Suamico and Little Suamico River Watershed Nonpoint Source Pollution Assessment Report

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I. INTRODUCTION

As recommended in the *Upper Green Bay Basin Water Quality Management Plan (1993),* Lake Michigan District Department of Natural Resources monitored streams in the Suamico and Little Suamico River watershed (Figure 1) in 1993 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 Suamico and Little Suamico 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, summer and fall 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.

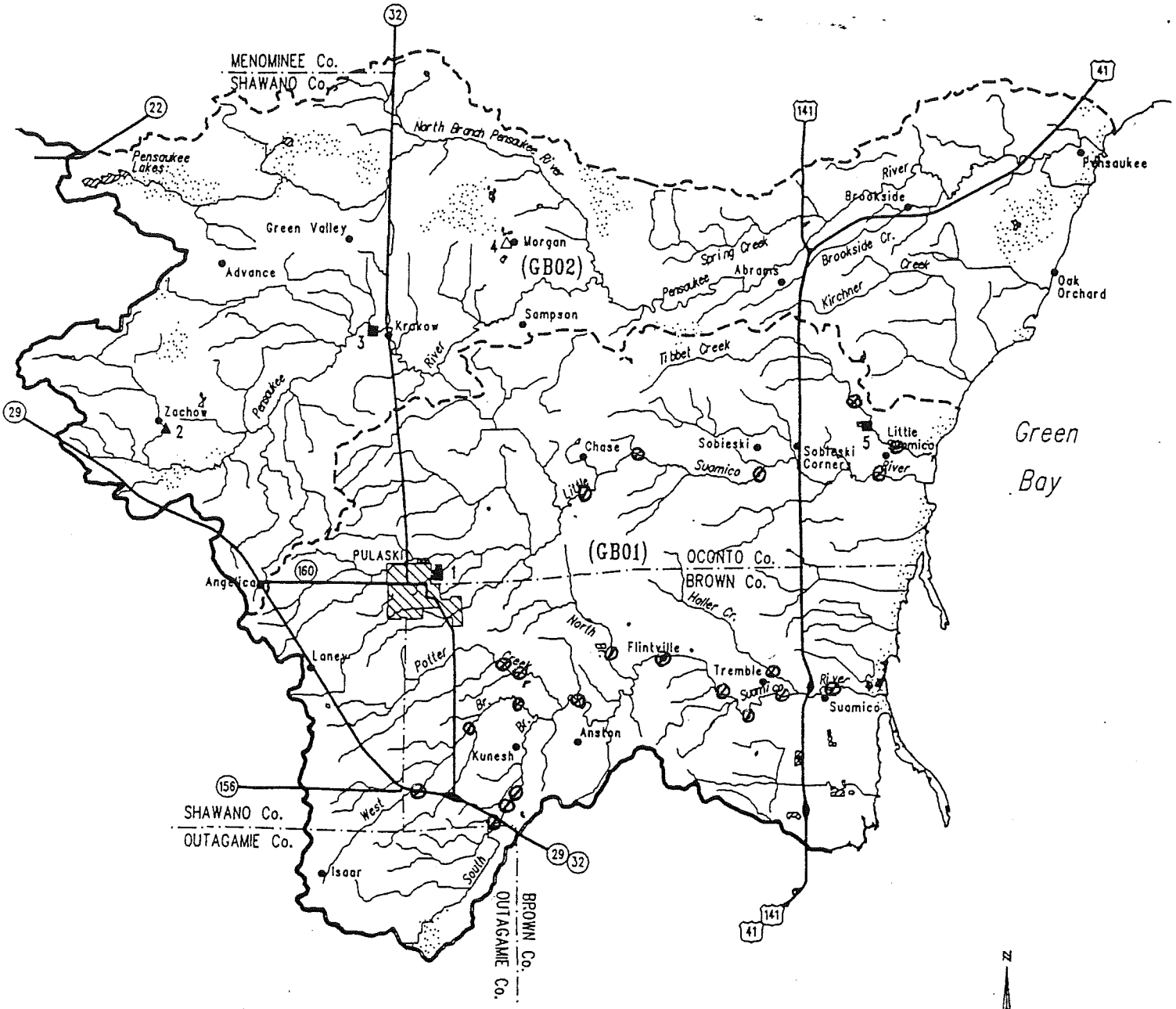
Aquatic macroinvertebrates were collected in spring and fall at several locations in the watershed and sent to UW-Stevens Point for sorting and identification. Sample results were evaluated using the Hilsenhoff Biotic Index (HBI) which provides a relative measure of organic loading to the streams (Hilsenhoff, 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 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 at the same time as the chemistry samples were taken.

