LEGAL STATUS OF THE NONPOINT SOURCE CONTROL PLAN

The North Branch 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, Wisconsin Administrative Code. It was prepared by the Department, the DATCP, and the Fond du Lac, Ozaukee, Sheboygan, and Washington County Land Conservation Departments in cooperation with the North Branch Milwaukee River Watershed Subcommittee.

This plan is the basis for the Department to enter into cost share and local assistance grants, and as such is used as a guide to implement measures to achieve the desired water quality conditions. In the event that a discrepancy occurs between this plan and the statutes or the administrative rules, or if the statutes or rules change during implementation, the statutes and rules will supersede the plan.

Comprehensive water quality management plans pertaining to the North Branch Milwaukee River Watershed have been completed by the Department and the Southeastern Wisconsin Regional Planning Commission (SEWRPC).[1,2] The SEWRPC also recently completed a water quality management plan for the Milwaukee Harbor Estuary. These reports recognize the importance of reducing nonpoint sources to achieve improved water quality in lakes and streams in the North Branch Watershed and in downstream areas of the Milwaukee River Basin.

Following approval of this priority watershed plan by the DATCP and Fond du Lac, Ozaukee, Sheboygan, and Washington counties, the Department will approve the plan. In doing so, the plan becomes an amendment to the Upper Milwaukee River Basin Areawide Water Quality Management Plan for those portions of the North Branch Watershed in Fond du Lac and Sheboygan counties.

These portions of the North Branch Watershed in Ozaukee and Washington counties are covered under the adopted areawide water quality management plan for southeastern Wisconsin prepared by SEWRPC. The Department requested that SEWRPC recommend to the Department that the priority watershed plan be approved as an amendment to the adopted areawide water quality management plan for southeastern Wisconsin.

RELATIONSHIP OF THE NONPOINT SOURCE CONTROL PLAN TO THE INTEGRATED BASIN MANAGEMENT PLAN

The 838-square mile Milwaukee River Basin is comprised of the North Branch, the East-West Branch, the Milwaukee River South, the Menomonee River, and the Cedar Creek watersheds.

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[1] A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000; Volume III: Recommendations, SEWRPC, Waukesha, 1989.

[2] A Water Resources Managment Plan For The Milwaukee Harbor Estuary, Volume II: Alternative and Recommended Plans, SEWRPC, Waukesha, 1987.

The basin drains to Lake Michigan in the city of Milwaukee and occupies portions of seven counties: Dodge, Fond du Lac, Milwaukee, Ozaukee, Sheboygan, Washington, and Waukesha. Home to more than one million people, the Milwaukee River Basin contains nearly 500 miles of streams and 21 major lakes, with a combined surface area of 3,400 acres.

The Department has designed and implemented a new approach to natural resource management in the Milwaukee River Basin, an approach called "integrated resource management." It uses the Nonpoint Source Control Program as the foundation for coordinating other Departmental environmental quality (solid waste, wastewater, water regulation and zoning, water resources management, water supply) and resource management (fisheries, forest management, parks and recreation, and wildlife and endangered resources management) efforts.

This coordinated program is documented in a seven-volume report entitled Milwaukee River Integrated Basin Management Plan: 2000.[3] It is being prepared by the Department with the cooperation of an advisory committee and six subcommittees, whose membership includes representatives from local, state, and federal units and agencies of government. The plan establishes comprehensive goals and management strategies for the Department's environmental quality and resource management programs. Also, the plan serves to coordinate Departmental activities with similar efforts of local, state, and federal units and agencies of government.

Importantly, recommendations contained in the Milwaukee River Integrated Basin Management Plan are incorporated in this priority watershed plan. Consequently, this nonpoint plan meets the requirements of Section 144.25 of the Wisconsin Statutes. This statute requires the Department to develop "an integrated resource management strategy to protect or enhance fish and wildlife habitat, aesthetics, and other natural resources" for priority watersheds.

PLAN ORGANIZATION

The remainder of this plan is divided into six chapters:

CHAPTER II. "General Watershed Characteristics," provides an overview of the cultural and natural resource features pertinent to planning and implementation efforts for the priority watershed project.

CHAPTER III. "Water Quality Conditions, Nonpoint Sources, and Water Resource Objectives," characterizes the existing and potential biological and recreational uses of surface waters. The results of the nonpoint source inventories, evaluations, and water resource objectives are discussed.

CHAPTER IV. "Nonpoint Source Control Needs," identifies the level of urban and rural nonpoint source control needed to meet the water resource objectives, and identifies the decision criteria and the nonpoint sources eligible for funding under the priority watershed project.

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[3]Upper Milwaukee River Basin Areawide Quality Management Plan: Recommendations Section, WDNR, Madison, 1980.

CHAPTER V. "Detailed Program for Implementation," describes the means by which the local units of government administer the project, estimates a local assistance and management practice cost share budget, and specifies a project tracking system. It also presents an evaluation and monitoring strategy to determine the effectiveness of the project in achieving the water resource objectives.

CHAPTER VI. "Information and Education Program," presents the manner in which the priority watershed project is implemented. This chapter also describes the elements, costs, and responsible parties needed to carry out a comprehensive Information and Education Program.

CHAPTER VII. "Project Evaluation and Monitoring," describes the evaluation and monitoring techniques used to determine the condition of surface and groundwater resources and the nonpoint sources impacting them.

PART ONE
THE WATERSHED ASSESSMENT

CHAPTER II - GENERAL WATERSHED CHARACTERISTICS

CHAPTER III - WATER QUALITY CONDITIONS, NONPOINT SOURCES, AND WATER RESOURCE OBJECTIVES

CHAPTER IV - NONPOINT SOURCE CONTROL NEEDS

CHAPTER II
GENERAL WATERSHED CHARACTERISTICS

The North Branch Watershed is a 149 square mile, egg-shaped surface water drainage area. It is the third largest of the five watersheds in the Milwaukee River Basin, occupying about 18 percent of the basin area. It is comprised of 19 smaller hydrologic drainage units called subwatersheds (Map 2). The following is a description of the North Branch Watershed's cultural and natural resource features pertinent to planning for the Priority Watershed Project. Additional descriptive information is contained in the previously referenced Milwaukee River Integrated Basin Management Plan: 2000 (Volume 3), North Branch Watershed Integrated Resource Management Plan.

