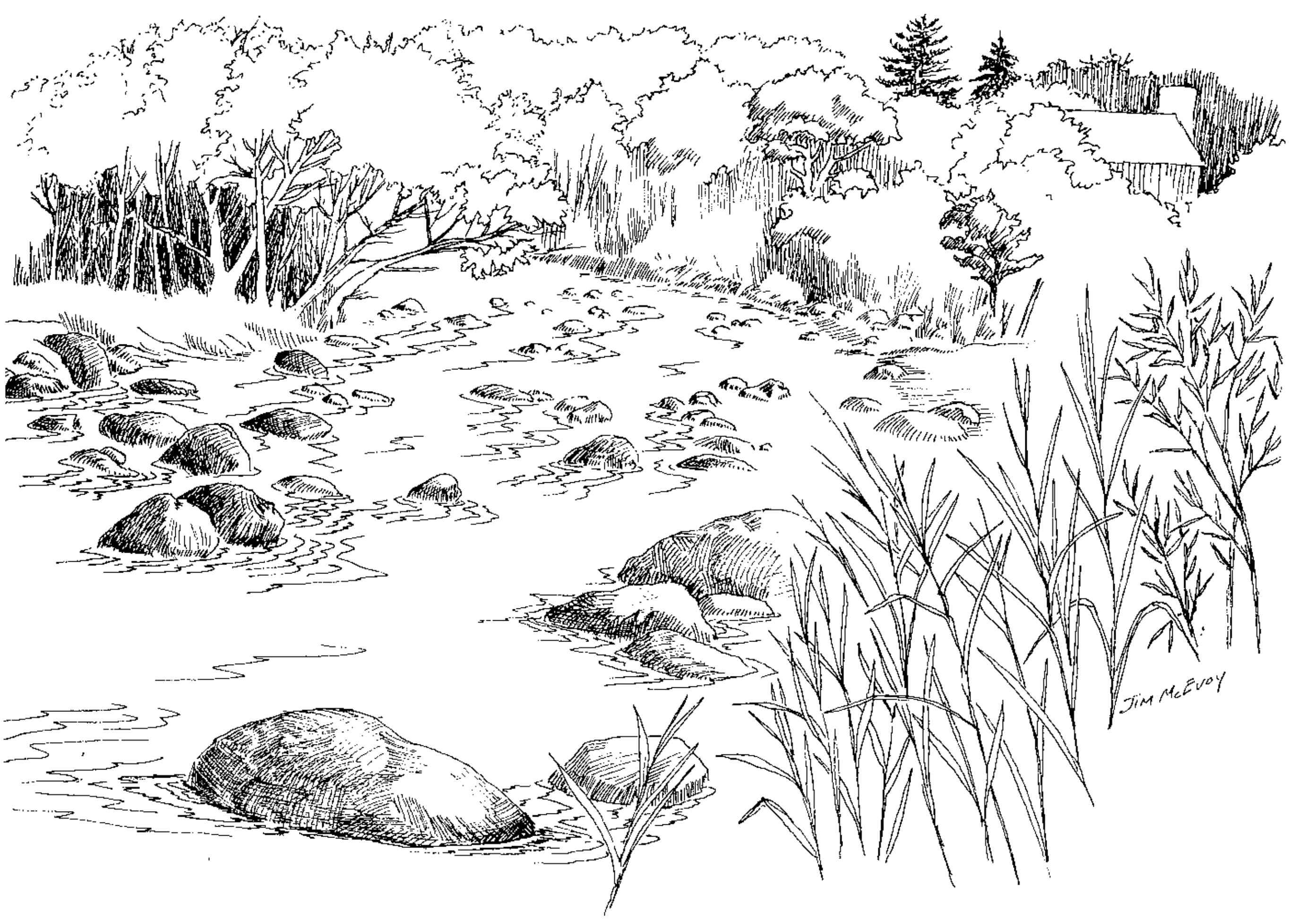
A Nonpoint Source Control Plan for the Upper Big Eau Pleine River Priority Watershed Project



This plan was prepared under the provisions of the Wisconsin Nonpoint Source Water Pollution Abatement Program by the **Wisconsin Department of Natural Resources** and the **Clark, Marathon, and Taylor County Land Conservation Departments.**

Watershed Plan Credits and Organization Information

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Bruce Baker - Director, Bureau of Water Resources Management
John Konrad - Chief, Nonpoint Source & Land Management Section
Dale Urso - Director, North Central District

Principal Participants in the Upper Big Eau Pleine River Priority Watershed Project Plan Development

Authors: John Lewis, Nonpoint Source & Land Management Section, Wisconsin Department of Natural Resources, Madison
Bill Jaeger, North Central District, Wisconsin Department of Natural Resources

Editor: Susan E. Bergquist, Nonpoint Source & Land Management Section, Wisconsin Department of Natural Resources, Madison

Graphics: University of Wisconsin-Madison Cartographic Lab
Jim McEvoy, Graphic Artist, Wisconsin Department of Natural Resources, Madison

Contributors:

Dean Kaatz - Marathon County Land Conservation Department
Mindy Schlimgen - Marathon County Land Conservation Department
Keith Foye - Clark County Land Conservation Department
Dan Renzoni - Taylor County Land Conservation Department
Roger Bannerman - Nonpoint Source and Land Management Section, Wisconsin Department of Natural Resources
James Vennie - Evaluation and Special Projects Section, Wisconsin Department of Natural Resources

Word Processing: Jean Somersett, Wisconsin Dept. of Natural Resources, Madison

A NONPOINT SOURCE CONTROL PLAN
FOR THE
UPPER BIG EAU PLEINE RIVER PRIORITY WATERSHED PROJECT

The Wisconsin Nonpoint Source Water Pollution Abatement Program

August, 1987

Plan Prepared By:

Wisconsin Department of Natural Resources
Bureau of Water Resources Management
Nonpoint Source and Land Management Section
P.O. Box 7921
Madison, Wisconsin 53707

In Cooperation With:

Marathon County Land Conservation Department
Clark County Land Conservation Department
Taylor County Land Conservation Department

Publication WR-197-87

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Carroll D. Besadny
Secretary

BOX 7921
MADISON, WISCONSIN 53707

August 11, 1987

File Ref: 2600

Mr. Stanley M. Grazadzielewski, Chair
Marathon County Board
Courthouse
Wausau, WI 54401

Dear Mr. Grazadzielewski:

I am pleased to be able to approve the Nonpoint Source Control Plan for the Upper Big Eau Pleine Watershed. The very high level of cooperation by your respective county staff members has resulted in a solid basis for conclusions reached in the Plan's nonpoint source control strategy. This cooperation and the strong commitment exhibited by the timely hiring of staff for this project bode well for its predicted success in protecting and improving water quality.

The Plan estimates total needs in the watershed to be $4.3 million for installation of nonpoint source management practices and 33 person years of effort to provide administration and technical assistance. Over the eight-year project, actual cost and personnel needs will, of course, depend on participation rates during the three-year sign-up period. The Department's Nonpoint Source Program will make funds available for additional county staff that may be needed to complete the project, and cost-sharing funds will be made available for the installation of management practices. Your personal attention in promoting participation of eligible landowners would be greatly appreciated.

The objectives of this plan were designed to work in concert with the Department's overall recommendations for comprehensive management of the Upper Big Eau Pleine Reservoir. Water level recommendations to be adopted through relicensing by the Federal Energy Regulatory Commission, wastewater treatment effluent quality adopted by the Wisconsin Pollution Discharge Elimination System and other recommendations contained in the Water Quality Management Plan for the Upper Wisconsin River Basin are all parts of that comprehensive management structure. The Nonpoint Source Control Plan for the Upper Big Eau Pleine Watershed, including the detailed program for implementation contained therein, meets the intent and conditions of s. 144.25, Statutes, and NR 120, Wisconsin Administrative Code. This priority watershed plan constitutes a revision to the Areawide Water Quality Management Plan under Ch. NR 121, Wisconsin Administrative Code.

Sincerely,

C. D. Besadny
Secretary

N0803-11

cc: Senator Walter Chilsen, 40S, State Capitol
Senator Marvin Roshell, 134S, State Capitol
Representative Heron Van Gorden, 302W, State Capitol
Representative Brad Zweck, 28W, State Capitol
Dale Urso, NCD, Rhinelander
Jim Lissack, WCD, Eau Claire
David Jacobson, NWD, Spooner
Secretary Howard Richards, DATCP
Charles Sutfin - U.S. EPA, Region V

COUNTY OF MARATHON
COURTHOUSE ANNEX
WAUSAU, WISCONSIN 54401-5501

LAND CONSERVATION DEPARTMENT
(715) 847-5213

July 16, 1987

Carroll D. Besadny, Secretary
Dept. of Natural Resources
Box 7921
Madison, WI 53711

Dear Mr. Besadny,

The Marathon County Land Conservation Committee has reviewed and approved of the Upper Big Eau Pleine Watershed Nonpoint Source Control Plan. The Marathon County LCC is willing to fully cooperate with the implementation of the plan upon finalization by the Department of Natural Resources.

Sincerely,

Loddie Loskot

Loddie Loskot, Chairman
Marathon County LCC

Clark County Land
Conservation Committee
Agricultural Service Center
Room 106, Courthouse
Neillsville, WI 54456

July 7, 1987

Mr. John Lewis
Planning Analyst
Bureau of Water Resources Management
Wisconsin Department
of Natural Resources
Box 7921
Madison, WI 53707

Dear Mr. Lewis:

The Clark County Land Conservation Committee has reviewed the draft of the "Nonpoint Source Control Plan for the Upper Big Eau Pleine River Priority Watershed." We feel a good job was done on the plan and have no comments. At our July 8, 1987 LCC meeting we resolved to recommend approval of the draft by the Wisconsin DNR. The LCC along with the Land Conservation Department and Soil Conservation Service in Clark County look forward to assisting DNR in implementing the Big Eau Pleine Water Quality Plan.

Sincerely,

Julius Klapatauskas

Julius Klapatauskas
Chairman

TAYLOR COUNTY LAND CONSERVATION DEPARTMENT

COURTHOUSE - ROOM G20
PHONE 748-2299
MEDFORD, WISCONSIN 54451

Our Soil — Our Strength

John Lewis
Bureau of Water Resource Management
Department of Natural Resources
Box 7921
Madison, WI 53707

On behalf of the Taylor County Land Conservation Department, I am stating our desire to cooperate fully with the Upper Big Eau Pleine priority watershed project. We will do all we can to promote the program and see to it that all eligible farmers have ample opportunity to participate.

Sincerely,

Dan Renzoni
Taylor County Conservationist

DR/mf

Organized By The Taylor County Board of Supervisors
To Assist In The Management Of Land And Water Resources

NONPOINT SOURCE CONTROL PLAN FOR THE UPPER BIG EAU PLEINE RIVER PRIORITY WATERSHED PROJECT

SUMMARY

PURPOSE:

The Upper Big Eau Pleine River Watershed was selected in 1984 to become a priority watershed project funded by the Wisconsin Nonpoint Source Water Pollution Abatement Program administered by the Department of Natural Resources. The criteria for watershed selection included the practicability of reducing nonpoint source pollutants; the willingness of local governments and landowners to participate in a project; and the public use of streams, lakes and groundwater in the watershed. The purpose of the watershed plan is to develop a strategy to protect and improve water resources in the project area through nonpoint source pollutant control.

THE PLANNING PROCESS:

Prior to the development of a strategy to control pollution from nonpoint sources in the Upper Big Eau Pleine River Watershed, two major assessments were completed. These assessments were the water resource appraisal and the nonpoint source inventory. The water resource appraisal established the current conditions and uses of the lakes and streams in the watershed. The nonpoint source inventory determined the location and magnitude of the major nonpoint source pollution occurring in the watershed. The information generated by these assessments was combined to produce water resource objectives and to target levels of nonpoint source pollutant control.

Upon completion of the two assessment activities a pollution control strategy was developed. The pollution control strategy addresses the qualities and costs of the management practices required to control the sources of pollutants.

WATER QUALITY APPRAISAL:

The water resource conditions within the Upper Big Eau Pleine River Watershed were assessed using several methods. These assessments were designed to determine the current uses of the water bodies and to project the optimal uses that could be achieved through the installation of nonpoint source pollution controls.

The results of the water resource appraisal indicate that the nonpoint source pollutants of most concern are excessive nutrient and organic matter, bacteria and sediment. The reduction of nuisance algae growth in the Upper Big Eau Pleine reservoir was selected as a primary goal, although the reduction of other pollutants will have a significant beneficial effect.

NONPOINT SOURCE INVENTORY

All lands within the watershed were included in the nonpoint source inventories. The properties of over 900 landowners were inventoried for the following four pollutant source types:

1) Barnyard runoff: Each livestock operation in the watershed was assessed for its relative potential to generate pollutants during a four-inch rainfall event. These results were used to rank the livestock operations within each subwatershed.

2) Field-spread manure runoff: The potential of each livestock operation to produce pollutants from field-spread manure was assessed. An estimate of the amount of manure produced was used to estimate the land area needed to spread the manure at an acceptable rate. The land available was evaluated in terms of slope and proximity to water bodies. A calculation was then performed which estimated the probability of spreading occurring on unsuitable lands. Each operation was then ranked using these results.

3) Upland erosion: All lands in the watershed were categorized by land use. The Universal Soil Loss Equation was applied to croplands, pasture, woodland, and vacant lands to estimate the average annual soil loss. The controllable soil loss for each landowner in the watershed was estimated, and was used to rank lands by landowner for their potential to generate pollutants by upland erosion.

4) Streambank erosion: All stream reaches were inventoried for the location and extent of streambank erosion sites. Very little streambank erosion was found in the watershed, but cattle access to streams was found to cause the destruction of fish habitat.

POLLUTANT LOADS AND REDUCTION POTENTIAL

The contribution of phosphorus from the Upper Big Eau Pleine Watershed to the reservoir was estimated to be 139,911 pounds per year. It was estimated that nonpoint sources contributed 84,776 pounds per year of the total amount and that management practices installed through this project could reduce the nonpoint source total by 26,196 pounds (see Figure 1). Since the total phosphorus load to the reservoir (from the combined loading of both the Upper and Lower Eau Pleine River Watersheds) is 161,636 pounds per year, the 21,196 pound reduction from nonpoint sources in the upper watershed would result in a 16.2% reduction in phosphorus to the reservoir.

Computer models of algae production (Vennie, 1982) indicate that an approximately equal reduction (16%) would be seen in algae production, though this change could lag behind phosphorus reduction by a number of years.

Point sources in the Upper Big Eau Pleine River Watershed were found to contribute a large proportion of the controllable phosphorus load to the watershed. The communities of Abbotsford and Milan accept wastewater from dairies which generate a total of 42,161 pounds of phosphorus per year. This plan recommends that this portion of the total watershed phosphorus load be monitored, and that the Department of Natural Resources consider requiring phosphorus removal at the two community wastewater treatment plants (or source reduction at the dairies) after an assessment of the potential load reduction which would result.

The combined potential for the reduction of phosphorus loads from point sources and nonpoint sources was estimated at 68,357 pounds per year which is 39% less than the current total estimated load to the reservoir (see Figure 2). Again, a proportionate reduction (39%) in algae production would be predicted.

POLLUTION CONTROL STRATEGY

The landowner rankings were used to place landowners into eligibility categories to insure that the landowners with the most critical sources are given highest priority for assistance and that the desired pollutant reduction in the watershed is achieved. The following table summarizes the number of landowners eligible in each category, and the percentage of controllable pollutant load in each category that is generated by these eligible operations.

Table S-1. Eligible Operations and Percentage of Controllable Pollutant Load in Each Category

	Manure Spreading	Cropland Erosion	Animal Lot Runoff
Eligible Operations	174	244	121
% of Controllable Load Generated by Eligible Operations	70%	90%	70%

PROJECT ADMINISTRATION:

The Marathon, Clark and Taylor County Land Conservation Departments (LCDs) will assume the primary responsibility for project administration at the local level. The Wisconsin Department of Natural Resources (DNR) has the overall program responsibility and administers the nonpoint source control program at the state level.

Among the primary responsibilities of the LCDs are: 1) contacting landowners; 2) designing pollutant control systems for cooperating landowners; 3) developing cost sharing agreements with landowners; 4) certifying proper practice installation; 5) and issuing cost share payments to landowners. The DNR will provide funds to the LCDs for both cost sharing and the support of the additional staff needed for project implementation. The LCDs will be assisted by the Soil Conservation Service, the Agricultural Stabilization and Conservation Service, and the University of Wisconsin-Extension.

IMPLEMENTATION PROCEDURES:

Project implementation will begin in August, 1987. At that time the LCD staffs will begin contacting eligible landowners to develop farm conservation (pollutant control) plans.

The vehicle for contracting with landowners is the cost share agreement. The cost share agreement is a legally binding contract between the landowner and the management agency, in this case the LCDs. The agreement details the management practices to be installed, the location of the practices, the installation schedule, the cost sharing rates, the maintenance period for the practices, and other regulations regarding the obligations of both the management agency and the landowner.

Cost share agreements may be developed and signed during the first three years of the project, with practice installation continuing up to five years after signing of the agreement. Subsequent to the signing of a cost share agreement, the management agencies will assist the landowner in practice design. Following practice installation, the management agencies will certify the practice complete and the landowner may receive cost share reimbursement.

The management agencies are responsible for project tracking and record keeping. The project will be audited for fiscal and programmatic adherence to program rules at least once during project implementation and at the close of the project.

PROJECT COSTS AND STAFFING

The nonpoint source inventory was used as a basis on which estimates of project costs were made. First, the quantity of each type of Best Management Practice needed to control the critical sources in the watershed was estimated. Second, the amount of staff time required to administer the project was estimated. Staff time estimates were based in part on the time required to design and install the practices and on previous experiences in similar priority watershed projects.

The total cost for installing Best Management Practices (including both state and landowner share), would be approximately 4.3 million dollars if one-hundred percent cooperation was achieved and all nonpoint sources were controlled. However, a more realistic estimate of landowner participation is seventy-five percent. At the seventy-five percent participation level, the total cost of Best Management Practices would be approximately 3.2 million dollars, with the state share being 2.1 million dollars.

The additional county LCD staff needed to implement the Upper Big Eau Pleine River Priority Watershed Project at the seventy-five percent participation level was estimated to be 47,463 hours over the eight-year life of the project. The greatest additional staff assistance will be required during the middle years of the project when most of the practice design and implementation is anticipated to occur.

PROJECT EVALUATION:

Two types of project evaluation will be undertaken in this project. These evaluations are the responsibility of the Department of Natural Resources. First, water quality monitoring will be carried out before and after Best Management Practice installation. Changes in key water quality parameters and habitat will be monitored. Second, the success of the project in achieving the installation of Best Management Practices to control critical sources will be evaluated. Estimates of the pollutant load reduction achieved through practice installation will be tracked on continuing basis. Project progress will be reviewed on an annual basis, and adjustments to the project schedule will be made as necessary.

PREFACE

The Upper Big Eau Pleine River Watershed was selected in 1984 as a priority watershed project under the Wisconsin Nonpoint Source Water Pollution Abatement Program. Since the program was enacted by the State Legislature in 1978, twenty-eight other priority watersheds have been selected.

Water pollution sources are separated into two categories: point sources and nonpoint sources. <u>Point sources</u> are concentrated discharges of wastewater originating from a specific site such as a sewage system treatment plant outfall. Point source pollutants can cause acute, highly visible water quality impacts. <u>Nonpoint sources</u> are generally defined as diffuse discharges of pollutants causing either acute or chronic water quality impacts. Examples of nonpoint sources include urban areas which contribute stormwater and snowmelt runoff, agricultural fields, livestock operations and construction sites.

Point and nonpoint sources require different management approaches to achieve water quality objectives. Point sources require the control of a discrete entity, whereas the control of nonpoint sources requires a comprehensive approach addressing a number of land management problems over a larger land area. Nonpoint source pollution is most effectively addressed when an entire watershed is assessed and treated as a whole. This is the approach used in the Wisconsin Nonpoint Source Water Pollution Abatement Program, which is also referred to in this plan as the Nonpoint Source Control Program.

Wisconsin Nonpoint Source Control Program priority watershed projects can be divided into various phases: inventory, planning, implementation and evaluation. During the inventory phase for this watershed, information was collected on individual parcels of land, streambank segments and animal operations. This information is critical to the success of the project since the decisions on eligibility for cost sharing are based on these data. The planning phase was used to assess these inventoried data and to develop the plan for implementation. The implementation phase begins upon completion of the watershed plan. The signing period for cost share agreements also starts with the beginning of the implementation period. The first and third phases are primarily the responsibility of the county Land Conservation Departments, Extension Agents, and the U.S. Soil Conservation Service. The planning phase is a joint effort of the local agencies and the Department of Natural Resources.

The project evaluation will review the success of the project in controlling the critical pollutant sources and will evaluate actual improvements in water quality and aquatic habitat.

The purpose of this Nonpoint Source Control Plan is to develop and document water quality and land use information about the Upper Big Eau Pleine River Watershed so the specific causes and critical areas that contribute to nonpoint source pollution in the watershed can be identified and the most practical means for controlling the pollutants can be developed.

The Nonpoint Source Control Plan is divided into four sections. The introductory section provides a project overview and states the legal basis for the project.

The second section, The Watershed Assessment, sets the goals and objectives for the watershed project by:

1. assessing the existing water quality problems;

2. identifying the significant nonpoint sources of pollutants and determining the significance of other pollutant sources such as point sources;

3. identifying the water quality improvements or objectives that can be reasonably achieved through nonpoint source controls;

4. identifying the priority management areas (the sites needing controls) and the Best Management Practices that will be effective in controlling the nonpoint sources of pollutants; and

5. estimating the costs of implementing the recommended nonpoint source control practices.

The third section, The Detailed Program for Implementation, outlines the process to be used in order to achieve the project objectives. It identifies:

1. the tasks necessary to accomplish the needs identified in the Watershed Assessment;

2. the agencies responsible for carrying out those tasks;

3. the time frame for carrying out the tasks;

4. the estimated hours of staff time needed to carry out the project; and

5. the administrative procedures to be used in carrying out the program.

The final section is a project evaluation plan designed to assess the effectiveness of the watershed project.

Upon completion of this plan, there will be an initial three year period during which critical landowners in the watershed will be contacted and will be eligible to sign cost share agreements for the practices which are recommended in the plan. The cost share agreement signed by the landowner and county officials outlines the practices, costs, cost share amounts, and schedule of installation. Practices can be scheduled for installation up to five years from the date of signing the agreement.

The Nonpoint Source Control Plan has several other uses. Because the plan represents a thorough inventory of pollution sources and control needs within the watershed, it can be used to pinpoint critical areas of the watershed where other resource management efforts can be directed. It can also serve an important educational function by showing the cause and effect relationship between land management and water quality. The plan is important as a guide for managing the watershed project and detailing procedures and responsibilities to aid staff in working more effectively. Finally, the inventory in this plan gives an accurate "before project" picture of the nonpoint source conditions in the watershed. A similar inventory after the project will allow for an assessment of changes that have occurred during the project. This document can be revised during the implementation phase if there is a need to change procedures or other portions of the plan.

A NONPOINT SOURCE CONTROL PLAN
FOR THE
UPPER BIG EAU PLEINE RIVER
PRIORITY WATERSHED PROJECT

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A NONPOINT SOURCE CONTROL PLAN FOR THE

UPPER BIG EAU PLEINE RIVER PRIORITY WATERSHED PROJECT

SECTION ONE:

INTRODUCTION TO THE WATERSHED PLAN

CHAPTER I. PLAN PURPOSE AND LEGAL STATUS

A. INTRODUCTION

The Upper Big Eau Pleine River Watershed is located in central Wisconsin, near the cities of Wausau and Marshfield. Most of the watershed is located in western Marathon County with smaller areas in Clark and Taylor Counties. There are several small communities located in the watershed, including Abbotsford, the largest with a population of 1,901, and Colby, Stetsonville, Stratford, and Unity. The watershed is shown in Map 1.

The watershed includes 224 square miles of mostly agricultural lands (primarily dairy) that drain into the Big Eau Pleine River. The river flows through the adjacent Lower Big Eau Pleine River Watershed enroute to the Big Eau Pleine Reservoir, an impoundment with a surface area of 6,830 acres when filled. Discharges from the dam enter the Wisconsin River south of Mosinee.

There are 13 named tributaries to the Big Eau Pleine River in the watershed. The mainstem of the river and one tributary segment are considered warmwater sport fish streams. The other streams support forage fish. There are no natural lakes or major impoundments within the boundaries of the Upper Big Eau Pleine River Watershed.

The watershed's rolling land form, well developed natural stream system plus constructed drainageways, and fine textured soils that retain water combine to produce a streamflow pattern consisting mostly of high runoff rates in spring and very little sustained base flow the rest of the year. Following spring runoff, the streams become essentially series of shallow warmwater pools separated by natural rock dams.

The water in these isolated pools is nutrient rich, and algae blooms and oxygen deficiencies are common. The deficient stream flows and water quality severely limit fish and other aquatic life in the watershed. During higher flows, pollutants are carried from the upper watershed to the Big Eau Pleine River via the lower watershed.

B. PROJECT OBJECTIVES AND GOALS

This plan for the Upper Big Eau Pleine River Priority Watershed Project establishes objectives and specific goals for each of the subwatersheds. as well as for the watershed as a whole.

The primary project objective is the reduction of phosphorus loading to the Eau Pleine Reservoir, since phosphorus is the nutrient that controls algae growth. There are secondary objectives for each subwatershed which pertain to the uses of each of the subwatersheds.

C. WATERSHED PLAN PREPARATION

In order to meet the project objectives mentioned briefly above and discussed in greater detail later in this Nonpoint Source Control Plan, water quality and land management information was collected and assessed for the Upper Big Eau Pleine River Watershed. This information was used to identify critical nonpoint sources of pollutants and the most practical means of controlling these sources. The watershed information and source control strategy are included in this plan.

The plan was prepared jointly by the Nonpoint Source and Land Management Section of the Wisconsin Department of Natural Resources and the Marathon, Clark and Taylor County Land Conservation Departments. Assistance was provided by the North Central District of the Department of Natural Resources, which is headquartered in Rhinelander.

Principal individual participants in the planning process are identified on the inside of the front cover of this plan.

D. PURPOSE OF THE WATERSHED PLAN

This plan has been prepared to guide the implementation of a priority watershed project for the Upper Big Eau Pleine River Watershed, located primarily in western Marathon County, with additional acreage in Clark and Taylor counties, as part of the Wisconsin Nonpoint Source Water Pollution Abatement Program. The plan is divided into four major sections:

1. an introduction to the watershed plan;

2. a watershed assessment;

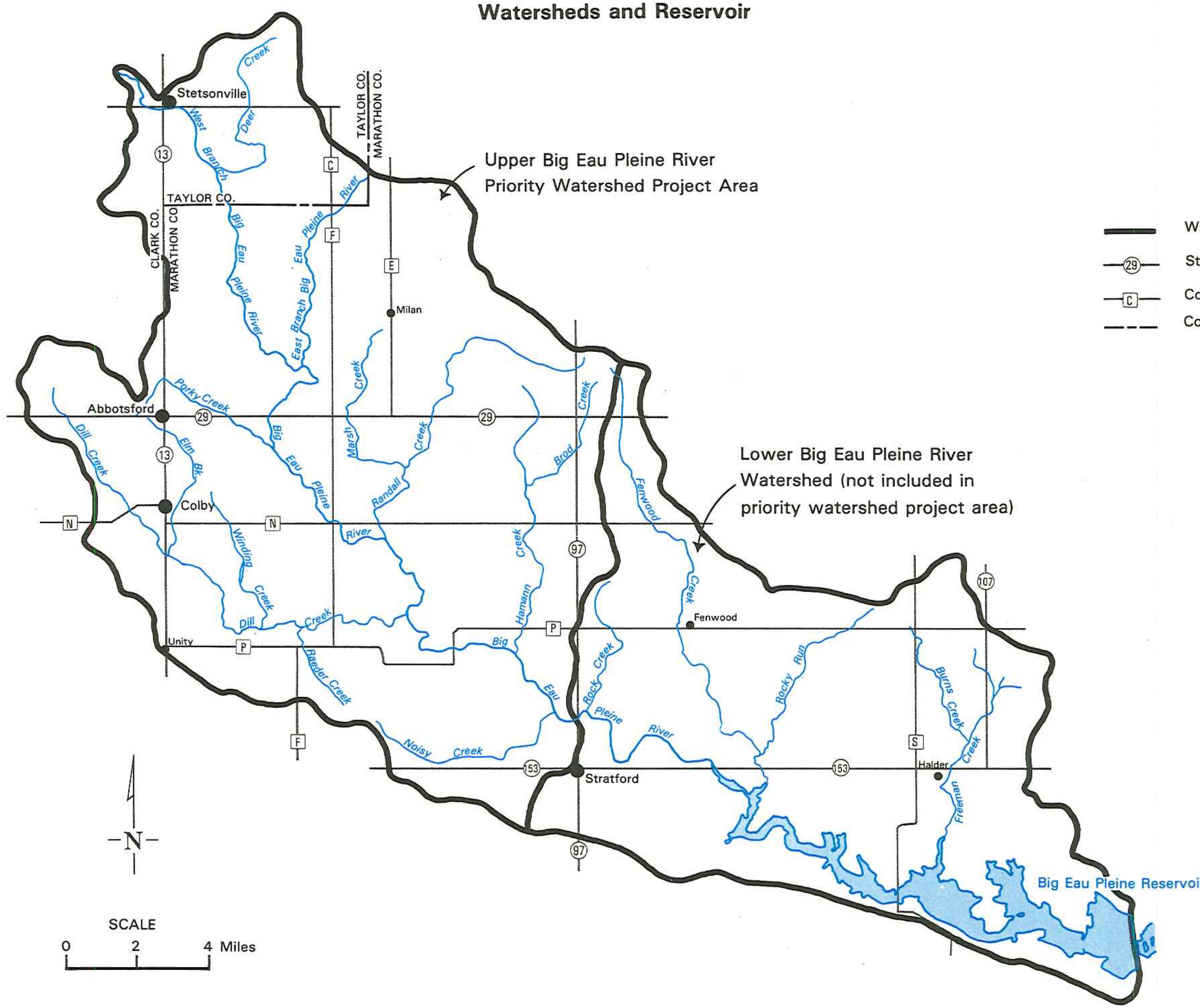
3. a detailed program for implementation; and

4. a project evaluation.

