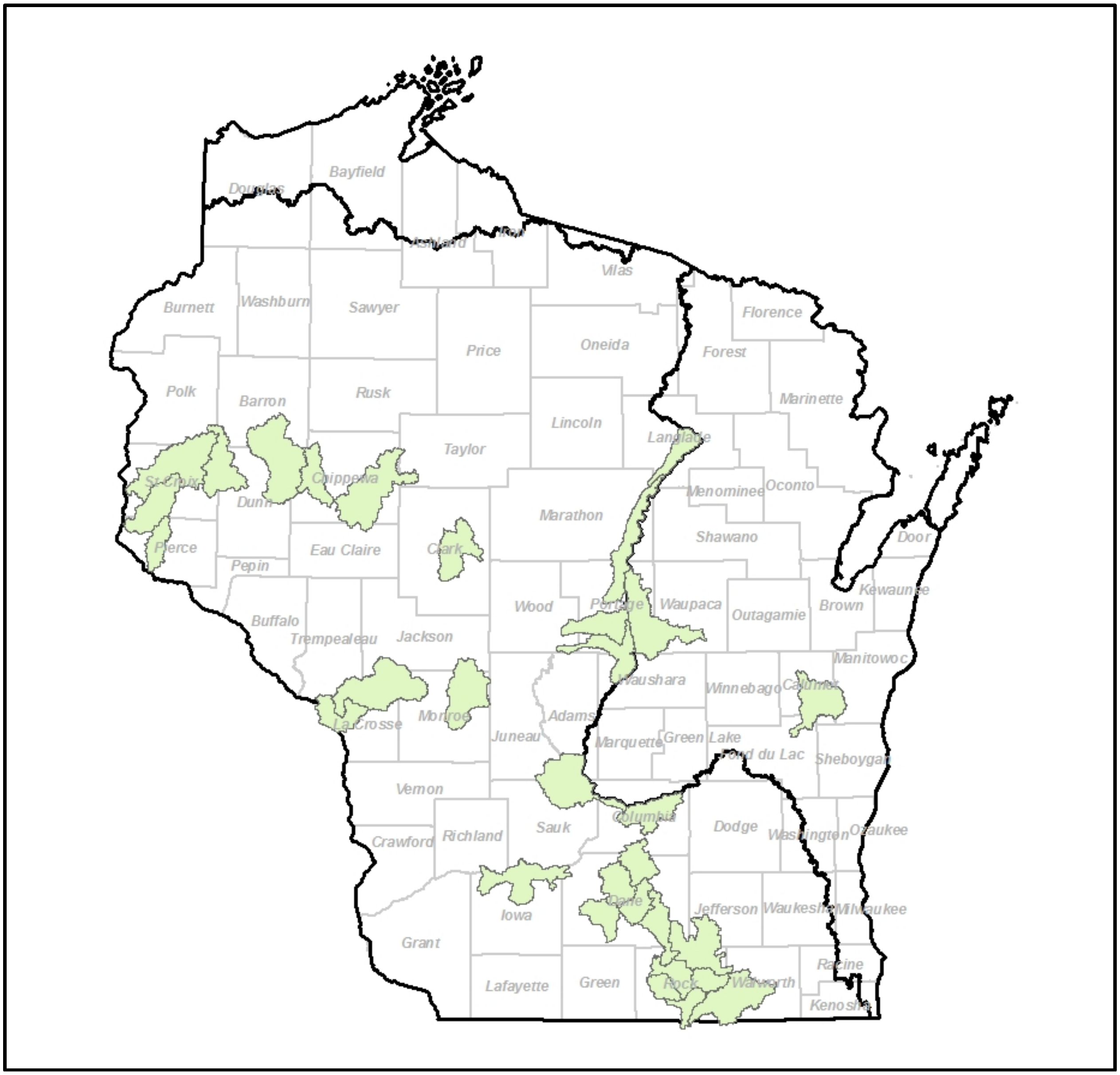

Figure 1.4 Top Group Safe Drinking Water - Nitrates

Mississippi River Basin Top Groups

Phosphorus – Surface Waters

Watersheds were analyzed according to SPARROW model incremental yields and median stream concentrations of phosphorus monitored during the growing season. The top group HUC 10 watersheds listed below comprises about 10% of the HUC 10 watersheds in the Mississippi River Basin. They are either:

- The top 20% for both SPARROW incremental yield modeling and stream monitoring growing season concentrations.

