

Pigeon River Watershed Nonpoint Source Assessment Report

Submitted by Mary Gansberg

Wisconsin Department of Natural Resources

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I. INTRODUCTION

As recommended in the *Wolf River Basin Water Quality Management Plan (1991)*, monitoring was conducted in 1991 and 1992 in the Pigeon River watershed to evaluate the extent of the nonpoint source impacts on water quality. The Pigeon River watershed lies in south central Shawano and north central Waupaca Counties. The watershed can best be described by dividing it into the Pigeon River Mainstem, North Branch Pigeon River, and South Branch Pigeon River.

Historical data for the Pigeon River watershed, including Pigeon Lake and Marion Millpond, can be found in the WDNR, Lake Michigan District water quality and lake management files. Several extensive studies have been done in the past and should be referred to before ranking this watershed for potential selection as a Priority Watershed project.

II. METHODS AND PROCEDURES

Stream habitat conditions were evaluated throughout the watershed in the spring and fall and recorded on the Stream Habitat Evaluation Form (Ball, 1982).

Aquatic macroinvertebrates were collected in spring and fall throughout 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).

Dissolved oxygen and temperature were measured every one half hour for seven consecutive days using a Hydrolab DataSonde 3 submersible water quality logger.

Water chemistry samples were collected and preserved following Field Procedures Manual protocol (1988). All samples were chilled on ice and sent to the State Lab of Hygiene for analysis.

III. RESULTS AND DISCUSSION

The Pigeon River watershed and monitoring locations are shown in Figure 1. A summary of habitat evaluation results, biotic index results, stream classifications, and special resource status for the major streams in the Pigeon River watershed are presented in Table 1. Water chemistry results are shown in Table 2.

Figure 1.
Pigeon River
Watershed
(WR10-112)