The purpose of <u>The Watershed Assessment</u> portion of the plan is to set the goals and objectives for the watershed project by:

1. assessing the existing water quality problems;

Map 1: Upper and Lower Big Eau Pleine River Watersheds and Reservoir



2. identifying the significant nonpoint sources of pollutants and determining the significance of other pollutant sources such as point sources;

3. identifying the water quality improvements or objectives that can be reasonably achieved through nonpoint source controls;

4. identifying the Best Management Practices that will be effective in controlling the sources of nonpoint pollutants, and

5. estimating the costs of implementing the recommended nonpoint source control practices.

The purpose of the Detailed Program for Implementation portion of the plan is to outline a strategy for achieving the project objectives. This will be done by assisting landowners and land operators in installing needed Best Management Practices to control the nonpoint sources of pollutants. This strategy includes:

1. the tasks necessary to accomplish the needs identified in the Watershed Assessment;

2. the agencies responsible for carrying out those tasks;

3. the time frame for carrying out the tasks;

4. the estimated hours of staff time needed to carry out the project; and

5. the administrative procedures to be used in carrying out the program.

The purpose of the Project Evaluation portion of the plan is to identify procedures and schedules for determining project progress and accomplishment. This includes estimating pollutant load reductions resulting from the installation of Best Management Practices, and measuring changes in water quality.

The Nonpoint Source Control Plan serves as a guide for managing the watershed project and details procedures and responsibilities to aid staff in working more effectively. The plan has two other important uses. Because the plan represents a thorough inventory of pollution sources and control needs within the watershed, it can be used to pinpoint critical areas of the watershed where other resource management efforts can be directed. And it can also serve an important education function by showing the cause and effect relationship between land management and water quality.

E. LEGAL STATUS OF THE WATERSHED PLAN

This plan has been prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program described in s. 144.25, Wisconsin Statutes, and Chapter NR 120 of the Wisconsin Administrative Code.

This plan is the basis for cost share and local assistance grants through the Nonpoint Source Water Pollution Abatement Program administered by the Wisconsin Department of Natural Resources. The Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code, however, govern the conduct of the Nonpoint Source Water Pollution Abatement Program. In the event a discrepancy occurs between this plan and the statutes or the administrative rules or if the statutes or administrative rule are changed, the statutes and rules override this plan.

This plan, once approved through the procedures described in Chapter NR 121, Wisconsin Administrative Code, is an update of the Areawide Water Quality Management Plan for the Upper Wisconsin River Basin.

SECTION TWO:

THE WATERSHED ASSESSMENT

CHAPTER II. GENERAL DESCRIPTION OF THE UPPER BIG EAU PLEINE RIVER WATERSHED

CHAPTER III. INVENTORY PROCEDURES AND WATERSHED POLLUTANT LOADS

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SECTION TWO:

THE WATERSHED ASSESSMENT

CHAPTER II. GENERAL DESCRIPTION OF THE UPPER BIG EAU PLEINE RIVER WATERSHED

A. LOCATION

The Upper Big Eau Pleine River Watershed is located mostly in western Marathon County, with smaller areas located in Clark and Taylor counties. This watershed is located in central Wisconsin, a few miles west of the City of Wausau (1980 population: 32,426) and just north of the City of Marshfield (population: 18,290). Several small communities are located in the watershed, with the largest being Abbotsford (population: 1,901). The watershed is shown in Map 1, which also shows the adjacent Lower Big Eau Pleine River Watershed.

The watershed includes 224 square miles of mostly agricultural lands.

B. SURFACE WATER RESOURCES

1. Major Water Resources

The surface water resources within the Upper Big Eau Pleine River Watershed are comprised almost entirely of the mainstem of the Big Eau Pleine River and its tributaries. The watershed contains 13 named tributaries to the Big Eau Pleine River. There are a number of constructed private ponds in the watershed, but no natural lakes or major reservoirs located within the watershed boundary.

The Big Eau Pleine Reservoir is located in the Lower Big Eau Pleine River Watershed, about six miles below the Upper Big Eau Pleine River Watershed outlet. The water quality of the reservoir is influenced to a large degree by the pollutants delivered by the Upper Big Eau Pleine River Watershed.

2. Fishery Classification of Streams

The streams in the Big Eau Pleine River Watershed can be categorized into two main groups, referred to as warmwater sport fish streams and warmwater forage fish streams. The mainstem of the Big Eau Pleine River and Segment 1 of Dill Creek comprise the sport fishery reaches. The remainder of the streams support forage fish.

Fishery resources are discussed in more detail by subwatershed and stream segment in Chapter IV of this plan.

3. Point Sources

Stetsonville, Abbotsford, and Colby have municipal wastewater collection and treatment systems which discharge into the Upper Big Eau Pleine River Watershed. These treatment plants are capable of producing effluents low in biochemical oxygen demand (BOD) and suspended solids, however they are nutrient sources to the surface waters because they are not designed and operated for nutrient removal. The treatment plants at Abbotsford and Milan accept wastewater from cheese factories, which are significant nutrient sources.

4. The Interrelationship of Water Resources, Topography, and Soils

The type of water resources found in the Upper Big Eau Pleine River Watershed are largely dependent on the geological history of the area. This area was not covered by the most recent glacial advance, as a result there are none of the natural lakes typical of glaciated areas.

This area is characterized by a well developed system of ephemeral (short-lived) and perennial streams that drain the land surface. These streams have been supplemented by constructed drainage-ways designed to quickly convey water off the land and dry the soils, because the fine textured soils (so-called "tight soils") retain water, making field work difficult and slowing crop growth. These soils retain water but have low permeability.

These soils, the rolling land form, and the drainage practices combine to produce high rates of runoff for short periods but very little sustained base flow in the streams. Stream gradients are generally substantial (Table 1). The high runoff rates have carved well-developed stream channels. The high flow periods regularly rearrange the streambeds.

This topography and "flashy" streamflow pattern is quite uniform throughout the watershed, with the exception that the headwaters of some of the tributaries have low gradients and some wetland areas.

After a runoff event, the streamflows quickly drop off to almost nothing and the streams become essentially series of shallow warmwater pools. The stream channels in the watershed contain a high proportion of gravel, rubble, and boulders. During base flow conditions, these streams can best be described as a series of pools separated by natural rock dams that often restrict fish movement.

Most of the tributaries have almost no flowing water during extended dry spells. During the winter, when there is no runoff feeding the streams, flows will also be minimal and anchor ice (that is, ice which is attached to the stream bottom) is common. In addition to low surface flows, there is very little groundwater to sustain base flow in the streams because the soils are shallow over nonporous bedrock.

The seven-day average low flow with a two-year reoccurrence interval for the Upper Big Eau Pleine River Watershed is only 2.8 cubic feet per second. This low flow severely limits habitat and stresses aquatic life in the streams.

The watershed land uses can amplify these problems. Much of the land adjacent to the streams is pastured. Where the streams are not fenced, the livestock trample the banks and wetland vegetation, and their wastes are direct sources of nutrient-rich pollutants in the streams. The extended low flow periods allow algae populations to build to high levels in the nutrient-rich pools. Large areas of the pool surfaces can become covered with thick floating mats of filamentous algae. Respiration by the algae during dark hours can deplete the oxygen to levels low enough to stress aquatic organisms.

Table 1. Physical Characteristics of Streams in the Upper Big Eau Pleine River Watershed.

Stream Name	Length (miles)	Watershed Area (sq. mi.)	Gradient (ft/mi)	Average Width (feet)	Average Depth (feet)
Big Eau Pleine River	18.8	224	9	99	2.3
Brod Creek	4	5.1	30	6	0.2
Deer Creek	6.3	11.4	8	7	0.8
Dill Creek	20	51.2	9	24	0.9
East Branch BEP River	8.5	24.9	9	26	1.3
Elm Brook	5	5.5	18	9	0.8
Hamman Creek	8.8	26.6	27	21	1.4
Marsh Creek	5	7.8	20	8	0.3
Noisy Creek	6.3	12.8	24	11	0.4
Porky Creek	6	8.3	25	10	0.7
Raeder Creek	2.8	3.9	34	7	0.5
Randall Creek	10	31.3	14	15	1.0
West Branch BEP River	11	34.8	10	36	1.2
Winding Creek	4	6.3	20	7	0.3

5. The Big Eau Pleine Reservoir

As mentioned earlier, the Big Eau Pleine Reservoir is located downstream of this watershed, in the Lower Big Eau Pleine River Watershed. The Big Eau Pleine Reservoir at full pool level extends to a surface area of 6,830 acres. At maximum drawdown it is reduced to 420 acres.

The reservoir is the major recreational resource in the region but suffers from algae blooms, periodic fish kills and fluctuating water levels. It is very productive of sport fish so these fish kills are a major use problem. The algae blooms impair swimming, boating, and aesthetic uses. Local interests have financed the installation and operation of an aeration system to prevent the winter dissolved oxygen depletion that causes fish kills. The existing aerator is not expected to entirely eliminate the fish kills.

A major water quality problem for the Upper Big Eau Pleine River Watershed is the need to control both algae production and oxygen depletion in the reservoir. Since phosphorus is the nutrient that limits algae production in the reservoir, upstream pollutant control measures should be designed to reduce phosphorus loading to the Big Eau Pleine River and its tributaries.

Sources of oxygen-depleting organic matter such as manure should also be controlled to reduce the fish kill potential. Mathematical modeling has predicted that a 50% reduction of phosphorus load to the reservoir will reduce algae production by 57%, while a 20% reduction in phosphorous will reduce algae by 25%. The phosphorus reduction goal for this watershed project will be derived after assessing the feasibility of phosphorous control in Chapter V.

Like all predictions, the phosphorus loading and algae relationship is subject to a degree of error which has not been quantified by the modeling process. The other factor which could limit success is the degree of landowner participation in this voluntary program.

In addition to improving water quality in the Big Eau Pleine Reservoir, the control of the phosphorus and organic matter loads will also benefit the aquatic communities of the Big Eau Pleine River and its tributaries. However in these streams the streamflow is the main limiting factor. The streamflow conditions will limit any potential for change in the type of fishery in any of the streams.

Another type of problem in the Big Eau Pleine Reservoir is the fluctuating water level, which limits fish habitat, impairs navigation and access, and resuspends pollutants from the sediment. The Big Eau Pleine Reservoir is one of 21 reservoirs in the Wisconsin River Basin. The operation of these reservoirs is being assessed by DNR in a Wisconsin River System Review Project. Recommendations for water level management of the Big Eau Pleine Reservoir will be made as part of the Wisconsin River System Review Project. These recommendations will be presented to the Federal Energy Review Commission for relicensing of the Big Eau Pleine Dam in 1993.

It is also recognized that additional benefits to the Big Eau Pleine Reservoir could be realized with the implementation of a nonpoint source control plan for the Lower Big Eau Pleine River Watershed in addition to this project.

C. Land Use

Land use in the watershed is mostly dairy agriculture. The Upper Big Eau Pleine River Watershed is located in an area which has been said to be the highest dairy producing section of Wisconsin. A substantial percentage of the area adjacent to the streams is wooded, but the woodlands are mostly pastured which reduces their value for protecting water quality.

Abbotsford, Colby, Stetsonville, Stratford, and Unity are the centers in the watershed for residential, light industry, and service land uses. These constitute a small proportion of the watershed land area and contribute only a small part to the overall nonpoint source pollutant loading to streams in the watershed.

Very little of the land along the tributaries to the Big Eau Pleine River is open to public use. However, much of the area adjacent to the streams is used for recreation. Hunting is one of the most common uses. The tributaries attract wildlife that depend on aquatic environments, such as mink, beaver, raccoon, kingfisher, and herons. As a result of the presence of furbearers, many of the streams are used by trappers in the fall.

CHAPTER III. INVENTORY PROCEDURES AND WATERSHED POLLUTANT LOADS

A. EXISTING WATER QUALITY STUDIES IN THE UPPER BIG EAU PLEINE RIVER WATERSHED

1. Introduction

When the water quality appraisal for this project was begun, extensive water quality data on the Upper Big Eau Pleine River Watershed already existed. Concerns about periodic fish kills in the Big Eau Pleine Reservoir had led to much earlier interest in finding the causes for the water quality problems.

2. University of Wisconsin - Stevens Point Research

Some earlier work had been conducted regarding water quality problems, but a study program carried out for several years at the University of Wisconsin-Stevens Point under the direction of Dr. Byron Shaw is the most complete. This study was designed to determine what factors were degrading the reservoir and to recommend a management program to correct water quality problems.

The watershed and reservoir were intensively monitored from 1976 to 1979. Water chemical and physical aspects were measured, land use and nonpoint pollutant sources were analyzed, several categories of aquatic organisms were studied, and the nutrient, organic matter and hydrologic cycles of the reservoir were characterized. At least 10 Master of Science Degree theses were written on this data base, and summary reports were produced.

In this watershed plan, the conclusions and management recommendations for the reservoir are based mainly on a Master of Science degree thesis, Water and Nutrient Budgets and Phosphorus Models for the Big Eau Pleine Reservoir, Wisconsin (1982), which was researched and written by James G. Vennie. The author used five different mathematical models to compare data from 1975 and 1976. He found a model developed by Dillon and Rigler (1974) best simulated reservoir water quality. This model was then used to predict changes in water quality resulting from reduced phosphorus loading.

3. Other Information Sources

a. Wisconsin Department of Natural Resources

A number of other existing data sources were also utilized in the preparation of this plan.

The Department of Natural Resources had monitored runoff in the Hamann Creek Subwatershed from 1976 to 1979, and the data summaries were reviewed for this plan. The DNR also maintains files on individual water resources and information regarding individual pollutant sources. These were reviewed for information regarding stream water quality in the Upper Big Eau Pleine River Watershed.

Department Fish Management personnel maintain files on individual water resources. The North Central District and Wausau field office files were reviewed for information on the aquatic life of the streams in the watershed. The recreational fishing potential of the tributaries to the Big Eau Pleine River is very limited so there has been almost no inventory or management of these fisheries.

b. Wisconsin Valley Improvement Corporation

The Wisconsin Valley Improvement Corporation (WVIC) operates the dam controlling the Big Eau Pleine Reservoir. Their personnel have monitored water quality in the reservoir for many years. Mr. Robert Gall of WVIC was consulted on the findings of their monitoring program.

c. United States Geological Survey

The United States Geological Survey (Holmstrom, et al. 1985) has maintained a discharge gauging station on the Big Eau Pleine River since 1916. That agency also conducted chemical and physical water quality monitoring at the gauge site and at the dam. These records were valuable to loading calculations done by UW-Stevens Point. Sediment load monitoring by the USGS (Hindale, 1975) was particularly valuable.

B. WATERSHED PROJECT INVENTORIES

1. Introduction

In addition to existing data, some monitoring was also done specifically for this appraisal.

2. Hilsenhoff Biotic Index

Bottom dwelling macroinvertebrate samples were collected at 20 sites in the watershed during fall 1985 and spring 1986. They were identified and analyzed by the Hilsenhoff Biotic Index method developed by Dr. William Hilsenhoff of the University of Wisconsin-Madison (1982).

The Biotic Index is based on the hypothesis that each species of aquatic invertebrate has a specific tolerance to dissolved oxygen depletion in a water body. The organisms collected from a site are identified and given a numerical tolerance rating of 0 to 10. The organism ratings for a site are then averaged to produce a numerical rating for the sample. The numerical rating can be converted to the classifications of excellent, very good, good, fair, poor, and very poor.

The sample sites for this project were selected by a review of USGS 7-minute quadrangle maps. The general locations of the sites were chosen for convenient access and to represent each stream segment discussed in this plan. The specific sample collection sites were chosen during the sampling visit to represent optimal habitat for the macroinvertebrates.

3. Aquatic Habitat Rating

Finally, several stream sites were evaluated for aquatic habitat. This "habitat rating" uses streambed, streambank, watershed, and stream flow physical characteristics to rate the quality of habitat for fish and other aquatic life. The result is a numerical rating which can be converted to the four categories of excellent, good, fair, or poor habitat.

The habitat rating was developed by Joseph Ball (1982) of the DNR to classify streams and to designate stream use for water quality standards. The original habitat rating has been supplemented with field data forms to record the actual physical characteristics the rating is based on. The data forms were developed by DNR Southeast District Water Resource Management staff and reviewed by a DNR staff committee formed to recommend a procedure for nonpoint source water resources appraisals.

C. DELINEATION OF SUBWATERSHEDS FOR INVENTORY ASSESSMENT PURPOSES

For purposes of inventory and assessment in this project, the watershed was divided into six subwatersheds as delineated on Map 2.

The six subwatersheds are 1) the Mainstem Subwatershed; 2) the Hamann Creek Subwatershed; 3) the Dill Creek Subwatershed; 4) the Randall Creek Subwatershed; 5) the West Branch Big Eau Pleine River Subwatershed; and 6) the East Branch Big Eau Pleine River Subwatershed.

D. POLLUTANT SOURCE ASSESSMENT METHODS AND RESULTS

1. Introduction

An important part of the watershed project planning process was the collection of information on the various nonpoint sources of pollutants and other sources of water contamination in the watershed. In this project, eroding croplands, improperly managed animal lots and improperly spread manure are the major nonpoint sources of pollutants.

2. Land Erosion

a. Land Inventory and Use of the Universal Soil Loss Equation

All of the watershed's 130,630 acres of cropland, woodland and grassland were inventoried parcel-by-parcel to determine land use. Soil losses on these lands were then computed by using the Universal Soil Loss Equation (USLE). This equation uses six factors to calculate sheet and rill (non-gully) soil loss in tons of soil per acre per year (T/A/Y). The six factors are rainfall, soil erodibility, slope (percent), slope length, cropping management, and support practice.

The parcels were drawn so that the USLE factors were as uniform as possible within the parcel. Over 9,900 parcels were delineated on Agricultural Stabilization and Conservation Service (ASCS) air photos (8" = 1 mile scale). Soils maps, topographic maps and field checks were utilized to determine physical parameters, and landowners supplied crop rotation information.

Although the inventory data were collected on all of the rural lands within the watershed, the calculation of soil loss was done only on the croplands, pastures, woodlots, and vacant grasslands. Soil loss calculations were not done for wetlands, farmsteads, and established residential areas which, because of their vegetative cover, have very little soil erosion.

The USLE soil loss calculation does not determine the amount of soil which actually enters the surface waters. It is only an estimate of the sheet and rill erosion on a given parcel of land. It is assumed for the purpose of this project that lands with high soil loss rates are contributing the most sediment to the surface waters.

b. Land Erosion Inventory Results

The results of the soil erosion inventory are summarized in Tables 2, 3, and 4, and are illustrated in Figure 1.

Table 2 shows the estimated soil loss for the entire watershed by land use. This table indicates that a very high percentage of soil erosion is occurring on cropland. The cropland category includes both continuous row crop and rotation crop practices. Based on this information, the most effective control of sediment entering the surface waters can be achieved by treating the cropland erosion problems. Sediment from the other land uses appears to be of less concern, though some gully erosion control practices may be needed.

Map 2: Subwatersheds of the Upper Big Eau Pleine River Watershed

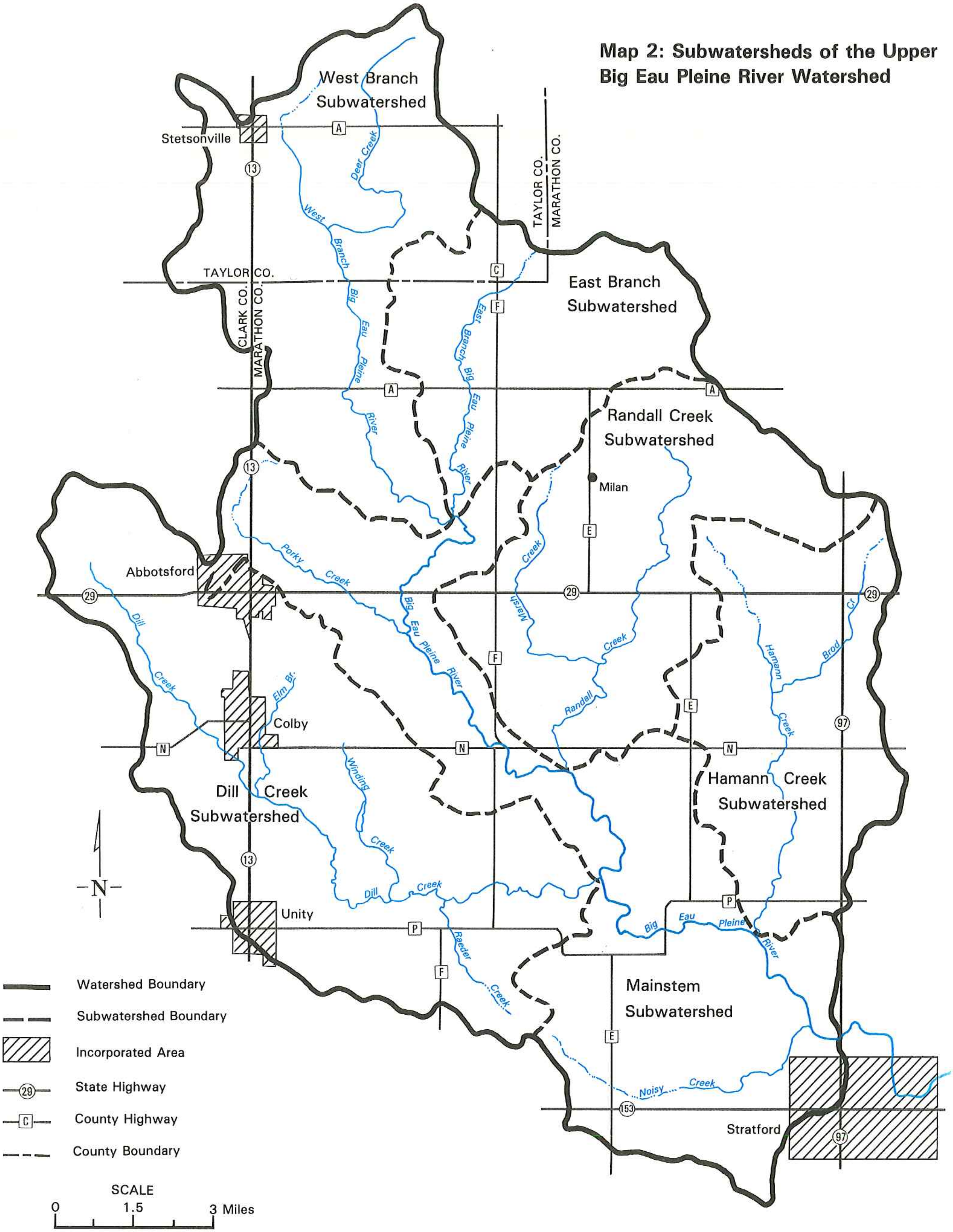


Table 2. Soil Loss on Inventoried Acreage in the Upper Big Eau Pleine River Watershed

	Cropland	Pasture	Grassland	Woodland	Total
Acres	87,330	9,340	4,923	29,037	130,630
Tons soil loss/yr	153,718	4,741	743	1,223	160,425*

* This number differs slightly from the following tables due to a difference in methodology for computation.

Source: Project Inventory

Table 3 gives an indication of how much of the present soil erosion would be controlled if all the lands eroding at two tons/acre/year or greater were brought down at least to the level of two tons/acre/year.

The total soil loss (before any practices were applied) was estimated at 160,060 tons/year. Applying the control practices to all acres eroding above the target rate of two tons/acre/year would result in a reduction of 44,634 tons per year of soil.

Note that two tons/acre/year (T/A/Y) is well below the productivity-related goal of "T". "T" is the "tolerable" rate of soil loss which is approximately equal to the rate at which soil is regenerated through natural processes (which would be in the three to four T/A/Y range in this watershed). As is shown by Table 4, a very large amount of erosion occurs in the low erosion rate categories. The goal of two T/A/Y will result in over twice as much soil loss reduction (44,634 T/Y reduction) than would a goal of three T/A/Y (20, 219 T/Y).

Table 3. Soil Loss in Tons Per Year, by Subwatershed

Subwatershed	Existing Condition	After Control*	Net Change	% Change
Dill Creek	42,165	28,653	13,513	32.0
East Branch	10,728	9,414	1,314	12.2
Hamann	23,131	15,625	7,506	32.4
Main Stem Eau Pleine River	42,658	28,730	13,928	32.7
Randall	22,438	16,857	5,581	24.9
West Branch	18,939	16,147	2,792	14.7
Total:	160,060	115,426	44,634	27.9

*Control to the target rate of two tons/acre/year.

Source: Project Inventory

Table 4. Total Soil Loss by Erosion Rate Groups (all subwatersheds combined)

Present Conditions According to the Inventory*

Erosion Rate Category tons/acre/year	Acres	Total Soil Loss tons/year
0.00 - 1.99	102,000	77,660
2.00 - 2.99	14,200	44,000
3.00 - 3.99	5,000	17,200
4.00 - 4.99	1,600	7,000
5.00 or more	2,400	14,200
Total		160,060

*This does not include the wetlands, farmsteads, or residential lands on which the USLE was not applied.

SOURCE: Upper Big Eau Pleine River Priority Watershed Project Inventory, 1986.

c. Management Practices Needed to Reduce Soil Loss

The Department has developed a computer program which uses the land management inventory data to determine what type of changes in management practice or practices are needed to reduce the soil loss on a given parcel to the desired target level. It should be pointed out that the application of new management practices often brings soil loss below the two T/A/Y target level, and conversely, some parcels can not be brought down to the target level with the management practices available.

Table 5 contains information on the types of management practices which were estimated to be needed to attain the reduction of soil loss to target levels.

Table 5. Estimated Needs for Changes in Management Practices

Practices Needed	Number of Fields	Number of Acres
Contour Cropping	1,727	21,327
Contour Strips	384	4,136
Conservation Tillage	46	707
TOTALS	2,164	26,170

SOURCE: WDNR Application of "MANAGEMENT" Program to Land Inventory Data.

The controllable soil loss is concentrated among relatively few landowners as Table 6 illustrates. This table shows how many landowners would have to reduce soil loss to two tons/acre/year to reach the cumulative percentage of soil loss control noted in the table.

Table 6. Comparison of Percentage Soil Loss Controlled to the Number of Landowners Needed to Control Soil Loss.

Cumulative % of soil loss controlled	Number of landowners (cumulative)
10	6
20	15
30	27
40	44
50	65
60	93
70	128
80	175
90	244
100	447

Source: Project inventory.

