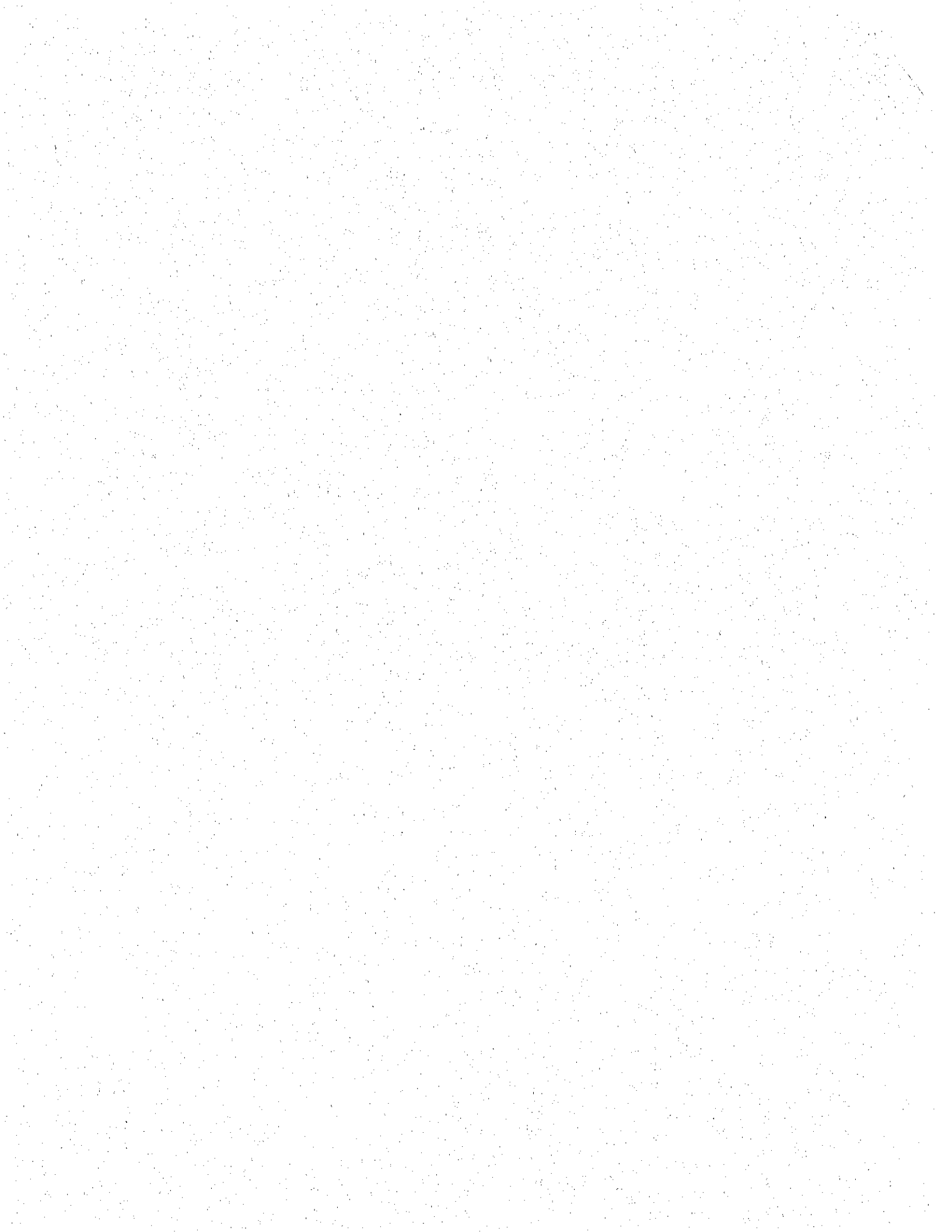


Red River Watershed
Nonpoint Source Pollution
Assessment Report

Submitted by Mary Gansberg

Wisconsin Department of Natural Resources

July 1996



I. INTRODUCTION

As recommended in the *Wolf River Basin Water Quality Management Plan (1996)*, Lake Michigan District Department of Natural Resources monitored streams in the Red River watershed - WR16 (Figure 1) in 1995 to evaluate the extent of nonpoint source pollution impacts on water quality. This information, along with existing watershed data, was used to rank the priority of the watershed streams for potential selection in the Priority Watershed program.

II. METHODS AND PROCEDURES

Described below is monitoring that was conducted in the Red River watershed to evaluate the extent of nonpoint source pollution impacts on the water resources and the process used to rank the priority of the watershed streams for selection as a possible priority watershed project.

Stream habitat conditions were evaluated throughout the watershed in the spring and summer and recorded on the Stream Habitat Evaluation Form (Ball, 1982). This rates the quality and quantity of habitat available in the stream for aquatic life.