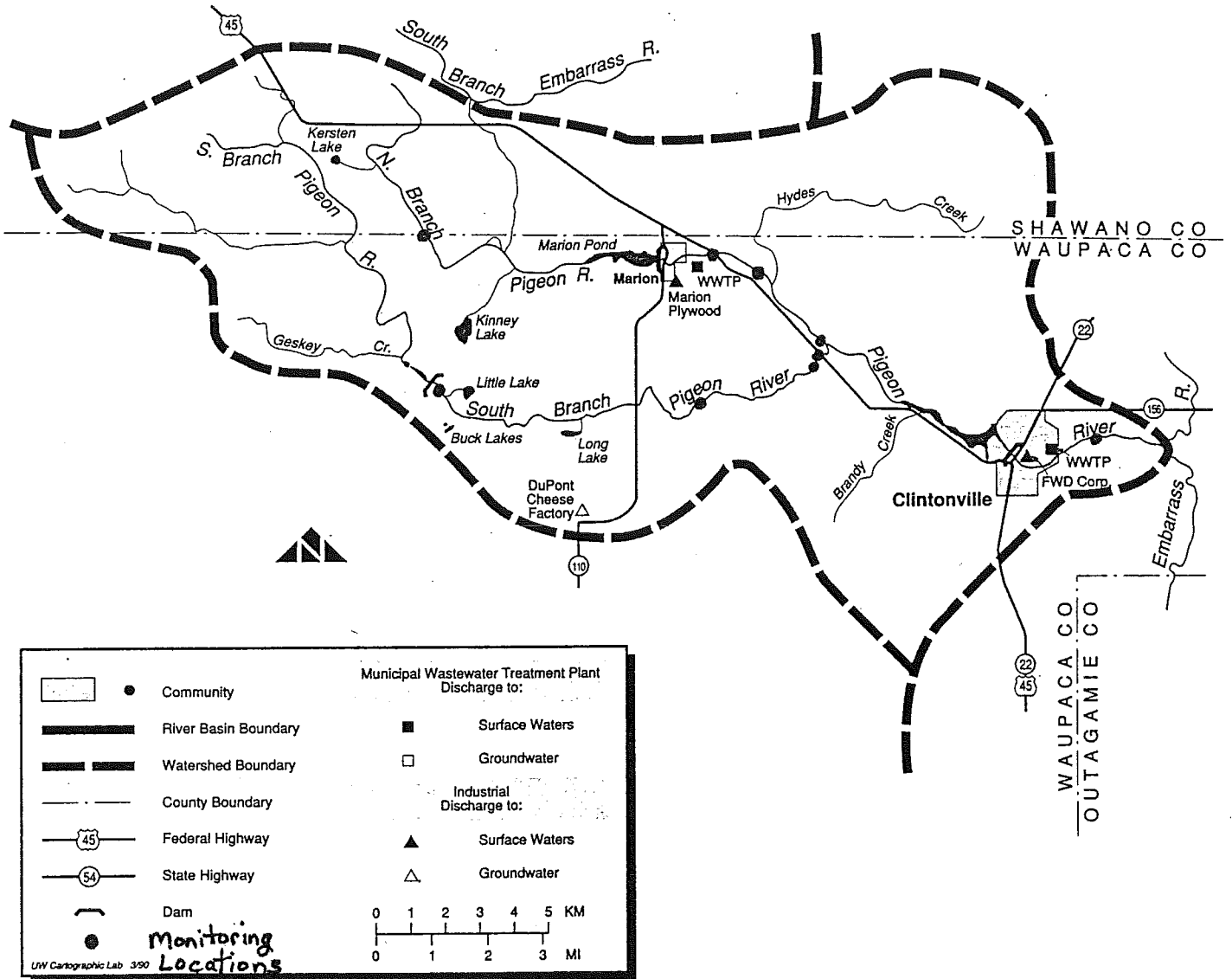


Table 1.

Water Resource Conditions for Stream in the Pigeon River Watershed

Stream	Location	Habitat Rating ¹		Biotic Index ²		Stream Classification ³	Special Status ⁴
		1991	1992	1991	1992		
Pigeon River	Klemp Road	fair/161*	fair/185	fair	very good	MWSF	—
M. Branch Pigeon River	Hunting Road	fair/130*	fair/145	very good	very good	Cold - Class I	ERW
M. Branch Pigeon River	HWY 45	fair/148	poor/205	fairly poor	—	Cold - Class I	ERW
M. Branch Pigeon River	Knitt Road	good/126	poor/211	excellent	excellent	Cold - Class I	ERW
M. Branch Pigeon River	Magalski Road	fair/156	fair/151	—	very good	Cold - Class I	ERW
S. Branch Pigeon River	Neitzke Road	fair/144	good/121	very good	very good	MWSF	—
S. Branch Pigeon River	North Circle J Road	fair/175	fair/145	good	fair	MWSF	—
S. Branch Pigeon River	HWY 45	—	fair/173	—	—	MWSF	—
S. Branch Pigeon River	Roger Road	fair/172	poor/213	none present	none present	MWSF	—

1. Habitat Rating:

<70 = excellent habitat
 71 - 129 = good habitat
 130 - 200 = fair habitat
 >200 = poor habitat
 * = average values

3. Stream Classification:

Cold - cold water trout stream
 Class I - natural reproduction
 Class II - some natural reproduction
 Class III - no natural reproduction
 MWSF - warm water sport fishery
 MWFF - warm water forage fishery
 LFF - limited forage fishery

2. Hilsenhoff Biotic Index (HBI):

Water Quality Degree of Organic Pollution
 Excellent No apparent organic pollution
 Very good Possible slight organic pollution
 Good Some organic pollution
 Fair Fairly significant organic pollution
 Fairly poor Significant organic pollution
 Poor Very significant organic pollution
 Very poor Severe organic pollution