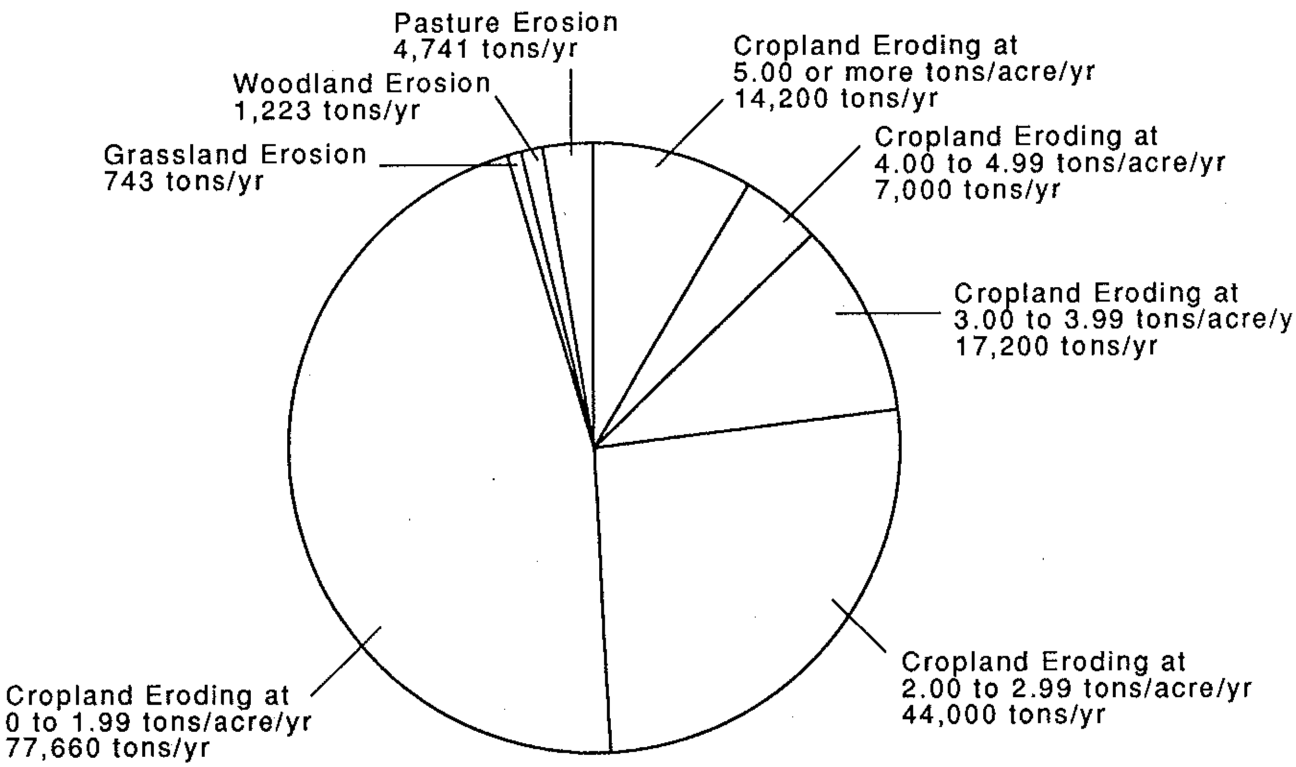


Figure 1: Soil Loss by Land Use and Erosion Rate on Areas Inventoried.

Source: Analysis by Nonpoint Source and Land Management Section, Water Resources Management Bureau, WDNR. Data collection by Land Conservation Department of Marathon County with assistance from Clark and Taylor County Land Conservation Departments.

3. Animal Lot Runoff

a. Animal Lot Inventory

All of the animal lots in the watershed were assessed for their livestock waste runoff potential. Information on the number and types of animals, the size of land areas draining through the lots, the distance of the lot from the stream and vegetative cover on the buffer area and the existing management practices was collected by county Land Conservation Department (LCD) personnel. At the same time, information on manure storage needs was recorded for each lot.

A total of 867 animal lots were assessed, which was the total number of animal lots in operation within the watershed when the inventory was conducted. However individual animal lots which were being managed as one operation at one site, and whose runoff had the same destination, were grouped so that the ranking considered them as a combined lot. This grouping procedure left a total 577 animal lots for the purpose of this project.

b. Phosphorus Load Model

The information on the animal lots was used in a mathematical model which estimates the phosphorus load from each animal lot to the receiving stream during a 10-year, 24-hour (4.0") rain storm. The animal lot runoff model, called An Evaluation System to Rate Feedlot Pollution Potential (Young, 1982), is used to evaluate the potential pollution problems from animal feedlots.

c. Animal Lot Rankings

The estimated phosphorus load from each barnyard was used to rank all lots in the watershed relative to each other in terms of how critical they are to water quality. In this manner the most important and least important lots can be determined. During the analysis of the animal lot inventory results, the lots were ranked as high, medium, or low priority.

The "high priority" lots (62 in number) are those which contribute the top 50% of total phosphorous and probably are the most cost-effective to control. The "medium priority" lots (totaling 59) are those yards which are less cost-effective to control but, when grouped with the high priority lots, contribute at least 70% of the total phosphorus from animal lot runoff.

The remaining 431 lots which collectively contribute less than the 70% level are ranked as low priority. Animal lots draining to a surface depression were automatically ranked "low", since soils in the watershed offer good protection from surface contamination. These will be reassessed at the time of the landowner contact to determine whether they may cause any groundwater problem.

In addition to the above criteria, animal lots which are subject to frequent flooding may be added to the "high" priority category during project implementation. A preliminary evaluation of this problem indicated that few lots were located in areas likely to be flood-prone.

4. Manure Spreading

a. Classification of Lands for Winter Spreading

During the land inventory, all fields owned by an animal lot operator were classified as <u>suitable</u> or <u>unsuitable</u> for winter spreading of manure, and the operator's total number of acres in each category was recorded.

All fields were designated as unsuitable for winter spreading if they 1) contained significant surface water drainage-ways, 2) had slopes greater than four percent, 3) were within 200 feet of a surface water, or 4) were flood prone (as determined by soil type).

b. Estimated Number of Unsuitable Acres

The ratio of <u>unsuitable</u> acres to total cropland acres for each operation was then multiplied by the number of <u>acres needed</u> for spreading six months' accumulation of manure for that operation at the rate of 25 tons per acre. The product of the <u>unsuitable</u> total ratio multiplied times the <u>acres needed</u> results in an estimated number of unsuitable acres which would be spread with manure by the operator in a given year if fields were chosen at random.

c. Ranking Animal Lot Operations

Animal lot operators were ranked according to their estimated number of unsuitable acres used for spreading manure. Many of these operations have storage capability and may be spreading only on suitable land. This analysis is used to estimate the potential for spreading on unsuitable acres which would cause pollutant runoff. It ranks the operator in the watershed as to the need for a manure management plan or for additional storage (to be determined during implementation).

5. Streambank and Gully Erosion

Streambank erosion is not a common problem in this watershed and few sites (five) were found that might have any potential for a pollutant or habitat problem. These were categorized as low priority, and no estimate was made of pollutant load. Gully erosion was also not estimated for the same reason. Streambank fencing will be an eligible practice, however, to prevent the destruction of vegetation which otherwise would act to catch sediment and organic material and to prevent these materials from entering surface waters.

6. Other Sources

Other nonpoint sources, such as urban runoff, are believed to have a low probabilities of significant pollutant loading in this watershed. Sources such as failing septic systems and wastewater sludge spreading are not classified as nonpoint pollution sources by Wisconsin Administrative Codes but are addressed through programs other than this one.

E. PRIORITY MANAGEMENT AREA

In this project, the entire watershed is considered a "Priority Management Area" in that nonpoint sources throughout the watershed were inventoried and analyzed to determine their need for pollutant control.

CHAPTER IV. DESCRIPTION OF THE WATER RESOURCES AND OBJECTIVES BY SUBWATERSHED

A. SURFACE WATER RESOURCES OF THE UPPER BIG EAU PLEINE RIVER WATERSHED

The results of the water resources inventories described in Chapter III are discussed in this chapter. The watershed's surface water resources are divided into the following six subwatersheds: 1) the Mainstem Subwatershed; 2) the Hamann Creek Subwatershed; 3) the Dill Creek Subwatershed; 4) the Randall Creek Subwatershed; 5) the West Branch Big Eau Pleine River Subwatershed; and 6) the East Branch Big Eau Pleine River Subwatershed (Map 2). Some of the information is further broken down by individual stream segments.

The appraisal results for the Upper Big Eau Pleine River Watershed are summarized by subwatershed in Table 7.

The Big Eau Pleine Reservoir is also discussed in detail in this chapter even though it is not in the Upper Big Eau Pleine River Priority Watershed Project. Its importance here is that it is the receiving body for the water, and pollutants, carried downstream by the Big Eau Pleine River. The reservoir will be a major beneficiary of the water quality improvements that result from this project.

Each of the six subwatersheds is discussed in detail in the following pages. The location of each subwatershed discussion is noted in the Table of Contents for this plan.

1. Mainstem Subwatershed

Water resource conditions for the mainstem subwatershed are summarized in Table 8. Monitoring data are summarized in Table 9. This subwatershed is shown in Map 3.

a. Mainstem of the Big Eau Pleine River

1. Physical Description. The mainstem of the Big Eau Pleine River is the most valuable water resource within the boundaries of the Upper Big Eau Pleine River Watershed. This segment has a length of 18.8 miles. Its lower end at Highway 97 is the furthest downstream point in the watershed project. The drainage area is 224 square miles.

2. Stream Flow. The United States Geological Survey (USGS) has maintained a gauging station at Highway 97 since 1916. The records from this gauging station clearly demonstrate the large variability in stream flow of the entire Upper Big Eau Pleine River Watershed. In 58 years of record the average discharge has been 176 cubic feet per second (cfs). The discharge has ranged from 0 to 41,000 cubic feet per second. In the winter of 1960, there was no flow for 15 days. The seven-day average, two-year reoccurrence low flow is 2.8 cubic feet per second, and the seven-day average, ten-year reoccurrence low flow is only 0.79 cubic feet per second.

Table 7. Summary of Upper Big Eau Pleine River Watershed Appraisal Results by Subwatershed.

Subwatershed	Beneficial Uses Existing	Beneficial Uses Potential	Extent of Use	Problems & Threats	Pollutant or Limiting Factor	Pollutant Reduction or Change Needed
Big Eau Pleine River	Warmwater sport fishing	Improved warm-water sport fishery	18.8 miles	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate* Change in peak and low flows
	Swimming	Improved quality and fewer days when swimming is prohibited		Health risk (potential for infection)	Fecal contam-ination	Moderate to large
	Boating	Improved quality and more days		Shallowness at constrictions	Flashy hydrology	Moderate
	Aesthetics	Better aesthetic value		Turbidity and silty bottom	Soil particles	Moderate
Hamann Creek	Forage fishery	Improved forage fishery	8.8 miles	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate*
				Degraded habitat	Livestock access	Livestock exclusion
				Filamentous algae	Phosphorus	Moderate
	Aesthetics	Better aesthetic value		Turbidity and silty bottom	Soil particles	Moderate
Dill Creek	Warmwater sport fishing	Increased warm-water sport fishery	9.5 miles	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate* Change in peak and low flows
				Filamentous algae	Phosphorus	Moderate
	Aesthetics	Better aesthetic value		Turbidity and silty bottom	Soil particles	Moderate
Randall Creek	Forage fishery	Improved forage fishery	10 miles	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate*
				Filamentous algae	Phosphorus	Moderate
	Aesthetics	Better aesthetic value		Turbidity and silty bottom	Soil particles	Moderate
West Branch Big Eau Pleine River	Forage fishery	Improved forage fishery	11 miles	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate* Change in flow
	Aesthetics	Better aesthetic value		Turbidity and silty bottom	Soil particles	Moderate
East Branch Big Eau Pleine River	Forage fishery	Improved forage fishery	8.5 miles	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate
	Aesthetics	Better aesthetic value		Turbidity and silty bottom	Soil particles	Moderate

Table 7. Summary of Upper Big Eau Pleine River Watershed Appraisal Results by Subwatershed (contd.)

Subwatershed	Beneficial Uses Existing	Beneficial Uses Potential	Extent of Use	Problems & Threats	Pollutant or Limiting Factor	Pollutant Reduction or Change Needed
Big Eau Pleine River	Warmwater sport fishing	Improved warm-water sport fishery	6830 acres	Low winter oxygen	Organic matter loading	Large
	Aesthetics	Better aesthetic value		Odor and turbidity from algae	Nutrients	87% phosphorus reduction**
				Fluctuating water level	Dam operation	Greatly reduced water level range
	Swimming	More swimmable days		Unappealing water quality	Dense algae bloom	Large (75%+)**
	Boating	More opportunity for boating use		Impaired access and navigability because of low water levels	Dam operation	Greatly reduced range of water level fluctuation

* Reduction of peak flows and increase in low flows are needed, but it is recognized the flashy character of the Upper Big Eau Pleine watershed is partly due to soil type and shallowness of bedrock and these factors will be largely uncontrolled.

** Smaller reduction would also be beneficial and could be achieved (see text).

Table 8. Water Resource Conditions - Mainstem Subwatershed.

Subwatershed	Beneficial Uses Existing	Beneficial Uses Potential	Problems & Threats	Pollutant or Limiting Factor	Pollutant Reduction or Change Needed
Big Eau Pleine River Mainstem	Warmwater sport fishing	Improved warm-water sport fishery	Reduced stream volume and sub-strate disturbance	Flash hydrology	Moderate* Change in flow
	Swimming	Improved quality and fewer days when swimming is prohibited	Health risk	Fecal contam-ination	Moderate to large
	Boating	Improved quality and more days	Shallowness at constrictions	Flashy hydrology	Moderate
	Aesthetics	Better aesthetic value (cleaner water)	Turbidity and silty bottom	Soil particles	Moderate
Noisy Creek	Forage fishery	Improved forage fishery	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate*
			Degraded habitat Filamentous algae exclusion	Livestock access Phosphorus	Livestock Moderate exclusion
	Aesthetics	Same			
Porky Creek	Forage fishery	Improved forage fishery	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate*
			Filamentous algae	Phosphorus	Moderate

* Reduction of peak flows and increase in low flows are needed, but it is recognized the flashy character of the Upper Big Eau Pleine watershed is partly due to soil type and shallowness of bedrock and these factors will be largely uncontrollable.

3. Fishery Information. Very little sampling has been done of the Big Eau Pleine River fish community, since it is difficult to work due to the poor navigability and variable stream flows. However, the fishery of the Big Eau Pleine River is fairly typical of a northern warm water riverine system. The sport fish present include muskellunge, northern pike, walleye, smallmouth bass, and panfish. Carp, suckers, and forage species are common. Muskellunge are stocked annually, and there is a limited sport harvest, especially near Cherokee.

   In the 1960s, several low-head dams were installed to increase pool size and depth for more favorable fish habitat. These remain in place and are the focus of most of the recreational activity on this segment of the river.

4. Water Quality. Some very intensive water quality sampling has been done on this segment. The USGS has sampled chemical and physical parameters of the water at the Highway 97 gauging station. An average annual sediment yield of 33 tons per square mile was reported. This can be compared to sediment yields less than 10 tons per square mile in the heavily forested "Northern Highland" region and over 400 tons per square mile in the "Driftless Area" of southwestern Wisconsin.

   Other water quality parameters, including nutrients and biochemical oxygen demand (BOD), have been monitored by the University of Wisconsin-Stevens Point. Data analysis has been aimed at relating pollutant load with problems in the Big Eau Pleine Reservoir located downstream. None of the past work has summarized the effects on the River.

   Benthic (bottom dwelling) macroinvertebrate samples were collected from two sites in this segment. Biotic index analysis indicated better water quality at the downstream site near Stratford than the upstream site at Cherokee. Water quality was rated "good" at Cherokee and "very good" at the Stratford site. The cause of the small, but statistically significant, difference is unknown.

5. Recreational Use. Beneficial uses of the Big Eau Pleine mainstem includes recreational fishing, swimming, some boating, and aesthetic values. In this an area of very few water resources, Marathon County maintains three parks along this segment which receive quite a lot of local use. Two of the county parks have swimming beaches. During the warm periods of most summers, these beaches are closed because of high fecal coliform bacteria levels. The source of the bacteria has not been determined. The possible sources of contamination are swimmers, septic system discharges to the river, and animal waste.

   The main factor limiting recreational fishing and boating in the mainstem is the flow pattern of the Big Eau Pleine River. Snowmelt and rainfall produce high stream flows that preclude recreation activities, while low flows during dry periods obstruct navigation and limit fish habitat.

6. Water Quality Goals. The water quality goals for the mainstem subwatershed are to 1) reduce the periodic high bacteria levels to meet recreational use standards, 2) maintain the present beneficial uses, 3) reduce nutrient delivery to the Big Eau Pleine Reservoir, and 4) reduce organic matter delivery to the reservoir.

b. Noisy Creek

1. Physical Description. Noisy Creek has a total length of 6.3 miles and gradient of 24 feet per mile. It drains an area of 12.8 square miles.

2. Fishery Information. There is no record of any fish survey work in Noisy Creek. It has been cited by the Department's Wisconsin Trout Streams publication (1980) as a brook trout stream, however, there has been no recent substantiation of this classification. Water temperatures have been recorded as too high for trout, and the DNR Area Fish Manager believes Noisy Creek cannot support trout (Allan B. Harbor, personal communication, 1985). Noisy Creek probably does support forage fish.

3. Water Quality. Noisy Creek was sampled near its mouth for benthic invertebrates. The biotic index rated water quality as "good."

4. Recreational Uses. There are no public recreational facilities on Noisy Creek but access is available at three bridge crossings.

5. Water Quality Goals. The water quality goals are to 1) protect existing uses and 2) reduce pollutant delivery to the Big Eau Pleine Reservoir.

c. Porky Creek

1. Physical Description. Porky Creek has a total length of six miles and its gradient is 25 feet per mile. It drains an area of 8.3 square miles. The low flow discharge rate has not been determined, but zero flow has been observed during dry periods. Dense filamentous algae growths "choking" pools during low flow conditions have been reported.

2. Fishery Information. Porky Creek was classified as a forage fish stream in 1976. There have not been any detailed fish surveys but forage species have been observed.

3. Water Quality. Biotic index sampling near the mouth of Porky Creek indicated dissolved oxygen levels able to support a "very good" invertebrate community.

4. Recreational Uses. Porky Creek has no public recreational facilities but access is possible at six road crossings. Its beneficial use is as a forage fishery.

5. Water Quality Goals. The water quality goals are to 1) improve the forage fishery and 2) reduce pollutant delivery to the Big Eau Pleine Reservoir.

Map 3: Mainstem Subwatershed

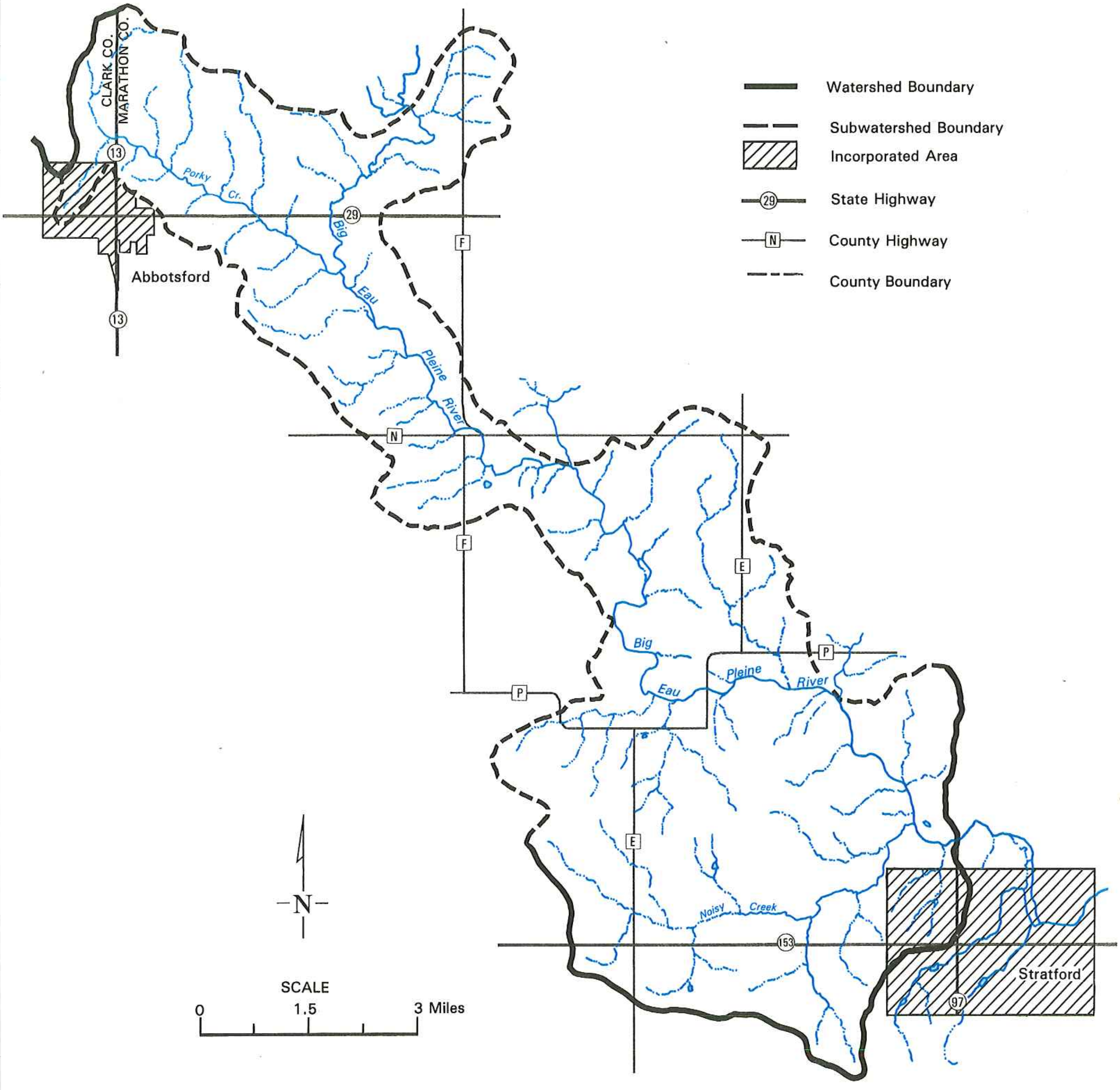


Table 9. Monitoring Data - Mainstem Subwatershed

Stream	$Q_{7,2}$* (cfs)	Biotic Index	Habitat Rating	Fishery
Big Eau Pleine River Mainstem	2.8	Good-Very Good	-	Warmwater Sport
Noisy Creek	Unknown	Good	-	Forage
Porky Creek	Unknown	Very Good	-	Forage

* $Q_{7,2}$ is defined as the seven-day average low flow with a two-year reoccurrence interval.

2. Hamann Creek Subwatershed

Water resource conditions for the Hamann Creek Subwatershed are summarized in Table 10. Monitoring data are summarized in Table 11.

a. Mainstem of Hamann Creek

1. Physical Description. The mainstem of Hamann Creek (Map 4) extends from the confluence with the Big Eau Pleine River up to Brod Creek. The total length of this segment is 5.6 miles, and it has an average gradient of 17 feet per mile. At its mouth, Hamann Creek drains a total area of 26.2 square miles.

2. Stream Flow. Near the upstream end of this segment, the seven-day average low flow, with a two-year reoccurrence interval ($Q_{7,2}$) has been estimated to be 0.15 cfs.

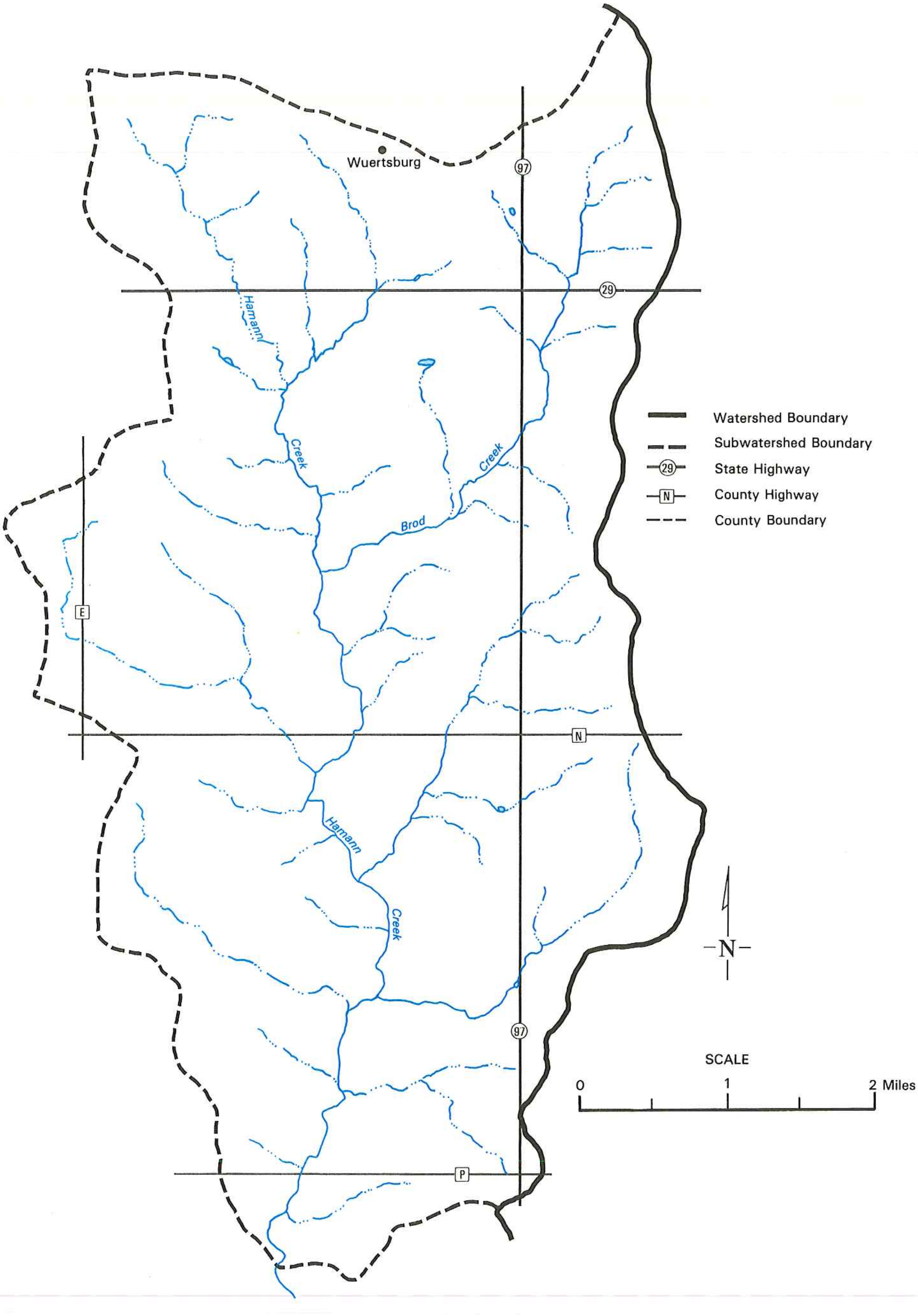
3. Fishery Information. Very little fishery information is available on Hamann Creek. No detailed fishery surveys have been conducted, but forage-sized fish have been observed. Hamann Creek is used by commercial dealers as a bait source, and landowners have complained of excessive seining activity.

Table 10. Water Resource Conditions - Hamann Creek Subwatershed.

Subwatershed Needed	Beneficial Uses: Existing	Beneficial Uses: Potential	Problems & Threats	Pollutant or Limiting Factor	Pollutant Reduction or Change
Mainstem Hamann Creek	Forage fishery	Improved forage fishery	Reduced stream volume and substrate disturbance	Flashy hydrology	Moderate* Change in flow
			Degraded habitat	Livestock access	Moderate
			Filamentous algae	Phosphorus	Moderate
	Aesthetics	Better aesthetic value	Turbidity and silty bottom	Soil particles	Moderate
Brod Creek	Forage fishery	Improved forage fishery	Reduced stream volume and substrate disturbance	Flashy hydrology	Moderate
			Degraded habitat	Livestock access	Moderate
West Branch Hamann Creek	Forage fishery	Improved forage fishery	Reduced stream volume and substrate disturbance	Flashy hydrology	Moderate
	Aesthetics	Better aesthetic value	Turbidity and silty bottom	Soil particles	Moderate

*Reduction of peak flows and increase in low flows are needed, but it is recognized the flashy character of the Upper Big Eau Pleine watershed is partly due to soil type and shallowness of bedrock and these factors will be largely uncontrollable.

Map 4: Hamann Creek Subwatershed



4. Water Quality. In the middle through late seventies, many water chemistry samples from Hamann Creek were analyzed. Snowmelt and rainfall events were sampled as well as base flow. Sediment concentrations over 1000 parts per million were found during rainfall events opposed to base flow concentrations of less than 5 ppm. Total phosphorus levels rose as high as one part per million (ppm) during runoff events from a mean base flow level of 0.05 ppm. Organic nitrogen concentrations increased about four-fold during runoff events.

   Macroinvertebrate biotic index samples rated water quality in Hamann Creek as very good. Habitat at one site in this segment was rated as "fair." Factors limiting uses are periodic low flow, small stream size, warm water temperature, bottom scouring from high runoff rates, and pollutants degrading water quality. Thick growths of filamentous algae are common, indicating a nutrient problem.

5. Recreational Uses. The most beneficial use of the mainstem of Hamann Creek is as a forage fishery, including commercial bait fishing and general recreation. The forage fish population could probably be improved by limiting algae growth through reduced nutrient concentrations and reducing habitat destruction by limiting cattle access. The lower reaches of this segment probably receive seasonal use by sport fish from the Big Eau Pleine River.

   There are no public recreation facilities on Hamann Creek. Access is available at five bridge crossings.