CULTURAL FEATURES

Civil Divisions

The North Branch Watershed lies in portions of four counties: Fond du Lac, Ozaukee, Sheboygan, and Washington. Most of the watershed (97 square miles or 65%) lies in Sheboygan County. Thirty nine square miles (26%) lie in Washington County. Twelve square miles (8%) in Ozaukee County and one square mile (1%) in Fond du Lac County make up the remainder of the watershed. The incorporated areas consist of the villages of Adell, Cascade, and Random Lake, with the unincorporated area including all of or portions of 11 townships.

Table 1
Distribution of Land Area Among Counties
in the North Branch Milwaukee River Watershed

County	Area within Watershed (sq. mi.)	Percent of Watershed
Fond du Lac	1.36	0.9%
Ozaukee	12.00	8.1%
Sheboygan	96.74	65.0%
Washington	38.82	26.1%
TOTAL	148.92	100.0%

Source: Wisconsin Department of Natural Resources and Southeastern Wisconsin Regional Planning Commission

Population Size and Distribution

The 1985 population in the North Branch Watershed was estimated to be 14,800 persons, making it the least populated watershed in the Milwaukee River Basin. The majority (7,600 persons or 51%) reside in Washington County. About 6,500 persons (44%) live in Sheboygan County. The remaining 700 persons (5%) reside in Fond du Lac and Ozaukee counties. An estimated 2,500 persons (17%) reside in the villages of Adell, Cascade, and Random Lake. The remaining 12,300 persons live outside incorporated areas in subdivisions, in isolated small enclaves of residential development, or on farmsteads.

Regional and watershed-specific trends suggest that the population will increase by between 20 percent and 50 percent over about the next 20 years, resulting in a population of between 17,800 and 22,200 persons by the year 2010. The increasing population and anticipated decrease in household size will increase the amount of urban development.

Land Uses

Rural land uses comprise more than 136 square miles (about 93%) of the drainage area, making it the least developed watershed in the Milwaukee River Basin. The predominant rural land uses are agricultural and related open space land uses, occupying 98 square miles or 71 percent of the watershed. The remaining rural land uses include wetlands and surface water, which together cover 26 square miles (or 19%), and woodlands, which occupy 14 square miles (10%).

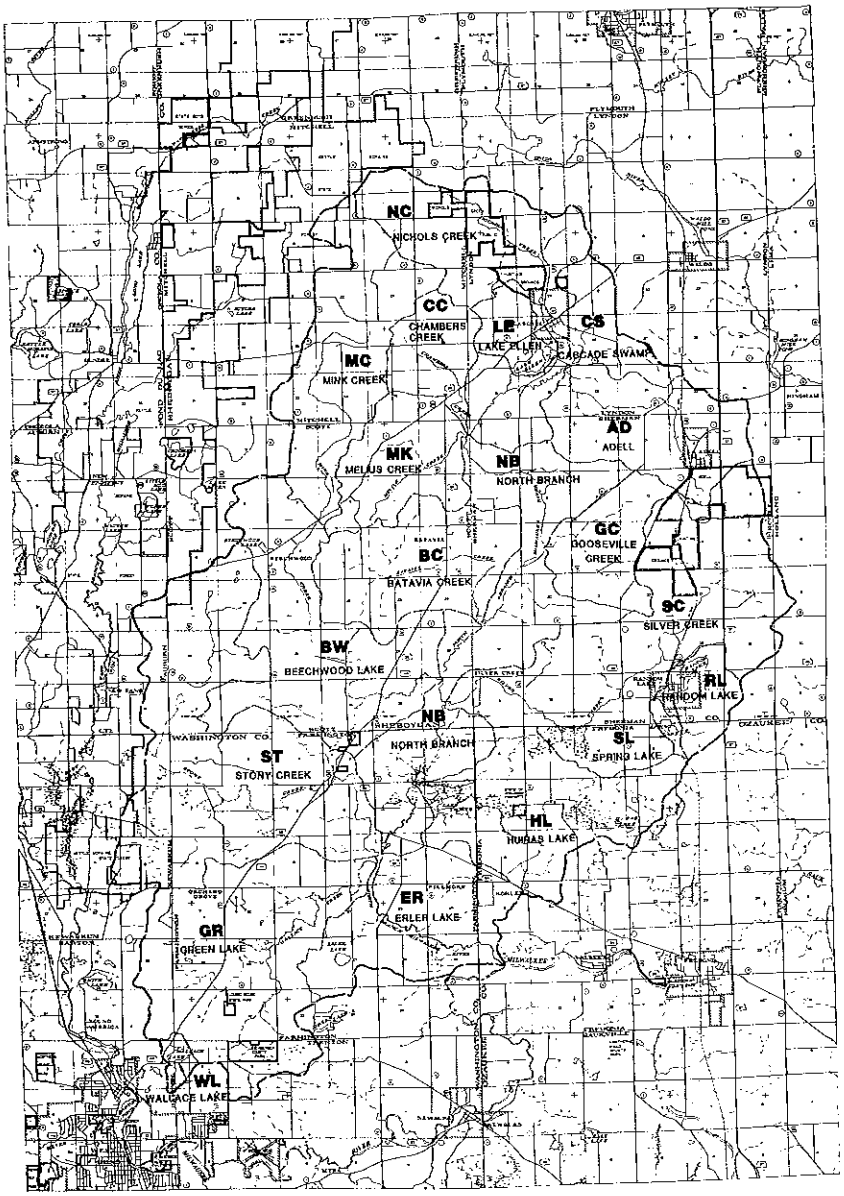
Table 2
Land Uses by County in the North Branch Milwaukee River Watershed (1)

Land Use	Fond du Lac (% of area)	Ozaukee (% of area)	Sheboygan (% of area)	Washington (% of area)	Watershed (% of area)
URBAN					
Residential	--	2.1	2.4	3.3	2.5
Transportation and Utilities	--	2.4	3.9	3.0	3.5
Other	--	0.4	0.7	1.0	0.8
SUBTOTAL	0.0	4.9	7.0	7.3	6.8
RURAL					
Agricultural and other Open	100.0	66.0	66.2	66.9	66.6
Woodland	--	4.9	10.0	9.7	9.4
Wetland	--	23.0	15.7	14.4	16.0
Surface water	--	1.2	1.1	1.7	1.2
SUBTOTAL	100.0	95.1	93.0	92.7	93.2
TOTAL	100.0	100.0	100.0	100.0	100.0

1. Figures are based on 1985 data.

Source: Wisconsin Department of Natural Resources and Southeastern Wisconsin Regional Planning Commission.