4. Special Resource Status: (NR102.11)

ORW - Outstanding Resource Waters
 ERW - Exceptional Resource Waters

Table 2. Pigeon River Watershed Water Chemistry Results

	Pigeon River Klemp Road July 25, 1991	North Branch Pigeon River Magaloski Road July 25, 1991	South Branch Pigeon River Hwy 45 June 19, 1991
pH su	8.4	8.4	8.3
Alkalinity mg/l	229	233	221
BOD ₅ mg/l	2.8	1.8	1.5
COD mg/l	20	26	27
Ammonia mg/l	0.056	0.031	0.026
NO ₂ + NO ₃ mg/l	0.278	1.15	1.04
Tot Kjehl-N mg/l	0.9	1.0	0.8
Tot Phos mg/l	0.10	0.11	0.07
Diss Phos mg/l	0.060	0.076	0.029
Tot Solids mg/l	314	330	318
Tot Vol Solids mg/l	106	120	118
Sus Solids mg/l	6	5	9
Vol Sus Solids mg/l	4	4	118
MFFCC /100 ml	270	500	—
Fecal Strep /100 ml	70	160	—

Pigeon River, Mainstem

The Mainstem of the Pigeon River located in Waupaca County is classified as Warm Water Sport Fish Community. The watershed is primarily agricultural lands. An impoundment of the Pigeon River near Clintonville forms Pigeon Lake. Pigeon Lake is a shallow 165 acre lake with a history of nutrient enrichment and severe aquatic plant problems. The Pigeon River discharges to the Embarrass River.

Stream habitat evaluations rated the Pigeon River as fair habitat. Stream bank erosion is moderate with some raw spots and potential during high flows. Bank vegetation is dominated by grasses with minimal soil binding characteristics. Sand is the predominant substrate type. The river bed has a moderate deposition of fine sediment and is generally less than 10% rubble, gravel and other stable habitat.

The Biotic Index values rated the Pigeon River as very good to fair with possible slight to fairly significant organic pollution. Ephemeroptera, Trichoptera, and Coleoptera were the most abundant aquatic organisms present in the two samples. These organisms are generally considered to be moderately intolerant to pollution.

Water chemistry samples collected on July 25, 1991 during non-runoff event conditions show low concentrations of nutrients, suspended solids, biochemical oxygen demand, and bacteria.

North Branch Pigeon River

The North Branch Pigeon River is a slightly stained Cold Water Class I Trout stream. As defined in NR102.11, the river is classified as Exceptional Resource Waters (ERW). Exceptional designation means it has excellent water quality and valued fisheries. The North Branch Pigeon River is dammed near Marion and forms the Marion Millpond. This shallow 110-acre pond also has a history of nutrient enrichment and aquatic plant problems.

The upper reaches of the watershed consist mostly of wooded rural and wetlands. The lower reaches have considerably more agricultural lands. Stream habitat evaluations rated the North Branch Pigeon River generally as fair habitat. Stream habitat is generally better upstream of the Marion Millpond than downstream. The river substrate is mostly shifting sand with 0 to 30% gravel and other stable habitat. Exceptions are at Hunting Road and CTH SS where the creek bed is mostly gravel and rubble with some sand. The stream bed is

generally wide and shallow with few riffles and deep pools. Riparian area is 70 to 90% stable plant density which has protected the stream banks from little erosion. Very little to no attached algae could be found in the stream. Aquatic plants are uncommon. Minnows and crayfish are abundant in all stretches of the river.