Continuous dissolved oxygen and temperature meters (Hydrolab DataSonde 3 Multiprobe Loggers) were placed in the Suamico River and the Little Suamico River for several days in August 1993 in addition to grab samples at several other locations in the watershed. Wisconsin Administrative code NR102 establishes dissolved oxygen water quality standards in order to maintain favorable aquatic life. For warm water streams the standard is 5 mg/l.

Figure 1.

Suamico and Little Suamico Rivers (GB01) and Pensaukee River (GB02) Watersheds



Legend

- Town (unincorporated)
- Dam
- River Basin Boundary
- Watershed Boundary
- River/Stream
- County Boundary
- Federal Highway
- State Highway
- Wetland
- Lake/Open Water
- Municipality
- Monitoring Locations

1 Pulaski WWTP
2 Graf Creamery
3 Krakow WWTP
4 Frigo Cheese
5 Little Suamico WWTP

Wastewater Treatment Plant

Municipal Discharge to:
- ■ Surface Water
- □ Groundwater

Industrial Discharge to:
- ▲ Surface Water
- △ Groundwater

Study Area

Upper Green Bay Basin

N

0 1 2 3 4 5

Miles

Scale 1:235000

BIM-GEO Services Section

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 and the overall watershed is given a high, medium, or low priority ranking.

III. RESULTS AND DISCUSSION

The Suamico and Little Suamico River watershed with monitoring locations are shown in Figure 1. A summary of habitat evaluation results, biotic index 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.

Suamico River

Suamico River is a perennial 16 mile long warm water river. The lower reaches are classified as warm water sport fish communities.

Stream flows in the Suamico River are extreme. During snowmelt runoff and rain events, the river channel floods easily, but during mid-summer conditions, the river barley trickles. The eroded banks from flood conditions and cattle access have caused the river channel to become wide and shallow. In the upper reaches, the channel substrate is mostly gravel and rubble with some deposition of sand and muck in the pools and slow areas. Sand bars are common. Where sunlight reaches the river channel, the bedrock and rocky substrate is covered with periphyton and algae growth in the summer. Aquatic life habitat rated as good to fair.

Dissolved oxygen and temperature monitoring conducted at Riverside Drive from August 18 to 25, 1993 shows extreme daily dissolved oxygen fluctuations, but at no time did dissolved oxygen fall below the 5 mg/l state standard. Water temperature reached as high as 80°F during the sampling period.

Macroinvertebrate sample results ranged from very good to fairly poor depending upon location and season. At Bridge Road, the HBI value was 6.57 in spring indicating fairly poor water quality with significant organic pollution present. The EPT was 14%. At St. Pats Drive, the HBI value was 3.62 in fall indicating very good water quality with possible slight organic pollution. The EPT was 55%. At CTH C, HBI values were 5.61 in spring and 4.25 in fall indicating fair to very good water

Table 1.