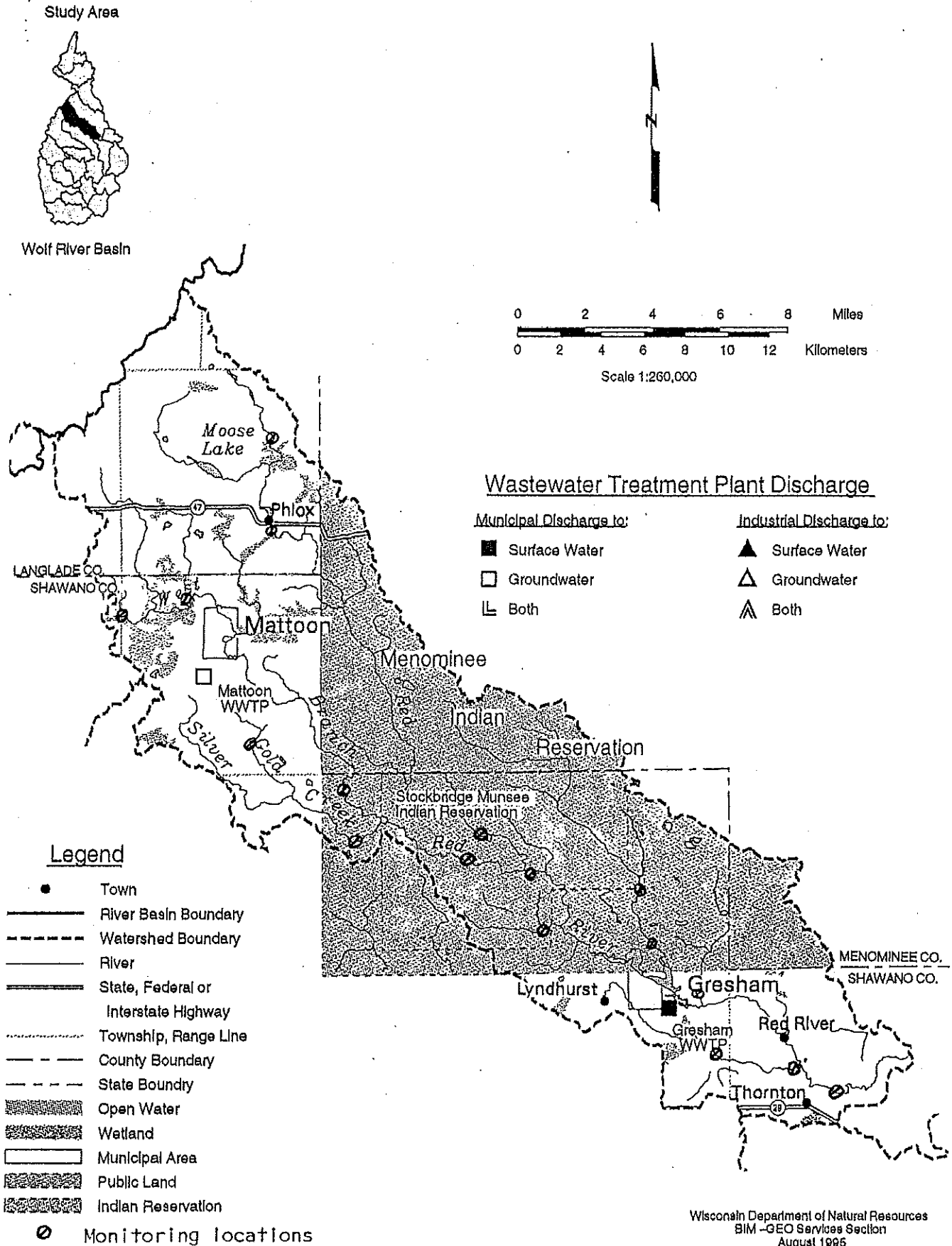
Aquatic macroinvertebrates were collected in spring and fall at several locations in the watershed and sent to UW-Stevens Point for sorting and identification. Sample results were evaluated using the Hilsenhoff Biotic Index (HBI) which provides a relative measure of organic loading to the streams (Hilsenhoff, 1987) and the Ephemeroptera, Plecoptera, Trichoptera (EPT) Index (Plafkin et al, 1989). The EPT index is the percent Ephemeroptera, Plecoptera, Trichoptera genera out of the total number of genera in a sample. These insect orders are generally known to be intolerant of pollution.

Water chemistry samples were collected by the DNR and preserved following the "Sample Handling and Preservation Handbook" protocol (1988). All samples were chilled on ice and sent to the State Lab of Hygiene for analysis. Samples were analyzed for total and dissolved phosphorus, suspended solids, nitrate-nitrogen, ammonia, and biochemical oxygen demand. Stream flow was also collected, when possible, at the same time the chemistry samples were taken.

Stream discharge and water chemistry data was collected from October 1992 to present by the U.S. Geological Survey who operates a gaging station on the Red River one mile downstream of the confluence of the West Branch Red River near Morgan (U.S. Geological Survey 1993, 94, & 95).

Figure 1.