- The top 10% of either SPARROW incremental yield modeling or stream monitoring growing season concentrations and the top 30% for the other.

Headwaters of the Big Eau Pleine River, Yellow River and the Black River in western Marathon County, Wood County and Clark County.

0704000702	Popple River
0704000704	Rock Creek-- Black River
0707000215	Dill Creek – Big Eau Pleine River
0707000217	Little Eau Pleine River
0707000311	Rocky Creek – Yellow River

Watersheds in southwestern Wisconsin south of Military Ridge, including those in the Grant-Platte and Sugar-Pecatonica River basins.

0706000303	Lower Grant River
0706000304	Little Platte River
0709000301	Mineral Point Branch
0709000303	Ames Branch – Pecatonica River
0709000304	Dodge Branch
0709000306	Ridgeway Branch – Pecatonica River
0709000307	Yellowstone River
0709000308	East Branch Pecatonica River
0709000309	Spafford Creek – Pecatonica River
0709000310	Honey Creek – Pecatonica River

Watersheds in the Rock River Basin[9]

0709000101	East Branch Rock River
0709000102	West Branch Rock River – Rock River
0709000104	Sinissippi Lake – Rock River
0709000108	Maunesha River
0709000109	Beaver Dam River
0709000110	Crawfish River
0709000111	Johnson Creek – Rock River

Others

0704000504	Middle Trempealeau River
0704000709	Lake Arbutus – Black River

[9] The two HUC 10s draining to Lake Mendota are ranked lower due to the SPARROW analysis where the analytical watershed is at the outlet of Lake Mendota and not at locations entering the lake. In the Rock River TMDL analysis where the SWAT Model was used, these two HUC 10s ranked in the top five HUC 10s in the basin. It is not clear whether as a result of a revised SPARRROW analysis that these two HUC 10s would be in the top group. See sidebar.

Nutrients in Lake Mendota and the Yahara River Watershed

Multiple efforts over many years have contributed to understanding of sediment and nutrient transport within the Yahara Watershed and ongoing refinement and calibration of nutrient loading models. Analysis consistently identifies the Lake Mendota-Yahara River Watershed (HUC10-0709000206) as a major source of nutrient loading within the Yahara Watershed (see references listed below). Those studies have led to substantial investment of resources and the development of Dane County ordinances to address nutrient losses.

References

- Wisconsin Department of Natural Resources: Bureau of Water Resources Management-Nonpoint Source and Land Management Section. (1997). *Nonpoint Source Control Plan for the Lake Mendota Priority Watershed Project*. Retrieved from http://www.countyofdane.com/lwrd/landconservation/papers/Lmw.pdf on May 28, 2013.
- Strand Associates, Inc. (2008). *Community Manure Management Feasibility Study*. Madison, WI:
- Yahara CLEAN Memorandum of Understanding Signatories. (2010). *A CLEAN Future for the Yahara Lakes: Solutions for Tomorrow, Starting Today*. Madison, WI: Sue Jones, Sue Josheff, Dennis Presser, Genesis Steinhorst. Retrieved from http://www.yaharaportal.org/sites/default/files/CLEAN_Report_090910.pdf on May 28, 2013.
- Montgomery Associates Resource Solutions, LLC. (2011). *Yahara CLEAN Non-Point Source Modeling Report for the Dane County Department of Land and Water Resources*. Cottage Grove, WI:
- UW-Extension. (2012). *Farm Practices in the Lake Mendota Watershed: A Comparative Analysis of 1996 and 2011*. Madison, WI: Ken Genskow & Carolyn Rumery Betz. Retrieved from http://www.yaharaportal.org/sites/default/files/MendotaFPIReporFINALJune2012.pdf on May 28, 2013.
- Strand Associates, Inc. (2012). *Yahara CLEAN Implementation Plan*. Madison, WI:
- Strand Associates, Inc. (2013). *Yahara CLEAN Engineering Report*. Madison, WI:
- Lathrop, R. C. (2007). Perspectives on the eutrophication of the Yahara lakes. *Lake and Reservoir Management* 23:345-365.
- Lathrop, R. C. and S. R., Carpenter. (2011). Phosphorus Loading and Lake Response Analysis for the Yahara Lakes. Pending publication.