Water Resource Conditions for streams in the Suamico and Little Suamico River Watershed

River	Location	Stream Classification[1]	Date	Habitat Rating[2]	HBI[3]	EPT[4]
Suamico River	Riverside Drive	FAL	8/17/93	117 - good	----	----
	Bridge Road	FAL	4/5/93	125 - good	6.57 - fairly poor	14%
	St. Pats Drive	FAL	8/17/93	144 - fair	----	----
			9/22/93	141 - fair	3.62 - very good	55%
	CTH M	FAL	8/17/93	117 - good	----	----
	CTH C	FAL	4/5/93	119 - good	5.61 - fair	30%
			8/6/93	163 - fair	----	----
			9/22/93	129 - good	4.25 - very good	38%
Haller Creek	Lark Road	COLD (CLASS III)	9/22/93	164 - fair	----	----
North Branch Suamico River	CTH B	WWFF	4/5/93	175 - fair	4.38 - very good	39%
			8/17/93	136 - fair	----	----
			9/22/93	160 - fair	4.13 - very good	33%
West Branch Suamico River	Old Hwy 29	Unknown	8/17/93	222 - poor	----	----
South Branch Suamico River	Old Hwy 29	Unknown	8/17/93	207 - poor	----	----
Little Suamico River	CTH J	WWSF	4/5/93	147 - fair	7.11 - fairly poor	17%
			9/22/93	136 - fair	----	----
	Cross Road	WWSF	9/13/93	154 - fair	4.02 - very good	63%
	Hilbert Road	WWSF	8/6/93	155 - fair	----	----
	CTH C	WWSF	4/5/93	151 - fair	7.92 - poor	38%
			8/6/93	149 - fair	----	----
			9/13/93	157 - fair	7.67 - poor	29%
Tibbet Creek	CTH S	WWSF	4/5/93	142 - fair	7.95 - poor	14%
			9/13/93	169 - fair	----	----
	Lade Beach Road	WWSF	9/13/93	181 - fair	----	----

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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 coldwater 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.
WWSF: warm water sport fish communities includes surface waters capable of supporting a community of warm water sport fish or serving as a spawning area for warm water sport fish.
WWFF: warm water forage fish communities includes surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.
LFF: limited forage fishery includes surface waters of limited capacity because of low flow, naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of aquatic life.
FAL: fish and aquatic life; streams not classified are assumed to meet Federal Clean Water Act goals of supporting recreation and aquatic life uses.

2. Habitat Rating:

0-70....excellent habitat
71-129....good habitat
130-200....fair habitat
>200....poor habitat

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 pollution
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

4. EPT:

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

Table 2.

Water Chemistry Sample Results - Suamico and Little Suamico 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/)	Suspended Solids (mg/l)
Suamico River	CTH C	3/3/93 #	----	14 *	1.26 *	1.358	0.78 *	0.28 *	37 *
		5/3/93 #	----	2.9	0.083	1.64	0.19 *	0.112 *	18
	Bridge Road	3/3/93 #	----	10 *	0.779 *	2.07	0.40 *	0.075 *	18
		5/3/93 #	----	3.3	0.094	1.21	0.20 *	0.103 *	35 *
North Branch Suamico River	CTH B	3/3/93 #	3.4	6.4	0.485 *	3.76	0.41 *	0.204 *	14
		5/3/93 #	28.3	3.2	0.051	0.817	0.25 *	0.168 *	12
South Branch Suamico River	CTH U	9/8/93	----	----	0.085	2.1	0.110 *	0.047 *	12
	School Lane	9/8/93	----	3.5	0.034	0.03	0.220 *	0.108 *	10
West Branch Suamico River	Kunesh North Road	9/8/93	----	----	0.025	4.2 *	0.060	0.47 *	2
	Town Hall Road	9/8/93	----	1.1	0.047	0.3	0.30 *	0.202 *	22
Potters Creek	Kunesh North Road	9/8/93	----	----	0.022	0.8	0.110 *	0.087 *	3
	Norway Road	9/8/93	----	----	0.020	0.7	0.09	0.068 *	2
Little Suamico River	CTH C	3/3/93 #	----	10 *	2.0 *	3.4	0.77 *	0.42 *	20
		5/3/93 #	123	2.9	0.105	1.13	0.18 *	0.112 *	8
	CTH J	3/3/93 #	23	17 *	1.58 *	1.87	0.98 *	0.51 *	13
		5/3/93 #	301	2.6	0.065	0.629	0.15 *	0.070 *	24

Legend
* = elevated concentrations
# = runoff event

quality with fairly significant to possible slight organic pollution. The EPT's were 30% and 38%, respectively.