6. Water Quality Goals. The water quality goals are to 1) improve the forage fishery and 2) reduce the nutrient load to the reservoir.

b. Brod Creek

1. Physical Description. Brod Creek is a tributary to Hamann Creek with a total length of four miles and a gradient of 30 feet per mile. It drains an area of 5.1 square miles.

2. Fishery Information. The fish population of Brod Creek has not been surveyed but forage fish are probably present.

3. Water Quality. Benthic organism analysis resulted in a "very good" water quality rating. There was also some water chemistry monitoring of Brod Creek in the 1970s. Runoff events seemed to have somewhat higher pollutant concentrations than those of the mainstem of Hamann Creek.

4. Recreational Uses. The beneficial use is limited to supporting forage fish and general recreation. There are no public use facilities on this stream. Access is available only at three bridge crossings.

5. Water Quality Goals. The water quality objectives are to 1) protect existing uses and 2) reduce pollutant delivery to the Big Eau Pleine Reservoir.

c. West Branch Hamann Creek

1. Physical Description. This segment comprises the part of Hamann Creek upstream of Brod Creek. Its length is 3.2 miles, the gradient is 44 feet per mile and the drainage area is 6.1 square miles.

2. Fishery Information. There is no information on the fishery of this segment. Forage fish are probably present.

3. Water Quality. Benthic invertebrate analysis rated water quality as "very good." Water chemistry sampling found the highest pollutant concentrations to occur during runoff producing events although water quality averaged better than the mainstem of Hamann Creek.

4. Recreational Uses. The beneficial use of this segment is as a forage fishery and a focus for recreation. There are no public use facilities on this stream. Access is limited to a couple of bridge crossings.

5. Water Quality Goals. The water quality objectives are to 1) protect existing uses and 2) reduce pollutant delivery to the Big Eau Pleine Reservoir.

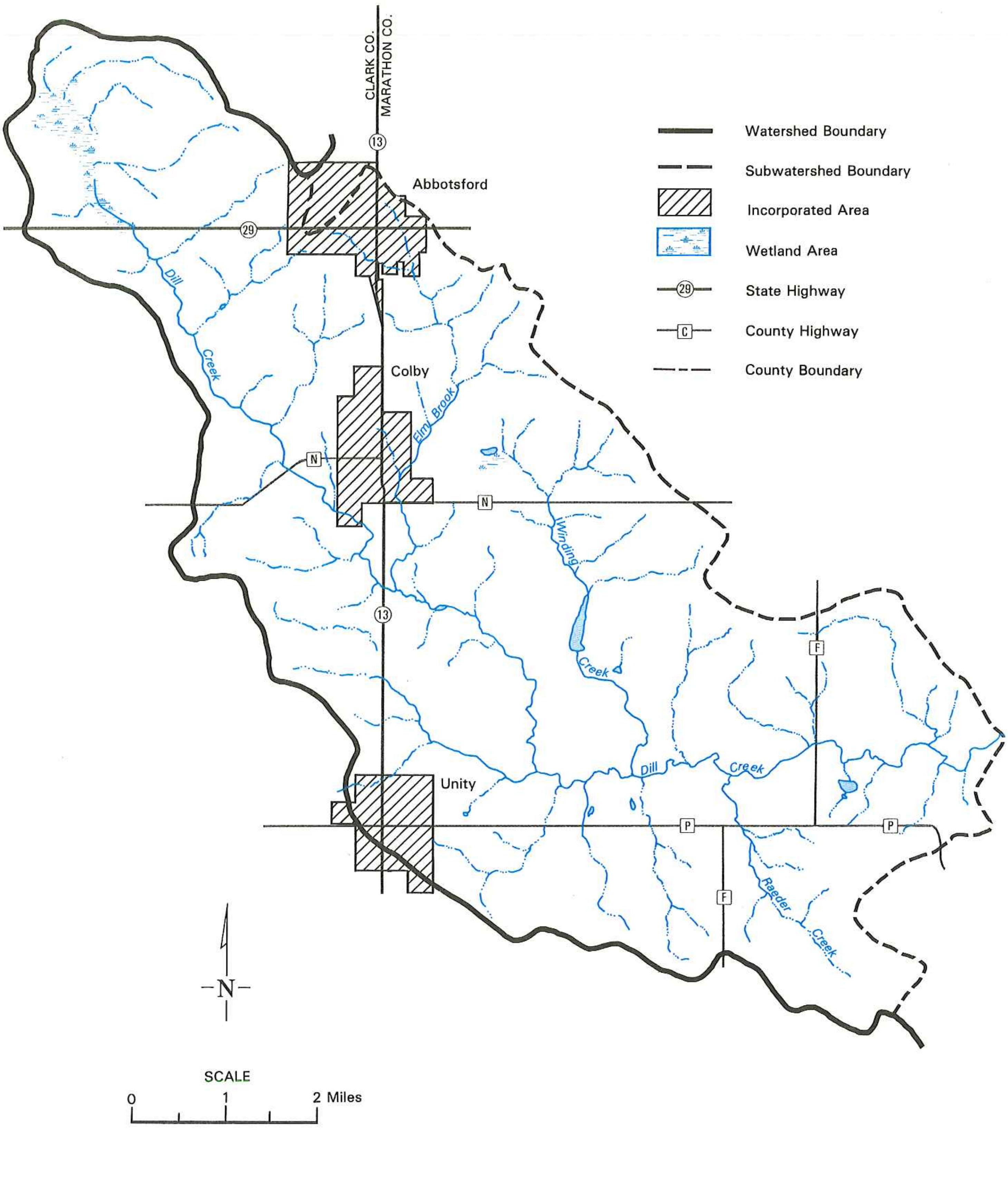
Table 11. Monitoring Data - Hamann Creek Subwatershed

Water Body	$Q_{7,2}$ (cfs)	Biotic Index	Habitat Rating	Fishery
Mainstem Hamann Creek	0.15	Very Good	Fair	Forage
Brod Creek	Unknown	Very Good	-	Forage
West Branch Hamann Creek	Unknown	Very Good	-	Forage

3. Dill Creek Subwatershed

Water resources conditions for the Dill Creek Subwatershed are summarized in Table 12. Monitoring data are summarized in Table 13. The subwatershed is shown on Map 5.

Map 5: Dill Creek Subwatershed



a. Dill Creek Segment 1

1. Physical Description. Dill Creek Segment 1 comprises the lower half of Dill Creek. It is bounded at the upper end by Blackberry Road (T28N, R2E, S32) and at the lower end by its confluence with the mainstem of the Big Eau Pleine River. The length is about 9.5 miles and it has a moderate gradient of 8.4 feet per mile.

2. Stream Flow. Like the rest of the Upper Big Eau Pleine River Watershed, this segment is characterized by high runoff flows and little base flow. The $Q_{7,2}$ has been estimated at 0.43 cfs and the $Q_{7,10}$ is 0.09 cfs.

   The geology and soils of the region result in streams that are generally wide, shallow, and slow moving. During much of the year, this section of Dill Creek is a series of pools connected by short riffles.

3. Water Quality. This stream segment has received little attention during water quality surveys. Benthic macroinvertebrate samples indicate "very good" water quality.

4. Fishery Information. In 1976, Segment 1 was classified to support fish and aquatic life in the warmwater sport fish category. No detailed fish surveys have been conducted, but smallmouth and rock bass, white sucker, creek chub, and forage species are known to be present.

5. Recreational Uses. The beneficial use of this segment is general recreation, warm water sport fishing, and commercial bait fishery. The limiting factors are excessive nutrient concentrations, sediment, warm stream temperatures, and low flow conditions. Public access is available on two miles of private Forest Crop Land plus three bridge crossings.

6. Water Quality Goals. Water quality goals for this segment are: 1) an improved warm water sport fishery and 2) to reduce delivery of pollutants to the Big Eau Pleine Reservoir.

b. Raeder Creek

1. Physical Description. Raeder Creek has a total length of 2.8 miles and a gradient of 34 feet per mile. Its drainage area is 3.9 square miles.

2. Water Quality. Macroinvertebrate samples rated water quality as "very good."

3. Fishery Information. The Marathon County surface water resources report (Carlson and Andrews, 1977) states that Raeder Creek is a Class II trout stream. However it is not officially designated as such by the DNR and file memorandums document that attempts to stock trout have failed. The Area Fish Manager concurs that Raeder Creek cannot support trout (Allan B. Harbor, personal communication, 1985).

Table 12. Water Resource Conditions - Dill Creek Subwatershed.

Subwatershed Needed	Beneficial Uses Existing	Beneficial Uses Potential	Problems & Threats	Pollutant or Limiting Factor	Pollutant Reduction or Change
Dill Creek Segment 1	Warmwater sport fishing	Increased warm-water sport fishery	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate* Change in flow
			Filamentous algae	Phosphorus	Moderate
	Aesthetics	Better aesthetic value	Turbidity and silty bottom	Soil particles	Moderate
Raeder Creek	Forage fishery	Improved forage fishery	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate* Change in flow
	Aesthetics	Better aesthetic value	Turbidity and silty bottom	Soil particles	Moderate
Winding Creek	Forage fishery	Improved forage fishery	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate* Change in flow
Dill Creek	Forage fishery	Improved forage fishery	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate* Change in flow
			Filamentous algae	Phosphorus	Moderate
	Aesthetics	Better aesthetic value	Turbidity and silty bottom	Soil particles	Moderate
Elm Brook	Forage fishery	Improved forage fishery	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate* Change in flow
			Very poor oxygen conditions	Biochemical oxygen demanding substances	Large

*Reduction of peak flows and increase in low flows is needed, but it is recognized the flashy character of the Upper Big Eau Pleine watershed is partly due to soil type and shallowness of bedrock and these factors will be largely uncontrollable.

There is no record of the existing fishery, but it is expected to support forage fish. Its maximum potential is as a forage fishery because of extreme low flows and lack of groundwater inflow to maintain adequately cold water for trout.

4. Recreational Uses. Beneficial uses of Raeder Creek also include general recreation, although there are no public facilities. Access is limited to three bridge crossings.

5. Water Quality Goals. The water quality goals for Raeder Creek are to 1) protect existing uses and 2) reduce the pollutant load to the Big Eau Pleine Reservoir.

c. Dill Creek Segment 2

1. Physical Description. This segment is the upper half of Dill Creek, with its downstream end at Blackberry Road. The $Q_{7,2}$ at about its mid-point is estimated to be 0.19 cfs. The length is 10.5 miles and the gradient is a moderate 10 feet per mile. The total drainage area at the lower end is 22.7 square miles. The stream is quite shallow in this segment. A survey of 7,000 feet of the lower end found the width ranging from six to 35 feet, with an average of 16 feet and the depth from one-third to three feet deep, averaging nine-tenths of a foot deep. Only one pool was more than 1.5 feet deep.

2. Water Quality. The Department of Natural Resources has monitored Dill Creek to measure the impact of the Colby municipal wastewater discharge on Dill Creek. It was learned that the oxygen concentrations have wide diurnal changes both above and below the wastewater source. The pH (degree of acidity) also varies over 24 hours. Primary production by dense growths of benthic algae are the main cause of these chemical changes.

   Macroinvertebrate samples have indicated water quality in the "good" category.

3. Fishery Information. There is no specific fish data on this segment. Forage fish have been noted as abundant during water quality surveys. In 1976, this segment was classified as a warm water forage fishery.

4. Recreational Uses. The beneficial use of this segment is chiefly as a forage fish source. The small size of the stream precludes much potential for warm water sport fish and a cold water sport fishery is unattainable because of the low base flow, warm stream temperatures, and stress caused by the wide diurnal oxygen changes. The forage fishery may be improved by limiting nutrients for algae production.

   The only public facility on this segment is a highway wayside along State Highway 13. Access is available at six bridge crossings.

5. Water Quality Goals. The water quality goals are to 1) improve the forage fishery and 2) reduce pollutant delivery to downstream resources.

d. Winding Creek

1. Physical Description. The total length of Winding Creek is four miles and its gradient is 20 feet per mile. The discharge under low flow conditions has not been estimated. Its drainage area is 6.3 square miles.

2. Water Quality. Biotic index macroinvertebrate samples indicate water quality to be "very good."

3. Fishery Information. The Department of Natural Resources has impounded two-thirds of a mile of Winding Creek as a walleye rearing facility. This impoundment is emptied annually as part of its normal operation. Its effect on Winding Creek is unknown.

   There is no fishery information for Winding Creek.

4. Recreational Uses. There are no public recreation facilities on Winding Creek.

5. Water Quality Goals. Water quality goals are to 1) protect the existing uses including the fish rearing impoundment and 2) reduce pollutant delivery to downstream resources, especially the Big Eau Pleine Reservoir.

e. Elm Brook

1. Physical Description. Elm Brook is five miles long and has a drainage area of 5.5 square miles. Its gradient is 18 feet per mile.

2. Stream Flow. Discharge under low flow conditions has not been estimated, but some flow is always maintained by the Abbotsford wastewater plant effluent which enters Elm Brook near its origin.

3. Water Quality. The water quality of the upper reaches of Elm Brook has been evaluated to assess the effects of the Abbotsford municipal wastewater discharge. Almost all the sampling took place in 1981 and 1982 before a 1987 upgrade of the treatment plant and therefore is not indicative of present conditions.

   In 1976, Elm Brook was surveyed to establish water quality standards. It was classified as a forage fish stream with a three part per million minimum dissolved oxygen standard.

   Macroinvertebrate biotic index samples have recently been analyzed from a site a mile above the junction with Dill Creek. They indicate "very poor" water quality. This degradation may be from the poorly treated municipal wastewater but is unlikely considering the outfall is 2.7 miles upstream of the sampling site. Additional sampling is recommended to determine if there are any other major sources for the severe degradation.

4. Fishery Information. There has not been any detailed fishery analysis of Elm Brook. Forage fish have often been noted, at times in abundant numbers.

5. Recreational Uses. The beneficial uses of Elm Brook are limited to the maintenance of a warm water forage fishery. There are not any recreation facilities along Elm Brook. Warm water temperature and low flows will always limit Elm Brook to a warm water forage fishery.

6. Water Quality Goals. The water quality goals are to 1) improve the forage fishery, 2) improve instream oxygen conditions and 3) reduce pollutant delivery to downstream resources.

Table 13. Monitoring Data - Dill Creek Subwatershed

Stream	$Q_{7,2}$ (cfs)	Biotic Index	Habitat Rating	Fishery
Dill Creek Segment 1	0.43	Very good	-	Warmwater sport
Raeder Creek	Unknown	Very good	-	Warmwater forage
Winding Creek	Unknown	Very good	-	Warmwater forage
Dill Creek Segment 2	0.19	Good	-	Warmwater forage
Elm Brook	Unknown	Very poor	-	Warmwater forage

Table 14. Water Resource Conditions - Randall Creek Subwatershed.

Subwatershed	Beneficial Uses Existing	Beneficial Uses Potential	Problems & Threats	Pollutant or Limiting Factor	Pollutant Reduction or Change Needed
Randall Creek Segment 1	Forage fishery	Improved forage fishery	Reduced stream volume and substrate disturbance	Flashy hydrology	Moderate* Change in flow
			Filamentous algae	Phosphorus	Moderate
	Aesthetics	Better aesthetic value	Turbidity and silty bottom	Soil particles	Moderate
Randall Creek Segment 2	Forage fishery	Improved forage fishery	Reduced stream volume and substrate disturbance	Flashy hydrology	Moderate* Change in flow
Marsh Creek	Forage fishery	Improved forage fishery	Reduced stream volume and substrate disturbance	Flashy hydrology	Moderate* Change in flow

*Reduction of peak flows and increase in low flows are needed, but it is recognized the flashy character of the Upper Big Eau Pleine watershed is partly due to soil type and shallowness of bedrock and these factors will be largely uncontrollable.

4. Randall Creek Subwatershed

Water resource conditions for the Randall Creek Subwatershed are summarized in Table 14. Monitoring data are summarized in Table 15. The subwatershed is shown in Map 6.

a. Randall Creek Segment 1

1. Physical Description. Segment 1 is the portion of Randall Creek between Marsh Creek and the mainstem of the Big Eau Pleine River. It has a total length of three miles and the gradient is 15 feet per mile. At the mouth, it drains 31.3 square miles, including Marsh Creek and Segment 2. The $Q_{7,2}$ is 0.20 cfs and the $Q_{7,10}$ is zero flow. Average width and depth are 15 feet and one foot, respectively.

2. Water Quality. Macroinvertebrate Biotic Index sampling indicated "very good" water quality. However the Biotic Index reflects only the level of organic load and resulting oxygen stress. It is not sensitive to nutrient problems which are evident from thick algae mats on the stream bottom. Habitat was rated as "fair."

3. Fishery Information. There have been no detailed fish surveys on this segment. Forage fish have been noted, including one observation of an abundant population of darters. Sport and panfish probably make seasonal use of this segment with the Big Eau Pleine River mainstem as their source.

   Randall Creek was classified to establish water quality standards in 1976. This segment was classified as a forage fish stream. That classification is still appropriate but it should probably be upgraded to a high quality forage stream. It is used for commercial baitfish gathering.

4. Recreational Uses. The beneficial uses of this segment are for a forage fishery and general recreation. The stream size, low baseflow and warm temperature preclude a sport fishery. The quality of the forage fish population could probably be improved by controlling the algae growth. There is no public frontage on Randall Creek and access is limited to a couple of road crossings.

5. Water Quality Goals. Water quality goals are to 1) reduce nutrient levels, 2) protect the existing uses, and 3) reduce pollutant delivery to the Big Eau Pleine Reservoir.

b. Randall Creek Segment 2

1. Physical Description. Segment 2 encompasses all of Randall Creek above the junction with Marsh Creek. It is seven miles long and the gradient is 13 feet per mile. The drainage area at the lower end is 18 square miles.

2. Water Quality. Water quality information is limited to a couple of Biotic Index samples which indicated "very good" water quality. This segment was classified as a forage fish stream in 1976.

3. Fishery Information. There have not been any detailed fish surveys but forage fish have been observed on several occasions. The beneficial use of this segment is as a forage fishery because of its small size, warm temperature and little base flow. Access is available at three road crossings.

4. Water Quality Goals. The water quality goals are to 1) protect existing uses and 2) reduce pollutant delivery to downstream resources.

c. Marsh Creek

1. Physical Description. Marsh Creek is five miles long and has a gradient of 20 feet per mile. It drains 7.8 square miles of watershed.

2. Water Quality. Biotic Index sampling rated the water quality as "good."

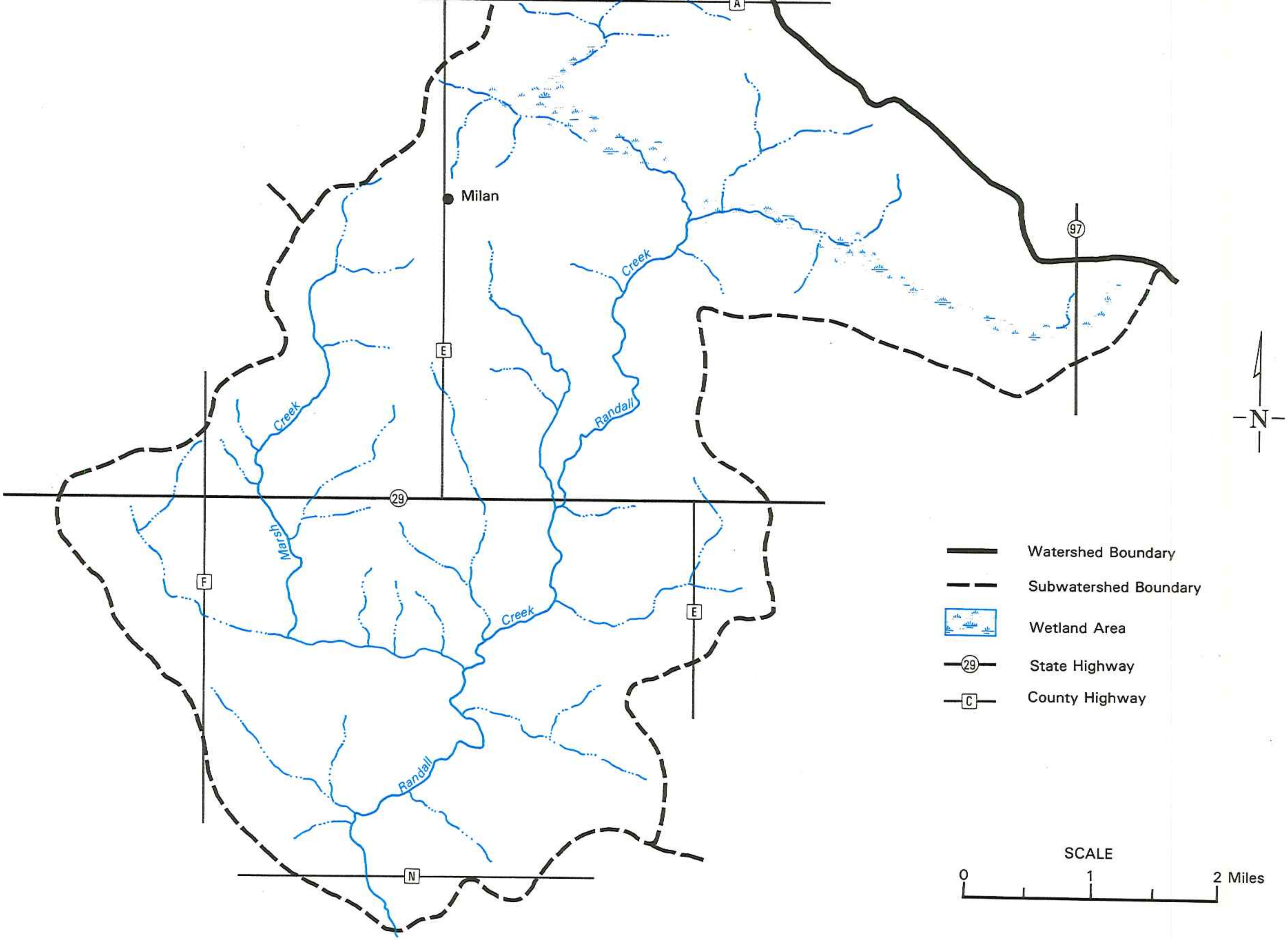
3. Fishery Information. Like Randall Creek, it has been classified as a forage fishery. The beneficial use is also limited to a forage fishery by the same factors that limit Randall Creek.

4. Water Quality Goals. The water quality goals are to 1) protect existing uses and 2) reduce pollutant delivery to the Big Eau Pleine Reservoir.

Table 15. Monitoring Data - Randall Creek Subwatershed

Stream	$Q_{7,2}$ (cfs)	Biotic Index	Habitat Rating	Fishery
Randall Creek Segment 1	0.02	Very Good	Fair	Good quality forage
Randall Creek Segment 2	Unknown	Very good	-	Forage
Marsh Creek	Unknown	Good	-	Forage

Map 6: Randall Creek Subwatershed



5. West Branch Big Eau Pleine River Subwatershed

Water resources conditions for the West Branch Big Eau Pleine River Subwatershed are summarized in Table 16. Monitoring data are summarized in Table 17. The subwatershed is shown on Map 7.

a. West Branch Big Eau Pleine River Segment 1

1. Physical Description. This portion of the Big Eau Pleine River is bounded by the mouth of Deer Creek at the upper end and the East Branch at the lower end. Its total length is 7.4 miles and the gradient is 11 feet per mile. It has a total drainage area at the mouth of 34.8 square miles which also includes the drainage area of the other two segments in the subwatershed. Surface Water Resources of Marathon County (Carlson and Andrews, 1977) lists the average width as 36 feet and average depth as 1.2 feet. The $Q_{7,2}$ is 0.18 cfs and the $Q_{7,10}$ is 0.08 cfs.

   An upstream segment has been officially classified to support fish and aquatic life, and Segment 1 should meet the same standards. The habitat is probably not adequate for a good population of game fish. The habitat rating is "fair," which reflects the shallowness and the low dry weather streamflow condition.

2. Water Quality. Water quality information includes two macroinvertebrate Biotic Index samples which indicated "good" water quality.

3. Fishery Information. There seems to be no information on the fish community in this segment, but forage fish are probably present. Recreational sport fishing has not been documented, despite some private fish management efforts.

   In 1965, the Abbotsford Sportsman's Club installed a low head dam to improve fish habitat. A six-acre impoundment was created, but there does not seem to be any record of amount of recreational use or whether it met expectations. The dam seems to have fallen into disrepair and public access to the impoundment is available only by navigation.

4. Recreational Uses. Access is available at six road crossings. Beneficial uses of the segment are as a forage fishery, general recreation, and aesthetics.

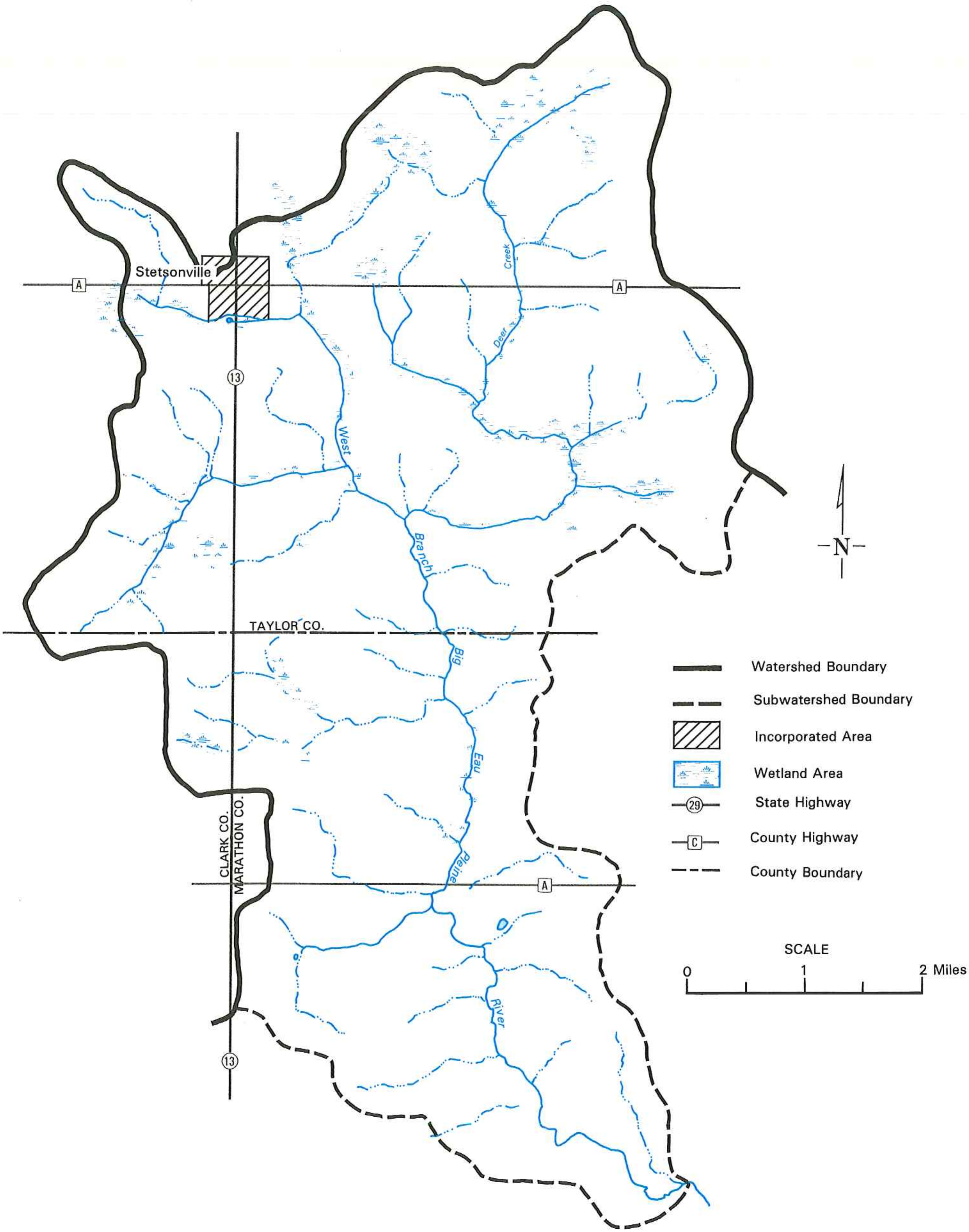
5. Water Quality Goals. The water quality goals are to 1) protect existing uses and 2) limit pollutant delivery to the Big Eau Pleine Reservoir.

Table 16. Water Resource Conditions - West Branch Big Eau Pleine River Subwatershed.

