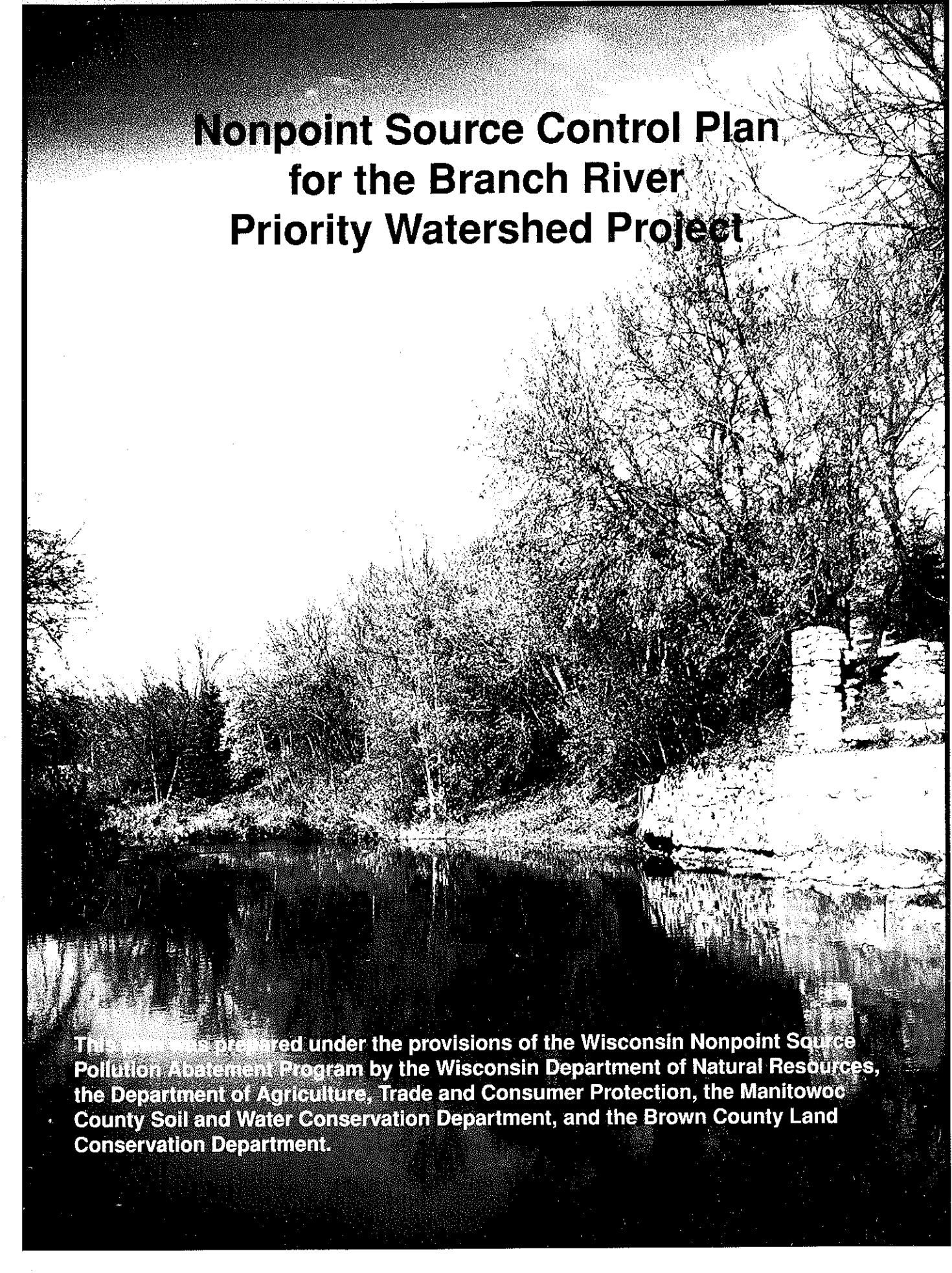




Nonpoint Source Control Plan for the Branch River Priority Watershed Project

This plan was prepared under the provisions of the Wisconsin Nonpoint Source Pollution Abatement Program by the Wisconsin Department of Natural Resources, the Department of Agriculture, Trade and Consumer Protection, the Manitowoc County Soil and Water Conservation Department, and the Brown County Land Conservation Department.

Watershed Plan Organization Information

Natural Resources Board 1996

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Nonpoint Source Control Plan for the Branch River Priority Watershed Project

The Wisconsin Nonpoint Source Water Pollution Abatement Program

February 1996

This Plan Was Cooperatively Prepared By:

The Wisconsin Department of Natural Resources
Wisconsin Department of Agriculture, Trade and Consumer Protection
and
The Manitowoc County Soil and Water Conservation Department and
The Brown County Land Conservation Department

Publication WR-449-96

For copies of this document please contact:

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The Department of Natural Resources acknowledges the Environmental Protection Agency's Region V Office for their involvement in the partial funding of this activity through Section 319 of the Water Quality Act.

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State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

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George E. Meyer, Secretary

Box 7921
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Madison, Wisconsin 53707-7921
TELEPHONE 608-266-2621
FAX 608-267-3579
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February 19, 1996

Mr. Markwardt, Chair
Manitowoc County Board
1701 Michigan Ave.
Manitowoc, WI 54220

Dem
Dear Mr. Markwardt:

I am pleased to approve the Branch River Priority Watershed Plan prepared through the Wisconsin Nonpoint Source Pollution Abatement Program. This plan meets the intent and conditions of S. 144.25, Wisconsin Statutes, and Chapter NR120, Wisconsin Administrative Code. This plan has been reviewed by the Department of Agriculture, Trade and Consumer Protection and was approved by the Land and Water Conservation Board on February 19, 1996. I am also approving this plan as an amendment to the Manitowoc River Basin Areawide Water Quality Management Plan.

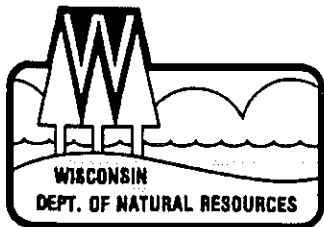
I would like to express the Department's appreciation to the Manitowoc County Soil and Water Conservation Department Staff that participated in preparing this plan. The implementation of the Branch River Priority Watershed Project will greatly enhance the regional water quality and set a standard for future projects selected as part of the Departments Nonpoint Source Pollution Abatement Program.

We look forward to assisting Manitowoc County and other units of government participating in the implementation of the Branch River Priority Watershed Plan.

Sincerely,

George E. Meyer
Secretary

cc: Alan Tracy, DATCP
Jim Bradley, LWCB
Thomas Ward, Manitowoc Co. SWCD
Anthony Smith, Manitowoc Co. SWCD
Dennis Weisensel, LMD
Rob McLennan, LMD
Keith Foye, DATCP
Cindy Hoffland, DNR
Terence Kafka, DNR
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February 19, 1996

Ms. Nusbaum, County Executive
Brown County
1150 Bellevue St.
Green Bay, WI 54302

Nancy
Dear Ms. Nusbaum:

I am pleased to approve the Branch River Priority Watershed Plan prepared through the Wisconsin Nonpoint Source Pollution Abatement Program. This plan meets the intent and conditions of S. 144.25, Wisconsin Statutes, and Chapter NR120, Wisconsin Administrative Code. This plan has been reviewed by the Department of Agriculture, Trade and Consumer Protection and was approved by the Land and Water Conservation Board on February 19, 1996. I am also approving this plan as an amendment to the Manitowoc River Basin Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Brown County Land Conservation Department Staff that participated in preparing this plan. The implementation of the Branch River Priority Watershed Project will greatly enhance the regional water quality and set a standard for future projects selected as part of the Departments Nonpoint Source Pollution Abatement Program.

We look forward to assisting Brown County and other units of government participating in the implementation of the Branch River Priority Watershed Plan.

Sincerely,

George
George E. Meyer
Secretary

cc: Alan Tracy, DATCP
Jim Bradley, LWCB
Merlin Vanden Plas, Brown Co. LCC Chair
William Hafs, Brown Co. LCD
Michael Mushinski, Brown Co. LCD
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Cindy Hoffland, CA/8
Terence Kafka, WR/2
Sue Porter, DATCP

RESOLUTION APPROVING THE BRANCH RIVER PRIORITY WATERSHED PLAN

TO THE CHAIRPERSON AND BOARD OF SUPERVISORS
OF MANITOWOC COUNTY, WISCONSIN

Supervisors:

WHEREAS, the Manitowoc County Board of Supervisors through Resolution No. 93/94-142 has expressed its support of the designation of the Branch River Watershed as a priority watershed project; and

WHEREAS, the inventory and planning phases of the project have been completed under the direction of the Manitowoc County Natural Resource and Education Committee in cooperation with the Wisconsin Department of Natural Resources and the Brown County Land Conservation Committee; and

WHEREAS, a priority watershed plan has been prepared which assesses the existing water quality and watershed conditions, identifies the management practices and actions necessary to improve or protect the water quality of the watershed, outlines the tasks required and the agency responsible for each, and establishes the time frame and cost estimates for the project; and

WHEREAS, a draft of the plan has been available for review and comments were accepted at a public hearing held December 5, 1995; and

WHEREAS the implementation of this plan will provide both technical assistance and cost share monies to eligible landowners within the priority watershed for the installation of conservation practices designed to reduce the sources of non-point pollution and protect or improve the quality of Manitowoc and Brown Counties' surface and groundwater resources;

NOW, THEREFORE, be it resolved by the Manitowoc County Board of Supervisors to approve the "Non-Point Source Control Plan for the Branch River"; and that the Natural Resource and Education Committee be given authority and responsibility to act on behalf of Manitowoc County to administer this Priority Watershed Project as outlined in the plan, and develop a project budget and execute an Administrative Grant with Department of Natural Resources for reimbursement of expenses.

Dated this 19th day of December, 1995.

Respectfully submitted by the Natural Resource
and Education Committee:

Robert L. Zenzel
Michael J. Cunningham
Wm. J. Hallander
Lester Koepfel

Adopted this 19th day of Dec., 1995.

25 Ayes 0 Noes 0 Absent

ATTEST:

Daniel R. Fischer
Daniel R. Fischer
County Clerk

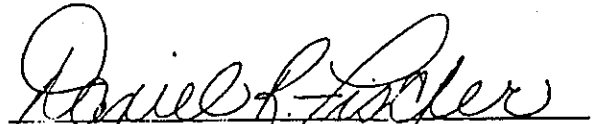
Fiscal Impact: Estimated annual year cost of \$304,886. All expenses except office and equipment are reimbursed 100% by the State government. The County is responsible for 30% of the office supply and equipment (\$1,800 expense budgeted for 1996). Interest earned on advances from the State for expenditures can be used to cover the 30% County cost of office supplies.

STATE OF WISCONSIN)

COUNTY OF MANITOWOC)

I, Daniel R. Fischer, County Clerk of Manitowoc County, do hereby certify that the attached resolution is a true and correct copy of the original resolution required by law to be in my custody and which was adopted by the County Board of Supervisors of Manitowoc County at a meeting held on December 19, 1995.

Set my hand and official seal this 27th day of December, 1995.


Daniel R. Fischer, County Clerk

January 17, 1996

TO THE HONORABLE CHAIRMAN & MEMBERS
OF THE BROWN COUNTY BOARD OF SUPERVISORS

Ladies & Gentlemen :

RESOLUTION RELATING TO THE APPROVAL OF THE
BRANCH RIVER PRIORITY WATERSHED PLAN

WHEREAS, the Branch River project was designated by the state legislature as a "priority watershed" in 1993 under the Wisconsin Nonpoint Source Water Pollution Abatement Program, and

WHEREAS, the Brown County Land Conservation Department and Manitowoc Soil & Water Conservation Department, in cooperation with the Wisconsin Department of Natural Resources and Wisconsin Department of Agriculture, Trade and Consumer Protection, conducted a detailed inventory of the land use within the watershed in 1994 & 1995, and

WHEREAS, a draft of the plan has been available for review and comments were accepted at a public informational hearing held December 5, 1995, and

WHEREAS, the priority watershed plan assesses the existing water quality and watershed conditions, identifies the management practices and actions necessary to improve or protect the water quality of the watershed, outlines the tasks required and the agency responsible for each, and establishes the time frame and cost estimates for the project, and

NOW, THEREFORE, BE IT RESOLVED, that the Brown County Board of Supervisors does hereby approve the "Branch River Priority Watershed Plan" and that the implementation of the plan begin as soon as possible.

LAND CONSERVATION COMMITTEE
PLANNING, DEVELOPMENT &
TRANSPORTATION COMMITTEE

COUNTY EXECUTIVE

Final Draft Approved by Corporation Counsel

Randy Johnson, County Clerk, Brown County, WI

Branch River Priority Watershed Project Summary

Introduction

The purpose of the Nonpoint Source Control Plan developed for this project is to assess the nonpoint pollutants in the Branch River Priority Watershed and guide the implementation of control measures. Nonpoint source control measures are needed to meet very specific water resource objectives designed to protect and enhance the surface and groundwater in the watershed.

Nonpoint source pollution cannot be easily traced to a single point of origin such as a point source effluent discharge from a wastewater treatment plant or industrial plant. Nonpoint source pollution occurs when rainwater or snow melt flows across the land and picks up soil particles, organic wastes, fertilizers or other pollutants and carries them to surface and/or groundwater. These soil particles and organic wastes contain phosphorus and nitrogen, the same compounds found in commercial fertilizers. Nonpoint source pollution in the Branch River Watershed has lead to a general decrease in both surface and groundwater quality.

The predominant sources of nonpoint pollutants in the Branch River Watershed originate from croplands and animal lots, primarily in the form of excess phosphorus, nitrogen and sediment. Barnyards and cropland combined account for an estimated 92 percent of the total phosphorus and 81 percent of total sediment delivered to surface water in the watershed. These sources, particularly cropland, often have a negative affect on the surface and groundwater quality in the Branch River Watershed.

Secondary sources of nonpoint pollutants in the Branch River Watershed originate from gully and streambank erosion, primarily in the form of sediment deposition to the stream. Streambank and gully erosion account for an estimated 19 percent of the total sediment and 8 percent of the total phosphorus load to surface water in the project area. These sources, particularly streambank erosion, generally affect surface water quality in the Branch River Watershed.

The Nonpoint Source Pollution Control Plan for the Branch River Watershed was prepared by the Department of Natural Resources (DNR), the Department of Agriculture, Trade and Consumer Protection (DATCP), the Manitowoc County Soil And Water Conservation Department and the Brown County Land Conservation Department. The DNR selected the Branch River Watershed as a priority watershed project through the Wisconsin Nonpoint Source Water Pollution Abatement Program in 1993. It joined approximately 76 similar watershed projects statewide in which nonpoint source control measures are being planned and implemented. The Nonpoint Source Water Pollution Abatement Program was created in 1978 by the Wisconsin State Legislature. The program provides financial and technical assistance to landowners and local governments to reduce nonpoint source pollution.

The project is administered at the state level by the DNR and DATCP. The Manitowoc County SWCD and the Brown County LCD will administer the project at the local level with assistance from the University of Wisconsin-Extension and the Natural Resource Conservation Service (U.S. Department of Agriculture). This plan is primarily used by and written for the DNR, DATCP, County LCDs, local units of government, legislators, external program evaluators, and the interested public.

General Characteristics

The Branch River Priority Watershed drains 107 square miles of land in Brown and Manitowoc Counties in east-central Wisconsin and is located within the Manitowoc River Basin. The Branch River flows unimpeded into the Manitowoc River, with the point of confluence occurring 11 miles upstream of Lake Michigan. Approximately 61 percent (41,656 acres) of the Branch River Watershed lies within the boundaries of Manitowoc County and 39 percent (27,020 acres) within Brown County. The Branch River Watershed was divided into eight smaller drainage areas, called subwatersheds, for this planning effort (Map S-1).

Groundwater is held in thick, permeable layers of soil and rock. The principal aquifers of the Branch River Watershed are the Eastern Dolomite, situated geologically on the western margin of the Michigan Basin that consists of Precambrian to Paleozoic age bedrock that encircles Lake Michigan and Lake Huron. The Branch River is located on the dip slope of the cuesta east of the Niagara escarpment - a dolostone ridge - composed primarily of Alexandrian Series Silurian formations and members.

The Branch River has been proposed as an exceptional resource water under NR102. The river provides steelhead trout (*Oncorhynchus mykiss*) fishing and also supports a unique fishery resource, the Greater Redhorse (*Moxostoma valenciennesi*) which is worthy of special protection. The Greater Redhorse, which was listed as a special concern species in 1979 and upgraded to threatened in 1989, is sensitive to chemical pollutants, turbidity and siltation. The streams of the watershed are not reaching their highest potential use due to pollution from point and nonpoint sources.

Farming is of vital importance to this area's economy as agriculture comprises over 70 percent of the overall land use in the Branch River Watershed (Table S-1). While the number of farms in the watershed has decreased steadily over the past two decades, the average farm size has increased from 164 acres in 1981, to 226 acres in 1991. The residential population in the watershed has been estimated at 4,700 residents, with the majority of the population in rural unincorporated areas. Population trends in the watershed show an overall stable trend with a projected growth rate of 1 percent between 1990 and 2015.

Map S-1. Branch River Priority Watershed

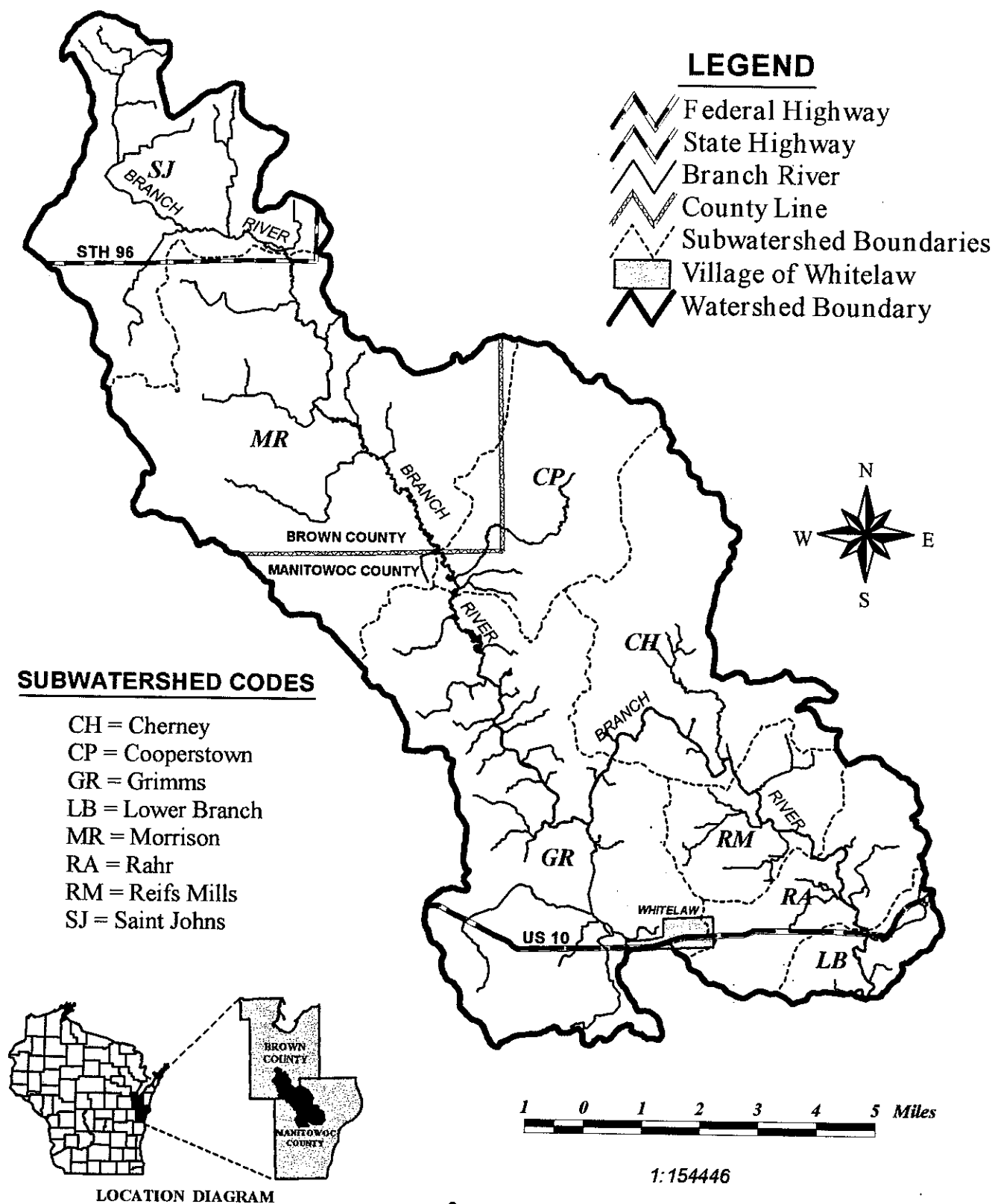


Table S-1 Summary of Land Uses in the Branch River Watershed

Land Uses	Acres	Percent
Cropland	47,040	68.5%
Wetland	9,861	14.4%
Woodland	5,683	8.3%
Grassland	2,949	4.3%
Developed	1,853	2.7%
Pasture	1,128	1.6%
Industry	58	0.2%
TOTAL	68,676	100%

Source: Manitowoc and Brown County LCDs.

Sources of Nonpoint Pollution

The Manitowoc and Brown County LCDs collected data on agricultural lands, barnyards, and streambanks in the watershed. This data was used to estimate the pollutant potential of these nonpoint sources. The following is a summary of the inventory results:

Barnyard Runoff Inventory

- * 233 barnyards and animal lots were inventoried.
- * An estimated 9,595 pounds of phosphorus is delivered to the streams in the watershed on an annual basis.

Streambank Erosion Inventory

- * 268 miles of intermittent and perennial streams in the watershed were inventoried.
- * An estimated 1,545 tons of sediment is eroded from streambanks annually, or about 10 percent of the watershed's total sediment load.
- * Livestock have access to an estimated 2 miles of stream length in the watershed, or about 1 percent of the total stream length in the watershed.

Gully Erosion Inventory

- * Gullies deliver an estimated 1,416 tons of sediment to the stream annually, or about 9 percent of the watershed's total sediment load.

Upland Sediment Inventory

- * More than 17,250 acres, or 25 percent of the watershed land area was inventoried.

- * An estimated 12,553 tons of sediment is delivered from cropland to watershed streams on an annual basis, or 81 percent of the total sediment load.

Groundwater Inventory

- * Of the 149 private wells in the watershed that were tested for Nitrates, more than 67 percent of the well samples tested over the Preventative Action Limit (PAL) of 2 mg/l, and more than 27 percent of the samples were above the Enforcement Standard (ES) Health Advisory Level of 10 mg/l, an indication of poor water quality in the Branch River Watershed.
- * An inventory of geological features in the watershed identified areas susceptible to groundwater contamination. Areas of particular concern are those that contain sinkholes, have shallow soils, or a high density of fracture traces, all of which can act as a direct conduit to groundwater.
- * Manitowoc County applied for PL566 watershed planning assistance from the NRCS to initiate a research project to assess the nitrate leaching potential of various soils in the Branch River Watershed using the NLEAP Model.

Project Goals

To protect and improve the aquatic habitat and water quality of the Branch River Watershed by reducing sediment; control and reduction of phosphorus, water temperature improvement; and restoration of watershed hydrology.

To improve and protect from degradation the groundwater of the Branch River Watershed, thru improved management of nutrients and pesticides; and through protection of drainage to karst features.

Sediment Objective

To reduce overall sediment delivered to streams in the Branch River Watershed by 25 percent, the following will need to be achieved:

- * Reduce sediment delivered to the stream from agricultural uplands by at least 3,138 tons or 25 percent.
- * Reduce streambank erosion by a minimum of 10 percent and maintain or develop stream woodland and grassland corridors by developing buffers that provide wildlife habitat, canopy, bank stabilization, and sediment reduction.
- * Reduce sediment delivered to streams within the Branch River Watershed from gully erosion by at least 50 percent.
- * Establish or maintain grassland and woodland corridors to protect or enhance the water resource. Corridors also provide wildlife habitat, streambank stabilization, canopy cover to lower stream temperatures, and pesticide and sediment retention.

Phosphorus Objective

To reduce overall phosphorus delivered to streams in the Branch River Watershed by 28 percent, the following will need to be achieved:

- * Reduce phosphorus runoff from barnyards to streams in the watershed by at least 62 percent (Similar reductions in organic loadings will also occur from this objective).
- * Eliminate manure applications on snow-covered cropland not suited for winter-spreading.
- * Reduce phosphorus delivered to streams in the watershed from agricultural uplands by at least 25 percent. This can be achieved by reaching the sediment reduction objective.

Groundwater Objective

To protect and enhance the groundwater resource in the Branch River Watershed, the following objectives will need to be achieved:

- * Eliminate direct discharges of nonpoint source pollutants to areas acting as direct conduits to groundwater, such as sinkholes, unused wells, and creviced bedrock.
- * Reduce the application of winter-spread manure on unsuitable cropland.
- * Reduce the over-application of commercial and organic fertilizers on soils with yield capabilities less than 70 percent of the surrounding soils.
- * Provide landowners with an extensive informational and educational program to promote awareness and to accept responsibility for the groundwater resource.

Hydrology Restoration Objective:

To improve aquatic habitat through reduced stream temperatures and stabilize stream flow, the following will need to be achieved:

- * Restore a minimum of 10 percent of all degraded or prior converted wetlands.
- * Reduce average maximum stream temperatures by at least two degrees fahrenheit on designated stream segments.
- * Preserve, maintain, or develop woodland and grassland corridors through buffers, wildlife habitat plantings and conservation easements.

Community Action Objective

To develop community action that fosters change that promotes sustained long term improvement and protection of the Branch River Watershed resources.

- * Train watershed staff to facilitate understanding and education about the watershed pollution reduction process.

- * Develop and implement educational programs that move the watershed community from awareness to action.
- * Facilitate the organizing of a community group to provide protection and stewardship of the watershed over time.

Critical Sites

Nonpoint source pollutant load reduction in the Branch River Priority Watershed Project will be achieved mainly through voluntary participation. However, state statutes require that the nonpoint source control plan contain the necessary language to ensure the reasonable likelihood of achieving water quality goals and objectives. Landowners with sites that meet the established critical site criteria are required by law to address those specific sites by reducing the nonpoint source pollutant load to an acceptable level. Pollutant reduction can occur solely through the action of the landowner with guidance from county staff or through watershed participation. Each identified site will be field verified before receiving notification as a critical site, with the findings sent to the DNR.

Landowners interested in receiving cost-share assistance for the installation of Best Management Practices will need to sign a cost-share agreement with the Manitowoc or Brown County Land Conservation Department.

Notification of landowners with critical sites will begin when Manitowoc and Brown County have the ability to identify individual fields for specific management categories on the FOCS/ WINHUSLE database. The highest ranked sites will be notified first until all landowners or land operators with critical sites are notified. The notification will include the following information:

- * The 36-month period in which landowners are eligible for the full level of state cost-sharing, after which the cost-share rate decreases by 50 percent.
- * The potential consequences of either Chapter NR243 for animal waste, or s.144.025(2)(u), (v), or (w), for sediment delivery, and groundwater protection that landowners may face if no action is taken. Some of these include receiving a notice of discharge, requiring of a WPDES permit, or the issuing of a notice of intent.
- * The right to appeal the designation of a critical site through a written request to the Land Conservation Committee (LCC) within 60 days of receipt of the notification letter. The LCC shall limit it's appeal affirmation consideration to whether the critical site designation is consistent with critical site criteria established in the implementation plan.

Impact and Scope of Critical Sites

Surface Water

- * Of the 233 barnyards inventoried, 12 have been designated as critical sites for control (5 percent), which will result in achieving a minimum reduction of 25 percent of the barnyard phosphorus objective.

- * Of the estimated 47,040 acres of cropland in the watershed, 3,400 acres have been designated as critical (7 percent).

Groundwater

- * Barnyards, Manure Stacks, or Leaking Manure Storage Structures that are overlying or up-gradient of sinkholes, visible creviced bedrock, or other conduits to groundwater such as gravel pits and wells. Of the 233 barnyards inventoried, an estimated 8 sites (3 percent) may meet this criteria.
- * Agricultural Nutrients from Surface Applied Manure will be targeted if spread without incorporation, or over-applied, within 300 feet of surface water drainage ways that are up-gradient of sinkholes, creviced bedrock within one foot of the surface, or other conduits to groundwater (an estimated that 4 sites fit this description).
- * Agricultural Tile Lines will be targeted if the tile outlet discharges directly to sinkholes, creviced bedrock or other conduits to groundwater (an estimated 4 sites fit this description).

Management Actions

The Manitowoc and Brown County LCDs will contact all landowners who are eligible to receive cost-share funds during the project's implementation. Management classifications are determined based on the level of pollution control needed to achieve water quality objectives in the watershed. Specific sites or areas within the watershed project are designated as either "critical," "eligible," or "ineligible." Designation as a critical site indicates that controlling that specific source is necessary if the pollutant reduction goals for the project are to be met. Nonpoint sources which are eligible but not critical contribute less of the pollutant load, but are included in cost sharing eligibility to further insure that water quality objectives are met. Landowners with eligible sites need not control every eligible source to receive cost-share assistance.

The Manitowoc and Brown County LCDs will assist landowners in the applying BMPs. Practices range from alterations in farm management (such as changes in manure-spreading and crop rotations) to engineered structures (such as diversions, sediment basins, and manure storage facilities), and are tailored to specific landowner situations. Manitowoc and Brown County staff will also examine the need for wellhead protection areas for municipal drinking water supplies.

Landowner Eligibility

Barnyard Runoff

To maintain cost effectiveness, only those landowners with barnyard sites delivering more than 50 pounds of phosphorus (which is equivalent to approximately 4,000 pounds of COD) to surface water on an annual basis will be eligible for a complete barnyard runoff management system (58 sites). Landowners with barnyards delivering 20 to 50 pounds of phosphorus to surface water annually will only be eligible to receive cost-sharing for low-cost diversions and roof gutters (60 sites).

Table S-2 Barnyard Runoff

Management Category	Phosphorus (lbs./year)	Number of Barnyards	P Controlled (lbs./year)	Percent of Reduction Objective
Critical	> 144	12	1,485	25%
Eligible	20 to 144	106	4,453	75%
Not Eligible	< 20	115	0	0%

Cropland Erosion

Due to the overall impact that upland sediment reduction will have towards achieving the overall resource goal of the Branch River Watershed, 50 percent of the pollutant reduction objective will potentially be achieved through critical site designation (Table S-3).

To promote and encourage voluntary participation, only those landowners with upland fields that deliver more than 1.5 tons over "T" and have a sediment delivery rate greater than 0.4 tons/acre/year will receive the initial critical site notification (1,550 acres). If acceptable progress toward achieving the water quality resource objective has been made after the fifth year of project implementation, secondary critical sites will be placed in the eligible management category (1,850 acres).

Table S-3 Cropland Sediment Delivery

Management Category	USLE/Sed. Delivery (tons/ac./yr.)	Acres	Tons of Sediment Reduced	Percent of Reduction Objective
Critical	> T and > 0.4	4,650	1,569	50%
Eligible	> 0.01 to 0.4	35,400	1,569	50%

Gully and Streambank Erosion

Because gully and streambank erosion have not been determined to be significant nonpoint sources in the Branch River Watershed, critical site designation will not be a component of control for these sites.

Table S-4 Gully Erosion

Management Category	Description	Target Reduction
Eligible	Actively Eroding Gullies	50% of Sediment Load
Not Eligible	Inactive Gullies	N/A

Table S-5 Eroding Streambanks.

Management Category	Sediment Delivery (tons/year)	Target Reduction
Eligible	≥ 1 ton/year	< 1 ton/year
Not Eligible	< 1 ton/year	N/A

Table S-6 Trampled Streambanks

Management Category	Description	Objective
Eligible	Trampled / Degraded / Livestock Access	Vegetated / No Livestock Access
Not Eligible	Vegetated / No Livestock Access	N/A

Project Implementation

Project implementation is scheduled to begin in 1996 and continue for a period of ten years. Implementation will consist of ongoing educational programming for watershed residents, individual farm conservation planning, the signing of cost share agreements and practice installation.

Table S-7 Total Project Costs: Branch River Priority Watershed

Eligibility Activity	Manitowoc County*	Brown County*	Total Cost (State Share)
Cost-Share Funds: Practices	3,993,141	2,123,319	6,116,460
Cost-Share Funds: Easements	975,000	97,500	1,072,500
Local Assistance Staff Support	1,757,119	791,191	2,548,310
Information and Education Activities	72,630	48,420	121,050
Other (travel, supplies, etc.)	11,900	11,900	23,800
Engineering Assistance	16,000	16,000	32,000
Total	\$6,825,790	\$3,088,330	\$9,914,120

*Estimates based on 75% participation and pending code changes.

Information and Education

The Manitowoc and Brown County LCDs will have initial responsibility for conducting an information and education program during the sign up and implementation phases of the project. University of Wisconsin-Extension staff in the counties will provide assistance. Education activities will be directed to all residents of the Branch River Watershed. The primary objectives are to:

- * Build community awareness, appreciation and stewardship of the local water resources, and awareness of local water quality resource problems.
- * Increase the understanding, knowledge and skills necessary to implement solutions to water quality resource problems.
- * Build awareness of the Branch River Priority Watershed Project and the Best Management Practices available to enhance and protect the water resource.

Conservation Planning and Contracting

Conservation planning and cost share agreements for installation of BMPs will be available to landowners throughout the implementation phase. Voluntary participation will be emphasized throughout the project. Sites determined as critical will be a priority. Other sites will be targeted for pollution control using locally developed GIS and inventory information. All practices on agreements must be installed before the project is scheduled to end. Landowners must maintain practices for at least ten years from the installation of the final practice listed on the cost share agreement.

Cost-share agreements are recorded with the register of deeds, and, in the event of property being sold, the new landowner will be required to install and maintain the remaining Best Management Practices. Practices can be installed as soon as a landowner signs a cost-share agreement with the Manitowoc or Brown County Land Conservation Department.

Project Implementation Costs

The DNR will award grants to Manitowoc and Brown County for the cost sharing of BMP's, staff support and educational activities. Table S-7 includes estimates of the financial assistance needed to implement nonpoint source controls in the Branch River Watershed, assuming a 75 percent participation rate of eligible landowners.

Project Evaluation and Monitoring

The evaluation strategy for the project involves collecting, analyzing and reporting information to track progress in three areas:

1. *Administrative:* This category includes the progress in providing technical and financial assistance to eligible landowners, and carrying out education activities identified in the plan. The Manitowoc and Brown County LCDs will track the progress in this area and report to the DNR and DATCP on an annual basis.
2. *Pollutant Reduction Levels:* The Manitowoc and Brown County LCDs will calculate the reductions in nonpoint source pollutant loadings resulting from changes in land use practices and report to the DNR and DATCP during the annual review meeting.

3. *Water Resources:* The DNR may monitor changes in water quality, habitat, and water resource characteristics periodically during the project and at the end of the project period.
4. *Geographic Information System:* GIS will be used as a tool to apply computer modeling technology to reassess nonpoint inventory information during the implementation phase of the project. In addition to data analysis, the GIS will be used to track pollutant load reductions that will be incorporated into an annual update of the implementation plan.

CHAPTER ONE

Purpose, Location Description, and Goals

Wisconsin Nonpoint Source Water Pollution Abatement Program

The State Legislature created the Wisconsin Nonpoint Source Water Pollution Abatement Program in 1978. The goal of the Program is to improve and protect the water quality of streams, lakes, wetlands, and groundwater by reducing pollutants from urban and rural nonpoint sources. The 107 square-mile Branch River Watershed, located in Manitowoc and Brown Counties, was designated a "priority watershed" in 1993. The primary objective of this project is to reduce nonpoint source pollution loads and to enhance and protect the water quality of the streams, groundwater, and lakes in the Branch River Watershed. The Branch River is part of the Manitowoc River Basin.

Nonpoint sources of pollution include: eroding agricultural lands, eroding streambanks and roadside, runoff from livestock wastes, agricultural practices, erosion from developing areas, and runoff from established urban areas. Pollutants from nonpoint sources are carried to the surface water or groundwater through rainfall runoff or seepage, and snowmelt.

Location and Community Information

The Branch River Watershed is a 107-square-mile drainage basin located approximately 8 miles southeast of the City of Green Bay and approximately 15 miles northeast of the City of Manitowoc in east-central Wisconsin (map 1-1). Approximately 61 percent (41,656 acres) of the Branch River lies within the boundaries of Manitowoc County and 39 percent (27,020 acres) within Brown County. Land use in the Branch River Watershed is primarily dairy farming. The intensity of cropland, pastures, and cattle numbers appear to be the greatest in the head-waters (Brown County) of the watershed.

Civil Divisions

The Branch River Watershed lies within Manitowoc and Brown Counties. Incorporated areas in the watershed include the village of Whitelaw and unincorporated communities such as Lark, Branch, Morrison, Wayside, Taus, Reif Mills, Mechalville, Maple Grove, Grimms, North Grimms, and Cato. Public land within the watershed includes the Way-Morr Park located in the town of Morrison.

Population Size and Distribution

The residential population of the Branch River Watershed has been estimated at 4,700 persons. Most of the watershed population lives in rural unincorporated areas. Population growth rates in the Branch River watershed between the 1980 and 1990 census show an overall stable trend. The

population of the watershed is projected to show a 1 percent increase between the years of 1990 and 2015 including a projected 12 percent increase for the village of Whitelaw.

Land Uses

Farming is of vital importance to this areas economy as agriculture comprises more than 70 percent of the land use in the watershed (Table 1-1). While the number of farms in the watershed has decreased steadily over the past two decades, the average farm size has increased from 164 acres in 1981, to 226 acres in 1991. With the continued trend of urban sprawl and the loss of farmland, the state of Wisconsin established a statute authorizing the development of farmland preservation plans. Financial assistance from the state has been given Manitowoc and Brown County the opportunity to define where prime agricultural land is located in the county able to provide tax incentives to farmers to maintain this land in agricultural use. In many areas, implementation measures are being taken in the form of exclusive agricultural, zoning districts. Kossuth township has not adopted exclusive agricultural zoning for Farmland Preservation.

Watershed Goals

To protect and improve the aquatic habitat and water quality of the Branch River Watershed by reducing sediment; control and reduction of phosphorus, water temperature improvement; and restoration of watershed hydrology.

To improve and protect from degradation the groundwater of the Branch River Watershed, thru improved management of nutrients and pesticides; and through protection of drainage to karst features.

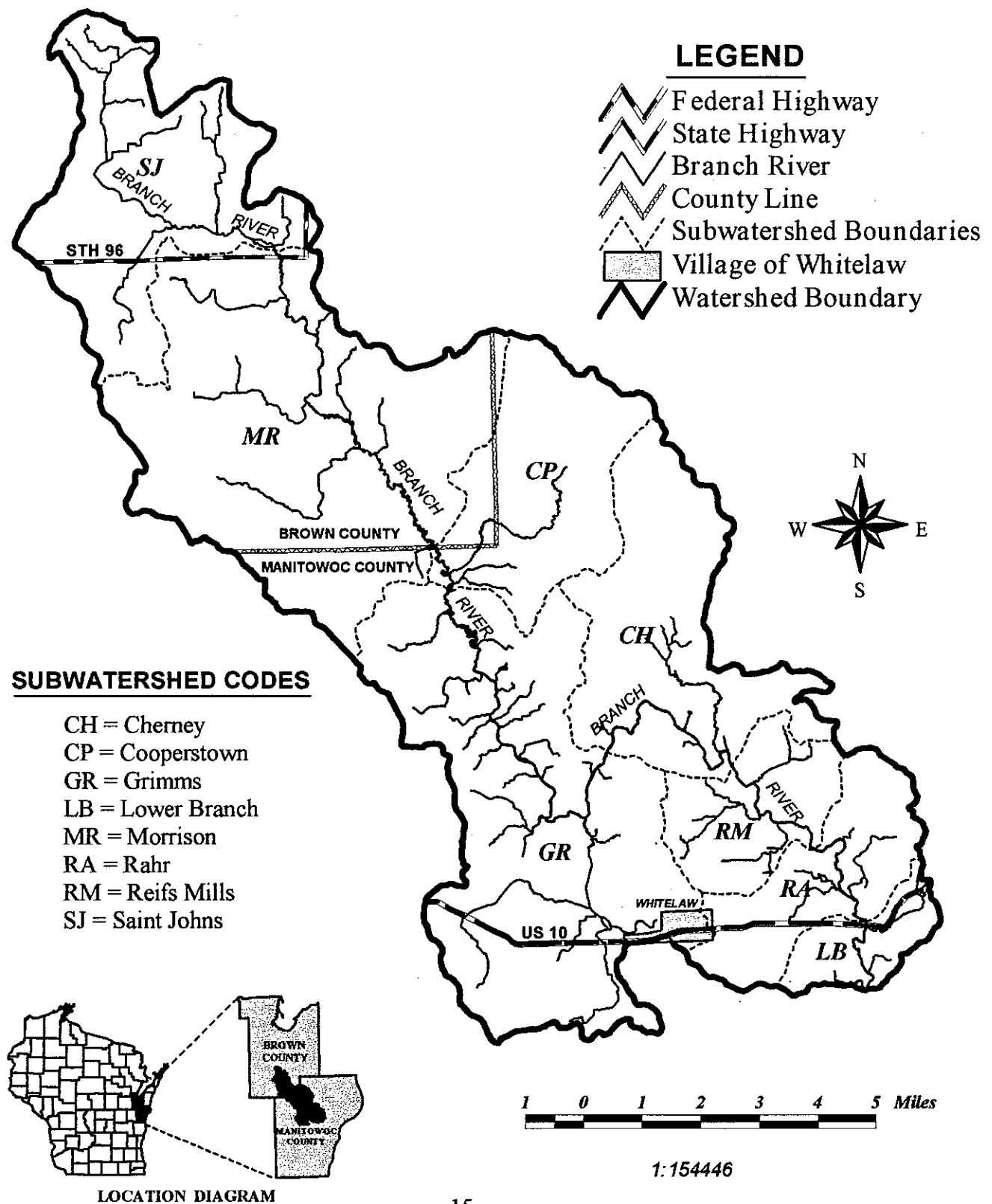
Table 1-1 Summary of Land Uses in the Branch River Watershed

Land Uses	Acres	Percent
Cropland	47,040	68.5%
Wetland ¹	9,861	14.4%
Woodland	5,683	8.3%
Grassland	2,949	4.3%
Developed	1,853	2.7%
Pasture	1,128	1.6%
Industry	58	0.2%
Total	68,676	100%

¹ This is an estimate of wetland acres based on the WINHUSLE inventory data. The estimates are of actual wetland acres, not cropped wet fields. See the wetland restoration section in chapter two for a more comprehensive estimate of wetland acreage.

Source: DNR and the Manitowoc and Brown County LCDs

Map 1-1. Branch River Priority Watershed



CHAPTER TWO

Watershed Conditions, Program Objectives, and Eligibility Criteria

This chapter discusses the physical characteristics, existing conditions, objectives and management categories for the water resources in the Branch River Priority Watershed. Information is presented for each subwatershed and by pollution source.

Physical Setting

Climate and Precipitation

The frequency, duration and amount of precipitation influences surface and groundwater quality and quantity, soil moisture content, runoff characteristics, and the physical condition of waterways. The Branch River Watershed lies in the continental zone which is characterized by winters which are long and relatively cold and snowy and summers which are mostly warm with periods of hot humid conditions. Mean annual precipitation for the region is about 33 inches of rain and melted snow; the majority falls in the form of thunderstorms during the growing season (May-September). Most runoff occurs in February, March, and April when the land surface is frozen and soil moisture is highest.

Topography

The landscape in the Branch River Priority Watershed is the result of several periods of continental glaciation that have left behind a gently sloping to sloping till plain that has some steep ridges. Also included are nearly level to gently sloping drainage ways and nearly level bottom lands. Elevation ranges from about 900 feet above sea level in the northern part of the watershed to about 700 feet where the Branch River enters the Manitowoc River in the south.

Geology

The Branch River Watershed lies just east of the Niagara escarpment that runs diagonally from northeast to southwest, parallel to the City of Green Bay and Lake Winnebago. The watershed is underlain by the Niagara dolomite formation that slowly slopes toward Lake Michigan to the East.

Two major glacial advances moved into the area where the Branch River watershed is today. As the glacial ice melted, it exposed the reshaped landscape much as we see it today. The Green Bay Lobe moved into this area from the northwest as it advanced down through the Bay of Green Bay. The Lake Michigan Lobe moved into the area from the northeast. The two Lobes came together near the center of the watershed just west of Menchalville. The steeper sloping areas in the watershed are often associated with the west edge of the Lake Michigan Lobe. Melt water running off the glacial ice, deposited lacustrine and outwash deposits in this area. Many depressions formed near the west margin of the Lake Michigan Lobe and have accumulations of organic soils in them.

Watershed Soils

Soils in the Branch River Watershed can be divided into five groups (Map 2-1). These groups are: 1) areas dominated by soils formed in glacial till; 2) areas dominated by soils formed in lacustrine deposits; 3) areas dominated by soils that are underlain by outwash deposits; 4) areas dominated by soils formed in glacial drift; and 5) areas dominated by organic soils.

Areas Dominated by Soils Formed in Glacial Till

Three soil associations that formed primarily in glacial till occur throughout the watershed.

Waymor-Hochheim Association - deep, nearly level to moderately steep, well drained soils that are loamy throughout on glacial till plains and ridges.

Hortonville - Symco Association - Deep, nearly level to moderately steep, well drained to somewhat poorly drained soils that are loamy throughout on glacial till plains and ridges.

Kewaunee - Manawa - Poygan Association - Deep, nearly level to steep, well drained to poorly drained soils with clayey subsoils on glacial till plains and ridges.

Uses and Limitations

The major soils in these associations are used for crops, pasture or woodland. These soils make up about 85 percent of the land area in the watershed. The main concerns in managing Waymor, Hochheim, Hortonville and Kewaunee soils are controlling water erosion and maintaining fertility. Improving drainage and maintaining tilth and fertility are the primary concerns on Manawa and Poygan soils when used for cultivated crops. The less sloping areas of Waymor, Hochheim and Hortonville soils are moderately suited to septic tank absorption fields because of slow permeability.

Areas Dominated by Soils Formed in Lacustrine Deposits

Two soil associations that formed in lacustrine deposits occur in the west central part of the watershed.

Zurich - Mundelein - Briggsville Association - Deep, nearly level to sloping, well drained to somewhat poorly drained soils that have loamy or clayey subsoils in glacial lake basins.

Pella - Mundelein - Shiocton Association - Deep, nearly level and gently sloping, somewhat poorly drained soils that are predominantly loamy throughout.

Uses and Limitations

The major soils in these associations are used for cultivated crops, pasture and woodland. The main concerns in managing Zurich and Briggsville soils are controlling water erosion and maintaining tilth

and fertility. Improving drainage and maintaining tilth are the main concerns on Mundelein, Pella and Shiocton soils. The well drained Zurich soils are suited to septic tank absorption fields.

Areas Dominated by Soils that are Underlain by Outwash Deposits

There is one association that formed in the soils underlain by outwash deposits that occurs in the central and southern parts of the Branch River Watershed.

Wasepi - Plainfield - Boyer Association - Deep, nearly level to moderately steep, excessively drained to somewhat poorly drained soils that are sandy and loamy on moraines, terraces and outwash plains.

Uses and Limitations

The major soils in this association are used for cultivated crops, pasture, woodland or as wildlife habitat. The main concerns in managing Wasepi soil are improving drainage and maintaining tilth and fertility. Controlling water erosion and soil blowing, and improving tilth and fertility are the main concerns on Plainfield and Boyer soils. Plainfield and Boyer soils are poorly suited to septic tank absorption fields because of poor filtering capacity and the danger of groundwater pollution.

Areas Dominated by Soils Formed in Glacial Drift

There is one small association that formed in glacial drift that occurs in the west central part of the watershed.

Kewaunee - Boyer - Nichols Association - Deep, gently sloping to steep, well drained and moderately well drained soils that are sandy, loamy, or clayey and are on moraines, outwash plains, and lacustrine plains.

Uses and Limitations

The major soils in this association are used for cultivated crops. The steeper soils are used for pasture or as wildlife habitat. The main concerns in managing these soils for crops are controlling water erosion and maintaining tilth and fertility. The less sloping areas of Nichols soils are suited to septic tank absorption fields.

Areas Dominated by Organic Soils

There are two associations that formed in organic deposits that dominantly occur in the east central part of the watershed.

Carbondale - Cathro - Marsh Association - Deep, nearly level, very poorly drained organic soils and marshes in glacial lake basins and on till plains.

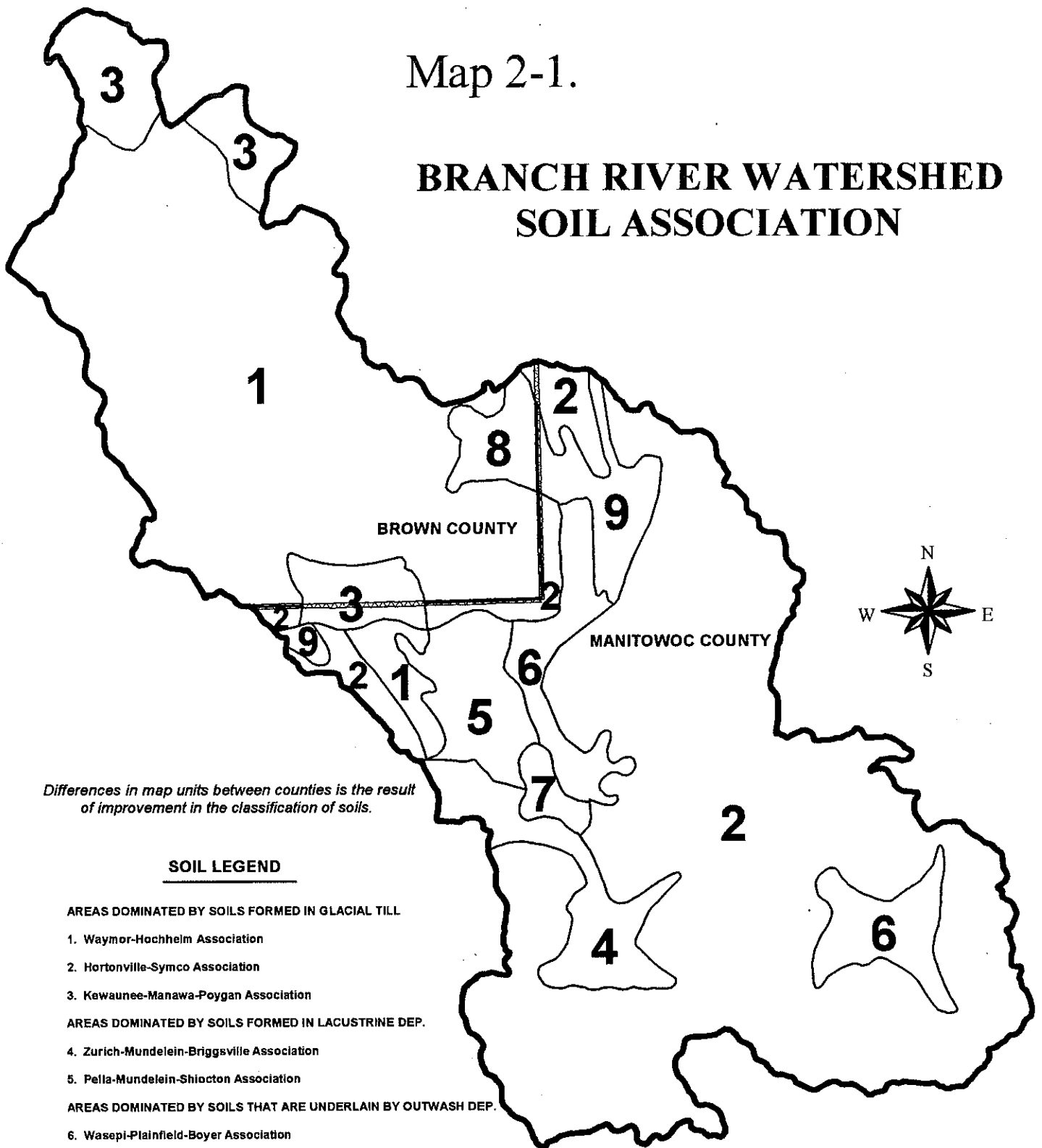
Houghton - Palms - Willette Association - Deep, nearly level, very poorly drained organic soils in glacial lake basins and on till plains.

Uses and Limitations

The major soils in these associations are in natural trees and sedges. Many areas are used for wildlife habitat and some small areas are used for pasture. These soils are poorly suited to cropland and septic tank absorption fields because of wetness.

Map 2-1.

BRANCH RIVER WATERSHED SOIL ASSOCIATION



Differences in map units between counties is the result of improvement in the classification of soils.

SOIL LEGEND

AREAS DOMINATED BY SOILS FORMED IN GLACIAL TILL

1. Waymor-Hochheim Association
2. Hortonville-Symco Association
3. Kewaunee-Manawa-Poygan Association

AREAS DOMINATED BY SOILS FORMED IN LACUSTRINE DEP.

4. Zurich-Mundelein-Briggsville Association
5. Pella-Mundelein-Shiocton Association

AREAS DOMINATED BY SOILS THAT ARE UNDERLAIN BY OUTWASH DEP.

6. Wasepi-Plainfield-Boyer Association

AREAS DOMINATED BY SOILS FORMED IN GLACIAL TILL

7. Kewaunee-Boyer-Nichols Association

AREAS DOMINATED BY ORGANIC SOILS

8. Carbondale-Cathro-Marsh Association
9. Houghton-Palms-Willette Association



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Water Resource Conditions and Goals

This section describes the general conditions of the surface and groundwater resources in the Branch River watershed. It also describes the classifications used for Wisconsin's waters, and the surface water and recreational resources in the watershed. Descriptions of the subwatersheds are also included, and table 2-1 provides a summary of the watershed's resources. Groundwater resources and quality are also discussed.

Water Use Classifications

Surface water quality standards and criteria are expressions of the conditions considered necessary to support biological and recreational uses. Water quality standards for recreational and biological uses are contained in Chapters NR 102, NR 103, NR 104, and NR 105 Wisconsin Administrative Code.