Water chemistry samples were collected during two runoff events at CTH C and Bridge Road in March and May, 1993. Total and dissolved phosphorus concentrations were elevated above desirable levels at all times. Suspended solids, ammonia, and biochemical oxygen demand were at elevated levels during some of the events.

Nonpoint sources of pollution seems to impact the Suamico River. Water chemistry samples show excessive nutrient, biochemical oxygen demand, and suspended solids runoff during events. Stream bank erosion from flooding and cattle access appears significant. Streambed sedimentation and excessive algae growth limits available habitat for fish and other aquatic life; therefore, the Suamico River received a high priority rating.

Haller Creek

Haller Creek is an intermittent four mile long class III cold water classified stream which discharges to the Suamico River near the community of Suamico. Aquatic life habitat received a fair rating in September at Lark Road. The substrate is mostly soft sand with a moderate deposition of silt near the banks. Some bank erosion is evident although much of the stream corridor is wooded or wetland. In years past, trout had been stocked in Haller Creek; however, a fishery survey in 1993 found no trout present in mid-summer.

Aquatic life in this creek is most significantly impacted by minimal stream flows. Nonpoint sources of pollution does not seems to be significantly impacting the habitat of Haller Creek and therefore, received a low priority rating.

North Branch Suamico River

North Branch Suamico River is a five mile long warm water forage fish community classified stream which discharges to the Suamico River upstream of Flintville. The upper one half only flows intermittently. Aquatic life habitat received fair ratings on three separate occasions at CTH B. Rubble and gravel are present; however, the substrate is dominated by sand. Macroinvertebrate samples at CTH B received HBI values of 4.38 and 4.13 in spring and fall which rates this section of the North Branch Suamico River as very good water quality with possible slight organic pollution present. EPT values were 39% in spring and 33% in fall.

Water chemistry samples collected during two runoff events at CTH B found elevated concentrations of both total and dissolved phosphorus during both events and elevated ammonia concentrations during snowmelt runoff.

Aquatic life habitat appears to be in fair condition considering the potential for degradation from cropland runoff in the immediate drainage area. Chemical monitoring shows significant levels of nutrient loading during runoff events; therefore, North Branch Suamico River received a medium priority rating.

Potters Creek

Potters Creek is a six mile long tributary to the Suamico River. This stream has not been formally classified but since it only flows intermittently, I believe it supports a limited forage fish community. Thick mats of filamentous algae cover the substrate during lower water level periods. The entire drainage area is intense agriculture.

Water chemistry samples collected at Kunesh North Road and at Norway Road in September found elevated concentrations of dissolved phosphorus on both occasions and total phosphorus on one of the two occasions.

Even though the most significant limiting factor for Potters Creek is stream flow, nonpoint sources of pollution seems to impact the water resource condition of Potters Creek. Significant nutrient loading during runoff events and resulting abundant filamentous algae growth limits available habitat for aquatic life. Therefore, Potters Creek received a high priority rating.

West Branch Suamico River

West Branch Suamico River is a eight mile long intermittent tributary to the Suamico River. This tributary has not been formally classified, but I believe it is capable of supporting limited forage fish communities. In the spring, suckers are known to run up as far as STH 29.

An aquatic life habitat evaluation rated the West Branch Suamico River as poor habitat because of the lack of flowing water. This creek only flow during runoff events which makes it very flashy and turbid. The banks are fairly stable and the substrate is mainly soft sediment. Water chemistry samples collected in September at Kunesh North Road and Town Hall Road found elevated concentrations of dissolved phosphorus at both locations. Total phosphorus and nitrate-nitrite were elevated at one location.