MAP 2



-LEGEND-

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

MILWAUKEE RIVER NORTH BRANCH WATERSHED

FOND DU LAC, OZAUKEE, SHEBOYGAN, AND WASHINGTON COUNTIES, WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Urban land uses occupy only 10 square miles (7%) of the watershed. Transportation facilities and residential areas total about nine square miles, or 90 percent of the urban area. The remainder includes commercial, industrial, recreational, and institutional land uses.

Municipal and Industrial Point Sources of Water Pollution

Discharges of wastewater from permitted municipal and industrial sources are important considerations for improving and protecting surface and groundwater resources. Additional information on point sources of pollution is presented in Chapter III and summarized below.

The municipal wastewater treatment plant in the village of Adell and a municipal facility serving the town of Scott Sanitary District No. 1 both discharge to groundwater through soil absorption systems. The two remaining municipal facilities serving the villages of Cascade and Random Lake discharge treated wastewater to the North Branch of the Milwaukee River and Silver Creek, respectively.

Six permitted industrial dischargers are located in the watershed. They include three cheese factories, two fruit and vegetable canning plants, and a fish hatchery. One cheese processing plant discharges treated process water to an unnamed perennial stream flowing northwest from the village of Adell. The two remaining cheese factories and the two canning plants discharge process water, cooling water, and wash water to the groundwater following treatment by soil absorption systems. A fish hatchery owned and operated by the Department discharges fish rearing water to Melius Creek.

Sanitary Sewer Service

Sanitary sewer service is limited to areas in and immediately adjacent to the villages of Adell, Cascade and Random Lake, and to lakeshore development in and around Wallace Lake and Lake Ellen. The combined service area is about one square mile in extent, or less than one percent of the watershed. Approximately 3,000 persons (20% of the watershed population) receive service. Wastewater generated by the remainder of the watershed residents (11,800 persons) is disposed of by private onsite systems.

Water Supply Service

The source of all potable water used in the watershed is groundwater. Three communities, the villages of Adell, Cascade, and Random Lake, have municipal water systems. They provide service to about one square mile, or less than one percent of the watershed and 1,800 persons, or 13 percent of the population. The remainder rely on individual privately-owned water supply systems.

NATURAL RESOURCE FEATURES

Climate

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. Precipitation events throughout the watershed are most frequently moderate in duration and quantity. A precipitation event, or rain event, is defined as a distinct period when precipitation is equal to or greater than 0.1 inch. Approximately 50 events per year occur in the watershed.

The drainage area annual precipitation is an average of 31 inches. The driest months are December, January and February, with an average of 1.54 inches, 1.31 inches, and 0.95 inches of precipitation, respectively. These are also the months of greatest snow accumulation, when more than 30 inches, or 68 percent, of the average annual snowfall occurs. The wettest months are June, July, August, and September when more than 14 inches, or 47 percent, of the average annual rainfall takes place. Most runoff occurs in March, April, and May when the land surface is frozen and soil moisture is highest.

Topography

Surface deposits left by the most recent period of glaciation are primarily responsible for the variation in the landscape. The resulting topography is extremely variable, ranging in elevation from more than 1,200 feet above mean sea level in the northwestern corner in the town of Mitchell, Sheboygan County, to about 800 feet above mean sea level at the confluence with the Milwaukee River in the town of Fredonia, Ozaukee County.

The topography in the northern areas is undulating and abruptly irregular. The landscape includes steeply sloped hills, shallow depressions, and relatively deep holes called kettles. Areas with the most uniform slopes include floodplains and upland areas, where broad expanses of glacial outwash material accumulated.

Soils

The predominant soils in the North Branch Watershed are well drained silt loams and loams with subsoils consisting of clay loam to sandy clay loam. They are underlain by calcareous loam and sandy loam glacial till, or by gravel and sand to sandy clay loam outwash materials. Common soil series are Theresa and Hocheim (glacial till soils), and Casco, Fox, Sisson, and Rodman (outwash soils). Slopes range from gentle to moderately steep.

Table 3
Named Perennial Streams in the North Branch Milwaukee River Watershed

Stream	Subwatershed	Stream length (miles)
North Branch Milwaukee River	North Branch, Erler Lake	20.3
Batavia Creek	Batavia Creek	5.1
Chambers Creek	Chambers Creek	2.0
Gooseville Creek	Gooseville Creek	2.2
Melius Creek	Melius Creek	3.0
Mink Creek	Mink Creek, Beechwood Lake1	14.9
Nichols Creek	Nichols Creek, Cascade Swamp	9.0
Silver Creek	Silver Creek	10.5
Stony Creek	Stony Creek	13.6
Wallace Creek	Wallace Creek	9.5
	TOTAL	90.1

Source: Wisconsin Department of Natural Resources

The erosion potential of these soils is based on their texture, structure, organic matter content, permeability, slope, and position on the landscape. A majority of the upland soils used for crop production in the North Branch Watershed have moderate to severe erosion potential.

Surface Water Resources

Streams: Perennial and intermittent streams are the predominant surface water features. The undulating, irregular topography resulted in the natural creations of 142 miles of streams. Perennial streams, which have a combined length of about 90 miles, maintain at least a small continuous flow throughout most of the year. Nearly all retain their natural condition, while the remainder have been impounded by artificial structures or channels. The longest are the Milwaukee River North Branch (20.3 miles), Mink Creek (14.9 miles), Stony Creek (13.6 miles), and Silver Creek (10.5 miles).

Intermittent streams, with a combined length of 42 miles, flow when runoff and groundwater discharge is highest. Sixteen miles, or 38 percent, have been channelized. However, 26 miles retain their natural condition. Intermittent waterways are the headwaters of many of the larger perennial streams, and their small size makes them particularly susceptible to nonpoint sources. However, their dynamic nature allows rapid improvement if pollutant sources are reduced.

Lakes: Twelve named lakes with a combined surface area of 618 acres are located in the watershed. The largest are Random Lake (213 acres) and Lake Ellen (121 acres). Seven of the named lakes, with a combined surface area of 76 acres, are man-made lakes or impoundments.

Historically, impoundments were created by installation of dams and sills to provide water power to mills, flood control, or recreation. Many are no longer serving their original function and offer limited recreational opportunities because of shallow depth, prolific weed and algae growth, degraded water quality conditions, and dominant rough fish populations. The structures also prohibit upstream migration of forage and game fish and restrict navigation.