Fish and Other Aquatic Life Uses

The biological use of the watershed streams is defined by the fish and other aquatic life communities currently living in the stream. Use assessment of the watershed streams are as follows:

Great Lakes = Great Lakes Communities includes Lake Superior, Lake Michigan and Green Bay including all bays, arms and inlets thereof and including those tributaries which serve as a spawning area for anadromous fish species.

COLD = Coldwater Communities include surface waters capable of supporting a community of coldwater fish and other aquatic life or serving as a spawning area for coldwater fish species.

WWSF = Warmwater Sport Fish Communities include surface waters capable of supporting a community of warmwater sport fish and/or serving as a spawning area for warmwater sport fish.

WWFF = Warmwater Forage Fish Communities include surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.

LFF = Limited Forage Fish Communities

Surface Water Resources

For the purposes of this project, the Branch River Watershed is subdivided into eight individual subwatersheds. Each subwatershed conveys surface water to the Branch River which ultimately drains to the Manitowoc River. Major tributaries, lakes, wetlands, and subwatershed divides are shown in map 1-1. See table 2-1 for the biological use classification and general condition of major water resources in the Branch River Watershed.

Table 2-1 Surface Water Resource Conditions, Problems, and Nonpoint Sources of Pollution.

Subwatershed	Stream Name	Fish and other aquatic life uses ¹	Habitat Rating ²	Biotic Index Rating ³	Problems/ Limiting Factor ⁴	Observed or Potential Sources ⁵
Saint Johns (SJ)	Branch River	WWSF			FLO, SED, PL, CH, DO, HAB, TEMP	CL, BY, NR
Morrison (MR)	Branch River	WWSF	Fair to Poor	Fair to Poor	FLO, SED, PL, CH, DO, HAB, TURB, TEMP	CL, PSB, PSM, BY, NR
	Intermittent Tributary (T21N, R21E, S9, NESW)	LFF				
	Intermittent Tributary (T21N, R21E, S33, NENE)	WWFF		Very Poor		
	Perennial Tributary (T21N, R21E, S21, NESE)	WWSF	Fair			
Cooperstown (CP)	Branch River	GLAC, ERW			SED, CH, NUT, PL, DO, HAB	CL, SB, BY, NR
	Perennial Tributary (T20N, R22E, S6, SENE)	WWSF	Fair			
	Intermittent Tributary (T20N, R22E, S6, NESE)	WWFF	Fair			
	Kellners Lake	-----				
Grimms (GR)	Branch River	COLD, GLAC, ERW	Good to Fair		SED, CH, DO, PL, NUT, HAB, TURB, TEMP	CL, SB, PSM, BY, NR
	Intermittent Tributary (T19N, R22E, S3, SWNE)	LFF				
	Perennial Tributary (T20N, R22E, S27, NWSW)	WWSF	Fair	Fairly Poor		
	Hempton Lake	-----				
Cherney (CH)	Branch River	COLD, GLAC, ERW	Good	Good	PL, NUT, SED, TEMP, HAB	CL, PSB, BY, NR
	Perennial Tributary (T20N, R22E, S24, NESW)	COLD	Good to Poor			
Reifs Mills (RM)	Branch River	COLD, GLAC, ERW	Excellent to Good		DO, PL, NUT	CL, BY, NR

Subwatershed	Stream Name	Fish and other aquatic life uses ¹	Habitat Rating ²	Biotic Index Rating ³	Problems/ Limiting Factor ⁴	Observed or Potential Sources ⁵
Rahr (RA)	Branch River	COLD, GLAC, ERW			DO, PL, NUT	CL, BY, NR
Lower Branch (LB)	Branch River	COLD, GLAC, ERW	Good to Fair	Very Good to Good	SED, PL, DO, NUT	CL, PSI, BY, NR

LEGEND:

¹ Fish and other aquatic life uses - Current - this column indicates the current biological use and classification supported by the stream.

- GLAC - great lakes aquatic communities
- COLD - coldwater communities
- WWSF - warmwater sport fish communities
- WWFF - warmwater forage fish communities
- LFF - limited forage fishery (intermediate surface waters)
- ERW - exceptional resource waters

² Habitat Rating - this column indicates the relative quality and quantity of aquatic life habitat in the stream.

³ Biotic Index Rating - this column indicates water quality condition based on the Hilsenhoff Biotic Index which uses macroinvertebrates as an indicator of organic pollution.

⁴ Limiting Factors

- HAB - Habitat (lack of sufficient habitat)
- SED - Sedimentation
- TEMP - Temperature (warm)
- DO - Dissolved oxygen problems
- FLOW - Limited stream flow
- PL - Aquatic plants/algae (abundant)
- NUT - Nutrient enrichment
- TURB - Turbidity
- CH - Channelization (ditching)

⁵ Observed or Potential Sources

- CL - Cropland erosion
- SB - Streambank erosion
- PSB - Pastured streambanks
- BY - Barnyard or exercise lot runoff
- PSM - Point source, municipal treatment plant discharge
- PSI - Point source, industrial discharge
- NR - Nutrient Runoff, commercial or organic fertilizer

Watershed Streams

The Branch River and several unnamed intermittent and perennial tributaries to the Branch River make up the watershed drainage area. The Branch River discharges to the Manitowoc River near the community of Branch. The Branch River is classified as great lakes communities downstream of the Brown County line and warm water forage fish communities above the Brown County line. The Branch River is designated as exceptional resource waters. Two large wetlands, Cooperstown Swamp and Morrison Swamp, two small lakes, Hemptons and Kellners Lake, are components of the water resources in this watershed.

The many intermittent tributaries make up the headwater of the Branch River system. Continuous flow starts near the highway 96 crossing. The river is generally slow, wide and deep in these upper reaches until about CTH J where the gradient increases significantly which changes the character of the river. Habitat is degraded in these upper reaches from sedimentation from bank erosion and field runoff. Most of the bank erosion is caused by flooding, however, livestock access does contribute. Nutrients, pesticides, and pathogens are often attached to sediment and delivered to surface water with sediment runoff. Habitat is also degraded when nutrients cause excess aquatic plant growth (algae and macrophytes). Phosphorus is the most significant nutrient which promotes aquatic plant growth. As the plants photosynthesize in the daylight they produce abundant oxygen, but the oxygen is used during plant respiration at night. These severe oxygen fluctuations stress aquatic life.

The Branch River from CTH J downstream supports higher quality aquatic life habitat than upstream because the river is more narrow, shallow, has many riffles, pools and a rocky substrate. The lower reaches are not directly impacted by sediment loading because the higher gradient of the river scours the substrate and flushes it downstream; however, the effects of nutrient loading to the river can be seen by the abundant aquatic plant growth on the substrate.

The lower reaches of the Branch River have an excellent anadromous salmonid fishery. The lower Branch River is the site of stocking of thousands of steelhead smolts and has major seasonal runs of anadromous trout and salmon. The fishery for these species is widely known and attracts anglers from all over the Midwest to participate in the fishery. Consequently, this section of the river is within the proposed Manitowoc - Branch River Fishery Area (WDNR, 1993). This fishery area designation would protect the developing fishery (especially steelhead) by acquiring riparian lands where possible, by encouraging proper land practices on non-acquired properties, and providing adequate public access and other outdoor recreational activities.

Native fish species, including smallmouth bass and northern pike have been on the decline in much of the watershed in recent years, but still are important members of the fish community. Northern pike are found in upstream sections of the Branch River and in tributaries that have warmer water. Small mouth bass are found in middle sections of the river that have cooler water temperatures. Trout and salmon are found in the lower section of the Branch River that are rocky, have the coolest water temperatures and a good flow. In general, both intermittent and perennial tributaries supply cooler water to the Branch River which ultimately benefits the aquatic communities of the river.

In areas of the Branch River which are intermittent or in tributaries to the Branch River, it is extremely important that any wetlands that are present should be protected or enhanced to provide spawning sites for northern pike. These wetlands would also slow the release of water downstream and permit northern fry to reach the Branch River. Wetlands also filter incoming water and act as a sediment trap which reduces the amount of nutrients and sediment entering the stream and improves water quality. If possible, wetlands should be created in areas that lack them to produce the same effects. Care must be taken in choosing these locations to mimic natural conditions and produce the desired effect.

Eroding croplands and stream banks and improperly managed livestock operations are the major sources of nonpoint pollution in the watershed. Overall, with the reduction of nonpoint source pollution, the Branch River watershed streams have the potential for better aquatic life habitat. An increase in habitat would promote longer residence, greater diversity, and abundance of fish species and macroinvertebrates. A reduction of pollutants to the two lakes in this watershed would only slightly slow their eutrophication. A reduction of pollutants to the wetlands would protect the wetlands from further degradation.

Surface water quality conditions in the watershed will be described in more detail in the subwatershed descriptions later in this chapter.

Groundwater Resources

Regional Aquifers

Groundwater is the only source of drinking water in the Branch River Priority Watershed. Groundwater is stored in porous spaces and cracks within subsurface soil and rock layers. The unconsolidated materials and rock layers which are saturated with water are defined as an aquifer. The top of the uppermost aquifer is called a water table.

Since 1936, the State of Wisconsin has required well drillers to document well construction and rock and soil layers encountered during well installation. Information from geologic logs, driller construction reports and Wisconsin Geological and Natural History Survey (WGNHS) reports is combined to identify groundwater occurrence in the Branch River Watershed.

There are two principal aquifers within the watershed, the unconsolidated sand and gravel aquifer and the consolidated Silurian Dolomite aquifer. The sand and gravel aquifer consists of unconsolidated glacially deposited sands and gravels which are generally less than 100 feet in total thickness. The underlying Silurian Dolomite aquifer is the principal aquifer and can be more than 450 feet thick. At the base of this aquifer is the relatively impermeable Maquoketa Shale, which can be as thick as 400 feet. Therefore, it is unlikely that wells in the Branch River Watershed would utilize groundwater from beneath the shale, as the upper aquifers can be prolific and the costs of deep wells are prohibitive.

Private wells in the unconsolidated sand and gravel aquifer typically range from 80 feet to 160 feet deep and yield 12 to 20 gallons per minute. The depth to water is generally about thirty feet below the ground surface. Wide variations from this can exist depending upon ground surface elevation and the glacial materials encountered in the subsurface. Artesian wells and springs may be present in areas where the groundwater is confined by a low permeability layer such as a clay layer. Clay layers may occur throughout glacially deposited sediments.

The Silurian Dolomite aquifer underlies the sand and gravel aquifer. Private water supplies which utilize this principal aquifer typically range from 55 to 341 feet in depth. The top of this dolomite can be found at ground surface to a depth of more than 120 feet below ground surface.

Water in the Silurian Dolomite aquifer is stored and withdrawn from porous fractures in the rock. Therefore the available water quantity and quality is highly dependent upon the density and configuration of fractures present. High density, well connected, and thick mantled fractures are the most susceptible to groundwater contamination resulting from land-use. Due to bedrock fracture conditions, well yields can be variable but are quite good and range from 10 to over 100 gallons per minute.

Direction of Groundwater Flow

Local shallow groundwater flow in the Branch River Watershed roughly follows the topography of the land surface and flows "downhill" or down gradient toward the Branch River. Groundwater usually enters the aquifer in upland areas as snowmelt or rainfall and percolates down through the soil until it reaches the saturated zone of an aquifer. This process of aquifer recharge typically occurs in upland areas and results in down gradient flow toward low points or discharge areas in a drainage basin. Sometimes it reaches the surface in the form of springs, artesian wells, or seeps into swamps, rivers, or lakes. These are defined as discharge areas. That portion of stream flow comprised of groundwater contributions is called baseflow. The Branch River in this watershed is comprised of baseflow and overland flow or runoff.

Beneath the unconsolidated sand and gravel aquifer is the consolidated Silurian Dolomite bedrock aquifer. This regional aquifer can be recharged anywhere where fractures, sinkholes, or openings are thinly covered or exposed at the ground surface. The Silurian bedrock is inclined or dipping slightly eastward across a broad regional extent. Groundwater flow direction in this regional aquifer does not necessarily mimic the surface topography but instead is controlled by fracture configurations, dip of the bedrock and the degree of confinement by overlying impermeable layers.

In the Branch River Watershed the unconsolidated sand and gravel aquifer and the consolidated Silurian Dolomite aquifer can be highly susceptible to pollution from land use. The sand and gravel aquifer is most at risk where the depth to the water table is shallow and soils are permeable. The Silurian Dolomite aquifer is most at risk where overlying soils are thin and porous and the bedrock is fractured or solution weathered.

Due to these high pollution susceptibilities, it is important to identify the location of groundwater recharge and discharge zones in the watershed and to avoid development on or near environmentally sensitive areas.

Most groundwater contamination is related to poorly sited land uses, such as agricultural manure storage and handling facilities located near a natural spring, seepage lake, karst feature, or over shallow soils. Once groundwater has been contaminated, depending on the pollutant, successful remediation can take years or may never occur. Remedial techniques are often extremely expensive. In the mean-time, health threatening contaminants can spread from one well to the next without the well users' awareness of the problem. This difficult situation can be prevented through safe storage and handling techniques for pesticides, for example, or through reducing the use of the problematic chemicals in the first place.

Groundwater Quality

Groundwater quality in the Branch River Watershed is generally considered poor. As part of the Water Quality Appraisal Report (Appendix A) private well samples were collected and analyzed for nitrate (NO_3) + nitrite (NO_2). Sample analytical results are summarized in table 2-2. Samples analyzed for nitrate (NO_3) + nitrite (NO_2) are measured in parts per million (ppm) or its equivalent, milligrams per liter (mg/L). The groundwater enforcement standard (ES) for nitrate is 10 mg/L; nitrate (NO_3) + nitrite (NO_2) concentrations above 2 mg/L exceed the states preventive action limit (PAL); The well water samples that were collected within the Branch River Watershed showed concentrations ranging from not detected to 27.9 mg/L in Manitowoc County and 26.5 mg/L in Brown County.

Enforcement Standard (ES) Health Advisory Level: The concentration of a substance at which a facility regulated by DILHR, DATCP, DOT or DNR must take action to reduce the concentration of the substance in groundwater.

Preventative Action Limit (PAL): A lower concentration of a contaminant than the Enforcement Standard. The PAL serves to inform DNR of potential groundwater contamination problems, to establish the level at which efforts to control the contamination should begin, and to provide a basis for design codes and management criteria.

Forty samples (27 percent) exceeded 10 mg/L and one-hundred of the samples (67 percent), exceeded 2 mg/L. Results so far do not indicate a pattern of groundwater contamination that can be linked to specific sources of nitrate. These results do not represent the overall groundwater quality of the watershed.

No samples were collected for coliform bacteria or hazardous substances such as volatile organic compounds. Coliform bacteria can be a drinking water problem where septic

systems, land spreading of manure or barnyards are located up gradient (generally uphill) from a private well. Bacteria can enter the drinking water supply through karst features, old unused wells, or along the well casing of improperly constructed wells. Wells with high levels of bacteria can often be rehabilitated.

Volatile organic compounds generally enter a well from nearby leaking underground gasoline or other fuel storage tanks and spills. Once these compounds are in the groundwater they are difficult to clean up. In most cases, the contaminated wells will need to be properly abandoned and a new well drilled.

Table 2-2 Well Sampling Results: NITRATES in the Branch River Watershed

Subwatershed	Number of Nitrate Samples		Number of Nitrate Samples		Number of Nitrate Samples	
	< than 2.0 mg/l	Percent	2.0 to 10.0 mg/l	Percent	> than 10.0 mg/l	Percent
Saint Johns	18	12%	3	2%	3	2%
Morrison	10	7%	19	13%	14	9%
Cooperstown	5	3%	5	3%	2	> 1%
Cherney	2	> 1%	1	< 1%	1	< 1%
Grimms	9	6%	22	15%	17	12%
Reifs Mills	2	> 1%	5	3%	1	< 1%
Rahr	1	< 1%	3	2%	0	0%
Lower Branch	2	> 1%	2	> 1%	2	> 1%
TOTAL	49	33%	60	40%	40	27%

Well Sampling Results: TRIAZINE in the Branch River Watershed						
Subwatershed	Number of Triazine Samples		Number of Triazine Samples		Number of Triazine Samples	
	< than 0.3 µg/l	Percent	0.3 to 3.0 µg/l	Percent	> than 3.0 µg/l	Percent
Saint Johns	23	19%	1	< 1%	0	0%
Morrison	39	32%	4	3%	0	0%
Cooperstown	10	8%	1	< 1%	0	0%
Cherney	2	< 2%	0	0%	0	0%
Grimms	30	24%	7	6%	0	0%
Reifs Mills	3	> 2%	1	< 1%	0	0%
Rahr	0	0%	0	0%	0	0%
Lower Branch	3	> 2%	0	0%	0	0%
TOTAL	110	89%	14	11%	0	0%

Water Supplies

Water supplies for domestic, agricultural, and industrial uses in the Branch River Watershed are obtained mainly from private groundwater sources and one municipal system. The village of Whitelaw has a single groundwater source that serves approximately 650 residents.

There are three principal aquifers beneath the watershed from which groundwater can be obtained. These include a limited sand and gravel aquifer, a dolomite (limestone aquifer), and a sandstone aquifer. The dolomite aquifer is the primary aquifer, while the sandstone aquifer remains largely untapped.

Municipal water supply systems supply more than 15 percent of the watershed population. The village of Whitelaw has a groundwater source in the dolomite aquifer at approximately 495 feet below the surface.

Wellhead Protection

There are no wellhead protection plans in place for wells within the Branch River Watershed. District and Central Office DNR staff have conducted contaminate source inventories for each Public Well Supply in the state in 1995. The DNR has also delineated a calculated fixed radius for each public well from existing well construction and pumping data.

Potential Groundwater Quality Problems

Previously identified potential groundwater quality problems in the Branch River Watershed include:

Sites or Facilities which may threaten to cause environmental pollution list:

- *Lemberger Fly Ash Landfill, Town of Franklin, Manitowoc County*
- *Lemberger Sites, Town of Franklin, Manitowoc County*

Leaking Underground Storage (LUST) Program List:

- *Branch Cheese, Branch, Manitowoc County*
- *Seefeld Miron, Town of Cato, Manitowoc County*
- *Whitelaw Conv., Town of Cato, Manitowoc County*

Registry of Waste Disposal Sites:

- *Town of Morrison, Morrison, Brown County*
- *Town of Cato, Cato, Manitowoc County*
- *Village of Whitelaw, Town of Cato, Manitowoc County*

Spills Program List:

- *Diesel Fuel, Cato, Manitowoc County*
- *Gasoline, Village of Whitelaw, Manitowoc County*
- *Milk, Village of Branch, Manitowoc County*
- *Gasoline, Village of Branch, Manitowoc County*
- *Fuel Oil, Village of Whitelaw, Manitowoc County*
- *Eptam (Contained / Recovered), Village of Whitelaw, Manitowoc County*

These sites were listed in DNR Publication SW-144, The Wisconsin Remedial Response Site Evaluation Report (December 1991) which lists superfund sites, solid and hazardous waste disposal sites, leaking underground storage tank sites and reported spill sites. Potential pollution associated with nonpoint sources is described in various sections throughout the remainder of this chapter.

Subwatershed Discussions

Monitoring was conducted in the Branch River watershed from September 1993 to August 1994 to appraise the physical and water quality conditions for each subwatershed in the Branch River Priority Watershed Project. Aquatic macroinvertebrates were collected and sample results were evaluated using the Hilsenhoff Biotic Index (HBI) or Hilsenhoff Family level Biotic Index (FBI) and Ephemeroptera, Plecoptera, Trichoptera (EPT) Index. The HBI and FBI provide a relative measure of organic loading to the stream. Percent EPT is the percent Ephemeroptera, Plecoptera, Trichoptera genera out of the total number of genera in a sample. These insect orders are generally known to be intolerant of organic pollution. Groundwater samples were gathered from farm owners between April 1994 and November 1994 to appraise the general condition of groundwater and contamination sources. Water samples were collected only with the landowners permission. Samples were analyzed for Nitrate, and screened for triazine. Table 2-2 summarizes the subwatershed well sample results. Table 2-1 summarizes the subwatershed conditions for surface water.

The following water quality discussions for each subwatershed are broken into four parts: a general description, water quality conditions, the nonpoint source pollutants impairing the subwatershed, and objectives for the subwatershed.

The following is an explanation of the meaning of the goals for surface water resources:

- **Protection:** Protection refers to maintaining the present biological uses supported by a stream. For example, if a stream supports a healthy warm water sport fishery, the goal seeks to maintain that use.
- **Enhancement:** Enhancement refers to a change in the overall condition of a stream or lake within its given biological use category. For example, if a stream supports a warm water fishery whose diversity could be enhanced, the goal focuses on changing those water quality conditions which keep it from achieving its full biological potential.
- **Restoration:** Restoration refers to upgrading the existing capability of the resource to support a higher category of biological use. An example would be a stream which historically supported healthy populations of warmwater game fish, but no longer does. This goal seeks to improve conditions allowing viable populations of forage and warmwater game fish species to become reestablished.

The water quality conditions needed to support the goals for streams and lakes are the basis for determining the type and level of nonpoint source control to be implemented under the priority watershed project.

Table 2-2A Subwatershed Goals

	reduce soil loss	reduce nutrient load	enhance and restore wetlands	reduce bank erosion	protect/ enhance fish spawning sites	develop warm water fishery	protect groundwater	stream corridor develop- ment	maintain wildlife values	protect springfeed areas
St. Johns	H	H	H				H	H		
Morrison	H	H	H	M	M	M	H	H		
Cooperstown	H			M			H	H	M	
Grimms	H	H	H	M			H	H	M	H
Cherney	M	M	H	M			H	H		
Reifs Mills	H	H	H				H	H		H
Rahr	H	H	H				H	H		H
Lower Branch	L	M	M				H	H		

LEGEND:

H, M, L - Indicates that a High, Medium, or Low level of nonpoint source pollutant control is needed to meet the water resource objectives.

Subwatershed Objectives

Sediment Objective: Reduce overall sediment delivered to surface water by 25 percent. To meet this objective, the following is needed:

- * Reduce sediment delivered to watershed streams from agricultural uplands by at least 25 percent.
- * A minimum of a 10 percent reduction of streambank sediment delivered to all streams and at least a 10 percent overall repair / restoration of all streambank habitat.
- * A minimum of a 50 percent reduction of sediment reaching the stream from gully erosion.

- * Establish or maintain grassland and woodland corridors to protect or enhance the water resource. Corridors will provide wildlife habitat, streambank stabilization, canopy cover to lower stream temperatures, and pesticide and sediment retention.

Phosphorus Objective: Reduce overall phosphorus delivered to surface water by 28 percent. To meet this objective, the following is needed:

- * A minimum of a 62 percent overall reduction in phosphorus (organic) from barnyards.
- * Eliminate manure applications on snow-covered cropland not suited for winter spreading.
- * A minimum of a 25 percent reduction in phosphorus from upland erosion.

Groundwater Objective: To protect and enhance the groundwater resource in the Branch River Watershed, the following objectives will need to be achieved:

- * Eliminate direct discharges of nonpoint source pollutants to areas acting as direct conduits to groundwater such as sinkholes, unused wells, and creviced bedrock.
- * Eliminate manure applications on snow-covered cropland not suited for winter spreading.
- * Reduce the over-application of commercial and organic fertilizers on soils with yield capabilities less than 70 percent of the surrounding soils.
- * Provide landowners with an extensive informational and educational program to promote awareness and to accept responsibility for the groundwater resource.

Hydrology Restoration Objective: To improve aquatic habitat through reduced stream temperatures and stabilize stream flow, the following will need to be achieved:

- * Restore at least 10 percent of degraded or prior converted wetlands.
- * Reduce average maximum stream temperatures by at least two-degrees fahrenheit on designated stream segments through vegetated buffer establishment.
- * Preserve, maintain, or develop woodland and grassland corridors through buffers, wildlife habitat plantings and conservation easements.

Community Action Objective: To develop community action that fosters change and promotes sustained long-term improvement and protection of the Branch River Watershed resources, the following will need to be achieved:

- * Train watershed staff to facilitate understanding and education about the watershed pollution reduction process.
- * Develop and implement educational programs that move the watershed community from awareness to action.
- * Facilitate the organizing of a community group to provide protection and stewardship of the watershed over time.

SAINT JOHNS SUBWATERSHED (SJ)

Description

Saint Johns subwatershed consists of the Branch River from its headwaters to Hwy 96 and nine intermittent and two perennial tributaries to the Branch River. Continuous flow starts in the Branch River at approximately Hwy 96. Upstream the river and its tributaries only flow during runoff events.

Water Quality Conditions

The Branch River in this section is classified as warm water forage fish communities. *In summer, water ponds in the river channel becomes warm and stagnate with low dissolved oxygen levels and thick duck weed growth. The Branch River and its tributaries in this subwatershed are significantly limited by flow during most of the year.* In this headwater area, the river banks appear to be well buffered with dense tree and shrub growth. The river bed is mostly soft sediment. Several of the intermittent tributaries have been ditched to accommodate rapid field drainage.

A reduction of sediment and nutrient loading would have minimal benefits to the water resources in this subwatershed, however, would improve water quality downstream. The protection, enhancement, or creation of wetlands would provide spawning sites for northern pike.

Groundwater contamination by nitrate and triazine has been detected within the subwatershed. Wells with contamination are distributed among wells with low or no contamination. Contamination may be originating from cropland, animal lots or domestic sewage disposal. Reduction of cropland nitrogen fertilizer inputs, crediting of nitrogen from manure and crop residues, and improved management of livestock yard runoff will help maintain or improve groundwater quality over time.

Nonpoint Source Pollutants

- The Saint Johns subwatershed contains 28 animal lots which deliver 1,787 pounds of phosphorus to surface water annually. This represents an estimated 19 percent of the total phosphorus from barnyard runoff in the watershed. The water resource objective

in the Saint Johns subwatershed is to reduce phosphorus runoff from barnyards by at least 65 percent.

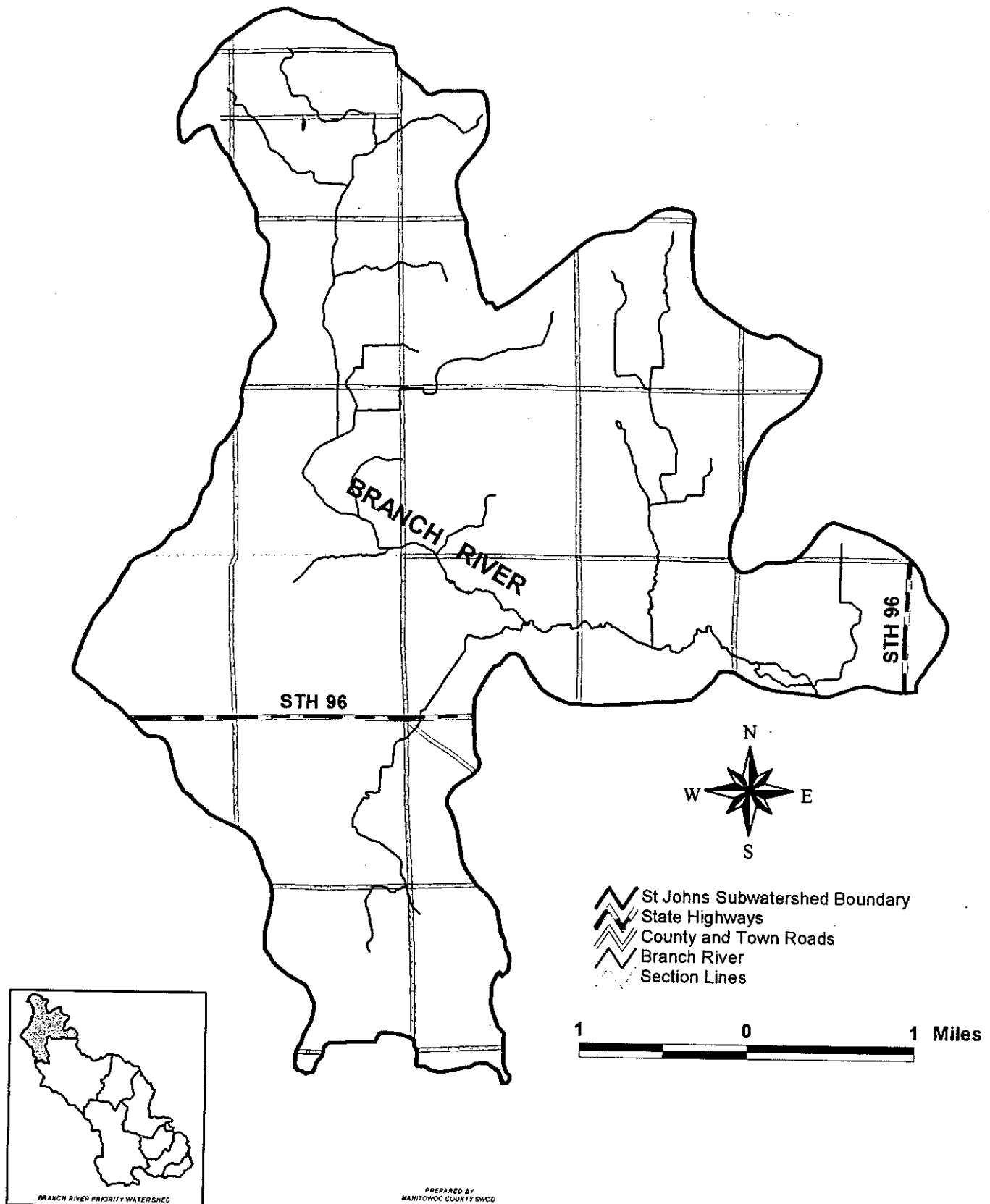
- Upland sediment delivered to streams within the Saint Johns subwatershed accounts for an estimated 18 percent (2,287 tons) of the total watershed sediment load. Cropland erosion is the major source of upland sediment in this subwatershed. The water quality resource objective is to reduce upland sediment delivered to the stream by at least 25 percent.
- Stream bank erosion occurring within the Saint Johns subwatershed accounts for an estimated 7 percent of the total sediment load caused by eroding banks in the watershed. The water resource objective in the Branch River Watershed is to achieve a minimum 10 percent overall reduction in sediment from eroding streambanks.
- An estimated 23 percent of the total sediment load that is delivered to watershed streams in the form of gully erosion, occurs within the Saint Johns subwatershed. The water resource objective is to reduce gully erosion by at least 50 percent, with individual farm goals of controlling all gullies contributing more than 3 tons/year down to zero.
- Of the 24 well-water samples taken in the Saint Johns subwatershed and analyzed for nitrate contamination, 25 percent of the wells exceeded the PAL limit of 2 mg/l and 13 percent exceeded the ES Health Advisory Level of 10 mg/l. Triazine residue was detected in 4 percent of the potable wells tested within the subwatershed (Table 2-2). The water resource objective within the Saint Johns Subwatershed is to implement nutrient management plans on at least 90 percent of all cropland acreage.

Water Resources Goals and Objectives

The following objectives are recommended for the surface water resources of Saint Johns subwatershed:

- A. Reduce sediment and nutrient loading by a high level during runoff events to enhance downstream aquatic life habitat.
- B. Preserve, maintain, or develop stream woodland and grassland corridors. Well developed corridors provide wildlife habitat, canopy, bank stabilization, and sediment retention.
- C. Protect, enhance, or create wetlands to provide spawning sites for northern pike.
- D. Protect or enhance groundwater quality by a high level.
- E. Decrease summer peak water temperatures by at least two-degrees fahrenheit to enhance native stream fish populations.

Map 2-2. Saint Johns Subwatershed



MORRISON SUBWATERSHED (MR)

Description

Morrison subwatershed consists of the Branch River from Hwy 96 downstream to the Brown and Manitowoc County line, one perennial and eleven intermittent drainage streams. The large Morrison Swamp is located in this subwatershed. There is also a golf course in this subwatershed. Several of the intermittent tributaries have been ditched (Map 2-3).

Water Quality Conditions

Morrison Sanitary District #1 discharges to an unnamed intermittent tributary (T21N, R21E, S9, NESW) to the Branch River.

At CTH G and Wayside Road, an unnamed intermittent tributary (T21N, R21E, S33, NENE) received an average macroinvertebrate biotic index value of 8.9 in 1987. This value indicates very poor water quality; however, biotic index values would not be expected to be much better given that this stream only flows intermittently. This stream is classified as warm water forage fish communities.

The only perennial tributary (T21N, R21E, S21, NESE) in this subwatershed discharges to the Branch River between the two CTH G crossings. This unnamed tributary received a fair aquatic life habitat rating. It has well buffered banks, 10-30% gravel and rubble substrate and some silt deposition near the banks and slow areas.

The Branch River in this section is classified as warm water forage fish communities. The river is very slow moving, warm, and stagnant. The river is especially turbid after runoff events. The Branch River received aquatic life habitat ratings ranging from good to fair at four different locations. At Hill Road, the Branch River received a poor rating, however, in 1987 it received a fair rating. Generally, the river has 30-50 percent rubble, gravel and other stable substrate. A layer of fine silt covers the substrate and is easily suspended with disturbance. Bank erosion is severe in some locations, but uncommon in most. Portions of the river banks are pastured and eroding. Macrophytes such as filamentous algae, duck weed, and Elodea are abundant in the slower portions of the river. The river appears to have been channelized at Way-Morr Park.

Macroinvertebrate samples ranged from fair at CTH G (HBI of 6.47) in 1987 to poor (HBI of 8.03 and 7.98 at Mill Road; 8.15 and 7.68 at Way-Morr Park) in 1993. The EPT index (Subwatershed Discussion section of chapter two) was 23 to 15 percent at Mill Road and 13 percent at Way-Morr Park. Lack of suitable habitat is the most significant limiting factor for abundance and diversity of macroinvertebrates at these locations.

The Branch River has severe dissolved oxygen problems. Dissolved oxygen swings below five and even close to zero during early morning hours on a regular basis. This is extremely stressful to aquatic life. These diel fluctuations are caused by nutrient enrichment and algal photosynthesis and respiration when higher temperatures depress oxygen solubility.

The Branch River and its tributaries in this subwatershed are *limited by the lack of stable aquatic life habitat, channelization, low stream gradient, turbid waters, warm water temperatures, silt covered substrate, bank erosion, livestock pasturing, dense macrophyte growth, and severe oxygen depletion.*

A reduction of sediment and nutrient loading to this subwatershed would significantly increase aquatic life habitat by preventing sedimentation of pools, limiting plant growth, and stabilizing dissolved oxygen swings. Eliminating pasturing in the stream corridor would greatly improve habitat. Protecting, enhancing, or creating wetlands would provide spawning sites for northern pike.

Groundwater contamination by nitrate and triazine has been detected within the subwatershed. Potable wells with contamination are distributed among wells with low or no contamination. Contamination may be originating from cropland, animal lots or domestic sewage disposal. Reducing cropland nitrogen fertilizer inputs, crediting of nitrogen from manure and crop residues, and improved management of livestock yard runoff will help maintain or improve groundwater quality over time.

Nonpoint Source Pollutants

- The Morrison subwatershed contains 59 animal lots which deliver 3,887 pounds of phosphorus to surface water annually. This represents an estimated 40 percent of the total phosphorus from barnyard runoff in the entire watershed. The water resource objective for the Morrison subwatershed is to reduce phosphorus from barnyard runoff by at least 65 percent.
- Upland sediment delivered to streams within the Morrison subwatershed accounts for 35 percent (4,347 tons) of the entire watershed sediment load. Cropland erosion is the major source of upland sediment in this subwatershed. The water resource objective is to reduce upland sediment delivered to the stream by at least 25 percent.
- Stream bank erosion in the Morrison subwatershed accounts for 90 percent of the total sediment load caused by eroding banks in the watershed. The water resource objective in the Branch River Watershed is to achieve a minimum 10 percent overall reduction in sediment from eroding streambanks.
- An estimated 25 percent (354 tons) of the total sediment load that is delivered to watershed streams in the form of gully erosion, occurs within the Morrison subwatershed. The water resource objective is to reduce upland sediment that is delivered to watershed streams as a direct result of gully erosion by at least 50 percent, with individual farm goals of reducing sediment from all gullies contributing more than 3 tons annually down to 0 tons/year.

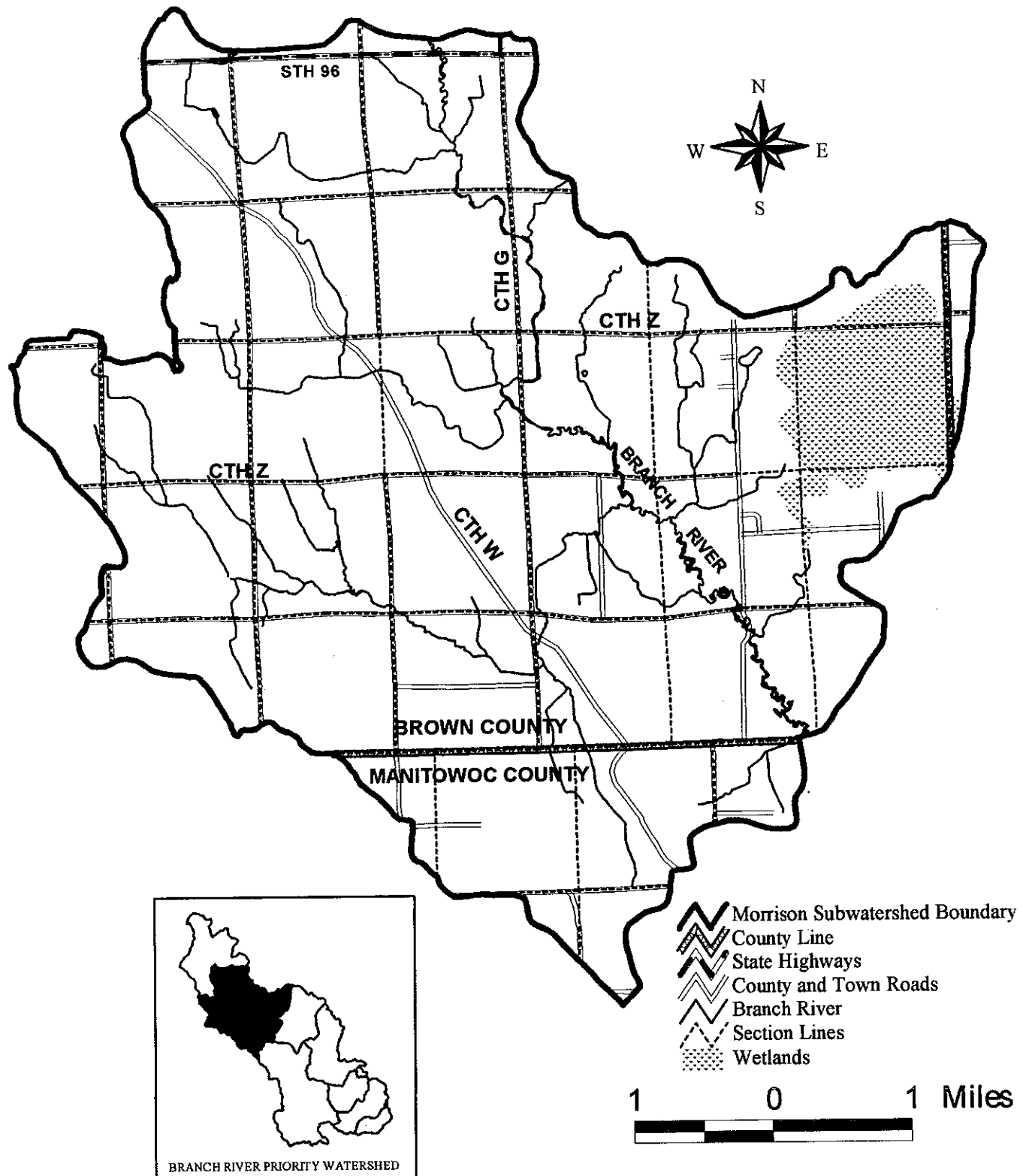
Of the 43 well-water samples taken in the Morrison subwatershed and analyzed for nitrate contamination, 77 percent of the potable wells exceeded the PAL limit of 2 mg/l and 33 percent exceeded the ES Health Advisory Level of 10 mg/l. Triazine residue was detected in 9% of all sampled wells in the subwatershed area (Table 2-2).

Water Resources Goals and Objectives

The following objectives are recommended for the surface water resources of Morrison subwatershed:

- A. Improve water quality and aquatic life in the streams by improving overall habitat conditions by:
 - * reducing sedimentation rates by a high level to waters other than to Morrison Swamp
 - * reducing nutrient/phosphorus loading by a high level to waters other than Morrison Swamp, which will reduce macrophyte growth and stabilize oxygen levels
 - * enhancing existing or degraded wetlands to filter runoff water, provide spawning sites for northern pike, and slow the release of water downstream to permit northern fry to reach the Branch River
 - * reducing stream bank erosion.
 - * reducing summer peak water temperatures by at least two-degrees fahrenheit to enhance native stream fish habitat.
- B. Preserve, maintain, or develop stream woodland and grassland corridors by developing buffers. Corridors provide wildlife habitat, canopy, bank stabilization, and sediment retention.
- C. Reduce sediment and nutrient loading to Morrison Swamp by a low level.
- D. Protect and enhance natural and existing fish reproductive areas.
- E. Develop a warmwater sport fishery in the lower half of this subwatershed.
- F. Protect or enhance groundwater quality by a high level.

Map 2-3. Morrison Subwatershed



COOPERSTOWN SUBWATERSHED (CP)

Description

Cooperstown subwatershed consists of the Branch River from the Brown - Manitowoc county line to approximately one river mile downstream. It also includes one perennial tributary that originates in the Cooperstown Swamp and one intermittent tributary to the Branch River. Kellners Lake is located in this subwatershed (Map 2-4).

Water Quality Conditions

The Branch River is classified as great lakes aquatic community from the county line downstream to its mouth. The characteristic of the Branch River in this subwatershed are similar to the characteristics of the Branch River in the Morrison subwatershed; however, bank erosion is more frequent in this stretch.

The perennial tributary (T20N, R22E, S6, SENE) exhibits changing characteristics as it flows downstream. At the first road crossing from Cooperstown Swamp, the tributary has been ditched. The straight slow moving creek has ideal conditions for thick macrophyte growth because the wetland supplies sufficient rich organic matter. An evaluation ranked this section as fair aquatic life habitat. Dissolved oxygen was low at 5.5 mg/l. The banks are covered by tall grasses and the substrate is mostly muck. Downstream at County Line Road, the flow is also slow and the deep water is a stained color. Further downstream at Grimms Road, the sand substrate inhibits macrophyte growth and flow increases. At this location, the banks are stable with good tree and shrub growth. Here the dissolved oxygen level increased to 7.5 mg/l. An evaluation ranked this section also as fair aquatic life habitat.

The small intermittent tributary (T20N, R22E, S6, NESE) has much cooler clear water. The banks are stable with tree and shrub cover. A fine layer of black organic matter covers the sand substrate. Aquatic life habitat was ranked as fair. This tributary flows through a wetland area before entering into the Branch River.

Kellners Lake, located in T20N, R22E, S3 of Manitowoc County, encompasses 14.65 acres, has a maximum depth of five feet, a shoreline totaling 0.70 miles and a predominately agricultural drainage basin of approximately two square miles. The property surrounding the lake is owned by one family and there is no public access. The riparian areas consist of a near monotypic stand of cattail. Surrounding the cattails is a conifer swamp.

This is a seepage lake whose entire bottom is in the littoral zone and which consists entirely of muck. There is extensive aquatic plant growth which is dominated by coontail. In summer months, the lake is ringed by a thick mat of floating algae. The combination of shallow depth and extensive weed growth promote severe winterkill conditions allowing only the most low oxygen tolerant minnow species to survive. Larger game and panfish are not present because of winterkill conditions.

This lake is probably quite resistant to acidification because of the buffering capacity generated by the limestone bedrock underlying this water body. This is evidenced by the

relatively high pH exhibited here and also by the conductivity levels. The ratio of total nitrogen to total phosphorus averaged 37, which indicates that phosphorus is the limiting nutrient for plant growth in the lake. Phosphorus, however, may be tied up in the biomass of the plants which would cause the low measured levels.

The wetlands surrounding the lake act as a filter to some of the nutrients and sediment from the watershed. However, because this system has no outlet there is little opportunity for the flushing of excess nutrients. The shallow water allows for recycling of nutrients from bottom sediments into the water column. In addition, the anoxic conditions prevalent in winter allow for the further release of phosphorus from bottom sediments. These give plants access to the nutrients and cause the dense aquatic macrophyte growth and algal blooms. Even with the wetland buffer surrounding the lake, improper land use in the past or small nutrient inputs in the present have had a cumulative effect to cause the eutrophication occurring here.

Overall, the wetlands have the most significant impact on the Branch River and its tributary streams in this subwatershed. The sand and muck substrate, stream channelization in some stretches, bank erosion, and macrophyte growth all limit aquatic life habitat. Kellners Lake is limited by the existing nutrients in the sediment, additional nutrients from the drainage basin, dense macrophyte and algae growth, and winterkill conditions.

Generally, the Branch River and its tributaries would not support more aquatic life than they currently support because of the wetland influences. Kellners Lake would never be mesotrophic because of the existing nutrients in the sediment and the lake morphology. Preventing additional nutrient and sediment delivery to the lake would, however, prevent it from becoming even more eutrophic.

Nonpoint Source Pollutants

- The Cooperstown subwatershed contains 14 animal lots which deliver 588 pounds of phosphorus to surface water annually. This represents an estimated 6 percent of the total phosphorus from barnyard runoff in the watershed. The water resource objective for the Cooperstown subwatershed is to reduce phosphorus runoff from barnyards by at least 35 percent.
- Upland sediment delivered to streams within the Cooperstown subwatershed accounts for an estimated 2 percent (240 tons) of the total watershed sediment load. Cropland erosion is the major source of upland sediment in this subwatershed. The water resource objective is to reduce upland sediment delivered to the stream by at least 25 percent.
- Stream bank erosion occurring within the Cooperstown subwatershed accounts for less than 1 percent of the total sediment load caused by eroding banks in the watershed. The water resource objective in the Branch River Watershed is to achieve a minimum 10 percent overall reduction in streambank erosion.
- * Of the 12 well-water samples taken in the Cooperstown subwatershed and analyzed for Nitrate contamination, 58 percent of the potable wells exceeded the PAL limit of 2 mg/l and 17

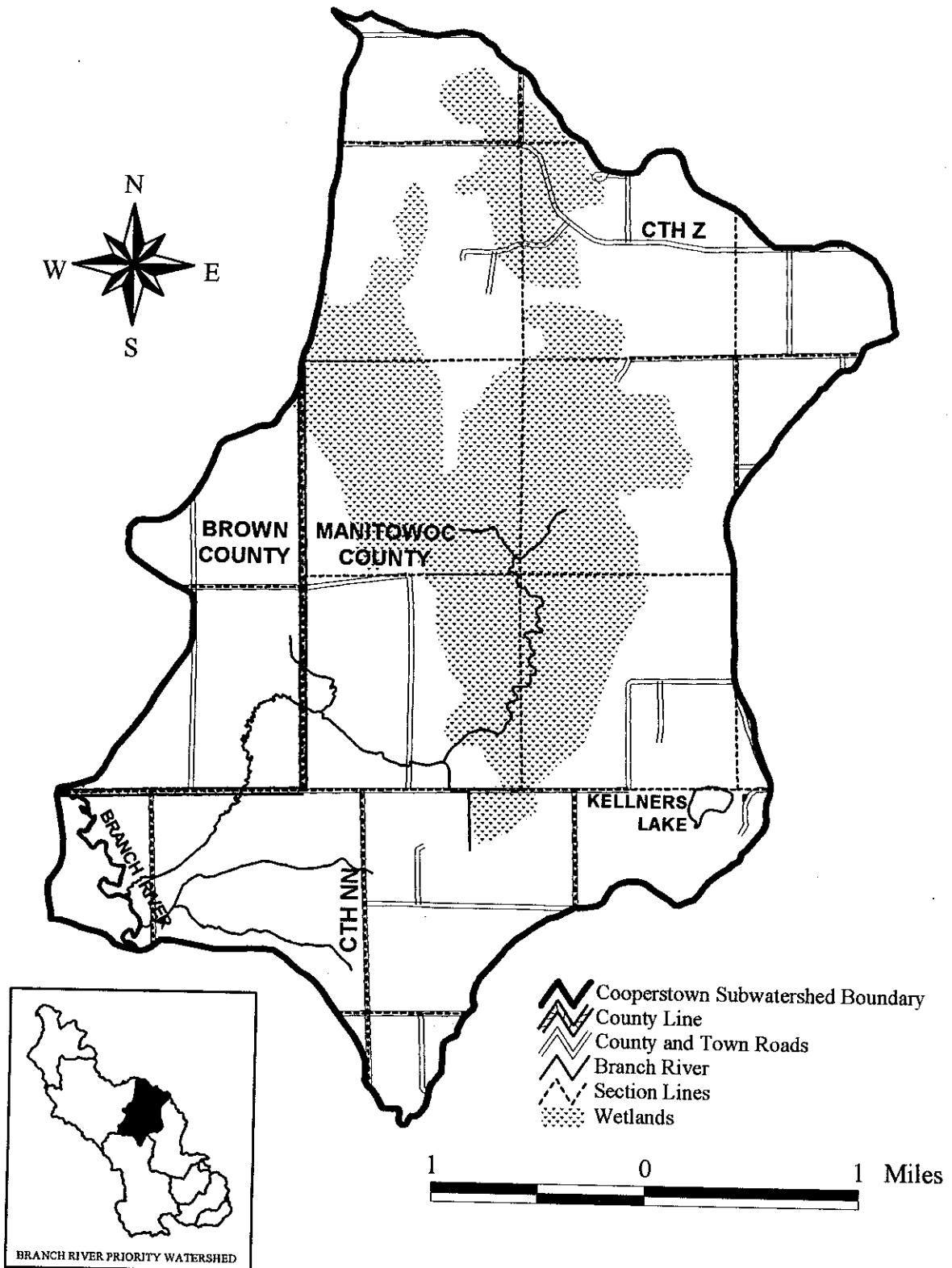
percent exceeded the ES Health Advisory Level of 10 mg/l. Triazine residue was detected in 9 percent of the potable wells tested within the subwatershed (Table 2-2).

Water Resources Goals and Objectives

The following objectives are recommended for the surface water resources of Cooperstown subwatershed:

- A. Protect wildlife and aquatic life habitat by:
 - * reducing sediment and nutrient loading by a low level to the wetlands that currently exist in this subwatershed
 - * reducing sediment and nutrient loading by a high level to the Branch River and its tributaries.
- B. Preserve, maintain, or develop stream woodland and grassland corridors by developing buffers. Corridors provide wildlife habitat, canopy, bank stabilization, and sediment retention.
- C. Maintain current wildlife values of Kellners Lake.
- D. Protect or enhance groundwater quality by a high level.

Map 2-4. Cooperstown Subwatershed



GRIMMS SUBWATERSHED (GR)

Description

The Grimms subwatershed consists of the section of the Branch River from approximately one river mile below the Brown - Manitowoc County line downstream to Taus Road. It also includes Hemptons Lake, one perennial stream (T20N, R22E, S27, NWSW), and seventeen intermittent tributaries to the Branch River (Map 2-5).

Water Quality Conditions

In this subwatershed, the Branch River is classified as great lake aquatic communities. It received good to fair aquatic life habitat ratings. In the upper reaches of this subwatershed, the Branch River is deep and slow moving with little scouring of the substrate. No riffle areas are present. In the lower reaches, the river flow increases and becomes somewhat more shallow with some riffles and pools. The banks are well buffered, however, bank erosion is still evident. The substrate is a combination of rocks, rubble and clay with a fine layer of silt which is easily suspended. The water is generally turbid especially after rain events.

A fish kill on the Branch River in August 1994 claimed 274 fish including 58 northern pike in the stretch between Grimms Road and West Hillcrest Road. The kill was near complete because of the presence of dead carp and bullheads. No apparent source of the kill was identified, however, it is believed that manure was the cause and was carried into the river during a major rain event on August 26, 1994.

The Lemberger Landfill and Lemberger Transport and Recycling, Inc., Superfund sites are located in this subwatershed. Currently, a Wisconsin Pollution Discharge Elimination System (WPDES) permit is being developed to discharge treated groundwater from this site to the Branch River.

Whitelaw Wastewater Treatment Plant discharges to a small intermittent (T19N, R22E, S3, SWNE) limited forage fish communities classified tributary to Hemptons Lake. Hemptons Lake is a shallow ten acre drainage lake with a history of poor water quality. The lack of public access prevented current monitoring of this lake. Hemptons Lake discharges to a perennial tributary (T20N, R22E, S27, NWSW) to the Branch River. This perennial tributary received a fair aquatic life habitat rating. At Sunny Slope and San Road, thick macrophyte growth caused dissolved oxygen levels to become supersaturated (greater than 20 mg/l) during daylight hours. Dissolved oxygen probably drops very low or even to zero at night during plant respiration. A macroinvertebrate sample at the mouth of this tributary received a FBI rating of 6.45 which indicates fairly poor water quality with substantial organic pollution likely. Sections of this tributary and several others have been channelized which decreases aquatic life habitat.

Temperature data was gathered continuously from June 21 until August 30, 1994 in the Branch River upstream and downstream of the perennial tributary along with ambient air temperature. The average temperature was 6.3°C cooler below the confluence of the tributary than above. This indicates that this tributary has a cooling, not warming, effect on the Branch River which ultimately benefits the fish communities.

The Branch River and its tributaries in this subwatershed are limited by silt and sediment covering substrate for aquatic life habitat, limited stream flow that is needed to scour substrate, bank erosion, turbid waters, warm water temperatures, macrophyte growth in the tributary from excess nutrients, possibly effects from the superfund sites, and stream channelization.

A reduction of sediment and nutrients in this subwatershed would benefit aquatic life habitat in the Branch River and its tributaries by preventing sedimentation of pools and riffles, limiting plant growth, and stabilizing dissolved oxygen swings.