Subwatershed	Beneficial Uses Existing	Beneficial Uses Potential	Problems & Threats	Pollutant or Limiting Factor	Pollutant Reduction or Change Needed
West Branch Segment 1	Forage fishery	Improved forage fishery	Reduced stream volume and sub-strate disturbance	Flashy hydrology	Moderate* Change in flow
			Filamentous algae	Phosphorus	Moderate
	Aesthetics	Better aesthetic value	Turbidity and silty bottom	Soil particles	Moderate
West Branch Segment 2	Forage	Same	Unknown		
Deer Creek	Forage	Same	Unknown		

*Reduction of peak flows and increase in low flows are needed, but it is recognized the flashy character of the Upper Big Eau Pleine watershed is partly due to soil type and shallowness of bedrock and these factors will be largely uncontrollable.

Map 7: West Branch Subwatershed



b. West Branch Big Eau Pleine River Segment 2

1. Physical Description. This segment includes all of the West Branch above Deer Creek. Its length is 3.6 miles, the gradient is eight feet per mile and it drains an area of about 8.5 square miles.

2. Water Quality. Segment 2 has been classified for water quality standards because it receives wastewater from the Village of Stetsonville. The designation is to support limited warm water forage fish above the junction with the tributary entering in Section 29. The remainder is classified to support warm water fish and aquatic life. The fish population has not been sampled.

   Water quality information includes several stream surveys to characterize the impacts of the wastewater discharge. Water chemistry sampling generally found good oxygen levels and ammonia has not been recorded at toxic levels. One survey found a depressed oxygen condition immediately below the wastewater discharge.

   Macroinvertebrate samples indicated "fair" water quality immediately above the junction with Deer Creek. The "fair" rating may indicate some water quality degradation that was not detected during the chemical sampling, or sources downstream of the chemical sampling stations. Additional work is recommended to determine if a pollutant source can be identified.

3. Recreational Uses. The beneficial use of this segment is as a forage fishery.

4. Water Quality Goals. The water quality goals are to 1) protect existing uses, 2) improve oxygen conditions to obtain a biotic index in the "good" range, and 3) limit pollutant delivery to downstream resources.

c. Deer Creek

1. Physical Description. Deer Creek is 6.2 miles long, drains 11.4 square miles and has a gradient of eight feet per mile.

2. Water Quality. The only water quality information that is available consists of two macroinvertebrate samples which had a "good" rating.

3. Fishery and Recreational Information. Surface Water Resources of Taylor County (Haanpaa et al., 1970) calls it a "warm water minnow stream." The beneficial use of this segment is as a forage fishery. Access is available at seven road crossings.

4. Water Quality Goods. The water quality goals are to 1) protect existing uses and 2) limit pollutant delivery to downstream resources.

Table 17. Monitoring data - West Branch Big Eau Pleine River Subwatershed

Stream	$Q_{7,2}$ (cfs)	Biotic Index	Habitat Rating	Fishery
Segment 1	Unknown	Good	Fair	Forage
Segment 2	Unknown	Fair	-	Forage
Deer Creek	Unknown	Fair	-	Forage

6. East Branch Big Eau Pleine River Subwatershed

Water resources conditions for the East Branch Big Eau Pleine River Subwatershed are shown in Table 19. Monitoring data are summarized in Table 18. The subwatershed is shown on Map 8.

a. East Branch Big Eau Pleine River Segment 1

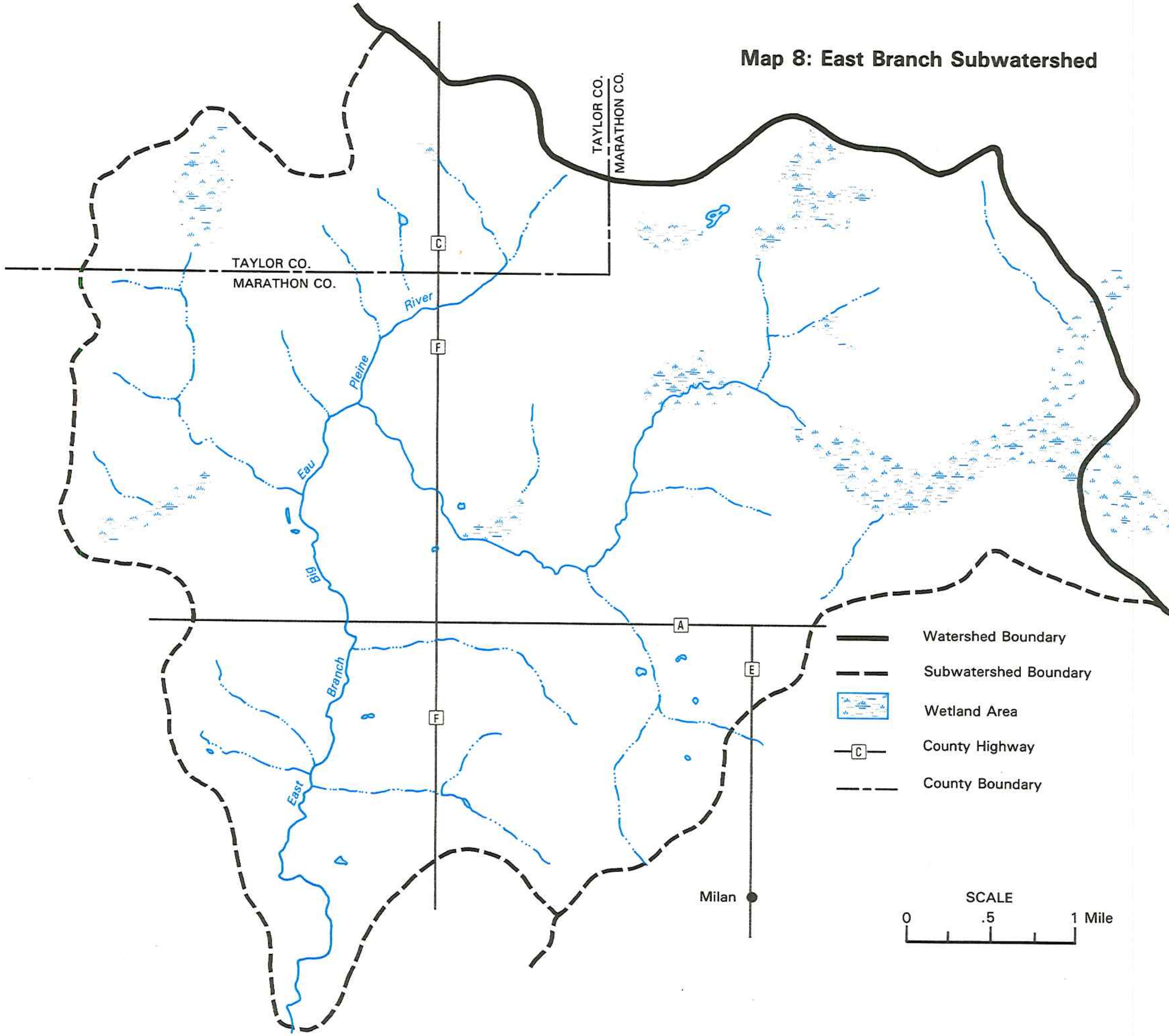
1. Physical Description. This segment is bounded at the upper end by Creek 2-9 (a DNR stream code) and at the lower end by the junction with the West Branch Big Eau Pleine River. It has a total length of 4.4 miles, a gradient of 13 feet per mile, and at its lower end receives drainage from a total area of 24.9 square miles. Water Resources of Marathon County (Carlson and Andrews, 1977) lists an average width of 26 feet and average depth of 1.3 feet.

2. Water Quality. Water quality information is limited to macroinvertebrate samples at two sites. Samples at the upper end of the segment indicated "fair" water quality, and "very good" water quality was indicated at the lower end. The poorer oxygen conditions at the upstream site may result from the high percentage of wetlands in this portion of the watershed.

3. Fishery Information. The only fishery information for this segment is the visual sighting of forage fish at one site. The habitat was rated as "fair" reflecting the stream shallowness and low dry-weather streamflow conditions.

4. Recreational Uses. Beneficial uses have not been documented. Access is limited to three bridge crossings.

Map 8: East Branch Subwatershed



5. Water Quality Goals. The water quality goals are to 1) protect existing uses and 2) control pollutant delivery to downstream resources.

b. East Branch Big Eau Pleine River Segment 2

1. Physical Description. Segment 2 is the entire stream above the junction with Creek 2-9. It is four miles long and drains 10 square miles. The gradient is a low five feet per mile.

2. Other Information. This segment drains a large area of wetland. There is not any water quality or fishery information available on this segment. Access is available at four bridge crossings. The beneficial uses have not been documented.

3. Water Quality Goals. The water quality goals are to 1) protect existing uses and 2) control pollutant delivery to downstream resources.

Table 18. Monitoring Data - East Branch Big Eau Pleine River Subwatershed

Stream	$Q_{7,2}$ (cfs)	Biotic Index	Habitat Rating	Fishery
Segment 1	Unknown	Fair to very good	Fair	Forage
Segment 2	Unknown	-	-	Unknown

B. THE BIG EAU PLEINE RESERVOIR

1. Physical Parameters and Primary Function

The Big Eau Pleine Reservoir was originally developed in the 1930s to store water for maintaining uniform flow in the Wisconsin River. Its operation is still centered on this use. A private corporation, Wisconsin Valley Improvement Company, manages the Big Eau Pleine River and operates the dam. The Big Eau Pleine River is the only water storage facility in the middle section of the Wisconsin River watershed so it is very important to downstream users. Flow augmentation is particularly important to hydro power generators and to wastewater dischargers which may have to restrict production and/or operation during low river flow periods.

With a maximum surface area of 6,830 acres at full pool level, the reservoir is one of the larger lakes in Wisconsin. The maximum depth is 46 feet and the extensive shoreline totals 66 miles. Under the maximum vertical drawdown of 31.5 feet, the surface area is reduced to 420 acres. The reservoir is not drawn down to minimum level every year but normal operation includes a very low level by late winter to provide storage capacity for spring runoff.

Table 19. Water Resource Conditions - East Branch Big Eau Pleine River Subwatershed.

Subwatershed	Beneficial Uses: Existing	Beneficial Uses: Potential	Problems & Threats	Pollutant or Limiting Factor	Pollutant Reduction or Change Needed
East Branch Segment 1	Forage fishery	Improved forage fishery	Reduced stream volume and substrate disturbance	Flashy hydrology	Moderate* Change in flow
	Aesthetics	Better aesthetic value	Turbidity and silty bottom	Soil particles	Moderate
East Branch Segment 2	Unknown	Unknown	Unknown		

*Reduction of peak flows and increase in low flows are needed, but it is recognized the flashy character of the Upper Big Eau Pleine watershed is partly due to soil type and shallowness of bedrock and these factors will be largely uncontrollable.

The total drainage area for the reservoir is 363 square miles. The Upper Big Eau Pleine River Priority Watershed Project includes 224 square miles of the drainage area for the reservoir.

Water resource conditions in the Big Eau Pleine Reservoir are summarized in Table 20.

2. Recreational Uses

The Big Eau Pleine Reservoir is used for a wide range of recreational activities. It is of local importance because it draws many people from the south and west where there are very few lakes large enough for most boating or deep enough to support a quality fishery.

Recreational facilities on the reservoir include a large county park with two swimming beaches, campgrounds, and picnic areas, private and commercial facilities for camping, several boat landings and a moderate amount of private recreational housing.

The Big Eau Pleine is capable of producing an outstanding sport fishery including walleye, northern pike, muskellunge and yellow perch. Carp are a major component of the total fish population.

In 1974, a petition circulated from the Marshfield area requested the Wisconsin Department of Natural Resources to take measures to control periodic fish kills in the reservoir. This petition received 11,000 signatures.

3. Use Problems

The Big Eau Pleine Reservoir has had periodic water quality problems since shortly after it was constructed and first filled. There are reports of fish kills during drawdown since the early 1940s. Fishkills occur during combined conditions of severe drawdown and winter ice cover. This combination results in low oxygen concentrations and subsequent suffocation of all types of fish.

The reservoir is considered a fertile waterbody and has even been characterized as hypereutrophic. Dense bluegreen algae blooms occur each summer which restrict body contact recreation and cause noxious odors. Some of the bluegreen algae have been found to be toxin-producing. Algae blooms commonly reduce water clarity to less than two feet.

The fluctuating water level makes access to the water difficult at times. During severe drawdown, docks and boat launching facilities are left unusable.

Reservoirs are often threatened with filling in because they act as catch basins for sediment loads. The Big Eau Pleine Reservoir is not susceptible to this problem because the sediment load is small in relation to total reservoir volume. The external sediment load has been estimated up to 26.6 acre-feet per year. The storage capacity

Table 20. Water Resource Conditions - Big Eau Pleine Reservoir.

Subwatershed	Beneficial Uses: Existing	Beneficial Uses: Potential	Problems & Threats	Pollutant or Limiting Factor	Pollutant Reduction or Change Needed
Big Eau Pleine Reservoir	Warmwater sport fishing	Improved warm-water sport fishery	Low winter oxygen	Organic matter loading	Large
				Sediment resus-pensions by drawdown	Unknown
	Aesthetics	Better aesthetic value	Odor and turbidity from algae	Nutrients	87% phosphorus reduction*
			Fluctuating water level	Dam operation water level range	Greatly reduced
	Swimming	More swimmable days	Unappealing water quality	Dense algae bloom	Large (75%+)*
	Boating	More opportunity for boating use	Impaired access and navigability because of low water levels	Dam operation	Greatly reduced range of water level fluctuation

**Smaller reduction would also be beneficial and could be achieved (see text).

is 102,319 acre-feet. At the cited loading rate, it would take many years for the reservoir to fill in. This estimate does not include internally generated sediment or account for sediment export. Export may be significant because scouring has been evident during drawdown.

4. Factors Causing Use Problems

The low oxygen and fish kill problems are the result of oxygen consumption by decaying organic matter. Organic matter enters the reservoir via tributaries and is produced internally by the algae. Some of the organic matter settles to the bottom as sediment.

Organic sediment can exert a very large oxygen demand. The fluctuating water level promotes turbulence which resuspends this sediment. The mixing of sediment with the overlying water accelerates the oxygen consuming process.

The excessive algae production is supported by high concentrations of nutrients. The original sources of nutrients come from outside of the reservoir. Some of the nutrients settle to the bottom and are stored in the sediment. These can then be recycled back to the water column and made available for algae production. This is not an infinite cycle, however, because a portion of the nutrients are annually exported with water and sediment flow out of the reservoir.

There are many sources for pollutants in the Big Eau Pleine Reservoir. Some are natural and have been feeding surface waters in Wisconsin since glacial times. Human-induced pollutants are usually of greater significance and can include municipal, industrial, cheese factory and agricultural waste; fertilizer loss; septage; and soil runoff.

Research has suggested that 50% or more of the annual nutrient supply is brought into the Big Eau Pleine Reservoir along with spring runoff. A similar proportion of the external organic load may be carried in by spring flows. The relative importance of the pollutant sources is discussed in the assessment section of this plan.

The fluctuating water level is a factor affecting the water quality of the Big Eau Pleine Reservoir. Water level management is not a source of pollutants but it is an important factor affecting their availability.

5. Reduction of Algae Production

a. Introduction

Controlling nutrient and organic pollution loads will be the most effective way to improve water quality in the Big Eau Pleine Reservoir. Algae require many nutrients and may be controlled by reducing the availability of any of these nutrients to a critical level that will inhibit their growth.

b. Phosphorus Research

Research has demonstrated the most common factor inhibiting algae growth in lakes is a shortage of phosphorus. It also happens that the chemical characteristics of phosphorus make it feasible to control.

There has been much research over the years to determine the critical phosphorus concentration for a lake to have an algae problem. In general, it has been demonstrated (Vennie, 1982) that a phosphorus concentration less than 0.01 parts per million will limit algae growth enough to produce a good quality clear lake. A phosphorus concentration over 0.02 parts per million is generally considered enough to allow an algae bloom.

c. Phosphorus Modeling

Lake modeling (Vennie, 1982) of the Big Eau Pleine Reservoir for the years 1975 and 1976 predicted the phosphorus load reductions needed to control algae production. These predictions are summarized in Table 21. Although it is doubtful that phosphorous loading can be reduced to the levels shown in Table 21 as "Desirable Loads", a considerable reduction is possible and would have a beneficial effect.

Table 21. Big Eau Pleine Reservoir Average Phosphorus Loading During 1975 and 1976.

	Segment 1	Segment 2	Segment 3
Measured Loads*	12.55	5.30	8.10
Desirable Loads*	0.82 (93.5%)	0.48 (90.9%)	0.77 (90.5%)
Excessive Load*	1.64 (87%)	0.96 (81.9%)	1.54 (81.1%)

* Units are gm/sq.m/yr, and the number in parentheses is the reduction needed to reach loading limit.

The reservoir was separated into three segments for the modeling effort (Vennie, 1982). Segment one, the uppermost part, requires the greatest phosphorus load reduction to improve water clarity. The model predicted segment one as needing an 87% loading reduction to prevent an excessive phosphorus concentration and a 93% reduction to reach the 0.01 part per million phosphorous concentration. With even the best of management on the Upper Big Eau Pleine River Watershed, this large loading reduction probably cannot be achieved.

The high productivity of the fishery in the reservoir is related to the high water fertility and production of algae. It is possible that bringing the nutrient loading below the excessive level could lower fish growth rates and subsequently reduce the quality of the fishery. Thus what is considered "excessive" to one observer may be "acceptable" to another.

The modeling (Vennie, 1982) also predicted that a 50% reduction in phosphorus load to the reservoir would produce a 57% reduction of algae concentration, while a 20% phosphorus reduction would reduce algae production by 25%. A 57% or a 25% reduction of algae growth in the reservoir would produce a significant improvement in water clarity and would do much to alleviate the algae scum accumulation and consequent odor problems. Algae reduction should be a water quality goal for the reservoir.

The Upper Big Eau Pleine River Watershed constitutes 62% of the total watershed of the reservoir but has been estimated (Vennie, 1982) to be the source of 80% of the phosphorus load. Since the upper watershed contributes such a large fraction of the phosphorus load, reduction of the load from that watershed can have a significant effect on the reservoir.

The actual potential for reduction will be estimated in Chapter VI. The largest algae reduction improvement will be seen in the uppermost segment of the reservoir because the Big Eau Pleine River discharges directly to segment one of the reservoir. Efforts should be made to select the Lower Big Eau Pleine River Watershed as a priority watershed project to realize a further benefit to reservoir water quality.

The phosphorus loading from both point and nonpoint sources in the watershed is illustrated in Figure 2. Figure 3 illustrates the potential algae reduction in the reservoir from controlling point and nonpoint sources in the upper watershed.

6. Oxygen Depletion in the Reservoir

a. The Oxygen/Organic Loading Relationship

The relationship of the oxygen depletion problem in the reservoir to watershed loading is not as clear as the phosphorus relationship. Oxygen-consuming organic matter is both produced in the reservoir by algae and carried in by runoff from upstream.

There has not been the large body of research on BOD dynamics in lakes such as that on phosphorus. Reducing the watershed delivery of organic matter and phosphorus will help prevent the oxygen depletion, but there is no mathematical basis to predict this relationship. Like the phosphorus prediction, the needed load reduction is probably greater than is practical under current land use. Therefore, the goal should be to reduce the oxygen-consuming organic load to the greatest extent practicable.

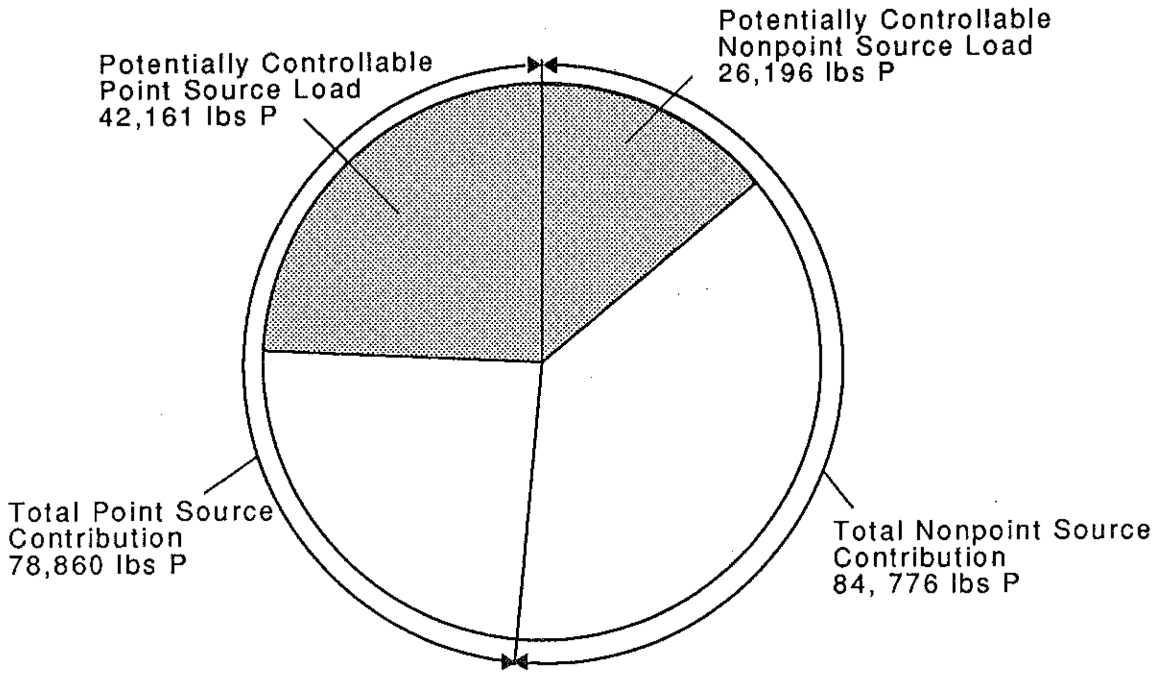


Figure 2: Phosphorous (P) Loading from the Upper Big Eau Pleine River Watershed
Source: Nonpoint Source and Land Management Section, Water Resources Management Bureau, WDNR.

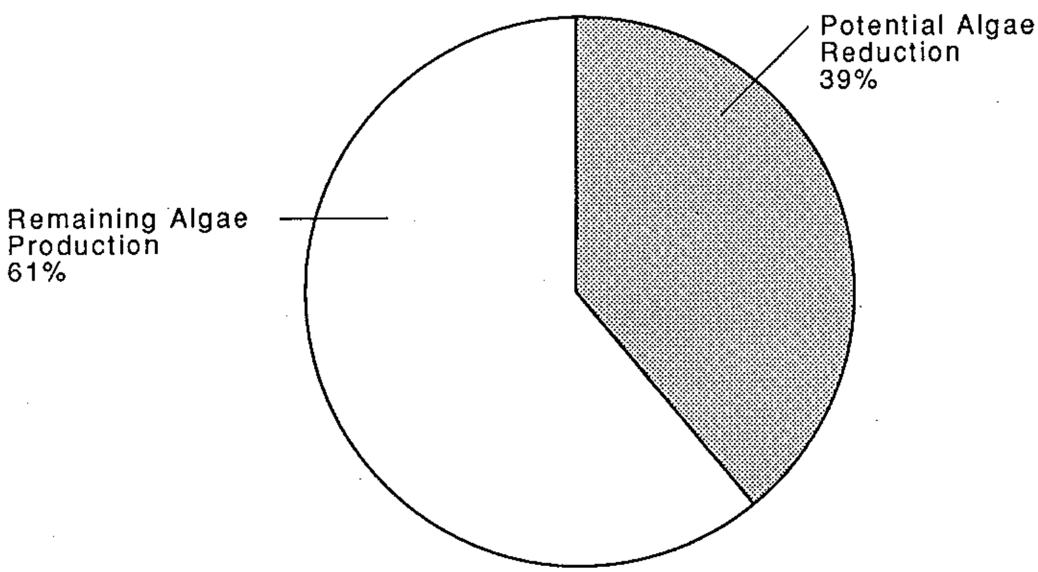


Figure 3: Potential Algae Reduction in the Big Eau Pleine Reservoir With Application of of Potential Nonpoint Source and Point Source Control in the Upper Big Eau Pleine River Watershed
Source: Nonpoint Source and Land Management Section, Water Resources Management Bureau, WDNR.

b. Mechanical Aeration

In 1980, a mechanical aerator was installed in the Big Eau Pleine Reservoir and has since been operated to help maintain wintertime oxygen concentrations to prevent fish kills. Since this installation, the severe oxygen condition has not occurred so there has not been a real test of the system. The existing system probably will not prevent fish kills during a severe winter. The Wisconsin Valley Improvement Company is exploring a proposal to install a second aerator.

Aeration is a good means to prevent winter kill, particularly as an interim measure while pollutant sources are being controlled. Unfortunately, aeration can do nothing to control algae production.

7. Water Storage Management

Water storage management has a major influence on the quality of the Big Eau Pleine Reservoir. The water level changes resuspends sediment, which depletes oxygen in the water column and probably increases nutrient levels. Drawdown may positively affect the reservoir by exporting sediment and phosphorus.

It has been suggested that an effort to allow passage of the first flush of spring runoff through the reservoir may also improve water quality. This would probably be physically possible only if the reservoir is in a fully drawn down stage. It should also be recognized any flushing of pollutants through the reservoir could be detrimental to downstream resources.

Less severe water level changes would facilitate recreational use and probably prevent fish kill problems. The Department of Natural Resources has a separate study project to make recommendations regarding the operation of the Wisconsin River reservoir system. The Big Eau Pleine Reservoir is a part of that project, and water level recommendations for the reservoir should wait until completion of the more extensive study.

C. GROUNDWATER RESOURCES

No widespread groundwater problems have been detected in the watershed. A review of analyses of samples from wells in the watershed indicates that nonpoint sources have not caused contamination of groundwater in this area. Soils in the watershed are not highly permeable and, therefore, act as a good barrier to protect groundwater from surface contaminants.

Criteria based on soil type and bedrock are being developed by the Department of Natural Resources to serve as guidelines for identifying areas where groundwater might be at risk for contamination from animal lots. Animal lots in this watershed will be reviewed after the criteria are selected, to determine whether any lots might create a hazard. Cost-sharing for the installation of Best Management Practices could be made available at that time.

CHAPTER V. POLLUTANT LOAD ESTIMATES AND POLLUTANT CONTROL RECOMMENDATIONS

A. INTRODUCTION TO PHOSPHORUS LOAD STUDIES

An effort was made during the development of this plan to quantify the sources of phosphorus, which is the key pollutant identified in the Watershed Assessment as being the pollutant most in need of control in the Upper Big Eau Pleine River Watershed. An extensive research project conducted by UW-Stevens Point had estimated the annual phosphorus (P) load for the years 1975-76, and this research was used as a starting point to estimate the existing phosphorus load and potential reduction (Vennie, 1982).

Several major changes have occurred since the 1975-76 study, however. Dairies at Abbotsford (AMPI) and Milan (Kraft) have converted their wastewater disposal from land application to surface water discharge through their respective municipal wastewater treatment plants. The total estimated annual P load from the Abbotsford and Milan municipalities is now 47,712 pounds per year, based on recent effluent samples. The number of samples used to estimate this load is small (seven at Milan and two at Abbotsford), but the result is not unreasonable considering the P load which would be expected to be contributed by dairies of the size of AMPI and Kraft. Monitoring by the plants would suggest a significantly lower annual load, so more sampling is recommended to confirm the actual load.

B. PHOSPHORUS LOAD RESEARCH

The estimated total annual phosphorus load from all sources was estimated by Vennie (1982) to average 103,565 lb/yr for 1975 and 1976 in the above-mentioned research project, which was directed by Dr. Byron Shaw of UW-Stevens Point. At that time, dairy waste was being applied to the land and some P undoubtedly was lost to surface water. The amount, however, would be considerably less than the current discharge.

Additional research in the watershed by Stephen Elbert (also of UW-Stevens Point) (Elbert, 1979) during the same time period concluded that the majority of P loading was the result of winter spreading of manure. This conclusion was based on the association of high P concentrations occurring with concurrently high levels of suspended solids and bacteria counts in winter and spring runoff. No estimation of the quantity of the P load attributable to manure spreading was made and there was no mention of contributions from animal lots and manure stacks. Cropland and cheese factory waste were identified as sources of P, but Elbert did not estimate the fraction of P load attributed to them.