Stream flow is the most limiting factor effecting habitat in the West Branch Suamico River; however, nonpoint sources of pollution in the form of sediment and nutrients also impact the streams potential and are a significant contribution to the Suamico River. Therefore, the West Branch Suamico River received a high priority ranking.

South Branch Suamico River

South Branch Suamico River is a nine mile long intermittent tributary to the Suamico River. This tributary has not been formally classified, but I believe it is capable of supporting limited forage fish communities.

The South Branch Suamico River only flows during runoff events and is very flashy and turbid. Much of its headwater areas have been channelized. An aquatic life habitat evaluation in summer at Old STH 29 rated this section of the stream as poor habitat. The substrate is mainly soft sediment with scarce deep pools and riffles. Access to the stream by horses has caused some degradation of the banks. Water chemistry samples at CTH U and School Lane in September found elevated levels of both total and dissolved phosphorus at both locations.

Stream flow is the most limiting factor effecting habitat in the South Branch Suamico River; however, nonpoint sources of pollution in the form of sediment and nutrients also impact the streams potential and are a significant contribution to the Suamico River. Therefore, the South Branch Suamico River received a high priority ranking.

Little Suamico River

Little Suamico River is a 22 mile long warm water sport fish community classified tributary to Green Bay.

Aquatic life habitat rated fair at all four stations evaluated. The river substrate is mostly rock and rubble, but some sediment bars are present. Algae and periphyton growth covers the hard substrate. The river is wide and shallow in summer. The river floods easily with runoff events causing bank erosion and turbid water. Many of the tributaries to Little Suamico River have been ditched and straightened. Barnyard and cropland runoff are obvious.

Macroinvertebrate samples collected at CTH J in spring received a biotic index value of 7.11 indicating fairly poor water quality with significant organic pollution present. The EPT was 17%. In fall at Cross Road, a biotic index value of 4.02 indicates very good water quality with possible slight organic pollution. The EPT was 63%. Finally, at CTH C in spring and fall biotic index values of 7.92 and 7.67 indicating poor

water quality with very significant organic pollution. In spring the EPT was 38% and in fall was 29%.

Water chemistry samples collected at CTH C and CTH J during two runoff events found elevated concentrations of both total and dissolved phosphorus during each event. Biochemical oxygen demand and ammonia were also elevated at both location during spring snowmelt runoff.

Dissolved oxygen and temperature monitoring conducted at CTH C from August 7 to 17, 1993 show extreme daily dissolved oxygen fluctuations. Dissolved oxygen reached levels higher than 20 mg/l then fell below the 5 mg/l state standard on a regular basis during the monitoring period. Water temperature reached as high as 81°F during the sampling period.

Nonpoint source pollution appears to impact Little Suamico River by decreasing available habitat for aquatic life. High levels of nutrients, mostly from croplands, are reaching the river and eventually reaching Green Bay. These nutrients cause periphyton and algae growth on the rocky substrate, which in turn, causes severe daily fluctuations in dissolved oxygen levels. Therefore, the Little Suamico River received a high priority ranking.

Tibbet Creek

Tibbet Creek is a five mile long warm water sport fish community classified tributary to Green Bay. The upper most reaches are intermittent, but the lower reaches flow continuously.

Aquatic life habitat ratings were fair at CTH S and at Lade Beach Road. Aquatic life is limited by low stream flows. The rock and rubble substrate provides some habitat, although filamentous algae covers most of the substrate in areas where sunlight reaches the stream bed. The banks are eroded from flooding and from cattle access. A macroinvertebrate sample at CTH S in spring received a biotic index value of 7.95 indicating poor water quality with very significant organic pollution present. The EPT was only 14%.