Nonpoint Source Pollutants

- The Grimms subwatershed contains 81 animal lots which deliver 2,159 pounds of phosphorus to surface water annually. This represents an estimated 23 percent of the total phosphorus load from barnyard runoff in the watershed. The water resource objective in the Grimms subwatershed is to reduce phosphorus runoff from barnyards by at least 65 percent.
- Upland sediment delivered to streams within the Grimms subwatershed accounts for an estimated 33 percent (4,071 tons) of the total watershed sediment load. Cropland erosion is the major source of upland sediment in this subwatershed. The water resource objective is to reduce upland sediment delivered to the stream by at least 25 percent.
- Stream bank erosion occurring within the Grimms subwatershed accounts for less than 1 percent of the total sediment load caused by eroding banks in the watershed. The water resource objective in the Branch River Watershed is to achieve a minimum of a 10 percent overall reduction in sediment from eroding stream banks.
- Of the 48 well-water samples taken in the Grimms subwatershed and analyzed for Nitrate contamination, 81 percent of the potable wells exceeded the PAL limit of 2 mg/l and 35 percent exceeded the ES Health Advisory Level of 10 mg/l. Triazine residue was detected in 19 percent of the potable wells tested within the subwatershed (Table 2-2).

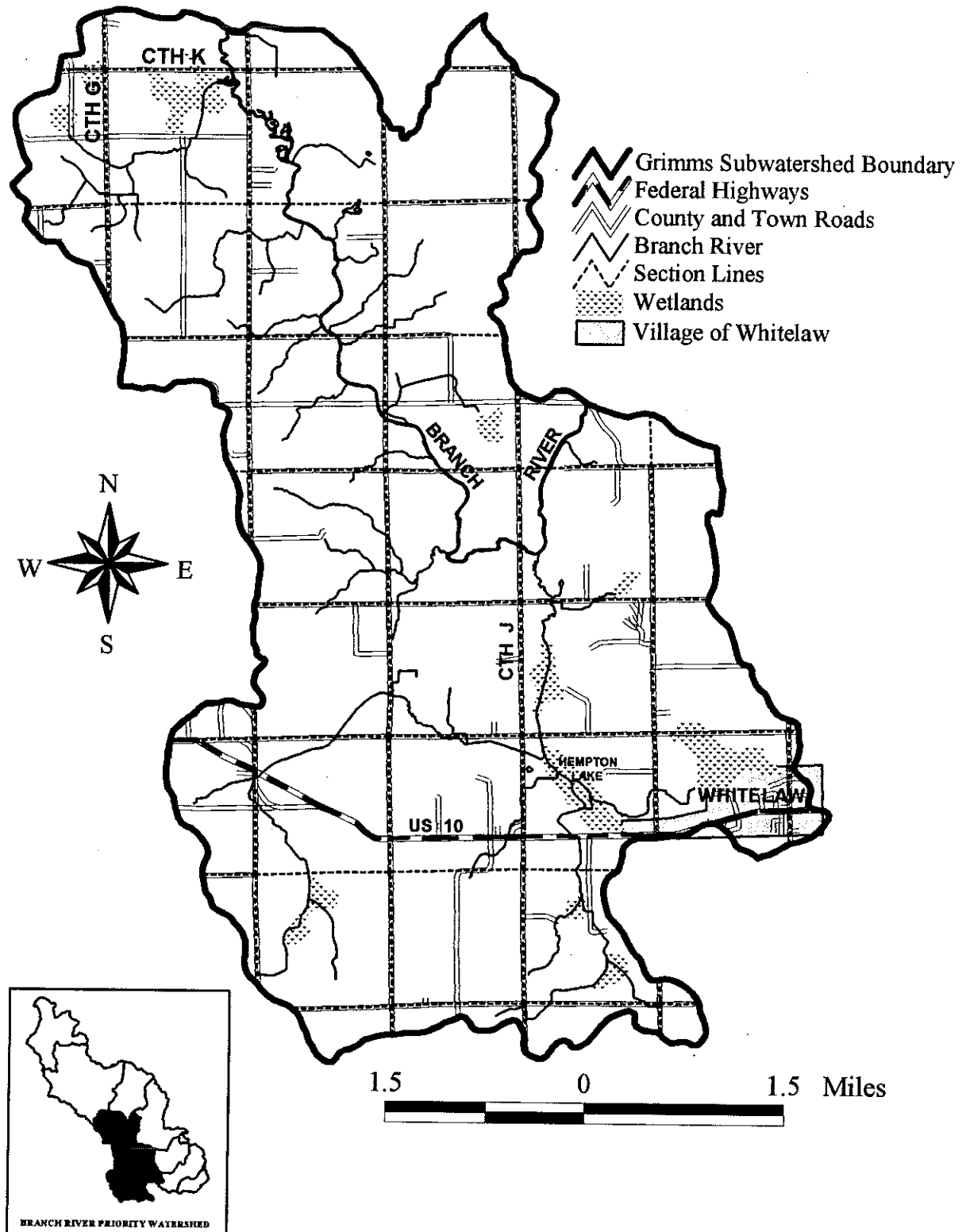
The following objectives are recommended for the surface water resources of Grimms subwatershed:

- A. Improve water quality and aquatic life in the streams by improving overall habitat conditions by:
 - * reducing sedimentation by a high level
 - * reducing nutrient/phosphorus loading by a high level to reduce macrophyte growth and stabilize oxygen levels
 - * enhancing existing or degraded wetland which act as filtering area and moderate water level fluctuation extremes
 - * reducing streambank erosion.

fahrenheit * reducing summer peak water temperatures by at least two-degrees
to enhance native stream fish populations.

- B. Preserve, maintain, or develop stream woodland and grassland corridors by developing buffers. Corridors provide wildlife habitat, canopy, bank stabilization, and sediment retention.
- C. Improve wildlife values of Hemptons Lake.
- D. Protect natural springhead areas from livestock degradation and/or pond development.
- E. Evaluate water resource improvements.
- F. Protect or enhance groundwater quality by a high level.
 - * reduce nutrient inputs on cropland.
 - * reduce surface water and tile water flow into karst features.

Map 2-5. Grimms Subwatershed



CHERNEY SUBWATERSHED (CH)

Description

The Cherney subwatershed consist of the section of the Branch River from Taus Road downstream to 1/4 mile before CTH T, one perennial tributary and four intermittent tributaries to the Branch River (Map 2-6).

Water Quality Conditions

In this subwatershed, velocity of the Branch River increases significantly which scours the rock/rubble substrate producing higher quality aquatic life habitat. Habitat evaluations at West Hillcrest Road (west and middle crossings) rated this section of the Branch River as good. Macroinvertebrate samples received HBI values of 4.55 and 4.59 which indicates good water quality with some organic pollution present. The EPT was 44 to 36% at the middle road crossing at West Hillcrest Road. Banks are well buffered from erosion with a diverse mix of trees and shrubs. With the shallower water in this section, light penetration increases causing periphyton and attached algae growth on the rocks and substrate. This does not occur in the upper reaches of the Branch River because of the deeper, turbid water. Abundant plant growth is a result of excess nutrients in the water column. This section of the Branch River is classified as a Great Lakes Aquatic Community (see the Water Resource Conditions and Goals section of this chapter)..

The four mile long perennial tributary (T20N, R22E, S24, NESW) to the Branch River received a habitat rating of poor at North Madson Road, but good downstream at West Hillcrest Road. The perennial flow starts at about Polifka Road. A horse pasture upstream of North Madson Road causes the water to be warmer here than upstream at Polifka Road, however still cooler than the Branch River itself. The banks are trampled and have no vegetative buffer. At West Hillcrest Road, the flow increases somewhat, banks are well buffered, and the substrate is more stable producing better aquatic life habitat than upstream; however, some soft sediment has accumulated near the bridge and lower banks.

The Branch River and its tributaries in this subwatershed are limited by nutrients and shallow depth causing algae and periphyton growth on the substrate, stream bank pasturing destroying habitat and warming water, and sediment filling in pools.

A reduction of sediment and nutrients in this subwatershed would benefit aquatic life habitat by limiting periphyton growth and sedimentation of pools and riffles. Eliminating pasturing in the tributary would greatly improve habitat and keep the water cooler.

Nonpoint Source Pollutants

- The Cherney subwatershed contains 9 animal lots which deliver 213 pounds of phosphorus to surface water annually. This represents an estimated 2 percent of the total phosphorus load from barnyard runoff in the watershed. The water resource objective for the Cherney subwatershed is to reduce phosphorus runoff from barnyards by at least 40 percent.

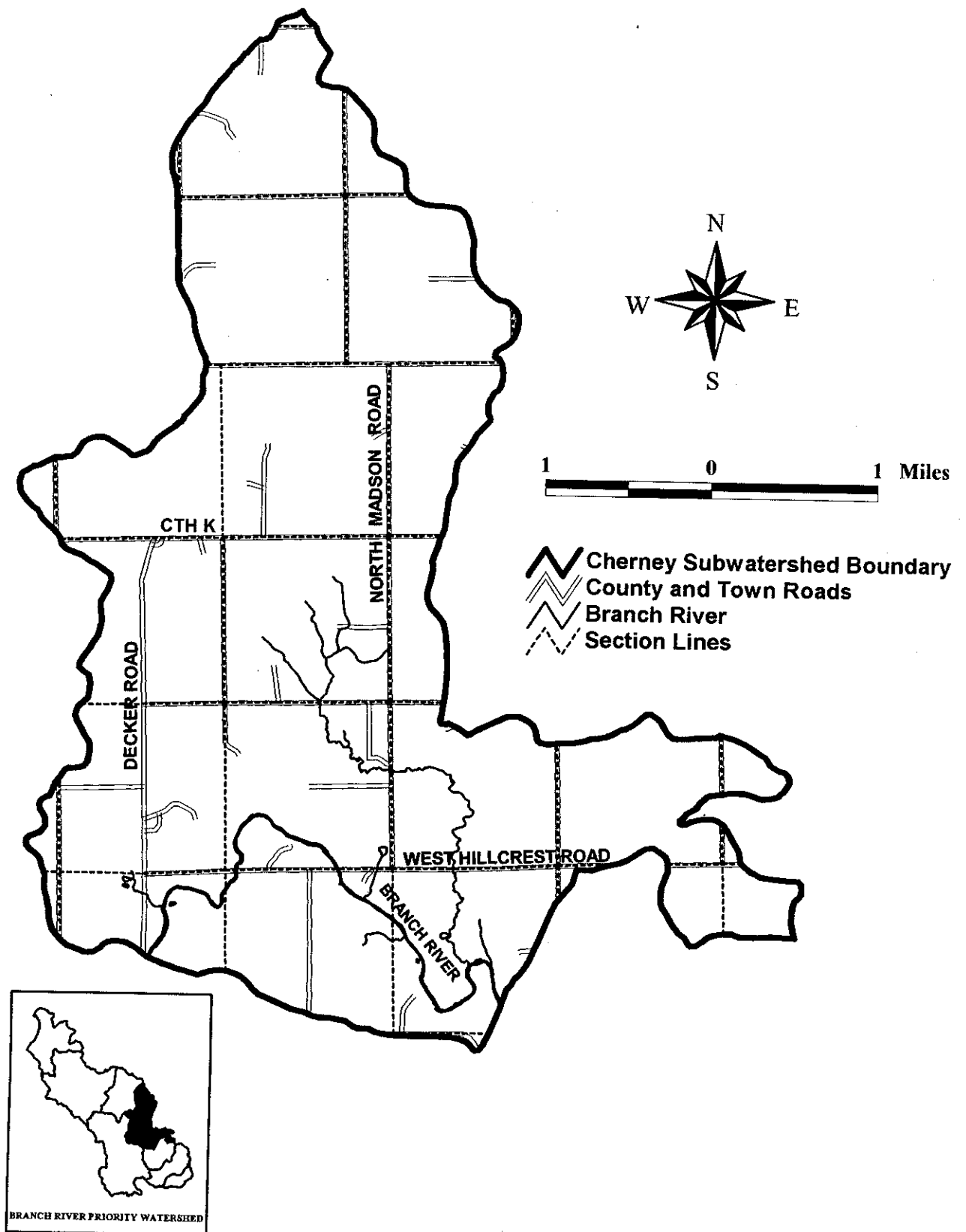
- Upland sediment delivered to streams within the Cherney subwatershed accounts for an estimated 4 percent (528 tons) of the total watershed sediment load. Cropland erosion is the major source of upland sediment in this subwatershed. The water resource objective is to reduce sediment delivered to surface water by at least 25 percent.
- Stream bank erosion occurring within the Cherney subwatershed accounts for less than 1 percent of the total sediment load caused by eroding banks in the watershed. The water resource objective in the Branch River Watershed is to achieve a minimum 10 percent overall reduction in streambank erosion.
- * Of the 4 well-water samples taken in the Cherney subwatershed and analyzed for Nitrate contamination, 50 percent of the potable wells exceeded the PAL limit of 2 mg/l and 25 percent exceeded the ES Health Advisory Level of 10 mg/l.

Water Resources Goals and Objectives

The following objectives are recommended for the surface water resources of Cherney subwatershed:

- A. Improve water quality and aquatic life in the streams by improving overall habitat conditions by:
 - * reducing sedimentation by a medium level
 - * reducing nutrient/phosphorus loading by a medium level which will reduce macrophyte growth and stabilize oxygen levels
 - * enhancing existing or degraded wetland which act as filtering area and moderate water level fluctuation extremes
 - * reducing streambank erosion.
- B. Preserve, maintain, or develop stream woodland and grassland corridors by developing buffers. Corridors provide wildlife habitat, canopy, bank stabilization, and sediment retention.
- C. Protect or enhance groundwater quality by a high level.
 - * reduce nutrient inputs on cropland.
 - * reduce surface water and tile water flow into karst features.

Map 2-6. Cherney Subwatershed



REIFS MILLS SUBWATERSHED (RM)

Description

The Reifs Mills subwatershed consists of the section of the Branch River from 1/4 mile upstream of CTH T downstream to Danmar Road and three intermittent tributaries to the Branch River (Map 2-7).

Water Quality Conditions

The Branch River characteristics in this subwatershed are similar to the Cherney subwatershed. As the velocity steadily increases downstream, aquatic life habitat improves. Habitat evaluations at CTH T received good ratings while downstream at Danmar Road, rated excellent. The rocky substrate is well scoured with plenty of riffles and pools. The banks are well buffered with diverse trees and shrubs. The Branch River is classified as Great Lake Aquatic Community (see the Water Resource Conditions and Goals section in this chapter).

Dissolved oxygen and temperature monitoring for nine days in August 1994 at Danmar Road shows daily diel fluctuations. Dissolved oxygen drops significantly during very early morning hours and comes very close to just below the 6 mg/L state standard, but then as daylight comes, oxygen increases to as high as 13 mg/L. These early morning hours are critical periods for aquatic life stability. Dissolved oxygen fluctuations are caused by nutrient enrichment and algae and periphyton photosynthesis and respiration.

The Branch River in this subwatershed is limited by nutrient enrichment causing algae and periphyton growth which in turn, effects oxygen levels. Nutrients may be coming from the upstream subwatersheds.

A reduction of nutrient loading to this subwatershed would benefit aquatic life by limiting plant growth and dissolved oxygen swings in the Branch River. A reduction of sediment loading would prevent downstream accumulations.

Nonpoint Source Pollutants

- The Reifs Mills subwatershed contains 12 animal lots which deliver 326 pounds of phosphorus to surface water annually. This represents an estimated 3 percent of the total phosphorus load from barnyard runoff in the watershed. The water resource objective in the Reifs Mills Subwatershed is to reduce phosphorus runoff from barnyards by at least 65 percent.
- Upland sediment delivered to streams within the Reifs Mills subwatershed accounts for an estimated 3 percent (427 tons) of the total watershed sediment load. Cropland erosion is the major source of upland sediment in this subwatershed. The water resource objective is to reduce upland sediment delivered to the stream by at least 25 percent.

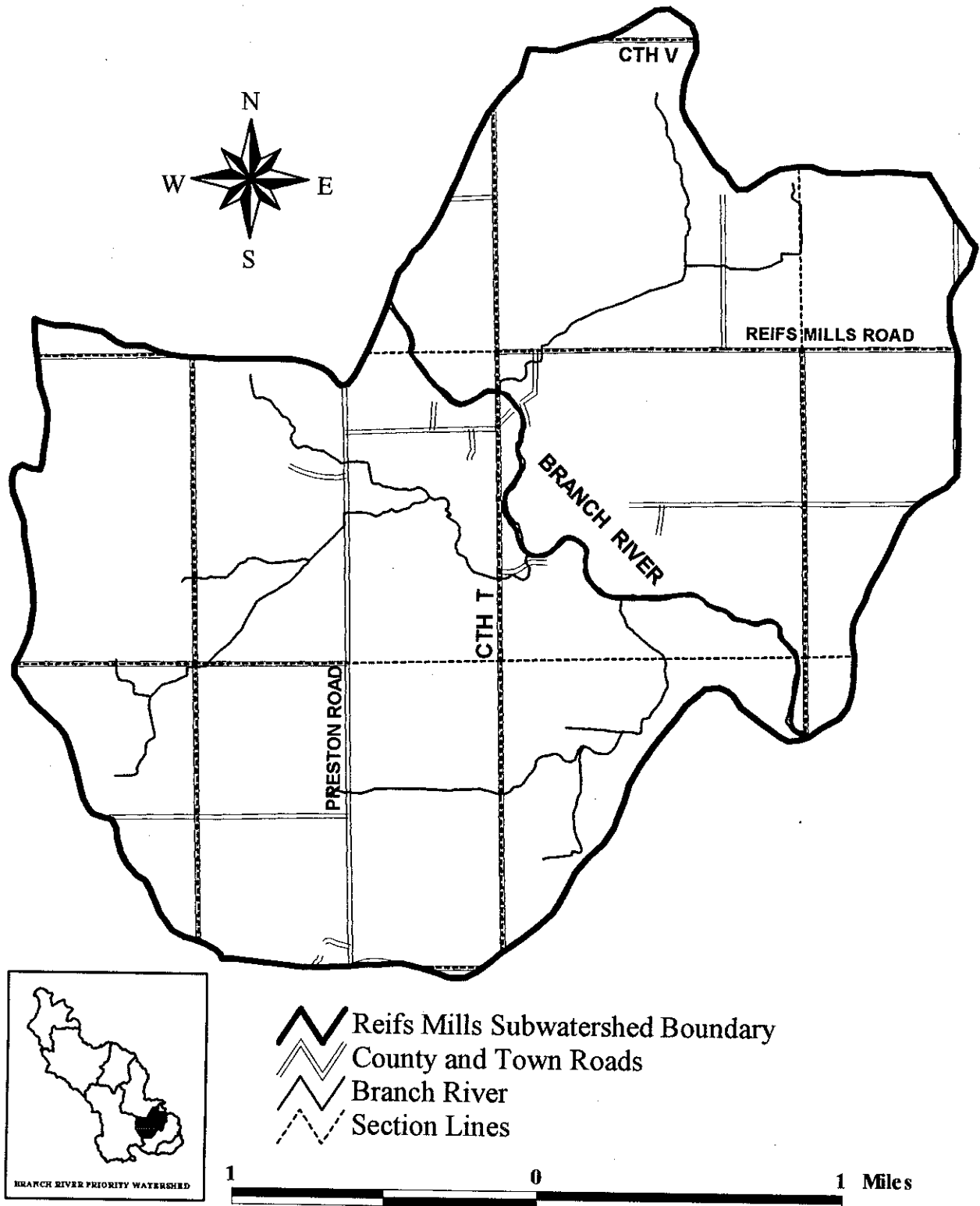
- Stream bank erosion occurring within the Reif Mills subwatershed accounts for less than 1 percent of the total sediment load caused by eroding banks in the watershed. The water resource objective in the Branch River Watershed is to achieve a minimum 10 percent overall reduction in streambank erosion.
- * An estimated 6 percent of the total sediment load that is delivered to watershed streams in the form of gully erosion, occurs within the Reif Mills subwatershed. The water resource objective is to reduce gully erosion by at least 50 percent, with individual farm goals of controlling all gullies contributing more than 3 tons/year down to zero.
- * Of the 8 well-water samples taken in the Reif Mills subwatershed and analyzed for Nitrate contamination, 75 percent of the potable wells exceeded the PAL limit of 2 mg/l and 8 percent exceeded the ES Health Advisory Level of 10 mg/l. Triazine residue was detected in 25 percent of the wells tested in the subwatershed (Table 2-2).

Water Resources Goals and Objectives

The following objectives are recommended for the surface water resources of Reifs Mills subwatershed:

- A. Improve water quality and aquatic life in the streams by improving overall habitat conditions by:
 - * reducing sedimentation by a high level
 - * reducing nutrient/phosphorus loading by a high level which will reduce macrophyte growth and stabilize oxygen levels
 - * enhancing existing or degraded wetland which act as filtering area and moderate water level fluctuation extremes.
- B. Preserve, maintain, or develop stream woodland and grassland corridors. Corridors provide wildlife habitat, canopy, bank stabilization, and sediment retention.
- C. Protect natural springhead areas from livestock degradation and/or pond development.
- D. Protect or enhance groundwater quality by a high level.
 - * Reduce nutrient inputs to cropland.
 - * Reduce surface water and tile water flow into karst features.

Map 2-7. Reifs Mills Subwatershed



RAHR SUBWATERSHED (RA)

Description

The Rahr subwatershed consist of the section of the Branch River from just below Danmar Road downstream to above Hwy 10 and two perennial tributaries to the Branch River (Map 2-8).

Water Quality Conditions

The characteristics of the Branch River in this subwatershed are similar to the Reifs Mills subwatershed. The Branch River is classified as great lake aquatic communities. The river velocity and substrate are ideal for aquatic life habitat. The only road crossing in this subwatershed is just above Hwy 10. About one mile of the Branch River runs through the Rahr Game Farm. There are several large and stable springs on the Rahr property which contribute significant volume and cool, clean water during the warm summer months. Conversely, during the cold months, this added water moderates stream temperatures. Fish are then able to inhabit these stream reaches for a longer period of time each year, adding stability to the system. This stretch of the Branch River has several excellent adult steelhead holding areas.

The Branch River in this subwatershed is limited by nutrient enrichment causing algae and periphyton growth which in turn effects oxygen levels. Phosphorus nutrients may be coming from the upstream subwatersheds.

A reduction of nutrient loading to this subwatershed would benefit aquatic life by limiting plant growth and dissolved oxygen swings in the Branch River. A reduction of sediment loading would prevent downstream accumulations.

Nonpoint Source Pollutants

- The Rahr subwatershed contains 16 animal lots which deliver 357 pounds of phosphorus to surface water annually. This represents an estimated 4 percent of the total phosphorus load from barnyard runoff in the watershed. The water resource objective for the Rahr Subwatershed is to reduce phosphorus runoff from barnyards by at least 65 percent.
- Upland sediment delivered to streams within the Rahr subwatershed accounts for an estimated 3 percent (352 tons) of the total watershed sediment load. Cropland erosion is the major source of upland sediment in this subwatershed. The water resource objective is to reduce upland sediment delivered to the stream by at least 25 percent.
- Stream bank erosion occurring within the Rahr subwatershed accounts for less than 1 percent of the total sediment load caused by eroding banks in the watershed. The water resource objective in the Branch River Watershed is to achieve a minimum 10 percent overall reduction in streambank erosion.

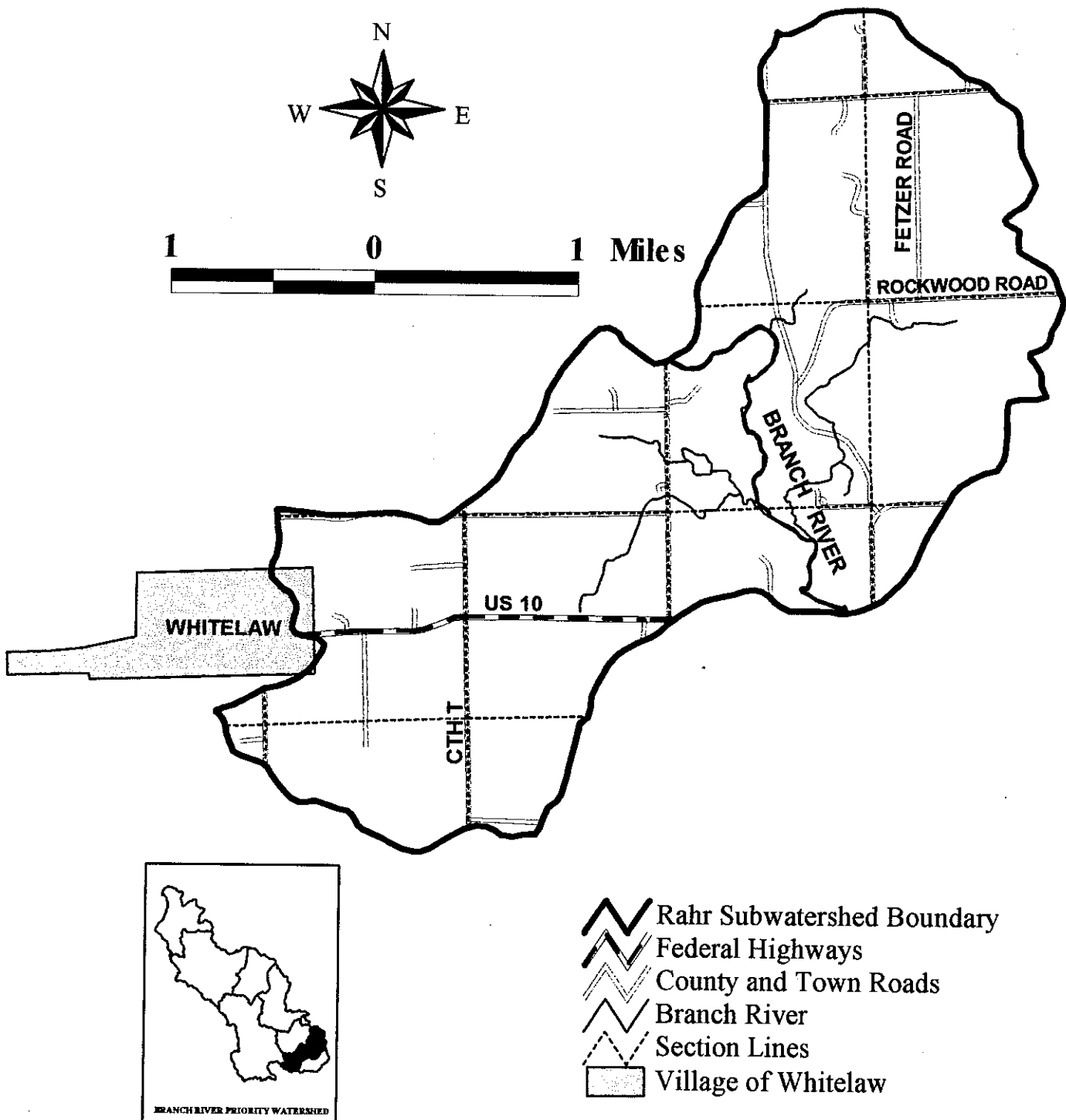
- * An estimated 3 percent of the total sediment load that is delivered to watershed streams in the form of gully erosion, occurs within the Rahr subwatershed. The water quality resource objective is to reduce gully erosion by at least 50 percent, with 100 percent of gullies eroding at 3 tons/year to be controlled.

Water Resources Goals and Objectives

The following objectives are recommended for the surface water resources of Rahr subwatershed:

- A. Improve water quality and aquatic life the streams by improving overall habitat conditions by:
 - * reducing sedimentation by a high level
 - * reducing nutrient/phosphorus loading by a high level which will reduce macrophyte growth and stabilize oxygen levels
 - * enhancing existing or degraded wetland which act as filtering area and moderate water level fluctuation extremes
 - * protecting the natural springheads which provide flow and cool water.
- B. Preserve, maintain, or develop stream woodland and grassland corridors. Corridors provide wildlife habitat, canopy, bank stabilization, and sediment retention.
- C. Protect or enhance groundwater quality by a high level.
 - * Reduce nutrient inputs to cropland.
 - * Reduce surface water and tile water flow into karst features.

Map 2-8. Rahr Subwatershed



LOWER BRANCH SUBWATERSHED (LB)

Description

The Lower Branch subwatershed consists of the Branch River just above Hwy 10 to the confluence of the Manitowoc River and two intermittent tributaries (Map 2-9).

Water Quality Conditions

The Branch River in this subwatershed changes from shallow, high velocity rocky substrate in the upper reaches to slow, deep, with a muddy bottom near North Union Road downstream to the river mouth. Habitat evaluations at Branch River Road on two occasions found good habitat present. The shallow, rocky substrate has abundant filamentous algae and periphyton growth caused by excess nutrients. Excess plant growth causes fluctuating dissolved oxygen levels in the river. The banks are stable and erosion does not appear to be a problem. Macroinvertebrate samples indicate very good to good water quality with HBI values of 3.96 and 5.15 at Branch River Road indicating possible slight to some organic pollution present. The EPT was 53 to 40% at Branch River Road. Above B.C. Acquisitions, the average HBI value was 2.73 in 1984 indicating good water quality. The creamery discharges to the Branch River about one mile above the river mouth. The old waste treatment ponds were abandoned. At North Union Road, habitat was rated as fair. Riffles are absent with a deep muddy bottom. There is public access off this road.

A golf course located near the village of Branch may contribute nutrients to the Branch River during runoff events; however, no specific monitoring was conducted to determine impacts.

The Branch River in this subwatershed is limited by excess nutrients causing algae growth on the rocks and oxygen fluctuations in the upper reaches and sediment accumulation in the lower reaches. The golf course may be one source of nutrients. Nutrients and sediment may also be coming from the upstream subwatersheds.

A reduction of nutrient and sediment loading in this subwatershed would benefit aquatic life habitat by limiting plant growth on the rocky substrate, stabilizing dissolved oxygen levels in the upper reaches and decreasing sedimentation in the lower reaches of the Branch River.

Nonpoint Source Pollutants

- The Lower Branch subwatershed contains 14 animal lots which deliver 588 pounds of phosphorus to surface water annually. This represents an estimated 6 percent of the total phosphorus load from barnyard runoff in the watershed. The water resource objective in the Lower Branch subwatershed is to reduce phosphorus runoff from barnyards by at least 40 percent.
- Upland sediment delivered to streams in the Lower Branch subwatershed accounts for an estimated 2 percent (301 tons) of the total watershed sediment load. Cropland erosion is the major source of upland sediment in this subwatershed. The water resource objective is to reduce upland sediment delivered to the stream by at least 25 percent.

- Stream bank erosion occurring within the Lower Branch subwatershed accounts for less than 1 percent of the total sediment load caused by eroding banks in the watershed. The water resource objective in the Branch River Watershed is to achieve a minimum 10 percent overall reduction in streambank erosion.

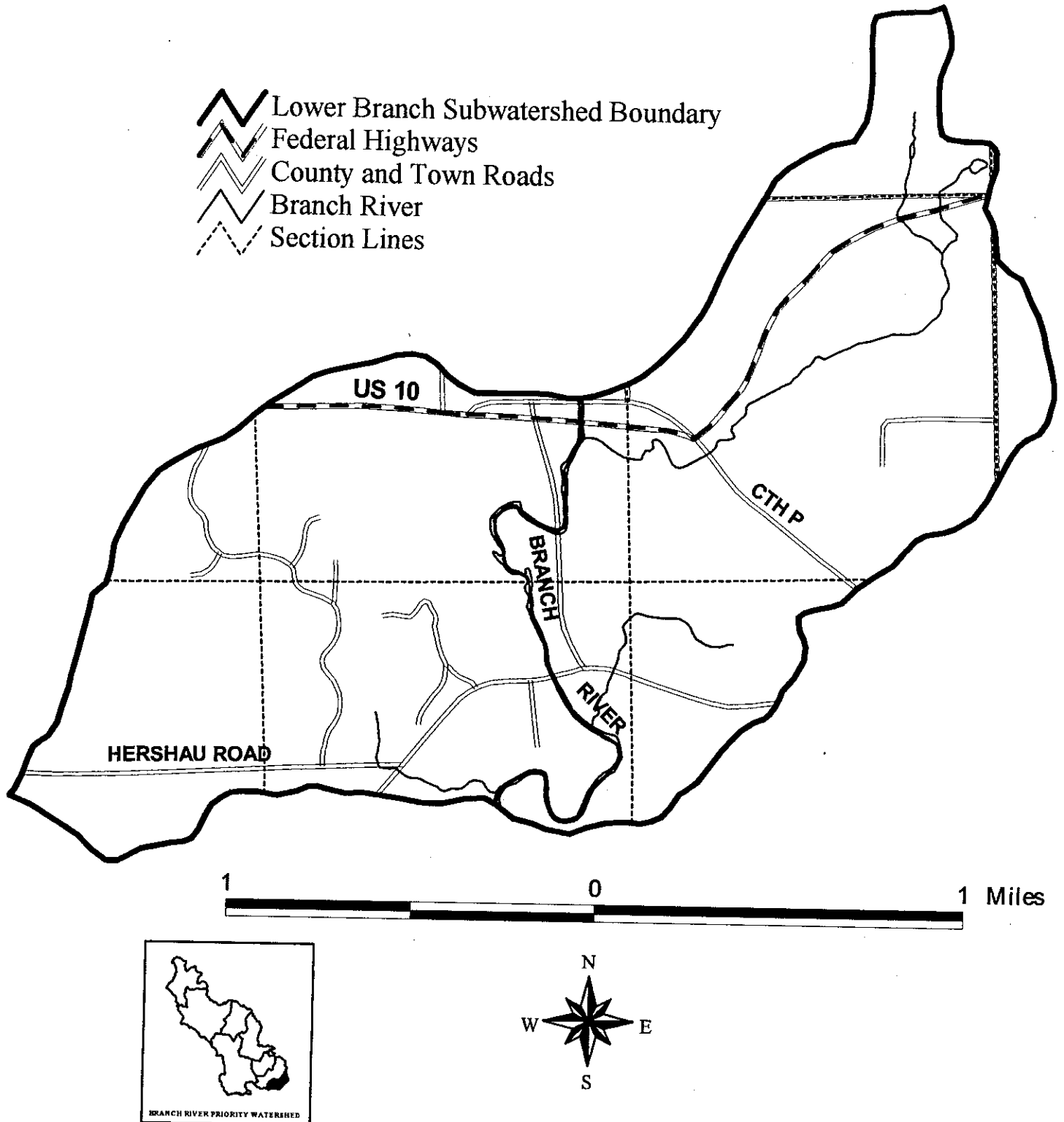
Of the 3 well-water samples taken in the Lower Branch subwatershed and analyzed for Nitrate contamination, 67 percent exceeded the PAL limit of 2 mg/l and 33 percent exceeded the ES Health Advisory Level of 10 mg/l (Table 2-2).

Water Resources Goals and Objectives

The following objectives are recommended for the surface water resources of Lower Branch subwatershed:

- A. Improve water quality and aquatic life in the streams and river mouth by improving overall habitat conditions by:
 - * reducing sedimentation by a low level
 - * reducing nutrient/phosphorus loading by a medium level which will reduce macrophyte growth and stabilize oxygen levels
 - * enhancing existing or degraded wetland which act as filtering area and moderate water level fluctuation extremes.
- B. Preserve, maintain, or develop stream woodland and grassland corridors. Corridors provide wildlife habitat, canopy, bank stabilization, and sediment retention.
- C. Protect or enhance groundwater quality by a high level.
 - * Reduce nutrient and pesticide inputs to cropland.
 - * Reduce surface water and tile water flow into karst features.

Map 2-9. Lower Branch Subwatershed



Rural Inventory Results, Nonpoint Source Pollutants, Objectives, and Cost-Share Eligibility Criteria

This section describes the results of the rural nonpoint source inventories, objectives and cost-share eligibility criteria for each pollutant source. These sources include: barnyard runoff; agricultural nutrients; and rural sediments from upland areas, gully erosion, and streambank erosion.

Management Categories

Cost-share funds for installing pollutant control measures will be targeted at sites which contribute the greatest amounts of pollutants (urban runoff, barnyards, manure spreading, upland fields, streambank and shoreline erosion or streambank habitat degradation sites). Management categories define which nonpoint sources are eligible for financial and technical assistance; they are based on the amount of pollution generated by a source and the feasibility of controlling the source. Specific sites or areas within the watershed project are designated as either "critical," "eligible," or "ineligible." Designation as a critical site indicates that controlling that specific source is necessary if the pollutant reduction objectives for the project are to be met. Nonpoint sources which are eligible but not critical contribute less of the pollutant load, yet it is essential that a high percentage of these sites be addressed to ensure that the water quality objectives are met. Landowners with eligible sites need not control every eligible source to receive cost-share assistance.

Management category eligibility criteria are expressed in terms of tons of sediment delivered to surface waters from eroding uplands and stream banks; pounds of phosphorus [organic] delivered to surface waters; the number of unsuitable acres spread with manure; feet of streambank trampled by cattle; and pounds of heavy metals and organics from urban areas. Management categories for particular sites may be revised up to the point that a landowner signs a cost-share agreement. Any newly created sources requiring controls after the signing of a cost-share agreement must be controlled at the landowners expense .

The Manitowoc and Brown County Land Conservation Departments (LCDs) will assist landowners in the implementation of BMPs. Practices range from alterations in farm management (such as changes in crop rotations and manure spreading applications) to engineered structures (such as diversions, sediment basins, and manure storage facilities), and are tailored to specific landowner situations.

Critical Site Management Category

Nonpoint source pollutant load reduction in the Branch River Priority Watershed Project will be achieved mainly through voluntary participation. Nonpoint sources included in this category contribute a significant amount of the pollutants impacting surface waters. State statutes require that the nonpoint source control plan contain the necessary language to ensure the reasonable likelihood of achieving water quality goals and objectives. Landowners with

sites that meet the established critical site criteria are required by law to address those specific sites by reducing the nonpoint source pollutant load to an acceptable level. Pollutant load reduction can occur solely through the action of the landowner with guidance from county staff, or through watershed participation. Each site will be field verified before receiving notification as a critical site, with the findings sent to the DNR District Office. Landowners interested in receiving cost-share assistance for the installation of Best Management Practices will need to sign a cost-share agreement with the respective County Land Conservation Department.

Notification of landowners with critical sites will begin when Manitowoc and Brown County have the ability to identify individual fields for specific management categories on the FOCS/WINHUSLE database. The highest ranked sites will be notified first until all landowners or land operators with critical sites have been notified. The notification will include the following information.

- * The 36-month period in which landowners are eligible for the full level of state cost-sharing, after which the cost-share rate decreases by 50 percent.
- * The potential consequences that a landowner may face if no action is taken as defined in either Chapter NR243 for animal waste, or s. 144.025(2)(u),(v), or (w), for sediment delivery and streambank erosion. Some of these include receiving a notice of discharge, requiring of a WPDES permit, or the issuing of a notice of intent.
- * The right to appeal the designation of a critical site through a written request to the Land Conservation Committee within 60 days of receipt of the notification letter.

Eligible Management Category

Specific nonpoint sources of pollution in this category contribute less significantly to surface and groundwater impacts. These sites are eligible for technical and cost-share assistance but not as critical to reaching water quality objectives when taken individually.

Other sites and practices which do not contribute pollution, but reduce pollutant loads; protect groundwater; improve and protect habitat for fish and wildlife will be eligible for cost-share assistance.

Ineligible Management Category

Sites which do not contribute sediment or nutrient pollutants are not eligible for funding and/or technical assistance for BMP's under the priority watershed project. Other DNR programs (e.g., wildlife and fisheries management) can, if warranted, assist county project staff to control these sources as implementation of the integrated resource management plan for this watershed. Other federal programs may also be applicable to these lands.

Groundwater Protection

Groundwater protection is an important aspect of the Branch River Watershed Project. The Branch River Watershed has many natural and man made features which increase the chances of human activities impacting groundwater. These include fracture traces, sinkholes, exposed bedrock, quarries and unused wells. Most of the drinking water use in the watershed is drawn from the unconsolidated glacial drift of the Silurian Dolostone aquifers, both of which are generally shallow and unconfined (Dueppen, 1995). In addition, the Dolostones are known to be modified elsewhere in the region by groundwater dissolution that has produced secondary porosity of karstification. A karst inventory was conducted by the University of Wisconsin Green Bay to locate these karst features. A published report of karst features and a digitized map of karst locations was prepared for the Branch River Project.

The primary objective was to inventory the geological features in the watershed that affect water quality, and to produce the following maps at a scale of 1:24,000. An exposed bedrock and solution features map which provides the locations of sinkholes, swallets, crevices, dolomite pavements, and springs and a fracture traces map which shows the locations of natural linear features as displayed by topographic, vegetation, or soil tonal alignments.

Soils which are susceptible to leaching contaminants from agricultural land use are present within the Branch River Project area (Appendix C). Through the Watershed Protection and Flood Protection Act (Public Law 83-566), the NRCS used the NLEAP model to predict the nitrate leaching potential that various watershed soils had on the groundwater resource. The NLEAP model also identified agricultural land-use management scenarios that either promote or hinder nitrate leaching.

Overall water quality measured through the Manitowoc and Brown County well water sampling program has found the groundwater to be in poor condition in the Branch River Watershed. Twenty-seven percent of the well water samples taken were elevated above the Enforcement Standard Health Advisory Level of 10 mg/l nitrate (Table 2-2).

The groundwater watershed boundaries will be reviewed for possible revision from existing surface water boundaries, utilizing GIS and additional geologic, hydrologic and well-water sampling information.

Groundwater Management Strategy

Landowner implementation of Nutrient and Pest Management (NPM) Standard 590 Plans will be the primary tool to reduce the current nitrogen levels in the groundwater. Groundwater informational materials will be developed to educate landowners about the impact that various land-use practices can have on the groundwater resource.

The following actions will also be taken to achieve the groundwater objectives for the project:

- * Soil types that have shown susceptibility to groundwater contamination based on NLEAP model results will be delineated on a GIS map for consideration in the development of a NPM plan.
- * NPM recommendations will be developed for consultants and landowners that include manure spreading and nutrient crediting, timing of alfalfa plow-down, cover crop use, and critical management zone identification.
- * Consultants will be annually updated on groundwater concerns.
- * Conservation Planners will identify groundwater management hazard areas in the landowners conservation plan.
- * Easements will be promoted by project staff as a viable alternative for landowners with areas that are susceptible to groundwater contamination.
- * Integrated Pesticide Management Plans will be randomly selected for review on an annual basis for compliance with groundwater standards.
- * Landowners will be encouraged to abandon existing wells that have not been in use for a period of one-year or more as a groundwater contamination prevention best management practice as defined in chapter three of this plan.

Agricultural Nutrient and Pesticide Runoff - groundwater protection

The need for Nutrient and Pest Management (NPM) in the Branch River Watershed is recognized as a major component for the protection and improvement of the groundwater resource. Because of wide-spread groundwater and surface water contamination, all landowners with cropland or livestock operations that meet the critical or eligible management criteria (Table 2-3 and 2-5) will be encouraged to participate in an on-farm NPM program to eliminate the over-application of nutrients and pesticides. An estimated 47,000 acres of cropland in the Branch River Watershed will be eligible for this practice.

Groundwater Critical Sites

Barnyards, Manure Stacks, or Leaking Manure Storage Structures. Organic runoff can pose a significant threat to human health because of the presence of bacteria and pathogens that make the water unfit for recreational use as well as for consumption. These sites will be targeted for nonpoint source pollution abatement action if:

- * The site is up-gradient of sinkholes, visible creviced bedrock, or other conduits to groundwater such as gravel pits and wells that have the potential to contaminate the groundwater resource (*an estimated 5 sites fit this description*).

- * The site is overlying sinkholes, visible creviced bedrock, or other conduits to groundwater, such as gravel pits and wells that have the potential to contaminate the groundwater resource (*an estimated 3 sites fit this description*).

During the groundwater contaminant verification process, the Manitowoc County SWCD or the Brown County LCD will document and submit all findings to the DNR District Nonpoint Source Coordinator for review. After a site has been verified by the respective County LCD in conjunction with the DNR as a probable source of groundwater contamination, the respective LCD will attempt to encourage the landowner to voluntarily rectify the problem either through watershed participation or through the landowners own initiative. Remediation of sites involving direct manure runoff to groundwater conduits will require either the redirection of runoff to a suitable outlet, or site abandonment and relocation.

Agricultural Nutrients from Surface Applied Manure will be targeted for nonpoint source pollution abatement action if spread without incorporation, or over applied, within 300 feet of surface water drainage ways that are up-gradient of sinkholes, creviced bedrock within one-foot of the surface, and other conduits to groundwater, such as gravel pits and wells (*an estimated 4 sites fit this description*).

The majority of these sites will only require landowners to slightly modify their management style to reduce the potential for groundwater contamination. Management changes will require landowners to incorporate manure applications within 48 hours on cropland within these karst topography drainage areas or to simply avoid surface application of manure in these areas altogether. If manure is applied, it cannot exceed UWEX nutrient management recommendations for the crops to be grown. No manure can be surface applied within 100 feet of areas draining directly to karst features or other conduits to groundwater.

Agricultural Tile Lines will be targeted for nonpoint source pollution abatement action if the tile outlet discharges directly to sinkholes, creviced bedrock or other conduits to groundwater, such as gravel pits and wells. Remediation of these sites will require the landowner to close, abandon, or relocate the outlet (*an estimated 4 sites fit this description*).

Rural Sediment Loading - groundwater protection

Croplands Delivering Sediment to Groundwater Conduits will be targeted for nonpoint source pollution abatement action if a cropland site is up-gradient of a sinkhole, visible creviced bedrock, or other conduits to groundwater, such as gravel pits or wells and meets the surface water critical site criteria identified in Table 2-5. Landowners with sites that meet the aforementioned criteria will be required to plan the targeted field down to a tolerable soil loss level of 3 tons/acre/year with 0 tons being optimum (*These sites will be addressed through the surface water critical site component*).

Surface Water Protection

Barnyard Runoff - Surface Water Protection

Runoff carrying a variety of pollutants from barnyards and other confined livestock areas is a major source of pollutants in the streams of the Branch River Watershed. Barnyard runoff is detrimental because of high BOD, COD, bacteria, phosphorus, ammonia, salts and sediment. Two hundred thirty three animal lots are a source of 9,595 pounds of phosphorus (table 2-3) and 719,798 pounds of COD per year.

Chemical Oxygen Demand (COD) is a measurement of all oxidizable matter that measures the pounds of oxygen demanded by organisms for the decomposition of organic material. Most of the oxygen-demanding pollutants and nutrients associated with these operations drain via concentrated flow to creeks and wetlands. Water quality is degraded by oxygen depletions caused by organic waste. When organic material reaches surface water, dissolved oxygen is depleted by organisms that decompose the waste. Organic material also poses a human health hazard because of the presence of bacteria and pathogens that make the water unfit for recreational use as well as for consumption. Water quality is further degraded by the excessive aquatic plant growth stimulated by phosphorus and nitrogen losses from the land. The dense aquatic plant growth causes severe oxygen fluctuations during plant photosynthesis (daytime), and respiration (nighttime), that causes additional stress to aquatic life.

While COD that is a result of barnyard runoff is a problem in the Branch River and its tributaries, phosphorus is the nutrient of primary concern because it is most often the limiting nutrient in natural bodies of water. Phosphorus is also the nutrient most amenable to control, and for this reason will be the target of most broad strategies for water quality management in the Branch River Watershed.

Certain components of waste management systems (as specified in NRCS Std. 312), specifically those involving collection, handling and storage, require the preparation of a nutrient management plan (NRCS Std. 590) for the acreage that the manure may be spread. Roof Runoff Management (NRCS Std. 588), Livestock Exclusion (NRCS Std. 472), Clean Water Diversion (NRCS Std. 362) are practices that are exempt from this requirement. Operations eligible for manure management systems are also eligible for cost-sharing of nutrient management practices, specifically the development of both nutrient management and pest management (NRCS Std. 595) plans, soil testing and crop scouting. See "Nutrient and Pest Management" later in this chapter for additional detail.

Barnyard Runoff Pollution Reduction Objective

The objective for barnyard runoff control is to reduce phosphorus loading to streams by at least 62 percent (5,938 lbs.). Based upon the recommendations from the water quality appraisal workgroup, it was determined that a total of 75 percent of this reduction (4,453 lbs.) will be obtained solely through voluntary participation (Table 2-3).

Barnyard Critical Sites

Barnyards which deliver the highest concentration of nonpoint source pollutants to surface water were identified during the inventory phase of the planning process. Landowners with barnyard sites contributing a phosphorus load greater than 144 pounds annually have been designated as critical sites. Twelve barnyards in the Branch River Watershed fall within the critical management category. Collectively, these sites deliver an estimated 2,931 pounds of phosphorus to surface water annually. A minimum of 25 percent of the resource objective (1,485 pounds) is to be obtained solely from barnyards that meet the critical management criteria. Those landowners with critical site barnyards will have two options to rectify their runoff problem:

- 1) Landowners can rectify the problem through their own initiative by installing the necessary practice(s) that will reduce the annual phosphorus load below the 144 pound target level. For the majority of these sites, this will only require the installation of low cost, clean water diversions and roof gutters. **Project staff will provide the necessary technical assistance.** *(Landowners choosing this option will not be eligible for cost-share assistance but are obligated to operate and maintain any installed practice for the length of the project).*
- 2) Landowners wishing to voluntarily participate in the Branch River Watershed Project need to sign a cost-share agreement and install the necessary practices to reduce the annual phosphorus level below the 40 pound target level. Project staff will provide the necessary technical assistance. *(Landowners choosing this option will be eligible for cost-share assistance and are obligated to operate and maintain all cost-shared practices for a period of ten years from the date that the final practice on the agreement was installed).*

Other Barnyard Sites

Landowners with barnyard sites that contribute between 50 and 144 pounds of phosphorus annually are eligible for cost-share assistance. Landowners who voluntarily wish to participate in the watershed project may be required to address their barnyard runoff problem if the local LCD determines the site to be essential to achieving the resource objective. These landowners would need only to divert clean upland and roof water away from the animal lot. There are 46 barnyards in the watershed that contribute an annual phosphorus load between 50 and 144 pounds. These landowners will be eligible for full barnyard systems; if a landowner chooses to install a complete runoff control management system, the annual phosphorus level must be reduced to the 20 pound target level.

Barnyard sites that contribute between 20 and 49 pounds of phosphorus annually will only be eligible for the low cost clean water diversion practices. There are 60 barnyards in the watershed that contribute an annual phosphorus load between 20 and 49 pounds. Installation of these practices alone will provide significant pollutant load reductions in the Branch River Watershed. These landowners may install more costly practices, but the cost-shared amount cannot exceed the estimated cost of roof gutters and clean water diversions.

Barnyard sites that contribute less than 20 pounds of phosphorus annually **will not be eligible for cost sharing.** There are approximately 103 landowners with animal lots in this category. However, individual barnyard sites may become eligible for cost sharing if a determination is made by County Staff and the DNR District Biologist that corrective measures would improve water quality within a specific stream segment.

The development and implementation of a Nutrient Management Plan will be a requirement for landowners receiving cost share dollars for the installation of a barnyard runoff management system. All NPM plans will be developed with a certified crop consultant. Those landowners installing low-cost clean water diversions and/or roof gutters will be encouraged to develop an NPM plan, but not required.

Table 2-3 Barnyards

Subwatershed	Inventory Results			Goal- 62 % reduction in Phosphorus loading from barnyards					
	Number of Yards	Pounds of Phosphorus (P)	Percent of P	Critical Management Category > 144 lbs. P			Eligible Management Category 20-144 lbs. P		
				Number of Barnyards	Target - Pounds Reduced	Percent of Objective	Number of Barnyards	Target - Pounds Reduced	Percent of Objective
Saint Johns	28	1,787	19	2	653	11%	15	509	8
Morrison	59	3,887	40	8	713	12%	32	1,814	31
Cooperstown	14	588	6	2	119	2%	5	87	1
Cherney	9	213	2	0	0	0	4	85	1
Grimms	81	2,159	23	0	0	0	36	1,403	24
Reifs Mills	12	326	3	0	0	0	5	212	4
Rahr	16	357	4	0	0	0	5	232	4
Lower Branch	14	278	3	0	0	0	4	111	2
Total	233	9,595	100%	12	1,485	25%	106	4,453	75%

Agricultural Nutrients and Pest Management Runoff Pollution Reduction Objective

The overall watershed goal is to reduce the amounts of nutrients, pesticides, and sediment that are being delivered to the stream. Mismanagement of cropland spread or stored manure, fertilizers, and pesticides causing runoff will be targeted for improved management through the adoption of an NRCS Nutrient and Pest Management Plan (standard 590). Manure Stacks or Leaking Manure Storage Structures will be targeted for abandonment or relocation to a suitable outlet.

Development of a Nutrient and Pesticide Management Plan will give a landowner an opportunity to balance water quality while maintaining a sustainable agricultural system that reduces excess nutrient applications and the costs associated with it.

Nutrient and Pest Management Sites

Nutrient and Pest Management is recognized as one of only a few BMPs that can be applied for protection or improvement of groundwater and surface water. Because of wide spread groundwater and surface water contamination, cropland involved in critical and eligible livestock operations (Table 2-3) and cropland used for "cash cropping" will be encouraged to participate in an on-farm nutrient and pest management educational program to reduce the over application of nutrients and pesticides. Cash cropping refers to cropland acreage that does not receive manure, organic by-products, or have hay in the cropping rotation. Over 47,000 acres of cropland from these operations will be eligible to participate in this program.

Nutrient and pest management will be addressed with the development of both nutrient management and pest management plans which may include crop scouting. Many of these plans will be prepared by crop consultants and must be in accordance with the NRCS Standard 590 and 595. **Soil erosion rates must be managed to the tolerable soil loss (T) as a minimum to qualify for nutrient management planning.** Landowners will be eligible for up to three years of cost-sharing towards crop consultant planning fees, *which includes soil sampling*. These plans will be submitted to and approved by the Manitowoc and Brown County Land Conservation Departments. Records should be kept showing progress towards reducing the use of fertilizer and pesticides.

Other practices not mentioned above that are cost-shareable are manure nutrient analysis, integrated pest management, and spill control basins for pesticide handling. A cost-sharing rate of 50 percent is available for all nutrient and pesticide management practices with a cost-share rate of 70 percent on spill control basins.