Nitrogen – Surface Waters

Watersheds were analyzed according to SPARROW model incremental yields and median stream concentrations of total nitrogen monitored during the growing season. The top group HUC 10 watersheds listed below comprises about 15% of the HUC 10 watersheds in the Mississippi River Basin. Many of those listed are also listed for phosphorus above, but a few, such as Blackhawk Creek, are ranked very high for nitrogen but not for phosphorus. Watersheds in Marathon, Clark and Taylor Counties listed above for phosphorus, do not come out as high for nitrogen. Due to similar overall results, a larger list for nitrogen than the list for phosphorus is appropriate. The HUC 10 watersheds are listed based on being in either:

- the top 20% for both SPARROW incremental yield modeling and stream monitoring growing season concentrations.
- the top 10% of either SPARROW incremental yield modeling or stream monitoring growing season concentrations and the top 30% for the other.

Watersheds in southwestern Wisconsin south of Military Ridge, including those in the Grant-Platte and Sugar-Pecatonica river basins.

0706000301	Upper Grant River
0706000302	Middle Grant River
0706000303	Lower Grant River
0706000304	Little Platte River
0706000305	Platte River
0706000502	Sinsinawa River – Mississippi River
0706000503	Galena River
0706000505	South Fork Apple River – Apple River
0709000301	Mineral Point Branch
0709000302	Headwaters Pecatonica River
0709000303	Ames Branch – Pecatonica River
0709000305	Blue Mounds Branch
0709000306	Ridgeway Branch – Pecatonica River
0709000307	Yellowstone River
0709000308	East Branch Pecatonica River
0709000309	Spafford Creek – Pecatonica River
0709000310	Honey Creek – Pecatonica River
0709000311	Richland Creek
0709000315	Raccoon Creek
0709000401	West Branch Sugar River
0709000402	Headwaters Sugar River
0709000403	Allen Creek
0709000404	Little Sugar River
0709000405	Story Creek – Sugar River
0709000406	Sylvester Creek – Sugar River
0709000407	Taylor Creek – Sugar River

Watersheds in the Rock River

0709000107	Headwaters Crawfish River
0709000108	Maunesha River
0709000110	Crawfish River
0709000204	Koshkonong Creek
0709000208	Badfish Creek
0709000209	Lake Kegonsa – Yahara River
0709000211	Blackhawk Creek
0709000212	Bass Creek
0709000214	Turtle Creek
0709000215	City of Beloit – Lower Rock River

Others

0712000401	Headwaters Des Plaines River

Nitrogen – Drinking Water/Groundwater

HUC 10 watersheds with higher nitrogen levels in well water compared to other watersheds in Wisconsin were identified statewide basis. The analysis included both the number and percent of public wells with nitrate concentrations of 5 mg/L or greater. The threshold of 5 mg/L was chosen as being well within the range of "human activity influenced" groundwater degradation for this nutrient, and is also thought to place the public system at greater risk of exceeding the enforcement standard of 10 mg/L. The top 10% of HUC 10 watersheds statewide are considered as the top group, and comprise about 12% of the HUC 10s in the Mississippi River Basin.