Table 4
Lakes in the North Branch Milwaukee River Watershed

Lake	Subwatershed	Lake Surface Area (acres)
Random Lake	Random Lake	213
Lake Ellen	Lake Ellen	121
Spring Lake	Spring Lake	57
Lake Twelve	Huiras Lake	53
Wallace Lake	Wallace Lake	52
Erler Lake	Erler Lake	37
Lake Seven	North Branch	27
Huiras lake	Huiras Lake	21
Lake Lenwood	Wallace Lake	14
Haack Lake	Stony Creek	12
Beechwood Lake	Beechwood Lake	11
TOTAL		618

Source: Wisconsin Department of Natural Resources

Wetlands: Wetlands are some of the most valuable natural resource features in the watershed. Their values include wildlife habitat, fish spawning and rearing, recreation, attenuation of runoff, and flood flows and removal of pollutants. They comprise about 23 square miles, or 16 percent of the watershed. The largest wetland areas include the Cascade Swamp and several large complexes located in the southeastern portion of the watershed.

Groundwater Resources

Maintenance and protection of groundwater quality is an essential element of the North Branch Watershed Plan. The following discussion provides an overview of groundwater resources in and adjacent to the drainage area.

Groundwater is contained in one of four aquifers underlying the watershed--sand and gravel, eastern dolomite (limestone), sandstone and dolomite, and crystalline bedrock. An aquifer is an underground rock or soil formation that stores and transmits water to lakes, streams, and wells. Aquifers in the North Branch are discussed in order of occurrence beneath the surface.

Sand and Gravel Aquifer - The sand and gravel aquifer is comprised of surface material deposited from glacial ice that covered the watershed approximately 10,000 years ago. These deposits, which are generally 100 to 200 feet deep, are unconsolidated soil material with physical and chemical characteristics different from agricultural soils.

Groundwater in these deposits occurs and moves in the void spaces among the grains of sand and gravel. It is locally important as a source of groundwater for both public and private use where there are relatively thick saturated unconsolidated deposits. The potential for contamination is high because of the shallow depth to groundwater and permeability of the bedrock.

Eastern Dolomite Aquifer - The eastern dolomite aquifer occurs beneath the sand and gravel formation. It was deposited approximately 400 million years ago and is 300 to 400 feet thick. It consists of both the Niagara dolomite formation and an underlying shale layer (Maquoketa shale). Dolomite is a brittle rock similar to limestone which contains groundwater in interconnected cracks. The Maquoketa shale formed from impermeable clays and prevents water from moving between the Niagara dolomite and the deeper aquifers. Most potable water used in the watershed comes from this formation. The potential for contamination is moderate.

Sandstone and Dolomite Aquifer - The sandstone and dolomite aquifer occurs beneath the eastern dolomite formation in deposits between 425 and 600 million years old. It consists of sandstone and dolomite bedrock between 400 and 600 feet thick, characterized by materials with variable water yielding properties. In eastern Wisconsin, most users of substantial quantities of water tap this deep aquifer to ensure adequate supplies are available. In areas where the Maquoketa shale underlies the dolomite aquifer, which is the case for most of the North Branch, the potential for contamination is low.

Crystalline Bedrock Aquifer - The crystalline bedrock aquifer is located beneath the sandstone and dolomite aquifer in formations more than 600 million years old. This aquifer is not a primary source of water in the watershed. Most of the deposits are very dense crystalline rock which normally yield small amounts of water. Fractures in the crystalline structured rocks store water but the quality and reliability of this water source and its extreme depth restrict its use.

Environmental Corridors

Areas within southeastern Wisconsin having the highest concentrations of natural, recreational, historic, aesthetic and scenic resources are called environmental corridors. These areas normally include selected elements of the natural resource base (lakes, rivers, streams, wetlands, woodlands, prairies, wildlife habitat areas, wet and poorly drained soils, rugged terrain, and areas of high-relief), as well as existing outdoor recreation sites, historic and archaeological sites, and natural and scientific areas.

Environmental corridors and isolated natural areas have been identified by the Department and SEWRPC. These areas contain primarily wetlands, woodlands and surface water, and comprise approximately 41 square miles (28%) of the watershed. Preservation of these areas is important for improving water quality in this watershed and the basin as a whole.

Natural Area Sites

Natural areas were identified statewide by the Wisconsin Scientific Areas Preservation Council and the Department's Bureau of Endangered Resources. These areas are contained exclusively in environmental corridors and isolated natural areas. They are tracts of land or water which exhibit pristine pre-settlement conditions and/or contain unique plant and animal communities.

Natural areas are classified in one of three categories: statewide or greater significance, county-wide or greater significance, and local significance. In this watershed four sites, all of county-wide significance, have been identified, including:

1. Beechwood Bog Lake and Hamilton Lake in the town of Scott, Sheboygan County.

2. Nichols Creek Springs in the town of Lyndon, Sheboygan County.

3. Hurias Lake in the town of Fredonia, Ozaukee County. The fourth site, Nichols Creek Springs, is publicly owned, with the remainder in private ownership. Together these areas form approximately 570 acres.

Endangered Species

The Department has documented the occurrence of four animal species, classified as endangered or rare in Wisconsin, from nine locations in the watershed. A fish, the striped shiner (Notropis chrsocephalus) is classified as endangered, and was recorded in both Stony Creek and Mink Creek. Three other fish species; redfin shiner (Notropis umbratilis), greater redhorse (Moxostoma valenciennesi) and the last darter (Etheostoma microperca), all of which are on the state watch list, are also known to exist in the watershed.

CHAPTER III
WATER QUALITY CONDITIONS, NONPOINT SOURCES, AND WATER RESOURCE OBJECTIVES

INTRODUCTION

This chapter presents the results of the water quality and nonpoint source assessments described in Appendix E, "Water Quality Assessment." This chapter is the basis for developing the nonpoint source control strategy for the North Branch Priority Watershed Project presented in Chapter V.

The first section of this chapter discusses water quality conditions and recreational uses. The water quality objectives for the priority watershed project are presented in the second section. The third section is an overview of nonpoint sources in the entire North Branch Watershed. Finally, the fourth section presents specific information pertaining to water quality, objectives, and nonpoint sources for each of the 19 subwatersheds.

WATER QUALITY CONDITIONS AND RECREATIONAL USES

Streams

Streams in this watershed exhibit some of the best water quality in the Milwaukee River Basin. The named streams include the North Branch of the Milwaukee River, Nichols Creek, Chambers Creek, Melius Creek, Gooseville Creek, Batavia Creek, Mink Creek, Silver Creek, Stony Creek, and Wallace Creek.