Red River Watershed (WR16)



Continuous dissolved oxygen and temperature meters (Hydrolab DataSonde 3 Multiprobe Loggers) were placed in the Red River and Kroenke Creek for several days in July and August 1995 in addition to grab samples at several other locations in the watershed. Wisconsin Administrative code NR 102 establishes dissolved oxygen water quality standards in order to maintain favorable aquatic life. For cold water streams the standard is 6 mg/l.

Cryptosporidium and giardia monitoring was conducted in 1993 and 1994 eleven times at both Kroenke and Miller Creek as part of a special statewide study to determine occurrence, concentrations and distribution in Wisconsin waters (Archer et al, 1995).

Using criteria defined in the Department of Natural Resources Planner's Guidance (1991), existing and new water quality information was applied to such things as water chemistry, macroinvertebrates, vegetation, and physical habitat so the watershed could be prioritized for selection as a priority watershed project. Based on impacts on the water resources from nonpoint sources of pollution, each major tributary stream as well as the overall watershed is given a high, medium, or low priority ranking.

III. RESULTS AND DISCUSSION

The Red River watershed with monitoring locations are shown in Figure 1. A summary of habitat evaluation results, macroinvertebrate results, and stream classifications for the major tributaries in the watershed are presented in Table 1. Water chemistry results are presented in Table 2. Appendix A and B show temperature and dissolved oxygen monitoring results. Following is a discussion of monitoring results and the resulting priority ranking for each of the major watershed streams.

Red River

Red River is a perennial 43 mile long cold water river that discharges to the Wolf River just north of the city of Shawano. The lower section of the Red River is dammed just above CTH G, forming 96 acre Upper Red Lake and below Gresham at Lake Road, forming 207 acre Lower Red Lake.

Aquatic life habitat rated as excellent to good. The bottom substrate consists of rock, rubble, and sand. The variety of riffles, pools, and bends provide a diverse habitat for aquatic life.

Table 1.

Water Resource Conditions for streams in the Red River Watershed						
River	Location	Stream Classification ¹	Date	Habitat Rating ²	HBI ³	EPT ⁴
Red River	Maple Ave.	Cold II	5/8/95	64 - excellent	4.14* - very good	34.2%*
			7/19/95	92 - good	----	----
			10/12/95	----	2.78 - excellent	57.7%
	STH 47	Cold	5/8/95	90 - good	5.37 - good	70.2%
Kroenke Creek	Cypress Road	Cold I - ERW	7/19/95	120 - good	----	----
	Kroenke Creek Road	Cold I - ERW	5/4/95	146 - fair	4.07 - very good	45.8%
Gardner Creek	Butternut Road	Cold I - ERW	7/19/95	124 - good	----	----
Miller Creek	Big Lake Road	Cold I - ERW	7/19/95	122 - good	----	----
Smith Creek	Schmidt Road	Cold II	7/19/95	163 - fair	----	----
West Branch Red River	Boehm Road	Cold II	5/8/95	94 - good	3.19 - excellent	23.4%
Silver Creek	Silver Creek Road	Cold I - ERW	5/4/95	110 - good	3.38 - excellent	50%
Gold Creek	Willow Road	Cold I - ERW	5/4/95	148 - fair	4.04 - very good	43.4%
Mondl Creek	Townline Road	Cold I - ERW	5/4/95	171 - fair	3.94 - very good	34.6%
Mud Creek	Maple Road	DEF	5/4/95	196 - fair	----	----
	Butternut Road	DEF	5/4/95	184 - fair	4.23 - very good	29%
Mayking Creek	Marl Road	Cold II	5/8/95	108 - good	4.02 - very good	55.6%

Legend

1. Stream Classification:

Cold: cold water trout stream communities includes surface waters capable of supporting a community of coldwater fish and other aquatic life or serving as a spawning area for cold water fish species.

Class I: streams are high-quality streams where populations are sustained by natural reproduction.

Class II: streams have some natural reproduction but need stocking to maintain a desirable fishery.

Class III: streams sustain no natural reproduction and require annual stocking of legal size fish for sport fishing.

DEF: streams not formally classified are assumed by the Federal Clean Water Act to meet the Clean Water Act goals of supporting a balanced warm water fish and other aquatic life community.

ERW: have excellent water quality and valued fisheries but may receive discharges.

2. Habitat Rating:

0-70....excellent habitat

71-129....good habitat

130-200....fair habitat

> 200....poor habitat

4. EPT:

Percent Ephemeroptera, Plecoptera, and Trichoptera insect orders in macroinvertebrate sample.

3. HBI - Hilsenhoff Biotic Index:

Biotic Index	Water Quality	Degree of Organic Pollution
0-3.50	Excellent	No apparent organic pollution
3.51-4.50	Very good	Possible slight organic pollution
4.51-5.50	Good	Some organic pollution
5.51-6.50	Fair	Fairly significant organic poll
6.51-7.50	Fairly poor	Significant organic pollution
7.51-8.50	Poor	Very significant organic pollution
8.51-10.0	Very poor	Severe organic pollution

* - Average values

Table 2.