As a basis for comparison, research by Christina Moore (1979) estimated P loads from animal waste for five large Great Lakes drainage areas in Wisconsin which included regions in Wisconsin with soils and topography similar to the Upper Big Eau Pleine River Watershed. Animal lots and stacks together were estimated to contribute 60% of one area's P load from animal waste, while winter manure spreading contributed 40%. Cropland was estimated to generate 2.3 times the P load of the total animal waste contribution in a study of one small subwatershed (in White Clay Lake Watershed in Washington County) within that region. Factors

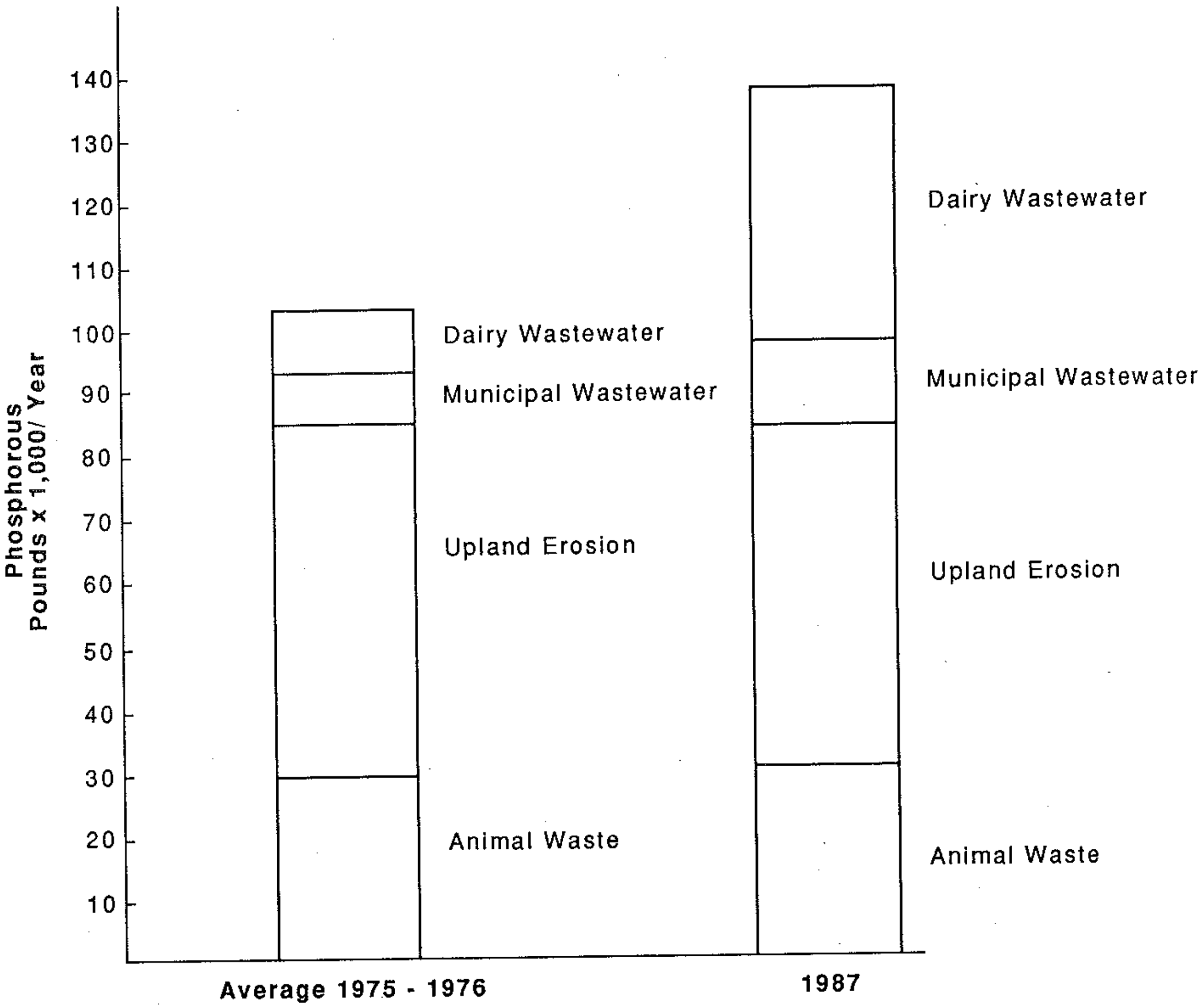


Figure 4: Estimated Phosphorous (P) Loading from Upper Big Eau Pleine River Watershed in 1975 - 1976 and 1987

Source: Nonpoint Source and Land Management Section, Water Resources Management Bureau, WDNR.

which might cause a substantially higher P load from animal waste in the Upper Big Eau Pleine River Watershed are: less pervious soils; greater concentration of dairy animals; and a more intensive drainage-way network than is present in most of the area described by Moore.

C. PHOSPHORUS SOURCES AND REDUCTION POTENTIALS

1. All Sources

Estimates of P loads by source, and their reduction potentials, are given in Table 22. Various phosphorus loads and reduction potentials are illustrated in Figures 4, 5 and 6. The methods for computing these loads are described in the following paragraphs. It should be pointed out that these estimates are based (except where noted) primarily on unit area loads computed for other regions of the state, although an effort was made to adjust them for the soils and drainage system characteristics of this watershed.

Table 22. Estimated Phosphorous Loads (pounds per year) from the Upper Big Eau Pleine River Watershed

	1975-76	1987	Potential Reduction From Nonpoint and Point Sources	Remaining Loads After Nonpoint & Point Source Reductions
Animal Waste	30,151	30,151	-13,086 (43%)[1]	17,065
Upland Erosion	54,625	54,625	-13,110 (24%)[2]	41,515
Municipal Wastewater	8,023	8,423		
Dairy Wastewater	10,766	46,712	{42,161[3]}	{12,974[3]}
Totals:	103,565	139,911	-68,357 (49%)[4]	71,554

(1) 43% reduction of animal waste load
(2) 24% reduction of upland erosion load
(3) represents reduction of combined municipal and dairy load
(4) 49% reduction of total 1987 load

2. Phosphorus from Animal Waste

The estimates of animal waste P loads are based on the annual delivered P loadings ranging from 0.198 pounds per animal unit per year (lb/au/yr) (which is 0.09 kilograms per animal unit per year, or kg/au/yr) to 0.726 lb/au/yr) from Moore (1979). These values represent the amount of P load delivered to surface water for each animal unit in a watershed. An "animal unit" is equivalent to a 1,000 pound cow which would produce 85 pounds of manure per year.

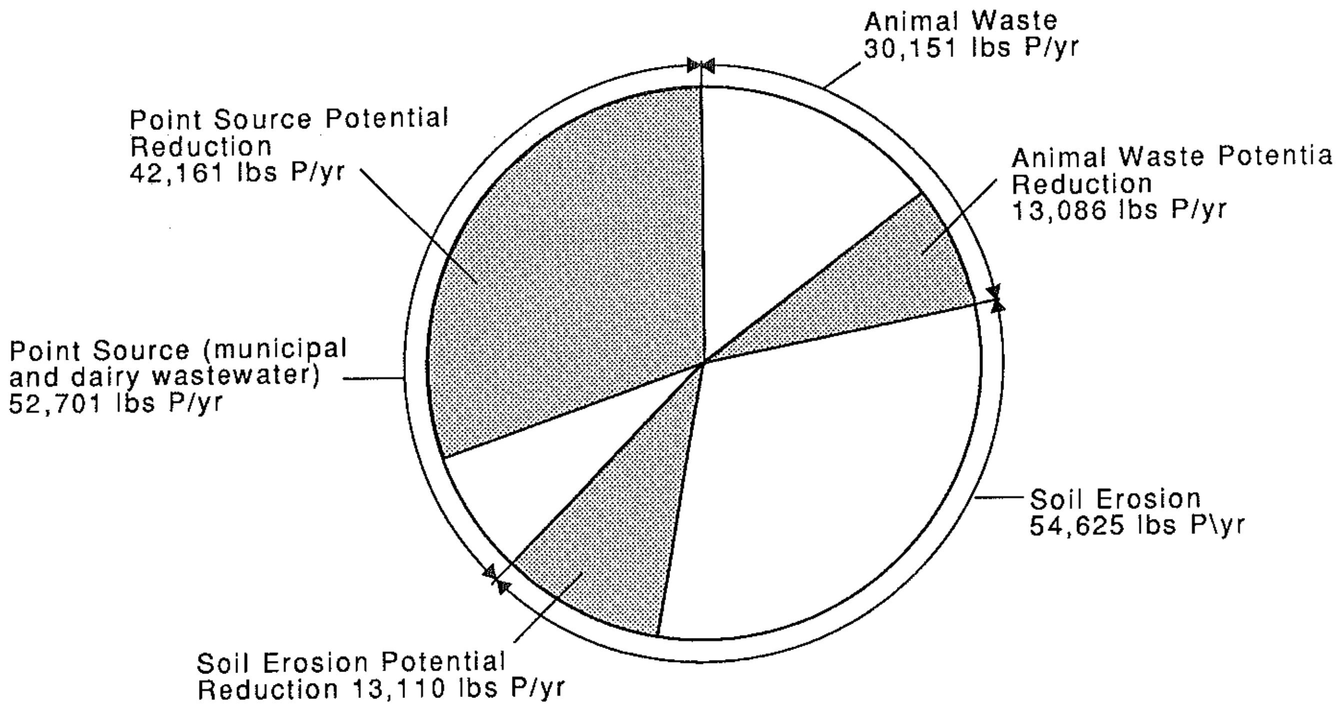


Figure 5: Estimated Phosphorous (P) Loads and Potential Reduction from the Upper Big Eau Pleine River Watershed

Source: Nonpoint Source and Land Management Section, Water Resources Management Bureau, WDNR.

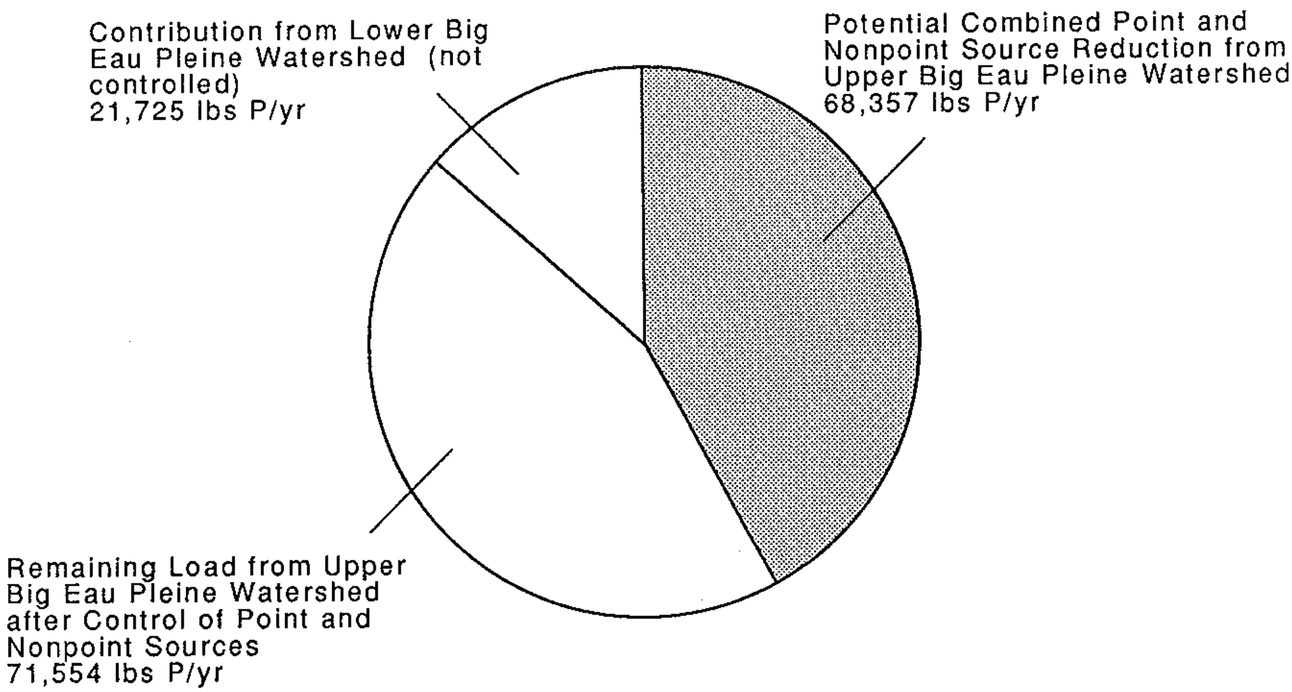


Figure 6: Estimated Phosphorous (P) Loads to the Big Eau Pleine Reservior and Potential Reduction from the Upper Big Eau Pleine River Watershed

Source: Nonpoint Source and Land Management Section, Water Resources Management Bureau, WDNR.

During the inventory of this watershed, the total number of animals present was determined and a total annual manure load was then computed (643,721 tons per year). It was then back-calculated to determine the 41,530 animal units represented by total manure production.

The value of 0.726 lb/au/yr was picked from the 0.198 to 0.726 range because it is evident from the Vennie (1982) and Elbert (1982) theses that very high amounts of animal waste runoff are occurring in this watershed due to the soils' low infiltration rate and the intense drainage network constructed for agriculture. The amount of P load contribution from animal waste may have decreased since 1977-76 due to construction of manure storage structures, but no decrease was estimated due to the lack of precision in the methodology used.

The reduction potential was computed by multiplying the number of eligible sources times the amount of control expected from each source. It is assumed that control of a manure spreading source would yield 50% reduction of that source and the control of a barnyard source would yield an 80% reduction in loading from that source.

The total reduction of P load from animal waste sources was estimated to be 13,086 lb/yr, which was 43% less than the total uncontrolled animal waste P load.

3. Phosphorus from Upland Erosion

Upland erosion was estimated to have generated 54,625 pounds of phosphorus per year, based on the unit area loading factor of 0.42 pounds per acre per year (lb/ac/yr) (which is 0.385 kilograms per hectare per year, or kg/ha/yr) derived by Miller (1979). Miller's study attempted to separate animal waste from erosion-generated P loads. The study predicted a range of 0.36 kg/ha/yr to 0.69 kg/ha/yr P load for watersheds with relatively small animal waste contributions.

The potential P load reduction for the Upper Big Eau Pleine River Watershed which could result from erosion control was computed by reducing the estimated P load (54,625 lb/yr) by the potential soil loss reduction factor (24%). The phosphorus load is not directly proportional to soil loss, but the correlation is adequate for this purpose. Soil loss reduction potential was derived from the total potential erosion control (27.1%) (see Chapter III) reduced by the 90% eligibility cutoff (0.9 x 27.1% = 24.4%).

4. Phosphorus from Municipal Wastewater Discharges.

Municipal wastewater contributed about 8,023 pounds of phosphorus per year in 1975, based on DNR records. This has increased by about 400 lb/yr due to the construction of a surface discharge treatment plant at Milan. Not included in the municipal P load calculations is the amount added by process wastewater and washwater from dairies. Two of these dairies now add about 46,712 pounds (total) of phosphorus per year to the municipal treatment plants at Milan and Abbotsford.

None of the dairies in the watershed had surface-discharged wastewater treatment in 1975-76 but it is estimated that about 10,766 lbs/yr P reached surface water from washwater discharge and runoff from land spreading. There is no record available on 1975-76 dairy discharge from which to calculate a P load, but this amount represents a reasonable estimate of the potential P load from the five dairies then in operation. The estimated value (10,766 lb/yr) was derived by subtracting the previously calculated totals for 1975-76 from all other sources (animal waste, upland erosion and municipal wastewater) from the total watershed P load (103,565 lbs/yr) predicted by Vennie (1982).

The potential reduction of the phosphorus load from municipal wastewater and dairy wastewater was estimated by applying the expected reduction available if P load reduction was required for the two wastewater treatment plants which accept dairy wastewater. The total P load from the two plants was 52,701 lb/yr (based on effluent quality sampling), which could be reduced by 80% removal, yielding a 42,161 lb/yr reduction.

The total 26,196 lb/yr P load reduction that is possible from nonpoint source control in the watershed (19% of the total watershed load) could produce a beneficial reduction in the total P load to the reservoir. However, when possible reductions from nonpoint source control are compared to the potential reduction from point sources (30% reduction of the Upper Big Eau Pleine Watershed total) it becomes apparent that controlling the Milan and Abbotsford point source loads should be investigated (see the following Point Source Investigation discussion).

The 19% P load reduction in this watershed from nonpoint source control would represent a 16.2% reduction to the reservoir. When this potential reduction is added to the potential point source reduction of 42,161 lb/yr from the upper watershed, the result would be a total reduction of 68,357 pounds of phosphorus load per year in the reservoir. This is a net 39% reduction in P load to the reservoir (see Table 23).

Table 23. Estimated Phosphorous Loads (pounds per year) to the Big Eau Pleine Reservoir

	1975-76	1987	Potential Reduction From Nonpoint and Point Sources	Remaining Loads After Nonpoint & Point Source Reductions
Upper Big Eau Pleine Watershed	103,565	139,911	-68,357	71,554
Lower Big Eau Pleine Watershed	21,725	21,725	0	21,725
Total to Reservoir	125,290	161,636	-68,357 (39%)*	83,279

* % reduction is expressed as % of total 1987 load to the reservoir

When a graphed curve is used to represent the algae reduction values predicted for phosphorus load reduction by Vennie (1982), algae reduction appears to be closely proportional to total P load reduction. Therefore, a 16% reduction in the reservoir's algae production would be predicted as a result of only the control of nonpoint sources in the Upper Big Eau Pleine River Watershed. A 39% reduction in algae production is predicted if both point and nonpoint sources are controlled in the Upper Big Eau Pleine River Watershed.

5. Point Source Investigation

Since such a large portion of the current total phosphorus load to the reservoir appears to result from the two point sources discussed above, the load from those sources and the potential for reducing that load should be examined carefully. Currently, the Department of Natural Resources does not require phosphorus removal from municipalities in the Upper Wisconsin Basin, since generally nonpoint sources contribute the large majority of P load to lakes and reservoirs in the basin. However, as nonpoint sources are controlled, more attention will be directed to point source contributions to P loading and the resulting excessive algae blooms.

Monitoring of the two treatment plants (Milan and Abbotsford) should continue to confirm the results obtained from past sampling. The estimated P loads from the AMPI and Kraft dairies are in agreement with expected P loads from dairies of their size and type. However, reports from the dairies indicate significantly lower P loads than the Department's estimates. This discrepancy may be due to the timing of the dairies' sampling with respect to the time of washdown, since much of the P load is due to the extremely high P content of industrial cleaners. The Department, with the dairies' cooperation, could check the total annual P load based on records of total consumption of cleaner in addition to estimating the phosphorus load of process wastewater.

Other dairies in the watershed which may have surface disposal of wastewater or washwater should be investigated as well.

To confirm the current total annual P load to the Big Eau Pleine Reservoir will require a major sampling effort. Flow monitoring at Stratford (the downstream limit of the Upper Big Eau Pleine River Watershed) is currently funded by the U.S. Geological Survey and the Wisconsin Valley Improvement Corporation, and is likely to continue. Water quality samples should be taken to determine P load concentrations at a frequency and duration necessary to estimate the average annual load from the upper watershed. Sampling to confirm the relatively small P load from the Lower Big Eau Pleine River Watershed should also be conducted. Reservoir sampling and re-running of the trophic model as described by Vennie (1982) may be used to confirm the results of estimates based on water quality and flow monitoring.

If the results of this investigation indicated that a phosphorus load reduction from surface water discharges at Milan and Abbotsford would result in a significant water quality improvement, several options should be considered. The dairies could choose to either reduce P loads in their effluent by treatment, or to reduce P load input from cleaning compounds. Some cleaners contain much less P load than those generally used by dairies, although they are less effective. Removal of P load at the municipal treatment plants could also be initiated with a cost recovery system to allow the dairies to pay for treatment.

D. HYDROLOGICAL FACTORS AND POLLUTANTS OTHER THAN PHOSPHORUS

As noted in the watershed appraisal, a number of other pollutants or limiting factors are also considered significant impairments to the use of the water bodies being addressed here.

1. Extreme Flows

Very high and very low flows (called "flashy hydrology" in the appraisal) would be reduced to a certain extent by the use of conservation tillage. However there is not a great potential to change these flow patterns while highly intensive agricultural practices continue in the watershed.

2. Sediment Loading

The sediment loading to surface waters would be reduced by about 25% if it is assumed that sediment delivery would be reduced proportionately to the reduction in erosion which would occur if all eligible landowners applied the conservation practices recommended in this plan. This would result in 4,000 tons per year less sediment if sediment delivery to streams is 10% of soil loss and if eligibility for cost sharing was set to allow all landowners in the top 90% of cumulative controllable soil loss to participate in the project (see Chapter VII).

3. Fecal Contamination

Fecal contamination reduction cannot be estimated given the analytical tools currently available. However the control of manure spreading and animal lot runoff at the rates made possible through this program should have a substantial effect on the fecal contamination of streams.

SECTION THREE:

A DETAILED PROGRAM FOR IMPLEMENTATION

SECTION THREE:
DETAILED PROGRAM FOR IMPLEMENTATION

CHAPTER VI. IMPLEMENTATION PROGRAM INTRODUCTION AND AGENCY INVOLVEMENT

A. INTRODUCTION

This detailed program for implementation identifies:

1. the tasks necessary to implement the nonpoint source control recommendations of the watershed assessment portion of the plan;

2. the agencies and units of government responsible for carrying out these tasks;

3. the time frame for the completion of these tasks; and

4. the type and amount of staff needed.

The Wisconsin Nonpoint Source Control Program is based on the voluntary installation of corrective land management practices designed to control the critical sources of pollutants. Cost share funds are provided to contract with landowners to cover a percentage of the costs of installing these practices. In addition, local assistance grants are made available to the implementing agencies to cover the additional work effort required to carry out their responsibilities.

B. PARTICIPATING MANAGEMENT AGENCIES AND THEIR RESPONSIBILITIES

1. Management Agencies

The counties of Marathon, Taylor and Clark are identified as being responsibility for the implementation of the Best Management Practices needed to improve water quality. The Land Conservation Commissions (LCC), acting for their respective county boards, are the management agencies for the watershed project. The LCCs are responsible for coordinating the project implementation and are also contractually and financially responsible to the State of Wisconsin for the management of the project.

Funding for any cost share agreements in Clark or Taylor Counties will be directed through the grant awarded to Marathon County, although each cost share agreement would be signed by the county in which the land is located.

The LCCs will be responsible for the day-to-day operations of the project and coordination with the other governmental agencies, groups, organizations and educational institutions. The LCCs will maintain complete project records at the county LCD offices. These records should include: correspondence; contracts and subcontracts; financial transactions; memoranda of understanding; project status and evaluation reports; landowner contacts; and landowner cost share agreements. A system of recording landowner contacts and project progress, including a map of areas under cost share agreement, will be developed. The map should be of sufficient detail to identify upland, barnyard and streambank practices needed and installed. The watershed project landowner files will be kept separate from LCC cooperator files.

For landowners who have signed cost share agreements, the files need to include: the agreement with any amendments; the conservation plan; practice design information; practice certification; progress reports; bills; proofs of payment (such as cancelled checks, paid receipts or bills marked "paid" if cash was used to pay bills) and other records of financial transactions; and the Landowner Tracking Form.

The Marathon County LCC will maintain project files for all of the landowners in the watershed. In addition, copies of the cost share agreements, practice certification, and progress reports will be kept in each landowners' county. The LCCs will be accountable to the Department of Natural Resources for maintaining complete records.

These three LCCs have been named by the DNR to carry out the responsibilities defined in the Wisconsin Administrative Rules, NR 120.06, and summarized below:

1. Assist with the development and approval of the priority watershed plan;

2. Recommend revisions to the plan to allow for necessary changes as the project is implemented;

3. Carry out education and information programs about nonpoint source pollution and land management needs;

4. Administer the cost sharing element of the project including sign-ups, approvals, authorization of payments, and record keeping;

5. Certify the installation, operation, and maintenance of Best Management Practices;

6. Coordinate and control cost sharing monies with local contributions;

7. Report to the DNR on project progress and recommended project modifications;

8. Screen applications for variances to established cost sharing rates; and

9. Determine priority for assistance among grant applications.

All of these activities may be carried out by the LCC or by delegation to other agencies or units of government.

2. Cooperating Agencies

In addition to the LCCs, the watershed project will receive assistance from the other agencies listed below.

1. Soil Conservation Service (SCS) - This agency works through the local Land Conservation Committee. The SCS provides technical assistance for installing conservation practices. They aid the county in planning, designing, layout, supervision, and certification of practice installations.

2. University of Wisconsin Extension - County Extension agents will provide expertise in planning, coordinating and conducting public information, education, and participation efforts. UW-Extension will also assist in the development of watershed tours, workshops, and newsletters.

3. Agricultural Stabilization and Conservation Service (ASCS) - The ASCS office of the U.S. Department of Agriculture will cooperate with the watershed project by coordinating the use of ACP (Agricultural Conservation Program) funds and informing potential candidates for priority watershed funding about its availability.

4. Department of Natural Resources - The Department has the overall administrative responsibility for the Wisconsin Nonpoint Source Water Pollution Abatement Program. The DNR is responsible for the allocation of funds to the project, for water quality evaluation surveys, and for watershed progress tracking.

CHAPTER VII. BEST MANAGEMENT PRACTICE DESCRIPTIONS, COST SHARE RATES, AND ESTIMATED NEEDS AND COSTS

A. BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) are defined as the practices, techniques, or measures identified to be the most effective and practical means of eliminating or reducing nonpoint source pollution. The Best Management Practices needed in the Upper Big Eau Pleine River Watershed are listed in the next section. Although some other practices may also be appropriate, only those anticipated to meet the most typical situations in the watershed are included in this list.

B. BEST MANAGEMENT PRACTICE DESCRIPTIONS

The Best Management Practices needed in this project are described below. A more detailed description of the practices, and the conditions under which they are cost shareable, is given in the Department's Administrative Rules NR 120, which is on file at the county Land Conservation Department and DNR offices.

1. Contour Strip Cropping - This practice involves growing crops on the contour of the land in alternated swaths which generally consist of corn, oats, and hay. Contour strip cropping can be used for fields that are currently in hay and row crop rotations and have high levels of erosion. This situation commonly applies to dairy operations.

2. Contour Cropping - This practice involves growing crops on the contour, but not in strips of alternating crop types.

3. Diversions - These are earthen berms constructed to divert excess water to sites where it can be transported safely in order to reduce soil loss.

4. Reduced Tillage - This practice includes a number of different planting, tilling, and cultivating methods all designed to leave a vegetative residue on the surface of the soil. This practice is used to reduce both soil erosion and nutrient and/or pesticide runoff from croplands. Regardless of the terminology used to define these various systems, all forms of conservation tillage must conform to the requirements in NR 120.14 of the DNR Administrative Rules, which include several important conditions regarding the application of insecticides.

5. Grassed Waterways - A grassed waterway is a natural or constructed water course that is shaped, graded, and established in a suitable vegetative cover as needed to prevent erosion by runoff waters. This practice can be used to stabilize small gullies on croplands.

6. Critical Area Stabilization - This practice consists of planting suitable vegetation, such as trees or permanent grass, on highly erosive areas. These areas may include roadsides, gullies, intermittent stream channels, and steeply-sloped lands.

7. Streambank Protection - This practice involves several measures designed to stabilize and protect the banks of streams against erosion. This practice could include the following measures: fencing to control livestock access to streams; riprap; livestock or machinery stream crossings; and shaping and seeding eroded banks.

8. Livestock Exclusion from Woodlots - This practice involves the protection of woodlots, especially those on steep slopes, from livestock grazing by installing fences or other means.

9. Barnyard Runoff Management - Barnyard runoff management is the use of structural measures such as gutters, downspouts and diversions to intercept and redirect surface runoff around the barnyard, feeding area or farmstead, and collect, convey and temporarily store runoff from the barnyard, feeding area or farmstead.

10. Long-Term Manure Storage Facilities - Long-term manure storage utilizes a structure for the storage of manure through the winter and early spring. Several important conditions apply to this practice and are detailed in NR 120.14.

11. Short-Term Manure Storage Facilities - Short-term manure storage utilizes a structure for the storage of manure for the periods of snow melt and soil saturation during early spring.

12. Roofs for Barnyard Runoff Management and Manure Storage Facilities - Roofs and supporting structures are designed specifically to prevent rain and snow from coming into contact with manure.

C. COST SHARING GUIDELINES

1. Introduction

Cost share funding is available in this watershed project to reimburse eligible landowners for a percentage of the costs of installing Best Management Practices on their lands. These are the practices which are necessary to meet the watershed project objectives. Landowners and operators have three years to sign up for cost sharing following the formal approval of the watershed plan and grant agreement development.

2. Cost Share Policies

The following general policies apply to the cost share eligibility under the Wisconsin Nonpoint Source Control Program:

a. Only Best Management Practices installed at the specific locations necessary to improve or protect water quality are eligible.

b. Cost sharing is not available for practices which:

   1. are normally and routinely used in growing crops

2. have drainage of land as the primary objective

3. the installation costs can reasonably be passed on to potential consumers

3. Customized Practices

It is possible that some practices may be "custom" designed and do not fit the established definition for a particular practice. The Nonpoint Source Control Program will provide for a substitute management practice after the DNR and the county LCD review and approve the practice, make a determination on eligibility for cost sharing, and assign a maximum cost sharing rate. Design specifications would be recommended by the Soil Conservation Service Technical Guide Work Group.

4. Permits

Some areas within the watershed project, may require local, state, or federal permits in order to install some of the management practices. The land areas most likely to require permits are the zoned wetlands of a county and the shorelines of streams and lakes. These permits are required whether the activity is associated with the watershed project or not. The planning and zoning office or the land conservation office in each county should be consulted to determine if any permits are required in specific cases.