Manure Storage as a component of the Nutrient Management Plan

Nutrient management will be a significant component of manure management systems, barnyards, and manure storage facilities. The strategy to address agricultural nutrients will be based on the Manure Storage Rating Guideline (MSRG) Model results. The MSRG Model will prioritize landowners based on the lack of available cropland suitable for winter spreading. Approximately 50 landowners will initially be contacted by the respective county staff. Project staff will develop a preliminary nutrient management plan for landowners interested in participating in the project to determine eligibility for manure storage or manure brokering/hauling. Landowners receiving cost sharing to install a manure storage

structure or implement a manure brokering/hauling program, will be required to develop a nutrient management plan with a certified crop consultant in accordance with the NRCS 590 standard.

Other landowners will be contacted at a later date, at which time their eligibility for manure storage or manure brokering/hauling practices will be determined. All landowners in this group will be encouraged to contract with private consultants to implement a nutrient management program. Cost-sharing eligibility for manure storage practices will be based on the development of a preliminary Nutrient Management Plan that is consistent with the NRCS 590 standard. An operation is eligible if the nutrient management plan demonstrates that manure cannot be practically managed during periods of snow-covered, frozen and saturated conditions without the installation of storage practices. The nutrient management plan must also demonstrate that proper utilization of the manure can be achieved following adoption of the intended storage practice. Existing structures which are environmentally unsound due to leaking to surface and/or groundwater will also be eligible. Critical site designation will not be a component of the management strategy for manure storage in the Branch River Watershed.

Cost sharing for manure storage facilities will also be based on the least cost system. These options may include manure stacks (in accordance with Std. 312), short term storage (capacity for 30 to 100 days production in accordance with Std. 313), and long term storage (capacity for up to 365 days production in accordance with Std. 313 or 425). Additional options for reducing the surface water quality impact from the over-application of manure to cropland are:

- * Reduce on-farm animal numbers.
- * Rent or purchase additional land that is suitable for winter spreading.
- * Haul manure or broker manure to a neighboring farm or "cash-cropland."

Cost-sharing will not be provided to landowners for manure storage or manure brokering/hauling if a nutrient management plan demonstrates that sufficient land is available for winter spreading.

Rural Sediment Runoff - surface water protection

Intensive agricultural land use practices has caused considerable amounts of eroded soil to reach streams, ponds, and wetlands in the Branch River Watershed. Upland erosion is the major source of sediment that is delivered downstream, beyond individual subwatershed boundaries.

Cropland Sediment

Upland sediment sources were evaluated through subarea sampling and interpolation for the entire watershed (107 square miles). The results of this inventory are summarized in table 2-6. An estimated 12,553 tons of soil per year are delivered to wetlands or streams in

the watershed from croplands. An additional 327 tons of sediment is delivered annually from land-use that is not associated with cropland. Uplands are the source of 79 percent of the sediment delivered to surface waters. Table 2-4 summarizes upland sediment loading by land use for all subwatersheds; Table 3-1 and 3-2 describes the various sediment control practices that eligible landowners may enter into cost share agreements to implement these practices.

Residue Management

The conservation tillage pilot project (Appendix D) will be utilized as an informational and educational activity to focus on High Residue Management as a nonpoint source pollution control abatement practice. The education activities for 1996 will be developed to identify the knowledge, skills, and activities necessary to implement this practice.

Previous Water Quality Accomplishments

Prior to designation as a Priority Watershed Project, many landowners within the Branch River Watershed participated in state and federal conservation programs such as Farmland Preservation (FPP) and the Agricultural Conservation Program (ACP). Many landowners within the project area have all of their cropland fields planned to the tolerable soil loss level (T) and continue to follow their conservation plan. With the exception of the Township of Kossuth, all other townships within the Branch River Watershed are zoned under the Exclusive Agricultural Ordinance. These conservation planning and erosion control efforts by the Manitowoc County SWCD, Brown County LCD, UWEX, NRCS, DATCP, and ASCS has contributed to a 25 percent reduction of sediment delivered to watershed streams on an annual basis.

The cropland sediment reduction objective is to reduce the amount of cropland sediment delivered to surface waters from eroding cropland by an additional 25 percent. This would reduce the sediment load delivered to surface waters by approximately 3,138 tons/acre/year. Soil erosion rates are calculated using the Universal Soil Loss Equation (USLE). Sediment delivery rates are calculated using the USLE in addition to other hydrology information located in the FOCS WINHUSLE model.

Cropland Critical Sites

Cropland fields delivering sediment to surface water at a rate greater than the tolerable soil loss, T, and greater than 0.4 tons/acre/year will be targeted for control and pollution abatement action . Approximately 3,400 acres of cropland in the Branch River Watershed (7 percent) meets the critical site criteria. When controlled through various management actions, these sites will account for 50 percent of the water quality objective for sediment reduction. This would reduce the sediment load delivered to watershed streams by an estimated 1,569 tons/ac/yr. All critical site cropland fields will need to be reduced to T or less, and deliver sediment to the stream at 0.4 tons/ac/yr or less. The average sediment delivery rate for the Branch River Watershed in 1995 was 0.30 tons/ac/yr.

To promote voluntary participation, only those landowners with cropland fields delivering the highest sediment to the stream will receive initial critical site notification. This would consist of approximately 1,550 acres, or 3 percent of all cropland within the watershed. These cropland fields would reduce the sediment load delivered to surface waters by approximately 785 tons/acre/year, or 25 percent of the total sediment reduction objective.

During the fifth year of project implementation, the Branch River Watershed will be evaluated by the Manitowoc and Brown County LCDs in conjunction with District Office DNR Staff for progress. If acceptable progress has been made prior to the fifth year of project implementation, the remaining critical sites that have not yet been notified by letter, will be immediately reclassified as eligible. This would consist of approximately 1,850 acres, or 4 percent of all cropland within the watershed. Acceptable progress is defined as achieving 65 percent of the project's total cropland sediment reduction objective (2,040 tons/acre/year) through cost share agreement sign-up.

The critical site verification contact strategy will focus on the development of cost share agreements with landowners that have cropland fields that meet the critical site criteria. The Farmland Preservation Program and cross-compliance activities will be used to maintain erosion levels below the tolerable soil loss (T).

Cropland Eligible Sites

Cropland fields not notified as critical sites that are delivering sediment to watershed streams at a rate greater than or equal to 0.01 tons/ac/yr will be targeted for control and pollution abatement. These sites will be categorized as eligible sites. When controlled through various management actions, these sites will account for 50 percent of the water quality objective for sediment reduction. This would reduce the sediment load delivered to watershed streams by an estimated 1,569 tons/ac/yr. These eligible site cropland fields will need to reduce the sediment delivery rate to 0.4 tons/ac/yr or less. **Cropland fields that deliver less than 0.01 tons/ac/yr will not be eligible for cost sharing of sediment reducing practices.**

Federal Program Integration

Landowners with high sediment delivery fields will be encouraged to participate in future Conservation Reserve Program (CRP) sign-ups, as well as the Federal Set-aside Program (Wetland Reserve).

Rotational Grazing

Rotational grazing will be promoted as a sediment reduction opportunity for watershed landowners. Informational and educational news letters and fact sheets will be widely distributed to encourage this practice. An on-site rotational grazing demonstration project will be chosen early in the implementation phase of the watershed project in an attempt to establish a landowner grazing network for potential watershed participants.

Table 2-4 Summary of Upland Sediment Loading By Land Use: Branch River Watershed

Subwatershed		Cropland	Developed	Grassland	Pasture	Industrial	Woodlot	Wetland	Totals
Saint Johns	Acres	6,450	234	308	89	11	622	1,713	9,427
	Sediment	2,287	41	0	3	0	0	0	2,331
Morrison	Acres	12,011	439	577	175	19	1,157	3,215	17,593
	Sediment	4,347	77	0	5	0	0	0	4,429
Cooperstown	Acres	3,317	128	162	25	3	869	2,229	6,733
	Sediment	240	7	0	0	0	0	0	247
Cherney	Acres	4,600	192	745	284	0	667	1,164	7,652
	Sediment	528	20	1	19	0	0	0	568
Grimms	Acres	13,601	506	556	233	25	710	1,095	16,830
	Sediment	4,071	98	1	6	0	0	0	4,176
Reifs Mills	Acres	2,910	138	290	6	0	541	110	3,995
	Sediment	427	19	0	1	0	0	0	447
Rahr	Acres	3,010	121	307	8	0	848	288	4,582
	Sediment	352	20	0	1	0	0	0	373
Lower Branch	Acres	1,141	95	4	308	0	269	47	1,864
	Sediment	301	13	1	1	0	0	0	316
TOTALS	Acres	47,040	1,853	2,949	1,128	58	5,683	9,861	68,676
	Sediment	12,553	295	3	36	0	0	0	12,887

Table 2-5 Cropland Sediment¹

Subwatershed	Inventory Results				Goal - 25 % reduction in sediment delivered					Not Eligible <T soil loss and <0.1 sed. del.
	Area - (Acres)	Tons per year - Sediment delivered	% contribut ed by subwater shed	objective reduction (%)	Critical Sites > T soil loss and > 0.4 sediment delivery rate					
					# Acres	ReductionTar get (tons)	% Reduced	# Acres	Target - Tons Reduced	
Saint Johns	9,427	2,287	18%	25%						
Morrison	17,593	4,347	35%	25%						
Cooperstown	6,733	240	2%	25%						
Cherney	7,652	528	4%	25%						
Grimms	16,830	4,071	33%	25%						
Reifs Mills	3,995	427	3%	25%						
Rahr	4,582	352	3%	25%						
Lower Branch	1,864	301	2%	25%						
TOTALS	68,676	12,553	100%	25%						

¹ Complete data not available at time of publication due to WINHUSLE model complications. Data will be made available by Brown and Manitowoc County when data base is operational.

Gully Erosion

Gully erosion contributes an estimated 9 percent (1,416 tons) of the total annual sediment load to surface water in the Branch River watershed. Since gully erosion has not been identified as a significant problem in the Branch River Watershed, no critical sites for control have been identified.

The Gully Erosion Reduction Objective is to achieve a minimum overall sediment reduction level of 50 percent.

Gully Sites

Landowners who enter into a cost share agreement voluntary or through critical site designation will be required to control 50 percent of the total sediment load delivered to surface water from gullies on their land. See Table 2-6 for gully erosion control eligibility criteria.

Soil erosion that occurs from gully activity on cropland will mainly be controlled through the installation of grassed waterways. In some instances, other Best Management Practices such as high residue management and/or the installation of structural practices that reduce peakflow and increase infiltration upfield may reduce or eliminate the need for grassed waterways.

If an on-site evaluation of an active gully leads local LCD staff to the conclusion that the installation of structural practices would not be cost effective, that site will be deemed as ineligible for those specific practices. All active gullies will be eligible for critical area stabilization and seeding.

Table 2-6 Eligibility Criteria for Gully Erosion

Management Category	Description	Target Reduction Level
Eligible	Actively Eroding Gullies	50 % of Sediment Load from all eroding Gullies
Not Eligible	Inactive Gullies	N/A

Streambank Erosion

Eroding streambanks contribute an estimated 10 percent of the total annual sediment load to surface water in the Branch River Watershed. Since streambank erosion has not been identified as a significant problem in the watershed, no critical sites for control will be designated.

Streambank Sediment Reduction Objective is to achieve an overall minimum sediment reduction level of 10 percent.

Streambank Sites

Approximately 268 miles of streams in the Branch River Watershed were evaluated. Significant erosion and aquatic habitat degradation was identified along approximately 10 miles (< 4 percent) of the streambank. An estimated 1,445 tons of sediment are eroding into the streams annually. See Table 2-9 for streambank inventory results.

Environmentally sensitive areas adjacent to, or within specific stream reaches have been identified in the Branch River Watershed. These specific areas are valued because of their potential for providing or enhancing spawning areas, aquatic habitat and water quality.

Landowner Eligibility - Streambank Erosion

Landowners who enter into a cost share agreement may be required to address specific eroding streambank sites that are located within environmentally sensitive areas. Manitowoc and Brown County LCD Staff will attempt to secure additional funding from various nonprofit environmental organizations to minimize landowner costs for practice installation on these sites.

Eligible streambanks are those sites that contribute at least 1 ton of sediment to the stream on an annual basis. If an on-site evaluation of an eroding streambank leads local LCD staff to the conclusion that installation of structural practices to correct the problem would not be cost effective, that site will be deemed as ineligible. Generally, streambank sites that are located within woodland or wetland areas are not accessible and the installation of structural practices would not be cost effective. **All eroding streambank sites will be eligible for critical area seeding to stabilize the bank by establishing a vegetative cover.** See Table 2-7 and 2-8 for streambank erosion control eligibility criteria.

Livestock Access to Watershed Streams

Livestock have access to approximately 1 percent of the total stream length in the Branch River watershed. Since livestock have such limited access to the stream, erosion from trampled streambanks has not been identified as a significant source of sediment in the watershed. *Therefore, no critical sites to control livestock access have been identified.*

Table 2-7 Eligibility Criteria for Eroding Streambanks

Management Category	Sediment Delivery (tons/year)	Reduction Objective (tons/year)
Eligible	≥ 1 ton/year	< 1 ton/year
Not Eligible	< 1 ton/year	N/A

Landowner Eligibility - Streams with Livestock Access

Landowners who enter into a cost share agreement that have a perennial or intermittent stream that shows signs of degradation due to livestock access, will be required to rectify the problem with a management action. Participating landowners will receive cost-share assistance to reseed the degraded streambank and given the option of either denying cattle access to the stream or implementing a rotational grazing management system to protect the streambank from further degradation. **All landowners allowing livestock access to a stream will be eligible for livestock exclusion practices and vegetation establishment.** Eligibility criteria for Cattle Trampled Streambanks is defined in Table 2-8.

Eligibility for Best Management Practices for surface or groundwater protection may be adjusted up to critical or eligible, or adjusted down to eligible or ineligible pending a field investigation. Results of field investigations will be documented and recorded on the WIS-FOCS database, or other appropriate tracking systems. Eligibility determinations will accompany watershed contracts when sent to the District Nonpoint Source Coordinator.

Landowners that do not allow livestock access to the stream, will be not be eligible for cost-share assistance for pastureland development within those specific stream reaches.

Table 2-8 Eligibility Criteria for Trampled Streambanks

Management Category	Streambank Condition	Water Quality Objective
Eligible	Trampled/Degraded/ Cattle Access	Vegetated Streambank/ No Cattle Access
Not Eligible	Vegetated, No current Cattle Access	N/A

Table 2-9 Streambank Inventory Results: Branch River Watershed Streambank Erosion and Degraded Habitat

Subwatershed	Inventoried Streambank Length (feet)	Eroded Sites (feet)	Trampled Sites (feet)	Slumped Sites (feet)	Cattle Access (feet)	Total Sediment Loss Tons/Year	% Bank Degraded From E, T, S	% of Total Bank Erosion in Watershed	Subshed Rank for Bank Erosion	Subshed Rank for Cattle Access
Saint Johns	157,872	12,710	1,100	0	1,100	111	9%	26%	2	2
Morrison	359,568	28,621	7,855	0	7,855	1,411	10%	70%	1	1
Cooperstown	102,432	586	0	0	0	16	<1%	<1%	3	4
Cherney	152,592	215	600	32	600	4	<1%	2%	4	3
Grimms	400,224	103	0	111	0	2	<1%	<1%	5	5
Reifs Mills	105,072	0	0	0	0	0	<1%	<1%	6	6
Rahr	85,008	0	0	0	0	0	<1%	<1%	7	7
Lower Branch	52,272	0	0	0	0	0	<1%	<1%	8	8
TOTALS	1,415,040	42,235	9,555	143	9,555	1,544	<4%	100%	N/A	N/A

Source: Manitowoc and Brown County LCDs

Tables 2-10 and 2-11 summarize the sediment and phosphorus reduction goals for the Branch River Priority Watershed Project.

Table 2-10 Watershed Sediment Reduction Goals

Source	Sediment Delivery(tons)	Sediment Reduction Goal	Sediment Reduced (tons)	Percent of total
Cropland Erosion	12,553	25 %	3,138	78 %
Gully Erosion	1,416	50 %	708	18 %
Streambank Erosion	1,545	10 %	155	4 %
TOTAL	15,514	26 %	4,001	100 %

Table 2-11 Watershed Phosphorus Reduction Goals

Source	Phos. Delivered (lbs)	Phos. Reduction Goal	Phos. Reduced (lbs)	Percent of total
Barnyards	9,595	62 %	5,938	13 %
Cropland	138,083	25 %	34,518	76 %
Other*	13,131	4 %	4,712	11 %
TOTAL	160,809	28 %	45,168	100 %

* The other category addresses the phosphorus reduction that is attributed to soluble phosphorus attached to sediment from active gullies and eroding streambanks.

Eligibility for Wetland Restoration and Easements

Wetlands are valuable natural resources that provide wildlife habitat, fish spawning and rearing areas, recreation, storage of runoff and flood flows and removal of pollutants. Wetlands in the watershed are mainly in the Branch River floodplain. Floodplain wetlands support furbearers and waterfowl populations and may provide seasonal habitat for sport fish. *The Wetland Restoration Objective is to restore or rehabilitate 10 percent of all degraded or prior converted wetlands to their natural condition (approximately 1,000 acres).*

Watershed staff will primarily focus on wetlands that are presently, or have been in the past, degraded through drainage, grazing, cropping, or other activities causing water storage loss and build up of sediments. Wetland restoration is considered as a best management practice for the purpose of controlling nonpoint sources of pollution. Wetland restoration includes: the plugging or breaking up of existing tile drainage systems, the plugging of open channel drainage systems, other methods of restoring the pre-development water levels of an altered wetland, and the fencing of wetlands to exclude livestock. Secondary benefits of wetland restoration include enhancement of fish and wildlife habitat, and moderating flow to surface waters.

Wetland restoration is an available option to address any of the following:

- * Cultivated hydric soils with tile or open channel drainage systems discharging to a stream or tributary.
- * Wetland restoration will reduce the amount of nutrients and pesticides draining from the altered wetland to a water resource and restore the hydrology supplying long-term base-flow either by establishing permanent vegetation or altering the drainage system.
- * Pastured wetlands riparian to streams, or tributaries.
- * Eliminating livestock grazing within wetlands will reduce the organic and sediment loading to the wetland and adjacent water resource, and reduce the direct damage to the wetland from the livestock. Livestock exclusion by fencing will control the pollutants and restore the wetland.
- * Prior converted wetlands downslope or upslope from fields identified as sediment sources through the WINHUSLE model.

Restoration of wetlands in these situations will do one of two things: 1) create a wetland filter which reduces the pollutants from an upslope field(s) to a water resource; or 2) reduces the volume and/or velocity of water flowing from an up-slope wetland to a down-slope critical field.

Landowner Eligibility

There will be no critical site areas targeted for wetland restoration. All wetlands (an estimated 9,861 acres), will initially be classified as eligible for restoration or rehabilitation and subject to field verification by project staff.

Landowner eligibility for wetland restoration will be dependent upon the following conditions:

- * Project staff will determine the effectiveness of a proposed wetland restoration project, considering sediment reduction, hydrologic improvements, and other nonpoint source pollution abatement benefits. Secondary benefits that enhance fish and wildlife habitat shall also be considered.
- * As a minimum, all upland fields immediately adjacent to a proposed wetland restoration site must have the sediment delivery rate planned down to 0.4 tons/acre/year.

Land Easements

Nonpoint source program funds may be used to purchase land easements in order to support specified best management practices. These practices, all of which involve the establishment and preservation of permanent vegetative cover, include:

- Shoreline Buffers: vegetative areas which minimize nonpoint source impacts and other direct impacts to streams; or karst drainage features.
- Critical Area Stabilization: stabilization efforts needed on sites that either erode at an excessive rate, or have high sediment delivery rates to surface water;
- Agricultural Sediment Basins: A structure designed to reduce the transport of sediment and other pollutants to surface waters and to decrease peak flow rates downstream.
- Wetland Restoration: areas where wetlands are intentionally restored or enhanced in order to improve their ecological values, such as natural filters of surface water.
- Areas of cultivated soil less than 2 feet, or highly permeable-high hazard NLEAP soils where current land use is suspected of contributing nitrate and pesticides to groundwater.

Easements may also be considered for protecting municipal well heads if it can be established that vegetative cover will correct an existing groundwater quality threat.

Although easements are not considered a best management practice, they can help achieve desired levels of nonpoint source pollution control in specific conditions. Easements are used to support best management practices, enhance landowner cooperation and more accurately compensate landowners for loss or altered usage of property. The benefits of using easements in conjunction with a management practice are: 1) riparian easements can provide

fish and wildlife habitat along with the pollutant reduction function; 2) easements are generally perpetual, so the protection is longer term than a management practice by itself; and 3) an easement may allow for limited public access (depending on the situation). The primary justification of an easement is to meet the water quality resource objective identified in the plan.

Easements should be considered in the following situations:

1. To exclude livestock from grazed wetlands or along streambanks within the watershed. Easements are not limited to, but are strongly recommended whenever:
 - There is any grazing of wetlands, streambanks, or floodplains.
 - Livestock density is so great that areas of unvegetated soil are within 100 feet of perennial streams, intermittent streams, or floodplains.
 - If a streambank is severely trampled due to cattle access.
 - Channel erosion is exacerbated by livestock grazing such that unvegetated streambanks are two feet or more in height.
2. When elimination of row cropping and the establishment of permanent vegetative cover will stabilize and protect a critical area or corridor. Easements are not limited to, but are strongly recommended whenever:
 - Row cropping is occurring within 100 feet or less of perennial streams, intermittent streams, or flood plains.
 - Row cropping is being practiced on slopes greater than 6 percent.
3. To support wetland restorations and protection of existing wetlands. Easements are not limited to, but are strongly recommended whenever:
 - The restoration or protection of a wetland increases the probability of achieving the water quality and resource objectives.
4. When a barnyard or animal feedlot is located within the flood plain and: a) a permanent easement is the least-cost alternative to provide adequate pollution reduction or b) a permanent easement provides a greater level of pollution reduction than on-site engineering options at a price that is cost-effective when compared to the level of pollution reduction and the price of the available engineering options. Easements are not limited to, but are strongly recommended whenever:
 - Engineering options would require intensive management in order to continue to provide adequate pollution reduction.
 - Surrounding land use is largely agricultural and it is anticipated that it will remain so for two decades or more.
5. The elimination of row cropping is determined to be the most effective nutrient and pesticide management action.

Urban Nonpoint Source Pollutants and Eligibility Criteria

Established and Developing Urban Areas

The Village of Whitelaw and the unincorporated developed areas throughout the Branch River Watershed, may be eligible for cost-share assistance to install urban nonpoint source control practices. Funds for practices installed in the developed incorporated areas would be administered through grants with Manitowoc and Brown Counties.

A detailed inventory of pollutant loading from developed areas was not conducted in the Branch River Watershed. However, where governmental units are interested in modifying existing stormwater runoff situations, cost-share and technical assistance may be available through the Priority Watershed Program. DNR Nonpoint Source staff are available to assist the Village of Whitelaw and the counties in reviewing current conditions and recommending a course of action such as the development of a comprehensive stormwater management plan. Feasibility studies would be necessary to select site specific practices that reduce the potential of nonpoint source contaminants reaching surface water. The cost and complexity of studies may vary, depending on the availability of land for practice location and the compatibility of existing stormwater drainage or storm sewer networks.

It is especially important that the Village of Whitelaw as well as Manitowoc and Brown Counties, consider the types of practices described below when areas are being developed or planned for future development. The cost of many of these practices would be financially more feasible if they are planned and installed as part of the original development in the area.

Urban Best Management Practices

There are four general classes of management practices used to reduce water quality problems caused by urban stormwater runoff and the associated problems caused by that runoff. These are:

- * Streambank erosion control practices
- * Nonpoint Source pollutant reduction practices
- * Stormwater infiltration practices
- * Stormwater wet detention practices

Streambank Erosion Control Practices

Streambank and shoreline erosion that occurs within developed areas will be eligible for cost-shared practices on a case by case basis that will be dependent upon the significance of the erosion that is occurring and the cost effectiveness of the control practice to be installed. Streambank erosion control criteria that was developed for rural areas shall also apply to urban and developing areas and can be found earlier in this chapter.

Nonpoint Source Pollutant Reduction Practices

These practices are intended to stem the generation of urban pollutants as close to the source as possible. Ideally, pollutant generation is eliminated or minimized prior to entering surface waters, either directly or via a storm sewer.

Source controls are generally non-structural in commercial and residential areas, relying instead on changes in products people use and in the way they live. Reducing the amount of automobile traffic in an area, and the current programs that remove lead from gasoline and asbestos from automobile brake linings are other examples of nonpoint source pollutant controls.

Source area controls that rely on better housekeeping practices, such as pet waste control programs and the judicious use of lawn and garden products can be enacted locally. These types of controls are inexpensive and are a vital component to any stormwater management program. Information and education efforts are critical in supporting this approach since this type of urban action is only as good as the collective effort of the general public responsible to carry it out. Several source control alternatives recommended in the Branch River Watershed are:

- Urban residents need to immediately remove pet waste from lawns, sidewalks and streets so bacteria contamination of urban runoff is reduced.
- Urban residents need to properly manage the timing, the amount and the type of fertilizer and pesticide applications to lawns and gardens.
- Urban residents need to properly dispose automobile waste fluids and keep those waste products out of storm sewer systems.
- Remove leaves and debris from streets and parking lot surfaces through street sweeping and leaf collection programs.
- Base zoning of land-use, in part, on site suitability for stormwater management practices needed to meet water quality, habitat and flood related objectives.
- Limit construction site erosion
- Limit the use of street de-icing compounds to a minimum.

Stormwater Infiltration Practices

The volume of urban runoff transporting pollutants to surface waters during a rainstorm is directly related to the amount of impervious urban area that is directly connected to the receiving waters. Impervious areas include rooftops, parking lots, streets and sidewalks.

Areas that are directly connected to those that drain to storm sewer pipes or concrete channels.

Reducing pollutant transport to surface waters involves disconnecting the urban stormwater flow. This is accomplished by increasing the infiltration of stormwater into the soil. Stormwater infiltration on a suitable site will effectively reduce all major stormwater pollutants. Infiltration can be used jointly with wet detention where needed to augment the water resources management capabilities of the less versatile wet detention pond.

Practices that promote infiltration include porous pavement, redirecting roof downspouts to grassy areas, directing runoff waters to infiltration trenches, grassed swale drainage systems and infiltration basins. Not all sites are appropriate for the use of infiltration practices. Slopes, heavy clay soils and the potential for groundwater contamination may limit the areas available for use of these practices.

Stormwater Wet Detention Practices

Wet detention ponds are effective at controlling particulate pollutants and can be designed to control peak flow discharges. Consequently, wet detention ponds can be employed to serve many of the needs including pollution control, flood control and control of stormwater flows that may be causing streambank erosion. Wet detention ponds have limited effectiveness in controlling urban pollutants in the dissolved state, and cannot effectively reduce the total stormwater volume. The wet pond is most commonly used to control runoff coming off large areas.

Wet detention ponds must be lined in areas where potential groundwater contamination from the pond is a concern.

Ordinances

Manure Storage Ordinance

Surface water and groundwater resources are at risk when animal waste storage facilities are improperly located, designed, or constructed. Manure overflows and storage facility failures are a serious threat to aquatic life. Counties adopt animal waste storage ordinances to prevent ground and surface water pollution by assuring the proper design, construction, location, and management of permitted facilities. An ordinance must meet the guidelines adopted by DATCP and cite the applicable NRCS construction and management standards. Ordinances require permits for the installation, modification and major repair of animal waste storage facilities.

To assure protection of surface and groundwater from animal waste storage facilities throughout the watershed, the adoption of a animal waste storage ordinance in Manitowoc County is necessary during the course of the Branch River Watershed project. Certain costs

for the development and administration of the ordinance are eligible for reimbursement under the Priority Watershed Project. As required by State statutes, the County must repay to the State all nonpoint source grant agreement funds if the ordinance is not adopted. This will be a condition of the Manitowoc County Nonpoint Source Grant Agreement.

Brown County enacted a animal waste storage ordinance in 1986.

Manitowoc County must have an ordinance to control manure or repay all of the NPS grant at the end of the project.

Livestock Expansion

Expansion of farming operations involving livestock poses a significant threat to both surface and groundwater in the Branch River Watershed. Expansion is of particular concern when a landowner does not have suitable cropland acreage to safely apply the manure generated by all existing livestock.

Manitowoc and Brown County will work toward development and adoption of an ordinance which will require any livestock operator to obtain the appropriate approval from the respective county prior to expanding or constructing a facility with the intent of increasing the number of animals on that site. The ordinance would require the landowner to demonstrate through a nutrient management 590 plan, that sufficient cropland is available for safe application of all manure generated from livestock from that operation.

Shoreland District

A Shoreland District Ordinance was approved by Brown County in 1995. The district includes all areas defined in Section 22.04 and those areas not within the conservancy or floodplain districts as indicated on the Shoreland-Floodplain Zoning Map. The purpose of the shoreland regulations is to prevent water pollution, preserve and protect hydrological and ecological relationships, promote public health, safety, prosperity and general welfare by providing for safe and orderly shoreland development.

The Shoreland District Ordinance will require a minimum establishment of a 35 foot buffer area along all navigable streams. The buffer area will be seeded to grass, alfalfa or other close-growing crop that shall be maintained between the farmed area and the edge of the stream. A landowner/operator may be exempt from this provision if the Brown County Land Conservation Department determines that the existing land-use practices are sufficient and no pollution is occurring.

If there is a nonpoint source pollution problem resulting from the grazing or pasturing of livestock, the landowner/operator will be required to erect a fence at a minimum distance of one rod (16.5 feet), from the edge of the navigable stream or take the appropriate

management action for pollution abatement. If a determination is made by the LCD that fencing is required, a provision will be allowed for livestock watering.

Construction Site Erosion

A number of local governments recognize that the cost of *preventing* damage from erosion and sedimentation is often less than the cost of *correcting* damage from erosion. Also, many believe that the cost of preventing erosion damage should be borne by those benefiting from the development rather than by taxpayers paying to remove sediment from ditches, culverts, streets, harbors, lakes, and streams. These local governments are developing or amending subdivision ordinances, zoning ordinances, and other local ordinances to include runoff and erosion control requirements for developing land areas.

Chapter 236 of the Wisconsin Statutes gives cities, villages, towns, and counties authority to control erosion from developing subdivisions and smaller land divisions. This chapter establishes the minimum standards and procedures for land division in Wisconsin. The chapter enables local governments that have an established planning agency to adopt subdivision ordinances that are more restrictive than the state standards. Several of these government units have included runoff and erosion control provisions in their ordinances. These ordinances typically require a developer to submit a detailed plan specifying control measure for minimizing erosion and runoff during and after development. Typically, before a final plat is filed the person who reviewed the erosion and runoff control plan visits the development site and certifies that the measures have been installed in accordance with the plan.

The DNR suggests that the Wisconsin Construction Site Erosion Best Management Handbook (DNR Publication WR-222-93) be used as a reference for any development that occurs in the Branch River Priority Watershed Project.

The Village of Whitelaw adopted a comprehensive construction site erosion control ordinance in 1996.

Other Pollution Sources

Many pollution sources contributing to surface water quality degradation in the watershed are typically not addressed by the priority watershed project. Control of these pollution sources occurs through other state and county regulatory programs, as described below.

Industrial Point Sources of Pollution

Discharges of wastewater from permitted municipal and industrial sources are important considerations for improving and protecting surface water resources. Chapter 147, Wis. Stats., requires any person discharging pollutants into the waters of the state to obtain a Wisconsin Pollution Discharge Elimination System (WPDES) Permit issued by the DNR.

Stella Foods, Inc.- Branch operation (formerly Branch Cheese Acquisitions, Inc.) is only one industrial discharger in the Branch River Watershed. Stella Foods, Inc.- Branch discharges effluent directly to the Branch River.

Sewage Treatment Systems

Sanitary sewer service availability is limited to the Villages of Whitelaw and Morrison. Wastewater generated by the remainder of the watershed residents is disposed of through private on-site systems.

Village of Whitelaw Wastewater Treatment Plant

The village of Whitelaw Wastewater Treatment Plant discharges to an unnamed intermittent tributary (T19N,R22E,S3,SWNE) to Hempton Lake. Hempton Lake discharges to a perennial tributary to the Branch River. Treatment of wastewater is by activated sludge, aerobic digestion and primary sedimentation. The system was last upgraded in 1995 and is operating within all permit parameters. The Village of Whitelaw Wastewater Treatment Plant current permit expires in December 1996.

Village of Morrison Sanitary District

The village of Morrison Sanitary District #1 discharges to an unnamed intermittent tributary (T21N,R21E,S9,NESW) to the Branch River. This Sanitary District began operation in 1993.

Private Sewage Systems

Septic systems consist of a septic tank and a soil absorption field. Septic systems fail due to soil type, location of system, poor design or maintenance such as tanks which go unemptied. Pollutants from septic system discharges are nitrates, bacteria, viruses and hazardous materials from household products. Generally, in the Branch River Watershed, the majority of soils are not (70%) suitable for conventional septic tank soil absorption systems. The dense glacial tills associated with the soils of the watershed either percolate too slowly or have a prohibitively shallow depth to groundwater for an effective absorption system. The Karst geology that underlies most of the watershed has many fractures and sinkholes that could cause groundwater contamination. These features virtually provide direct access for contaminants to reach groundwater. Landspreading of septic system waste during the winter months can also create surface water quality problems.

Counties have been using the Wisconsin Fund since 1981. The Wisconsin Fund is a Private Sewage System Replacement Grant Program offering financial assistance designed to help eligible homeowners and small business operators offset the costs of replacing a failing septic system. The program is administered by the Brown and Manitowoc County Zoning Departments. The grant program applies to principle residences and small businesses built prior to July 1, 1978, and is subject to income and size restrictions. Seasonal homes are not eligible for participation in this program. Interested individuals should contact their county zoning department for more information.

Land Application of Municipal and Industrial Wastes

Sludge is an organic, non-sterile, by-product of treated wastewater, composed mostly of water (up to 99 percent). The re-use of sludge through land application is considered a beneficial recycling of nutrients and a valuable soil conditioner. Use of sludge in this manner is also considered to be the most cost-effective means for the treatment facility to dispose of the material.

Land application of municipal and industrial sludge is regulated under NR 204 and NR 214 respectively which require a WPDES permit, site criteria, minimum distances from wells, application rates to ensure that environmental and public health concerns such as proper soil types, depth to groundwater, distance from surface water, and the type of crop to be grown on sludge amended fields are taken into consideration when the DNR approves agricultural fields for sludge application.

Solid Waste Disposal Sites

Lemberger Landfill Incorporated

The Lemberger Landfill is located in the Franklin township, T20N-R22E, SEC 27. The site covers 21 acres of what was an old gravel pit used as an open dump from about 1940 until 1970. From 1970 until 1976, Lemberger Landfill Incorporated operated the site as a licensed sanitary landfill. Fill operations ceased no later than 1977. This site is a documented source of groundwater contamination as leachate seeps which flow to a nearby wetland have been observed and contaminants have shown up in residential wells. It is anticipated that Superfund will be used to finance the site clean-up.

Lemberger Transport and Recycling

Lemberger Landfill Incorporated, an active Wisconsin corporation, operated the 16 acre Lemberger Transport and Recycling landfill. The landfill is an unlined pit in thin soils overlying dolomite bedrock. The site operated from 1970 to 1976 and received various industrial and hazardous wastes. Fill operations ceased no later than 1977. This site is a documented source of groundwater contamination which is used for private water supplies. There is a slight chance of direct contact with wastes at this site. However, the risk is considered to be small. The contractor is currently on site and has removed over 400 drums. EPA will issue a separate source control decision in the future.

Petroleum Storage: Leaking Underground Storage Tank (LUST) Sites

The Wisconsin Remedial Response Site Evaluation Report (DNR publication number SW-144-91) lists the sites identified through the LUST program. There are three sites listed within the watershed and are listed earlier in this chapter.

Atrazine Prohibition Area

An atrazine prohibition area located in the Township of Morrison - T21N R21E Sections 3,4,9 and 10 in Brown County was identified by the DATCP in 1994. Atrazine prohibition areas are established under the authority of the Department of Agriculture, Trade and Consumer Protection under Ag. 30. The Township of Morrison was designated as a atrazine prohibition area when two samples exceeded the Enforcement Standard of 3.0 parts per billion (ppb).

The atrazine prohibition for the above area was lifted by the DATCP in late 1995.

Other Contaminated Sites

The Wisconsin Remedial Response Site Evaluation Report also has the Inventory of Sites or Facilities Which May Cause or Threaten to Cause Environmental Pollution and the Spills Program List which includes sites or facilities identified under the Hazardous Substance Spill Law. All known potential sources of groundwater quality problems are mentioned earlier in this chapter.

CHAPTER THREE

Branch River Watershed's Implementation Program

Introduction

This chapter identifies the means for implementing the rural and urban management actions for nonpoint source pollution control described in the previous chapter. It is divided into two major sections. The first describes the nonpoint source implementation strategy for rural areas. The second section describes the implementation strategy for the village of Whitelaw. The success of this priority watershed project depends on the aggressive implementation of these nonpoint source pollution control strategies.

This chapter identifies:

- The best management practices (BMPs) necessary to control pollutants on the sources identified in Chapter Two;
- The local cost containment policies and implementation strategy;
- The cost-share agreement procedures
- Schedules for implementing the project;
- The project budget including the expense for cost-sharing; and staffing for technical assistance, administration, and the information and education program.

Agricultural and Urban Best Management Practices (BMPs)

BMPs Eligible For Cost-Sharing And Their Rates

Best management practices control nonpoint sources of pollution and are identified in NR 120. The practices eligible for cost-sharing and the cost share rates for each BMP are listed in tables 3-1 and 3-2 below; the rates listed in these tables are contingent upon approval of second phase revision of the NR120 Administrative Code. If the proposed Administrative Code revisions are not approved, cost share rates for all Best Management Practices will

revert to the approved version of the code. The BMPs listed in table 3-1 can either be cost-shared at 50% or at the flat rates listed.

Design and installation of all BMPs must meet the conditions listed in NR 120. Generally these practices use specific standard specifications included in the NRCS Field Office Technical Guide. In some cases additional specifications may apply. The applicable specifications for each BMP can be found in NR 120.14. The Department may also approve other alternative best management practices and design criteria based on the provisions of NR 120.15.

If the installation of BMPs destroys significant wildlife habitat, NR 120 requires that habitat will be recreated to replace the habitat lost. The DNR District Private Lands Wildlife Specialist or a designee will assist the LCD in determining the significance of wildlife habitat and the methods used to recreate the habitat. Every effort shall be made during the planning, design, and installation of BMPs to prevent or minimize the loss of existing wildlife habitat. Wildlife habitat restoration components of the practice are cost-shared at 70 percent.

Table 3-1 Practices Using a Flat Rate for State Cost-Share Funding

BEST MANAGEMENT PRACTICE	FLAT RATE ⁵
Contour Farming	\$\$ 9.00/ac ¹
Contour Stripcropping	\$ 13.50/ac ¹
Field Stripcropping	\$7.50/ac
High Residue Management Systems	\$ 18.50/ac ²
Cropland Protection Cover	\$25.00/ac ³
Riparian Vegetated Buffer Strips	\$100.00/ac ⁴

¹ Wildlife habitat restoration components of this practice are cost-shared at 70%.

² Rate is contingent upon approval of NR120 Phase 2. Cost-share period may be extended to 5 years if the final evaluation of the Arrowhead/Rat River IBMP justifies this action.

³ \$25.00 per acre per year for 3 years.

⁴ Approved IBMP for the Branch River Watershed at \$100.00/acre/year for up to 5 years.

⁵ Rates contingent upon approval of Phase 2 of the Administrative Code (NR120).

Table 3-2 State Cost-Share Rates for Best Management Practices¹

BEST MANAGEMENT PRACTICE	STATE COST SHARE RATE
Nutrient and Pesticide Management	50%
Livestock Exclusion from Woodlots	50%
Intensive Grazing Management	50% ²
Manure Storage Facilities - for the first \$20,000 costs	70% ³
Manure Storage Facilities - remaining costs	50% ³
Well Abandonment	70% ⁶
Pesticide Spill Control Facilities	70%
Animal Waste System Storage Abandonment	70%
Field Diversions and Terraces	70%
Grassed Waterways	70%
Critical Area Stabilization	70% ⁴
Grade Stabilization Structures	70%
Agricultural Sediment Basins	70%
Shoreline and Streambank Protection	70% ⁴
Shoreline Buffers	70% ⁴
Wetland Restoration	70% ⁴
Barnyard Runoff Management	70%
Animal Lot Relocation	70%
Roofs for Barnyard Runoff Management and Manure	70%
Structural Urban Best Management Practices	70% ⁵
Milking Center Waste Control Systems	70%
Cattle Mounds	70%
Manure Hauling and Brokering	70% ⁷
Surface/subsurface Tile Outlet Relocation or Removal	70% ⁷
Settling Basins (Ag Sediment Basin)	70%

¹ Table 3-1 shows BMPs cost shared at a flat rate.

² To a maximum of \$2,000 per watering system

³ Maximum cost share amount is \$35,000 for manure storage including manure transfer equipment

⁴ Easements may be entered into with landowners identified in the watershed plan in conjunction with these BMPs. See Chapter Two for an explanation of where easements may apply.

⁵ The maximum cost-share rate for land acquisition, storm sewer rerouting, and removal of structures necessary to install structural urban BMPs is 50%.

⁶ Eligibility of this practice as a cost-shared BMP is contingent upon approval of the NR 120 Phase 2.

⁷ This practice has been approved as an Interim BMP for the Branch River Watershed.

Following is a brief description of some of the most commonly used BMPs listed above. A more detailed description of these practices can be found in NR 120.14.

Contour Farming. The farming of sloped land so that all operations from seed bed preparation to harvest are done on the contour.

Contour Stripcropping. Growing crops in a systematic arrangement of strips or bands, on the contour, in alternate strips of close grown crops, such as grasses or legumes, and row-crops.

Field Diversions. The purpose of this practice is primarily to divert water from areas it is in excess or is doing damage to where it can be transported safely.

Terraces. A system of ridges and channels with suitable spacing and constructed on the contour with a suitable grade to prevent erosion in the channel.

Grassed Waterways. A natural or constructed channel shaped, graded and established with suitable cover as needed to prevent erosion by runoff waters.

High Residue Management Systems. A system which leaves at least 30 percent of the ground covered with crop residue after crops are planted. It is utilized in two situations; one for continuous (at least 3 consecutive years) row crops, the other for short crop rotations (no more than 2 years corn and small grains and hay) or for the establishment of forages and small grains.

Nutrient Management. The management and crediting of nutrients from all sources, including legumes, manure, and soil reserves for the application of manure and commercial fertilizers. Management includes the rate, method and timing of the application of all sources of nutrients to minimize the amount of nutrients entering surface or groundwater. This practice includes manure nutrient testing, routine soil testing, and residual nitrogen soil testing.

Pesticide Management. The management of the handling, disposal and application of pesticides including the rate, method and timing of application to minimize the amount of pesticides entering surface and groundwater. This practice includes integrated pest management scouting and planning.

Cropland Protection Cover (Green Manure). Cropland protection cover are close-growing grasses, legumes or small grain grown for seasonal soil erosion protection and soil improvement.

Intensive Grazing Management (Rotational Grazing). Intensive grazing management is the division of pastures into multiple cells that receive a short but intensive grazing period followed by a period of recovery of the vegetative cover. Rotational grazing systems can correct existing pasturing practices that result in degradation and should replace the practice of summer dry-lots when this practice results in water quality degradation.

Critical Area Stabilization. The planting of suitable vegetation on nonpoint source sites and other treatment necessary to stabilize eroding lands.

Grade Stabilization Structure. A structure used to reduce the grade in a channel to protect the channel from erosion or to prevent the formation or advance of gullies.

Agricultural Sediment Basins. A structure designed to reduce the transport of sediment of other pollutants eroded from agricultural fields to surface waters and wetlands.

Shoreline and Streambank Stabilization. The stabilization and protection of stream and lake banks against erosion and the protection of fish habitat and water quality from livestock access.

Shoreline Buffers. A permanently vegetated area immediately adjacent to lakes, streams, channels and wetlands designed and constructed to manage critical nonpoint sources or to filter pollutants from nonpoint sources. When this practice is installed under a shoreland ordinance it will be perpetually maintained. In other areas, the practice will be maintained for a 10 year operation and maintenance period beyond the last cost share payment.

Lake Sediment Treatment. Lake sediment treatment is a chemical, physical, or biological treatment of polluted lake sediments. Sources of pollution to the lake must be controlled prior to treatment of lake sediments. Treatment does not include dredging.

Wetland Restoration. The construction of berms or destruction of the function of tile lines or drainage ditches to create conditions suitable for wetland vegetation.

Barnyard Runoff Management. Structural measures to redirect surface runoff around the barnyard, and collect, convey or temporarily store runoff from the barnyard.

Animal Lot Relocation. Relocation of an animal lot from a critical site such as a floodway to a suitable site to minimize the amount of pollutants from the lot to surface or groundwater.

Manure Storage Facility. A structure for the storage of manure for a period of time that is needed to reduce the impact of manure as a nonpoint source of pollution. Livestock operations where this practice applies are those where manure is winter spread on fields that have a high potential for runoff to lakes, streams and groundwater. The facility is needed to store and properly spread manure according to a management plan.

Manure Storage System Abandonment. Manure storage system abandonment is the proper abandonment of leaking and improperly sited manure storage systems, including: a system with bottom at or below groundwater level; a system whose pit fills with groundwater; a system whose pit leads into the bedrock; a system which has documented reports of discharging manure into surface or groundwater due to structural failure; and a system where there is evidence of structural failure. The practice includes proper removal and disposal of wastes, liner materials, and saturated soil as well as shaping, filling, and seeding of the area.

Milking Center Waste Control Systems. A milking center waste control system is a piece of equipment, practice or combination of practices installed in a milking center for purposes of reducing the quantity or pollution potential of the wastes.

Roofs for Barnyard Runoff Management and Manure Storage Facilities. Roofs for barnyard runoff management and manure storage facilities are a roof and supporting structure constructed specifically to prevent rain and snow from contacting manure.

Livestock Exclusion from Woodlots. The exclusion of livestock from woodlots to protect the woodlots from grazing by fencing or other means.

Cattle Mounds. Cattle mounds are earthen mounds used in conjunction with feeding and dry lot operations and are intended to provide a dry and stable surface area for cattle.

Structural Urban Best Management Practices. These practices are source area measures, transport systems and end-of-pipe measures designed to control storm water runoff rates, volumes and discharge quality. These practices will reduce the amount of pollutants carried in runoff and flows destructive to stream habitat. These measures include such practices as infiltration trenches, porous pavement, oil water separators, sediment chambers, sand filtration units, grassed swales, infiltration basins and detention/retention basins.

Easements. Easements are legally binding restrictions on land titles. Easements are purchased to ensure permanent vegetative cover.

Vegetated Riparian Buffers. This is an Interim Best Management Practice for the Branch River Watershed (Appendix B). Riparian Buffers are permanently vegetated areas immediately adjacent to intermittent or perennial streams that are designed and constructed to function as a filter to delay, absorb, or purify contaminated runoff before it enters a stream or wetland (Appendix B).

Surface/Subsurface Outlet Relocation or Removal. Interim Best Management Practice for the Branch River Watershed (Appendix B). Allows for the relocation and/or removal of a surface or subsurface water conveyance system to protect surface or groundwater at the site.

Manure Hauling and Brokering. Interim Best Management Practice for the Branch River Watershed (Appendix B). Manure hauling is the transport of manure from a storage facility to agricultural lands for the purpose of meeting crop nutrient needs.

Interim Best Management Practices

The Nonpoint Source Pollution Abatement Program is continually striving to improve the way nonpoint pollution problems are addressed in Priority Watershed Projects. Administrative Rule NR 120.15 provides for Interim Best Management Practices (IBMP) or Alternative Design Criteria where necessary to meet the water resource objectives identified in the watershed plan. Under some circumstances, practices not currently listed as eligible

BMP's may be identified during the planning phase out of necessity. Interim BMP's are created to meet the specific and individual needs identified during the planning process of a priority watershed project and will be used on a trial basis (Appendix B). Each Interim BMP will be evaluated for its effectiveness before consideration as a standard BMP. A procedure defining the process for interim BMP approval is detailed within the DNR Nonpoint Source Implementation Handbook. The Department may identify in the nonpoint source grant agreement the design criteria and standards and specifications where appropriate, cost share conditions, and cost share rates for each alternative best management practice.

Practices Not Cost-Shared

Practices not cost-shared, but which shall be included on the cost share agreement if necessary to control the nonpoint sources, are listed below (as listed in NR 120.17):

- That portion of a practice to be funded through other programs.
- Practices previously installed and necessary to support cost-shared practices.
- Changes in crop rotations.
- Changes in location of unconfined manure stacks involving no capital cost.
- Non-stationary manure spreading equipment.
- Practices needed for land use changes during the cost-share agreement period
- Other practices determined necessary to achieve the objectives of the watershed project.
- Minimum levels of street sweeping and leaf collecting.

Priority watershed cost-share funds cannot be used to control sources of pollution and land management activities specifically listed in NR 120.10(2). The following is a partial list of those ineligible activities:

- Operation and maintenance of cost-shared BMPs,
- Actions which have drainage of land or clearing of land as the primary objective,
- Practices already installed, with the exception of repairs to the practices which were rendered ineffective due to circumstances beyond the control of the landowner,
- Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program or covered in other ways by Chapter 147 of Wis. Stats.

(including livestock operations with more than 1,000 animal units, or livestock operations issued a notice of discharge under ch. NR 243),

- Septic system controls or maintenance,
- Dredging activities,
- Silvicultural activities,
- Bulk storage of fertilizers and pesticides,
- Activities and structures intended primarily for flood control,
- Practices required to control sources which were adequately controlled at the time the cost-share agreement was signed, with the exception of those that occurred which were beyond the control of the landowner,
- Other practices or activities determined by DNR not to meet the objectives of the program.

Project Implementation

During the first six months of implementation, watershed staff will continue to develop inventories for:

- erosion
- wetland restoration
- riparian buffer strip protection
- potential northern spawning sites

This information will assist Manitowoc and Brown counties in identifying critical sites prior to verification and landowner notification. The goal will be to contact landowners with identified critical sites and allow them the opportunity to voluntarily participate before receiving a written notification.

Project implementation will begin in February 1996. The conservation planning process of identifying the nonpoint pollution control needs and an implementation schedule of best management practices will be utilized with project participants. This planning process will identify pollution problems and attempt to find solutions that are mutually acceptable to the landowners/operators and the watershed staff. Participants in the Branch River Watershed project may sign cost share agreements throughout the watershed plan's implementation phase to provide financial assistance with the implementation of the designated best management practices.

Plans developed by staff will address eligibility for other programs including Farmland Preservation and USDA programs. Participants in these programs will have status reviews completed and conservation plans updated by watershed staff. It will be a priority for the

watershed staff to contact landowners participating in the Farmland Preservation Program that were previously only screened for conservation compliance. Staff will develop conservation plans that delineate mutually agreed upon conservation practices that comply with the county's soil and water conservation guidelines for the farmland preservation program. All conservation plans developed for this watershed project will incorporate best management practices that balance:

- * groundwater and surface water protection
- * soil erosion control
- * wildlife and forest management
- * protection of endangered or threatened species
- * protection of architectural and/or archeological features

The project implementation and the annual review meetings will incorporate coordination with other agencies identified in Chapter 4 Integrated Resource Management Program. This cooperation with other agencies and programs will ensure efficient services that may assist in the implementation of the project.

This project will incorporate a GIS (Geographic Information System) that will form a landowner based resource management system. This system will display each landowner's current practices and provide a tool for solving resource management problems. The GIS will combine the Field Office Computing System's (FOCS) landowner data with existing county data and vector line work, soils mapping and associated database, existing zoning coverage, wetland delineation, shoreland buffer zones which include perennial and intermittent streams, program participation coverage, parcel and field boundaries, field inventory results, digital ortho quads, and other applicable coverage to create an agricultural zoning map. This specialized zoning map will greatly reduce the amount of technical time currently devoted to referencing and updating countless paper map products used to perform daily conservation inventory, planning, and watershed accomplishment analysis reporting.

By the end of 1996, the GIS should produce a customer product that will include a map of field boundaries and practice locations that can be updated as changes dictate. The GIS component will also serve as a tool in monitoring resource management progress through applying new modeling technologies. Additionally, the groundwater specific Geographic Information System (GIS) layers should be completed. Some of these layers delineate soils series, karst features, and soils sensitive to leaching from the NLEAP model. In addition, USGS and DNR will be petitioned to identify groundwater flow direction. As a result of this data, both counties involved in the Branch River Watershed project will request an expansion of the groundwater watershed boundary for project eligibility if the need can be documented to the Departments satisfaction.

Coordination with existing DNR/DATCP/NRCS modeling and database tools will be a top priority to avoid duplication in data entry. The database will be created to enhance the existing county digital line work fields into a comprehensive GIS.

In accordance to a prior agreement with DNR, Manitowoc Soil and Water Conservation Department and Brown County Land Conservation Department will make available all

acquired experience, knowledge, and expertise from this GIS project. This information could be used by LCDs around the state to implement their own GIS database for future state integration with DNR, DATCP, and NRCS.

Cost-Share Budget

Costs of Installing BMPs

The quantity and type of management practices that are required to meet the water quality objectives of this project are listed in table 3-3a, 3-3b, and 3-3c. The capital cost of installing the rural BMPs are listed for a 75 and 100 percent landowner participation rate. Units of measurement and cost per unit for the various BMPs are also included.

The capital cost of installing the rural Best Management Practices is approximately \$11.3 million, assuming 75 percent landowner participation.

- State funds necessary to cost-share this level of control would be approximately \$8.2 million.
- The local share provided by landowners and other cost-share recipients would be approximately \$2.5 million.

The capital cost of installing the urban Best Management Practices is approximately \$200,000, assuming 100 percent participation.

- State funds necessary to cost-share this level of control would be approximately \$200,000.
- The local share provided by landowners and other cost-share recipients would be approximately \$100,000.

Easement Costs

Chapter Two identifies where nonpoint source program funds can be used to purchase easements. The estimated cost of purchasing easements on eligible lands in Manitowoc and Brown Counties are shown in table 3-3a, 3-3b, and 3-3c. At 100 percent participation, the estimated purchase price of rural easements on eligible lands would be \$1.1 million.