Water Chemistry Sample Results - Red River Watershed									
Stream	Location	Date	Flow (cfs)	Biochemical Oxygen Demand (mg/l)	Ammonia (mg/l)	Nitrate + Nitrite (mg/l)	Total Phosphorus (mg/l)	Dissolved Phosphorus (mg/l)	Suspended Solids (mg/l)
Red River	Maple Ave.	3/23/95	51	1.4	---	1.18	0.04	0.01	---
		8/14/95	---	---	0.105	0.208	0.063	0.023*	5
		Mean [@]	---	1.4	---	0.85	0.045	0.014	---
Kroenke Creek	Cypress Road	3/23/95	12	1.5	0.118	1.19	0.07	0.023*	5
		8/14/95	---	1.3	---	0.148	0.077	0.032*	7
Miller Creek	Town Hall Road	3/23/95	37	1.8	0.137	0.238	0.04	0.009	---
		8/14/95	---	---	---	0.037	0.035	0.007	---
West Branch Red River	Murphys Road	3/23/95	77	1.8	0.064	0.921	0.06	0.011	10
		8/14/95	---	1.2	---	0.065	0.052	0.012	9
Silver Creek	Silver Creek Road	3/23/95	22	---	---	0.884	0.04	0.007	---
		8/14/95	---	1.0	0.062	0.051	0.041	0.006	14

@ Based on between 6 to 14 samples collected throughout the year
 * Slightly elevated concentrations

Macroinvertebrate samples at Maple Ave received HBI values of 4.14 (mean) in spring and 2.78 in fall which rates this section of the Red River as very good to excellent water quality with no apparent to possible slight organic pollution present. EPT values were 34.2% (mean) in spring and 57.7% in fall. At STH 47 in spring, the HBI value was 5.37 which rates this upper section of the Red River as good water quality with some organic pollution present. The EPT was 70.2%. A dam just upstream of STH 47 forms Phlox Lake.

Water chemistry samples were collected during two runoff events and monthly in 1995. Dissolved phosphorus was slightly elevated during one runoff event sampled. Otherwise, all chemical results were within acceptable levels.

Thirty chemistry samples were collected on the Red River near Morgan by the U.S. Geological Survey. Of all the parameters monitored, dissolved phosphorus was the only nutrient detected above the desirable level of 0.01 mg/l. 13 out of 30 samples were between 0.02 and 0.04 mg/l. Water temperature was recorded as high as 80°F on one occasion in July 1995. Dissolved oxygen was adequate at a range between 7.4 and 14.9 mg/l.

Dissolved oxygen and temperature monitoring conducted at Maple Ave from July 19 to August 3 show daily dissolved oxygen and temperature fluctuations (Appendix A). Dissolved oxygen fell below the 6 mg/l state standard on a daily basis. This swing is caused by periphyton growth on the rocky substrate. Aquatic plants produce oxygen through photosynthesis during daylight hours and use the oxygen during respiration at night. Readily available dissolved phosphorus causes the growth of periphyton and other aquatic plants in the river. Extremely high flows on August 10 through 15 caused both dissolved oxygen and temperature to stabilize, deleting the high and low levels. Water temperature reached as high as 82°F during the sampling period. Although temperatures did not remain this high, these warm temperatures are stressful for cold water species like trout.

Aquatic life habitat and the macroinvertebrate communities were very good although dissolved phosphorus from nonpoint sources may contribute to the periphyton growth and resulting exaggerated dissolved oxygen fluctuations found in the Red River. Therefore, the Red River received a medium priority rating. I think the cold water classification of the Red River below Lower Red Lake should be re-evaluated. It may be better classified as cool or warm water.

Kroenke Creek

Kroenke Creek is a perennial 7.2 mile long class I and II cold water classified stream. It is also designated as exceptional resource waters. Exceptional classification (Wisconsin Administrative Code NR 102) means the water resource has excellent water quality and valued fisheries, but receives or may receive future wastewater discharges.

Agriculture is the predominant land use in the subwatershed, occurring on approximately 65 percent of the area. The remaining portions are dominated by deciduous woodlands and smaller meadows. Land management practices are generally good with problematic areas limited to the upper portions of the subwatershed. Sources of pollutants are primarily runoff from farm fields and feedlots. Stream bank pasturing has resulted in bank breakdown, erosion, and loss of vegetative cover which adds sediment and organic material to the stream (Archer et al, 1995).

Aquatic life habitat received a good to fair rating. Much of the substrate consist of shifting sand with some rubble, gravel and other stable habitat present.

A macroinvertebrate sample in spring at Kroenke Creek Road received a HBI value of 4.07 indicating very good water quality with possible slight organic pollution present. The EPT was 45.8%.

Water chemistry samples collected at Cypress Road found elevated levels of dissolved phosphorus during both the snowmelt and rain runoff events sampled. All other parameters were at acceptable levels.