D. COST SHARING ELIGIBILITY CATEGORIES

During the preparation of this plan, the landowners were ranked as to their need for nonpoint source control practices in cropland erosion, barnyard runoff, and manure management. The landowners were ranked in three categories: "eligible-essential," "eligible-nonessential," and "not eligible." These categories are discussed by pollutant source in the remainder of this chapter.

E. ELIGIBILITY CATEGORIES BY POLLUTANT SOURCE

1. Upland Erosion

For upland erosion, the first category ("eligible-essential") includes those landowners whose combined lands accounted for 70% of the total erosion targeted for control in the watershed. The second major category ("eligible-nonessential") includes the landowners whose combined lands make up the next 20% of the total targeted soil loss within a watershed. The "not eligible" landowners are those whose lands contribute the last 10% of the targeted soil loss. These "not eligible" lands may have needs for erosion control practices, but generally it is not efficient to control these lands in order to control water quality problems. Table 24 shows the number of landowners in the eligible categories for both cropland erosion and animal waste management.

2. Animal Lots

Animal lots are rated for eligibility as follows:

a. Eligible-essential - High priority (top 50% of estimated pollutant load), or flood-prone.

b. Eligible-nonessential - Medium priority (top 70% of estimated pollutant load).

c. Not eligible - Low priority (bottom 30% of pollutant load).

3. Manure Management

Manure management eligibility categories have determined by the following criteria:

a. Eligible-Essential - Includes those operations in the top 50% of cumulative unsuitable acres spread.

b. Eligible-Nonessential - Includes those operations in the top 70% of cumulative unsuitable acres spread.

c. Not Eligible - Includes operations in the bottom 30% of cumulative unsuitable acres spread.

The definition of unsuitable acres spread is found in the Manure Spreading Inventory.

The manure management eligibility categories are based on less detailed information than was available for animal lots and erosion. Therefore it should be expected that corrections will be made during the implementation phase of this project, based on the availability of suitable land for spreading and the landowner's operating practices.

Eligibility for individual operations can be determined after completing an animal waste management plan and comparing the landowner's "critical acres spread" (CAS) value to the fifty percentile (≥16 acres) and seventy percentile (≥11 acres) values. A "CAS" value ≥16 acres would make the operation fall in the eligible-essential category and a "CAS" value ≥11 acres would make the operation eligible. If the operator has enough suitable acres available for spreading he or she would not be eligible for storage cost sharing, but could receive assistance in developing a waste management plan.

4. Streambank and Gully Erosion

All streambank protection and gully erosion sites will be considered to be in the eligible-nonessential category for cost sharing. These sites will be identified during the implementation and approved with guidance from the Department of Natural Resources.

What the eligibility categories mean in terms of the installation of Best Management Practices is described below:

Eligible-Essential: These are nonpoint pollutant sources which must be controlled in order to achieve a significant effect on the pollutant load in a subwatershed. A landowner with control needs in this category must agree to control these sources in order to qualify to have other practices on the land cost shared. The control of the nonpoint sources in this category would be the county's first priority.

Eligible-Nonessential: Sources in this category are less critical in the effects on water quality. Practices on these lands are eligible for cost sharing but it is not mandatory that a landowner control these sources in order to receive cost sharing for other critical needs on his or her land.

Not Eligible: This category includes sources that are not efficient to control in order to improve water quality. Cost share money is generally not available for sources in this category.

One of the reasons for establishing these management categories is that it is a policy of the watershed project to control all critical nonpoint sources on a landowner's property. This means that if a landowner is in the "eligible-essential" category for barnyard runoff and in the "eligible-nonessential" category for cropland erosion, the landowner must agree to cost sharing for control of the barnyard runoff in order to receive cost sharing for the cropland erosion. Control of nonpoint sources in the "eligible-nonessential" category is optional to the landowner.

It is important to note that the ranking of landowners in these categories is based on inventory data that was collected in 1986. Nonpoint source conditions may change during the project. Changes in these conditions may result in changes in the eligibility of certain landowners for cost sharing of practices.

Table 24. Number of Landowners Eligible for Cropland and Animal Lot Management Practices*

Manure Spreading		Cropland Erosion		Animal Lot Runoff	
Eligible-Essential	Eligible-Not Essential	Eligible-Essential	Eligible-Not Essential	Eligible-Essential	Eligible-Not Essential
100	73	93	151	62	59

* There is some overlap among the categories so that the total number of eligible landowners is less than the total of the numbers on the table.

Source: Wisconsin Department of Natural Resources

F. The Cost Share Agreement

The cost share agreement is a legal contract between each landowner and his or her county Land Conservation Department (LCD). Each cost share agreement includes 1) the number and types of practices that are needed, 2) the estimated installation dates, 3) the estimated practice costs, 4) the cost share percentage rates, and 5) the estimated cost share reimbursement amounts. Each agreement also lists practices which are needed to meet water quality objectives but cannot be cost shared under the Nonpoint Source Control Program. Once the agreement is signed, the landowner has five years to install the practices.

CHAPTER VIII. PROJECT NEEDS AND COSTS

A. INTRODUCTION

Under the Nonpoint Source Control Program, state funds are provided 1) to cost share with the landowner or operator the cost of installing the needed control practices and 2) to the participating counties to reimburse the costs they incur in administering the watershed project. This chapter discusses both types of funding, the Best Management Practices approved for this project, and estimated project costs.

B. MANAGEMENT PRACTICE NEEDS AND COSTS

1. General Discussion

The Best Management Practices found to be needed in the Upper Big Eau Pleine River Watershed are listed in Table 25. The quantities of BMPs needed were estimated based on the assumptions discussed in this section.

The estimated costs for each unit of practice were based on the county's experience and the costs of similar practices in other priority watershed projects. For 100% landowner cooperation, the estimated state cost share total is shown in Table 25. Because 100% participation is not very likely due to the voluntary nature of the Wisconsin Nonpoint Source Water Pollution Abatement Program, a participation level of 75% has been used to more accurately estimate the budget needs. This estimated cost is also shown in Table 25 and Figure 7.

2. Cropland Management Practices

Management practices were "applied" to each parcel of cropland which is currently eroding above two tons per acre per year through the use of a computer, by modifying the "C" and "P" factors. The practices were "applied" in order, going from the least intensive to the most intensive erosion control. The practices were applied one at a time until the targeted maximum level of erosion was attained or all of the designated practices were used.

3. Grassed Waterways

The number of acres of needed waterways was determined by applying a ratio to the entire watershed. The ratio was derived by using several farm plans within each county to determine the acres of waterway needed per total acres of cropland.

4. Streambank Stabilization

The quantities of shaping and seeding, riprap and fencing needed in the watershed were based on county estimates.

Table 25. Quantity and Costs of Rural Best Management Practices Needed in the Upper Big Eau Pleine River Priority Watershed Project(1)

Practice	Estimated Quantity	Cost $/Unit	Total Cost	Cost share Rates	Total Cost share
Cropland					
contour cropping	21,327 ac	12.00/ac	255,924	50%	127,692
contour strips	4,136 ac	20.00/ac	82,720	50%	41,360
conservation tillage	707 ac	20.00/ac[2]	14,140	50%	7,070
diversions	40,000 LF	2.00/LF	80,000	70%	56,000
Grade Stable. Str.	-0-	--	-0-	70%	-0
Woodlot Fencing	-0-	9.00/rd	-0-	50%	-0-
Streambank					
rip rap	2,600/LF	20.00/LF	52,000	70%	36,400
shaping & seeding	1,000/LF	1.25/LF	1,250	70%	875
fencing	38,400 rd	18.00/rd	691,200	50%	345,600
livestock crossing	20	1,000 ea	20,000	70%	14,000
Waterways	400 ac	1,500/ac	600,000	70%	420,000
Critical Area Stab./Pasture	100 ac	30/ac	3,000	70%	2,100
Barnyard Runoff Management	121	12,000/ea	1,452,000	70%	1,016,400
Manure Storage	87(2)	12,500/ea	1,087,500	70%(3)	761,250
Totals at 100% participation			$4,339,734		$2,829,017
Totals at 75% participation (4)			$3,254,801		$2,121,763

(1) This table is to be used to estimate budget needs only; it does not limit the amount of funding that will be available.

(2) Based on total eligible operators who are currently spreading manure in winter.

(3) $10,000 maximum long-term, $6,000 maximum short-term.

(4) The 75% participation level is not a project goal; it is used for the purpose of budget estimation only.

Units of Measure

ac = acre
LF = lineal feed
rd = rod

Source: Wisconsin Department of Natural Resources

5. Critical Area Stabilization

The number of acres needing stabilization was estimated by the counties.

6. Barnyard Runoff Management

Based on the inventory data, all barnyards included in the "eligible essential" and the "eligible nonessential" categories were determined to need runoff management.

7. Manure Storage

The need for manure storage was based on the total number of eligible operators who are winter spreading.

8. Diversions

The number of lineal feet of diversions needed in this project was based on county estimates.

C. LOCAL ASSISTANCE NEEDS AND COSTS

1. Introduction

The Local Assistance Agreement provides reimbursement to the county for the costs of administering the watershed project. The costs handled in this agreement include the costs to conduct 1) the landowner contacts; 2) conservation planning; 3) the design and inspection of the installed management practices; 4) the information and education program; and 5) the direct costs for attending an annual project manager's meeting.

The duration of the Local Assistance Agreement is eight years, or the length of the project period specified in the agreement. Each year the agreement is reviewed and amended to provide monies for the following 12 months.

The forms used to apply for reimbursement under the Local Assistance Agreement are:

Form 3200-54-Reimbursement sheet
Form 3200-78-Work sheet
Form 3200-79-Tracking/Summary sheet

2. Estimated Need Work Hours

An important aspect of the Local Assistance Agreement is that it is used to estimate the work load for the project and how much, if any, additional resources are needed by the county in order to complete the projected work load.

The estimated work hours that will be needed for the Upper Big Eau Pleine River Priority Watershed Project are shown in Table 26.

Table 26. Estimated Project Work Hours

Activity	Total Watershed Needs	Rate Hrs/Unit	Hours @ 100% Part.	Hours @ 75% Part.	Project Years when Work Occurs
Landowner Contacts	300	6 hrs ea	1,800	1,350	1-3
Cost Share Agr. Devel.	400	2 hrs ea	800	600	1-3
Conservation Planning	400	27.5 hrs/pl	11,000	8,250	1-3
Contour Cropping	21,327 ac	.3 hr/ac	6,398	4,799	1-8
Contour Strips	4,136 ac	.3 hr/ac	1,241	931	1-8
Conservation Tillage	707 ac	.3 hr/ac	212	159	1-8
Waterways	400 ac	20 hrs/ac	8,000	6,000	1-8
Diversion	40,000 ft	.02 hr/ft	800	600	1-8
Grade Stabilization Structure	-0-	50 hrs/ea	-0-	-0-	-0-
Woodlot Fencing	-0-	.2 hr/ac	-0-	-0-	-0-
Streambank Riprap	2,600 ft	.1 hr/ft	260	195	1-8
Streambank Shape & Seed	1,000 ft	.05 hr/ft	50	38	1-8
Streambank Fencing	38,400 rd	.2 hr/rd	7,680	5,760	1-8
Livestock & Machinery Stream Crossings	20	12 hr/ea	240	180	1-8
Critical Area (Pasture) Stabilization	100 ac	.3 hr/ac	30	23	1-8
Barnyard Runoff Management	121	50 hr ea	6,050	4,538	1-8
Manure Storage	104	80 hr ea	8,320	6,240	1-8
Cost Share Review	400	1 hr ea	400	300	1-8
Practice Maint. Check	400	1 hr ea	400	300	1-8
Project and Fiscal Managment	800 yr	x 8 yr	6,400	6,400	1-8
Information/Education	100 yr	x 8 yr	800	800	1-8
TOTALS:			60,881	47,463	

3. Estimated Work Effort and Schedule

As discussed earlier, the categories of work effort needed to implement the recommendations of this plan include education, project and fiscal management, and technical assistance needs. Technical assistance includes landowner contacts, conservation planning, and the design and inspection of installed practices. Technical assistance will comprise a large majority of the implementation hours. A Local Assistance Agreement will be developed annually to cover the effort necessary under these categories of activities to carry out the watershed project, with the exception of the project and fiscal management activities, which are the responsibility of the participating counties.

The costs of the educational activities completed each year are eligible for reimbursement under the Local Assistance Agreement. These activities (and subsequent hours) are the greatest during the first three years of the project, and taper off towards the later years. UW-Extension will assist in some of the educational activities, but the LCDs will be responsible for most of these activities.

The LCDs, along with SCS, will have the majority of the technical assistance responsibilities. The technical assistance hours needed for the watershed project are summarized in Table 26. These hours are based on a 75% landowner participation level in order to be used as an estimate of the actual hours of technical assistance which will be needed.

In addition, a reasonable schedule of how the total work effort might be divided among the eight year project life is also given in Table 26. This schedule will enable the LCCs to estimate the quantity and type of staff that will be needed throughout the project to insure successful implementation.

Table 26 shows that at different times during the project there will be a need for staff with different abilities. In the first three years, the major portion of the work involves landowner contacts and planning practices. Following that period, the design, installation, and certification of the practices make up the major portion of the project effort.

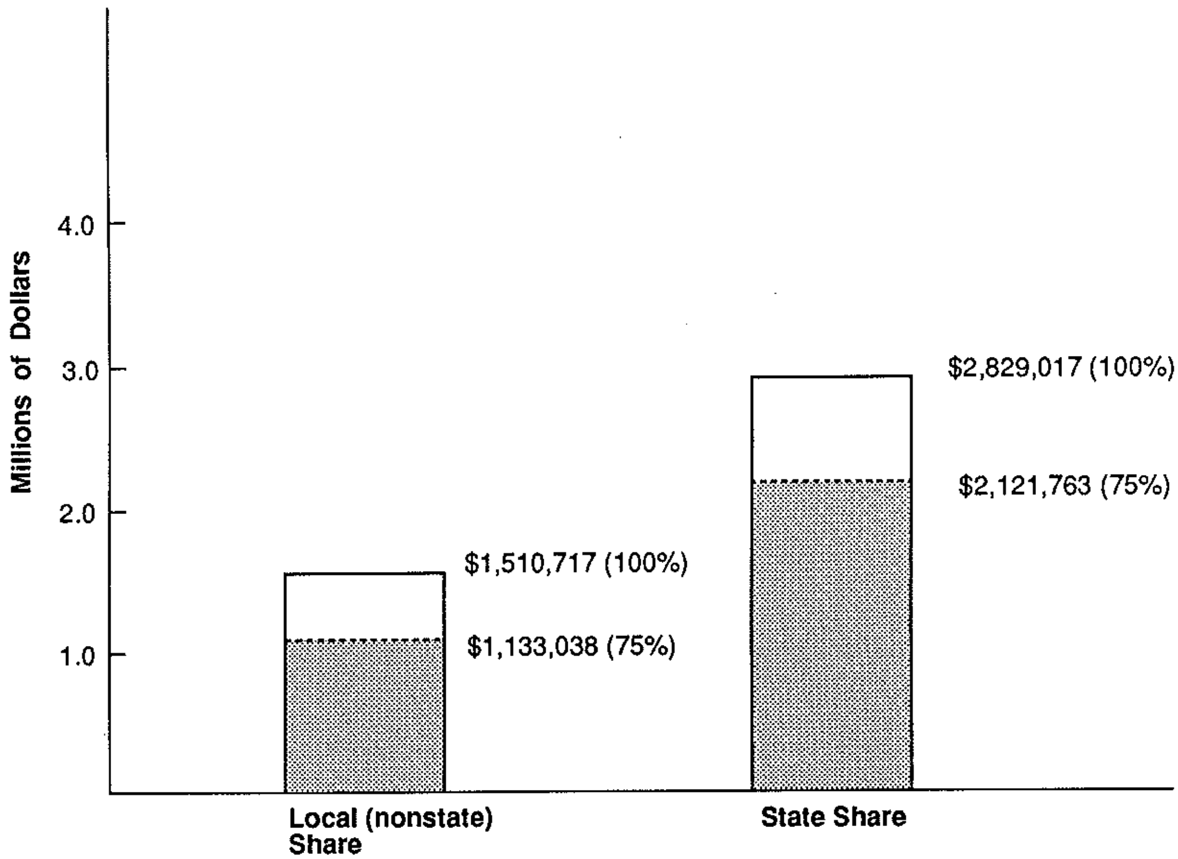


Figure 7: Estimate of Cost for Control of Nonpoint Sources at 100% and 75% Rates of Participation
Source: Nonpoint Source and Land Management Section, Water Resources Management Bureau, WDNR.

CHAPTER IX. ADMINISTRATIVE PROCEDURES

A. ADMINISTERING THE COST SHARE FUNDS

1. Department of Natural Resources and Marathon County LCC Responsibilities

a. Nonpoint Source Grant Agreement

Cost share funds will be transferred from the DNR to the Marathon County LCC by the Nonpoint Source Grant Agreement. The grant agreement controls only the cost share funds, that is, money for the installation of Best Management Practices. Several items are defined on this agreement, including:

1) The parties to the agreement (in this case, the DNR and the Marathon County)
2) The watershed project the agreement is to be used for
3) The amount of the agreement
4) The eligible period for entering into cost share agreements
5) The effective period of the grant
6) Eligible practices which can be cost shared
7) The sites eligible for the cost sharing funds
8) The conditions which the DNR and the county must follow

b. Advance Funding

Advance money (totalling a maximum of 10%) will be available to Marathon County through the Grant Agreement in order to establish the watershed cost share fund account in the county. With this fund, landowners can be rapidly reimbursed directly from the county for the cost share amounts for the installed practices.

c. Reimbursement Process

As landowners are reimbursed by the county for completed practices and the fund balance is drawn down, the county will forward the appropriate documents to DNR for additional funds. The Department will in turn reimburse the county so the county's account always has a balance.

The necessary documentation for a reimbursement request from the county includes: 1) the "Cost share Calculation and Practice Certification Form" (Form #3200-53) for each landowner who was reimbursed; 2) a "Request for Advance or Reimbursement Form" (Form #3400-54) which indicates total prior pay requests and the amount of reimbursement being requested; and 3) a "Reimbursement Claims Worksheet" (Form #4400-47) which lists the landowners that were paid from the reimbursement request.

d. Grant Agreement Balances

The initial amount of the Nonpoint Source Grant Agreement is less than the project will likely need throughout the project period. The agreement will be amended to increase this "grant amount" as practices are cost shared. At no time can the total costs of the practices under cost share agreement exceed the total amount of funds in the grant agreement.

2. Inter-County Procedures

Marathon County, as the lead management agency, will send reimbursement checks directly to the landowners in Taylor and Clark Counties after the proper documentation has been submitted and approved by the LCC. The checks will be accompanied by cover letters from the landowner's county.

Although many of the responsibilities of fiscal management can be handled by other agencies (such as ASCS), the county remains responsible for ensuring that the fiscal management activities are carried out in accordance with NR 120.

3. Procedures Between Counties and Landowners

a. Discussion

A procedure has been established for the administration of cost share funds from the time a landowner is contacted to the time the landowner is reimbursed for an installed management practice. In order to assure cost containment, the counties will require that bids to be taken and that the lowest qualified bids be accepted for structures costing over $2,000. Stream crossings costing over $500 will also need bids. A range of cost will be used for other practices.

b. Procedure

The cost share fund reimbursement procedure is as follows:

1) The landowner and conservation planner meet to discuss the watershed project and the landowner's management practice needs.

2) The landowner agrees to cooperate with the project.

3) A Conservation Plan (if necessary) is prepared by the SCS or LCD.

4) The landowner agrees to the plan, and a Cost share Agreement (form 3400-68) is signed by the landowner and the county representative.

5) Practices are designed by the SCS or the LCD, and a copy of the design is delivered to the landowner.

6) The landowner obtains a contractor.

7) The SCS or LCD lay out the practices, if necessary.

8) The contractor installs the practices.

9) The SCS or LCD certifies the installation (form 3200-53).

10) The landowner submits paid bills and cancelled checks to his or her county LCD office (Clark and Taylor counties approve the expenditures and forward this information along with the form 3200-53 to Marathon County).

11) The Marathon County LCD prepares vouchers for the bills.

12) The Marathon County LCC approves the vouchers at a regular monthly meeting.

13) A Marathon County financial officer issues the check on approved vouchers. The check is delivered to the landowner.

14) The LCD records the check amount, number, and date on form 3200-53.

B. ADMINISTERING LOCAL ASSISTANCE FUNDS

The Local Assistance Agreement provides reimbursement to the county for the costs of administering the watershed project. The costs handled in this agreement include the costs to conduct 1) the landowner contacts; 2) conservation planning; 3) the design and installation of the management practices; 4) the information and education program; and 5) the direct costs for attending an annual project manager's meeting.

C. PROGRESS TRACKING AND EVALUATION

Project progress will be evaluated quarterly and reported to the DNR by the LCC, using the forms provided by DNR. More detailed evaluations will be conducted annually by DNR and the LCCs. The following information will be recorded for the purpose of project tracking:

1. Landowner contacts: who has been contacted; when; what is their management category; who is left to contact;

2. Update of inventory information: if changes have occurred from the inventoried conditions, these changes should be noted;

3. Landowner contracts: what sources were controlled; what the new pollutant levels are (such as new erosion rates or phosphorus runoff); what does this represent in terms of the objectives set for each subwatershed;

4. Status of the cost share agreement: what has been designed, installed, certified, and reimbursed; is the schedule of installation still accurate?

Two forms are to be used to assist in tracking the project. The first form is the "Landowner List". This is a list of all the rural landowners in the project and their management category for each of the inventoried pollutant sources. This list will be kept by each county, will be updated on a quarterly basis and will be made available for Department review.

The second form is a "Landowner Tracking Form". This form is filled out after the landowner has been contacted. Space is provided for the landowner name and location, and for comments to be filled in by the county field person after each contact with the landowner. There is also a section for updating the landowners' inventory situation if the inventory information is no longer accurate. Finally, if a Cost share Agreement is signed listing the appropriate management practices, there is space to record the "after: situation of the source conditions." These forms will be kept in the county and made available to the Department for evaluation of the project's progress.

D. PLAN REVISION

At the end of the first and second project years, the practice needs and costs per practice identified in the plan will be reviewed and adjusted as needed. The watershed plan was written with the best information available at the time of its preparation. Situations and conditions may change during the implementation of this plan which may require changes in the document. The plan may be revised at any time upon agreement by the counties and the Department of Natural Resources.

CHAPTER X. INFORMATION AND EDUCATION PROGRAM

A. INTRODUCTION

1. Objectives and Goals

The objectives of the information and education program are to create an awareness and understanding of the watershed project and to generate interest and support for the project among landowners. An important goal of this program is to develop and distribute sufficient information to allow each landowner to evaluate and make intelligent decisions regarding his or her involvement and participation in this water quality program.

The focus will be to create problem awareness, explain the voluntary nature of the project, present the financial incentives involved, motivate landowners to action and convince them to alter land management in order to reduce nonpoint pollutant sources.

2. Activity Timing

The selection and timing of activities and events is designed to move through the phases of project plan preparation, public awareness, BMP implementation and evaluation. A variety of methods of providing information and education is suggested in order to reach as many people as possible. Most of the activities will occur during the early stages of this project and will gradually taper off through later stages of project implementation as the contract sign up period ends.

3. Reviews

To meet the objectives of the information and education program, goals have been established for these activities. These goals are to be viewed as minimum efforts to be accomplished and will be reviewed annually to insure that the project objectives are being met. These annual reviews may result in alterations of the goal components in order to meet identified needs.

4. Audiences

The audience for these education and information activities has been identified to be specific eligible landowners in the watershed, local officials and lawmakers, civic groups and the general public.

B. ACTIVITIES

The paragraphs that are following describe each of the activities to be undertaken during the eight-year implementation period. In each of these activities the County LCCs have the primary responsibility for carrying out the objectives. Costs for the activities are supported by a grant from the Department of Natural Resources (see Table 27 for summary).

1. <u>Newsletters</u>

Newsletters will be the primary communication mechanism to provide all landowners and units of government in the watershed with specific information about practices and policies of the project. The goals of the newsletters will include: a) developing cooperation between all the agencies and individuals involved in the project; b) supplying needed fact sheets to the public; c) giving updates on the progress of the watershed; d) introducing conservation management practices to the landowners; e) developing ongoing communication between all the people in the watershed; and f) encouraging landowners to become involved in the watershed activities.

Primary responsibility for newsletter development and printing will lie with the Marathon County LCC with assistance from Clark and Taylor Counties and Soil Conservation Service and U.W. Extension.

2. <u>News Releases</u>

News releases will be used to give short updates on information pertaining to ongoing activities in the watershed. They will also highlight landowners who have cooperated in the project. These releases will help develop a positive public image toward the watershed project and explain the importance of water quality improvements to the community. Contributions will be made by the Soil Conservation Service and the U.W. Extension.

Table 27. Educational Program Cost in Dollars

		Project Year								
Product	Cost/Unit	1	2	3	4	5	6	7	8	Total
Newsletters	$500	(4) 2,000	(4) 2,000	(4) 2,000	(4) 2,000	(4) 2,000	(4) 2,000	(4) 2,000	(4) 2,000	(32) 64,000
News Releases	$10	(5) 50	(5) 50	(5) 50	(5) 50	(5) 50	(5) 50	(5) 50	(5) 50	(40) $400
Watershed Slide Program	$100	(1) $100	-0-	-0-	-0-	-0-	-0-	-0-	-0-	(1) $100
Tours of Demonstration Site	-0-	(1) -0-	(1) -0-	(1) -0-	-0-	-0-	-0-	-0-	-0-	(3) -0-
Fact Sheets	$100	(1) $100	-0-	-0-	-0-	-0-	-0-	-0-	-0-	(1) $100
Manure Management Reminder Mailing	$200	(1) $200	(1) $200	(1) $200	(1) $200	(1) $200	(1) $200	(1) $200	(1) $200	(8) $1,600
										$86,000

3. Barnyard Runoff Control

The barnyard runoff control demonstration is designed to provide local first-hand evidence and information about the effects and importance of this practice. Additional BMPs are being planned with the intent being to acquaint landowners within the Watershed with successful practices that have been implemented in the Watershed. These tours will provide landowners with examples of solutions to serious barnyard and other problems, as well as providing them with a chance to talk with the farmers and landowners who have participated in a Wisconsin Fund Project. An interagency effort will be utilized in developing the tour.

4. Information Packet

This is a pocket folder with the watershed name and map printed on the front. The packet will contain materials that explain the purpose of the watershed project, who is involved, the responsibilities and benefits of landowners receiving cost-sharing and fact sheets. The folder will also contain a BMP brochure with photos and write-ups that describe what each of the cost sharable conservation practices are designed to do. An information packet will be distributed to each landowner at the initial contact. This information packet is being designed by the Land Conservation Departments.

5. Portable Display

A portable display will be designed and displayed in the watershed area at local farmer-visited businesses. Information that will be included on the poster will be the location and boundaries of the project, and problems and solutions to nonpoint pollution problems. These will be designed by the Marathon County Land Conservation Department staff.

6. Contractor Workshop

These workshops will be planned on an annual basis to give contractors appropriate training and information. County Land Conservation Department staff will be used to assist contractors in becoming more skillful in the application of conservation practices. Information will be distributed that is related to the quotation procedure, and upcoming scheduled installations of practices for that construction season. A cooperative effort between the Soil Conservation Service and the Land Conservation Department will be used to organize the workshops.

7. Manure Management Plan Reminder

The counties will annually send a reminder letter to all operators who have manure management plans asking them to state whether they were able to follow their plan requirements. It is recognized that weather or other conditions may occasionally preclude conformance with that plan, but the letter should remind the operators of their legal responsibilities to adhere to the plan when possible.

SECTION FOUR: THE PROJECT EVALUATION

CHAPTER XI. EVALUATION PLAN

SECTION FOUR:
THE PROJECT EVALUATION

CHAPTER XI. EVALUATION PLAN

A. INTRODUCTION

The water resources of the Upper Big Eau Pleine River Watershed will be monitored to measure trends in water quality. Monitoring activities will be designed to identify progress in achieving the water quality objectives discussed earlier in the nonpoint source control plan for the priority watershed project.

Monitoring will be conducted throughout the eight-year project period, and will continue for an additional two years. Thus the monitoring activities will not be completed until 1997. Since the main objective of the plan is to improve recreational opportunities in the Big Eau Pleine Reservoir, much of the monitoring activity will take place in the reservoir.

B. BIG EAU PLEINE RESERVOIR MONITORING

Monitoring in the reservoir will be directed toward measuring planktonic algae production because an overabundance of algae is a major nuisance. Chlorophyll a, total phosphorus, and water transparency will be the principal parameters measured.

Water transparency will be measured with a Secchi disc and possibly also with light extinction measuring equipment. Summer algae blooms commonly reduce Secchi readings to less than one meter. At these low transparencies, photometric equipment can be much more sensitive than Secchi readings. Two highway crossings separate the Big Eau Pleine Reservoir into three segments, and one site in each segment will be monitored. The site locations are shown on Map 9. Samples will be collected a minimum of five times per year.