Cost Containment

Cost Containment Procedures

Chapter NR 120 requires that the Land Conservation Departments, as grantors of cost share agreements, identify and agree to use one or more of the following cost containment

procedures that are described below to control the costs of installing BMPs. The cost containment procedure to be used by Manitowoc and Brown Counties will frequently involve the determination of average costs and range of costs. However, all the procedures listed below may be employed to contain costs.

Average Costs: Based on past cost information, the Land Conservation Department determines an average cost per unit of materials and labor for the installation of a Best Management Practices (BMPs) which may not be exceeded.

Range of Costs: Based on past cost information, the Land Conservation Department establishes a cost range for the installation of a best management practice. Eligible costs may not exceed the maximum cost of the range.

Bidding: The Land Conservation Department requires the landowner or land operator to request bids from contractors for the installation of best management practice. The cost share payment shall be calculated based on the lowest bid received.

Flat Rates: BMPs using flat rates are shown in Table 3-1. The rates shown are the State's share of the practice installation costs.

Maximum Cost share Limit: The Land Conservation Department or the department established a maximum cost share rate limit not to exceed the rates specified in s. NR 120.18 for installation of a best management practice.

Municipal Work Group: The Land Conservation Department hires or assigns its employees to install a best management practice for a number of landowners and land operators if the employees are able to perform the work at a cost lower than the private sector.

Wisconsin Conservation Corps: The Land Conservation Department uses the Wisconsin conservation corps to install best management practices for landowners and land operators.

Other cost containment procedures: If the Land Conservation Department determines another cost containment procedure would be more effective than the cost containment procedures described in this subsection, it shall include the alternative in the detailed program for implementation portion of the watershed plan.

Payments for "in kind" contributions will be based on the county's guidelines. Cost share recipients who wish to install a BMP using their own labor, material and equipment must submit a quote plus one quote from a qualified contractor for the practice installation.

Cost-share payments will be based on actual installation costs. If actual installation costs exceed the amount of cost-sharing determined by cost estimates, then the amount paid the grantee shall be documented in writing explaining the unusual circumstances and attached to the cost share agreement or amendment and attached to the request for reimbursement submitted to the DNR by the Land Conservation Department.

Cost-Share Agreement and Contact Strategy

Money for cost share agreements is distributed by the Manitowoc County SWCD and the Brown County LCD from a Nonpoint Source Grant provided by the DNR. Manitowoc and Brown County will receive additional grant money to support administrative responsibilities. Cost share agreements are binding contracts between landowners and the respective counties. Landowners must meet eligibility requirements as defined in chapter two of this plan before cost-share assistance can be provided.

The following procedure will be used to make landowner contacts:

- * Within six months following department plan approval, the process of notification to landowners with critical sites shall begin. The notification will begin with the highest ranked sites, and proceed in accordance with the schedule until all landowners have been notified. The department may grant up to three 90-day extensions beyond the six month notification period to allow the counties sufficient time to verify that all sites meet the critical site criteria.
- * During the first two years of the implementation period, all landowners or operators with eligible nonpoint sources will receive a mailing from the county explaining the project and how they can become involved.
- * After the initial landowner mailings, county staff will make personal contacts with all landowners that have been identified as having critical nonpoint sources of pollution. These contacts will occur within the cost-share sign-up period.
- * The county will continue to make contacts with eligible landowners and operators until they have made a definite decision regarding participation in the program.
- * The county will contact all eligible landowners not signing cost-share agreements by personal letter six months prior to the end of the cost-share sign-up-period.

Landowners will be contacted for participation through newsletters, the public hearing, direct mailing, and news releases. County offices will maintain a "Landowners Requesting Assistance" list. Staff time and assistance will be given to landowners contributing significant pollution to the water resource (i.e. sediment or phosphorus from barnyard sources). These landowners may provide public demonstration of installed practices such as buffers, easements, wetlands, waterways, and rotational grazing.

Critical site verification and notification will be completed as stated in the approved NR120 Administrative Rule. Manitowoc and Brown County have requested three 90-day extensions from the Department. The extension period, if approved, will begin six-months from the date that the nonpoint source control plan was approved by the Land and Water

Conservation Board (LWCB). The extension period would give landowners additional time to voluntarily participate in the watershed project before critical site notification begins.

Groundwater source - An active informational and educational approach will be taken by Manitowoc and Brown County, in conjunction with state, federal, and private sector partners to encourage landowners to assume responsibility for the groundwater resource. In certain situations, critical site designation of sites where nonpoint source contaminants are allowed to drain directly to groundwater conduits may be required to achieve this objective (refer to the groundwater critical site criteria in chapter two).

Landowners with known groundwater critical sites, such as sinkholes, will be contacted in the first eight months of implementation (1996). Additional groundwater priority areas and sinkholes will be identified during the landowner planning process. Each sinkhole will be again be evaluated based on the aforementioned critical site criteria and verified as either in the critical or eligible management category.

Barnyard runoff source - 12 sites have been identified. In the first three months of implementation, landowners of these sites will be contacted and the site verified for pollution contributions consistent with the criteria listed in Chapter 2 .

Landowners with barnyard sites that meet the critical site criteria will be contacted first for program participation in the Branch River Watershed. Barnyard runoff systems installed during the planning phase or early in the sign-up phase of the watershed project will be used as demonstration sites for other landowners. Informational and Educational materials will be used in conjunction with other educational program activities to target eligible landowners for watershed participation. Priority assistance will go to landowners that have sites initially identified as critical; secondary contacts will be landowners with barnyards contributing between 50 and 144 pounds of phosphorus annually.

Sediment delivery source - The soil erosion inventory will be completed by the end of 1996. By August 1996, 184 Manitowoc County critical site fields from 90 landowners and 100 Brown County critical site fields from 50 landowners will be verified for pollution contributions consistent with the criteria listed in Chapter 2. This verification may require three 90-day extensions of the critical site notification period depending on the currently approved NR 120 Administrative Rule.

Manure Storage - The strategy to address agricultural nutrients will be based on the Manure Storage Rating Guideline (MSRG) Model results. The MSRG Model will prioritize landowners based on the lack of available cropland suitable for winter spreading. Approximately 50 landowners will initially be contacted by the respective county staff. Project staff will develop a preliminary nutrient management plan for landowners interested in participating in the project to determine eligibility for manure storage or manure brokering/hauling. Landowners receiving cost sharing to install a manure storage structure or implement a manure brokering/hauling program, will be required to develop a nutrient management plan with a certified crop consultant in accordance with the NRCS 590 standard.

Other landowners will be contacted at a later date, at which time their eligibility for manure storage or manure brokering/hauling practices will be determined. All landowners in this group will be encouraged to contract with private consultants to implement a nutrient management program.

Budget and Staffing Needs

This section estimates the funding and staffing required to provide technical assistance for the rural portion of this project.

Staff Needs and Costs

Table 3-4 lists the total estimated staff needed to implement the project assuming a 100 percent level of participation by eligible landowners. A total of approximately 141,120 staff hours are required to implement this plan. This includes 15,690 staff hours to carry out the information and education program.

Currently, 6.3 staff positions are being funded on the Branch River Watershed Project. The Branch River Watershed and agencies will determine the need for additional staff based on the annual Workload Analysis.

The estimated cost for staff at the 75 percent participation rate (see table 3-6) is approximately \$2.2 million. These costs will be paid by the state through the Local Assistance Grant Agreement.

Fuel Storage Tanks

Leaking fuel storage tanks can be a source of contamination for both groundwater and surface water. Description of programs funding removal and remediation of Underground Storage Tanks can be obtained from:

Department of Natural Resources
1125 North Military Avenue
Green Bay, WI 54307
(414) 497-4034

Farm-A-Syst

Manitowoc and Brown County staff will use the Farm-A-Syst system to identify groundwater protection activities to be undertaken at individual farm sites. Farm-A-Syst is a systematic checklist of areas of concern for groundwater protection, covering areas such as fertilizer and manure handling practices, pesticide storage and waste water disposal. Farm owners will be encouraged to implement actions identified through the process. For more information on Farm-A-Syst contact:

Gary Jackson
UW Madison/Extension
Steenbock Memorial Library, B142
550 Babcock Dr.
Madison, WI 53706-1293
608-265-2773

Private Sewage System Maintenance and Rehabilitation

Poorly situated or improperly functioning private sewage systems have the potential to contaminate groundwater and surface waters in the Branch River watershed. Pollutants from sewage system discharge includes bacteria, viruses, household chemicals, nitrates and phosphorus. Many sewage systems located in riparian areas are out-dated and installed in soils which do not adequately filter pollutants due to the poor filtering ability of the soil and/or a high water table. Failing sewage systems in riparian areas are a special concern since pollutants can enter the surface waters with minimal filtering. Sewage system failure is often due to poor maintenance, primarily a failure to pump septic tanks on a regular basis.

Manitowoc and Brown County staff will prepare educational materials to promote the proper maintenance of private sewage systems. Sewage system maintenance and household tips to reduce groundwater contamination will also be stressed during field visits and "home environmental audits".

Wisconsin Fund

The Private Sewage System Replacement & Rehabilitation Grant Program (Wisconsin Fund) provides financial incentives to protect and improve groundwater quality in Wisconsin. The Wisconsin Fund

Groundwater Management

Groundwater contamination is attributed to a wide range of natural features in the Branch River watershed along with human actions. Sources of nitrate contamination can be attributed to excess cropland fertilizer, excess manure applications, shallow soils, failing domestic sewage disposal, poorly situated barn yards and manure storage facilities, surface water flow into sink holes, bedrock fractures, improperly abandoned wells and more.

Excessive manure and fertilizer applications can be reduced through the development and implantation of nutrient and pest management plans (590/595). Nutrient management planning through watershed staff or private consultants can reduce nitrate leaching and runoff by crediting natural fertilizer contributions from crop residues and manures. Any nutrient applications to be made do not exceed the expected crop needs. Nutrient management plans also identify sites especially sensitive to environmental hazards that need specific management to reduce risks of nutrient movement.

Improperly abandoned wells are a significant threat to groundwater quality in the Branch River watershed. Wells provide a direct conduit for pollutants to reach groundwater resources. Preventing well contamination and sealing abandoned wells are important steps for protecting these resources. If not properly sealed, abandoned wells can directly channel contaminated surface water or shallow groundwater into deeper drinking water aquifers, bypassing the normal purifying action that takes place as surface water slowly percolates downward.

Manitowoc County Soil and Water Conservation Department and Brown County Land Conservation Departments will encourage all landowners to properly seal abandoned wells. Information on the proper abandonment procedures will be provided to landowners when abandoned wells are located. Design assistance for abandonment is available from local well drillers, USDA- NRCS, Brown County LCD and Manitowoc County SWCD.

Wisconsin Well Compensation Grants

Wisconsin's Well Compensation grant program provides financial assistance to replace or treat private wells contaminated with heavy metals, pesticides, solvents or gasoline. Wells must exceed state or federal drinking water standards. Replacement of wells contaminated with bacteria or nitrate are not eligible for cost-sharing, with the exception of livestock wells contaminated with more than 40 mg/l of nitrate. DNR district water supply personnel should be consulted for more information concerning income limits and other eligibility requirements.

Eligible landowners will be encouraged to apply for well replacement funds through the Wisconsin Well Compensation Grant Program.

optimize the resource. Additional information can be obtained from the DNR Fishery Managers listed below:

Steve Hogler
DNR
1314 Highway 310
Manitowoc, WI 54220
414-683-4923

Terry Lychwick
DNR
200 N. Jefferson St. Suite 511
Green Bay, WI 54307
414-448-5140

Wetland Restoration

Significant amounts of wetlands that can be restored or rehabilitated exist, but have not been identified in the Branch River Watershed. Wetlands serve as natural settling areas for sediment nutrients and pesticides. Many of these wetlands are located in or adjacent to farm fields. Wetlands that are important wildlife or fishery habitats will be identified in consultation with DNR Wildlife Management and Water Management personnel. Shoreline buffer easements may be acquired adjacent to these wetlands to offer better protection from sedimentation and other nonpoint source pollution. Rehabilitation programs exist through the Branch River Priority Watershed Program, USDA-NRCS Wetland Reserve Program, USDA-NRCS Waterbank Program, USDA-FSA Conservation Reserve Program, USDA-FSA Agriculture Conservation Program, US Fish and Wildlife Service, and DNR Wildlife Management Programs. USDA-NRCS wetland inventory maps will be utilized by watershed staff to identify potential sites for wetland restoration projects.

When available, landowners will be guided to consider these programs when wetland rehabilitation projects are desired. Watershed staff will direct referrals to the NRCS staff who in turn refer and advise agencies on projects meeting the respective program objectives. Projects not funded through cooperating programs will be considered for design assistance and possible funding through the Branch River Priority Watershed.

Water Regulations and Zoning

Local, State, and Federal regulations regarding surface water and wetland protection will be considered whenever BMPs are installed. Land owners will be referred to appropriate regulators prior to construction projects for proper permit approvals. Types of regulations includes Wisconsin Shore land and Wetland Zoning, Local Shore land protection ordinances, sediment control ordinances, US Army Corp of Engineers permits.

Watershed staff will be available for comment and advise on local wetland protection hearings conducted by local zoning boards. Notice of public hearing notices will be requested from both county and town zoning authorities. Additional information can be obtained from the Wildlife Managers listed below:

Jeff Pritzl
DNR
1314 Highway 310
Manitowoc, WI 54220
(414) 683-4926

US Fish and Wildlife Service
Gary Van Vreede
Green Bay ES Field Office
1015 Challenger Ct.
Green Bay, WI 54311
(414) 433-3803

CHAPTER FOUR

Integrated Resource Management Program

Introduction

To provide holistic integrated resource management, watershed staff will work to coordinate the efforts of many programs and benefits to provide the best possible management of land and water resources in the watershed.

While the primary purpose of the priority watershed project is to improve and protect water quality, wildlife and fishery management are also listed as project goals. Other programs provide additional opportunities to protect and improve the resources targeted through the priority watershed project. In many cases funding is available through other programs which will complement the goals of the watershed project.

The purpose of this chapter is to identify existing state, federal and local resource management programs and management issues which provide benefits for water quality and/or fish and wildlife resources in the Branch River Watershed.

Wildlife and Fisheries Management

Watershed best management practices (BMPs), such as streambank protection, shoreline buffer strips and easements, should be implemented in a manner that preserves and enhances the management goal of providing a quality fishery in the Branch River watershed. Specifically, all streambank protection BMPs should be installed using large diameter-sized rock below the water line. Rock riprap should be installed and sized so that the placement and size of rock will positively benefit fish habitat. Vegetative shoreline erosion control using emergent aquatic vegetation for habitat enhancement should be used where applicable. Wildlife habitat components should also be incorporated into vegetative filter strips along streams or in upland areas.

Shoreline erosion control measures will be installed in a manner beneficial to fisheries and wildlife habitat. DNR Fish Management and Wildlife Management personnel will be consulted for input in the design of streambank and shoreline protection BMPs to maximize benefits to the fish and wildlife communities. In cooperation with counties, DNR staff will also be asked to review placement of agricultural sediment basins, and provide technical assistance when the installation of BMPs will require the removal of obstructions or other wildlife habitat by proposing measures to minimize impact on wildlife habitat, and assist in resolving questions concerning effects of agricultural nonpoint source BMPs on wetlands. DNR fish manager will assist Manitowoc and Brown County Staff in the identification of important fish spawning areas which require additional, or specific management to

Table 3-5 Total Project Costs: Branch River Priority Watershed

Eligibility Activity	Manitowoc County*	Brown County*	Total Cost (State Share)
Cost-Share Funds: Practices	3,993,141	2,123,319	6,116,460
Cost-Share Funds: Easements	975,000	97,500	1,072,500
Local Assistance Staff Support	1,757,119	791,191	2,548,310
Information and Education Activities	72,630	48,420	121,050
Other (travel, supplies, etc.)	11,900	11,900	23,800
Engineering Assistance	16,000	16,000	32,000
TOTAL	\$6,825,790	\$3,088,330	\$9,914,120

Implementation Schedule

Grant Disbursement and Project Management Schedule

Implementation may begin upon approval of this watershed plan by the Manitowoc and Brown County Boards; LWCB; and the DNR. The priority watershed project implementation period lasts ten years. Cost share agreements with Critical and Eligible landowners can be signed through the first ten years of implementation. Practices on any cost-share agreement must be installed within a five years of signing the CSA. Limited extensions for the installation period for practices on individual cost-share agreements must be approved by DNR.

The disbursement of the grants (Local Assistance and Nonpoint Source) to Manitowoc and Brown Counties will be based on an annual workload analysis and grant application process.

Total Project Cost

The total state funding required to meet the rural and urban nonpoint source pollution control needs at 75 percent level of landowner participation is presented table 3-6. This figure includes the capital cost of practices, staff support, and easement costs presented above. The estimated costs to the state are

\$9.5 million for rural practices and an estimated \$200,000 for urban. The sum of estimated cost to landowners and or others is \$800,000 for rural practices and \$50,000 for the urban component.

This cost estimate is based on projections developed by the agency planners and local staff. Historically, the actual expenditures for projects are less than the estimated costs. The factors affecting expenditures for this watershed project include: the amount of cost sharing that is actually expended; the number of staff working on the project; and the amount of support costs.

Table 3-4 Estimated County LWCD Staff Needs: Branch River Watershed

Activity	Project years when work will be done	Brown County	Manitowoc County
		100% Landowner Participation (staff hours)	100% Landowner Participation (staff hours)
Project and Financial Mgmt.	1-10	4,000	8,000
Information and Education	1-5	7,845	7,845
Pre-Contact Office Inventory; Landowner Contracts; and Progress Tracking	1-5	3,000	3,000
Conservation Planning and Cost- Share Agreement Development	1-5	6,500	7,000
Plan Revisions and Monitoring	1-10	4,500	7,150
Practice Design & Installation			
Upland Sediment Control	1-10	8,500	20,000
Animal Waste Mgmt	1-10	6,500	14,000
Streambank Erosion Control	1-10	9,000	2,000
Easements	1-10	1,600	16,000
Training	1-10	1,400	3,280
Total LCD Workload:		52,845	88,275
Estimated Staff Required for Years 1-5:		3.5 per yr	5.2 per yr
hours		7,219 per yr	10,812 per yr
Estimated Staff Required for Years 1-5:		1.8 per yr	3.5 per yr
hours		3,750 per yr	7,243 per yr

Source: WI Department of Natural Resources; WI Department of Agriculture, Trade and Consumer Protection and Land Conservation Departments of Manitowoc and Brown Counties.

Table 3-3c

Total Cost-Share Budget Needs for Rural Management Practices in Manitowoc & Brown County

Management Needs Best Management Practices	Number		Cost/Unit	Total Cost	100% Participation		75% Participation	
					State Share	Local Share	State Share	Local Share
Upland NPS Control								
Change in Crop Rotation	19,500	ac	NA(2)	0	0	0	0	0
Contour Cropping	350	ac	\$6	2,100	2,100	(3)	1,575	(3)
Contour and field stripcropping	200	ac	\$12	2,400	2,400	(3)	1,800	(3)
Reduced Tillage (4) (9)	31,500	ac	\$93	2,913,750	2,913,750	0	2,185,313	0
Cover and Green Manure Crop (7)	4,500	ac	\$75	337,500	337,500	(3)	253,125	(3)
Intensive Grazing Management	7	ea	\$4,000	28,000	14,000	14,000	10,500	10,500
Critical Area Stabilization	185	ac	\$800	148,000	103,600	44,400	77,700	33,300
Grass Waterways	95	ac	\$3,000	285,000	199,500	85,500	149,625	64,125
Field Diversions & Terraces	0	ft	\$3	0	0	0	0	0
Grade Stabilization	5	ea	\$5,000	25,000	17,500	7,500	13,125	5,625
Agricultural Sediment Basin	20	ea	\$11,800	236,000	165,200	70,800	123,900	53,100
Nutrient Mgmt only (6)	14,000	ac	\$18	252,000	126,000	126,000	94,500	94,500
Nutrient and Pest Mgmt. (6)	18,500	ac	\$30	555,000	277,500	277,500	208,125	208,125
Infield Buffers	15	ac	\$150	2,250	2,250	(3)	1,688	(3)
Wetland Restoration	170	ea	\$2,000	340,000	238,000	102,000	178,500	76,500
Livestock Exclusion from Woodlots	6,000	ft	\$1	6,000	3,000	(3)	2,250	(3)
Spill Control Basins	7	ea	\$20,000	140,000	98,000	42,000	73,500	31,500
Tile Outlet Relocation (9)	20	ea	\$3,000	60,000	42,000	18,000	31,500	13,500
Well Abandonment (9)	150	ea	\$600	90,000	63,000	27,000	48,250	20,275
Animal Waste Management								
Barnyard Runoff Control								
Complete System	70	ea	\$25,000	1,750,000	1,225,000	524,000	918,750	393,750
Roof Gutters	40	ea	\$1,500	60,000	42,000	18,000	21,500	16,200
Clean Water Diversion	40	ea	\$2,500	100,000	70,000	30,000	52,500	22,500
Cattle Mounds	16	ea	\$3,000	48,000	33,600	14,400	25,200	10,800
Manure Storage Facility (5)	70	ea	\$38,570	2,699,900	1,330,000	770,000	997,500	577,500
Animal Waste Storage Abandonment	5	ea	\$10,000	50,000	35,000	15,000	26,250	11,250
Animal Lot Abandonment	9	ea	\$5,000	45,000	31,500	13,500	23,625	10,125
Milking Center Waste Control	48	ea	\$7,000	336,000	235,200	100,800	176,400	75,600
Streambank Erosion Control								
Shape and Seeding	72,800	ft	\$3	218,400	152,880	65,520	114,660	49,140
Streambank Fencing	13,000	ft	\$1	13,000	9,100	(3)	6,825	(3)
Rock Riprap	1,200	ft	\$30	36,000	25,200	10,800	18,900	8,100
Bio Riprap	1,500	ft	\$25	37,500	26,250	11,250	19,688	8,438
Shoreline Buffers (8) (9)	800	ac	\$500	400,000	280,000	120,000	210,000	90,000
Livestock/Machinery								
Crossing/Watering Ramp	20	ea	\$3,000	60,000	42,000	18,000	31,500	13,500
Remote Watering Systems	5	ea	\$3,500	17,500	12,250	5,250	9,188	3,938
Subtotal:				11,294,300	8,155,280	2,532,220	6,116,460	\$1,899,165
Easements	2,200	ac	\$650	1,430,000	1,430,000	0	1,072,500	0
TOTALS				12,724,300	9,585,280	2,532,220	\$7,188,960	\$1,899,165

\$1,899,165

(1) Total cost to control identified critical pollution sources.

(6) \$6/ac for NM and \$10/ac for NPM for up to 3 years.

(2) NA means that cost share funds are not available for this practice.

(7) \$25 per acre for up to 3 years for cropland protection cover (green manure).

(3) Local share consists of labor and any additional equipment costs.

(8) Rate of \$100/ac/yr for up to 5 years.

(4) Reduced tillage education project \$18.50 for 5 years.

(9) Approved IBMP.

(5) Maximum cost-share is \$35,000. 70% of first \$20,000 & 50% of the remaining cost including waste transfer equip.

Table 3-3b

Cost-Share Budget Needs for Rural Management Practices in Brown County

Management Needs Best Management Practices	Number	Cost/Unit	Total Cost (1)	100% Participation		75% Participation		
				State Share	Local Share	State Share	Local Share	
Upland NPS Control								
Change in Crop Rotation	3,500	ac	NA(2)	0	0	0	0	
Contour Cropping	150	ac	\$6	900	900	(3)	675	(3)
Contour and Field Stripcropping	100	ac	\$12	1,200	1,200	(3)	900	(3)
Reduced Tillage (4) (9)	7,500	ac	\$93	693,750	693,750	0	520,313	
Cover and Green Manure Crop (7)	3,500	ac	\$75	262,500	262,500	(3)	196,875	(3)
Intensive Grazing Management	3	ea	\$4,000	12,000	6,000	6,000	4,500	4,500
Critical Area Stabilization	150	ac	\$800	120,000	84,000	36,000	63,000	27,000
Grass Waterways	40	ac	\$3,000	120,000	84,000	36,000	63,000	27,000
Field Diversions & Terraces	0	ft	\$3	0	0	0	0	0
Grade Stabilization	0	ea	\$5,000	0	0	0	0	0
Agricultural Sediment Basin	15	ea	\$11,800	177,000	123,900	53,100	92,925	39,825
Nutrient Mgmt only (6)	7,000	ac	\$18	126,000	63,000	63,000	47,250	47,250
Nutrient and Pest Mgmt. (6)	2,500	ac	\$30	75,000	37,500	37,500	28,125	28,125
Infield Buffers	5	ac	\$150	750	750	(3)	563	(3)
Wetland Restoration	30	ea	\$2,000	60,000	42,000	18,000	31,500	13,500
Livestock Exclusion from Woodlots	1,000	ft	\$1	1,000	500	(3)	375	(3)
Spill Control Basins	3	ea	\$20,000	60,000	42,000	18,000	31,500	13,500
Tile Outlet Relocation (9)	3	ea	\$3,000	9,000	6,300	2,700	4,725	2,025
Well Abandonment (9)	50	ea	\$600	30,000	21,000	9,000	15,750	6,750
Animal Waste Management								
Barnyard Runoff Control								
Complete System	35	ea	\$25,000	875,000	612,500	262,500	459,375	196,875
Roof Gutters	12	ea	\$1,500	18,000	12,600	5,400	9,450	4,050
Clean Water Diversion	12	ea	\$2,500	30,000	21,000	9,000	15,750	6,750
Cattle Mounds	6	ea	\$3,000	18,000	12,600	5,400	9,450	4,050
Manure Storage Facility (5)	30	ea	\$38,570	1,157,100	570,000	330,000	427,500	247,500
Animal Waste Storage Abandonment	2	ea	\$10,000	20,000	14,000	6,000	10,500	4,500
Animal Lot Abandonment	4	ea	\$5,000	20,000	14,000	6,000	10,500	4,500
Milking Center Waste Control	3	ea	\$7,000	21,000	14,700	6,300	11,025	4,725
Streambank Erosion Control								
Shape and Seeding	70,000	ft	\$3	210,000	147,000	63,000	110,250	47,250
Streambank Fencing	8,000	ft	\$1	8,000	5,600	(3)	4,200	(3)
Rock Riprap	1,000	ft	\$30	30,000	21,000	9,000	15,750	6,750
Bio Riprap	500		\$25	12,500	8,750	3,750	6,563	2,813
Shoreline Buffers (8) (9)	300	ac	\$500	150,000	105,000	45,000	78,750	33,750
Livestock/Machinery								
Crossing/Watering Ramp	10	ea	\$3,000	30,000	21,000	9,000	15,750	6,750
Remote Watering Systems	3	ea	\$3,500	10,500	7,350	3,150	5,513	2,363
Subtotal:				4,359,200	3,056,400	1,042,800	\$2,292,300	\$782,100
Easements	200	ac	\$650	130,000	130,000	0	97,500	0
TOTALS				4,489,200	3,186,400	1,042,800	\$2,389,800	\$782,100

(1) Total cost to control identified critical pollution sources.

(2) NA means that cost share funds are not available for this practice.

(3) Local share consists of labor and any additional equipment costs.

(4) Reduced tillage education project \$18.50 for 5 years.

(5) Maximum cost-share is \$35,000. 70% of first \$20,000 & 50% of the remaining cost including waste transfer equip.

(6) \$6/ac for NM and \$10/ac for NPM for up to 3 years.

(7) \$25 per acre for up to 3 years for cropland protection cover (green manure).

(8) Rate of \$100/ac/yr for up to 5 years.

(9) Approved IBMP.

Table 3-3a Cost-Share Budget Needs for Rural Management Practices in Manitowoc County

Management Needs Best Management Practices	Number	Cost/Unit	Total Cost (1)	100% Participation		75% Participation		
				State Share	Local Share	State Share	Local Share	
Upland NPS Control								
Change in Crop Rotation	16,000	ac	NA(2)	0	0	0	0	0
Contour Cropping	200	ac	\$6	1,200	1,200	(3)	900	(3)
Contour and field stripcropping	100	ac	\$12	1,200	1,200	(3)	900	(3)
Reduced Tillage (4) (9)	24,000	ac	\$93	2,220,000	2,220,000	0	1,665,000	0
Cover and Green Manure Crop (7)	1,000	ac	\$75	75,000	75,000	(3)	56,250	(3)
Intensive Grazing Management	4	ea	\$4,000	16,000	8,000	8,000	6,000	6,000
Critical Area Stabilization	35	ac	\$800	28,000	19,600	8,400	14,700	6,300
Grass Waterways	55	ac	\$3,000	165,000	115,500	49,500	86,625	37,125
Field Diversions & Terraces	0	ft	\$3	0	0	0	0	0
Grade Stabilization	5	ea	\$5,000	25,000	17,500	7,500	13,125	5,625
Agricultural Sediment Basin	5	ea	\$11,800	59,000	41,300	17,700	30,975	13,275
Nutrient Mgmt only (6)	7,000	ac	\$18	126,000	63,000	63,000	47,250	47,250
Nutrient and Pest Mgmt. (6)	16,000	ac	\$30	480,000	240,000	240,000	180,000	180,000
Infield Buffers	10	ac	\$150	1,500	1,500	(3)	1,125	(3)
Wetland Restoration	140	ea	\$2,000	280,000	196,000	84,000	147,000	63,000
Livestock Exclusion from Woodlots	5,000	ft	\$1	5,000	2,500	(3)	1,875	(3)
Spill Control Basins	4	ea	\$20,000	80,000	56,000	24,000	42,000	18,000
Tile Outlet Relocation (9)	17	ea	\$3,000	51,000	35,700	15,300	26,775	11,475
Well Abandonment (9)	100	ea	\$600	60,000	42,000	18,000	31,500	13,500
Animal Waste Management								
Barnyard Runoff Control								
Complete System	35	ea	\$25,000	875,000	612,500	262,500	459,375	196,875
Roof Gutters	28	ea	\$1,500	42,000	29,400	12,600	22,050	9,450
Clean Water Diversion	28	ea	\$2,500	70,000	49,000	21,000	36,750	15,750
Cattle Mounds	10	ea	\$3,000	30,000	21,000	9,000	15,750	6,750
Manure Storage Facility (5)	40	ea	\$38,570	1,542,800	760,000	440,000	570,000	330,000
Animal Waste Storage Abandonment	3	ea	\$10,000	30,000	21,000	9,000	15,750	6,750
Animal Lot Abandonment	5	ea	\$5,000	25,000	17,500	7,500	13,125	5,625
Milking Center Waste Control	45	ea	\$7,000	315,000	220,500	94,500	165,375	70,875
Streambank Erosion Control								
Shape and Seeding	2,800	ft	\$3	8,400	5,880	2,520	4,410	1,890
Streambank Fencing	5,000	ft	\$1	5,000	3,500	(3)	2,625	(3)
Rock Riprap	200	ft	\$30	6,000	4,200	1,800	3,150	1,350
Bio Riprap	1,000	ft	\$25	25,000	17,500	7,500	13,125	5,625
Shoreline Buffers (8) (9)	500	ac	\$500	250,000	175,000	75,000	131,250	56,250
Livestock/Machinery								
Crossing/Watering Ramp	10	ea	\$3,000	30,000	21,000	9,000	15,750	6,750
Remote Watering Systems	2	ea	\$3,500	7,000	4,900	2,100	3,675	1,575
Subtotal:				6,935,100	5,098,880	1,489,420	\$3,824,160	\$1,117,065
Easements	2,000	ac	\$650	1,300,000	1,300,000	0	975,000	0
TOTALS				8,235,100	6,398,880	1,489,420	\$4,799,160	\$1,117,065

(1) Total cost to control identified critical pollution sources.

(2) NA means that cost share funds are not available for this practice.

(3) Local share consists of labor and any additional equipment costs.

(4) Reduced tillage education project \$18.50 for 5 years.

(5) Maximum cost-share is \$35,000. 70% of first \$20,000 & 50% of the remaining cost including waste transfer equip.

(6) \$6/ac for NM and \$10/ac for NPM for up to 3 years.

(7) \$25 per acre for up to 3 years for cropland protection cover (green manure).

(8) Rate of \$100/ac/yr for up to 5 years.

(9) Approved IBMP.

provides funds to update private sewage systems installed before 1978. To be eligible the septic system must have been inspected by the Manitowoc or Brown Counties', County Sanitarian and determined to be failing by discharging waste to the groundwater or surface water. Only permanent residences qualify, and there are income restrictions. Applications for Wisconsin Fund assistance are made through the Manitowoc County Planning and Parks Department and the Brown County Zoning and Solid Waste Department.

Manitowoc and Brown County staff will inform watershed residents about the benefits of the Wisconsin Fund grant program and encourage eligible landowners to apply.

Manitowoc County Planning and Zoning Dept
1701 Michigan Avenue
Manitowoc, WI 54220

Brown County Zoning Dept.
Northern Building
305 East Walnut St.
Green Bay, WI 54301

Forestry Programs

Private forest lands account for a significant area within the Branch River watershed. Private forest lands contributes significantly to the quality of water resources and fish and wildlife resources in the watershed. Financial assistance is available for forest management and soil and water resource protection through the Stewardship Incentive Program (SIP), the Managed Forest Law Program (MFL) and other forest stewardship programs. Additional information can be found in DNR publication FR-093-95, Wisconsin Forestry Best Management Practices For Water Quality, developed by DNR Bureau of Forestry.

Stewardship Incentive Program

The Stewardship Incentive Program (SIP) was developed to stimulate enhanced management of forest lands by cost-sharing approved management practices. SIP provides cost share funding of up to 75% for practices that provide soil and water protection. The SIP program applies to nonindustrial private forest land of 10 acres or more on forested or forest related (i.e., prairie, wetlands) lands. Practices that are cost-shared by SIP include: development of a landowner forest stewardship plan; site preparation and tree planting; timber stand improvement; windbreak and hedgerow establishment; soil and water protection and improvement; riparian and wetland protection and improvement; fisheries habitat enhancement; wildlife habitat enhancement; and forest recreation enhancement.

Managed Forest Law

The goal of the Managed Forest Law (MFL) program is to encourage long-term sound forest management. MFL is a tax incentive program for industrial and nonindustrial private woodland owners who manage their woodlands for forest products while also managing for water quality protection, wildlife habitat and public recreation. In return for following an approved management plan, property taxes are set at a lower rate than normal. At a later time when the landowner receives an income from a timber harvest, some of the deferred tax is collected in the form of a yield tax. Management plans are based on the landowners objectives. These plans may address harvesting, planting, thinning, release and soil erosion on a mandatory basis while addressing other practices such as wildlife and aesthetic activities on a voluntary basis.

Managed Forest Law and Stewardship Incentive Program are available to landowners with manageable parcels 10 acres or greater. The management plans developed for SIP and MFL will include Forestry Best Management Practices for sediment control.

Other Stewardship Programs

Some other forest stewardship programs available to watershed landowners include the Forest Improvement Program (FIP) and ACP. These programs provide funding for the establishment of timber stands.

The Brown County LCD, Manitowoc County SWCD, DNR, and consulting foresters will encourage eligible forest landowners in the Branch River watershed to participate in Forest Stewardship Programs to benefit water resources and forest habitat. Protection of soil and water resources should be addressed in all SIP and MFL plans where applicable.

Private consulting foresters will be encouraged to identify management goals on private lands that will meet the goals of the client landowners, as well as the project goals for wildlife habitat and sediment control.

Scott Fischer
Wis DNR
1314 Hwy 310
Manitowoc, WI 54330
(414) 683-4924

Linda Kurtz
DNR Suite 511
200 N Jefferson
Green Bay, WI
(414) 448-5139

Pete Wagner
7702 Sinawa Rd
Valders, WI 54245
(414) 433-3803

Coordinating Regulations, Permits, and Zoning

Best management practices that address shoreline erosion such as riprap or vegetative shoreline stabilization will require permits from the DNR. Any BMP which effects wetland form or function may require permits from the DNR, Manitowoc County, Brown County or town Zoning offices and the US Army Corps of Engineers.

Manitowoc and Brown County will work closely with the DNR Water Regulation and Zoning staff, the local zoning authorities, Department and the US Army Corps of Engineers to assure that necessary permits are received prior to the installation of shoreline stabilization and wetland rehabilitation practices.

In an attempt to protect the use, enjoyment and water quality of our lakes and streams the state, federal and local government activities on riparian properties. Activities that disturb or remove the natural vegetation surrounding our lakes and streams reduces the buffering capacity of the area and often drastically increases erosion, sedimentation and nutrient runoff.

NR243

Farm sites with an excess of 1000 animal units or those cited as pollution sites will be investigated for water pollution runoff. Operations with less than 1000 animal units will be investigated on a complaint driven basis. Landowners with pollution levels that meet or exceed critical site criteria as described in chapter two of the nonpoint source control plan for the Branch River Watershed will

receive a notification letter explaining the actions required as well as the potential consequences if no action is taken. These sites will be priority areas for development of pollutant abatement solutions through the Watershed Project. Sites cited and given a WPDES permit will no longer be eligible for Priority Watershed funds for control of animal waste runoff. Applications for WPDES permits required by NR243 should be directed to:

Mark DeBaker
DNR District Headquarters
1125 North Military Ave.
P.O. Box 10448
Green Bay, WI 54307-0448
(414) 492-5909

WPDES

Permits for land application of waste sludge from municipalities and industries will be coordinated to meet the surface and groundwater protection goals of the Branch River Priority Watershed. WPDES permits are regulated by administrative rules NR204, and NR214. Identified bedrock fracture traces and karst features will be indicated for DNR Area personnel issuing WPDES application permits. NRCS 590 (Standard) criteria will be used on all permitted applications. Watershed staff will provide comment on how to make the permitted applications compatible with the Branch River Watershed goals. Contact people for WPDES permits are:

Jeff Hach - Manitowoc County	Green Bay Area DNR Office
Gary Kincaid - Brown County	200 N Jefferson St. Suite 511
Tom Tewes - Small Industry	Green Bay, WI 54301
	(414) 448-5151

Coordination with County and Local Ordinances

Locally developed ordinances will be implemented and developed during the sign-up and installation phases of the Branch River Project. Ordinances can be used to motivate landowners with pollution problems who would not voluntarily participate with BMP installation otherwise. Existing Ordinances are:

Streambank and Shoreline Protection Ordinance - Brown County

Excess streambank erosion caused by livestock access to a stream channel will be controlled. Control on excessively eroding sites will be recommended on a site by site basis. Row cropping within 35 ft of perennial stream banks and intermittent streams will not be allowed unless determined acceptable by Brown County LCD staff. Cropping of non-row crops and grazing will be allowed in these corridors.

Construction Site Erosion Control Ordinance - Village of Whitelaw

The Village of Whitelaw approved a construction site erosion control ordinance in 1996.

Manure Storage Ordinance - Brown County

Farm operators seeking to construct permanent manure storage structures are required to obtain a manure storage construction permit. Permittee's must submit a construction plan that meets NRCS standards 312, 313, 425.

Public Nuisances Ordinance - Manitowoc County

At the time of public hearing, Manitowoc County does not have a manure storage or management ordinance in place. An ordinance to address storage and nutrient management is anticipated within 2 years of approval of this watershed plan by the Land and Water Conservation Board.

Manitowoc County Code 7.12(2) - Public Nuisances. No person shall erect, construct, cause, continue, maintain, or permit any public nuisance or human health hazard within the County. Nuisances related to nonpoint pollution include unburied carcasses, manure, solid waste, sludge, waste water, surface water pollution, groundwater pollution. Violations are investigated by the county Health Officer after written and signed complaints.

Jim Blaha
Manitowoc County Health Department
823 Washington St
Manitowoc, WI 54220
414-683-4155

Coordination With State and Federal Conservation Programs

Conservation Compliance

The Branch River Priority Watershed Project will be coordinated with the conservation compliance features of the Wisconsin Farmland Preservation Program (FPP), administered jointly by DATCP and county LCDs, and the Federal Food Security Act (FSA) administered by the Natural Resource Conservation Service. DATCP, LCD and NRCS offices will jointly identify landowners within the watershed that are subject to the compliance provisions of FOP and FSA. USDA and FPP compliance plans have been developed on approximately 70% of the farmland in the Branch River Watershed. Implementation of these programs has resulted in a 25% reduction of sediment reaching the Branch River prior the land use inventory.

Implementation and amendment of these conservation plans will be necessary during the implementation phase of the watershed project. Watershed project staff will inform FPP and NRCS staff of changes in plans resulting from management decisions and the installation of needed BMPs for nonpoint source pollution abatement. One comprehensive plan to cover all programs is the goal.

A high level of wetland protection has been accomplished through compliance provisions of the USDA programs. Wet crop fields have been inventoried primarily into categories of:

- * Nonwetlands
- * Prior Converted Wetlands
- * Farmed Wetlands
- * Wetlands
- * Converted Wetlands

Prior Converted, Farmed Wetlands, and Converted Wetlands have and high potential for rehabilitation projects. Watershed staff will encourage landowners with these conditions to take advantage of either State or Federal Programs to achieve restoration or enhancement of these areas.

Federal Programs

The Agriculture Conservation Program (ACP) is jointly administered by the USDA NRCS and FSA. ACP provides cost share funding for best management practices county wide in both Manitowoc and Brown Counties. Because the funding level of the program has been declining in recent years ACP funds will be available to Manitowoc landowners only for practices not available through the Branch River Priority Watershed Program.

The Acreage Reduction Program (ARP) or "set aside" is a program designed to reduce volume of commodity crops produced by encouraging landowners to grow crops such as alfalfa. Watershed staff will work with FSA and NRCS to locate "set aside fields" in areas where they can serve as stream buffers etc..

The Conservation Reserve Program (CRP) is a 10 to 15 year land idling and conservation program designed to offer landowners long term rental agreements for establishment of permanent vegetative cover. Landowners who qualify for the program have the option of planting permanent stands of grasses or trees. Sign up for the program has been conducted roughly annually. Special emphasis is being given to Great Lakes tributaries, including the Branch River watershed. Brown and Manitowoc County watershed staffs will work with to present the CRP program as a viable option for reducing sediment and nutrient runoff. Areas of high priority will be areas to serve as stream buffers. Additional information can be obtained by contacting the following NRCS representatives:

Manitowoc County

George Gottier
District Conservationist
1701 Michigan Av.
Manitowoc, WI 54220
(414) 683-4183

Brown County

Jim Hunt
District Conservationist
1150 Bellevue Street
Green Bay, WI 54302
(414) 391-4622

Wisconsin Conservation Corps

Wisconsin Conservation Corp (WCC) is a state program developed to provide job training to young adults, and to provide labor for conservation related projects for the public benefit. WCC assistance will be utilized for both educational activities in the Branch River Watershed and for assistance installing BMPs that control sediment, or enhance wildlife.

WCC crews are authorized to work on waterfront projects which include waterfront restoration and preservation, promoting better water quality, creating or improving access to the water, increase waterfront aesthetics, and encourage wildlife observation.

WCC crews are also authorized to work on Shoreland Management projects. This includes projects that prevent shoreline erosion, prevent surface runoff, and any type of watershed protection.

Paul Klein
Projects Field Support Specialist
30 W Mifflin
Rm 406
Madison, WI 53703
(608) 266-7730

Coordination with Local Fish, Wildlife and Conservation Groups

Local Sporting and Conservation clubs provide a grass roots support for protection of local waters and other conservation concerns. Past efforts have included assistance in implementation, funding, and education about stream protection and wildlife habitat restoration and creation.

A list of groups likely to be involved in the Branch Watershed include:

- * **Manitowoc County Fish and Game Assn.**
- * **Reedsville Sportsmen Club**
- * **Whitelaw Sportsmen Club**
- * **Southern Brown County Sportsmen Club**
- * **Trout Unlimited**
- * **Ducks Unlimited**
- * **Wisconsin Waterfowlers**
- * **Isaac Walton League**

Many other groups will be contacted and invited to participate with the Branch River Watershed Project.

Archaeological Sites: Coordination with State and Federal Historic Preservation Laws

Projects using state and federal funding, assistance, licenses and permits are required by law to consider the effects of their actions on archaeological and historical sites and historical structures. The watershed project is a joint cooperative effort between federal, state, and county agencies as well as the private landowners who volunteer to participate in the program. As a result, the federal Historic Preservation Act of 1966, as amended, and the state historic preservation statute, s. 44.40, Wis. Stats., have been blended to produce a cultural resource management program which is both compatible to preserving cultural sites and implementing the watershed project.

There are many known archaeological sites within the Branch River Watershed. The sites range from historic Native American camp sites, to early settlement building sites, to architectural in nature. These areas will need special consideration when structural best management practices are being

considered. Settling basins, manure storage structures, and streambank or shoreline shaping and riprapping are likely practices that may impact archaeological sites. As discussed above, state and federal laws require preservation of archaeological resources within the framework of the NPS Program.

The Branch River Priority Watershed Project addresses these concerns with the following procedures:

1. Archeological sites have been plotted on project maps with assistance from the Wisconsin State Historical Society. Counties will obtain a supply of landowner questionnaires from the historical society which will be used to identify additional non-inventoried sites. The questionnaires are relatively short and easy to fill out.
2. Landowner questionnaires will be sent to the State Historical Society for determination of archaeological significance. In addition, landowners will have their lands evaluated by county staff for the need to conduct an archaeological survey (essentially compare property with known archaeological site locations). The historical society will determine the need for additional, extensive surveys. The counties and the DNR District NPS Program coordinator will also be involved in this determination.
3. If the inventory or questionnaire does reveal an archaeological site and the proposed best management practice may impact the site, an archaeological survey conducted by a qualified archaeologist will need to be completed. The survey will assess the potential of the practice to significantly impact the site. Alternative BMPs may need to be considered both before and after the results of the survey.
4. A cost-share agreement is signed before the survey is conducted. In certain instances a survey may reveal a significant archaeological site which precludes the installation of a particular BMP at that specific site. Cost-share agreements will contain language which nullifies or partially nullifies the cost-share agreement based on the final results of the archaeological survey. Archaeologic investigations will be funded through the prospective counties Local Assistance Grant.

Endangered and Threatened Resources

Information on threatened and endangered resources was obtained from the Bureau of Endangered Resources of the DNR. Endangered resources include rare species and natural communities. It should be noted that comprehensive endangered resource surveys have not been completed for the entire Branch River Priority Watershed. The lack of additional occurrence records does not preclude the possibility that other endangered resources are present in the watershed. In addition, the Bureau's endangered resource files are continuously updated from ongoing field work. There may be other records of rare species and natural communities which are in the process of being added to the database and so are not listed in this document.

Rare Species

Rare species are tracked by Wisconsin's Natural Heritage Inventory of the Bureau of Endangered Resources. Species tracked by the inventory include those that are listed by the U.S. Fish and Wildlife Service or by the state of Wisconsin.

Wisconsin Endangered Species

An endangered species is one whose continued existence as a viable component of this state's wild animals or wild plants is determined by the DNR to be in jeopardy on the basis of scientific evidence. Records do not show that any Wisconsin Endangered species exist in this watershed.

Wisconsin Threatened Species

A threatened species is one which, if not protected, has a strong probability of becoming endangered. Wisconsin threatened species within the watershed are:

Buteo lineatus, Red-Shouldered Hawk

Moxostoma valenciennesi, Greater Redhorse

Lythrurus umbratilis, Redfin Shiner

Trillium nivale, Snow Trillium

Poa paludigena, Bog Bluegrass

Wisconsin Special Concern Species

A special concern species is one for which some problem of abundance or distribution is suspected in Wisconsin, but not yet proven. The purpose of this category is to focus attention on certain species before they become endangered or threatened. Wisconsin special concern species within the watershed are:

Clinostomus elongatus, red side dace

Bat hibernaculum, Bat hibernaculum

Euphyes dion, Dion Skipper

Euphyes Bimacula, Two-Spotted Skipper

Viola rostrata, Long-Spurred Violet

Medeola Virginiana, Indian Cucumber Root

Diplazium pycnocarpon, Glade Fern

Adlumia fungosa, Allegheny Vine

Arethusa bulbosa, Dragon's Mouth

Jeffersonia diphylla, Twinleaf

Natural Areas

Natural areas are sites that contain high quality examples of natural communities.

The following natural areas have been identified in the Branch River Priority Watershed:

- * Southern Dry-Mesic Forest
- * Northern Wet Forest
- * Northern Mesic Forest
- * Northern Wet-Mesic Forest
- * Shaded Cliff
- * Stream--Slow, Hard, Warm

If site specific or other information is needed about these species or natural communities, contact the Bureau of Endangered Resources, DNR. **Please note** that the specific location of endangered resources is sensitive information. Exact locations **should not** be released or reproduced in any publicly disseminated documents.

CHAPTER FIVE

Information and Education Activities

Education Plan: Overview

This education plan addresses existing gaps in the knowledge, skills and attitudes of watershed staff and watershed residents. The assessment of these gaps took place in 1994 using a phone survey and focus groups, and the educational objectives are based on these data. The education campaign addresses human performance (achieving end results) rather than "behavioral Change" (observable actions and unobservable decisions that people make), and the objectives are written as performance-based objectives. This plan does not target "behavioral change" since people can pursue activities that we define as acceptable behavior, but still produce negative outcomes. For example, people can behave/act like conservation farmers (according to our definition) by using a chisel plow and leaving 30% residue. Yet, they still may perform poorly and produce a negative end result by producing poor crops, increasing chemical usage and developing a bad attitude towards conservation tillage.

Manitowoc and Brown County Staff and the Citizens Advisory Committee (CAC), jointly developed the Branch Information and Education program to be the following;

- * Be responsive to people through incorporation of focus group findings; development of staff in adult education skills; seeking ongoing feedback for ongoing program improvement.
- * Foster change and actions that sustained long-term by implementing educational process that fosters understanding, emphasises performance, and promotes value of the Branch River Watershed resources.
- * Encourage community organization to: create new ideas, support action, share experience and knowledge, and facilitate responsibility and accountability to each other for resource protection.

Goal

The Branch River Watershed Education Program will be responsive to people; foster change and actions that will be sustained long-term; and will support community organizing. This educational program will move people (both farm and non-farm) from their present level of performance to a higher level of performance that will benefit the learners and the natural resources in the watershed.

Needs Assessment

In general, the needs assessment showed that farmers in the watershed are 1) aware of the watershed project, 2) understand how to reduce runoff pollution, 3) perceive the watershed program as a cost-shared manure storage program, 4) do not use runoff pollution prevention measures because they do

not perceive a need for them and 5) hold negative attitudes towards the program and program staff. Furthermore, the phone survey and focus groups generated baseline data that we will use in a summative evaluation of the educational program. The baseline data collected on farmers in the watershed includes:

- 1) Their level of awareness of local water quality problems
- 2) Their opinions of the watershed project and county staff
- 3) Their uses of the Branch River and their knowledge of specific runoff pollution sources
- 4) Their awareness and perceptions of different "Best" Management Practices (BMPs).
- 5) Barriers that prevent them from implementing these BMPs
- 6) Their willingness to obtain information about BMPs
- 7) Their preferences for source of information.

Although we diagnosed several performance problems through a needs assessment, we cannot address all of the problems through education. The performance problems that we can address through education are those associated with:

Knowledge - People may not understand what they are to do and why. They may lack the necessary information to take action and make a decision.

Skills - People may lack the ability to perform a task.

Attitude - People may have different ideas, perceptions, values, feelings, believes or opinions towards the river and natural resources. [Attitudes are probably the most difficult aspect of education to arrive at, and even tougher to assess and evaluate. The trick in attitude education is to get the learners to adopt new feelings by experiencing greater success with the new feelings than with the old feelings. The education plan has a large attitudinal component because opinions of the watershed project, watershed staff, farmers, non-farmers, etc. greatly affects peoples performance].

We assume that by enhancing peoples skills, knowledge and attitudes we will enhance their performance and improve the quality of the river. However, not all performance problems can be addressed through education. People can possess the skills, knowledge and or attitudes necessary to perform common tasks, but still not do them. In this case, non-educational factors are impacting peoples performance. Some of these include:

The Performance Environment - They may lack the necessary equipment, tools and resources.

Motivation - People may not want to do things differently. This could be due to poor feedback, lack of confidence or an inadequate reward system.

Aptitude - They may lack the physical and/or mental capability to perform certain tasks.

Consequences - There are always consequences caused by our actions. We may consider the consequences to be positive or negative, or to have little value. In addition, we may not experience the consequences (positive or negative) because they are long-term, or we may not receive accurate information regarding the consequences. Not experiencing or valuing the consequences can influence people's performance.

Feedback - People may not be receiving enough feedback. Or, they may not be receiving the right kind of feedback at the right time. In fact, the feedback that they do receive could be negative

feedback. Furthermore, without feedback, people may not know when they are performing "successfully." Feedback can also help build confidence.

Reward System - A reward system may not exist, or if it exists, it may reward the wrong kind of performance (actions contradictory to watershed goals). One of the basic needs of people is to be affirmed, and the affirmation (and feedback) must be timely and specific. Furthermore, people pursue activities that they are rewarded for doing, and pursue rewards that they value.

While an education program cannot address these non-educational factors directly, we did list some activities that can help motivate people. Activities such as encouragement from watershed staff, partnerships, feature stories, youth activities (youth can support and encourage adult actions), peer learning (quality circles), one-on-one instruction (coaching), mentoring and watershed success charts that shows progress towards the watershed goals.

Evaluation

The needs assessment (phone surveys and focus groups) collected baseline data that we will use to evaluate the education campaign. These data were only collected from farmers, however. Therefore, we should design an inexpensive assessment tool for the non-farm community. General categories of assessment tools include questionnaires, interviews and direct observations.

While several education evaluation models exist, this education program follows the evaluation model of Dr. Donald Kirkpatrick (UW-Madison). According to Kirkpatrick, educational programs can/should be evaluated at four different levels:

1. **Reaction** - (customer satisfaction). Was the learning activity offered at a good time and location? Were the materials easy to read, clear, concise and appropriate? Did the right people participate? Did the program address the needs and interests of the participants? Were the facilitators and speakers well organized, clear, approachable, personable, etc.? While this type of information does not assess learning, it can assess barriers to learning. Therefore, if we discover that the participants did not learn the concepts presented at a field day, it could be due to a poorly designed program or poor delivery system. This type of evaluation is very useful for improving an activity or for deciding on the usefulness of an activity.