The HUC 10 watersheds of the top group located within the Mississippi River Basin in order of HUC 10 number are:

0703000510	Willow River
0703000511	Kinnickinnic River
0704000103	Trimbelle River
0704000601	Halfway Creek – Mississippi River
0704000704	Rock Creek – Black River
0704000712	Fleming Creek – Black River
0705000503	Lake Wissota
0705000504	Duncan Creek
0705000705	Lake Chetek
0705000707	Lower Pine Creek – Red Cedar River
0707000211	Spring Brook
0707000301	Plover River
0707000304	Fourmile Creek
0707000305	Tenmile Creek
0707000315	Upper Lemonweir River
0707000319	Dell Creek – Wisconsin River
0707000501	Duck Creek – Wisconsin River
0707000512	City of Spring Green – Wisconsin River
0709000205	Headwaters Yahara River
0709000206	Lake Mendota – Yahara River
0709000207	Lake Monona – Yahara River
0709000209	Lake Kegonsa – Yahara River
0709000210	Lake Koshkonong – Rock River
0709000211	Blackhawk Creek
0709000212	Bass Creek
0709000213	Marsh Creek – Rock River
0709000214	Turtle Creek
0709000215	City of Beloit – Lower Rock River
0709000402	Headwaters Sugar River

Lake Michigan Basin Top Groups

Watersheds in the Lake Michigan Basin were analyzed for phosphorus and total nitrogen in surface waters and nitrogen in drinking water/groundwater in the same manner used for the Mississippi River Basin.

Phosphorus – Surface Waters

Those HUC 10s listed below comprise about 16% of the HUC 10s in the Lake Michigan Basin.

Watersheds in the Manitowoc and Sheboygan River Basins.

0403010103	North Branch Manitowoc River
0403010104	South Branch Manitowoc River
0403010107	Sevenmile & Silver Creeks – Frontal Lake Michigan
0403010108	Pigeon River
0403010112	Black R, Sauk Cr and Sucker Cr – Frontal L. Mich.

Watersheds in the Lower Fox River Basin.

0403020401	Duck Creek – Frontal Green Bay
0403020402	Plum Creek – Fox River
0403020403	East River
0403020404	Fox River – Frontal Green Bay (Apple–Ashwaubenon-Dutchman Creeks)

Watersheds surrounding or west of Lake Winnebago.[10]

0403020104	Upper Grand River
0403020112	Lake Butte des Mortes
0403020208	Shioc River
0403020213	Bear Creek – Embarrass River
0403020214	Bear Creek – Wolf River.
0403020302	Fond du Lac River

Nitrogen – Surface Waters

Those HUC 10s listed below comprise about 13% of the HUC 10s in the Lake Michigan Basin. Many of those listed are also listed for phosphorus above.

Watersheds in the Manitowoc, Sheboygan and Milwaukee River Basins.

0403010101	East Twin River – Frontal Lake Michigan
0403010103	North Branch Manitowoc River
0403010104	South Branch Manitowoc River
0403010105	Branch River

[10] The relative rank of these watersheds would be lower if the "delivered" SPARROW results are used where trapping of phosphorus within Lake Winnebago is incorporated.

0403010106	Manitowoc River – Frontal Lake Michigan
0403010107	Sevenmile & Silver Creeks – Frontal Lake Michigan
0403010108	Pigeon River
0403010109	Mullet River
0403010112	Black R, Sauk Cr and Sucker Cr – Frontal L. Mich.
0403010203	Kewaunee River
0404000301	North Branch Milwaukee River

Nitrogen – Drinking Water/Groundwater

The top 10% statewide are considered as the top group, and comprise about 2% of the HUC 10s in the Lake Michigan Basin. The HUC 10 watersheds of the top group located within the Lake Michigan Basin are:

0403010104	South Branch Manitowoc River
0403020218	Waupaca River

1.2.3 Models and Monitoring Data.

For this data-driven analysis, results from the USGS SPAtially Referenced Regressions On Watershed attributes (SPARROW) model, DNR Watershed Rotation Water Quality Monitoring (aka "pour point") data, and public drinking water systems well data were used as follows:

- USGS SPARROW Model[11] -- This model was used for this analysis since it consistently provided both phosphorus and nitrogen load information. "Incremental" nonpoint phosphorus and nitrogen yield results from the MRB3 SPARROW models (Robertson and Saad 2011) were aggregated at the HUC 10 level. Yields are expressed in average annual pounds per acre per year over several years centered around 2002, because these values are not influenced by the size of the watershed. Use of the "incremental" yield rather than the "delivered" incremental yield to downstream receiving waters places greater emphasis on local waters rather than on downstream waters, such as the Mississippi River and Gulf of Mexico.

- DNR watershed "pour point" monitoring concentrations data set – DNR collected water quality samples once per month during one year throughout the 2006-2011 period at the downstream location "pour point" of about 330 delineated watersheds on a rotating basis (50 to 60 per year. Median growing season (May through October) concentrations were used in this analysis. A minimum of four samples were needed to compute the median value. If an adequate number of samples were not available, other data specific to the watershed were used and shown in brackets in the HUC 10 table in Appendix A.

- Safe Drinking Water Nutrient Impacts – The prevalence of wells in the public drinking water supply systems reporting well water results of 5 mg/L or greater for nitrate were used as an

[11] For more information on SPARROW modeling, see http://wi.water.usgs.gov/rna/9km30/index.html

approximate indicator that groundwater quality within the watershed shows evidence of significant nutrient impact. Two factors were considered jointly; the frequency of occurrence and the ratio of impacted wells to total active public drinking water systems located in the HUC 10 watershed. Each impacted groundwater well is counted only once for the ten year period from 2003-2012.

1.2.4 Urban Watersheds

The analysis of the SPARROW model results described above did not include the municipal and industrial wastewater facility contribution identified with SPARROW for a number of reasons. Federal funding programs are likely to focus on agricultural nonpoint source management and there isn't a creditable point source nitrogen data set. However, if these wastewater point source phosphorus discharges were included, the SPARROW incremental and delivered phosphorus yields would change greatly for a small number of HUC 10 watersheds.

In the Mississippi River Basin:

- Pine Creek – Mississippi River (0704000605) due to the presence of the La Crosse wastewater facility,
- Lake Kegonsa – Yahara River (0709000209),
- Marsh Creek – Rock River (0709000213) due to the Janesville facility, and
- City of Winona – Mississippi River (0704000306) due to Winona Minnesota and other facilities

- In the Lake Michigan Basin: Pike River (0404000204).

1.2.5 Targeting within Watersheds

Although this chapter focuses on targeting watersheds for implementation funding and management activities, it is also important to recognize the Wisconsin efforts to identify critical sources areas and to target implementation activities within these watersheds. This is especially important for management of phosphorus where the majority of the phosphorus load may come from less than one-third of the croplands and from concentrated sources, such as animal lots. In many areas steeply sloped "dry lots" where livestock are located in close proximity to intermittent channels may be some of the most significant sources. Wisconsin is committed to continuing work to identify and understand management in critical source areas and their role in targeting within watersheds.
A research project in the Pleasant Valley watershed located in southwest Wisconsin, has found that about 12% of the crop and pasture lands have a P Index above 6 and contribute about a third of the phosphorus load from these agricultural lands. In addition, managing those fields so that a P Index of 6 is attained will reduce the phosphorus load by about 14%. Managing all fields above a P Index of 3 to 3 would reduce loads by 35%. (L. Ward Good, personal communication)