Complete water chemistry samples will be collected in spring near the time of maximum reservoir water level. The water chemistry parameters to be analyzed are listed in Table 28. The remaining sampling times will be mid-month in June, July, August, and September. These summer samplings will consist of chlorophyll a and total phosphorus.

Past sampling programs have shown a high degree of variability in algae concentration over the Big Eau Pleine Reservoir. To partly compensate for this problem, surface samples will be collected from three locations in the near vicinity (100-200 foot radius) of the sample site and composited for analysis. Transparency will also be measured at each of the locations. One sample will be collected for total phosphorus one meter above the bottom at each site. Dissolved oxygen and temperature profiles will be measured at one meter intervals at each site. Algae populations are quite dynamic, and monthly samples may not adequately represent water quality. Twice per month sampling is preferable and will be done if staffing and funds allow.

Table 28.

Laboratory Analytical Support Needed and Individual Analysis Cost for Big Eau Pleine Monitoring Plan

Parameter	Cost per Analysis (1988 Dollars)	Number of Analyses per Water Year									
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
$NO_3 + NO_3 - N$	$ 6.05	6	6	6	6	6	6	6	6	6	6
$NH_3 - N$	10.45	6	6	6	6	6	6	6	6	6	6
TKN	8.25	6	6	6	6	6	6	6	6	6	6
Cl^-	10.45	6	6	6	6	6	6	6	6	6	6
Tot. P	8.25	94	78	42	58	42	42	58	42	42	58
Diss. P	8.25	58	42	6	22	6	6	22	6	6	22
Ca	7.15	6	6	6	6	6	6	6	6	6	6
Mg	7.15	6	6	6	6	6	6	6	6	6	6
Na	6.05	6	6	6	6	6	6	6	6	6	6
K	7.15	6	6	6	6	6	6	6	6	6	6
pH	3.30	6	6	6	6	6	6	6	6	6	6
SO_4	9.35	6	6	6	6	6	6	6	6	6	6
Tot. Alk	6.60	6	6	6	6	6	6	6	6	6	6
Fe	5.50	6	6	6	6	6	6	6	6	6	6
Mn	5.50	6	6	6	6	6	6	6	6	6	6
Color	4.40	6	6	6	6	6	6	6	6	6	6
Turbidity	4.95	6	6	6	6	6	6	6	6	6	6
Tot. Diss. Solids	8.25	6	6	6	6	6	6	6	6	6	6
Vol. Solids	5.50	6	6	6	6	6	6	6	6	6	6
Sus. Solids	8.25	6	6	6	6	6	6	6	6	6	6
Chlorophyll _a_	22.00	42	42	42	42	42	42	42	42	42	42
Periphyton Chlorophyll _a_	22.00	12			12			12			12
Biotic Index	50.00		28			28			28		28

Summer algae populations are dominated by the less desirable bluegreen taxa. Changes in algae populations to more beneficial types can also indicate improved water quality. Algae samples will be collected and preserved concurrently with the water chemistry sampling. At the time this plan was written it was not known if the identification and enumeration of algal species will be accomplished, but the samples will be archived for future reference.

Additional water transparency data could be collected through the Department of Natural Resources Self Help Monitoring Program. Ideally, each segment could be monitored weekly by Secchi disc readings. The Big Eau Pleine Property Owners Association will be contacted to help find individuals willing to cooperate.

Water level, inflow, and discharge are important to the recreational use and water quality of the reservoir. Reservoir stage and discharge are recorded by the Wisconsin Valley Improvement Company (WVIC), the operator of the Big Eau Pleine Dam. The United States Geological Survey continuously monitors the discharge of the Upper Big Eau Pleine River Watershed at the Stratford gauge. Sixty-two percent of the flow to Big Eau Pleine Reservoir is from the Upper Big Eau Pleine River Watershed, making it a good index of inflow to the reservoir. These data will be incorporated into the evaluations and reports on water quality progress in the Big Eau Pleine Reservoir.

Recreational fishing is one of the most popular uses of the Big Eau Pleine Reservoir. The winter fish kills caused by oxygen depletion are considered by many to be the most serious problem in the reservoir. An extensive survey of the reservoir fishery in 1985 indicated the gamefish population was still in a recovery stage from the last major winterkill. The instability of the gamefish population will make it difficult to compare pre-project and post-project surveys. The 1985 survey included a modified creel census. While post-project monitoring of a similar nature could demonstrate changes in recreational use, it may not be possible to draw conclusions about changes resulting from nonpoint source pollutant controls. However, this plan does recommend continued monitoring of the Big Eau Pleine Reservoir fishery. Mid-project and post-project surveys should adequately monitor the fishery. The surveys should include relative abundance measures of the gamefish population and creel census' to make the surveys compatible with the 1985 survey.

Oxygen concentrations during critical winter months are being monitored by WVIC. Weekly surveys are run with sample points at one-mile intervals the length of the Big Eau Pleine Reservoir. Dissolved oxygen and temperature are measured, and water samples are collected for biochemical oxygen demand (BOD) analysis. This program of oxygen monitoring during critical periods is essential to measure the success of the Upper Big Eau Pleine River Priority Watershed Project.

The Wisconsin Valley Improvement Company staff collects water samples at three sites in the Big Eau Pleine River Watershed. They monitor Fenwood Creek, the Big Eau Pleine River, and the reservoir (at the dam). Analysis is done for alkalinity, acidity, BOD_5, chloride, carbon dioxide, color, pH, conductivity, dissolved oxygen, hardness, nitrogen, phosphorus, temperature, and turbidity. Phytoplankton samples are collected and preserved but are not presently being analyzed. The WVIC data will be valuable supplements to this monitoring effort.

Finally, the Marathon County Health Department monitors fecal coliform bacteria at three beaches along the Big Eau Pleine Reservoir. Sampling is done bi-weekly during the swimming season until counts approach the maximum levels for swimming; then sampling frequency increases to weekly. This monitoring is expected to be continued, although bacteria are not a common problem in the reservoir.

C. UPPER BIG EAU PLEINE RIVER WATERSHED MONITORING

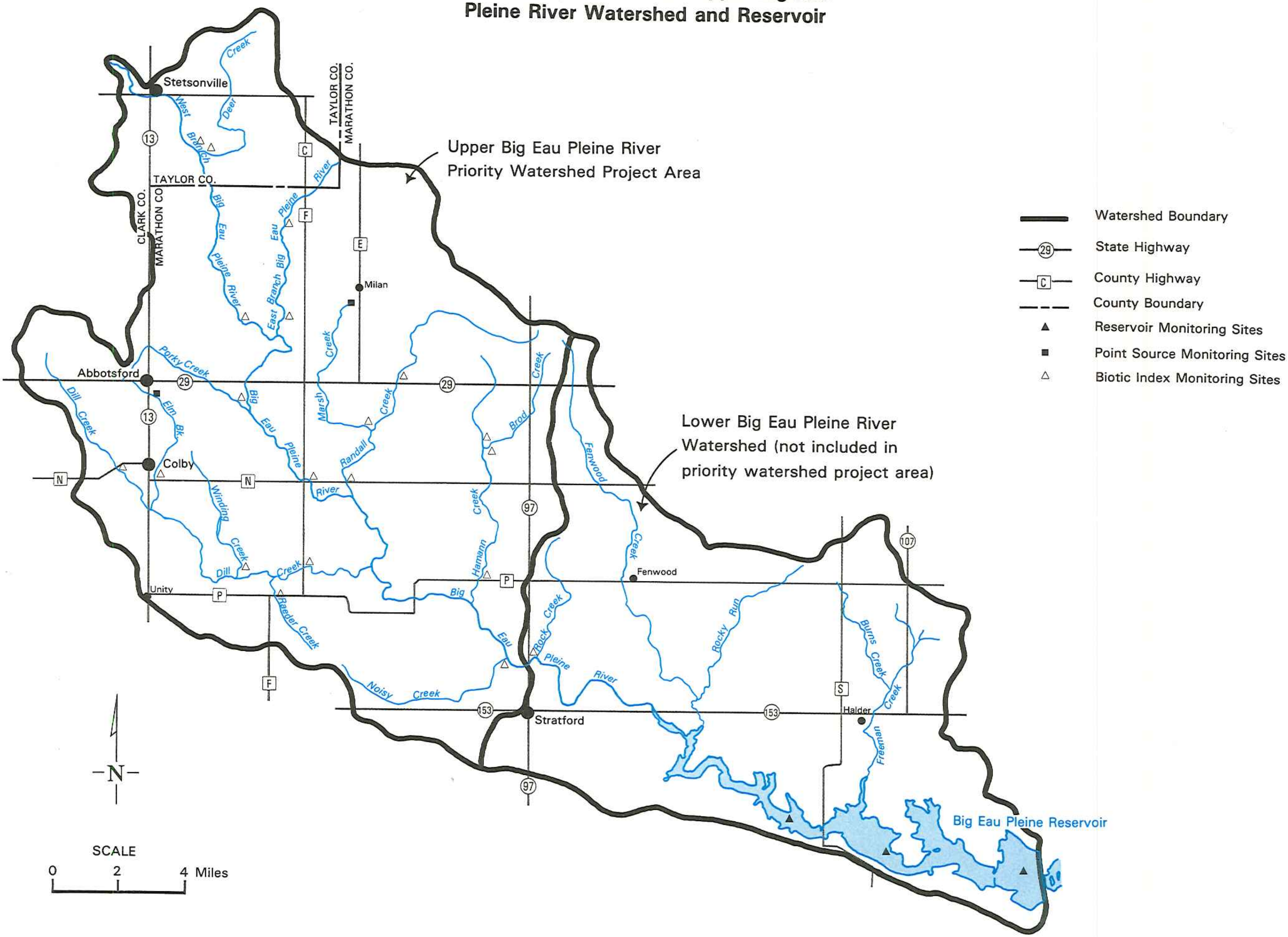
There are a number of different monitoring approaches that could be utilized to measure water quality improvements in the Upper Big Eau Pleine River Watershed.

An ideal watershed monitoring program for this project would measure pollutant loading at the watershed outlet and at the mouths of at least two of the tributaries. However, accurately estimating annual pollutant loads is expensive because many individual samples taken throughout the year as needed. Because of the demonstrated high annual variability of pollutant loading, monitoring would be desirable for the eight years of the project and for two years after completion.

Since the main project objective is to reduce loading to the Big Eau Pleine Reservoir, monitoring of the watershed outlet near Stratford is the highest priority. The United States Geological Survey will monitor water quality with the cost shared by a second party. Estimated cost share for pollutant load monitoring at the Stratford gauge is $10,000 for the first year and $4,000 for each additional year. At this cost, 12 runoff events per year would be monitored to estimate sediment and phosphorus load. This cost is for monitoring at an existing gauging station. Other sites would have additional costs for monitoring the discharge rate. At the time of preparation of this plan, funding for monitoring pollutant loading is uncertain. Historical monitoring data should be analyzed to estimate how sensitive pollutant loading is to rainfall intensity. This information can then be used to predict the minimal loading reduction detectable by the monitoring program. This can then be related to the expected pollutant reduction to determine if the monitoring will be useful. Funding will be pursued for pollutant loading monitoring of the Big Eau Pleine River at the Stratford gauge.

The watershed assessment discussed earlier identified point source wastewater discharges as major sources of phosphorus in the watershed. A one-year monitoring program will be undertaken to better estimate the point source phosphorus load. The municipal wastewater discharges from Abbotsford, Colby, Fenwood, Milan, Stetsonville, and Stratford will be monitored monthly. The only permitted industrial discharges are cooling water effluents from cheese factories. These discharges will be screened for phosphorus and biochemical oxygen demand content to confirm they are not pollutant sources.

Map 9: Monitoring Sites in the Upper Big Eau Pleine River Watershed and Reservoir



The appraisal identified filamentous algae growth as impairing the aesthetic quality of tributaries to the Big Eau Pleine River. To investigate this growth, two tributaries will be monitored for oxygen levels and periphyton colonization (periphyton are organisms that live attached to underwater surfaces). Mace et al (1984) recommended analyzing the growth on scored bricks placed at sites for a four-week period. In this study, bricks will be scored to delineate predetermined surface areas and three bricks will be placed at each site for four weeks. The periphytic growth will then be scraped off of the bricks, composited to one sample for each site, and analyzed for chlorophyll a content. Two sample sites on each stream will be selected at the time of the initial survey.

In addition, continuous oxygen monitoring will be done for a three-day period at the beginning and the end of each four-week colonization period. Stream water samples will be collected at each site visit for total and soluble phosphorus analysis, and water velocity across the bricks will be measured. In order to find areas of abundant periphytic growth, Hamann Creek and Randall Creek are the two tributaries to be monitored. Hamann receives minimal point source effluent, and its watershed has been identified as likely to have a good rate of landowner participation in the watershed project. Randall Creek represents a stream that receives a large point source phosphorus load. The periphyton sampling will be done in the peak July and August growth periods of the years 1988, 1991, 1994, and 1997.

Macroinvertebrate samples were collected at 20 sites (Map 9) throughout the watershed in the fall of 1985 and the spring of 1986. The survey will be repeated in 1989, 1992, 1995, and 1997 to indicate changes in water quality. Since most sites indicated good water quality, not much improvement is expected overall. One sample will be collected during spring at each site for analysis by the Hilsenhoff Biotic Index technique. At 20 percent of the sites two additional samples will be collected and analyzed to indicate replicability of the sample collection, handling, and analysis methods. Site location descriptions are listed in Table 29. Three sites, one each on the East and West Branches of the Big Eau Pleine River plus Elm Brook, indicated poorer water quality. These sites will be resampled in the spring of 1988. If they again indicate degraded conditions, the streams will be investigated to find the sources of degradation if staff resources allow for it.

The water quality assessment identified hydrology as the main factor limiting the fish communities in the streams of the Upper Big Eau Pleine River Watershed. The watershed project is expected to have only minimal effect on the hydrologic characteristics of the watershed, and only minimal improvement is expected in the stream fishery. Most of the tributaries will remain as forage fisheries. Past attempts at surveying fish populations in the Big Eau Pleine River mainstem have resulted in little success. Thus it is recommended that monitoring efforts be concentrated on the fish community in the reservoir and the stream fishery not be monitored.

Table 29.

Biotic Index Sample Sites

Site No.	Stream	Road Crossing	Legal Description	Storet Station Number
1	Big Eau Pleine River	State Hwy. 97	NE¼ SE¼, S13, T27N, R3E	373325
2	Hamann Creek	CTH "P"	SE¼ SW¼, S35, T28N, R3E	373355
3	Randall Creek	CTH "N"	NE¼ NW¼, S19, T28N, R3E	373358
4	Dill Creek	CTH "F"	NW¼ SW¼, S36, T28N, R2E	373357
5	E. Br. Big Eau Pleine River	Holton Rd.	SE¼ SW¼, S23, T29N, R2E	
6	W. Br. Big Eau Pleine River	Chestnut Rd.	NE¼ NE¼, S28, T29N, R2E	
7	Noisy Creek	Equity St.	NW¼ SW¼, S13, T27N, R3E	
8	Big Eau Pleine River	CTH "N"	SW¼ SW¼, S13, T28N, R2E	
9	Brod Creek	Huckleberry Rd.	SW¼ SE¼, S11, T28N, R3E	
10	Hamann Creek	Huckleberry Rd.	SW¼ SE¼, S11, T28N, R3E	
11	Randall Creek	State Hwy. 29	NW¼ NE¼, S05, T28N, R3E	
12	Marsh Creek	Chestnut Rd.	NE¼ NE¼, S07, T28N, R3E	
13	E. Br. Big Eau Pleine River	Draper Rd.	NE¼ NW¼, S11, T29N, R2E	
14	Deer Creek	Elm Ave.	SE¼ SE¼, S29, T30N, R2E	
15	W. Br. Big Eau Pleine River	Elm Ave.	SW¼ SE¼, S29, T30N, R2E	
16	Porky Creek	Chestnut Rd.	NE¼ SE¼, S04, T28N, R2E	
17	Dill Creek	CTH "N"	NE¼ NE¼, S14, T28N, R1E	
18	Elm Brook	CTH "N"	SW¼ SW¼, S18, T28N, R2E	
19	Winding Creek	Chestnut Rd.	SE¼ NE¼, S33, T28N, R2E	
20	Raeder Creek	CTH "P"	SW¼ NW¼, S02, T27N, R2E	

The United States Geological Survey has measured the discharge of the Big Eau Pleine River at the outlet of the watershed for 61 years. Continued discharge monitoring could be especially important if funding would be found to monitor pollutant load discharge from the watershed.

Marathon County maintains two public swimming beaches on the mainstem of the Big Eau Pleine River at the Cherokee and Big Rapids parks. These beaches are often closed because of high bacterial counts. The sources of bacterial contamination have not been identified. It is unlikely that the contamination originates from nonpoint sources because it seems to occur during periods of high temperature and low stream flow. For this reason, bacteria monitoring is not a high priority for this plan. It would be beneficial to recreational use in the watershed to determine the source and controllability of the bacterial contamination but resources are not available to conduct this monitoring.

D. METEOROLOGY

Meteorologic data is important when a watershed is being monitored. There are at least eight precipitation monitoring sites in or near the Upper and Lower Big Eau Pleine River Watersheds. They are maintained by WVIC and the University of Wisconsin. The Wisconsin Valley Improvement Company also monitors the snow pack in order to estimate spring runoff. The WVIC also monitors total daily solar radiation at the Big Eau Pleine Dam. Sullivan (1978) attributed a 100 percent increase of phytoplankton biomass in the Big Eau Pleine Reservoir from 1975 to 1976 largely to a 31 percent increase of solar radiation.

E. REPORTING AND DATA INTERPRETATION

Results of the monitoring efforts in the Upper Big Eau Pleine River Watershed will be reported in annual water year summaries. Each report will summarize the past year's monitoring, relate it to previous monitoring results, and make recommendations for changes to the monitoring plan. At the end of the project an overall monitoring report will be written which will describe the impacts of the project on water quality. Where the data base will permit, these reports will include statistical analyses.

The staff time needed to conduct monitoring is listed in Table 30. Laboratory analyses and costs are listed in Table 29 and Table 31 respectively. A summary of the monitoring program is included in Table 32.

Table 30. Upper Big Eau Pleine River Watershed Monitoring Plan Staff Time Estimate

Element	Water Year									
	88	89	90	91	92	93	94	95	96	97
Reservoir complete	2	2	2	2	2	2	2	2	2	2
Sediment and Phosphorus Load	5	5	5	5	5	5	5	5	5	5
TP, Chla, etc.	9	9	9	9	9	9	9	9	9	9
Periphyton	9			9			9			9
Point Source P	18	9								
Biotic Index	1	4			4			4		4
Fishery				?						?
Reporting	12	10	6	8	8	6	8	8	6	15
TOTAL DAYS:	55	39	22	33	28	22	33	28	22	44
TOTAL HOURS:	448	312	186	264	224	176	264	224	176	352

Table 31.
Laboratory Costs for Department of Natural Resources
Water Resources Management Monitoring Activities
in the Big Eau Pleine Watershed

	Water Year									
Element	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Reservoir complete	$ 845	$ 845	$ 845	$ 845	$ 845	$ 845	$ 845	$ 845	$ 845	$ 845
TP, Chla, etc.	829	829	829	829	829	829	829	829	829	829
Periphyton	528			528			528			528
Point Source P	594	594								
Biotic Index	150	1400			1400			1400		1400
Total 1988 Dollars	$2946	$3668	$1674	$2202	$3074	$1674	$2202	$3074	$1674	$3602

Table 32. Upper Big Eau Pleine River Watershed Monitoring Summary

Element	Description
Reservoir complete water chemistry	One sample date near time of spring maximum stage. Sampled at one site in each of the three segments as mapped in figure 1. Two depths: one meter from the water surface and one meter above the lake bottom. Eighteen constituents: NO2-N + NO3-N; NH3-N; TKN; Cl^-; Diss. P; Ca; Mg; Na; K; pH; SO4; total alk; Fe; Mn; Color; turbidity; total diss. solids; volatile solids; and suspended solids.
Phosphorus and sediment load at Stratford gauge	Contract with the USGS to monitor runoff events and estimate phosphorus and sediment load carried by the Big Eau Pleine River.
Reservoir total phosphorus, chlorophyll _a_, transparency, oxygen and temperature	One sample from each of the three segments in spring and mid-month of June, July, August, and September. Additional sample in July and August if possible. Total phosphorus and chlorophyll _a_ samples will be collected at one meter depth as a composite of three samples. Additional total phosphorus sample collected one meter above bottom. Transparency measured by Secchi disk or light extinction meter. Dissolved oxygen and temperature measured at one or two meter intervals.
Water quality monitoring by Wisconsin Valley Improvement Co.	Monthly samples collected at face of dam, Big Eau Pleine River at Highway 97 and Fenwood Creek. Analysis for alkalinity; acidity; BOD_5; Cl^- CO_2; color; pH; conductivity; dissolved oxygen; hardness; NO_2+NO_3-N; TKN; total and soluble phosphorus; transparency; temperature; and turbidity. Reservoir samples are collected one meter off the bottom, mid-depth, and surface. Phytoplankton samples are collected at reservoir site and preserved.
Reservoir winter oxygen monitoring	WVIC monitors oxygen, temperature, and BOD_5 once per week during periods of low oxygen concentration under ice over. Sample points are at one-mile intervals along the length of the reservoir and vertical profiles are measured.

Table 32. Upper Big Eau Pleine River Watershed Monitoring Summary (contd.)

Element	Description
Tributary periphyton and diel oxygen	Hamann Creek and Randall Creek will each be monitored at two sites for periphytic algae and diel oxygen concentration. Three scored bricks will be placed at each site and retrieved four weeks later. Algae will be scraped from a known surface area and analyzed for chlorophyll a content. Oxygen will be continuously monitored for three days at the beginning and end of the colonization period. Stream water samples will be collected at each site visit and analyzed for total and soluble phosphorus. Sampling will be done during July and August of 1988, 1991, 1994, and 1997.
Point source phosphorus loading	The municipal wastewater discharges from Abbotsford, Colby, Fenwood, Milan, Stetsonville, and Stratford will be monitored monthly for one year. Other discharges will be screened for phosphorus and BOD_5.
Biotic index sampling	Macroinvertebrates will be sampled and analyzed by the Hilsenhoff Biotic Index technique at 20 sites in the watershed. Spring samples will be collected in 1989, 1992, 1995, and 1997. At four sites, three replicates will be collected and analyzed.
Big Eau Pleine Reservoir fishery	Surveys using creel census and measurement of relative abundance of game fish should be conducted to compare with the 1985 survey. A mid-project survey in 1991 and a post-project survey in 1997 are recommended.
Reservoir stage and discharge	The water level and discharge rate of the Big Eau Pleine Reservoir are monitored daily by Wisconsin Valley Improvement Company.
Big Eau Pleine River discharge at Highway 97	The United States Geological Survey continuously monitors the flow volume of the Big Eau Pleine River. Winter monitoring accuracy is compromised by ice cover.

Table 32. Upper Big Eau Pleine River Watershed Monitoring Summary (contd.)

Element	Description
Meteorology	Wisconsin Valley Improvement Company monitors precipitation and solar radiation daily. Snowpack is also monitored weekly when significant.
Aerator operation	Wisconsin Valley Improvement Company operates and monitors the aerator on the Big Eau Pleine Reservoir.
Waterborne bacteria at beaches	Marathon County Health Department monitors total and fecal coliform at five beaches during the swimming season. Three of the beaches are on the reservoir and two are on the Big Eau Pleine River mainstem.

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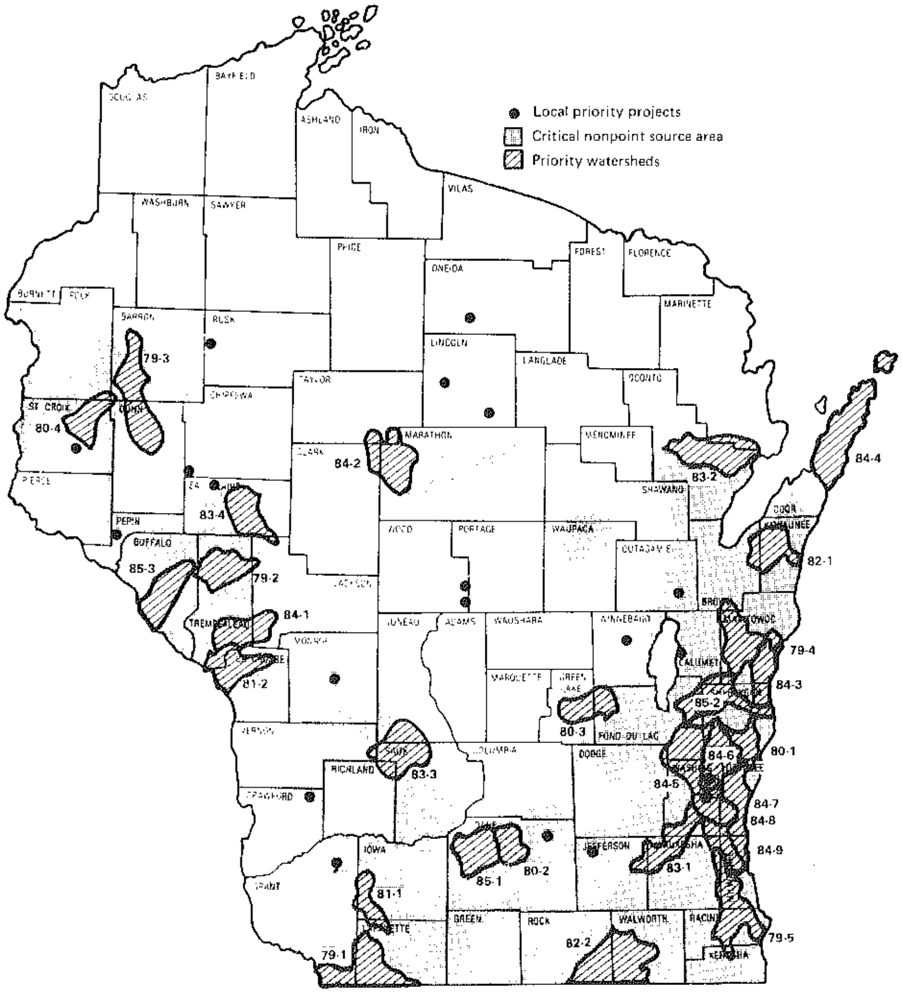
CURRENT PRIORITY WATERSHED PROJECTS IN WISCONSIN



Map Number	Project	County	Year Project Selected
79-1	Galena River	Grant, Lafayette	1979
79-2	Elk Creek	Trempealeau	1979
79-3	Hay River	Barron, Dunn	1979
79-4	Lower Manitowoc River	Manitowoc, Brown	1979
79-5	Root River	Racine, Milwaukee, Waukesha	1979
80-1	Onion River	Sheboygan, Ozaukee	1980
80-2	Sixmile-Pheasant Branch Creek	Dane	1980
80-3	Green Lake	Green Lake, Fond du Lac	1980
80-4	Upper Willow River	Polk, St. Croix	1980
81-1	Upper West Branch Pecatonica River	Iowa, Lafayette	1981
81-2	Lower Black River	La Crosse, Trempealeau	1981
82-1	Kewaunee River	Kewaunee, Brown	1982
82-2	Turtle Creek	Walworth, Rock	1982
83-1	Oconomowoc River	Waukesha, Washington, Jefferson	1983
83-2	Little River	Oconto	1983
83-3	Crossman Creek/Little Baraboo River	Sauk, Juneau, Richland	1983
83-4	Lower Eau Claire River	Eau Claire	1983
84-1	Beaver Creek	Trempealeau, Jackson	1984
84-2	Upper Big Eau Pleine River	Marathon, Taylor, Clark	1984
84-3	Seven Mile-Silver Creeks	Manitowoc, Sheboygan	1984
84-4	Upper Door Peninsula	Door	1984
84-5	East & West Branch Milwaukee River	Fond du Lac, Washington, Sheboygan, Dodge	1984
84-6	North Branch Milwaukee River	Sheboygan, Washington, Ozaukee	1984
84-7	Cedar Creek	Washington, Ozaukee	1984
84-8	Milwaukee River South	Ozaukee, Milwaukee	1984
84-9	Menomonee River	Milwaukee, Waukesha, Ozaukee, Washington	1984
85-1	Black Earth Creek	Dane	1985
85-2	Sheboygan River	Sheboygan, Fond du Lac, Manitowoc, Calumet	1985
85-3	Waumandee Creek	Buffalo	1985

OUR MISSION:

To protect and enhance our Natural Resources —
our air, land and water;
our wildlife, fish and forests.

To provide a clean environment
and a full range of outdoor opportunities.

To insure the right of all Wisconsin citizens
to use and enjoy these resources in
their work and leisure.

And in cooperation with all our citizens
to consider the future
and those who will follow us.

Wisconsin
Dept. of Natural Resources