2. **Learning** - Assessing *what* people learned and *how much* they learned: Did we achieve our learning objectives. If people do not perform differently after the program, they may not have learned anything from the program.

3. **Performance** - Or on-the-job application of the new knowledge, skills and attitudes that the learners gained from the education activity or program. This also includes increased stewardship and community involvement.

4. **Results** - Or the impact of the watershed education program on the quality and integrity of the watershed ecosystem. This is very difficult to assess since we will not be the only show in town. Not only do people learn from a variety of sources (with our programs being a very small part of the learning network), but many activities unrelated to our education programs will influence the watershed ecosystem.

The performance-based education objectives listed on the top of Tables 1, 2 and 3 are the overall objectives, or **educational outcomes** for the watershed--how we want people to perform by the end of our educational program. Listed under each educational outcome is a list of activities that will help us arrive at the outcome. The watershed education specialist will have to write learning objectives for each of these activities in order to evaluate learning (the second level in Kirkpatrick's model). The educational outcomes are level 3 in the model. Another way of stating this is that we will conduct both formative and summative evaluations in the watershed. The summative evaluation strategies will measure the educational outcomes--the sum of our efforts. The formative evaluation strategy, on the other hand, will measure the individual learning activities--the learning objectives for those activities. The baseline data for the summative evaluation were collected through focus groups and phone surveys, and most of the educational outcomes are based on the results of these up-front assessments. The baseline data for the formative evaluations will come from needs assessments conducted before individual activities.

Formative evaluations will take place throughout the program and will serve as benchmarks or yardsticks for the education program (are the learners improving/progressing towards the objectives). They will also be used to modify learning objectives, change/modify learning activities, and to drop ineffective learning activities. In addition, both the formative and summative evaluation processes will be viewed as learning processes rather than means of measuring and showcasing successes.

Formative Evaluation

Formative evaluations will be used to 1) determine whether the activity obtained the stated learning objectives, 2) assess the value of the learning activity (should it be discontinued?), 3) identify the proper audience for future activities of this type, and 4) identify areas that need improvement (instructor, location, content, etc.). Specifically, formative evaluation will measure level 1 and 2 in Kirkpatrick's model: reaction and learning.

To have a meaningful formative evaluation, the watershed educator must first conduct an upfront analysis (needs assessment) of the learner's knowledge, skills or attitudes to determine if a gap exists between what the learners already poses and what they should poses in order to perform at a higher level. Next, the educator designs an activity that will help the learners improve their skills, attitudes or knowledge. Then the educator reassesses the learners skills, knowledge or attitudes and compares the post-learning results to the pre-learning results. While providing baseline data for an evaluation, the needs assessment also helps the educator understand the desires of the learner and design a more effective learning technique (activity). For example, if people are deficient in the skills needed to manage a conservation tillage program and the needs assessment indicates that the problem is caused by people failing to remember the steps involved in measuring crop residue, then a job aid would be more appropriate than a training program on how to measure crop residue.

Summative Evaluation

Summative evaluation occurs after the campaign to see if we achieved what we set out to achieve (since a change in knowledge, skill or attitude brought on by a learning activity does not necessarily mean that people changed their performance). The last row in each table is titled "evaluation," and the technique listed should be used for the summative evaluation since the educational outcomes are based on information generated from that technique. While other evaluation strategies can be used, these techniques will provide the most accurate results by comparing the data before and after the educational programs.

Evaluation Techniques

To develop an evaluation technique, look at the verb in the objective. For example, if the verb is "explain" or "implement," a true-false test will not be appropriate. The evaluation technique should measure the participants ability to explain a concept or implement a practice. To accomplish this, some of the objectives will need to be enhanced by adding criteria. For example, "Farmers will implement a conservation tillage program" is not specific enough. Instead, we should add evaluation criteria so that it reads, "Farmers will implement a conservation tillage program that does not increase their production costs but reduces sediment delivery to the stream by 50%." Furthermore, people will need time to incorporate new skills, knowledge, attitudes into their daily routines or businesses. Therefore, skills that are used daily can be evaluated sooner than skills that are used less frequently.

In his *Final Report* for the needs assessment, Aaron Williamson states that the margin of error in the phone survey was "fairly high" and that we must contend with this by increasing our sample size when we conduct the summative evaluation. Furthermore, In the *Survey of the Branch River Priority Watershed Project* (pgs. 33-34), Williamson recommends that the same questions be asked for the summative evaluation. In particular, we should look for changes in the data reported in tables 1 through 13.

The watershed educator, Carol Holden, Tom Ward and Bill Hafs should coordinate the evaluation with Garrett O'Keefe of the UW-Madison. Garrett O'Keefe was an advisor on this project (as Aaron Williamson's Major Professor) and he has conducted similar projects in other watersheds.

The following list of evaluation techniques is not exhaustive, but should serve as a guide to evaluating the educational activities and outcomes.

To Evaluate Learning:

Discussions

Demonstrations

Creative assessments such as a modified version of Jeopardy. (Not paper and pencil examinations or anything associated with the word "test")

Role Play/Simulations/critical incident exercises - The learners perform a task (such as operate a chisel plow) and observers measure the performance.

Analyze the work products produced by the learners

Self Assessment

Surveys

Interviews with learners

The ability to teach others

To Evaluate Attitudes:

To accurately assess attitudinal changes, the educator must find out precisely what feelings, emotions, values, beliefs, opinions towards the subject/issue, ideas, etc. the participants hold before and after a program.

Sharing ideas

Attitude Surveys/Questionnaires (Using a rubric rating system)

Focus Groups

Interviews with learners

Observations

To Evaluate On-The-Job Performance (application of new knowledge, skills, attitudes).

This may require hard data about actual performance, such as farm production records, measuring runoff, etc. And gathering hard data often requires the use of control groups.

Interviews with learners, co-workers, supervisors

customer Service Surveys

Focus Groups

Demonstrations

Self-Appraisals, including Performance Checklists

On-Site Observations of peers, supervisors, professionals ("experts")

Performance Records - comparing reports before and after the educational programs. Examples of reports include customer complaints, equipment breakage, safety reports, etc.

Critical Incident Analysis

Performance Appraisals/Performance Checklists

To Evaluate Learner Reactions to Educational Activities:

Ask the participants (informally)

Graffiti Charts (Flip charts for participants to write comments).

Questionnaires

Buzz Groups

Group Discussions

A note about Questionnaires. Questionnaires can interfere with the learning and may generate resentment if you use them too often when assessing reactions to a learning activity. Also, to gather reliable information about peoples reactions, the questions must be specific. For example, "What things do you do as a result of your learning?" will probably produce better results than "What do you think you learned?"

Both the formative and summative evaluations should measure secondary outcomes--positive or negative outcomes that we did not design into the learning activities. For example, when students take an English course, a secondary outcome may be a hatred for poetry. In the watershed educational program, a secondary outcome may be a distaste for natural resource protection, conservation tillage, modern agriculture, etc.

The Education Activity Table

The educational outcomes listed in the tables were generated using the SMART method: The outcomes are Simple, Measurable, Attainable, Rewarding and Timely. To make them SMART, the outcomes complete this phrase "After the educational/informational program, the learners will..." Each outcome starts with an action verb that is measurable, and then we added the evaluation criteria. The outcomes are listed across the top of the tables, with the activities running down the side. In each cell the first date listed (followed by /) is the year that the activity is planned. The space after the / allows for scheduling changes as priorities change.

In the activity table for "Skills" (Table 3), a number of different agricultural BMPs are listed. Rather than focusing on all the BMPs at one time, the project managers will prioritize the BMPs, annually.

The outcomes dictate the scope of each activity. Therefore, while one activity may be appropriate for several outcomes, the messages will be different. For example, "Feature Stories" can help meet

several outcomes. But, if the main objective is "Farmers will select practices that protect and enhance diversity in riparian areas..." a newsletter article will feature the efforts of a farmer who protected and enhanced the diversity of a riparian area. This article may help achieve another outcome, such as "Farm and non-farm groups will trust and respect each other..." if the farmer and a group of non-farmers worked together to protect and enhance the riparian area.

We could not fit all 26 educational outcomes on one table, so we broke them down into their learning domains. Table 1 contains the attitudinal outcomes (Attitudinal domain), Table 2 contains the knowledge outcomes (Cognitive domain), and Table 3 contains includes the skill outcomes (Psychomotor Domain).

Activities Described

Listed below, in alphabetical order, are descriptions of the activities in Tables 1, 2 and 3.

Biology in a Bottle - Similar to a terrarium. (Scott Hendrickson has information).

Responsibility: Watershed education specialist

Brochure - A small three or four fold document that provides information to readers who are usually busy, preoccupied, dislike junk mail and probably not keenly interested in the subject. To reach these people the brochure must be targeted for a specific audience, have a single focus (one main theme) and a precise function (advocate a viewpoint, sell an idea or program, convey a message, inform or teach, etc.).

Time: 20 hours per brochure

Responsibility: Watershed education specialist/UWEX

Frequency: As needed

Cost: \$100 for artwork and printing

Building Partnerships Between Community Groups - Bringing existing community groups together to talk about issues and identify common interests. The goal is to have the groups working together on watershed projects.

Time: 15 hours

Responsibility: Manitowoc County CNRED Agent/Area Water Education Agent

Frequency: one year

Building Partnerships Between Farm and Non-Farm Groups - Bringing farmers and non-farmers together to talk about issues and learn from each others perspective. The goal is to have these groups find common ground on issues and work together rather than cast blame. They will accomplish this by sharing thoughts, ideas, visions, experiences, and solving problems.

Time: 100 hours

Responsibility: Manitowoc County CNRED Agent

Frequency: One year

Business Partnerships - Businesses working with watershed staff to help educate watershed residents. A win-win relationship where businesses support the watershed efforts and the watershed staff support the business efforts by including business representatives in field days, tours, group learning, newsletter articles, etc.

Time: 200 hours to build relationships

Responsibility: Watershed education specialist

Frequency: Annually

Canoe Trip - A canoe trip for all watershed residents (including the children) where the residents (particularly farmers and environmentalists) can learn about the watershed ecosystem from one another.

Time: 40 hours

Responsibility: Watershed education specialist

Frequency: Two consecutive years in late April or early May.

Cost: \$200

Customer Service Evaluations - Measuring the quality of service that staff provide to their customers; also, measuring the rapport between landowners and watershed staff.

Responsibility: County Conservationists

Frequency: Annually

Customer Service/Performance Evaluation - The County Conservationists will include customer service as a major component of staff performance evaluations.

Responsibility: County Conservationists

Frequency: Annually

Demonstrations - Visual explanations of a process, fact or idea. Demonstrations show how things are done and prove the advantages of a new method, thought or idea. They are designed to teach other people as well as the person conducting the demonstration. In the watershed we will demonstrate innovative agricultural and non-agricultural activities that reduce runoff pollution. These innovative ideas will be covered in feature stories. The demonstration site and/or adjacent waters will be monitored before and after the demonstration to document improvements (See Signs of Success). Existing projects both in and out of the watershed will also serve as demonstrations.

Time: 30 hours per demonstration

Responsibility: Watershed staff

Cost: \$500 per demonstration for a sign.

Direct Mail - Letters and information mailed to a select group of people.

Responsibility: Watershed staff

Frequency: twice per year

Cost: Postage

Exhibit - Table top or floor-standing display board with several different sets of photos and text to explain the watershed project, provide information, create interest, and show results. The exhibit will include the vision for the watershed.

Time: 30 hours

Responsibility: Watershed education specialist

Cost: \$2,000

Fact Sheets - Developing fact sheets to show how runoff pollution occurs: A little bit of runoff from many acres of land. We will use the "It All Adds Up" theme and a format like "Storm Sewers, The Rivers Beneath Our Feet" to show that a little bit of runoff over a large area, not catastrophic events from a few areas, cause pollution. Also, we will produce (or search for) a fact sheet on how to identify sheet erosion (small pedestals of soil capped with stones, exposed roots, etc.). Existing fact sheets from other states and other agencies will also be used whenever possible.

Time: 60 hours to develop one fact sheet

Responsibility: Watershed education specialist/UWEX

Frequency: Annually

Cost: \$600 for illustrations

Farm Press - Providing feature story ideas and general information about runoff pollution and watershed management to the agricultural magazines and newspapers. This also includes pitching stories to a freelance writer in Manitowoc County.

Responsibility: Watershed education specialist/Freelance writer

Frequency: As opportunities arise

Feature Stories - Feature the efforts of people/groups who have worked to enhance the watershed. Some of the efforts that we will feature are stated in the objectives. The feature stories will appear in newsletters, newspapers (local and state agricultural papers), farm magazines and on television.

Time: 70 hours per year to write stories for the newsletter

Responsibility: Watershed education specialist

Frequency: Quarterly

FFA Programs - Getting FFA groups involved in the Green Stripe Program and getting runoff pollution (how it occurs, how to stop it) in the vo-ag curriculum. FFA members should also be invited to tours and field days.

Time: 100 hours

Responsibility: Watershed education specialist/FFA Directors

Frequency: Annually

Field Day - In-the-field instruction that teaches people how to use/manage a BMP.

Time: 20 hours per field day

Responsibility: Watershed staff/UWEX

Frequency: As needed

Cost: \$500 per field day for food, signs, flyers or equipment

Group Learning - Workshops, clinics, institute, etc. where groups of people learn together.

Time: 20 hours per workshop

Responsibility: Watershed education specialist/UWEX

Frequency: As needed

Cost: \$500 per activity for room rental, refreshments, advertising, materials.

Increased Public Access to the River - If the watershed community desires more public access to the river, we will try to obtain it through land donations, easements, and purchases (fish and game clubs purchasing waterfront property). The Watershed Association will identify the areas for public access.

Responsibility: Watershed staff/Watershed Association

Frequency: Annually

Information Packets - Folders that contain different sets of fact sheets for the following groups:

Agriculture

Riparian landowners/Others

Non-farm residents

Business and industry

Units of Government

Each folder (and fact sheet) will include simple, specific actions that people can take to improve the watershed. They will also include several simple, key messages that will be repeated throughout the life of the project:

Agriculture

Profitability of BMPs

Nutrient Management

No winter spreading of manure

Control erosion and runoff

Protect groundwater

Control milkhouse waste water

Non-Farm

Septic Systems

Groundwater:

Wells

Fertilizer/pesticide applications
sinkholes

Dumping trash in waterways

Riparian protection

Around the House:

runoff controls

lawn care

drainage

auto maintenance

Construction erosion controls

Rented land (renting to farmers)

Government

Cooperation with the watershed project

Management of roadside ditches

Regulatory options

Land use planning to reduce runoff pollution

Watershed goals

Business

Waste Product Disposal

Sponsoring related activities

Participation in water quality improvement--golf courses

Riparian/Other

Change the "want." What some people desire is detrimental to the watershed. Through education, we should try to change the want.

Time: 150 hours

Responsibility: Watershed education specialist or an intern

Cost: \$300 for folders

Job Aid - Quick-reference guides that reduce complicated information to simple terms. They provide easy access to critical information and work well to reinforce learning that takes place through instruction (workshops, field days, etc.). They also work well to help people remember complicated procedures, especially when the procedures are not used frequently. Job aids are presented in an easy-to-use format and must be accessible during the activity. Examples of job aids include posters,

signs, wallet-sized cards (etc.) that contain step-by-step instructions, photos and descriptions to help with identifications, flowcharts/decision aids, checklists and placards. Some job aides already exist for manure management, identifying runoff, managing pesticides and conservation tillage.

Time: 40 hours to develop an aid.

Responsibility: Watershed education specialist

Frequency: As needed

Cost: \$800 to develop and print a set of job aides

Media - Writing news releases, advertising events and general public relations work. (Includes time for arranging feature stories).

Time: 400 hours per year

Responsibility: Watershed education specialist

Frequency: Annually

Mentoring - Mentoring is a way to move information through a community using the most experienced/knowledgeable people. We can establish a mentoring program using two different approaches:

1) Provide a list of people willing to serve as mentors (names followed by their areas of knowledge/expertise) and then match mentorees with mentors. This list will have to be updated frequently.

2) Group mentoring. Placing an experienced person in with a group of 4-6 less experienced people. The group exchanges ideas and analyzes issues. The group members also provide feedback and guidance to one another. The mentor is a partner in the group so there is shared learning and leadership.

In both formats the mentor:

- Asks questions to provoke new ideas and new ways of thinking
- Offers suggestions
- Offers advice based on experience--When Asked!
- Helps people learn from their own experiences
- Reinforces performance
- Is a good listener

Time: 30 hours

Responsibility: Watershed staff

Frequency: Annually

Neighborhood Water Watchers - An extension of the Watershed Association. A local group of people working together to enhance and monitor an area. They become the Stewards for a part of the watershed. They will also uphold the vision that grows out of the Watershed Association.

Time: 200 hours to organize the groups

Responsibility: Citizen group and Watershed staff

Newsletter - Printed quarterly to show the efforts of people and their commitment to protecting the watershed. The newsletter will truly be a *news* letter, covering watershed news.

Time: 120 hours

Responsibility: Watershed staff/Watershed Education Specialist/UW-Extension

Frequency: Quarterly

Cost: \$1,300 per issue

One-On-One Instruction - Watershed staff, watershed businesses and other "experts" work directly with landowners to help them learn and successfully manage BMPs.

Time: 120 hours

Responsibility: Watershed staff/UWEX

Frequency: Annually

Peer Learning - Neighborhood groups of six to eight people who meet in living rooms to discuss watershed issues and how to successfully incorporate water quality protection measures into their businesses/lifestyles. "Early Adopters" will lead the discussions that should help slower adopters integrate new ideas into their lives. [See also Mentoring]

Time: 40 hours to organize groups and meet with discussion group leaders

Responsibility: Watershed education specialist/staff with good small group facilitation skills.

Frequency: During the winter months

Pilot Projects - Similar to demonstrations, except they are individual learning experiences. Pilot projects allow people to practice a new idea, technique etc. on a small scale.

Time: 30 hours per project

Responsibility: Watershed staff

Presentations - To civic groups, schools groups, environmental groups, conservation groups, community groups, etc.

Time: 80 hours per year

Responsibility: Watershed staff/speakers bureau

Frequency: Annually

Quarterly Phone Calls - Contacting high priority landowners.

Time: 40 hours per year

Responsibility: Watershed Staff

Frequency: Quarterly, after the plan is approved

River Clean-Up Day - Held in May to clean up the trash left along the lower reaches of the river by the anglers.

Time: 80 hours (coordinating and publicizing)

Responsibility: Watershed education specialist/Citizen Group

Frequency: Annually

Cost: \$500

River Walk - An organized walk along and in the river so people can experience the flora, fauna and aesthetics of the river.

Time: 20 hours

Responsibility: Watershed education specialist

Frequency: Annually in the fall

School Programs - Working with school districts and/or individual teachers to build natural resource/water quality issues into the curriculum or classroom activities. This activity also includes providing booklets, posters, models and other learning materials to teachers; Building the water quality monitoring program into the curriculum; and establishing an outdoor classroom at one of the schools. The outdoor classroom may include a pond/wetland, prairie and woodland.

Time: 100 hours for the first year, then 40 hours per year after that

Responsibility: Watershed education specialist

Frequency: This will be an ongoing activity once it is started

Cost: \$5,000 for the outdoor classroom, \$1,000 for in-service training (cost for materials and paying for substitute teachers).

Scouting Project - A project that will help a Boy Scout, Girl Scout, Weblow, Brownie, Cub Scout, Daisy Scout or Tiger Scout earn a badge.

Time: 20 hours

Responsibility: Scout Troop leader/Watershed education staff

Frequency: Annually

Self-Study Program - A program (complete with study guides) that allows people to pursue a learning activity at their convenience.

Time: 80 hours

Responsibility: Watershed education specialist

Cost: \$500 for materials

Signs of Success - Documenting accomplishments through photographs and data taken/collected before and after a watershed improvement effort.

Time: 80 hours

Responsibility: Watershed education specialist/Watershed Staff/DNR Biologists

Frequency: Annually

Skills Training - Interpersonal communication skills and customer service skills training for watershed staff.

Time: 490 hours

Responsibility: Area Water Education Agent/Manitowoc County CNRED Agent

Frequency: Once

Smallmouth Bass Fishing Derby - Catch and Release outing held in the lower stretches of the river to draw attention to the quality of the resource.

Responsibility: Watershed education specialist/Fishing Clubs/Sportsman Clubs

Frequency: Once (Repeat if it successfully accomplishes the objective)

Staff Business Cards - Watershed staff include their business cards in all customer correspondence.

Staff: One-on One - Watershed staff involved in the watershed visioning process will describe the vision to watershed customers. Staff will also help individual landowners recognize runoff on their property and understand the effects of the runoff on the stream. In addition, the staff will provide feedback on the successfulness of pollution reduction efforts and will affirm people for their efforts.

Success Charts - Bar charts, thermometers, graphics, etc. that show progress towards watershed goals.

Responsibility: Watershed education specialist and project managers

Frequency: Ongoing

Tours/Trips - Viewing watershed protection efforts and then discussing them as a group.

Time: 20 hours per tour

Responsibility: Watershed education specialist/Watershed staff/UWEX

Frequency: Annually

Cost: \$300

Videos - Existing video tapes on runoff pollution, organizing a citizen action group, organizing a lake association, successful citizen involvement, etc.

Time: 2 hours

Responsibility: Watershed education specialist

Frequency: Annually

Vignette - A short clip from a larger story. In this case, a short video clip (less than two minutes) that people view and then discuss. We can use clips from the "It All Adds Up" video series. We can produce also produce new clips from the "It All Adds Up" field tapes.

Time: 40 hours

Responsibility: Watershed education specialist/Area Water Education Agent

Cost: \$200 (editing costs)

Volunteer Water Monitoring - Students (classes), scouting troops, 4-H clubs, service clubs, conservation groups and citizen groups receive equipment and training to test the quality of the river. They will test for dissolved oxygen, nitrate-nitrogen, total phosphorus, turbidity and macroinvertebrates. The test results can be used in a number of ways, such as monitoring the effects of watershed improvement efforts, applying educational concepts to the "real world" (school groups), or to earn a badge (scouting programs). The costs include ten complete sets of testing equipment (test kits, sampling gear, etc.) and a one-day training program for ten project leaders (teachers, youth directors, club presidents, etc.).

Time: 200 hours the first year, then 100 hours/year after that

Responsibility: Watershed education specialist

Frequency: Annually

Cost: \$3,500 the first year and \$250-500 annually to replace equipment

Water Quality Plans - The water quality plans written for/with farmers will identify why a practice is identified in the plan.

Responsibility: Watershed staff and landowners

Frequency: Annually

Watershed Association - An organized group of watershed residents (farm and non-farm, businesses and public organizations) who take responsibility for the watershed. They will maintain watershed protection efforts after the program ends, conduct education programs (possibly write the newsletter), and direct the watershed project. Formation of this group will occur after Building Partnerships and Community Association Education. This group will also solve watershed problems, and through the problem solving process, they will learn about water quality issues. They will also learn how to deal effectively with community and individual problems.

Time: 15 per year

Responsibility: Manitowoc County CNRED Agent/Area Water Education Agent

Frequency: work with the group annually

Watershed Association Education - Help the watershed association become organized through leadership development training and group organization training (process skills and planning for action). This group will also establish a dialogue with all watershed stakeholders to develop a vision for their watershed and how to obtain that vision.

Time: 30 hours

Responsibility: Manitowoc County CNRED Agent/Area Water Education Agent
Frequency: Twice

Watershed Open House/June Dairy Month - Setting up a display to show how the watershed program will/has improved the natural resources in the watershed. The display will be used at fairs, Farm Progress Days, banks, golf course club houses and other businesses.

Time: 40 hours

Responsibility: Watershed staff

Watershed Picnic - Affiliated with the canoe outing or river walk.

Responsibility: Watershed Association/ LCC

Frequency: Once in mid to late May

Cost: \$1,000

Watershed Signs - Signs will draw attention to good conservation measures, good stretches of streams (healthy riparian zones), and demonstration sites.

Time: 30 hours

Responsibility: Watershed education specialist

Frequency: Annually

Cost: \$2,000

Watershed Speakers Bureau - Watershed staff and Watershed Association Members who give presentations on subjects of interest. The speakers will only cover topics where they have knowledge and experience.

Youth/Children: Speeches and Posters - Encourage speeches and posters that have a water quality/watershed/runoff pollution theme. Civic and service groups, schools or conservation organizations may also sponsor speech and poster contests, or science fairs with poster sessions.

Time: 30 hours

Responsibility: Watershed education specialist

Frequency: Annually

Cost: \$200

4-H Environmental Project - 4-H members conduct their environmental projects in the watershed.

Responsibility: Watershed education specialist/4-H Agent

Frequency: Annually

Implementation of Project Activities

The information and education program that is planned for residents in the Branch River Watershed will take an estimated 15,690 staff hours to be fully implemented. Completion of all activities listed in the following tables in this chapter will be contingent upon the availability of future funding through the Nonpoint Source Pollution Abatement Program.

Table 5-1 Attitudes - Educational Objectives (Outcomes)

Activity	A	B	C	D	E	F	G	H	I
	People will integrate new ideas about water quality into their work and their lifestyles; and take responsibility for protecting the river by investing their time and resources into BMPs and integrating these water quality protection measures into their work and lifestyles.	Farm and non-farm groups will trust and respect each other enough to develop a watershed group that will oversee the watershed project and educate people about water quality.	Farm and non-farm groups will describe the water quality improvement efforts (and constraints to implementing BMPs) of the other groups.	Learners will show an interest in water quality by taking responsibility for their learning and seeking information.	Farmers will acknowledge that factors within their control contribute to runoff pollution in the Branch River (heavy rains or catastrophic events are not the only cause of runoff pollution).	People will select practices that protect and enhance diversity in riparian areas. Diversity of plants and stream morphology (a change in attitude away from straight channels with grazed banks to meandering channels with vegetated banks).	The community will increase its recreational use of the resources in the watershed.	Community members will share the same vision for the watershed project and will describe the watershed program in positive terms.	There will be increased trust and respect between watershed staff and watershed customers.
School Programs	1997/								
Youth: Speeches and Posters	— / —								
Feature Stories	1995/		— / —	— / —		— / —		— / —	
Presentations	Upon Request			— / —					
Demonstrations	As opportunities arise ²					— / —			
Information Packet	1995-1997/								
Neighborhood Water Watchers	1997-1981/							— / —	
River Clean-up	May 1996/			— / —					

²Innovative agricultural and/or non-agricultural demonstration.

Table 5-1 - Attitudes

Educational Objectives (Outcomes)

	A	B	C	D	E	F	G	H	I
Media	Ongoing				___/___/___	___/___		___/___	
Vol. Water Mon.	1997-1998/___								
Peer Learning	1996/___								
Bldg Partnerships between Comm. Groups ³		1996/							
Watershed Assoc. Education		1996/							
Bldg Partnerships between farm and Non-farm groups			1995/					1995/___	
Newsletter			1995/1995	___/___	___/___			___/___	
Tour			1996/___	___/___		___/___			
Signs of Success			1998/___		___/___				
Open House/June Dairy Month			___/___	___/___					
Exhibit				1996/					
River Walk				Fall 1996/			Fall 1996/		
Canoe				Spring 1996/			Spring 1996/		
Vinette					1996/				
Direct Mail					1995/	___/___			
Fact Sheets					1995/	___/___			
Farm Press					___/___				
FFA Programs					1996-99/___				
Mentoring					Fall 1995/	___/___		___/___	

³Assembling existing groups and facilitating the formation of partnerships that support water quality protection measures in the watershed.

Table 5-1 - Attitudes

Educational Objectives (Outcomes)

	A	B	C	D	E	F	G	H	I
4-H Programs					1996/				
Water Qty Plans					Fall 1995/				
Watershed Signs						1996-1997/			
Watershed Assoc		1996/				199 /			
Smallmouth Bass Fishing Derby							1997/		
Success Chart	1997/	1997/		1997/		1997/	1997/	1997/	
Watershed Picnic							1997/		
Inc. Public Access							1996/		
Staff: one-on-one								/	/
Watershed Speakers Bureau								/	/
Customer Serv/Perf. Eval.									1996/
Skills Training									1995-96/
Qrtly phone calls									1996/
Staff Bus. Cards									1995/
Customer Service Evals									1996/
EVALUATIONS	Focus Groups ⁴				Phone Survey		Phone Survey	Focus Groups and Phone Survey	Focus Groups and Phone Survey

⁴People currently believe that government staff (namely, DNR staff) are aware of all pollution-causing activities and, therefore, the activity must be acceptable since the DNR didn't stop it.

Table 5-2 Knowledge - Educational Objectives (Outcomes)

Activity	A	B	C	D	E	F	G
	People will describe how phosphorus and sediment negatively impact the Branch River	People will recognize polluted runoff on their property	People will be able to explain how manure crediting, soil testing and streamside buffers protect water quality	People will be able to explain how septic systems, business wastes, soil erosion, cattle in streams, pesticide runoff, road salt, wells, karst and yard wastes contribute to water pollution	Farmers will be able to calculate the economic benefits of conservation tillage, manure crediting, crop scouting and other BMPs	People will be able to explain the purpose of the watershed project [as more than manure storage program]	People will be able to describe the characteristics of a healthy stream/river
Media	Ongoing		___/___	___/___		___/___	___/___
Fact Sheet	1995/___		1995/___		1995/___		1995/___
Canoe Trip	Spring 1996/ ⁵						Spring 1996/___
Newsletter	___/___ ⁶	___/___	___/___			___/___	___/___
Volunteer Water Monitoring	1997-1998/___						1997-1998/___
Demonstration	As opportunities arise		___/___	___/___	___/___		
School Program	1997/___			___/___			___/___
4-H	1996/___						
FFA Program	1996-1999/___				___/___ ⁶		
Field Day	___/___				___/___		
Tour	1996/___ ³						

⁵To identify impaired stream uses.

⁶Articles showing/describing impaired biological uses in different stretches of the river.

⁶FFA Curriculum, not an FFA project

Table 5-2 - Knowledge

Educational Objectives (Outcomes)

	A	B	C	D	E	F	G
Exhibit	1996/ ____	1996/ ____		1996/ ____			
Presentation	Upon request				____/ ____		
Group Learning		____/ ____			____/ ____		____/ ____
Job Aid		1997/ ____ ⁴			____/ ____ ⁷		
Mentoring		____/ ____	____/ ____		____/ ____		
Staff Training		1995-1996 ⁵					
Speakers Bureau		____/ ____				____/ ____	
Information Packets		1995-1997/ ____		1995-1997/ ____			
Feature Story			____/ ____	____/ ____			
Direct Mail			1995-1996/ ____			1995/ ____	
Business Partnerships			____/ ____		____/ ____		
One-on-one Instruction				____/ ____	____/ ____	____/ ____	
River Walk				Fall 1996/ ____			
Farm Press					____/ ____		
Brochure						1994/1994	

³specific steps to see/touch impaired and good conditions⁴Another organization may have already developed this job aid.⁷Calculation sheet⁵Using good communication skills and customer service skills, staff will help people recognize polluted runoff on their property.

Table 5-2 - Knowledge

Educational Objectives (Outcomes)

	A	B	C	D	E	F	G
Youth: Posters & Speeches						___/___	___/___
Building Partnerships between farm & non-farm groups						1995/___	
Watershed Association						1998/___	
Biology in a bottle							___/___
Small-mouth bass fishing derby							1997/___
EVALUATION		Phone Survey	Phone Survey: Ability to recognize but not explain.	Phone Survey: Ability to recognize but not explain.	Focus Groups Phone Survey (Limited Information)	Focus Groups	Focus Groups

Table 5-3 Skills - Educational Objectives (Outcomes)

Activities	A Farmers will implement and manage a conservation tillage program that results in lower sediment delivery to the branch river	B Farmers will implement and manage streamside buffer strips, riparian buffer, enhance wildlife habitat and reduce sediment delivery to the branch river	C Farmers will implement and manage sediment reduction practices (contour strips, grass waterways, rotational grazing, etc.) that reduce sediment delivery to the branch river	D Woodland owners will implement and maintain management practices that are profitable, protect water quality, and enhance wildlife habitat	E Farmers will implement and manage barnyard runoff control systems that are economically sound and protect surface water and ground water	F Farmers will implement and maintain milkhouse waste treatment systems that are economically sound and protect surface water and ground water	G Homeowners will properly abandon wells	H Farmers will implement and maintain a pest management program	I People will be able to identify a healthy stream/river	J The community will organize themselves and function as an autonomous group that oversees water quality protection efforts in the branch river
Fact Sheets	1995/ as opportunities arise	1995/ /	1995/ /	1995/ /	1995/ /	1995/ /	1995/ /	1995/ /	1995/ /	1995/ /
Demonstration	/	/	/	/	/	/	/	/	/	/
Farm Press	/	/	/	/	/	/	/	/	/	/
Field Day	/	/	/	/	/	/	/	/	/	/
Business Partnerships	/	/	/	/	/	/	/	/	/	/
Pilot Projects	/	/	/	/	/	/	/	/	/	/
Mentoring	/	/	/	/	/	/	/	/	/	/
Information Packet	1995-97/ /	1995-97/ /	1995-97/ /	1995-97/ /	1995-97/ /	1995-97/ /	1995-97/ /	1995-97/ /	1995-97/ /	1995-97/ /
Group Learning	/	/	/	/	/	/	/	/	/	/
Job Aid	1996-97/ /	1996-97/ /	1996-97/ /	1996-97/ /	1996-97/ /	1996-97/ /	1996-97/ /	1996-97/ /	1996-97/ /	1996-97/ /
One-on-one Instructions	/	/	/	/	/	/	/	/	/	/
Media	/	/	/	/	/	/	/	/	/	/
FFA Program	/	/	/	/	/	/	/	/	/	/
Success Chart	1997/ /	1997/ /	1997/ /	1997/ /	1997/ /	1997/ /	1997/ /	1997/ /	1997/ /	1997/ /
Scouting Project	/	/	/	/	/	/	/	/	/	/
Newsletter	/	/	/	/	/	/	/	/	/	/
Volunteer Water Monitoring	/	/	/	/	/	/	/	/	/	/
Self Study Program	/	/	/	/	/	/	/	/	/	/
Canoe Trip	/	/	/	/	/	/	/	/	/	/
Building Partnerships between Farm & non-farm groups	/	/	/	/	/	/	/	/	/	/
Signs of Success	/	/	/	/	/	/	/	/	/	/
Neighborhood Water Watchers	/	/	/	/	/	/	/	/	/	/
Staff Training	/	/	/	/	/	/	/	/	/	/
Community Group Education	/	/	/	/	/	/	/	/	/	/
Building Partnerships between community groups	/	/	/	/	/	/	/	/	/	/
Videos	/	/	/	/	/	/	/	/	/	/
EVALUATION	phone survey ⁵	phone survey ⁵	phone survey ⁵						Focus Group and phone survey (limited data)	

²Watershed groups/organizations mentoring each other³Statewide groups (such as successful lake associations) will mentor these groups to become a cohesive group⁴Using existing videos (possibly Lake Association videos) to help existing groups get organized into a watershed association⁵Will show a change in the number of people using the practice (behavior) but not successful implementation (performance)

Table 5-4 Information and Education Activities

Information and Education Activity	Staff Hours years 1-3	Staff Hours Years 4-10	Direct Costs
Newsletters	1,080	1,680	58,400
News releases/Feature stories/Media	1,200	2,400	7,200
Public Meetings	120	0	900
Demonstration tours/trips/field days	450	400	4,000
Demonstration Farm Fact Sheet	80	0	1,500
Demonstration Farm Video	20	30	100
Slide Presentaion	50	0	200
Fact Sheets	180	360	3,000
Youth: Speeches and Posters	90	80	1,250
School Programs	180	160	600
FFA, 4H, Scout Programs	300	600	0
Smallmouth Derby, Carpshoot	100	0	0
Vignette	40	0	200
Business Patnerships	600	200	0
Watershed Signs	90	180	5,000
Group Learning	60	120	1,500
Job Aid	40	0	800
Presentations	240	240	0
Pilot Projects	540	0	0
Information Packets	150	0	500
Neighborhood Water Watchers	150	50	150
River Clean-up Day	240	480	5,000
Volunteer Water Monitoring	400	600	8,000
Peer Learning	40	40	0
Building Partnerships with Groups	40	40	0
Watershed Association and Education	40	40	1,000
Signs of Success	40	40	500
Watershed Open House/Dairy Month	40	0	0
Exhibit	30	0	2,000
River Walk	90	180	0
Canoe Trip	80	0	400
Watershed Picnic	100	100	3,600
Skills Training	250	240	0
Self Study Program	0	80	500
Direct Mail	100	100	16,000
TOTAL	7,250	8,440	\$121,050

Conservation Planning Efforts

Many landowners in the Branch River Watershed feel that they are doing an adequate job with their current conservation plans. These landowners have their cropland fields planned to the tolerable soil loss level, yet many of these fields are still delivering sediment to watershed streams. The information and education program will focus on developing landowner awareness and knowledge of how sediment reaches surface water and through promotion of the benefits of reduced tillage and wetland restoration. The following strategy will be employed to reach these landowners:

- a) Following completion of the upland inventory, landowners with high sediment delivery fields that are planned to the tolerable soil loss will be targeted for informational and educational activities that will encourage watershed participation.
- b) Wetland Restoration, Vegetated Riparian Buffers, and High Residue Management Practices will be promoted as viable Best Management Practices.
- c) A landowner survey to evaluate landowner needs and attitudes toward adoption of High Residue Management Practices will be initiated by project staff.
- d) Watershed participation of landowners with high sediment delivery fields planned to the tolerable soil loss will be monitored and progress reported to the DNR Project Coordinator on an annual basis.
- e) An aggressive easement program will be initiated by project staff to target these specific sites.

CHAPTER SIX

Project Evaluation

This chapter briefly summarizes the plan for monitoring the progress and evaluating the effectiveness of the Branch River Priority Watershed Project. The evaluation strategy includes these components:

- 1) Administrative review
- 2) Pollution reduction evaluation
- 3) Watershed resource evaluation monitoring (Signs of Success monitoring)
- 4) Evaluation of special approvals for innovative approaches
- 5) Final project report

Evaluation Overview

Information on the first two components will be collected by the Manitowoc County Soil and Water Conservation Department and the Brown County Land Conservation Department. The information will be reported on a regular basis to the DNR and the DATCP. Additional information on the numbers and types of practices on cost-share agreements, funds encumbered on cost-share agreements, and funds expended will be provided by the DNR's Bureau of Community Assistance.

The third component, Signs of Success (SOS) monitoring, will be conducted by DNR Water Quality Biologists. The monitoring will be conducted to demonstrate changes in water quality and/or habitat conditions resulting from installation of Best Management Practices. SOS monitoring at specific sites will follow guidelines established by DNR's Bureau of Water Resources Management.

The fourth component involves evaluating special approvals granted for innovative approaches in the watershed project. The DNR Nonpoint Source Pollution Abatement Program is continually striving to improve the way nonpoint pollution problems are addressed in Priority Watershed Projects. The Program commonly gives special approval for watershed projects to try new and innovative approaches. In the Branch River Watershed, innovative approaches, interim BMP's (Appendix B), enhanced high residue management cost sharing pilot (Appendix D), and improved conservation planning, tracking, and implementation through integration with Geographic Information System (GIS) computer technology (Appendix E).

Additionally, while not formally part of the watershed project, watershed project integration with special research conducted through a Federal NRCS PL-566 grant will also be assessed (Appendix C). The research addressed nitrogen leaching susceptibility through soils and the environmental effectiveness of riparian buffers.

A final project report will be prepared once the implementation period of the project has ended. Many practices will still be in their required operation and maintenance period at this time. The report will summarize evaluations of all aspects of the project.

Annual Administrative Review

Project administration will be reviewed annually. Each year county project managers will report a variety of information to the DNR and the DATCP. The information is used to track financial expenditures, landowner participation, and progress toward the water quality, aquatic habitat, and pollution load reduction objectives of the watershed project.

Annual Review Meetings

The information listed above and described in detail in the following sections, will be analyzed and discussed at an annual review meeting conducted with county, DATCP, and DNR staff. At the annual review meeting annual reduction goals, contact strategy modifications, progress with critical sites, and work planning needs will be jointly developed for each subsequent year. Each year the county project managers, DNR, and DATCP staff will compare actual performance to the interim annual goals. Local assistance grant recommendations and awards will, in part, be determined by annual progress toward meeting the watershed project's water quality, aquatic habitat, and pollution load reduction objectives.

Accomplishment Reporting

The Field Offices Computing System (FOCS) is a computer data management system that has been developed by the U.S. Natural Resources Conservation Service (NRCS). The NRCS, the DNR and the DATCP use FOCS to meet the accomplishment reporting requirements of all three agencies. Manitowoc and Brown County will use FOCS to collect data for administrative accomplishments, and will provide the information to the DNR and the DATCP for program evaluation. Manitowoc and Brown County LCD's will keep the DNR apprised of the changing status of critical site landowners.

Accomplishment data are summarized in the Annual Accomplishment Report prepared by DATCP and DNR, and are also discussed at annual administrative watershed review meetings. The Manitowoc and Brown County LCD's will provide the following data to the DNR and the DATCP on an annual basis unless otherwise directed:

- Number of farms and acres in the project having conservation plans
- Number and type of conservation practices/BMP's installed by project

- Number of farms and acres of cropland monitored for program compliance
- Number of personal contacts made with landowners
- Information and education activities completed
- Number of cost-share agreements signed
- Number of farm conservation plan and cost-share agreement status reviews completed

Details of the reporting requirements are contained in the jointly published evaluation plan for the Soil and Water Resource Management Program and the Nonpoint Source Water Pollution Abatement Program (DNR Publication WR-223-94). The publication is reviewed every two years by DATCP and DNR and revised as necessary.

Likewise, participating local units of government implementing the urban nonpoint source management program will meet periodically with DNR staff to review progress. The DNR and local units of government will jointly evaluate the urban implementation program. Annual reports of governmental units will include:

- Information and education activities completed
- Construction site erosion control ordinance amendments adopted
- Number of permits monitored for ordinance compliance
- Implementation of urban "housekeeping" program activities
- Acres of post-1996 urban development, by land use, covered by storm water management plans for controlling water quality
- Storm water management ordinance provisions adopted

Financial Expenditures

The Manitowoc and Brown County Land Conservation Departments, including other participating units of government, will provide the following information to the DNR and the DATCP on an annual basis unless otherwise directed:

- Number of landowner cost-share agreements signed
- Amount of money encumbered in cost-share agreements
- Number of landowner reimbursement payments made for the installation of best management practices (BMP's), and the amount of money paid
- Staff travel expenditures
- Information and education expenditures
- Expenditures for equipment, materials, and supplies
- Expenditures for professional services and staff support costs
- Total project expenditures for project staff
- Amount of money paid for installation of BMP's, and money encumbered in cost-share agreements
- Staff training expenditures
- Interest money earned and expended
- Total budget and expenditures on the project

Time Spent On Project Activities

The Manitowoc County SWCD, Brown County LCD, and other participating governmental units with local assistance grants will provide time summaries to both departments for the following activities on an annual basis unless otherwise directed:

- Project and fiscal management
- Clerical assistance
- Pre-design and conservation planning activities
- Technical assistance: practice design, installation, cost-share agreement status review and monitoring
- Educational activities
- Training activities
- Leave Time

Nonpoint Source Pollutant Load Reduction

The purpose of this evaluation is to estimate reductions in nonpoint source pollutants as a result of installing BMP's. Data collected for evaluation include sediment load reduction from uplands, streambanks and gullies; reduced winter spreading of manure; and streambank (habitat) protection. Chapter two of this plan describes target pollutant reductions for each of the subwatersheds. Annual pollutant load reduction objectives will be established during the annual review meeting between Manitowoc and Brown county watershed staff, the DNR, and the DATCP.

Cropland Sources

Manitowoc SWCD and Brown County LCD will use the WINHUSLE (Wisconsin Nonpoint Source) model to estimate sediment reductions due to changes in cropping practices. Manitowoc and Brown County will use FOCS to provide data for the WINHUSLE model on an annual basis, as described above. A Geographic Information System (GIS) approach will be developed to assist in progress tracking and analysis over the course of the project. The Manitowoc County SWCD and Brown County LCD will also estimate the phosphorus reduction achieved through sediment control in the Branch River Watershed.

Notification of landowners with critical sites will begin when Manitowoc and Brown County have the ability to identify individual fields for specific management categories on the FOCS/WINHUSLE database. The highest ranked sites will be notified first until all landowners or land operators with critical sites are notified.

At the end of the fifth year of project implementation, evaluation of the project will be conducted by Manitowoc and Brown county watershed project managers in conjunction with the DNR. The evaluation will determine if acceptable progress has been made toward reaching the project's sediment reduction objective. Progress will be determined by the total

sediment reduction achieved from practices on signed cost share agreements. Acceptable progress is defined as achieving 65% of the project's total cropland sediment reduction objective. If acceptable progress has been made the critical management criteria for cropland sediment will be modified so the remaining 50% of the critical management sediment load will be reclassified as eligible rather than critical. The critical cropland sediment load will be immediately reclassified from critical to eligible if 65% of the total cropland sediment reduction goal is achieved during the first five years of the project.

The five year critical management control time frame may be extended if extenuating socio-economic circumstances occur reducing voluntary participation and slowing progress toward achieving sediment objectives.

Streambank Sources

Manitowoc County SWCD and Brown County LCD staff will estimate reductions in sediment generated from streambank erosion. A tally will be kept of landowners contacted, the amount of streambank sediment (in tons) being generated at the time of contact, and changes in erosion levels estimated after installing BMP's.

Barnyard Runoff

County staff will use the BARNY computer model to estimate phosphorus reductions from the installation of barnyard control practices. The results will be reported to the DNR through FOCS. In the event that FOCS is replaced, the replacement system will be used for all project tracking.

Barnyard critical site landowners will be contacted in the first six months of the project. It is anticipated that there will not be modification of the barnyard critical site criteria.

Urban Areas

The Branch River Watershed is predominantly a rural project with an estimated population of 4,700 residents; the Village of Whitelaw, with a population of 700 residents, is the only incorporated area in the watershed. The Bay-Lake Regional Planning Commission (Overall Economic Development Program Annual Report, 1994) projects an overall stable growth rate of one-percent between the years of 1990 and 2015 in the project area. During the same period, the population of the Village of Whitelaw is expected to increase by 13.6 percent and is eligible to participate in the Branch River Watershed Urban Implementation Program.

The Manitowoc County Soil and Water Conservation Department and the Brown County Land Conservation Department will continue to work with the Village of Whitelaw and unincorporated areas to promote water quality. Manitowoc and Brown County shall report annually to the DNR on any activities that may result in changes in urban pollutant loadings.

Examples include acres of existing and post-1996 urban development served by new storm water BMP's; pollution reduction achieved; acres of new urban lands not served by storm water BMP's; and other information requested by the DNR concerning BMP construction, implementation, and operation and maintenance.

Construction Sites

If the Village of Whitelaw (population 800) or other incorporated areas decide to participate in the urban implementation program, they will report annually to the DNR on the number of construction sites served by adequate erosion control practices, number of construction sites that received appropriate permits, and any amendments to construction site erosion control ordinances that affect sediment loads associated with these sources. The Village of Whitelaw passed a comprehensive constructive site erosion control ordinance in January 1996.

Watershed Resource Evaluation Monitoring

Signs of Success

Signs of success (SOS) is short-term monitoring designed to provide some early evidence that better land management does make a difference. At least one, and possibly several sites in Manitowoc and Brown counties will be chosen for SOS monitoring in the Branch River Watershed. On each site, SOS monitoring will focus on one practice such as barnyard runoff controls, manure storage, or streambank fencing that is expected to have an immediate effect on the adjacent stream.

Monitoring will take place over a two-year period--the year before and the year after a practice is installed. Habitat sampling and photographs will be used to indicate the benefit of the practice. Limited chemical monitoring and fish sampling may be conducted at some sites.

The results of the SOS monitoring will be featured in educational materials such as local newsletters and newspapers and the statewide newsletter "Fields and Streets."

SOS sites for Branch River Watershed Project are still being identified and will be established shortly after the implementation stage begins by the District Water Quality Biologist.

Evaluation of Special Approvals for Innovative Approaches

Evaluation of special approvals for innovative approaches will be conducted by Manitowoc and Brown county staff at least every three years and for the final report.

Interim Best Management Practices

Interim BMP's were created to meet the specific and individual needs identified during the planning process of the Branch River Watershed Project and will be used on a trial basis.

These interim BMP's (Appendix B) will be evaluated by the County LCD and the DNR for their effectiveness in reducing nonpoint source pollution before consideration as a standard BMP. These cost shared practices are: vegetative buffer zone establishment along intermittent and perennial stream channels, manure brokering and hauling, and surface/subsurface drainage outlet relocation or removal.

Evaluation will include an analysis of practice utility based on landowner acceptance, state and landowner cost, and if possible, the amount of pollution controlled. The report will also include a discussion of results, problems encountered, likelihood of transferability to other watershed projects, and recommendations based on local experience with the BMP's.

High Residue Management Pilot Project

The high residue management pilot project (Appendix D) is intended to promote conservation tillage by allowing landowners to implement reduced tillage on 20 acres with a direct incentive payment of \$25/acre for up to three years. The landowners would still be eligible to sign cost share agreements for conservation tillage after receiving three years of incentive payments.

Upon completion of the pilot project, the Manitowoc and Brown County LCD's will submit an evaluation to the DNR that will include analysis of the number of landowners participating in the pilot, costs, changing landowner attitudes toward conservation tillage, amount of sediment controlled, and the number of landowners who continue conservation tillage with or without cost sharing.

Geographic Information System Technology

The GIS effort (Appendix E) will seek to integrate county GIS capability with the needs of the Branch River Priority Watershed Project. This will allow the counties to enhance record keeping by tying inventory data and pollution loads with specific land parcels.

Evaluation will include an analysis of the effectiveness of utilizing GIS for these purposes, costs, and staff time needed to enter and maintain the GIS data base. The report will also include a discussion of results, problems encountered, likelihood of transferability to other watershed projects, and recommendations based on local experiences.

Federal PL-566 Watershed Planning Assistance

The federal watershed planning effort seeks to integrate federal project funding for specific research activities with the needs to the watershed project (Appendix C). Research on soil nitrogen leaching potential is being developed for certain soils in the watershed. This information will be useful in determining groundwater susceptibility to nitrate contamination from agricultural practices. Additional research is determining the effectiveness of riparian buffers for controlling nonpoint pollution delivery to surface waters. This information is needed to more thoroughly evaluate the buffer strip interim BMP.

Evaluation will include a discussion of results, problems encountered, likelihood of transferability to other watershed projects, and recommendations based on local experiences.

Final Report

A Final Report will be jointly prepared for the Branch River Priority Watershed Project by the Manitowoc and Brown County LCD's within 18 months of the end of the grant period. This report will include information on pollution load reduction achieved, effectiveness at addressing nonpoint threats to groundwater, landowner participation, project management, grant management, and technical assistance provided to landowners. It will also serve as the final evaluation of special approvals and innovative approaches. The report will summarize findings from Signs of Success monitoring and may include information from any other monitoring conducted in the watershed.

The Final Report is developed to evaluate progress made toward attaining water quality and pollution reduction objectives, evaluate BMP effectiveness, and provide recommendations which target key areas needing improvement in the NPS program. It will be jointly prepared by the Manitowoc County SWCD, Brown County LCD, DNR, and the DATCP.

APPENDIX A

Groundwater Assessment

Geology

From its lowest depths, Branch River Watershed geology is composed of a sequence of Precambrian crystalline granitic basement rock, Cambrian sandstone, Ordovician sandstone, dolomite, shale, Silurian dolomite, and Pleistocene glacial deposits. The major geologic units of concern from a groundwater quality perspective are the upper Silurian dolomite and Pleistocene glacial deposits, or the upper 200 to 400 feet in depth.

The Silurian age dolomite and limestone were formed around 425 million years ago, and the Pleistocene age glacial geology was deposited between 11,000 and 17,000 years ago.

The Silurian age dolomite rock consists of massive dolomite with varying amounts of fossil fragments, gypsum crystals, pyrite, and minor amounts of limestone. The dolomite has well defined bedding layers, and is highly fractured. A major series of dominant joint trends is present in the formation at an angle of approximately N23W (north 23 degrees west of north), N70E, and to a lesser degree, N20E. The entire formation layer dips less than 1 to 5 degrees to the southeast under Lake Michigan. Past geologic investigations have reported the Silurian dolomite to be more than 450 feet thick. The Silurian dolomite is generally covered by thick Pleistocene glacial deposits, but has ground surface exposures at several mapped locations within the watershed.

The Pleistocene glacial deposits in the Branch River Watershed resulted from two major glacial advances. Glacial ice advanced in two lobes from the north across the bay of Green Bay called the Green Bay lobe, and advanced from the west across Lake Michigan called the Lake Michigan lobe. The two glacial ice lobes intersect each others paths approximately down the center of the watershed. Each of the major ice advances was accompanied by numerous smaller advances and retreats of the lobes.

Pleistocene epoch geology consists of a complex sequence of unconsolidated glacial deposits nearly 200 feet thick in some places, but totally absent in others. These glacial deposits consist of two types of materials: **outwash** - the sand, silt, clay, and gravel deposited by glacial meltwater; and **till** - the material carried along with the ice, poorly sorted and deposited adjacent to, or under the base of the glacier. The five till members deposited, now exposed within the watershed, include the Glenmore Till, Chilton Till, Branch Till, Valders Till, and the Liberty Grove Till.

Specific work identifying the geologic features in the watershed was done as part of this project. The technical report titled *Mapping and Inventorying of Geological Features in the Branch River Priority Watershed* is available for more detailed information at the Soil and

Water Conservation Offices in Brown and Manitowoc counties, and through the Department of Natural and Applied Sciences at the University of Wisconsin Green Bay.

Groundwater/Surface Water Integration

Groundwater is a resource that is hidden from view except in rare circumstances. One of the ways to "see" groundwater is through the contribution it makes as the base flow or low flow volume of rivers and streams. Groundwater contribution in most rivers and streams accounts for that portion of flow which is always present, even under the driest conditions.