Dissolved oxygen and temperature monitoring conducted at Cypress Road from July 19 to August 3 show an extreme dissolved oxygen depletion that lasted nine days during a heavy August rain event (Appendix B). Dissolved oxygen recovered rapidly when flows receded. Although the monitoring recorded dissolved oxygen levels at zero, a water chemistry sample during this same event on August 14 revealed a biochemical oxygen demand concentration of only 1.4 mg/l indicating that a slug of oxygen demanding substance was not the cause of the low dissolved oxygen levels recorded. Dissolved oxygen was probably used in plant respiration but because of the high flows and dark stained water, plant photosynthesis could not occur until water levels receded. After the runoff event, normal daily dissolved oxygen and temperature fluctuations returned. Water temperature increased somewhat during this event, but did not exceed 69°F.

No cryptosporidium oocyst were detected in eleven samples collected between November, 1993 and October, 1994 at Hickory Road. Giardia was detected on two occasions (Archer et al, 1995).

Nonpoint sources of pollution are present in the Kroenke Creek drainage area, but not severe. Elevated nutrient levels were detected during runoff events and aquatic life habitat and macroinvertebrate communities were good. Although the dissolved oxygen depletion recorded during the August runoff event could not be attributed to nonpoint source pollution, an incident like this could kill fish and other aquatic life. Kroenke Creek received a medium priority rating.

Gardner Creek

Gardner Creek is a 3.7 mile long cold water class I trout stream. It is also designated as exceptional resource waters. Gardner Creek discharges to the Red River just downstream of Lower Red Lake.

Aquatic life habitat received a good rating at Butternut Road. Rubble and gravel are present; however, the substrate is dominated by sand. Some silt from the upstream wetlands has accumulated on the lower banks and in pool areas. The banks are well protected from erosion with trees and grass. Dissolved oxygen levels and stream flow were good in July.

Aquatic life habitat appears to be in good condition and does not seem to be threatened by nonpoint source pollution; therefore, Gardner Creek received a low priority rating.

Miller Creek

Miller Creek is 20 miles long. It is classified as a cold water trout stream and exceptional resource waters. Miller Creek meanders through the Menominee and Stockbridge-Munsee Indian Reservation before discharging into the Red River. The subwatershed is mostly forest and scattered wetlands.

An aquatic life habitat evaluation rated habitat as good at Big Lake Road. The stream bed is predominantly sand with significant black organic sediment accumulation from the upstream wetlands. Macroinvertebrate samples could not be collected because of the soft bottom. The stream banks are stable and well protected from erosion.

Water chemistry samples collected at Town Hall Road during a snowmelt and rain runoff event found low concentrations of nutrients, biochemical oxygen demand, and suspended solids.

No cryptosporidium oocyst were detected in eleven samples collected between November, 1993 and October, 1994 at Anderson Road. Giardia was detected at low levels on two occasions (Archer et al, 1995).

Nonpoint sources of pollution does not seem to impact the water resources of Miller Creek. Water chemistry samples show low concentrations of contaminants during runoff events and habitat is good for this type of stream. Cryptosporidium and giardia are not significant in this subwatershed. Thus, Miller Creek received a low priority rating.

Smith Creek

Smith Creek is a four mile long tributary to the Red River. Smith Creek is classified as a Class II cold water trout stream.

An aquatic life habitat evaluation at Schmidt Road rated habitat as fair. Cattle access to the stream has caused some bank erosion. Filamentous algae growth was present in this small and shallow stream. Water temperature was 66°F and dissolved oxygen was 7.6 mg/l in July.

Minimal stream flow and cattle trampling of the stream banks seem to have the most significant impact on the habitat of Smith Creek. Nonpoint source pollution in the form of nutrients and sediment are present, but minimal; therefore, Smith Creek received a medium priority ranking.

West Branch Red River

West Branch Red River is a 31 mile long tributary to the Red River. 4.3 miles are classified as class I trout stream and exceptional resource waters; 20.8 miles are class II while the remaining 6 miles are warm water sport fish communities.

An aquatic life habitat evaluation in spring at Boehm Road rated this section of the river as good habitat. Some filamentous algae growth is present on the rocky substrate. The banks are well buffered and protected from erosion.

A macroinvertebrate sample in spring at Boehm Road received a HBI value of 3.19 indicating excellent water quality with no apparent organic pollution present. The EPT was surprisingly low at 23.4%.

Water chemistry samples collected at Murphys Road during a snowmelt and rain runoff event found low concentrations of nutrients, biochemical oxygen demand, and suspended solids.

Nonpoint sources of pollution does not seem to impact the water resources of the West Branch Red River. Water chemistry samples show low concentrations of contaminants during runoff events. Stream habitat and the macroinvertebrate community is good. Thus, West Branch Red River received a low priority rating.

Silver Creek

Silver Creek is a 10 mile long cold water class I trout stream which is also designated as exceptional resource waters. Silver Creek is a tributary to the West Branch Red River.