The North Branch is the primary stream in the watershed. It begins as a small, clear, fast-flowing stream about 4 miles west of the village of Cascade, and flows southwesterly for 29 miles, where it empties into the main stem of the Milwaukee River in the town of Fredonia, Ozaukee County.

That portion of the North Branch upstream of the village of Cascade and Chambers, Gooseville, Melius, Mink, Wallace, and portions of Stony Creek(s), have cold to cool water temperatures, rapid flow, and high dissolved oxygen concentrations. High quality habitat supports cold and cool water fish species, including trout and sculpins.

Downstream portions of the North Branch and Batavia Creek, Silver Creek, Wallace Creek, and several unnamed streams have cool to warm temperatures, moderate flow rates, and lower dissolved oxygen concentrations. Northern pike, smallmouth bass, and a few largemouth bass are found in larger stream reaches. Panfish such as black and white crappie, bluegill, and rock bass are also present.

Lakes and Impoundments

The watershed's 19 natural lakes and impoundments exhibit variable water quality. Spring Lake and several of the other smaller lakes have good water quality, with few limitations for supporting healthy biological communities and diverse recreational uses. Several of the larger lakes--Lake Ellen, Random Lake, and Wallace Lake--have fair water quality and seasonal heavy aquatic weed growth, which impair their biological health and restrict recreational uses. The impoundments--Gooseville millpond, Boltonville millpond--generally have poorer water quality than the natural lakes. Sedimentation and excessive aquatic weed growth are common problems.

The lakes and impoundments have variable fish communities. The natural lakes, including Lake Ellen, Random Lake, and Wallace Lake, support native populations of warmwater fish species including northern pike, largemouth bass, and numerous types of panfish.

Recreational Uses

The watershed's streams, lakes, and wetlands offer diverse and high-quality recreational opportunities. The most popular are canoeing, fishing, swimming, and waterskiing. Other popular activities are wildlife observation, hiking, hunting, and trapping.

Groundwater Quality Contamination Susceptibility

Contamination Sources: Limited site-specific evaluations of groundwater contamination sources were conducted as part of the priority watershed project. These included primarily the destination of runoff and underlying soil characteristics for barnyards draining to internally drained areas not connected to surface waters.

The rural aspect of the watershed suggests that agricultural activities would likely be the most widespread source of contamination. Statewide investigations indicate that Sheboygan (17th of 72) and Washington (25th of 72) counties rank in the upper 50 percent of Wisconsin counties in the amount of nitrogen-bearing wastes (human and animal wastes and fertilizer) applied per acre. These materials are a source of nitrites and bacteria in groundwater. Furthermore, Sheboygan (20th of 72) and Washington (34th of 72) counties rank in the top 50 percent for the amount of the pesticides atrazine and alachlor applied per acre.

Susceptibility to Groundwater Contamination: A statewide evaluation of susceptibility to groundwater contamination used soil characteristics, types and character of subsurface unconsolidated materials, bedrock characteristics, depth to bedrock, and depth to the water table, to evaluate areas susceptible to groundwater contamination.

This evaluation found that southeastern Wisconsin, especially the area along the shore of Lake Michigan, is less susceptible to contamination than some other areas of the state. Some portions of the North Branch Watershed are more susceptible than others, and isolated occurrences of contamination have been recorded. However, a layer of impermeable bedrock (Maquoketa shale) underlying much of the watershed isolates the deeper aquifers from surface contaminants. In addition, some glacial deposits which locally may contain thick silts and clays may filter out contaminants before they percolate down to the groundwater. Some areas of the watershed in the Kettle Moraine area have soils with lesser amount of clay with more limited filtering capacity.

WATER QUALITY OBJECTIVES

Surface Water

Specific stream and lake objectives for the priority watershed project focus on biological and recreational uses discussed in Appendix E. As shown in Table 5, approximately 76 miles of stream, or 65 percent of the streams in the North Branch Watershed, are not fully supporting their potential biological uses. In addition, only three of the watershed's 19 lakes and impoundments are achieving their potential biological uses.

The following statements identify the basic objectives for streams and lakes under the priority watershed project:

1. Protection--Protection refers to maintaining the present biological and recreational uses supported by a lake or stream. For example, if a stream supports a healthy coldwater fishery and is used for full-body contact recreational activities, the objective seeks to maintain those uses.

2. Enhancement--Enhancement refers to a change in the overall condition of a stream or lake within its given biological and recreational use category. For example, if a stream supports a warmwater fishery whose diversity could be enhanced, the objective focuses on changing those water quality conditions which keep it from achieving its full biological potential.

3. Improvement--Improvement 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 objective 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 objectives 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. As previously discussed, comprehensive water quality management plans prepared by the Department and SEWRPC identified the levels of nonpoint source control needed to protect and improve water quality in streams and lakes in the North Branch Watershed.

The Department's plan pertains to those portions of the North Branch Watershed in Sheboygan and Fond du Lac counties. Nonpoint source reduction goals for this area are subwatershed-specific refinements of the generalized recommendations in the above referenced plan.

The SEWRPC Areawide Water Quality Management Plan pertains to those portions of the North Branch Watershed in Ozaukee and Washington counties. The SEWRPC plan identified the need for minimum (about 25 percent) reductions in the amount of pollutants from nonpoint sources to protect and improve water quality to a level necessary to achieve regional water quality standards. These levels of reduction were also identified in the previously described SEWRPC plan for the Milwaukee Harbor estuary, as necessary, to improve the water quality of downstream portions of the Milwaukee River Basin.

The nonpoint source pollutant goals in this plan are similar to those identified by SEWRPC. However, the site-specific water quality and aquatic habitat investigations completed as part of the priority watershed project provided information to refine the levels described in the SEWRPC water quality management plans.