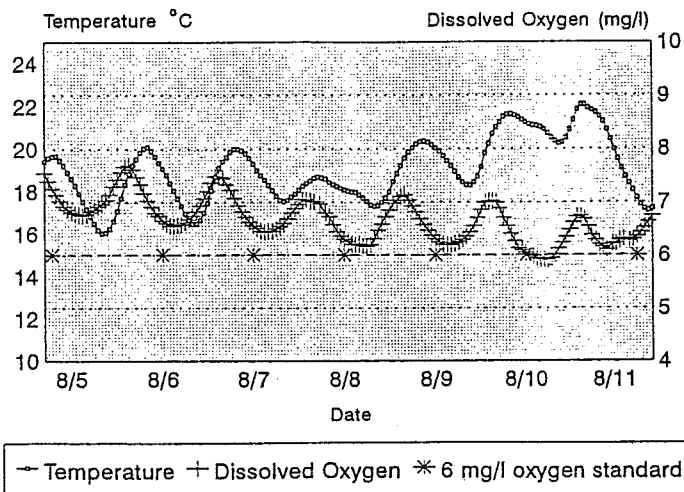
The Biotic Index values ranged from excellent to fairly poor depending upon the monitoring location. The shifting sand substrate limits the amount of suitable habitat for organisms and is generally present only at riffle areas below bridge abutments where rubble and gravel from rip-rap is present. Because of the substrate type, at some locations macroinvertebrates could not be found, however, a variety of macroinvertebrates were present at the other four sampling locations. Ephemeroptera, Trichoptera, Coleoptera, and Diptera were the most abundant macroinvertebrates present. These organisms are generally considered to be intolerant to moderately tolerant to organic pollution.

Water chemistry samples collected on July 25, 1991 during non-runoff event conditions show low concentrations of nutrients, suspended solids, biochemical oxygen demand, and bacteria.

Dissolved oxygen and temperature monitoring was measured every one half hour at Knitt Road for one week in August 1992. Dissolved oxygen levels fell below the cold water state standard of 6 mg/l for four and one half hours during early morning on August 10, 1992 (see Figure 2 below). Normal oxygen diurnal fluctuations occur as plants produce oxygen in the daylight during photosynthesis then respire at night and use oxygen.

Figure 2.

North Branch Pigeon River Dissolved Oxygen and Temperature - 1992



South Branch Pigeon River

The upper reaches of the South Branch Pigeon River is classified as Cold Water Class I Trout stream. The upper reaches are also designated as Exceptional Resource Waters as defined in NR102.11. The lower reaches are classified as Warm Water Sport Fish Community. The river is dammed to form the 20-acre Keller Lake. The South Branch is considerably larger in size than the North Branch.

The upper reaches of the watershed consist mostly of wooded rural and wetlands. The lower reaches have considerably more agricultural lands. Stream habitat evaluations rated the river generally as having fair habitat. Stream bank erosion is infrequent, but with some potential during floods. Bank vegetative protection is 70-90% density with diverse trees, shrubs, and grasses that apparently have a good root systems. Sand is the predominant substrate type at most of the monitoring locations, however, some silt has formed in the slow moving areas of the bends and near the banks. In contrast to this, stream substrate is mostly rock, rubble and gravel at Neitzke Road. Crayfish and minnows were common at all monitoring locations. Aquatic vegetation is common in the upper reaches but uncommon to none existent in the lower reaches.

The biotic index values ranged from very good to fair with possible to fairly significant organic pollution. A variety of macroinvertebrates were present at the two monitoring locations, however, Ephemeroptera, Diptera, and Coleoptera were the most abundant. Because of the sand substrate, habitat suitable for some macroinvertebrate species is generally limited to riffle areas below bridge abutments where rubble and gravel from rip-rap is present.

Water chemistry samples collected on June 19, 1991 during non-runoff event conditions show low concentrations of nutrients, suspended solids, and biochemical oxygen demand.

IV. CONCLUSIONS

The watershed streams did not receive good or excellent habitat ratings or biotic index results because of the natural characteristics of the watershed. The shifting sand substrate generally does not provide a variety of habitat with deep pools and riffles, rubble, gravel and other stable habitat which are desirable characteristics for abundance and diversity of aquatic organisms. Very little nonpoint sources of pollution could be found in the watershed streams; however, the excessively nutrient enriched condition of the lakes and ponds in this watershed are believed to be caused by years of nonpoint source runoff.

I concur with the current "medium" priority ranking for potential selection in the Nonpoint Source Priority Watershed programs that this watershed received in the 1991 Wolf River Water Quality Management Plan.

V. REFERENCES

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