Aquatic life habitat rated good at Silver Creek Road. The predominantly rubble substrate, protected banks, decent flow and depth, and variety of deep pools, rifles, and bends provide adequate habitat for aquatic life.

A macroinvertebrate sample collected at Silver Creek Road in spring received a HBI value of 3.38 indicating excellent water quality with no apparent organic pollution present. The EPT was 50%.

Water chemistry samples collected at Silver Creek Road during a snowmelt and rain runoff event found low concentrations of nutrients, biochemical oxygen demand, and suspended solids.

There is no evidence of significant nonpoint sources of pollution impacting the water quality of Silver Creek nor does there appears to be a potential for future problems; therefore, the Silver Creek subwatershed received a low priority ranking.

Gold Creek

Gold Creek is a six mile long class I trout stream which is tributary to Silver Creek. Gold Creek is also designated as exceptional resource waters.

Aquatic life habitat rated fair at Willow Road. Flows are minimal and the creek bed is covered with naturally occurring dark organic matter and silt. The stream banks are stable with a diverse growth of trees, shrubs, and grasses.

A macroinvertebrate sample collected at Willow Road in spring received a HBI value of 4.04 indicating very good water quality with possible slight organic pollution present. The EPT was 43.4%.

Nonpoint source pollution does not seem to have a significant impact on the water resources of Gold Creek. The heavy silt deposition decreases available aquatic life habitat, but occurs naturally. Gold Creek received a low priority ranking.

Mondl Creek

Mondl Creek is a three mile long class I trout stream which is tributary to the West Branch Red River. Mondl Creek is also designated as exceptional resource waters.

Aquatic life habitat rated fair at Townline Road. The creek is similar to Gold Creek. Flows are minimal and the creek bed is covered with naturally occurring dark organic matter and silt. The banks are well protected from erosion and the trees provide good shading to the creek.

A macroinvertebrate sample collected at Townline Road in spring received a HBI value of 3.94 indicating very good water quality with possible slight organic pollution present. The EPT was 34.6%.

Nonpoint source pollution does not seem to have a significant impact on the aquatic life habitat and the macroinvertebrate community of Mondl Creek; therefore, it received a low priority ranking.

Mud Creek

Mud Creek is a five mile long unclassified stream. It is tributary to West Branch Red River upstream of the village of Mattoon.

Aquatic life habitat rated fair at both Maple Road and at Butternut Road. Flows and water depth are minimal and the substrate is mostly soft silt with limited gravel and riffle areas. Fields are near the creek although tree and shrub growth buffers the stream corridor and protects the banks from erosion. Dissolved oxygen was 10.7 mg/l and temperature was 51°F in May.

A macroinvertebrate sample collected at Butternut Road in spring received a HBI value of 4.23 indicating very good water quality with possible slight organic pollution present. The EPT was surprisingly low at 29%.

Nonpoint source pollution does not seem to have a significant impact on the water resources of Mud Creek. Habitat is fair and organic pollution is only slight. Mud Creek received a low priority ranking. I recommend the DNR classify Mud Creek.

Mayking Creek

Mayking Creek is a five mile long tributary to the headwaters of the Red River. The first two miles from the mouth are classified as class II and remaining three miles are class I trout waters. The class I portion is also designated as outstanding resource waters. Outstanding resource waters means it has the highest resource values, excellent water quality, and high quality fisheries.

Aquatic life habitat rated good at Marl Road. The creek bed is mostly rubble, gravel, and other stable substrate with some soft sediment accumulated near the banks. Macrophytes are common. The banks have a diverse mix of trees and shrubs which provide protection from erosion. Dissolved oxygen levels were adequate.

A macroinvertebrate sample collected at Marl Road in spring received a HBI value of 4.02 indicating very good water quality with possible slight organic pollution present. The EPT was 55.6%.

Nonpoint source pollution does not seem to have a significant impact on the water resources of Mayking Creek. Habitat and macroinvertebrate communities are good; therefore, Mayking Creek received a low priority ranking.

IV. CONCLUSIONS

West Branch Red River, Gardner, Miller, Silver, Gold, Mondl, Mud, and Mayking Creeks all received low priority ranking because nonpoint sources of pollution do not seem to be impacting the water resources of these streams. Red River, Smith Creek, and Kroenke Creek received medium rankings because of the known problems and effects on the water resources from nonpoint source pollution. Applying the priority watershed ranking procedures outlined in the Planner's Guidance, overall the *Red River watershed* ranked *low* priority for streams for potential selection in the Nonpoint Source Priority Watershed Program. I recommend the DNR classify Mud Creek and re-evaluate the cold water classification of the Red River from Lower Red Lake to the ~~Wolf~~ River.

Wolf

V. REFERENCES

Ball, Joe. 1982. Stream Classification Guidelines for Wisconsin. Wisconsin Department of Natural Resources Technical Bulletin.

Hilsenhoff, William. 1987. An Improved Biotic Index of Organic Stream Pollution.