Table 5
Water Quality Characteristics of Surface Water in the North Branch Milwaukee River Watershed

Subwatershed	Surface Water	Length (miles)	Biological Use Classification Current	Biological Use Classification Potential	Miles Supporting Potential Use Fully	Partially	Not
Nichols Creek	Nichols Creek	4.4	FAL-A	FAL-A	4.4	---	---
	Cascade Millpond	7 acres	FAL-A	FAL-A	---	X	---
Cascade Swamp	Nichols Creek	4.6	FAL-B	FAL-B	2.9	1.7	---
	Lake Ellen Outlet	0.5	FAL-B	FAL-B	0.5	---	---
Lake Ellen	Lake Ellen	121 acres	FAL-B	FAL-B	---	X	---
	intermittent stream	1.0	FAL-C	FAL-C	0.4	0.6	---
	intermittent stream	0.1	FAL-C	FAL-C	---	0.1	---
Chambers Creek	Chambers Creek	1.7	FAL-A	FAL-A	---	1.7	---
Adell	Adell tributary	5.1	INT-D	FAL-C	0.5	---	4.6
	perennial stream	0.5	FAL-C	FAL-C	---	0.5	---
Melius Creek	Melius Creek	3.0	FAL-A	FAL-A	0.5	2.5	---
	perennial stream	0.6	FAL-A	FAL-A	0.4	0.2	---
North Branch	North Branch	13.4	FAL-B	FAL-B	9.4	4.0	---
	perennial stream	0.5	FAL-C	FAL-C	0.5	---	---
	Gooseville Millpond	38 acres	FAL-B	FAL-B	---	X	---
Gooseville Creek	Gooseville Creek	0.8	FAL-C	FAL-C	---	0.8	---
		1.0	FAL-C	FAL-C	1.0	---	---
		0.7	FAL-A	FAL-A	---	0.7	---
Batavia Creek	Batavia Creek	4.1	FAL-C	FAL-B	---	4.1	---
Mink Creek	Mink Creek	4.8	FAL-C (cold water)	FAL-A	---	4.8	---
Beechwood Lake	Mink	8.4	FAL-A	FAL-A	4.2	4.2	---
	perennial stream	3.7	FAL-A	FAL-A	---	3.7	---
	Beechwood Lake	11 acres	FAL-B	FAL-B	---	X	---
Silver Creek	Silver Creek	1.2	INT-D	INT-D	1.2	---	---
	Silver Creek	9.3	FAL-B	FAL-B	2.2	7.1	---
	Random Lake Outlet	0.6	FAL-B	FAL-B	0.6	---	---
Huiras Lake	perennial stream	4.1	FAL-B	FAL-B	3.0	1.1	---
	Huiras Lake	21 acres	FAL-B	FAL-B	---	X	---
	Lake Twelve	53 acres	FAL-B	FAL-B	---	X	---
Stony Creek	Stony Creek	3.1	FAL-C	FAL-C	0.7	2.4	---
	Stony Creek	2.6	FAL-A	FAL-A	---	2.6	---
	Stony Creek	7.9	FAL-B	FAL-B	1.8	6.1	---
	Perennial stream	2.7	FAL-C	FAL-C	---	2.7	---
	Boltonville Millpond	11 acres	FAL-B	FAL-B	---	X	---
	Haack Lake	12 acres	FAL-B	FAL-B	X	---	---

Green Lake	Wallace Creek	9.5	FAL-B	FAL-A	2.0	---	7.5
	intermittent streams	7.6	FAL-C	FAL-C	---	7.6	---
Wallace Lake	Wallace Lake	52 acres	FAL-B	FAL-B	---	---	X
Spring Lake	Spring Lake	57 acres	FAL-B	FAL-B	X	---	---
	Spring Lake Outlet	0.7	FAL-B	FAL-B	0.7	---	---
Random Lake	Random Lake	213 acres	FAL-B	FAL-B	---	X	---
Erler Lake	North Branch	4.9	FAL-B	FAL-B	---	4.9	---
	Erler Lake Outlet	1.3	FAL-B	FAL-B	1.3	---	---
	Erler Lake	37 acres	FAL-B	FAL-B	---	X	---

FAL A Cold Water Sport Fish -- Streams categorized under this use classification are capable of supporting a cold water sport fishery, or as serving as a spawning area for salmonid (trout, salmon) species. The presence of an occasional trout or salmon in a stream does not justify it being classified as capable of supporting a cold water sport fishery.

FAL B Warm Water Sport Fish -- Streams categorized under this use classification are capable of supporting a warm water sport fishery or serving as a spawning area for warm water sport fish (walleye, bluegill, smallmouth bass). Although warm water fish are occasionally found in many small streams, fish must commonly be found in a water body for it to be classified under this use designation.

FAL C Cold/Warm Water Forage Fish -- Streams categorized under this use classification are capable of supporting an abundant, usually diverse, population of forage fish (shiners, minnows) and/or aquatic macroinvertebrates (insects, clams, crayfish) which are intolerant of pollution. These streams are generally too small to support cold or warm water sport fish, but have natural water quality and habitat sufficient to support forage fish and/or aquatic macroinvertebrates. Streams capable of supporting valuable populations of tolerant forage fish are also included in this classification.

Intermediate D -- Streams categorized under this use classification are capable of supporting small populations of forage fish tolerant of pollution, or fish and aquatic macroinvertebrates which are tolerant of pollution. The aquatic community in these streams is usually limited by naturally poor water quality or habitat deficiencies.

The reduction goals for the North Branch Priority Watershed Project are for the control of sediment and phosphorus. Sediment and phosphorus were used because they were identified as having the most widespread and significant impact on streams and lakes. Reducing the quantity of sediment and phosphorus will also decrease the amount of bacteria, pesticides, and other substances impacting streams and lakes which prohibit achievement of their potential biological uses.

Three levels of reduction, listed below, have been identified for the North Branch Priority Watershed Project. Reduction levels for each subwatershed necessary to achieve water quality conditions which support identified potential biological uses are discussed later in this chapter.

The three reduction levels are:

1. High (greater than a 50%)
2. Moderate (25 to 50%)
3. Low (less than 25%).

Wetlands

An underlying water quality objective for the priority watershed project is the protection of wetlands. These areas provide some of the best wildlife habitat, and also contain fish spawning areas. Furthermore, they serve to buffer streams and lakes from sediment and other materials which would otherwise be carried to surface waters.

Groundwater

The Department is responsible for protecting the quality of groundwater. Existing Departmental administrative rules and policies designed to protect groundwater from contamination attributed to nonpoint sources will apply in this project. As discussed in Chapter IV, eligibility criteria for cost sharing nonpoint sources that impact groundwater are established and used during project implementation.