Nonpoint source pollution does not seem to be having a significant impact on the water resources of Tibbet Creek; however, filamentous algae growth and pollution tolerant organisms are abundant in the stream. Tibbet Creek received a medium priority ranking.

IV. CONCLUSIONS

Haller Creek received a low priority ranking because nonpoint sources of pollution do not seem to be impacting the water resources of this creek. North Branch Suamico River and Tibbet Creek received medium ranking because of the localized effects from nonpoint source pollution. The Suamico River, Potters Creek, West Branch Suamico River, South Branch Suamico River, and Little Suamico River all ranked high priority. Nonpoint sources of pollution limits the abundance and diversity of aquatic communities in these watershed streams by destroying available habitat and degrading water quality. The high level of sediment and nutrient loading to the watershed streams either is deposited in the river mouth or reaches Green Bay. Applying the priority watershed ranking procedures outlined in the Planner's Guidance, overall the *Suamico and Little Suamico River watershed* ranked ***high*** priority for streams for potential selection in the Nonpoint Source Priority Watershed Program.

V. REFERENCES

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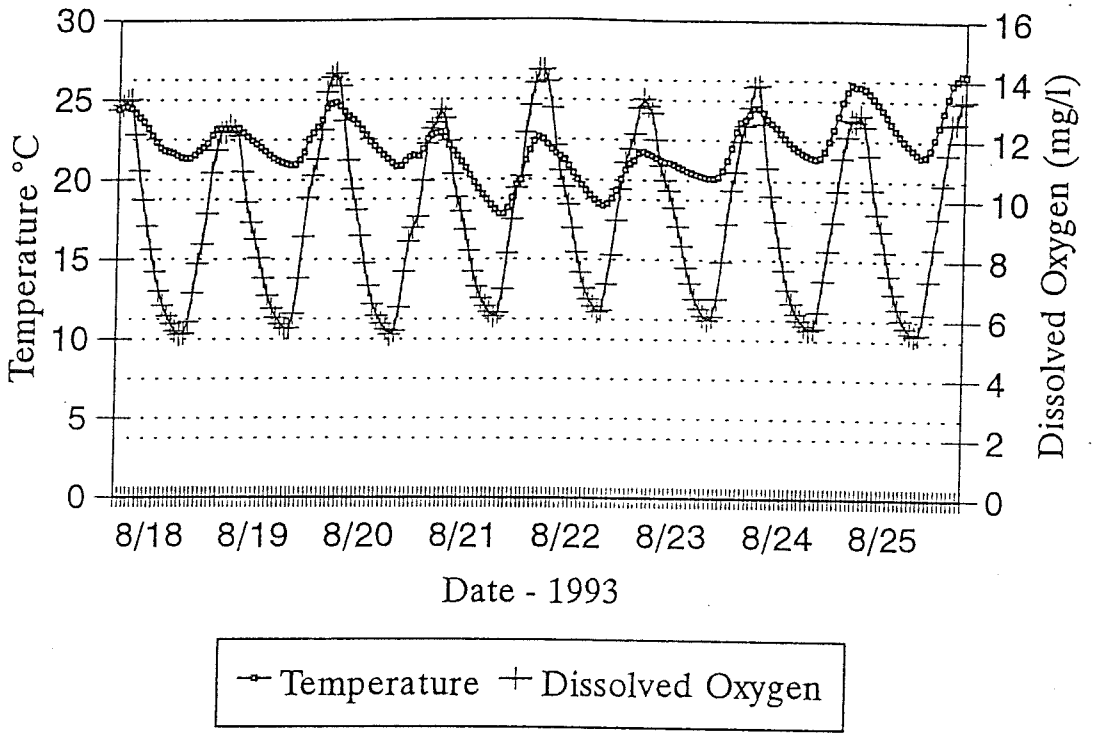
Appendix A

Suamico River
Riverside Drive



Appendix B

Little Suamico River
CTH C