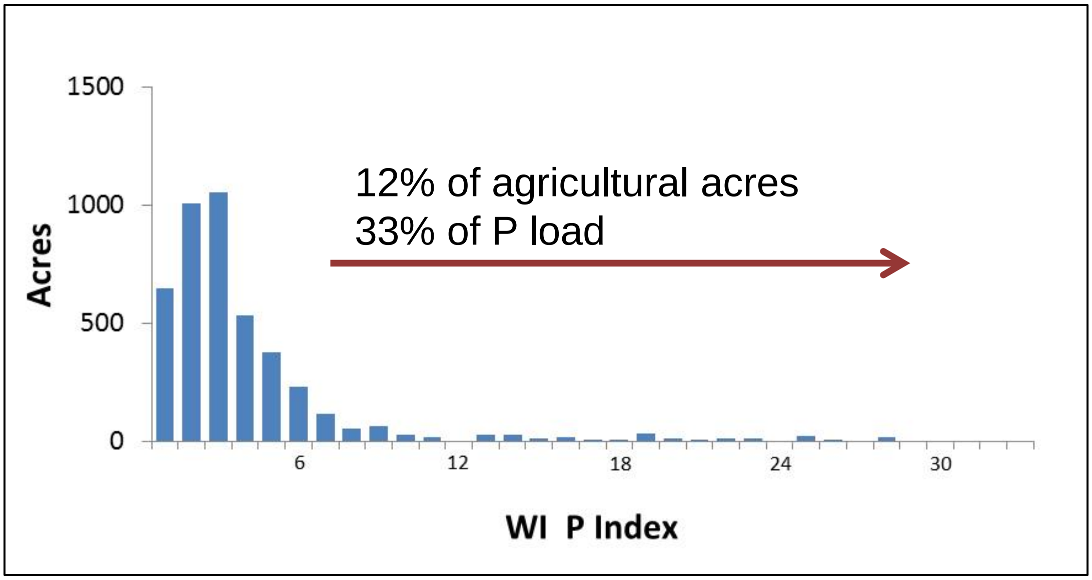

Figure 1.5 P Index values from cropland and pastures in the Pleasant Valley watershed (does not include grazed woods). Source: UW-Madison Soils.

Several other elements of this strategy also address targeting within priority watershed areas, including Chapter 4 Agricultural Nonpoint source Nutrients, Chapter 7 Accountability and Verification Measures and Chapter 8 Water Quality Monitoring.

1.3 Future Directions

Members of the multi-agency work group identified the following future directions:

1. Additional Information for Identifying Target and Priority Areas

   In future analyses, it is anticipated that additional lines of evidence, such as likelihood of the stream or lake to respond to nutrient reductions, will be also incorporated.

2. Move toward an analysis at the HUC 12 level.

   Since much of the nonpoint source implementation will take place at the HUC 12 level, it is desirable to move toward a systematic and data driven analysis at that watershed scale. This will allow variation within HUC 10 watersheds to be considered. For example, the Big Green Lake HUC 10 watershed has a wide range of topography from very flat areas in its eastern part to steeply sloped areas in its southern part. Overall, it does not rank high based on this initial analysis. However, an analysis at the HUC 12 level could result in the southern watershed areas ranking high.

   A systematic data driven analysis would, however, require further sophistication in modeling and additional monitoring. Further sophistication in modeling may include defining all model inputs at smaller than a county level, incorporation of soil groupings and bedrock geology. However, uniform "pour point" monitoring for each of the 1800 HUC 12 watersheds is beyond the staff time and money of the Department of Natural Resources. Future HUC 12 monitoring may need to be focused on those watersheds likely to rank high as nutrient contributors.

3. Incorporation of information from the Healthy Watersheds Initiative.

    The Wisconsin DNR is currently conducting a Healthy Watersheds Initiative assessment to rank watersheds on scales of health and vulnerability. These rankings may be used to target appropriate funding, focus management practices, promote protection through education and assess trends. Incorporation of this assessment could allow targeting on both a restoration and protection basis.