Table 6
Destination of Phosphorus Loading from Barnyards
in the North Branch Milwaukee River Watershed

Streams/Lakes		Wetlands		Deep Soils		Shallow Soils		Total	
No.	Lbs. P	No.	Lbs. P	No.	Lbs. P	No.	Lbs. P	No.	Lbs. P
156	1,283	20	170	35	514	9	53	220	2,020

Source: Wisconsin Department of Natural Resources

NONPOINT SOURCES OF POLLUTION

The nonpoint sources inventoried and the means for evaluating their impact on surface and groundwater resources were discussed in Appendix E, "Water Quality Assessment." Nonpoint sources are significant contributors of sediment and nutrients to most surface water in the North Branch Watershed. To a lesser extent, they have the potential to have localized adverse impacts on groundwater quality. Agricultural nonpoint sources, particularly upland erosion and barnyard runoff, contribute the major portion of the suspended sediment and phosphorus to surface water. Urban runoff can be a significant localized source of sediment and other pollutants. Streambank erosion is widespread but variable in its extent, severity, and impact on surface water quality. The following discussion provides detailed information on nonpoint sources from a watershed perspective.

Rural Nonpoint Sources

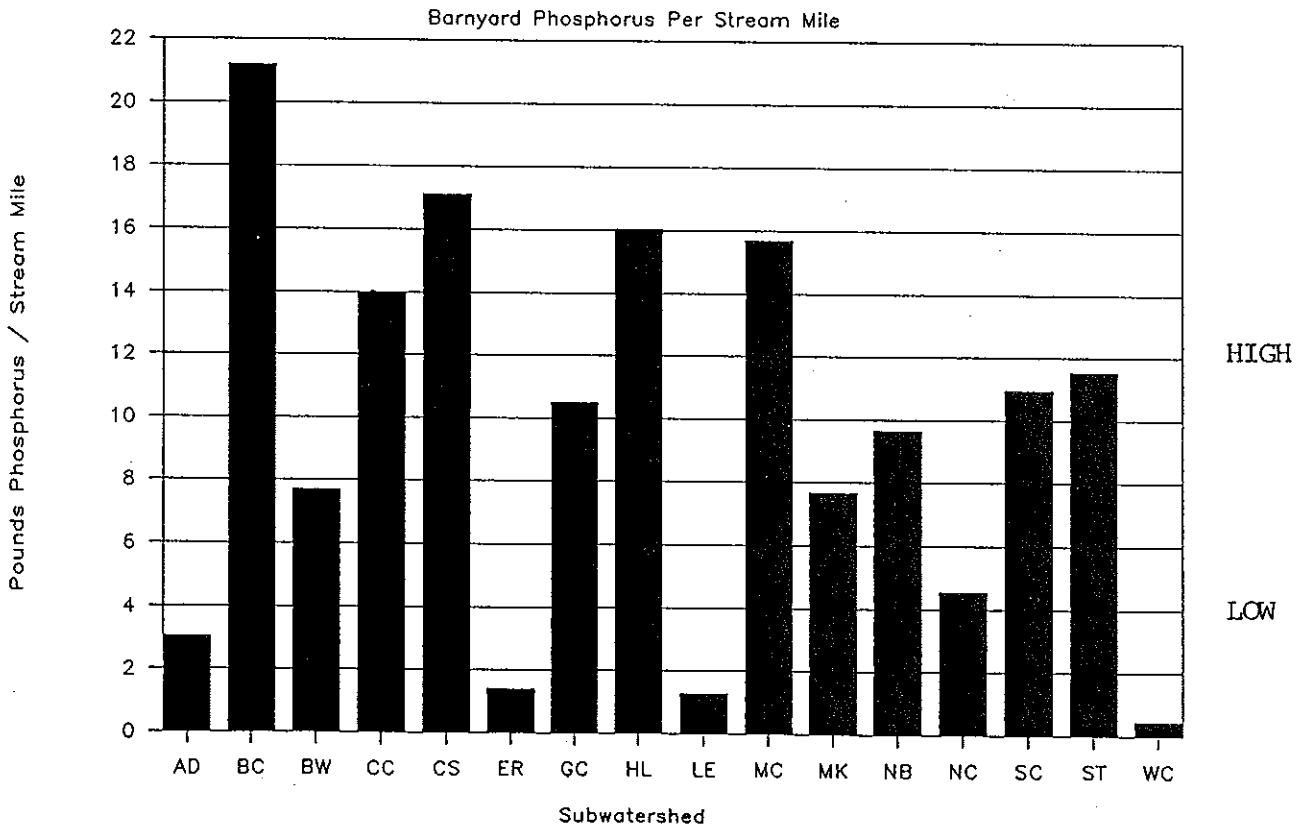
The rural nonpoint sources investigated were barnyard and livestock area runoff, upland erosion and sediment delivery, streambank erosion, and runoff from areas winter spread with livestock manure. As discussed in Appendix E, the relative amount of sediment and phosphorus entering surface waters from these sources was determined. Sediment and phosphorus were used because they

were identified as having the most widespread and significant impact on water resources. Importantly, reducing the quantity of these substances reaching surface and groundwater decreases the amount of other substances--heavy metals, pesticides, and bacteria--which degrade water quality.

Barnyard and Livestock Area Runoff: Runoff - carrying a variety of pollutants from barnyards and livestock feeding, loafing, and pasturing areas - is one of the most significant sources of nonpoint pollution in the watershed. Livestock operations, comprised of 220 beef and dairy farms, are a source of 2,020 pounds of phosphorus under a 10 year, 24-hour rainfall event. Figure 1 shows the phosphorus loading rate per mile of stream for each subwatershed.

Runoff from 156 livestock operations or 71 percent drain to streams, lakes, or riparian wetlands. An estimated 1,283 pounds of phosphorus or 64 percent of the total, was calculated as originating at these sites. About 700 pounds, or 55 percent of the estimated phosphorus load to streams, lakes, and riparian wetlands originates from only 20 of the 156 barnyards.

Figure 1



The remaining livestock operations (64 or 29%) drain either to areas covered with deep soils (greater than 36" to bedrock or groundwater - 35 sites), pocket wetlands (20 sites), or areas covered with shallow soils (less than 36" to bedrock or groundwater - 9 sites) . Runoff transports 737 pounds of phosphorus or 36 percent of the total to these areas.

Stony Creek (36 sites), Beechwood Lake (31 sites), Silver Creek (24 sites), North Branch (23 sites), and Wallace Creek (21 sites) subwatersheds have the greatest number of barnyards. Together, these drainage areas contain 135 barnyards, or 62 percent of the watershed total and are a source of 1,270 pounds of phosphorus, or 63 percent of the total.