The groundwater-surface water connection in the Branch River Watershed can be determined using surface water monitoring data collected on low-flow characteristics at a sewage-treatment plant at the lower end of the watershed. Low-flow would be defined as periods when water levels in the river are at a minimum for the year. The Branch River Country Club sewage treatment plant located 0.1 miles upstream from the town road, and 0.6 miles south of Branch listed a low-flow $Q_{7,2}$ (Q seven two) flow of 5.3 ft³/s and a $Q_{7,10}$ (Q seven ten) flow of 3.0 ft³/s in 1972. The $Q_{7,2}$ and $Q_{7,10}$ represent the annual minimum 7-day mean flow that occurs on the average of once in 2 or 10 years respectively.

Three day measured values for river flow volume, or discharge indicated an average river discharge of 19.33 ft³/s. Using this average discharge value and the $Q_{7,2}$ and $Q_{7,10}$ numbers, groundwater is contributing 3 to 5.3 ft³/s of flow to the Branch River, or from 15.5% to over 27% of the average river flow volume. These percentages may under-represent the groundwater contribution to the river. Low-flow conditions represent a contribution from similar periods of low groundwater levels. As conditions normalize, groundwater levels should also rise and contribute more to the overall system.

Hydrogeology

Groundwater flow within the Silurian dolomite aquifer is generally in a south-south easterly to easterly direction toward Lake Michigan. The groundwater flow direction is documented at a regional scale in the *Groundwater Atlas of the United States* and *Ground-water Flow and Quality in Wisconsin's Shallow Aquifer System* publications from the U.S. Geological Survey.

The direction of groundwater flow and volume of groundwater transported are controlled by three factors: 1) presence of sand and gravel in the overlying glacial till units; 2) presence and thickness of clay in the glacial till units; and 3) fracture traces and density in the Silurian dolomite. Higher percentages of sand and gravel in the till units greatly effects the groundwater transmissivity (rate of water transmitted through a unit width of aquifer). Groundwater moves very easily through sand and gravel, taking the path of least resistance.

The presence of clay in the till tends to restrict groundwater movement. Clay does not transmit water very easily because of very small pore spaces between the clay particles. Clay tends to act more as a barrier to groundwater movement.

The presence of fractures and karst features (solution features) in the Silurian dolomite act as conduits to direct the flow of groundwater. Water does not flow through solid rock, but through openings in the rock.

General Groundwater Chemistry

County watershed technicians gathered farm inventory data and sampled wells in the watershed for nitrates and triazine based pesticides. Sampling was done in conjunction with the farm inventory data collection visit. Current records indicate that 139 nitrate samples and 117 triazine immunoassay screens were collected and then analyzed at the State Laboratory of Hygiene (SLOH) under the Branch River Watershed project. The triazine immunoassay screen is a test which uses specific antibodies (proteins produced by an immune system in response to the presence of a foreign substance), designed to selectively bind to target compounds present in low concentrations. The presence of triazine based compounds produces a measurable color change from the reaction.

As shown in table 1, nitrate sampling indicates that of the 139 wells sampled, 98 had a nitrate detect, 86 exceeded the Preventative Action Limit (PAL) of 2.0 ppm, and 37 exceeded the Enforcement Standard (ES) of 10 ppm. These numbers indicate that 26.6% of the wells sampled exceeded the ES for nitrate. The statewide average tends to be around 10% for comparison, although this number includes counties as low as 3% (Lincoln) and as high as 35% (Rock). Triazine screen sampling data in the watershed indicates that of 117 samples taken, 71 samples (60.7%) had a detect of a triazine based compound.

Table A-1 Watershed Project Well-Water Sample Results

Parameter Description	Total Samples Tested	Samples with Detects	Enforcement Standard (ES)	Samples Exceeding ES	Preventive Action Limit (PAL)	Samples Exceeding PAL
Nitrogen NO ₃ +NO ₂	139	98	10 ppm	37	2.0 ppm	86
Triazine Screen	117	71	N/A*	N/A	N/A*	N/A

* The triazine screen or immunoassay screen for triazine based compounds does not have an ES or PAL standard set. The triazine screen is linked to atrazine because atrazine is one of 11 compounds screened for using this test method. It does not report atrazine specifically, but reports the presence of any of the 11 triazine based compounds. The reported result can not be directly related to the atrazine standard because there is no direct reporting of an atrazine specific value in the screen.

Table 2 lists additional sample data for wells located within the watershed boundaries that were not sampled as part of this watershed project. These data indicated that 77 samples were collected for nitrates and 22 samples were collected for the triazine immunoassay screen. The nitrate data from the additional wells had 59 PAL exceedances and 15 ES exceedances. Data for other compounds with a groundwater standard was included to provide additional information about existing groundwater quality in the watershed.

Table A-2 Nonproject Well-Water Sample Results

Parameter	Samples Tested	Samples with Detects	Enforcement Standard (ES)	Samples Exceeding (ES)	Preventive Action Limit (PAL)	Samples Exceeding PAL
Nitrogen NO3 + NO2	77	68	10.0 ppm	15	2.0 ppm	59
Triazine Screen	22	13	N/A	N/A	N/A	N/A
Chloride	41	41	250.0 ppm	0	125.0 ppm	1
Sulfate	42	42	250.0 ppm	0	125.0 ppm	0
Lead Total	72	42	15.0 ppm	11	1.5 ppm	33

Groundwater Use

Groundwater provides 100% of the drinking water within the watershed. Groundwater withdrawal includes the municipal well in the city of Whitelaw, other-than-municipal wells (mobil home parks, apartments, and subdivisions), non-community wells (gasoline stations, parks, restaurants, and motels), and private water supply wells.

Reported water withdrawal for the municipal well in the city of Whitelaw indicated that over 31 million gallons of groundwater was withdrawn for the period of January 1994 - December 1994.

The watershed also includes the cities of Branch, Cato, Reifs Mills, Menchalvill, Wayside, and Morrison which are not served by municipal water supply systems.

Contamination Sources Listing

The following listings represents existing contamination problems and sources with the potential to cause a problem. This list is compiled by the Bureau of Solid and Hazardous Waste Management (SW) at the DNR. Each listing has a title as classified by SW.

Site	Town/City	Location/Legal Description
Sites or Facilities which May Threaten to Cause Environmental Pollution List		
Lemberger Fly Ash Landfill	Franklin	T20N R22E 27 NE SE
Lemberger Sites	Franklin	T20N R22E 34 NE
LUST Program List		
Branch Cheese	Branch	T19N R23E 5
Seefeld, Miron	Cato	T R
Whitelaw Conv.	Whitelaw	T R
Registry of Waste Disposal Sites List		
Town of Morrison	Morrison	T21N R21E 10 NE NW
Town of Cato	Cato	T19N R22E 3 SE SE
Village of Whitelaw	Cato	T19N R22E 2 NW SE

There is an atrazine prohibition area located in the town of Morrison - T21N R21E Sections 3,4,9, and 10. Atrazine prohibition areas are established under authority of Department of Agriculture, Trade and Consumer Protection (DATCP) under Wisconsin Administrative Code ATCP 30. DATCP establishes atrazine prohibition areas where two groundwater samples exceed the ES for atrazine plus metabolites of 3.0 parts per billion (ppb). The current atrazine standard includes atrazine plus its three metabolites; deethylatrazine, deisopropylatrazine, and diaminoatrazine.

Wellhead Protection

There are currently no wellhead protection plans in place within the Branch River watershed. Current workplans for the summer of 1995 indicate that District and Central Office DNR staff will be conducting a contaminant source inventory for the Whitelaw Public Water Supply, as well as defining a wellhead protection area.

References Cited

- Stieglitz, Ronald D. and Dueppen, Thomas J., 1995, Mapping and Inventorying of Geological Features in the Branch River Priority Watershed
- W.A. Gebert and B.K. Holmstrom, 1974, Low-Flow Characteristics of Wisconsin Streams at Sewage-Treatment Plants, p. 43
- Bureau of Solid and Hazardous Waste Management BBS, LUST.DB
- Bureau of Solid and Hazardous Waste Management BBS, SPILLS.DB
- Bureau of Water Supply, 1994, Well Construction Database
- Emergency and Remedial Response Program, 1991, Wisconsin Remedial Response Site Evaluation Report, PUBL-SW-144
- Wisconsin Emergency and Remedial Response Program, 1993, Registry of Waste Disposal Sites in Wisconsin, PUBL-SW-108-93
- Division of Environmental Quality Groundwater Retrieval System
- D.Q. Bowen, 1978, QUATERNARY GEOLOGY A Stratigraphic Framework for Multidisciplinary Work

APPENDIX B

Interim Best Management Practices

(The Nonpoint Source Pollution Abatement Program will no longer use alternative as the defining word for interim Best Management Practices (BMPs). Interim BMPs are created to meet the specific and individual needs identified during the planning process of a priority watershed project and will be used on a trial basis. The practice will be evaluated for its effectiveness before consideration as a standard BMP. A procedure defining the process for interim BMP approval will be detailed within the Implementation Handbook.)

A. Name of Interim Best Management Practice:
Vegetated Riparian Buffer

B. Definition
Riparian Buffers are permanently vegetated areas immediately adjacent to intermittent or perennial streams that are designed and constructed to function as a filter to delay, absorb, or purify contaminated runoff before it enters watershed streams.

C. Purpose
The predominant sources of nonpoint source pollutants in the Branch River Priority Watershed originate from croplands in the form of excess phosphorus, nitrogen and sediment. Establishment of Vegetated Riparian buffer-strips will provide significant protection to the water resource and increase the likelihood of achieving the water quality objectives identified in the Branch River Watershed Nonpoint Source Control Plan.

This practice is primarily an informational and educational tool to promote water quality awareness, with the intent of providing watershed participants with a feasible management option that will reduce nonpoint source pollutant runoff to surface water.

All watershed participants will also be eligible for NPS corridor easement acquisition where the establishment of a vegetated riparian buffer is necessary to meet nonpoint source program objectives.

D. Eligibility Parameters for Buffer Establishment

1. To be eligible for an annual payment, the establishment of a 35 foot-wide buffer strip will be required as a minimum although a 66 foot wide buffer is preferred.
 - a. All perennial and intermittent streams delineated on the USGS 7.5 minute quadrangle are eligible for buffer establishment. Approval from the DNR District Coordinator will be required to establish eligibility for streams not delineated on a USGS map.
 - b. The measurable width of a buffer begins at the centerline of an intermittent stream, and the edge of bank of a perennial stream (ordinary high-water mark).

- c. Vegetated buffer widths may be extended to cover floodplain areas to meet nonpoint source program objectives. Approval from the DNR District Coordinator will be required for proposed buffer areas that exceed 66 feet in width.
2. At a minimum, buffers must be maintained in permanent hayland or an NRCS approved perennial grass mixture for a period of 10 years from the installation date of the final practice listed on the cost-share agreement.
 - a. Once a landowner with an established vegetated riparian buffer (*that is located within the boundaries of Brown County*) has fulfilled the operation and maintenance period requirements for this practice, the buffer will then be maintained in accordance with ordinance 22.24(3)(a)(1)(2).
3. The mowing and removal of grasses that were established through the nonpoint source program for the specific intent of providing a vegetated buffer will be allowed between July 15 and September 1 of each year to maintain grasses.
 - a. Permanent hayland established at the expense of the landowner may be harvested for forage prior to September 1 of each year during the growing season.
 - b. Soil disturbance within the established buffer area during reseeding shall be held to a minimum. When soil disturbance becomes necessary due to streambank or gully repair, the appropriate action(s) shall be taken to limit the disturbance and protect all exposed areas.
4. Wildlife and environmental consideration must be given when designing this practice.
5. A Cost-Share Agreement must be signed by the landowner.
6. Cost-share eligibility for the establishment of vegetated riparian buffers is dependent upon the cost effectiveness and the ability to produce a sheet flow (laminar) condition throughout the width of the buffer.
7. Before a landowner is to receive an annual payment, the sediment delivery rate of fields immediately adjacent to the proposed vegetated riparian buffer shall be planned down to the tolerable soil loss ("T").
8. Installation of the vegetated riparian buffer must be verified by county staff before the initial payment to the landowner is made.
9. Buffer strip boundaries shall be delineated in an identifiable manner. Acceptable methods would be fencing or sign placement every 100 feet, or other DNR approved methods.
10. As a minimum, a status review of established buffers shall be conducted by the county agent every 3 years. If a riparian buffer is rendered ineffective due to circumstances beyond the cost-share recipients control during the grant period, the local unit of governmental may amend the cost-share agreement to make the necessary repairs.

While conducting a status review of a riparian buffer, the county agent shall inspect for the following conditions:

- a. encroachment within the delineated boundary.
- b. the presence of rills or gullies.
- c. sparse vegetative cover and the presence of invasive species.
- d. buffer degradation due to cattle or machinery access.

11. Outstanding flat-rate payments for the vegetated riparian buffer practice will be taken into account during the easement appraisal process for those landowners interested in selling a NPS corridor easement.

E. Cost-sharing is authorized

1. At a rate of 70% for the grading and shaping of the buffer area to eliminate concentrated flow.
2. At a rate of 70% for permanent fencing or boundary delineation.
3. At a rate of 70% for the planting of trees or an NRCS approved perennial grass mixture.
4. At a flat rate of \$100.00/acre/year for a maximum of 5 years for buffers planted to an NRCS approved perennial grass mixture that does not contain Reed Canary grass.

F. Cost-sharing is not authorized for

1. Areas with pre-established vegetated buffers that meet the requirements listed under condition number 1.
2. The establishment of buffer areas for/or in conjunction with another program such as the Conservation Reserve program or Federal "set-aside" acreage.
3. The establishment of vegetated buffers in areas in which the landowner or operator will allow livestock access.
4. Sites where there is no direct benefit to protecting the surface water resource.

G. Sediment and Phosphorus Crediting Parameters

1. The establishment of vegetative riparian buffers that comply with the aforementioned conditions can be credited at a 46 percent sediment and phosphorus removal rate. Due to varying soils and site conditions, removal credits and conditions will only apply to the Branch River Watershed.
2. Cropland within 300 feet of a vegetated riparian buffer that has a slope greater than ten percent, is not eligible for a sediment and phosphorus reduction credit.

3. Sediment and phosphorus removal credits for vegetative buffer strips of 35 to 66 feet wide is limited to drainage areas of 1,750 feet or less, measured perpendicular to the buffer.

A. Name of practice
Manure Hauling and Brokering

B. Definition

The intent of this practice is to provide the local governmental unit with an additional management tool as well as providing the landowner with another viable alternative to constructing a manure storage facility.

Manure hauling is the transport of manure from a storage facility to agricultural lands for the purpose of meeting crop nutrient needs. Hauling includes the loading, transport, and unloading at the suitable site.

Manure broker is the agent or organization that provides any of the services needed to meet the requirements of manure hauling.

C. Purpose

Many areas of Wisconsin generate more manure than can be utilized without potentially impacting the surface and groundwater of the state. This interim best management practice will provide the relief and incentive to transport manure where it can be agronomically and environmentally applied to agricultural lands in a safe manner. It is the intent of this practice to promote the private sector adoption of manure hauling/brokering services.

D. Conditions

1. Manure hauling is an eligible component when a 590 nutrient management plan determines that a farm operation does not have adequate acreage to safely apply all livestock generated manure to cropland within a reasonable hauling distance (Reasonable hauling distance is defined as less than 3.0 miles. Cropland is defined as land owned or operated by the participant.)
2. Manure brokering is an eligible component when the watershed plan identifies the need to facilitate the long distance hauling of manures. Long distance hauling is defined as distances equal to or greater than 3 miles.
3. All manures must be tested to identify nutrient values.
4. All lands receiving manure as a result of this BMP must have a current nutrient management plan meeting NRCS Field Office Technical Guide Standard 590, including all owned and rented cropland.
5. Vehicles used to haul liquid manure a distance greater than three miles must be liquid tight.
6. Cost sharing may be provided for:
 - a. the nutrient management plan for the land receiving the product that is contiguous to land within the watershed.
 - b. soil and manure testing to determine nutrient content.

- c. hauling and brokering costs to include loading, transport, and unloading. The receiving land does not have to be contiguous for cost sharing the loading, transport, and unloading.
 - d. the rental of land within 3.0 miles of the farmstead that is generating excess manure provided that:
 - 1) the participant does not own, rent, operate, or have a vested interest in the land at the time the agreement was signed;
 - 2) the landowner is willing to enter into a rental agreement that identifies the use for manure application;
 - 3) the cost-share will be used for the needed spreadable acres only, as identified within the 590 - Nutrient Management Plan.
 - e. three times within the grant period, with a \$30,000.00 maximum incentive per watershed participant.
7. Cost sharing may not be provided for:
- a. farmsteads that have adequate lands available to apply manure meeting NRCS Standard 590;
 - b. the field application of the manure;
 - c. equipment needed to load, haul, or apply the manure;
 - d. the rental of land beyond 3 miles;
 - e. landowners who have received cost sharing for the installation of manure storage structures.
8. Cost sharing will be provided at a flat rate of:
- a. \$3.00 per ton for distances of 3-10 miles.
 - b. \$4.00 per ton for distances of 10-19 miles.
 - c. \$5.00 per ton for distances of greater than 20 miles. (Liquid manure shall be converted to tons using UWEX Publication - A3381, "Determining Manure Application Rates.")
 - d. 50% of the cost of the nutrient management plan, soil test, and manure/byproduct testing.
 - e. 50% of the total eligible costs for rental acres or a flat rate of \$25.00/acre.

9. The designated management agency (DMA) or the Land Conservation Department (LCD) will be responsible for verifying the volume of material moved for the purposes of payment. This can be accomplished by measuring (estimating) the material removed from the storage structure, volume or capacity of the tank used for hauling, or by requiring weight slips of material hauled.
10. The DMA or LCD will be responsible for the development of the contractual agreement used between the manure owner, hauler/broker, and the recipient. The contract/agreement will specify language to meet the intent of this practice and will be used to identify the amount of payment to be issued to the owner, hauler/broker, and recipient.
11. For evaluation purposes of the cost share agreement, this interim BMP will be considered to be applied when the manure has been properly managed on an annual basis.

- A. Name of Practice
Surface/Subsurface Outlet Relocation or Removal
- B. Definition
The relocation and/or removal of a surface or subsurface water conveyance system to protect the surface or groundwater at the site.
- C. Purpose
To relocate or remove drainage systems that convey agricultural pollutants directly to a surface waterbody and/or the groundwater. For example, many agricultural field drainage systems were developed using drainage wells for outlets. These drainage wells provide direct conduits to the groundwater for any of the pesticides, fertilizers, or other pollutants the tiled water may carry.
- D. Conditions
1. Cost-Sharing may be provided for:
 - a. The removal and/or relocation of the surface or subsurface outlet to a site that provides adequate buffering.
 - b. Eligible costs are grading, shaping, tile replacement, outlet pipe replacement, and other customary costs associated with the relocation or removal of a surface or subsurface outlet.
 2. Cost-Sharing may not be provided:
 - a. For sites where there is no direct benefit to protecting the surface or groundwater resource.
 - b. When lower cost alternatives can be implemented to achieve the water quality such as the addition of a field buffer.
 - c. Surface or subsurface drainage systems that will allow for the draining of additional acres that were not previously converted and/or drained.
 - d. The drainage of any wetlands identified by the DNR Wetland Inventory, NRCS Wetland Inventory, or other sources.
 - e. Increases in the size of drainage outlets to provide for the draining of additional acres.
 3. When relocation of a subsurface outlet requires crossing undrained sites, nonperforated tile will be used.
 4. The maximum state cost-share rate is 70% of the total eligible cost.
 5. Standards and specifications. NRCS field office technical guide standards and specifications as of January, 1995:
 - a. 620 - Underground Outlet;
 - b. 362 - Diversion;
 - c. 412 - Grassed Waterway;
 - d. 468 - Lined Waterway or Outlet;
 - e. 606 - Subsurface Drain.

APPENDIX C

NRCS NLEAP Report

Estimating Nitrate Leaching Using NLEAP for Branch River Priority Watershed Project

Introduction

More than 20% of the domestic wells in the Branch River Priority Watershed have tested above the 10 ppm nitrate nitrogen national health standard. The purpose of this study was to determine if nitrate leaching from corn production is a source of nitrate in groundwater.

NLEAP Model Scenarios & Mechanics

The NLEAP model (Shaffer et al., 1991) was used to determine annual potential nitrate leaching to groundwater when growing corn on seven soils in Manitowoc County under average climatic conditions (Tables 1-4). NLEAP utilizes a detailed precipitation, tillage, and fertility event-by-event approach to compute nitrate leached based on water and N budgets.

The model takes into account N sources, additions, losses, and transformations during the year. N sources include fertilizers, manures, crop residues, soil organic matter, and N in precipitation. N transformation and losses include nitrification, denitrification, ammonia volatilization, mineralization-immobilization of organic residues, runoff and erosion losses, crop uptake, and nitrate leached below the root zone. For these modeling scenarios, an aquifer depth of 6 foot was used because most soils in the watershed are 6 foot or less to fractured limestone bedrock. The NLEAP model is modeling the susceptibility of soils to leach nitrate to a depth of 6 feet under various management conditions.

NLEAP Limitations

The NLEAP model may underestimate nitrate leaching because it does not take into account water movement through soil macropores, such as cracks and worm holes. Drought conditions in June and July produced in many fields 1-2 inch wide soil cracks to a depth of 1-2 feet (T. Smith, personal communication).

The original NLEAP model default parameters also tended to underestimate nitrate production and leaching from manure, legumes, and other organic sources. NLEAP calculates nitrate production based on the amount of organic material present and its rate of decomposition. In calibrating the model, the model was modified to increase the organic matter decomposition rate by 100%. The calibration was based on local knowledge and discussions with USDA Agricultural Research Service NLEAP model developers concerning manure mineralization (M. Brodahl, ARS, personal communication). This situation shows the importance of modifying the model to local conditions. After calibrating the model, the scenarios were rerun.

Organic N sources showed increased levels of nitrate available to leach (NAL) and nitrate leached (NL) when compared to inorganic fertilizer N. UWEX N recommendations show that 50 ton/ac dairy

manure supplies inorganic nitrogen to corn equivalent to 160 lb N/ac of commercial fertilizer. On Manawa, Kewaunee, Hortonville, Hochheim, and Waymore soils, the revised model showed that 50 ton/ac of manure produced 70-85% of NAL compared to 160 lb N/ac as urea (Table 2). Under the same conditions with the original default values NLEAP showed that 50 ton/ac of manure produced only 40-50% of the NAL compared to 160 lb/ac of urea.

Definitions & Background Information Concerning Tables 1-4

Word definitions and other background information used to develop Tables 1-4 are as follows:

Soils: Seven Manitowoc County soils with their respective data bases were used in modelling. Manawa silt loam, Kewaunee loam, Hochheim loam, Hortonville silt loam, Waymore silt loam, Kolberg loam and Tedrow loamy fine sand are important agricultural soils in the watershed. Crop rooting depth in the soil was estimated to be 5', unless stated differently. Soil organic matter (OM) levels are also listed. The Kolberg soil was analyzed based on two different depths: 2.5' and 3.0'.

Yield: For Tables 1 & 2, average corn yields for Manitowoc Co. were used based on soil type. These values came from the NRCS soils data base. For Tables 3 & 4, a typical range of yields (100-140 bu/ac) for Manawa soil included a five year average yield of 120 bu/ac.

Climate: Two average annual climatic and average rainfall scenarios were used in the model to simulate a range of typical conditions. An "average year" from the Green Bay airport weather station (1) and the Marshfield Experimental Farm weather station (2) were selected. These weather stations were the closest to the watershed (30 and 90 miles, respectively). Specific daily rainfall and pan evapotranspiration events were used to calculate estimated nitrate leached.

Fertilizer, dairy manure and legume N sources applied to corn: starter (Tables 1-4): 8-32-16 @ 200 lb/ac at planting on 5/1 dairy manure (Tables 1 & 4): 0, 25, 50, & 75 t/ac applied 4/24 alfalfa N (Tables 1 & 3): 2.5 t/a of dry matter plowed down 4/25, 160 lb N/ac for 1st year corn alfalfa N (Tables 2 & 4): 0 lb N/ac for 2nd year corn preplant N (Table 2): urea @ 0, 50, 80, 110, 120, or 160 lb N/ac applied to 2nd year corn on 4/23 preplant N (Table 3): urea @ 0 and 60 lb N/ac applied to 1st year corn on 4/23 preplant N (Table 4): urea @ 0, 60, or 160 lb N/ac to 2nd year corn on 4/23 split application N (Table 2): 50% of the N was applied preplant as urea on 4/23 and 50% was applied side-dressed as anhydrous ammonia on 6/12. Such treatments are noted with "spl." for split application designation. Sidedress N (Table 2): anhydrous ammonia @ 110, 120, or 160 lb N/ac to 2nd year corn on 6/12. Nitrate Available to Leach (NAL) annually, Low: 0-80 lb NO₃-N/ac Mod.: 80-160 lb NO₃-N/ac High: > 160 lb NO₃-N/ac Nitrate N leached (NL) below root zone, Low: 0-40 lb NO₃-N/ac Mod.: 40-80 lb NO₃-N/ac High: > 80 lb NO₃-N/ac Potential Leaching Volume (PLV) in inches, Represents the volume of water leached below the root zone annually.

Projected Depth of Leaching Below the Root Zone in feet, For most soils, depth of root zone was estimated at 5 feet. For the shallow to bedrock Kolberg, rooting depth was estimated at 2.5 and 3 feet. Aquifer Risk Index (ARI), Indicates potential impacts of nitrate on aquifer water quality over 10 a year period for a crop. ARI values of 11 or higher suggest the underlying aquifer is more vulnerable to nitrate contamination and should be monitored (Shaffer et al., 1991). For data in Tables 1-4, ARI values have been grouped into the following categories: ARI = 0-10 GW slightly vulnerable ARI = 11-20 GW vulnerable ARI = >20 GW highly vulnerable

Results & Discussion

A typical crop rotation in the county usually includes two years of corn followed by 3-5 years of alfalfa. Table 1 shows NLEAP predicted nitrate leaching from first year corn while Table 2 shows nitrate leaching from second year corn. Farmers typically apply various rates of manure for first year corn after alfalfa. Previous field studies have shown that farmers can obtain optimum corn yields from alfalfa residue (legume N) without applied manure. In Table 1 four manure rates (0, 25, 50, & 75 t/ac) were applied to seven soils growing corn after alfalfa under 2 average climatic conditions. The results show that the fine textured Manawa soil is least likely to leach (ARI values = 5-7) even at high manure rates. Kewaunee, Hortonville and Waymore soils are somewhat more likely to leach (ARI values = 5-12), especially at high manure rates. Hochheim, with its gravelly subsoil (ARI = 8-19), the shallow Kolbergs (ARI = 11-29) and coarse textured Tedrow (ARI = 28-42) are much more likely to leach, even when no manure is applied. The shallower Koberg (depth: 2.5") is more susceptible to nitrate leaching than the deeper one (depth: 3.0").

The Tedrow and Koberg soils have less water holding capacity than the other soils. Consequently, both soils are drought prone and lower yielding except in wetter growing seasons. Lower yields mean less available nitrate is likely to be taken up by the crop and more is subject to leaching. Unfortunately, most farmers fertilize most of their fields the same, as if they were all high producers (Nowak et al., 1995). UWEX N recommendations for corn call for Tedrow and Kolberg soils to be fertilized at 2/3 the rate of the other soils. All soils allowed water to percolate through the rooting zone. The six finer textured soils showed projected leachate volumes (PLV) of 2-5 inches annually while the sand had PLVs of 7-9 inches annually.

NLEAP predicted values for second year corn are shown in Table 2. UWEX recommends 160 lb N/ac for optimum yields on Manawa, Kewaunee, Hortonville, Hochheim, and Waymore soils. The results show that 160 lb N/ac of preplant urea under one of the average climatic conditions (scenario 1) can produce significant N leaching on all 5 soils (ARI = 12-21). Hochheim loam with its coarse subsoil was the most susceptible. These results suggest that even under average climatic conditions increasing the current land use intensity by going to continuous row cropping (cash grain farming) will increase nitrate levels in groundwater. Under the most common current rotation of two years of corn followed by 3 to 5 years of alfalfa, nitrate levels in groundwater is less likely to increase. Alfalfa is able to scavenge nitrate released by organic material or previously applied manures or fertilizer.

For second year corn (Table 2), high rates of manure (50 & 75 t/ac) on Manawa, Kewaunee, Hortonville and Waymore soils did not significantly increase the risk of groundwater contamination (ARI = 5-8). Hochheim was slightly more susceptible with high manure rates (ARI = 7-11). A "slow release" fertilizer such as manure, if managed properly, may be less likely to leach compared to inorganic fertilizers. However, these results may be misleading as NLEAP may be underestimating nitrate production and leaching from manures. Limited monitoring data on sands near Stevens Point in 1989 showed that decomposition of alfalfa residues and manure applied to first year corn caused high nitrate levels in groundwater of 10-85 ppm NO₃-N/ac after a 2-3 inch rain (Byron Shaw, personal communication).

Kolberg and Tedrow soils are very susceptible to nitrate leaching, especially when fertilized with commercial fertilizers (ARI = 11-45). Applying UWEX recommendations of 110 to 120 lb N/a of urea on these soils may result in significant groundwater contamination (ARI = 13-36).

Sidedress applications of anhydrous ammonia fertilizer on these soils slightly reduced the risk of groundwater contamination compared to preplant or split application of fertilizer N. Sidedress N is less likely to leach because it was applied 7 weeks after the preplant treatment and much closer to heavy uptake of N by corn in July and August. However, other risks are associated with sidedress N. Wet conditions in June may prevent application. Incorporation of sidedress N loosens soil and increases the risk of erosion and surface water contamination if heavy runoff events should occur after application. Such conditions did occur in Wisconsin in 1993.

For all 7 soils, high rates of manure (50 & 75 t/a) showed higher risk of leaching (higher ARI values) for first year corn compared to second year corn. In the model, first year corn includes a legume N source while second year corn does not.

Manawa soils were further investigated to determine if other conditions may favor nitrate leaching (Tables 3 and 4). If yields decrease to 100 bu/a, the crop takes up less nitrate so more is subject to leaching (ARI values increase). Conversely, if yields increase to 140 bu/a, the crop takes up more nitrate so less nitrate is subject to leaching (ARI values decrease). Optimum yields reduces the risk of groundwater contamination while yield reductions increase that risk. This finding emphasizes the importance of fertilizing for realistic yield goals.

Some soil map units in the watershed contain small inclusions of other soils. Often these inclusions are shallower than the soil indicated on the map. Shallower soils are more prone to leaching. One farmer said a field of predominately Kewaunee soil dried out 4-7 days earlier than similar soils elsewhere on his farm. This suggests that the Kewaunee contains inclusions of shallower soils. Fractured bedrock below the soil is probably acting as natural tile draining the field. A careful investigation of another field near Valders revealed a previously undetected outcrop of limestone bedrock within a Kewaunee map unit.

Occasionally, Kolberg and Tedrow soils are found in fields containing more productive soils. If these fields are fertilized according to the recommendations of more productive soils, the Kolberg and Tedrow soils will be overfertilized and nitrate leaching is more likely. Table 2 shows ARI values of 15-43 after application of 160 lb N/ac of preplant urea for these soils.

It is important to get reliable soil organic matter data. A 1% increase in organic matter can increase nitrate-N levels 30 -60 lb N/ac (M. Brodahl, personal communication). If a modeler is planning to run scenarios based on actual field data, including soil organic matter levels, soil samples must be taken or adjusted to the proper depth to minimize errors. The model uses percent organic matter based on soil depth. Most soil test samples are taken at 6-8 inch depths.

Conclusions

NLEAP can be used to identify soils and management conditions that are potentially more susceptible to nitrate leaching and groundwater contamination. The NLEAP modeling shows that Tedrow and Kolberg soils are highly susceptible to leaching followed by Hochheim loam. Kewaunee, Hortonville, and Waymore are moderately subject to leaching while Manawa is least subject to leaching. However, under average climatic conditions, even the Manawa soil is susceptible to significant leaching, especially under high rates of manure for first year corn. Conditions that favor leaching include coarse soil, shallow soil, low yields, and over-fertilization, especially with commercial fertilizer.

Other Factors Causing High Nitrate in Groundwater

The watershed is a karst area with numerous fracture traces and some sinkholes. It has been reported that some fields with Manawa and other poorly drained soils have been tile drained with outlets directly into sinkholes. Tile water is often very high in nitrate. A sinkhole receiving tile water has essentially been converted into an injection well, allowing high nitrate water and other contaminants to contaminate an aquifer. A sinkhole receiving surface runoff or tile water should be plugged and the water diverted to a safe outlet. These waters should remain on the surface so naturally occurring denitrification can reduce nitrate levels. Little denitrification occurs in groundwater.

A number of limestone rock quarries and gravel pits exist in the watershed. Some farmers have been known to use such areas as feedlots or to store manure. These practices are also a major threat to groundwater, allowing contaminants direct access to aquifers.

GIS-NLEAP Tool

A GIS-NLEAP tool would be very useful in identifying fields susceptible to nitrate leaching. GIS layers could include a digitized soil layer, a digitized karst features layer, and NLEAP analysis based on current nutrient management and integrated crop management.

Literature Cited

- Nowak, P., R. Shepard and F. Madison. 1995. Farmers and Manure Management: A Critical Analysis (In press).
- Shaffer, M.J., A.D.Halvorson, F.J.Pierce. 1991. Nitrate Leaching and Economic analysis package (NLEAP): model description and application. In "Managing Nitrogen for Groundwater Quality & Farm Profitability". Follett et al., eds., SSSA. Madison, WI, pp. 285-322.

Table C-1 NLEAP Predicted Values for First Year Corn After Alfalfa Grown on 7 Soils Under Average Yields, 2 Average Climatic Conditions and 4 Rates of Manure in Manitowoc Co.

Soils	Grain Yield	Average Climate	Dairy Manure	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	inches	feet	
Manawa silt loam (OM: 3% in top 12")	120	1	0	78	4	3	0.8	5
	120	2	0	95	7	5	1.4	7
	120	1	25	96	4	3	0.8	5
	120	2	25	112	8	5	1.4	7
	120	1	50	125	4	3	0.8	5
	120	2	50	143	8	5	1.4	7
	120	1	75	155	4	3	0.8	5
	120	2	75	175	8	5	1.4	7
Kewaunee loam (OM: 2% in top 10")	120	1	0	72	3	2	0.5	6
	120	2	0	67	9	4	1.1	10
	120	1	25	116	3	2	0.5	6
	120	2	25	116	10	4	1.1	10
	120	1	50	160	3	2	0.5	6
	120	2	50	161	11	4	1.1	11
	120	1	75	201	3	2	0.5	12
	120	2	75	203	11	4	1.1	10

Soils	Grain Yield	Average Climate	Dairy Manure	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	inches	feet	
Hortonville silt loam (OM: 2% in top 9")	120	1	0	56	3	4	0.5	6
	120	2	0	57	10	2	1.1	10
	120	1	25	98	3	4	0.5	6
	120	2	25	104	10	2	1.1	11
	120	1	50	141	3	4	0.5	6
	120	2	50	152	11	2	1.1	12
	120	1	75	184	3	4	0.5	6
	120	2	75	200	12	2	1.1	13
	120	1	0	70	3	2	1	5
	120	2	0	73	8	4	1.9	9
Waymore silt loam (OM: 2% in top 12")	120	1	25	96	3	2	1	6
	120	2	25	101	9	4	1.9	10
	120	1	50	128	3	2	1	6
	120	2	50	135	9	4	1.9	10
	120	1	75	161	3	2	1	7
	120	2	75	169	9	4	1.9	11

Soils	Grain Yield	Average Climate	Dairy Manure	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	inches	feet	
Hochheim loam (OM: 3% in top 7")	120	1	0	72	6	3	0.9	8
	120	2	0	77	18	5	1.5	14
	120	1	25	125	7	3	0.9	9
	120	2	25	129	19	5	1.5	16
	120	1	50	166	7	3	0.9	9
	120	2	50	183	21	5	1.5	17
	120	1	75	214	8	3	0.9	10
	120	2	75	236	23	5	1.5	19
	80	1	0	78	47	7	5.7	29
	80	2	0	83	55	9	7.2	28
Tedrow loamy fine sand (OM: 2% in top 8")	80	1	25	94	53	7	5.7	33
	80	2	25	104	62	9	7.2	31
	80	1	50	113	60	7	5.7	37
	80	2	50	126	70	9	7.2	35
	80	1	75	131	67	7	5.7	42
	80	2	75	148	78	9	7.2	39

Table C-2 NLEAP Predicted Values for Second Year Corn After Alfalfa Grown on 7 Soils Under Average Yields, 2 Average Climatic Conditions, and Various Manure Rates & Nitrogen Fertilizer Values for Manitowoc Co.

Soils	Grain Yield	Average Climate	Dairy Manure	Nitrogen Fertilizer	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	# N/ac	inches	feet	
Manawa silt loam (OM: 3% in top 12")	120	1	0	160	138	4	3	0.8	6
	120	2	0	160	148	14	5	1.4	12
	120	1	0	160 spl.	143	4	3	0.8	6
	120	2	0	160 spl.	153	13	5	1.4	12
	120	1	0	160 sdrs.	141	3	3	0.8	5
	120	2	0	160 sdrs.	146	9	5	1.4	8
	120	1	25	80	107	4	3	0.8	6
	120	2	25	80	117	11	5	1.4	10
	120	1	50	0	100	3	3	0.8	5
	120	2	50	0	107	6	5	1.4	5
	120	1	75	0	129	3	3	0.8	5
	120	2	75	0	135	6	5	1.4	5
Kewaunee loam (OM: 2% in top 10")	120	1	0	160	128	4	2	0.5	7
	120	2	0	160	134	13	4	1.1	14
	120	1	0	160 spl.	145	3	2	0.5	7
	120	2	0	160 spl.	144	13	4	1.1	15
	120	1	0	160 sdrs.	151	3	2	0.5	5
	120	2	0	160 sdrs.	150	9	4	1.1	10

Soils	Grain Yield	Average Climate	Dairy Manure	Nitrogen Fertilizer	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	# N/ac	inches	feet	
Hortonville silt loam (OM: 2% in top 9")	120	1	25	80	125	3	2	0.5	6
	120	2	25	80	128	10	4	1.1	11
	120	1	50	0	109	3	2	0.5	5
	120	2	50	0	111	6	4	1.1	7
	120	1	75	0	153	3	2	0.5	5
	120	2	75	0	156	7	4	1.1	8
	120	1	0	160	126	4	2	0.5	7
	120	2	0	160	121	13	4	1.1	14
	120	1	0	160 spl.	139	4	2	0.5	7
	120	2	0	160 spl.	134	13	4	1.1	13
	120	1	0	160 sdrs.	145	3	2	0.5	5
	120	2	0	160 sdrs.	143	9	4	1.1	9
	120	1	25	80	115	4	2	0.5	7
	120	2	25	80	122	10	4	1.1	11
	120	1	50	0	95	3	2	0.5	5
	120	2	50	0	109	6	4	1.1	7
	120	1	75	0	138	3	2	0.5	5
	120	2	75	0	157	7	4	1.1	8

Soils	Grain Yield	Average Climate	Dairy Manure	Nitrogen Fertilizer	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	# N/ac	inches	feet	
Waymore silt loam (OM: 2% in top 12")	120	1	0	160	127	3	2	1.0	6
	120	2	0	160	125	12	4	1.9	13
	120	1	0	160 spl.	139	3	2	1.0	6
	120	2	0	160 spl.	140	12	4	1.9	13
	120	1	0	160 sdrs.	146	2	2	1.0	5
	120	2	0	160 sdrs.	146	9	4	1.9	10
	120	1	25	80	106	3	2	1.0	6
	120	2	25	80	112	9	4	1.9	10
	120	1	50	0	89	3	2	1.0	5
	120	2	50	0	94	6	4	1.9	6
	120	1	75	0	121	3	2	1.0	5
	120	2	75	0	128	6	4	1.9	7
Kolberg loam (depth: 3.0') (OM: 2.0% in top 10")	90	1	0	120	139	10	3	0.7	13
	90	2	0	120	141	23	4	1.1	23
	90	1	0	120 spl.	150	10	3	0.7	13
	90	2	0	120 spl.	150	22	4	1.1	23
	90	1	0	120 sdrs.	156	8	3	0.7	11
	90	2	0	120 sdrs.	158	19	4	1.1	19
	90	1	0	160	169	11	3	0.7	15

Soils	Grain Yield	Average Climate	Dairy Manure	Nitrogen Fertilizer	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	# N/ac	inches	feet	
	90	2	0	160	165	26	4	1.1	26
	90	1	25	50	138	10	3	0.7	13
	90	2	25	50	141	17	4	1.1	18
	90	1	25	80	160	10	3	0.7	14
	90	2	25	80	162	21	4	1.1	21
	90	1	50	0	143	8	3	0.7	11
	90	2	50	0	152	13	4	1.1	15
	90	1	75	0	188	9	3	0.7	12
	90	2	75	0	198	15	4	1.1	15
	90	1	0	120	139	16	3	0.7	16
	90	2	0	120	141	28	4	1.1	28
	90	1	0	120 spl.	150	13	3	0.7	13
	90	2	0	120 spl.	150	28	4	1.1	24
	90	1	0	120 sdrs.	156	11	3	0.7	13
	90	2	0	120 sdrs.	158	24	4	1.1	24
Kolberg loam (depth: 2.5') (OM: 2.0% in top 10")	90	1	0	160	169	14	3	0.7	17
	90	2	0	160	165	33	4	1.1	32
	90	1	25	50	138	12	3	0.7	15
	90	2	25	50	141	22	4	1.1	26

Soils	Grain Yield	Average Climate	Dairy Manure	Nitrogen Fertilizer	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	# N/ac	inches	feet	
	90	1	25	80	160	26	3	0.7	16
	90	2	25	80	162	13	4	1.1	22
	90	1	50	0	143	10	3	0.7	12
	90	2	50	0	152	16	4	1.1	16
	90	1	75	0	188	9	3	0.7	14
	90	2	75	0	198	11	4	1.1	18
	120	1	0	160	146	9	3	0.9	12
	120	2	0	160	146	26	5	1.5	21
	120	1	0	160 spl.	158	8	3	0.9	11
	120	2	0	160 spl.	159	24	5	1.5	19
Hochheim loam (OM: 3% in top 7")	120	1	0	160 sdrs.	160	5	3	0.9	7
	120	2	0	160 sdrs.	171	11	5	1.5	9
	120	1	25	80	136	8	3	0.9	10
	120	2	25	80	147	20	5	1.5	16
	120	1	50	0	117	6	3	0.9	7
	120	2	50	0	132	11	5	1.5	9
	120	1	75	0	164	6	3	0.9	8
	120	2	75	0	185	13	5	1.5	11

Soils	Grain Yield	Average Climate	Dairy Manure	Nitrogen Fertilizer	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	# N/ac	inches	feet	
Tedrow loamy fine sand (OM: 2% in top 8")	80	1	0	110	66	51	7	5.7	32
	80	2	0	110	92	72	9	7.2	36
	80	1	0	110 spl.	80	55	7	5.7	34
	80	2	0	110 spl.	92	77	9	7.2	38
	80	1	0	110 sdrs.	91	55	7	5.7	35
	80	2	0	110 sdrs.	100	67	9	7.2	34
	80	1	0	160	95	69	7	5.7	43
	80	2	0	160	106	90	9	7.2	45
	80	1	25	50	61	40	7	5.7	25
	80	2	25	50	81	58	9	7.2	29
	80	1	50	0	57	28	7	5.7	18
	80	2	50	0	73	36	9	7.2	18
	80	1	75	0	67	32	7	5.7	20
	80	2	75	0	86	42	9	7.2	21

Table C-3 NLEAP Predicted Values for First Year Corn After Alfalfa on Manawa Soil Under Various Yields, Average Climatic Conditions, Manure Rates, and Nitrogen Fertilizer Rates in Manitowoc Co.

Rotation	Grain Yield	Average Climate	Dairy Manure	Nitrogen Fertilizer	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	# N/ac	inches	feet	
1st yr corn	100	1	0	0	92	4	3	0.8	6
	100	2	0	0	117	8	5	1.4	7
	100	1	25	0	108	4	3	0.8	6
	100	2	25	0	131	8	5	1.4	7
	100	1	25	60	142	5	3	0.8	6
	100	2	25	60	166	13	5	1.4	11
	100	1	50	0	137	4	3	0.8	6
	100	2	50	0	163	9	5	1.4	7
	100	1	75	0	167	4	3	0.8	6
	100	2	75	0	194	9	5	1.4	8
	120	1	0	0	78	4	3	0.8	5
	120	2	0	0	95	7	5	1.4	7
	120	1	25	0	96	4	3	0.8	5
	120	2	25	0	112	7	5	1.4	7
	120	1	25	60	123	4	3	0.8	6
	120	2	25	60	145	12	5	1.4	10
	120	1	50	0	125	4	3	0.8	5

Rotation	Grain Yield	Average Climate	Dairy Manure	Nitrogen Fertilizer	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	# N/ac	inches	feet	
1st yr corn	120	2	50	0	143	7	5	1.4	7
	120	1	75	0	155	4	3	0.8	5
	120	2	75	0	175	8	5	1.4	7
	140	1	0	0	52	4	3	0.8	5
	140	2	0	0	64	7	5	1.3	6
	140	1	25	0	78	4	3	0.8	5
	140	2	25	0	92	7	5	1.3	6
	140	1	25	60	103	4	3	0.8	6
	140	2	25	60	124	11	5	1.3	10
	140	1	50	0	107	4	3	0.8	5
	140	2	50	0	123	7	5	1.3	6
	140	1	75	0	135	4	3	0.8	5
	140	2	75	0	155	8	5	1.3	7

Table C-4 NLEAP Predicted Values for Second Year Corn After Alfalfa on Manawa Soil Under Various Yields, Average Climatic Conditions, Manure Rates, and Nitrogen Fertilizer Rates in Manitowoc Co.

Rotation	Grain Yield	Average Climate	Dairy Manure	Nitrogen Fertilizer	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	# N/ac	inches	feet	
2nd yr corn	100	1	0	160	161	5	3	0.8	7
	100	2	0	160	174	14	5	1.4	12
	100	1	25	60	117	4	3	0.8	6
	100	2	25	60	127	10	5	1.4	9
	100	1	50	0	117	4	3	0.8	5
	100	2	50	0	123	6	5	1.4	6
	100	1	75	0	147	4	3	0.8	6
	100	2	75	0	155	7	5	1.4	6
	120	1	0	160	138	4	3	0.8	6
	120	2	0	160	148	14	5	1.4	12
	120	1	25	60	98	4	3	0.8	6
	120	2	25	60	106	10	5	1.4	8
	120	1	50	0	100	3	3	0.8	5
	120	2	50	0	107	6	5	1.4	5
	120	1	75	0	129	3	3	0.8	5
	120	2	75	0	135	6	5	1.4	5
	140	1	0	160	113	4	3	0.8	6

Rotation	Grain Yield	Average Climate	Dairy Manure	Nitrogen Fertilizer	Nitrate Available to Leach	Nitrate Leached	Projected Leachate Volume	Proj. Depth Leach Below Root Zone	Annual Risk Index in 10 Years
name	bushels/ac	scenario	ton/ac	# N/ac	# N/ac	# N/ac	inches	feet	
2nd yr corn	100	1	0	160	161	5	3	0.8	7
	100	2	0	160	174	14	5	1.4	12
	140	2	0	160	123	13	5	1.4	12
	140	1	25	60	77	4	3	0.8	6
	140	2	25	60	85	9	5	1.4	8
	140	1	50	0	94	3	3	0.8	4
	140	2	50	0	100	5	5	1.4	5
	140	1	75	0	113	3	3	0.8	5
	140	2	75	0	124	6	5	1.4	5

APPENDIX D

High Residue Management Pilot Project

The Nonpoint Source Pollution Abatement Program allows for the development of innovative pilot demonstrations to meet the individual and specific needs of a Priority Watershed Project. A pilot demonstration will begin during the planning phase of a watershed project and may continue for a period not to exceed three years in duration. The pilot project will be evaluated for its effectiveness before being considered for use in other watersheds. A procedure defining the process for approval and evaluation will be detailed within the Implementation Handbook.

A. Definition

High residue management systems refer to any planting system that is designed to reduce soil erosion caused by water or wind. These systems often are categorized as one of the following:

*No-till: The soil is left undisturbed prior to planting. Planting is completed in a narrow seedbed or slot created by the planter or drill.

*Mulch-till: The total soil surface is disturbed by tillage prior to planting. Tillage tools such as chisels, field cultivators, disks, or sweeps are used.

*Ridge-till: The soil is left undisturbed prior to planting. The seedbed is prepared on ridges with sweeps, disks, or other row cleaners. The ridges are rebuilt for the next years crop during cultivation.

*Strip-till: The soil is left undisturbed prior to planting. Tillage in the row is done at planting using tools such as a rototiller, in row chisel, or other row cleaner.

B. Purpose

Because cropland erosion has been identified as a key concern, additional measures need to be taken to achieve the water resource objectives for the Branch River Watershed Project. Currently, project staff have a limited number of options to assist landowners with upland erosion control. Contour farming, contour strip-cropping, and field strip-cropping are not viable alternatives in a watershed where the average field is 11 acres in size, and the local topography is not conducive to the installation of these practices.

The high residue management pilot will allow farm operators in the Branch River Watershed to become actively involved during the planning phase of the project, and give them the necessary exposure to conservation tillage by allowing them to see it work on their own land. In addition to addressing the landowners skepticism regarding the workability of conservation tillage on clay soils, this pilot project will give landowners the opportunity to see the benefits without the initial financial commitment that would otherwise be required.

The high residue management pilot will allow the Brown and Manitowoc County LCDs the ability to forge a partnership with the private sector, giving the Priority Watershed Project more credibility with the landowners. Combining the efforts of local, state, and federal government agencies with the private sector is an effective method of attaining the desired water quality goals and objectives within the Branch River Watershed.

C. Conditions

- 1) Eligible cropland will be located within or contiguous to the delineated Branch River Watershed boundary. Any field in the Branch River Watershed may be eligible. However, fields with poor drainage or fertility should be avoided.
- 2) Participation is limited to 40 sites within the watershed.
- 3) Participants will receive an incentive of \$25.00 per acre, and the associated costs for agronomy consultation. Enrollment will be limited to a maximum of 20 acres per participant.
- 4) The crop residue percentage will be increased to a target level higher than the current tillage/residue management system used. A minimum residue level of 30 percent will be accepted.
- 5) Most conservation tillage systems are eligible (using disks as primary tillage will not be eligible). Conservation tillage systems included are but not limited to:
 - * Mulch-till with chisel plows
 - * Chisel plow with sweeps
 - * Zone-till
 - * No-till
- 6) Eligible types of operations include chiseling corn ground to be planted to row crops, small grains, or hay; no-till or reduced tillage plantings of small grains into wheat or oat stubble.
- 7) A professional crop or agronomy consultant will be hired to assist in field selection, fertility management, weed control, machinery selection, and tillage and planting techniques. Agronomists will attempt to provide individual field yield goal data to farm operators and the Manitowoc and Brown County Land Conservation Departments.

- 8) Participants will use high residue tillage management systems on designated cropland for the 1996, 1997, and 1998 crop seasons; alternative crop fields can be utilized due to crop rotation constraints.
- 9) Copies of soil erosion control plans will be provided to crop or agronomy consultants by the Manitowoc County Soil and Water Conservation Department and the Brown County Land Conservation Department.
- 10) Landowner sign-up for the HRM Pilot will be primarily through private and co-op agronomists. Participation forms will be available through area agronomists or from Manitowoc and Brown County conservation staff. The Nonpoint Source Pollution Abatement Program allows for the development of innovative pilot demonstrations to meet the individual and specific needs of a Priority Watershed Project. A pilot demonstration will begin during the planning phase of a watershed project and may continue for a period not to exceed three years in duration. The pilot project will be evaluated for its effectiveness before being considered for use in other watersheds. A procedure defining the process for approval and evaluation will be detailed within the Implementation Handbook.

APPENDIX E

Geographic Information Systems Pilot Project

The Brown County Land Conservation Dept. would like to submit a number of proposals for a '95 LAG amendment. The proposals have been drafted separately for individual consideration. The focus of these proposals concentrates on a main theme, implementation of a county wide Geographical Information System (GIS).

The Brown County Surveyors office is diligently compiling a co. base map including graphical representation of the road and stream networks, political and hydraulic boundaries, lot lines and parcel information, etc. Combining the precise geographical representations with the necessary and relevant data concerning agricultural pollution and the prevention there of, produces a tool for record keeping, site analysis, watershed planning, and watershed evaluation. For instance, combining all inventory data, soils data, proximity to the stream (geographically calculated), and landowner information, we could analyze all priority watersheds in the county for critical sites based on a specific set of criteria in a fraction of the time it would take to manually gather and analyze the information.

With two-thirds of the county now falling within priority watershed boundaries, record keeping will increase exponentially. This creates the need to produce a single platform to track all financial, inventory and implementation data, pollution loading reduction data, etc. A single platform allows a trained technician or manager to access a wide variety of watershed and landowner information across watershed boundaries. This enhanced information accessing will dramatically cut hours of research time normally spent searching and compiling data from a variety of database programs for the proper answer.

A question that faces all watersheds is "how do we determine the net impact of the BMPs installed in a watershed?". Many separate computer models have been developed to try to answer this question, but none of the models incorporate all available data to create a single watershed model. Brown Co. plans to incorporate all available and relevant data into this GIS project to answer this question.

Brown County and Manitowoc County have recently agreed to initiate a Branch River GIS Pilot Project. Brown County's current effort will not replace that project, merely extend the GIS through out the county.

The experience and knowledge gained over the next few years from this county wide GIS project will hopefully be freely distributed through out the state. This will allow other county LCDs the ability to lessen the record keeping and analysis burdens more readily and without the development time. Brown Co. LCD would also favor giving demonstrations and presentations on the progress of the GIS project. If requested, a quarterly report,

meticulously detailing every step of the way, may be sent to DNR, Madison. With cooperation, support, and suggestions from any and all relevant agencies, this GIS project will be a success.