Wisconsin Department of Natural Resources. 1996. Wolf River Basin Water Quality Management Plan.

Wisconsin Department of Natural Resources. Lake Michigan District: Water Resources Management files.

Wisconsin Department of Natural Resources. 1988. Field Procedures Manual. Draft 2nd Edition.

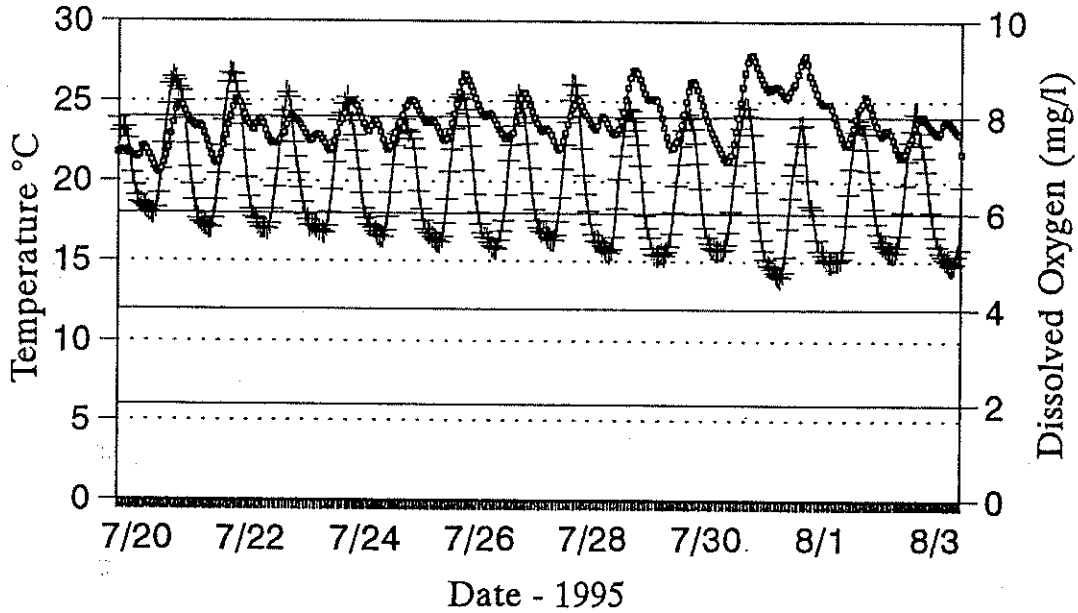
Wisconsin Department of Natural Resources. 1991. Planner's Guidance: Water Quality Management Plans. Chapter Six.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. Rapid Bioassessment Protocols for use in Streams and Rivers. U.S. Environmental Protection Agency, Office of Water, EPA/444/4-89-001, Wash. D.C. 20460.

Archer, J.R., J.R. Ball, J.H. Standridge, S.R. Greb, P.W. Rasmussen, J.P. Masterson, L. Boushon. (1995). Cryptosporidium spp. Oocyst and Giardia spp. Cyst Occurrence, Concentrations and Distribution in Wisconsin Waters. Wisconsin Department of Natural Resources PUBL-WR420-95.

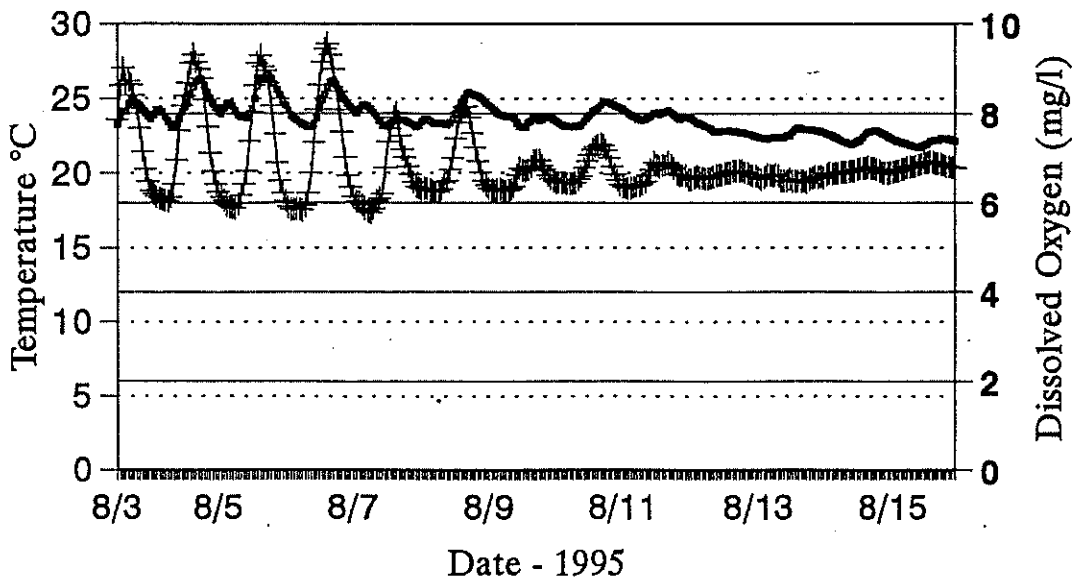
U.S. Geological Survey. 1993, 1994, and 1995. Water Resources Data - Wisconsin.