Upland Erosion and Sediment Delivery: This inventory evaluated the erosion and destination of sediment for 141 square miles (or 95%) of the watershed. Approximately 80 square miles (or 57%) drain to streams and lakes. The remaining 61 square miles or (43%) drain to internally drained upland areas, wetlands isolated from lakes or streams, or wetlands adjacent to lakes and streams.

An estimated 189,200 tons of soil erode annually from croplands, pastures, woodlots, grasslands, and other "open areas." This is enough soil to fill more than 17,000 standard-sized dump trucks. Lined up end to end, they would stretch from the headwaters of Nichols Creek to Random Lake.

Sediment delivered to streams and lakes is estimated to be 5,900 tons annually, or about three percent of the total amount of eroded soil. The greatest amount of eroded soil reaching streams and lakes is occurring in the Stony Creek (877 tons), North Branch (785 tons), Mink Creek (687 tons), Silver Creek (597 tons), and Beechwood Lake (478 tons) subwatersheds, which together total 3,424 tons or 58 percent of the total. Figure 2 shows the sediment loading rate per mile of stream for each subwatershed.

Table 7
Soil Erosion and Sediment Delivery in the North Branch Milwaukee River Watershed

Total Acres	Acres Delivering Sediment to Streams	Percent of Total	Total Eroded Sediment	Sediment Delivered to Streams/Lakes	Percent of Total
90,092	51,341	57	189,237 tons	5,943 tons	3

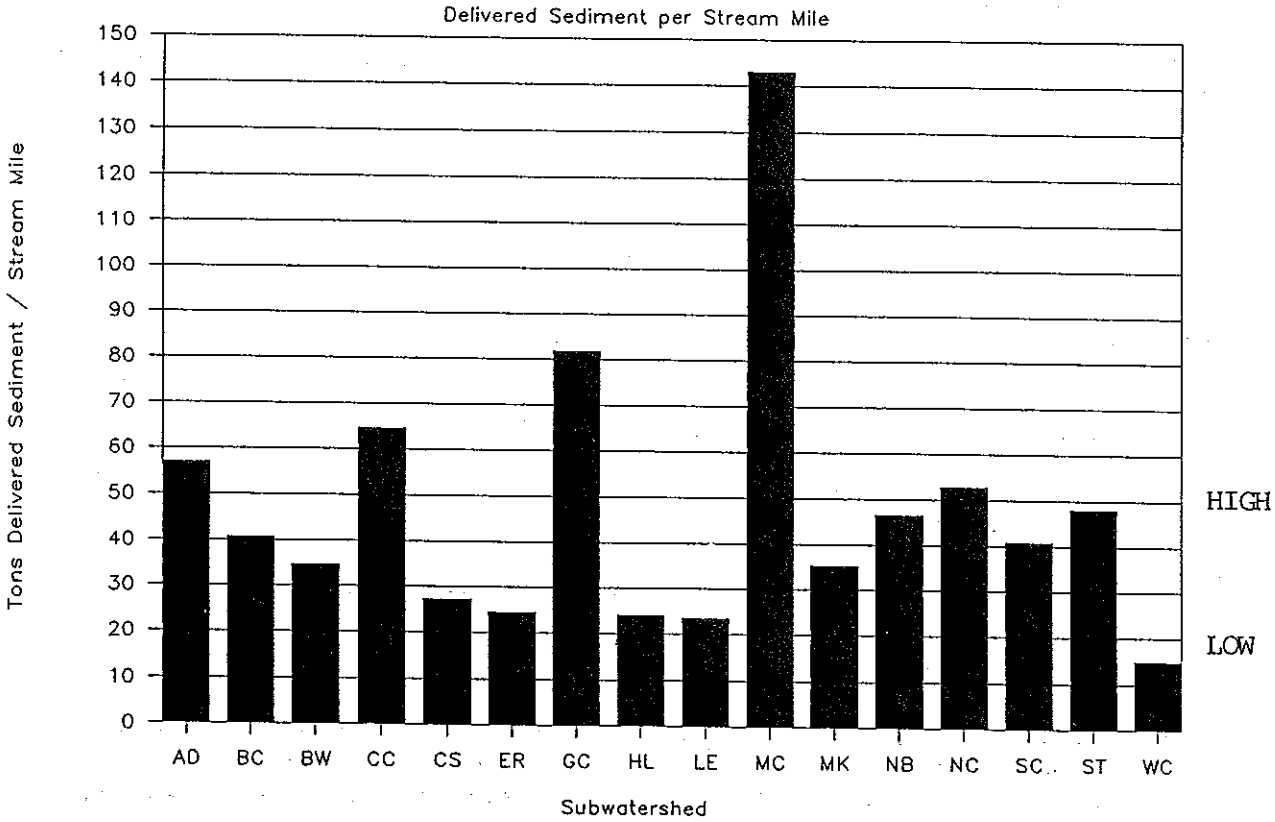
Source: Wisconsin Department of Natural Resources.

The amount of eroded soil delivered to lakes and streams (3%) is approximately the same as reported in the Milwaukee River East-West Branch drainage area. The abundance of internally drained areas and the extensive network of riparian wetlands limits the amount of eroded soil delivered to lakes and streams.

Streambank Erosion: Eroding streambanks are a source of sediment for many streams. Approximately 120 miles, or 85 percent of the watershed's 140 stream miles were evaluated. Significant erosion was occurring and/or aquatic habitat and water quality were degraded at 51 sites encompassing approximately eight miles of streambank. An estimated 70 tons of sediment are eroding into streams at these sites.

Mink Creek, Silver Creek, and Wallace Creek, with a combined total of six miles of affected streambank, are the streams where this problem is greatest. Bank instability and erosion are most often caused by uncontrolled livestock access and human induced or natural fluctuations in stream flow.

Figure 2



LEGEND				
	AD-Adell	CS-Cascade Swamp	LE-Lake Ellen	NC-Nichols Creek
	BC-Batavia Creek	ER-Erler Lake	MC-Mink Creek	SC-Silver Creek
	BW-Beechwood Lake	GC-Gooseville Creek	MK-Melius Creek	ST-Stony Creek
	CC-Chambers Creek	HL-Huiras Lake	NB-North Branch	WC-Wallace Creek

Runoff from Areas Winter Spread with Livestock Manure: The 220 livestock operations produce an estimated 118,000 tons of manure during the six-month period from late fall through mid-spring. This is the period when areas spread with manure have the greatest potential to be pollution sources. It was estimated that approximately 3,900 acres, or four percent of the watershed are needed to spread the manure generated during this period.