This is a list of all agencies willing to contribute information, expertise, and data:

- Brown Co. Data Processing Department
- Brown Co. Surveyors Department
- Brown Co. and Green Bay Planning
- Manitowoc Co. SWCD and Planning
- Oneida Tribe
- Bay Lakes Regional Planning
- Wisconsin Land Information Association
- Wisconsin Department of Natural Resources
- URISA (national GIS convention and organization)

Proposal for County Wide GIS Consulting

Concept:

Brown Co. Data Processing, Register of Deeds, Real Property Listing, and Surveyor Departments have acquired the services of Nancy Von Meyer, past president of Wisconsin Land Information Association (WLIA), to complete a county wide assessment for the implementation of the land records and imaging portion of the County's GIS system. To keep consistent with the county's efforts, the LCD proposes to follow the same channels to implement an agricultural pollution portion of the GIS. The LCDs portion of the consultation would include an evaluation of all reports and analysis tools necessary to achieve a comprehensive database and associated geographic line work. A database structure would be created to ensure proper consistency and best use of the available resources to produce a working GIS. Coordination with current DNR/DATCP/SCS modeling and database tools will be a top priority to avoid any duplicate entry.

Justification:

This portion (consultation) of the LCDs contribution to the county wide GIS is critical in the smooth transition to automated record keep-ing and analysis in priority watersheds. With the combined knowledge and years of practical experience of the WLIA, a user friendly, all encompassing GIS database will be achieved in a much shorter time frame without integration shortfalls. This will save thousands of LCD staff hours that would be spent developing and redeveloping this almost infinitely complex modeling tool. The benefits of this consultation and research may be reaped by all LCDs interested in the ultimate watershed modeling tool.

Proposal for Data Processing Professional Services

Concept:

The Brown County LCD utilizes the professional services of the Data Processing Department (DP) for support of all computer related issues. This includes the acquisition, setup, and maintenance of all hardware and the acquisition and support (in house or contracted) of all software.

Justification:

The services rendered by DP are essential to a "well oiled" network of computer stations. The LCD will be networking all AutoCAD and GIS stations to a main file server. This possesses many advantages. First, any software package, including individual data files, loaded on the file server may be accessed from any computer, eliminating the bottlenecks that occur when five technicians need to access the same computer at the same time. Secondly, the cost of software is dramatically reduced. Since the file server holds all of the necessary software for all computer stations, it is not necessary to purchase the software for every computer. The number of software licenses required equals the number of people using the software at a given time. Example: Eight machines are networked with various software packages on the file server, four software licenses are purchased for each software package. All machines are capable of running each software package, but only four machines may run a single package at one time. Not all technicians on the network will need to run a single software package at the same time. This saves thousands of dollars when you look at the price of software. AutoCAD costs \$3500; Softdesk costs \$4500; ArcCAD costs \$4000; the total costs increase dramatically. The final advantage is realized in sharing equipment. All computer stations utilize the same printer, plotter, modem, etc. This saves thousands of dollars in equipment purchases.

Estimated Cost Breakdown:

(Labor Charges Based on \$42.26 per Hour)

Labor Charges for Proposed Outlay Installation, Setup, and Support	\$4,122
Labor Charges for Network Integration	\$4,660
Labor Charges for Database Maintenance and General Systems Support	\$7,456
Cost of Support for Labor Hours	<u>\$2,402</u>
Total:	\$18,640

Proposal for Outlay and Software

Concept and Justification:

Brown County LCD has been acquiring computer hardware and software for the automated design of civil engineering practices. The LCD plans to add two GIS stations with the AutoCAD and ArcCAD software packages and two AutoCAD stations for the implementation of the proposed GIS project. A laptop computer with graphic viewing capability will bring the computer generated designs, maps, and reports where they are needed most, the landowners doorstep. Network integration hardware and software are essential if the LCD is to realize the cost and time associated benefits of networking. A CD-ROM Carousel and photo CD software will enable the technicians to efficiently view the Digital Ortho Quads (DOQs) ordered from USGS from any computer station on the network. With the magnification and easy access of the DOQ it will greatly reduce time spent accessing printed areal photos.

Estimated Costs: (Prices may be found on accompanying Data Processing Chargebacks For 1995 Sheet)

37.5% Funding of Outlay and Software \$20,464

Equipment Description and Usability Breakdown:

GIS Station w/ ArcCAD-

High end computer stations capable of producing high resolution graphics and producing, maintaining, and querying complex databases.
Use: GIS implementation.

AutoCAD Stations and AutoCAD/Sofdesk Software-

Computer stations capable of producing high resolution graphics for the design of civil engineering plans. Use: watershed practice design.

Laptop PC w/ Photo Software-

Battery powered computer station capable of producing high resolution graphics. Use: watershed planning and other related "on farm" visits

CD-ROM Carrosel-

A data transfer device capable of containing large quantities of data.
Use: enhanced access to the digital ortho quads supplied by USGS for 70% of Brown County. (Local Assistance Grant Amendment for Branch River Priority Watershed).

APPENDIX F

PURPOSE AND LEGAL STATUS

Wisconsin Nonpoint Source Water Pollution Abatement Program

The State Legislature created the Wisconsin Nonpoint Source Water Pollution Abatement Program in 1978. The goal of the Program is to improve and protect the water quality of streams, lakes, wetlands, and groundwater by reducing pollutants from urban and rural nonpoint sources. The 107 square-mile Branch River Watershed, located in Manitowoc and Brown Counties, was designated a "priority watershed" in 1993. The primary objective of this project is to reduce nonpoint source pollution loads and to enhance and protect the water quality of the streams, groundwater, and lakes in the Branch River Watershed. The Branch River is part of the Manitowoc River Basin.

Nonpoint sources of pollution include: eroding agricultural lands, eroding streambanks and roadside, runoff from livestock wastes, agricultural practices, erosion from developing areas, and runoff from established urban areas. Pollutants from nonpoint sources are carried to the surface water or groundwater through rainfall runoff or seepage, and snowmelt.

The following is an overview of the Nonpoint Source (NPS) Priority Watershed program:

- The DNR administer the program in cooperation with DATCP. Wisconsin is divided into 330 discrete hydrologic units called watersheds. These watersheds are assessed for water quality concerns as part of a comprehensive basin planning program. Watersheds with a high degree of water quality impairment from nonpoint sources of pollution become eligible for consideration as a priority watershed project. Designation as a priority watershed project enables special financial support to local governemts and private landowners in the watershed to reduce nonpoint source pollution.
- A priority watershed project is guided by a plan prepared cooperatively by the DNR, DATCP and local units of government, with input from a local citizen's advisory committee. Project staff evaluate the conditions of surface water and groundwater, and inventory the types of land use and nonpoint sources of pollution throughout the watershed. The priority watershed plan assesses nonpoint and other sources of water pollution and identifies best management practices (BMPs) needed to control pollutants to meet specific water resource objectives. The plan guides implementation of these practices in an effort to improve water quality.

- Upon approval by state and local authorities, local units of government implement the plan. Water quality improvement is achieved through mandatory and voluntary implementation of nonpoint source controls (BMPs) and the adoption of ordinances. Landowners, land renters, counties, cities, villages, towns, sanitary districts, lake districts, and regional planning commissions are eligible to participate.
- Technical assistance is provided to aid in the design of BMPs. State level cost-share assistance is available to help offset the cost of installing these practices. Eligible landowners and local units of government are contacted by the local staff to determine their interest in installing the BMPs identified in the plan. Signed cost-share agreements list the practices, costs, cost-share amounts and a schedule to install management practices. Municipal governments are also assisted in developing and installing BMPs to reduce urban pollutants.
- Informational and educational activities are developed to encourage participation.
- The DNR and DATCP review the progress of the counties and other implementing units of government, and provide assistance throughout the ten-year project. The DNR monitors improvements in water quality resulting from control of nonpoint sources in the watershed.

Legal Status of the Nonpoint Source Control Plan

The Branch River Priority Watershed Plan was prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program described in Section 144.25 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code. It was prepared through the cooperative efforts of the DNR, DATCP, and the Manitowoc and Brown County Land Conservation Departments.

This watershed plan is the basis for the DNR to enter into cost-share and local assistance grants with agencies responsible for project implementation and will be used as a guide to implement measures to achieve desired water quality conditions. If a discrepancy occurs between this plan and the statutes or the administrative rules, or if statutes or rules change during implementation, the statutes and rules will supersede the plan. This watershed plan does not in any way preclude the use by local, state or federal governments of normal regulatory procedures developed to protect the environment. All local, state and federal permit procedures must be followed. In addition, this plan does not preclude the DNR from using its authority under chapters 147 and 144 of the state statutes to regulate significant nonpoint pollution sources in the project area.

This priority watershed plan was approved by DNR following approvals by the Land and Water conservation Board, and the Manitowoc and Brown County Board of Supervisors.

Amendments to the Plan

This plan is subject to the amendment process under NR120.08(4) for substantive changes. The Department of Natural Resources will make the determination with the local sponsors if a proposed change will require a formal plan amendment.

Relationship of the Nonpoint Source Control Plan to the Stormwater Discharge Permit Program

Wisconsin's Pollution Discharge Elimination System (WPDES) Storm Water Permit Program is administered by DNR's Bureau of Wastewater Management under Chapter 147 of the Wisconsin Statutes. This program is separate from the Nonpoint Source program and applies to certain classes of dischargers statewide as identified in NR 216. In cases where the programs do overlap, implementation grants may only apply to activities identified in the watershed plan. Practices to control construction site erosion and storm water runoff from new development are not eligible for cost sharing. In industrial areas, cost sharing is available as specified in NR 120.10 (1)(g) — only in the non-industrial parts of facilities where a problem has also been identified in the priority watershed plan.

Priority Watershed Project Planning and Implementation Phases

Planning Phase

The planning phase of the Branch River Watershed project began in 1994. The following information gathering and evaluation activities were completed during this stage::

- Determine the conditions and uses of groundwater, streams, and lakes.
- Inventory types of land uses and severity of nonpoint sources affecting groundwater, streams and lakes.
- Evaluate the types and severity of other factors which may be affecting water quality. Examples include discharges from municipal wastewater treatment plants and natural or endemic stream conditions. (This has been completed through the ongoing integrated resource management planning efforts in the Manitowoc River Basin.
- Determine nonpoint source controls and other measures necessary to improve and/or protect water quality.
- Prepare and gain approval of a program for local implementation of the project so that plan recommendations would be carried out.

Implementation Phase

The implementation phase of the Branch River Priority Watershed Project began following review of the draft priority watershed plan, a public hearing, and approval by the DNR, LWCB, and the Board of Supervisors for Manitowoc and Brown Counties. Public review during plan development occurred primarily through the efforts of the Branch River Citizen Advisory Committee.

During the implementation phase:

- DNR enters into local assistance agreements with local units of government that have implementation responsibilities identified in the plan. These agreements provide funds necessary to maintain the resources and staff required for plan implementation.
- In the rural portions of the watershed, the Manitowoc and Brown County LCDs contact eligible landowners to determine their interest in installing best management practices identified in the plan.

In the urban portions of the watershed, the DNR or its designee contacts local units of government to discuss in detail the required actions for implementing the plan recommendations.

- In rural areas, the landowner signs a cost-share agreement with the county that outlines the practices, costs, cost-share amounts and a schedule for installation of management practices. Practices are scheduled for installation after an agreement is signed. Practices must be maintained for at least 10 years. Easements must be for a period of at least 20 years, and will be perpetual.

In urban areas, similar processes are used. In some cases, the local units of government and the DNR sign agreements for urban practices. In other cases the agreements will be between local units of government and their private landowners.

APPENDIX G

LIST OF ACRONYMS

ACP	Agricultural Conservation Program
ASCS	Agricultural Stabilization and Conservation Service
BARNY	Barnyard nutrient analysis model
BIM-GEO	DNR Bureau of Information Management-Geographical Unit
BMP	Best Management Practice
BOD	Biological Oxygen Demand
CAC	Citizen Advisory Committee
CFSA	Consolidated Farm Services Agency (NRCS, ASCS)
COD	Chemical Oxygen Demand
CRP	Cropland Reserve Program (USDA)
CSA	Cost share agreement
DATCP	Wisconsin Department of Agriculture, Trade, and Consumer Protection
DILHR	Department of Industry, Labor, and Human Relations
DNR	Wisconsin Department of Natural Resources
ECP	Erosion Control Program
EPA	United States Environmental Protection Agency
FFA	Future Farmers of America
FPP	Farmland Preservation Program
FOCS	Field Offices Computing System
FPP	Wisconsin Farmland Protection Program
FSA	Food Security Act
GIS	Geographic Information System
GW	Groundwater
HEL	Highly Erodible Land
I&E	Information and Education
LCC	Land Conservation Committee
LCD	Land Conservation Department
LUST	Leaking Underground Storage Tanks
LWCB	Land and Water Conservation Board
NPM	Nutrient and Pest Management
NRCS	Natural Resource Conservation Service
SHS	Wisconsin State Historical Society
SIP	Stewardship Incentive Program
SOS	Signs of Success monitoring program
SWCD	Soil and Water Conservation Department
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UWEX	University of Wisconsin-Extension
WGNHS	Wisconsin Geological and Natural History Survey
WIN-HUSLE	sediment transfer model based on the Universal Soil Loss Equation
WPDES	Wisconsin Pollutant Discharge Elimination System [permit system]
WUWN	Wisconsin Unique Well Number assigned to well sample sites

APPENDIX H

GLOSSARY

ACUTE TOXICITY: Any poisonous effect produced by a single short-term exposure to a chemical that results in a rapid onset of severe symptoms.

ADVANCED WASTEWATER TREATMENT: The highest level of wastewater treatment for municipal treatment systems. It requires removal of all but 10 parts per million of suspended solids and biological oxygen and/or 50 percent of the total nitrogen. Advanced wastewater treatment is also known as "tertiary treatment."

AGRICULTURAL CONSERVATION PROGRAM (ACP): A federal cost-sharing program to help landowners install measures to conserve soil and water resources. ACP is administered by the USDA ASCS through county ACP committees.

ALGAE: A group of microscopic, photosynthetic water plants. Algae give off oxygen during the day as a product of photosynthesis and consume oxygen during the night as a result of respiration. Therefore, algae effect the oxygen content of water. Nutrient-enriched water increases algae growth.

AMMONIA: A form of nitrogen (NH_3) found in human and manures. Ammonia can be toxic to aquatic life.

ANAEROBIC: Without oxygen.

ANOXIC: Absence of oxygen.

AREAWIDE WATER QUALITY MANAGEMENT PLANS (208 PLANS): A plan to document water quality conditions in a drainage basin and make recommendations to protect and improve basin water quality. Each basin in Wisconsin must have a plan prepared for it, according to section 208 of the Clean Water Act.

AVAILABILITY: The degree to which toxic substances or other pollutants are present in sediments or elsewhere in the ecosystem and are available to affect or be taken up by organisms. Some pollutants may be "bound up" or unavailable because they are attached to clay particles or are buried by sediment. Oxygen content, pH, temperature and other conditions in the water can affect availability.

BACTERIA: Single-cell, microscopic organisms. Some can cause disease, but others are important in organic waste stabilization.

BARNY: The Wisconsin Barnyard runoff model, a computer model used to assess the water quality impacts of barnyards or feedlots. It was developed by DNR with assistance from NRCS and DATCP.

BASIN PLAN: See "Areawide Water Quality Management Plan".

BENTHIC ORGANISMS (BENTHOS): Organisms living in or on the bottom of a lake or stream.

BEST MANAGEMENT PRACTICE (BMP): The most effective, practical measures to control nonpoint sources of pollutants that runoff from land surfaces.

BIOACCUMULATION: The uptake and retention of substances by an organism from its surrounding medium and food. As chemicals move through the food chain, they tend to increase in concentration in organisms at the upper end of the food chain such as predator fish, or in people or birds that eat these fish.

BIOASSAY STUDY: A test for pollutant toxicity. Tanks of fish or other organisms are exposed to varying doses of treatment plant effluent. Lethal doses of pollutants in the effluent are then determined.

BIOCHEMICAL OXYGEN DEMAND (BOD): A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. BOD₅ is the biochemical oxygen demand measured in a five day test. The greater the degree of pollution, the higher the BOD₅.

BIODEGRADABLE: Waste that can be broken down by bacteria into basic elements. Most organic wastes such as food remains and paper are biodegradable.

BIOTA: All living organisms that exist in an area.

BUFFER STRIPS: Strips of grass or other erosion-resisting vegetation between disturbed areas and a stream or lake.

CARCINOGENIC: A chemical capable of causing cancer.

CATEGORICAL LIMITS: All point source discharges are required to provide a basic level of treatment. For municipal wastewater treatment plants this is secondary treatment (30 mg/l effluent limits for SS and BOD). For industry the level depends on the type of industry and the level of production. More stringent effluent limits are required, if necessary, to meet water quality standards.

CHLORINATION: The application of chlorine to wastewater to disinfect it and kill bacteria and other organisms.

CHLORORGANIC COMPOUNDS (CHLORORGANICS): A class of chemicals that contain chlorine, carbon and hydrocarbon. This generally refers to pesticides and herbicides that can be toxic. Examples include PCB's and pesticides such as DDT and dieldrin.

CLEAN WATER ACT: See "Public Law 92-500."

COMBINED SEWERS: A wastewater collection system that carries both sanitary sewage and stormwater runoff. During dry weather, combined sewers carry only wastewater to the treatment plant. During heavy rainfall, the sewer becomes swollen with stormwater. Because the treatment plant cannot process the excess flow, untreated sewage is discharged to the plant's receiving waters, i.e., combined sewer outflow.

CONFINED DISPOSAL FACILITY (CDF): A structure built to contain and dispose of dredged material.

CONSERVATION TILLAGE: Planting row crops while only slightly disturbing the soil. In this way a protective layer of plant residue stays on the surface. Erosion rates decrease.

CONSUMPTION ADVISORY: A health warning issued by DNR and WDHSS that recommends people limit the fish they eat from some rivers and lakes based on the levels of toxic contaminants found in the fish.

CONTAMINANT: Some material that has been added to water that is not normally present. This is different from a pollutant, which suggests there is too much of the material present.

CONVENTIONAL POLLUTANT: Refers to suspended solids, fecal coliforms, biochemical oxygen demand, and pH, as opposed to toxic pollutants

COST-EFFECTIVE: A level of treatment or management with the greatest incremental benefit for the money spent.

CRITERIA: See water quality standard criteria.

DIEL: Referring to a 24-hour period, usually involving a day and a night.

DIOXIN (2,3,7,8-tetrachlorodibenso-p-dioxin): A chlorinated organic chemical which is highly toxic.

DISINFECTION: A chemical or physical process that kills organism that cause disease. Chlorine is often used to disinfect wastewater.

DISSOLVED OXYGEN (DO): Oxygen dissolved in water. Low levels of dissolved oxygen cause bad smelling water and threaten fish survival. Low levels of dissolved oxygen often result from inadequate wastewater treatment. The DNR considers 5 ppm DO necessary for fish and aquatic life.

DISTRICTS: DNR field offices. There are six DNR administrative districts in the state (see inside back cover for map).

DREDGING: Removal of sediment from the bottom of water bodies.

ECOSYSTEM: The interacting system of biological community and its nonliving surrounding.

EFFLUENT: Solid, liquid or gas wastes (byproducts) that are disposed on land, in water or in air. As used in the RAP, effluent generally means wastewater discharges.

EFFLUENT LIMITS: The DNR issues WPDES permits establishing the maximum amount of pollutant to be discharged to a receiving stream. Limits depend on the pollutant and the water quality standards that apply for the receiving waters.

EMISSION: A direct (smokestack particles) or indirect (busy shopping center parking lot) release of any contaminant into the air.

ENVIRONMENTAL PROTECTION AGENCY (USEPA): The federal agency responsible for enforcing federal environmental regulations. The Environmental Protection Agency delegates some of its responsibilities for water, air and solid waste pollution control to state agencies.

ENVIRONMENTAL REPAIR FUND: A fund established by the Wisconsin Legislature to deal with abandoned landfills.

EROSION: The wearing away of the land surface by wind or water.

EUTROPHIC: Refers to a nutrient-rich lake. Large amounts of algae and weeds characterize a eutrophic lake (see also "Oligotrophic" and "Mesotrophic").

EUTROPHICATION: The process of nutrient enrichment of a lake leading to increased production of aquatic organisms. Eutrophication can be accelerated by human activity such as agriculture and improper waste disposal.

FECAL COLIFORM: A group of bacteria used to indicate the presence of other bacteria that cause disease. The number of coliform is particularly important when water is used for drinking and swimming.

FILAMENTOUS ALGAE: Algae that forms filaments or mats attached to sediment, weeds, rocks, ect.

FISHABLE AND SWIMMABLE: Refers to the water quality goal set for the nation's surface waters by Congress in the Clean Water Act. All waters were to meet this goal by 1984.

FOOD CHAIN: A sequence of organisms where each uses the next as a food source.

GREEN STRIPS: See buffer strip.

GROUNDWATER: Undergroundwater-bearing areas generally within the boundaries of a watershed, which fill internal passageways of porous geologic formations (aquifers) with water that flows in response to gravity and pressure. Often used as the source of water for communities and industries.

HABITAT: The place or type of site where a plant or animal naturally lives and grows.

HEAVY METALS: Metals present in municipal and industrial wastes that pose long-term environmental hazards if not properly disposed. Heavy metals can contaminate ground and surface waters, fish and other food stuffs. The metals of most concern are: arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium and zinc (see also separate listings of these metals for their health effects).

HERBICIDE: A type of pesticide that is specifically designed to kill plants and can also be toxic to other organisms.

INFLUENT: Influent for an industry would be the river water that the plant intakes for use in its processing. Influent to a municipal treatment plant is untreated wastewater.

IN-PLACE POLLUTION: As used in the RAP, refers to pollution from contaminated sediments. These sediments are polluted from past discharges from municipal and industrial sources.

ISOPHTHALBIPHENYL: A chemical compound used as a substitute for PCB.

LANDFILL: A conventional sanitary landfill is "a land disposal site employing an engineered method of disposing of solid wastes on land in a manner that minimizes environmental hazards by spreading solid wastes in thin layers, materials at the end of each operating day". Hazardous wastes frequently require various types of pretreatment before they are disposed of, i.e., neutralization chemical fixation encapsulation. Neutralizing and disposing of wastes should be considered a last resort. Repurifying and reusing waste materials or recycling them for another use may be less costly.

LEACHATE: The contaminated liquid which seeps from a pile or cell of solid materials and which contains water, dissolved and decomposing solids. Leachate may enter the groundwater and contaminate drinking water supplies.

LOAD: The total amount of materials or pollutants reaching a given local.

MACROPHYTE: A rooted aquatic plant.

MASS: The amount of material a substance contains causing it to have weight in a gravitational field.

MASS BALANCE: A study that examines all parts of the ecosystem to determine the amount of toxic or other pollutant present, its sources, and the processes by which the chemical moves through the ecosystem.

MESOTROPHIC: Refers to a moderately fertile nutrient level of a lake between the oligotrophic and eutrophic levels. (See also "Eutrophic" and "Oligotrophic.")

MILLIGRAMS PER LITER (mg/l): A measure of the concentration of substance in water. For most pollution measurement this is the equivalent of "parts per million".

MITIGATION: The effort to lessen the damages caused, by modifying a project, providing alternatives, compensating for losses or replacing lost values.

MIXING ZONE: The portion of a stream or lake where effluent is allowed to mix with the receiving water. The size of the area depends on the volume and flow of the discharge and receiving water. For streams the mixing zone it is one-third of the lowest flow that occurs once every 10 years for a seven day period.

NONPOINT SOURCE POLLUTION (NSP): Pollution whose sources cannot be traced to a single point such as a municipal or industrial wastewater treatment plant discharge pipe. Nonpoint sources include eroding farmland and construction sites, urban streets, and barnyards. Pollutants from these sources reach water bodies in runoff, which can best be controlled by proper land management.

OLIGOTROPHIC: Refers to an unproductive and nutrient-poor lake. Such lakes typically have very clear water. (See also "Eutrophic" and "Mesotrophic.")

PATHOGEN: Any infective agent capable of producing disease. It may be a virus, bacterium, protozoan, etc.

PERIPHYTON: Microscopic plants growing on the rocks and other substrate.

PESTICIDE: Any chemical agent used to control specific organisms, such as insecticides, herbicides, fungicides, etc.

PH: A measure of acidity or alkalinity, measured on a scale of 0 to 14 with 7 being neutral and 0 being most acid, and 14 being most alkaline.

PHENOLS: Organic compounds that are byproducts of petroleum refining, textile, dye, and resin manufacture. High concentrations can cause taste and odor problems in fish. Higher concentration can be toxic to fish and aquatic life.

PHOSPHORUS: A nutrient that, when reaching lakes in excess amounts, can lead to overfertilized conditions and algae blooms.

PLANKTON: Tiny plants and animals that live in water.

POINT SOURCES: Sources of pollution that have discrete discharges, usually from a pipe or outfall.

POLLUTION: The presence of materials or energy whose nature, location, or quantity produces undesired environmental effects.

POLYCHLORINATED BIPHENYLS(PCBs): A group of 209 compounds, PCBs have been manufactured since 1929 for such common uses as electrical insulation and heating/cooling equipment, because they resist wear and chemical breakdown. Although banned in 1979 because of their toxicity, they have been detected on air, land and water. Recent surveys found PCBs in every section of the country, even those remote from PCB manufacturers.

POLYCHLORINATED ORGANIC COMPOUNDS: A group of toxic chemicals which contain several chlorine atoms.

PRETREATMENT: A partial wastewater treatment required from some industries. Pretreatment removes some types of industrial pollutants before the wastewater is discharged to a municipal wastewater treatment plant.

PRIORITY POLLUTANT: A list of toxic chemicals identified by the federal government because of their potential impact in the environment and human health. Major dischargers are required to monitor all or some of these chemicals when their WPDES permits are reissued.

PRIORITY WATERSHED: A drainage area about 100,000 acres in size selected to receive Wisconsin Fund money to help pay the cost of controlling nonpoint source pollution. Because money is limited, only watersheds where problems are critical, control is practical, and cooperation is likely are selected for funding.

PRODUCTIVITY: A measure of the amount of living matter which is supported by an environment over a specific period of time. Often described in terms of algae production for a lake.

PUBLIC LAW 92-500 (CLEAN WATER ACT): The federal law that sets national policy for improving and protecting the quality of the nation's waters. The law set a timetable for the cleanup of the nation's waters and stated that they are to be fishable and swimmable. This also required all dischargers of pollutants to obtain a permit and meet the conditions of the permit. To accomplish this pollution cleanup, billions of dollars have been made available to help communities pay the cost of building sewage treatment facilities. Amendments in the Clean Water Act were made in 1977 by passage of Public Law 95-217, and in 1987.

PUBLIC PARTICIPATION: The active involvement of interested and affected citizens in governmental decision-making.

PUBLICLY OWNED TREATMENT WORKS (POTW): A wastewater treatment plant owned by a city, village or other unit of government.

RECYCLING: The process that transforms waste materials into new products.

REMEDIAL ACTION PLAN: A plan designed to restore beneficial uses to a Great Lakes Area of Concern.

REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS): An investigation of problems and assessment of management options conducted as part of a superfund project.

RETRO-FIT: The placement of an urban structural practice in an existing urban area, which may involve rerouting existing storm sewers and/or relocating existing buildings or other structures.

RIPARIAN: Belonging or relating to the bank of a lake, river or stream.

RIPRAP: Broken rock, cobbles, or boulders placed on the bank of a stream to protect it against erosion.

RULE: Refers to Wisconsin administrative rules. See Wisconsin Administrative Code.

RUNOFF: Water from rain, snowmelt, or irrigation that flows over the ground surface and returns to streams. Runoff can collect pollutants from air or land and carry them to receiving waters.

SECONDARY IMPACTS: The indirect effects that an action can have on the health of the ecosystem or the economy.

SECONDARY TREATMENT: Two-stage wastewater treatment that allows the coarse particles to settle out, as in primary treatment, followed by biological breakdowns of the remaining impurities. Secondary treatment commonly removes 90% of the impurities. Sometimes "secondary treatment" refers simply to the biological part of the treatment process.

SEDIMENT: Soil particles suspended in and carried by water as a result of erosion.

SEPTIC SYSTEM: Sewage treatment and disposal for homes not connected to sewer lines. Usually the system includes a tank and drain field. Solids settle to the bottom of the tank. Liquid percolates through the drain field.

SLUDGE: A byproduct of wastewater treatment; waste solids suspended in water.

SOLID WASTE: Unwanted or discharged material with insufficient liquid to be free flowing.

STANDARDS: See water quality standards.

STORM SEWERS: A system of sewers that collect and transport rain and snow runoff. In areas that have separated sewers, such stormwater is not mixed with sanitary sewage.

SUPERFUND: A federal program that provides for cleanup of major hazardous landfills and land disposal areas.

SUSPENDED SOLIDS (SS): Small particles of solid pollutants suspended in water.

TERTIARY TREATMENT: See advanced wastewater treatment.

TOP-DOWN MANAGEMENT: A management theory that uses biomanipulation, specifically the stocking of predator species of fish to improve water quality.

TOTAL MAXIMUM DAILY LOADS: The maximum amount of a pollutant that can be discharged into a stream without causing a violation of water quality standards.

TOXIC: An adjective that describes a substance which is poisonous, or can kill or injure a person or plants and animals upon direct contact or long-term exposure. (Also, see toxic substance.)

TOXIC SUBSTANCE: A chemical or mixture of chemicals which, through sufficient exposure, or ingestion, inhalation or assimilation by an organism, either directly from the environment or indirectly by ingestion through the food chain, will, on the basis of available information cause death, disease, behavioral or immunologic abnormalities, cancer, genetic mutations, or development of physiological malfunctions, including malfunctions in reproduction or physical deformations, in organisms or their offspring.

TOXICITY: The degree of danger posed by a toxic substance to animal or plant life. Also see acute toxicity, chronic toxicity and additivity.

TREATMENT PLANT: See wastewater treatment plant.

TROPHIC STATUS: The level of growth or productivity of a lake as measured by phosphorus content, algae abundance, and depth of light penetration.

TURBIDITY: Lack of water clarity. Turbidity is usually closely related to the amount of suspended solids in water.

UNIFORM DWELLING CODE: A statewide building code for communities larger than 2500 residents specifying requirements for electrical, heating, ventilation, fire, structural, plumbing, construction site erosion, and other construction related practices.

UNIVERSITY OF WISCONSIN-EXTENSION (UWEX): A special outreach, education branch of the state university system.

VARIANCE: Government permission for a delay or exception in the application of a given law, ordinance or regulation. Also, see water quality standard variance.

VOLATILE: Any substance that evaporates at a low temperature.

WASTELOAD ALLOCATION: Division of the amount of waste a stream can assimilate among the various dischargers to the stream. This limits the amount (in pounds) of chemical or biological constituent discharged from a wastewater treatment plant to a water body.

WASTEWATER: Water that has become contaminated as a byproduct of some human activity. Wastewater includes sewage, washwater and the water-borne wastes of industrial processes.

WASTE: Unwanted materials left over from manufacturing processes, refuse from places of human habitation or animal habitation.

WASTEWATER TREATMENT PLANT: A facility for purifying wastewater. Modern wastewater treatment plants are capable of removing 95% of organic pollutants.

WATER QUALITY CRITERIA: A measure of the physical, chemical or biological characteristics of a water body necessary to protect and maintain different water uses (fish and aquatic life, swimming, etc.).

WATER QUALITY STANDARDS: The legal basis and determination of the use of a water body and the water quality criteria, physical, chemical, or biological characteristics of a water body, that must be met to make it suitable for the specified use.

WATER QUALITY STANDARD VARIANCE: When natural conditions of a water body preclude meeting all conditions necessary to maintain full fish and aquatic life and swimming, a variance may be granted.

WATERSHED: The land area that drains into a lake or river.

WETLANDS: Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a variety of vegetative or aquatic life. Wetland vegetation requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs and similar areas.

WINHUSLE: A computer model for evaluating sediment delivery to surface waters from agricultural lands. It was developed by DNR with assistance from NRCS.

WISCONSIN ADMINISTRATIVE CODE: The set of rules written and used by state agencies to implement state statutes. Administrative codes are subject to public hearing and have the force of law.

WISCONSIN FUND: A state program that helps pay the cost of reducing water pollution. Funding for the program comes from general revenues and bonds and is based on a percentage of the state's taxable property value. The Wisconsin Fund includes these programs:

Point Source Water Pollution Abatement Grant Program - Provides grants for 60% of the cost of constructing wastewater treatment facilities. Most of this program's money goes for treatment plant construction, but three percent of this fund is available for repair or replacement of private, on-site sewer systems.

Nonpoint Source Water Pollution Abatement Grant Program - Funds to share the cost of reducing water pollution. Nonspecified sources are available in selected priority watersheds.

Solid Waste Grant Program - Communities planning for solid waste disposal sites are eligible for grant money. \$500,000 will be available each year to help with planning costs.

WISCONSIN NONPOINT SOURCE WATER POLLUTION ABATEMENT GRANT PROGRAM: A state cost-share program established by the State Legislature in 1978 to help pay the costs of controlling nonpoint source pollution. Also known as the nonpoint source element of the Wisconsin Fund or the Priority Watershed Program.

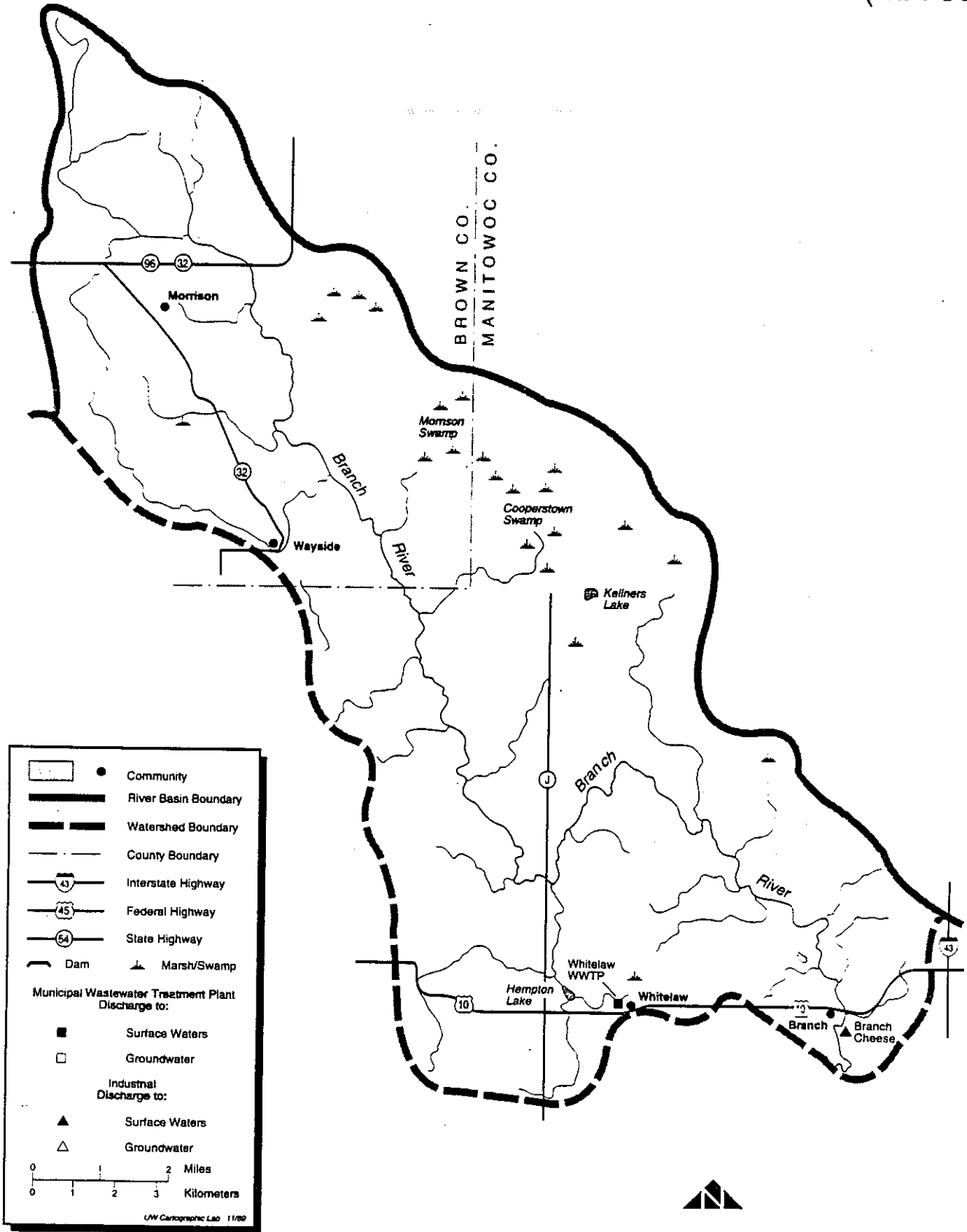
WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM (WPDES): A permit system to monitor and control the point source dischargers of wastewater in Wisconsin. Dischargers are required to have a discharge permit and meet the conditions it specifies.

APPENDIX I

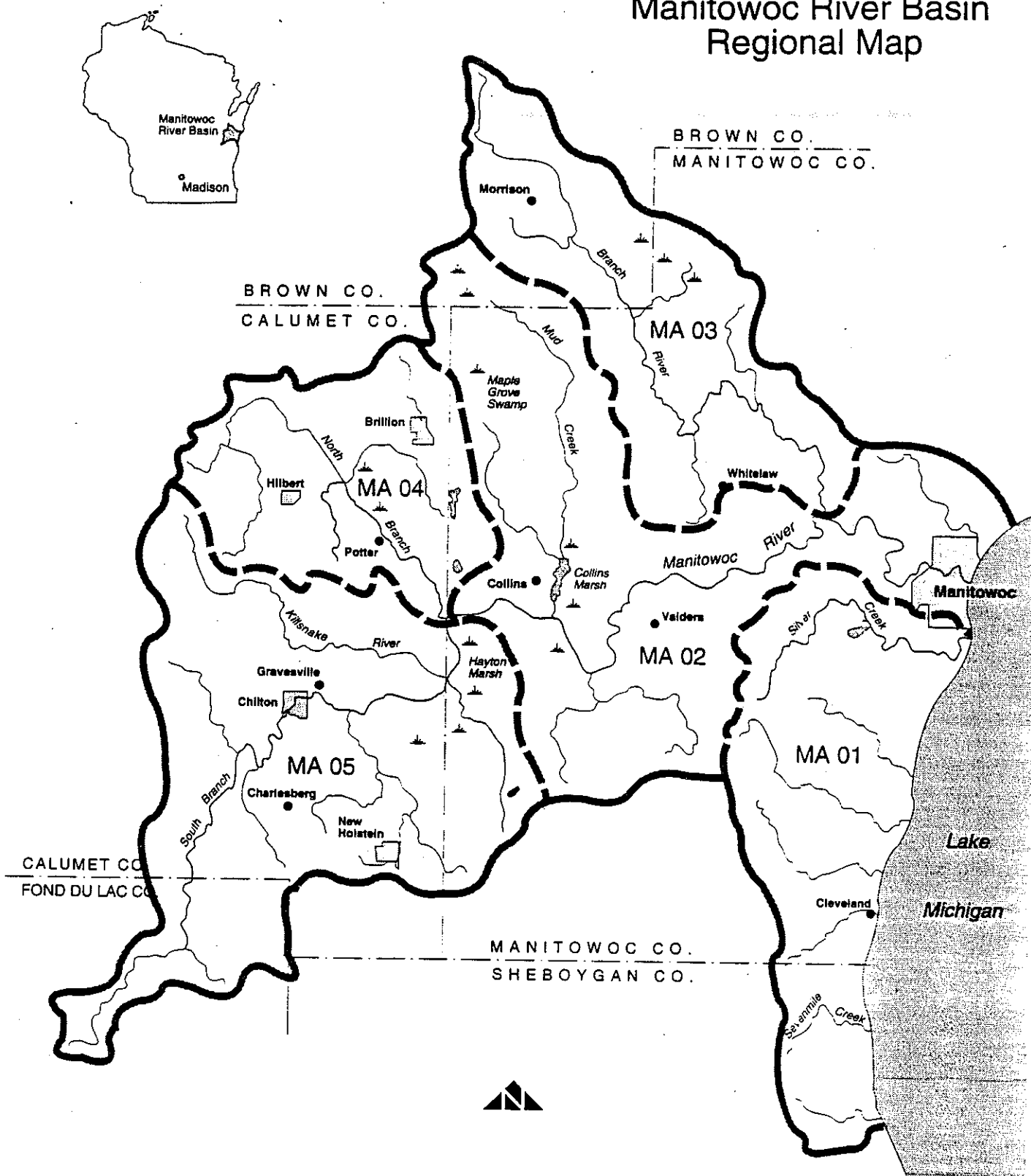
BIBLIOGRAPHY

- Ball, J. 1982. "Stream Classification Guidelines for Wisconsin." Unpublished Draft Technical Bulletin, Department of Natural Resources. 13 pages.
- Bennett, S. J. 1995. "Branch River Watershed Education Plan." University of Wisconsin Extension. 28 pages.
- Clark, R. V. 1995. "Branch River Priority Watershed Groundwater Assessment." Wisconsin Department of Natural Resources. Unpublished Technical Report. 5 pages.
- Dueppen, T. J. and R. D. Stieglitz. 1995. "Mapping and Inventorying of Geologic Features in the Branch River Priority Watershed." University of Wisconsin-Green Bay and Wisc. Department of Natural Resources. Unpublished Technical Report. 64 pages.
- Gansberg, M. K. 1995. "Branch River Priority Watershed Surface Water Resource Appraisal Report." Wisconsin Department of Natural Resources. Unpublished Technical Report. 28 pages.
- Hilsenhoff, W. 1982. "Using a Biotic Index to Evaluate Water Quality in Streams." Wisconsin Department of Natural Resources. Technical Bulletin.
- Kreitlow, J. D. 1991. "Manitowoc River Basin Areawide Water Quality Management Plan." Wisconsin Department of Natural Resources. Technical Report. 75 pages.
- Williamson, A. E. and S. J. Bennett. 1995. "Focus Group Results for the Branch River Watershed." Wisconsin Department of Natural Resources and University of Wisconsin Extension. 33 pages.

Branch River (MA 03)



Manitowoc River Basin Regional Map



Watersheds

MA 01 Sevenmile-Silver Creek
MA 02 Lower Manitowoc River
MA 03 Branch River

MA 04 North Branch Manitowoc River
MA 05 South Branch Manitowoc River

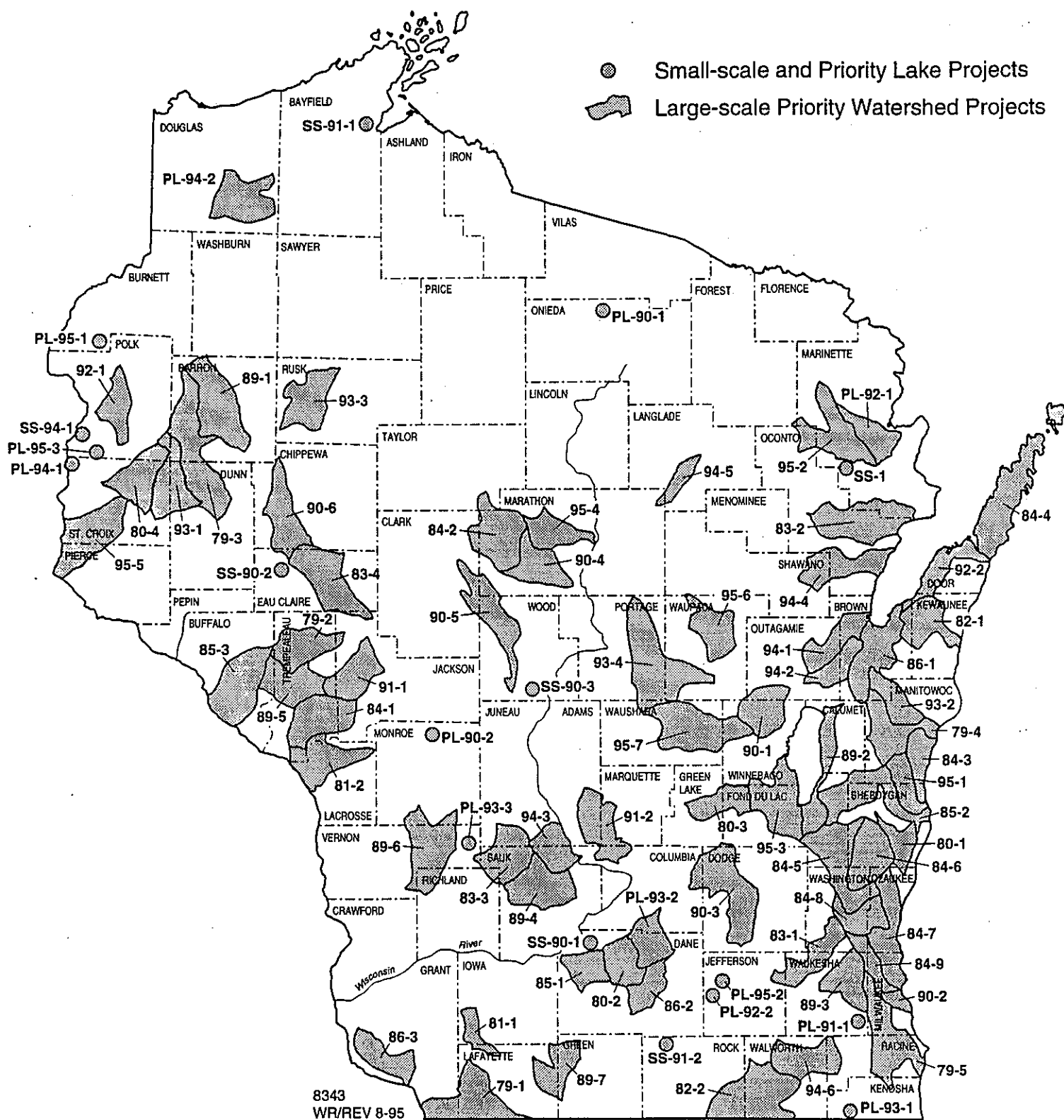
Priority Watershed Projects in Wisconsin: 1995 - 1996

Year Selected- Map Number	Large-scale Priority Watershed Project	County(ies)	Small-scale Priority Watershed Project		County(ies)
			Year Selected- Map Number	Small-scale Priority Watershed Project	
79-1	Galena River ♦	Grant, Lafayette	90-5	Upper Yellow River	Wood, Marathon, Clark
79-2	Elk Creek ♦	Trempealeau	90-6	Duncan Creek	Chippewa, Eau Claire
79-3	Hay River ♦	Barron, Dunn	91-1	Upper Trempealeau River	Jackson, Trempealeau
79-4	Lower Manitowoc River ♦	Manitowoc, Brown	91-2	Neenah Creek	Adams, Marquette, Columbia
79-5	Root River ♦	Racine, Milwaukee, Waukesha	92-1	Balsam Branch	Polk
80-1	Union River ♦	Sheboygan, Ozaukee	92-2	Red River - Little Sturgeon Bay	Door, Brown, Kewaunee
80-2	Sixmile-Pheasant Branch Creek ♦†	Dane	93-1	South Fork Hay River	Dunn, Polk, Barron, St. Croix
80-3	Big Green Lake ♦	Green Lake, Fond du Lac	93-2	Branch River	Manitowoc, Brown
80-4	Upper Willow River ♦	Polk, St. Croix	93-3	Soft Maple/Hay Creek	Rusk
81-1	Upper West Branch Pecatonica River ♦	Iowa, Lafayette	93-4	Tomorrow/Waupaca River	Portage, Waupaca, Waushara
81-2	Lower Black River ♦	La Crosse, Trempealeau	94-1	Duck Creek	Outagamie, Brown
82-1	Kewaunee River ♦	Kewaunee, Brown	94-2	Apple/Ashwaubenon Creeks	Outagamie, Brown
82-2	Turtle Creek ♦	Walworth, Rock	94-3	Dell Creek	Sauk, Juneau
83-1	Oconomowoc River	Waukesha, Washington, Jefferson	94-4	Pensaukee River	Shawano, Oconto
83-2	Little River	Oconto, Marinette	94-5	Spring Brook	Langlade, Marathon
83-3	Crossman Creek/Little Baraboo River	Sauk, Juneau, Richland	94-6	Sugar/Honey Creeks	Walworth, Racine
83-4	Lower Eau Claire River ♦	Eau Claire	95-1	Pigeon River	Manitowoc, Sheboygan
84-1	Beaver Creek	Trempealeau, Jackson	95-2	Middle Peshigo/Thunder Rivers	Marinette, Oconto
84-2	Upper Big Eau Pleine River	Marathon, Taylor, Clark	95-3	Fond du Lac River	Fond du Lac, Winnebago
84-3	Sevenmile-Silver Creeks	Manitowoc, Sheboygan	95-4	Lower Rib River	Marathon
84-4	Upper Door Peninsula	Door	95-5	Kinnickinnic River (St. Croix Basin)	St. Croix, Pierce
84-5	East & West Branch Milwaukee River	Fond du Lac, Washington, Sheboygan, Dodge, Ozaukee	95-6	Lower Little Wolf	Waupaca
84-6	North Branch Milwaukee River	Ozaukee	95-7	Pine & Willow Rivers	Waushara, Winnebago
84-7	Milwaukee River South	Sheboygan, Washington, Ozaukee, Fond du Lac			
84-8	Cedar Creek	Ozaukee, Milwaukee			
84-9	Menomonee River	Washington, Ozaukee, Milwaukee, Waukesha, Ozaukee, Washington			
85-1	Black Earth Creek	Dane			
85-2	Sheboygan River	Sheboygan, Fond du Lac, Manitowoc, Calumet			
85-3	Waumandee Creek	Buffalo			
86-1	East River	Brown, Calumet			
86-2	Yahara River - Lake Monona	Dane			
86-3	Lower Grant River	Grant			
89-1	Yellow River	Barron			
89-2	Lake Winnebago East	Calumet, Fond du Lac			
89-3	Upper Fox River (Ill.)	Waukesha			
89-4	Narrows Creek - Baraboo River	Sauk			
89-5	Middle Trempealeau River	Trempealeau, Buffalo			
89-6	Middle Kickapoo River	Vernon, Monroe, Richland			
89-7	Lower East Branch Pecatonica River	Green, Lafayette			
90-1	Arrowhead River & Daggets Creek	Winnebago, Outagamie, Waupaca			
90-2	Kinnickinnic River (Milwaukee Basin)	Waupaca			
90-3	Beaverdam River	Dodge, Columbia, Green Lake			
90-4	Lower Bio Eau Pleine River	Marathon			

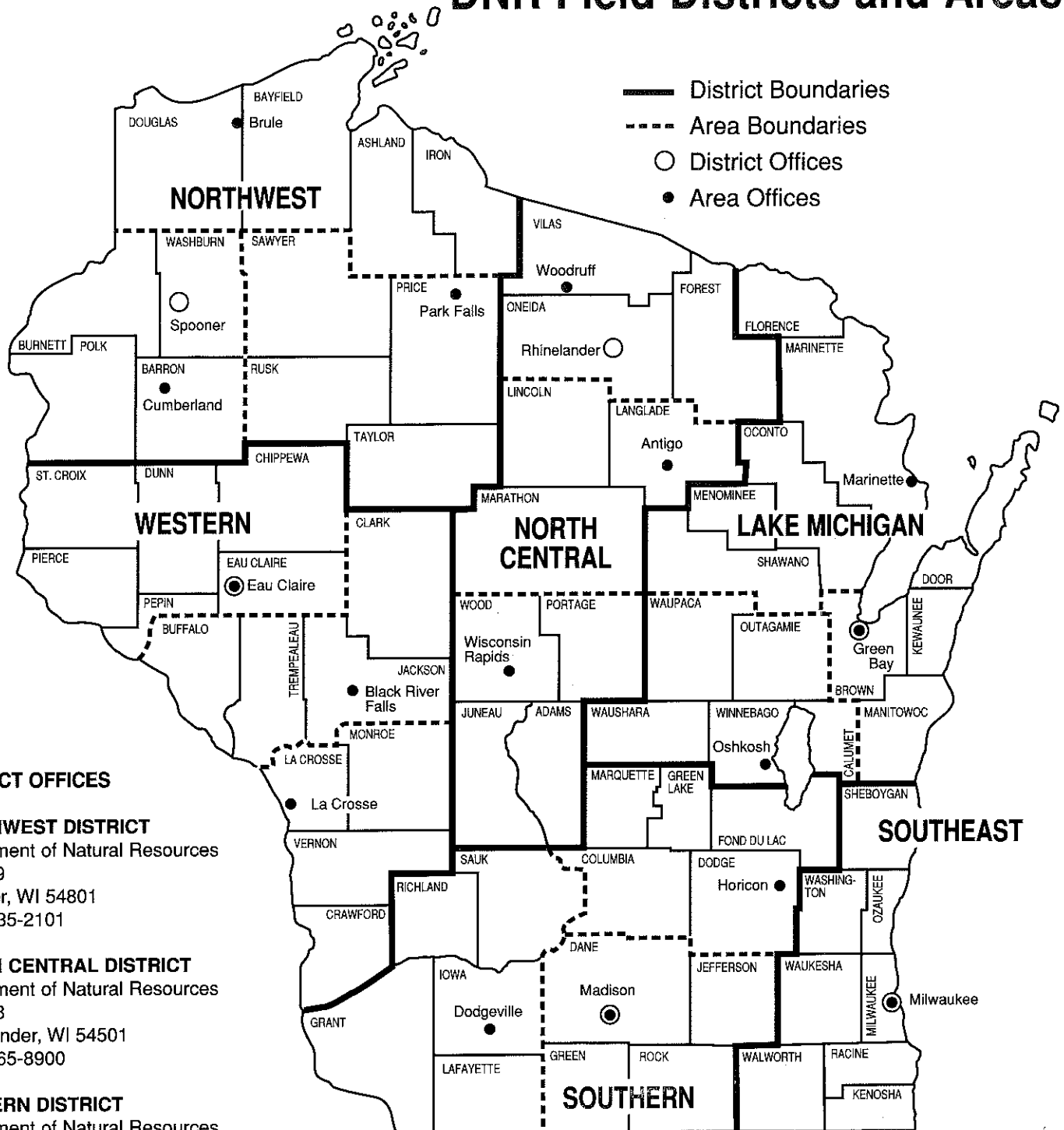
♦ Project completed

† Sixmile-Pheasant Branch is being redone as part of the Lake Mendota project (PL-93-2).

1995-1996



DNR Field Districts and Areas



REV 3/96

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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.