Red River Maple Ave



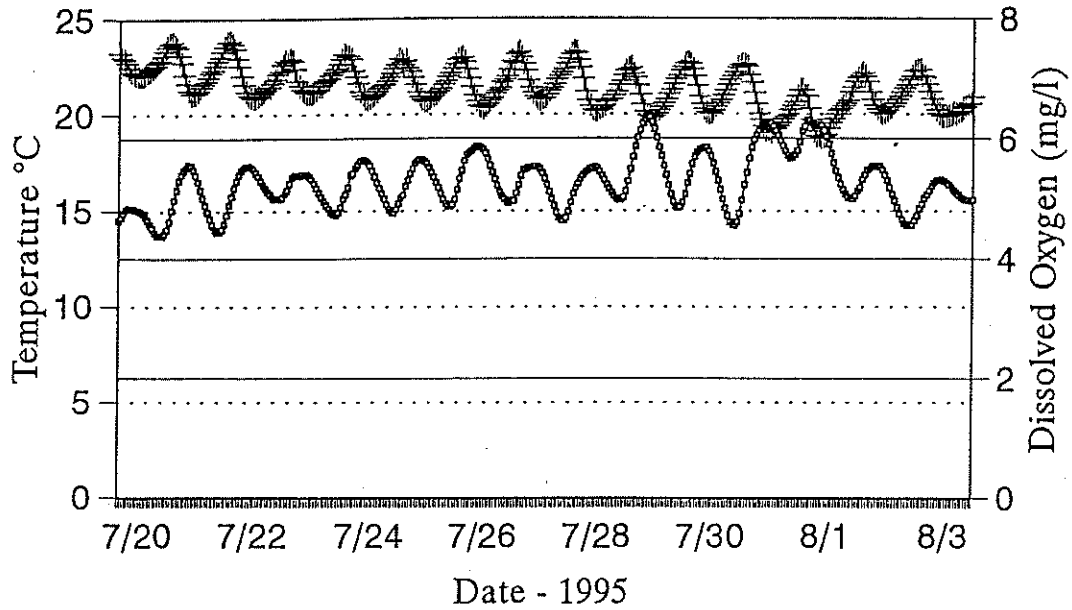
→ Temperature + Dissolved Oxygen

Red River Maple Ave



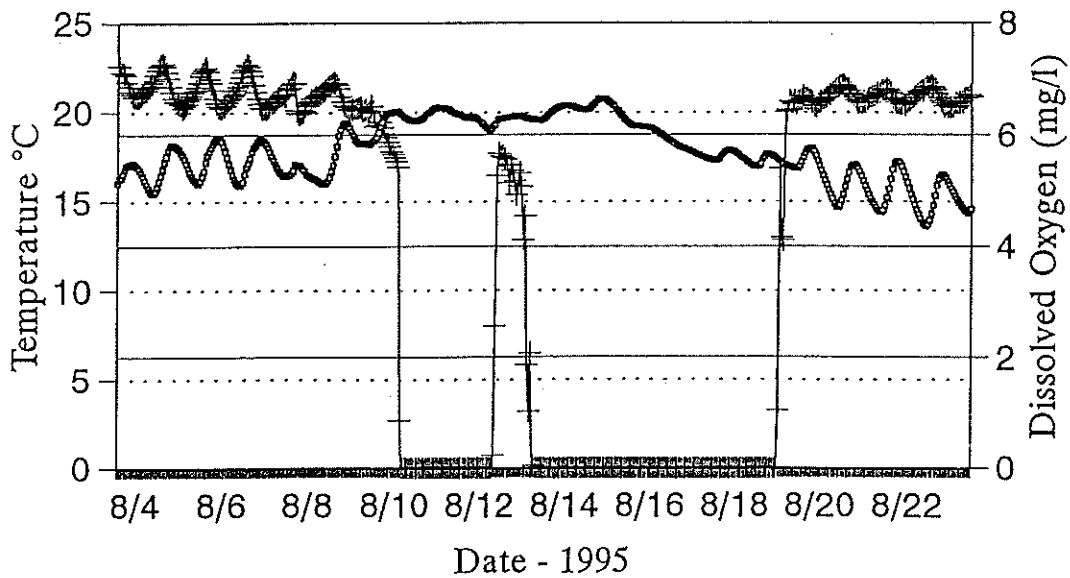
→ Temperature + Dissolved Oxygen

Kroenke Creek Cypress Road



—□— Temperature + —+— Dissolved Oxygen

Kroenke Creek Cypress Road



—□— Temperature + —+— Dissolved Oxygen